Delegate Pack

ASAB Spring Conference 2024

Spring conference of the Association for the Study of Animal Behaviour at the University of Exeter, U.K.

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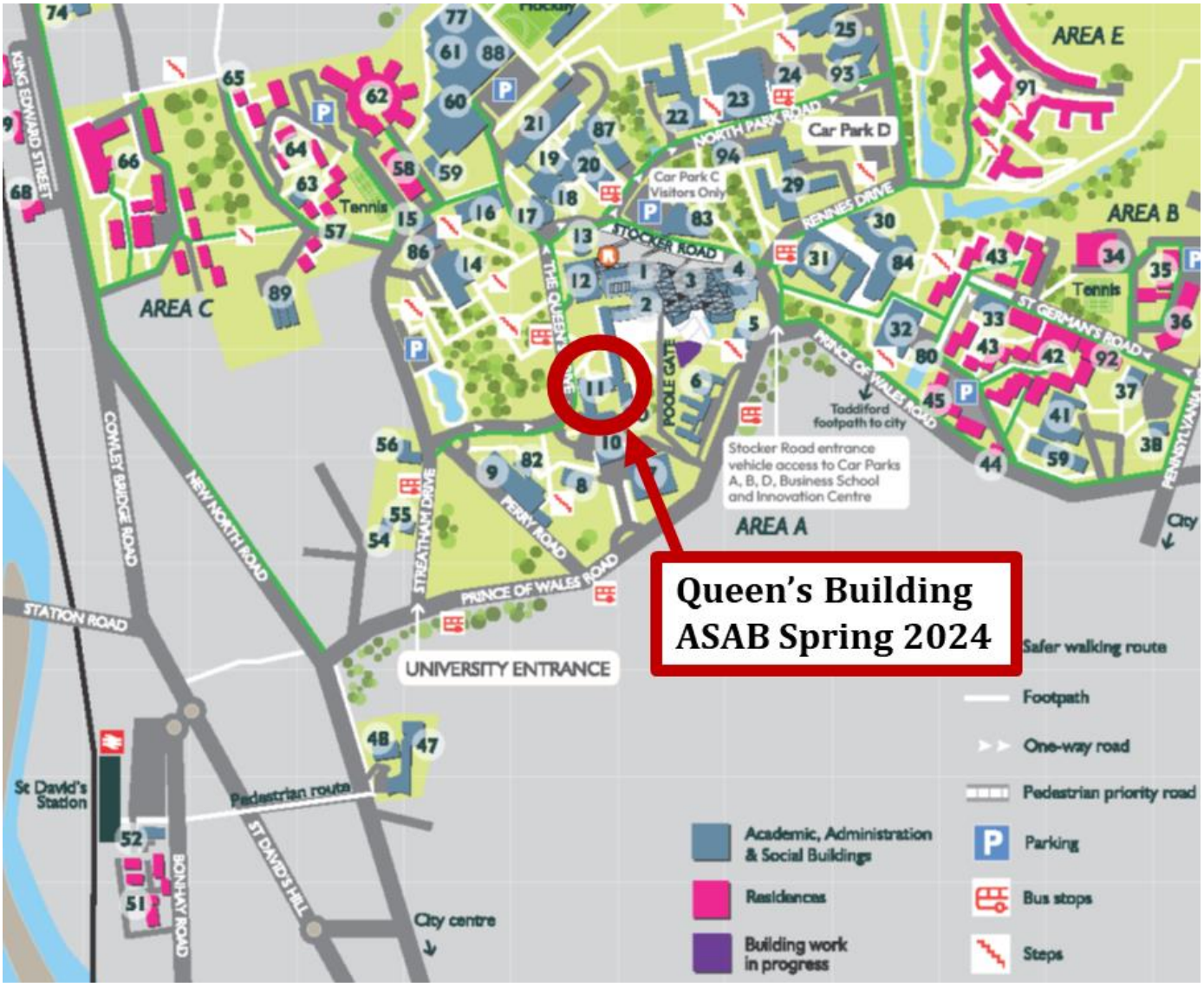
In the schedule table below, **bold text** are links to the Abstracts for that section.

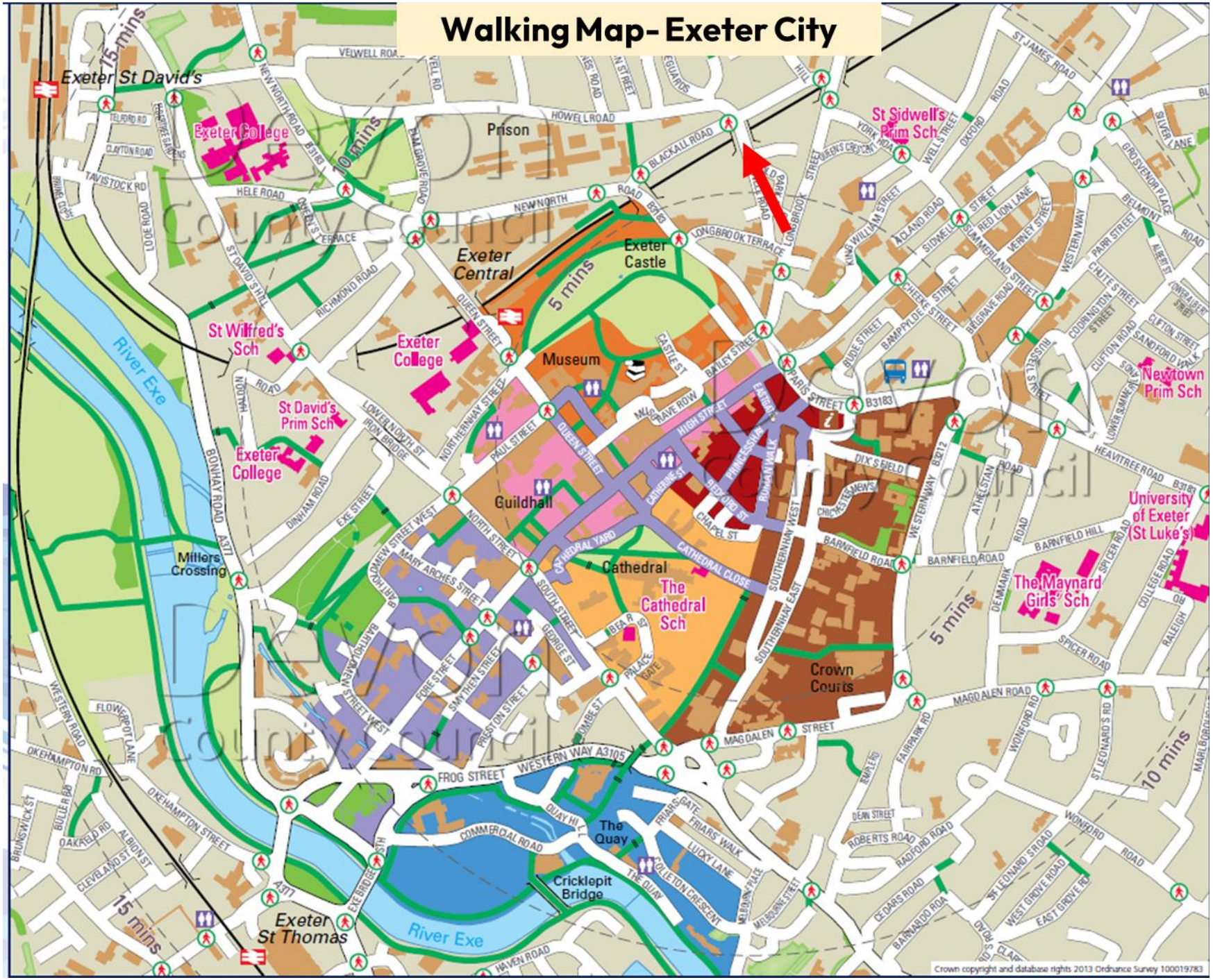
Workshop Day: Tuesday 23rd April			
09.00 – 09.30	Reception desk open		
09.30 – 10.00	Welcome and Introduction (Lecture Theatre 2)		
10.00 – 10.30	Morning coffee and getting into groups (Margaret Rooms Foyer)		
	Class A	**Class B**	**Class C**
10.30 – 11.30	Writing (Room 1B)	Visuals (Room 1G)	Coding (Room 1C)
11.30 – 12.30	Coding (Room 1C)	Writing (Room 1B)	Visuals (Room 1G)
12.30 – 13.30	Lunch		
13.30 – 14.30	Visuals (Room 1G)	Coding (Room 1C)	Writing (Room 1B)
14.30 – 15.30	Ethics of AI use (Lecture Theatre 2)		
15.30 – 16.00	Afternoon tea (Margaret Rooms Foyer)		
16.00 – 17.30	Twitter threads & Discussion		

Conference Day 1: Wednesday 24th April	
08.30 – 09.30	Reception desk open
09.00 – 09.30	Welcome and Introduction
09.30 – 10.30	**Plenary 1** Chair: Andrew Higginson Sigrunn Eliassen (University of Bergen) *Adaptive decision–making and animal interactions in social networks*
10.30 – 11.00	Morning coffee
11.00 – 12.00	**Contributed talks 1.1** Chair: Sam Ellis
11.10 – 11.15	Alexandra Glavaschi (University of Padova) *The effects of heatwaves on sexual selection dynamics in the guppy Poecilia reticulata*
11.15 – 11.30	Isabelle Leavy (University College London) *A tight squeeze: exploring obstetric outcomes and behaviours in non–human primates*
11.30 – 11.45	Marios Chatzigeorgiou (University of Bergen) *Decoding the sensory bases of navigation and settlement behaviours in a zooplanktonic marine invertebrate*
11.45 – 12.00	Kristina Pascual (Newcastle University) *Investigating the effect of early–life nutritional stress on the response to adult food insecurity in the European Starling*
12.00 – 12.30	**Flash talks 1** Chair: Sam Ellis
12.00 – 12.05	Josie McPherson (University of Edinburgh) *Are consistent individual differences in behaviour retained across metamorphosis in Xenopus Tropicalis?*
12.05 – 12.10	Ari Drummond (University of Plymouth) *The Crustacean Antennule: An indicator of selective attention in hermit crabs*
12.10 – 12.15	Marwa Kavelaars (Max Planck Institute for Human Development) *Decision making in a complex world: how social context impacts foraging strategies in human foragers*
12.15 – 12.20	Rachel John (University of Exeter) *Investigating and comparing maternal and alloparental care in resident killer whales*
12.20 – 12.25	Kathryn Bullough (University of Exeter) *Sensory processing during mate choice in swordtail fish*
12.25 – 12.30	Özge Kilic (Free University Berlin) *Tracking collective behavioural responses of termites with machine learning pose estimation software*
12.30 – 13.00	Lunch
13.00 – 14.00	Poster session
14.00 – 15.00	**Plenary 2** Chair: Lauren Brent Stephanie King (University of Bristol) *Unlocking the secrets of dolphin cooperation in the wild*
15.00 – 15.30	**Contributed talks 1.2** Chair: Christos Ioannou
15.00 – 15.15	Harry Suter (University of Bristol) *Self–control: waiting longer is not necessarily better*
15.15 – 15.30	Chloe Mason (University of Sheffield) *Effects of female–specific selection for maternal investment on male fertility traits*
15.30 – 16.00	Afternoon tea
16.00 – 17.30	**Contributed talks 1.3** Chair Erin Siracusa
16.00 – 16.05	Daniel Villar (University of Oxford) *Population density, mistaken identity, and interspecific variation in avian same–sex sexual behaviour*
16.05 – 16.10	Cedric Aumont (Freie Universität Berlin) *Exploring the evolution of termite immunity across phylogeny, sociality and foraging behaviour*
16.10 – 16.15	Theo Brown (University of Helsinki) *Testing flash coloration in wild avian predators: delayed detection of conspicuous prey in motion*
16.15 – 16.20	Hemal Naik (Max Planck Institute of Animal Behavior) *Quantitative monitoring of large animal aggregations using a fleet of drones and AI*
16.20 – 16.25	Josh Arbon (University of Bristol) *Mongoose movements: how social and ecological factors shape space use in a group–living carnivore*
16.25 – 16.30	Rebecca Cummins (Queen's University Belfast) *The cost of reproduction in a capital breeding ungulate*

Conference Day 2: Thursday 25th April		
08.30 – 09.30	Reception desk open	
09.00 – 10.00	**Plenary 3**	Chair: Lisa Leaver
	Tom Tregenza (University of Exeter) *Selection on insect behaviour in the wild*	
10.00 – 10.30	Morning coffee	
10.30 – 11.30	**Contributed talks 2.1**	Chair: Delphine De Moor
10.30 – 10.45	Libby Chapman (University of Exeter) *Practice makes perfect? The role of personal reproductive experience on nest building in a wild bird*	
10.45 – 11.00	Becky Padget (University of Bristol) *Should I stay or should I go? The consequences of uncertainty for cooperative partnership stability*	
11.00 – 11.15	Linnet Jessell (University of Liverpool) *Environmentally driven differences in foraging behaviour variability of black–legged kittiwakes*	
11.15 – 11.30	Marina Papadopoulou (Swansea University) *A tale of clones, robots, and agents: the role of behavioural individuality in the collective behaviour of vertebrates*	
11.30 – 12.00	**Flash talks 2**	Chair: Delphine De Moor
11.30 – 11.35	Thomas MacGillavry (University of Veterinary Medicine, Vienna) *Of beauty and brains: complex song and dance evolves independently of brain size in the birds of paradise*	
11.35 – 11.40	Erik Versluijs (Inland Norway University of Applied Sciences) *Behavioural dependent habitat selection of free-ranging cattle in the boreal forest*	
11.40 – 11.45	Lucia Kotianová (University of Veterinary Sciences Brno) *Effect of temporary isolation within different age periods on the behaviour of dairy goat kids*	
11.45 – 11.50	Kingsley Hunt (University of Exeter) *The social microbiome as a driver of colony fusion in Pacific dampwood termites (Zootermopsis angusticollis)*	
11.50 – 11.55	Rohan Vishwas Joglekar (University of Exeter) *Does exposure to environmental pollutants affect the migratory behaviour of UK estuarine wading birds: An energy budget approach*	
11.55 – 12.00	*Biotechnology and Biological Sciences Research Council*: Update on UKRI Animals Policy	
12.00 – 12.30	Lunch	
12.30 – 13.30	Poster session	
13.30 – 14.30	**Chris Barnard Award**	Chair: Joah Madden
	Nobuaki Mizumoto (Auburn University) *Evolutionary perspectives of termite collective behavior*	
14.30 – 15.00	**Contributed talks 2.2**	Chair: Ines Fürtbauer
14.30 – 14.45	Thomas O'Shea–Wheller (University of Exeter) *VespAI: Applying Deep Learning to Quantify Hornet Behaviour*	
14.45 – 15.00	Joe Wilde (University of Exeter) *Robotic crabs reveal flexible adjustment of sexual signalling in a wild invertebrate*	
15.00 – 15.30	Afternoon tea	
15.30 – 17.00	**Contributed talks 2.3**	Chair: Tim Fawcett
15.30 – 15.45	Naomi Walsh (Liverpool John Moores University) *AI Enhanced Camera Monitoring: Assessing Behaviour and Welfare*	
15.45 – 16.00	Frigg Speelman (University of Groningen & Macquarie University) *Automated tracking of birds in the wild; quantifying the benefits of socially monogamous partnerships*	
16.00 – 16.15	Alexandra Childs (Bielefeld University) *Milking it: extended dependency in the Galápagos sea lion (Zalophus wollobecki)*	
16.15 – 16.30	Charli Grimes (University of Exeter) *Postreproductive female killer whales reduce socially inflicted injuries in their male offspring*	
16.30 – 16.45	Daniel Sankey (Newcastle University) *The role of mutualisms in social behaviour*	
16.45 – 17.00	Fionnuala McCully (University of Liverpool) *The temporal scale of coordinated parental care: evidence from the long–term tagging of breeding black–legged kittiwakes (Rissa tridactyla*)	


Queen's Building
ASAB Spring 2024
AREA A
AREA B
AREA C
AREA E
Car Park D
Car Park C
Visitors Only
Tennis
Tennis
Stocker Road entrance
vehicle access to Car Parks
A, B, D, Business School
and Innovation Centre
Taddiford
footpath to city
UNIVERSITY ENTRANCE
Pedestrian route
City centre
City
STATION ROAD
PRINCE OF WALES ROAD
NORTH PARK ROAD
STOCKER ROAD
RENNES DRIVE
ST GERMANS ROAD
POOLE GATE
PERRY ROAD
STREATHAM DRIVE
NEW NORTH ROAD
COWLEY BRIDGE ROAD
KING EDWARD STREET
ST DAVIDS HILL
BONHAY ROAD
St David's
Station
Safer walking route
Footpath
One-way road
Pedestrian priority road
Parking
Bus stops
Steps
Academic, Administration
& Social Buildings
Residences
Building work
in progress

Walking Map- Exeter City



Coffee & Brunch

- **Sacred Grounds**– vegan plant-based brunch cafe
- **The Press House** – a letterpress studio come coffee shop & brunch spot
- **The Crankhouse** – Speciality coffee roasters with cakes & snacks
- **Exploding Bakery**– Coffee, Cakes & Sandwiches
- **Lilac Bakery**– Homemade treats & great coffee
- **How on Earth Deli**– Plant-based deli, 100% vegan
- **Boston Tea Party-** Large breakfast/brunch/lunch place right by the high street.

Food **booking recommended*

- **The Flat** – vegetarian & vegan pizzas in a rustic restaurant *
- **KinKhao** – Thai & Asian food in a relaxed environment
- **Namaste** – Authentic South Indian food
- **Harry's Restaurant** – smart, long-established & family-run *
- **Al Farid** – Moroccan & Lebanese restaurant offering traditional dishes & mezze, deserts & wine
- **Franco Manca** – Sourdough Pizzas with vegan & vegetarian options

Drink

- **Imperial-** *Positives*: closest pub to campus; nice and large building. *Negatives*: is a Weatherspoons.
- **Topsham Brewery**– microbrewery, taproom & portal pizza at the quay
- **Tabac** – Small, specialist bar & pub
- **Mill on the Exe** – red-brick pub with beamed ceilings & waterside gardens overlooking a weir & footbridge
- **The Old Firehouse –** Rustic, dark wood pub with exposed ceiling beams
- **Cuckoo** – Craft beers

Exploring Exeter

Exeter Cathedral
Exeter Quayside
Royal Albert Memorial Museum & Art Gallery
Nothernhay Gardens
Underground Passages
St Nicholas Priory

Around Exeter

Topsham: estuary town of the River Exe with a rich maritime history (train, bus, walk along the River Exe)

Exmouth: a port town and seaside resort on the east bank of the River Exe. Exmouth is a popular swimming spot (train 32 mins).

Totnes – Historic town which combines stunning countryside with independent shopping, local food & drink and interesting attractions. (train 30 mins).

Exploring Devon

Totnes: From Totnes, you can walk to Dartington

Okehampton: a town and civil parish in West Devon situated in the northern edge of the moor. (train 38 mins). From here you can walk along the Granite Way and visit Okehampton castle

Dartmoor – National Park with Neolithic tombs, Bronze Age stone circles and villages. Difficult to get to (only by car) but absolutely gorgeous.

Abstracts: Plenaries

Sigrunn Eliassen (University of Bergen)

Adaptive decision–making and animal interactions in social networks

Classical game theory has trained our intuition about important aspects of social interactions, from conflict to cooperation. Moving beyond the basic models, we appreciate that interactions are dynamic in nature, cost and benefits are inherently linked to local context, and animal responses are based on previous experiences and adaptive decision-making. Information and the ability to acquire, integrate and restrict it, may alter individual strategies, and influence evolutionary dynamics. I will illustrate this using a model of coevolving mating strategies in social networks. Further I will propose a framework for adaptive decision-making where I consider the cognitive machinery that enables animals to behave autonomously, make predictions about the future and adaptive decisions in real time. May viewing the animal as an agent, with goal-directed rather than purely stimulus-driven cognitive and behavioral control, improve our understanding of animal decision-making in natural environments?

Stephanie King (University of Bristol)

Unlocking the secrets of dolphin cooperation in the wild

Coming soon…

Tom Tregenza (University of Exeter)

Selection and variation in insect behaviour in the wild

Anticipating the impacts of climate change and habitat loss requires an understanding of how organisms are adapted to their environment. Behaviour provides animals with extreme plasticity, giving it a unique role in evolutionary ecology. Small ectotherms can use behaviour to change their local climate to a much greater extent than larger animals. To study behaviour in wild insects, we have developed approaches that allow us to observe every adult in a natural population of crickets (Gryllus campestris) in a meadow in northern Spain. By taking tiny DNA samples from parents and their offspring we can assign parentage and relate variation in behavioural and other traits to fitness. I will discuss observations of variation in selection in behavioural and other traits across years and experiments examining evidence for local adaptation in behaviour. My aim is to provide insights into the extent to which behavioural plasticity and local adaptation will affect how insects and other small ectotherms are impacted by environmental change.

Nobuaki Mizumoto (Auburn University)

Evolutionary perspectives of termite collective behavior

In animal collective behavior, group-level phenomena emerge from individual-level behavioral rules for social interactions. The theory of complex systems predicts that there is no simple one-to-one relationship between variations in collective patterns and variations in individual behaviors; therefore, it is essential to know how actual behavior evolves to change pattern formation. Here I introduce my comparative approach to studying the diversity of termite collective behavior in both group-level patterns and individual-level behaviors. First, I will show the mechanical relationship between termite tunnel structures and excavation behavior. Two related species excavate tunnels with a shared transportation mechanism but build tunnels with distinct branching patterns. On the other hand, a third species has independently evolved a similar tunnel structure to one of the first two species but builds it using a distinct transportation mechanism (bucket brigade by legs). Second, I will introduce the evolution of termite tandem running, the simplest movement coordination by a mating pair that involves leader-follower relationships. The extensive movement analysis of termite tandem runs highlights its flexibility in leader-follower roles. A systematic literature survey and phylogenetic comparative analysis show that flexibility comes from their ancestral

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state. By integrating computational behavioral analysis and phylogenetic comparative methods, I envision tracing the evolutionary origin of complex termite collective behavior.

Abstracts: Standard Talks

Contributed talks 1.1

1.1: 11.10 – 11.15 Alexandra Glavaschi (University of Padova)

The effects of heatwaves on sexual selection dynamics in the guppy Poecilia reticulata

Extreme weather events such as heatwaves are becoming increasingly frequent under anthropogenic climate change, with severe consequences for wildlife. Heatwaves negatively impact a wide range of biological traits and processes, including gamete production and function, courtship behaviours, sexual ornaments and mating tactics. How these effects accumulate at the population level and whether or not they influence sexual selection dynamics remains unknown. This is a major knowledge gap, because sexual selection is a key process underlying population persistence in rapidly changing environments. Here we expose groups of fish to either a heatwave treatment, consisting of four days at 31□C, or to a control temperature of 25□C. We record all instances of courtship, forced mating attempts and consensual matings, while keeping track of individual identities. Our preliminary results indicate that exposure to a heatwave is associated with a reduction in mating frequency and the number of partners in both males and females. Furthermore, they point to heatwave effects on the variance in reproductive behaviour, potentially leading to stronger sexual selection on males. We discuss these findings in the context of population adaptation to environmental change.

1.1: 11.15 – 11.30 Isabelle Leavy (University College London)

A tight squeeze: exploring obstetric outcomes and behaviours in non–human primates

The high rates of obstructed labour in childbirth observed across human populations are often considered to be a consequence of the combined effects of a narrow pelvis resulting from obligate bipedalism and increases in brain size during human evolutionary history. This so-called obstetric dilemma is assumed to be unique to humans, however, other primates such as Hylobates and Macaca exhibit a comparable “tight fit” between the foetal head and pelvic outlet, despite the fact that they are not bipedal. In this study, I explore parturition events in non-human primates to answer the question: are high rates of obstructed labour unique to Homo sapiens? I present data on maternal behaviour, morphology, and birth outcomes collected from publicly available videos of non-human primate parturition accessed via YouTube. I analyse variation in birth behaviour and body positioning and correlate these data with pelvic morphology, social support and outcomes such as obstructed labour or infant death. The results of this study can be applied to better understand and support birth in captive primates and to shed light on elements of human obstetric evolution.

1.1: 11.30 – 11.45 Marios Chatzigeorgiou (University of Bergen)

Decoding the sensory bases of navigation and settlement behaviours in a zooplanktonic marine invertebrate

Marine invertebrates with biphasic life cycles are among the most abundant organisms inhabiting the oceans. Their freely-swimming larvae disperse in the water column in search of a site where they can attach and undergo a transformative process termed metamorphosis, giving rise to benthic sessile adults. One of the biggest challenges for these microscopic organisms equipped with relatively small nervous systems lies in their ability to detect the relevant chemical and mechanical cues that will allow them to navigate in the ocean and identify suitable settlement sites. How they achieve this remains a mystery. We used the genetically tractable model organism Ciona intestinalis to solve this enigma. Through quantitative behavioral assays, chemogenetics and functional imaging we discovered that a small number of sensory cells in the animal's head can detect mechanical stimuli as well as a surprising diversity of long-range and short-range chemical cues abundant near the sea floor. Our work revealed that Ciona leverages polymodal sensory cells to map its surrounding sensory environment. By employing cutting-edge functional imaging, we captured high-speed neuronal dynamics across the entire brain. At rest, Ciona larvae displayed neuronal activity in localized brain regions that were likely required for spontaneous locomotion. Moreover, the presentation of attractive or repulsive cues led to drastically different brain-wide activity patterns, suggesting that the streamlined

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nervous system of Ciona can compute the valence (attractive or repulsive) of a particular chemical cue. This process then activates specific neuronal pathways, guiding the larvae to make stimulus-driven behavioral action choices, such as whether to inhabit or abandon a putative settlement location.

1.1: 11.45 – 12.00 Kristina Pascual (Newcastle University)

Investigating the effect of early–life nutritional stress on the response to adult food insecurity in the European Starling

Early-life nutritional stress (ELNS) can have long-term impacts on animal physiology and behaviour, impacting adult health and welfare. Adult exposure to food insecurity, defined as having limited or unpredictable access to food, can also cause acute changes in physiology and behaviour. However, little is known about the interaction between early-life and adult experience, specifically whether ELNS prepares animals for coping with adult food insecurity. We took European starlings at four days post-hatching and simulated the experience of ELNS with a 10-day feeding manipulation. Pairs of siblings were semi-randomly assigned to either Benign treatment, receiving ad libitum food on each feeding visit, or a Harsh treatment, in which feeding was restricted and did not occur on every visit. Results showed stunted growth in the Harsh group, exhibiting significant lower weight, smaller skeletal size and later fledging compared to the Benign group. One year later, we subjected these birds to a two-week period of limited and unpredictable food, with the aim to understand how ELNS alters how adult starlings respond to food insecurity. We found that all birds responded to food insecurity by increasing their body mass, as predicted by the insurance hypothesis. However, the size of this response was not affected by the early-life treatments. Our results suggest that ELNS does not affect how well starlings cope with adult food insecurity, and thus provide no support for the predictive adaptive response hypothesis of developmental plasticity.

Contributed talks 1.2

1.2: 15.00 – 15.15 Harry Suter (University of Bristol)

Self–control: waiting longer is not necessarily better

Self-control, which entails both future planning and inhibitory control, is often used as an indicator of cognitive ability. To measure self-control in non-human animals, subjects are typically tested on how long they will wait for a larger–later food reward at the expense of a smaller–sooner food reward. Animals that have waited for longer are deemed to have exhibited better self-control, with interspecific variation in wait times used to support key hypotheses in cognitive evolution. However, by developing an optimal foraging model centred around the delayed-choice procedure used commonly to measure wait times, we demonstrate that animals maximise their net rate of energy intake by choosing the smaller–sooner reward past a subject-specific delay. Thus, waiting longer does not always lead to an increase in fitness. By comparing qualitative results generated from our model with existing data on observed wait times, we showcase empirical evidence that animals are behaving as if attempting to maximise their net rate of energy intake. These findings question the underlying assumption that species waiting longer for a larger–later reward have better self-control; we suggest that good self-control is redefined as knowing when to wait for a larger–later reward and for how long. Our work highlights the importance of considering the adaptive significance of performance in cognitive tasks if we are to assess cognition and its variation accurately.

1.2: 15.15 – 15.30 Chloe Mason (University of Sheffield)

Effects of female–specific selection for maternal investment on male fertility traits

Although males and females share the majority of their genomes, their reproductive strategies differ, leading to sex-specific selection. Selection acting on one sex can have positive, negative or neutral fitness consequences on the opposite sex. Female-limited selection for maternal investment in Japanese quail (Coturnix japonica) causes an increase in male fertilisation success under sperm competition. This study investigated the mechanisms underpinning this sperm competition advantage. Males from lines selected for high maternal investment (high-line) had increased

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testis asymmetry (a relatively larger left testis) compared to males from lines selected for low maternal investment (low-line). This observation aligns with high-line females' larger left-side restricted oviduct, suggesting a positive genetic correlation between male and female gonad development. In both lines, the left testis had a greater volume of sperm-producing tissue and a greater concentration of sperm, highlighting functional differences between the left and right testes. Despite having increased fertilisation success, high-line males produced shorter sperm compared to low-line males. However, sperm velocity, motility, and the number of sperm that reached the ova remained consistent across the lines. Therefore, mechanisms involved in post-copulatory female mate choice and/or the role of seminal fluid in sperm motility may be more likely to contribute to the sperm competition advantage of high-line males.

Contributed talks 1.3

1.3: 16.00 – 16.05 Daniel Villar (University of Oxford)

Population density, mistaken identity, and interspecific variation in avian same–sex sexual behaviour

Same-Sex Sexual Behaviour (SSB) occurs across many taxa, but drivers of its interspecific variation remain poorly understood. Historically, mistaken identity has acted as a non-adaptive null hypothesis for SSB, but recently theoretical work has challenged the idea that mistaken identity is non-adaptive. It has been suggested that SSB may arise due to selection against narrow acceptance thresholds for mate choice in species where sex signaling is costly, such as those where encounters with potential mates are rare due to low population densities. We tested whether adaptive indiscriminate mating is a significant driver of interspecific variation of SSB, and whether it is driven by mistaken identity, using phylogenetic analysis to compare rates of SSB across all bird species which are known to exhibit the behaviour. We distinguished between male-male and female-female SSB, and between mounting, pair bonding, and courtship behaviour. We found strong evidence for adaptive indiscriminate mating for male-male SSB, but none for female-female SSB, and found only weak support for mistaken identity driving indiscriminate mating.

1.3: 16.05 – 16.10 Cedric Aumont (Freie Universität Berlin)

Exploring the evolution of termite immunity across phylogeny, sociality and foraging behaviour

The phylogeny of the Blattodea boasts a wide degree of sociality spanning from solitary cockroaches to advanced ecosystem-dominating termite societies. The emergence of sociality in termites was associated with the acquisition of a diverse range of social structures and caste-specific behaviours. From wood-dwelling to fungus-growing and cooperative scouting, termite foraging strategies require different immune defences to confront the diverse pathogens found in the foraging environment. Previous work has found evidence for a caste-specific social defence system in termites leading to an immune system that may favour group over individual defence. While preliminary work suggests a correlation between social transitions and a reduction of immune gene family diversity, the lack of available high-quality termite genomes hampers complete knowledge of the true diversity of immune gene evolution across termite phylogeny. Here, we report on the sequencing and near-chromosome level assembly of 47 high-quality long-read-based genomes across major termite and cockroach sister-branch lineages. We investigate the diversity and evolutionary history of immune genes across genomes, focusing on correlations between immune gene evolution, transitions in sociality and foraging behaviour diversity over termite phylogeny.

1.3: 16.10 – 16.15 Theo Brown (University of Helsinki)

Testing flash coloration in wild avian predators: delayed detection of conspicuous prey in motion

Colouration serves diverse functions in the natural world, from extravagant mating displays to camouflage. While protective colouration has been extensively studied across taxa, empirical testing of colour's function in moving prey presents inherent challenges. Here, we employ a novel Touchscreen Operant Chamber (TOC) to investigate how wild avian predators respond to prey exhibiting flash colouration, in which conspicuous colours are only visible when in motion; this 'flashing' is thought to bewilder pursuing predators. Our research reveals a significant delay in the

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detection of prey displaying conspicuous colours during evasion, supporting the classic tenets of flash coloration theory. While previous research has centered on anatomy-based ecological predictions and experiments using humans, our study provides pioneering empirical support for flash colouration in the context of wild predators. This sheds new light on the complex interplay between prey coloration and predator behaviour.

1.3: 16.15 – 16.20 Hemal Naik (Max Planck Institute of Animal Behavior)

Quantitative monitoring of large animal aggregations using a fleet of drones and AI

Animals aggregate in the wild for various reasons from feeding to breeding and from migration to mating. Studying aggregations is challenging due to the difficulty in obtaining high-frequency behavioral recordings of animals spread across a relatively larger area. We offer a practical solution to tackle the problem of large-scale animal monitoring using a fleet of 6 drones (3 at a time). The aerial tracking method is developed to study the mate choice behavior of blackbucks during the lekking season. Our method can monitor blackbucks (200+) in a large area (200 x 300 meters) continuously for up to 90 mins. We use computer vision and machine learning to detect, track, and link movement in all drones. Further, we use photogrammetry to register the drone footage with satellite images to obtain geo-referenced positions of the animals (like high-frequency GPS bio-loggers). The workflow is scalable i.e. drones can be added for adding recording hours or covering a larger area. The method should be widely applicable for use cases in wildlife management and conservation e.g. population monitoring, rewilding, or habitat mapping. I will also offer key insights to plan data collection, curation, and post-processing techniques while executing AI-enabled projects involving field biology and drones.

1.3: 16.20 – 16.25 Josh Arbon (University of Bristol)

Mongoose movements: how social and ecological factors shape space use in a group–living carnivore

A core theoretical principal in group living animals is that larger groups will require larger homeranges to satisfy their resource needs. However, different and often conflicting relationships between the movement patterns of groups and both social and ecological factors have been identified. Illuminating the factors that determine how animals move within their environment is therefore key to bridging gaps between theory and observed data. We tracked eight habituated groups of dwarf mongooses for a period of 12 years to investigate how social (group size and composition) and ecological factors (seasonality) impacted their movement patterns and choices of sleeping burrows. We found that larger groups defended larger areas, although the effect of seasonality was nuanced. The presence of pups, however, had a marked impact on the movements of groups due to the different needs of offspring at different stages of development. We also found that there were marked seasonal differences in burrow use. Mongoose groups used many more burrows and switched more frequently in the breeding season, likely as a mitigation against increases in parasite and predator abundance. Our results largely fall in line with theoretical expectations and highlight the importance of understanding species ecology to contextualise seemingly conflicting findings.

1.3: 16.25 – 16.30 Rebecca Cummins (Queen's University Belfast)

The cost of reproduction in a capital breeding ungulate

Rather than feeding during the mating season, capital breeding ungulates rely on their stored resources for reproductive investment. This strategy, common among species with distinct mating periods, incurs high costs, leading to a physical decline as resources are consumed. I recorded the behaviour of free-ranging fallow deer males (Dama dama) during their annual rut. Using 3D photogrammetry, I investigated the relationship between reproductive effort and changes in body size of individually identifiable bucks. Bucks lost up to 27%, 33% and 47% of their upper, middle and lower torso, respectively. The decline in body size was not associated with number of matings or fights implying that high-quality males may efficiently convert energy into reproductive success. Vocal rate, a less costly behaviour than fighting, was negatively correlated with fighting but was positively associated with

upper torso loss. This indicates that lower-quality individuals who lose greater size may perform less costly behaviours. These findings offer insights into the trade-off between performing behaviours and conserving energy and have important implications for using non-invasive measurements in wild populations.

Contributed talks 2.1

2.1: 10.30 – 10.45 Libby Chapman (University of Exeter)

Practice makes perfect? The role of personal reproductive experience on nest building in a wild bird

While much is known about the functions of avian nests in reproduction, the role of experience in nest building has often been overlooked, especially in natural populations. Nest building is often considered to be innate, remaining unchanged throughout an animal's life. However, evidence from captive birds suggests that environment and individual experience affects nest-building decisions. To determine whether this might also be detectable in a wild population of blue tits (Cyanistes caeruleus), we asked whether experience affected the material composition and effectiveness of the nest the bird chose to build. We investigated the composition and reproductive success of nests built by individual blue tits between 2016-2022. We found that individuals that failed to raise chicks incorporated more insulating material into their nest the following year, while blue tits that were previously successful were less likely to alter their nest design in this way. A high insulation: structure ratio was associated with increased hatching success, so the changes individuals make do improve nest function. Overall, our results on material choice suggest that the role of learning involved in nest design is strong enough to be detected in a natural system.

2.1: 10.45 – 11.00 Becky Padget (University of Bristol)

Should I stay or should I go? The consequences of uncertainty for cooperative partnership stability

Social animals often form differentiated social relationships with conspecifics, developing much closer partnerships with some than others. In choosing who to form close partnerships with, individuals face an exploration/exploitation trade-off: sticking with a known partner might be sub-optimal if better options are available, but switching partners can be risky if the new partner's behaviour is uncertain. The benefits of switching likely depend on the rate at which an individual learns about its current partner, and its knowledge of others in the population. To investigate this trade-off we developed a Bayesian learning model, which shows that when individuals have more information about the population, partnerships should be more stable in quick learners but less stable in slow learners. However, when we simulate a population of individuals who behave according to these rules, emergent behaviour does not reflect this because individuals cannot control whether their partner switches from them. Our model predicts that in fast-learning species, those with more information will form the most stable relationships; in slow-learning species, those with less information will. This demonstrates that information can either stabilise or destabilise social relationships, dependent on how information is acquired and used, which ultimately depends on species' ecology and life history.

2.1: 11.00 – 11.15 Linnet Jessell (University of Liverpool)

Environmentally driven differences in foraging behaviour variability of black–legged kittiwakes

Global environments are changing not only in average conditions, but also becoming more variable, causing increased extinction risk for many species. These changes in environmental conditions can reduce and redistribute prey availability which in turn, often elicit changes in foraging behaviour. As the variability of environmental conditions differs spatially, the individual- and population-level behavioural responses are also predicted to vary, but this is not currently well understood. Here, using data on black-legged kittiwake (Rissa tridactyla) colonies across the north Atlantic and Arctic, we quantify differences in foraging trip duration within and between colonies with respect to variability of sea surface temperature (SST) conditions. We then compare the importance of colony level variation with between-individual level variation on determining behavioural responses and explore the importance of individual repeatability in behaviour. We found evidence that trip duration is linked to SST conditions, with birds making longer foraging trips in colder SSTs. We also found that SST range is linked to trip duration, with birds making

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longer foraging trips in less variable environments. This study improves our understanding of how differences in behaviour may be adaptive in a changing climate, and hope to delve further into how individual variability of behavioural traits can allow adaptation to these changes.

2.1: 11.15 – 11.30 Marina Papadopoulou (Swansea University)

A tale of clones, robots, and agents: the role of behavioural individuality in the collective behaviour of vertebrates

Grouping is vital for many animals, and whilst identifying many reasons for social behaviour (e.g., foraging or predator avoidance), the mechanisms underlying collective behaviour are not fully understood. Computer simulations, that are necessary to disentangle these mechanisms, usually assume that individuals are identical. However, individuals in a group may differ in both their physical characteristics and behavioural traits ('personality'). This heterogeneity is especially interesting when individuals are genetically identical, as in the Amazon molly (Poecilia formosa), or when it is a result of the group's social network, for instance in chacma baboons (Papio ursinus). Here, we investigate how individual heterogeneity affects collective motion dynamics and decision-making by combining empirical data, bio-mimetic robotics, and computer simulations. Through lab experiments, we find that the ability of a Robofish to drive a group of clonal fish varies with the group's social tendency composition. In GPS tracks of baboons in nature, we examine their individual contributions when initiating collective movements. Using our empirical findings, we develop agent-based models that include the heterogeneity of our species and investigate how the collective patterns we observe emerge through self-organization. Overall, our study provides a unifying framework to link individuality and collective behaviour across species and ecological contexts.

Contributed talks 2.2

2.2: 14.30 – 14.45 Thomas O'Shea–Wheller (University of Exeter)

VespAI: Applying Deep Learning to Quantify Hornet Behaviour

The invasive hornet Vespa velutina nigrithorax is a rapidly proliferating threat to pollinators in Europe and East Asia. To effectively limit its spread, colonies must be detected early in the invasion curve, however the current reliance upon visual alerts by the public yields low accuracy. Advances in deep learning offer a potential solution to this, but the application of such technology remains challenging. Here I outline VespAI, an automated system for the rapid detection and behavioural quantification of V. velutina and V. crabro. VespAI leverages a hardware-assisted AI approach, combining a standardised monitoring station with deep YOLOv5s architecture, trained on a bespoke end-to-end pipeline. This enables the system to detect hornets in real-time—achieving a mean precision-recall score of ≥0.99—and send associated data via a compact remote processor. While primarily developed to monitor invasive species, the platform has emerged as an invaluable research tool for remotely studying the behaviour of hornets in the field. I discuss the development and future deployment of the system, and highlight the broader potential for aligned technologies to enhance the scope and sustainability of insect behavioural research.

2.2: 14.45 – 15.00 Joe Wilde (University of Exeter)

Robotic crabs reveal flexible adjustment of sexual signalling in a wild invertebrate

Sexual displays are prevalent across many taxa. Signallers often adjust their display in response to their physical and social environment, such as predation risk and proximity to potential mates or rivals. To maximise their relative attractiveness, individuals might also adjust their displays in response to changes in the signalling behaviour of rivals. However, this is difficult to study in a wild population because manipulation of behaviour is difficult to achieve. In this study, we used a biomimetic robot to experimentally manipulate rival signalling behaviour in a wild population of fiddler crabs (Afruca tangeri). Male fiddler crabs signal by waving their major claw to attract females, increasing their chances of mating. We investigated whether this change in rival waving behaviour led to changes in the activity and waving behaviour of a focal male. We found no evidence that the focal male's waving rate changed in response to changes in the behaviour of the robotic rival. However, bouts of waving lasted longer when the robotic rival was

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waving at a fast rate. Focal males were also less likely to enter their burrow when the robotic rival was waving and spent less time in their burrow if they did enter. These results reveal, in a wild population, the flexible nature of bout-structured sexual displays and the complexity of signalling behaviours when employed within the kinds of social networks that signallers are often embedded in.

Contributed talks 2.3

2.3: 15.30 – 15.45 Naomi Walsh (Liverpool John Moores University)

AI Enhanced Camera Monitoring: Assessing Behaviour and Welfare

Remote monitoring technologies such as camera traps, drones, and acoustic recorders are becoming increasingly popular in animal research due to their ability to aid in data collection and free up researcher time. Recently, studies have begun incorporating artificial intelligence to automatically classify the large and often unmanageable amount of data produced by these technologies. Although increasingly common in wider conservation research, the use of these technologies in zoological collections is far less common. This research aims to investigate whether image recognition allows for automatic species identification and pose estimation to monitor behavioural diversity across multiple species within zoos. It will then examine how this compares to human observed results. Using 4G cameras, images are automatically classified and uploaded to Conservation AI's portal, with the unclassified image then analysed separately by a trained human observer. Initial results focussing on species level classification currently show that an increase in model training using previously incorrectly classified images has improved the AI classifications and reduced the difference between the AI and human observer. The next stage is to incorporate automatic pose estimation analysis to display the potential for these technologies as a monitoring system in zoological collections to facilitate behavioural and welfare research.

2.3: 15.45 – 16.00 Frigg Speelman (University of Groningen & Macquarie University)

Automated tracking of birds in the wild; quantifying the benefits of socially monogamous partnerships

The majority of bird species are socially monogamous, where individuals reproduce in pairs and often closely associate with one another. These partnerships hold crucial evolutionary significance and impact the ecology and behaviour of species, and ultimately increase individual reproductive output and survival. To date, it has been extremely challenging to characterize how closely partners associate through time and space, and how the strength of these social partnerships may affect the ability of individuals and pairs to cope with unpredictable environments. We use solar-powered radiotags on the socially monogamous Chirruping wedgebill (Psophodes cristatus), an understudied non-migratory species in the ecologically unpredictable Australian arid zone. By continuously tracking these birds, every 15 seconds for 24 hours per day, for months, we have precisely estimated pair-bond strength in the wild by using high-resolution measurements of spatial activity. Specifically, we (1) quantified pair-bond strength and variability, (2) examined the emergent benefits of pair-associations over time, (3) determined resilience to heatwaves within the context of the pair-bond. This study enhances our understanding of social partnerships in the wild, and the gains that are made by the individuals within the partnership in extreme environments, and ultimately how social monogamy can evolve.

2.3: 16.00 – 16.15 Alexandra Childs (Bielefeld University)

Milking it: extended dependency in the Galápagos sea lion (Zalophus wollobecki)

Weaning is a critical period in the life of any species. The challenge of shifting from a regularly available and rich food source to independent foraging is the gateway to successful adulthood. The extension of dependency beyond the usual weaning age has been previously documented in mammalian species however only one account of this behaviour in sea lions has been fully reported. Here we describe the phenomenon of super suckling in a colony of Galápagos Sea Lions (Zalophus wollobecki) and investigate its occurrence in relation to sea surface temperature (SST), offspring birth weight and sex, mother's age and experience at parturition, the success of the cohort, and

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population size. Logistic regression models were used to examine the relationship between this behaviour and the environmental and state variables. We found that contrary to expectations, SST and state variables of both the offspring and mother have no significant relationship to this behaviour. However, cohort success has a significant effect on the number of super suckling observations made in a given season. We argue that this behaviour is more commonplace than previous thought but has been overlooked due to the necessity of collecting repeat long-term data on identifiable individuals. We believe that that the regular occurrence of super suckling within the subject colony is indicative of the long-term maintenance of mother-offspring relationships that contribute to a complex adult social life. The observations of behaviours like super suckling are a strong argument for the continued support of long-term studies that allow researchers to investigate behaviours that may only become evident after a number of years and when a full life history is known.

2.3: 16.15 – 16.30 Charli Grimes (University of Exeter)

Postreproductive female killer whales reduce socially inflicted injuries in their male offspring

Understanding the evolution of menopause presents a long-standing scientific challenge—why should females cease ovulation prior to the end of their natural lifespan? In human societies, intergenerational resource transfers, for example, food sharing and caregiving, are thought to have played a key role in the evolution of menopause, providing a pathway by which postreproductive females can boost the fitness of their kin. To date however, other late-life contributions that postreproductive females may provide their kin have not been well studied. Here, we test the hypothesis that postreproductive female resident killer whales (Orcinus orca) provide social support to their offspring by reducing the socially inflicted injuries they experience. We found that socially inflicted injuries, as quantified by tooth rake marks, are lower for male offspring in the presence of their postreproductive mother. In contrast, we find no evidence that postreproductive mothers reduce rake marking in their daughters. Similarly, we find no evidence that either reproductive mothers or grandmothers (reproductive or postreproductive) reduce socially inflicted injuries in their offspring and grandoffspring, respectively. Taken together, our results highlight that directing late-life support may be a key pathway by which postreproductive females transfer social benefits to their male offspring.

2.3: 16.30 – 16.45 Daniel Sankey (Newcastle University)

The role of mutualisms in social behaviour

Relationships between different species that are mutualistic, where both partners benefit, are universal. Yet, we know very little about how mutualisms influence the social systems of animals. Animals may live in groups because groups are beneficial to their mutualistic partners (plants they pollinate, anemones they inhabit, microbial bacteria they provision in their gut). I have developed mathematical models to understand the role of the mutualistic partner on the evolution of social structures. My models are presently being tested on a long term field experiment on clownfish (or, Nemo's), and their mutualistic anemone. Altogether, I will present a theoretical case (backed up with empirical data) for the importance of mutualisms in the question of why complex animal groups evolved.

2.3: 16.45 – 17.00 Fionnuala McCully (University of Liverpool)

The temporal scale of coordinated parental care: evidence from the long–term tagging of breeding black–legged kittiwakes (*Rissa tridactyla*)

Coordinating biparental care may reduce sexual conflict at the expense of individual autonomy. Challenges tied to the long-term deployment of biologgers have limited our understanding of how partners respond to one another over different temporal scales. We asked if breeding birds were more sensitive to their partner’s short or long-term behaviour when making foraging, and consequently coordination, decisions. By deploying VHF tags on 19 pairs of black-legged kittiwakes (Rissa tridactyla) for five weeks, we created the largest known repeated-measures dataset on breeding kittiwake trip durations. Coordination (matching trip durations) was detected in incubation and brooding. The birds’ long-term behaviour was highly correlated with their short-term behaviour, suggesting that coordination

decisions can be satisfactorily explained by the birds' responses to their partners' most recent behaviour. We discuss how real-time adjustments to trip duration, guided by partner behaviour, might prevent parents from accumulating 'investment debt', thereby promoting equal effort in parental care.

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Abstracts: Flash Talks

Flash talks 1

F1: 12.00 – 12.05 Josie McPherson (University of Edinburgh)

Are consistent individual differences in behaviour retained across metamorphosis in *Xenopus tropicalis*?

The majority of animals undergo metamorphosis. Metamorphosis involves huge shifts in ecology, morphology and physiology. Thus, research on individual behaviour over metamorphosis could provide key insights into the links between individual behaviour and ecology, morphology and physiology. In this project, 200 Xenopus Tropicalis tadpoles were recorded in three behavioural assays (activity, exploration and startle response). These assays were repeated again after metamorphosis in the same individuals. Each assay was repeated eight times per individual in the tadpole and frog stage. Video analysis is ongoing, but nearly complete. This data will allow detailed analysis of how both among- and within- individual variation in behaviour changes across metamorphosis, and as a result give exciting insights into the proximate and ultimate drivers of individual behaviour.

F1: 12.05 – 12.10

Ari Drummond (University of Plymouth) The Crustacean Antennule: An indicator of selective attention in hermit crabs

What are invertebrates paying attention to? Most of Pancrustacea are organisms with highly diverse sensory biologies that acquire and process information in ways vastly divergent from the "normal" human experience. Examining active forms of attention and interest in these species poses distinct challenges to behavioural biologists. To better understand attention, cognition and decision-making in Malacostracan crustaceans, we designed an experiment to test whether or not we could observe selective attention to six chemical stimuli in two species of intertidal hermit crab, *Pagurus bernhardus* and *Clibanarius erythropus*. While antennule behaviours have been used to examine sensory biology and physiology in crustaceans, to the best of our knowledge, this is the first time these behaviours have been applied to examine attention and subsequent interest or aversion.

F1: 12.10 – 12.15 Marwa Kavelaars (Max Planck Institute for Human Development)

Decision making in a complex world: how social context impacts foraging strategies in human foragers

Adaptive decision making is crucial for navigating our increasingly complex world and requires continuous integration of different information sources, including prior information about the environment, information from interacting with the environment, and information from others (social information). Despite many studies focusing on isolated aspects of these processes in the lab, how people dynamically integrate these information streams across various socio-ecological settings in the real world remains unknown. We will close this gap by studying a prime example of continuous decision making: human foraging. Using ice fishing as a novel study system, we aim to understand how humans integrate these different information streams. Field work is carried out in Joensuu, Finland, where we equip Finnish ice fishers with GPS trackers and head cameras to collect movement and behavioural data across socio-ecological contexts. Here, I will present the first results of this project and show how social context (solitary, competitive and cooperative foraging) affects individual/group foraging strategies and success. By uniquely combining perspectives and methods from animal ecology and psychology, the project surmounts the challenges of discerning how humans dynamically integrate information, which is vital for comprehending decision making in the real world.

F1: 12.15 – 12.20 Rachel John (University of Exeter)

Investigating and comparing maternal and alloparental care in resident killer whales

Many long-lived mammals, including humans, make the investment of extensive and extended maternal care for their offspring. Additionally, many mammals direct alloparental care towards conspecific young, but the identity of

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these caretakers, as well as the drivers of this behavior, vary greatly by species. Studying fine-scale maternal and alloparental behavior patterns and development in wild systems - especially marine systems - presents a significant challenge because of the need for both long-term demographic and fine-scale behavior data. The Southern Resident Killer Whale population has been closely studied by the Center for Whale Research (CWR) for almost 50 years, with well-established identification and maternal relatedness for every individual. They are a critically endangered, fish-eating ecotype inhabiting the Northeast Pacific Ocean, comprised of 75 individuals as of the latest CWR census. Since 2018, the CWR has also collected video data via Unmanned Aerial Vehicles (UAS), allowing us to analyze fine-scale behaviors and interactions between individuals. Using this UAS footage, I am performing focal follows on calves to characterize their behavior, as well as the behavior and identity of their close associates (mainly mothers and potential alloparents). Here I present my pilot data to give the first insight into patterns of maternal and alloparental care in resident killer whales.

F1: 12.20 – 12.25 Kathryn Bullough (University of Exeter)

Sensory processing during mate choice in swordtail fish

Mating preferences are often influenced by the magnitude of sexual signals, which indicate signaller quality. Whilst it is often assumed that these signals are perceived linearly by the receiver, increasing evidence suggests that stimuli perception may be subject to nonlinear perceptual adaptations and constraints. An example of this is through proportional processing (Weber's Law), where discrimination between signals is based upon their proportional difference rather than their absolute difference. Weber's Law has the potential to dramatically alter sexual selection, changing the evolutionary dynamics between male traits and female preferences to drive signal limitation, exaggeration, or elaboration. In this study, we use green swordtail fish (Xiphophorus helleri) to build on work illustrating proportional processing of a visual sexual signal (body size). I aim to assess whether proportional processing of size occurs in another population of swordtails, as well as making experimental trials more ecologically relevant by investigating proportional processing where males are experienced sequentially. Results demonstrate that proportional processing may not be as widespread as previously thought, with both replicated and novel experiments failing to show any evidence for the usage of Weber's Law during assessment of body size in this population.

F1: 12.25 – 12.30 Özge Kilic (Free University Berlin)

Tracking collective behavioural responses of termites with machine learning pose estimation software

This study seeks to expand upon existing research on the collective behavioural responses of termites (Reticulitermes flavipes) to fungal infections (Metarhizium anisopliae), by incorporating advanced machine learning analyses through the SLEAP software. Unlike traditional observational studies, our approach allows for a high-throughput, nuanced analysis of termite behaviours, including grooming, cannibalism, and burial, in response to varying stages of fungal infection. Furthermore, this research extends into the exploration of spatial fidelity within semi-natural environments, providing insights into how termites navigate and maintain their social structure under pathogenic stress. By inoculating termite colonies 3D printed habitats with M. anisopliae and observing their responses over time, we aim to quantify the behavioural dynamics and spatial organization with unprecedented detail and accuracy. The application of SLEAP for behavioural tracking enables the extraction of complex behavioural patterns and interactions, offering a deeper understanding of social insect behaviour under duress. Our findings will not only shed light on the sophisticated social defences employed by termites but also illustrate the potential of machine learning in ethological research. Unlike manual methods, tracking termites with machine learning software and analysing their behaviour with a combination of clustering algorithms give us more unbiased and real social behaviours. Most importantly, this allows for the comparison of changes in the collective response of the entire colony against pathogens. This study underscores the significance of integrating technological advancements with ecological and biological research to unravel the complexities of animal behaviour in the face of environmental challenges.

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Abstracts: Flash Talks

Flash talks 2

F2: 11.30 – 11.35 Thomas MacGillavry (University of Veterinary Medicine, Vienna)

Of beauty and brains: complex song and dance evolves independently of brain size in the birds of paradise

Complex signalling behaviours, such as birdsong and display, have been associated with larger relative brain size, presumably as brain size correlates with motor coordination and learning abilities. Tests of this hypothesis are troublesome due to the difficulties associated with quantifying behavioural complexity. We compiled a µCT-based brain size dataset of more than half of the known birds of paradise (family Paradisaeidae) species, which perform some of the most elaborate courtship displays among birds, and used multiple display complexity metrics to test the hypothesis that larger brains facilitate the evolution of more elaborate repertoires of motor and vocal displays. In contrast with previous work, we found that complex courtship display behaviours evolved independently from brain size in this clade. These conclusions held across three different kinds of behavioural and two different kinds of vocal complexity scores. Our results suggest that brain size may only coevolve with complex motor learning abilities when brain size is a limiting factor, which is likely not the case in the large-brained birds of paradise, where brain size rivals that of medium-sized corvids.

F2: 11.35 – 11.40 Erik Versluijs (Inland Norway University of Applied Sciences)

Behavioural dependent habitat selection of free-ranging cattle in the boreal forest

During the 20th century, when large carnivores were subject to eradication in Norway, farmers started to release their livestock unsupervised in the forests during summer. Since 1970, Norway has committed to conserve large carnivores, which led to high losses in domestic sheep herds. Therefore, farmers are encouraged to use cattle instead, as cattle have a hundred times lower depredation rate. However, farmers report increased stress in cattle, and income loss. We GPS collared all adult cattle (N = 125) in four herds and two areas in the Innlandet County of SE-Norway. The collars included accelerometer sensors and were equipped with virtual fencing technology to retain the animals inside areas up to 25 km2. We registered GPS positions of cattle using 15-minute intervals and predicted common behaviours such as grazing, walking, vigilance, and resting, using accelerometry signatures. We used multi-state step-selection analyses to study effects of environmental variables (habitat, weather) on cattle behaviours, body condition, and seasonal variability. Preliminary results indicated that cattle used mostly forest roads for walking, as previously shown. Our results provide novel insights about cattle's space-use in boreal forests, and the potential to study the compatibility of free-ranging cattle with carnivores and effects on animal welfare.

F2: 11.40 – 11.45 Lucia Kotianová (University of Veterinary Sciences Brno)

Effect of temporary isolation within different age periods on the behaviour of dairy goat kids

Social isolation induces fear and stress in milking goats, affecting their welfare. For the first 2-14 days, the goat kids are considered hiders, then follow their mother closely until 2-3 months old, syncing behaviours with other kids instead of their mothers. Nowadays, significant attention is given to non-invasive approaches for evaluating acute stress in farm animals. This study assesses the impact of short-term isolation on 2-week-old and 2-month-old goat kids using behavioural coding and infrared thermography. We compared the potential variations in behavioural and physiological reactions among kids of two different age groups. Ten animals in each group were observed before and after separation from their mothers for 30 minutes. Both age groups exhibited increased vocalization ($P < 0.05$), with surface temperature showing significant differences ($P < 0.05$) in the younger group and highly significant differences ($P < 0.01$) in the older group during isolation. Younger goat kids displayed higher locomotion and exploratory behaviour ($P < 0.05$) compared to older group. No statistically significant difference ($P > 0.05$) in eye temperature was observed between groups post-separation. In conclusion infrared thermography has the potential to become a valuable non-invasive contactless method of acute stress assessment in goats.

F2: 11.45 – 11.50 Kingsley Hunt (University of Exeter)

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Abstracts: Flash Talks

The social microbiome as a driver of colony fusion in Pacific dampwood termites (Zootermopsis angusticollis)

Group living is thought to evolve when the benefits of sociality outweigh the costs. It's long been recognised that acquiring pathogens from social partners can be costly, but only recently has this argument been flipped on its head to consider the exchange of beneficial mutualistic microorganisms. This concept, of an adaptive 'social microbiome', is most likely to occur in species that have high levels of interaction, resource exchange and where the microbiome is of high functional importance, such as in wood-eating termites. In my PhD, I will use 16S rRNA sequencing to describe the composition of the bacterial microbiome of wild colonies of Pacific dampwood termite (Zootermopsis angusticollis). I will combine this information with behavioural observations and microsatellite genotyping of each colony, which will provide insight into the breeding structure of each colony and importantly whether they originate from simple founding pairs, or from the cooperative fusion of different, previously unrelated colonies. I will test whether dampwood termites show evidence for unique colony-specific social microbiomes and will examine how colony fusion shifts the microbiome. The overall aim for this project is to better understand the role that the microbiome can play in social evolution and social behaviour.

F2: 11.50 – 11.55 Rohan Vishwas Joglekar (University of Exeter)

Does exposure to environmental pollutants affect the migratory behaviour of UK estuarine wading birds: An energy budget approach

In birds, migration is an integral part of their lives and many birds around the world migrate to acquire seasonally available resources to fulfil activities like moulting and breeding whilst minimizing stressful conditions associated with unfavourable weather and reduced food availability. UK estuaries have been a hotspot for many wintering migratory wading birds which fulfil their energetic demands by providing them with huge quantities of rich food resources needed to fuel their migratory and breeding requirements. However, for many years, these estuaries have been impacted by severe pollution caused by industrial activities, domestic waste, and agriculture. By means of field observations of birds and prey sampling and by using biochemical analysis, this project aims to study the feeding and general wintering migratory behaviour of these UK estuarine birds to understand their energy requirements, quantify the organic and heavy metal pollution load accumulated in their body and their food source, and use GPS tracking to study their migratory movement. This will result in the build-up of a dynamic energy budget model to understand if pollutants cause a significant impact on their migratory behaviour by affecting their energetic levels, a topic which will be of worldwide significance.

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Abstracts: Posters

01 Josie McPherson (University of Edinburgh)

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02 Thomas MacGillavry (University of Veterinary Medicine, Vienna)

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05 Marwa Kavelaars (Max Planck Institute for Human Development)

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Effect of temporary isolation within different age periods on the behaviour of dairy goat kids

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07 Rachel John (University of Exeter)

Investigating and Comparing Maternal and Alloparental Care in Resident Killer Whales

Many long-lived mammals, including humans, make the investment of extensive and extended maternal care for their offspring. Additionally, many mammals direct alloparental care towards conspecific young, but the identity of these caretakers, as well as the drivers of this behavior, vary greatly by species. Studying fine-scale maternal and alloparental behavior patterns and development in wild systems - especially marine systems - presents a significant challenge because of the need for both long-term demographic and fine-scale behavior data. The Southern Resident Killer Whale population has been closely studied by the Center for Whale Research (CWR) for almost 50 years, with

well-established identification and maternal relatedness for every individual. They are a critically endangered, fish-eating ecotype inhabiting the Northeast Pacific Ocean, comprised of 75 individuals as of the latest CWR census. Since 2018, the CWR has also collected video data via Unmanned Aerial Vehicles (UAS), allowing us to analyze fine-scale behaviors and interactions between individuals. Using this UAS footage, I am performing focal follows on calves to characterize their behavior, as well as the behavior and identity of their close associates (mainly mothers and potential alloparents). Here I present my pilot data to give the first insight into patterns of maternal and alloparental care in resident killer whales.

08 Kingsley Hunt (University of Exeter, Penryn Campus)

social microbiome as a driver of colony fusion in Pacific dampwood termites (Zootermopsis angusticollis)

Group living is thought to evolve when the benefits of sociality outweigh the costs. It's long been recognised that acquiring pathogens from social partners can be costly, but only recently has this argument been flipped on its head to consider the exchange of beneficial mutualistic microorganisms. This concept, of an adaptive 'social microbiome', is most likely to occur in species that have high levels of interaction, resource exchange and where the microbiome is of high functional importance, such as in wood-eating termites. In my PhD, I will use 16S rRNA sequencing to describe the composition of the bacterial microbiome of wild colonies of Pacific dampwood termite (Zootermopsis angusticollis). I will combine this information with behavioural observations and microsatellite genotyping of each colony, which will provide insight into the breeding structure of each colony and importantly whether they originate from simple founding pairs, or from the cooperative fusion of different, previously unrelated colonies. I will test whether dampwood termites show evidence for unique colony-specific social microbiomes and will examine how colony fusion shifts the microbiome. The overall aim for this project is to better understand the role that the microbiome can play in social evolution and social behaviour.

09 Kathryn Bullough (University of Exeter)

Sensory processing during mate choice in swordtail fish

Mating preferences are often influenced by the magnitude of sexual signals, which indicate signaller quality. Whilst it is often assumed that these signals are perceived linearly by the receiver, increasing evidence suggests that stimuli perception may be subject to nonlinear perceptual adaptations and constraints. An example of this is through proportional processing (Weber's Law), where discrimination between signals is based upon their proportional difference rather than their absolute difference. Weber's Law has the potential to dramatically alter sexual selection, changing the evolutionary dynamics between male traits and female preferences to drive signal limitation, exaggeration, or elaboration. In this study, we use green swordtail fish (Xiphophorus helleri) to build on work illustrating proportional processing of a visual sexual signal (body size). I aim to assess whether proportional processing of size occurs in another population of swordtails, as well as making experimental trials more ecologically relevant by investigating proportional processing where males are experienced sequentially. Results demonstrate that proportional processing may not be as widespread as previously thought, with both replicated and novel experiments failing to show any evidence for the usage of Weber's Law during assessment of body size in this population.

10 Rohan Vishwas Joglekar (University of Exeter)

Does exposure to environmental pollutants affect the migratory behaviour of UK estuarine wading birds: An energy budget approach

In birds, migration is an integral part of their lives and many birds around the world migrate to acquire seasonally available resources to fulfil activities like moulting and breeding whilst minimizing stressful conditions associated with unfavourable weather and reduced food availability. UK estuaries have been a hotspot for many wintering migratory wading birds which fulfil their energetic demands by providing them with huge quantities of rich food

resources needed to fuel their migratory and breeding requirements. However, for many years, these estuaries have been impacted by severe pollution caused by industrial activities, domestic waste, and agriculture. By means of field observations of birds and prey sampling and by using biochemical analysis, this project aims to study the feeding and general wintering migratory behaviour of these UK estuarine birds to understand their energy requirements, quantify the organic and heavy metal pollution load accumulated in their body and their food source, and use GPS tracking to study their migratory movement. This will result in the build-up of a dynamic energy budget model to understand if pollutants cause a significant impact on their migratory behaviour by affecting their energetic levels, a topic which will be of worldwide significance.

11 Özge Kilic (Free University Berlin)

Tracking collective behavioural responses of termites with maschine learning pose estimation softwares based on their their infection stage and showing spatial fidelity in semi-natural environments

This study seeks to expand upon existing research on the collective behavioural responses of termites (Reticulitermes flavipes) to fungal infections (Metarhizium anisopliae), by incorporating advanced machine learning analyses through the SLEAP software. Unlike traditional observational studies, our approach allows for a high-throughput, nuanced analysis of termite behaviours, including grooming, cannibalism, and burial, in response to varying stages of fungal infection. Furthermore, this research extends into the exploration of spatial fidelity within semi-natural environments, providing insights into how termites navigate and maintain their social structure under pathogenic stress. By inoculating termite colonies 3D printed habitats with M. anisopliae and observing their responses over time, we aim to quantify the behavioural dynamics and spatial organization with unprecedented detail and accuracy. The application of SLEAP for behavioural tracking enables the extraction of complex behavioural patterns and interactions, offering a deeper understanding of social insect behaviour under duress. Our findings will not only shed light on the sophisticated social defences employed by termites but also illustrate the potential of machine learning in ethological research. Unlike manual methods, tracking termites with machine learning software and analysing their behaviour with a combination of clustering algorithms give us more unbiased and real social behaviours. Most importantly, this allows for the comparison of changes in the collective response of the entire colony against pathogens. This study underscores the significance of integrating technological advancements with ecological and biological research to unravel the complexities of animal behaviour in the face of environmental challenges.

12 Krish Sanghvi (University of Oxford)

Low reproductive output of polygynous males is mediated by seminal fluid, not sperm number

Polygynous males can become quickly depleted of ejaculate reserves, leading to lower reproductive output as males progress through a mate multiplication sequence. This effect can be exaggerated by males being of poor quality, such as of an old age. However, whether sperm or seminal fluid mediate such effects is currently unknown. Here, we use mate multiplication assays to investigate changes in reproductive output of old and young males through a mating sequence, and whether the effects are driven by sperm or seminal fluid depletion. We find that while old males have generally lower reproductive output than young males, this effect is despite old males having more sperm than young males. Surprisingly, the observed effects are driven by seminal fluid limitation in old males. Our study highlights the important of age-dependent changes in seminal fluid and sperm that might affect male reproductive success in polygynous species.

13 Veronika Simanová (University of Veterinary Medicine and Pharmacy in Košice)

Experimental proposal: Cognitive dysfunctions of senior dogs and effect of gut microbiome on their development

The increased average lifespan of dogs due to progress of modern veterinary medicine is associated with the emergence of neurodegenerative diseases such as the canine cognitive dysfunction syndrome (CCD) observed in senior dogs (>8 years). Dogs suffering from this syndrome exhibit various behavioural changes and CCD also affects

the individual's physiology. The diagnosis of CCD currently relies on the patient's history and recognition of the typical symptoms, while the therapy mostly consists of the nutritional adjustment, enrichment of the dog's living environment, and the use of medications.

Because of the existence of the gut-brain axis (GBA), the connection between the gut microbiome and the development of neurodegenerative diseases have become a studied topic. However, the exact effect of gut microbial composition on the development of CCD needs to be explored.

Using a set of behavioural tests, clinical examination, blood and faecal samples and complex questionnaires, we aim to bring more targeted insight into cognitive changes in ageing dogs, monitor their occurrence, explore their forms, find connection between the bacterial composition of gut microbiome and development of CCD, explore new methods of CCD prevention and detection, and simultaneously provide new data on the prevalence of CCD.

14 Roxanne Holmes (University of Cambridge)

Lionfish activity in response to coral reef soundscapes

Sound is a reliable cue in the marine environment and is used in long distance navigation by larval reef fishes during settlement. Ambient sounds generated by different habitats contain information about the direction and content of the sound source and may offer information about the availability of resources or risk, subsequently affecting the behavioural decisions of animals. These soundscapes, therefore, could be used by predators to select suitable areas to forage. However, despite its role in the early life of reef fishes, whether post-settlement reef fish use ambient soundscapes to inform their movement decisions remains less clear. In a field-based playback experiment we found that lionfish (Pterois volitans) show no preference to move towards the playbacks of two different habitat types during daylight hours. In a laboratory-based playback experiment testing whether lionfish (Pterois miles) changed their exploratory behaviour in response to ambient soundscapes of degraded and healthy reefs at low and high Sound Pressure Level (SPL)s, we found that lionfish only altered their activity in response to soundscape playbacks at night, but not during the day. We interpret our findings to suggest that lionfish display behavioural responses to ambient soundscape characteristics such as SPL and habitat health, but that this depends on the time of day. While acoustic lures have been speculated to be a promising addition to existing lionfish trap designs, our findings suggest that playbacks of ambient soundscapes are unlikely to be successful in attracting lionfish that have already settled on reefs as they do not induce directional movement.

15 Daisy Johnston-Barrett (University of Bristol)

How Saltatory Movement of Prey Affects the Risk of Predation

Movement is integral to biological interactions at every scale and provides a useful lens through which to study animal psychology, behaviour, and ecological interactions. Saltatory movement is a stop-and-go search strategy found across a wide variety of taxa, but little is known about its effect on how vulnerable prey are to their predators. Intermittent periods of pause in saltatory movement decrease activity, which has previously been linked to an adaptive decline in conspicuousness in prey. Accordingly, we predicted that predators would preferentially attack constantly moving prey more than prey with saltatory movement. Using a system of stickleback predators (Gasterosteus aculeatus) and simulated virtual prey, we investigated how saltatory movement of prey affects the risk of predation. Computer-generated dots were used for simulating the prey which could be programmed to move in any search pattern, and were projected on to an experimental tank. The four prey types ranged from constant to highly saltatory movement (0%, 20%, 40% or 60% of the time stationary). The frequency of attacks on the four prey types was found to be not statistically significant; similarly, aggregating all the saltatory prey showed no difference in attack preference compared to the constantly moving prey. Saltatory search, therefore, appears no more beneficial, or costly, than constant motion. This prompts further research on the costs and benefits of saltatory search, how predators perceive intermittent motion, and more broadly the relationship between movement and conspicuousness.

Link to schedule

Abstracts: Posters

16 Awani Bapat (University of Vienna)

Do common ravens use objects to mediate social interactions?

Social play has been shown to facilitate the formation and development of social relationships between individuals. Social play may also involve objects. Most research on object play behavior suggests that it is explorative in nature and adaptive in gaining foraging skills. However, not much is known about how individuals may use objects to initiate social interactions with others. Captive ravens have been shown to engage in interactions over cached objects, thereby learning about others' behaviors. In this study, we test the hypothesis that ravens may engage in object play to attract the attention of and initiate interactions with other ravens. To examine our hypothesis, we collected ~300 focal observations between October 2021 – December 2023 on the object-handling behavior in a group of non-breeder ravens in free-flight in the Northern Alps of Austria. Our preliminary analysis shows a trend that object-handling behavior elicits approaches from other ravens and, indeed, may lead to social interactions. However, the exact social context seems to differ between the age-classes. The potential implications of these results and further steps in the analysis will be discussed.

17 Nicki Phillips (University of Lincoln)

How does zoo animal behaviour influence visitor perceptions of zoo animal welfare?

The public perception of zoo animal welfare can impact visitor behaviour, including visit likelihood and engagement with conservation initiatives. Therefore, it is important to understand what factors are influential to visitor perceptions of animal welfare if the public is to visit zoos. To identify influential factors, we conducted a mixed-methods systematic review on 115 peer reviewed articles, and we identified some key animal factors affecting visitor perceptions of animal welfare. Animal behaviour was particularly important. Behaviours perceived as natural and/or active were viewed favourably, and those perceived as inactive and/or abnormal viewed negatively. However, visitors were not always accurate in their judgements of which behaviours were natural/unnatural, and natural behaviour was not always equated with good welfare, or what visitors reported as desirable to observe. Similarly, social behaviours were generally assumed to indicate good welfare, though how accurately visitors interpret the function of behaviours and their impact to welfare is ambiguous. Further research is therefore required, including how zoos may best communicate with visitors regarding animal behaviour and welfare, as positive perceptions may subsequently influence visitor behaviour and aid zoos' abilities to achieve high welfare standards.

18 Alana Carroll (University of St. Andrews)

Multiple roost-building in white-browed sparrow weavers

White-browed sparrow weavers (Plocepasser mahali) are group-living birds that build single-occupancy roosts in which adults sleep overnight. Given that the building of these roosts seems energetically costly, we might expect only one structure to be built per individual. However, each group of sparrow weavers has considerably more roosts than group members. It is not yet clear why groups build and maintain so many roosts. To gauge the purpose of these ancillary roosts, we first needed to determine which roosts the birds use, and how frequently. To do this, we documented the nighttime roost usage of 26 different sparrow weaver families and measured the dimensions, position, orientation, and condition of all their structures. We found that for all families, birds used some of the structures nearly every night, while other structures were rarely or never used. These data suggest that the extra roosts serve a purpose beyond that of simply providing shelter against harsh desert conditions. Potential purposes include disguising sleeping locations from predators or parasites, insuring against roost loss or usurpation, signaling genetic quality, and forming roost microclimates suited to different conditions. Distinguishing between these theories will require tracking roost usage across multiple seasons.

19 Molly Simpson (University of Nottingham)

Interaction of co-founding and social immunity in Messor barbarus

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Abstracts: Posters

I am investigating the interaction between co-founding in harvester ant gynes (Messor barbarus) and social immunity against the generalist insect fungal parasite Metarhizium, during colony establishment. To investigate this interaction, I will be innoculating harvester ant queens with spores when on their own or as part of a co-founding pair of gynes. The behaviour of the gynes will be monitored for a week prior to the exposure of Metarhizium, then after Metarhizium exposure, behaviour will be monitored during colony establishment. Behaviours to be recorded include self-grooming, allo-grooming and handling of brood. Reproductive success by each nest will be monitored and resistance to the same fungal parasite assessed in the worker offspring, which will provide a measure of immune priming. I hypothesise that exposure to a pathogen will impact on the colony found phases of co-founding queens in a different manner to that of solo queens, due to the opportunity for social immunity. The interaction between co-founding and immunity is not well characterised in this species, but a greater understanding of its role in colony establishment will add to our knowledge of social evolution and how social insects combat disease outbreaks.

20 Livio Flüeler (University of Zurich)

Behaviour-related heart rate in wild meerkats as an indicator of arousal

Emotional state is thought to influence behavioural responses in reaction to situations or stimuli. Emotions in animals, categorized along the dimensions of valence (positive/negative) and arousal (high/low), are difficult to measure. Physiological changes have been identified as indicators of emotional arousal. To investigate emotional arousal in a wild, free-living animal, we implanted 12 wild meerkats (Suricata suricatta) with heart rate loggers. We first confirmed whether there was variation in heart rate between different behavioural activities. We then examined if there was context related variation in heart rate between behaviours with similar physical activity levels, to investigate arousal related changes in heart rate while controlling for activity related effects. We compared social vs. asocial grooming, and digging in pursuit of prey vs. digging for burrow maintenance. The results show, that during social grooming individuals displayed lower heart rates compared to asocial self-grooming, implying a possible calming effect. When digging for prey, individuals exhibited higher heart rates than digging for burrow maintenance, suggesting an emotional influence, perhaps due to excitement. These findings highlight the relationship between emotional arousal and heart rate, providing novel insights into the emotional lives of meerkats in their natural habitat.

21 Tristan Canterbury (University of Exeter)

Social Feedback and the Adaptive Value of Information in a Dynamic Game of Divorce

There is burgeoning interest in the role of social feedback in information use in animals, but an information theoretic perspective is scarcely utilised, and little is known about the population dynamics between information use and information states. We model a dynamic game of observation and divorce wherein decision making is dependent on female knowledge about the quality of her mate. Females must decide whether to make costly observations of mate quality, and whether to divorce their partner and enter the pairing pool. We explore the roles of uncertainty, noise, opportunity costs, mortality costs, lifespan, and the mate quality distribution in the adaptive value of information and divorce strategies. We find that the evolutionary stable divorce strategy is determined by the pairing pool quality, which is largely influenced by the resident divorce and observation strategies. For the observation strategy we find that while a long lifespan, low noise, and low observation costs can increase information value, population effects of information use on uncertainty in the pairing pool can negate these effects. Social feedback ought to play a significant role in informational strategies in nature. We also outline extensions to the model that may disambiguate the effect of greater social complexity.

22 Andrew Houldcroft (University of Exeter)

Using inlabru to predict and map wildlife densities in heterogeneous landscapes

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Abstracts: Posters

Shared landscapes in which humans and wildlife coexist, are increasingly recognised as integral to the long-term persistence of many threatened species. However, these landscapes are heterogeneous and expose wildlife to spatially complex threats including hunting, bidirectional zoonosis and infrastructural mortalities. Effective conservation therefore necessitates population density and distribution data at finer spatial resolutions than offered by conventional approaches. Using the R package inlabru, we develop a full-likelihood joint log-Gaussian Cox process model to simultaneously perform spatial distance sampling and model a spatially varying cluster size distribution, which we condition upon detection probability to account for cluster-size bias. We also incorporate a non-stationary Gaussian random field for the first time, enabling the explicit inclusion of geographical barriers to wildlife dispersal. We demonstrate this model using 136 georeferenced detections of Campbell's monkey (Cercopithecus campbelli) clusters, collected with 398.56-km of line transects across a shared agroforest landscape mosaic (1067-km2) in Guinea-Bissau. We assess a suite of anthropogenic and environmental spatial covariates, finding that normalized difference vegetation index (NDVI) and proximity to mangroves are both powerful spatial predictors of densities, suggesting that mangroves are providing hunting refuge benefits at the landscape scale. We estimate a population of 10,730 (95% CI [7608-15,330]) individuals and produce a fine-resolution predictive density map, revealing the importance of mangrove-habitat interfaces for the persistence of this heavily hunted primate. This work demonstrates a powerful, widely applicable approach for monitoring wildlife and informing evidence-based conservation in complex, heterogeneous landscapes moving forward.

23 Joseph Gillson (University of Oxford)

Investigating the relationship between body size and vibrational signalling in two species of delphacid planthopper

Delphacid planthoppers (Hemiptera: Fulgoromorpha) use substrate-borne vibrational signals during courtship, conspecific mate identification and location, as well as in male-male aggression. However, how the information contained within the courting signals relates to the signalling individual has remained unstudied not only for delphacids, but Hemiptera more broadly. To this end, the current study utilises laser-Doppler vibrometry to investigate whether the frequency and magnitude of the substrate-borne vibration signals produced by the males of two delphacid species [Javesella dubia (Kirschbaum, 1868) and J. pellucida (Fabricius, 1794)] are associated with body-size, as well as aspects of the signal structure (duration, rate of production and number of signal peaks). This study reports that the external morphology of the vibration-producing snapping organ in these two species is nearly identical, suggesting that the differences found in the vibrational signals between the two species are likely to be due to neurogenic control, rather than originating from morphological differences. This work additionally finds no evidence for an association between male size and the signalling parameters and reports some unusual truncations in the signalling of J. pellucida.

24 Li Veiros (University of St Andrews)

Predator inspection in rockpool fishes

Predator inspection, where small groups of prey animals approach a potential threat, has been suggested as an example of reciprocal cooperation in fishes. However, most previous work has made use of artificial laboratory settings with only a few freshwater species. Additionally, those studies have almost exclusively studied dyads, which might not resemble predator inspection in the wild. This ongoing field study aimed at investigating whether predator inspection is more widespread than currently believed and whether predator inspection takes place in dyads or bigger groups. This involved testing free-swimming, non-model fish species in the wild, this time in a marine setting. Our experiment presents either a model fish predator, non-threatening fish, or counter-shaded object in rockpools and reactions from wild fish were recorded, including the lesser sand eel (Ammodytes tobianus), juvenile whiting (Merlangius merlangus) and goby (Pomatoschistus microps). Data will be extracted on frequency of predator inspection events, inspecting group size, and direction of approach relative to the head of the model predator. Extracted data will be analysed in R with a generalised linear mixed model with a binary response variable. This will be among the first studies to look for predator inspection in the wild.

Link to schedule

Abstracts: Posters

25 Luca Hahn (University of Exeter)

Social relationships shape social foraging in wild jackdaws on proximate and ultimate levels

Many social animals form differentiated relationships that have been linked to fitness benefits across taxa. However, it is less clear how social relationships influence short-term decisions and outcomes that translate to long-term consequences. For example, social relationships could mediate behaviour during social foraging, often characterised by dynamic, uncertain social interactions involving many individuals. We investigated fine-scale social interactions in wild jackdaws (Corvus monedula), a highly social corvid, by using RFID feeding stations. We arranged feeders to create situations where two individuals could be perched in close proximity. We predicted that social interactions during foraging should be governed by social relationships, with individuals favouring associates, such as mated partners or kin, and benefitting from their presence. Social relationships determined the likelihood, mechanisms, and outcomes of social interactions during foraging in close proximity. Pairs and kin foraged more synchronously and were overrepresented in terms of joint visits, and these relationships, characterised by greater social tolerance, facilitated access to information and the food itself. Our research, linking proximate and ultimate questions of sociality, highlights that social relationships play a key role in shaping the short-term daily foraging situations in an open society in which highly uncertain and competitive interactions occur.

26 Robert Kelly (University of Exeter)

What behaviour is important behaviour? A quantitative review of how wild and zoo-housed animals differ in their time activity

Natural behaviour performance in captive animals is traditionally utilised as a metric to establish welfare states, with an increase in natural behaviour associated with positive welfare. Captive environments, including zoos strive to replicate ecologically relevant ecologically-relevant environments that promote species-specific and adaptive behaviour performance. However, spatial restrictions and complex habitats required by some species creates various challenges for zoo staff to implement management and husbandry practices that achieve these results. Some species struggle to adapt and cope in captive environments, with increased abnormal behaviour performance and subsequently reduced welfare. Some groups of animals may adapt to captivity in novel ways, demonstrating flexibility in their behaviour patterns without compromising their welfare. However, research indicating behaviourally flexibility in captive animals is sparse. The main aim of this review was to categorise animals as being fully behaviourally flexible, partially behaviourally flexible or behaviourally inflexible. Effect sizes (Hedges' g) were calculated to compare behavioural categories of animals in the wild and zoo, grouped by taxonomic Order or selected ecologically traits to determine which groups demonstrate behavioural flexibility. Effect sizes were analysed to decipher which specific behavioural categories were deemed more important and therefore contribute to improved welfare. Despite variation across all groups, abnormal behaviour was consistently highest in zoo animals, with reproductive and foraging behaviours most often compromised. Overall, full behavioural flexibility was suggested in Testudines, completely migratory species and ring-tailed lemurs (Lemur catta), with all other groups either partially behaviourally flexible or behaviourally inflexible. Prevalence of abnormal behaviours and reduced foraging and reproductive behaviours in these groups suggests an inability to adapt to captivity. This necessitates more focussed investigations that identify environmental features or other aspects of a managed environment to meet the animals' needs.

27 Jeroen Zewald (University of Veterinary Medicine, Vienna)

Tracking object alignment: asymmetrical shape fitting in Goffin's cockatoos (*Cacatua goffiniana*)

For efficient use of objects in construction or tool use behaviour, object-substrate alignment is a crucial element. In humans and other tool-using primates, the development of alignment capabilities is often investigated using a shape fitting paradigm, where an individual inserts a shape into a similarly shaped aperture, either using a visual or a haptic alignment technique respectively. Additionally, these alignment abilities are also likely challenged by the asymmetry

of the shape. We set out to investigate the alignment abilities of the Goffin's cockatoo (Cacatua goffiniana) and especially how asymmetry influences these. For this, we presented them with 18 shapes, all equipped with markers. Using a deep learning model, we could track the rotational and central alignments of the shapes over time, giving us a detailed look at the object movements made by the cockatoos. We found a strong effect of asymmetry both showing that cockatoos had more difficulty and improved slower with more asymmetrical shapes. They performed similarly to the other tool using primates which has been suggested to reflect their tool use abilities. Future studies should look at the alignment abilities of non-tool using species to further investigate this potential linkage.

28 Isla Botting (Liverpool John Moores University)

Understanding movement of migratory shorebirds during the non-breeding period

Our rapidly changing world presents challenges to migratory shorebirds, with climate change, sea-level rise, and anthropogenic development threatening their survival. Many shorebirds, including knot Calidris canutus islandica, migrate from Arctic breeding grounds to areas of North-western Europe, such as the Wadden Sea, to moult and overwinter. While many knot stay within the Wadden Sea post-moult, resighting and automated radio-tracking (ATLAS) data have shown some individuals to migrate between coastlines to intertidal zones within the UK, such as The Wash and Liverpool Bay. Despite knot movement between coastlines being well documented, site connectivity is less understood. Moreover, how movement may influence population resilience, and if there is individual variation to movement, is unknown. By assessing a combination of ringing data, colour-ring resightings, and ATLAS tag detections, I aim to quantify individual movement across three intertidal areas in the UK and the Netherlands and to present the preliminary results of these analyses. With shorebird numbers declining in the UK, investigating population-level and individual-level variation of knot intertidal movements is imperative for supporting conservation efforts.

29 Macaela Skelton (University of Exeter)

Age-related changes in how rhesus macaques engage with social information

People are increasingly living to reach old age, placing growing demand on health services. Social isolation can occur in the elderly, which may reduce health and survival, making it imperative to understand how ageing alters social engagement. Though recent studies have shown social selectivity in humans and nonhuman primates, whereby older individuals prioritise social over non-social information, it remains unclear if all social mechanisms are affected in the same way. Here I investigate how age influences engagement with different types of social information in different contexts in rhesus macaques. As expected, motivation or ability to attend to non-social information declined, while the effect of age on social engagement depended on the type of stimuli. Attentiveness towards photos of other females' hindquarters remained constant with age, but engagement towards noisy scream vocalisations declined with increased age. Older females were not more attentive to vocalisations from close friends. These results expand existing research, indicating that ageing might not affect all social mechanisms equally. As we age, social engagement may vary based on the social context, the type of social information, and the way that information is transmitted. These findings improve our understanding of which mechanisms drive age-related changes in social engagement in nonhuman primates and thus, in humans. These causal links must be made to understand not just how, but why ageing affects social engagement in elders, so that we may provide efficient care to support the world's growing elderly population.

30 Daniel Marsh (University of St Andrews)

Do white-browed sparrow-weavers Plocepasser mahali adjust the morphology of their structures according to predation risk?

Weaverbirds (Ploceidae) build intricate and elaborate nests, often either pendant or with long entrance tubes. It has often been assumed that nests with these morphologies are adapted to prevent predators such as snakes from accessing the nest contents. However, this hypothesis has rarely been tested. We have attempted to do this by

examining how the structures built by white-browed sparrow-weavers Plocepasser mahali vary in the length of their entrance tubes and in the precarity with which they are attached to trees. If structures that are built closer to the ground, closer to the tree trunk, and securely attached to the tree are readily accessed by terrestrial predators, we investigated whether sparrow weavers alter the length of the entrance tubes of their structures (roosts and nests), depending on any of these factors. However, the length of entrance tubes does not appear to correlate with the height of a structure from the ground or its distance from the tree trunk. And, contrary to expectations, entrance tube length appears to increase as the attachment type becomes more precarious. These results suggest that white-browed sparrow-weavers do not adjust the morphology of their structures to compensate for building in sites that are more easily accessed by predators.

31 Marco Fele (Swansea University)

Lower-ranked baboons have more and less interrupted nighttime rest

Studies on animal sleep are often highly controlled, focus on model species, and aim to understand the genetic and molecular mechanisms underlying sleep regulation. Animal-attached tags (bio-loggers) now provide opportunity to study animal sleep in the wild, under relevant social and ecological contexts. Nevertheless, sleeping remains mainly unexplored, with only a handful of studies conducted in field settings. Here, we study the nighttime resting behaviour of baboons and explore if and how social dominance effects resting patterns. We investigated the total duration and interruption of resting for our study animals during the night using tracking collars containing tri-axial accelerometers worn by 12 individuals (10 females, 2 males) over 25 nights. Then, we addressed the role that dominance has on both quality and quantity of individual rest. Furthermore, we investigated the group-level patterns of resting, such as synchrony of individual state and behavioral influence. We find that lower dominance individuals have more and lower quality rest. We also find that the group synchronizes its resting, and that similarly dominant individuals are more synchronized. Lastly, we find that dominant individuals set the pace of resting and activity for the rest of the troop. In conclusion, we shown how dominance is a central aspect of baboon behaviour, and is relevant for determining the social aspects of the groups resting.

32 Eve Jourdain (University of Oslo)

Social and genetic connectivity despite ecological variation in a killer whale network

Philopatric kin-based societies encourage a narrow breadth of conservative behaviors due to individuals primarily having access to learning from close kin, promoting behavior homogenization. However, social ties across behaviorally diverse groups could be sufficient to induce variation and a greater ecological niche breadth, but empirical evidence has remained scarce. We investigated a network of 457 photo-identified killer whales from Norway (548 encounters in 2008-2021) with diet data available (46 mixed diet individuals feeding on both fish and mammals, and 411 exclusive fish-eaters) to quantify patterns of association within and between diet groups, and to identify underlying correlates. We used a subset of 106 whales with genetic data to further assess patterns of genetic differentiation. Our results suggested kinship as main driver of social bonds within and among cohesive social units, whilst diet was most likely a consequence reflective of cultural diffusion, rather than a driver. Flexible associations within and between ecologically diverse social units led to a highly connected network, with no social or genetic differentiation between diet groups. Our study points to a role of social connectivity, in combination with individuals' behavioral variation, in influencing populations ecology in killer whales.

33 Ishani Nanda (Queen Mary University of London)

Discrimination of duration of flashing lights in the bumblebee, Bombus terrestris

In the domain of animal behaviour, the ability to process temporal information is crucial for activities like foraging, mating, and predator avoidance. Research has investigated circadian rhythms and interval timing while much less is known about the ability to process patterns and durations of events in the range of seconds. Whether or not insects

can solve the task of discriminating two lights flashing at different frequencies remains unknown. In this work, we focus on the ability of bumblebees (Bombus terrestris) to discriminate the duration of visual events presented as filled yellow circles that flash for different durations. Bees were trained to associate either the long or short-duration stimulus with a sugar reward until reaching a criterion of 15 out of 20 correct trials. Then, bees were tested without sucrose solution, to find whether they had learned to discriminate between the different durations. In Experiment 1, we assessed the ability to discriminate between a long stimulus (2.5 or 5 seconds) and a short stimulus (0.5 or 1 second). In each cycle of the presentation, the long stimulus was 5 times longer than the short stimulus. The bees learned to discriminate between the two stimuli either when trained the short stimulus was rewarded and when the long stimulus was rewarded. In Experiment 2, we investigated whether bees could discriminate between stimuli with the same overall amount of proximal stimulation, with the short stimulus having a duration of 0.5 seconds and the long stimulus having a duration of 2.5 seconds. Preliminary results indicate that bees might be able to discriminate between different durations in a free foraging task. This suggests that insects such as bumblebees can use temporal patterns of the duration of seconds to drive their foraging choices, revealing the sensitivity and flexibility of their visual cognition to time.

34 Grace Balchin (Swansea University)

Modelling chacma baboon population dynamics in Cape Town, South Africa.

Chacma baboons (Papio ursinus) living on the Cape Peninsula, South Africa are geographically isolated from the rest of the species range, effectively making the troops that live there a 'closed' population. Space use of many troops is largely determined by management practices aimed at minimising human-animal conflict via limiting the time troops spend in urban and agricultural landscapes and culling of habitual urban-foraging adult males. This management is complemented with monitoring via regular census of troop size and demography, creating a valuable and unusually extensive long term wild primate population data set that is yet to be used to understand the different factors influencing the dynamics of their population.

As a part of my year in research with my host research group SHOAL at Swansea University, I am working to create a sex and age-class structured model incorporating metapopulation dynamics of exchange of individuals between troops informed by their ecology and behaviour. I will present preliminary data and outputs from our model, discussing the value of simulations for understanding population dynamics and stability, and specifically for investigating the impacts of different management practices. Ultimately, we expect our findings to inform decision-making of those tasked with management of this population.

35 David Felipe Rivas Sánchez (University of Bristol)

Parallel trait-shifts in behaviour and neuroanatomy in high-altitude Heliconius butterflies

Parallel trait-shifts occurring across similar gradients of environmental variation may indicate adaptation to local sources of natural selection and can underly ecological speciation. For example, the independent and repeated reduction of armor plate number in freshwater sticklebacks and loss of eye development in cavefish from separate populations suggests that equivalent phenotypic responses result from common selective pressures. I explore two cases of ongoing divergence in Heliconius butterflies along altitude gradients, from the sea level up to mid mountain in the Colombian and Ecuadorian Cordillera of the Andes. These transitions involve abrupt shifts from wet, large-leaved, warm forests at low-altitude to dry, open, cold scrubs at mid mountain. In particular, Heliconius erato venus and H. e. cyrbia inhabit the low-altitude forests whereas the two parapatric mountain specialists, H. chestertonii and H. himera, occur at high-altitude forests colonized independently. This takes place despite continued geneflow with lowland erato, implying selection against migrants. Such system allows for testing hypothesis about the role of high-altitude in driving adaptive evolution in Heliconius in traits related to behaviour and neuroanatomy, and their impact during ecological speciation. My current results confirm ecological similarities between the geographically independent high-altitude habitats of H. chestertonii and H. himera and demonstrate mirroring, altitude-driven behavioral shifts in the pairs H. e. venus-H. chestertonii and H. e. cyrbia-H.himera. I interpret these phenotypic

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responses as outcomes of deterministic processes akin to ecological speciation rather than products of stochastic evolution.

36 Jude Lynch (Swansea University)

A user experience of the swaRmverse : a tool for detecting and analysing animal collective movements

Collective movement is the coordinated motion of individuals in an animal group. Whilst there are a growing number of studies of collective motion, no large comparative studies exist due to the lack of standardized methods for analysing and comparing group movements across different species and contexts. Such comparative investigations are particularly important because collective movements and associated decisions made by groups ultimately determine where groups move, forage, and reproduce. During my time as a research placement student (between year 2 and 3 of my degree) with SHOAL group at Swansea University, I have been testing a new R package swaRmverse designed by my colleagues and co-authors. Using high resolution collective motion data recorded via satellite, GPS, and video camera tracking, that I have collected from open access data repositories, I conducted Principal Component Analyses on a variety of animal species' collective movement and compared these data in a Swarm Space allowing me to visualise and investigate the intra- and inter-specific variation in group motion across my datasets. Here I discuss the pipeline of the package, and the possibility of using it to analyse collective motion across all types of social species.

37 Ingerid Helgestad (University of Exeter)

Machine learning classification of accelerometer data as a method to detect caching in grey squirrels (Sciurus carolinensis)

Caching animals invest in the future by storing food in times of plenty for later retrieval. Scatter-hoarding squirrels make up to several thousand caches per caching season, that are widely distributed. Because of this, quantifying individual caching behaviour is a difficult task. Animal-borne accelerometers that record acceleration along multiple axes can record distinct patterns of acceleration produced by different behaviours. These patterns can be classified using machine learning. In my PhD I investigate the caching decisions of grey squirrels (Sciurus carolinensis). This species' caching behaviour consists of a highly stereotyped sequence of movements with behavioural segments distinct only to caching. The behaviour should therefore produce a distinct acceleration pattern that can be recorded with accelerometers. Utilising this method will allow quantification of caching behaviour over longer time scales such as weeks and months and provide fine scaled information of individual caching strategies. In this project I have collared 13 grey squirrels with 3-axis accelerometers throughout a caching season and aim to a) develop a method for detection of caching in grey squirrels by classifying accelerometer data using machine learning, and b) quantify individual differences in frequency and temporal patterning of caching.

38 Justyna Hinchcliffe (University of Bristol)

Objective methods to quantify the emotional states in laboratory rodents.

Conventional methods for assessing the emotional states in rodents lack specificity and sensitivity. We have developed tasks to quantify emotional states in rodents based on affective state-induced biases in reward learning and memory. The affective bias test (ABT) is sensitive to acute changes in affective state while the reward learning assay (RLA) is sensitive to changes in core affective state. In the ABT, the animal learns two independent substrate-reward associations in a bowl-digging task under either treatment or control conditions with a subsequent choice test used to quantify the arising affective bias. The RLA follows a similar protocol, but animals remain in the same affective state throughout with a reward-induced bias generated by associating one substrate with a higher value reward. In mice, we have modified the RLA to use a complex cue T-maze to reduce human handling. Mice are presented with pairs of rewarded cues of two different values (high vs low), and their learning rates across successive sessions are monitored. Normal animals develop a learning bias to the high reward cues. Studies in phenotypic

models and following pharmacological or psychosocial manipulations of affective state suggest these approaches provide objective and sensitive methods to investigate affective states in rodents.

39 Katie Crawford (Liverpool John Moores University)

Can plasticity in hibernation behaviour help European hedgehogs adapt to urbanisation?

Human population growth is leading to rapid urban expansion and by 2050 66% of the world's population is expected to live in cities. This increase in urban habitats will have detrimental effects on wildlife populations as cities challenge animal survival through pollution, changes in food sources and loss of habitat. There is therefore an urgent need to understand what traits and resources species require to survive in densely populated areas. European hedgehogs (Erinaceus europaeus) are one of the last keystone species in the UK and are regarded as doing well within urbanised areas, despite overall population decline. The life history of hedgehogs is markedly characterised by hibernation during winter in which they undergo month-long phases of inactivity. Energy savings through hibernation can enable individuals to survive periods of low food availability, but hibernators are also assumed to be particularly vulnerable to changes in their environment because they require optimal winter conditions and suitable hibernation sites. I aim to quantify the potential for behavioural and physiological plasticity in hedgehogs along an urban-rural gradient and will present data on a pilot study looking at hibernation behaviour and nest site use. This research will pave the way for an enhanced understanding of the impacts of urbanisation on behaviour and physiology of species.

40 Jessie Dermody (University of Exeter)

All the Colours of Anemones

Colour and light are vital signals between shallow water marine organisms (Bandaranayake 2006, Marshall et al. 2015), and anemone species are amongst the most colourful of all marine invertebrates. Anemones are also fierce predators that experience high levels of inter and intra specific competition (Francis. 1988, Turner et al. 2003, Collins et al. 2017). However, few recent studies have looked into anemone colouration or how this relates to competition & habitat selection. So the functions of common colour morphs are unknown. Possible functions of colour include background matching for camouflage, prey-luring and warning potential predators of their defences (Sharpe. 2019, Sanamyan et al. 2020). Here, we investigate colour in situ amongst anemone populations in Cornwall and relate this to microhabitat usage, in order to determine possible functions of common colour morphs. We make use of transects across a wide variety of rocky shore sites and digital image analysis to objectively measure colour values in the field. Our results will provide important insights into anemone ecology and an excellent foundation for future research into the functions of colour for shallow water marine invertebrates (Hawkins et al. 2020).

41 Sara Cardoso (Institute of Science and Environment, University of Saint Joseph, Macao)

Behavioural changes after exposure to microplastics in the marine medaka Oryzias melastigma larvae and adults

Microplastics (MP) are a growing concern due to their detrimental impact on ecosystems. In marine environments, the unique characteristics of MPs influence their distribution and bioavailability to organisms at different developmental stages, which interact actively and passively with these particles. Ingestion is the most likely interaction between organisms and MPs. However, the precise consequences of MP exposure on organisms remain uncertain, with studies showing the possibility of these particles being translocated across biological membranes and reaching the central nervous system by crossing the blood-brain barrier. In the present study, we aimed to investigate the effects of microplastic exposure on behaviour at different developmental stages using the marine medaka Oryzias melastigma as a model species. Larvae of marine medaka were exposed to 1 mg/L of polystyrene MPs (PS-MPs), either with 0.5 µm or 1 µm, during the first two weeks of their development (long exposure) or only for four days (short exposure, 10-14 dpf), and their behaviour assessed on the last day using the light-dark challenge test. Adult males and females were exposed to the same particle concentration and sizes as the larvae for 21 days, and their behaviour assessed on the last day using the open-field test. Overall, larvae exposed to MPs tended to be more

active (measured as the total distance travelled) than the control treatment, with statistical differences depending on the particle size and exposure time to MPs. Adult fish exposed to MPs did not differ statistically within sex when analysing their behaviour for PS-MP-0.5 and PS-MP-1 and, hence, were grouped for subsequent analyses with the control treatment. Females exposed to MPs were more active than exposed males, while exposed males spent less time in the open area of the tank when compared to control males but similar to both female treatments. These results highlight the importance of looking at different exposure times in larvae and sex-specific changes in adult behaviour in response to MP exposure in the marine medaka. Further work will focus on determining which organs and tissues these particles are translocated to from the gut and possible changes in gene expression at the neurogenomic level.

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