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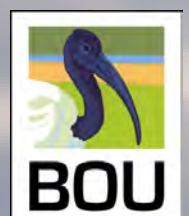
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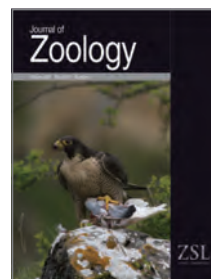


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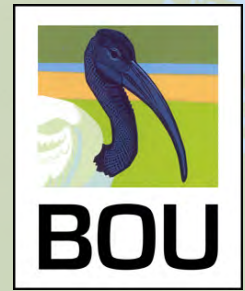
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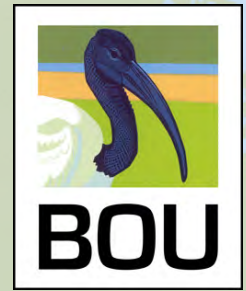
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Welcome to #BOU2016 – the BOU's 2016 Annual Conference

The annual BOU conference for 2016 is themed on *Urban birds: pressures, processes and consequences*. This is a very timely and exciting conference topic, and we are delighted that it has attracted so many ornithologists from around the world.

Urban development already dominates much of the globe, and urban areas are set to continue expanding rapidly, posing enormous challenges to biodiversity conservation but also creating new opportunities for those species that are able to adapt successfully to urban environments. Understanding how wildlife responds to this profound change in land use is rapidly becoming a global research priority, and this conference will highlight some of the most important and exciting recent research in this field; we will hear about such diverse topics as the impacts of urbanization on population trends, ecological consequences of bird feeders, impacts of artificial light, noise, pharmaceuticals, infectious diseases and domestic cats, and interactions between birds and people. We will also learn about the many ways that birds are responding to urban pressures, from a diverse range of viewpoints including demographic, behavioural, genetic and epigenetic perspectives.

Many of the species that will be discussed at this conference are struggling to cope with urban environments, resulting in population declines, while some are coping so well that they are rapidly acquiring pest status. The fascinating information gained from studying species' responses to urbanization therefore carries vital additional lessons for species conservation and population management.

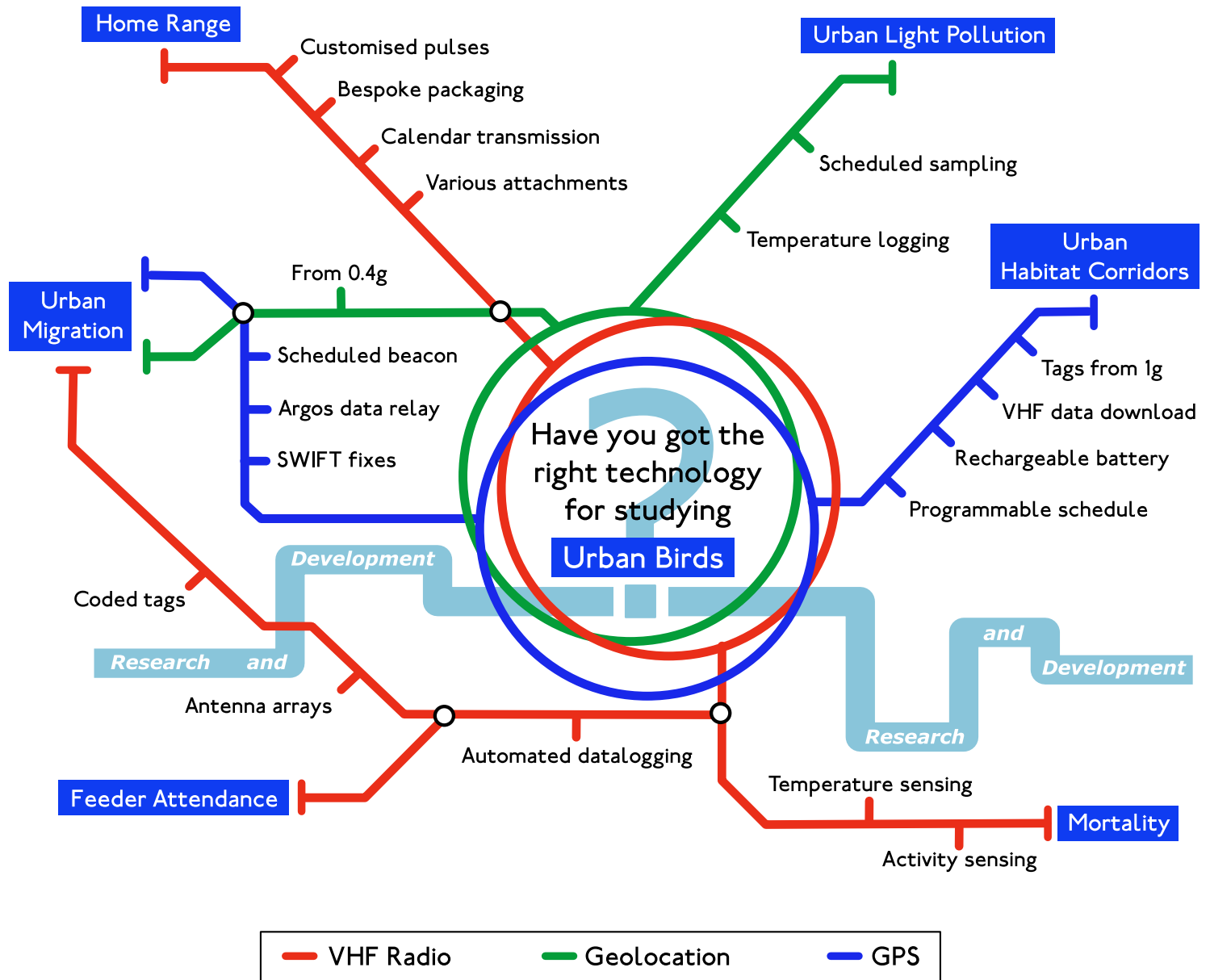
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ABSTRACTS

Abstracts are in programme order. Abstracts for talking posters (page 38) and posters (page 44) are in surname alphabetical order.

TUES, 5 APRIL, 20.30 h

PLENARY

Avian ecology and evolution in an urbanizing world

JOHN M. MARZLUFF

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Unique biogeochemical cycles and energy flows interact with altered disturbance regimes and human preferences to support a unique ecological play on the evolutionary stage that is the urban ecosystem. As humans are now predominantly an urban species, it is increasingly relevant to understand the ecology and evolution of birds in cities, suburbs, and exurbs. I review the urban ornithological literature, which is rapidly increasing, and draw on the studies conducted over the last decade in conjunction with my graduate students in the Northwestern USA to illustrate new discoveries in community-, population-, evolutionary-, and neuro-ecology. This will show how overall diversity in suburbs and exurbs may increase as native lands are urbanized and animal communities rapidly shift from being dominated by sensitive, interior habitat specialists ('avoiders') to those dominated by tolerant, flexible, edge and early successional species ('adapters' and 'exploiters'). The proximate drivers of community change, including habitat transformation and local diversification, supplementation by humans, expansion of predators and parasites, obstructive lights, towers, and buildings, and myriad other human activities are well known. These potent selective forces have been shown to drive rapid evolution change in plumage, diet, morphology, and migratory habits of birds. However, the ultimate reasons why some populations increase while others decrease is poorly studied. By comparing reproduction, survivorship, and movements of sensitive 'avoiders' to those of tolerant 'adapters' and 'exploiters' we are beginning to understand the ultimate reasons why communities change in response to urbanization. Experimental studies of birds in urban ecosystems remain rare, yet vital to advancing knowledge. Opportunities to conduct experiments in the urban ecosystem abound as I illustrate with: 1) research on bird communities and populations before, during, and after suburban development, and 2) research on the behavioral and neurobiological responses of crows to individual people.

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John Marzluff is the James W. Ridgeway Professor of Wildlife Science at the University of Washington. His research focuses on the behavior, ecology and conservation of corvids and the effects of urbanization on songbirds. Professor Marzluff has written five books, most recently *Welcome to Subirdia* (2014 Yale). He is a subject-matter editor for *Ecological Applications* and is a Fellow of the American Ornithologist's Union.

WEDS, 6 APRIL, 09.05 h

KEYNOTE

Neighborhood Nestwatch: Engaging citizens in urban-suburban biology right in their own yards.

PETER P. MARRA* & ROBERT REITSMA

Migratory Bird Center, Smithsonian Conservation Biology Institute, Washington DC

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Urbanization during the latter half of the twentieth century has altered habitats, restructured avian communities, and influenced the range sizes and population dynamics of animal species. Neighborhood Nestwatch (NN) is a citizen science program developed and implemented by the Smithsonian's Migratory Bird Center to study the ecology and evolution of birds along the expanding urban to rural land use gradient. NN reconnects people in such human-dominated landscapes with nature while helping scientists gain access to private property and quantify the effects of human development on wildlife – primarily birds. Scientists visit yards of participants in the Washington DC/Baltimore region during annual bird ringing visits and capture, color-ring, measure and release focal neighborhood bird species. This unique experience provides participants with captivating close up views right in their own backyards while teaching them about science and the challenges faced by birds and other wildlife in human-dominated environments. During the visit, scientists also convey basic facts about the biology and ecology of birds, provide tips for finding and monitoring nests, how to re-sight color-ringed birds, record and submit data and suggest improvements to backyards for wildlife enhancement. The citizen scientist experience continues as participants keep a watchful eye throughout the year to identify and observe “their” color-ringed birds as well as find and monitor nests. Participants access the NN website to enter their data, learn more about the ecology of birds, and communicate with Smithsonian scientists.

Through this unique scientific approach, NN has gained key insights into the survival and reproduction of birds, the impacts of non-native species and contaminants in urbanized landscapes

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and how data collected by citizens compares to data collected by scientists. In this overview of the NN program, I will present key scientific findings and describe how citizen science participants benefit from science engagement in their own yards.

Pete Marra is Head of the Smithsonian Migratory Bird Center. His research in conservation science focuses on discovering the factors that govern population dynamics. Pete's research examines the roles of climate change, habitat destruction, food and disease as well as other direct sources of mortality (cats, buildings) on bird survival. His research emphasizes incorporating events throughout the annual cycle to understand how more complex interactions across seasons drive the ecology and conservation of species.

WEDS, 6 APRIL, 09.45 h

Urban bird population trends; twenty years of survey data and methods

KATE RISELY

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The BTO's Garden BirdWatch (GBW) survey has been running for over twenty years, and around 13,000 participants submit weekly counts of the birds seen in their garden in every week throughout the year. To date just under 100 million observations have been collected via GBW, which is based on self-selected sites across the UK. Weekly observations allow annual patterns in garden use to be examined in detail, and linked to food supplies and environmental variation.

New online tools have been developed to visualise GBW data, including graphs of long-term and annual patterns of bird recording rates and average counts. Using these, I will present comparisons for common garden birds between GBW long-term patterns and urban-specific trends from the structured annual BTO/JNCC/RSPB Breeding Bird Survey (BBS), along with a comparison of the methodologies of the two surveys and their strengths and weaknesses for investigating changes in urban bird populations.

GBW data have been used to investigate the urban trends and habitat preferences for garden bird species including Blackcaps, House Sparrows and Greenfinches; a précis of previous research and planned future directions will be presented.

Kate Risely is the Garden BirdWatch Organiser, responsible for maintaining participation in the scheme and facilitating research using GBW data. She has worked for the British Trust for

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Ornithology for over ten years, previously organising the Breeding Bird Survey and working in the Ringing Scheme.

WEDS, 6 APRIL, 10.05 h

Winners and losers on the rural-urban gradient

SIMON GILLINGS*, KATE E. PLUMMER & GAVIN M. SIRIWARDENA

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It is well known that certain bird species are able to tolerate and even thrive in the built environment whereas others can cope with only the lowest levels of fragmentation of their preferred habitat. An unanswered question, however, is whether the changes in bird community composition one sees whilst traversing the rural-urban gradient are constant across different city-scapes. In this study we utilise an extensive atlas-derived dataset to relate bird species occurrence and relative abundance to different measures of urbanisation, including green-space vs grey-space metrics and human density. We test whether relationships are transferable among British city-scapes with the ultimate aim of finding examples of good practice in urban planning and management (by accident or design) that explain apparent differences in bird community structure among cities.

Simon Gillings is interested in factors shaping the distributions of birds at different spatial scales. He recently co-authored Bird Atlas 2007–11 and is now actively engaged in research to answer distribution-related questions using atlas data with a particular focus on urban and upland habitats and climate change.

WEDS, 6 APRIL, 11.40 h

A study of the motivations of the general public in feeding birds in their gardens

DAVID CLARK* & JAMES REYNOLDS

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Despite bird feeding being deeply embedded within human culture in the UK and it being likely to increase in popularity as a consequence of urbanisation, understanding of motivation(s) for this

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human behaviour remains poorly researched. Pleasure has been viewed as the ultimate motivation for bird feeding but this might be only one of a number.

A combination of qualitative and quantitative approaches was adopted to investigate the motivational basis of bird feeding and this started with 30 in-depth interviews with male and female bird feeders spanning multiple age cohorts. These informed an on-line questionnaire which was completed by a further 550 people who fed birds.

We identified several motivations for bird feeding which revealed that the practice has deep complex cultural roots which have been formed through our historic ambivalent relationship with birds as foci for domestication, pet ownership, garden ownership and a wish to be close to nature. Motivations reflect this complexity and ambivalence with both altruism and selfishness expressed in ecocentric and anthropocentric terms. Pleasure was revealed as an important motivator but so too were promotion of bird survival, a desire to nurture, education of children, atonement for environmental damage, connection with nature, companionship and a conservation ethic. Our findings also highlighted that pleasure may be experienced and expressed in many different ways including excitement, control, possession and pride. Furthermore, we also found that triggers for bird feeding are often 'seeded' in childhood and are related to garden ownership. We identified important social and economic barriers to feeding birds that help in our understanding of why people feed birds. Our findings inform us of how best to communicate with the bird feeding public and how bird feeding might promote conservation initiatives, as well as adding to a body of evidence relating human health and well-being to our closeness with nature.

David Clark completed his MSc in Ornithology at the University of Birmingham in 2013. He comes from a commercial background of qualitative market research where understanding human motivations is a frequent objective. He maintains a keen interest in how citizen science can advance our understanding of human-bird interactions within an urban context and he is keen to research further the motivational themes that have been uncovered during the present study.

WEDS, 6 APRIL, 12.00 h

Is feeding on anthropogenic food good for gulls?

NINA O'HANLON¹*, RONA MCGILL² & RUEDI NAGER¹

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With human populations increasing across the globe, urban habitats are expanding leading to an increase in the number of species coming in to contact with urban environments. Certain wildlife,

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particularly generalist, opportunistic feeders, increasingly use food sources derived from human activities. However, little is known about how well these species fare on these food sources. Herring Gulls *Larus argentatus* are one such generalist, opportunistic forager which have experienced large changes in their distribution; declines have been observed in their natural marine environment with an expansion in to urban habitats. Human activities in and around urban areas may provide Herring Gulls with abundant and predictable anthropogenic food, potentially benefiting the birds. On the other hand if food obtained in these habitats is of poorer quality than foraging in the marine environment, this may be detrimental to the birds. In order to assess the influence of natural versus anthropogenic food resources on the Herring Gull we collected data from several Herring Gull colonies nesting in their natural habitat in south-west Scotland and Northern Ireland. The colonies differed in the extent of built-up area within the vicinity of the colony which could be exploited for foraging. We collected data on habitat use using GPS tracking data, and resource utilisation by using pellets and stable isotopes. This allows us to identify the extent to which birds in these colonies are using traditional marine food sources in comparison to anthropogenic resources gained from terrestrial habitats in and around built-up areas. We will test what effect the gulls' resource use has on their egg characteristics, provisioning rate and productivity, providing insights in the influence of anthropogenic food on reproductive performance. These insights will help explain the changing fortunes of the Herring Gull in recent decades.

Nina O'Hanlon is a PhD student at the University of Glasgow investigating seabirds as monitors of coastal marine habitats; focusing on the spatial, behavioural and foraging ecology of the Herring Gull. She has an interest in all aspects of conservation and ornithology, particularly associated with seabirds and the marine environment.

WEDS, 6 APRIL, 12.20 h

Supplementary feeding in gardens explains the widespread presence of a reintroduced raptor in an urban area

MELANIE ORROS^{1*} AND MARK FELLOWES¹

¹ People and Wildlife Research Group, School of Biological Sciences, University of Reading, Reading RG6 6AS, UK

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The Red Kite *Milvus milvus*, a charismatic raptor of conservation concern, has been reintroduced across the UK over the last 25 years following its near extinction after centuries of persecution and habitat changes. The species was not expected to recolonize urban areas; its historical association with human settlements is attributed to scavenging on human waste and refuse, resources greatly reduced in modern European cities. However, kites have become common daytime visitors to Reading, a large town in southern England approximately 20 km from the first English

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reintroduction site. Given a near-absence of breeding and roost sites, we investigated habitat associations and foraging opportunities that might explain the use by Red Kites of this urban area. Road transects found positive associations between kites and residential areas and surveys of a cross-section of residents revealed that 4.5% (equivalent to 4349 households) fed kites in their gardens. A separate survey of kite feeders indicated that 28% provide food on any given day, with a daily median of 21 g thought to be taken by kites per garden. Across Reading, this is sufficient to provision 142–320 kites, a substantial proportion of the 140–440 estimated to visit. By contrast, surveys of discarded human foods and road-kill indicated that these could support at most 13–29 kites. Individual decisions by thousands of people, rather than inadvertent provisioning, thus appear to have collectively influenced the local abundance and distribution of this species. Our findings are therefore relevant to reintroductions around urban settlements of other species that might use anthropogenic resources. Furthermore, our survey of kite feeders revealed the most common motivation to be the opportunity to see kites at close range, hinting at the value of garden feeding of wild animals in providing an accessible experience of wildlife to a human population increasingly disconnected from nature.

Melanie Orros's PhD at Reading encompassed various aspects of garden bird feeding. In addition to the work on Red Kites, she also investigated indirect effects upon invertebrates and estimated how much energy is added to local ecosystems. Most recently, she reviewed Red Kite feeding ecology for the Hawk Conservancy Trust.

WEDS, 6 APRIL, 12.40 h

Supplementary feeding may increase rates of local nest predation

HUGH J. HANMER*, REBECCA L. THOMAS & MARK D. E. FELLOWES

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Almost half of householders in the UK, and similar numbers in countries such as the US, Canada and Australia, feed wild birds. Year round garden bird supplementary feeding is now encouraged by conservation organisations as a means of both supporting wild bird populations and increasing contact between members of the public and their local wildlife. However, little is understood of how this feeding affects the behaviour and ecology of target and non-target species. While winter feeding is associated with increased adult survival, the apparent direct effects of supplementary feeding on breeding success are mixed with evidence for increases and decreases in productivity. In addition more indirect factors at supplementary feeding sites may alter local breeding productivity. In one experiment we asked if providing supplementary food attracts nest predators and therefore affects

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the likelihood of nest predation in the vicinity of the feeder. We provided feeding stations (empty, peanut feeder, peanut feeder with guard) in an area of suburban parkland and monitored the predation rate suffered by eggs placed in artificial nests. Predation caused by opportunistic omnivore predators was higher when nests were adjacent to filled feeders. The presence of a guard (to exclude nest predators) did not significantly reduce nest predation. As supplementary feeding is ubiquitous in suburban habitats, we suggest that providing point attractants to nest predators during the breeding season may have unexpected consequences for urban bird conservation.

Hugh Hanmer is a University of Reading PhD researcher focusing on urban bird ecology and conservation. A lifelong birdwatcher and bird ringer from a young age Hugh has always been interested in bird research. He completed his BSc (Hons) Zoology and MRes Environmental Biology at the University of St Andrews.

WEDS, 6 APRIL, 14.30 h

Whole-organism response of songbirds to artificial light at night: from gene expression to behaviour

DAVIDE M. DOMINONI^{1,2*} & BARBARA HELM¹

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* Davide M. Dominoni

Associated with increasing urbanisation, artificial light at night (ALAN) is now recognised as an important problem for animal and human health. In birds, ALAN has been shown to affect circadian rhythms and in particular to cause temporal changes in behaviour, for instance dawn song, and physiology, such as melatonin production. However, circadian rhythms are intimately linked to several biological processes such as metabolism and immunity, implying that the effects of ALAN can be more extensive than currently realised. To fill this gap, we exposed four different groups of adult male Great tits *Parus major* to four different intensities of ALAN for three weeks. We then collected brain, liver, spleen and testes tissues, as well as plasma samples, at day and night. We performed real time RT-qPCR on the organs to analyse the expression of candidate genes involved in circadian rhythms, metabolism, immune function and reproduction. We detected strong changes in the expression of specific genes in all organs. In addition, in order to assess the effects of ALAN on the whole-body metabolism we use plasma samples to perform high-throughput metabolomics analyses. We identified 10 % of metabolites to have a circadian pattern of expression, which were under- or over-expressed with increasing levels of ALAN. These results highlight ALAN as a potent

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environmental factor which is able to affect several biological functions of birds, and call for an implementation of new policies to limit the impact of light pollution on wildlife.

Davide Dominoni is broadly interested in how animals cope with and adapt to changes in their environment. His research spans several levels of biological organization, from molecular biology to eco-physiology, to behavioural ecology and population dynamics. He particularly focus on urbanization as source of environmental change and birds as model species. He became interested in the effects of artificial light at night during his PhD at the Max Planck Institute for Ornithology and he continues to work on this topic as a current postdoc at the University of Glasgow.

WEDS, 6 APRIL, 14.50 h

Medicating the environment: exposure to and impacts of pharmaceuticals on urban birds

KATHRYN E. ARNOLD

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Many wildlife species forage on sewage-contaminated food, for example, at wastewater treatment plants, in urban rivers and on fields fertilized with sewage sludge. The resultant exposure to human pharmaceuticals remains poorly studied for terrestrial, particularly avian, species. However, we know or suspect that pharmaceutical residues are present in a wide range of ecosystems and organisms. Environmental concentrations are often low, but pharmaceuticals typically are designed to have biological effects at low doses, acting on physiological systems that can be evolutionarily conserved across taxa. This paper introduces the latest research investigating the risk of environmentally relevant concentrations of pharmaceuticals on urban birds. I take an holistic, global view of environmental exposure to pharmaceuticals encompassing terrestrial, fresh water and marine ecosystems in developed and developing countries.

Next, I will present data from studies we have carried out on avian exposure to antidepressants. On the basis of predicted and measured exposure levels in the wild, we administered the common antidepressant fluoxetine or control treatment via prey to wild-caught starlings *Sturnus vulgaris* for 22 weeks over winter. We found effects of low concentrations of fluoxetine (also known as Prozac) on diurnal patterns of foraging, stress responsiveness and courtship behaviour. Although individual variability makes interpreting the sub-lethal endpoints measured challenging, our data suggest that fluoxetine at environmentally relevant concentrations can significantly alter behaviour and physiology.

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Given that global pharmaceutical consumption is rising with the growing and aging human population and more intensive food production, pharmaceuticals in the environment will continue to be a problem for a range of avian populations. This paper aims to help clarify the uncertainties, highlight opportunities and inform ongoing scientific and policy debates on the impacts of pharmaceuticals in the urban environment.

Kathryn Arnold is a behavioural ecologist working mainly on the behavioural and physiological responses of vertebrates to changes in the environment. Current research includes the assessment of exposure to and effects of contaminants on wildlife and the ecology of rural and urban birds. Also, she continues her research on social behaviour, utilising birds, bees and manta rays. Kathryn promotes the interests of women in science through her work with Athena SWAN initiatives.

WEDS, 6 APRIL, 15.10 h

Bridging the gap between environment and behaviour: urban noise affects developing songbird brains

DOMINIQUE A. POTVIN^{1,2,3*}, ADRIANA DIEZ^{1,2} & SCOTT A. MACDOUGALL-SHACKLETON^{1,2}

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Over the past decade, numerous studies have observed changes in bird vocalizations – especially song - in urban habitats. Such changes tend to increase the active space of a signal in the new environment, and are therefore considered to be advantageous. While some adjustments have been shown to be individually flexible, others have been identified as cultural modifications occurring over generations, indicative of cultural evolution or adaptation to a changing environment. However, the proximate mechanisms mediating this evolutionary process are, as yet, unknown.

We performed a captive experiment to identify whether urban noise exposure might affect song learning in young birds, leading to this cultural, generational change. We used Zebra Finches *Taeniopygia guttata* to test effects of traffic noise on song development throughout the learning process, additionally testing for effects of noise on baseline corticosterone (a stress hormone that, when elevated, is known to affect song development). We also investigated whether noise affected brain development in males and females, focusing on structures associated with song learning and production.

We found that noise affected song frequency in very early stages of development, with effects lasting through to song crystallization. While young male birds tended to learn syllables accurately from

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tutors regardless of noise environment, syntax (the ordering of syllables within songs) was also distinctly affected by noise. Noise did not affect baseline circulating corticosterone in young birds, however certain brain structures associated with song learning (HVC and Area X) were smaller in males that had experienced noise in early development. Subsequent analysis of female brains and the effect of noise on the development of discrimination capacity show equally compelling results. These findings now give us a possible mechanism by which noise is affecting behaviour, leading to cultural evolution in urban and noisy environments in wild song-learning birds.

Dominique Potvin is a behavioural ecologist, ornithologist and evolutionary biologist interested in the proximate and ultimate sources of selection on bird song, as well as the impacts of anthropogenic noise on vertebrate populations and behaviours. She obtained her PhD at the University of Melbourne, and has held postdoctoral positions at Museum Victoria (Australia) and the University of Western Ontario (Canada). Her research is interdisciplinary and broad-scale, incorporating genetics, bioacoustics, physiology and neuroscience. She is currently situated at the Helsinki Lab of Ornithology at the Finnish Natural History Museum.

WEDS, 6 APRIL, 15.30 h

The effect of domestic cat predation on urban birds

REBECCA THOMAS* & MARK FELLOWES

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Urban domestic cat *Felis catus* populations can attain high densities and are not limited by natural prey availability. This has generated concerns that they may negatively affect prey populations, leading to calls for their management. We enlisted cat-owners to record prey returned home for two years to estimate individual and collective patterns of predation by free-roaming pets within the town of Reading, UK. Questionnaire surveys were also used to investigate attitudes to different management options and GPS tracking was used to obtain estimates of the area ranged by free-ranging pet cats and how these varied in relation to season, sex, time of day and habitat availability.

Prey return rates were highly variable with only 20% of cats returning ≥ 4 prey annually. The predation rate varied markedly both spatially and temporally. Data also suggest a significant sex bias in prey captures, with male Blackbirds *Turdus merula* being more likely to be killed. Comparisons with the density of six common bird prey species indicated that cats killed numbers equivalent to adult density on c. 40% of occasions. Such levels of predation could reduce the size of local populations of some species. Conversely, most urban residents did not consider cat predation to be a

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significant problem. Collar-mounted anti-predation devices were the only management action acceptable to the majority of urban residents (65%), but were less acceptable to cat-owners because of perceived risks to their pets; only 24% of cats were fitted with such devices.

Cat predation did appear to be of sufficient magnitude to affect some prey populations although most owners are potentially unaware of the cumulative numbers killed because they only receive prey intermittently. The management of the predatory behaviour of urban cats in the UK is, therefore, likely to be challenging and will require considerable engagement with cat owners.

Rebecca Thomas is an ecologist whose PhD research focused on the predatory behaviour of the urban domestic cat. Since then her research has widened to understand the influences of urbanisation on the abundance and diversity of species. Current work is looking at understanding the conservation value of urban areas for birds.

WEDS, 6 APRIL, 16.40 h

Supplementary feeding in gardens is a driver of evolutionary change in a migratory bird species

KATE PLUMMER*, GAVIN M. SIRIWARDENA, GREG J. CONWAY, KATE RISELY & MIKE P. TOMS

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Urbanisation is responsible for some of the most extreme human-altered habitats and is a known driver of evolutionary change, but evidence and understanding of these processes is limited. For birds, a fundamental feature of the urban landscapes is the high abundance of anthropogenic food resources. However, whilst it is perceptible that supplementary feeding might elicit evolutionary responses within wild bird populations, this possibility has largely been overlooked by previous studies. Here, we examine whether supplementary feeding in British gardens during winter has contributed to the contemporary evolution of migratory behaviour in Eurasian blackcaps (*Sylvia atricapilla*). Blackcaps from central Europe have been wintering in urban areas of Britain with increasing frequency over the past 60 years, rather than migrating south to the Mediterranean. Using a long-term national-scale dataset, the British Trust for Ornithology's Garden BirdWatch, we examine the potential drivers of blackcap wintering behaviour in Britain. Our findings suggest that both human supplementary feeding activities and changes to the British winter climate have been important in facilitating the establishment of a wintering population of blackcaps in Britain. This study presents new and timely evidence that some species may be more resilient to rapid environmental change than previously assumed.

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Kate Plummer is a Research Ecologist at the British Trust for Ornithology. Her research is focused on understanding the complexities of human-wildlife interactions in urban areas, using a combination of citizen science and novel field surveys. As one of BTO's first appointed Research Fellows, she is currently investigating the long-term impacts of garden bird feeding on wild bird populations in Britain

WEDS, 6 APRIL, 17.00 h

Great Tit adaptation to the urban habitat: the role of personality from a behavioural and epigenetic perspective

JUAN CARLOS SENAR¹, SEPAND RIYAH¹, MATS BJÖRKLUND², FERNANDO MATEOS-GONZALEZ²⁻³, MARTA SÁNCHEZ-DELGADO⁴, FRANCESC CALAFELL⁵ & DAVID MONK⁴

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A larger melanin-based black breast stripe in the urban Great Tit *Parus major* has been associated with shorter survival, while the reverse is true for nearby forest birds. Due to the pleiotropic effect of the melanocortin system, it has been proposed that such differences in stripe size could be a by-product of differences in personality. We tested the potential relationship between stripe size, personality and habitat in 130 wild great tits captured in Barcelona city and nearby forests. All birds underwent standard novel environment and novel object tests. We found that both urban and forest birds with larger black stripes were more explorative than birds with smaller stripes. However, urban birds were more explorative and displayed shorter latencies to approach a novel object than forest birds, irrespectively of their stripe size. Novel environment and novel object scores were correlated for forest birds, but not for urban birds, suggesting that a personality syndrome was present in forest populations but not in urban-dwelling birds. To further understand patterns found, we genotyped our birds for *DRD4* and *SERT*, two candidate genes for personality traits, and performed promoter sequencing and methylation profiling. We found the *SERT* SNP234 to be significantly correlated with novelty seeking behaviour, with the allele increasing this behaviour being more frequent in urban birds. However, this was not the case for *DRD4* SNP830 polymorphism. Additionally, we found that methylation in these two locus was 1–4% higher in urban than in forest birds, and that the methylation at a single CpG dinucleotide located 288 bp from

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the transcription start site was related to exploration score only in urban birds. Altogether, our data show that, at least in Barcelona, urbanization can exert selection pressure on personality independently of stripe size, and that this variation probably has both a genetic and an epigenetic basis.

Juan Carlos Senar is a biologist with a main research focus on local adaptation. He is currently particularly interested in adaptation to the urban habitat, from a behavioural perspective, integrating personality, sexual selection, population dynamics and genetics. After his PhD in Barcelona University, supervised by Neil Metcalfe (Glasgow University), he focused on the study of social behaviour, plumage coloration and sexual selection. He is now working as Head of Research at the Natural History Museum of Barcelona and leads the “evolutionary ecology” group at this Museum.

WEDS, 6 APRIL, 17.20 h

Big city life – adaptations to multi-dimensional environmental factors in Great Tits

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Urbanisation causes exceptional environmental variation because it involves one of the most extreme forms of land-use alternation. Thereby, urbanisation constitutes a unique setting to assess adaptive micro-evolutionary processes of human-induced rapid environmental change. Urbanisation has most often been investigated by comparing urban to rural populations. Such studies typically assume that the differences between urban and rural areas are attributable to variation in environmental conditions associated with urbanisation. Only since recently have researchers started to directly quantify the effects of environmental factors that might cause differences in phenotypic traits between urban and rural areas. To test the ability of birds to adapt to human induced environmental factors, I established a nest box population along urban gradients in the city of Munich, Germany. Multiple environmental factors were quantified at each nest box to allow assessing how environmental variation along urban gradients may shape life history and behavioural traits of a common passerine bird (Great Tit *Parus major*). Data from the first two breeding seasons imply that differences in phenotypic traits between urban and rural areas stem from spatial variation or plasticity that is not induced by the quantified environmental components. These findings therefore provide new insights in micro-evolutionary effects of urbanisation.

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Philipp Sprau is a biologist with a main research focus on urban ecology and behavioural ecology. He is specifically interested in revealing the implications of urban environmental traits on behaviour and reproductive success in animals. After he obtained his PhD at Groningen University and the Netherlands-Institute-Of-Ecology, he worked as a post-doctoral researcher at the Max-Planck-Institute-for-Ornithology in Seewiesen, Germany. He is currently a post-doctoral researcher in Munich leading the project „Tierisches München“.

WEDS, 6 APRIL, 17.40 h

Phenotypic and genetic adaptation of songbirds to urban environment

DIETER THOMAS TIETZE

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We have replicated studies on phenotypic adaptations of forest-dwelling songbirds to city life. Along two urbanisation gradients we for example studied song differences in three common species and aimed to work out environmental traits that led to adjustments in song features. We recorded territorial song of Blackbirds *Turdus merula*, Blue Cyanistes *caerules* and Great Tits *Parus major* across the cities of Frankfurt am Main and Heidelberg, Germany, as well as in the Odenwald forest in between. Differences in morphology, physiology and susceptibility to diseases such as Usutu are also in the focus of our ongoing project.

Before this phenotypic background I primarily focus on how such observable adaptations are realised based on basically identical genomes. We have whole transcriptomes assembled *de novo* based on pooled RNA extracts from almost 20 types of tissue from urban and forest individuals. Contigs from the single-tissue mRNA from a certain study site will be compared to the respective species' transcriptome to work out which genes are over- or underexpressed in this tissue on either level of urbanisation. Specifically, I expect genes for heat protection, learning and other cognitive abilities as well as immunocompetence to be expressed at higher rates in urban individuals than in forest individuals. A future step would be to even quantify the underlying genetic mechanisms of adaptations to urban life in passerine birds.

Dieter Thomas Tietze has been studying the ecology and evolution of mostly songbirds in Eurasia. His main fields of interest are local populations ("natural" and urban), speciation processes, lineage diversification and trait evolution as well as the build-up of regional communities. He has considered bird vocalisations and used molecular methods.

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THURS, 7 APRIL, 09.00 h

KEYNOTE

The dynamics between birds and people in urban landscapes

J. AMY BELAIRE

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More than half of our planet's 7 billion people now live in cities. As our world becomes increasingly urbanized, cities are often where we come into contact with the natural world. Our interactions with nature are a two-way relationship. People affect birds through management activities at a range of spatial scales, from gardens to networks of forest fragments. In addition to changing habitat, our activities can change ecological processes like microclimate and species interactions. At the same time, nature affects people too. Birds provide important ecosystem services, from controlling pests to inspiring art. Recent studies in urban ecosystems have suggested a link between bird richness (either real or perceived) and benefits like psychological well-being and neighborhood satisfaction. These interactions between people and nature in urban areas can have important implications for public support of conservation and pro-environmental behavior. Birds may play a particularly important role in cities as a relatable and linkable connecting point between city dwellers and the broader environment. Here I will discuss human-avian dynamics in urban landscapes, with a specific focus on the potential for a positive feedback loop between people and birds. I will walk through a series of inter-related questions that demonstrate the importance of human-avian interactions for both people and birds alike.

J. Amy Belaire is a landscape ecologist who focuses on social-ecological systems, especially urban and suburban environments. Currently, she is the Interim Director of the Wild Basin Creative Research Center at St. Edward's University in Austin, Texas. Amy was a National Science Foundation IGERT interdisciplinary fellow during her doctoral program at the University of Illinois at Chicago. She also received a master's degree in Environmental Management from Duke University.

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THURS, 7 APRIL, 09.40 h

Does experience reflect presence? Potential cultural service provision by urban birds

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Access to the natural environment can have measurable benefits to human physiological health and psychological well-being. With the majority of daily interactions people have with nature now taking place in urban environments, there is growing appreciation of the need to gain a better understanding of the dynamics of these relationships. Birds are arguably the most conspicuous component of urban biodiversity to the general public, thereby providing a greater cultural ecosystem service than other taxonomic groups. However, differences between species' in their ecology, behavioural characteristics and detectability make it difficult to quantify the ways in which they interact with and thereby deliver well-being benefits to people. Furthermore, distribution and abundance of different bird species will be greatly dependent upon the habitat composition of the urban environment, especially with respect to green space availability and the vegetation structure therein.

Here we present the findings of avian abundance and behavioural surveys conducted across three structurally diverse urban centres in Eastern England – Milton Keynes, Bedford and Luton. We explicitly demonstrate the disparity in urban habitat usage by people and birds, with higher levels of human activity predominantly occurring during periods of below average avian abundance, richness and diversity. We then go on to quantify the avian “detection deficit”, or difference between actual and experienced abundance, for 36 individual species. We show that this deficit is significantly affected by species morphology and that it varies along gradients in the green and built-up components of urban form. We also consider how behavioural characteristics may confound relationships between bird presence and potential aesthetic service provision further.

The results indicate that many elements of bird fauna might commonly be under-appreciated by the general public, therefore suggesting that important environmental effects might not be perceived. We will discuss the implications of these findings for future urban planning and development.

Gavin Siriwardena is the Head of Terrestrial Ecology at the BTO, primarily working on bird-habitat relationships and mechanisms underlying population change. Although mostly working on farmland birds, he has a long-standing interest in bird-human interactions and has been working on ecosystem service provision by birds for around five years.

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THURS, 7 APRIL, 10.00 h

Interplay of Opportunities and Challenges for urban Black Kites in Delhi, India

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Some species in human modified landscapes have adapted and thrive on the opportunistic abundance of garbage based food. The Black Kite *Milvus migrans*, a medium sized raptor, is a typical example which acts as a city cleaner in the Old World. This research is aimed at studying Black Kite density, phenology, breeding success, diet and behaviour in and around the city of Delhi. The overall city comprises both urban and semi-urban areas with poor solid waste management. It affords plenty of food to these birds in the form of rubbish, carrion and remains from slaughterhouses. Nearly 200 Kite nests are surveyed every year for their breeding success, through a network of 40 plots of 1km², distributed on the gradient of urbanization.

Black Kite nest habitat selection was affected by the trade-off between the availability of green areas and of food resources within the city. It was supported by the fact that they are city scavengers with an acute preference for trees as nesting substrate. A temporal stability in their overall breeding density since the 1960s and major contribution of human refuse to their diet were estimated while ecosystem service provided through this scavenging and its impacts on kite physiology, survivorship, behaviour etc. are yet to be determined. Our study has found numerous associations between religious and cultural beliefs and kite ecology. Such beliefs affect kites both positively e.g. through a ritual of offering meat chunks to these birds to get rid of sins and negatively where people regard them as bad omens and sacrifice them for witchcraft. Backed by preliminary ethnographic surveys, data will be obtained on how best people acknowledge the presence of Black Kite and other birds around and whether this has been affected by the recent decline in Vulture and Sparrow populations in a changing world of human development. Our results illustrate the possibilities of understanding the specific adaptations of birds to overcome limitations of an extreme anthropogenic environment.

Nishant Kumar's doctoral research focuses on ethno-ornithology, population and spatial ecology of Black Kites, to delineate their opportunities and constraints in rapidly changing urban-ecosystem.

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After his MSc in 2013 from Wildlife Institute of India, where he initiated this ongoing collaborative study, he joined Oxford as Felix Scholar in October 2014.

THURS, 7 APRIL, 10.20 h

Destroyers, dive-bombers and devils: the unexpected nature of contemporary human-avian interactions in Australian cities

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The well-documented restructuring of avian communities in urban environments appears to be one of increasing homogeny, with a highly predictable suite of the same or similar species predominating while local smaller species often decline. This tendency has been noted throughout the world, with the avifauna of cities from vastly different locations and climates becoming dominated by columbids, corvids and parids. This vastly simplified avifauna limits perceptions of urban biodiversity and potentially reduces the capacity and range of human-avian interactions. Chickadees in Philadelphia, tits in Leicester, crows and pigeons everywhere!

While the process of urbanisation underway in the large cities of Australia is among the most rapid and transformative in the world, the changes in the urban bird communities have been very different to that of other regions. This is especially evident in the more tropical cities where numerous species have unexpectedly become highly successful urban exploiters, often dramatically transforming the nature of interactions with human residents. In the sub-tropical city of Brisbane (population approximately 2 million), three large species in particular have become unexpectedly abundant over the previous decade, challenging both suburban residents and urban ecologists in terms of coexistence and explanations for their unforeseen successes.

The Australian Brush-turkey *Alectura lathami* is a large (2-4kg) megapode rapidly invading urban areas from northern Queensland to Sydney. This species constructs massive (4 tonne) incubation mounds from leaf litter and if sited in a garden can result in significant “landscape redesigning”. The Australian Magpie *Gymnorhina tibicen* (not a corvid) is extremely abundant throughout urban areas and is unique in its violent defence of nesting areas, attacking human intruders and causing many injuries. Nonetheless, the species remains the most favoured feeding bird. Most recently, the Bush Stone-curlew *Burhinus grallarius*, a large nocturnal ground-dwelling species well-known for its loud and haunting calls, has become abundant throughout Brisbane, establishing nests in many suburban and urban parks. The success of these unusual species is resulting in rapidly changing

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perception of urban nature in Australia, and reshaping expectations of long-established human-wildlife interactions.

Darryl Jones is based at Griffith University in Brisbane, Queensland, Australia where he has been studying urban birds for over thirty years. He works closely with the local and state governments to understand bird-related urban wildlife conflicts and regularly advises on approaches that encourage effective coexistence between humans and the native species living among us.

THURS, 7 APRIL, 11.25 h

Disease ecology in peri-domestic habitats: the dynamism of infectious disease affecting British garden birds over the past decade

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Feeding garden birds in domestic gardens is a popular pastime of the British public, in habitats that span the rural to urban gradient. This close proximity of humans and wild birds in peri-domestic environments offers an ideal opportunity for wildlife disease surveillance employing a citizen science approach. Whilst provision of supplementary food has many associated benefits for wild birds, it may influence disease emergence and transmission through various means, including increased species density, novel opportunities for interspecific contact, and pathogen exposure at contaminated sites. Disease surveillance conducted over the past decade has identified a rapidly changing epidemiology of some of the best known diseases affecting British garden birds. Epidemic mortality of wild birds has occurred due to two previously-known pathogens, one parasitic and the second viral, which have emerged in new host species. Finch trichomonosis, caused by a single clonal strain of *Trichomonas gallinae*, is thought to have originated from sympatric columbiforms and has led to a significant population decline of the greenfinch (*Chloris chloris*). Paridae pox, primarily affecting great tits (*Parus major*), is believed to have emerged following incursion of a novel strain of avian poxvirus from Scandinavia or continental Europe. In contrast, the prevalence of an endemic bacterial disease, passerine salmonellosis, caused by host-associated strains of *Salmonella* Typhimurium, has dramatically reduced. Recent detection of likely endemic pathogens affecting various songbird species, such as the bacteria *Suttonella ornithocola* and *Chlamydia psittaci*, may give the impression of an increased rate of disease emergence events but probably simply reflect increased research effort. Our understanding of the extent to which anthropogenic activity

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influences infectious disease ecology is limited by our paucity of knowledge of disease transmission out with garden habitats. Nevertheless, the precautionary principle should be adopted and best practice for feeding garden birds is recommended for disease prevention and control during outbreaks.

Becki Lawson is a Research Fellow in the Wildlife Epidemiology Theme based at the Institute of Zoology, London, whose research focuses on wildlife disease investigation. In collaboration with the RSPB and BTO, she has investigated infectious disease as a cause of mortality of British garden birds over the past decade.

THURS, 7 APRIL, 11.45 h

Adaptation or acclimation to urban anthropogenic stressors: A case study of the Great Tit

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To estimate the past and future impact of urbanisation on birds, it is important to understand the mechanistic underpinnings of a physiological response to anthropogenic stress. It is well known that air pollution such as nitrogen oxides and particulate matter, directly associated with urban habitats, increases oxidative stress - a state when the detoxifying antioxidant system is overwhelmed by reactive oxidants, which may cause tissue damage linked to disease and pre-mature senescence. Urban Great Tits *Parus major* have, repeatedly, shown to have a higher antioxidant activity than rural conspecifics, sometimes sufficient enough to prevent tissue damage and sometimes not. Regardless, an increased antioxidant defence is probably not cost free for the urban birds, which is why we need to understand the mechanistic cause(s) for generating this habitat difference in physiology. Is it a result of: *i) the evolutionary history* (i.e. a strong selection pressure for greater antioxidant capacities in urban habitats); *ii) the present environment* (i.e. direct physiological up-regulation in response to current urban stressors); or *iii) the individual history combined with the present environment* (i.e. developmental programming of gene regulation and the potential for match/mis-match between environment and optimal physiological response). By using the European Great Tit as our model system, we address these three mechanistic pathways for generating variation in antioxidant capacities between populations and individuals.

Caroline Isaksson is Associate Professor in Biology at Lund University. Caroline received her PhD in 2007 at Gothenburg University, after which post doctoral work was conducted at University of Groningen and at the EGI/Oxford University. Her main interests lie in combining ecophysiology and

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evolutionary ecology, currently, focusing on the impact of anthropogenic stress and its implications for urban birds.

THURS, 7 APRIL, 12.05 h

Infection with avian malaria *Plasmodium relictum* is associated with reduced juvenile survival and population declines of the House Sparrow

**DARIA DADAM^{1,†}, ROBERT A. ROBINSON², ANABEL CLEMENTS¹, WILL J. PEACH³,
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The decline of the House Sparrow *Passer domesticus* in Britain has been well documented, with the latest trend showing a 68% decline between 1977 and 2013. No single definitive cause has yet been found, and although previous studies have addressed several hypotheses, including lack of invertebrates for nestlings, reduced availability of nest sites, predation by cats, and competition with other species, none of them focused on the role of parasites. Parasites have the ability to control animal populations by modifying host survival and/or reproductive success and here we investigate the association between the malaria parasite *Plasmodium relictum* and House Sparrow population decline and survival in London. The study, conducted over three years, focused on 11 sites across London, where over 370 birds were blood-sampled. Individuals were also colour-ringed to conduct mark-resighting analyses at five of the sites, and a standardised survey of House Sparrows was conducted over five years to produce population trends for each site.

Results showed that intensity of malaria was higher in declining sites than in non-declining ones. Survival analyses were also conducted to test over-winter survival in relation to parasite intensity. Results showed that juveniles, but not adults, with higher intensity of malaria parasite infection experienced lower survival rate than those with lower or no infection. This is in accordance with previous studies that had identified low juvenile survival as a possible cause behind population decline of House Sparrows. This study therefore suggests an important role of malaria in the decline of the House Sparrow in the urban environment.

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Daria Dadam is an ecologist with particular interest in avian disease, urban, and farmland ecology. Following her PhD on House Sparrow decline in London she started working as research ecologist at the British Trust for Ornithology focusing on a variety of research topics and collaborating with other research institutions.

THURS, 7 APRIL, 12.25 h

The effects of urbanisation on foraging strategies and health status of Black Sparrowhawks in a newly colonised urban population

PETRA SUMASGUTNER*, JESSLEENA SURI, ELÉONORE HELLARD, GARETH TATE, ANN KOESLAG & ARJUN AMAR

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Despite the rapid and global transformation of natural landscapes into urban environments, we still lack a clear understanding on how these developments impact ecological interaction and evolutionary processes. This is particularly true for predator-prey and host-parasite interactions and the influence of urbanisation on individual animal health. Urban birds may be exposed to prolonged stress, potentially through disturbance, food shortage or pollutants, and this may alter their body condition and parasite resistance. Especially in raptors, where the availability of prey is a major factor driving their reproductive performance, the question of how trophic behaviour relates to individual health is of high interest in an urban context. In this study we focus on the health status (blood parasites, body condition and heterophils/lymphocyte ratios) of Black Sparrowhawk *Accipiter melanoleucus* nestlings along an urbanisation gradient in Cape Town, South Africa, and test whether any such relationships could be driven by differences in diet or prey abundance.

Surprisingly, no negative health impacts of urban nestlings were obvious. In fact for one blood parasite, *Leucocytozoon* sp., we found a positive association between the degree of urbanisation and infection, potentially because there is less habitat for this parasite's vectors (Black Flies) available, which require running water to breed. This study also found no change in diet composition, consistent with the finding that prey species of Black Sparrowhawks were equally abundant across different habitat types. Our findings help to understand the success of the species in this newly colonised urban environment.

Petra Sumasgutner defended her PhD-thesis in urban ecology of Eurasian Kestrels with distinction in 2014 (project of the University of Vienna, Austria and the University of Turku, Finland). She joined the Percy FitzPatrick Institute, Cape Town as a post-doctoral fellow and aims to understand the establishment of urban raptor populations.

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THURS, 7 APRIL, 12.45 h

Fatty acid profiles of Great Tits: are there differences between growing in the city or the forest?

ALEJANDRA TOLEDO^{1*}, MARTIN N. ANDERSSON², HONG-LEI WANG², PABLO SALMÓN¹ & CAROLINE ISAKSSON¹

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Cities are characterized by the provision of abundant supplementary food, but its nutritional features are different from what birds can find in nature, e.g. in the profile of fatty acids (FAs). FAs fulfil important functions in the body and take part in multitude of physiological processes during the whole life of animals, but probably they are even more crucial at early life stages, when cells and tissues are developing. Exploring the differences in the FA profile between urban and rural populations at these early stages is important for understanding how urbanization is affecting bird communities through differences in diet. The aims are 1) identify and quantify the FAs of yolk and nestlings' plasma of Great Tit *Parus major* to 2) compare the FA profiles between urban and rural populations. In addition, we 3) test for differences in nestling morphological development between these populations using condition index increment as proxy of growth, and 4) the potential influence of the functional classes of FAs on this trait is investigated. Inter-population differences were found, most likely linked to food differences. Since polyunsaturated FAs affect inflammatory responses, these differences are intriguing to further explore in relation to how urban birds can handle environmental stressors that increase inflammation.

Alejandra Toledo is a biologist interested in avian ecophysiology and conservation, particularly in disentangle the causes of population decline with physiological tools. The study that she is presenting is the result of her master thesis, supervised by Caroline Isaksson and Martin N. Andersson at Lund University, Sweden.

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THURS, 7 APRIL, 14.30 h

Effects of supplementary feeding on suburban House Sparrows

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Factors limiting population size in suburban birds are poorly understood. Large declines in some UK suburban house sparrow populations since the mid-1990s have been accompanied by reduced reproductive success as measured by BTO nest record cards. Previous field studies have shown that reproductive success in suburban house sparrows is limited by invertebrate availability. We conducted a supplementary feeding experiment to test whether population size in suburban house sparrows is limited by invertebrate availability (during the breeding season) or seed availability (year-round). The study was conducted over four years at 33 sparrow colonies spread across suburban London, with 33 comparable unfed colonies serving as controls.

Invertebrate (mealworm) provision increased the abundance of recently fledged juvenile sparrows by 62% but had only a small overall positive impact on colony size (restricted to small colonies). Year-round seed provision (sunflower hearts) had no effect on overwinter survival and only a small positive impact on colony size. We conclude that food availability does not limit sparrow population size in suburban London and has probably not (on its own) driven population declines. We consider environmental correlates of sparrow population change at our study colonies and across a wider sample of London BBS (1km²) survey squares.

Will Peach is Head of Research Delivery at the RSPB. He leads a small team of biologists developing conservation solutions for priority birds of the wider countryside especially farmland. He previously worked on integrated population monitoring for the BTO.

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THURS, 7 APRIL, 14.50 h

Plugging the urban sink: metapopulation responses to conservation in human-dominated landscapes

ZACHARY S. LADIN^{1*}, VINCENT D'AMICO², JAN M. BAETENS³, ROLAND R. ROTH¹ & W. GREG SHRIVER¹

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Loss of forest habitat to urbanization is a primary cause of forest-breeding songbird population declines as human-dominated landscapes continue expanding. Understanding the relative effects of different mitigation strategies is necessary to stop population declines for sensitive species. We studied the Wood Thrush *Hylocichla mustelina* a declining forest-breeding Neotropical migratory species that is sensitive to urbanization. We integrated 40-years of demographic data with contemporary metapopulation model simulations to predict population responses to conservation scenarios. We compared four conservation scenarios over a 30-year time period (2014 – 2044) representing A) current state (null), B) reduced impervious surface, C) reduced brood parasitism by the Brown-headed Cowbird *Molothrus ater*, and D) simultaneous reductions of impervious surface and brood parasitism. Compared to the null scenario, simulations of reduced brood parasitism, reduced impervious surface, and simultaneously reduced brood parasitism and impervious surface increased mean annual wood thrush population trends by 38 %, 54 %, and 98 %, respectively. Mean annual growth rates per site were greater in scenarios where brood parasitism ($\lambda = 0.92$) and impervious surface ($\lambda = 0.94$) were reduced compared to the null scenario ($\lambda = 0.88$). However, only when brood parasitism and impervious surface were simultaneously reduced, did the population stabilize ($\lambda = 1.00$). Our results suggest that independently mitigating negative effects of impervious surface and cowbird parasitism could slow negative population trends of wood thrushes. However, conservation efforts that jointly reduce impervious surface and cowbird parasitism, at regional and local scales, respectively, may stabilize wood thrush populations breeding within increasingly urbanized landscapes.

Zachary Ladin is a quantitative ecologist broadly interested in how individual-based behaviour and ecological dynamics are linked with population-level patterns and processes. His recent work seeks to understand how demographics, mating structure, and food resource use may be related to population declines in forest-breeding birds that are sensitive to urbanization.

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THURS, 7 APRIL, 15.10 h

Urban bird benchmark

JIP LOUWE KOOIJMANS

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Four urban exploiters became Red Listed in the Netherlands in 2004, this drew attention to the fact that cities were rapidly degrading as bird habitat. It was the reason to start a conservation program on urban birds. Through a point count scheme, based on the Dutch postal code system, data are being collected. Citizens can easily join the program by counting their own postal code area. The program delivered data to develop: a Benchmark for urban birds and a State of the urban birds in 2009. The latter compares the trend of 40 species in urban and rural areas. The differences are surprisingly great. The benchmark for urban birds shows the relative species richness of a location. For both the benchmark and the state of the urban birds, the bird species are lumped in 'guilds' not based on biological family but on landscape use. Therefore giving a direct implication of the conservation measurements needed in a certain location e.g. city. The benchmark goes together with a handbook on the conservation of urban birds. It can be used by municipalities and citizens as well as the building industry, the most challenging of all stakeholders. To make the book easy-to-use for the building industry a checklist was developed in cooperation with the biggest contractor in the country. This is quite a revolutionary cooperation. The checklist consists of simple yes or no questions that lead to an advice of what conservation measurements that can be taken on a building site.

Jip Louwe Kooijmans is the team leader for the national program on urban bird conservation and co-moderator of BIGUB (BirdLife International Group on Urban Birds). He has published several books and reports, including *Stadsvogels* (handbook on urban bird conservation, 2009), *State of the urban birds* (2009 & 2013) and *Stadsvogels in hun domein* (urban bird benchmark, 2014).

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TALKING POSTERS

Abstracts are in surname alphabetical order.

Talking Posters are a series of short, un-manned, narrated slideshows that show continuously throughout the conference in their own screening room. Six presentations will be shown, each lasting around 5 mins.

TALKING POSTER

Resolving an urban human-wildlife conflict: an experimental test of using falconry to reduce Egyptian Geese in Cape Town

ARJUN AMAR¹* ALEX AITKINS¹, STEVE REDPATH² & ROB LITTLE¹

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Urbanisation can lead to changes in predator-prey dynamics, and may drastically alter the demographics and behaviour of prey species. As a result some prey species may increase in abundance, becoming a nuisance for humans which may require management. One management option is lethal control, but such approaches are often controversial and tend to be particularly unpopular amongst the general public within urban environments.

Within Cape Town, South Africa, Egyptian Geese *Alopochen aegyptiaca* have increased dramatically in abundance over the last few decades, and there is now a human-wildlife conflict centred on Cape Town's golf courses where large numbers of geese congregate and defecate on the fairways and greens, causing problems for golf course managers and players. Previous research has highlighted that the highest numbers of birds occur in more open areas and vigilance levels in these hotspots tend to be lower than in less preferred areas. With these findings in mind, we experimentally tested whether introducing a predator to the system in the form of trained hawks could increase vigilance and thereby decrease the abundance of these nuisance animals.

Over three months, numbers of Egyptian Geese declined by 73% at the treatment site, but remained constant (or increased) at the control sites. Simultaneously, vigilance levels increased by 76% at the treatment site, but showed no such increase at the control sites. Our experiment suggests that falconry can be a very effective non-lethal technique to reduce Egyptian goose numbers. These findings suggest that the use of trained raptors may be a useful technique to reduce the number of

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nuisance birds by replacing lost interactions with predators. This approach may be particularly useful in urban areas where the use of lethal techniques are often undesirable.

Arjun Amar is a Senior Lecturer at the Percy FitzPatrick Institute for African Ornithology at the University of Cape Town with interests in the conservation and evolutionary ecology of raptorial birds. He has a long standing interest in research aimed at resolving human-wildlife conflicts.

TALKING POSTER

Diversity and natural history of birds in green urban areas of the city of Quito, Ecuador (America)

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The diversity and ecology of urban bird communities have been extensively studied in Neartic and Palearctic areas, however, little is known about urban Neotropical areas. Quito, capital city of Ecuador, is placed on a highland valley in the megadiverse tropical Andes. Founded in 1534, Quito didn't increase significantly its urban area until the late 19th century, growing at an accelerated and unplanned rate during the 20th century. About 100 species were known to inhabit on Quito at the end of the 19th century. Currently, most authors estimated that no more than 40 species occur in Quito, although no systematic bird studies have been conducted. Our research is a first approach to the avifauna of Quito, surveying the diversity living in green urban areas within the city borders. We used two field methodologies, i.e. line transects and point counts, to survey 16 green urban areas over 12 months. We recorded 65 species of birds, belonging to 20 families and 9 orders. Three species were the most common and frequent: Eared Dove *Zenaida auriculata*, Rufous-collared Sparrow *Zonotrichia capensis*, and Great Thrush *Turdus fuscater*, being omnivores and granivores adapted to anthropic habitats with low ecological complexity. Six species were equally common but not as frequent: American Kestrel *Falco sparverius*, Sparkling Violetear *Colibri coruscans*, Black-tailed Trainbearer *Lesbia victoriae*, Brown-bellied Swallow *Oreochelidon murina*, Black Flowerpiercer *Diglossa humeralis*, and Cinereous Conebill *Conirostrum cinereum*, being nectarivores or small predators. All other species were either uncommon or rare, mainly insectivores and frugivores that prefer wildlife habitats with mid/high ecological complexity, and restricted to large urban parks with patches of native vegetation. We found a negative correlation between human impact and bird

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richness in all studied areas. These data provide important information to encourage better urban practices and to promote conservation and recovery of Quito's native wildlife.

Diego F. Cisneros-Heredia is a zoologist studying the diversity of species, the factors underlying their distribution patterns, and the effects of human activities on species and habitats, in order to support its long-term conservation. Currently, he is full-time professor at Universidad San Francisco de Quito USFQ, where he is director of the Laboratory of Terrestrial Zoology.

TALKING POSTER

Quality or quantity? An important question for urban house sparrows at lunch time

AMPARO HERRERA-DUEÑAS^{1*}; JAVIER PINEDA-PAMPLIEGA¹; M. TERESA ANTONIO² & JOSÉ I. AGUIRRE¹

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Cities offer a new habitat to colonize by wildlife, but urban lifestyle is quite different compared with rural one, also for birds. Noise traffic, interactions with people, pollution... are just some of the stressors that urban birds have to face. However cities also show some advantages being the abundance of food resources one of them.

The House Sparrow *Passer domesticus* is an urban exploiter species, whose distribution is always linked with humans. However urban population are on decline in many European cities and diet could be involved. This species, mainly granivorous, is well-adapted to forage in urban parks and pavements. But the composition of this food is quite different compared with cereals that they used to intake in rural areas. Anthropogenic food is usually rich in fats and sugar, but poor in other important nutrients as vitamins or minerals present in wheat, oat or sorghum.

We analysed the effect of anthropogenic food on nutritional status and oxidative balance in house sparrows. Briefly, birds were captured and divided in four different groups regarding its origin (urban or rural) and experimental diet (anthropogenic or natural). The experimental treatment lasted 21 days; and a blood sample was taken at day 0, 11 and 21 of treatment. Parameters related with nutritional status like albumin, cholesterol, triglycerides and total antioxidant capacity were

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measured in plasma; oxidative damage and activity of antioxidant enzymes were determined in red blood cells.

Our results provide experimental data on the consequences of anthropogenic diet on birds' physiology. Among other factors, this diet could be related with the increase of oxidative stress levels reported in some urban populations. Stressors promote a prooxidant condition, so a lack in antioxidant intake could compromise the oxidative status of house sparrows in cities.

Amparo Herrera-Dueñas is a biologist interested on the effect of urbanization on wildlife, mainly from an ecophysiological perspective. She is member of Evolution and Conservation Biology research group from Complutense University of Madrid, where she is developing her thesis about the impact of urbanization in house sparrows through oxidative stress biomarkers.

TALKING POSTER

Bird community variations along tropical urbanization gradients: opposing trends of diversity and biomass

DEREK POMEROY¹, LILIAN TWANZA¹, MICHEAL KIBUULE¹, ROGER SKEEN¹ & DAN CHAMBERLAIN^{2*}

¹ Makerere University, Kampala, Uganda.

² University of Turin, Turin, Italy.

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Variations in bird communities along gradients of urbanization (i.e. from city centres to peri-urban rural areas) are commonly studied in the developed world, but there has been little research into urban gradients in tropical cities in the developing world. A series of 2km transect surveys was undertaken annually from 2010 to 2015 in Kampala, a large tropical city of some 1.5M people in Uganda, East Africa. The transects covered a gradient of land use from the highly urbanized city centre to the adjacent small-scale farmland just outside the main suburban areas. There was a significant increase in species richness and species diversity from urban to rural sites. The mean annual species richness varied from 14 species in the city centre to 51 species in the peri-urban farmland. However, abundance was constant across the gradient, and total biomass showed a significant decrease from urban to rural sites. The urban community was dominated by large

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scavengers (e.g. Marabou Storks *Leptoptilos crumenifer*) and raptors (e.g. Yellow-billed Kite *Milvus aegyptius*, Hooded Vulture *Necrosyrtes monachus*). There was also a temporal pattern evident, where larger birds increased as overall richness declined in the more urbanized sites. For example, at Makerere University's campus, average monthly lists have declined from 53 species in the 1980s to 34 in 2015, during which time student numbers have risen from 4000 to 40,000. Such a pattern of urban 'winners' being amongst the largest species is not evident in studies of native species in temperate cities. We hypothesize that these patterns are due to greater energetic resources being available for exploitation, and to less persecution of the urban exploiters in tropical urban areas. We urge similar studies across urban gradients in other tropical countries to assess the universality of this pattern.

Dan Chamberlain is a researcher at the University of Turin. Over 20 years' post-doctoral research experience has produced a large body of work on the ecology of birds in highly modified habitats, including urban areas. In particular, he has published on the relative importance of habitat versus food supply in influencing the urban bird community, the demographic differences between urban and rural populations, the role of predation in urban bird population trends and the use of urban greenspace by birds. His current research is focussed on impacts of environmental change, and in particular climate change, on biodiversity in alpine habitats, including studies on birds, carabid beetles and dung beetles.

TALKING POSTER

Kleptoparasitism by gulls in urban and shoreline foraging environments

ROBERT SPENCER

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Gulls are found in a variety of environments, forage in mixed-species groups, and invest heavily in food stealing behaviours (kleptoparasitism). Some UK gull species have declined significantly over the last century making them a conservation priority. These same species have shown population increases in urban areas. Invading urban spaces requires simultaneously solving a number of problems, the most pressing of which is finding food. Kleptoparasitism requires opportunistic food sources and the presence of other foragers and, where these conditions are met, could allow gulls to forage adaptively in novel environments. Kleptoparasitism was predicted to be an important behaviour in allowing gulls to meet the energy requirements in urban environments.

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I compared the rate of kleptoparasitism in foraging gull populations in two environments. The first, Brancaster (Norfolk, UK), is a coastal site where gulls aggregate to forage at low-tide. This was viewed as indicative of the shoreline foraging ecologies encountered by gulls throughout their evolutionary history. The second, Billingsgate Market (London, UK), is an urban site where gull populations aggregate to exploit food waste in the car park areas. In addition, I assessed the significance of three ecological variables as predictors of kleptoparasitism across environments. These were: population density, prey-size, and duration of foraging patches. These variables captured several conditions outlined by Brockmann and Barnard (1979) as facilitators of kleptoparasitism.

Kleptoparasitism was significantly greater in the urban population, suggesting that stealing food from conspecifics is an important foraging strategy for gulls when novel environmental conditions are encountered. All three ecological variables were significant predictors of kleptoparasitism, the best predictor being prey-size, indicating larger food items at the urban site provided visual cues to the presence of food that could be targeted for theft.

Reference: Brockmann, H. J. & Barnard, C. J. (1979). Kleptoparasitism in birds. *Animal Behaviour*, 27, 487-514.

Robert Spencer is a behavioural ecologist conducting PhD research at Middlesex University. His research investigates the behaviours of generalist species that forage socially and invade different environments. He uses gull (*Laridae*) populations to assess the ecological and social factors that influence kleptoparasitic behaviours in competitively asymmetric mixed-species foraging groups.

TALKING POSTER

Dublin decisions: Context dependent risk management in high arctic migratory bird species overwintering in urban Ireland

FREYDÍS VIGFÚSDÓTTIR^{1,2}, IAN CLEASBY¹, THOMAS BODEY¹ & STUART BEARHOP¹

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It is thought that non-lethal effects of predation may play a far more important role in determining the behaviour, condition, density and distribution of animals. This is because the avoidance behaviour associated with fear is costly itself, as it can result in lost foraging opportunities, increased energy expenditure and stress. Hence fear can limit access to resources, influencing body condition, and thus has potentially significant consequences for fitness. Urban environment is home to

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numerous migratory bird species and may offer relatively stable overwinter feeding habitats such as parks, golf courses and gardens. However, such feeding grounds are often under high level of disturbance leaving the animals to evaluate of the risk of staying put and keep foraging or to flee the threat. This study will systematically investigate individual, context-dependent risk management in a wild population of a migratory bird species, Light-bellied Brent Geese *Branta bernicla hrota*, breeding in the Canadian high arctic, staging in Iceland and overwintering in highly urban areas of Ireland. We predict that individuals will be more tolerant of disturbance in spring because of the requirement for fuel deposition, but in turn may express heightened stress levels during this period as the cost of fear. We explore how fear is moderated according to the context in which the threat is delivered; why individuals might vary in the ways in which they respond behaviourally and physically (i.e. via measures of condition and stress hormones). We discuss the fitness consequence of individual variation in fear in relation to the trade off between food and safety as mediated by endogenous fat reserves and stress hormones and hypotheses about adaptive risk management by individuals.

Freydís Vigfúsdóttir is an ecologist interested in spatial and trophic ecology of animals, particularly intra-population variation in foraging and dispersal behaviours. After her PhD at UEA, where she studied influences of resource limitations on seabird productivity, she was awarded a fellowship for her current work on the Brent geese presented here.

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POSTERS

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POSTER

Maladaptive reproductive investment and behavioural variation in an urban habitat

VIRGINIE DEMEYRIER*, ARNAUD GRÉGOIRE, MARCEL LAMBRECHTS & ANNE CHARMANTIER

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Increasing urbanization imposes novel constraints for wildlife, providing opportunities to study mechanisms of adaptation. Urban areas have recently been defined as potential sinks or ecological traps for wildlife, attracting individuals to breeding sites with man-fabricated cues disconnected from true habitat quality. In cavity-exploiting species, reproductive investment has been shown to be influenced by the breeding cavity size either through individual plastic adjustment or non-random distribution of individuals varying in clutch size. However, this behaviour is adaptive only if cavity size is with a reliable cue of the breeding environment quality.

We tested along an urban gradient whether artificial cavity size induced maladaptive breeding responses via an ecological trap mechanism. We performed an experiment where urban insectivorous cavity-nesting Great Tits *Parus major* were offered three nest-box sizes, covering the natural cavity range, in the city of Montpellier, France. We monitored the breeding phenology during four years and measured anthropogenic perturbations and resource abundance. Additionally to this experiment, open-field trials over two years allowed to compare Great Tit personalities across this urban gradient and in a deciduous forest near the city of Montpellier.

We show that Great Tits are more attracted to large rather than smaller artificial cavities. Larger cavities host larger clutches yet they also produce fewer fledglings. In addition, overall the urban breeders produce fledglings in poor physical condition, in part because their clutches are maladaptively large. Increasing family size according to cavity size has previously been described. However, our results reveal that this strategy is maladaptive when large artificial cavities are placed in urbanized invertebrate-poor environments. Finally, our behavioural measures show contrasted personalities in rural versus urban environments, in line with the theory predicting that urban

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factors should promote bold individuals to settle in urban habitats. These results shed light on behavioural adaptation and maladaptation in an urban context.

Virginie Demeyrier is biologist with a main research focus on wildlife ecology and conservation. After an engineer degree in conservation biology and management, she is doing her PhD in urban ecology and evolution at the Evolutionary and Functional Ecology Center (CEFE) in Montpellier, France.

POSTER

Urbanization modifies plumage and beak color of Common Blackbirds in Europe

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Living in the city may affect the expression of secondary sexual traits in birds. The color of avian traits has been suggested to be modified due to urbanization, however, previous evidences are based on single comparisons between urban and rural habitats. Here we have studied plumage and beak color of the common blackbird (*Turdus merula*) in five urban and five forest populations in Europe. Plumage color in this species is melanin-based while the beak color is carotenoid-based and thought to reflect individual quality in males. We compared the lightness, chroma and hue of blackbirds living in urban and natural habitats. We have found no differences in plumage lightness between habitats, but feathers of females living in urban areas had higher hue values, and young urban females had higher chroma values implying more saturated plumage color. Beak lightness and chroma did not differ between habitats, while bills of old male blackbirds had higher hue values in urban areas indicating yellower bills in cities and more orange bills in natural habitats. Plumage results could reflect different environmental conditions during the growing of feathers between habitats that could involve lower oxidative stress ability in urban birds. We explain beak results in the context of two previously proposed hypotheses: (1) lower intake of carotenoids by urban in comparison with non-urban birds and/or (2) higher need of carotenoids for immune or detoxification processes in urban areas. Our findings suggest that urbanization is affecting some

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aspects of coloration in both male and female birds and could be subsequently affecting sexual selection in this group of animals.

Juan Diego Ibáñez-Álamo completed his PhD at the University of Granada. He is now working in a share position between the University of Groningen and the Estación Biológica de Doñana. His research is focused on inter specific interactions, mainly nest predation, brood parasitism and human-animal interactions, with a particular focus on eco-physiology.

POSTER

Integration of stable isotopes and behavioural data reveal poor diet and health in urban-dwelling Blue Tits

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In birds, urbanization has been generally associated with poor reproductive success. However, we still have a little understanding about the underlying mechanisms responsible for such effects. We hypothesized that 1) the availability of the preferred diet of developing nestlings is lower in urban areas, and 2) urban parents might compensate for this by providing nestlings with anthropogenic resources. We investigated this hypothesis by studying two populations of Blue Tits *Cyanistes caeruleus* breeding in an urban park in the city centre of Glasgow and in one native oak forest 30 miles north of the city. First, we sampled invertebrates twice a week for the entire breeding season. Both invertebrate diversity and abundance of Blue Tits chicks' main diet, caterpillars, were lower in Glasgow, and did not show any clear seasonal peak. We then recorded provisioning behaviour of adult Blue Tits by deploying infrared cameras inside their nests when chicks were 12 days old. Urban parents delivered a lower amount of caterpillars and compensated for this by providing more spiders and other items that we suspect to be anthropogenic resources such as peanuts and seeds. Conversely, forest chicks were almost exclusively fed with caterpillars. Last, we obtained a blood sample from the chicks and performed Stable Isotope Analysis to identify the uptake of C and N isotopes in the birds' tissues. We found higher signatures of both ¹³C and ¹⁵N isotopes in the urban chicks, suggesting their diet to be richer in human processed food (¹³C) and invertebrates of higher trophic levels than caterpillars, such as spiders (¹⁵N). Fledgling success and body mass before

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fledgling were lower in the city, but in both populations a positive correlation was detected between the volume of caterpillars fed per chick and fledgling success, suggesting a mechanism explaining the lower fitness of urban birds.

I am broadly interested in how animals cope with and adapt to changes in their environment. My research spans several levels of biological organization, from molecular biology to eco-physiology, to behavioural ecology and population dynamics. I particularly focus on urbanization as source of environmental change and birds as model species. After having established my own research line on the physiological effects of light pollution in wild birds, I recently became interested in the role that natural food availability and bird feeding play in determining the widespread reduction in reproductive success observed in urban passerine species.

POSTER

Great Tits *Parus major* increase vigilance and reduce foraging effort during peaks of aircraft noise

J. IGNACIO KLETT¹ & DIEGO GIL^{1*}

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Most organisms face predation risk at some point of their daily life, and vigilance behaviour may take a significant amount of their time. Some behavioural contexts, such as foraging, demand a good deal of attention, leading to a reduction of vigilance levels and an increase in the risk of predation. Many studies have shown that the trade-off between foraging and vigilance is modulated by the relative predation risk than individuals face. Anthropogenic noise can disturb acoustic communication by masking both direct predator detection and the perception of conspecific alarm calls.

We tested whether an increase in noise produced by commercial aircraft flying overhead would reduce foraging effort and increase vigilance in Great Tits *Parus major*. We video-taped the birds while they were feeding on peanut feeders in the vicinity of an airport, and measured behavioural sequences before, during and after peaks of noise generated by airplanes. Our results show that the ratio between vigilance and foraging increased when aircraft noise increased, attained maximum levels when noise peaked (>100 dB) and returned to baseline levels when noise faded out. Our study shows how a plastic behavioural trait can contribute to the resilience of avian populations exposed to anthropogenic disturbance.

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Diego Gil is a behavioural ecologist interested in the behavioural and physiological mechanisms used by birds to adapt to anthropogenic modifications of habitat. His main theme of research is acoustic communication.

POSTER

Caterpillar abundance and its seasonal dynamics differ between forests and urban habitats

**TAMÁS HAMMER^{1*}, GÁBOR SERESS¹, ERNŐ VINCZE¹, BÁLINT PREISZNER¹, SÁNDOR PAPP¹,
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Breeding of birds generally coincides with seasonal peaks in food supply. Laying a few days earlier or later may lead to suboptimal nestling development. For many forest passerines arthropods, and particularly caterpillars, are the main nestling food, and the decline in the productivity of these species in urban habitats has been suggested to involve reduced availability of nestling food. In this study we tested this hypothesis by comparing caterpillar biomass between two forest and two urban sites in Hungary during the whole breeding season of Great Tits *Parus major*, which is a common breeding bird in both habitat types.

The biomass of caterpillars in tree foliage was estimated using the mass of fecal pellets (frass) that drop from the foliage. Frass was collected in all study sites every 2–3 days from April to June. The samples (n= 1329 in 2013 and n= 1289 in 2014) were dried after collection, and cleaned and measured later with 0.0001 g accuracy. We calculated hourly caterpillar mass for each sampling episode by dividing frass mass by the number of hours between consecutive collections and by correcting for the mean temperature during collection. We also monitored the breeding success of Great Tits at the 4 sites in both years.

We found that the biomass of caterpillars was approximately 10 times higher in 2013 and 4 times higher in 2014 in the forests than in the urban habitats. Furthermore, we detected a clear caterpillar peak at both forest sites, whereas in urban habitats we found several smaller peaks in caterpillar abundance throughout the breeding season. In parallel, Great Tits had lower breeding success at the

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urban sites than in the forests. These results support the proposition that reduced food abundance and its altered seasonal availability can play an important role in the reduced productivity of urban birds.

Tamás Hammer is a PhD student at the University of Pannonia. He is interested in the effects of habitat urbanization on food availability and the breeding success of birds. In his MSc work, he used field observations and geoinformatics to analyse how various environmental factors (e.g. nest height, vegetation cover, built-in areas, roads) affect occupancy of nest-boxes and number of fledged chicks in Great Tits *Parus major*. In his current PhD research he investigates (1) the differences in the availability of nestling food between urban and forest breeding Great Tits, and (2) the anthropogenic environmental factors that may cause these differences. Furthermore, he is also investigating foraging behaviour of Great Tit parents by using radio telemetry.

POSTER

Two ways to become an urban dweller: Spreading patterns of Pygmy Woodpecker and Narcissus Flycatcher in Nagoya City, Japan

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Nagoya City, located in central Japan, is a highly urbanized city, yet forests and parks still remain in some of the urban area. A bird census in approximately 50 major habitats throughout the city has been performed every five years by the City of Nagoya, starting 1974. I analysed the population trends of breeding birds in Nagoya City using these census reports, from 1985 to 2008, and observed that two species, the Japanese Pygmy Woodpecker *Dendrocopos kizuki* and Narcissus Flycatcher *Ficedula narcissina*, showed an increase in their population and expansion of their range.

Although both species were only distributed in a mountain located northeast of Nagoya city in 1985, and are now distributed throughout most of the relatively large wooded areas of Nagoya City, the spreading pattern of these two species differed. The Japanese Pygmy Woodpecker, a resident bird, spread gradually from the forests in the urban fringe (east) to parks in the urban centre (west). In contrast, the Narcissus Flycatcher, a summer breeder in Japan, spread from the large forests to the mid-sized urban woods in the urban centre. I described these spreading patterns using logistic regression models.

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Variables for the woodpecker distribution models of breeding season and wintering season included distribution in the non-breeding season 5 years before and distance from a breeding site 5 years before, respectively. The driving forces for the woodpecker to become an urban dweller included the growth of trees in the urban woods and parks and the woodpecker population increase in the mountainous areas due to an increase in pine trees succumbed to wilt disease.

Equations describing flycatcher distributions during the breeding season differed each year, and the only influential variable was the area of woods. There was no spatial autocorrelation for the distribution of this migratory flycatcher.

Hiroshi Hashimoto is a landscape ecologist with a main research focus on birds in urban and suburban areas. After his PhD in Kyoto University, Japan, which served as the basis for habitat models of birds in urban woods, he is working as an Assistant Professor in landscape design at Meijo University since 2006.

POSTER

Feeding to see and to save: An international comparison of wild bird feeding practices and beliefs

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The feeding of wild birds is probably the most popular and widespread form of human-avian interaction in the world. Every day, millions of people collectively provide enormous amounts of food for local birds to utilise, all of which is additional to naturally occurring foraging resources. The scale of the practice has been likened to a global supplementary feeding experiment yet the ecological consequences of the massive input of anthropogenic foods have been little studied. What is clear, however, is that bird feeding can profoundly alter avian communities, influence population structure and demography and has been implicated in the spread of important avian diseases. Nonetheless, in many parts of the world, wild bird feeding is promoted as an essential element of bird conservation, especially in urbanised areas. Indeed, the practice is widely regarded as one of the most important activities that private citizens can perform to support biodiversity.

The potential for the practice of wild bird feeding to result in both negative and positive impacts at vast scales means that it is critical that we understand this extremely significant phenomenon as deeply as possible. As this past-time is popular throughout the world, a comparison of the practices

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and beliefs associated with feeding in different countries may provide important insights into the motivations of participants. We compared aspects of bird feeding in the United Kingdom and Australia because while the activity is strongly promoted in the UK it is generally discouraged in Australia. Despite this, participation rates are similar.

We conducted an online survey exploring the patterns of feeding, motivations and attitudes, and formally assessed care and connection with nature of feeders. Relationships between this connection and conservation values and behaviours was also investigated. It was found that despite the difference in attitudes toward feeding in Australia and the United Kingdom patterns of bird feeding were very similar in both countries with the majority of participants feeding to help support and care for birds. Bird feeders were also found to have a high level of love, care and emotional connection with nature; that in turn was seen to demonstrate a positive relationship with both pro-environmental values and behaviour.

Renee Chapman and Darryl Jones have been collaborating on wild bird feeding research for over seven years, initially undertaking one of the first detailed studies of the social and environmental implications of urban water bird feeding. This presentation forms part of Renee's doctoral research.

Darryl Jones is an ornithologist based in Queensland, Australia and has been studying aspects of bird feeding for over ten years. He is developing the first guidelines for wild bird feeding for BirdLife Australia, the peak body and has recently completed a major book on the worldwide bird feeding scene.

POSTER

Impacts of habitat modification on avian food-web structure and resilience

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Birds breeding in modified habitats often have to feed their nestlings on diets that differ from what they would have been fed in habitats without anthropogenic modifications. How diets are affected in detail and how altered diet compositions affect breeding success and fledgling condition has previously been hard to tell for species feeding on small arthropod prey. Prey items are often from taxonomically diverse groups and hard to identify through either observations or from remains in faecal sacks. Metabarcoding of

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several species simultaneously in combination with the possibility of amplifying degraded DNA of prey species makes it possible to determine diets from faecal samples and compare diets between habitats. We are developing techniques to identify prey species for a range of upland birds, in particular the meadow pipit. By comparing diets between differently managed breeding grounds we can test how the diet composition affects breeding success, growth rate and fledging condition and identify important factors such as prey diversity or key prey species.

The importance of limiting components in foodstuff is poorly understood for free-living birds and is unlikely to be the same as for birds reared in captivity with lower energy costs. By using stoichiometry to determine ratios of different substances in avian diets in comparison to individual growth rate and fledgling condition data, we are also investigating the limitations and variations of nutrients in nestling diets.

The effects of modified habitats on breeding success is investigated through nestling prey composition and nutrient quality. We aim to develop methods for diet and nutrient analysis applicable to a range of insectivorous passerines which can facilitate the investigation of long term effects on populations whose main distribution is in areas undergoing management changes.

Lisa Malm is doing a PhD at Newcastle University and the James Hutton Institute. She is interested in food-web ecology and the effects of community structure on interaction consistency and species adaptability to environmental change. Before starting a PhD she did an MSc at Uppsala University and the Swedish University of Agricultural Sciences.

POSTER

Behavioural and Physiological consequences of breeding under urban noise in the House Sparrow *Passer domesticus*

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Urban life is known to be characterized by difficult and restrictive conditions (e.g., fragmentation, degradation and loss of habitat, air and noise pollution, human disturbance) that can have detrimental effects on wild birds. However, the proximate mechanisms through which urbanization affects birds are still poorly understood. In this study, we investigated the impact of a specific factor

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associated with urban life: noise pollution. Although the effects of anthropogenic noise on avian acoustic communication have been well documented, to date, very little is known about the physiological and behavioural consequences of chronic noise exposure on breeding and developing birds. To study the direct effects of anthropogenic noise, we experimentally exposed free-living House sparrows breeding in nest boxes to either a traffic noise (disturbed birds) or a rural background noise (control birds) during the whole breeding period. We then focused on the impact of such disturbance on (1) the anti-predator behavioural response of parents (by measuring the flushing distance) and their reproductive performances, and (2) the phenotype of nestlings by measuring three major components that are known to affect the ability of individuals to cope with their environment later in life (stress physiology, telomeres and growth). We found that disturbed parents increased their vigilance (i.e. flushing more rapidly) compared to controls, without any impact on their reproductive performances. Moreover, we found no effect of our experimental treatment on nestlings' growth, body condition and stress physiology, suggesting that house sparrows could be relatively insensitive to urban noise. However, we showed that despite the absence of any obvious immediate consequences, nestlings reared under traffic noise exposure exhibited reduced telomere lengths compared to their unexposed neighbours. Although the mechanisms responsible for this effect remain to be determined, our results indicate that noise pollution can have particularly complex effects on bird's development, with possible life-long consequences.

Alizée Meillère is a PhD student at the Centre d'Études Biologique de Chizé (France) studying the influence of urbanization, and in particular, the impact of specific factors associated with urban life (noise and heavy metal pollutions) on the physiology and behavior of passerine birds.

POSTER

Spatial variation of urban bird communities: relationships with land use and social features

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Urbanization is a worldwide phenomenon affecting biodiversity and, consequently, urban conservation has become a top priority. Urban ecosystems are defined by human activities, habitat

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infrastructures and vegetation components. However, little is known about the processes underlying the spatial variation of urban bird communities.

Here we examined (1) the relationship of bird diversity and abundance with land use and social features through generalized linear models and (2) whether bird diversity, abundance and biomass vary according to height levels in an urban environment. For this, we surveyed bird communities during breeding season in eight neighbourhoods of Aveiro, Portugal.

We found that most neighbourhoods were dominated by omnivorous species, namely *Columba livia* and *Passer domesticus*. Our results show that species richness is higher in neighbourhoods furthest away from esplanades, with higher density of trees, building height and density, alongside low imperviousness, busy streets and human population density. Moreover, neighbourhoods furthest away from esplanades, showing higher building age, height and density, busy streets but lower human population density, hold higher avian abundance. We also found that medium height levels exhibit higher bird diversity, abundance and biomass than both lower and higher height levels.

Our findings strongly suggest that focusing on a combination of local land use and social features, rather than single features, provide a better understanding of spatial structures of urban bird communities. Furthermore, due to the complexity of urban ecosystems, we underlie the relevance of integrating urban planners and social researchers into urban ecological studies.

Mariana Morgado is a Portuguese biologist whose main research focus is urban ecology. During her bachelor's degree she investigated feeding habits, breeding and wintering patterns of the *Ciconia ciconia* populations of Ria de Aveiro. She recently completed her master's degree in Applied Ecology and is currently a Research Fellow at the Centre for Environmental and Marine Studies, University of Aveiro.

POSTER

The influence of food discovery on calling rate of American crows

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Urban birds often alter their foraging strategies to avoid or exploit human activity. Humans can be a source of persecution, but also a source of food for American crows (*Corvus brachyrhynchos*) living in Seattle, WA. American crows form territorial family groups and communicate across long distances

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with a large repertoire of vocalizations. American crows sometimes give calls when they are flying in to a person who is feeding them (Marzluff and Miller 2014), but the motivation behind these calls is unclear. I designed an experiment to test four alternative hypotheses to explain this behaviour: 1) they are making themselves more noticeable to the feeder, 2) they are recruiting family members, 3) they are warning other crows not to enter their territory, or 4) the calls are random.

My experiment consisted of presenting urban wild crows with a sudden food source (peanuts) and recording the calls they gave prior to, during, and after the food appearance. I also kept track of how many crows were initially present and when more arrived. To determine whether some calls were directed at a human feeder, I varied whether a person actively tossed peanuts to the crows, or whether the peanut pile was left for the crows to find. I also varied the number of peanuts used (1, 5, or 25) to see if the size of the food patch influenced the calls given.

After 149 trials, preliminary results show that crows are more likely to call when more peanuts are present ($p=0.001$), however human feeder presence/absence does not have a significant effect on likelihood to call ($p=0.13$). When the crows do call, their call rate is not significantly affected by peanut quantity ($p=0.623$) or feeder presence/absence ($p=0.147$).

Loma Pendergraft is a graduate student with interests in animal behaviour and neuroethology who is currently working with UW professor John Marzluff to explore how a crow's brain behaves when it is exposed to various audio/visual stimuli. Loma graduated from Oklahoma State University with a BSi in Wildlife Ecology.

POSTER

Developing methodologies for surveying urban gulls

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There have been three complete censuses of the breeding seabird population of Britain and Ireland: Operation Seafarer (1969-1970), the Seabird Colony Register (SCR) Census (1985-88) and Seabird

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2000 (1998-2002). Project partners from the Seabird Monitoring Programme (SMP) are currently working together to deliver the next of these periodic censuses of the breeding seabirds of Britain and Ireland: '*Seabirds Count*'.

Each previous census has seen improvements in methods and new baseline estimates for species. For *Seabirds Count*, one group where there is a desire for improved methods to provide the comprehensive coverage that would be required to deliver key outputs is urban gulls, predominantly Herring Gulls *Larus argentatus* and Lesser Black-backed Gulls *L. fuscus*, but also including other species such as Common Gulls *L. canus* and Black-legged Kittiwakes *Rissa tridactyla*.

While gulls nesting in urban environments have been surveyed by Seabird 2000 in 1998-2002 (Mitchell *et al.* 2004) and previously by Monaghan and Coulson (1976) and Raven and Coulson (1997), the spread in the species' distributions to urban habitats apparent from 'Bird Atlas 2007-11' (Balmer *et al.* 2013) and concerns regarding the accuracy and efficacy of some previous approaches (Coulson & Coulson 2015) have highlighted the need for a robustly designed survey methodology.

We report on the development of methods that would enable the delivery of key objectives relating to urban gulls as part of *Seabirds Count*, including both national and site-level population estimates. The project encompasses:

- A review of existing methodologies, including both land-based and remote techniques;
- A review of current knowledge on the distribution of urban nesting gulls in Britain and Ireland;
- The development of proposals for the design and implementation of surveys.

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Kathryn Ross is an ecologist with an interest in understanding the ecological impacts of environmental change, particularly in coastal ecosystems. She completed her PhD at Bournemouth University on predicting the effects of environmental change to coastal birds, using behaviour-based models and has worked at the British Trust for Ornithology since September 2014 on projects broadly focussed on monitoring and identifying signals and drivers of environmental change.

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POSTER

Quantifying the potential for impact from housing development to coastal birds on protected sites

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Coastal Special Protection Areas (SPAs) are important sites for many wintering and passage wildfowl and waders. While birds value these sites for rich intertidal food resources and safe roosting sites, humans value them for diverse recreational opportunities. New housing can lead to increases in recreational pressures to these sites, such as walking, cycling, dog walking and water-sports. Predicting the levels of impact that might be associated with new housing is complicated by a range of site-specific factors such as site morphology, current access levels and visitor behaviour.

In spite of these challenges, there is a need to look strategically across sites in England to inform government and local planning authorities which sites would be most vulnerable to impacts from new housing, and where strategic mitigation is potentially required or more intensive study necessary. To address this, we gathered data from all English SPAs with intertidal habitat and wintering waterbird interest (39 sites). We generated a ranking of sites according to their overall vulnerability to impacts from recreation. This was based on current housing levels, changes in housing (2001-2013), access infrastructure (car-parks, path network), habitat area and distribution. The relative importance of variables was reviewed through expert consultation in the form of a Delphi-style workshop.

The ranking placed the Mersey Narrows & North Wirral Foreshore, Benfleet & Southend Marshes and Chichester & Langstone Harbour SPAs as the three most vulnerable sites. At the other end of this spectrum are Hamford Water, Upper Solway Flats & Marshes and Chesil Beach & the Fleet SPAs.

Linking a site's vulnerability to the type and scale of mitigation schemes remains a challenge. But it is hoped that our ranking will allow a strategic view of the development pressures that waterbirds face on SPAs that will ultimately aid wildlife conservation and planning for sustainable urban growth.

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Kathryn Ross is an ecologist interested in ecological impacts of environmental change, particularly in coastal ecosystems. Following her PhD at Bournemouth University, developing behaviour-based models of coastal birds, she began working on disturbance research – first at Footprint Ecology and subsequently at the British Trust for Ornithology. Based at BTO since September 2014, she now works on a variety of projects, broadly focussed on monitoring and identifying signals and drivers of environmental change.

POSTER

Ageing in the city: telomere dynamics in an urbanisation context

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Urbanisation of natural habitats is rapidly intensifying and poses a potential global threat to many species and populations. Nonetheless, many forest-dwelling species have extended their distributions into urban environments where parks and gardens provide alternative habitats. Despite this, cities may impose new challenges and stressors to urban wildlife, e.g. from traffic noise, artificial light, and air pollution.

Telomeres are highly-conserved tandem repeats of a short DNA sequence at the ends of eukaryotic chromosomes. In wild populations, telomere length has been shown to be correlated with important life-history traits such as survival, senescence and lifetime reproductive success. Telomere loss is normally unavoidable with each cell division and the rate of telomere shortening has been proposed to play an important role in organismal senescence. However, repeated exposure to stressors can be associated with accelerated telomere attrition, potentially reducing individual fitness.

Understanding telomere dynamics in an urban context provide important information about the effects of urban life on vertebrate populations. However, to date, no studies have examined this molecular marker in an urbanisation context.

We here present telomere attrition data from two Great Tit *Parus major* populations, one established in an urban park and the other in a natural forest. Comparing telomere dynamics between these two

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contrasting populations provides insights into the impact of urban environment on the senescence process and physiological health status of urban bird populations.

Pablo Salmón is a PhD student at Lund University with a main research focus on animal evolutionary ecology. His current research investigates physiological and molecular responses of birds to urbanisation, attempting to disentangle the mechanisms involved in environmentally-induced phenotypic responses.

POSTER

8 years Monitoring Urban Species: a simple and successful scheme for breeding birds in the built-up area

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MUS (Monitoring Urban Species) was started in 2007, as an initiative of Sovon (Dutch Centre for Field Ornithology, www.sovon.nl) in cooperation with Birdlife the Netherlands. Territory mapping is not popular in the urban area. Though already 16% of the Netherlands is urbanised. But many species (>50) breed in a greater part in the urban area and therefore important for the population and trends. The field work method consists of five minute point counts on 8-12 randomly selected points per postal code area. There are 3 counts per season: 1-30 April, 15 May- 15 June (both dawn) and 15 June-15 July (evening, especially for Swift). In 2007-2014 the number of points counted grew from 4.950 to 6.930. About 35% of the 750 volunteers are female, which is very high compared to other Dutch monitoring schemes. Furthermore, half of the participants are new to Sovon, and did not participate in bird monitoring before. Since 2014 MUS is part of the Network Ecological Monitoring (NEM, <http://www.netwerkecologischemonitoring.nl/>), a partnership of governmental institutions.

Yearly 160 species are counted. Reliable trends can be derived for 76 species. Six species showed a strong decline, 28 a moderate decline, 11 were stable, 23 showed a moderate increase and eight species a strong increase. In general species that breed in trees and shrubs are declining, as well as partial migrants and the feeding guilds insectivores and granivores. Most water birds and carnivores are increasing.

As a result of MUS we are now able to derive national population trends for Domestic Mallard *Anas platyrhynchos domesticus*, Swift *Apus apus* and Feral Pigeon *Columba Livia* (all three moderate decline).

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Furthermore, MUS data enable trend and density estimation per city, and compare these with regional benchmarks. I invite you to listen to Jip Louwe Kooymans of Birdlife the Netherlands in the oral program.

Jan Schoppers is a self made ornithologist with a special interest in urban birds. He was a partner in de development of MUS in 2007 en since 2009 he is the project leader of MUS. Other projects he is involved are the www.tuintelling.nl the Dutch Garden BirdWatch, regional coordination of water birds, the monitoring en protection of the Corncrake *Crex crex* and fieldwork breeding bird monitoring. Jan is also a portal between amateur birders and the office and a publisher on the website, social media and in papers. He is a bird ringer especially House Sparrow *Passer domesticus* and Starling *Sturnus vulgaris*.

More information about MUS on www.sovon.nl and a presentation
<http://www.slideshare.net/SOVON/8-years-of-monitoring-urban-species-wgus-meeting>

POSTER

More than just a corridor: suburban rivers enhance avian functional diversity

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As the world experiences rapid urban growth, natural landscapes are being transformed into cities at an unprecedented rate. Ecological infrastructure such as rivers may enhance biodiversity conservation, ecological functioning and ecosystem service delivery within cities. This study assesses the value of a small urban river and its catchment in Cape Town, South Africa in terms of its effect on the taxonomic and functional diversity of birds. Contrary to the homogenised assemblage that might otherwise be expected of an urban area, the catchment contains a diverse avian assemblage.

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A total of 178 bird counts were carried out at 89 sites in the catchment and 95 species were recorded. The nine functional groups considered in this study were all present in statistically indistinguishable proportions in the catchment and in the whole of Southern Africa, making the catchment a microcosm of the region's avifauna in terms of its functional composition. RLQ and fourth-corner analyses were used in order to determine the strongest environmental determinants of community composition. Our results suggest that the river is responsible for the occurrence of certain species and functional groups that would not otherwise occur in the suburbs. The heterogeneity within the catchment and proximity of the river to other natural remnants also contribute towards increased species diversity in the catchment.

We are able to conclude that the unique combination of a river, a heterogeneous urban matrix and an adjacent national park makes the Liesbeek catchment an exemplar of the value of ecological infrastructure for urban biodiversity. The findings of this study can be applied to other urban rivers which may be similarly valuable in enhancing urban avian diversity and strengthening the ecological functions carried out by birds.

Jessleena Suri has just completed an MSc in Conservation Biology at the University of Cape Town in South Africa. She is interested in the interface between natural and human-dominated landscapes and in urban biodiversity conservation. She is particularly interested in the value of ecological infrastructure for urban birdlife and in urban raptor ecology.

POSTER

Urban Great Tit population genomics

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Urban areas covered 0.5% of the planet's area in 2000 and are predicted to expand 12-fold between 2000 and 2050. But our understanding of natural variation, response to selection and adaptation in wild animals living in urban environments is very limited, and more insight into the ecological genomics of free-living animals in urban environments is sorely needed. We used a single-end RAD-sequencing approach to infer population and landscape genomic properties of wild Great Tits from Montpellier, France. 235 individuals originating from 6 populations set on an urbanisation gradient were sampled to generate short RAD sequence reads from which a large SNP dataset was derived. First, we discuss which axes of environmental variation influence genomic structuration

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between and within study sites. Second, we ask whether particular outlier SNP loci carry signatures of selection that co-vary with defined urbanisation gradients. Third, we discuss these results in the light of earlier microsatellite work on the same population, as well as future work to be carried out in a matching urbanisation gradient in the city of Warsaw (Poland).

Marta Szulkin worked on wild Great Tits in Wytham, Oxfordshire (PhD and JRF, Dpt of Zoology, University of Oxford) and on Blue Tits in Corsica (Marie Curie Fellowship, CEFCE CNRS Montpellier, France). She is now starting a Wild Urban Ecology and Evolution Lab (CeNT, Warsaw, Poland), and plans to put up 500 nestboxes along an urbanisation gradient in the city of Warsaw.

POSTER

Population genomics of *Mixornis gularis* in a fragmented, urban-dominated landscape

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Although edge-tolerant species are known to benefit from habitat fragmentation in the short term, little is known about the long-term impacts of population isolation resulting from extreme fragmentation on such species. It is possible that population spikes in edge-tolerant species may merely be an immediate response to an increase in edge habitats, and that subsequent secondary fragmentation may result in these edge-tolerant species being isolated from each other.

In this study, we used double digest RAD-Sequencing (ddRAD-Seq) to determine the population structure of the abundant forest edge-dwelling Striped Tit-Babblers (*Mixornis gularis*) in heavily-fragmented and urban-dominated Singapore to determine if discernible effects of population isolation can be detected in the species over fine spatial scales. We subsequently applied landscape genomic analyses to determine if the structure of the landscape affects the level of genetic connectivity between forest fragments.

Our results indicate a complex mix of gene flow and isolation between forest fragments, with one isolated sub-population exhibiting significant levels of inbreeding and incipient levels of population

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divergence, while the remaining sub-populations appear to be connected and sustained by weak but tangible dispersal corridors. The observation of incipient genetic divergence is particularly surprising owing to the close proximity of the forest patch to nearby source populations and the short time-scale at which this is occurring. Our results point toward the power of multilocus neutral genomic SNP data in enabling the elucidation of population genetic structure over fine spatial scales, and also points to the importance of functional habitat corridors in maintaining metapopulation dynamics in even the most resilient and edge-tolerant species.

David Tan is a research assistant who recently graduated from the National University of Singapore. His research interests centre on the ecology of Southeast Asian birds, and is currently exploring the use of next-generation sequencing and remote sensing to elucidate population genomic patterns over fine spatial and temporal scales.

POSTER

Feeling the Heat: Birds as Bioindicators of Flame Retardant Emissions from Landfill

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There is a vast reservoir of brominated flame retardants (BFRs) associated with waste electronics and soft furnishings that accumulate in UK landfill. Given concerns about the health impacts of such chemicals and their ability to bioaccumulate, this project, working in both Europe and North America, aims to test the hypothesis that landfill represents an important source of BFRs to UK wildlife.

This will be achieved by comparing concentrations of BFRs in bird eggs and tissues from landfill sites compared to both urban and rural locations.

This research aims to test the hypothesis that emissions from waste materials in landfill constitute an important source of BFRs to the environment and the terrestrial food chain especially.

At this early stage, we hypothesise that concentrations in eggs and tissues of birds foraging at landfill sites will significantly exceed those in birds that do not.

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Gulls are our chosen sentinel species because they are omnivorous apex predators and are thus especially vulnerable to bioaccumulation of these contaminants

Andrew Tongue is a PhD student at the University of Birmingham's Centre for Ornithology. Prior to this he spent three years as a Senior Research Assistant at the RSPB Centre for Conservation Science, where his research interests included yellow wagtail ecology and the impacts of offshore renewables on seabirds. Andrew has also worked as a Consultant Ornithologist.

POSTER

Seasonal fluctuation of bird diversity along an urbanization gradient

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Urbanization is one of the main drivers of land use change, altering significantly the composition of avian communities. Bird diversity generally decreases with a gradient of increasing urbanization, a factor which may also be subject to seasonal changes.

Our study aims to investigate how avian communities respond to different levels of urbanization in spring and winter time in an eastern Mediterranean city (Patras, Greece). We used data from 90 grid cells of 500X500m randomly selected and evenly distributed along an urbanization gradient (urban, suburban, peri-urban zones). Breeding and wintering bird communities were sampled twice during each season, using the point count method.

A total of 57 bird species were recorded, of which 30 are resident, 8 are migratory breeding species and 19 are winter visitors. The general trend was that overall species richness was higher during winter and increased from the urban to the peri-urban zone. In winter, the peri-urban zone exhibited a significantly higher species number per grid cell than the urban one, but the difference became negligible when compared to the suburban zone. Nevertheless, during the breeding season, no significant difference was observed among the three urbanization zones.

Our findings demonstrate that the peri-urban zone is more diverse than the other two urbanization zones but not as much as it would be expected. During winter, several bird species seem to prefer the urban environment, taking advantage of the provided food and finding shelter from the harsh climatic conditions.

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Olga Tzortzakaki is a biologist with a keen interest in avian ecology and conservation. At the moment she is a PhD candidate at the University of Patras (Greece). Her PhD project is focused on the impacts of urbanization on animal communities and aims to identify the drivers of the observed biodiversity patterns along an urbanization gradient.

POSTER

Birds species richness and diversity in rapidly changing urban habitat of Delhi, India

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Urbanization is happening at rapid pace all around the world. This development process is an important threat to biodiversity at various levels. Little is known on the processes underlying such effects. In this paper we have discussed avian diversity, compositions and structure in different urban landuse classes. For this, we surveyed residents bird communities in four representative land use categories of Delhi region. We recorded 63 species of birds at 15 sites comparing the four landuse classes in Delhi. Our study show high variation of bird's communities along the four representative classes. Commercial areas were highly dominated by few generalist species (Common myna, Common crow, and Rose ringed parakeet) of birds, while the green areas have higher specialist species diversity. Bird abundance increased and bird species richness decreased with the urbanization intensity. Also, our results indicate that bird species richness and abundance values are reasonable to site specific habitat characteristics. Although the taxonomic homogenization with respect to urbanization is not that significant, our results show some relationship does exist between urbanization and homogenization of bird communities. Thus, three main urban planning and management activities which should be implemented and incorporated in city plan are : (1) Regular bird monitoring program, (2) Raise more green scape inside the city region, (3) Regulation of land use pattern. These steps will help to identify focal areas that need management and assist with ecological data for urban planning.

Yashmita Ulman is a Senior Research Scholar in Department of Forestry, NERIST, Arunachal Pradesh. She is keenly interested in wildlife conservation and community interaction studies. Currently she is working on contribution of agroforestry systems in biodiversity and wildlife conservation in Northeast India.

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POSTER

An Assessment of Avian Homogenization in Western Himalayas

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The homogenisation effects of urbanisation on avifauna were studied in three towns located along Beas River and its tributary (Sainj River) in Himachal Pradesh, India. The towns varied in size, shape and population and constitute an urban gradient with Sainj town being least urbanized, followed by Kullu town while Mandi town had relatively high urbanization. In each town, bird community was analysed. Firstly, the bird community composition and abundance of the three studied towns were compared. The most abundant avian species of each town were compared if their abundance increased or decreased along the urban gradient. Line transect method was used for bird counting in summer season i.e. in the month of June 2015. Our results showed that only five avian species constituted 55% of the total bird count in Sainj, 76% in Kullu, and 78% in Mandi. Out of these only *Acridotheres tristis* population increased significantly along the gradient of increasing urbanization ($P < 0.01$). This preliminary study showed that only few avian species were dominating in Himalayan towns and increased in urbanization lead to avian homogenization. Furthermore, bird community of Mandi and Kullu shared higher similarity compared to Sainj. The rapid development owing to tourism and developmental projects (Hydro power development and expansion of roadways) will expect to cause increase in urbanization in this region. As the region comes under Endemic Bird Area and close to Great Himalayan National Park (A UNESCO World Heritage Site) hence it provides refuge to number of mountain birds, however avifauna homogenization dilutes avifauna biodiversity. In near future there is a need for careful and systematic planning and modification of Himalayan towns to prevent domination of few species.

Virat Jolli is an environmental biologist having broad interest in ornithology and Himalayan ecology. He completed his PhD in Environmental Studies from University of Delhi in which he studied the impacts of dam building activity on Himalayan birds. Currently, he is a President of Biodiversity and Environmental Sustainability, a Trust for Nature Conservation and running a citizen science project in Western Himalayas.

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POSTER

Surviving in the city: mechanisms underlying adaptation to urban environments

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Given the unprecedented rates of global urban expansion, it is of increasing importance to understand if and how birds can cope with, and/or adapt to, urban environmental stressors. Marked differences in physiology, behaviour and morphology have been widely documented between urban and rural birds, but to what extent differences are driven by genetic variation, epigenetic variation and/or phenotypic plasticity is unknown. The development of next-generation sequencing techniques offers the opportunity to examine responses to environmental cues at the molecular level. We quantified differences in gene expression in the liver and blood of urban- and rural-dwelling Great Tits *Parus major*. Urban and rural Great Tits exhibited marked differences in gene expression profiles. Many genes linked to stress responses were expressed at higher levels in urban birds, in agreement with our prediction that urban wildlife is exposed to greater environmental stress. The primary functional differences between urban and rural birds, in terms of gene expression, relate to immune and inflammatory responses, detoxification, lipid metabolism and epigenetic regulation of gene expression. The pathways involved suggest that differences in diet and exposure to pollutants and pathogens between urban and rural environments could underlie the observed variation in gene expression. The results indicate a potential key role for epigenetic mechanisms to mediate environmentally-induced phenotypic variation. Aberrant patterns of DNA methylation (the most well-understood epigenetic mark) have been linked with pollutant exposure, diet, cancers, and cardiovascular diseases in humans. However, we know little about the consequences of modifications in methylation for the health and fitness of wild animals. We will further discuss the functional significance of differences in gene expression and the use of next-generation tools to further our understanding of responses to urban stressors.

Hannah Watson is interested in the mechanisms underlying phenotypic responses to environmental stressors, particularly those that mediate long-term effects of exposure to early-life stress. She is currently working on the epigenetic basis of urbanisation effects in wild birds at Lund University, Sweden, funded by a Marie Skłodowska-Curie Actions Individual Fellowship.

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POSTER

Monitoring birds in an industrial development zone in eastern South Africa

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The East London Industrial Development Zone (ELIDZ) was established in 2002 and was the first operational IDZ in South Africa. It occupies 236 hectares of land on the east coast and its industries include the manufacture of automotive parts, aquaculture and a dairy. Much of the area is still undeveloped and comprises a mosaic of natural and semi-natural habitats including acacia scrub, thicket, grassland and a small wetland.

A long-term project was started in 2010 to establish the numbers and species of birds present and to monitor changes in numbers, community structure and species richness resulting from natural changes and the process of development. Field visits are carried out on a quarterly basis. All individuals of each species are recorded by walking transects approximately 100 m apart, utilising roads and tracks where possible. From 2013, registrations were plotted onto maps to try to reduce the likelihood of multiple recording of the same individuals. Dragonflies, butterflies, reptiles and mammals are also recorded. Three zones are currently covered, one of which (Zone 1C) acts as a control as there are currently no plans to develop this section.

Development has hitherto progressed at a slow rate and approximately 25% of Zone 1A had been developed by early 2015 while Zone 1B remains undeveloped. It is considered that most changes recorded to date are of a seasonal nature. By February 2015, a total of 193 bird, 19 dragonfly, 59 butterfly, seven reptile and six mammal species had been recorded within the three zones. There is as yet no indication of a decline in either numbers or species richness within the study area. This may be due to the fact that significant areas of each habitat type remain intact at present and that increased familiarity with the area has resulted in more thorough coverage.

Phil Whittington is an ornithologist at East London Museum and a research associate of Nelson Mandela Metropolitan University, South Africa. Completed a doctorate on African Penguins at the University of Cape Town in 2002. Ornithologist at the British Trust for Ornithology, 1981-1991. Has published widely in the scientific and popular press.

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POSTER

The UK House Martin Survey 2015–2016

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House Martins *Delichon urbicum* are strongly associated with human-dominated landscapes, and construct their nests below the eaves of buildings. House Martin is 'Amber-listed' in the UK, and data from long-term monitoring schemes suggest that it declined by 69% in England over the period 1967-2012, and that the biggest declines occurred in urban/suburban areas (<http://blx1.bto.org/birdtrends/species.jsp?&s=houma>). However, trends have not been uniform across the UK, and the species has increased in Scotland and Northern Ireland.

A number of different potential factors behind the decline have been proposed, some linked to the availability of insects or mud (e.g. climate change and land use changes), and others to direct breeding failure or a reduction in the availability of nest sites (e.g. human interference, predation, increased use of PVC soffits on housing).

The BTO House Martin Survey is being conducted over two years (2015 and 2016) using two different, yet complementary, volunteer-based surveys involving c.3,000 citizen scientists throughout the UK (<http://www.bto.org/volunteer-surveys/house-martin-survey>). This approach will enable us to (1) produce a robust baseline population estimate against which future population changes can be measured; (2) obtain more detailed information about variables such as nest-site location, and the timing and outcome and number of breeding attempts; (3) compare the results with previous studies, and across different habitats and different geographical areas in the UK.

We present a summary of current knowledge about House Martin populations and their breeding ecology and describe the aims and methodology of the project. Through the complementary survey strands, we anticipate that the BTO House Martin Survey will provide baseline information against which change can be measured in the future, characterise favoured breeding locations and direct future work which will help to confirm the key factors driving the changes.

Ian Woodward Ian Woodward is a Research Officer at the BTO, with one of his roles being the House Martin Survey Organiser. Prior to working for the BTO, he co-ordinated and undertook BTO and local surveys in North London, including a survey of House Martins in the London Borough of Waltham Forest during 2004–2007.

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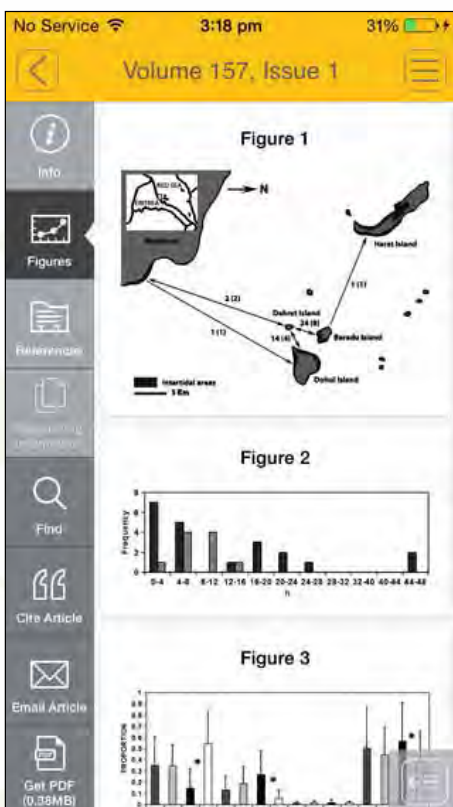
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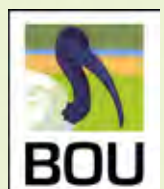
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