Tracking migration:
drivers, challenges and consequences of seasonal movements

#BOU2019

BRITISH ORNITHOLOGISTS' UNION
2019 Annual Conference

UNIVERSITY OF WARWICK
26 – 28 March 2019

supported by

UNIVERSITY OF ICELAND

UNIVERSITY OF AMSTERDAM

universidade de aveiro

CEH Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

and

LOTEK WIRELESS
FISH & WILDLIFE MONITORING

PATHTRACK
Low Power GPS Solutions

nhbs
wildlife | ecology | conservation

wildlife ACOUSTICS

BOU

@IBIS_journal   @IBIS_journal   ibisjournal   英国鸟类学会会刊   BOU.ORG.UK

IBIS

THE INTERNATIONAL JOURNAL OF AVIAN SCIENCE

PUBLISHED BY THE BRITISH ORNITHOLOGISTS' UNION

WWW.IBIS.AC.UK

- No page charges
- Rapid publication after acceptance
- Online Accepted Articles
- Enhanced Article Format for improved viewing on smart devices
- ISI Journal Citation Reports © Ranking (2018)
  2-year IF 2.234 | 4/25 Ornithology
  5-year IF 2.152 | 4/25 Ornithology
- 159 years of papers to view online

Ordinary membership from £40 pa
**Early-career membership from £15 pa**
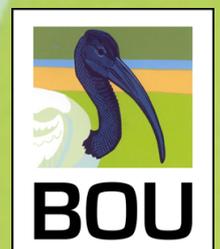
@IBIS_journal   @IBIS_journal   ibisjournal   英国鸟类学会会刊   BOU.ORG.UK

Keeping in touch with the **BOU** and **IBIS** has never been easier!

ibis.ac.uk
no. 1 journal in ornithology

@IBIS_journal
on Twitter

Ibisjournal
on Facebook

Ibis_journal
on Instagram

英国鸟类学会会刊
on Weibo
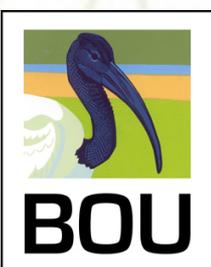
bou.org.uk
for newsletters, blogs, grants, conferences and more

nanoFix® - GPS TAGS FROM 0.95g

With tags ranging from 0.95g to 32g (400m depth variant) we have an extensive range of devices available, including UHF and GSM enabled devices tags that download data without the need to recapture animals. Our customizable devices also offer users a wide-range of solar and battery options depending on the target species. Rigorously tested packaging, combined with immersion sensors allow researchers to track deep-diving seabirds using the smallest and lightest GPS tags on the market.

Pathtrack deliver revolutionary data and outstanding customer support to assist your conservation and behavioural research. Please contact us for more information:

enquiries@pathtrack.co.uk

Field proven technology

nanoFix® tags have been successfully deployed around the globe on a wide variety of bird species, including:

Species	Tag Type
Storm petrels	0.95g GPS
Terns	2.6g GPS+UHF
Kittiwakes	4.2g GPS+UHF
Noddies	4.5g GPS+UHF
Puffins	8.3g GPS+UHF
Guillemots	11g GPS+UHF
Gulls	11g GPS+UHF
Penguins	24g & 32g GPS
Gannets	31g GPS+GSM

The **British Ornithologists' Union** (BOU)**,** founded in 1858 by Professor Alfred Newton FRS, is one of the world's oldest ornithological bodies. The BOU's aim is to promote ornithology and a better understanding of ornithology, birds and related issues, within the scientific and birdwatching communities.

To help achieve this aim, the BOU organises meetings, seminars and conferences at which ornithologists and others can discuss and learn more about work being undertaken around the world and topical ornithological issues.

The BOU has been organising conferences and meetings for over 100 years, and they provide an opportunity for people, from widely differing professional backgrounds, to explore and relate to a discrete scientific theme of common interest. Recent topics have included *Birds in upland and alpine habitats, Avian Food webs, Ecosystem Services: do we need birds?, Avian Tracking, Avian Food-webs, Ecosystem Services, Migratory Birds, Birds and Disturbance, Renewable Energy and Birds, Lowland Farmland Birds* and *Birds & Public Health*. Such meetings help to promote understanding of environmental issues and the sharing of knowledge, the presentation of contentious academic theories to critical public debate and the defence of such ideas lie at the heart of healthy science. The proceedings of many BOU conferences can be viewed for free online via WWW.BOUPROC.NET.

The BOU further achieves its aim by the quarterly publication of our international journal - *Ibis*. Established in 1859, *Ibis* - the world's leading ornithological journal - publishes work at the cutting edge of our understanding of the world's birdlife, be it behaviour, population dynamics, systematics, breeding biology, taxonomy, habitat use or conservation. IBIS is available in print and online – visit WWW.IBIS.AC.UK.

ACKNOWLEDGEMENTS

CONFERENCE PROCEEDINGS
Abstracts, papers and other items from the oral and poster papers presented at the conference will be published online at WWW.BOUPROC.NET. Some presentations may appear as full papers in *Ibis* and will then be linked to from the conference abstract.

PACK CONTENTS

LEICA NOCTIVID.
EXCEPTIONAL
VIEWING EXPERIENCE.

LEICA NOCTIVID 10 x 42

Named after the *Athene noctua*, the symbol of wisdom, knowledge and insight, the compact Leica
Noctivid offer the perfect balance of attributes for crystal clear viewing experiences.

Leica is proud to support the Wildfowl & Wetland Trust's
'Saving the Spoon-billed Sandpiper' project.

Leica Store Mayfair │ 64-66 Duke Street │ W1K 6JD │ www.leica-sportoptics.com

Welcome to #BOU2019 – the BOU's 2019 Annual Conference

The annual BOU conference for 2019 is themed *Tracking migration: drivers, challenges and consequences of seasonal movements*. This is a very timely and exciting conference topic, and we are delighted that it has attracted so many ornithologists from around the world.

Avian migration has long captured our imagination, and recent advances in tracking technology have allowed us to study the migratory movements and behaviour of a wide range of species in unprecedented scope and detail.

Over the coming days, ornithologists and ecologists from a variety of institutions and organisations in the UK and internationally will explore recent advances in our understanding of avian migration through the innovative use of diverse tracking techniques, from continental-scale connectivity, through energetics, flight behaviour, navigation and social learning, to responses to environmental change and implications for species conservation.

We try to make BOU conferences as welcoming as possible for everyone. Those attending a BOU conference for the first time have 'N E W' on their name badge, so please be especially welcoming to the new members our BOU family.

We very much hope that you enjoy the conference.

Prof. Keith Hamer | BOU President

Code of Conduct

We have always taken it for granted that BOU events are safe for all participants, but in light of difficulties experienced by other societies, we have drawn up this simple code for all BOU events.

We welcome everyone to BOU events, be these in person at our conferences, meetings and workshops, or online events such as Twitter conferences.

We work hard to engender and promote a welcoming environment that is collaborative, supportive and engaging for everyone involved. Our events provide opportunities to share, develop and broaden viewpoints in a safe and inclusive environment.

We celebrate diversity in all its forms and expect that all our participants are respectful and considerate of each other, that they provide supportive critique, and embrace the multitude of opinions that are on offer.

If you have any concerns, or feel that any participant of an event has breached this code, or have suggestions for how we can make our events more inclusive and productive, please contact any member of the BOU staff, BOU's Meetings Committee or event organisers (named contacts are listed in all event programmes).

During an event, please report any incident as soon as you feel able, to allow us to act upon your concerns. Any reports will be handled in confidence.

Your primary contacts for any issues that may arise during this conference are:

Juliet Vickery
BOU Vice President
Chair, Equality & Diversity
Working Group

Steve Dudley
BOU Chief Operations Officer

Angela Langford
BOU Journal & Office Manager

Your conference menus

The University of Warwick has Bronze level accreditation with the Soil Association's Food For Life Catering Mark. This demonstrates the University's commitment to ethical, sustainable and fresh food.

The University's lunch and dinner menus have met these standards, which means:

- At least 75% of dishes on its menus are freshly prepared from unprocessed ingredients
- The University buys all meat from farms satisfying UK Animal Welfare standards
- No fish is served from the Marine Conservation Society 'fish to avoid' list
- Eggs are from free range hens
- No undesirable additives or artificial trans fats are used
- No genetically modified ingredients are used
- Free drinking water
- Menus are seasonal and all in-season produce is highlighted
- Information on food provenance is available on request
- Menus provide for all dietary and cultural needs

Working with your conference host, the menus for this event have been selected to help reduce the impact on the environment so contain no beef, lamb or seafood.

EVENTS

#BOUsci19
22 November 2019
Newcastle University
More from Moors

#BOU2020
7–9 April 2020
University of Nottingham, UK
'Restoration'

@IBIS_journal   @IBIS_journal   ibisjournal   英国鸟类学会会刊   BOU.ORG.UK
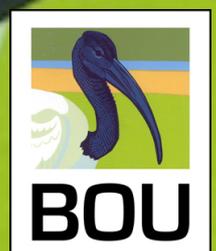
BOU

Tracking Migration: drivers, challenges and consequences of seasonal movements

26 – 28 March 2019 | University of Warwick, UK

PROGRAMME

Presenting authors are listed below. All authors of multiple-author papers are included within the abstracts. Unless stated, the venue is the Ramphal building.

TUESDAY, 26 MARCH 2019

1700	Registration opens
1700 – 2200	Time to view posters and exhibitors/shops

1900	**DINNER**	Hot-buffet in Ramphal Building Foyer

2030   **Welcome** | Keith Hamer | BOU President | University of Leeds, UK | 🐦 @KeithCHamer

ALFRED NEWTON LECTURE

Using waterbird telemetry data to support freshwater wetland conservation in China

Lei Cao | RCEES, Chinese Academy of Sciences, China

– 2200   Time to view posters, exhibits, shops and displays
No access to Ramphal Building after 2200

– 0000   **BAR |** Terrace Bar (Students Union) (to 0000)
NOTE: Both the Dirty Duck and the Rootes bar are closed due to a private functions

WEDNESDAY, 27 MARCH 2019

0730	**BREAKFAST**	Rootes Restaurant

0830   Registration opens

0900   **Conference opening**
Keith Hamer | BOU President | University of Leeds, UK

SESSION 1   **CONTINENTAL AND FLYWAY SCALE TRACKING**

0905   **KEYNOTE**
Bright lights in the big cities: migratory birds' exposure to artificial light
Kyle Horton | Cornell Lab of Ornithology, US | 🐦 @Kyle__Horton / @CornellBirds

0935   **Space-time interpolation of nocturnal bird migration at continental scale using weather radar**
Raphaël Nussbaumer | University of Lausanne, Switzerland (ECR presenter)

0950   **Consistent patterns despite different environmental conditions? How environment affects bird migration patterns over Europe**
Annika Aurbach | ETH Zürich, Switzerland (ECR presenter)

WEDNESDAY, 27 MARCH 2019 (CONT)

1005 **ARUs: an effective technique for monitoring the European Bee-eater migration**

Cristian Pérez-Granados | Universidad Autónoma de Madrid, Spain (ECR presenter)

1020 **Forecasting bird migration at continental scales**

Benjamin M. Van Doren | University of Oxford, UK | 🐦 @egioxford (ECR presenter)

1035 **SPEEDY POSTERS**

Each poster author has just 30 seconds to introduce their work – it's fast and it's fun!

The work of the BOU's Equality & Diversity Working Group (EDWG)

Juliet Vickery | BOU Vice President & Chair, EDWG | RSPB Centre for Conservation Science, UK

1045 **COFFEE** | serving points in foyer and two side rooms (see floor plan)

Time to view posters, exhibits, shops and displays

SESSION 2 **Connectivity and range shifts**

1130 **KEYNOTE**

Range-scale responses of migratory birds to climate change

James Gilroy | University of East Anglia, UK | 🐦 @j_gilroy1 / @uniofeastanglia

1200 **Contrasting migration and wintering movement strategies of two distinct populations of Red-necked Phalarope breeding in the Western Palearctic**

Yann Kolbeinsson | Northeast Iceland Nature Research Centre, Iceland

1215 **Migration of wild and captive bred Asian Houbara**

Yves Hingrat | Reneco International Wildlife Consultants, United Arab Emirates

1230 **Tracking seabird migration to identify priority areas for their conservation**

Maria Dias | Birdlife International, UK | 🐦@BirdLife_news

1245 **LUNCH** | Buffet in Ramphal Foyer

Time to view posters, exhibits, shops and displays

SESSION 3 **ENERGETICS, FLIGHT BEHAVIOUR, NAVIGATION AND SOCIAL LEARNING**

1415 **KEYNOTE**

The high altitude ecology and physiology of the Bar-headed Goose

Lucy Hawkes | University of Exeter, UK | 🐦 @DrLucyHawkes

1445 **Flight behaviour in individual songbirds throughout the migration**

Sissel Sjöberg | University of Copenhagen, Denmark | 🐦@SisselSjoberg (ECR presenter)

1500 **Thermal soaring by raptors over temperate seas: the Osprey exception?**

Flavio Monti | Université Paul-Valéry Montpellier, France (ECR presenter)

#BOU2019

Tracking Migration: drivers, challenges and consequences of seasonal movements

26 – 28 March 2019 | University of Warwick, UK

WEDNESDAY, 27 MARCH 2019 (CONT)

1515 **Migration distance and body condition drive shorebird migration strategies and stopover decisions during southbound migration**
Alexandra M. Anderson | Trent University, Canada | 🐦@aande763 / @TrentUniversity (ECR presenter)

1530 **The influence of haemosporidian infections on flight bout durations, resting times and flight height in long-distance migratory Great Reed Warblers**
Tamara Emmenegger | Swiss Ornithological Institute | 🐦@tavimalara / @Vogelwarte_scie (ECR presenter)

1545 **TEA** | serving points in foyer and two side rooms (see floor plan)
Time to view posters, exhibits, shops and displays

SESSION 4 **MIGRATION, LIFE-HISTORIES AND POPULATION DYNAMICS**

1630 **Life-history variation shapes migratory behaviour in bird**
Andrea Soriano-Redondo | University of Exeter, UK | 🐦@SorianoRedondo / @UniExeCornwall (ECR presenter)

1645 **European Turtle Doves migrating over sea and desert: links with population trends**
Francesc Sardà-Palomera | CTFC – Forest Sciences Center of Catalonia, Spain

1700 **Migration routes and winter ranges of Egyptian Vultures tracked from the Douro Valley, Spain-Portugal: the challenge of insecurity**
Louis Phipps | Vulture Conservation Foundation, the Netherlands | 🐦@louis_phipps / @4Vultures

1715 **Strong head-winds during Sahara crossings increase in-flight mortality rates of Black-tailed Godwits**
Jelle Loonstra | University of Groningen, the Netherlands | 🐦@univgroningen (ECR presenter)

1730 **Testing times: post-fledging movements, behaviour and survival in a long-lived migratory seabird**
Jude Lane | University of Leeds, UK | 🐦@heyjooode / @UniversityLeeds

1800 **BOU AGM** (Ramphal lecture theatre)

1830 **BOU ECR EVENT** (First floor, Ramphal Building)

– 1945 Time to view posters, exhibits, shops and displays
<u>No access to Ramphal Building after 2000</u>

2000 **CONFERENCE DINNER** (Panorama Suite, Rootes Building)

– 0000 **BAR |** Panorama Suite (to 0000)

#BOU2019
Tracking Migration: drivers, challenges and consequences of seasonal movements

26 – 28 March 2019 | University of Warwick, UK

THURSDAY, 28 MARCH 2019

| 0730 | **BREAKFAST** | Rootes Restaurant |

| 0830 | Registration opens |

SESSION 5 — **PARTIAL MIGRATION, MIGRATORY STRATEGIES, FITNESS TRADE-OFF**

0900 — KEYNOTE
Partial migration and population dynamics in a seasonally inhospitable world
Jane Reid | University of Aberdeen, UK | 🐦@aberdeenuni

0930 — Favourable energy balance, but poor fitness, in Sanderlings wintering in tropical rather than temperate zones
Jeroen Reneerkens | University of Groningen, the Netherlands | 🐦@J_Reneerkens / @univgronin

0945 — Are tropicbirds resident or migrant? Migratory patterns of Red-billed Tropicbird in multiple Atlantic colonies
Sarah Saldanha | Universitat de Barcelona, Spain | 🐦@SarahSaldanha1 / @UniBarcelona

1000 — Do timing delays and winter site quality carry-over to influence productivity in Icelandic Whimbrel?
Camilo Carneiro | University of Aveiro, Portugal | 🐦@Camilo_Carneiro (ECR presenter)

1015 — Does landfill use influence the speed and efficiency of first-year migration in a partially migratory species?
Kate Rogerson | University of East Anglia, UK | 🐦@Katiebee1991 / @uniofeastanglia
(ECR presenter)

| 1030 | **COFFEE** | serving points in foyer and two side rooms (see floor plan) |
Time to view posters, exhibits, shops and displays

SESSION 6 — **DISPERSAL, SETTLEMENT AND ONTOGENY**

1115 — KEYNOTE
Tracking Spoonbill migration in a changing world: from patterns to mechanisms
Tamar Lok | NIOZ Royal Netherlands Institute for Sea Research and Utrecht University, the Netherlands | 🐦@TamarLok

1145 — An ontogenetic perspective on migration learning and critical life-history traits in raptors
Wouter M.G. Vansteelant | Estación Biológica de Doñana (CSIC), Spain| 🐦@WMGVs
(ECR presenter)

1200 — Understanding individual differences in migratory behaviour: an ontogenetic approach
Mo A. Verhoeven | University of Groningen, the Netherlands
🐦@VerhoevenMo / @univgroningen (ECR presenter)

THURSDAY, 28 MARCH 2019 (CONT)

1215 — **The role of dispersal in adaptation to climate change: an experimental approach**

Koosje Lamers | University of Groningen, the Netherlands | 🐦 @KoosjeLamers / @univgroningen

1230 — **Wintering grounds and summer vagrancy of young Red Kites from central Europe on a continental scale**

Ivan Literák | University of Veterinary and Pharmaceutical Sciences Brno, Czech Republic

---

1245 — **LUNCH** | Ramphal Foyer

Last chance to view posters, exhibits, shops and displays

1400 — Voting for best ECR presentations closes

SESSION 7 — **MIGRATORY SCHEDULES, RESPONSES TO ENVIRONMENTAL CHANGE**

1415 — **KEYNOTE**

Seabird migration in the anthropocene

James Grecian | University of St Andrews, UK | 🐦 @JamesGrecian / @univofstandrews

1445 — **Long-distance migratory shorebirds travel faster in spring, but fly faster in autumn**

Sjoerd Duijns | Carleton University, Canada | 🐦 @SjoerdDuijns / @Carleton_U

1500 — **The protandry paradigm revisited: is migration timing sex-specific throughout the annual cycle?**

Martins Briedis | Swiss Ornithological Institute, Switzerland | 🐦 @biobriedis / @Vogelwarte_scie (ECR presenter)

1515 — **Does migration timing hamper the advancement of laying dates in Arctic migratory birds?**

Thomas K. Lameris | Royal Netherlands Institute for Sea Research (NIOZ), the Netherlands
🐦 @thomaslameris (ECR presenter)

1530 — **Evidence for evolution in the advancing phenology of a migratory bird**

Barbara Helm | University of Groningen, the Netherlands | 🐦 @BBirdClocks / @univgroning

1545 — **Closing summary**

Close of conference

Keith Hamer | BOU President | University of Leeds, UK

AFTERNOON TEA and departure

IBIS

THE INTERNATIONAL JOURNAL OF AVIAN SCIENCE

PUBLISHED BY THE BRITISH ORNITHOLOGISTS' UNION

WWW.IBIS.AC.UK

- **No page charges**
  Open Access options available

- **Fast turnaround**
  We aim to give first decision within eight weeks of submission

- **Fast publication**
  Accepted version online seven days after acceptance; final version published Early View four weeks after acceptance

- **Promotion**
  No society journal works harder to promote your paper on social media; email alerts sent to over 3,000 registrants; monthly e-newsletters sent to over 7,500 subscribers

- **Altmetrics**
  Highest scoring journal in ornithology

@IBIS_journal   @IBIS_journal   ibisjournal   英国鸟类学会会刊   BOU.ORG.UK
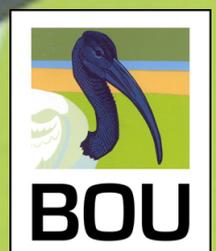
BOU

ABSTRACTS

Abstracts for the oral programme are in programme order. Poster abstracts (page 55) are in alphabetical order on the surname of the presenting author.

TUES, 26 MARCH, 2030 h

Alfred Newton Lecture

Professor Lei Cao

Regional Ecology, Research Center for Eco-Environmental Sciences (RCEES), Chinese Academy of Sciences, China

Using waterbird telemetry data to support freshwater wetland conservation in China

Despite attention focused on coastal wetland loss in China, freshwater habitat is also subject to rapid loss. Declines in migratory waterbirds overwintering on the Yangtze River Floodplain since the early 2000s contrast with the favourable conservation status of the same species elsewhere in Far East Asia. Evidence suggested that factors away from Chinese wintering grounds could contribute, but we lacked waterbird flyway definition to understand where along their migratory corridors these species were potentially being impacted. Recent deployment of over 2000 telemetry devices on 42 species of waterbird throughout Far East Eurasia confirmed the Yangtze River Floodplain's outstanding importance for wintering cranes, herons, ducks, geese, swans and wading birds, breeding from western Yamal (70°E) to Anadyr (180°E) in the Russian Arctic, throughout the eastern Russian taiga forest, the Mongolian steppes and temperate China.

Unlike farmland-feeding waterbirds in Europe, North America, Japan and Korea, telemetry showed that Yangtze River Floodplain waterbirds are prisoners of their wetland wintering habitat, trapped by economic development, disturbance and heavy persecution. Continued wetland loss and degradation has therefore affected all species along their migratory flyways. Specialist-feeding wintering

waterbirds are increasingly concentrated at Poyang Lake (PL 29°8'N, 116°17'E) because of large inundation area (1,400 km^2), exceptional water quality (the "last pot of clear water" in the Yangtze River Floodplain) and nature protection measures. Telemetry data has also shown how recent proposals to construct dams around PL will affect water level recession patterns and waterbird feeding at the last major Yangtze River Floodplain wetland of global significance, necessitating swift action to safeguard the site and its waterbirds for future generations.

Professor Lei Cao of RCEES at the Chinese Academy of Sciences, researches effects of climate change, habitat destruction and human disturbance on movement patterns, distribution and abundance of migratory waterbirds on the East Asian-Australasian Flyway. Professor Cao's group has combined deployment of cutting-edge telemetry devices with international waterbird monitoring and research throughout Eurasia to generate a better understanding and create a basis for their effective future conservation. Professor Cao has published over 60 articles on ecology, ornithology and multidisciplinary sciences in international journals including *Nature, Current Biology, Biological Conservation, Ibis, Ambio, Aquatic Ecology, Aquatic Conservation* and *The Condor*.

WEDS, 27 MARCH, 0905 h

KEYNOTE

Bright lights in the big cities: migratory birds' exposure to artificial light

Kyle Horton

Cornell Lab of Ornithology, US

kgh48@cornell.edu 🐦 @Kyle__Horton

Billions of migratory birds fill the airspace over North America each spring and fall. Many species of migratory birds have evolved the capacity to migrate at night, and the recent and rapid expansion of artificial light at night has dramatically altered the nighttime sky through which they move. But risks to migrating birds from artificial light are not spatially nor temporally uniform, representing a primary challenge for mitigating potential hazards and developing action plans to catalog risks. I will draw from work leveraging more than two decades of weather surveillance radar data to quantify nocturnal migration, revealing how this remote-sensing platform can be used to identify threats from local to continental scales. Understanding when and where migrants pass, particularly the number of nights that comprise the majority of aerial movements, is of great conservation importance to simplifying this complex problem. I will show how we map seasonal and spatial relationships of these movements and how machine learning approaches can be used to forecast these events. This

investigation highlights the challenge and value of targeted aerial threat mitigation, especially in the face of increasing risks to migrating birds from light pollution, wind energy, and collisions with structures.

Kyle Horton received his BS in Biology from Canisius College, US in 2011, MS in Wildlife Ecology from the University of Delaware, us in 2013, and PhD in Ecology and Evolutionary Biology from the University of Oklahoma, US in 2017. He is currently a Rose Postdoctoral Fellow at the Cornell Lab of Ornithology. His work on migratory birds employs a range of tools and approaches, including the use of radar, acoustics, and citizen science data.

WEDS, 27 MARCH, 0935 h | ECR PRESENTER

Space-time interpolation of nocturnal bird migration at continental scale using weather radar

Raphaël Nussbaumer[1]*, Lionel Benoit[2], Baptiste Schmid[3], Grégoire Mariethoz[2] & Felix Liechti[3]

[1] Institute of Earth Sciences, University of Lausanne, Lausanne, Switzerland

[2] Institute of Earth Surface Dynamics, University of Lausanne, Lausanne, Switzerland

[3] Swiss Ornithological Institute, Sempach, Switzerland

* raphael.nussbaumer@unil.ch

Exhaustive 4D information of bird migration intensity with high spatio-temporal resolution has the potential to reveal detailed bird migration mechanisms, such as the importance of specific stopover sites, or varying migration patterns related to weather types or climate change. The use of weather radars in the field of ecology has created an exceptional opportunity for providing such rich datasets. However, although radars are scattered over extensive areas, their individual spatial coverage is limited, thus leading to large gaps between observations. As a result, the effective information about bird migration is a (multi-)point process, and interpolation is required to have the global picture of the migration. Classical geostatistical methods provided in standard packages fall short to provide accurate estimates and uncertainty at the targeted high resolution.

In this study, we created a geostatistical methodology specifically adapted to model and interpolate the areal density of nocturnal migrant birds. One advantage of this method is to rely uniquely on the space-time correlation contained in the data to obtain predictions at unknown locations, therefore it does not need covariates as is typically the case for machine learning approaches. The result is a set of maps of bird migration density at high resolution (15 min in time, 0.2° lat-long in space) together with the associated uncertainty induced by the interpolation process.

The proposed method is tested on a dataset covering North-Western Europe for a part of the 2016 autumn migration, and the results are validated by a cross-validation procedure and a comparison with independent X-band radar measurements. The results (available at www.zoziologie.raphaelnussbaumer.com/bmm-map) are promising and pave the way for an operational interpolation of bird migration data collected continuously by large networks of weather radars.

Raphaël Nussbaumer is an environmental scientist finishing his PhD on the integration of complex spatial datasets in the field of hydrogeophysics. As a keen ornithologist, he is now working on applying these geostatistical methods to avian datasets.

WEDS, 27 MARCH, 0950 h | ECR PRESENTER

Consistent patterns despite different environmental conditions? How environment affects bird migration patterns over Europe

Annika Aurbach[1]*, Baptiste Schmid[2], Felix Liechti[2], Ndaona Chokani[1] & Reza Abhari[1]

[1] Laboratory for Energy Conversion, ETH Zürich, Sonneggstrasse 3, CH–8092 Zurich, Switzerland

[2] Swiss Ornithological Institute, Seerose 1, CH–6204 Sempach, Switzerland

* aurbacha@lec.mavt.ethz.ch

The spatial and temporal patterns of broad front bird migration are governed by the distributions of landmasses, mountain ranges, and weather conditions. These conditions influence migration performance including energy consumption, and timing of departure and landing, and are therefore crucial to the survival of birds through the migration season. Hence, migrants prefer favourable environmental conditions, which consequently lead to concentrations of migration, and to the evolution of migratory flyways.

To learn more about the drivers of these temporal and spatial concentrations, we developed a computational framework to simulate Europe-wide nocturnal passerine migration at the resolution of individual birds using an agent-based simulation approach.

We simulated the autumn migration of the ten most abundant Palaearctic long-distance migrants. The spatial and temporal distributions of millions of migratory birds are modelled at a temporal resolution of 30 seconds along the western European flyway. We modelled the behavioural responses of the individual birds to the environment as presented by the wind flow as well as geographic barriers such as oceans and mountain ranges. The spatial and temporal variations of the wind flow are simulated using a mesoscale weather simulation tool; the geographic barriers are

detailed from high spatial resolution satellite imagery. The recently available Europe-wide weather radar data provide the initial spatial and temporal intensities of simulated birds.

A goal of this work is to predict the continental-wide bird movements in order to provide insights on how the environment modulates birds' movement patterns as well as the birds' energy conditions. In this study we focus on a relatively short period of autumn migration to describe in detail the interconnectedness of environmental conditions and migration intensity patterns on a European level.

Annika Aurbach is a computational biologist with a main research focus on modelling movement behaviour. Currently her primary work is the implementation of a temporal and spatially explicit forecast model for bird migration patterns over Europe to predict areas of high collision risk with renewable energies such as wind turbines.

WEDS, 27 MARCH, 1005 h | ECR PRESENTER

ARUs: an effective technique for monitoring the European bee-eater migration

Cristian Pérez-Granados[1,3], Juan Traba[1], David Girat[2], Francesc Sardà-Palomera[2] & Gerard Bota[2]

[1] Terrestrial Ecology Group (TEG-UAM), Department of Ecology, Universidad Autónoma de Madrid, Madrid, Spain.

[2] Biodiversity and Animal Conservation Lab. Landscape dynamics and Biodiversity programme. Forest Sciences Center of Catalonia (CTFC), Solsona, Catalonia, Spain.

[3] National Institute for Science and Technology in Wetlands (INAU), Federal University of Mato Grosso (UFMT), Computational Bioacoustics Research Unit (CO.BRA), Cuiabá, Mato Grosso, Brazil.

[*] cristian.perezg@uam.es.

Autonomous Recording Units (ARUs) has widespread as an effective and efficient alternative for monitoring vocally active wildlife. Many birds utter flight calls while migrating, and therefore recording of flight calls provide information on the migration behaviour for some species. In this paper we aimed to elucidate whether ARUs might be used to monitor the migration period for the European Bee-eater *Merops apiaster* in Northeastern Spain.

We monitored daily 3-4 acoustic monitoring stations (placed around beehives, one ARU per station, programmed to record during 30 minutes at six specific diurnal day-times (from 9:00 to 19:00) from 11 August to 20 September 2017. Beehives are known to be feeding areas for bee-eaters during diurnal migration where they make short-stops for feeding. . Recordings were analysed automatically using Song Scope 4.1.5.

In total, we collected 734 30-mins recordings (367 hours of recording) during the study period. We found a high and significant correlation (R^2 = 0.690, P < 0.001) between number of calls per recording and European Bee-eater abundance flying around ARUs estimated by human surveys. European Bee-eater migration in the study area peaked during the last week of August and was significantly higher during the first and last hours of the day, in agreement with prior results obtained in the study area by traditional field counts.

We have shown that ARUs can be considered as a viable tool for surveying migration of the European Bee-eater on their stopovers. Our results might be also applied for other migrating fauna and it would allow researchers to amplify the spatial and temporal scales of the migration period.

Cristian Pérez-Granados is a biologist focused on steppe-bird conservation, but he is also interested in the development of Autonomous Recording Units for monitoring different aspects of birds' life, such as habitat occupancy, timing of migration or the predator-prey interaction.

WEDS, 27 MARCH, 1020 h | ECR PRESENTER

Forecasting bird migration at continental scales

Benjamin M. Van Doren[1]* & Kyle G. Horton[2]

[1] Edward Grey Institute, Department of Zoology, University of Oxford, Oxford OX1 3PS, UK

[2] Cornell Lab of Ornithology, Cornell University, Ithaca, NY 14850, USA

* Email: benjamin.vandoren@zoo.ox.ac.uk 🐦 @bvdbirds

Billions of migratory birds cross the globe each year, and monitoring birds during migration provides important information on avian populations and ecology. However, monitoring efforts can be hampered by the unpredictability of birds' movements, which typically occur in spatiotemporally irregular pulses across the landscape. In this study, we applied machine learning methods to forecast the atmospheric distributions of migrating birds at a continental scale. We used over two decades of weather radar observations from 143 stations across the continental United States to identify associations between atmospheric conditions and bird migration intensity. Our models explained up to 81% of variation in migration intensity at altitudes up to 3000 meters, and performance remained high in forecasting events 1 to 7 days in advance. We identified key differences in the environmental correlates of migration between spring and autumn: in spring, air temperature was the dominant atmospheric covariate associated with migration intensity, while in autumn winds were more important. This contrast may reflect a seasonal difference in time and energy minimization strategies. Summing model predictions across the country, we found that avian migratory movements over the

United States likely exceed 500 million individuals per night during peak passage. Bird migration forecasts have the potential to reduce collisions with buildings, airplanes, and wind turbines, inform a variety of monitoring efforts, and engage the public with the often-unseen phenomenon of nocturnal bird migration.

Benjamin Van Doren studies bird migration across scales, from individuals to continents. Currently a PhD student, he focuses on change and flexibility in migration and how environmental and endogenous drivers shape migratory behaviour.

WEDS, 27 MARCH, 1130 h

KEYNOTE

Range-scale responses of migratory birds to climate change

James Gilroy

University of East Anglia, UK

J.Gilroy@uea.ac.uk 🐦 @j_gilroy1

Species distributions are limited, at least in part, by the suitability of local climatic conditions. With climate change, zones of climatic suitability for many species are shifting in space, meaning that species must either adapt to novel conditions within their current ranges, or shift their distributions by colonizing new sites. Migratory species face a unique challenge in this context, because they occupy multiple different areas across the course of the annual cycle, each characterised by their own set of bioclimatic conditions. Zones of climatic suitability at each stage of the migratory programme could therefore shift independently in space as the climate warms. In the absence of adaptation to new climates, migrants might need to track these season-specific shifts concomitantly, potentially necessitating changes in migratory distance and/or direction in order to colonize new areas of suitability. This presentation will explore the complex ways in which migratory species are responding to this challenge, using insights from long-term citizen science datasets, model-species case studies and evolutionary simulations. We will examine the extent to which migratory programmes are flexible enough to allow species to track multiple shifting climate envelopes, and explore how flexibility varies across different stages of the migratory cycle. Challenges and frontiers in this field will be explored, as well as the wider conservation implications of climate change for migratory birds.

James Gilroy is a Lecture in Ecology at University of East Anglia. His research combines ecological modelling, large-scale spatial analysis and field-based empirical studies to examine how movement behaviour influences the way species respond to environmental change. Alongside his work on migratory birds, he has a strong interest in exploring how human land-use decisions can be optimised to protect biodiversity, particularly in the tropics.

WEDS, 27 MARCH, 1200 h

Contrasting migration and wintering movement strategies of two distinct populations of Red-necked Phalarope breeding in the Western Palearctic

Yann Kolbeinsson[1]*, Rob S.A. van Bemmelen[2], Olivier Gilg[3,4], Malcolm Smith[5], Jose A. Alves[6,7], Aleksi Lehikoinen[8], Hans Schekkerman[9], Raül Ramos[10], Ib Krag Petersen[11], Böðvar Þórisson[7], Aleksandr A. Sokolov[12], Kaisa Välimäki[8], Tim van der Meer[13], J. David Okill[14], Mark Bolton[15], Børge Moe[16], Sveinn Are Hanssen[17], Loïc Bollache[3,4], Aevar Petersen[18], Sverrir Thorstensen[19], Jacob González-Solís[10], Ingrid Tulp[2] & Raymond H.G. Klaassen[20]

[1] Northeast Iceland Nature Research Centre, Hafnarstétt 3, 640 Húsavík, Iceland

[2] Wageningen Marine Research, the Netherlands

[3] Chrono-environnement, UMR 6249, Université de Bourgogne Franche-Comté, 16 route de Gray, 25000 Besançon, France

[4] Groupe de Recherche en Ecologie Arctique, 16 rue de Vernot, 21440 Francheville, France

[5] RSPB Scotland, The Baelans, Fetlar, Shetland, ZE2 9DJ, UK

[6] CESAM, University of Aveiro, Campus de Santiago, 3810-193 Aveiro, Portugal

[7] South Iceland Research Centre, University of Iceland, Lindarbraut 4, 840 Laugarvatn, Iceland

[8] The Helsinki Lab of Ornithology (HelLO), Finnish Museum of Natural History, FI-00014 University of Helsinki, Finland

[9] SOVON, Dutch Centre for Field Ornithology, Toernooiveld 1, 6525 ED Nijmegen, the Netherlands

[10] Department of Evolutionary Biology, Ecology and Environmental Sciences (BEECA), Faculty of Biology, Biodiversity Research Institute (IRBio), Universitat de Barcelona, Av Diagonal 643, 08028 Barcelona, Spain

[11] Department of Bioscience - Wildlife Ecology, Department of Bioscience, Science and Technology, Aarhus University, Denmark

[12] Arctic Research Station of Institute of Plant and Animal Ecology, Ural Branch, & Russian Academy of Sciences, Russia

[13] Castricum, the Netherlands

[14] Heilinabretta, Trondra, Shetland, ZE1 0XL, UK

[15] RSPB Centre for Conservation Science, Sandy, UK

[16] Norwegian Institute for Nature Research (NINA), Pb 5685 Sluppen, NO-7485, Trondheim, Norway

[17] Norwegian Institute for Nature Research (NINA), Fram Centre, Tromsø, Norway

[18] Brautarlandi 2, 108 Reykjavík, Iceland

[19] Lönguhlíð 9a, 603 Akureyri, Iceland

[20] Dutch Montagu's Harrier Foundation, Conservation Ecology Group, Groningen Inst. for Evolutionary Life Sciences (GELIFES), Groningen Univ., PO Box 11103, NL-9700 CC, Groningen, the Netherlands.

* yann@nna.is

Non-breeding movement strategies of migratory birds are expected to be flexibly adjusted to the distribution and quality of habitat, but only few studies compare movement strategies between populations using distinct migration routes and wintering areas.

In this study we explore the individual movement strategies of Red-necked Phalaropes *Phalaropus lobatus*, a species breeding in Arctic tundras but with a pelagic lifestyle in the non-breeding period. By collating geolocator data from nine sites between Greenland and Yamal, we show that two distinct migration routes and wintering areas occur within the Western Palearctic. Breeding populations from Greenland, Iceland and Scotland show a ~9200 km westward migration to the northern Humboldt Current in the Pacific, whereas those breeding in Scandinavia and Russia migrate ~6000 km to winter in the Arabian Sea. We use the contrast in availability of suitable stopover habitat along the migration routes and the difference in spatio-temporal variation in ocean productivity at the two wintering areas, to study differences in migration and winter movement strategies.

Migrations to and from the Pacific were performed with more frequent but shorter stopovers in autumn and at a higher migration speed in spring than migrations to and from the Arabian Sea. At the wintering grounds, individuals were resident in the stable conditions in the Humboldt Current but generally itinerant (i.e. using multiple sites) in the much more dynamic Arabian Sea. This study is one of few showing adjustment of large-scale movement strategies in response to habitat within a species. It also highlights the value of large international collaborations.

Yann Kolbeinsson is a biologist mainly focused on researching/monitoring cliff-nesting species around Iceland, as well as monitoring breeding waterbirds and open-land bird populations in northeast Iceland. Him and his colleagues have used geolocators in recent years as an important tool for better understanding population fluctuations of seabirds.

WEDS, 27 MARCH, 1215 h

Migration of wild and captive bred Asian Houbara

Yves Hingrat

Reneco International Wildlife Consultants, LLC. PoBox 61741, Abu Dhabi, UAE

yhingrat@reneco-hq.org

Asian migrant Houbara has benefited from population reinforcement since 2009 using captive-bred houbara (CBH). From 2009 to 2017, about 10 000 migrant Houbara were released in several sites in Kazakhstan and Uzbekistan. Different release trials were conducted either in late summer (prior to

Tracking Migration: drivers, challenges and consequences of seasonal movements

26 – 28 March 2019 | University of Warwick, UK

fall migration) or in spring (after spring migration). The monitoring of 741 captive-bred juveniles, equipped with GPS-satellite transmitters, showed that CBH migrate but their survival after full migration greatly varied between countries, release sites, years and season of release. After late summer release, return rates ranged from 14.4 to 57.4% in Kazakhstan and from 21.9 to 55.1% in Uzbekistan. After spring release in Uzbekistan, average return rate (51.4%) was higher compared to late summer release (34.5%). Using daily locations from 174 wild juveniles and 282 CBH which completed a full migration, we tested the effects of latitude, bird origin and season of release on departure dates, migration distance, migration duration, duration on stopovers and 'ground time' (time on breeding and wintering grounds). Globally, in Kazakhstan and in Uzbekistan, CBH departed later, migrate shorter distances and spend more time on stop overs as well as on wintering and breeding grounds when compared to wild Houbara. However, the latitude of release sites and years also had significant effects on migration parameters, while sample sizes between wild and CBH were not balanced through time and space. Interestingly, when controlling for site and year, Houbara released in spring departed at the same time than wild juveniles; whereas birds released in fall departed 7 days later. Our results highlight (1) the importance of the release method (timing of release) on the performances of translocated animals and (2) the importance and challenge of long-term and large-scale monitoring to uncover spatial and temporal sources of variation of animal demographics and avoid generalizing results gathered locally.

Yves Hingrat is a biologist which research focus on ecology and behaviour of bustards, mainly the North African and Asian Houbara bustard species. His researches aim improving conservation programmes on bustards combining in-situ ad ex-situ conservation actions for the restoration of houbara populations.

WEDS, 27 MARCH, 1230 h

Tracking seabird migration to identify priority areas for their conservation

Maria Dias [1,2]*, Martin Beal[1,2] , Ana Carneiro[1], Paulo Catry[2], Tammy Davies[1] & Lizzie Pearmain[1]

[1] Birdlife International, The David Attenborough Building, Pembroke Street, Cambridge, CB2 3QZ, UK

[2] MARE – Marine and Environmental Sciences Center, ISPA - Instituto Universitário, Rua Jardim do Tabaco 34, 1149-041 Lisboa, Portugal.

* maria.dias@birdlife.org

Many seabird species are long distance migrants that cover large areas of the ocean throughout their annual cycles. Seabirds are also one of the most threatened groups of birds, and tackling the threats they face, especially while at-sea, requires a good understanding of their seasonal movements to ensure effective protection of the key areas they use.

Tracking has proved to be a fundamental tool in seabird conservation, as it offers crucial information on the distribution patterns of individuals and populations. Some well-known applications include mapping the overlap between seabird distributions and threats such as fisheries by-catch, or the use of tracking data to identify marine Important Bird and Biodiversity Areas during different stages of the breeding cycle.

In this study we present a review of the use of tracking data in the conservation of migratory seabirds, along with some knowledge gaps, major challenges and priorities for future research. In particular, we explore the importance of understanding the drivers of flexibility in migratory behaviour at the population level (including the role of age) for the identification of priority sites for conservation. We will also present the results of a large scale collaborative study that resulted in a proposal for the creation of a Marine Protected Area used by more than 20 species of migratory seabirds during different stages of their life cycle (breeding, wintering and as a stopover site during migration), travelling from more than 100 colonies in the South and North Atlantic. Finally, we will present the major gaps in seabird tracking in the context of their conservation, and suggest possible links to the conservation of other migratory species, both marine and terrestrial.

Maria Dias is the Senior Marine Science Officer at BirdLife International, where she coordinates and develops the scientific work underpinning BirdLife's Marine Programme. Maria's PhD focused on the conservation of estuarine areas for migratory shorebirds and her post-doc research on the individual flexibility of migratory behaviour in seabirds.

WEDS, 27 MARCH, 1415 h

KEYNOTE

The high altitude ecology and physiology of the Bar-headed Goose

Lucy Hawkes

University of Exeter, UK

L.Hawkes@exeter.ac.uk 🐦 @DrLucyHawkes

High altitudes present a range of challenges to humans and animals, including low temperatures and hypobaric hypoxia (low oxygen as a consequence of reduced air pressure). Among the best known avian migrants in such environments is the Bar-headed Goose, an Asian species that breeds in Russia, Mongolia and China, and crosses the Tibetan Plateau to winter in Nepal and India. This talk

will review the wide range of research that has been done on this species and aspects of its physiology and ecology that make its famous high altitude flight possible. I will also review recent findings of the effect of high-altitude adaptation on Bar-headed Goose physiology and detail latest insights into the thermal physiology of Bar-headed Goose, and that they should be capable of flight up to nearly 8000 metres altitude. Finally, I will highlight that a range of other, more poorly studies, species may carry out similar flights and issue a call for data and collaborative research on the topic.

Lucy Hawkes is a physiologist ecologist. Her main research fosues are on the costs and drivers of migratory strategies in vertebrates using techniques such as satellite telemetry and physiological measurements, including respirometry. Her work also focuses on the impact of external forcing factors, such as climate change, migration and breeding ecology. Her future research aims to make inroads into mega-vertebrate migratory physiology using emerging technologies and multi-technique approached.

WEDS, 27 MARCH, 1445 h | ECR PRESENTER

Flight behaviour in individual songbirds throughout the migration

Sissel Sjöberg[1], Lykke Pedersen[1], Thomas Alerstam[2], Kasper Thorup[1], Anders P. Tøttrup[1], Arne Andersson[2] & Johan Bäckman[2]

[1] Center for Macroecology, Evolution and Climate, University of Copenhagen, Copenhagen, Denmark

[2] Department of Biology, Lund University, Lund, Sweden

* ssjoberg@snm.ku.dk 🐦 SisselSjoberg

Understanding animal migration is one of the most compelling and challenging problems of modern biology. For a long time, we have been hindered by the large geographical scale of migratory movements and the small sizes of most migratory animals. Recent advances in tracking technology are based on the use of miniature sensors for recording new aspects of individual migratory behaviour. We used accelerometer loggers to explore migratory behaviour in songbirds during the annual cycle, in combination with barometric sensors to measure flight altitudes. The birds performed their migration stepwise in travel segments and used strictly nocturnal flight schedules; however, some prolonged flights were recorded during passages of barriers. Both departure and landing times were conserved within each travel segment, and we do not observe any effect of total remaining migratory distance, which earlier has been suggested. The use of accelerometer loggers with barometric pressure sensors to estimate flight altitudes will open up new avenues for research and, importantly, advance our understanding of how small birds behave during migratory flights. We did not observed high flight altitudes to be related to the beginning of flights, indicating that birds do not start a migratory flight by sampling wind conditions before choosing a cruising altitude. Frequent

changes in flight altitudes rather indicate continuous regulation of flight altitudes in relation to winds throughout the flights.

Sissel Sjöberg is an ecologist with a main research focus on migratory behaviours in songbirds. She has a special interest in departure decisions, orientation and flight behaviours and how these are affected by environmental cues.

WEDS, 27 MARCH, 1500 h | ECR PRESENTER

Thermal soaring by raptors over temperate seas: the osprey exception?

Olivier Dureiz[1], Guillaume Peron[2], David Gremillet[1,3], Andrea Sforzi[4] & <u>Flavio Monti</u> [5*]

[1] Centre d'Ecologie Fonctionnelle et Evolutive, UMR 5175, CNRS - Université de Montpellier - Université Paul-Valéry Montpellier - EPHE, Montpellier, France

[2] UMR CNRS 5558 – LBBE "Biométrie et Biologie Évolutive", UCB Lyon 1 - Bât. Grégor Mendel, 43 bd du 11 novembre 1918, 69622 VILLEURBANNE cedex, France

[3] FitzPatrick Institute, DST/NRF Excellence Centre at the University of Cape Town. Rondebosch 7701. South Africa

[4] Maremma Natural History Museum, Strada Corsini 5, 58100 Grosseto, Italy

[5] Department of Physical Sciences, Earth and Environment, University of Siena, Strada Laterina, 8, 53100 Siena, Italy

* flaviomonti00@gmail.com

Large raptors on migration generally avoid crossing the sea and prefer making large detours to concentrate at straits and isthmus. The explanation generally given is that there are no thermal ascending currents over temperate seas to practice soaring-gliding flight. The Osprey *Pandion haliaetus* is an exception as it is able to cross several hundred km of open sea, presumably in sustained flapping flight. We tested the hypothesis that osprey may benefit from wind assistance when crossing the sea that would allow dynamic or thermal soaring flight. We equipped 5 juvenile ospreys with GPS-Accelerometer-Magnetometer loggers. All birds were able to find and use thermal uplift while crossing the Mediterranean Sea, on average 7.5 times per 100 km, and could reach altitudes of 900 m above sea surface. Thermals were weaker than over land, since the climb rate was 1.6 time slower than over land and birds had to flap when circling. The occurrence of thermals was correlated to water masses that were warmer than the air, inducing convective atmospheric movements. This finding leads reconsidering the ecology of raptors in migration and the definition of ecological barriers.

Flavio Monti is concerned with evolutionary biology, ecology and behaviour of birds (mainly raptors) and the integration of some aspects of basic research with applications in conservation biology and wildlife management around the Mediterranean Basin.

WEDS, 27 MARCH, 1515 h | ECR PRESENTER

Migration distance and body condition drive shorebird migration strategies and stopover decisions during southbound migration

Alexandra M. Anderson[1*], Sjoerd Duijns[2], Christian Friis[3], Paul Smith[2] & Erica Nol[1]

[1] Trent University, 1600 West Bank Drive, Peterborough, Ontario, Canada K9J 0G2

[2] National Wildlife Research Centre, Environment and Climate Change Canada, 1125 Colonel By Drive, Ottawa, Ontario, Canada K1S 5B6

[3] Canadian Wildlife Service, Environment and Climate Change Canada, 4905 Dufferin Street, Toronto, Ontario, Canada M3H 5T4

* aande763@gmail.com   @aande763

Migration strategies are variable across birds, but technological constraints have limited the ability to compare and determine drivers of migratory behavior of small-bodied, long-distance migrants. The development of tiny VHF transmitters (< 1.0 g) paired with automated radio telemetry allowed us to track small shorebirds and test hypotheses about migration strategies of six shorebird species from a subarctic stopover site, the southwestern coast of James Bay, Ontario, Canada during southbound migration. We predicted that species with the longest migrations (~9,000 to 11,000 km from James Bay; pectoral sandpiper and white-rumped sandpiper) would be more likely to follow time-minimizing migration strategies compared species travelling shorter distances (~5,000 to 7,500 km; least sandpiper, semipalmated plover, semipalmated sandpiper, and lesser yellowlegs) that migrate with characteristics more typical of an energy-minimizing migration strategy. For adults, longer distance migrants had longer stopover lengths in James Bay, departed with higher fuel loads, flew with faster ground speeds and airspeeds, and had a lower probability of stopover in North America after departing James Bay. The predicted relationship between migration distance and migratory strategy was not as clear in juveniles; longer distance migrants did not depart James Bay with higher fuel loads or travel with faster airspeeds. Despite our prediction that longer distance migrants would be less wind selective at departure and fly into headwinds *en route*, all species and age classes departed and migrated with supportive winds. Additionally, we found that birds with poor body condition had lower probability of detection after departing the stopover site and before crossing the Atlantic Ocean, which we interpret as lower apparent survival. Birds in poor condition that did survive this portion of migration were more likely to take an additional stopover in North America. This study shows that migratory behaviour of small, long-distance migratory shorebirds has predictable patterns based on migration distance, but these patterns are moderated by body condition of individuals which has fitness implications.

Alexandra Anderson is an avian ecologist interested the ecology and evolution of migration and how bird populations respond to environmental change. She is a PhD candidate currently working

with the James Bay Shorebird Project, a collaborative team working to conserve shorebirds in the Canadian subarctic.

WEDS, 27 MARCH, 1530 h | ECR PRESENTER

The influence of haemosporidian infections on flight bout durations, resting times and flight height in long-distance migratory great reed warblers

Tamara Emmenegger*, Steffen Hahn & Silke Bauer

Department of Bird Migration, Swiss Ornithological Institute, Seerose 1, 6204 Sempach, Switzerland

* tamara.emmenegger@vogelwarte.ch 🐦 @tavimalara

How parasite infections alter migration performance of their hosts has remained a debated issue as past studies have found negative, positive or no response of host migration schedules and performance to infections. This particularly applies to small migratory birds whose migration behaviour could not be monitored in detail over longer time-intervals so far.

Therefore, we investigated how the migrations of great reed warblers are influenced by infections with blood parasites. To characterize migration behaviour during their whole journeys, we used newly-developed multi-sensor tracking devices that record light intensity, acceleration and air pressure. We retrieved such loggers from 24, 5 and 3 individuals from breeding populations in Bulgaria, Czech Republic and Russia, respectively. We determined migration routes and schedules, flight bout durations, resting times and flight heights, and we related those variables to the intensity of infections with haemosporidian parasite as determined by real-time qPCR.

While we found the onset of autumn migration to be delayed with increasing intensity of infection, the timing in other periods of the year was not related to infection. Flight bout durations and flight height were not significantly related to infection intensity. However, we found the maximum individual resting time to be decreasing with increasing infection intensity.

Thus, avian blood parasites seem to have mostly subtle effects, occurring at specific times and places only, which might explain the ambiguous results from earlier studies. Overall, our study sheds new light on the mechanistic pathways behind infection-related delays in migration timing of passerines.

Tamara Emmenegger is a biologist with research focus on bird migration and a strong interest in a mechanistic understanding of host-parasite interactions in migratory birds. She enjoys programming and developing methods for analysis as well as applying these on various question-driven research projects.

WEDS, 27 MARCH, 1630 h | ECR PRESENTER

Life-history variation shapes migratory behaviour in birds

Andrea Soriano-Redondo[1]*, Jorge S. Gutiérrez[2], Dave Hodgson[1] & Stuart Bearhop[1]

[1] Centre for Ecology and Conservation, College of Life and Environmental Sciences, University of Exeter, Cornwall Campus, TR10 9EZ, UK

[2] Centro de Estudos do Ambiente e do Mar (CESAM), Departamento de Biologia Animal, Faculdade de Ciências da Universidade de Lisboa, Portugal

* a.soriano-redondo@exeter.ac.uk 🐦 SorianoRedondo

Migration is a widespread phenomenon across the animal kingdom, spanning all major vertebrate groups. Although it has attracted scientific attention for millennia, many questions about the causes and consequences of migration remain unanswered. Here, we investigate how life-history variation shapes migratory behaviour in birds. To do so, we compiled a dataset of migratory strategies (migratory vs non-migratory) and seven key life history traits linked to reproduction, growth and longevity for 756 bird species. Phylogenetically-corrected principal components analysis of the life history traits captured variation of two components: fast-slow continuum and reproductive strategy. Using phylogenetic generalised linear mixed models in a Bayesian framework, we then explored the relationship between the migratory strategy and latitude, and the two life history components. We found a strong positive relationship between migration probability and pace of life: species with a faster pace of life had a higher probability to migrate. Overall, the reproductive strategy did not present a significant relationship with migration probability and latitude had a positive effect, i.e. species occurring in northern and southern latitudes had a higher probability of migrating than species from the tropics. Importantly, our results show that migration and pace of life are linked, which highlights the selection pressures that shaped bird species over evolutionary time.

Andrea Soriano-Redondo is a conservation biologist working on population ecology and migration. She tries to understand the drivers of animal population changes such as climate change and animal translocations.

WEDS, 27 MARCH, 1645 h

European Turtle Doves migrating over sea and desert: links with population trends

Francesc Sardà-Palomera [1]*, Lara Moreno-Zarate [2], Gerard Bota [1], Mario Fernández Tizón [2], Carlos Santisteban [1] , Carles Carboneras [3,4] & Beatriz Arroyo [2]

[1] Biodiversity and Animal Conservation Lab, CTFC – Forest Sciences Center of Catalonia, Solsona, Spain.

[2] Instituto de Investigación en Recursos Cinegéticos (IREC, CSIC-UCLM-JCCM), Ciudad Real, Spain.

[3] Royal Society for the Protection of Birds, Sandy, United Kingdom

[4] Migrant Landbird Study Group (MLSG)

* francesc.sarda@ctfc.cat

European Turtle Dove *Streptopelia turtur* is globally threatened because of its widespread declines on European breeding grounds in recent decades, albeit with some exceptions. The European population winters in the Sahel and migrates along three main flyways. Although the main cause of population decline is degradation of breeding habitat, aggravating factors could be conditions in the wintering grounds and hunting during migration (known to be unsustainable along the western flyway).

Hunting pressure varies spatially and is heaviest in south-central Spain. Previous tracking has shown that populations breeding in UK, western France and western Spain cross to Africa over Gibraltar, thus flying through the hunting hotspots, where hunting occurs during the peak of Turtle-dove migration. Spanish, British, French and Dutch populations have globally declined by at least 40% in recent decades; however, Turtle-dove numbers in Catalonia (NE Spain) appear to be stable.

On evidence that a single tracked Turtle-dove from southern France crossed over the western Mediterranean in a straight line to Algeria, we hypothesized that differences in population trends might be associated with different migration routes between Catalonian and central Iberian populations. Thus, in summer 2018 we tagged 11 breeding TDs with 4 gr Biotrack PinPoint GPS-Argos devices (7 in Catalonia; 4 in central Spain).

Our results show that Turtle-doves from central Spain followed the traditional inland route through Gibraltar to western Sahel. In contrast, Turtle-doves from Catalonia migrate along coastal eastern Spain, over the sea and into Algeria, wintering further east. Differences in conditions in wintering grounds or in hunting pressure between both routes may account for the different population trends. Our discovery can potentially have consequences for conservation policies in light of the International Species Action Plan recently approved for the species.

Francesc Sardà-Palomera is a biologist interested in understanding species response to habitat and ecosystem alterations due to human activities, both from population and behavioural ecology perspectives, and aiming to benefit biodiversity conservation.

WEDS, 27 MARCH, 1700 h

Migration routes and winter ranges of Egyptian Vultures tracked from the Douro Valley, Spain-Portugal: the challenge of insecurity

Louis Phipps[1]*, Franziska Loercher[1], José Pedro Tavares[1], José Pereira[2], Eduardo Realinho[3], Lubomir Peske[4], Julieta Costa[5], Isidoro Carbonell Alanis[6] & António Monteiro[3] *et al.*

[1] Vulture Conservation Foundation, Koninklijke Burgers' Zoo b.v., Antoon van Hooffplein 1, 6816 SH Arnhem, the Netherlands

[2] Palombar, Associação da Conservação da Natureza e do Património Rural, Antiga Escola Primária de Uva, Uva, Portgual

[3] Transumância e Natureza – Associação (ATN), Rua Pedro Jaques de Magalhães, Figueira de Castelo Rodrigo, Portugal

[4] Moskevska 61, 101 00 Prague 10, Czech Republic

[5] Sociedade Portuguesa para o Estudo das Aves (SPEA), Avenida João Cristóstomo, 18, 4ºD, Lisbon, Portugal

[6] SALORO, S.L.U., Plaza de la Constitución 20, 37255 Barruecopardo, Spain

[7] Instituto da Conservação da Natureza e das Florestas (ICNF), Avenida da República, 16, Lisbon, Portugal

* l.phipps@4vultures.org 🐦 @louis_phipps

The Egyptian Vulture *Neophron percnopterus* population in Europe has declined by 50-79% in the last 40 years and is listed as Endangered on the IUCN Red List. As a migratory species the Egyptian Vulture faces multiple threats (e.g. poisoning; food shortages; electrocutions and collisions with energy infrastructure) which vary in intensity across the breeding and wintering ranges and along the migration routes. The European Union LIFE Rupis project aims to implement actions to strengthen the Egyptian vulture population in the Douro Valley trans-border region of Spain and Portugal, a current stronghold for the species with 135 breeding pairs being present. Here we present the results from the first year of GPS tracking nine individuals (five breeding adults; one non-breeding adult; a sub-adult; and two juveniles) from the breeding grounds in the Douro Valley, across the Strait of Gibraltar migration bottleneck, to their winter ranges in the West African Sahel. Of the eight vultures that migrated to Africa in 2017 (one juvenile overwintered in Extremadura, Spain), one juvenile was assumed to have died in southern Morocco while all of the adults and the sub-adult travelled to southern Mauritania and Mali (covering >3,200 km in 12-16 days). The five breeding adults traversed extensive winter ranges (mean±SE 95% kernel density contour = 22,836±4,344 km^2; n = 5) compared to their summer ranges (mean±SE 95% kernel density contour = 169±58 km^2; n = 5). Although the sub-adult vulture regularly visited protected areas in southern Mali, the majority of the vultures spent the winter periods in overlapping core ranges in the insecure and unprotected cross-border regions between Mali, Senegal and Mauritania. These preliminary findings illustrate the vulnerability of

Egyptian Vultures along their migration route and in their winter ranges, and support calls for a "flyway approach" to Egyptian Vulture conservation in Western Europe and Africa.

Louis Phipps is the Research Officer for the Vulture Conservation Foundation which works towards the conservation and recovery of the four vulture species found across Europe. He is a conservation biologist with a particular interest in studying the spatial ecology of vultures using GPS tracking data to inform conservation actions.

WEDS, 27 MARCH, 1715 h | ECR PRESENTER

Strong head-winds during Sahara crossings increase in-flight mortality rates of Black-tailed Godwits

A.H. Jelle Loonstra[1]*, Mo. A. Verhoeven[1], Nathan R. Senner[2] & Theunis Piersma[1,3]

[1] Conservation Ecology Group, Groningen Institute for Evolutionary Life Sciences (GELIFES), University of Groningen, P.O. Box 11103, 9700 CC Groningen, the Netherlands

[2] Department of Biological Sciences, University of South Carolina, 700 Sumter Street, Columbia, South Carolina, USA 29208

[3] NIOZ Royal Netherlands Institute for Sea Research, Department of Coastal Systems and Utrecht University, P.O. Box 59, 1790 AB Den Burg, Texel, the Netherlands

* a.h.j.loonstra@rug.nl

Migratory flights over large geographic areas without emergency stopover sites are predicted to have a higher risk of mortality due to unpredictable weather and wind conditions. However, because it is difficult to study in-flight mortality, the empirical evidence for this prediction is mostly lacking. Previous work on Black-tailed Godwits (hereafter: godwits) has revealed a relative high mortality-rate during crossings of the Sahara Desert, but the cause for this is unclear. To further investigate the heightened mortality risk of crossing the Sahara, we studied the relationship between the survival of satellite tagged godwits and their experienced wind conditions during this crossing. For more than 70 individuals making more than 150 Sahara crossings, we estimated wind conditions using a wind-based algorithm that calculated the most efficient path time-wise through a temporal 3D-grid in which we allowed individuals to switch directions and altitudes. We show that the wind-conditions during southward migration across the Sahara are less severe than during northward migration. This is most likely the result of predictable local trade winds that result in a higher frequency of tailwinds during southward migration and headwinds during northward migration. We also show a strong association between wind conditions during migration and survival; stronger head winds resulted in lower survival probabilities during migration. Wind conditions during migration can thus directly influence the population dynamics of a species and changing wind conditions as a result of global change could therefore have a profound influence on the viability of long-distance migration.

Jelle Loonstra is a PhD student at the University of Groningen and is fascinated by the incredible amount of variation in migration. In order to understand this variation, his PhD research focusses on the developmental ecology of migration in Continental Black-tailed Godwits.

WEDS, 27 MARCH, 1730 h | ECR PRESENTER

Testing times: post-fledging movements, behaviour and survival in a long-lived migratory seabird

Jude V. Lane[*] **& Keith C. Hamer**
School of Biology, University of Leeds, Leeds LS2 9JT United Kingdom
* bms0jl@leeds.ac.uk 🐦 heyjooode

Post-breeding migrations from temperate latitudes allow animals to improve survival by tracking food supplies and seeking out milder climatic conditions. In long-lived species such as seabirds, which have several years of immaturity before becoming breeders, successful migration is a key parameter influencing long-term population dynamics.

Most seabird tracking studies have focused on adult behaviour during the breeding season but developments in tracking technology are now opening up opportunities for exploring behaviour during earlier life stages and larger-scale movements during migration.

Northern Gannets fledge at approximately 13 weeks, after which they are entirely independent of their parents. Tracking their behaviour during this early life stage is vital for understanding dispersal and survival and may have consequences for conservation measures, which are currently based solely on data for adults.

In October 2018 we attached Argos GPS-PTTs to 21 fledgling gannets on the Bass Rock, Scotland. Here we present the first GPS and satellite tracking data for these birds during their initial few weeks at sea, providing new insights into the timing, route choices and staging grounds used by birds on their maiden migration.

Jude Lane has recently completed a PhD where she explored the three-dimensional foraging behaviour of Northern gannets from Bass Rock, Scotland. She is particularly keen on understanding how seabird behaviour is influenced by weather and prey availability and the potential interactions between seabirds and renewable energy developments.

Tracking Migration: drivers, challenges and consequences of seasonal movements

26 – 28 March 2019 | University of Warwick, UK

THURS, 28 MARCH, 0900 h

KEYNOTE

Partial migration and population dynamics in a seasonally inhospitable world

Jane M. Reid

University of Aberdeen, UK

jane.reid@abdn.ac.uk

Major goals in contemporary ecology are to understand how populations will respond to environmental change and deterioration, including increasing frequencies of extreme climatic events. Progress requires detailed understanding of patterns of life-history and demographic variation arising within populations, including those inhabiting spatially-structured seasonally-varying environments. Seasonal migration is one key trait that has evolved to allow individuals to avoid seasonally inhospitable environments, but that can vary substantially within and among population members and potentially drive variation in reproduction and survival, including during and following extreme events. Yet, we still lack comprehensive understanding of how seasonal migration varies among different sets of population members, and of the consequent variation in reproduction and survival in the face of environmental variation. I use nine years of data on partially migratory European Shags *Phalacrocorax aristotelis* to illustrate the complexity of among-individual and within-individual variation in seasonal migration versus year-round residence arising in a meta-population system. I quantify associated variation in reproductive success and survival, and highlight key short-term and longer-term implications for population dynamic responses to environmental variation and change.

Jane Reid is a population and evolutionary ecologist interested in understanding how environmental, genetic and demographic variation combine to influence population dynamics and evolution. She uses long-term data from wild bird populations and sophisticated statistical and simulation models to understand population dynamics and evolutionary causes and consequences, with particular interests in mating systems and partial migration.

THURS, 28 MARCH, 0930 h

Favourable energy balance, but poor fitness, in Sanderlings wintering in tropical rather than temperate zones

Jeroen Reneerkens[1]*, Tom S. L. Versluijs[1,2], José A. Alves[3,4], Mark Boorman[5], Teresa Catry[6], Colin Corse[7], José P. Granadeiro[6], Kirsten Grond[8], Gunnar Thor Hallgrimsson[9], Pedro Lourenço[6], Yaa Ntiamoa-Baidu[10,11], Alfred A. Nuoh[11], Peter M. Potts[12], Job ten Horn[2] & Theunis Piersma[1,2]

[1] Conservation Ecology Group, Groningen Institute for Evolutionary Life Sciences (GELIFES), University of Groningen, P.O. Box 11103, 9700 CC, Groningen, the Netherlands

[2] NIOZ Royal Netherlands Institute for Sea Research, Department of Coastal Systems and Utrecht University, PO Box 59, 1790 AB Den Burg, Texel, the Netherlands

[3] DBIO & CESAM – Centre for Environmental and Marine Studies, University of Aveiro Aveiro, Portugal

[4] South Iceland Research Centre, University of Iceland, Lindarbraut 4, IS-840 Laugarvatn, Iceland

[5] Box 1445, Swakopmund, Namibia

[6] Centro de Estudos do Ambiente e do Mar (CESAM), Departamento de Biologia Animal, Faculdade de Ciências da Universidade de Lisboa, 1749-016 Lisboa, Portugal

[7] Orkney Ringing Group, Garrisdale, Lynn Park, Kirkwall, KW15 1SL, UK

[8] Department of Molecular and Cell Biology, University of Connecticut, Torrey Life Sciences 409, 91 North Eagleville Road, Storrs, CT 06269-3125, USA

[9] Institute of Biology, University of Iceland, Sturlugata 7, 101 Reykjavik, Iceland

[10] Centre for African Wetlands, University of Ghana, P.O. Box LG 67, Legon, Accra, Ghana

[11] Department of Animal Biology and Conservation Science, University of Ghana, P.O. Box LG 67, Legon, Accra, Ghana

[12] Farlington Ringing Group, Solent Court Cottage, Chilling Lane, Warsash, Southampton SO31 9HF, UK

* J.W.H.Reneerkens@nioz.nl 🐦 @J_Reneerkens

Evolutionary theories of seasonal migration generally assume that costs of longer migrations are balanced by benefits at the non-breeding destinations. We studied time budgets, intake rates, diet composition, food availability, thermoregulation costs and three components of fitness of High Arctic Sanderling *Calidris alba* at six non-breeding sites ranging in latitude between England (55° N) and Namibia (25° S). Birds at tropical sites had more favourable energy budgets, with more profitable trophic conditions and lower thermoregulation costs. Surprisingly though, survival probabilities were considerably lower in tropical West-Africa (Mauritania: 0.77 and Ghana: 0.76) than at three European sites (0.82, 0.83 and 0.85) and in Namibia (0.84). Sanderlings also more often stayed in the tropics during the first possible breeding season and occurred 5-16 days later at the last stop-over site during northward migration than birds wintering further north or south. Namibia-wintering Sanderlings tracked with solar geolocators staged in West-Africa during southward but not during northward migration. Migrating Sanderlings defy long distances but may end up in non-breeding

locations with poor fitness prospects. We discuss that despite favourable wintering conditions, spring fuelling in the tropics is constrained.

Jeroen Reneerkens is an animal ecologist whose research focuses on migration ecology, reproductive strategies, seasonal interactions, individual trade-offs and their consequences for population demography, distribution, and conservation in High Arctic shorebirds. Sanderlings are his favourite research species and he coordinates a large international research collaboration involving thousands of citizen scientists.

THURS, 28 MARCH, 0945 h | ECR PRESENTER

Are tropicbirds resident or migrant? Migratory patterns of Red-billed Tropicbird in multiple Atlantic colonies

Sarah Saldanha[1], Teresa Militão[1], Ngoné Diop[1,2], Marcos Hernández-Montero[3], Annalea Beard[4], Artur Lopes[3], Papa Ibnou Ndiaye[2], Leeann Henry[4], Cheikh Tidiane Ba[2], Jacob González-Solís[1]

[1] Institut de Recerca de la Biodiversitat (IRBio) and Department de Biologia Evolutiva, Ecologia i Ciències Ambientals (BEECA), Universitat de Barcelona, Av Diagonal 643, Barcelona 08028, Spain

[2] Department of Animal Biology, Cheikh Anta Diop University, Av Cheikh Anta Diop, Dakar, Senegal

[3] Projeto Biodiversidade, Santa Maria, Sal, Cabo Verde

[4] Marine Section, Environmental Managements Division of the Environmental and Natural Resources Directorate, St Helena Government, Essex House, Jamestown, St Helena Island

* sarahsaldanha9@gmail.com 🐦 @SarahSaldanha1

Although knowledge of the migratory strategies and areas species use year-round is essential for understanding the basic biology and conservation of all species, it is lacking for many seabirds, particularly in tropical areas. Tropicbirds were previously assumed to be resident or dispersive, but light-based geolocators (GLS) are uncovering more complex patterns. Recent studies on Red-tailed (*Phaethon rubricauda*) and White-tailed (*Phaethon lepturus*) Tropicbirds have revealed that these species behave as partial migrants, while the migratory strategy of another species, the Red-billed tropicbird (*Phaethon aethereus*), remains unknown. We deployed GLS on breeding adults from five islands in the eastern Atlantic, between 2015 to 2017: Sal (N=11), Boavista (N=4) and Raso (N=5) in Cape Verde, îles de la Madeleine (N=12) in Senegal and St. Helena (N=11) in the south tropical Atlantic. After recovering the GLS in following years, we determined migratory patterns and used wet and dry data to infer activity behaviour at sea. While some individuals remained close to their breeding colonies, others undertook westward migrations, confirming Red-billed Tropicbirds also behave as partial migrants. Migrating birds mirrored movements of western Atlantic tropicbirds, moving towards the mid-Atlantic ridge for the non-breeding period. Interestingly, migratory patterns and the proportion of partial migrants varied substantially across the different populations,

suggesting a longitudinal segregation between migratory bird populations and a relatively strong migratory connectivity. Activity data showed tropicbirds spent more time foraging during the day and resting at night, indicating a mainly diurnal activity. Our results are essential in understanding the different threats this declining species is exposed to over the year and can aid in identifying marine Important Bird Areas in a vastly understudied area: the tropical Atlantic.

Sarah Saldanha is a biologist whose main research focus are the movement ecology and conservation of birds. She is currently working on foraging ecology and migratory patterns of Red-billed Tropicbirds and brown boobies in West Africa.

THURS, 28 MARCH, 1000 h | ECR PRESENTER

Do timing delays and winter site quality carry-over to influence productivity in Icelandic Whimbrel?

Camilo Carneiro[1,2*], Tómas G. Gunnarsson[2] & José A. Alves[1,2]

[1] Dep. Biology & CESAM, University of Aveiro, Campus de Santiago, 3810-193 Aveiro, Portugal

[2] South Iceland Research Centre, University of Iceland, Lindarbraut 4, IS-840 Laugarvatn, Iceland

* camilofcarneiro@gmail.com 🐦 @Camilo_Carneiro

When living in seasonal environments timing is crucial. Timing of breeding, in particular, is often linked to reproductive success and consequently has the potential to influence fitness. However, timing of breeding may be dependent on preceding stages of the annual cycle. Delays and/or sub-optimal conditions experienced in one phase of the year can affect subsequent events through carry-over effects. These links can be particularly apparent in birds breeding at high latitudes, due to the short window when suitable breeding conditions occur, and even more so for long distance migrants, that incur considerable energetic migratory costs and time constraints. Icelandic Whimbrels *Numenius phaeopus islandicus* breed mostly in Iceland and perform long non-stop flights to/from the wintering sites. Between 2012 and 2018, we tracked their migration using geolocators and surveyed their breeding phenology, investment and success at the individual level. Additionally, we measured the wintering habitat quality (through energetic balance) of three sites located at 5850, 4900 and 2880 km from Iceland and assigned the winter origin of breeding birds through stable isotope analysis. Here, we explore (1) temporal correlations along the annual cycle of Icelandic Whimbrels that may cascade to influence breeding phenology and success and (2) potential effects of wintering site on breeding onset and breeding investment.

Camilo Carneiro is a PhD student at the Universities of Aveiro and Iceland exploring the implications of long distance migratory strategies and variation of wintering habitat use on individual fitness. He

investigates these links on Icelandic Whimbrels, developing fieldwork between Iceland and West Africa and using several individual tracking techniques (colour-rings, stable isotopes and geolocators).

THURS, 28 MARCH, 1015 h | ECR PRESENTER

Does landfill use influence the speed and efficiency of first-year migration in a partially migratory species?

Kate F. Rogerson[1]*, Andrew Slater[1], Ines Catry[1, 2], Jennifer Gill[1], Phil W. Atkinson[3] & Aldina M.A. Franco[1]

[1] University of East Anglia, Norwich Research Park, Norwich, NR4 7TJ, UK

[2] CEABN/InBio- Rede de Investigação em Biodiversidade e Biologia Evolutiva, Instituto Superior de Agronomia, Universidade de Lisboa, 1349 - 017 Lisboa, Portugal

[3] British Trust of Ornithology, The Nunnery, Thetford, IP24 2PU, UK

* Katharine.rogerson@uea.ac.uk 🐦 @Katiebee1991

Migratory birds are influenced by environmental change affecting their population size as well as migratory behaviour. Many populations are shrinking, however in the last three decades the Portuguese population of White Storks *Ciconia ciconia* has increased from 1500 breeding pairs in 1984 to 12,000 in 2014. This coincided with an increase in individuals no longer undertaking traditional migrations to sub-Saharan Africa but remain in Portugal all year-round. Changes to population size and migratory behaviour may have been facilitated by changes to food resources. This study aims to understand how food resources provided at landfill sites, predictable anthropogenic food subsidies (PAFS) , in Portugal influences first-year migration of this newly partially migratory population of white storks.

First-year migration is a crucial period as naïve individuals learn to undertake a successful migration. This study benefits from the deployment of 73 GPS transmitters on juveniles (2016 and 2017), providing high spatial and temporal resolution data on their movement behaviour. We investigated the influence of PAFS (proportion of fixes on landfill sites and proximity of nest to the landfill sites), on the speed and efficiency of route of first-year southward migration. Our results show that large juveniles, from nests close to landfill sites, are more likely to complete their first southward migration than smaller birds. In addition, we will show if there are carry over effects of landfill site use that influences the northward migration or if conditions in Africa are more influential.

Changes to landfill sites are currently prescribed by EU directives, leading to the closure of many sites and reducing organic waste in those that remain open. This study shows that the removal of this food resource will influence the survival of the migratory juveniles.

Kate Rogerson is an ecologist and forth year PhD student at the University of East Anglia, interested in the study of movement behaviour with GPS technology and how human modifications to the environment can alter animal behaviour which affects population demographics.

THURS, 28 MARCH, 1115 h

KEYNOTE

Tracking spoonbill migration in a changing world: from patterns to mechanisms

Tamar Lok[1]*, Petra de Goeij[2], Otto Overdijk[3], Joost Tinbergen[2] & Theunis Piersma[1,2]

[1] Department of Coastal Systems, NIOZ Royal Netherlands Institute for Sea Research and Utrecht University, P.O. Box 59, 1790 AB Den Burg, Texel, the Netherlands

[2] Conservation Ecology Group, Groningen Institute for Evolutionary Life Sciences (GELIFES), University of Groningen, P.O. Box 11103, 9700 CC Groningen, the Netherlands

[3] Moddergat, the Netherlands

* tamar.lok@nioz.nl 🐦 @TamarLok

Seasonal migration allows animals to exploit seasonal peaks of resource abundance while avoiding resource depression. To do so, they have to make decisions when to migrate and where to. Changes in any of the sites that migratory animals use during their annual cycle will affect the optimality of these decisions.

Using 25 years of mark-recapture data on Eurasian Spoonbills *Platalea leucorodia*, combined with several years of intensive fieldwork in a Dutch breeding colony, we show that the decision where to spend the winter is made in the first year of life. Moreover, birds that migrate short distances to winter in southern Europe are doing better than those that cross the Sahara to winter in West Africa, both in terms of survival and reproductive output.

While an increasing part of the population is now wintering in Europe, the northward shift in the wintering distribution of spoonbills is slower than would be optimal to achieve the highest fitness. There thus seem to be factors that prevent spoonbills from making optimal winter site choices. To better understand the role of genetic and environmental effects in shaping their migration strategies, we are now collecting data on genetic relatedness and are tracking the autumn migration of juvenile spoonbills and their parents with GPS-trackers. Some first results of this ongoing research will be presented during this seminar.

Tamar Lok is a post-doctoral fellow at the NIOZ Royal Netherlands Institute for Sea Research. She works at the interface of behavioural, evolutionary and population ecology and is particularly interested in better understanding the impressive variation in migration strategies observed in the wild.

THURS, 28 MARCH, 1145 h | ECR PRESENTER

An ontogenetic perspective on migration learning and critical life-history traits in raptors

Wouter M.G. Vansteelant

[1] Figuerola Lab, Estación Biológica de Doñana (CSIC), Av. Américo Vespuccio, s/n. 41092 Sevilla, Spain

[2] Computational Geo-ecology, Inst. for Biodiversity and Ecosystem Dynamics, Univ. of Amsterdam, Science Park 904, 1098 XH Amsterdam, the Netherlands

* vansteelant.wouter@gmail.com 🐦 @WMGVs

Tracking studies are uncovering migration strategies for many species, often vastly more complex and diverse than ever imagined. The way in which these strategies develop, however, is largely unknown. At previous conferences I have presented preliminary results of a longitudinal tracking study of migratory development in European Honey-buzzards *Pernis apivorus*. I thereby argued that young buzzards mainly depend on social information to learn traditional flyways between Europe and Africa. However, based on additional data collection I must rectify that honey buzzards actually learn traditional overland flyways primarily by chance, whereby individuals learn completely different loop migration routines depending on stochastic early-life experiences. And this has major life-history implications.

Honey-buzzards could stay in Africa until their 5th calendar year (CY) before attempting a first return to Europe. It seems this is due to the high risk of mortality during the first return migration, such that birds were more likely to grow older by extending their stay in Africa. Individuals that survive their first return in CY3-4 certainly gain migratory experience by doing so, but spend too little time in their natal area to familiarize themselves with potential breeding sites. Four birds were tracked until CY6-7 but none bred successfully.

Slowly reproducing raptors usually minimize juvenile mortality through synchronized migration between age groups, allowing young birds to learn safe flyways by following elders. It seems this allows for faster recruitment too, with species like lesser spotted eagle breeding as early as CY4-5. The honey-buzzard migration system thus appears to exist at the limits of what can be maintained through stochastic migration learning. In my talk I will discuss how critical life-history traits allow for the maintenance of stochastic migration learning strategies across various raptor species, while necessitating the evolution of social migration in others.

Wouter Vansteelant is a behavioural ecologist with a keen interest in raptor migration. His current focus is on migration learning, trying to resolve how long-lived raptors learn to migrate under

dynamic atmospheric conditions. Wouter is co-founder of the Batumi Raptor Count and acts as secretary of the Migrant Landbird Study Group.

THURS, 28 MARCH, 1200 h | ECR PRESENTER

Understanding individual differences in migratory behaviour: an ontogenetic approach.

Mo A. Verhoeven[1]*, A.H. Jelle Loonstra[1], Nathan R. Senner[1,2], Christiaan Both[1] & Theunis Piersma[1,3]

[1] Conservation Ecology Group, Groningen Institute for Evolutionary Life Sciences, University of Groningen, P.O. Box 11103, 9700 CC Groningen, the Netherlands

[2] Department of Biological Sciences, University of South Carolina, 700 Sumter Street, Columbia, South Carolina, USA 29208

[3] NIOZ Royal Netherlands Institute for Sea Research, Department of Coastal Systems and Utrecht University, P.O. Box 59, 1790 AB Den Burg, Texel, the Netherlands

* Email: m.a.verhoeven@rug.nl   Twitter handle: @VerhoevenMo

Previous tracking studies have revealed that within some avian species there are large differences in migratory strategies among individuals. These include using different wintering areas and exhibiting differences in migratory timing. Repeated measures of the same individuals have generally shown that these differences are consistent across years. These observations lead to questions such as: Why is there consistent individual variation within some species and populations, but not others? And, how do these consistent differences arise — are they the result of genetic differences, plastic differences, or both? To start addressing these questions, we outfitted 40 juvenile Black-tailed Godwits (*Limosa limosa limosa*, hereafter "godwits") in 2016 and 2017 with satellite transmitters. We did this in our long-term study area in Fryslân, the Netherlands, where we have also tracked adult godwits from 2012 onwards. The satellite tags have allowed us to compare the first southward migration of juvenile godwits to the southward migration of adult godwits in the same and previous years. We found that adults consistently winter either north or south of the Sahara. Adults also exhibit consistently different migratory timing among individuals — for example, some cross the Sahara in the beginning of June, whereas others cross at the end of July. Furthermore, adult survival on southward migration is very high. The actual migration routes of adults and juveniles were similar. However, in contrast to the adults, juvenile godwits departed the Netherlands later, flew non-stop to West Africa more often and had higher mortality. Furthermore, the likelihood that juveniles wintered south of the Sahara depended on migratory timing: those juveniles that migrated later were less likely to successfully cross the Sahara. Lifelong tracking of these individuals will elucidate whether these initial differences among juveniles in migratory timing lead to the different annual routines observed in adults.

Mo Verhoeven is interested in the variation in bird behaviour. He asks questions like: Why are there differences between species and within species? What is the source of this variation - genes, or the environment? Why is or isn't this variation selected against? Mo lives in the Netherlands and likes salty liquorice.

THURS, 28 MARCH, 1215 h

The role of dispersal in adaptation to climate change: an experimental approach

Koosje Lamers[1,2]*, Marion Nicolaus[1], Raymond Klaassen[1], Jan-Åke Nilsson[2] & Christiaan Both[1]

[1] Conservation Ecology, GELIFES, University of Groningen, Nijenborgh 7, 9747 AG Groningen, the Netherlands
[2] Evolutionary Ecology, Lund University, Sölvegatan 37, 223 62 Lund, Sweden
* k.p.lamers@rug.nl   🐦 @KoosjeLamers

Climate change is advancing the onset of spring, and thereby shifting food peaks. In such a changing world, dispersal could accelerate adaptation if individuals that arrive too late at their original breeding site continue migration northward to areas with later spring phenology. However, whether prolonged migration can aid in adaptation to climate change is a two-fold issue. On the one hand, dispersing individuals that carry genes that promote early annual time schedules need to be able to spread these genes at more northern breeding grounds. On the other, the annual timing of migration needs to have a genetic component rather than be defined by the environment in which an individual grows up.

We are studying these two conditions based on an experimental approach in a pied flycatcher (*Ficedula hypoleuca*) study system. Through translocation of pied flycatcher females from the Netherlands to Sweden, we "experimentally disperse" birds to determine the effects of long-distance dispersal on reproductive success and determine whether southern immigrants have an advanced timing. Moreover, through combining these female translocations with egg translocations to Sweden, we have created a common garden of wild birds of different genetic origins (natural Swedish, hybrid, and Dutch) that we monitor to determine whether genes or environment determine the timing of the annual cycle.

Translocated Dutch females bred earlier than Swedish control females. Moreover, the first year of our common garden experiment provides evidence that variation between populations in the timing of the annual cycle is based on genetic differences. Dutch recruits in Sweden completely adhered to Dutch timing and bred over two weeks earlier than their Swedish counterparts. Our preliminary work therefore reveals that the potential exists for long-distance dispersal to accelerate adaptation to climate change through spreading genes for early timing from early to late populations.

Koosje Lamers is a behavioural ecologist interested in dispersal, life history strategies and migratory behaviour, with a passion for small passerine nestbox population studies. Using an experimental approach, she is investigating whether long-distance dispersal can play a role in adaptation to climate change.

THURS, 28 MARCH, 1230 h

Wintering grounds and summer vagrancy of young Red Kites from central Europe on a continental scale

Ivan Literák [1*], Rainer Raab[2], Stanislav Vyhnal[1], Péter Spakovszky[2], Hynek Matušík[3] & Claudia Schütz[2]

[1] Department of Biology and Wildlife Diseases, Faculty of Veterinary Hygiene and Ecology, University of Veterinary and Pharmaceutical Sciences Brno, Palackého tř. 1, 61242 Brno, Czech Republic
[2] Technisches Büro für Biologie Mag. Dr. Rainer Raab, Quadenstrasse 13, 2232 Deutsch-Wagram, Austria
[3] 68713 Březolupy 324, Czech Republic
[*] literaki@vfu.cz

Red Kites *Milvus milvus* (pulli) fitted with telemetry GPS/GSM loggers in nests in Austria (n = 14), the Czech Republic (n = 37), and Slovakia (n = 3) during 2014–2017 were included in the study. The spatial movements of 54 birds during their first (migration) post-breeding period proved to differ substantially among individuals. Some juvenile birds wintered in the breeding area (14 birds); some migrated relatively short distances to winter in Hungary, Croatia, Austria, and Germany (8); other birds undertook long-distance migration to winter on the Iberian Peninsula (9), in France (10), Italy (11), or Greece (2).

During the first winter stay, the majority of birds used only one wintering ground. During the first spring (migration) period, the 2cy birds (n = 23) returned from their wintering grounds to their natal sites but did not breed. After their second post-breeding period, some birds wintered at their natal areas (7 birds); some birds wintered in Hungary, Croatia, and eastern France (4 birds); other birds migrated to the Iberian Peninsula (2), southern France (4), Italy (3), or Greece (1). Fidelity to wintering grounds was recorded for 7 out of 21 birds. One bird used different regions for wintering in the first winter (Greece) and the second winter (Spain). During the second spring (migration) period, 3cy birds again returned to their natal areas (7 birds). Three birds bred not far from their hatching sites (7, 28, 59 km), thus indicating natal philopatry. Four birds did not breed, but showed a period of summer vagrancy.

The wintering distribution of central European Red Kites covers a large area ranging from south-western and central Europe to the Balkan Peninsula. They are characterized by a highly individualistic migratory behaviour, albeit with obvious features of natal philopatry and wintering ground fidelity.

Ivan Literák is a biologist with a main research focus on wildlife diseases and movement ecology of wild birds, now especially Eurasian raptors. He is particularly interested in kites and their species-habitat interactions and migrations.

THURS, 28 MARCH, 1415 h

KEYNOTE

Seabird migration in the anthropocene

W. James Grecian

Sea Mammal Research Unit & Scottish Oceans Institute, University of St Andrews, UK

wjg5@st-andrews.ac.uk @JamesGrecian

Animal migration is a widespread and diverse phenomenon allowing species to target seasonally varying resources. Nevertheless, the degree to which migratory behaviours are innate or learned is poorly understood. For example, individuals may exhibit long-term fidelity to specific wintering areas or shift winter destinations from one year to the next in response to changes in local food availability. Seabirds make some of the longest migrations known, traversing whole ocean basins and often targeting upwelling regions where the mixing of nutrient-rich cool water with warm surface layers fuels primary production and drives bottom-up cascades. By integrating conditions across wide geographic areas, seabirds are exposed to a range of environmental stressors and so can act as barometers of ecosystem function or environmental change. Recent advances in bio-logging technology has allowed vast amounts of data to be collected on animal movement, but the techniques available to analyse these data are still evolving. Using studies conducted across a broad-range of seabird species over the last decade, I will discuss the potential consequences of differences in winter strategies, the environmental drivers of diversity in wintering hotspots, and the anthropogenic threats posed to seabirds during migration. I will also outline some of the analytical approaches recently developed to answer these questions.

James Grecian is a a post-doctoral research fellow at the University of St Andrews.
His research focuses on understanding the distribution and behaviour of apex marine predators such as seabird and seals, particularly the effect that human activities such as offshore energy extraction, fisheries and climate change have on foraging behaviour and migration. To answer these questions, he uses a range of techniques including bio-logging, stable isotope analysis and quantitative modelling.

THURS, 28 MARCH, 1445 h

Long-distance migratory shorebirds travel faster in spring, but fly faster in autumn

Sjoerd Duijns[1,2]*, Alexandra M. Anderson[3], Yves Aubry[2], Amanda Dey[4], Scott A. Flemming[3], Charles M. Francis[2], Christian Friis[2], Cheri Gratto-Trevor[2], Diana Hamilton[5], Rebecca Holberton[6], Stephanie Koch[7], Ann E. McKellar[8], David Mizrahi[8], Christy A. Morrissey[9], Sarah Neima[9], David Newstead[10], Larry Niles[11], Erica Nol[12], Julie Paquet[2], Jennie Rausch[2], Lindsay Tudor[13], Yves Turcotte[14] & Paul A. Smith[2]

[1] Department of Biology, Carleton University, Ottawa, ON, Canada

[2] Environment and Climate Change Canada, Wildlife Research Division, Canada

[3] Environmental and Life Sciences Graduate Program, Trent University, Peterborough, ON, Canada

[4] Endangered and Nongame Species, New Jersey Division of Fish and Wildlife, USA

[5] Department of Biology, Mount Allison University, Sackville, NB, Canada

[6] Lab of Avian Biology, Department of Biology & Ecology, University of Maine, Orono, ME, USA

[7] United States Fish and Wildlife Service, Sudbury, MA, USA

[8] New Jersey Audubon Society, Bernardsville, NJ, USA

[9] Dept of Biology and School of Environment and Sustainability, University of Saskatchewan, SK, Canada

[10] Coastal Bend Bays and Estuaries Program (CBBEP), Corpus Christi, TX, USA

[11] L J Niles Associates LLC, Greenwich, NJ, USA

[12] Department of Biology, Trent University, Peterborough, ON, Canada

[13] Maine Department of Inland Fisheries and Wildlife, Bangor, ME, US

[14] Département des sciences et techniques biologiques, Collège de La Pocatière, La Pocatière, QC, Canada

* duijns.sjoerd@gmail.com 🐦 @SjoerdDuijns

Long-distance migrants are thought to be more time-limited during spring migration compared to autumn. Although breeding-related time constraints may be absent in autumn, additional factors such as predation risk could lead to previous underestimations of time constraints en route. By using an automated radio telemetry system, we compared spring and fall movements of long-distance migrant shorebirds on a continent-wide scale. From 2014 to 2016, we deployed radio transmitters on 1,937 individuals of 4 shorebird species at 13 sites distributed across North America. Following theoretical predictions, all species migrated faster in spring compared to autumn migration. Differences between both seasons appeared to reflect differences in stopover duration. Despite this, all species had higher airspeeds in autumn, irrespective of seasonal wind differences. Arriving at the breeding grounds in good body condition is beneficial for survival and reproductive success and this energetic constraint might explain why airspeeds are not maximised in spring. We show that the higher airspeeds in autumn precede a wave of avian predators, which could suggest that migrant shorebirds show predation-minimizing behaviour. Our results reaffirm the important role of time

constraints in spring, and suggest that both energy and predation-risk constrain migratory behaviour in autumn.

Sjoerd Duijns is a behavioural ecologist, interested in the mechanisms by which organisms deal with the aspects of their (changing) environment and he's fascinated how animals respond to this. He aims to unravel this by integrating behaviour, demography and population dynamics using statistical and theoretical models with empirical data.

THURS, 28 MARCH, 1500 h | ECR PRESENTER

The protandry paradigm revisited: is migration timing sex-specific throughout the annual cycle?

Martins Briedis*, Silke Bauer & Steffen Hahn

Swiss Ornithological Institute, Sempach, Switzerland

* martins.briedis@vogelwarte.ch 🐦 Twitter handle: @biobriedis

Timing of annual activities, like breeding, migration, and moult, underpins the success of individual performance. In migratory birds, different demographic groups, however, might be constrained by varying factors when it comes to optimal timing of their annual movements. As such, males typically arrive at the breeding sites ahead of females – a phenomenon termed protandry – yet our knowledge regarding sex-specific migration timing at other stages of the annual cycle remains limited.

We applied and tested the protandry hypothesis across the entire annual cycle revisiting, quantifying, and challenging this long-standing spring arrival concept also for the autumn migration. Our dataset consisted of more than 350 annual migration tracks from 14 small-bodied Afro-Palearctic long-distance migratory landbirds from 25 European breeding populations.

In spring, we found marked differences with males departing Africa on average 3 days earlier and arriving at the breeding sites approximately 4 days ahead of females. In autumn, males initiated migration ca. 2 days earlier, but this pattern did not translate further upon arrival at the non-breeding sites. A cross-species comparison revealed that protandry, however, is not a ubiquitous pattern in all long-distance migrants. In addition, we found tight links between individual timing of migratory departure and arrival in both seasons, but only for males the timing of spring migration was linked to the timing of previous autumn migration.

The results illustrate that migration schedules and linkage between the timing of consecutive migration stages are substantially different for males and females. The species-, sex-, and season-

specific differences in migration strategies are likely mediated by a combination of intrinsic (e.g., individual body condition and cross-seasonal carry-over effects) and extrinsic (e.g., competition for limited resources at the final destination) factors operating across the annual cycle.

Martins Briedis is a wildlife ecologist with a main research focus on avian migration ecology in the context of the full annual cycles. He is particularly interested in the concept of migratory connectivity from a spatio-temporal viewpoint, links between different annual phases, and interactions between migrants and the environment.

THURS, 28 MARCH, 1515 h | ECR PRESENTER

Does migration timing hamper the advancement of laying dates in Arctic migratory birds?

Thomas K. Lameris[1,2]*, Rascha J. M. Nuijten[2], Michiel P. Boom[2], Willem Bouten[3], Adriaan M. Dokter[4], Bruno J. Ens[5], Klaus-Michael Exo[6], Jan A. van Gils[1], Sveinn Are Hanssen[7], Bethany Hoye[2], Henk van der Jeugd[8], Andrea Kölzsch[2, 9], Helmut Kruckenberg[10], Borge Moe[7], Gerard J.D.M. Müskens[11], Bart A. Nolet[2,3], Ivan Pokrovsky[9], Ingrid Tulp[12] & Rob S. A. van Bemmelen[12]

[1] Royal Netherlands Institute for Sea Research (NIOZ), Landsdiep 4, 1797 SZ 't Horntje, the Netherlands

[2] Netherlands Institute of Ecology (NIOO-KNAW), Droevendaalsesteeg 10, 6708 PB Wageningen, the Netherlands

[3] University of Amsterdam, Sciencepark 904, 1098 XH Amsterdam, the Netherlands

[4] Cornell Lab of Ornithology, Cornell University, Ithaca, NY 14850, USA

[5] Sovon Dutch Centre for Field Ornithology, Sovon-Texel, 1797 SZ t' Horntje, the Netherlands

[6] Institute of Avian Research, An der Vogelwarte 21, 26386 Wilhelmshaven, Germany

[7] Norwegian Institute for Nature Research (NINA), Høgskoleringen 9, 7034 Trondheim, Norway

[8] Dutch Centre for Avian Migration and Demography (NIOO-KNAW), 6708 PB Wageningen, the Netherlands

[9] Max-Planck Institute for Ornithology, Am Obstberg 1, 78315 Radolfzell, Germany

[10] Institute for Waterbird and Wetlands Research (IWWR), Am Steigbügel 3, D-27283 Verden, Germany

[11] Wageningen Environmental Research, Droevendaalsesteeg 3-3 A, 6708 PB Wageningen, the Netherlands

[12] Wageningen Marine Research, Haringkade 1, 1976 CP Ijmuiden, the Netherlands

* thomaslameris@gmail.com   🐦 @thomaslameris

Under climate warming, the optimal timing of reproduction is advancing for many animals. This is especially true in the Arctic region, where the rate of climate warming is amplified compared to more temperate regions. Advancement in laying dates of migratory birds can be constrained by their timing of arrival on the breeding grounds. Earlier arrival requires migrants to shorten stopover duration and/or to depart from the wintering grounds earlier. However, it is unclear to what degree migrants can adjust migration timing to Arctic conditions.

We tested whether reproduction and migration phenology advanced with earlier onsets of the Arctic spring in Arctic migratory birds breeding in Lapland, Svalbard and North-Western Russia. We compiled multi-annual tracking data from 9 species (including waterfowl, seabirds, raptors and shorebirds) and related annual timing of migration and reproduction to the local date of snow melt.

We find different responses to earlier snowmelt among species groups. Species of waterfowl advance arrival and laying dates under earlier snow melt, likely as their pace of migration is slower, allowing for adjustment during migration. Raptors and shorebirds do not adjust their timing of migration to varying dates of snowmelt, but delay breeding when snowmelt occurs late. Skuas do not adjust timing of arrival and laying to varying dates of snowmelt. Our results suggest that the need and ability of Arctic migrants to predict the onset of Arctic spring during migration varies between species groups, and especially waterfowl has leeway to advance or delay arrival once underway. For raptors and shorebirds, timing of migration may constrain earlier laying. On the other hand, skuas may be less driven to advance timing of reproduction and migration if their prey, lemmings and marine resources, do not advance in earlier springs. While the ability to adjust timing of migration may become an important determinant for population viability in a warming Arctic, the need to do so may strongly differ between species groups.

Thomas Lameris studies how climate change in Arctic regions affects migratory birds and to what extent birds can adjust to these changes. He conducts most of his research in Arctic Russia.

THURS, 28 MARCH, 1530 h

Evidence for evolution in the advancing phenology of a migratory bird

Barbara Helm[1], Benjamin Van Doren[2], Dieter Hoffmann[3] & Ute Hoffmann[3]

[1] GELIFES - Groningen Institute for Evolutionary Life Sciences, University of Groningen, 13 Groningen, the Netherlands

[2] Edward Grey Institute, Department of Zoology, University of Oxford, Oxford, OX1 3PS, UK

[3] Hanhofer Straße 35a, D-67376 Harthausen, Germany

* b.helm@rug.nl   🐦 @BBirdClocks

Global warming has modified the seasons, leading to increasingly earlier springs in many regions on earth. Some species of migratory birds are not sufficiently advancing the timing of migration and breeding to compensate for these earlier springs. Reproduction in these species may thereby become mistimed relative to the peak of food availability for raising their offspring. In some species, such mistiming is associated with local population declines. Flexible responses of birds to early springs may be constrained by the inherited, clock-based timing programmes that regulate long-

distance migrations. In this case, evolutionary adjustments are the only viable mechanism for keeping pace with shifting phenology.

Therefore, it is imperative to understand whether circannual timing programmes can rapidly evolve, but detecting evolutionary change is difficult without experimentation. The Pied Flycatcher *Ficedula hypoleuca* is a model for studying constrained ecological responses to climate change. Using a laboratory experiment, we show that the phase of the flycatcher clock controlling spring moult, migration, and reproductive timing advanced by 6-12 days over 21 years, whereas no such changes occurred in autumn and winter. Our paired field records, collected in a citizen scientist project, show that a nearby population mirrored these changes, advancing egg-laying by 11 days in the wild. Furthermore, the spring time window during which flycatcher laydates were most sensitive to ambient temperature advanced by three weeks. These results support a role of microevolution in modifying spring phenology and suggest that the inherited timing programmes of long-distance migratory birds may be more labile than previously thought, leaving some scope for evolutionary rescue in a changing climate.

Barbara Helm is a researcher in Groningen, the Netherlands, to where she recently moved from Glasgow. She is keenly interested in migration, especially with respect to time-keeping. Her research revolves around biological rhythms of wild birds in natural and modified environments, applied for example to effects of urbanization and light pollution.

POSTER | ECR PRESENTER

Influence of weather conditions on the migratory performance of juvenile White Storks (*Ciconia ciconia*)

Marta Acácio[1], Kate Rogerson[1], Inês Catry[2], Alejandro Onrubia[3], Phil Atkinson[1,4], João Paulo Silva[2,5], Aldina Franco[1]

[1] School of Environmental Sciences, University of East Anglia, NR4 7TJ Norwich, United Kingdom

[2] CIBIO-INBIO Universidade do Porto, Campus de Vairão, Rua Padre Armando Quintas, nº 7, 4485-661 Vairão, Portugal

[3] Fundación Migres, CIMA, Centro Internacional de la Migración de las Aves (Bird Migration International Center), CP 11380, Spain.

[4] British Trust for Ornithology, The Nunnery, IP24 2PU Thetford, United Kingdom

[5] Centre for Ecology, Evolution and Environmental Changes Faculdade de Ciências da Universidade de Lisboa, Edifício C2, 5º Piso, Sala 2.5.46 Campo Grande, 1749-016 Lisboa, Portugal

* m.serra-acacio@uea.ac.uk 🐦 @MartaAcacio

White Storks (*Ciconia ciconia*), traditionally a fully migratory species, established resident populations in the Iberia Peninsula in recent decades and the number of resident and wintering storks has been increasing since the 1980s. This change in migratory behaviour has been accredited to several factors including the use of landfill sites, a stable food resource all year-round. Landfill use seems to influence adult movements, however the effects of landfills on juvenile movement and survival remains poorly understood.

White storks are large soaring birds, requiring suitable weather conditions to succeed in their migration. Weather conditions that enable thermal soaring facilitate the crossing of large migratory barriers, such as the Mediterranean Sea and the Sahara desert. However, the weather is not constant throughout the migratory season hence, the timing of migration will be crucial to determine the conditions birds' experience.

We used data from 107 juvenile white storks, tracked with GPS/GPRS devices deployed between 2016 and 2018, to examine the influence of landfill use on the timing, duration and efficiency of migration. Landfill use did not influence the total migration duration or efficiency of juvenile white storks. However, storks that foraged on landfills began the migration later in the season and had different performance from non-landfill users while crossing migratory barriers. We used weather variables, such as temperature, humidity and wind speed and direction, to understand how different weather conditions influence barrier crossing, as well as total migration distance, speed, efficiency and mortality during the first migration of juvenile white storks.

Marta Acácio is a biologist with an interest in movement ecology. She is studying the environmental drivers of dispersal and migratory behaviour of white and black storks from the Portuguese partially migratory population.

POSTER | ECR PRESENTER

Bird-habitat relationships to inform environmental management at a landscape-scale in order to mitigate bird population declines in the UK

Ailidh Barnes[1], **Ross Hill[1]**, **Richard Stillman[1]**, **Richard Broughton[2]**, **Shelley Hinsley[2]**

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

[2] Centre for Ecology & Hydrology, Maclean Building, Crowmarsh Gifford, Wallingford OX10 8BB, UK

* abarnes@bournemouth.ac.uk 🐦 @ailidhbarnes

Biodiversity is declining on a global scale despite efforts to the contrary, and many UK birds have declined since the 1960s, particularly on farmland. 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 the consequences of habitat and landscape changes on bird populations in two contrasting and mixed land-use sites, the New Forest in Hampshire and predominantly arable farmland in Cambridgeshire. The New Forest is a National Park comprising a mixed woodland and heathland landscape. The woodlands are a mix of broadleaved Beech and Oak, interspersed with conifer plantations and stretches of heathland with encroaching scrub. Cambridgeshire, by contrast, is an agricultural landscape of mainly arable farmland with mostly deciduous woodland patches and hedgerows. Recently acquired, high resolution airborne remote sensing datasets (LiDAR) will be used to develop metrics that quantify structure, composition and condition of the two study landscapes. Bird diversity and community composition will be assessed in relation to remotely sensed metrics to determine the effects of landscape characteristics on bird community dynamics. At the landscape scale, bird distribution and abundance will be assessed in relation to landscape structure and vegetation composition, testing scenarios of how changes in land-use would affect bird population persistence. The overall aim of this study is to provide realistic measures to develop sustainable landscapes in order to conserve avian diversity.

Ailidh Barnes is in her final year of her PhD studying bird communities in various habitats in two contrasting landscapes. Her aim is to utilise habitat structure and composition in spatial modelling to evaluate habitats and provide sustainable management strategies in order to conserve bird species communities.

POSTER | ECR PRESENTER

Using temporal patterns of day-to-day passerine migration over the North Sea to infer departure behaviour

Maja Bradarić[1], **Ruben Fijn**[2], **Willem Bouten**[1], **Judy Shamoun-Baranes**[1]

[1] Animal Movement Ecology, Institute for Biodiversity and Ecosystem dynamics, University of Amsterdam, Science Park 904, 1098 XH Amsterdam, The Netherlands

[2] Bureau Waardenburg, Varkensmarkt 9, 4101 CK Culemborg, The Netherlands

* m.bradaric@uva.nl

Increasing number of tracking and radar studies is revealing the migratory patterns of even the smallest avian migrants, the passerines. However, studying migratory behaviour of these small migrants at sea remains challenging as well as intriguing. Large water bodies are considered ecological barriers for small migrants, which they generally tend to cross by trying to make use of preferable weather conditions, according to which they calibrate their departure times.

Previous studies of bird migration around the North Sea basin have suggested that most of the birds that migrate over the North Sea are nocturnal migrants. They are believed to depart from land one hour after sunset, whereupon they take one of the main proposed migratory routes (between Scandinavia and S Europe and Africa, between NE Europe and the UK and between Norway and the Netherlands). To test expectations regarding departure decisions, we used a 4-year dataset collected simultaneously by two different types of radar offshore and at the coast in the NW Netherlands during both spring and autumn migration. Based on the timing of arrival at the radar location, measured groundspeed and track direction and assuming constant flight behaviour we answered the following questions: I) What are the potential departure times and locations on land? II)Knowing this, how much time do migrants potentially need to reach the radar location? III) How much time do they need to cross the North Sea? IV) To what extent does timing of arrival at sea vary within a season?

The results describe daily temporal migration patterns over the North Sea and suggest how they can be used to understand departure decisions from land. Furthermore, they provide important information needed to mitigate the impact of wind farms on migratory birds.

Maja Bradarić is an ecologist with the main research focus on animal movement ecology. She is principally curious to understand how environmental factors shape spatio-temporal animal movement patterns in order to better comprehend their ecology, thus helping development of proper conservation management plans.

POSTER | ECR PRESENTER

Carry-over effects of the non-breeding ground quality on the phenology of annual cycle

Vojtěch Brlík[1,2*]**, Gintaras Malmiga**[3]**, Jaroslav Koleček**[1]**, Dimitar Dimitrov**[4]**, Tamara Emmeneger**[5]**, Denis Hasselquist**[3]**, Mikkel Willemoes**[3]**, Bengt Hansson**[3]**, Petr Procházka**[1]

[1] The Czech Academy of Sciences, Institute of Vertebrate Biology, Květná 8, CZ-60365 Brno, Czech Republic

[2] Department of Ecology, Faculty of Science, Charles University in Prague, Viničná 7, CZ-12844 Praha, Czech Republic

[3] Department of Biology, Molecular Ecology and Evolution Lab, Lund University, SE-22362 Lund, Sweden

[4] Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Gagarin Street 2, BG-1113 Sofia, Bulgaria

[5] Bird Migration Department, Swiss Ornithological Institute, Seerose 1, CH-6204 Sempach, Switzerland

* vojtech.brlik@gmail.com 🐦 @VojtechBrlik

Long-distance migratory birds spend most of their lives on the non-breeding grounds or *en route*. Therefore, studying how non-breeding habitat conditions impact the annual cycle events is essential for understanding the inter-individual variability observed on the breeding grounds in e.g. timing of arrival or breeding success.

Here, we will quantify the carry-over effects of the timing of the previous phases and the non-breeding ground quality to the subsequent phases of the annual cycle in the Great Reed Warbler (*Acrocephalus arundinaceus*). We will use spatio-temporal information of 146 full annual cycles obtained from geolocator-tagged individuals breeding in five populations (Sweden, Czech Republic, Bulgaria, Turkey and Kazakhstan). We will gather Normalized-Difference Vegetation Index values for the stationary locations as proxies for the non-breeding habitat greenness and estimate greenness stability and trend. Moreover, remarkable intra-tropical movements in response to seasonal habitat changes in sub-Saharan Africa were detected in many of the tracked individuals. We will relate these intra-tropical movements as well as non-breeding habitat quality and the information on individual movement strategies (such as ratio of stopover duration to duration of migration) to the timing of the subsequent annual cycle stages. Our results will identify the most important temporal dependencies among the annual cycle events and the effect of individual movement strategies especially on the arrival at the breeding grounds. Finally, this unique dataset could help us find proximate causes of the differences between sexes and populations.

Vojtěch Brlík is a master's student of ecology with main research focus on bird migration. He is particularly interested in the temporal and spatial links between annual cycle events and implications of using different flyways by sympatric populations at migratory divides.

POSTER | ECR PRESENTER

Leave or Remain? Fitness consequences of different migratory strategies in partially migratory populations: a multi-taxa meta-analysis

Claire Buchan[1]*, James Gilroy[1], Inês Catry[2], Javier Bustamante[3], Philip Atkinson[4], Aldina Franco[1]

[1] School of Environmental Sciences, University of East Anglia, Norwich, NR4 7JT, UK

[2] Centro de Ecologia Aplicada 'Prof. Baeta Neves' and InBio – Rede de Investigaçaõ em Biodiversidade e Biologia Evolutiva, Instituto Superior de Agronomia, Universidade de Lisboa, Lisbon, Portugal

[3] Estación Biológica de Doñana (EBD-CSIC), 41092 Seville, Spain

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

* c.buchan@uea.ac.uk 🐦 @buchanding

Migration – spatial displacement in response to environmental variability – is risky, and must confer sufficient fitness benefits to have evolved as a viable strategy. Partial migration, wherein migratory and non-migratory individuals exist within the same population, represents a behavioural dimorphism; for it to persist over time, both strategies must yield overall equal individual fitness returns. This balance may be maintained through a trade-off in which migrants gain survival benefits by avoiding unfavourable conditions, while residents gain breeding benefits through early access to resources – but there has been little overarching quantitative analysis of the evidence for this. Given that migrants – especially long-distance migrants – may be particularly susceptible to environmental change, it is also unclear whether anthropogenic stressors may be altering the relative balance of these trade-offs in favour of residency.

We conducted a multi-taxa meta-analysis to assess these predictions – including examining for any deviance from the expected parity in benefits according to population latitude and migratory distance, as would be expected from differential effects of environmental change.

Of 2103 studies found in a systematic literature search, twelve contained suitable information for meta-analysis, from which we calculated 53 standardized effect sizes. Once these were weighted according to precision, we found residency to confer greater fitness benefits than migration, and that these benefits were generally associated with survival, not productivity. The benefits of residency increased with the number of years of data over which effect sizes were calculated, suggesting that deviations from fitness parity are not due to sampling artefacts.

Selection pressures driving the evolution of migratory behaviours may be changing: altered seasonality and increasing anthropogenic threats posed along migratory routes may be altering the balance of relative fitness between strategies. Long-term studies concerning partial migration may be

increasingly important as a means of shedding light on responses of migratory species to environmental change.

Claire Buchan is a PhD student at the University of East Anglia studying the fitness consequences of different migratory strategies in partially migratory populations of Lesser Kestrels (*Falco naumanni*).

POSTER | ECR PRESENTER

Individual variation in migration of Guillemots and Razorbills: insights from a multi-colony tracking study

Lila Buckingham[1,2*], Maria Bogdanova[1], Jonathan Green[2], Bob Furness[3], Francis Daunt[1]

[1] Centre for Ecology and Hydrology (Edinburgh), Bush Estate, Penicuik, Midlothian, EH26 0QB, UK

[2] School of Environmental Sciences, University of Liverpool, Jane Herdman Building, Liverpool, L69 3GP, UK

[3] MacArthur Green, 93 South Woodside Road, Glasgow, G20 6NT, UK

* libuck51@ceh.ac.uk @LilaBuckingham

Many avian studies have focussed on periods of the annual cycle when individuals are comparatively immobile and at high density, and therefore more readily studied, such as during colonial breeding or winter aggregating. Yet migration is a key biological trait undertaken by a huge range of species and remains an understudied phenomenon. In particular, we lack a clear understanding of how migration strategies vary across populations and among individuals within populations. This variation is a critical question in migration ecology, as it has profound effects on population dynamics and conservation management. Many seabird species are colonial during the breeding season, but undertake extensive migrations in the autumn and spring between colonies and distant wintering grounds, often far from land, limiting opportunities for direct observation. Quantifying variation in migration strategies is therefore particularly challenging in seabirds. Tagging devices have revolutionised the study of seabird migration, enabling year-round studies. In a multi-colony study of two species of colonially breeding seabirds, the Common Guillemot I and Razorbill *Alca torda*, we quantified variation in migration strategies among and within populations. Over 400 tags were deployed in the 2017 breeding season across 13 colonies in the northern UK, with 118 Guillemots and 47 Razorbills recaptured in 2018, providing a substantial data set on movements in the 2017-18 winter. We mapped migration routes and identified key hotspots during two key potential energetic bottlenecks: the flightless moult period and late winter when food is scarce. In addition, we determined how migration movements varied both among colonies and between individuals. Our results provide key insights into drivers of variation in winter movements of multiple populations, which can be used to inform population models and spatial planning, particularly in the context of future marine developments and conservation designations.

Lila Buckingham is an ecologist with a particular interest in movement ecology, using seabirds as a study system. She has recently started a PhD studying the wintering ecology of guillemots and razorbills, with previous experience as a spatial analyst within government.

POSTER | ECR PRESENTER

Birds on the beb – Sightings of feral parakeets around the world

Richard Bufton[1], Jon Sadler[2] & Lee Chapman[2], Laurence A. Hurst[3], Jim Reynolds[1]

[1] Biosciences, College of Life and Environmental Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT.

[2] Geography, Earth and Environmental Sciences, College of Life and Environmental Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT.

[3] I. T. Research Support, Computer Centre, University of Birmingham, Edgbaston, Birmingham, B15 2TT.

* Email: RDB781@student.bham.ac.uk

Parakeets are naturally found in tropical and sub-tropical areas of the world, yet many parakeet species are found as feral birds across the temperate zone. In the United Kingdom, more than 30,000 Rose-ringed Parakeets (*Psittacula krameri*) are found, mostly in London and the Isle of Thanet. The London population is rapidly increasing in numbers (possibly by 30% a year) and yet their range is increasing very slowly (less than 2km a year).

What is limiting the spread of these highly successful non-native invasive birds?
To try to answer this question and model their distribution, it is vital to find out where the feral parakeets actually are. We are looking to map the distribution of feral parakeets across Europe, the USA and Canada.

To do this, we have produced a website, parakeetsightings.bham.ac.uk , to gather details on sightings (presence) and non-sightings (absence) of feral parakeets and some details of their populations (where known). A smartphone app is also in production!

We need sightings (and non-sightings) of feral parakeets, not just in the United Kingdom, but in any European or North American country. Every sighting and every bit of information on the populations of feral parakeets and parrots will help us to identify why these birds thrive so well in so many of our cities.

We need your sightings! (and non-sightings…..)

Richard Bufton, twenty years a nurse, trained as a bird-ringer, before studying BSc Conservation Biology at Roehampton University and MSc Applied Wildlife Conservation at Anglia Ruskin University. In 2017, he started a PhD at the University of Birmingham, investigating whether Urban Heat Islands influence bird activity budgets.

POSTER

Human food waste and the recent changes on migratory behaviour of White-storks (Ciconia ciconia): towards the end of migration?

Inês Catry [1,2,3], **Aldina Franco**[3], **Marta Acácio**[3], **Katharine Rogerson**[3], **Teresa Catry**[4], **Carlos Pacheco**[5], **Phil Atkinson**[6], **Francisco Moreira**[1,2]

[1] CEABN/InBIO – Centro de Ecologia Aplicada "Professor Baeta Neves", Instituto Superior de Agronomia, Universidade de Lisboa, Lisboa, Portugal

[2] REN Biodiversity Chair, CIBIO/InBIO – Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Vairão, Portugal

[3] School of Environmental Sciences, University of East Anglia, Norwich, UK

[4] Centro de Estudos do Ambiente e do Mar (CESAM), Departamento de Biologia Animal, Faculdade de Ciências da Universidade de Lisboa, Lisboa, Portugal

[5] Rua João Freitas Branco 38, 2º dto, Lisboa, Portugal

[6] British Trust for Ornithology, BTO, The Nunnery, Thetford, Norfolk, UK

* inescatry@gmail.com 🐦 @InesCatry

The migratory patterns of birds are changing in response to global environmental change with many species forming resident populations in areas where they were once migratory. The iconic White Stork (*Ciconia ciconia*) is a very adaptable, opportunistic species. Since the mid-1980s, increased food availability and milder temperatures in winter have enabled increasing numbers of residents, individuals that choose to stay in Iberia, rather than migrate to Africa. Between 5 and 10 October 2015, we surveyed the wintering population of white-storks in Portugal to assess the proportion of resident individuals and describe the trend of the wintering population using data from seven previous surveys (1995 to 2008). Moreover, we used data from resident storks fitted with GPS track devices to quantify the extent and consistency of landfill attendance during the winter. The number of wintering white-storks in Portugal has increased significantly from 1187 individuals in 1995 to 14434 in 2015. Although the long-term positive trend in the number of breeding birds could partially explain the observed increase in the wintering population numbers, our results unveil a change in the migratory behaviour of white-storks, as the proportion of resident individuals in the population increased from 18% in 1994/1995 to 62% in 2014/2015. Our results from tracked storks showed that resident adult birds strongly rely on landfill sites for foraging during the winter season, when other

food resources are scarcer. The migratory status of the white-stork is changing substantially and, in the mid-term, if environmental conditions continue to favour non-migratory individuals, the population is likely to change towards full residency. Nonetheless, the closure of landfills, as required by EU Landfill Directives, might invert the observed patterns, causing dramatic impacts on white stork populations.

Inês Catry is an ecologist mainly interested in understanding how global environmental changes can impact the breeding biology, migratory behaviour, habitat quality and population dynamics of birds. Her ongoing project "Birds on the move" aims to investigate the adaptive migratory behaviour of white-storks in response to human-induced environmental change.

POSTER | ECR PRESENTER

Linking migratory patterns with breeding success: unravelling migration of the European Bee-eater (*Merops apiaster*) breeding in southwest Iberia

Joana S. Costa[1], Afonso Rocha[1], Steffen Hahn[2], José A. Alves[1,3]

[1] Department of Biology & CESAM - Centre for Environmental and Marine Studies, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal

[2] Swiss Ornithological Institute, Seerose 1, 6204 Sempach, Switzerland

[3] University of Iceland, South Iceland Research Centre, Lindarbraut 4, IS-840 Laugarvatn, Iceland

* joana.santcosta@gmail.com 🐦 @JoanaSantCosta

Throughout Europe, population declines are being reported in a wide range of Afro-Palearctic migrants. The causes of these declines remain unclear due to their wide distribution ranges and the large number of locations which individuals use. In order to determine when and where these species may be mostly affected and how potential consequences for productivity we require a detailed understanding of their migratory schedule and routes, as well as, the location of nonbreeding areas and breeding season parameters.

The European Bee-eater (*Merops apiaster*) is an AP migrant that breeds in temperate regions and overwinters at tropical latitudes. Despite the species' relatively well known breeding area, little is currently known about their spatio-temporal distribution throughout the annual cycle. We used light-level geolocators to explore migratory patterns of adult bee-eaters breeding in southwest Iberia. We attached 60 geolocators during the breeding season of 2016, from which we were able to retrieve 20 full annual tracks and 2 incomplete tracks in the following year. In addition, we quantified breeding season parameters such as hatching date and the number of fledglings per nest of each brood.

The tracks confirmed that Bee-eaters breeding in Iberia use a western migratory corridor to overwinter in West Africa with the majority of birds stopping more than once during spring and autumn migration. Wintering latitude doesn't seem to influence individuals' arrival date to the breeding grounds and no differences were found in migratory timings between males and females or between 2nd year and older birds. However, birds arriving earlier to their breeding grounds tend to lay their eggs earlier in the breeding season and have higher productivity. Our results provide the first insight into migratory patterns and its association with breeding success of European bee-eater breeding in Iberia.

Joana Costa is a biologist interested on bird phenology and migration, population ecology, behavior and conservation. She is currently conducting a PhD at the University of Aveiro and Swiss Ornithological Institute on migratory strategies and demographic processes of an Afro-Palearctic migrant, the European Bee-eater.

POSTER

Between species variation in arrival phenology investigated using field observation data

Mark Eddowes

Independent Researcher, Hollybank, The Dale, Bonsall, Derbyshire, DE4 2AY, UK

mark@eddowesaviationsafety.com

Technological advances in micro-electronics are providing exciting new insights into migration, in particular migration behaviours across areas of the world for which direct field observation and ringing recovery data are often very sparse, for example identifying migration routes and wintering areas across Africa.   These new tracking data are typically available for a limited number of individuals and species only.

In other areas, such as Western Europe, field observation data is often available for a large number of individuals and species. For example, the UK BirdTrack internet-based survey holds data on a wide range of species, including several thousand individual weekly observations across the UK of the more common summer migrants. Amid the excitement generated by the findings provided by new tracking technologies, it is important not to overlook the potential insights into migration behaviour at the population level that can be gained from these field observations.

Analysis of the arrival distributions determined from these data and the associated variation between years has demonstrated the utility of these field observation data in the study of the response of

some species to warming along the migration route and its possible role in influencing phenological change (Eddowes, 2018).   Study of a wider range of species covered by these data indicates variable responses to en-route climate variables. Analysis of these differences may further improve the understanding of the mechanisms influencing these phenological responses, their variations between species and the varied fortunes of different summer migrant species in the face of climate change.

Eddowes, M.J. 2018 Does warming along migration routes explain the advancement of spring arrival in long distance migrants? Presentation at BOU2018

Mark Eddowes is an independent researcher with a wide range of ornithological interests developed through volunteer involvement in ornithology. He has a particular interest in long-distant passerine migrant arrival phenology.

POSTER | ECR PRESENTER

Repeated migration of a juvenile European Nightjar *Caprimulgus europaeus*

Ruben Evens[1], Natalie Beenaerts[2], Eddy Ulenaers[3], Nele Witters[4], Tom Artois[1]

[1] Research Group Zoology: Biodiversity and Toxicology, Centre for Environmental Sciences, Hasselt University, Campus Diepenbeek, Agoralaan, Gebouw D, 3590 Diepenbeek, Belgium

[2] Research Group: Environmental Biology, Centre for Environmental Sciences, Hasselt University, Campus Diepenbeek, Agoralaan, Gebouw D, 3590 Diepenbeek, Belgium

[3] Agentschap Natuur en Bos, Regio Noord-Limburg, Herman Teirlinck Havenlaan 88 bus 75, 1000 Brussels, Belgium

[4] Research Group: Environmental Economics, Centre for Environmental Sciences, Hasselt University, Campus Diepenbeek, Agoralaan, Gebouw D, 3590 Diepenbeek, Belgium

* ruben.evens@uhasselt.be   @REVNJ

Studies that compare migration strategies between juvenile and adult light-weight (<100g), long-distance migrants are scarce. Most of our current knowledge on migration strategies in juvenile light-weight birds still originates from laboratory studies, displacement experiments and partial migration tracks. It is presently assumed that naïve migrants, which migrate without apparent social input from experienced conspecifics, rely on their innate clock-and-compass program during their first migration. In subsequent years, these birds are expected to re-use stopover sites and wintering areas from previous years, as such behaviour promotes their survival.

In this study we deployed one geolocator on one juvenile European Nightjar (*Caprimulgus europaeus*). This bird was recaptured two years later as a territorial male, approximately two kilometres from its

birth place. The recovered geolocator contained robust data covering two complete migration tracks, one track as a juvenile and the consecutive second as an adult. Analysis of the migration routes indicated a loop migration pattern of approximately 16,500 km between breeding periods. This bird crossed the Mediterranean, the Sahara and the Central African Tropical Rainforest on its way to wintering sites in sub-equatorial Africa. This Nightjar showed remarkable capabilities during its first naïve migration to search for stopover zones and wintering areas similar to those used by adult Western European Nightjars and to relocate these specific areas again the next year. During the second migration cycle, arrival times at stopover zones were earlier and stopover times in Europe were shorter. Following these observations, our results suggest that the innate migration program of juvenile nightjars allows them to reach species-specific stopover zones and wintering grounds during their first migration and that experience allows them to fine-tune this program in order to re-use such important areas the next year.

Ruben Evens is a biologist with a main research focus on foraging ecology, migration and conservation. He is mainly interested in investigating the impact of individual foraging and migration strategies on population processes in order to improve conservation management.

POSTER | ECR PRESENTER

Changes in the distribution and abundance of breeding Eurasian Curlew (*Numenius arquata*) in Breckland, UK

Harry Ewing[1*], Jennifer Smart[2], Samantha E. Franks[3], Niall H. K. Burton[3], Jennifer A. Gill[1]

[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 SG19 2DL, UK

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

* h.ewing@uea.ac.uk   Ewing_birds

In recent decades, ground-nesting waders have experienced steep declines globally, none more so than large-bodied waders within the tribe Numeniini, of which two species may already be extinct and five are classified globally as Endangered, Vulnerable or Near Threatened. Recent studies implicate low breeding productivity, mainly caused by land-use change, agricultural intensification and an increased abundance of generalist predators, as a key driver behind declines of many wader species. However, understanding these declines in detail is complex and requires in-depth knowledge of key demographic rates and changes, within populations.

In the UK, numbers of breeding Eurasian Curlew (*Numenius arquata*), a near-threatened, large-bodied wader, have declined 48% in the last 20 years, leading to many local extinctions. However, the

lowland population breeding in the Brecklands of Norfolk and Suffolk still persists, despite unsustainably low breeding productivity. Consequently, efforts to maintain this population are likely to require the use of tools designed to increase hatching and fledging success. This study will use BTO and RSPB survey and nest record data to explore the spatial and temporal-scale over which population-level demographic changes are occurring in Breckland and the landscape and environmental changes that may be influencing them. This will provide a strong foundation for targeted, evidence-based conservation of the lowland Curlew population, in the Brecks.

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 the causes of Curlew declines in the UK and how to best to conserve important lowland populations.

POSTER | ECR PRESENTER

Spatial and temporal consistency in migration routes of seabirds

Kirsty Ann Franklin[1*], Malcolm Nicoll[2], Ken Norris[2], Simon Butler[1], Norman Ratcliffe[3], Jennifer A. Gill[1]

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

[2] Institute of Zoology, Zoological Society of London, Regent's Park, London, UK

[3] British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET, UK

* kirsty.franklin@uea.ac.uk 🐦 @kirstyyfranklin

There is growing evidence that migratory species are particularly vulnerable to rapid environmental changes arising from human activity. However, assessing the ability of a species to adjust to these changes in the environment relies on understanding the degree of individual flexibility (or, conversely, consistency) in migratory routes and timings. This individual-based approach has been made possible by recent advances in remote-tracking technology, and so far has revealed a high degree of between-individual variation but within-individual consistency in the movement patterns of multiple bird species. Despite this, our understanding of the ecological processes involved in these large-scale movements remains rather limited. For example, the degree to which individual differences in migration strategies are influenced by genetics or environmental conditions still requires further investigation. Here, we will present preliminary results from an extensive literature search on all papers estimating repeatability of avian migratory strategies. In addition to this, we will investigate the consistency of individual movement patterns in time and space of a tropical seabird, using light-level geolocators. The Round Island petrel population in the Indian Ocean is a three-way hybrid complex consisting of one species from the Atlantic (*Pterodroma arminjoniana*), two species from the Pacific (*P. heraldica & P. neglecta*), and inter-specific hybrids. By comparing data on migration

trips from the same individuals across multiple years, we will examine how consistent they are in their migratory routes and timings. Using genetic and environmental data, this project will be able to explore associations between individual genotype (which describes individual origin), the environmental conditions experienced, and the migratory routes and timings that are undertaken, and the potential consequences at the individual and population levels.

Kirsty Franklin is a first year PhD student at the University of East Anglia interested in movement ecology and conservation. Her PhD uses a combination of spatial, genetic, demographic, and environmental data in order to investigate the drivers of ocean movement patterns in Round Island petrels. Kirsty's PhD is the first to be funded by the BOU's John & Pat Warham Studentship Fund.

POSTER | ECR PRESENTER

The role of physical condition in the carry-over effects between breeding and migration

Marie Claire Gatt[1]*, Maaike Versteegh[2], Irene B. Tieleman[2], José Pedro Granadeiro[1], Paulo Catry[3]

[1] Centro de Estudos do Ambiente e do Mar (CESAM), Departamento de Biologia Animal, Faculdade de Ciências da Universidade de Lisboa, 1749-016 Lisboa, Portugal

[2] Groningen Institute for Evolutionary Life Sciences, University of Groningen, Groningen, The Netherlands

[3] Marine and Environmental Sciences Centre (MARE), ISPA-Instituto Universitário, Rua Jardim do Tabaco 34, 1149-041 Lisbon, Portugal

* mcgatt57@gmail.com 🐦 @MarieClaireGatt

Migration and breeding are energetically expensive and often reported to require trade-offs with other physiological processes. Early return to the breeding grounds in high physical quality, particularly in the case of males, is hypothesised to increase the individual's chance to secure and defend a nest and cope with energetic demands of breeding. Moreover, arrival condition is thought to carry over from the costs of previous reproduction or migration strategy. In the Cory's Shearwater (*Calonectris borealis*), a long-lived seabird exhibiting partial migration, early relief from breeding duties due to failure has been associated with earlier moult and altered movement phenology into the following spring. Here, we expand on this knowledge by investigating whether immune function and nutritional condition are tied to the energetic trade-offs of migration and the costs of reproduction. We quantified an array of physical condition indices on Cory's Shearwaters on their arrival to the breeding colony (Selvagem Grande) from return migration, after experimentally manipulating previous breeding success. We found no differences in haptoglobin concentration, natural antibody and complement activity, leukocyte profile, nitric oxide concentration, and size-corrected body mass

between experimental and control groups for breeding success or between birds of different migration strategies. Tail feather fault bar frequency, a reflection of acute stress during feather growth, was the only variable to be significantly lower in resident birds. This apparent lack of carry-over effects reflects the possibility of Cory's Shearwater to canalise against energetic costs in their annual cycle.

Marie Claire is a PhD student studying the causes and consequences of individual variability in migratory behaviour of the Cory's Shearwater. Throughout her scientific career she has been working on themes related to movement ecology, physiology, and behaviour, mostly in relation to seabirds.

POSTER | ECR PRESENTER

Testing the efficiency of Stone-curlew Burhinus oedicnemus management through a landscape-scale experiment

Robert Hawkes [1,]*, **Jennifer Smart** [2,], **Andy Brown** [3], **Paul Dolman** [1],

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

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

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

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

Stone-curlew *Burhinus oedicnemus* is a Species of European Conservation Concern protected under Annex 1 of the EC Birds Directive (EC 1979) due to historic declines across their European range. In the UK, most pairs breed in arable habitats in Southern and Eastern England, where the population depends upon costly interventions (nest marking and chick rescues) to prevent brood destruction through farming operations. To reduce their reliance on this strategy, conservationists are attempting to increase the number of breeding pairs on 'safe' grassland habitats by creating areas of physically disturbed ground (herein 'grassland plots'). Although this management provides suitable nesting habitat, it is unclear whether it provides a foraging resource, and whether prescription detail matters.

Here, we examine the habitat preferences of five adult Stone-curlew, using GPS loggers, within a grassland-arable matrix comprised of 144 experimental grassland plots (differing in establishment method and disturbance age/frequency). Preliminary results from nocturnal habitat models (when birds feed) suggest that during breeding attempts birds utilise grassland plots, but not exclusively; relying also on arable habitats, including spring-sown crops, pig farms and manure heaps, but avoiding undisturbed grassland and winter-sown crops. Nocturnal habitat selection is similar after brood failure, but grassland plots and spring-sown crops are used to a greater and lesser extent, respectively. During and after breeding the number of daily fixes, per grassland plot, was higher on

recently disturbed plots (compared to one-year-old fallows), and on plots closer to the nest/territory centre.

Our results suggest that targeting grassland plots close to preferred arable habitats (spring-sown crops, manure heaps, and pig units), and creating nearby areas of recently-disturbed grassland, will give breeding Stone-curlew access to their preferred foraging habitats. This has important implications for how limited conservation resource is targeted.

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 PRESENTER

Do light-level geolocators affect the behaviour and fitness of Common Terns?

Nathalie Kürten[1,2*], Oscar Vedder[1], Jacob González-Solís[3], Heiko Schmaljohann[1,2], Sandra Bouwhuis[1]

[1] Institute of Avian Research, An der Vogelwarte 21, D–26386 Wilhelmshaven, Germany

[2] Institute of Biology and Environmental Sciences, University of Oldenburg, Carl-von-Ossietzky-Str. 9 – 11, D–26129 Oldenburg, Germany

[3] Department of Animal Biology, University of Barcelona, Avinguda Diagonal 643, E–08028 Barcelona, Spain

* nathalie.kuerten@ifv-vogelwarte.de 🐦 @CommonTerns

Light-level geolocators are increasingly popular devices for the individual tracking of many migratory bird species. However, for each species, the potential effects of these devices on behaviour and performance should be assessed prior to extensive use. We therefore investigated whether light-level geolocators affected a ~125 g long-distance migratory seabird, the Common Tern *Sterna hirundo*. Using a balanced experimental design, we tested for 48 focal birds (24 geolocator and 24 control birds; 12 ♂ and 12 ♀ each) and their partners, all of known identity and life history, whether geolocators (Intigeo-C65; ~1.3 % of body mass) deployed during early incubation affected subsequent incubation and provisioning behaviour, reproductive performance, phenology and survival. In the year of deployment (2016), we found no evidence for the behaviour of focal birds, or that of their partners, to be affected by the geolocators. Moreover, we found no differences in reproductive performance and departure date from the colony. Finally, neither local survival to 2017 nor arrival date in 2017 differed between focal birds or their partners. Our results therefore show that light-level

geolocators can be used for individual tracking of common terns and that any potential effects on the birds' behaviour and fitness are minor.

Nathalie Kürten is a PhD candidate at the Institute of Avian Research with a main research focus on ecology and evolution. She investigates effects of climate, as well as climate change, on migratory strategies of a threatened seabird, the common tern.

POSTER

Sympatric wintering of Red Kites and Black Kites in southeastern Europe

Ivan Literák[1*], David Horal[2], Rainer Raab[3], Hynek Matušík[4], Stanislav Vyhnal[1], Dana Rymešová[1], Péter Spakovszky[3], Theodora Skartsi[5], Kostas Poirazidis[5, 6], Sylvia Zakkak[7], Adrian Tomik[8]

[1] Department of Biology and Wildlife Diseases, Faculty of Veterinary Hygiene and Ecology, University of Veterinary and Pharmaceutical Sciences Brno, Palackého tř. 1, 61242 Brno, Czech Republic

[2] Nature Conservation Agency of the Czech Republic, Regional Office Brno, Kotlářská 51, 60200 Brno, Czech Republic

[3] Technisches Büro für Biologie Mag. Dr. Rainer Raab, Quadenstrasse 13, 2232 Deutsch-Wagram, Austria

[4] 68713 Březolupy 324, Czech Republic

[5] WWF Greece, Dadia Program, 21 Lempesi str., 117 43 Athens, Greece

[6] Department of Environmental Technology, Technological Educational Institute of Ionian Islands, Minotou Gianopoulou, Panagoula, 29 100, Zakynthos, Greece

[7] Dadia-Lefkimi-Soufli Forest National Park, Management Body, p.o. 1413, 684 00 Dadia, Greece

[8] Croatian Society for the Bird and Nature Protection, Croatia

[*] Email: literaki@vfu.cz

Ten juvenile (pulli) Red Kites *Milvus milvus* equipped with GPS/GSM telemetry loggers in nests in central Europe (Austria, Czech Repubic, Slovakia) from 2014 till 2017 and wintering in southeastern Europe were included in the study. These Red Kites occupied winter grounds in Hungary, Croatia and Greece. Birds arrived to winter grounds from 10 July to 12 December and departed from winter ground from 14 February to 22 May, staying at winter grounds from 121 to 229 days. Usually, we found during *in situ* inspection a number of Red Kites wintering together at winter grounds, some of Red Kites wintered alone.

We found Black Kites *Milvus migrans* wintering together with Red Kites at the same winter grounds in 6 out of 14 cases. The numbers of Black Kites wintering together with Red Kites were higher than the number of Red Kites in all Greek winter grounds. In winter grounds in Hungary and Croatia, the

numbers of Black Kites were lower than the numbers of Red Kites or Black Kites were lacking. Habitats of all winter grounds were similar: they were located in lowlands with agricultural landscape characterized by small fields, orchards and meadows and small to medium-sized forest patches. Small villages to medium sized cities were nearby.

If we use as a most important marker of the size of a home range Kernel Density Estimate 80% (area of main foraging and roosting activities), we revealed that the size of a home range of Red Kites staying at one place for all winter is from 10 to 108 km^2 and that the size of home range of birds with local shift(s) in winter ground is from 344 to 620 km^2 which is substantially higher than the size of home ranges of Red Kites wintering in central and southwestern Europe published till now.

Ivan Literák is a biologist with a main research focus on wildlife diseases and movement ecology of wild birds, now especially Eurasian raptors. He is particularly interested in kites and their species-habitat interactions and migrations.

POSTER | ECR PRESENTER

Using citizen science data to understand changes in wader migratory phenology

Thomas Mondain-Monval[1]*, Jamie-Leigh Chapman[2], Andrew MacColl[3], Stuart P. Sharp[1]

[1] Lancaster University, Lancaster Environment Centre, Library Avenue, Lancaster, LA14YQ

[2] Lancaster University, STOR-i Centre for Doctoral Training, Science and Technology Building, Lancaster, LA14YR

[3] University of Nottingham, University Park, Nottingham, NG72RD

* t.mondain-monval@lancaster.ac.uk 🐦 @TMondain

Avian species globally are expected to face increased environmental pressures due to anthropogenic climate change. Documenting the responses of individuals and populations to such change is increasingly at the forefront of ecological studies. Migratory species are thought to be particularly susceptible to climate change as they are reliant on distinct geographic regions whose local climate regimes may change differently over time. This has resulted in changes to the timing of migration, an important life history trait to understand as it can have significant knock-on effects for reproductive success and survival.

There have been many studies documenting changes in migratory species' phenology, focussing on both single populations and multiple populations from across a species' range. Although theory suggests that migratory species should advance arrival to the breeding grounds in order to coincide with the earlier onset of spring, studies have often found contradictory results regarding whether the timing of migration has advanced or delayed. The impact of climate change across different species is

not well understood, but could reveal important information about how they respond and shed light on their potential to adapt. Using bird sightings data collected from the online resource eBird and changepoint analysis we investigate changes in the timing of spring and autumn migration in forty-six wading bird species from the Nearctic and Afro-Palearctic Flyways. To our knowledge, previous studies of phenology using citizen science have typically worked on relatively small scales, investigating the timing of arrival of a few species to specific locations. We aim to determine whether it is possible to use citizen science data to investigate migratory bird phenology across flyways, rather than at a population level, and to identify any overarching trends in the timing of migration over recent decades.

Thomas Mondain-Monval is a PhD student interested in behavioural, population and conservation ecology, currently focussed on understanding declines in migratory bird species. He is particularly interested in how the behaviour of individuals influences whole-population trends, in order to implement conservation schemes.

POSTER | ECR PRESENTER

Migration and breeding phenology in Common Greenshank: Individual consistency and latitudinal variation revealed by light-level geolocators

Josh Nightingale[1,2], Peter M. Potts[3], Ed Rowsell[4], Jennifer A. Gill[2], José A. Alves[1,5]

[1] Department of Biology & CESAM - Centre for Environmental and Marine Studies, University of Aveiro, Campus Universitário de Santiago, Aveiro, Portugal

[2] School of Biological Sciences, University of East Anglia, Norwich Research Park, Norwich, UK

[3] Farlington Ringing Group, Solent Court Cottage, Chilling Lane, Warsash, Southampton, UK

[4] Solent Bird Studies, East Solent Coastal Partnership, Southmoor Depot & Offices, 2 Penner Road, Havant, UK

[5] University of Iceland, South Iceland Research Centre, Laugarvatn, Iceland

* nightingale.joshua@gmail.com 🐦 @Luscinia_joshua

Timing of life-history events such as migration and breeding is commonly variable in wader populations, with departures from wintering grounds and arrival on breeding grounds spanning several weeks. This variation could reflect inter-annual variation in individual phenologies or population-level variation among individuals. Here we explore sources of phenological variation by tracking individuals from one winter location during the breeding season.

We present results from nine Common Greenshank *Tringa nebularia* tagged with geolocators in the Solent, south UK, during autumn or winter. Two birds bred in Scotland; all others migrated to Scandinavia or west Russia during the breeding period, but were spread widely over the area.

Individual migration schedules varied greatly with the latitude at which those individuals bred. During spring migration, more northerly-breeding birds left the Solent later, travelled for longer, and arrived later at their breeding sites. More northerly birds also initiated incubation later. However, the gap between arrival on territory and beginning incubation was shorter for more northerly individuals.

For all individuals, returning migratory travel duration during autumn (from breeding sites to the Solent) was shorter than in spring. Schedules in autumn were less strongly influenced by latitude, and more by events during the breeding season. Timing of spring migration and incubation showed high individual inter-annual consistency relative to the population variance. We also found that individuals tended to incubate consistently diurnally or nocturnally.

These results show that wintering flocks contain individuals on very different schedules. These consistent individual differences lead to the variation seen at a population level.

Josh Nightingale is an ecologist with particular interests in waders and migration. He is currently a PhD candidate at the University of Aveiro, studying juvenile waders' settlement decisions and their role in populations' responses to environmental change.

POSTER | ECR PRESENTER

Radar View on the Adriatic Flyway – First Bird Migration Research Using Radar in NW Balkans

Elena Patčev[1,2], Maja Maslać Mikulec[1,3], Marin Grgurev[4]

[1] Geonatura Ltd., Fallerovo šetlište 22, Zagreb, Croatia

[2] Department of Geography, Faculty of Science and Education, University of Mostar, Mostar, Bosnia and Herzegovina

[3] Department of Biology, Faculty of Science, University of Zagreb, Zagreb, Croatia

[4] Exatto Ltd., Zvonimira Rogoza 5, Zagreb, Croatia

* epatcev@geonatura.hr

The Adriatic Flyway through the Balkan Peninsula is quite broad, making it challenging to study and to give estimation on its usage. Also, due to its geopolitical past, large areas in this region are understudied when it comes to bird migration, particularly with relatively novel and costly methodologies, such as radar monitoring.

This study focused on the Podveležje mountain (Bosnia and Herzegovina), where two X-band marine radars were used (horizontal and vertical) to study autumn migration in 2014. Results have shown

daily and diurnal difference in migration rate, with two large peaks of nocturnal migration, during the
research period. Altitudinal distribution of migration traffic rates has shown that the nocturnal
migration peak is between 1000 and 1300 m, while during the daytime most signals were found on
much lower altitudes. General direction of the nocturnal migration was N to S and also NE to SW, as
expected.

These data provide new insight to the usage of the Adriatic Flyway, chiefly for nocturnal migration
patterns and intensities. In order to better describe the importance and threats for this flyway,
comparison to other flyways is given in this work.

Elena Patčev is an ornithologist with research focus in bird conservation and ecology. Her special
interest is radar research of bird migration, focusing on Balkans region and the understudied Adriatic
flyway.

POSTER | ECR PRESENTER

Post-breeding movements of Pink-footed Geese on Svalbard: two routes with different causes and consequences

Kees H.T. Schreven [1]*, Jesper Madsen [2], Bart A. Nolet [1,3]

[1] Dept. Animal Ecology, Netherlands Institute of Ecology (NIOO-KNAW), Wageningen, The Netherlands.

[2] Dept. Bioscience, Aarhus University, Denmark.

[3] Dept. Theoretical and Computational Ecology, Institute for Biodiversity and Ecosystem Dynamics (IBED), University of
Amsterdam, The Netherlands.

* k.schreven@nioo.knaw.nl

Post-breeding movements of Pink-footed Geese on Svalbard have been described for failed and non-
breeders, and show that the geese move east and north before moult, presumably avoiding
competition with breeders (i.e. in the west) and exploiting areas with later phenology and thus higher
food quality. However, for breeders, post-breeding movements are not well-studied even though
geese stay on Svalbard 1.5 months after the chicks fledge. We caught groups of breeders and tagged
35 female Pink-footed Geese with GPS-GSM neckband transmitters, in two areas: Longyearbyen
(southeast of Isfjorden) and Daudmannsøyra (northwest of Isfjorden). We found that these geese
used two main post-breeding routes: via Edgeøya in the east, and via the western Nordenskiöld Land
and South Spitsbergen. However, the birds from the western tagging location mainly used the
eastern route, and those from the eastern location mainly used the western route. We think that local
geography explains this pattern, because geese from Daudmannsøyra moved mainly along the north
coast of Isfjorden towards the east, thereby ending up in the valley of Sassendalen that leads them to

the east. Geese that migrated east, from both areas, were later in their moult cycle during our catches. In the group from Longyearbyen, those geese that took the eastern route had more chicks. Nevertheless, geese on the eastern route left almost a week earlier for over-sea migration than geese taking the western route. We test if this is a constraint (i.e. does winter start earlier in the east due to the influence of the Arctic Ocean?) or facilitated by a higher food quality in the east (as suggested by the elevation of the areas that the geese actively visited, and by CN-ratio of droppings). These findings suggest that local geography plays an important role for post-breeding movements of Pink-footed Geese on Svalbard.

Kees Schreven is a biologist interested in a variety of systems and eco-evolutionary questions. His focus has been on raptors, waders, skuas, passerines and geese while looking at ageing, foraging decisions, annual timing, copulation behaviour, personality and migration. His PhD project is about the potential of Pink-footed geese to cope with effects of climate change in the Arctic.

POSTER | ECR PRESENTER

Climatic niche of the Saker Falcon: predicted new areas to direct population surveys in Central Asia

Luke J. Sutton[1,2,3]* & Robert Puschendorf[1]

[1] School of Biological and Marine Sciences, University of Plymouth, Drake Circus, Plymouth, PL4 8AA, UK

[2] The Peregrine Fund, 5668 West Flying Hawk Lane, Boise Idaho 83709 US

[3] Hierofalcon Research Group, Via Stazzone 235, 95124 Catania, Italy

* lukesutton696@gmail.com 🐦 @RapBiol

Accurate species distribution data across remote and extensive geographic areas are difficult to obtain. Here, we use bioclimatic envelope models to determine climatic constraints on the distribution of the migratory Saker Falcon *Falco cherrug* to locate unknown populations in data-deficient regions. Sakers live at low densities, across large ranges in remote regions, making distribution status difficult to assess. We show the utility of Species Distribution Modelling (SDM) to address distribution knowledge gaps, and target surveys for this endangered species.

Using presence-background data and eight bioclimatic variables, we applied the MAXENT algorithm to construct bioclimatic envelope models for both breeding and wintering ranges. Occurrence data were spatially-filtered and climatic variables tested for multicollinearity, before selecting best fit models using Akaike Information Criteria (AIC) by tuning MAXENT parameters. Biogeographical interpretations were based on predicted climatic suitability, response curves and jack-knife tests of variable importance.

Model predictive performance tested using continuous Boyce index (B) was high for both breeding (BTEST = 0.921) and wintering models (BTEST = 0.735), with low omission rates and minimal overfitting. The Sakers' climatic niche was defined by precipitation in the warmest quarter in the breeding range model, and mean temperature in the wettest quarter in the wintering range model. Model predictions identified new areas to guide exploratory surveys in Central Asia, in particular the Qinghai-Tibet plateau in western China.

Our models accurately predict areas of highest climate suitability and define the climatic constraints on a wide-ranging rare species, suggesting that climate is a key determinant of Saker distribution across macro-scales. We recommend targeted population surveys for the Saker based on model predictions to areas of highest climatic suitability in key regions with distribution knowledge gaps. Further applications of our models could identify protected areas and reintroduction sites, inform development conflicts, and assess climate change impacts.

Luke Sutton is a raptor biologist and biogeographer interested in how apex predators function in ecosystems and spatio-temporal patterns of raptor distributions. He is particularly interested in using spatial models to identify unknown populations of endangered raptors, and to assess the potential impact of climate change on raptor distributions.

POSTER | ECR PRESENTER

Discovering the new population of Black-tailed Godwits along the East Asia – Australasian Flyway

Bing-run Zhu[1,3]* Chris J. Hassell[2], Yvonne[1]. Verkuil[3], Mo Verhoeven[1], Jelle Loonstra[1], Zhengwang Zhang[3], Theunis Piersma[1]

[1] University of Groningen, the Netherlands

[2] Global Flyway Network

[3] Beijing Normal University, China

* drewbingrun@outlook.com / b.zhu@rug.nl   🐦 @DrewBingrun

Black-tailed Godwits *limosa limosa* are widely distributed in the Palearctic realm. In China, each year more than 20.000 Black-tailed Godwits stage at the northern part of Bohai Bay in order to refuel for subsequent northward migration. However, there is little knowledge about this staging-population: to which subspecies do they belong? where is their breeding/wintering grounds, do they stopover after leaving Bohai Bay?

Tracking Migration: drivers, challenges and consequences of seasonal movements

26 – 28 March 2019 | University of Warwick, UK

In order to investigate this, we compared the morphometrics of this population with all known *Limosa limosa* subspecies, tracked 21 individuals with high-resolution GPS-trackers and evaluated the genetic similarity of this staging-population with the other known subspecies.

Overall, Black-tailed Godwit in Bohai Bay was larger than *Limosa limosa melanuroides*, it is the only subspecies ever recorded within this flyway, GPS-tracking revealed that the distribution of Black-tailed Godwits from Bohai Bay is not overlapping with *melanuroides,* and lastly, we found a unique haplotype of Bohai Bay population on its mitochondrial control region which could distinguish them out of 3 known subspecies . By taking into account these findings we will discuss whether Black-tailed Godwits in Bohai Bay should be classified as a new subspecies.

Bingrun Zhu (Drew) is an ornithology/ecology major Ph.D. candidate, his research focuses on a specific population of wader species (black-tailed godwit) in East Asian - Australasian Flyway (EAAF), and describe this population through the perspectives of morphology, migration and molecular.