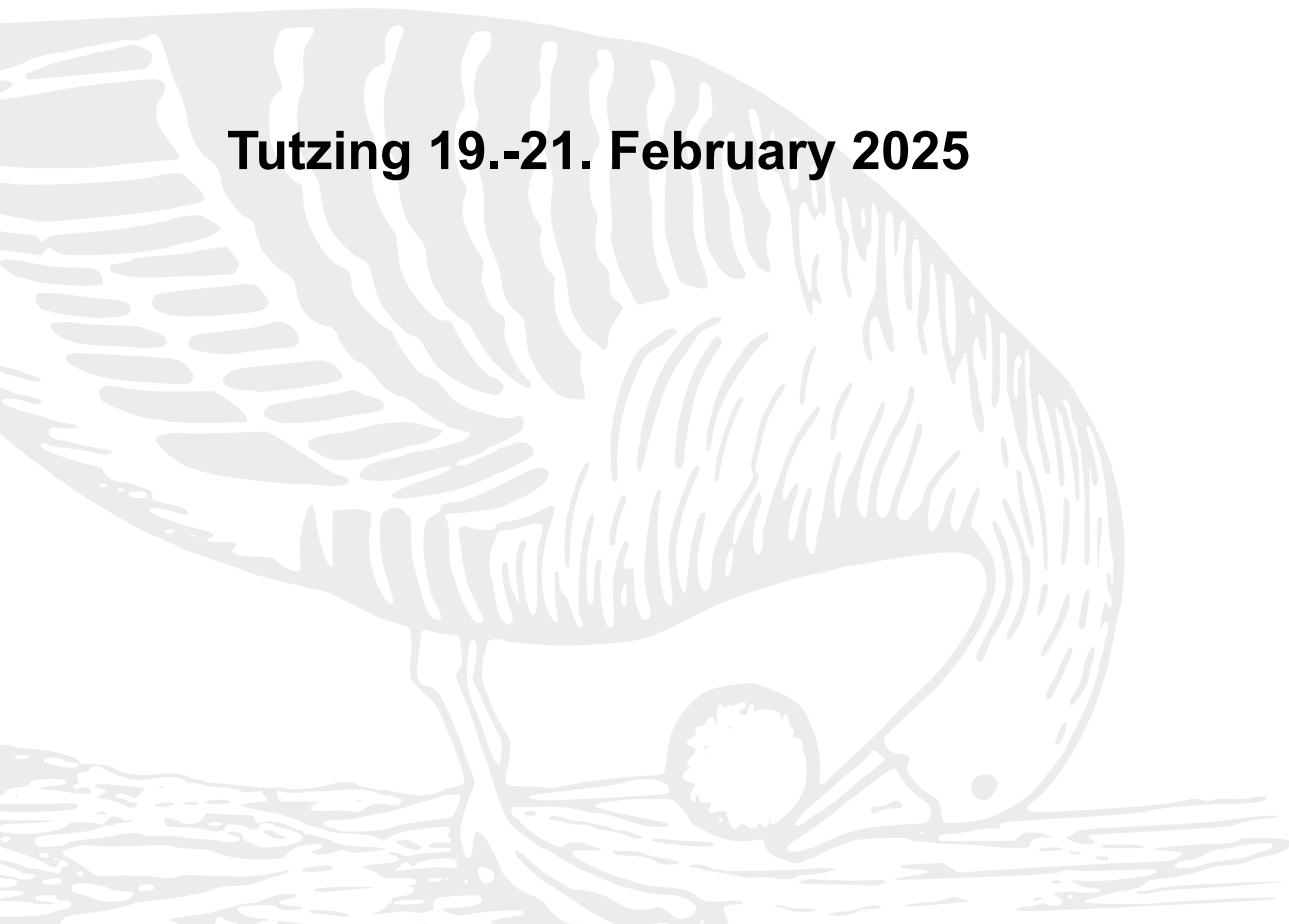


Annual Meeting of the Ethologische Gesellschaft

Abstract Book

Tutzing 19.-21. February 2025



Plenary Lectures

Life history predictions: Sometimes intuitive, sometimes not

Hanna Kokko

Feb 19, 14:00h

From conflict to co-existence: The farmer-cheetah conflict

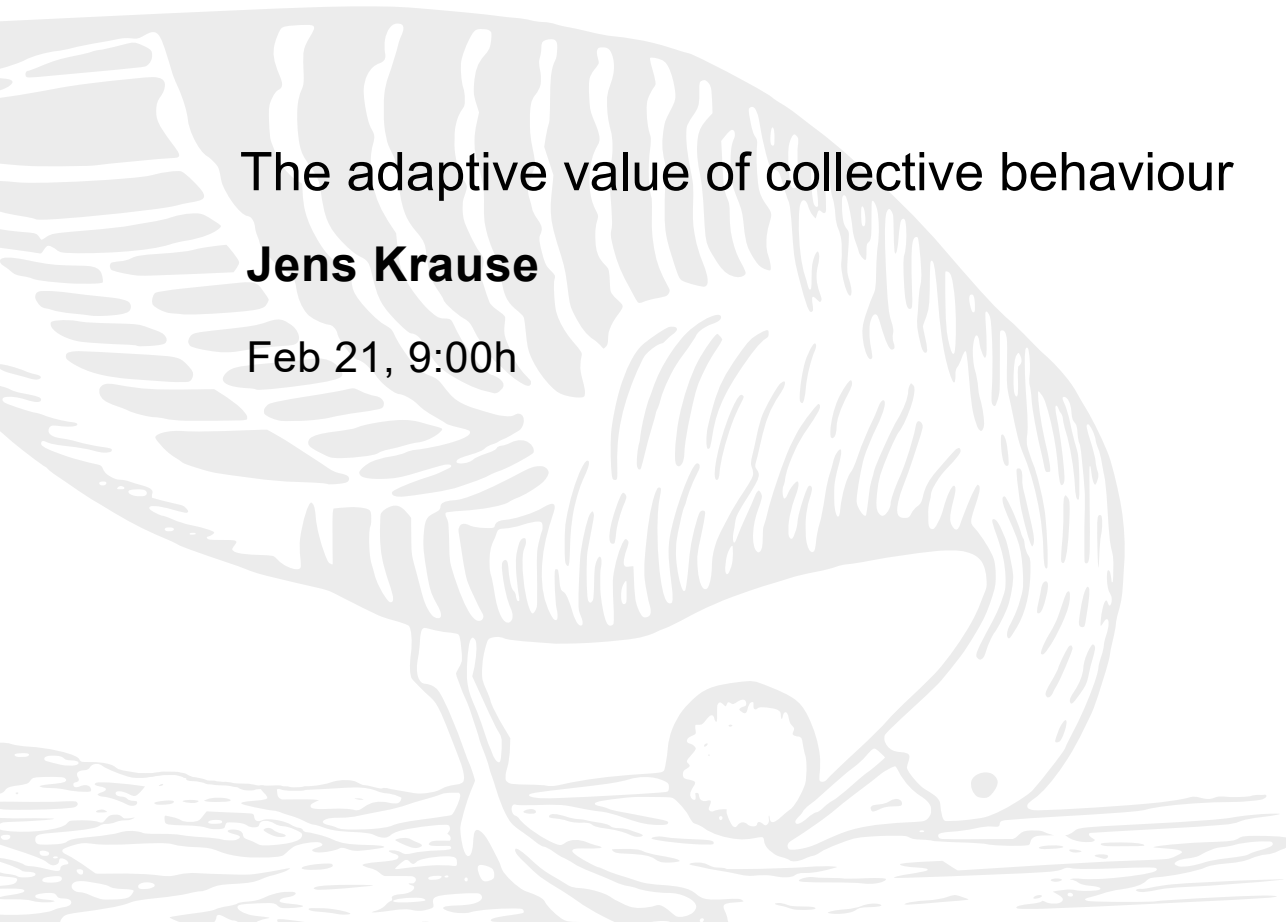
Bettina Wachter

Feb 20, 9:00h

The adaptive value of collective behaviour

Jens Krause

Feb 21, 9:00h



Special Talk

Tinbergen's Five: rethinking the future

Martin Wikelski

Feb 20, 17:30h



Symposium Talks

Wednesday Feb 19th



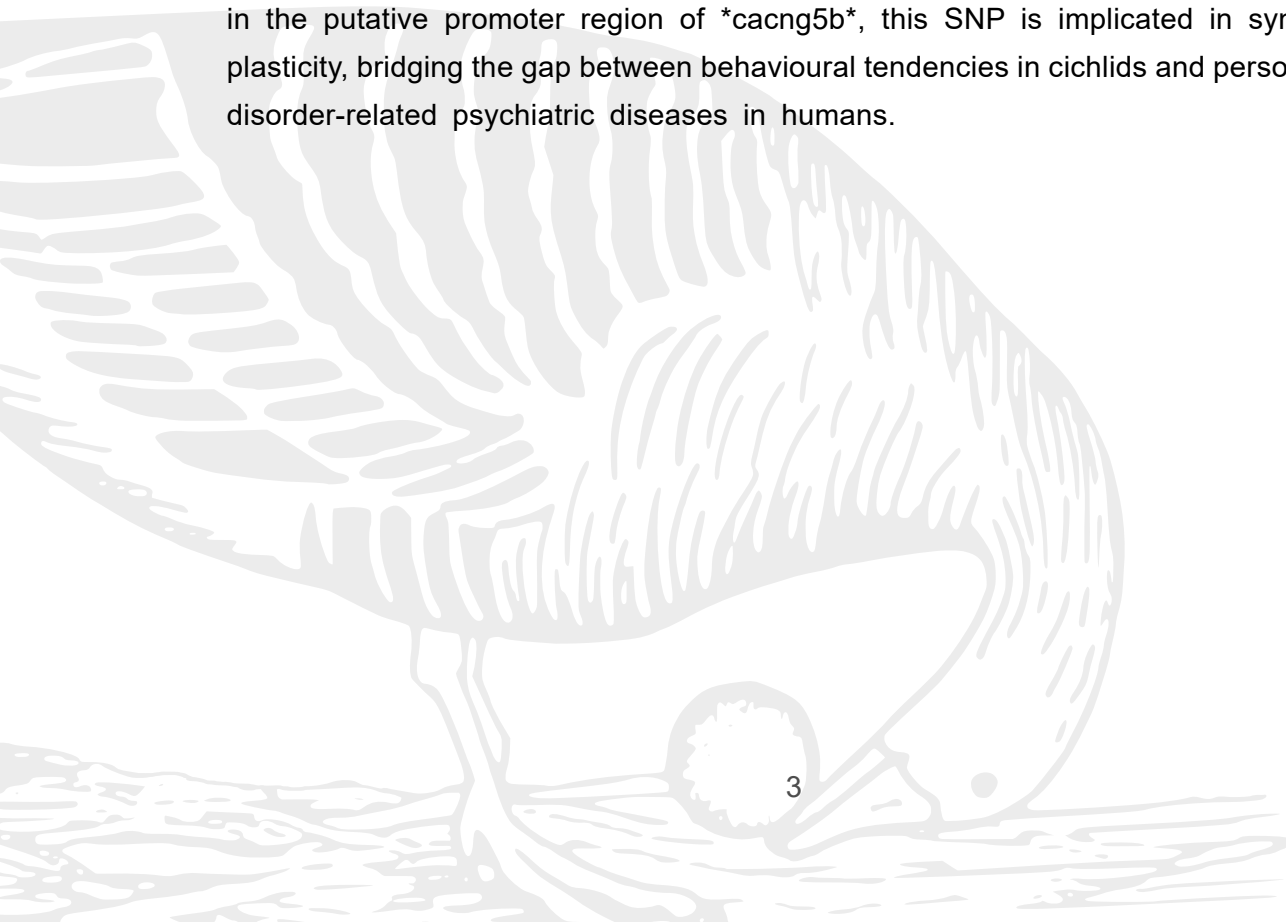
The genetic basis of exploratory behaviour in African cichlid fishes

Carolyn Sommer-Trembo

Universität Zürich



Behaviour plays a pivotal role in survival and reproduction of animals, and potentially drives diversification and evolutionary radiations. Despite its importance, the genetic mechanisms behind adaptive behavioural variation are still largely unknown. Our study delves into the exploratory behaviour of the cichlid fishes of Lake Tanganyika, one of the most extensive adaptive radiations worldwide. By examining the exploratory behaviour of 57 cichlid species (702 wild-caught individuals), we found highly consistent species-specific exploratory tendencies. The integration of the quantitative behavioural data with eco-morphological and genomic information showed exploratory behaviour to be part of a niche-adaptation syndrome in Tanganyikan cichlids. Furthermore, we uncovered an outstanding association between a single nucleotide polymorphism (SNP) upstream the AMPA glutamate-receptor regulatory gene **cacng5b** and differences in exploratory behavior. This relationship was further validated using neural network behavioral predictions and CRISPR-Cas9 genome editing. Located in the putative promoter region of **cacng5b**, this SNP is implicated in synaptic plasticity, bridging the gap between behavioural tendencies in cichlids and personality disorder-related psychiatric diseases in humans.



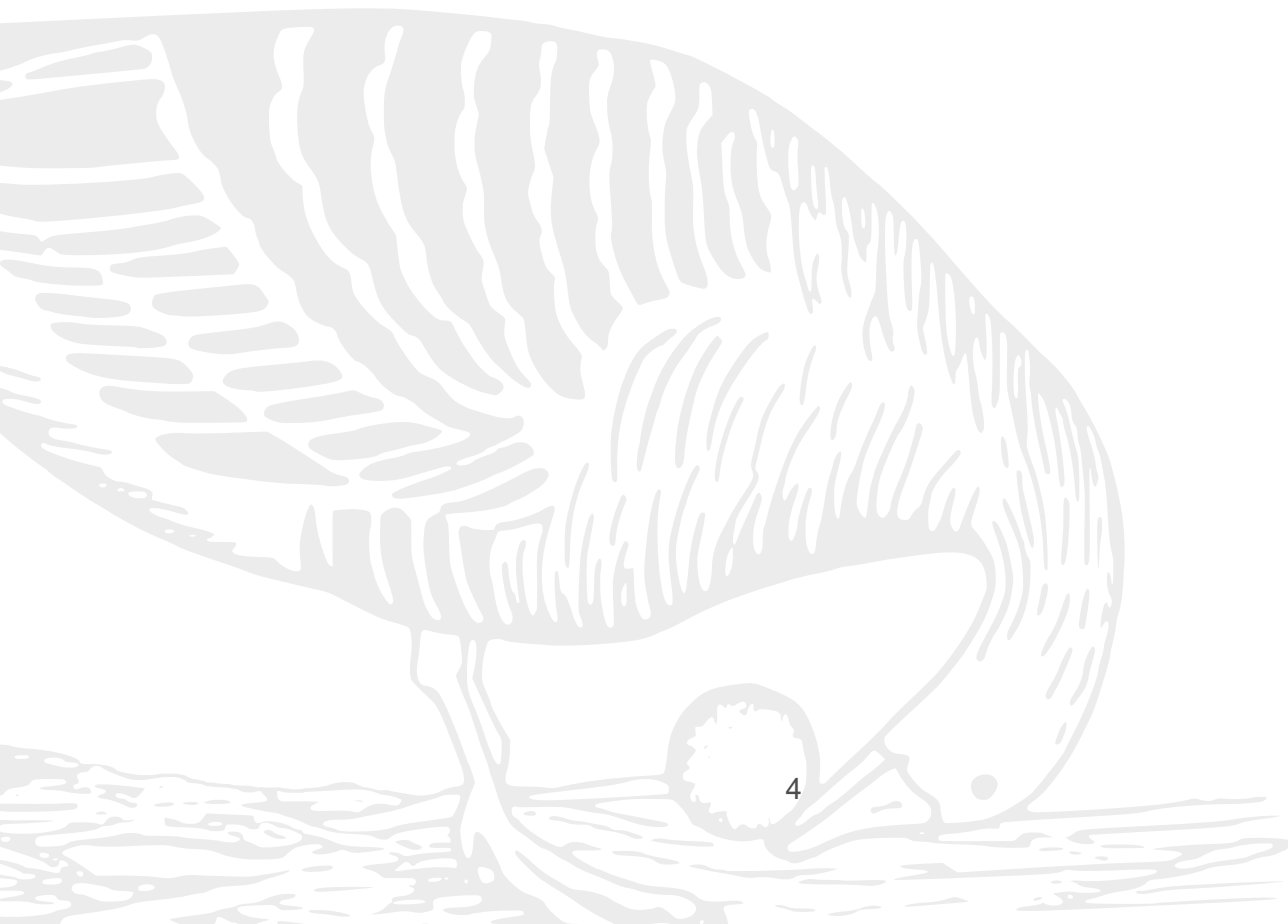
In the eye of the butterfly?

Richard Merrill

Ludwig-Maximilians-Universität München



Visual attraction is an important driver of mate choice and sexual selection, but little is known about the underlying genes, or how they evolve. I will talk about a long-term project focused on the genetics and sensory ecology of visual preferences that are known to contribute to speciation in *Heliconius* butterflies. By combining population genomic and gene expression analyses, data from hundreds of behavioural experiments, and genome editing using CRISPR/Cas9, we have been able to link a specific gene to the evolution of visual preference behaviours. I will discuss how these results i) implicate a role for interspecific hybridization, and adaptive introgression, during the evolution of behaviour; and ii) also show how visually-guided behaviours contributing to adaptation and speciation can be encoded within the genome. Finally, I hope to introduce some emerging work in which we are attempting to place these results within the broader context of visual evolution, including the specific cues involved and shifts in visual acuity associated with changes in habitat.



What is the link between mate recognition and opsin expression in *Morpho* butterflies?

Joséphine Ledamoisel

Centre Interdisciplinaire de Recherche en
Biologie (CIRB) Paris

Vincent Debat; Violaine Llaurens



As visual cues are involved in mate choice in many animal species, mate recognition can impact the evolution of the photoreceptive genes (opsins) involved in vision across taxa. In butterflies in particular, the recognition of visual cues is often involved in mate discrimination. The evolution of their visual system is thus likely influenced by their micro-habitat and the evolution of their coloration. In *Morpho* butterfly species, blue iridescent coloration is observed on the dorsal side of their wings, with variations in light reflectance depending on different angles of illumination or observation. *Morpho helenor theodorus* and *Morpho helenor bristowi* are two subspecies living in the Amazonian forest that display dissimilar blue iridescent patterns on their wings. We investigate whether the detection of visual cues is involved in mate recognition, and test whether the evolution of mate preferences is associated with a distinct evolution of visual systems in those two *M. helenor* subspecies. We first characterized the visual systems of Morphos and the opsin genes involved in color discrimination in this genus. We then quantified the variations of iridescence among those subspecies. Behavioral tests show that *M. h. theodorus* and *M. h. bristowi* display different mating behaviors and different levels of attraction toward iridescent visual cues, despite having identical photoreceptive proteins and similar levels of opsin expression. In light of those results, we discuss the decorrelation between visual discrimination and visual preference and conclude on the link between opsin genotype and mating behavior in *Morpho*.

A supergene shapes diverse reproductive tactics

Clemens Küpper

Max-Planck-Institut für Biologische Intelligenz
Seewiesen



Mating success is a strong component of individual fitness that is often the subject of fierce competition. To obtain a competitive advantage, individuals may deploy different reproductive tactics depending on their own condition, or the tactics employed by others. Individuals may vary in their tactical flexibility but occasionally tactics are fixed for life. Genetic determination of tactics can enable the evolution of specialists with distinct life history strategies. Examining the genomic basis of such tactics can then reveal the mechanistic underpinnings of distinct behavioural phenotypes linked with life history strategies. In ruffs, *Calidris pugnax*, a supergene underlies three male mating morphs with striking differences in size, appearance, androgen levels, and social behaviours. The supergene shows clear hallmarks of antagonistic pleiotropy; its variants do not only have profound fitness consequences for adult males but also for female reproductive success, development and survival of chicks. A detailed examination of transcriptomic differences in males has provided a better understanding of molecular-physiological regulation of sex steroids. Specifically, the concentrations of circulating androgens that vary between morphs are regulated by a single steroid-related gene, HSD17B2, which encodes 17- β -hydroxy-steroid dehydrogenase-2, an enzyme that metabolizes testosterone. HSD17B2 is expressed differentially in neural key tissues of androgen regulation. It may hence also underlie the observed differences in aggression and territoriality between male morphs. Taken together, our studies have identified different mechanisms of balancing selection and the accelerated evolution of a single gene to play a major role in enabling diverse reproductive within a single species.

Genetic architecture of male self-sacrificial traits in a sexually cannibalistic widow spider

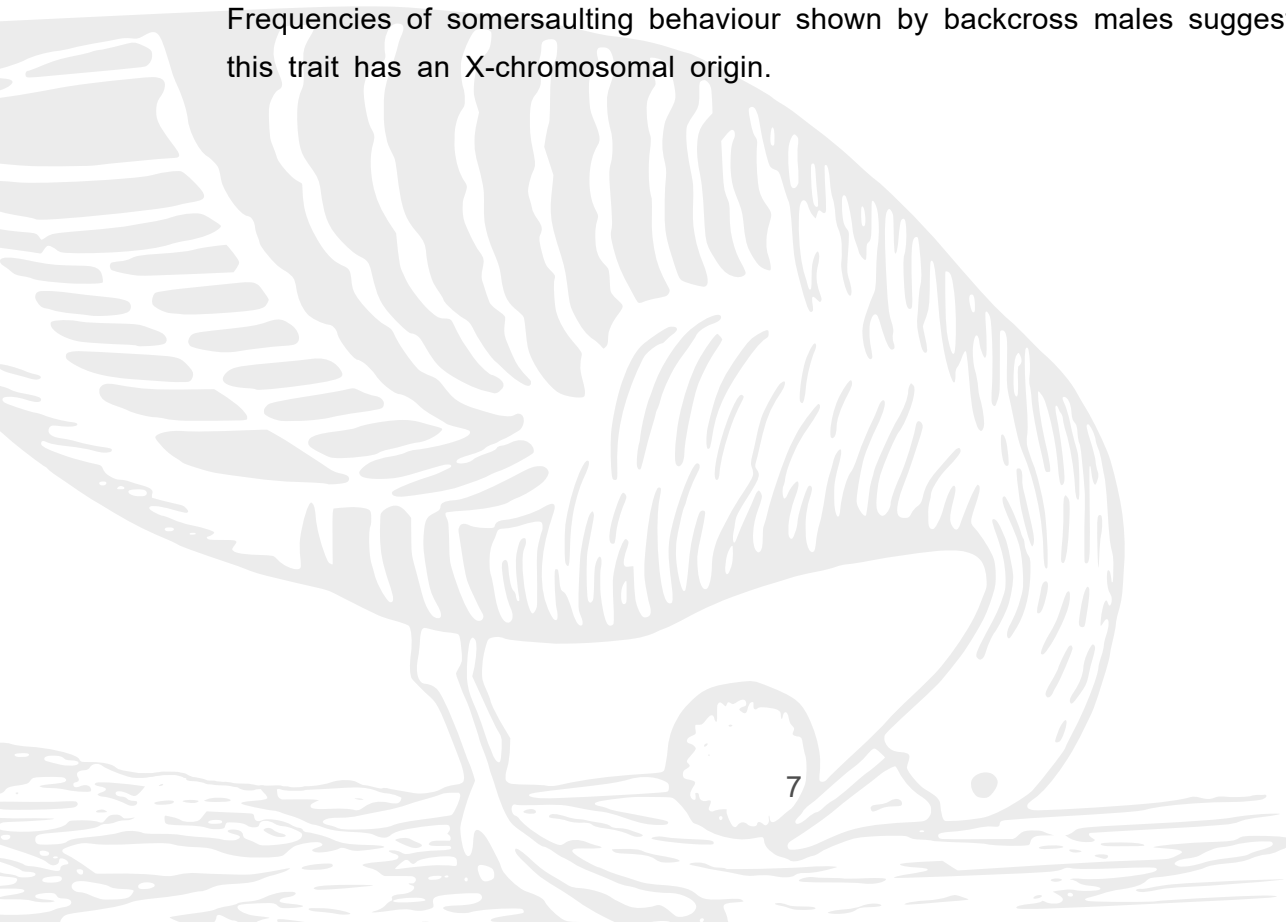
Kardelen Özgün Uludag

Universität Hamburg

Jutta Schneider



Australian redback spider, *Latrodectus hasselti*, is a well-known species with extreme sexual size dimorphism (eSSD) and extreme mating traits. Males show a series of adaptations that facilitate mating and monopolisation of paternity, including a copulatory somersault, mating plugs, and abdominal constriction that prolongs mating during sexual cannibalism. The sister species *Latrodectus katipo*, however, exhibits completely different traits, with lower degree of sexual size dimorphism, males showing none of the extreme mating behaviours found in *L. hasselti* and females showing no cannibalism. *L. katipo* females are able to mate with *L. hasselti* males and produce fertile hybrid offspring. In order to reveal the inheritance of these extreme male mating traits and to enlighten the evolution of different mating systems in these spiders, we used this hybridization and further backcrossing of hybrid females with either *L. hasselti* or *L. katipo* males. Backcross males were then tested with *L. katipo* females and observed during mating for the presence of copulatory somersault. Frequencies of somersaulting behaviour shown by backcross males suggest that this trait has an X-chromosomal origin.



Changes in visual acuity and sensory weighting reflects patterns of neural investment during ecological divergence in *Heliconius* butterflies

Jose Borrero

Ludwig-Maximilians-Universität München

Daniela Lozano; Richard M. Merrill; Elisa Mogollon-Perez; Stephen H. Montgomery; Carolina Pardo-Diaz; Geraldine Rueda-Muñoz; Camilo Salazar; Daniel Shane



As populations diverge across environmental gradients, the reliability of sensory modalities may change, favoring divergence in neural investment and sensory perception. Neotropical *Heliconius* butterflies provide an excellent opportunity to study how different sensory environments shape the sensory and neural systems during the early stages of divergence. During their divergence across closed-forest and forest-edge habitats, closely related butterflies *Heliconius cydno* and *Heliconius melpomene* evolved distinct brain morphologies and eye sizes, with the former investing more in vision. Quantitative genetic analyses suggest that selection drove these changes, but their behavioural consequences remain uncertain. We hypothesized that differences in visual investment, associated with changes in habitat use, may lead to behavioral shifts such as differences in visual acuity and sensory weighting. Tests based on an optomotor response assay revealed higher visual acuity levels in *H. cydno* compared to *H. melpomene*, as well as higher resolving power in males than females. Finally, to test differences in sensory weighting, we trained individuals in an associative learning experiment using both colour and odour cues. When positively rewarded stimuli were presented in conflict, i.e. pairing positively trained colour with negatively trained odor and vice versa, *H. cydno* prioritized visual cues more strongly than *H. melpomene*. Our results suggest that differences in visual performance and sensory weighting stem from divergent neural and investment as adaptations to local sensory environments.

Impact of multigenerational inbreeding on mating and social behaviour in a cichlid fish

Timo Thünken

Universität Bonn



Animal mating systems are assumed to be characterized by outbreeding and active inbreeding avoidance. However, recent studies suggest that inbreeding avoidance is rarer than expected and theory predicts fitness benefits from inbreeding. *Pelvicachromis taeniatus*, a biparental cichlid fish from West Africa has been shown to prefer kin as mating partners. Inbreeding is adaptive because related parents are more cooperative during brood care, while we did not find evidence for inbreeding depression in F1-inbred offspring. Here, we examined the impact of multigenerational inbreeding on kin-mating preference, mate choice and on foraging behaviour in adult fish as well as on kin shoaling (preferences) in juveniles. Continuous inbreeding (resulting from full-sibling mating) altered kin mating preferences. While outbred fish showed similar kin preferences as reported in previous studies, fourth-generation inbred fish preferentially mated with non-kin. Furthermore, highly inbred adult fish were less selective during mate choice with respect to the phenotypic quality of potential partners and in a foraging context with respect to the quality of food resources. Our results suggest that the costs of inbreeding are not constant but change with persisting inbreeding. Kin-mating preferences in adults seem to oscillate according to the associated costs and benefits. In juveniles, inbreeding did not negatively affect kin-shoaling preferences. However, inbred sibling shoals differed from outbred sibling shoals; for instance, inbred siblings recovered more quickly after a perturbation potentially pointing to an improved coordination in inbred sibling groups.

Genetic regulation of complex social behaviors in male mating morphs

Alex Zemella

Max-Planck-Institut für Biologische Intelligenz
Seewiesen

**Vladimir Jovanovic; Clemens Küpper;
Jasmine Loveland; Katja Nowick**



Intense competition over matings has led to the evolution of elaborate ornaments and behaviors in males, allowing dominant individuals to secure most matings. Occasionally, subdominant males adopt alternative mating tactics to achieve reproductive success. These tactics are often associated with distinct physiological adaptations, such as altered concentrations of sex steroids, which are thought to underlie the behavioral differences. However, how variation in sex steroid levels affects the brain, and thus behaviors, remains unclear. In this study, we analyzed transcriptomic data to profile gene expression variation across nine brain regions in a lekking sandpiper, the ruff (*Calidris pugnax*). This species features three genetically distinct mating morphs: Independent, Satellite and Faeder. During the breeding season, males of these morphs show near-discrete variation in aggression and courtship behaviors, as well as in circulating androgen levels. Two non-aggressive morphs, Satellites and Faeders, are characterized by low circulating testosterone whereas Independents have high circulating testosterone and exhibit territorial aggressive behaviors. Simultaneously, Satellites and Independents perform elaborate courtship displays, while Faeders mimic females in appearance and behavior to sneak copulations. Here, we capitalized on the existing natural genetic and behavioral contrasts between ruff mating morphs to investigate the proximate mechanisms of reproductive behaviors in this species. Using a combination of differential gene expression and gene co-expression network analyses, we characterized sets of candidate genes underlying aggression and courtship in the brain of the three morphs. Taken together, these results provide unique insights into the link between gene expression variation and the evolution of complex social behaviors.

Regular Talks

Wednesday, Feb. 19th



Risking infanticide or losing precious time?

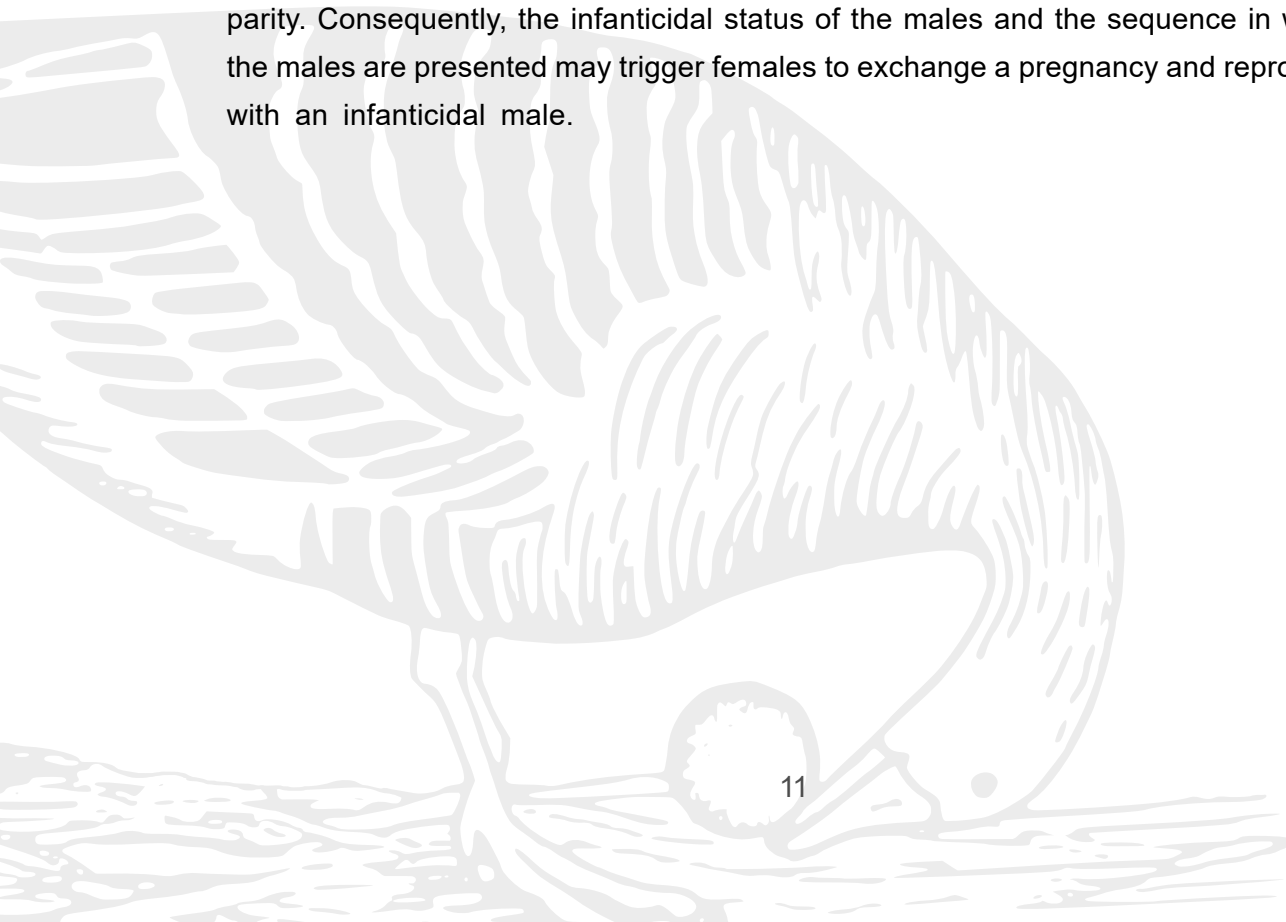
Lea Vodjerek

Universität Potsdam

**Jana A. Eccard; Jasmin Firozpoor; Heiko
G. Rödel**



Nonparental infanticide, or killing of conspecific young infants, is an extreme form of sexual conflict that is widespread throughout the animal kingdom. One of the female counterstrategies to reduce the damage of infanticide is the “Bruce effect”, i.e., the termination of a pregnancy sired by the former breeding male after the invasion of a new breeding male. Using bank voles (*Myodes glareolus*) as experimental subjects we phenotyped males for infanticidal types (attacking unrelated pups or not), and we exchanged the breeding male in the early second trimester of a potential pregnancy, allowing the female to terminate the pregnancy and breed with the new male (pregnancy replacement). We found that the proportion of late litter was significantly higher if the second male encountered was infanticidal, and males' probability to reproduce was affected by both infanticidal tendency and the sequence in which it was presented to the female. We found no connection between infanticidal tendencies and male quality, and females' choice was not affected by male quality or female parity. Consequently, the infanticidal status of the males and the sequence in which the males are presented may trigger females to exchange a pregnancy and reproduce with an infanticidal male.



Into the unknown: Consequences of relocation for adolescent mice

Ekaterina Gorshkova

Max-Planck-Institut für Evolutionsbiologie
Christian-Albrechts-Universität zu Kiel

**Christine Böhmer; Anja Guenther; Daniela
E. Winkler**



The “island syndrome” phenomenon has been recognized since Darwin's time and results in the island population being different in both behavior and morphology from the mainland population. The majority of the studies investigate already accrued changes, but questions about how and what causes these changes remain open. In our study, we focused on the founding generation of wild house mice relocated to “islands,” similar to being introduced to novel environments by human transportation. Our „islands” are seminatural environments with different dietary regimes. These diets varied in consistency but were comparable in caloric content and mimicked the natural diet of the mice. We compared the behavior and morphological traits of mice from “islands” to those of a control population maintained on a standard artificial pellet diet after 8 months. We examined behavioral stress-coping strategies and foraging, as these are critical for survival during and after environmental change. Interestingly, our analysis of stress-coping in the Open Field test and foraging behavior (safe and risky environments) did not reveal statistically significant differences. However, when we looked at morphological traits such as body length, tail length, and masticatory muscle strength, we observed a trend suggesting that these traits are already beginning to diverge from those of the control population. This result stands out since these were the founder generations that experienced relocations as they were already young adults, indicating that morphology is still plastic at that age, however, behavior adjustments need more time.

Reproductive trade-offs and the evolution of sex biases in lifespan

Ella Rees-Baylis

Universität Bern

Colin Olito; Xiang-Yi Li Richter; Lotte de Vries



Patterns of sex biases in mortality and lifespan vary widely across the animal kingdom, yet there is limited consensus on their underlying mechanisms. A major hypothesis is that sex differences in lifespan are adaptive and driven by sex-specific survival-reproduction trade-offs. Due to differences in reproductive roles between the sexes, natural selection may favour different optima in life-history strategies for each sex. For instance, in many species, females often experience mortality costs from offspring production, while males can face trade-offs linked to competition for mates. However, these existing insights are largely empirical, lacking formal theoretical predictions about how these life-history trade-offs influence lifespan evolution. To address this gap, we developed a mathematical model to investigate how sex-specific trade-offs shape the evolution of sex differences in lifespan within a monogamous mating system. In our model, individuals evolve to optimise a trade-off between reproduction and survival, which operates through mate competition in males and offspring production in females. By systematically varying the strength of these trade-offs, we find that either males or females can evolve greater longevity, depending on relative trade-off strengths. However, across the range of trade-off strengths, we find that males outlive females more often under monogamy, aligning with empirical evidence. These findings offer new theoretical insights into the adaptive basis of sex-biased longevity and highlight the importance of life-history trade-offs via reproductive behaviour in shaping lifespan evolution.

Individual variation and plasticity in a producer-scrourer game: a threshold trait model

Dhanya Bharath

Universität Bern

Thomas Ray Haaland; Jonathan Wright



Social systems often exhibit frequency dependence, where the optimal phenotype for an individual to adopt depends on the phenotypes of other individuals in the population. While evolutionary game theory predicts population-level evolutionary stable strategy (ESS) equilibria of phenotypes in frequency-dependent games, it does not discuss individual-level optimal strategies: when populations will consist of ESS frequencies of non-plastic individuals always playing the same fixed tactic, or individuals using plastic strategies to choose the more beneficial tactic preferentially, are unanswered questions. Furthermore, the reaction norm framework to study phenotypic plasticity of individuals in a population has almost always assumed traits that are continuously distributed. Yet, many socially and ecologically important traits have markedly non-linear phenotypic reaction norms and exhibit discrete rather than continuous variation. Therefore, to predict individual behaviour in socially foraging producer-scrourer systems, we use a threshold trait model where the choice to produce or scrounge depends on whether a continuously distributed 'liability' to produce is above or below a threshold. We perform agent-based evolutionary simulations to understand emergent variation in individual tactic use and plasticity in the producer-scrourer game, under diverse regimes of spatiotemporal environmental variation. Resulting reaction norms and population compositions indicate selection for significant among- and/or within-individual variation in tactic use, depending on the timescale and speed of environmental fluctuation. This work highlights the importance of considering the mechanisms of tactic choice when predicting population responses to environmental variation.

Cultural breadth before cultural depth: Insights from evolutionary transitions in individuality

Claudio Tennie

Universität Tübingen

Claes Andersson



Cultural evolution of trait depth is a hallmark of humans, yet it remains rare among other apes. Archaeological explanations often attribute this uniqueness-among-apes to early hominins' abilities to culturally transmit technical know-how, e.g. in Oldowan stone tools (2.6mya). However, Oldowan patterns across time, space, and species do not clearly indicate know-how copying. Various recent findings indicate that these tools may not have required such copying and that other types of social learning sufficed. We propose that human cumulative culture began through the gradual build-up of the number (breadth) of individually developable, interconnected cultural traits specific to their supporting social groups (Andersson & Tennie 2023). The chimpanzee-like splitting and spreading of social groups (demic diffusion) created parent-offspring relations for specific cultural mixes of groups. This situation – rare among the animal kingdom, where number of cultural traits within groups are usually too small – made our ancestors faithfully inherit entire networks of practices without an (initial) need to copy know-how depth. This led to an evolutionary process on the newly created trait network level – an evolutionary transition in individuality (ETI). The breadth of cultural knowledge within groups thereby led, secondarily, to the evolution of cultural depth. Our account has the potential to help solve the question why widespread cumulative cultural evolution of technological depth is rare.

Responsiveness to playback after a recent range expansion: song variation and dispersal tendency related to asymmetry

Xiaoying Xing

Northeast Forestry University, China

**Changjian Fu; Fumin Lei; Hans
Slabbekoorn; Gang Song; Xiaochen Wang;**



Birdsong variation among populations within species has been regarded as a possible precursor for variation between species and may play a role in speciation. However, acoustic variation between two populations of the same or different species can have a variable impact on mutual responsiveness. We currently lack sufficient insight into the underlying reasons, which may be related to song similarity, genetic relatedness, and ecological conditions. We here report on geographic song variation and responsiveness to playback for the light-vented bulbul (*Pycnonotus sinensis*), a species with recent range expansions in China. We tested responsiveness in two southern and two northern locations to songs from southern and northern birds. Besides songs from the other distribution range (south to north and north to south), we used recordings for playback from local, near-by, and far-away dialects from within their own distribution range. Playback results revealed strong discriminatory responsiveness in the south, with birds rejecting almost all non-local songs. Responsiveness to playback in the north contrasted with the south in revealing aggression to a wide-range of stimuli, including local, near-by and far-away northern dialects, which may be related to song type sharing or the individual mobility and aggression associated with the recent range expansion. Our results add a well-replicated case study with an asymmetric response pattern among populations of the same species. We also provide an updated review of what studies on birdsong variation and responsiveness can tell about the potential of birdsong variation to promote avian speciation.

Size-selective mortality impacts the brain and cognitive abilities in zebrafish, *Danio rerio*

Tamal Roy

Humboldt Universität zu Berlin

Pavel Němec; Robert Arlinghaus



Human and non-human predators target individuals of specific size-classes in fish populations. While the larger fish are captured in most fisheries, small fish fall prey to gape-limited fish predators. Increased mortality of larger fish often fosters the evolution of fast life-history emphasizing early reproduction at smaller size, i.e., higher energy investment into reproduction. This could be traded-off with lowered energy investment into other energy-expensive tissues like the brain, thereby leading to reduced brain size and/or reduced neuronal numbers, and reduced cognitive abilities. We tested this using three experimental evolution-generated selection lines of zebrafish adapted to large, random and small size-selective harvesting over five consecutive generations. We assessed the potential for divergent selection responses in size (weight) of the brain and different brain regions, and the total neuronal count. We then tested inhibitory learning ability and flexibility as executive functions in individuals and groups using a detour assay. We found that the absolute weights of brain and telencephalon were significantly higher in the large line fish compared to the control line. The large line fish also had higher number of neurons in the brain and telencephalon compared to the control line. In the detour assay, the small line fish showed significantly reduced inhibitory learning ability and flexibility in behaviour as individuals and collectives, compared to the control line. Our results showed that size-selective mortality can lead to evolutionary changes in the brain and cognitive functions in zebrafish.

Cross-taxa comparison of infant vocalization uttered in low- and high arousal contexts

Marina Scheumann

Tierärztliche Hochschule Hannover



Mammalian vocalizations encode the emotional state of the sender. Thereby, it is assumed that the encoding of emotions follows similar rules in humans and animals based on the similarity of the vocal apparatus. However, increasing studies showed a more diverse pattern, which might be explained using different experimental paradigms or species. In this study, the same paradigm will be applied to various mammalian taxa of five different mammalian orders (Scandentia, Primates, Carnivora, Rodents, Artiodactyla) investigating the encoding of two behavioural contexts in infant vocalizations. In both experimental conditions, infants were separated by their parents and siblings. In the Isolation context, they were left undisturbed inducing a negative emotion of low arousal. In the Handling context, they were manipulated by the experimenter suggested to induce a higher level of arousal. Comparing infant vocalizations between both contexts revealed no universal pattern across species. Whereas some species varied the call type, other species varied the acoustic characteristics of the same call type between contexts. Thereby, the arousal-dependent changes in vocal characteristics were not the same across species. Moreover, for some species, we found variations when testing different age classes. Based on the results it will be discussed that the production of animal vocalizations can reflect behavioural adaptations to the socio-ecological environment.

Reproductive tactics and cognitive trade-offs in male house mice (*Mus musculus*): across controlled and semi-naturalistic environments

Anustup Bandyopadhyay

Max-Planck-Institut für Evolutionsbiologie Plön

**Alexandros Vezyrakis; Fragkiskos Darmis;
Anja Guenther**



Alternative Reproductive Tactics (ARTs) in males represent two distinct strategies for mate and resource access. Territorial males defend mates and/ or resources, whereas roamers, with limited resource access, adopt opportunistic behaviors to overcome disadvantages. Here, we investigated ART-linked differences in spatial (maze) learning, space use, and problem-solving in controlled experiments and semi-natural enclosures in male house mice (*Mus musculus*). In controlled experimental settings, territorials demonstrated superior spatial learning, needing fewer trials to learn to navigate the maze. In contrast, roamers outperformed territorials in problem-solving tasks, showing more targeted interactions and greater success in a complex problem setup, consistent with the Bad Competitor hypothesis. In socially complex semi-natural enclosures, the patterns of controlled experiments were reflected and extended to space use and social interactions. Roamers visited more problem-boxes; boxes containing similar problems with food rewards used in the controlled experiment, placed in various locations across the enclosure. Territorials on the other hand focused on having control over few, specific boxes. Territorials were also more likely to initiate fights and protect the problem boxes from other individuals whereas roamers showed higher tolerance. Interestingly, both tactics spent similar durations in boxes. Overall, our results from controlled experiments revealed the ecological relevance of cognitive differences between ART's: territorials defended problem boxes, i.e., novel food resources, leveraging spatial learning for territory control, while roamers explored more, and conserved energy by avoiding unnecessary conflicts.

Regular Talks

Thursday, Feb. 20th



Human food sources shape daily, altitudinal movements of an alpine corvid species

Kristina Beck

Senckenberg Biodiversität und Klima
Forschungszentrum Frankfurt am Main

Matthias Claudio Loretto



Alpine ecosystems are characterized by extreme environmental conditions that pose significant challenges to animal survival. Some species mitigate these challenges through altitudinal movements, seeking milder conditions and richer resources at lower elevations. While the ecological drivers of these movements have been widely studied, the influence of anthropogenic factors remains poorly understood. Addressing this knowledge gap is crucial in the context of increasing human-induced environmental changes, such as the provision of supplemental food sources, and their impacts on animal movement. Here, we examine the altitudinal movements of the alpine chough (*Pyrrhocorax graculus*), a corvid species known to frequently forage on human food sources. During winter, alpine choughs descend to lower elevations searching for food. Contrary to many other species, alpine choughs return daily to their roost sites located 1500m higher in elevation which renders them an ideal study species to examine altitudinal movements. Using GPS tracking and behavioural observations, we demonstrate that the space use at low elevations overlapped significantly with urban areas where they exploited human-provided food. Moreover, individuals exhibited strong site fidelity, consistently revisiting specific urban locations and following similar routes back to higher elevations. Our findings highlight the profound influence of human activity on the altitudinal movements of alpine choughs. Long-term research is needed to understand how changes in human behaviour and environmental conditions in alpine regions will affect these movement patterns over time.

MoveTraits – using movement data to integrate animal behavior into trait-based ecology

Anne Eberhart-Hertel

Ludwig-Maximilians-Universität München



Animal behavior plays a central role in many ecological processes and has been proposed as an important pathway by which animals can adapt to global change. Trait-based approaches have developed as a key tool facilitating an improved mechanistic understanding of ecosystem dynamics. Yet, to date, animal behavior has not been integrated into trait-based ecology, mainly due to a lack of systematically collected behavioral trait data for wild animals.

We proposed that biologgers can close this gap: movement data in particular have been collected for the past 30 years on many species across the globe and are often archived in movement data repositories. Individual- and species-level summaries of movement behavior, calculated with standardized workflows, can facilitate the integration of movement behavior into trait-based ecology.

We sketch out the practical workflow from raw biologging data to trait metric processing calculation and archiving, and propose an initial suite of metrics and their ecological meaning. We then present a first proof-of-concept movement trait database, based on currently available open-access tracking studies spanning 40 terrestrial mammal and 78 bird species. We illustrate how movement traits summarized at the species, inter-individual, and intra-individual level can fill critical trait data gaps. Beyond their importance for ecological research, movement traits have significant potential to inform predictions whether and how species will be able to adapt to changing environmental conditions.

Navigating a landscape of carcasses: Ravens' behavioral adaptations for locating wolf kills

Matthias-Claudio Loretto

Veterinärmedizinische Universität Wien

Daniel R. Stahler; Kristina Beck; Martin

Wikelski; Kamran Safi; Thomas Müller;

John M. Marzluff



Many species rely on memory of past foraging events to predict future resource distribution. For scavengers, locating food is particularly challenging due to the low spatiotemporal predictability of carcasses. It has been proposed that some scavengers mitigate these challenges by directly following 'carcass producers' such as large carnivores. However, whether scavengers engage in consistent following behavior remains untested. We investigated this hypothesis by tracking 69 ravens, 20 wolves, and 11 cougars in Yellowstone National Park over 2.5 years. Direct following of carnivores was rare, though ravens associated with wolves more often than expected by chance based on shared space use. Instead of continuous following, ravens displayed 'checking-in' behavior, frequently revisiting wolves from large distances (mean = 40 km). They also exhibited oriented movements toward new wolf kill sites over distances of up to 170 km, similar to their frequent movements to permanent anthropogenic food sources like landfills. While the precise time and location of wolf kills are unpredictable, they become relatively predictable at larger spatial scales, such as a wolf pack's territory or productive hunting areas. We conceptualize this as a 'landscape of carcasses'—a probability landscape based on carrion abundance over time. This framework suggests that carcasses are not as unpredictable as previously assumed, enabling ravens, and potentially other scavengers, to efficiently locate these resources using memory of past foraging events rather than direct following behavior.

Small mammals along a gradient of human presence and disturbance: behavioural and cognitive perspectives from the wild

Valeria Mazza

University of Tuscia

**Virginia Schianini; Daniele Canestrelli;
Claudio Carere**



Human activities expose wildlife to multiple novel situations in which the ability to produce innovative behaviour could be beneficial. Innovation is generally considered crucial for survival, particularly in novel, complex, and dynamic environments. However, the relationship between animal innovation and anthropogenic alterations is usually examined within highly urbanised areas, leaving the effects of human disturbance in natural areas – where less innovation-prone animals are presumed to find refuge – relatively uninvestigated.

Here we exploit a gradient of human presence and disturbance that includes areas with different levels of protection within a National Park, as well as green areas in small human settlements outside the Park, to investigate small mammals' innovation propensity. Using standardized tests in the field, we compared innovative problem-solving performance of free-living small mammals in a battery of foraging extraction tasks of increasing difficulty, including four, an escape test, and dietary innovation assessments.

Preliminary results suggest that even low levels of human disturbance are linked to differences in problem-solving performance. Among-individual variation in innovation propensity might thus play a key role in individuals' successful coping with the rapid and recent expansion of humans across environments.

Shaped from an early age: behavioural and hormonal profiles in juvenile guinea pig males living in distinct social environments

Melanie Gleske

Universität Münster

Sylvia Kaiser; Helene Richter



The individualised social niche results from interactions of an individual with its social environment, which can change during lifetime. Thus, individuals need to be able to conform to different individualised social niches over lifetime. Our goal is therefore to elucidate when and how social niche conformance in guinea pigs can occur. In this study, juvenility was investigated: an important developmental phase characterized by prominent changes of the social environment, since the focus on social interactions shifts from parents to peers. For this approach, juvenile male guinea pigs lived in two distinct social environments: while males of both groups lived in heterosexual pairs, males of one group were socially stimulated regularly whereas males of the other group were not. This procedure increases the number of social interactions, which is a crucial factor constituting individualised social niches. Socially stimulated males showed different conformance processes to their social environment in comparison to non-socially stimulated males. They displayed an initially increased stress response, enabling them to adequately react to the unpredictable social encounters. Over time, males then habituated to this challenging environment and displayed a decrease in stress response again. Moreover, only socially stimulated males showed a significant increase of courtship and sexual behaviour with age. Taken together, these findings demonstrate that already in juvenile male guinea pigs the social environment induced hormonal adjustments and behavioural changes and thus established the foundation for social niche conformance.

Frozen oases: Unraveling the winter secrets of the diademed sandpiper plover

Luke Eberhart-Hertel

Max-Planck-Institut für Biologische Intelligenz Seewiesen

Fernando Diaz; Alejandro Pietrek; Cristian Pinto; Andrea Contreras-Sepúlveda; Fabrice Schmitt; Eric Sandvig; Peter Santema; Kim Teltscher; Mihai Valcu; Jim Johnson; Bruce Lyon; Bart Kempenaers



The Diademed Sandpiper Plover (*Phegornis mitchellii*, hereafter “DSP”) is a charismatic shorebird inhabiting the high Andes of South America. Despite the species’ iconic status for ecotourists and ornithologists worldwide, surprisingly little is known about the annual movements of DSP throughout the continent. Current understanding of DSP life history suggests that breeding activities are limited to high elevation (>2500 m) brackish or freshwater wetlands often fed by thermal springs. Although these wetlands experience freezing temperatures, high winds, and/or snowfall over the winter, no DSP have been observed at lower elevations on the Andean Pacific slope, suggesting that DSP remain sedentary at high elevation wetlands or migrate to unidentified regions of the continent. To unravel this ornithological mystery, we deployed Argos tags on DSP at two breeding sites spanning the central core and southern limit of the species’ range: Lagunas de Vilama, Argentina, and the El Yeso Valley, Chile. Data collection during the austral winter is still ongoing, but preliminary evidence suggests that DSP do not exhibit concerted latitudinal or elevational migrations. Rather, DSP remain sedentary around thermal springs used during the breeding season, or move to adjacent thermal springs up to 150 km away – presumably where local carrying capacity allows for over-wintering. Our results demonstrate that DSP are a unique ‘extremophilic’ shorebird whose range may be restricted, in part, by geothermal activity. Future work will document the social cohesion and foraging ecology of DSP at these winter oases, providing insights into their behavioral adaptations and evolutionary history in harsh environments.

Affinity with injured individuals predicts social wound care in ants

Ebi Antony George

University of Lausanne

**Ebi Antony George; Alba Motes-Rodrigo;
Laurent Keller; Eric Frank**



In eusocial insects, workers perform the various tasks necessary for the colony's survival and growth without any centralized control. Foraging is a risky task due to exposure to predators, and foragers often get injured. Recently, it was discovered that ant foragers with injured legs are given wound care by other workers, allowing them to forage again. However, the identities of the caregivers and changes in the colony's social network in response to injured ants remain unknown. We performed experiments using an automated system which tracked the interactions of all individuals in six *Camponotus fellah* sub-colonies to quantify this social care towards individuals with a sterile injury and a fungal pathogen infected injury. We find two novel mechanisms of social care - separation of care provisioning networks from food provisioning networks and care provisioning without discriminating based on the infection status of injuries. Importantly, the affinity of nestmates with the injured ants in the time preceding the injury predicted whether an individual provided care. We also observed localised changes in colony networks with an increase in clustering but no drastic rewiring of the network in response to the presence of injured ants. This was driven by ants which interacted with the injured ants, who showed a transient increase in the number of ants they were connected to following the introduction of the injured ants. These results provide new insights into the role of social interactions in driving task performance and maintaining colony homeostasis in eusocial insects.

Shaping love through microbiome: Microbial composition of sexually-selected scent organ

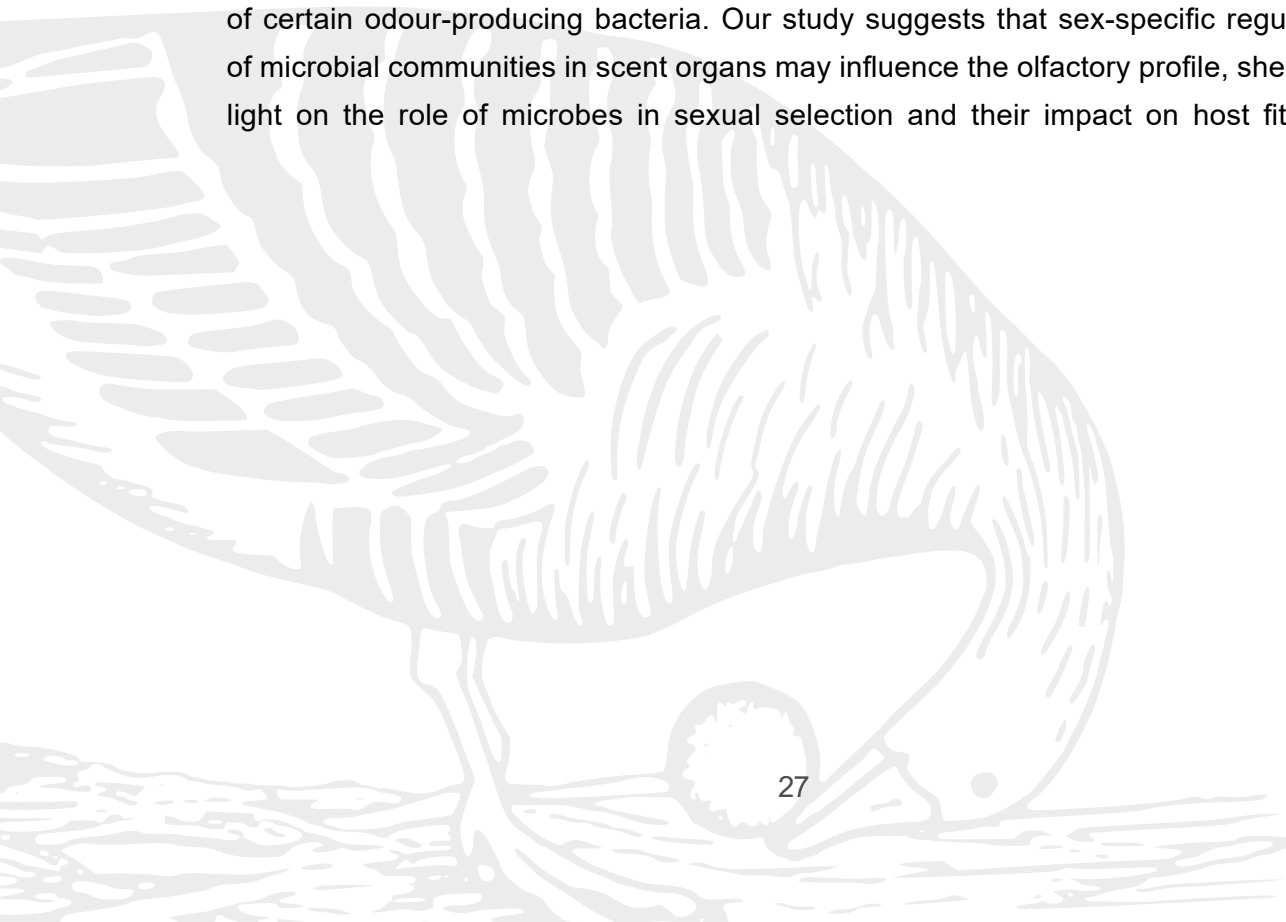
Öncü Maraci Karaoglan

Universität Bielefeld

Barbara Caspers



Chemical cues are crucial in social communication and influence various fitness-related behaviours, including mate choice. These cues are complex traits shaped by external and individual-specific factors, including microbially-produced odours reflecting individual differences in the microbiome. However, it's unclear how animal hosts regulate the microbiome in scent glands. We investigated this in greater sac-winged bats (*Saccopteryx bilineata*), a small, neotropical bat species with a harem-polygynous mating system, which have specialized wing sacs for storing odoriferous secretions used in courtship displays. Males engage in daily cleaning and refilling of these sacs with various liquids. This stereotypic, time-consuming behaviour of perfume blending is proposed to be performed to control microbial fermentation and maintain individual-specific odour profiles. We sampled microbial communities around the wing sacs of 52 bats from two locations in Costa Rica, employing 16s rRNA metabarcoding. We found lower microbial diversity in males, with compositional differences and enrichment of certain odour-producing bacteria. Our study suggests that sex-specific regulation of microbial communities in scent organs may influence the olfactory profile, shedding light on the role of microbes in sexual selection and their impact on host fitness.



Bros and brothers disperse together in spotted hyenas

Eve Davidian

Institut des Sciences de l'Évolution de
Montpellier (ISEM)

Oliver P. Höner



Why do some individuals coordinate their behaviour in space and time and settle in the same breeding group? Is it an active decision that is driven by the selective advantages of settling with kin and social allies? Or the mere consequence of similarities in needs, capacities and available destinations? We examined the likely drivers of the coordination in breeding-group choice among male spotted hyenas. We used 24 years of continuous demographic and social monitoring of the eight hyena social groups inhabiting the Ngorongoro Crater in Tanzania. We compared the choices of 148 pairs of same-cohort males that varied in similarity (i.e., maternal and socio-ecological background and genotype) and kinship. We found strong support for both active and passive processes! Twin brothers who share most cumulative similarity were most likely (70%) to settle in the same group, followed by distantly-related but familiar peers (36%), and of strangers originating from different groups (7%). Also, coordination among twins and other closely-related males increased when population density and associated benefits of kin cooperation increased. I will further cover the implications that these patterns likely have for cooperation between males after clan settlement in their new group.

Female reproductive synchrony in free-ranging dogs

Melissa Vanderheyden

Veterinärmedizinische Universität Wien

Andreas Berghänel; Giulia Cimorelli; Sarah Marshall-Pescini; Friederike Range



In theory, female reproductive synchronization reduces male infanticide and facilitates cooperative breeding and should thus have evolved in many mammal species. However, despite intensive research, evidence for such synchronization beyond seasonal reproduction remains scarce. We report on reproductive synchronization and its dependence on female relationship strength in a large population of free-ranging dogs in Morocco. Our results support current evidence that reproductive synchrony evolved mainly for the benefits of cooperative breeding and the facilitation of allonursing rather than avoidance of male infanticide.



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

Yasmin Naz Akyürek

University of Turin

Brian Fisher; Clelia Gasparini; Sofia Gigliotti; Sylvain Hugel; Cristina Tuni



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 being in even greater risks as they 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. 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. 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=80) and maintained a group of control males (n=80) 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.

Regular Talks

Friday, Feb. 21st



Density-dependent transitions in locust swarm motion: From circular milling to directed marching

Vishwanath Varma

Max-Planck-Institut für Verhaltensbiologie
Konstanz

Luke Costello; Ian Couzin; Einat Couzin-Fuchs; Dan Gorbonos; Gregory Sword



Locust swarms are massive collectives that can number in the billions and span several hundred square kilometres. Consequently they have the potential to disrupt ecosystems and livelihoods during their transcontinental migrations. To date, however, laboratory studies have been limited to a maximum of approximately one hundred individuals with prominent claims suggesting that locusts explicitly align with near neighbors, leading to density-dependent transitions between disordered motion (gas-like behavior) and ordered motion (fluid-like behavior). Our recent findings challenge these claims, showing no evidence that locusts use optical flow or other alignment mechanisms, nor that such transitions occur in small-scale experiments. Here, we present experiments with swarms two orders of magnitude larger than previous studies, involving up to 12,000 locust nymphs in large arenas (~5m). These experiments provide the first evidence of density-dependent collective transitions, including high-order traveling bands and motility-induced phase separation, where stationary clusters coexist with mobile individuals. We show that these transitions are influenced by locust density, arena shape, external cues (e.g., light), life stage, and time. Using reflective motion capture markers, we analyzed individual speeds, relative positions, and pairwise interactions to uncover the underlying mechanics of these behaviors. By modelling locust swarms as continuous media, we attempt to understand phenomena such as traveling wave patterns, phase separation, and dispersal across space. This work advances insights into locust collective behavior and provides a basis for understanding the scaling from individual to collective behavior in this notorious pest species.

Better and faster collective decisions by larger fish shoals in the wild

Korbinian Michael Pacher

Humboldt Universität zu Berlin

David Bierbach; Jens Krause; Lenin-Arias Rodríguez; Yunus Sevinchan



Studies on collective cognition have provided many examples of decision-making benefits in terms of animals sharing information about predators, prey or resources in their environment. It has been shown how the efficient spread of adaptive information within groups can provide benefits which increase with group size. Little is known, however, to which extent groups also amplify maladaptive information such as false alarms and whether such costs reduce or even nullify the above benefits. Here, we investigated fish shoals in the wild that responded collectively with escape dives when attacked by birds. We analysed the response of shoals in reaction to hard-to-detect bird attacks and similar but harmless flybys as a function of shoal size. With increasing shoal size fish increasingly detected predator attacks (true positives) while their false alarms remained constant. Therefore, larger shoals became better at correctly classifying potentially dangerous stimuli rather than becoming more sensitive to all stimuli potentially related to attacks. In addition, decision time decreased with increasing shoal size. Larger shoals were thus able to mitigate two major trade-offs inherent in solitary decision making: the trade-off between true and false positives and the trade-off between speed and accuracy. We report performance increases at shoal sizes of tens of thousands of fish and pose challenges for the modelling of the underlying mechanisms.

Leader-follower dynamics emerge from expertise imbalance during foraging

Dardo Ferreira

Ludwig-Maximilians-Universität München

**Bahador Bahrami; Jumpei Matsumoto;
Andrey Sobolev**



Gregarious animals live and learn together, leveraging diverse knowledge and experience within the group to adapt to environmental challenges. While modern behavioral neuroscience has made strides in understanding individual learning processes, the influence of conspecifics within a task setting remains underexplored. To address this gap, we studied freely moving Mongolian gerbils engaging in a joint auditory discrimination and foraging paradigm, the Sensory Island Task (SIT).

We paired same-sex littermates into dyads with distinct task expertise levels: “experts” (trained individually to achieve high performance) and “students” (initially naive). In the dyad phase, both animals could trigger a single food reward by correctly responding to a sound change. Notably, students demonstrated high task proficiency from their first individual, post-dyadic session, highlighting that they learned during social sessions.

Using cutting-edge analysis methods of behavior and vocal communication in freely interacting dyads, we show that task structure and expertise significantly shapes vocal and locomotor patterns. Vocalizations occurred exclusively in the presence of conspecifics and were modulated by task demands and individual expertise. Furthermore, competition for food rewards led to emergent leader-follower dynamics, characterized by distinct foraging strategies driven by knowledge asymmetry and visual cues.

These findings demonstrate how social interactions influence decision-making, learning, and foraging in a naturalistic, ecologically relevant context. By examining behavior and communication in freely moving animals, our results highlight the interplay between task demands, social dynamics, and expertise differences, offering novel insights into the mechanisms of social interaction.

Urban lizards differ in their use of social information in novel situations

Isabel Damas Moreira

Universität Bielefeld

Avery Maune; Carolin Stober; Barbara Caspers; Isabel Damas Moreira



Urbanization drastically transforms habitats worldwide, imposing new challenges on animals. Social cues can help individuals navigate risky or unfamiliar situations by providing shortcuts to valuable environmental information. However, how social information facilitates adjustment to urban environments remains poorly understood. Since urban populations are hypothesized to better handle unfamiliar situations, an important question is thus whether they exploit social information more effectively in novel contexts.

The Italian wall lizard (*Podarcis siculus*) and the common wall lizard (*Podarcis muralis*) are successful in anthropogenic and novel habitats, thriving as urban and invasive species. These species can occur in syntopy along an urban gradient, making them ideal for comparing social information use and identifying shared patterns or divergences. We conducted field experiments with sympatric *P. siculus* and *P. muralis* in urban and non-urban habitats. Lizards were placed in novel arenas and exposed to two scent-preference tests: (a) conspecific vs unscented control and (b) conspecific vs heterospecific. In test (a), urban and non-urban populations showed no differences in their preference; however, *P. siculus* preferred conspecific scents over controls, consistent with previous research on their social behaviour. In test (b), non-urban lizards preferred conspecific over heterospecific scents, and spent more time in the conspecific-scented area than urban lizards. This suggests that urban lizards of both species are more tolerant of heterospecifics, likely due to habitat limitations, higher densities, and lack of competition over females. Our findings have implications for understanding how cities can reshape behaviour within-and-between species, offering insights into the factors shaping urban success.

Active sensing in groups - the how, what and why?

Thejasvi Ravindra Beleyur

Max-Planck-Institut für Verhaltensbiologie
Konstanz



How individual bats sense the world around them is well understood. Individuals emit loud ultrasonic calls and listen for faint returning echoes to detect objects. Echolocation in groups however, seems paradoxical. Each individual is constantly emitting loud calls, while listening for their own faint echoes amidst a barrage of neighbours' loud calls and echoes. Despite this paradox, bats are extremely gregarious – gathering in the tens to millions. How individuals manage in such a challenging sensory & motor scenario remains to be answered.

In this talk I will present a multi-pronged approach to studying active-sensing groups. From a theoretical perspective, I will present results from modelling showing how echolocation in groups may result in minimal, and yet functional amounts of sensory information for individuals to show collective behaviour. The experimental study of bat aggregations is fraught with complex data, that requires methods development. I will share some of the methods developed to align multi-sensor datasets, and perform source localisation in audio with overlapping signals. Lastly, I will present the pilot 'Ro-BAT' robotic echolocating platform we have been developing. The ROBAT platform will be used to study how echolocating swarms can echolocate together through a combination of manipulative and synthetic evolution experiments. Using a combination of modelling, experimental study in the field and controlled robotics experiments I will provide glimpses into the how, what, and hint at the 'why' of active sensing in groups.

Agonistic acoustic signals in a highly social fish species are a reliable indicator of sex and body size

Miles McGaffighan

Manchester Metropolitan University

Joachim Frommen; Jade Newton-Youens;

Sue Anne Zollinger



Multi-modal communication is an important way to send multiple redundant or non-redundant signals across different media. While visual communication is well described in fishes, knowledge of acoustic signals in aggressive and courtship interactions is limited to a few species. Here we describe visual and acoustic signalling during aggressive encounters in an undescribed species of cooperatively breeding cichlid fish from Lake Tanganyika, *Julidochromis* sp. 'Kombe'. We investigated how signalling varied during staged encounters, depending on sex and size of the test fish. In an agonistic context 272 individual sounds ("purrs") were identified across 9 of the 18 fish recorded, making them the first observed sound producers in the *Lamprologini* tribe. Purring proved to be an escalated form of aggressive signalling, used at a late stage of the aggressive signalling cascade. The number of purrs was positively correlated to the size of the individual, making them a reliable proxy of the individuals' resource holding potential. While both sexes were equally likely to produce sound, males produced longer purrs featuring more pulses than females which produced shorter, faster purrs. In summary, this study provides the first evidence of acoustic aggressive communication in a cooperatively breeding fish species. It helps better understand how sounds are utilised as part of a multi-modal signal in fish and shed light on multi-modal communication in highly social animals in general.

The emergence of division of labour through helping niche specialization

Barbara Taborsky

Universität Bern

Michael Taborsky



Division of labour among group members reflects the pinnacle of social complexity. The synergistic effects created by task specialisation and the sharing of duties benefitting the group raises the efficiency of the acquisition, use, management and defence of resources by a fundamental step above the potential of individual agents. At the same time it may stabilise societies because of the involved interdependence among collaborators. While demand for tasks exists at the group level, assigning them to specific members poses an organizational challenge. The “Helping Niche Specialization Hypothesis” suggests that cues indicating societal demand for tasks, along with the current distribution of help, influence individual biases toward specific task preferences. This process may begin during early ontogeny, even before helping behaviours are actively performed. We propose that early life experiences collected in the larval or juvenile stages can give rise to specialisation in filling particular helping niches when adult. This will be corroborated by examples of how worker control, non-genetic maternal effects and own early environmental experiences can induce task specialisation and, consequently, division of labour.

Asymmetric song and colour recognition across a tinkerbird hybrid zone revealed using playback experiments with robotic models

Alexander Kirschel

University of Cyprus

**Vasiliki Apostolakopoulou; Sifiso Lukhele;
Stacey de Souza**



Both visual and acoustic signals function in mate choice and species recognition, and where related species come into contact, may play an important role in maintaining reproductive isolation. But the relative importance of differences among species in multimodal visual and acoustic signals can be challenging to test experimentally. Yellow-fronted and Southern red-fronted tinkerbird differ primarily in the colour of their forecrown and the speed of their rhythmic song. We tested the strength of responses of each species to models representative of the two phenotypes. Because tinkerbirds produce active movements while they sing, we aimed to replicate this aspect of their visual signal by using robotic models. We used either 3D printed models or mounted skins, the latter including an inflatable balloon within to replicate the tinkerbirds' synchronous air sac inflation while vocalising. To test for differences in responses to songs, we focused on latency to approach, and for differences in forecrown colour, on the closest approach distance in two-choice tests. There were differences in responses to song playback between sympatry and allopatry, with responses stronger to red-fronted playback than yellow-fronted playback in sympatry. Birds also approached closer to the models than the speaker with red-fronted playback than yellow-fronted playback. Furthermore, birds approached closer to the model that matched the playback, especially from red-fronted subjects, consistent with a pattern of asymmetric assortative mating inferred from genomic data, suggesting red-fronted tinkerbirds discern differences between the two phenotypes and mate with partners of their own species.

Posters

Thursday, Feb 20th 14:30 - 17:30



Social information transfer and use during a foraging task in Palestine sunbirds

Dorothea Schwarz

University of Haifa

Shai Markman

Poster 1



Poster

Social information transmission is essential to ecological interactions within and between species. To gain a broader understanding of social foraging and the associated dynamics within pollinator systems, we assessed the role of social information that might be transmitted between individuals. In this study, we examined the ability of Palestine sunbirds, a small pollinator bird species, to use visually revealed information during a foraging task. Wild Palestine sunbirds were captured and given a task with artificial flowers of different colours, only one of which was rewarding. Birds in the test group were allowed to observe an experienced forager on this task before their own performances were evaluated and compared to those of a control group. Although no disparity was found between the observer group and the control group in their first choice, the results revealed significant differences in the foraging success of the groups during the first minute of the task. Observer birds were twice as likely as control birds to reach a rewarding flower within the given time. The observers also exhibited shorter latency to initiate the task and greater persistence during foraging. These results provide evidence that observer birds received and utilized social information, enabling them to outperform control birds in terms of foraging efficiency. Alongside additional research, these findings serve as a basis for our further studies, such as investigating the influence of specific floral nectar alkaloids (nicotine and anabasine) on the behaviour of avian pollinators.

The stability of social relationships during and after establishment of wild house mice populations

Alexandros Vezyrakis

Max-Planck-Institute für Evolutionsbiologie
Plön

Anja Guenther; Valeria Mazza

Poster 2



Poster

Acquiring and maintaining beneficial social relationships is vital for animals in social groups, yet the factors shaping how these relationships are formed and maintained remain unclear. We studied wild house mice (*Mus musculus domesticus*) in four semi-natural enclosures over six months to explore these dynamics. Each enclosure began with 35 founders that were free to associate with each other, form social groups and reproduce, and reached over 100 individuals/enclosure at the end of the study period. Their visits to the provided nests were tracked using RFID antennas. Additionally, we recorded all individuals who visited a voluntary foraging task taking place in empty areas of the enclosures at four different time periods. We investigated whether initial associations, potentially formed by chance, persist through time or whether factors such as kinship or communal nursing influence the formation and maintenance of social connections. To achieve this, we built social networks of each population using the RFID data collected (a) continuously at the nests, i.e. during the resting period and (b) while mice were participating in the foraging task, i.e. during activity bouts. This combined approach will help capture both social interactions that take place in nest, the core of activity for housemice, as well as broader social interactions. Understanding how social relationships evolve as populations establish in new environments will help us uncover some of the evolutionary factors driving sociality.

Nest-building behaviour and social information use in wild jackdaws

Luca Hahn

University of Exeter

**Zazie Benoit-Delaby; Ines Fürtbauer;
Andrew King; Guillam McIvor; Alex
Thornton**

Poster 3



Poster

Animal culture is prevalent across taxonomic groups and socio-ecological contexts, but avian nest construction has been understudied. Birds use learning during nest construction, but it is less evident whether social learning results in architectural traditions. We studied nest-building behaviour and social information use in three nest-box colonies of wild jackdaws (*Corvus monedula*), highly social corvids. To examine socio-ecological factors that determine nest-building behaviour, we documented the phenology and materials of 86 nests. Additionally, to investigate parental effort and social information use, we recorded visits at 40 nest boxes via RFID technology. The start and duration of nest building, and the diversity of materials used, did not differ across colonies and nest-box clusters within colonies. Clusters varied in the extent to which jackdaws incorporated anthropogenic materials, but this effect was likely driven by proximity to anthropogenic environments. The duration of building was not linked to parental visit rate, but jackdaws that started building later adjusted their behaviour by building faster. Birds that did not occupy a nest-box made more prospecting visits than nest-box owners, suggesting that they gathered information about nest sites. Our preliminary results in this ongoing study do not implicate the presence of local architectural traditions. Supporting recent findings on bird nest building, jackdaws showed flexible behaviour, shortening their building duration to synchronise clutch initiation, and selecting anthropogenic materials based on availability. Given that jackdaws prospect during nest building, forthcoming experimental and observational research aims to better understand patterns and consequences of social information use during this phase.

Social competence - what are we measuring?

Aparajitha Ramesh

Universität Bern

Barbara Taborsky

Poster 4



Poster

Social competence is the ability of an animal to optimize social behaviour based on available social information. This ability can significantly impact the fitness of social species which have many social interactions. Yet, understanding the defining traits of social competence is challenging. We successively assigned individuals of the cooperatively breeding cichlid, *Neolamprologus pulcher*, to two opposite social roles: a smaller territory owner (TO) and a larger territory intruder (INT). Socially competent behaviour in these roles differ: as TOs they should submit to INTs to remain accepted in the territory, while as INTs they should quickly take over the territory from TOs. We find that measures of social competence within each context are correlated, but high competence in one role does not predict competence in the other. Instead, we observe individual variation in aggressive behavioural types across contexts which weakly negatively correlates with submission rates. The submissive – non-submissive types have been shown in previous studies to relate to the propensity of philopatry vs natal dispersal. Our findings emphasize the importance of measuring social competence across multiple ecologically relevant contexts, highlighting its complexity in studying behavioural strategies shaping the evolution of social systems.

Resource dynamics and the value of social information: Lessons from oceanic ecosystems

William Oestreich

Monterey Bay Aquarium Research Institute



Poster

Poster 5

Animals rely on information to reduce uncertainty and make informed behavioral decisions in dynamic ecosystems. Such information can be acquired via direct observation of one's environment (personal information) or by observing others (social information). In theory, the relative value of personal and social information depends on the spatiotemporal dynamics of the resource to which the information pertains. Yet empirical tests to refine such theory remain challenging and restricted to a subset of the spatiotemporal dynamics found across Earth's ecosystems. Oceanic ecosystems represent an important gap in this space: these vast and fluid ecosystems comprise >95% of Earth's habitable space and exhibit unique spatiotemporal dynamics, with extremely patchy resources aggregating in ephemeral hotspots. In my research program I explore this gap, combining high-resolution, persistent in situ observations of various oceanic predators' behavior (across individual, group, and population levels) with measurements of physical forcing and resource distribution. Here I focus on Earth's largest predator, the blue whale, showing how long-distance social information enables their collective migration and foraging behaviors. I first show how patterns in blue whales' widely propagating songs encode information about their behavioral state, providing crucial social information for matching breeding migration timing with interannual variation in ecosystem phenology. I then show how separate long-range acoustic signals mediate social foraging aggregations at high-quality but ephemeral prey patches. These discoveries underscore the importance of long-distance social information in vast and dynamic oceanic ecosystems, and provide insights for protecting oceanic predators and the ecosystems they inhabit in an era of rapid change.

Reversed coping styles: proactive individuals have higher glucocorticoid levels under natural conditions

Rebecca Rimbach

Universität Münster

**Melanie Dammhahn; Sophia Kroker;
Rupert Palme; Jules Petit**



Poster

Poster 6

Individuals differ in how they cope behaviorally and physiologically to environmental challenges. These responses are often grouped into sets of correlated traits, referred to as coping styles, where proactive (i.e. bolder or more explorative) individuals are predicted to have lower baseline stress hormone levels than reactive ones. Since coping styles are mainly studied under benign laboratory conditions, we aimed to test the hypothesis that physiological and behavioral traits are correlated in free-ranging adult individuals of two *Apodemus* mice species. We determined fecal corticosterone metabolites (fCM) and assessed behavior in dark-light and open field tests (N = 113 measurements). We repeatedly measured fCM and conducted behavioral tests twice for a subset of 20 individuals. Latency to leave the dark tube (boldness), number of crossings into the central area of the open field (exploration), and measurements of fCM were all repeatable over time. Using bivariate Bayesian mixed models, we estimated among- and within-individual correlations between fCM and both personality traits. We found no support for within-individual correlations, but moderate positive among-individual correlations between fCM and boldness, as well as exploration. Thus, each personality trait was functionally integrated with corticosterone levels into a syndrome, albeit in the opposite direction as predicted by the coping style hypothesis. These results highlighting the complexity of the relationship between behavioral and physiological responses to environmental challenges and additional research is needed to understand which selection pressure under natural environmental conditions may favor such relationships between hormonal and behavioral responses.

From dusk till dawn: Individualisation in activity patterns of a strictly nocturnal European fire salamander population

Sean Gwydion Grond

Universität Bielefeld

Bulisa Masiga; Cemil Durgut; David Kupitz; Jonas Loheide; Laurence Jeanjean; Manuela Schmidt; Pia Deimann; Saskia Ebert



Poster

Poster 7

Conspecifics differ in their behaviour. This variation is partly driven by environmental cues but individuals also show intrinsic behavioural differences. One essential part of animal behaviour is activity. Deciding when to become active drives feeding and movement behaviour and is crucial for intraspecific interactions such as mating or competition.

In this study we investigated the variation in surface activity patterns of a European fire salamander (*Salamandra salamandra*) population. Under favourable conditions, the species occurs in high densities. Fire salamanders in our study population are strictly nocturnal, and can be found from shortly after sundown until the morning. However, individual activity patterns are completely unknown. Furthermore, activity is less studied in nocturnal than in diurnal animals. Most studies conducted on nocturnal activity in amphibians concern anuran species; studies on *Caudata* species are scarce.

With a standardised, non-invasive monitoring method, we observed fire salamander abundance at a high temporal resolution throughout whole nights and subsequently identified recaptures of individuals, utilising A.I. based image identification and manual picture comparison. With that data set we aim to point out peaks in surface activity and assess individual differences in activity patterns. We also look at internal and external drivers of activity differences such as group belonging or habitat parameters. As individual behaviour is understudied in amphibians so far, this study will contribute to a holistic understanding of behavioural ecology in amphibians and will help to develop tailored conservation measures.

Influenced by the tiniest? - The connection between microbiome and animal personality

Sabine Kraus

Universität Bielefeld

Barbara Caspers; Öncü Maraci; Carmen Schwietz



Poster

Poster 8

The presence of consistent differences in behaviour among individuals of the same population, called animal personality, is ubiquitous throughout the animal kingdom and has been recognised as a major contributor to differences in survival and fitness among individuals. However, our understanding of the mechanisms by which personality is shaped and maintained remains incomplete.

The gut microbiome has been increasingly recognised as an essential contributor to host physiology and as a modulator for brain and behaviour, potentially mediating individual differences in behaviour and cognition.

In this study, we investigate whether zebra finches (*Taeniopygia castanotis*), artificially selected for different personalities, differ in their gut microbial communities.

We have developed a standardised test battery comprising three personality traits. We measured aggression towards a mirror, exploration in a novel environment and fearlessness in a tonic immobility test. Faecal samples were taken at the same time as the behavioural testing to analyse microbial communities residing in the gastrointestinal tracts of the individuals. Microbial composition and diversity were analysed using 16S rRNA gene sequencing.

First analyses show that the birds with low trait values for exploration had higher microbial diversity. Furthermore, we found significant differences in community composition between the birds with high and low trait values in fearlessness and exploration selection lines. Albeit correlational, our study offers pioneering evidence for the microbiota–gut–brain axis in birds, laying the groundwork for future microbiome research.

Do problem-solving and behaviour predict life-history traits?

Fragkiskos Darmis

Max-Planck-Institut für Evolutionsbiologie

Plön

Poster 9



Poster

The acknowledgement that individuals within-populations differ consistently in behaviour, for example in boldness or exploration behaviours, has led researchers to also test and establish among-individual variation in cognition and problem-solving. However, it is not well-established how those differences in cognitive performance predict life-history and if they are linked to variation in life-history traits such as reproductive success or growth. Here, using wild house mice (*Mus musculus domesticus*), we attempted to take a step towards that direction and understand if problem-solving performance and behaviour were linked to life-history. Importantly, we also varied an important predictor of mice' growth and reproductive potential, caloric composition of food: we provided two food-qualities, one low and one high, and explored if problem-solving and behaviour (measured in an experimental setup with no confounding factors) explained development and variation in life-history traits in a seminatural context. Our results indicate that there are consistent among-individual differences in problem-solving performance and that food-quality affects the likelihood to solve, among others. In a broader context, our findings suggest that the link between cognitive performance and behaviour, measured in standardised tests, with life-history traits is more complex than previously thought.

An urban gradient and its understory: Do personality traits change with macro- and microhabitat use in two *Apodemus* spp.?

Sophia Kroker

Universität Münster

Melanie Dammhahn; Jules Petit

Poster 10



Poster

Urbanisation significantly impacts environmental conditions of animals. Studies have revealed differences in behaviour of urban and rural populations, potentially allowing individuals of specific behavioural phenotypes to better adapt to urbanisation. However, these studies mainly investigated how behavioural changes along rural-urban gradients are linked to macrohabitat changes (e.g. imperviousness), while very little is known at the microhabitat level. For small rodents, understory is a key microhabitat feature linked to (perceived) predation risk, which is likely altered under urban conditions. Here, we aimed to test whether individuals of *Apodemus sylvaticus* (n=190) and *Apodemus flavicollis* (n=63) exhibit behavioural differences due to microhabitat variations embedded in an urbanisation gradient. We measured three personality traits (boldness, exploration, docility) and assessed ground vegetation coverage at trapping locations as a proxy of microhabitat use. We found that all behaviours were repeatable ($R = 0.25$ to 0.55) for both species. At a macro scale, individuals of *A. sylvaticus* were less docile in more urbanised areas in contrast to *A. flavicollis*. Individuals of *A. flavicollis* were bolder in more urbanised areas but there was no pattern in *A. sylvaticus*. Both species did not change in exploration. At the microhabitat level - contrary to our prediction - individuals' behaviour did not change in function of the ground vegetation coverage. Although our preliminary results did not support our hypothesis linking understory and behavioural differences along a rural-urban gradient, we could show that even closely related species react differently to urbanisation and that general statements should be made with caution.

Small mammal responses to anthropogenic food along an urban-rural gradient

Wiebke Jordis Mette Berns

Universität Münster

Melanie Dammhahn; Rebecca Rimbach

Poster 11



Poster

Urbanisation has a strong influence on the viability of animals. Habitat fragmentation, noise, light and chemical pollution, as well as anthropogenic disturbance, are key aspects of environmental change caused by urbanisation. Only a limited number of species tend to thrive in urban environments and behavioural adjustments appear to play a major role in this process. Specifically, how animals respond to novelty appears to be an important predictor of adjustment to urban conditions. Furthermore, urban individuals tend to be bolder and more flexible in their behaviour than rural individuals. Using a cafeteria experiment performed along a rural-urban gradient in Münster, we aimed to test for differences in reactions towards novel food sources in small mammals. We placed "spyboxes" with cameras for three consecutive days and nights at 20 study sites and monitored the reactions to novel and known food of three different taxa of small mammals: shrews (*Crocidura spp.*), wood mice (*Apodemus spp.*) and bank voles (*Myodes glareolus*). Across species we found no support for individuals from more urbanised areas being more likely to interact with novel food than those from more rural areas. However, urban individuals tended to interact faster with novel food sources. Thus, in contrast to other previous studies small mammals did not show differences in most responses to novel food sources along the urban-rural gradient and hence, reduced neophobia and increased neophilia might not be prominent in all species successfully adjusting to urban conditions.

Social life in the city: how urbanization is shaping social behavior

Avery Maune

Universität Bielefeld

Barbara Caspers; Isabel Damas-Moreira

Poster 12



Poster

Urbanization is a key driver of environmental change, presenting animals with novel challenges and environmental stressors. It is well established that environmental conditions can largely influence social behavior, and thus urbanization has the potential to reshape social interactions within- and between-species. Given its critical role in reproduction and survival, understanding how social interactions change in response to urban conditions is crucial in addressing species responses to urbanization.

We conducted an extensive systematic review, synthesizing literature investigating the impact of urbanization on social behavior, which resulted in 227 studies divided into three key topics: (i) comparisons of intraspecific social systems between urban and non-urban populations ($n=170$), (ii) social responses to specific urban stressors ($n=75$), and (iii) changes in interspecific social interactions ($n=10$). Our literature search revealed several trends, biases, and gaps. For example, 62% of all studies focused on birds, and 85% of studies testing urban stressors investigated the effects of anthropogenic noise. Given animals exhibit diverse social systems, there is obvious substantial variation in social responses to urban conditions. However, we identify trends and draw on studies investigating environmental change more broadly to form predictions. We suggest guidelines for future research, that are necessary to allow for better generalizations across taxa, and to quickly address species responses to spreading urban areas. Understanding the causes and consequences of social responses to urbanization across taxa may be key to explaining why some species thrive in cities while others are excluded. This knowledge is crucial to inform conservation efforts and guide urban planning.

Phenotypic flexibility in the city: A meta-analysis on variation

Jules Petit

Universität Münster

Melanie Dammhahn

Poster 13



Poster

Phenotypic flexibility represents reversible phenotypic transformations individuals can express (i.e., within-individual variation). Individuals with high phenotypic flexibility are predisposed to show a larger range of phenotypic responses than individuals with low phenotypic flexibility. In the context of rapidly fluctuating environments - within the lifetime of an individual - the capacity of phenotypic flexibility in behaviour, physiology and morphology could be highly adaptative to match new environmental conditions. Previous work suggests that individuals show higher phenotypic flexibility under increased environmental heterogeneity or variability. However, this prediction has not been tested rigorously. Urbanisation offers an ideal set-up as urban environments are assumed to be more heterogeneous and variable in space and time, due to e.g. habitat fragmentation and temporal anthropogenic food sources variation. Using a meta-analysis approach, we tested the hypothesis that individuals of urban populations show higher phenotypic trait flexibility than their rural counterparts. We extracted 128 variance components resulting in 74 effect sizes to compare urban and non-urban populations across multiple labile phenotypic traits from 25 studies including 18 species. After partitioning variation into between-individual (fixed variation) and within-individual variation (reversible variation), we found - in contrast to our prediction - that across taxa both types of phenotypic variation did not differ between individuals from urban or non-urban habitats. We discuss how taxonomic bias (66% bird species) and methodological bias (e.g. measurement scales) affect our results. Equal levels of phenotypic flexibility could result from convergent selective pressure - maintaining phenotypic integrity within individuals - for both urban and non-urban populations.

Urbanization and acute stress do not influence sleep expression in lizards

Nitya Mohanty

Museum National d'Histoire Naturelle

Dhanya Bharath; Mihir Joshi; Paul-Antoine Libourel; Maria Thaker



Poster

Poster 14

Animals can sleep variably, with substantial flexibility in sleep duration and distribution, in response to ecological conditions. However, robustly quantifying sleep variation at ecologically relevant scales (across individuals and populations), is challenging in small animals, such as lizards. Using recently developed miniature loggers, we recorded sleep in 19 wild-caught individuals of *Psammophilus dorsalis* lizards. First, we validated the use of electrooculogram (EOG) as a proxy for sleep in lizards by comparing it to diel variation in arousal response. We then compared three populations each from urban and rural environments, for EOG-derived sleep parameters (sleep duration, bout frequency, duration, and interval), and behaviourally-measured sleep intensity (latency to arousal). Finally, we simulated a predation attempt that induced acute stress in these individuals and tested for changes in sleep response across populations. Lizards slept mostly at night, with a total sleep time of on average 11.7h, typically in 60 min bouts separated by 8 min of wake state. Sleep characteristics did not differ between urban and rural lizards, though daytime sleep bouts were shorter and more consolidated in urban lizards. Contrary to evidence from mammals, acute stress did not impact sleep, overall or with respect to populations; therefore, a greater diversity of animal taxa must be investigated to determine how sleep varies across populations and in response to ecological stressors. In robustly measuring sleep-wake patterns in small vertebrates at a population level, our study paves the way for quantifying sleep responses over longer time periods, in mesocosms and in the wild.

Neophobia across social contexts in juvenile herring gulls

Sophia Knoch

Ghent University

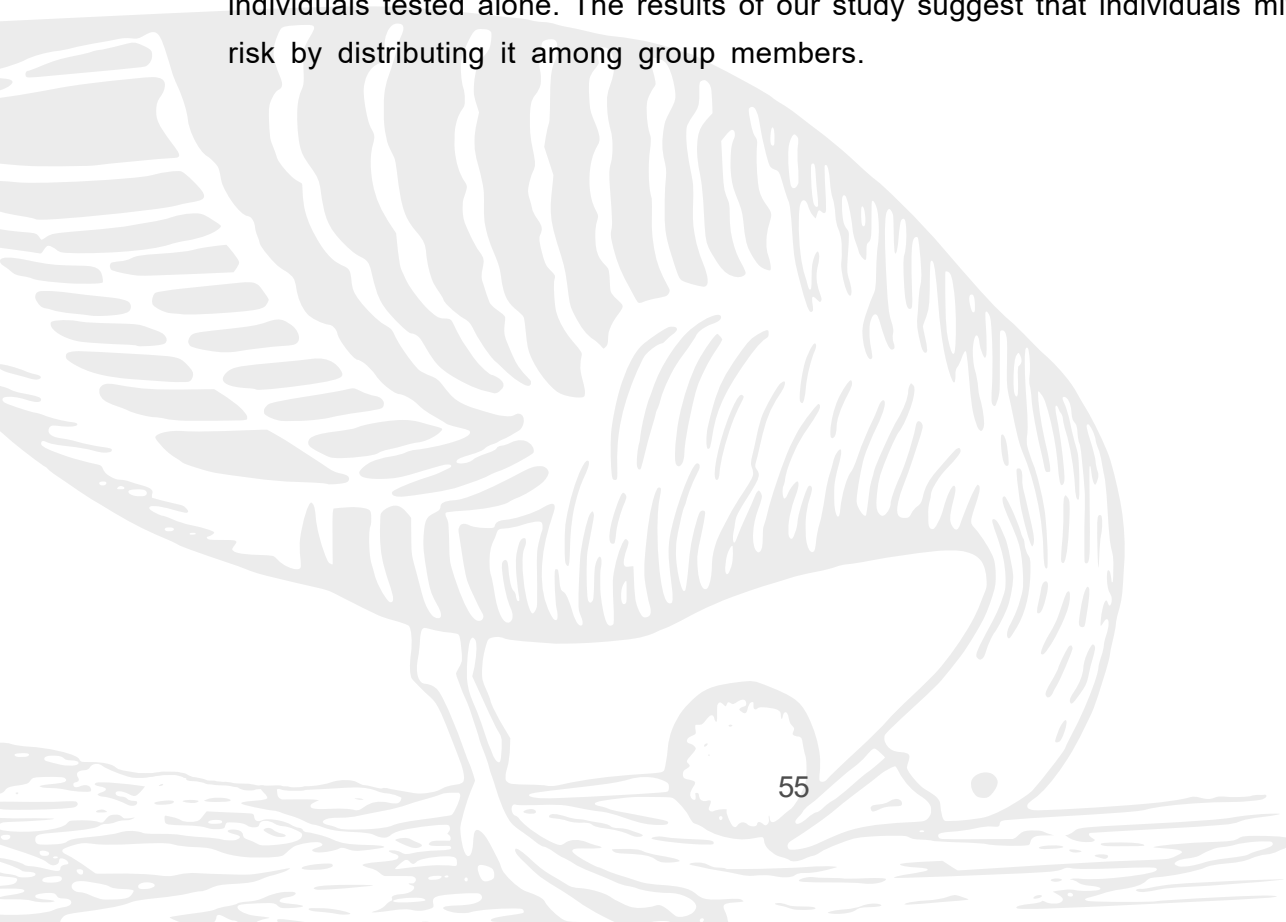
**Simon Braem; Dries Debeer; An Martel;
Wendt Müller; Eric Stienen; Luc Lens;
Frederick Verbruggen**



Poster

Poster 15

Neophobia, the fear or avoidance of the unfamiliar, can have significant fitness consequences. It is typically assessed by exposing individuals to unfamiliar objects when they are alone, but in social species the presence of conspecifics can influence neophobia. However, previous research on the effect of group dynamics on neophobic responses has produced mixed results. Here, we explored the degree of neophobia of an individual in different social contexts in a highly social species, the herring gull. To this end, we exposed juvenile herring gulls to novel objects in both individual and group settings, repeating each condition twice to establish reproducibility. Individuals in groups were quicker to eat, and spent more time near a novel object than individuals tested alone. The results of our study suggest that individuals mitigate risk by distributing it among group members.



Separating movement and function: Assessing time allocation during spatial exploration

Dimphy van Boerdonk

Universität Münster

Melanie Dammhahn; Filippa Erixon

Poster 16



Poster

Exploration is one of the most widely studied animal personality traits and its key functions are to help animals familiarize themselves with the environment or gather information. Exploration is most commonly measured by movement within a novel environment or open field. Variation in this movement behaviour is however likely driven by multiple factors and information gathering may not be prime among them. Hitherto, the link between spatial movement and information gathering is largely assumed, but has rarely been tested explicitly, and novelty is usually used as a stand-in for information. By introducing a potential non-novel source of information inside of a multicell maze, we aimed to disentangle interactions with information from other drivers of movement within a novel environment. A total of 76 bank voles (*Myodes glareolus*) were allowed to explore the maze two times for 15 min. We assessed time investment in informative versus less informative cells and in cells of different safety. Though animals spend most of their time in safer cells, they also allocated more time to informative cells compared to less informative cells. This pattern suggests that, under equal safety, information does have an impact on explorative movement and time investment in a structured novel environment. We show that safety and information-value likely contribute in different ways to spatio-temporal patterns. Thus, while time allocation within a novel environment might reflect information gathering, our findings also suggest that care is needed in designing tests to quantify exploration as it relates to information gathering and not just movement.

Seabirds increase hunting efficiency by associating with underwater predators

Max Licht

Humboldt Universität zu Berlin

Alicia Burns; Felicie Dhellemmes; Amy Then; Edna Correia; Matthew Hansen; Stefan Krause; Palina Bartashevich; Jens Krause

Poster 17



Poster

Associations between predator species are a frequent occurrence in the open ocean. Groups of marine predators target the same prey group, often small schooling fish like sardines, in so called multi-predator feeding aggregations. Among these the most commonly described associations are those between seabirds and underwater predators. However, detailed behavioural observations are difficult in the open ocean and previous work has primarily focused on describing co-occurrence of different species rather than assessing actual hunting performance. A limited number of studies have worked with detailed footage during these hunting events and were able to show benefits for at least one predator species. To accurately assess the increase in hunting performance a species gains by associating with another, foraging behaviour of a species foraging *alone* must also be monitored. Here I show first data from Malaysia in which we assess the hunting behaviour of bridled terns (*Onychoprion anaethetus*) with and without association with teleost predators. Terns not only increase their hunting performance when foraging with other predators, but the associations also trigger a curious self-organised behaviour in the seabirds.

Back to the assumption: Does seed diversity reflect foraging time under different perceived predation risks?

Marion Varga

Universität Münster

Jana Anja Eccard; Melanie Dammhahn

Poster 18



Poster

All prey animals face the trade-off between acquiring food and avoiding predation. Giving-up-densities (GUDs), the resource density that remains after an animal quits a patch, are widely used in behavioural ecology to quantify perceived risk while foraging. Recently, it has been further developed to measure cascading effects of variation in foraging behaviour via resource diversity at GUD (DivGUD). However, the reliability of GUD and DivGUD as indirect measures of foraging activity under risk are rarely tested. Here, we aimed to test the key assumption of the theoretical framework by linking GUDs measurements with real time spent in patches of different predation risks. We set up 60 feeding stations - refilled in a 10/14h day/night cycle for six days - with a mix of seeds in large near-natural grassland enclosures where perceived risk was manipulated via vegetation height. Twenty stations were additionally equipped with both plate antennas and camera traps. Camera traps recorded visitation rates and foraging duration of all visitors, detecting bank voles (**Myodes glareolus**) and yellow-necked mice (**Apodemus flavicollis**). Plate antennas provided individual identification and quantified patch use for 10 RFID-tagged bank voles. We estimated quitting harvest rates for seeds of different functional traits along a vegetation gradient, calculated α -DivGUD and constructed harvest rate curves. Based on these measures we assessed the robustness of the GUD method for application in DivGUD studies, providing a critical step towards the interpretation of cascading effects of prey behaviour on biodiversity while offering a replicable framework for cross-method validation in optimal foraging theory.

Goats who stare at wolves – first steps in the development of an affect-driven attention bias test for small ruminants

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Dummersdorf

Anja Eggert; Steve Lebing; Christian Nawroth

Poster 19



Poster

The assessment of affective states is of central importance in animal welfare research. One way to do this is by linking them to an animal's attention to environmental stimuli as individuals in negative affective states tend to focus more on threatening compared to neutral or positive stimuli (so-called affect-driven attention bias). As one of the first steps in developing and validating an affect-driven attention bias test for goats, we aimed to identify visual stimuli that goats perceive as potentially threatening using a looking time paradigm. We exposed 30 subjects to photographs of 12 different animal species (6 natural predators of goats vs. 6 non-predatory species) from three different taxa (mammals, reptiles, birds) shown for 10 seconds on either the left or right video screen of an experimental apparatus. Each animal participated in four sessions á 6 trials, two in which the whole body of the stimulus animal and two in which only its face was presented, resulting in 24 trials per test subject in total. Subjects' looking duration was analysed using a linear mixed-effects model. We found an interaction effect between the presented taxon and whether the presented stimulus individual was a predator or not ($p = 0.01$). Subjects paid more attention to predatory compared to non-predatory reptiles, while for mammals the opposite pattern occurred. These findings indicate that the use of stimuli from predatory reptiles (in our case snakes) has the potential to serve as negative stimuli in a subsequent attention bias test, although further validation is needed.

In the nose of the beholder: the role of olfactory cues and MHC compatibility on female mate choice in zebrafish

Maria Santacà

Universität wien

**Alessandro Devigili; Alessandro Grapputo;
Clelia Gasparini**



Poster

Poster 20

Research on mate choice has mainly focused on the role of morphological traits, but other sensory modes may play an important role. Since olfactory cues are likely related to compatibility among the partner at major histocompatibility complex (MHC), they could strongly affect female mate choice in a macrosmatic species such as the zebrafish. We assessed the role of visual and olfactory cues on precopulatory mating preference and, subsequently, we investigated the genetic similarity at MHC loci. To do so, we presented the same two males to a female in two consecutive days, but one day the female could rely only on vision to choose between males whereas the other day also olfactory cues were provided. Completed the trials, all females and males were genotyped to determine their MHC similarity. Our results revealed that olfactory cues changed not only the strength but also the direction of mate choice in the zebrafish. Moreover, only when olfactory cues were provided, females preferred males with a higher number of unshared MHC alleles and also males that were more genetically different at those loci. No preference for a higher MHC compatibility was indeed found when females could rely only on visual cues to choose between the two males. Thus, our results revealed that olfactory cues convey information about MHC compatibility that influence social and reproductive behaviors in the zebrafish with females willing to maximize the resistance of offspring towards potential infections.

The impact of visual illusions on mate choice in ring doves

Finn Kreuzer

Universität Wien

**Clíodhna Quigley; Virginie Canoine;
Leonida Fusani; Maria Santacà**



Poster

Poster 21

Physical attractiveness is a critical factor in mate choice, influencing reproductive success in many species. However, attractiveness is not an objective quality and can be shaped by context-dependent perception. Visual illusions—perceptual distortions that arise from specific environmental or contextual cues—can alter the perception of traits such as size, potentially affecting an individual's evaluation of potential mates. Although visual illusions are known to occur naturally and have been studied in controlled settings, their role in shaping social decisions, such as mate preferences, remains largely unexplored in non-human animals.

This study investigates how visual illusions influence mate choice in ring doves (*Streptopelia risoria*), using the classical Ebbinghaus illusion. This illusion alters the perceived size of a central object based on the size of surrounding elements. In this experiment, female doves will be exposed to video playbacks of the same courting male displayed in two opposing illusory contexts. Behavioural and endocrine responses will be quantified as proxies for sexual interest.

This study is ongoing and focuses on understanding how perceptual distortions influence mate selection. It represents a first step toward exploring the role of sensory manipulation in social decision-making. By presenting our experimental design and preliminary insights, this poster aims to foster discussion on the cognitive processes underlying mate choice and the broader implications of visual perception in animal behaviour research.

From the periphery to the brain: variable visual system investment influences visual behaviour in *Heliconius* butterflies

Shane Wright

Ludwig-Maximilians-Universität München

Anupama Manuel; José Borrero; Benito Wainwright; Caroline Bacquet; Stephen Montgomery; Richard Merrill



Poster

Poster 22

When populations experience different sensory conditions, natural selection may favor sensory system divergence. To date, most sensory adaption examples involve single aspects of sensory perception (e.g., colour vision), whereas few studies consider the multifaceted nature of sensory perception. We examine the evidence for habitat-associated sensory system adaptation across different levels of the visual pathway and assess the behavioural implications. *Heliconius erato cyrbia* and *H. himera* are closely related butterflies distributed across an environmental gradient in Ecuador: *H. e. cyrbia* occurs in low-elevation wet forests, whereas *H. himera* occurs in higher semi-arid forests. Prior reports suggest habitat-associated neural adaptation; the brain regions associated with visual processing are larger in *H. e. cyrbia*, and in choice assays, visual stimuli are preferred over olfactory cues. To examine the evidence for visual system adaptation more broadly, we reared both species and report more ommatidia in the eyes of *H. e. cyrbia*, and more ommatidia in males of both species. We also performed the first tests of visual acuity in *Heliconius*: *H. e. cyrbia* has higher acuity, and males have higher acuity than females. Visual modeling suggests that acuity may differentially influence the perception of wing pattern vs. colours elements, and eyeshine experiments revealed species- and sex-specific differences in colour sensitivity. Finally, we tested if sensory adaptations converge under similar environmental conditions by including additional populations: *H. e. lativitta* from low-elevation wet forests in Ecuador (but allopatric to *H. e. cyrbia*), and *H. e. venus* (forest resident) and *H. chesteronii* (montane resident) from Colombia.

A small vocal repertoire during the breeding season expresses complex behavioral motivations and individual signature in the common coot

Xiaoying Xing

Northeast Forestry University, China

Changjian Fu; Atul Kathait; Feng Li; Xiang Li; Guangyi Lu

Poster 23



Poster

Although acoustic communication plays an essential role in the social interactions of Rallidae, our knowledge of how Rallidae encode diverse types of information using simple vocalizations is limited. We recorded and examined the vocalizations of a common coot (*Fulica atra*) population to test 1) different call types can be emitted under different behavioral contexts, and 2) variation in the vocal structure of a single call type may be influenced both by behavioral motivations and individual signature. We measured 61 recordings of 30 adults while noting the behavioral activities and compared acoustic parameters of the same call type emitted under different behavioral activities to determine how frequency and temporal parameters changed depending on behavioral motivations and individual differences. We found that adult common coots had a small vocal repertoire, including 4 types of call, composed of a single syllable that was used during 9 types of behaviors. The 4 calls significantly differed in both frequency and temporal parameters and can be clearly distinguished by discriminant function analysis. Call *a* was the most commonly used (in 8 of the 9 behaviors detected), and maximum frequency of fundamental frequency and interval of syllables contributed the most to variation in call *a*. Syllable duration in call *a* can vary with different behavioral motivations after individual vocal signature being controlled. These results demonstrate that several call types of a small repertoire, and a single call with function related changes in the temporal parameter in common coots could potentially indicate various behavioral motivations and individual signature.

Subspecies taxonomy and inter-population divergences of the critically endangered yellow-breasted bunting: evidence from song variations

Xiaoying Xing

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**Wenshuang Bao; Geoffrey John Carey;
Batmunkh Davaasuren; Zhongyong Fan;
Jun Gou; Yukihiro Hanada; Makoto
Hasebe; Paul Ian Holt; Atul Kathait; Xiang
Li; Kiyoaki Ozaki; Lukas Pelikan;
Alexander Thomas; Siyu Wang**

Poster 24



Poster

The critically endangered Yellow-breasted Bunting has undergone population collapse globally because of illegal hunting and habitat deterioration. It was listed as critically endangered (CR) by the International Union for Conservation of Nature (IUCN) in 2017 and designated a Class I (highest level) national conservation bird species in China in 2021. Birdsong in the breeding season is the main communicative signal under sexual selection, and song variations have long been considered critical evidence of divergence among subspecies or populations. We compared the songs of 89 males from 18 populations to test subspecies taxonomy. We found that songs of the Yellow-breasted Bunting *Emberiza aureola* are subspecies specific and that three subspecies can be clearly discriminated by song divergences. Moreover, an analysis of multiple vocal traits supports the claim that *insulana* is distinct from *aureola* and *ornata*. Finally, at the geographic population level, populations can be clearly classified in accordance with the three subspecies, although the **aureola** population in Xinjiang, China is differentiated from other populations of the same subspecies. The results of this study demonstrate that all populations and subspecies are unique and should be protected to maintain intraspecies song diversity. In addition, several specific populations, such as *insulana* populations in Japan and the Xinjiang, China population of *aureola*, need to be paid special attention to prevent the extinction of unique or local taxa.

Should you keep the table talk light? How communication influences foraging behavior and success in the Common Raven (*Corvus corax*)?

Grigorios Nikolopoulos

University of Copenhagen

Thomas Bugnyar, Silvia Damini; Elodie Mandel-Briefer; Jim McGentrick

Poster 25



Poster

Social foraging can be advantageous, as conspecifics may provide information about food and reduce predation risk. Concurrently, it increases competition, and acquisition of resources can become strenuous. Common ravens are social scavengers that regularly form foraging groups with moderate to high fusion-fission dynamics. When ravens find a food source they cannot access alone, they tend to produce a distinctive food call, also known as the “Haa” call. In previous studies, these calls were found to be functionally referential, meaning that they provide sufficient information to the receiver about the context of the call. The relationship between calling and foraging efficiency, however, remains unclear. Here, we examined the hypothesis that “Haa” calls influence foraging behavior and foraging success. More specifically, if “Haa” calling expresses the birds’ motivation to feed, we predicted that call rates before feeding should positively correlate with the number of agonistic interactions during foraging and the success in obtaining and/or keeping food, as the birds will be more eager to obtain food,. We video-recorded the behavior of individually marked free-ranging ravens as they joined standardized feedings of wild boars in the Cumberland Wildlife Park, Austria and recorded their calls before and during those foraging events. Furthermore we explored how calling influences behavior around a foraging problem using the loose-string paradigm in four pairs of captive ravens. We found some of the predicted relationships between call rates and agonistic interactions, as well as measures of foraging success and here we discuss our results on the group and individual level.

Bird song plasticity and multimodal shift along noisy rivers

Léna de Framond

Max-Planck-Institut für Biologische Intelligenz
Seewiesen

Henrik Brumm

Poster 26



Poster

River specialists inhabit a naturally and constantly loud environment, with potentially large variations in ambient noise amplitude. Plastic adjustments of vocal signals in noisy conditions are ubiquitous among birds and other taxa. An interesting strategy is to convey the same message through multiple modalities (e.g. both auditory and visual channels) to facilitate communication. Signals in one modality can even increase the salience of signals in another, a phenomenon known as cross-modal enhancement. Despite an increasing number of studies on the effects of noise on animal communication, evidence of so-called multimodal shifts is still scarce. We investigated noise-related multimodal shifts in the white-throated dipper *Cinclus cinclus*, a songbird species strictly tied to rivers for foraging and nesting. Dippers have a complex song that is surprisingly low in amplitude given their noisy habitat. They have distinctive snow-white eyelids that contrast sharply with their brown plumage, and their blinking rate is relatively high (53 blinks per minute), making this behaviour an ideal candidate for the visual part of a multimodal signal. Using a colour-banded population of dippers in Cumbria, England, we simultaneously measured the blinking rate, song parameters, and river noise. We found that dippers adjusted both their song and blinking rate to the river noise level. Second, we found an audience effect on the use of the visual signal: blinking rates were adjusted to river noise only when a conspecific was within 25 m. Interestingly, birds that sang at higher amplitudes blinked less frequently than those with quieter songs when conspecifics were nearby. These results suggest that dippers use both vocal and visual signals in a balanced way to optimise communication in noisy environments. Blinking may function as a multimodal component complementing the song, with its use being modulated by the social context and the acoustic conditions of their habitat. This study highlights the adaptive complexity of animal communication in overcoming environmental noise constraints.

Altitude, latitude, and subspecies: drivers of song variation in fiery-necked nightjars

Alberto Comin

Max-Planck-Institut für Biologische Intelligenz
Seewiesen

Henrik Brumm

Poster 27



Poster

Birds use acoustic signals (songs) in mate attraction and intrasexual competition and thus these vocalisations are influenced by natural and sexual selection, shaping species-specific songs. Most bird-song studies on population divergence and biogeographic effects have focused on diurnal species. However, nocturnal birds are thought to rely much more heavily on acoustic signals for mate recognition because they cannot use visual signals as diurnal species do. The fiery-necked nightjar (*Caprimulgus pectoralis*) is a nocturnal, vocal non-learning bird that is widely distributed throughout sub-Saharan Africa. We studied the songs of fiery-necked nightjar across its entire distribution range to assess how biogeographical gradients and subspecies differentiation affect signal characteristics. Bergmann's rule states that endothermic animals tend to be larger in colder environments, while smaller ones are found in warmer regions. Given that vocal frequencies in birds are constrained by body size, Bergmann's rule predicts lower-pitched vocalizations at higher latitudes and altitudes, where birds are exposed to colder climates and thus are bigger. Using 124 recordings spanning the entire distribution range of the species across Africa, we analysed peak frequency, rhythm (inter-onset interval), and frequency-modulation ratio to test predictions related to Bergmann's rule and subspecies divergence. In accordance with the predictions of Bergmann's rule, we found that altitude significantly affected peak frequency, with lower song frequencies at higher elevations (i.e. in cooler habitats). Latitude had a weak, non-significant effect in the predicted direction. In contrast, latitude had a discernible effect on song rhythm, which also varied significantly between two of the five subspecies, potentially reflecting ecological or behavioural adaptations. Our findings highlight the impact of environmental factors and subspecies differentiation on vocal traits, and emphasize the intricate interplay between ecology, physiology, and evolution in nocturnal birds.

Are there sex-specific differences in the parental communication of Mongolian gerbils?

Saskia Sperfeld

Tierärztliche Hochschule Hannover

Marina Scheumann

Poster 28



Poster

All mammals rely on maternal care, but paternal care is very rare. However, in socially monogamous species such as Mongolian gerbils (*Meriones unguiculatus*), biparental care is often observed. In this study we investigated how Mongolian gerbil mothers and fathers communicate with their offspring and respond to infant vocalizations.

We performed reunion experiments with five families at four infant age classes. To identify the sender of ultrasonic vocalizations, an acoustic camera was used. Further, we performed playback experiments with ten experienced parents and ten inexperienced adult gerbils, where we played pup USVs and ADVs, adult contact calls and a control stimulus. All experiments were audio- and videotaped.

Both parents investigated the removed pup and produced contact calls, whereas pups produced USVs. While the calling rate of fathers was higher than that of mothers, they did not differ in call types and pups' vocalizations were independent of the sex of the contacting parent. Playback experiments revealed a significant effect of stimulus type and an interaction of sex and experience. Inexperienced males responded stronger than females, which may be due to the similarity of pup USVs to mating calls or due to the novelty of pup calls. The reactions of experienced males and females did not differ significantly. Thus, no sex-specific differences in the parental communication or behavior of Mongolian gerbils were found. This suggests that in socially monogamous species, fathers are as involved in parent-offspring communication as mothers, demonstrating their important role in rearing offspring.

Ultrasonic vocalizations of female mice (*Mus musculus*) in semi-natural housing conditions reveal the behaviour context and level of arousal

Anna Klenova

Technische Universität Berlin

Benjamin Lang; Anne Jaap; Christa Thöne-Reineke; Lars Lewejohann; Paul Miske

Poster 29



Poster

Mice emit surprisingly complex ultrasonic vocalizations (USVs), often employed as a behavioural readout in various fields of biomedical science. Strong scientific efforts aim at understanding of the functions of mouse USVs, however most acoustic studies have very specialised aims and evaluate the behaviour only within short (often 5-10 minute) and not always biologically relevant experimental tests. Therefore, we conducted a pilot long-term study of the acoustic activity of socially established female mouse groups housed in enriched modular environment, using synchronised recording of audio and video data. With frame-by-frame video analysis we tested the effect of behavioural context on the time-frequency parameters of USVs and the occurrence of different call types. We found that female mice usually produce USVs during direct social interactions. Most of the call parameters showed a strong relation with context, however the largest changes during the transition from peaceful to aggressive interactions were found in the fundamental frequency (decrease), duration (increase), proportion of calling (increase) and the presence of nonlinear phenomena (increase). Since these changes in mice USVs (except for fundamental frequency) align with those obtained for audible calls of many mammals with increase in arousal, they may reflect some general biological rule that applies to both audible and ultrasonic signals. In the future, low-frequency, prolonged USVs with a high proportion of non-linear phenomena can potentially be used as non-invasive indicators of increased negative emotional expression in groups of female mice in home cages for a wide range of applied tasks.

Can you feel the love tonight? Muting a characteristic vibrational signal in multimodal spider courtship

Morgan Oberweiser

Universität Greifswald

Paul-Robin Franz; Monika Eberhard

Poster 30



Poster

The majority of courtship displays in the animal kingdom involve multimodal signals, where various types of sensory cues are used simultaneously. These complex displays offer a puzzle to researchers, as the interactions between separate components can influence female choice in diverse ways. The European Nursery Web Spider *Pisaura mirabilis* performs a multimodal courtship display which includes a nuptial gift, chemical signals on the silk wrapping the gift, and a characteristic substrate-borne vibrational signal consisting of short consecutive pulses. While this vibrational signal has been shown to be condition-dependent, its role in female choice remains poorly understood.

In this study, we removed or altered the vibrational signal of male *P. mirabilis* courtship through two separate methods of muting in order to measure the effect of its absence on female choice. In the first experiment, males were muted with the placement of wax between their prosoma and opisthosoma, restricting the joint responsible for tremulation. In the second experiment, mating trials were performed on a marble table, which completely dampened the transference of the substrate-borne signal. In both experiments, female choice behaviors such as latency to contact, latency to copulation, and copulation duration were measured for both muted and control males.

The combination of these two muting methods will help us to determine whether the characteristic vibrational signal seen during *P. mirabilis* courtship is a fundamental component of the multimodal courtship display, or if other sensory modalities play a more dominant role in female mate choice.

Do old males miss a beat? Age effect on male vibratory courtship performance in a nursery web spider

Denise Becker

Universität Greigswald

Denise Becker; Morgan Oberweiser

Poster 31



Poster

Throughout an animal's lifetime, communication patterns can change due to a dynamic allocation of limited resources in foraging, survival, or reproduction. Animals tend to invest more in reproduction after maturation, since both fecundity and the probability of finding a mate decline with increasing age. As a part of courtship, males of the Nursery Web Spider *Pisaura mirabilis* produce pre-copulatory vibrations by tremulating their opisthosoma and transferring pulses onto the substrate via their legs. There is great variability in vibrations within a population of males with regard to pulse rate and the consistency of pulse intervals. However, a male's vibratory courtship performance appears to be individually consistent and can therefore be assumed to transfer honest information about his physical condition. We hypothesize that male age influences vibrational courtship performance due to a decline in physical condition with age. We recorded courtship vibrations of 237 *P. mirabilis* males ranging from 8 to 24 days of age using a Laser Doppler Vibrometer. Pulse rate as well as the consistency of pulse intervals in each screening were scored and correlated with male age. We expect younger males to show a high pulse rate and consistent pulse intervals, and older males to produce fewer pulses and inconsistent pulse intervals. The analysis of this data will evaluate if male vibrational courtship performance is influenced by male age and will help us understand changes in vibrational signaling throughout an animal's lifetime.

Adult sex ratio bias as a symptom of population fragmentation and decline of the whinchat *Saxicola rubetra*

Amulya Hosur

Ludwig-Maximilians-Universität München

Jennifer Border; Stephen Baillie; Wolfgang Goymann

Poster 32



Poster

Anthropogenic activity has led to the large-scale decline of suitable habitats for a significant portion of the planet's biodiversity. Declining habitats lead to species being isolated in small fragments of viable habitats with poor connectivity. In such fragmented patches with small populations, the adult sex ratio can be an indicator of the population's viability. The adult sex ratio of a population is determined by hatching or birth sex ratios and sex-specific survival during ontogeny and adulthood, including life history traits such as dispersal. In most birds, females are the dispersing sex and a fragmented island situation may therefore lead to a net-outflux of females, resulting in male-biased populations. Whinchats belong to long-distance Afro-Palearctic migratory birds, whose populations have undergone a massive decline in the past decades. In our breeding population in Murnauer Moos we discovered that the adult sex ratio has gotten increasingly male-biased over the last couple of years. Here we propose to test whether this is true also for other populations across Europe by using records from ringing stations collected over 58 years from all over Europe. Using these data, we inferred whether the decline of the species is associated with a biased sex ratio and whether adult sex ratios are more biased in birds ringed at the western edge of the breeding distribution of whinchats.

The effect of background colour on development and behaviour of golden mantella (*Mantella aurantiaca*) tadpoles

Prathik

Manchester Metropolitan University

Joachim Frommen; Jade Newton-Youens

Poster 33



Poster

Amphibians are the vertebrate class with the highest percentage of endangered species, making ex-situ conservation crucial to prevent many species from extinction. Still, there is a considerable gap of knowledge of amphibian husbandry requirements, jeopardising the success of captive breeding programmes. The housing environment significantly influences the welfare of captive animals, with different species having different needs. Therefore, incorporating species-specific enrichment is necessary to improve the living conditions of animals in human custody. While amphibians' natural habitat exposes them to diverse environmental factors, such as light and background colouration, this variation is often not taken into consideration while planning their captive environment. By raising golden mantella (*Mantella aurantiaca*) tadpoles in tanks with a light or dark background we explored how background colour impacts development, activity and sheltering behaviour during various stages of ontogeny. We furthermore tested for preferences for light or dark backgrounds in a two-choice experiment. Tadpoles preferred the darker environment and this preference weakened as tadpoles matured. Rearing conditions did not influence preferences of tadpoles or their growth rate and sheltering behaviour. However, tadpoles were less active when reared under dark conditions. These results suggest that tadpoles have clear preferences for darker backgrounds and that rearing them in their preferred environments might lead to lower stress levels. Our results underline the importance of tailoring the husbandry of amphibians to their specific needs, starting already at tadpole age.

Effects of enrichment on behaviour of zoo-housed porcupines (*Hystrix indica*)

Arne Kalinowski

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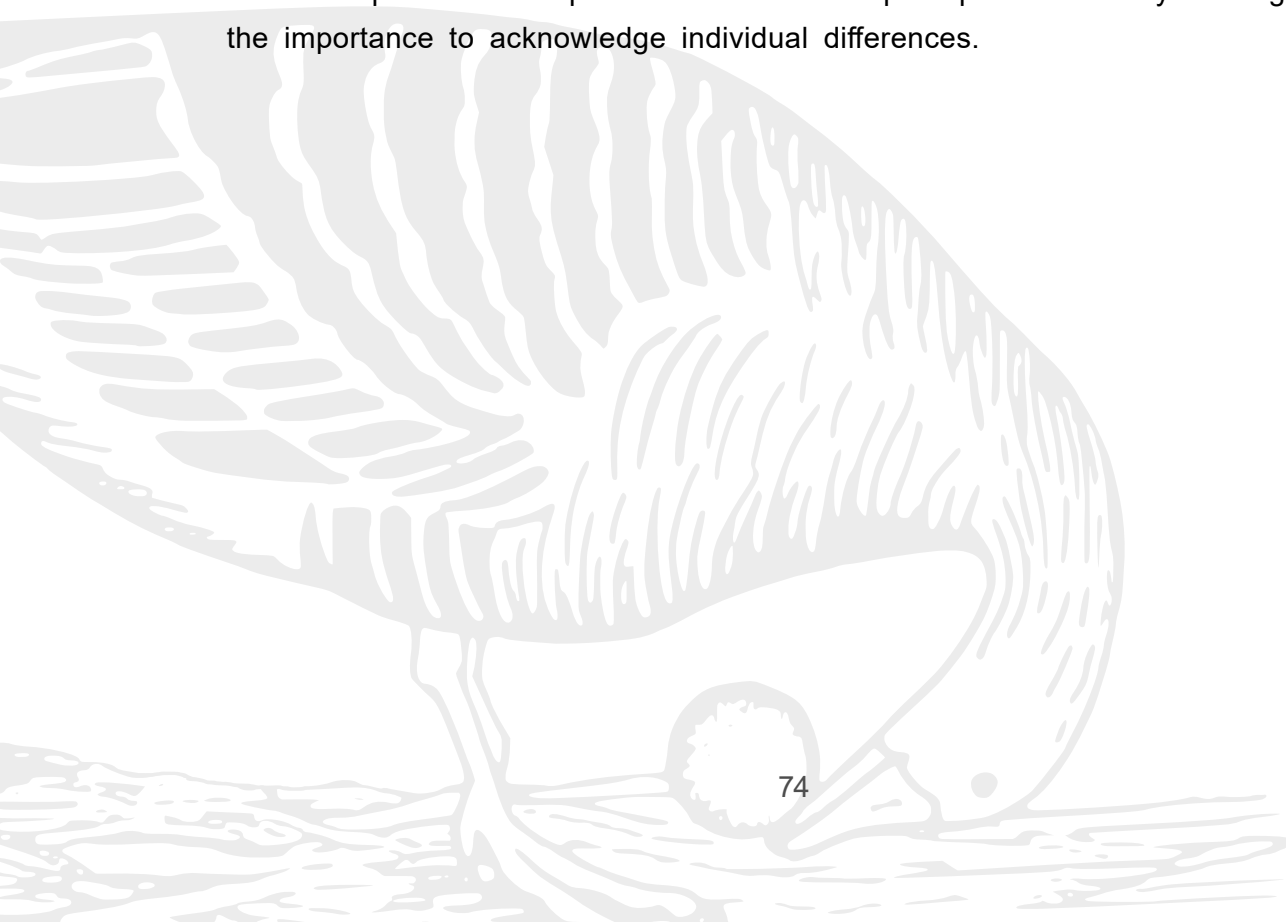
Barbara Caspers; Miriam Göbel

Poster 34



Poster

While in the past, zoobiological research has primarily focused on charismatic large mammals, less is known about the behaviour and welfare of smaller mammals under human care. To promote natural behaviour and positive animal welfare, behavioural enrichment is becoming more and more important. We subjected family groups of Indian crested porcupines (*Hystrix indica*) in four zoos to alternating enrichment regimes, including the provision of additional hides, olfactory, food-related, and object enrichment devices. Furthermore, we investigated potential effects of several other parameters, such as loudness and visitor presence. First results indicate porcupines engaged in enrichment of all four types, the extent varying between husbandries and individuals. Our study investigates various influences on porcupine behaviour under human care, in particular the effects of different enrichment types. It has the potential to improve evidence-based porcupine husbandry and highlight the importance to acknowledge individual differences.



Quantifying territorial behaviour of lekking ruffs (*Calidris pugnax*) using automatic tracking

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Poster 35



Poster

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 in nature 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 males by morph influences lek dynamics and alter male aggression, potentially causing sneaker males to adopt territorial behaviors or display increased aggression in the absence of dominant independent males. In the next step we plan to investigate whether individual and seasonal variation in circulating androgens affects space use by lekking ruffs. The aim of this study is to shed more light on the interplay between genetic, physiological and social factors on the evolution and maintenance of ARTs in the ruff.

Egg ejection in whinchats: a response to brood parasitism, nest sanitation, or clutch size reduction?

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Wolfgang Goymann

Poster 36



Poster

Egg ejection, the removal of eggs from the nest by a parent, is a puzzling behavior. Why would parents, particularly females, reduce their reproductive success after investing in egg production? The most common explanations include inter- and intraspecific brood parasitism: Parents (hopefully correctly) recognize and reject eggs from brood parasites, thereby reducing energetic costs and protecting their own offspring. They may also eject unviable eggs to sanitize the nest. Another, less studied explanation is that parents reduce the clutch size in response to unfavorable environmental conditions during incubation.

We studied whinchats (*Saxicola rubetra*) in a nature reserve over 5 years and documented 15 cases of egg ejection, affecting 15.6% of monitored nests. While we cannot rule out parasitism and nest sanitation with certainty, they seem unlikely to be main reasons for egg ejection in this population. Therefore, using generalized linear mixed models, we investigated which internal (clutch size, lay date, mother ID) and environmental factors (temperature, rain) influenced the probability of egg ejection.

We found strong evidence that weekly rain sum was a key factor for daily probability of egg ejection. This suggests that whinchats use this behavior as a mechanism to adjust clutch size in response to adverse weather, possibly to reduce energetic costs during incubation. Our preliminary findings highlight that this mechanism may not be as rare as previously thought, and call for further studies on the ecological and evolutionary significance of egg ejection behavior across species.

Disentangling the sex effects on shared copulatory traits in *Gryllodes sigillatus*

Tuba Rizvi

Universität Bielefeld



Poster

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In most mating systems, shared copulatory traits like copulation duration or sperm transfer speed are at the heart of sexual conflict as males and females usually have different optima. The contribution of both sexes to such shared sexual traits is highly understudied as most research focuses on one sex at a time. We study the male and female effects on different copulatory traits using *G.sigillatus* as our model system. For this we use an experimental manipulation of rearing density of both sexes followed by a full cross mating design to analyse the effect of the treatment on mating latency, copulation duration and number of sperm transferred. Our results show a strong effect of male treatment on the number of sperm transferred during mating with males reared in high density producing an transferring more sperm, keeping in line with sperm competition. Copulation duration, however, shows no such trend and interestingly, copulation duration and amount of sperm transfer are also not positively correlated. These results highlight the complexities of copulatory behaviour, male and female interaction and how the field can implement similar methods to other organisms to study sexual conflict on a behavioural level.

The timid invasion: behavioural interactions of native wood mice in Ireland displaced by invasive bank voles?

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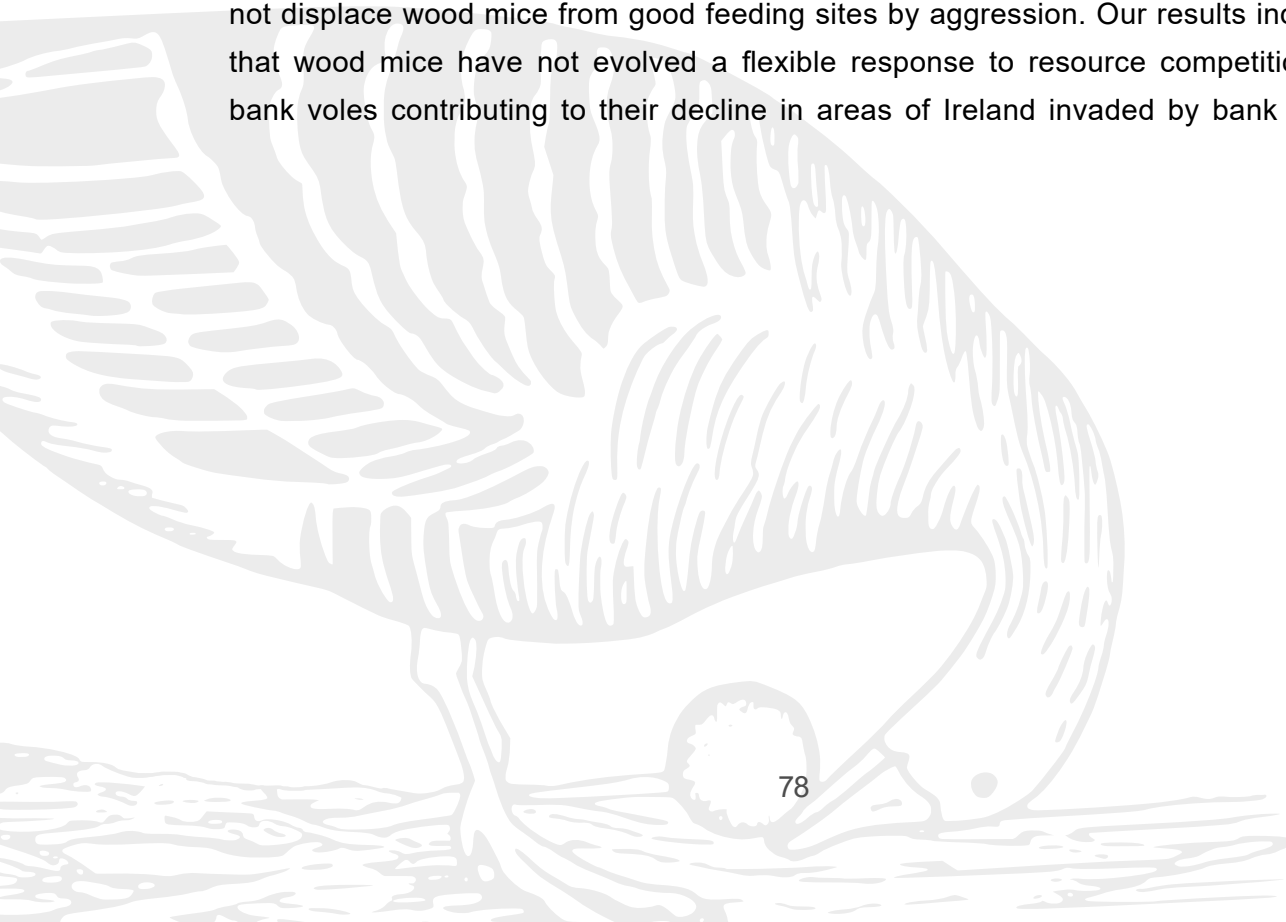
Bernd Boßlet; Ian Montgomery; Peter Stuart

Poster 38



Poster

There is only one native species of forest rodent in Ireland, the wood mouse (*Apodemus sylvaticus*). Continental bank voles (*Myodes glareolus*) have been invading Irish hedges, woods and plantations since the 1920s. The invasion shows spatial sorting, with bank voles being shyer at the invasion edge than in established ranges (Eccard et al. 2023, Mazza and Eccard 2023)). We investigated behavioural differences between the two species, comparing 6 invasion and pre-invasion sites using camera traps with a shortened focal length (360 trap nights). Bank voles fed more efficiently than wood mice; wood mice did not prolong their activity pattern in response to the increased resource pressure from the bank voles. However, bank voles did not displace wood mice from good feeding sites by aggression. Our results indicate that wood mice have not evolved a flexible response to resource competition by bank voles contributing to their decline in areas of Ireland invaded by bank voles.



Carotenoid-enriched diet changes colouration but not size in fire-bellied toads

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Sue Anne Zollinger



Poster

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Breeding amphibians in captivity is central to ongoing conservation efforts. Still, there is a considerable gap in knowledge of their husbandry requirements, jeopardising the success of captive breeding programmes. This includes dietary deficiencies, colouration disparity and behavioural differentiation. This study focused on the impact supplementary carotenoids have on the colouration of Fire-bellied Toads (*Bombina orientalis*). Carotenoids are phytochemicals responsible for vivid colours and immune responses across animal species.

We kept fire-bellied toads from tadpole stage onwards on three different diet regimes, with one group receiving the commonly used standard diet, whilst the other groups received additional 1mg/g (Low) or 5mg/g (High) of carotenoid supplementation. At 24 weeks old, post-metamorphosis, dorsal and ventral photos were taken of all bombinas. From these photos, RGB and HSB measurements were taken for colour analysis, along with the snout-vent length of each bombina to analyse any potential influence carotenoids have on post-metamorphosis growth.

Dorsal and ventral pigmentation significantly differed between treatments, and these differences increased with increasing amounts of carotenoid supplementation. The Colouration of high-diet individuals closely resembled that of wild individuals. There was no significant difference in snout-vent length between any group, suggesting that carotenoid supplementation has no impact on bombina growth. These results highlight that small changes in the diets of captive amphibians have the potential to lead to more natural phenotypes, which will have a considerable impact on the success of breeding and re-introduction programmes.

A modular environment for recording big data from laboratory mice

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Poster

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Behavioral data of laboratory mice are often recorded in short tests using experimental setups that claim to measure very specific domains. However, it must be questioned whether the tests generate too artificial and potentially stressful situations and thus, whether the results reflect the behavior mice would exhibit under natural conditions. Instead of snapshot tests, we need a completely new approach for a holistic observation, in which the behavior of animals in their natural environment is recorded.

To approach such an ideal data collection, we present a novel system for housing and observing laboratory mice. The system consists of individual housing modules connected to a complex, large enclosure for mice. The modules are affordable, easy to assemble and suitable for use in a laboratory environment. Each module is equipped with a camera, an ultrasonic microphone, and connecting tubes with RFID antennas. A dual PC setup in combination with a self-developed hardware trigger enables continuous, synchronized recording of audio, video and RFID data. Big data is recorded in order to obtain highly detailed information about individual and group behavior. The aim of the current research project is to find focal points and patterns in the behavioral data that can be used to create test procedures based on a mouse-centric perspective. By bringing the test to the mouse instead of bringing the mouse into the test, we expect more transferable and reliable scientific data. In addition, our initial observations show that the animals really appreciate this type of housing.

The effects of carotenoids on colour, calling and female preference in adult golden mantella (*Mantella aurantiaca*) frogs

Edward Andrews

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Joachim Frommen; Jade Newton-Youens;

Emma Smith; Sue Anne Zollinger



Poster

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Amphibians face an unprecedented rate of population decline with the highest percentage of species facing extinction. Currently, many of these species only survive because they are kept under human care. Successful ex-situ conservation should be implemented with comprehensive understanding of species-specific husbandry. This however is often not the case for many amphibians due to a lack of knowledge of their natural habitat and diet, frequently resulting in captive populations experiencing deficiencies affecting health, physiology and behaviour. We aimed at elucidating the role of carotenoids in the diet of golden mantella (*Mantella aurantiaca*), an endangered frog species in which both sexes show a bright yellow-red aposematic colouration. We raised male golden mantella either on a carotenoid-enriched diet or the standard diet usually used for this species and measured their colouration after reaching sexual maturity. We then let females choose between these males in a two-choice design and measured their mating calls. Males on the high carotenoid diet developed a more intense red colouration, and these brighter males received significantly more female attention than their duller counterparts. Furthermore, males fed on the enriched diet produced significantly less but more complex calls. These findings suggest that the bright aposematic colouration of the golden mantellas also has a sexually selected component. Optimising the diet of ex-situ bred individuals is therefore crucial to produce animals with the highest fitness, both under laboratory and wild conditions.

Unraveling the genetic architecture of male song and female preference in *Chorthippus* grasshoppers

Dörte Neumeister

Ludwig-Maximilians-Universität München



Poster

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Speciation occurs when populations accumulate genetic differences that lead to reproductive barriers, such as incompatible mating signals, ecological interactions, or gene interactions. However, gene flow can erode these barriers through recombination. To understand the genetic basis of these traits, particularly in systems primarily driven by behavioral isolation, experimental approaches beyond the observation of natural populations are essential. *Chorthippus* grasshoppers, although broadly sympatric, lack recognizable ecological differentiation but exhibit strong behavioral isolation driven by male mating songs and female preferences. We conducted experimental crosses between two sympatric sister taxa, *C. brunneus* and *C. biguttulus*, to investigate male mating signals and female preferences. First, we recorded the mating traits of F2 and backcrossed individuals to characterize their variation. Next, we plan to use genetic analyses to identify the genomic regions associated with these traits, shedding light on the mechanisms of reproductive isolation. By mapping these traits to specific genomic regions, we aim to determine whether signaling-preference coevolution arises through assortative mating or is facilitated by physically linked loci. Our findings will help illuminate the genetic architecture of behavioral isolation and contribute to the ongoing debate on speciation in the presence of gene flow.

Genetic architecture of behavioral traits involved in speciation and adaptation

Jürgen Gadau

Universität Münster



Poster

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Forward and reverse genetics have been used to understand the genetic basis of behavioral traits. The parasitoid wasp genus *Nasonia* is ideal to study the genetic architecture of behavioral traits because all four species can produce viable and fertile hybrids. I will briefly present three studies; a QTL study of species differences in male courtship behavior showing a complex genetic architecture involving many independent loci, epistasis and transgressive phenotypes. We also investigated a female trait, female attractiveness/acceptance based on cuticular hydrocarbon components, contributing to prezygotic isolation during courtship because *N. giraulti* and *N. longicornis* males differ in their preference for con- and allospecific females. In a first step, we determined three CHC components out of 54, making up the CHC profile of females, whose quantities are significantly different between the two species and at the same time were significantly preferred by *N. longicornis* males. A thorough genetic analysis based on 10 females of more than 100 isofemales lines with different cytoplasmic backgrounds, revealed several candidate regions and genes involved in female attractiveness. One QTL region and two candidate genes in particular had a pleiotropic effect, i.e. it explained a significant percentage of the differences in 11,x-DiMeC37, a CHC component, and female attractiveness. Finally, using dsRNAi we systematically knocked down candidate genes involved in the production of CHC and found that several effected both the CHC profiles and female attractiveness, sometimes simultaneously and sometimes independent from each other.

Beyond the null: Recognizing and reporting true negative findings

Manon Schweinfurth

University of St. Andrews

Joachim Frommen

Poster 44



Poster

Science is based on ideas that might be true or false in describing reality. In order to discern between these two, scientists conduct studies that can reveal evidence for an idea, i.e., positive findings, or not, i.e., negative or null findings. The outcome of these studies can either be *true*, i.e. reflecting the real world, or *false*. Much has been said about disentangling true from false positive findings and the danger of a publication bias towards positive findings. Here, we argue that publishing negative findings is important to provide an accurate picture of the real world. At the same time, we highlight that a cautious approach should be taken to minimise the impact of publishing false negative findings, which has received limited attention so far. We discuss sources of false negative findings, using experimental and observational animal behaviour and cognition studies as examples, which often differ from those of false positive findings. We conclude by recommending strategies for rigorous studies, such as conducting positive controls, selecting diverse samples, designing engaging protocols and clearly labelling negative findings. These practices will lead to studies that contribute to our knowledge, regardless of whether they result in positive or negative findings.