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Restoring Bird Populations



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OFFERED ORAL PRESENTATION (ECR)

Foraging for a foothold in a novel environment: diet specialisation influences reintroduction success

Caitlin E. Andrews^{1,2}, John G. Ewen² & Rose Thorogood^{1,3,4}

¹ Department of Zoology, University of Cambridge, Downing Street, Cambridge CB2 3EJ, UK

² Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY, UK

³ Helsinki Institute of Life Science (HiLIFE), University of Helsinki, Helsinki 00014, Finland

⁴ Research Program in Organismal and Evolutionary Biology, Faculty of Biological and Environmental Sciences, University of Helsinki, Helsinki 00014, Finland

* cea48@cam.ac.uk | [@CEAndrews](#)

In many bird reintroduction programmes, there are dual objectives of successfully re-establishing a missing species and restoring their ecological role, for example as pollinators or seed dispersers. While there are challenges in achieving both of these objectives, much more attention is paid to species recovery with the assumption that ecosystem recovery will naturally follow. Ensuring both goals are met may be enhanced by recognising that individuals within species behave differently even when faced with similar environmental challenges. If this variation has consequences for individual survival and pollination or dispersal efficiency, then managers could manipulate their reintroductions to best achieve species- and ecosystem-level objectives.

We tested these ideas in the Hihi (*Notiomystis cincta*), a threatened New Zealand passerine and important pollinator of several native plants. As a species, Hihi have a broad diet, but we found that individual diets vary widely, with generalists surviving significantly better than specialists. By tracking dietary changes during a reintroduction, we found that individuals shift toward a more generalist diet in the early stages of establishment, likely due to competitive release. However, as the population grows, individuals may seek refuge from competition through niche partitioning, highlighting a long-term need for diverse food sources at the release site.

Finally, we conducted a multi-site study comparing pollination outcomes across sites with and without Hihi. Our results suggest that, in degraded habitats, non-native pollinators may compensate for (and even exceed) the services provided by native pollinators. This information could be used by conservation managers to select release sites where Hihi could have the greatest restorative effect. Within a Hihi site, pollination outcomes also varied across Hihi territories, suggesting that behavioural trait variation could be used to identify superior pollinators. Combined, these results suggest a path forward for ecosystem restoration that uses behavioural and environmental variation to improve reintroduction success.

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Caitlin Andrews is fascinated by how behavioural variation at the individual level can be used to improve conservation efforts at multiple levels of the ecosystem. She enjoys working with a range of species and, before embarking on a PhD with Hihi, spent time studying primates, grey parrots, and domestic dogs.

OFFERED ORAL PRESENTATION

Choosing an unsuitable site for reintroduction: the case of Madagascar Pochard

Andy J Bamford^{1*}, Geoff M Hilton¹, Peter A Cranswick¹, Nigel S Jarrett¹, Felix Razafindrajao², H. Glyn Young³, Lily Arison René de Roland⁴ & Robert G Shore¹

¹ Wildfowl & Wetlands Trust, Slimbridge, Gloucestershire, GL2 7BT, UK

² Durrell Wildlife Conservation Trust, BP4113, Antananarivo, Madagascar

³ Durrell Wildlife Conservation Trust, Les Augrés Manor, Jersey, JE3 5BP

⁴ The Peregrine Fund, BP8511, Antananarivo, Madagascar

* andrew.bamford@wwt.org.uk | [@WWTconservation](https://twitter.com/WWTconservation)

Standard rules for species translocation dictate that species' needs are understood, that the release site is in appropriate condition, and that the threats which caused the species' decline are understood and have been minimised. None of these requirements could be honestly addressed for the Madagascar Pochard, a diving duck that suffered large declines in the early 20th century and was believed extinct until a remnant population was discovered in 2006.

Trying to save a species limited to fewer than 30 individuals at just one site, we were faced with a remnant population surviving at a site that is atypical for the species. An absence of historical ecological studies meant a very incomplete understanding of how the pochards would be impacted by the large range of threats found in wetlands across the country. National surveys revealed no potential release sites capable of supporting the pochard. In fact, the picture was of widespread wetland degradation, which also meant an absence of good condition reference sites to guide research and ecosystem restoration efforts.

Lake Sofia, although degraded, was chosen as a reintroduction site. Here we present the rationale developed to reintroduce pochards to a potentially unsuitable new site in the absence of required data, using an adaptive programme of research alongside conservation actions and trial releases, to ensure that the approach remained on the right side of agreed reintroduction requirements and methods.

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Andy Bamford is an ecologist with broad interests in animal behaviour and conservation. He has spent most of his working life researching mammals and birds in various parts of Africa, and has been working on the Madagascar pochard and Malagasy wetlands since 2011.

POSTER (ECR)

Is bird diversity the best measure of habitat importance? A New Forest Perspective.

Ailidh E. Barnes^{1*}, Richard A. Stillman¹, Richard K. Broughton², Shelley A. Hinsley² & Ross A. Hill¹

¹ Bournemouth University, Christchurch House, Talbot Campus, Fern Barrow, Poole, BH12 5BB, UK

² CEH Wallingford, Maclean Building, Crowmarsh Gifford, Wallingford, OXON, OX10 8BB, UK

*abarnes@bournemouth.ac.uk |  @AilidhBarnes

Biodiversity is declining on a global scale despite efforts to the contrary. Many UK birds have declined since the 1960s, and are now classified as endangered or rare. Birds are effective indicators of ecosystem health, occurring in almost every habitat on Earth. Therefore, habitat diversity affects avian diversity attesting that birds are a vital resource to conservationists. Not only are the birds influenced directly by their immediate habitat, they are also indirectly affected by the surrounding landscape, indicating the need for local and landscape-level studies and management.

This study takes a multi-scale approach to examine bird-habitat relationships in the New Forest National Park in southern England. The New Forest landscape is predominantly broadleaved woodland, interspersed with conifer plantations and lowland heath. Recently acquired, high resolution airborne remote sensing datasets (LiDAR) were used to develop metrics that quantify structure. In addition, ground surveys were used to quantify vegetation composition and overall condition of habitats in the study landscape. Measures of bird density, species richness and diversity, and also the number of declining bird species, conservation priority and rarity were calculated from plot based breeding bird surveys and related to vegetation structural metrics and vegetation composition to determine the effects of landscape characteristics.

The study showed that bird-habitat relationships differ depending on the measure of birds: bird diversity was highest in successional scrubland, whilst the highest number of bird species with declining populations were in beech woodlands, and the rarest bird species were in the heathland and the non-pine conifer plots. This demonstrates that habitats which increase bird diversity may not be suitable for rare or declining species. This also indicates that management

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strategies should incorporate multiple measures of bird-habitat relationships and that increasing habitat heterogeneity at the landscape scale is required in order to conserve overall landscape bird diversity.

Ailidh Barnes is nearing the end of her PhD in “Modelling mitigation of bird population declines in the UK through landscape-scale environmental management” at Bournemouth University. She is a keen birder having her C ringing permit and also experience organising and carrying out breeding bird surveys, specialising in avian ecology.

POSTER (ECR)

Resilience to breeding population declines: evidence for the buffer effect in the Common Guillemot

Sophie Bennett^{1,2*}, Sarah Wanless¹, Mike Harris¹, Mark Newell¹, Kate Searle¹, Jon Green² & Francis Daunt¹

¹ Centre for Ecology & Hydrology Edinburgh, Bush Estate, Penicuik, Midlothian EH26 0QB, UK

² School of Environmental Sciences, University of Liverpool, Liverpool L69 3GP, UK

* sobenn@ceh.ac.uk |  bennett_sophie

As more bird populations decline and face multiple anthropogenic threats, understanding the parameters that govern key demographic rates such as productivity becomes increasingly vital for effective population restoration. When populations experience declines in size, individuals are predicted to preferentially occupy the highest quality sites. Additionally, fewer new sites, which are of lower quality, are expected to be established. As the population increases, higher quality sites become limiting, forcing pairs to occupy those of lower quality, which are often peripheral to the colony– a process known as the ‘buffer effect’.

However, few studies have tested whether this regulatory process operates in populations experiencing variation in population trends. Here we use time series data from a population of Common Guillemots *Uria aalge* on the Isle of May, south-east Scotland, which has shown sustained periods of population increase, decrease and stability over the last 40 years, to investigate the effect of changes in population status on breeding site occupancy and quality.

We found that higher quality sites were preferentially occupied when the population size was low, hence average breeding site quality was higher. However, contrary to the predictions of the buffer effect, new sites were established when the population was declining or stable. These results suggest that the buffer effect may enable populations to recover from periods of decline.

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Sophie Bennett is a PhD student researching the year-round population ecology and behaviour of seabirds. Her work focuses on understanding the drivers of individual variation in behaviour and how this scales up to population-level change through investigating breeding performance, winter colony attendance and the spatial movements of Common Guillemots.

OFFERED ORAL PRESENTATION (ECR)

Can trait-based bird assemblages predict species-level responses to landscape structure? Informing conservation interventions in Neotropical human-modified landscapes

Tom Bradfer-Lawrence^{1*}, Nick Gardner¹, Eben N. Broadbent², Nils Bunnefeld¹, Stephen G. Willis³ & Daisy H. Dent^{1,4}

¹ Biological & Environmental Sciences, University of Stirling, UK

² School of Forest Resources & Conservation, University of Florida, USA

³ Department of Biosciences, Durham University, UK

⁴ Smithsonian Tropical Research Institute, Panama City, Republic of Panama

* tom.bradfer-lawrence@stir.ac.uk | [🐦 @_EcologyTom](https://twitter.com/_EcologyTom)

Sustaining bird populations in human-modified tropical landscapes is essential for biodiversity conservation and the maintenance of ecosystem services. Designing effective conservation actions to support bird populations necessitates detailed knowledge of how species and communities will respond to further disturbance and habitat change. However, tropical bird communities often contain a large proportion of rare species; with few detections it can be difficult to ascertain how an individual species might respond to disturbance in structurally complex landscapes. One potential means of over-coming this difficulty involves grouping species according to their functional traits and habitat preferences, and examining group-level responses to landscape structure.

We investigated this approach using over 36,000 bird detections collected during 1520 point counts, located across a human-modified landscape in the Republic of Panama. We divided species into eight groups according to dietary traits and habitat preferences. Using a Poisson-Binomial mixture model, we examined avian responses to proportion of forest cover and extent of fragmentation at three scales: 10ha, 50ha and 500ha. Within-group responses to landscape features varied among spatial scales. Species responded consistently within groups to local scale features (i.e. in the surrounding 10ha). However, at the landscape scale (i.e. the surrounding 500ha), species' responses varied within group, suggesting that trait-based groupings may be less suitable for predicting species' responses to wider-scale landscape change. To demonstrate how this approach could be applied in conservation planning, we selected five example species with

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contrasting responses to landscape features. We predicted abundance for these example species across the landscape, identifying range edges and areas that may be acting as bottlenecks, pinpointing where interventions might have the greatest effect. Highlighting key areas that restrict avian distributions in this way may facilitate more effective conservation interventions.

Tom Bradfer-Lawrence is currently finishing a PhD on the bird assemblages of a human-modified landscape in Panama. He is interested in finding ways to maximise the biodiversity potential of such landscapes, and integrating new research methods in wildlife monitoring, particularly ecoacoustics.

TWITTER-ONLY PRESENTATION

Spatially explicit threat mapping reveals anthropogenic impacts on migratory birds

Claire Buchan

University of East Anglia, UK

* c.buchan@uea.ac.uk | [@Buchanding](https://twitter.com/Buchanding)

European migratory birds, especially long-distance migrants, are declining faster than non-migratory species. Migrants' movements through multiple ranges may render them particularly vulnerable to anthropogenic threats, but the spatial distribution and population-scale effects of these threats have not been quantitatively assessed. We combined remote-sensed data, expert opinion and global datasets to map sixteen anthropogenic threats relevant to migratory birds across the Afro-Palaearctic, including the first pan-Continental assessment of relative hunting threat. By combining each threat with morpho-behavioural traits-based weightings (reflecting relative threat susceptibility), we created species-specific risk maps for 103 migratory birds breeding in Europe. We related population trends to combined threat exposure scores across species ranges. Population trends were negatively associated with direct mortality threats; in the breeding season, this relationship was mediated by habitat loss threats. The maps and accompanying workflow represent a valuable resource for spatial analyses of anthropogenic threats to migratory birds, and, ultimately, targeted conservation actions.

Claire Buchan is a final year PhD student at the University of East Anglia studying consequences of migratory strategies in the context of anthropogenic threats.

ABSTRACTS

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KEYNOTE

Cultural and social values in restoring bird populations – why this matters

Mary Colwell

Curlew Media, UK

mary@curlewmedia.com | [@curlewcalls](#)



Restoring a vibrant natural world certainly requires science to guide us to the right actions, but without garnering the citizens of the world it will struggle to find momentum. How do the facts of science translate into meaningful action across every level of society? This can only be done by using the right language, telling meaningful stories and touching people's hearts. We need to find enchantment in nature through language, story and soul. David Attenborough put it another way, he urged people to fall in love again with the earth.

Out of all the groups, birds have the easiest job. They look and sound beautiful and many species live alongside us. Bird soul-stories have been around for as long as there have been people on earth. Meaningful tales have been handed down through the generations and we should rediscover them.

Stories are powerful motivators, as Richard Thaler in his ground-breaking book on 'nudge theory' explores. People are calm and rational for sure, but we are also emotional beings and prone to all kinds of less-than-rational behaviours. None of us operates on the pure logic of Mr Spock. By engaging with this, rather than fighting it, effective solutions are more likely to be found. We can be 'nudged' to do the right thing by igniting our hopes, our loyalties, affiliations, cultural pride and love of traditions. The birds of the world deserve us to explore all avenues to help them.

Mary Colwell is a producer and writer interested in all aspects of the natural world. She is particularly drawn to the complex and shifting interface between wildlife and society, where the most inspiring and difficult issues lie. She is a trustee of New Networks for Nature, a yearly conference that brings together scientists, conservationists, artists, writers and musicians to celebrate nature through different lenses.

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POSTER

Re-introduction of Red-billed Chough in Jersey, Channel Islands

Elizabeth Corry

Durrell Wildlife Conservation Trust

* Elizabeth.Corry@durrell.org | [🐦@Corry_Liz](https://twitter.com/Corry_Liz)

Red-billed Choughs *Pyrrhocorax pyrrhocorax* (hereafter: choughs) are specialist invertebrate feeders found in mountain or coastal regions of Europe, North Africa, and Asia. Choughs are listed as Least Concern by IUCN. However, in the British Isles, the population has become fragmented with less than 500 breeding pairs.

Choughs became locally extinct on Jersey, and the other British Channel Islands, at the turn of the 20th century. Changes in agricultural practices and, to a lesser extent, human persecution (including egg collecting) led to their demise. Many of Jersey's coastal farmland bird species have or are facing a similar threat.

Birds On The Edge, a multi-partner project, was established in 2010 to restore Jersey's depleted bird populations through management of coastal farmland, and to reintroduce the chough, which will help drive habitat restoration. Durrell Wildlife Conservation Trust manages the re-introduction with a captive breeding programme at Jersey Zoo.

Soft-releases of 43 captive-bred birds were conducted between 2013 and 2018. Birds were released in small cohorts, replicating normal family group size, and provided with supplemental feed post-release. All birds were fitted with leg rings and VHF-transmitters to determine survival, dispersal, and foraging habits. Annual survival was high (93.7%) once the birds reached their first year at liberty. Successful breeding in the wild started in 2015 further supporting population growth.

Future efforts will focus on understanding feeding ecology, so supplemental feeding can be minimized, and estimating the carrying capacity for Jersey. Further release of unrelated birds may be attempted (in future?) to increase genetic diversity.

Elizabeth Corry manages the chough reintroduction project for Durrell Wildlife Conservation Trust in Jersey. She has worked on several of Durrell's *in situ* conservation projects over the past 16 years including St. Lucian Iguana, Galápagos Finches and Montserrat Galliwasp.

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TWITTER-ONLY PRESENTATION

Conserving the regent honeyeater- insights from a national monitoring program

Ross Crates

Australian National University

* ross.crates@anu.edu.au | [@CratesRoss](https://twitter.com/CratesRoss)

The critically endangered regent honeyeater is one of Australia's most threatened songbirds, but the species' large range, small population size and long distance, nomadic movement patterns have hindered efforts to monitor the population. We established a new, range wide monitoring program in 2015 to provide more robust data to help inform conservation of the wild population. This presentation will describe the monitoring program and summarise the results to date, including: contemporary breeding biology, Allee effects, impact of the 2019/20 megafires, song culture, population genetics and population viability analysis.

Ross Crates is a postdoc with the Difficult Bird Research Group, Australian National University. He completed a BSc in ecology at the University of East Anglia, before working as a research assistant at the Edward Grey Institute, Oxford University. Ross completed a PhD on regent honeyeaters in 2018.

KEYNOTE

Working with governments to restore migratory birds and their habitats

Nicola Crockford

RSPB, The Lodge, Sandy, Beds SG19 2DL, UK

nicola.crockford@rspb.org.uk | [@numenini](https://twitter.com/numenini)



Government involvement in conservation restoration works best when all share a common vision, even if the motivations differ between stakeholders. Hence policy advocacy works best when there is real understanding of the motivations of, and pressures on, government counterparts – and their bosses. How can delivery of what you know the birds need, also deliver for the decision makers? How can you convey the birds' needs in a manner that those decision makers can absorb? How can you jointly come up with a win-win vision that they embrace as their own? What tools facilitate this?

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In most of the world, the sticks available for enforcing conservation restoration are very weak. Carrots work best, if they can be presented enticingly enough. Peer pressure is a vital tool in most cases.

This talk will explore these questions with reference to some examples, such as working with China to save the Yellow Sea coasts for birds like the spoon-billed sandpiper, implementing species action plans, stopping illegal killing of birds and working with the energy sector to minimize impacts on birds.

It will touch on how biologists can have greater impact in achieving conservation outcomes through partnerships and better targeting and communicating research. It will also consider how such approaches can be built into the Post-2020 biodiversity framework that is being negotiated this year, in terms of connectivity and international cooperation.

Nicola Crockford has worked for 28 years on species conservation for the RSPB at national, European and, for the past decade, global levels. She is RSPB Principle Policy Officer, and also policy lead for BirdLife International's Global Flyways Programme and its focal point for the Convention on Migratory Species and a range of other treaties for migratory bird conservation. She works with governments around the world to get the best deal for migratory birds.

OFFERED ORAL PRESENTATION

Close order management of wader populations: the case for headstarting

Lynda Donaldson¹*, **Rebecca Lee^{1,2}, **Nigel S Jarett¹** & **Geoff M Hilton¹****

¹ Wildfowl & Wetlands Trust (WWT), Slimbridge, Gloucestershire, GL2 7BT, UK

² RSPB, Beds, Cambs & Herts Area Office, Cambridgeshire, CB24 4QG, UK

* Lynda.Donaldson@wwt.org.uk | [@donaldsonlynda1](https://twitter.com/donaldsonlynda1)

Close order management tools are critical amid a world of declining biodiversity and resulting small, remnant populations of species, where urgent actions are required for population persistence. Headstarting is a technique developed on chelonian species, whereby eggs are harvested from the wild and reared in captivity, before being released back into the population at a later life-stage. Ultimately, the aim is to improve demographic rates during a period to which population growth is most sensitive, and one in which captive-rearing is feasible. In this talk, we will discuss the benefits and challenges associated with this technique for managing small, isolated populations using the Eurasian Curlew (*Numenius arquata*) and Black-tailed Godwit (*Limosa limosa limosa*) in the UK as case-studies. Breeding populations of these species have suffered historic declines as a result of climate change, changes in agricultural practices, and

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increasing mesopredator abundance. In common with other waders, productivity is low, with high mortality during both the nest and chick-rearing periods. Age-structured stochastic population models showed that headstarting could boost population growth by increasing productivity up to ten-fold. In turn, this can buy critical time to understand impending threats to these species and implement the necessary conservation procedures, as well as accelerate recovery of very small populations once sites are in favourable condition.

The success of these projects to date for securing sustainable populations of these species will be discussed. We also consider the role of such close order management techniques in species conservation, and how such projects should be planned, monitored and integrated into wider population recovery plans.

Lynda Donaldson is a Principal Research Officer at the Wildfowl & Wetlands Trust, focusing on species recovery. She has broad interests in securing populations of threatened species over the long-term, preserving wetlands at the landscape-scale, and achieving practical conservation solutions.

KEYNOTE

Decision Science for Population Reintroduction and Reinforcement

John G Ewen

Institute of Zoology, Zoological Society of London, Regents Park, NW1 4RY,
London, UK

john.ewen@ioz.ac.uk |  @hihinews



Reintroduction and reinforcement are two predominant types of conservation translocation. Their use continues to increase and they are essential methods for recovering threatened species and ecosystems and as a component of rewilding. Yet, the success of these methods is not guaranteed. The rewards from conservation translocations will be maximised if good processes are followed. Undertaking any conservation translocation requires making a series of difficult decisions under uncertainty. These decisions will begin with whether a conservation translocation is the best method to achieve our objectives, what form it should take and what post-release support might be required. I will show how these decisions can be approached to provide the best possible conservation translocation outcomes. I encourage a values-focussed approach with an explicit treatment of uncertainty such that the science informs (but does not make) our decisions. In this sense science is critical but we need to know where it fits and how to use it. Through a series of examples from bird reintroductions including New Zealand hihi (*Notiomystis*

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cincta), Mauritius 'echo' parakeets (*Psittacula eques*) and Mauritius olive white-eye's (*Zosterops chloronothos*), along with reinforcements including hihi and Australian Regent Honeyeater (*Anthochaera phrygia*) and developing plans for assisted colonisation of Sihek (Guam Kingfisher, *Todiramphus cinnamominus*), I will show how science has helped inform conservation translocations and where our decisions remain difficult.

John Ewen's research focusses on reintroduction biology. He is a member of the IUCN's Conservation Translocation Specialist Group and coordinates their training for effective use of the Guidelines for Reintroductions and Other Conservation Translocations. John is co-chair of the Hihi Recovery Group, member of the BIAZA Reintroduction Advisory Group and is involved in many conservation translocation projects globally.

POSTER (ECR)

Informing local and landscape-scale management of a threatened wader population.

Harry Ewing^{1*}, Jennifer Smart², Samantha E. Franks³, Niall H. K. Burton³ & Jennifer A. Gill¹

¹ School of Biological Sciences, University of East Anglia, Norwich Research Park, Norwich, UK

² RSPB Centre for Conservation Science, Royal Society for the Protection of Birds, The Lodge, Sandy, UK

³ British Trust for Ornithology, The Nunnery, Thetford, UK

* h.ewing@uea.ac.uk |  Ewing_birds

In recent decades, many species of wader have declined in abundance and range across all major migratory flyways. Population declines have been particularly severe in species of large-bodied wader within the tribe Numeniini, including two species which may already be extinct and five which are classified as globally 'Endangered', 'Vulnerable' or 'Near Threatened'. To restore populations and prevent further extinctions within the tribe, implementation of local and landscape-scale conservation management is essential. To do this successfully, situations in which demographic rates can be boosted need to be identified so that conservation management can be tailored accordingly.

The Eurasian Curlew (*Numenius arquata*) is the UK's fastest declining Numeniini species, with the number of breeding pairs having decreased by 48% in the last 20 years. As a large-bodied species, curlew have a high adult survival rate however, curlew populations in the UK are generally thought to suffer from unsustainably low rates of breeding productivity and high rates of nest predation. Consequently, efforts to restore curlew populations in the UK are likely to require the use of tools designed to boost breeding productivity and studies investigating how to deploy these tools effectively.

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To inform the deployment of conservation tools designed to boost curlew breeding productivity, field-based observations were used to investigate how demographic rates varied across a gradient of habitat and land management types, in Breckland; a large biogeographic region of eastern England where breeding curlew are still sufficiently abundant for this type of study to take place. The study aimed to identify situations in which breeding productivity needs boosting and also, situations in which breeding productivity is already high, so that the conditions promoting population stability or growth can be replicated elsewhere. This study will provide a strong foundation for targeted, evidence-based conservation of lowland breeding curlew populations, in the UK.

Harry Ewing is an ornithologist focused on researching the applied ecology and conservation of breeding waders. He is currently undertaking a PhD at the University of East Anglia, on understanding how best to conserve lowland breeding curlew populations.

OFFERED ORAL PRESENTATION (ECR)

Evaluating joint genetic and ecological approaches to restoring a threatened bird population

Sarah Fenn^{1*}, Amanda Trask^{1,2}, Eric Bignal³, Sue Bignal³, Davy McCracken⁴, Pat Monaghan⁵ & Jane Reid¹

¹ School of Biological Sciences, Zoology Building, University of Aberdeen, Aberdeen, UK

² Institute of Zoology, Zoological Society of London, London, UK

³ Scottish Chough Study Group, Isle of Islay, UK

⁴ Department of Integrated Land Management, Scotland's Rural College, Auchincruive, Ayr, UK

⁵ Institute of Biodiversity, Animal Health and Comparative Medicine, University of Glasgow, Glasgow, UK

* s.fenn.17@abdn.ac.uk |  @SarahFenn11

Effective restoration and conservation of small threatened populations often requires mitigation of simultaneous genetic and ecological threats to population viability. However, the effects of independent versus simultaneous management of genetic and ecological threats on survival and reproduction are rarely quantified, hindering robust assessment of population-level consequences and conservation policy decisions. This situation is epitomised by the remaining Scottish Red-billed Chough (*Pyrrhocorax pyrrhocorax*) population, which is of major conservation concern. Demographic calculations revealed a critically small effective population size, implying that population reinforcement to alleviate inbreeding will be necessary to ensure population persistence. However, recent crashes in survival have been linked to poor food availability,

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implying that population reinforcement alone may not be enough to ensure population viability if habitat quality is insufficient to support introductions.

To fulfil their legal responsibility to maintain biodiversity, Scottish Natural Heritage funded a multi-year (2010-18) emergency supplementary feeding programme to alleviate ecological constraints on survival. Supplementary feeding is widely used to aid conservation of threatened populations, but existing evidence regarding its efficacy is still highly conflicting. We use intensive colour-ring resighting data to show that supplementary feeding successfully increased first-year survival. Further, we use before-after control-impact analyses of long-term demographic data to show that feeding stabilised breeding success against a background decline, and increased adult survival probability. Consequently, the supplementary feeding intervention alleviated multiple major constraints on population growth rate, and substantially increased the probability of population persistence.

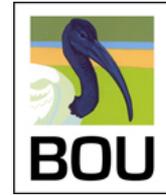
However, simulations show that even effective supplementary feeding may ultimately fail to ensure longer-term population restoration unless population reinforcements to alleviate inbreeding are also enacted.

This case study of science-informed conservation policy demonstrates that supplementary feeding, a widely used conservation tool, can have strongly beneficial conservation effects, and highlights that simultaneous mitigation of both ecological and genetic constraints may be vital to ensure successful population restoration.

Sarah Fenn is PhD student with broad interests in applied population ecology. She is particularly interested in the demographic and environmental drivers of population change, and how this can be applied to inform effective long-term conservation strategies.

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OFFERED ORAL PRESENTATION

Land sparing for birds and multiple ecosystem services

Tom Finch^{1*}, Brett Day², Simon Gillings³, Dario Massimino³, John Redhead⁴, Rob Field¹, Andrew Balmford⁵, Rhys Green^{1,5} & Will Peach¹

¹ RSPB Centre for Conservation Science, RSPB, The Lodge, Sandy, Bedfordshire, UK

² University of Exeter, Rennes Drive, Exeter, UK

³ British Trust for Ornithology, Thetford, Norfolk, UK

⁴ Centre for Ecology and Hydrology, Maclean Building, Wallingford, Oxfordshire, UK

⁵ Conservation Science Group, Department of Zoology, University of Cambridge, Cambridge, UK

* tom.finch@rspb.org.uk | [@tomfinch89](https://twitter.com/tomfinch89)

Land is finite, yet demand is growing for the services it provides. Understanding how to allocate land for the sustainable delivery of multiple and often competing objectives is therefore a major societal challenge. In addition to nature conservation, natural or seminatural habitats have the potential to contribute to multiple environmental goals including carbon sequestration, water purification and recreation. In most regions, increasing the area of natural or seminatural habitat requires a reduction in the area of farmland which, in turn, implies an increase in production per unit area of farmland if demand for food is to be met.

Here, for two regions of lowland England, we use empirical data and predictive models to ask whether the environmental costs of producing more food per unit area from farmland are compensated by the potential to create larger areas of natural and seminatural habitats (land sparing). For a suite of spatially-explicit land-sharing and land-sparing scenarios in The Fens and Salisbury Plain we predict outcomes for bird populations, global warming potential, diffuse pollution and outdoor recreation.

We show that land-sparing scenarios (i.e. those which produce more food from farmland whilst increasing the area of natural and seminatural habitat) can deliver multiple environmental benefits simultaneously. However, not all land-sparing scenarios resulted in multiple wins; environmental outcomes also depended on the spatial arrangement of natural or seminatural habitat, the types of natural or seminatural habitat promoted on spared land, and the overall regional food production target.

Tom Finch is interested in population ecology, land-use, agriculture and conservation. He works for the RSPB as a Conservation Scientist.

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OFFERED ORAL PRESENTATION (ECR)

Changes in social groups across reintroductions and effects on post-release survival

**Victoria R. Franks^{1,2*}, Caitlin E. Andrews^{1,2}, John G. Ewen², Mhairi McCreedy^{3,4}, Kevin A. Parker⁵
& Rose Thorogood^{1,6,7}**

¹ Department of Zoology, University of Cambridge, Downing Street, Cambridge, CB2 3EJ, UK

² Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY, UK

³ Rotokare Scenic Reserve Trust, 365 Sangster Road, Rawhitiroa 4398, New Zealand

⁴ Hihi Conservation Charitable Trust, 31 Catherine Crescent, Paparangi, Wellington 6037, New Zealand

⁵ Parker Conservation, PO Box 130, Warkworth, Auckland, New Zealand

⁶ Helsinki Institute of Life Science (HiLIFE), University of Helsinki, Helsinki 00014, Finland

⁷ Research program in Organismal and Evolutionary Biology, Faculty of Biological and Environmental Sciences, University of Helsinki, Helsinki 00014, Finland

* vix_franks@live.com | [@VixFranks](https://twitter.com/VixFranks)

Reintroductions, essential to many conservation programmes, disrupt both abiotic and social environments. Despite growing recognition that social connections in animals might alter survival (e.g. social transmission of foraging skills, or transmission of disease), there has thus far been little focus on the consequences of social disruption during reintroductions. Here we investigate if moving familiar social groups may help a threatened species to adjust to its new environment and increase post-release survival. For a reintroduction of 40 juvenile Hihi (*Notiomystis cincta*, a threatened New Zealand passerine), we observed social groups before and after translocation to a new site and used social network analysis to study three levels of social change: overall group structure, network associations, and individual sociality. We also tested alternate translocation strategies where birds were kept either in familiar groups during holding, or in aviaries where their prior association was mixed. Although social structure remained similar among juveniles that remained at the source site, we detected significant changes at both the group- and individual- level post-release. Crucially, there was some tendency that translocated juveniles who gained more associates during re-assortment of social groups were more likely to survive their first year post-release. However, our holding treatments did not affect these social bonds so we remain unable to maintain or manipulate social groups during translocation. Nevertheless, we suggest that prior sociality may not be important during translocations, but rather individuals that are most able to adapt and form associations at a new site are most likely to be the surviving founders of reintroduced populations.

Victoria Franks is a zoologist with a main interest in understanding how we can predict animals' behavioural responses to changing environments. She is particularly interested in how we can

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apply such research to reintroductions, and how it can provide evidence that helps better inform translocation management of threatened species.

OFFERED ORAL

Research and Conservation efforts for the protection of endemic birds in Taita Hills cloud forest

Paul Gacheru^{1*}, Luca Borghesio^{2}, Lawrence Wagura², Kariuki Nding'ang'a³, Sarah Havery⁴, Mwangi Githiru⁵ & Paul Matiku¹**

¹ Nature Kenya – the East African Natural History Society, National Museum of Kenya, Museum Hill, Nairobi, Kenya

² National Museums of Kenya, Museum Hill, Nairobi, Kenya

³ Birdlife International Africa Partnership Secretariat, P.O. Box 3502 – 00100, Nairobi, Kenya

⁴ RSPB Global Species Recovery, The Lodge, Pottton road, Sandy, Bedfordshire. SG19 2DL. UK

⁵ Wildlife Works, 242 Redwood Hwy, Mill Valley, CA 94941, USA

* species@naturekenya.org; ** borghesio@gmail.com | [@Nature_Kenya](https://twitter.com/Nature_Kenya)

The Taita Hills, an isolated massif rising up to 2,200m above the surrounding dry plains in south-eastern Kenya, is part of the Eastern Afrotropical Biodiversity Hotspot. Three endemic birds depend on the Taita Hills, the Endangered Taita White-eye *Zosterops silvanus*, and the Critically Endangered Taita Apalis *Apalis fuscicularis* and Taita Thrush *Turdus helleri*.

Taita's montane cloud forest habitat is now intensely fragmented, with c.98% of the original forest having been destroyed over the last 200 years. The remaining forest comprises 12 fragments ranging in size between 1–220 ha restricted to the highest peaks and steepest slopes, surrounded by a dense matrix of human settlements.

Through a partnership project, efforts are underway to protect and improve the cloud forest habitat while enhancing their connectivity for the threatened endemic species. The science-driven multi-tactic approach involves trials of various habitat restoration techniques, land lease and/or purchase, policy and advocacy, and research to understand the drivers of population trends for *A. fuscicularis* and *T. helleri*.

The achieved 25-years land lease and the ongoing land purchase efforts have already secured 9.25ha capable of providing habitats for c. 20 pairs of *A. fuscicularis*. More efforts are being put in land purchase targeting an additional 21ha to expand habitats and create an important habitat corridor between two fragments. However, the exercise is faced with challenges due to high land value and unwillingness to sell by many land owners. Trial habitat restoration plots with combined total size of c.8ha in two fragments have demonstrated a cost-effective approach and

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quick recovery of low natural vegetation which form ideal habitat for the species. We demonstrate the local-scale preparations required prior to scaling up restoration efforts, which in the long-term will protect Taita's unique biodiversity and provide water security and climate change mitigation to the local communities.

Paul Gacheru is a wildlife ecologist working as a program manager at Nature Kenya supporting forest landscape restoration initiatives across the country.

Luca Borghesio is a biologist with more than 20 years of experience working on bird conservation projects in the forests of East Africa.

POSTER

Movement and migratory behaviour of released UK-bred White Stork (*Ciconia ciconia*) - monitoring the success of the reintroduction project

Lucy Groves^{1,4*}, Rosalind Kennerley¹, Tim Mackrill², Jamie Craig³, Charlie Burrell⁴, Penny Green⁴, Kate Rogerson⁵ & Aldina Franco⁶

¹ Durrell Wildlife Conservation Trust, The Malthouse, 17-20 Sydney Buildings, Bath, BA2 6BZ, UK

² Roy Dennis Wildlife Foundation, UK

³ Cotswold Wildlife Park, Bradwell Grove, Burford, Oxfordshire, OX18 4JP, UK

⁴ Knepp Estate, Estate Office, Knepp Castle, West Grinstead, Horsham, RH13 8LJ, UK

* lucy.groves@durrell.org | [@lucyinthewild](https://twitter.com/lucyinthewild)

The White Stork Project is a pioneering partnership of private landowners and nature conservation organisations, who are working together to restore a self-sustaining, free-living, breeding population of approximately 50 pairs of White Storks (*Ciconia ciconia*) in southern England by 2030 through phased releases over the next five years. Whilst hefted adult birds have been released in order to establish a sedentary population at Knepp, Sussex, the subsequent release of first year birds is considered to be a key requirement to encourage some migration within the population.

For both the adult releases and captive breeding of juveniles for release, storks were sourced from eastern and western populations, leading to an artificial mixing between the two flyways. Additionally, the close proximity of breeding populations in continental Europe means that if Sussex juveniles cross the English Channel it is highly likely that they will soon encounter migratory flocks and potentially follow those instead. Tracking migration success and routes of the juveniles allows for monitoring the success of the reintroduction programme and understanding migration behaviours, therefore, high spatial and temporal resolution data on

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their movements was collected on eight of the 24 juveniles released by fitting Movetech Flyway-50 transmitters. This data can be used to determine home ranges, habitat choice, foraging strategies, and distance moved per day. Here we report on the initial year of monitoring and tracking UK captive-bred juvenile storks that were released in summer 2019. This reintroduction provides a novel opportunity to: determine the influence of heritable, social and environmental variables on the movement/migratory behaviour of the reintroduced birds; investigate the foraging and movement behaviour of the reintroduced storks; and to quantify causes of mortality and identify management measures that may enhance the success of the reintroduction programme.

Lucy Groves is a conservation biologist working on projects across Sussex with an interest in animal behaviour. As the White Stork Project Officer for Durrell, based at Knepp, Sussex, Lucy is responsible for post-release monitoring including feeding ecology and movement data, coordinating partner organisations and volunteers, and delivering public engagement.

OFFERED ORAL PRESENTATION (ECR)

Multi-taxa consequences of restoring historic management within cultural landscapes

Robert Hawkes^{1,*}, Jennifer Smart², Andy Brown³ & Paul Dolman¹

¹School of Environmental Sciences, University of East Anglia, Norwich, Norfolk, UK

²RSPB Centre for Conservation Science, Royal Society for the Protection of Birds, Sandy, UK

³Natural England, Unex House, Bourges Boulevard, Peterborough, UK

* Robert.hawkes@uea.ac.uk |  @Robert_W_Hawkes

Throughout Western Europe, many conservation efforts focus on semi-natural habitats shaped by a long history of human management. Here, conservation interventions often mimic perceived 'traditional' land-use practices and target at a few charismatic species that depend on the habitat. Systematic examination of species requirements at a landscape scale (biodiversity auditing), synthesised with an understanding of landscape history, emphasises the importance of historical land-use practices for regional biota; simply mimicking 'traditional' management may not restore the range and complexity of past conditions. To test whether restoring complex historical management enhances priority bird populations and other regional biota requires multi-taxa experiments.

Through a landscape-scale experiment across the UK's largest grass-heath, we examine the consequences of restoring this management (physically-disturbed grass-heath, varying in disturbance age and complexity) by implementing a large number of replicate plots and

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comparing responses to undisturbed controls. Responses were assessed for a bird species of conservation concern (Woodlark, *Lullula arborea*) and the richness of plants, spiders, beetles, true bugs and aculeates – sampling over 900 invertebrate and 200 plant species. Woodlark abundance increased through the study and was higher on the treatments compared to the controls; however, there was no benefit of complex historic management over an alternative ground disturbance treatment which lacked complexity. For invertebrates and plants, the restoration of historic management resulted in a considerable increase in species richness across taxa, including rare, scarce and threatened species. Interestingly, those species we predicted to increase from management, based on *a priori* examination of species requirements, responded best. Finally, we identify which treatments are optimum and explore how much management is needed to benefit these populations at a landscape-scale. Our experiment demonstrates the benefits of restoring historic management to cultural landscapes and emphasizes the value of integrating *a priori* knowledge of species requirements and land-use history into conservation planning.

Robert Hawkes is a PhD student at the University of East Anglia, UK. His research investigates outcomes of management to support avian figurehead species for other diverse taxonomic groups (plants, beetles, true bugs, ants, bees, wasps and spiders), utilising one of the largest replicated landscape-scale experiments in Europe.

POSTER (ECR)

Wetland size and open water matters: constructed agricultural wetlands as alternative breeding sites for boreal waterbirds

Ilona Helle^{1,2*}, Panu Halme^{1,2} & Atte Komonen^{1,2}

¹ Department of Biological and Environmental Science, University of Jyväskylä, Survontie 9, FIN-40014, Jyväskylä, Finland

² School of Resource Wisdom, University of Jyväskylä, P.O. Box 35, FIN-40014, Jyväskylä, Finland

* Ilona.h.helle@jyu.fi |  @helleilona

The loss and degradation of natural wetlands by agriculture, forestry and other human activity, has caused declines in wetland dependent bird species worldwide. Constructed wetlands can provide alternative habitats for waterbirds and thus mitigate the negative effects of natural wetland loss. It is poorly known, however, what biological and physical characteristics of constructed wetlands are important for waterbirds.

We studied the relationship between constructed wetland characteristics and waterbird species diversity and habitat use at 31 constructed agricultural wetlands in boreal zone, Finland. We

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measured six environmental factors to find out which habitat characteristics of the constructed wetlands are the most important ones for waterbirds, especially for breeding and brood rearing waterfowl. We predicted that 1) the total area of the wetland, 2) open water area, 3) shoreline length, 4) average water depth, 5) number of different vegetation zones and 6) age of the wetland, would be associated with the species richness of all breeding waterbirds and waterfowl as well as the individual species detected breeding or brood rearing at the sites.

Our results show that the most important wetland characteristic explaining the species richness of all breeding species was the total size of the wetland. For waterfowl, the area of the open water was the most important environmental characteristic. According to a species-specific analysis, the total size of the wetland, the area of the open water and the shoreline length were the most important variables in determining species occurrence on the sites. Moreover, different species have different environmental requirements for breeding and brood rearing, and this should be taken into account in constructing and managing artificial wetlands in order to maximize the biodiversity gains for waterbirds, especially waterfowl that breed mainly in boreal areas.

Ilona Helle is a PhD student in ecology studying the biodiversity of constructed wetlands from an ecological and socioeconomical point of view.

POSTER

Identifying and managing infertility in the critically endangered kākāpō

James Savage¹, Jodie Crane², Kākāpō Recovery Consortium² & Nicola Hemmings^{1*}

¹ Department of Animal & Plant Sciences, University of Sheffield, UK

² Department of Conservation, Invercargill, New Zealand

* n.hemmings@sheffield.ac.uk |  @HemmingsNicola1

The Kākāpō (*Strigops habroptilus*) is a critically endangered flightless parrot native to New Zealand that reproduces infrequently and has a high incidence of hatching failure (~70%). Kākāpō breeding is extremely unpredictable, driven by the abundance of fruit from masting species with irregular cycles. The 2019 breeding season was unprecedented: ecological conditions from late December 2018, including a record abundance of rimu fruit, induced record-breaking breeding rates. These unique circumstances provided a once-in-a-generation opportunity to obtain the sample sizes required to address crucial questions about kākāpō reproduction, including why their eggs fail and how this is influenced by variation in maternal investment and condition. Here, we will report how rates of fertility and embryo mortality vary across the kākāpō population and, for the first time, estimate the extent to which male infertility drives reproductive failure. In

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addition to their direct relevance for kākāpō conservation management, these findings will fundamentally improve our broader understanding of reproductive problems in endangered species.

Nicola Hemmings is a Royal Society Dorothy Hodgkin Research Fellow based in the Department of Animal & Plant Sciences, University of Sheffield. Her research interests lie in the reproductive behaviour and physiology of birds, and the applications of this field to conservation biology.

POSTER

Research and action to restore breeding Common Scoters *Melanitta nigra* in west Inverness-shire, Scotland.

Geoff M Hilton ^{1*}, **Ed Burrell** ¹, **Henry Dobson** ², **Mark Hancock** ³, **Larry Griffin** ¹, **Andrew Low** ⁴, **Alison MacLennan** ⁵, **Carl Mitchell** ¹, **Alastair Stephen** ⁴ & **Andrew Douse** ⁶

¹ Wildfowl & Wetlands Trust, Slimbridge, Gloucester, UK, GL2, 7BT, UK

² Forestry and Land Scotland, Torlundy, Fort William, PH33 6SW, UK

³ Royal Society for the Protection of Birds, Scotland, Etive House, Beechwood Park, Inverness IV2 3BW, UK

⁴ Scottish & Southern Energy Renewables, Inveralmond House, 200 Dunkeld Road, Perth, PH1 3AQ, UK

⁵ Royal Society for the Protection of Birds, Scotland, Isle of Skye Office, Broadford, Isle of Skye, IV49 9AB, UK

⁶ Scottish Natural Heritage, Great Glen House, Leachkin Road, Inverness, IV3 8NW, UK

* geoff.hilton@wwt.org.uk | [@geoffmhilton](https://twitter.com/geoffmhilton)

Common Scoter *Melanitta nigra* is Red Listed in the UK with a population decline of almost 40% between 1995 and 2007. With fewer than 50 pairs remaining, there is a high risk of the scoter disappearing as a UK breeding species. Furthermore, there are now concerns that the species might be declining globally, with declines reported in the core population that winters in the Baltic.

Recent research by WWT, RSPB and SNH, aimed at identifying factors driving the decline, has led to a suite of conservation actions being delivered at key sites by partner organisations (including SSE and FLS) and the local community. Low numbers of broods appearing on lochs relative to the number of females present in the pre-breeding phase indicated high nest and duckling predation rates. Intensive studies of scoter activity and nest survival, involving the use of temperature loggers and custom-made cameras to determine nest fate, provided valuable information on ecology and habitat use. Colour-ringing of females enabled assessment of adult survival and reproductive rates, while females fitted with geolocators revealed the location and timing of movements in relation to wintering areas.

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The research findings underpin a range of conservation interventions. Management of vegetation on natural islands at key sites is supplemented by the trialling of artificial islands to buffer water level fluctuations. The construction of an anti-predator fence in conjunction with diversionary feeding to deflect mammalian predator attention from one key nesting area is underway and will be monitored using trail cameras in addition to those at nest sites. At another location, detailed hydrological modelling was used to inform a revised water level management regime aimed at maintaining island integrity and minimising predator access during incubation, while providing shallow water foraging habitat during brood rearing. Consideration is also being given to headstarting to accelerate recovery. [299 words]

Geoff Hilton is the Head of Conservation Evidence at WWT, overseeing wide-ranging research to underpin the conservation of wetland nature. Previously he worked on the restoration of island endemics and seabirds. More recently he has worked on the recovery of Eurasian Crane, Spoon-billed Sandpiper, Greenland White-fronted Goose, Black-tailed Godwit and Eurasian Curlew.

OFFERED ORAL PRESENTATION (ECR)

The ability of functional diversity metrics to measure different aspects of ecosystem functioning

Lisbeth Hordley^{1*}, Simon Gillings², Owen Petchey³, Joseph Tobias⁴ & Tom Oliver¹

¹School of Biological Sciences, University of Reading, Whiteknights, PO Box 217, Reading, Berkshire, RG6 6AH, UK

²British Trust for Ornithology, The Nunnery, Thetford, IP24 2PU, UK

³Department of Evolutionary Biology and Environmental Studies, University of Zurich, Zurich, Switzerland

⁴Department of Life Sciences, Imperial College London, Ascot, Berkshire, SL5 7PY, UK

* l.hordley@pgr.reading.ac.uk | [🐦 @LisbethHordley](https://twitter.com/LisbethHordley)

Functional diversity metrics aim to provide information on ecosystem functioning, but trait choice is critical. From ecological theory, we expect that a high diversity of response traits will lead to communities with greater resilience against environmental perturbations, whereas effect trait diversity will support communities to provide a higher mean level of functioning. However, it has not been investigated whether the combination of traits used in functional diversity metrics measure two different aspects of ecosystem functioning: stability and mean function level over time.

Here, we use Breeding Bird Survey data for 90 British birds from 1994-2018 to measure the mean and stability of two ecosystem functions, seed dispersal and pest control. Functional traits are split into either effect, response, or those that provide both, and combinations of these are used to calculate two functional diversity metrics (FD and FDis).

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Seed dispersal effect trait diversity calculated using FD is positively correlated with the mean level of function and negatively related to stability as predicted. For both seed dispersal and pest control, response trait FD is positively related to stability, as predicted. However, functional diversity calculated using FDis shows contrasting results.

Overall, we show that the type of trait combinations included in functional diversity metrics influences which aspects of ecosystem functioning they predict – a finding that is highly relevant for the use of such metrics in ecosystem management. We also found that the choice of functional diversity metric (e.g. FD versus FDis) appears to have an impact on the ecological conclusions drawn from functional diversity measures.

Lisbeth Hordley is a PhD student at the University of Reading with a main research focus on applied conservation and ecosystem functioning. She is particularly interested in using functional traits to understand the link between human-driven environmental changes and their impact on ecosystem functions and services.

ALFRED NEWTON LECTURE

Can we save the rarest of the rare? Process and progress in the restoration of endangered species

Carl G. Jones

Durrell Wildlife Conservation Trust & Mauritian Wildlife Foundation

* carlgjones@btinternet.com | [@DurrellWildlife](https://twitter.com/DurrellWildlife)



The conservation management of birds has developed from their utilitarian use, with many of the techniques having been developed from game-bird management and aviculture. Methods of conserving species have become increasingly sophisticated as we have learnt more about their population biology and how to manipulate their productivity and survival. There have been spectacular successes, although major challenges still exist, and for many species we have to develop the techniques and approaches that will guarantee their futures. Some species due to life history characteristics are likely to be problematic. A review of successful bird restoration projects shows that there are few quick fixes and the restoration of species may take many decades, often with some supportive management during that period. The good news is that species focused restoration projects can be powerful drivers for the transference of knowledge to other similar species, and also the restoration of their habitats and ecosystems. Despite advances in their conservation, birds are still becoming extinct with c.37 species having been lost

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since 1950. During this same period 42 species have survived that would have had an estimated >50% chance of extinction without conservation.

Carl Jones is Chief Scientist at the Durrell Wildlife Conservation Trust and scientific director of the Mauritian Wildlife Foundation. He has worked in bird conservation for over four decades and has specialized in the restoration of critically endangered birds using intensive management techniques. These include the captive breeding, reintroductions and the long-term management of species in the wild.

OFFERED ORAL PRESENTATION

Effects of wetland restoration on bird communities

Ineta Kačergyté^{1*}, Jonas Knape¹, Debora Arlt^{1, 2}, Åke Berg³, Michał Żmihorski⁴, Tomas Pärt¹

¹ Ecology department, Swedish University of Agricultural Sciences, 750 07 Uppsala, Sweden

² Swedish Species Information Centre, Swedish University of Agricultural Sciences, 750 07 Uppsala, Sweden

³ Biodiversity Centre, Swedish university of agricultural sciences, 750 07 Uppsala, Sweden

⁴ Institute of Nature Conservation, Polish Academy of Sciences, Poland

* Ineta.kacergyte@slu.se | [🐦 ka_ineta](https://twitter.com/ka_ineta)

During the last century wetland destruction, inflicted by urbanisation and agricultural activities, has been estimated at 70 %, which has led to wetland-related biodiversity loss. Luckily, many countries are promoting wetland restoration to increase wetland bird diversity. However, standardised inventories of local restorations and large-scale evaluations of bird species in such interventions are largely lacking. We contacted more than 250 people from various governmental and nature conservation organisations to collect data on the restoration of agricultural wetlands and associated bird inventories in Sweden.

Although more than 100 restored wetlands had been inventoried at least once, only 1/3 were repeatedly inventoried (time series data). Fortunately, a similar amount of surveys had both before and after restoration data on bird communities. Using only before-after data for each species and wetland, we estimated species-specific abundance responses to the restoration to be used in a meta-analysis. Based on our results, we discuss which species groups benefit or might suffer from wetland restorations. Additionally, we provide suggestions regarding the conservation effort to restore wetlands that should be linked to follow-ups and evaluations of these intervention effects to determine whether wetland restoration successfully achieves their goals.

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Ineta Kačergytė is a PhD student in landscape ecology and conservation research area, focusing mainly on wetland ecosystems. She is interested in how wetland creation and restoration affect bird communities, and whether the conservation measures to restore aquatic habitat is successful for water related biodiversity.

OFFERED ORAL PRESENTATION (ECR)

Upland rush management increases predation of artificial wader nests

Leah A. Kelly^{1*}, David J.T. Douglas², Mike Shurmer³ & Karl L. Evans¹

¹ Department of Animal and Plant Sciences, University of Sheffield, Alfred Denny Building, Western Bank, Sheffield S10 2TN, UK

² RSPB Centre for Conservation Science, RSPB Scotland, 2 Lochside View, Edinburgh Park, Edinburgh EH12 9DH, UK

³ RSPB Midlands Regional Office, 1st Floor, One Cornwall Street, Birmingham B3 2JN, UK

* lakelly1@sheffield.ac.uk | [@LeahAKelly](https://twitter.com/LeahAKelly)

Farmland birds, including breeding waders, have declined across Europe. One frequently advocated strategy to facilitate population recovery is using agri-environment schemes (AES) to improve vegetation structure. A key example is cutting dense rush *Juncus* to open the sward which aims to increase the abundance of wading birds, for example by improving foraging conditions. Effects on breeding success are, however, unknown. This is a critical knowledge gap as high nest and chick predation rates are a key driver of wader declines. For wader species that nest across a range of sward structures, e.g. Eurasian curlew *Numenius arquata* and common snipe *Gallinago gallinago*, converting denser swards to more open ones may reduce opportunities for nest concealment and thus increase predation risk. Due to the difficulties of locating large numbers of wader nests, we assess rush management impacts on nest predation risk using artificial wader nests ($n = 184$) in two upland areas of England, using fields in which rush is managed according to AES prescriptions (treatment; $n = 21$) or un-managed (control; $n = 22$) fields. Daily nest predation rates (DPRs) were twice as high in treatment (0.064 day⁻¹) than control fields (0.027 day⁻¹). Within treatment fields, DPRs were twice as high for nests in cut rush patches (0.108 day⁻¹) than in uncut rush (0.055 day⁻¹). Modelling links higher DPRs associated with rush cutting to the resultant shorter and less dense vegetation. Our results highlight the need to assess how AES prescriptions that alter vegetation structure impact all aspects of the target species' fitness and thus determine population recovery. Studies using real wader nests should test whether AES rush management inadvertently creates an ecological trap by altering vegetation structure, and identify the sward structure and configuration that optimises trade-offs between foraging conditions and nest predation risk.

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Leah Kelly is a biologist with a main research focus on wildlife ecology and conservation, primarily concerning wading birds. She is predominantly interested in research where findings can be directly applied and used to inform on-the-ground conservation interventions.

POSTER

Recovery Trends of Three Endemic Bird Species in the Nominated World Natural Heritage Site "Northern Part of Okinawa Island"

Nobuhiko Kotaka¹, Katsuhi Nakata², Asako Miyamoto³ & Tsutom Yagihashi⁴

¹ Forestry and Forest Products Research Institute, Kyushu Research Center, 4-11-16 Kurokami, Chuo-ku Kumamoto, Kumamoto, 860-0862, Japan

² Ministry of the Environment, Yambaru Wildlife Conservation Centre, 263-1 Hiji, Kunimgai, Okinawa, 905-1413, Japan

³ Forestry and Forest Products Research Institute, Centre for Biodiversity, 1 Matsunosato, Tsukuba, Ibaraki, 305-8687, Japan

⁴ Forestry and Forest Products Research Institute, Department of Forest Vegetation, 1 Matsunosato, Tsukuba, Ibaraki, 305-8687, Japan

* kotaka@ffpri.affrc.go.jp | [🐦 @N_Kotaka](https://twitter.com/N_Kotaka)

Endemic species that have evolved on an island environment tend to be vulnerable to the effects of alien species. Okinawa Island is located in the southwestern part of Japan, which is the largest island among the Endemic Bird Area (EBA) "Nansei Shoto" identified by Birdlife International. Three endemic bird species, Okinawa Woodpecker *Dendrocopos noguchii*, Okinawa Rail *Hypotaenidia okinawae*, and Okinawa Robin *Larvivora namiyei*, are distributed in the northern part of Okinawa Island. Here we introduce the results of the ongoing project to restore the endemic bird populations in the Northern Part of Okinawa Island.

The Japanese government and Okinawa Prefecture started the eradication project of the invasive alien species Small Indian Mongoose *Herpestes auropunctatus* in the Northern Part of Okinawa around 2000. As a result of thorough mongoose control measures, the number of mongooses caught declined around 2007, and then not only the Okinawa Rail but also the Okinawa Woodpecker and the Okinawa Robin, recovered significantly in the following 10 years. The progress of the mongoose countermeasures and the recovery of the three endemic bird species in northern Okinawa is a good example of contributing to the achievement of the Aichi target in 2020.

The Japanese government submitted the nomination document of "Amami-Oshima Island, Tokunoshima Island, the Northern Part of Okinawa Island, and Iriomote Island," to UNESCO as a candidate for a World Natural Heritage in February 2019. In order to ensure the viability of

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endemic species populations at the Northern Part of Okinawa Island, it is necessary to establish future ecosystem management plans for the entire Okinawa Island.

Nobuhiko Kotaka is a biologist with a main focus on wildlife ecology and conservation, mainly in island forest ecosystems. He is particularly interested in developing the ecosystem management plans for conservation of endangered endemic species in harmony with local community at “Nansei Shoto”.

OFFERED ORAL PRESENTATION (ECR)

Restoring cultural landscape towards wilderness may put both avian diversity and endemism at risk: a Tibetan case study

Li Li^{1*}, Dieter Thomas Tietze², Andreas Fritz³, Zhi Lü¹, Matthias Bürgi⁴ & Ilse Storch⁵

¹ School of Life Sciences, Peking University, Beijing, 100871, China

² Natural History Museum Basel, Augustinerstrasse 2, 4001 Basel, Switzerland

³ Chair of Remote Sensing and Land Information Systems, University of Freiburg, 79106 Freiburg, Germany

⁴ Research Unit Landscape Dynamics, Swiss Federal Research Institute WSL, 8903 Birmensdorf, Switzerland

⁵ Chair of Wildlife Ecology and Management, University of Freiburg, 79106 Freiburg, Germany

* li.li@pku.edu.cn |  @Antelopelili

Ecological restoration is becoming a primary strategy to increase provisions of ecosystem services and converse biodiversity losses. In cultural landscapes undergoing land use extensification, rewilding has been proposed as a viable approach to reverse biodiversity loss through reducing human impacts. The world’s largest grassland restoration campaign is taking place on the eastern Qinghai-Tibetan Plateau (QTP) to reverse degradation and enhance the upper stream region’s water retention capacity. However, little is known about if the large-scale rewilding also benefits the unique bird assemblage of the eastern QTP.

Our study aims to make science-based conservation recommendations for the Tibetan avifauna by detecting their diversity and endemism distribution patterns at the local scale. In the breeding seasons of 2014 and 2015, we carried out bird surveys and conducted a habitat mapping using three Unmanned Aerial Vehicles (UAVs). Our results indicate that the distributions of avian diversity, endemism and abundance are not congruent on the eastern QTP, calling for the conservation of different habitat types. Long-time human–nature interaction between Tibetan nomads and the alpine environment formed a complex vegetation structure. Vertical and horizontal habitat heterogeneity maintain the local bird diversity with anthropogenic elements significantly enriching the overall bird abundance. Degraded pastures provided key habitats for

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two high-abundant endemic passerines, i.e. the White-rumped Snowfinch *Onychostruthus taczanowskii* and the Ground Tit *Pseudopodoces humilis*.

Our results reveal that Tibetan cultural landscape maintains the structural heterogeneity needed to achieve multiple bird conservation objectives on the eastern QTP. Restoring the cultural landscape into a “natural” tall-grass or dense-shrubland state may result in the loss of both high-abundance avian communities and endemic species diversity. Our empirical study also showed implications that rewilding abandoned agricultural landscape will not necessarily lead to a desired conservation outcome especially when the requirements of habitat specialists and endemics are not taken into account. Moreover, ecological restoration projects should evaluate the divergences between its ecosystem service and biodiversity objectives.

Li Li is an ecologists focusing on interactions of social–ecological systems, mainly in alpine grasslands. She has over ten years research experiences on the Tibetan Plateau. Using bird as the biodiversity indicator, she is currently studying the impacts of human land use on multiple facets of biodiversity, including taxonomic, phylogenetic, and functional diversities.

OFFERED ORAL PRESENTATION

Changes in the availability of the vulture-toxic drug diclofenac in South Asia and its impact on the recovery of three critically endangered Gyps vultures

John W. Mallord^{1*}, Toby H. Galligan¹, Vibhu M. Prakash², Krishna P. Bhusal³, ABM Alam⁴, Richard G. Cuthbert¹ & Rhys E. Green^{1,5}

¹RSPB Centre for Conservation Science, The Lodge, Sandy, Bedfordshire, SG19 2DL, UK

²Bombay Natural History Society, Hornbill House, Mumbai, 400023, India

³Bird Conservation Nepal, PO Box 12465, Lazimpat, Kathmandu, Nepal

⁴IUCN Bangladesh Country Office, House B-138, Lane 22, Mohakhali DOHS, Dhaka 1206, Bangladesh

⁵Conservation Science Group, Department of Zoology, University of Cambridge, Cambridge, CB2 3QZ, UK

* john.mallord@rspb.org.uk |  @RSPBScience

Three species of resident *Gyps* vulture underwent catastrophic population declines across their range in South Asia from the 1990s onwards, with a 99.9% reduction in the numbers of White-rumped Vultures, and 97% reduction of both Long-billed and Slender-billed Vultures. The cause of these declines was poisoning by the non-steroidal anti-inflammatory drug diclofenac, which proved to be toxic to vultures who fed on the carcasses of cattle recently treated with the drug. The sale of diclofenac for veterinary use was banned by the Government of India in 2006,

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followed shortly after by Nepal and Bangladesh, with further strengthening in 2015 when it became illegal to sell larger (i.e. 30 ml) vials intended for human use.

Since 2007, undercover surveys of pharmacies in India, Nepal and Bangladesh have been undertaken to assess the availability of diclofenac and other NSAIDs to farmers and veterinary practitioners. A local man was employed to tell the pharmacist he had a sick cow and to buy the first drug that was offered to him. Although, there was a decrease in the sales of diclofenac across all three countries, disappearing from Nepal and Bangladesh, it continued to be widely available in India, accounting for 10-46% of sales across states in the latest surveys.

Vulture populations have been monitored by road transect surveys across India and Nepal, since 1992 and 2002, respectively. The rate of decline of vulture populations in both countries slowed after the initial ban of diclofenac in 2006, with evidence of a slight recovery after its later tightening, especially in Nepal, where diclofenac has all but disappeared from sale in pharmacies, illustrating that the ban has been successful. Although a positive story, threats remain: diclofenac is still widely available in India, and other NSAIDs also known to be toxic to vultures are increasing their market share.

John Mallord has worked at the RSPB for over 20 years, initially working on threatened species in the UK, before focussing on migrant birds in the non-breeding season in West Africa. Since 2018, he has led the RSPB's science work on the globally threatened *Gyps* vultures in South Asia.

OFFERED ORAL PRESENTATION (ECR)

Why do eggs fail? A review of hatching failure in managed wild and captive bird populations

Ashleigh F. Marshall^{1,2*}, Francois Balloux², John Ewen¹, Gary Ward³, Nicola Hemmings^{4†} & Patricia Brekke^{1†}

¹ Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, UK

² Department of Genetics, Evolution and Environment, University College London, London, WC1E 6BT, UK

³ Zoological Society of London, Regent's Park, London, NW1 4RY, UK

⁴ University of Sheffield, Western Bank, Sheffield, S10 2TN, UK

† Joint senior authors

* ashleigh.marshall@ioz.ac.uk |  @Belfast_Ash9

Hatching failure is a ubiquitous phenomenon throughout all birds, affecting 10% of eggs on average. However, the rate of failure can be much higher in both wild and captive endangered populations, and this can represent a barrier to improving the reproductive success of individuals

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in conservation programmes. Previous research has suggested that the primary cause of hatching failure may vary between wild and captive endangered populations, with wild populations primarily experiencing hatching failure as a result of embryo mortality, while captive populations have a higher incidence of fertilisation failure. Such variation may impact the efficacy of different management interventions aiming to mitigate hatching failure, which may not be designed to specifically target the factors leading to embryo mortality and/or fertilisation failure. However, this prior research had some limitations, such as few populations and species being included and a lack of comparison between wild and captive populations of the same species.

Here we aim to test the generality of this observation by conducting a systematic literature review, including information from the 'grey literature' and several available unpublished datasets. Where possible, we investigate patterns of true fertilisation failure versus embryo mortality, compare hatching failure rates between different populations of the same species, identify the leading drivers of hatching failure, and determine the potential influence of different management interventions. This effort allows us to accurately characterise the rate of hatching failure in a large number of wild, managed wild, and captive bird populations, across a variety of species.

The results of this review will highlight the potential key factors leading to fertilisation failure and embryo mortality in managed bird populations. The patterns we characterise will inform management strategies that can be tested to reduce hatching failure, and hence maximise reproductive success of threatened species.

Ashleigh F. Marshall is a PhD researcher investigating the behavioural, environmental, and disease-related drivers of fertilisation failure and embryo mortality in managed wild and captive bird populations. Her aim is to deliver research that helps to support management decisions and improve reproductive success in conservation programmes.

OFFERED ORAL PRESENTATION (ECR)

A structured approach to recovery planning for New Zealand's rarest breeding bird

Thalassa McMurdo Hamilton^{1,2*}; Stefano Canessa^{1,3}; Troy Makan⁴; Tim Blackburn²; John G. Ewen¹

¹ Institute of Zoology, Zoological Society of London, London, UK

² Centre for Biodiversity and Environment Research, UCL, London, UK

³ Wildlife Health Ghent, Faculty of Veterinary Medicine, Ghent University, Ghent, Belgium

⁴ Department of Conservation, Conservation House, Wellington, New Zealand

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* Thalassa.mcmurdohamilton@ioz.ac.uk | [@tha_lassie](#)

Threatened species recovery is made challenging by a lack of clarity in the problems to be solved by groups of stakeholders, their competing management objectives and the diverse management alternatives that might be proposed. These factors are compounded by uncertain outcomes of interventions for data-poor species and subjective attitudes towards the risk of action. Structured Decision Making (SDM) is a powerful process that works through these challenges, providing a framework to use appropriate scientific tools and allowing managers to make the best choice. Whilst SDM is widely used in resource management, its application to species recovery is rare.

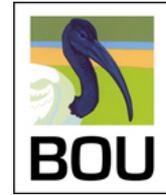
We used SDM to assist the Tara iti Recovery Group to develop a recovery plan for New Zealand's (NZ) rarest breeding bird. Tara iti, or New Zealand Fairy Tern (*Sternula nereis davisae*), has a breeding population of approximately 10-12 pairs with little population growth over the last decade and no clear direction in what to do to promote population recovery. Working with multiple stakeholders, including the dual decision makers of NZ government and Māori (NZ's indigenous people), we structured a collaborative process, centred on identifying fundamental objectives of management and a range of management alternatives that could be used to achieve these objectives. Using available data and expert elicitation, we predicted the consequences of each alternative on each objective, including building a bespoke population model, and solved the optimal choice based on the decision-makers' values and risk attitudes.

Overall, the SDM provided a platform for dialogue between frequently opposed stakeholder groups, allowing all voices to be heard. Focussing on values first provided the required context to rationally develop and compare possible management alternatives, preventing decisions being driven by unclarified individual beliefs. Most powerfully, this allowed the decision makers to have the appropriate information to make an informed choice.

Thalassa McMurdo Hamilton is a conservation scientist with a research focus on the efficacy of conservation interventions, application of decision science to conservation problems and population modelling, predominantly for seabird conservation. She is particularly interested in techniques for overcoming the barriers that prevent conservation managers from making sustainable decisions.

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POSTER

Restoring a top avian predator: reintroduction of White-tailed Sea Eagles to Ireland

Allan Mee ^{1,2*}, Torgeir Nygård ², Clare Heardman ³ & Lorcan O'Toole ⁴

¹ Golden Eagle Trust, Ardpatrick, Kilmallock, Co. Limerick, Ireland

² Norwegian Institute for Nature Research, Høgskoleringen, 7485 Trondheim, Norway

³ National Parks & Wildlife Service, Glengarriff Nature Reserve, Glengarriff, Co. Cork, Ireland

⁴ Golden Eagle Trust, Churchill, Letterkenny, Co. Donegal, Ireland

* kerryeagle@gmail.com | [@kerryeaglemee](https://twitter.com/kerryeaglemee)

Translocations including species reintroduction, reinforcement or introduction have been used successfully to restore populations of species extirpated from all or part of their former range, to reinforce existing populations and, exceptionally, to introduce a species to areas outside its former range where conservation action is needed to prevent global extinction. White-tailed Eagles *Haliaeetus albicilla* were extirpated as a breeding species in Ireland in the early 20th century following population decline due to human persecution. Preparatory studies including population modelling, site selection and identification of a donor population, resulted in the initiation of a reintroduction programme in the Republic of Ireland. Between 2007 and 2011 one hundred young White-tailed Eagles (51 males and 49 females) were collected from nests in Norway under licence and released in Killarney National Park, SW Ireland. Wing-tags and radio and/or GPS satellite transmitters were attached to birds for individual identification and tracking post-release. Birds dispersed over much of the island of Ireland with at least six birds sighted or tracked to Scotland and one to northern England. First territories were established in 2010, first breeding efforts in 2012 with chicks fledged successfully in 2013. The number of territorial pairs increased rapidly but declined after 2014 with the loss of some adult birds. However, the number of breeding pairs and the number of young fledged continues to increase, with 26 young fledged to date. Comparison of population growth and breeding success with the first phase of the Scottish west coast Sea Eagle reintroduction (1975-85) suggests that the outlook for the Irish population is reasonably optimistic but may need supplementation. Illegal poisoning (58% of known mortalities) has had a serious impact on population growth and continues to threaten the viability of the reintroduction programme.

Allan Mee is a biologist with a life-long interest in endangered species biology and conservation. He has worked on species from waders to raptors including California condor recovery, managed the White-tailed Sea Eagle reintroduction in Ireland since 2007 and currently the EU Nature RaptorLIFE project in SW Ireland.

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OFFERED ORAL PRESENTATION (ECR)

Evidence of flexibility and positive responses to habitat change in the European nightjar *Caprimulgus europaeus*

Lucy J. Mitchell, Kathryn E. Arnold & Piran C.L. White

Department of Environment and Geography, University of York, Heslington, York, YO10 5NG, UK

* lucyjayneryan@gmail.com | [@lucyjayneryan](https://twitter.com/lucyjayneryan)

Restoration of habitat often revolves around physical land management, which may impact on species use of a habitat by altering how animals can meet their needs. Habitat change may impact individuals within a population differently and understanding how this individual variation contributes to the population mean is important when developing conservation strategies. For example, high individual variation may indicate a generalist and flexible population that is resilient to environmental change, but individuals themselves may in fact be specialised. Evidence of this variation can be collected using GPS tracking devices that can identify movement and habitat use of multiple individuals within a population. Here we have tracked 41 European nightjars, over four years of habitat change that occurred as part of a peatland restoration project on the Humberhead Peatlands NNR, UK. We calculated individual habitat selection measures and analysed home range size change in line with changes in habitat availability to understand functional trade-offs made by the birds

Individual variation was high and explained more than variation between years. The population contained specialist individuals, with strong selection for single habitat types, and generalist individuals that used multiple habitat types more evenly. However, functional relationships did not vary significantly between individuals. Across the population, home range size decreased as the availability of cleared habitat increased, but as the amount of open water increased, home range size also increased. High individual variation in habitat choice shows that the population is flexible and that a mosaic of different habitat types should be provided. Changes in home range size do however demonstrate that some habitats may be more valuable than others. Our results demonstrate the importance of using measures of habitat selection and functional responses at the individual level, rather than a mean value, to produce more informative conservation measures.

Lucy Mitchell is an applied avian ecologist, particularly interested in collecting data on space use, movement and energetics to create evidence-based management options for species conservation. She has a range of experience in tracking birds using GPS and VHF, spatial analysis using R, metabarcoding and survival analysis.

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TWITTER-ONLY PRESENTATION

Patterns of Egg Infertility and Embryo Mortality in a Threatened Bird, the Hihi

Fay Morland

University of Sheffield, UK

* fmorland1@sheffield.ac.uk | [@fay_morland](https://twitter.com/fay_morland)

Hatching failure is often frequent in threatened bird populations, posing a risk to their establishment and growth. The hihi (*Notiomystis cincta*), a threatened passerine endemic to New Zealand, suffers from small population sizes, low genetic diversity, and high rates of hatching failure (25%). Using microscopic analysis of unhatched eggs, we demonstrate that embryo mortality is the primary cause of hatching failure in hihi, dominated by failures during early embryonic development. Although true infertility is rare in this population, our preliminary results suggest that fertility rates vary considerably across years and with population size and sex ratio. We discuss the potential roles of demographic factors, physiological traits, and individual behaviour in explaining patterns of embryo mortality and infertility, and highlight potential avenues for future research.

Fay Morland is a third year PhD student and her project is focused on further understanding reproductive failure in the hihi. She is interested in individual differences, behavioural plasticity, and how they affect the response of a species to the trials of our changing world.

OFFERED ORAL PRESENTATION

Lessons from a conservation icon: contrasting recovery trajectories of four reintroduced populations of the Mauritius Kestrel

Malcolm Nicoll¹, Carl Jones^{2,3}, Sion Henshaw², Vikash Tatayah² & Ken Norris¹.

¹ Institute of Zoology, Zoological Society of London, Regent's Park, London, NW14RY, UK

² Mauritian Wildlife Foundation, Grannum Road, Vacoas, Mauritius

³ Durrell Wildlife Conservation Trust, Les Augres manor, Trinity, Jersey

* Malcolm.nicoll@ioz.ac.uk | [@malcnicoll](https://twitter.com/malcnicoll)

Reintroduction is now a commonly used approach for the conservation of threatened avian species, but with variable outcomes not only across species but also within species-specific recovery programmes. Understanding why outcomes vary and how perceived success rates might

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be improved is central to further developing the field of reintroduction biology and historical reintroductions can provide valuable insights.

One of the earliest conservation avian reintroduction programmes, initiated in the early 1980s, was for the (then) Critically Endangered Mauritius kestrel and over 10 years 331 captive-reared kestrels were released into 4 isolated sub-populations. Using data from short-term, island-wide surveys and >25-year population-specific, long-term monitoring programmes we show that these four sub-populations have very different recovery trajectories, including local extinction, recent decline and comparative stability. We explore the demographic reasons behind these differences and illustrate how previously overlooked population limiting factors are responsible for the recent population decline. We also show how the resulting evidence can guide management recommendations, particularly reintroduction efforts that are currently being implemented.

This assessment of a long-term reintroduction programme provides valuable insights into the merits of post-release monitoring and highlights the challenges associated with identifying and mitigating for the drivers of rarity in threatened avian species in a constantly changing environment.

Malcolm Nicoll is a conservation biologist with a focus on the recovery and management of small populations, principally in tropical island systems. His research combines both population ecology and movement ecology to generate evidence which guides the recovery programmes for a range of threatened bird species.

POSTER (ECR)

Identifying species' pools for indicator species selection

Enya O'Reilly¹, Simon Butler¹, Lynn Dicks¹ & Richard Gregory²

¹ University of East Anglia, School of Biological Sciences, Norwich Research Park, Norwich, NR4 7TJ, UK

² Royal Society for the Protection of Birds, The Lodge, Potton Road, Sandy, Bedfordshire, SG19 2DL, UK

* E.OReilly@uea.ac.uk |  @enya_oreilly

Multi-species indicators are embedded in environmental management, sustainable development and biodiversity conservation policy and practice, acting as metrics against which progress towards national, regional and global targets are measured. The choice of species included in an indicator has a defining influence on how well it reflects ecosystem condition, the speed and extent to which it responds to environmental change and the confidence intervals around its metric value. When choosing species to act as informative indicators, approaches often rely on expert opinion or data availability; generally applicable and objective methods for species'

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selection are frequently lacking. We endeavour to address this issue by employing an objective measure of species' relative habitat use (RHU) to define the pool of species from which an indicator set can be drawn.

Taking the development of a European Forest Bird indicator as a model system, we use Pan-European Common Bird Monitoring Scheme (PECBMS) data to quantify RHU for a suite of European breeding birds and quantifying reliance on forest habitats accordingly. We explore regional variation in RHU, variation in RHU dependent on forest density within sites and discuss the implications for defining the pool of species from which a forest indicator set should be drawn. Finally, we demonstrate how this process can be combined with an existing indicator species selection protocol to construct a European Forest Indicator. Integrating these approaches provides us with an effective protocol for informative indicator species selection which is of growing demand from policy makers and stakeholders for greater consistency and standardisation in species selection.

Enya O'Reilly is a UEA PhD student focusing on population dynamics and ecosystem functioning. She is interested in species' interactions with environmental change and human intervention. The focus of her PhD is developing an informative and objective method for indicator species selection to better inform conservation practice and influence policy.

OFFERED ORAL PRESENTATION (ECR)

A cultural approach for the reintroduction of the Floreana Mockingbird *Mimus trifasciatus* on the Galapagos Islands

Enzo M. R. Reyes*, Michelle M. Roper, Dianne H. Brunton, Adam N. H. Smith & Luis Ortiz-Catedral

School of Natural and Computational Sciences, Massey University, North Shore Mail Centre, Private Bag 102904, Auckland, New Zealand

* e.rodriquez-reyes@massey.ac.nz |  @enzomrr1990

The Floreana Mockingbird is an endemic passerine restricted to two islets of the Galapagos Islands, occupying 0.5% of its original distribution range after local extinction from Floreana Island in the early 1990s. With an estimate of 300 individuals across two isolated populations the species is one of the least studied birds in the Galapagos Archipelago. Currently there is no active conservation management due to its population's being considered as stable with no immediate risk of extinction. However, a plan for its reintroduction to Floreana Island has been proposed for 2025.

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This research is part of a broad project aligned with the goals of the reintroduction plan which aims to improve the genetic diversity and viability of the current global population. A third population will be created on Floreana Island by reintroducing individuals from both extant populations. To date, besides genetics and population monitoring, no other aspects of the ecology have been considered for the conservation of the species. Especially, exploring the potential impact of cultural divergence on the success of its reintroduction.

Here, we investigate the effects of cultural drift between the two remaining populations of Floreana Mockingbirds and the importance of incorporating the cultural aspect in the reintroduction plan of this species. We compared acoustic characteristics of the vocalisations and found evidence of cultural divergence in both populations explained by a cultural drift-like process in one of the populations. Our results are parallel with the genetic divergence found previously that shows a genetic divergence by genetic drift. With our study, we highlight a behavioural problem that might arise in this highly social bird. Cultural divergence might act as a possible gene flow barrier hindering the success of the reintroduction itself. We recommend more studies regarding signal responses between populations before any reintroduction is attempted.

Enzo M. R. Reyes is a PhD student researching the ecological and behavioural aspects that might facilitate the reintroduction of the Floreana Mockingbird. His work is focused on population dynamics, social interactions and culture diversification of this endemic species of the Galapagos Island. Before the PhD he worked as a research assistant in the Galapagos Islands monitoring the populations and behaviours of the Nazca Boobies and Waved Albatross.

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OFFERED ORAL PRESENTATION (ECR)

Using time travelling mud (palaeolimnology) as a tool to underpin waterbird conservation and restoration

Hannah J. Robson^{1,2,3}, Geoff M. Hilton², Vivienne J. Jones¹, Stephen J. Brooks³, Carl D. Sayer¹, Carole Roberts¹, Georgina Charnley¹, Lilian Unger¹, Jan C. Axmacher¹, Maarten van Hardenbroek⁴, Andrew Douse⁵ & Eileen Rees²

¹ Environmental Change Research Centre, Department of Geography, University College London, UK

² Wildfowl & Wetlands Trust, Slimbridge, Gloucestershire, UK

³ Department of Entomology, Natural History Museum, London, UK

⁴ School of Geography Politics and Sociology, Newcastle University, UK

⁵ Scottish Natural Heritage, Inverness, UK

* Hannah.Robson@wwt.org.uk |  @hjobson2

Diagnosing causes of decline and identifying restoration targets is fundamental to species recovery. A common approach in decline diagnosis is to make comparisons of between environmental conditions at sites where a species currently persists and those from which it has been lost. However, this approach rests on the risky assumption that contemporary site-differences reflect an optimal habitat state or persisting drivers of historic decline. Here we use three case-studies to show how evidence from lake sediment cores (palaeolimnology) brings a historic perspective to underpin waterbird restoration.

While rapid environmental change in the high arctic breeding grounds may be a driver of Bewick's Swan decline, long-term data that could show the nature and consequence of environmental change in the region is lacking. We used sediment cores to explore how freshwaters in the Pechora Delta has changed over the last 200 years, and the implications of this for breeding swans.

Madagascar pochard - formerly widespread on the Madagascan plateau - now persists at a single, remote lake complex. As is typical of such situations, the remaining site is probably atypical of historic habitat, but due to ubiquitous wetland degradation elsewhere, it is difficult to identify restoration target conditions. Palaeolimnology is being used to fill gaps in long term data and set restoration targets.

The Flow Country in northern Scotland is the key breeding site for the declining Common scoter. Contemporary spatial comparisons suggested that scoter decline might be associated with decline in macroinvertebrate food availability. Using multiproxy palaeolimnology, we were able to show a general increase in lake productivity and invertebrate abundance in recent decades,

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coincident with widespread catchment afforestation, suggesting that food limitation is an unlikely driver of decline.

We use these case studies to discuss the application of paleoecology to species restoration, and the future directions offered by new technologies.

Hannah Robson is a wetland scientist with a background in freshwater entomology, water quality analysis and palaeolimnology. Her research focuses on the use of innovative, cross-disciplinary approaches to assess recent environmental change in relation to the restoration of rare and/or declining water bird populations.

TWITTER-ONLY PRESENTATION

A New Zealand bellbird population shows plasticity in life history responses to ecological restoration

Michelle M. Roper

Massey University, New Zealand

* mmroper@mail.com | [@Musedmichelle](https://twitter.com/Musedmichelle)

Ecological restoration projects provide excellent opportunities to study how animals adapt their behaviour in response to a changing environment. A key-way an animal can optimise reproductive success in changing conditions is to alter the breeding system. The New Zealand bellbird (*Anthornis melanura*) has a long history on Tiritiri Matangi Island (Tiri), from a degraded agricultural past to recent restoration. We studied the breeding biology of the NZ bellbird to assess how their breeding parameters have responded over time to the restoration on Tiri. Our main finding was that clutch size reduced over time from a mean of 3.6 to 2.4, most likely due to the population becoming density-dependent. We also found a directional change in patterns of parental investment between historic and current studies. These results suggest that the bellbirds, life-history traits are plastic in response to local conditions which provides an advantage when repopulating a regenerating or changing habitat.

Michelle Roper's research focuses on the ontogeny and production of female birdsong within the context of the life history of songbirds to establish the groundwork needed to understand the function and evolution of birdsong. Her research also extends to conservation biology to understand the role of song culture in species re-introductions.

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OFFERED ORAL PRESENTATION

Restoring farmland bird populations through landscape-scale restoration: Predicting the extent of agri-environment provision needed to reverse population declines of farmland birds in England.

Elwyn Sharps^{1*}, Andrew Bladon², Dave Buckingham², Phil Grice³, Gavin Siriwardena⁴ & Will Peach²

¹ RSPB Centre for Conservation Science, North Wales Office, Llys Castan, Parc Menai, Bangor, Gwynedd LL57 4FH, UK

² RSPB Centre for Conservation Science, The Lodge, Sandy, Bedfordshire, SG19 2DL, UK

³ Natural England, Foss House, Kings Pool, 1-2 Peasholme Green, York, YO1 7PX, UK

⁴ British Trust for Ornithology, The Nunnery, Thetford, Norfolk, IP24 2PU, UK

⁵ Now: Natural Resources Wales, Maes y Ffynnon, Penrhosgarnedd, Bangor, Gwynedd LL57 2DW

* elwyn.sharps@cyfoethnaturiolcymru.gov.uk | [elwynsharps](https://twitter.com/elwynsharps)

Agri-environment schemes (AES) aim to reverse widespread declines of farmland birds, but it is unclear how much AES provision is enough to achieve this. Our study quantified how the extent of AES provision has affected Population Growth Rates (PGRs) of conservation priority farmland bird species and asked: (1) How have AES affected PGRs of farmland bird species? (2) What proportion of the populations of farmland bird species need to be under AES to stabilise PGRs? The level of AES provision was defined according to the density of bird-friendly options provided through previous AES in three contrasting regions of England (UK): Arable East Anglia (EA), the mixed farming landscape of Oxfordshire (OX) and the grass-dominated West-Midlands (WM). We used data on changes in bird abundance and AES provision during the period 2008-17 from 70 higher level scheme (HLS) farms and 652 Breeding Bird Survey (BBS) 1-km squares. PGRs of 20 farmland bird species, and the composite Farmland Bird Index (FBI) were compared across three levels of bird-friendly AES: HLS provision (averaging 10% of the farmed area), 'entry-level scheme' provision (averaging 2.4% of the farmed area; ELS) and no bird-friendly AES provision. Overall, 13 out of 20 species responded positively to AES, 5 species showed no effect, and 2 species showed a negative response (to ELS level management in a single region). Initial estimates of AES coverage needed for future schemes varied between species and regions but were most consistent for the FBI. In the absence of any ELS-level provision, to stabilise populations the proportion of FBI species required to be exposed to HLS-level provision was 38%. Therefore, we suggest that future AES scheme design should aim to stabilise or increase populations of farmland bird species by ensuring that at least 38% of farms are subject to HLS-level bird friendly AES options.

Elwyn Sharps completed his PhD thesis "The effects of saltmarsh conservation grazing on breeding Common Redshank" at Bangor University in 2015. From 2015–19 he worked for the

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RSPB both as a Conservation Officer and as a Conservation Scientist. He now works for Natural Resources Wales as a Biodiversity Lead Officer and as an Ornithologist.

OFFERED ORAL PRESENTATION

Saving Black-tailed Godwits in the UK through predator management and head-starting

Jennifer Smart^{1*}, Mark Whiffin¹, Helen Jones¹, Natalia Zielonka¹, Nigel Butcher¹, Hannah Ward², Charlie Kitchin², Lynda Donaldson³, Geoff Hilton³, Rebecca Lee³ & Nicola Hiscock³

¹ RSPB Centre for Conservation Science, UK

² RSPB, UK

³ Wildfowl and Wetland Trust, UK

* Jennifer.smart@rspb.org.uk |  @drredshank

There are now fewer than 50 pairs of Black-tailed Godwits *Limosa limosa limosa* breeding in the UK with around 90% of the population in the Fens in eastern England. Most of the population breed at one site, the Nene Washes, where low breeding success driven by high predation, has caused the population to decline. Project Godwit, a five-year partnership between the RSPB and the Wildfowl and Wetlands Trust funded by EU LIFE, aims to secure the future of black-tailed godwits as a breeding species in the UK.

Project Godwit has two key objectives: 1) to improve breeding success at the Nene Washes by using multiple methods of predator management to reduce the impacts of key predators and 2) to trial the use of head-starting, where chicks are reared in captivity and released once fledged, which could boost breeding success and fast track colonisation of grassland sites on the Ouse Wash that have been created for godwits.

Three years into this programme of conservation interventions, this presentation will review the progress we have made towards improving the fortunes of this nationally important breeding population of Black-tailed Godwits.

Jen Smart is Head of Species at RSPB England having previously worked for the RSPB Centre for Conservation Science where she specialised on breeding waders and conservation solutions to reverse their population declines. Her current role is about ensuring the RSPB is delivering the correct conservation actions in the right places for their priority species.

Restoring bird populations: scaling from species to ecosystems

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POSTER (ECR)

Effects of increasing tree cover along the urban-rural gradient on avian assemblages in Bangkok, Thailand

Phakhawat Thaweepworadej* & Karl L. Evans

Department of Animal and Plant Sciences, The University of Sheffield, Sheffield, S10 2TN, UK

* Pthaweepworadej1@sheffield.ac.uk

South-east Asia is one of the world's most rapidly urbanising regions, for example Bangkok's population has grown from 6.4 million in 2000 to 10.4 million in 2019 with resultant urban expansion substantially reducing vegetation cover. Whilst it is well established that avian species richness is lower in highly urbanised locations the answers to two key questions remain equivocal. First, in temperate regions and at fine spatial scales avian species richness tends to peak at intermediate levels of urbanisation. This pattern is attributed to higher habitat diversity in these sub-urban regions, but it is unclear if such patterns arise in tropical regions. Second, the extent to which habitat restoration in urban areas can promote higher species richness is uncertain. Whilst many bird species are highly mobile and can colonise distant habitat patches colonisation potential may be reduced by surrounding intensively urbanised land, and habitat quality in such patches may be lowered by pressures from the surrounding urban matrix. Here, we assess spatial patterns in avian species richness and the composition of avian assemblages along an urban to rural gradient throughout the Bangkok region using repeated point count data (visited 3 times during March to July 2018) from 150 1 km x 1 km cells selected using random stratification across the gradient. In each cell, point counts were conducted in a randomly selected location and within the largest available patch of woodland or trees. We contrast avian assemblages in these two locations along the urban-rural gradient to provide a proxy of the potential for increasing urban tree-cover to enhance avian communities. Over 150 bird species were detected across all survey points. Avian diversity in woodland patches was consistently higher than in randomized locations. Although bird species richness declines linearly with increasing urbanisation intensity, the beneficial impacts of woodland patches appear to be maintained across the urbanisation gradient. Urban avian diversity will thus be adversely impacted by urban development but there is considerable potential to mitigate these impacts by increasing tree densities within urban green-spaces.

Phakhawat Thaweepworadej is a PhD student at Department of Animal and Plant Sciences, the University of Sheffield, focusing on the impact of urbanisation on biodiversity (especially birds and mammals) and ecosystem services.

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KEYNOTE

The role of birds in ecosystem restoration: ecological functions, networks and interactions

Joseph A. Tobias*

Department of Life Sciences, Imperial College London, Silwood Park, Buckhurst
Road, Ascot SL5 7PY, UK

* j.tobias@imperial.ac.uk | [@ja_tobias](https://twitter.com/ja_tobias)



Birds play a prominent role in a wide range of ecological functions, some of which are crucial for ecosystem resilience and restoration. Pollination, seed dispersal and insect predation by birds, for example, can theoretically accelerate reforestation in degraded or fragmented habitats. However, few studies have quantified the contribution of birds to the maintenance and restoration of functioning ecosystems, particularly at broader spatial scales. I will summarise evidence for the importance of avian trophic interactions in promoting ecosystem restoration with a particular focus on recent analyses based on avian functional traits. Results indicate that changes in land-use and climate may substantially impair the provision of ecological services by birds, and suggest that trait-based analyses can help to reframe conservation priorities with the goal of conserving and restoring ecosystem functions.

Joe Tobias started out as a behavioural ecologist with a PhD on European Robins at Cambridge University, then worked for BirdLife International and other conservation NGOs, before returning to academia as a Lecturer in Evolutionary Ecology at the Edward Grey Institute, Oxford University. He is now Reader in Biodiversity & Ecosystems at Imperial College London, where his research group studies avian macroecology and macroevolution, with a particular focus on understanding how ecosystems function and respond to environmental change.

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POSTER

Recovery planning for an extinct-in-the-wild species, the Sihek (Guam Kingfisher, *Todiramphus cinnamominus*)

Amanda Trask¹, Stefano Canessa², Axel Moehrenschalger^{3,4} & John Ewen¹

¹ Institute of Zoology, Zoological Society of London, London, UK

² Wildlife Health Ghent, Faculty of Veterinary Medicine, Ghent University, Ghent, Belgium

³ Centre for Conservation Research, Calgary Zoological Society, Calgary, Canada

⁴ IUCN SSC Conservation Translocation Specialist Group

* Amanda.trask@ioz.ac.uk |  @amandaetrask

Successful species recovery planning needs to account for multiple stakeholder objectives and high potential uncertainty around outcomes, leading to variable risk tolerances. These problems are compounded for extinct-in-the-wild species, in particular when threats still exist in the species' native range. Then, it is imperative to understand the dynamics of the captive population to ensure harvests for release are sustainable. Additionally, there is uncertainty over the fitness of captive-bred individuals when released at alternative wild release sites and, where assisted colonisations to areas outside the species' native range are considered, potential impacts on release site ecosystems.

We are using a structured decision-making approach to plan re-establishment of wild populations of Sihek (Guam Kingfisher *Todiramphus cinnamominus*). Potential release sites include reintroduction to Guam and assisted colonisations outside the Sihek's native range. Stakeholder-identified fundamental objectives include minimizing global extinction risk and maximising viability of released populations, but also minimizing impacts on release-site ecosystems. We built an individual based model to assess future viability of both the captive population under alternative harvest regimes and wild populations at alternative release sites. We used a novel approach to assess the potential for impacts from Sihek releases to occur through different mechanisms at alternative release sites, using expert elicitation and following the Environmental Impact Classification for Alien Taxa framework. A key expert-identified potential impact mechanism was predation, which we therefore further assessed for each site using the newly developed Invader Relative Impact Potential metric. We thereby predicted the consequences of alternative translocation strategies on the joint objectives of increasing Sihek population viability and minimizing ecosystem impacts, to inform rational decision-making. Our work provides a template for use where there are uncertain outcomes in species recovery that potentially result in highly variable risk tolerances, both in terms of focal-species extinction risk and potential impacts on native ecosystems.

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Amanda Trask is a conservation biologist and population ecologist at the Zoological Society of London. Her main research interests are in the demographics and genetics of small, threatened populations and in the use of conservation translocations in species recovery planning.

POSTER (ECR)

Modelling the impacts of scenarios of land use change on farmland and woodland bird indicators

Emily Upcott¹, John Redhead¹, Gavin Siriwardena² & Richard Pywell¹

¹ Centre for Ecology & Hydrology, Maclean Building, Benson Lane, Wallingford, Oxfordshire, OX10 8BB, UK

² British Trust for Ornithology, The Nunnery, Thetford, Norfolk IP24 2PU, UK

* emiupc@ceh.ac.uk | [@emily_upcott](https://twitter.com/emily_upcott)

There is increasing pressure on British agricultural systems to meet demands of a growing population whilst minimising environmental impacts. The Achieving Sustainable Agriculture Systems (ASSIST) programme aims to address this issue by investigating “sustainable intensification”: developing agricultural systems that simultaneously increase the efficiency of food production and improve environmental quality. To meet these goals, it is important to understand current agricultural practices, how these vary across Great Britain and how these may change in the future. The ASSIST Scenario Exploration Tool (ASSET) allows exploration of current and future land cover and use scenarios and their impacts on socio-ecological factors across Great Britain.

This study’s aim was to model predicted output metrics for farmland and woodland bird indicators across all scenarios, including newly-developed likely future drivers of environmental change: afforestation and grassland management intensity.

The study utilised existing and newly-developed spatial data, incorporating the Land Cover Map (2015), CEH Land Cover® plus Crops, scenarios of afforestation and grassland intensity, climate data (January and July temperature, rainfall year) and modelled bird coefficients from BTO/JNCC/RSPB Breeding Bird Surveys. ASSET baseline and scenario rasters were reclassified according to crop and grassland intensity. Bird abundance was modelled as a function of baseline land cover and climate data. Model coefficients were then used to predict bird abundances under each scenario. Individual farmland and woodland bird indicator species results were grouped according to indicator and the geometric mean for each group of modelled results was calculated, in accordance with BTO’s processing of indicator species.

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This resulted in over 10,000 unique rasters of bird indicator responses to land use scenarios. These responses will be fed into ASSET, complementing existing output metrics. This will enable ASSET to continue to contribute to policy maker and stakeholder engagement, and improving our understanding of land use intensification impacts on key environmental outcomes.

Emily Upcott is a Spatial Ecology Research Associate at the Centre for Ecology & Hydrology. She uses spatial methods to address ecological questions, particularly relating to sustainable agriculture. She has a background in GIS, Conservation Science and Ecology, having previously worked in raptor-wader conflicts, riparian ecology and habitat restoration.

KEYNOTE

Island restoration to benefit seabirds: What have we done so far and what can we do better?

Karen Varnham, Laura Bambini, Sophie Thomas & Leigh Lock

RSPB, The Lodge, Sandy, Beds, SG19 2DL

* Karen.Varnham@rspb.org.uk | [@RSPBScience](https://twitter.com/RSPBScience)



Eradicating invasive mammalian predators from islands is one of the most effective conservation tools we have for protecting seabird populations, with benefits reported for many species in the UK and worldwide. Most UK projects have targeted rats but ambitious programmes have also been carried out for species including coypu, hedgehogs, American mink and stoats. Island restoration involves more than simply eradicating invasive species, however, and biosecurity - preventing the return of invasives and the arrival of new ones - is just as important. To date biosecurity has rarely received the attention and funding given to projects eradicating invasive mammals on islands but the tide is turning. Effective biosecurity is a long-term endeavour involving island communities and conservationists, working together with transport, fishing, farming, tourism and many other sectors. To achieve this common goal requires awareness raising, education and training, enabling us to protect islands where predators have been eradicated, as well as those they have not yet reached.

Karen Varnham is part of the RSPB's Seabird Island Restoration Programme and has worked on island invasive species for more than twenty years. She has worked on islands around the world including the Caribbean, Mauritius, Indonesia, Malta and the South Atlantic, as well as many islands in the UK, Crown Dependencies and Overseas Territories. As well as planning and carrying out island restoration projects she is increasingly involved in biosecurity and training.

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OFFERED ORAL PRESENTATION

Restoring peatlands delivers bird population and wider ecosystem benefits

Nick Wilkinson¹, David J T Douglas¹, Mark Hancock² & Jeremy D Wilson¹

¹ RSPB Centre for Conservation Science, RSPB Scotland, 2 Lochside View, Edinburgh Park, Edinburgh, EH12 9DH, UK

² RSPB Centre for Conservation Science, RSPB Scotland, Etive House, Beechwood Park, Inverness, IV2 3BW, UK

* nick.wilkinson@rspb.org.uk | [@RSPBScience](https://twitter.com/RSPBScience)

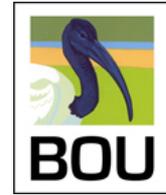
Peatland restoration is internationally recognised for reversing effects of peatland degradation. Whilst much restoration is aimed at restoring water and carbon storage functioning, peatlands support important wildlife including birds that are expected to benefit from restoration. However, knowledge of bird responses is currently poor. We systematically reviewed the available literature to identify how birds respond to peatland restoration in temperate areas globally.

The review found that bird population responses may be dramatic and rapid, with marked abundance responses within 10 years and transformation of breeding bird communities in less than 20 years in cases where restoration is associated with change of land use. Bird responses often include increases in species of conservation concern, including those associated with wetlands, which globally are habitats that have suffered a high degree of conversion and fragmentation by agriculture and urban development.

Focussing on one study in more detail as a case study of restoration of upland water catchments in the UK, we examined the factors associated with bird responses. Over 9 years, restoration measures included grazing reduction, drain blocking, bog vegetation inoculation, conifer removal, native woodland planting and scrape creation. Of 18 bird species with sufficient data for analysis, restoration measures were associated with consistently positive population responses for five (European Golden Plover *Pluvialis apricaria*, Dunlin *Calidris alpina*, Eurasian Curlew *Numenius arquata*, Skylark *Alauda arvensis* and White-throated Dipper *Cinclus cinclus*) and consistently negative effects for only one (Meadow Pipit *Anthus pratensis*). Dipper response was associated with the overall package of restoration measures; management to raise water tables was associated with positive responses by Golden Plover, Curlew and Skylark, whilst bare peat revegetation was associated with positive responses by Dunlin and Curlew and a negative response by Meadow Pipit. Monitoring of breeding bird responses should be considered for evaluation of all landscape-scale peatland restoration interventions.

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Nick Wilkinson works on a range of applied ecological projects including avian responses to peatland restoration, work on farmland birds and detailed demographic studies of the response of twite to recovery measures.

OFFERED ORAL PRESENTATION

Ongoing efforts to save the critically endangered Liben Lark *Heteromirafra archeri* in Ethiopia

**Simon Wotton^{1*}, Nigel Collar², Sarah Havery¹, Rebecca Jefferson¹, Kariuki Ndang'ang'a³,
Mengistu Wondafrash⁴, Abduba Yacob⁵ & Paul Donald²**

¹ RSPB, The Lodge, Sandy Bedfordshire, SG19 2DL, UK.

² BirdLife International, Pembroke Street, Cambridge, CB2 3QZ, UK.

³ BirdLife Africa Partnership Secretariat, Volker's Garden on Terrace Close, Rhapta Road, Westlands, Nairobi, Kenya.

⁴ Ethiopian Wildlife and Natural History Society, Bole Sub City, PO Box 13303, Addis Ababa, Ethiopia.

⁵ SOS Sahel, PO Box 3262, Addis Ababa, Ethiopia.

* simon.wotton@rspb.org.uk | [@RSPBScience](https://twitter.com/RSPBScience)

The critically endangered Liben Lark *Heteromirafra archeri* is known from only two small grasslands in Ethiopia: the Liben Plain in southern Ethiopia and near Jijiga, c600km to the north-east (an area with significant security issues). The Liben Plain supports over 10,000 pastoralists with usufruct property rights, but has suffered from rangeland degradation through overgrazing, scrub encroachment, and conversion to crops, exacerbated by an increasing number of permanent settlements and the effects of severe drought.

A Darwin project was established on the Liben Plain in 2015, until March 2019. Using participatory rangeland management, the project worked to build capacity of the local pastoralists to create more sustainable livelihoods while restoring the grasslands and improving the habitat for the Liben Lark, through the creation of four communally managed grassland reserves (kallos). The kallos were managed by pastoralist communities to provide fodder for cattle during the dry seasons. However, the project was affected by a combination of political instability and the impacts of a severe drought over two years, 2015 to 2017.

On the Liben Plain numbers have declined since the first comprehensive survey in 2007, when 67 territories were found along 20 established transects, and the population estimated at 90-256 adults. A survey in June 2019 found just 13 territories on the transects, but most noticeable was that the kallos had fallen into disrepair in a short period.

To have a chance of saving the Liben Lark, the grassland in the area where birds were found in 2019 should be restored, by restoring the kallos and reducing grazing pressure, at least during the spring and autumn rainy seasons. At the same time, we need to understand why the kallos have

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not worked, through interviews with Liben Plain pastoralists, and to find a sustainable way to manage and restore the Liben Plain grasslands.

Simon Wotton is a Senior Conservation Scientist at the RSPB Centre for Conservation Science and is involved with single species surveys and large-scale monitoring projects, in the UK and in Africa
