# Coimbra - Portugal - 2024

16TH INTERNATIONAL

Seabird Group Conference

# Conference Programme

1 2 9 0 UNIVERSIDADE D COIMBRA

dcv.uc DEPARTMENT OF LIFE SCIENCES FACULTY OF SCIENCES AND TECHNOLOGY UNIVERSITY OF COIMBRA

MARE ecology and conservation of top predators UCoimbra

the Seabird Group

# WELCOME MESSAGE

Bem-Vindo / Welcome to the XVI International Seabird Group Conference, 2-6 September, 2024, Coimbra, Portugal.

We accepted the challenge proposed by Liz Humphries at the last conference in Cork, and are delighted to organize the 16th International Seabird Group Conference for the first time in Portugal. Our research group, the ECOTOP (Ecology and Conservation of Top Predators), after receiving a large number of high - quality abstracts, was able to design a programme with an exciting line-up of plenary speakers and presentations covering the latest seabird research, together with social events that characterise the cultural and student atmosphere of the secular University of Coimbra.

In order to accommodate more presentations, we opted for more 5-minute talks, and to give the opportunity for everyone to adequately present their posters, we opted for two poster sessions. Overall, we are covering a very wide range of topics, from Monitoring to Movement Ecology, Climate Change, Toxicology, Conservation and Renewable Energy. The promotion of diversity, equity, inclusion, and belonging is important to secure an effective scientific community, and we included a session to reflect on this. Throughout we ensure diversity and equality, and a good balance of career stages and gender across presentations.

There will be many opportunities to socialise and network. The catering and the conference dinner include Portuguese food specialities, and both posters sessions include Portuguese wine. Music from Coimbra will be present at the Welcome Reception with a student's tuna, and at the Conference Dinner with Fado de Coimbra (Coimbra Song) and a traditional local band which will take you to the dance floor!

Finally, we suggested two field trips, to the Island of Berlenga, where you can spot some pelagic seabirds and the largest Cory's Shearwater colony in mainland Portugal, and to the Mondego estuary where you will have a taste of salt and coastal seabirds. You may also take the opportunity to visit other natural or cultural areas of Portugal, including the Islands of Madeira and Açores.

If you have any questions during the conference, we are here to help. Just look out for the conference t-shirts, all ECOTOP members will be wearing one.

We wish you a fantastic conference, full of enthusiastic scientific debates, networking and good memories.

Jaime A. Ramos

## The Organising and Scientific Committee

ECOTOP – Ecology and Conservation of Top Predators
MARE - Marine and Environmental Sciences Centre, Department of Life Sciences, University of Coimbra, Portugal
Jaime A. Ramos
Vitor H. Paiva
José C. Xavier
Ana C. Norte
Filipe R. Ceia
Pedro M. Araújo
José Seco
Jorge M. Pereira

## The Seabird Group Committee

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Andie McQuillan (Secretary)
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# PROGRAM

| | Monday, 2 September 2024 | | | |
|---|---|---|---|---|
| **13:00 - 17:00** | Registration at Auditório da Reitoria | | | |
| **13:30 - 17:00** | Parallel Workshops | | | |
| Workshop 1 | José C. Xavier<br>José Seco | MARE - University of Coimbra, Portugal | How and when to approach senior (seabird) experts for research opportunities? | Dep Life Sciences Room 1.1 |
| Workshop 2 | Paulo Martins and<br>María Casero | RIAS - Wildlife Rehabilitation and Investigation Center, Portugal | Necropsy in wild birds. | Department Chemistry, Room 4.5 |
| Workshop 3 | Richard A Phillips<br>Ana PB Carneiro<br>Pep Arcos<br>Francis Daunt<br>Yann Rouxel | British Antarctic Survey, Cambridge<br>BirdLife International, Cambridge<br>SEO BirdLife, Barcelona<br>Centre for Ecology and Hydrology, Edinburgh<br>Birdlife International Marine Programme, RSPB | The opportunities and challenges of translating seabird research into policy. | Department of Life Sciences, Room 1.4 |
| Workshop 4 | Bethany Clark<br>Antonio Vulcano | Birdlife International | Mapping seabird sensitivity to offshore wind development: showcasing existing tools and practices and exploring enhanced methods using seabird distribution data. | Dep. Life Sciences, Room 2.4 |
| | Invited speakers:<br>Maria Dias<br>João Guilherme<br>Marine Conservation team | University of Lisbon, Portugal<br>Independent researcher<br>SPEA, Portugal | | |
| Workshop 5 | Morten Frederiksen<br>Kate Layton-Matthews<br>Elizabeth Humphreys | Aarhus University, Denmark<br>Norwegian Institute for Nature Research, Norway<br>British Trust for Ornithology, UK | How can technology enhance seabird monitoring programmes? | Dep. Life Sciences, Amphitheater I |
| Workshop 6 | Alexandra Donargo<br>Sharon Camm | Wildlife Acoustics, Inc. USA | Wildlife acoustics special workshop: Using bioacoustics as a valuable seabird research tool: a hands-on workshop with the song meter mini 2. | Dep. Life Sciences, Room 1.3 |
| **17:00 - 17:30** | Coffee Break | | | |
| **17:30 - 18:00** | Opening Ceremony | | | |
| **18:00 -19:00** | Welcome adress | | | |
| | Paulo Catry | ISPA / MARE University of Lisbon | The wanderings of Cory's Shearwaters nesting on the Selvagens Islands. | |
| **19:00 - 20:00** | Welcome reception | | | |

| | Tuesday, 3 September 2024 | | | | |
|---|---|---|---|---|---|
| **9:00 - 10:00** | Samantha Patrick | University of Liverpool, UK | Optimising movement decisions in a changing environment: what can we learn from seabirds? | Plenary 1 | |
| **10:00 - 10:15** | Caitlin Frankish | Norwegian Polar Institute, Norway | Modelling year-round energy need of North Atlantic seabirds. | Talk 1 | Movement Ecology |
| **10:15 -10:30** | Quentin Queiros | Swedish University of Agricultural Sciences, Sweden | Predicting foraging trips of the world's seabirds. | Talk 2 | |
| **10:30 -10:45** | Stephanie Harris | University of Bangor, UK | Variable wind selectivity in shearwaters implies knowledge of the foraging landscape. | Talk 3 | |
| **10:45 -11:00** | Oliver Padget | University of Liverpool, UK | Rethinking the role of diffuse competition in seabird distributions. | Talk 4 | |
| **11:00 - 11:30** | Coffee Break | | | | |
| **11:30 -11:45** | Vance Mak | University of Exeter, UK | Responsibility for the conservation of Black-legged Kittiwake Rissa tridactyla in the North Atlantic. | Talk 5 | Movement Ecology |
| **11:45 -12:00** | Sophie Benboudjema | Institute for Sustainable Development, France | Simulation through deep learning of seabird's trajectories for the evaluation of offshore windfarm's impact. | Talk 6 | |
| **12:00 - 12:15** | Ruben Fijn | Waardenburg Ecology, Netherlands | Migration and wintering locations of Sandwich Terns: large-scale northbound pre-migration dispersal and unexpected wintering sites. | Talk 7 | |
| **12:15 - 12:30** | Jana Jeglinski | University of Glasgow, UK | Decades to recovery: present and future impacts of High Pathogenicity Avian Influenza outbreaks on the NorthEast Atlantic gannet metapopulation. | Talk 8 | |
| **12:30 - 12:35** | Téo Barracho | Woods Hole Oceanographic Institution, USA | On-ice navigation of homing breeding Emperor Penguins. | Speed 1 | Other |
| **12:35 -12:40** | Daniel Johnston | British Trust for Ornithology, UK | Incorporating dive attributes within state-space modelling of seabird behaviour at-sea. | Speed 2 | Movement Ecology |
| **12:40-12:45** | Airam Rodríguez | Museo Nacional de Ciencias Naturales, Spain | Feral Pigeons as a new threat to seabirds. | Speed 3 | |
| **12:45 - 12:50** | Debs Allbrook | University of Exeter, UK | Ecology of Black-legged Kittiwakes *Rissa tridactyla* on an offshore oil and gas platform in the Irish Sea. | Speed 4 | Other |
| **12:50 - 12:55** | Vegard Sandøy Bråthen | Norwegian Institute for Nature Research, Norway | Repeatability of non-breeding strategies in northern European Herring Gulls *Larus argentatus*. | Speed 5 | |
| **13:00 - 14:00** | Lunch | | | | |
| **14:00 - 14:15** | Maite Louzao | AZTI, Spain | Assessing the impact of climatic extreme events on bird mortality. | Talk 9 | Climate Change and Extreme Events |
| **14:15 - 14:30** | Ewan Wakefield | Durham University, UK | The importance of changing Antarctic Sea-ice habitats for albatrosses and petrels. | Talk 10 | |
| **14:30 - 14:45** | Kirsty Laurenson | Heriot Watt University, UK | Long term multi-species demographic studies reveal divergent negative impacts of winter storms on seabird survival. | Talk 11 | |
| **14:45 - 15:00** | Sarah Bond | University of Oxford, UK | Behavioural responses of breeding Manx Shearwaters during North Atlantic marine heatwave. | Talk 12 | |
| **15:00 - 15:15** | Ella-Sophia Benninghaus | University of Aberdeen, UK | Temporal resolution matters: using oceanographic variables to explain seabird breeding success and chick diet. | Talk 13 | |
| **15:15 - 15:20** | Ignacio Juarez Martinez | University of Oxford, UK | Snowfall-induced catastrophic breeding failure increasingly frequent in a warming Antarctic Peninsula: Subcontinental analysis of a decade of breeding success for three penguin species. | Speed 6 | |
| **15:20 - 15:25** | Andrés De la Cruz | University of Cádiz, Spain | Global distribution, threats and population trends of the critically endangered Balearic Shearwater *Puffinus mauretanicus*. | Speed 7 | Census, Monitoring and Demography |
| **15:25 - 15:30** | Emma Murphy | University College Cork, Ireland | Dependability of seabird censusing; can we count on our counts? | Speed 8 | |
| **15:30 - 15:35** | Nicolas De Almeida E. Silva | University of Deakin, Australia | Improved passive acoustic monitoring tools reveal environmental influences on breeding phenology in Short-tailed Shearwaters. | Speed 9 | |
| **15:35 - 15:40** | Sarah Kunzig | University of Gloucestershire, UK | Does Atlantic Puffin age structure vary with population trajectory? A groovy citizen science project. | Speed 10 | |
| **15:45 - 16:30** | Coffee Break | | | | |
| **16:30 - 16:45** | Oliver Leedham | UK Centre for Ecology and Hydrology, UK | Estimating the quantity and spatial distribution of seabird prey offtake for marine impact assessments. | Talk 14 | Renewable energy |
| **16:45 - 17:00** | Eleni Melis | Wageningen Marine Research, Netherlands | Assessing the effects of offshore windfarms on marine bird survival and body condition. | Talk 15 | |
| **17:00 - 17:15** | Volker Dierschke | Dachverband Deutscher Avifaunisten, Germany | Seabird sensitivity maps for guiding maritime spatial planning in the German North Sea. | Talk 16 | |
| **17:15 - 17:30** | Lila Buckingham | Norwegian Institute for Nature Research, Norway | An individual-based model to quantify the non-breeding season impact of windfarms on seabirds. | Talk 17 | |
| **17:30 - 17:45** | Ana Almeida; Fraser Carter | SPEA, Portugal | Seabirds, old and emerging threats: Is there room for compensation of potential impacts of offshore windfarms in a migratory seabird species? | Talk 18 | |
| **17:45 - 17:50** | Susanne van Donk | Wageningen Marine Research, Netherlands | Developing accurate seabird density maps to assess cumulative effects of offshore windfarms. | Speed 11 | |
| **18:00 - 19:45** | Poster Session 1 (Poster 1 to 80) | | | | |

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| | Wednesday, 4 September 2024 | | | | |
| **9:00 - 10:00** | Jennifer Provencher | Wildlife Health, Canada | Moving from examining conservation issues separately to considering cumulative effects; a case study of bringing it all together when assessing the threats to Northern fulmars in the Canadian Arctic. | Plenary 2 | |
| **10:00 - 10:15** | Ivo dos Santos | University of Coimbra, Portugal | Assessing the impact of trace element contamination in the physiological condition and health of coastal and oceanic seabirds breeding along the Portuguese coastline. | Talk 19 | Pollution, Toxicology and Diseases |
| **10:15 - 10:30** | Lemesle Prescillia | LIENSs - LIttoral ENvironnement et Sociétés, France | HESISTg and PFAS contamination in seabirds: a multispecies and multisite study in metropolitan France. | Talk 20 | |
| **10:30 - 10:45** | Kerry Schutten | Ontario Veterinary College, Canada | Plastic ingestion, accumulated heavy metals, and health metrics in four gull species feeding at an urban landfill in Newfoundland and Labrador, Canada. | Talk 21 | |
| **10:45 - 11:00** | Thierry Boulinier | CEFE CNRS - Université Montpellier, France | Infectious disease ecology of seabirds: tales of gannets, skuas, albatrosses and penguins. | Talk 22 | |
| **11:00 - 11:15** | Amandine Gamble | Cornell University, USA | More than meets the eye: a detailed eco-epidemiological investigation of highly pathogenic avian influenza on a Subantarctic archipelago sheds light on transmission dynamics. | Talk 23 | |
| **11:15 - 11:45** | Coffee Break | | | | |
| **11:45 - 12:00** | Sofia Roda | IMEDEA, Spain | Predicting foraging areas of European Storm-Petrels: conservation implications in the Western Mediterranean. | Talk 24 | Foraging and Feeding Ecology |
| **12:00 - 12:15** | Maria I. Laranjeiro | University of Coimbra, Portugal | How does foraging in two different environments influences the fatty acid profile of two close-related shearwater species? | Talk 25 | |
| **12:15 -12:30** | Aurore Counilh | University of Deakin, Australia | Overnight foraging trips in a diurnal seabird, the Australasian Gannet *Morus serrator*. | Talk 26 | |
| **12:30 -12:35** | Lauren Evans | University of Bangor, UK | What's for dinner? Using DNA metabarcoding to investigate the diet of Manx Shearwater chicks and adults. | Speed 12 | |
| **12:35 -12:40** | Lara Cerveira | University of Coimbra, Portugal | Stalking terns: Spatial and trophic ecology of an estuarine species and the effect of human disturbance. | Speed 13 | |
| **12:40-12:45** | Astrid Dedieu | University College Cork, Ireland | To dive or not to dive: flight-cost versus foraging strategy in the Manx Shearwater and the Atlantic Puffin. | Speed 14 | |
| **12:45 - 12:50** | Nina Dehnhard | Norwegian Institute for Nature Research, Norway | Fine-scale foraging behaviour of European shags in kelp forests. | Speed 15 | |
| **12:50 - 12:55** | Letizia Campioni | Ornis Italica, Italy | Fine-scale movement data of the Bermuda Petrel highlights surface foraging and greater nocturnal flight activity. | Speed 16 | |
| **13:00 - 14:00** | Lunch | | | | |
| **14:00 - 14:15** | Mónica C. Silva | University of Lisbon, Portugal | The importance of mesopelagics in the diet of pelagic seabirds in the Atlantic Ocean. | Talk 27 | Foraging and Feeding Ecology |
| **14:15 - 14:30** | Francesco Ventura | Woods Hole Oceanographic Institution, USA | Pelagic seabird chases cyclones to improve foraging efficiency. | Talk 28 | |
| **14:30 -14:45** | Norman Ratcliffe | British Antarctic Survey, UK | Population size and foraging movements of penguins at the world's largest colony. | Talk 29 | |
| **14:45 - 15:00** | Evelyn Alexander | Heriot-Watt University, UK | Bird-borne cameras reveal gannet diet and social foraging. | Talk 30 | |
| **15:15 - 15:20** | Patricia Serafini | Universidade Federal de Santa Catarina, Brasil | Biochemical and molecular biomarkers in Manx Shearwaters *Puffinus puffinus* and associations to marine pollution. | Speed 17 | Pollution, Toxicology and Diseases |
| **15:20 - 15:25** | Yasmina Rodríguez | University of the Azores, Portugal | Cory's Shearwater as a key bioindicator of plastic contamination for Northeast Atlantic hotspots of marine litter. | Speed 18 | |
| **15:25 - 15:30** | Víctor Martín-Vélez | Marine Science Institute, Spain | Gulls as spreaders and sentinels of Antibiotic Resistant Bacteria in farmland environments. | Speed 19 | |
| **15:30 - 15:35** | Lucie Michel | Universtiy of Giessen, Germany | Per- and polyfluoroalkyl substances (PFAS) in breeding shearwaters from the central Mediterranean Sea. | Speed 20 | |
| **15:40 - 16:10** | Coffee Break | | | | |
| **16:10 - 16:40** | Claudia Cavadas | CNC, University of Coimbra, Portugal | The contribution of each scientist to promote diversity, equity, inclusion, and belonging in science. | EDI Talk 1 | EDI |
| **16:40 - 16:55** | Eleanor Maedhbh Honan | Norwegian Institute for Nature Research, Norway | Toileting and menstruation during seabird fieldwork. | EDI Talk 2 | |
| **16:55 - 17:10** | B. John Hughes | Army Ornithological Society, UK | Variations in the time interval between feral Domestic Cat *Felis catus* eradication and the recovery of tropical seabird populations on Ascension Island in the South Atlantic. | Talk 31 | Other |
| **17:10 - 17:25** | Mayline Strouk | University of Edinburgh, UK | Following those who follow seabirds: Geography of marine ornithologists' mobilities to the field site in and around the Arctic. | Talk 32 | |
| **17:25 - 17:40** | Signe Christensen-Dalsgaard | Norwegian Institute for Nature Research, Norway | Silent bird cliffs – a photographic journey through shifting baselines. | Talk 33 | |
| **17:40 - 17:45** | Martin Poot | Wageningen Marine Research, Netherlands | Intensive shipping disturbance pushes common scoters around and away from their food in the main Dutch staging area in spring. | Speed 21 | |
| **18:00 - 19:45** | Poster Session 2 (Poster 81 to 155) | | | | |

| | Thursday, 5 September 2024 | | | | |
|---|---|---|---|---|---|
| **9:00 - 10:00** | Katarzyna Wojczulanis-Jakubas | University of Gdańsk, Polony | Parental care: a challenge for seabird parents… and seabird researchers. | Plenary 3 | |
| **10:00 - 10:15** | Bertille Mohring | University of Liverpool, UK | Investigating the temporality of reproductive trade-offs in two albatross populations breeding under contrasting environmental conditions. | Talk 34 | Behaviour and Evolution |
| **10:15 - 10:30** | Alice Trevail | University of Exeter, UK | Prospecting behaviour in a tropical seabird, the Red-footed Booby. | Talk 35 | |
| **10:30 - 10:45** | Guillem Izquierdo Arànega | University of Barcelona, Spain | Pervasive hybridisation throughout the evolutionary history of Mediterranean Puffinus Shearwaters prevents inbreeding depression. | Talk 36 | |
| **10:45 - 11:00** | Chloe Cargill | University of Aberdeen, UK | Insights into kittiwake population connectivity derived from host-parasite microsatellite analyses. | Talk 37 | |
| **11:00 - 11:30** | Coffee Break | | | | |
| **11:30 - 11:45** | Katherine Snell | Max Planck Institute, Germany | Arctic Skua *Stercorarius parasiticus* ocean scale migration and population level processes. | Talk 38 | Census, Monitoring and Demography |
| **11:45 - 12:00** | Wouter Courtens | Research Institute for Nature and Forest, Belgium | Highly pathogenic avian influenza in Sandwich tern Thalasseus sandvicensis: impact on population size and demography. | Talk 39 | |
| **12:00 - 12:15** | Ingrid Pollet | Acadia University, Canada | Adult survival in seabird, Leach's Storm-Petrel *Hydrobates leucorhous*, covaries with the Atlantic Multidecadal Oscillation over the past six decades. | Talk 40 | |
| **12:15 - 12:30** | Eve Merrall | University of Liverpool, UK | Quantitatively Assessing the Sensitivity of Seabirds to Anthropogenic Pressures Using PVA. | Talk 41 | |
| **12:30 -12:45** | Maria Dias | University of Lisbon, Portugal | A review of the ecology and conservation status of Gadfly Petrels in the world: gaps and priorities for research and management. | Talk 42 | Other |
| **12:45 -12:50** | Roger Colominas-Ciuró | Institut de Ciències del Mar, Barcelona, Spain | Foraging strategies in anthropogenic landscapes modulate pathogen load and antioxidant status in an opportunistic predator. | Speed 22 | Foraging and Feeding Ecology |
| **12:50 - 12:55** | Wiebke Schäfer | University of Justus Liebig Giessen, Germany | Niche Segregation of Sympatric Storm-Petrels in the Eastern Pacific: A GPS Tracking and Prey DNA Metabarcoding Study. | Speed 23 | |
| **12:55 - 13:00** | Anne-Sophie Bonnet-Lebrun | University of La Rochelle, France | Non-breeding strategies and genetics of the Northernmost population of Subtropical Brown Skua *Stercorarius antarcticus*. | Speed 24 | Behaviour and Evolution |
| **13:00 - 13:05** | Antoine Morel | Memorial University of Newfoundland, Canada | Social interactions beyond near neighbours: the influence of spatial nest distribution on Atlantic Puffin's social network. | Speed 25 | |
| **13:10 - 14:15** | Lunch | | | | |
| **14:15 -14:30** | Darren Wilkinson | University College Cork, Ireland | Habitat modelling of aerial survey data reveals the displaced coastal distribution and at-sea population size of an elusive seabird: the European Storm-Petrel. | Talk 43 | Census, Monitoring and Demography |
| **14:30 - 14:45** | April Hedd | Environment and Climate Change Canada | Collaborative monitoring, tracking and modeling to improve the conservation outlook for declining Leach's Storm-Petrels in the north Atlantic. | Talk 44 | |
| **14:45 - 15:00** | Téo Barracho | Centre Scientifique de Monaco, Monaco | I'll be back … or not: Survival of juvenile Adélie Penguins continues to decline across the species range. | Talk 45 | |
| **15:00 -15:15** | Céline Le Bohec | CNRS-France & Centre Scientifique de Monaco, France | Fitness consequences of pre- and post- fledging environmental conditions in King Penguins. | Talk 46 | |
| **15:15 - 15:30** | Richard Phillips | British Antarctic Survey, UK | Trends, threats, knowledge gaps, and global political responsibility for the conservation of priority populations of albatrosses and large petrels. | Talk 47 | Fisheries |
| **15:30 - 15:45** | Mathilde Huon | Obervatoire Pelagis, University of La Rochelle, France | Evaluating the interaction between marine food subsidies and the main scavenging seabird species in the Bay of Biscay (Northeastern Atlantic). | Talk 48 | |
| **15:45 - 16:00** | Ana Marçalo | Centre of Marine Sciences, Portugal | Reducing seabird interactions with bottom set-nets: Lessons learned from the Project LIFE + Ilhas Barreira. | Talk 49 | |
| **16:00 - 16:05** | Ewen Le Scornec | University of La Rochelle, France | Automatic identification of interactions with boats is limited by individual variations in behaviour in Wandering Albatrosses. | Speed 26 | |
| **16:10** | Prizes and Closing | | | | |

# WELCOME ADRESS

## The wanderings of Cory's Shearwaters nesting on the Selvagens Islands.

Paulo Catry
*ISPA, Portugal
*MARE - Marine and Environmental Sciences Centre / ARNET - Aquatic Research Network, Portugal

Long before ecology existed as a science, people wondered about animal movements and the changes in their abundance. The Selvagens (meaning "wild"), part of the Archipelago of Madeira (Portugal), are some of the most remote and seabird-rich islands in the Northeast Atlantic. Here, since 2004, we have monitored population size and trends, and researched the behavioural ecology of Cory's Shearwaters *Calonectris borealis*, with a strong focus on spatial ecology. Over a period of 18 years, we have tracked the migratory movements of birds of all age classes, revealing a surprising diversity of strategies and a high level of individual variability that still defies our understanding. During this talk, I will discuss the intrinsic factors (age, sex, body condition) and extrinsic factors (winds) that drive such variability, and look at different correlates and consequences, including telomere dynamics, physiological condition, accumulation of pollutants and timing of migration. I also report the good news that the population is increasing and consider possible ways to monitor burrow and crevice-nesting seabirds, such as shearwaters, for which data on population trends are still remarkably scarce.

PLENARY SPEAKER 1

## Optimising movement decisions in a changing environment: what can we learn from seabirds?

Samantha Patrick
*University of Liverpool, UK

Phenotypic plasticity is often one of the first changes observed in response to environmental change. With many traits, individuals do not have control of the environment they experience, leaving changes in phenotype as their only option. Movement behaviours offer a rare opportunity where by individuals can change their behaviour in a given environment or move to a new environment. Adaptive changes in space use are well described by patch switching and habitat matching theory, but examining changes in spatial and non-spatial traits concurrently is essential. Seabirds are ideal model system to study these questions as their slow life-history limits the potential for rapid evolutionary change and their wide-ranging movements, which are well studied, offer ample opportunity to switch habitats. Foraging is a classic example of repeated movements over time and is fundamental to movements both within the breeding season and the winter period. Using evidence from a range of seabird species across the globe I will explore the evidence for plasticity in temporal and spatial foraging traits in changing environments. Finally, I will assess how evolution may act on plasticity in movement traits. This will combine research on the fitness consequences of movement behaviour and the heritability of different foraging parameters. By combining empirical and theoretical evidence, this talk aims to highlight the importance of combining habitat switching and plasticity in non-spatial traits for understanding plasticity in adaptive changes in movement in a changing environment.

# MOVEMENT ECOLOGY

Talk 1

## Modelling year-round energy need of North Atlantic seabirds.

Caitlin K. Frankish; Hallvard Strøm; Tycho Anker-Nilssen; Maria I. Bogdanova; Mark Bolton; Oskar Bjørnstad; Vegard S. Brøthen; Lila Buckingham; Andrew Call; Olivier Chastel; Signe Christensen-Dalsgaard; Kendrew Colhoun; Jóhannis Danielsen; Francis Daunt; Nina Dehnhard; Sébastien Descamps; Kyle Elliott; Alexey Ezhov; Per Fauchald; Annette L. Fayet; Jérôme Fort; Morten Frederiksen; Stefan Garthe; Maria Gavrilo; Grant Gilchrist; David Grémillet; Gunnar T. Hallgrímsson; Erpur S. Hansen; Mike P. Harris; April Hedd; Morten Helberg; Mark Jessopp; Yuri Krasnov; Aili L. Labansen; Raphaël A. Lavoie; Jannie Linnebjerg; Svein-Håkon Lorentsen; Ulrik Løtberg; Yann Kolbeinsson; Mark L. Mallory; Ivan Mizin; Børge Moe; William A. Montevecchi; Anders Mosbech; Svenja Neumann; Mark A. Newall; Stephen Newton; Bergur Olsen; Tone Reiertsen; Shiants Seabird Research Group; Robert L. Swann; Geir H. Systad; Arnaud Tarroux; Paul Thompson; Thorkell L. Thórarinsson; Robin Ward; Katarzyna Wojczulanis-Jakubas; Sarah Wanless; Susanne Ökesson; Benjamin Merkel
*Norwegian Polar Institute, Norway

Investigating how long-lived species adapt their behaviour to survive seasonally varying environments is critical to understanding population viability, particularly in the face of climate change. In the North Atlantic, thanks to tracking projects such as SEATRACK, we have an increased understanding of the year-round spatial distributions of different seabird species. Yet, less is understood of how these movements affect individual fitness. Energetics offer a mechanistic means to bridge this gap by linking behaviour with individual physiology and the external environment. Here, we combine activity budgets derived from immersion data with monthly population density maps to calculate region-wide energy expenditure, and hence, 'energy need' of six pelagic seabird species (Northern Fulmar *Fulmarus glacialis*, Atlantic Puffin *Fratercula arctica*, Common Guillemot *Uria aalge*, Brünnich's Guillemot *Uria lomvia*, Little Auk *Alle alle* and Black-legged Kittiwake *Rissa tridactyla*). We investigate which processes (intrinsic and extrinsic) drive variation in this metric and predict how energy needs might differ under several climate change scenarios (Coupled Model Intercomparison Project [CMIP6] sea surface temperature projections). Overall, our study highlights 1) the diversity of behavioural strategies used by seabirds to survive their annual cycle, 2) the predatory pressure exerted by this group at a regional-level (i.e., minimum prey biomass required to meet energy needs), and 3) times and locations where current and future energy need, and hence, mortality risk, are greatest.

Talk 2

## Predicting foraging trips of the world's seabirds.

Quentin Queiros, Astrid A. Carlsen, Jonas Hentati-Sundberg
*Swedish University of Agricultural Sciences, Sweden

Threatened by climate change and competition with fisheries for food, worldwide seabird populations have declined since the mid-20th century. Seabirds are central-place foragers during breeding, commuting long distances between colonies and feeding areas. Understanding their foraging areas is essential for informing spatial management measures to protect habitats and prey populations. While foraging of several seabirds has been intensively studied, knowledge on two-thirds of the world's seabird species is still lacking. Here, we propose to calculate species-specific foraging features (e.g., distance from the colony, time at sea, habitat use) for well-studied species and use those to predict these features for understudied species. By compiling 350 datasets from two global seabird tracking databases (>14,000 individuals), we have estimated the foraging features for 79 seabird species. Then, we have developed phylogenetically informed models by including morphological traits (e.g., wing length, body mass) and flying-diving styles as explanatory variables. The results will be integrated into a bio-energetic model to calculate energy requirements of the world's seabirds and estimate their prey requirements.

Talk 3

## Variable wind selectivity in shearwaters implies knowledge of the foraging landscape.

Stephanie Harris, Charles Bishop, Paul Fernandes, Tim Guilford, Patrick Lewin, Oliver Padget, Pete Robins, Will Schneider, James Waggitt, Sophie Wilmes, Line Cordes
*University of Bangor, UK

Seabirds must make complex decisions about where to forage across huge expanses of ocean. While some species appear to visit memorised foraging areas, others are known to fly in the most wind-efficient direction, maximising distance covered and thereby prey encounter rates. Here, using an extensive GPS-accelerometer dataset of 661 Manx Shearwater *Puffinus puffinus* foraging trips, we investigated whether shearwaters balance the advantage of being wind selective versus visiting known foraging areas. We extracted wingbeats during bouts of commuting flight and measured costs of flying in different wind conditions. Shearwaters were highly wind selective, preferring conditions which reduced their required flapping input (cross- and tailwinds). However, wind selectivity varied both within and between foraging trips. Shearwaters were less wind selective in lower winds, implying that under these conditions birds favoured reaching known profitable areas rather than choosing the most wind-efficient travel direction. Shearwaters were also less wind selective during long bouts of continuous flight than during shorter flight bouts, which may reflect a trade-off between flying towards a known target (long bouts) vs. short bouts of wind-selective flight when opportunistically scanning for foraging opportunities. Brought together, we show that shearwater foraging decisions involve a context-specific trade-off between using favourable winds to fly at low cost and knowledge of the prey landscape.

Talk 4

## Rethinking the role of diffuse competition in seabird distributions.

Oliver Padget, Tim Guilford
*University of Liverpool, UK

A widespread observation in ecology is that within species, the population or sub-population from which individuals originate determines their foraging or migratory distributions. For example, many migratory bird species's wintering distributions are segregated by breeding population, known as differential migration. Another example is the counter-intuitive segregation in the foraging distribution of animals from neighbouring populations, or colonies, more than expected from differences in commuting costs. Common to both is a departure from a null hypothesis "the ideal free distribution" warranting explanation. In the literature the main explanation for this departure is intraspecific competition which is either implicitly or explicitly diffuse (via consumption of resources). Here we argue, with the help of a simple simulation model, that diffuse competition cannot easily explain segregation by population in either case. We reveal that segregation driven by diffuse competition is a potentially widespread fallacy, principally because same-species populations ought to retain the same patch quality rank under intraspecific diffuse competition conditions. Our simulation instead points towards other properties of populations that may result in different migratory optima, such as their resource requirements, or local social information to explain why ideal free distributions do not account for many observed patterns in animal movement.

Talk 5

## Responsibility for the conservation of Black-Legged Kittiwake *Rissa tridactyla* in the North Atlantic.

Vance Mak, Richard B. Sherley, Alice M. Travail, Simon P. Neill, Sion Roberts, Stuart Bearhop, Cat Horswill
*University of Exeter, UK

The efficacy of conservation endeavours for migratory species could be compromised by their high mobility, especially if efforts are lacking or vary between regions. This underscores the imperative for international cooperation in marine management. Previous work on Black-legged Kittiwake *Rissa tridactyla* showed variation in migratory strategies. Here, in addition to high-seas areas, a subset of individuals remained resident in their breeding countries year-round, or moved to non-breeding grounds within other countries' exclusive economic zones. We expand on this, collating tracking data from global location sensor (GLS) tags deployed on 1,498 kittiwakes from 36 colonies in 10 jurisdictions over 16 years, and quantifying the proportion of time the global kittiwake population spends within various countries and high-seas areas. While much time was spent in origin countries (~33%), and high-seas areas (~26%), including the North Atlantic Current and Evlanov Sea basin high-seas MPA, a substantial portion of time was cumulatively spent in non-origin countries (~41%). We highlight key links between origin and destination countries, identifying national jurisdictions kittiwakes transit through and remain in during migrations. Our results quantify the relative responsibility different nations hold in global kittiwake conservation, and highlight the importance of developing international cooperation when designing strategies to safeguard internationally important seabird populations.

Talk 6

## Simulation through deep learning of seabird's trajectories for the evaluation of offshore windfarms' impact.

Sophie Benboudjema, Géraldine Nogaro, Nastassia Urien, Thierry Jouhanique, Amédée Roy, David Grémillet, Pascal Provost, Steven Votier, Sophie Lanco
*French National Research Institute for Sustainable Development, France

In the past 20 years, the global increase in development of offshore wind farms (OWFs) has raised concern about their potential impacts on seabirds, such as barrier effect, a change of the spatial distribution of seabirds, and a risk of mortality through collision. The advent of tracking tools such as GPS has allowed the acquisition of precise data on seabird behaviour in relation to planned and operational OWFs but is limited in spatio-temporal extent. The goal of this work is thus to utilise tracking data to develop a model of seabird trajectories by using a neural network trained on extant GPS datasets. This model should allow us to account for environmental conditions such as bathymetry, wind and presence of OWFs. Using data from four different Northern Gannets *Morus bassanus* colonies with different environmental conditions, we will be able to test the model's predictive power for seabird trajectories simulation. Once properly trained, the model should be able to predict possible seabird trajectories under a range of different scenarios such as the presence of new OWFs and their potential impacts on seabirds, depending on different locations. Perspectives of this work are to develop a new tool that might be able to help the impact assessment of future OWFs on seabirds.

Talk 7

## Migration and wintering locations of Sandwich Terns: large-scale northbound pre-migration dispersal and unexpected wintering sites.

Ruben Fijn, Rob van Bemmelen, Wouter Courtens, Judy Shamoun-Baranes
*Waardenburg Ecology, Netherlands

Understanding migration and wintering behaviour is critical for adequate year-round conservation of seabirds. Terns Sternidae are of particular interest due to the large variation in their migration strategies. Although Sandwich Terns *Thalasseus sandvicensis* are iconic migrants of the East-Atlantic flyway, their non-breeding movements and wintering habitat use are poorly known. In this study, we analysed 25,274 colour-ring recoveries of 3,187,"Dutch" Sandwich Terns, as well as year-round GPS tracking data of 24 individuals. Post-breeding, colour-ringed Sandwich Terns first disperse northward before moving south; GPS-tracking revealed that individuals use many staging sites on the North Sea coasts as they do so. During the non-breeding season, Sandwich Terns stay between France (50°N) and South Africa (35°S), but mainly in Western and Southern Africa. Some individuals used multiple staging sites, whilst others remained in one location. Sandwich Terns migrated during both day and night, with overland crossings of up to 400 km. Most south-bound post-breeding migration routes were coastal, except for crossings of the Bay of Biscay and the Gulf of Guinea. During pre-breeding migration, most birds took more direct routes further offshore. The use of many non-breeding sites and variation in migration routes, both across and within individuals, require a broadly targeted international effort to identify and adequately protect the areas used by terns.

## MOVEMENT ECOLOGY

Speed 1

### On-ice navigation of homing breeding emperor penguins.

Aymeric Houstin, Téo Barracho, Céline Le Bohec, Alexander Winterl, Sebastian Richter, Ben Fabry, Daniel P. Zitterbart
*Woods Hole Oceanographic Institution, USA

The navigational cues used by animals (e.g., visual, magnetic, olfactory, chemical) are often unknown as well as the influence of environmental drivers. For instance, how Emperor Penguins *Aptenodytes forsteri* are able to find their breeding colony located on the sea ice several kilometres away from the open water is still an open question. Here, we used datasets collected from 13 emperor penguins equipped with GPS-accelerometer to shed light on homing navigational strategies of chick-rearing emperor penguins commuting between the sea ice edge and their colony in Atka Bay, Queen Maud Land, Antarctica. To assess the birds' reliance on visual cues, we investigated their navigational pattern under contrasting weather conditions and used automated machine learning to classify and allocate time budgets to the fundamental behaviours of commuting emperor penguins: walking, tobogganing, lying, and standing. Our data show that under good visibility, they follow near-straight line-of-sight trajectories over 10 km with minimal stops and a total detour of less than 400 m. By contrast, under poor visibility, they adopt a 'shelf hugging' strategy, using the ice shelf edge as a landmark to guide them to the colony, performing a detour 9-fold longer and travelling at one-fourth the speed measured under good visibility. This study demonstrates the influence of environmental drivers on emperor penguin navigation on ice and strongly suggests their reliance on visual cues for homing.

Speed 2

## Incorporating dive attributes within state-space modelling of seabird behaviour at-sea.

Daniel J. Johnston, Gary D. Clewley, Nina O'Hanlon, Jacob G. Davies, Sophie Bennett, Chris B. Thaxter, Samuel Langlois Lopez, Ewan Weston, Ros Green, Katherine A. Booth Jones, Niall H.K. Burton, Aonghais S.C.P Cook, Elizabeth M. Humphreys
*BTO, UK

Identifying key marine areas used by seabird species for foraging and commuting informs our understanding of collision, displacement and barrier effects arising from offshore wind farms. At-sea movements are commonly investigated using tracking data, with behavioural states inferred using state-space modelling techniques like Hidden Markov Models (HMMs). HMMs identify hidden states based on attributes of step length and turning angle between successive coordinates. We explore whether the integration of dive duration information collected by Time-Depth Recorders (TDRs), further refines the identification of foraging, commuting and resting states by HMMs. To achieve this, we used data collected from GPS-TDR tagged Razorbills *Alca torda* and Common Guillemots *Uria aalge* within the Buchan Ness to Collieston Coast special protection area (SPA) in June 2023. We found significant differences in states allocated between HMMs with and without TDR dive data, with models based solely on GPS data often misidentifying locations as commuting and resting, which were in fact associated with foraging/diving behaviour. Despite this discrepancy, spatial distribution of behaviours between modelling methods were found to strongly overlap. We display that the assignment of behaviour states is greatly improved through the inclusion of dive data, especially in deep diving seabirds. This talk will discuss the underlying causes for the differences between these modelling techniques, and their implications for assessing the impacts of offshore wind farms.

## OTHERS

Speed 3

**Feral pigeons as a new threat to seabirds.**

Airam Rodríguez, Beneharo Rodríguez, Felipe Siverio, Juan M. Martínez, Enrique Sacramento, Yarci Acosta
*Institut de Ciències del Mar (ICM - CSIC), Spain

Petrels are particularly sensitive to predation by introduced species. Many populations have reduced their breeding ranges, currently mainly occupying predator-free sites. Breeding range reduction leads to interspecific competition for nesting sites, which can be detrimental to petrels. Here, we evaluate how the presence of introduced mammals (cats and rats) and potential competitors for nest sites (Cory's Shearwaters and feral Rock Pigeons) shape the distribution, breeding density, and breeding performance of Bulwer's Petrel. Nest density was higher in predator-free colonies on marine rocks. Cat presence was the best predictor of nest density, but it was not correlated with either presence or abundance of competitors. Breeding success varied between years and colonies but was not related to nest characteristics. Pigeon competition for nests was the most frequent cause of breeding failure (7.3%), followed by rat predation (6.3%). We also compared petrel and pigeon nest cavities and found considerable overlap in the physical size of nestsites. Our study provides insights into an overlooked impact of the invasive rock pigeon: nest competition with small seabirds. We encourage more research on the effects of pigeons on nest density, as well as disease and pathogen transmission, and vegetation changes within seabird colonies.

Speed 4

## Ecology of Black-legged Kittiwakes *Rissa tridactyla* on an offshore oil and gas platform in the Irish Sea.

Debs Allbrook
*University of Exeter, UK

Black-legged Kittiwakes *Rissa tridactyla* are increasingly colonising man-made structures across Northern Europe. Many of these are offshore oil and gas platforms, which are notoriously difficult to reach, access and survey. As a result, very little is known about these colonies, and their numbers are generally not included in population censuses. Our study site is an Irish Sea offshore platform group (n=8) which support 622 kittiwake breeding pairs but are scheduled for decommissioning (removal or repurpose) in the next two years. Loss of these sites could be detrimental to local colonies, but on a broader scale, similar works elsewhere could represent a significant impact on population-wide breeding success. We present important insight into the breeding ecology of offshore kittiwakes from time-lapse cameras (deployed 2023-2024), particularly breeding phenology, productivity, and trip durations. We will also present the first offshore biologging study, comprising GPS tracks from ~60 individuals (2024). These data will allow us to identify critical foraging areas around the platforms, and to investigate at-sea spatial segregation between offshore and traditional colonies. Furthermore, foraging effort data will shed light on the benefits of offshore breeding for access to distant feeding grounds. As kittiwakes's natural populations decline, our study provides crucial understanding of offshore breeding ecology, and the importance of artificial platforms for this vulnerable seabird.

Speed 5

## Repeatability of non-breeding strategies in Northern European Herring Gulls *Larus argentatus.*

Vegard Sandøy Bråthen, Manuel Ballesteros, Arild Breistøl, Aleksander Cherenkov, Signe Christensen-Dalsgaard, Nina Dehnhard, Kjell Einar Erikstad, Sindri Gíslason, Gunnar Thor Hallgrimsson, Morten Helberg, Hálfdán Helgason, Magdalene Langset, Svein-Håkon Lorentsen, Sunna Björk Ragnarsdóttir, Tone Kristin Reiertsen, Vladimir Semashko, Hallvard Strøm, Geir Helge Rødli Systad, Grigori Tertitski
*NINA - Norwegian Institute for Nature Research, Norway

While urban populations of European Herring Gulls *Larus argentatus* are increasing, rural populations are declining over wide parts of the species' breeding range. Herring Gulls are generalists with potentially a high degree of individual specification and are more linked to human activities than most other seabirds. However, we have a limited understanding of how individuals may repeat or adapt their strategies across multiple years, and to what extent individual behaviour can be linked to for example breeding populations. Our study investigates these matters using geolocators retrieved from seven rural breeding sites in Iceland, Norway and in the White Sea. We quantified consistency in individual non-breeding movements, marine-terrestrial connectivity, and encounters with human sources of light at night. We found that individual strategies were to some degree linked to specific regions, e.g., birds breeding in Northern Norway spent all-year-round more time at sea, although being distributed widely during the non-breeding season. Overall, Herring Gulls exhibited a moderate degree of repeatability, with individuals generally maintaining consistent strategies across multiple non-breeding seasons. However, there were many exceptions, suggesting that individuals adapt when necessary. We show a specific case of coastal purse seine fishery in Northern Norway as an example of how Herring Gulls can adapt to where the hauls are concentrated each year.

# CLIMATE CHANGE AND EXTREME EVENTS

Talk 9

## Assessing the impact of climatic extreme events on bird mortality.

Maite Louzao, Isabel García-Barón, Javier Franco, Jose Miguel Escribano, Manena Fayos, Daniel Fernández, Aitor Lekuona, Céline Maury, Álvaro Oleaga, Amaia Astarloa, Garnier Rolland, Andrea Del Campo, Almudena Fontán
*AZTI, Spain

The increase in the intensity and frequency of extreme weather events has increased in recent decades. Extreme events have a major impact on biological systems by reducing the reproductive output of species and increasing mortality, increasing the occurrence of mass mortality events in the last decades. In the North Atlantic, bird mortality events occur almost every year due to severe weather conditions and prolonged periods of storms in marine ecosystems. Within this context, we explored bird mortality in Southern Europe as a result of multiple extreme wind and wave events based on data of wildlife recovery centres. By focusing on a highly vulnerable species, the Common Guillemot *Uria aalge*, we hypothesized that bird mortality would be related to a cumulative effect of extreme wind and wave events during the 2003-2021 period. At the weekly scale, cumulative patterns of extreme wind events and bird mortality were correlated following similar sigmoidal curves. The period of maximum mortality fell within the time frame of maximum extreme wind events during Winter (beginning of December - end of February). Our methodological approach provides insights on the definition of the number of extreme wind and wave events that should serve as a warning signal to activate the coordination of local administrations and volunteers to anticipate the occurrence of mass-mortality events under future climatic scenarios.

Talk 10

## The importance of changing Antarctic sea-ice habitats for albatrosses and petrels.

Ewan Wakefield, Erin L. McClymont, Sébastien Descamps, Ana P.B. Carneiro, John P. Croxall, Jacob González-Solís, Hanna M.V. Granroth-Wilding, W. James Grecian, Eleanor M. Honan, Lesley Thorne, Victoria Warwick-Evans, Andrew G. Wood, Jose C. Xavier, Richard A. Phillips
*University of Deakin, UK

The Antarctic sea-ice zone (SIZ) - one of the world's most extensive, productive, and seasonally variable marine habitats - has recently begun to shrink. Use of the SIZ by albatrosses and petrels remains relatively poorly known, so the impacts of this change are uncertain. Here, we use tracking to quantify use of sea-ice habitats by albatrosses and petrels breeding in the subantarctic at South Georgia, and then to describe in more detail habitat selection by snow petrels breeding on the adjacent Antarctic continent. Foraging latitudes of White-chinned Petrels *Procellaria aequinoctialis* and most albatrosses varied sinusoidally across the breeding season, likely due to the lagged effects of solar irradiance on primary production. These species avoided pack ice but used the SIZ 5-7 weeks after the spring breakup. In contrast, light-mantled albatrosses used waters adjacent to the Marginal Ice Zone (MIZ) throughout the season and Southern Giant Petrels *Macronectes giganteus* used both open and the ice-covered waters, sometimes travelling 100s Km into the pack ice. Snow petrels preferentially foraged in areas with intermediate sea ice concentrations, tracking the receding MIZ as the spring breakup proceeded. Based on these results, we hypothesise that the phenology and demography of many mid to high-latitude breeding Procellariformes is mechanistically linked to sea-ice dynamics. Sea ice loss could therefore modulate or exacerbate the already unsustainable anthropogenic impacts being experienced by many of these populations.

Talk 11

## Long term multi-species demographic studies reveal divergent negative impacts of Winter storms on seabird survival.

Kirsty Laurenson, Matt Wood, Tim Birkhead, Matthew Priestley, Richard B. Sherley, Annette Fayet, Tim Guilford, Ben Hatchwell, Stephen Votier
*University of Heriot-Watt, UK

Climate warming is increasing storm frequency and intensity with potentially profound ecological consequences. Intense storms can lead to mass mortality of seabirds (wrecks), but the population-level impacts of storms are poorly understood. Long-term demographic studies are required to elucidate responses of wild populations to environmental change. Here, we combined multidecadal mark-recapture data from three seabird species frequently associated with Winter wrecks (Common Guillemot *Uria aalge*, Atlantic Puffin *Fratercula arctica*, and Razorbill *Alca torda*) breeding in sympatry in the Northeast Atlantic with storm and environmental data from geolocation-derived wintering areas to determine storm impacts on survival, and whether storm characteristics can signal wrecks. Guillemot and Razorbill survival was negatively correlated with storms, while Puffin survival was reduced by Winter sea surface temperature (SST). There was also an additive, negative impact of Summer SST for guillemots, and a negative interaction with population size for razorbills. The number of days per winter with wind speeds exceeding 30 and 35 m/s reduced razorbill and guillemot survival, respectively; while puffin survival was higher when gaps between storms were longer. Long windy periods and short gaps between storms may restrict foraging, leading to starvation and wrecks. Our results suggest negative but divergent storm impacts on these closely related species, which may be compounded by warming seas.

Talk 12

## Behavioural responses of breeding Manx Shearwaters during North Atlantic marine heatwave.

Sarah Bond, Ollie Padget, Katrina Siddiqi-Davies, Lewis Fisher-Reeves, Patrick Lewin, Tim Guilford
*University of Oxford, UK

In a rapidly changing climate, the ability of individual animals to respond to environmental cues and alter their behaviour adaptively is intrinsic to their survival and breeding success. Temperate seabirds are limited to a single annual breeding attempt which is timed to coincide with the energetically intense chick-rearing period with peak local resource availability. In 2023, unusually high temperatures were recorded in the North Atlantic Ocean, linked to changes in wind patterns and broad-scale climate indices. This was characterised by a decrease in westerly wind speeds across the North Atlantic, reducing the strength of ocean currents and mixing in frontal zones, resulting in stratification, and reduced primary productivity. This event provides an opportunity to measure behavioural responses of seabirds to reduced quality of normally predictable foraging patches. We characterised the foraging behaviour of Manx Shearwaters *Puffinus puffinus* breeding on Skomer Island (Wales) in 2023, in the context of 15 years of GPS tracking, to understand whether this marine heatwave was associated with changes beyond normal variation. When supplemented with long-term immersion data and colony-based breeding observations, we were able to examine how behavioural changes were linked with breeding success via foraging behaviour. This work provides an insight into the potential flexibility or vulnerability of seabirds to marine heatwaves, which are predicted to become increasingly common in the future.

Talk 13

## Temporal resolution matters: using oceanographic variables to explain seabird breeding success and chick diet.

Ella-Sophia Benninghaus, Neda Trifonova, Lars Boehme, Dafne Eerkes-Medrano, W. James Grecian, Michael P. Harris, Kerstin Kober, Mark A. Newell, Lucy Quinn, Helen Wade, Sarah Wanless, Francis Daunt, Beth Scott
*University of Aberdeen, UK

There are critical times of the year when environmental conditions have disproportionate impacts on the life history, prey availability, and breeding activity of seabirds. Previous studies have investigated the relationships between averaged seasonal environmental variables (i.e., sea-surface temperature) and seabird demographic rates to inform species conservation. However, findings are often contradictory, and we are still lacking clarity on the complex links between environmental changes, seabird demography, and chick diet. This study quantified the relationship between breeding success and chick diet for five seabird species on the Isle of May, Scotland and three environmental covariates (sea-bottom temperature, stratification, and primary production) derived from EU Copernicus Marine Service Information. We compared three different temporal resolutions: seasonal means, means calculated over time periods relevant to the breeding phenology of individual seabird species, and means over time periods denoted by the timing of primary productivity (Spring bloom). We found that seasonal means and means over chick-rearing were the best time periods to explain breeding success, while sea-bottom temperature was the best overall explanatory variable. We explore the implications of these results in relation to seabird conservation under climate change.

Speed 6

## Snowfall-induced catastrophic breeding failure increasingly frequent in a warming Antarctic Peninsula: Subcontinental analysis of a decade of Breeding Success for three penguin species.

Ignacio Juarez Martinez, Claire Flynn, Alex Kacelnik, Tom Hart
*University of Oxford, UK

The Antarctic Peninsula is warming at an unprecedented rate. This has already caused a record shift in phenology in all three *Pygocelis* penguin species (Gentoos, Adelies and Chinstraps). Here we study whether those changes are impacting breeding success negatively, or alternatively, these changes are allowing these species to adapt their reproductive ecology to these warmer conditions. We estimate breeding success over ten years in a selection of 20 colonies throughout the Antarctic Peninsula using Penguin Watch time-lapse imagery. This provides a time-series of breeding success across 10 seasons (2012-2023) for the three congeners. Results do not prove a direct effect of temperature increase on breeding success but show a significant effect of snowfall at critical times in the breeding season, reaching the extent of catastrophic failure in seasons with a snow presence of over 30 days. Effects are different for each of these species in different parts of their breeding ranges with marked differences across the Peninsula. We also found the number of snowing days estimated per colony is increasing steadily, which raises great concerns for the viability of some populations.

## CENSUS, MONITORING AND DEMOGRAPHY

Speed 7

### Global distribution, threats and population trends of the critically endangered Balearic Shearwater Puffinus mauretanicus.

Andrés de la Cruz, Jorge Pereira, Gonzalo M. Arroyo, Jaime Ramos, Hany Alonso, José Manuel Arcos, Fernando Ramos, Jorge Tornero, Camilo Saavedra, José Antonio Vázquez, Isabel García-Barón, Amaia Astarloa, Maite Louzao, Sophie Laran, Ghislain Dorémus, James Waggit, Vitor H. Paiva
*University of Cádiz, Spain

Knowledge of spatial distribution and population trends is crucial for conserving threatened species. We analyzed a 21-year dataset (2000-2020) of at-sea counts for the critically endangered Balearic Shearwater *Puffinus mauretanicus*. The study aimed to assess global distribution, habitat suitability, and population trends, alongside the overlap with marine threats (fisheries, offshore renewables) and protective measures (marine protected areas). Results highlighted species abundance around the Balearic Islands and the Atlantic coast of Iberia, with sea surface temperature (SST) and bathymetry as key habitat factors. Population trends indicated a decline in the Mediterranean, linked to rising SST, while trends in the Atlantic Iberian waters were stable or slightly declining. The Celtic Sea, English Channel, and Southern North Sea showed an upward trend, suggesting a northward shift. Significant threats included longline fisheries in the Mediterranean and purse seine and gillnet fisheries in the Atlantic. The expansion of offshore wind farms posed a new threat. Marine conservation zones varied in overlap, with more in the Atlantic. This study underscores the importance of at-sea population assessments, complementing breeding colony research and offering vital insights for conservation efforts. It provides a comprehensive view of the distribution, threats, and trends of the Balearic Shearwater, contributing valuable data for conservation strategies.

Speed 8

## Dependability of seabird censusing; can we count on our counts?

Emma Murphy, David T. Tierney, Alyn Walsh, Andrew Power, Mark Jessopp
*University College Cork, Ireland

Seabirds are in global decline with increasing numbers of species being listed as of conservation concern. However, the national census of all breeding seabirds in the UK/Ireland only occurs on a 10-15-year cycle, making it difficult to accurately assess population trends. The most recent national census of Northern Gannets *Morus bassanus* was in 2013/14, since which an outbreak of Highly Pathogenic Avian Influenza (HPAI) in 2022 resulted in significant seabird mortalities. We conducted a census of all gannet colonies in Ireland in 2023 following noted mortalities from HPAI. Across all colonies, Ireland now supports a breeding population of 44,755 pairs, representing a decrease nationally of 7% since 2013/14. This was driven entirely by a 25% reduction in Apparently Occupied Sites (AOS) at Ireland's largest colony, Little Skellig. These declines were not evenly distributed, with some areas experiencing much larger declines than others. Due to the infrequency of censuses, we cannot be sure if this decline is a catastrophic mortality event resulting from HPAI, or the result of other ecosystem processes occurring between census efforts. This census provides a new post-HPAI baseline for measuring further population change and highlights the need for more regular censusing of Ireland's breeding seabirds. Technological advancements (e.g., drones) will likely help to increase the frequency of censusing to better detect population change and inform effective conservation interventions.

Speed 9

## Improved passive acoustic monitoring tools reveal environmental influences on breeding phenology in Short-Tailed Shearwaters.

Nicolas de Almeida E Silva, Paco Bustamante, John P.Y. Arnould
*University of Deakin, Australia

Monitoring the size of breeding populations of burrowing seabirds, especially at remote island colonies, can be logistically complicated. This is especially true for the Short-tailed Shearwater *Ardenna tenuirostris*, Australia's most numerous seabird, which has a breeding distribution spread across approximately 285 island colonies along the continent's Southern coast. Passive Acoustic Monitoring (PAM) provides a relatively cheap solution, and previous preliminary studies have demonstrated correlations between the density of occupied burrows and the Normalized Difference Sound Index (NDSI). However, information gained from the NDSI is limited. The present study investigated the use of a biophony index (BI), optimised for the audio frequencies of STSW, to obtain information on breeding phenology and population size. There was a strong positive correlation between BI and occupied burrow density, both during incubation and chick-rearing (r2 = 0.8). In addition, BI patterns throughout the breeding season reflected events such as the pre-laying exodus, incubation and long-trip durations, and the rate of nest abandonment. Analysis of these features across 18 sites between 2016-24 revealed influences of environmental conditions close to the breeding colonies and in the Southern Ocean. These findings suggest the use of BI from PAM data can provide a cost-effective tool for monitoring STSW breeding population size and environmental influences on breeding success.

Speed 10

## Does Atlantic Puffin age structure vary with population trajectory? A groovy citizen science project.

Sarah Kunzig, Matt Wood
*University of Gloucestershire, UK

Atlantic Puffins *Fratercula arctica* are experiencing global population declines, although some colonies are faring much better than others. To take two examples, the puffin population on Skomer Island, Wales, has been increasing whereas the population on Fair Isle, Scotland, has been declining for the past 20 years. The age structure of seabird colonies is an understudied factor of seabird populations and can reveal demographic processes. Estimating the age structure of most seabird populations requires the ringing of a large number of chicks resulting in individuals of known age. However, what's interesting about puffins is that they can be aged by inspecting the grooves on their beak, which can provide a non -invasive method of estimating the age structure of the population. I will use hundreds of images of puffins from different UK colonies, including photo series from Project Puffin, an RSPB-led citizen science project. This will help estimate the age structure of various colonies and examine how age structure variation between colonies relates to population growth rates. Will puffin colonies have a higher proportion of immatures in increasing populations? This project aims to understand population dynamics in a range of colonies around the UK and assist in the continued conservation efforts of this species.

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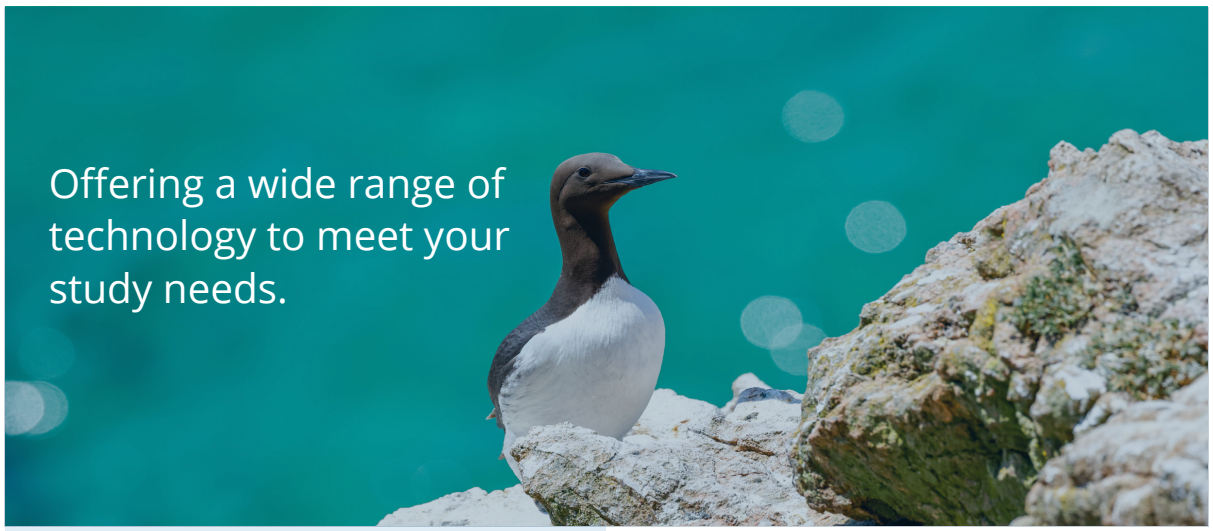


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## RENEWABLE ENERGY

Talk 14

### Estimating the quantity and spatial distribution of seabird prey offtake for marine impact assessments.

Oliver Leedham, Adam Butler, Charlotte Regan, Maria I. Bogdanova, Francis Daunt, Kate R. Searle
*Centre for Ecology & Hydrology, UK

Each year, the British Isles host globally important populations of breeding seabirds. In these species, breeding adults forage at sea, often travelling great distances from the colony. This central place foraging modality-combined with an increased foraging burden for chick provisioning-mean that patterns of at-sea predation are central to understanding breeding performance in these critical periods. An increasingly important issue for the conservation of seabirds is the development of offshore renewable energy infrastructure, which may impact the accessibility of prey to foraging seabirds via displacement and barrier effects. We present a new method to estimate the quantity and spatial distribution of prey offtake by chick-rearing seabirds. We first use information on species' energetics, demography and population counts to estimate total prey offtake by focal populations, with uncertainty. We combine these estimates with measures of foraging space use to produce predation maps for key seabird species on the Isle of May and the British Isles. We summarise this novel predation mapping approach, presenting predictions for the coverage of predation by Special Protection Areas, and potential losses to offshore windfarm exclusion scenarios. These results contribute to demographic modelling to quantify population-level consequences of offshore developments, and to spatial planning and impact assessments of anthropogenic activities on protected seabird populations.

Talk 15

## Assessing the effects of offshore windfarms on marine bird survival and body condition.

Eleni Melis, Daniel Benden, Susanne van Donk, Chun Chen, Martin Poot, Vincent Hin, Tobias van Kooten, Floor Soudijn
*Wageningen University, Netherlands

In the Dutch North Sea, Offshore Wind Farms (OWFs) are rapidly expanding, targeted to increase from the current 4.5GW to 70GW by 2050. This expansion raises concerns for marine bird species like the Common Guillemot *Uria aalge*, Razorbill *Alca torda*, and Northern Gannet *Morus bassanus*, facing potential displacement and loss of important foraging habitat. To assess the cumulative impacts of existing and planned OWFs, we developed a comprehensive model framework integrating habitat suitability, individual-based, and population models. Our Individual-Based Model (IBM) tracks bird condition and survival relative to food intake with and without OWFs during the nonbreeding season. Our results indicate that the effects of OWFs on bird populations depend on some key assumptions in the IBM about bird behaviour, such as their knowledge regarding the location of good foraging areas. The planned future expansion of OWFs on the North Sea is likely to affect large areas of bird foraging habitat. A better understanding of the degree of density dependent regulation of foraging at sea in the nonbreeding season, the behavioural responses of marine birds to OWFs, and foraging preferences of marine birds are essential for realistic impact assessments of OWFs for marine birds.

Talk 16

## Seabird sensitivity maps for guiding maritime spatial planning in the German North Sea.

Volker Dierschke, Kai Borkenhagen, Leonie Enners, Stefan Garthe, Moritz Mercker, Verena Peschko, Henriette Schwemmer, Nele Markones
*DDA - Dachverband Deutscher Avifaunisten, Germany

Humans have been using the oceans for centuries, but we are currently witnessing a dramatic intensification in various activities. Thanks to years of surveys, the quantitative distribution of seabirds in many parts of the oceans is well known. In order to enable maritime spatial planning that takes seabird habitats into account, we have developed sensitivity indices to illustrate the sensitivity of individual species to certain types of human activity. The species sensitivity index (SSI) contains factors that reflect the species' reaction to the disturbing factors of an activity, the costs of this reaction for an individual and the costs on the level of the population. In combination with the density of individuals and summed up across all species, sensitive and less sensitive areas can be identified with regard to a particular activity. The example of the German North Sea will be used to show where suitable and unsuitable areas are located for activities such as shipping traffic and offshore wind farms and how these findings can be incorporated into maritime spatial planning.

Talk 17

## An individual-based model to quantify the non-breeding season impact of wind farms on seabirds.

Lila Buckingham, Elizabeth A. Masden, K. Layton-Matthews, Maria I. Bogdanova, Vegard Sandøy Bråthen, Emma Jane Critchley, Francis Daunt, Per Fauchald, Michael H. Harris, Mark A. Newell, Kate R. Searle, Arnaud Tarroux, Sarah Wanless, Signe Christensen-Dalsgaard
*NINA - Norwegian Institute for Nature Research, Norway

Seabirds are threatened by offshore wind farms (OWFs) via lethal collisions and sub-lethal displacement effects, which can affect behaviour and energetics and ultimately impact survival and breeding success. We do not have a comprehensive understanding of the impacts of OWFs on seabird populations, particularly outside of the breeding season. To address this knowledge gap, we developed an individual-based model to predict the non-breeding season impacts of OWFs on seabirds. We used long-term tracking data from geolocator-immersion loggers to estimate population-level distributions and activity budgets. We simulated individual movement, behaviour, energetics, and OWF interactions. We demonstrate our model by assessing the non-breeding season impacts of OWFs that are either currently operational or likely to be by 2030 on Common Guillemots *Uria aalge* and Black-legged Kittiwakes *Rissa tridactyla* that breed at the Isle of May, East Scotland. We quantified collision risk in kittiwakes by integrating the stochastic Collision Risk Model. We quantified risk and energetic consequences of displacement in guillemots, which we converted into mass change and resulting changes to non-breeding survival or end of season mass. Our model is designed to be adaptable for other species and populations and will reduce uncertainty surrounding the impacts of OWFs on seabirds during the non-breeding season, improving sustainability of renewable energy development in the Northeast Atlantic.

Talk 18

## Seabirds, old and emerging threats: Is there room for compensation of potential impacts of offshore windfarms in a migratory seabird species?

Fraser Carter, Ana Almeida, Flávia Carvalho, Nuno Oliveira, Joana Andrade
*SPEA - Portuguese Society for the Study of Birds, Portugal

Bycatch is one of the major threats to seabirds worldwide. In European waters, estimates suggest that 200,000 seabirds are bycaught annually. In Portugal, a bycatch monitoring program was first implemented in 2010. Based on a combined methodology of questionnaires to fishermen, observers on-board and logbooks, it was possible to identify the most vulnerable species and problematic fishing gear. Bycatch also affects fishing activity, increasing operational times and reducing its efficiency. To reduce all these impacts, several mitigation measures have been trialed under the framework of different SPEA projects, considering gears, species and fishing locations. The scarybird, a visual deterrent that imitates an aerial predator, showed promising results when applied to bottom gillnets. Migratory species, such as the Northern Gannet, are significantly affected by bycatch, but are also threatened by potential cumulative impacts of European offshore windfarms. This presents an opportunity to consider bycatch mitigation measures as potential compensatory actions that offset the impacts of offshore wind farms. This is especially pertinent in light of evidence demonstrating migratory connectivity between breeding colonies in Scotland and their migratory and wintering grounds off the coast of Portugal. Compensation for seabirds as a result of potential impacts from offshore wind development is becoming rapidly more important as nations look to boost electricity generation offshore.

Speed 11

## Developing accurate seabird density maps to assess cumulative effects of offshore windfarms.

Susanne van Donk, Rob van Bemmelen, Chun Chen, Eleni Melis, Ingrid Tulp
*Wageningen Marine Research, Netherlands

The Netherlands has currently seven operational offshore wind farms (OWFs) installed producing 4,5 GW, but this is set to increase to 70GW in 2050, covering 7,5-13,4% of the Dutch part of the sea. To inform policy makers, the cumulative effects of these OWFs of planned and already built offshore windfarms on species with a protected status within European legislation are assessed. Accurate seabird density maps are critical for these assessments. Before, density maps were generated by interpolating raw (averaged) seabird counts from ship-based and aerial surveys. To address shortcomings of this method, a statistical method for estimating bird distributions was developed. The resulting maps are based on GLMMs in which the densities in space and time per species are predicted based on statistical correlations between relevant covariates ((a-)biotic conditions and human activities) and a random spatial-temporal factor. In addition to the predicted densities, these maps also provide information about reliability and statistical uncertainty regarding the predicted densities that can be used in assessments of possible effects and further calculations. By including covariates, this new method permits a deeper understanding of the ecological processes underlying the observed seabird distributions.

## PLENARY SPEAKER 2

### Parental care: a challenge for seabird parents… and seabird researchers.

Katarzyna Wojczulanis-Jakubas
*University of Gdańsk, Poland

Seabirds have long been neglected in studies on parental care, and this is because studying their parental behaviour continues to be a challenge. Nevertheless, seabirds are truly devoted parents and offer an unusual perspective in the discussion on differences of male and female contribution into raising the offspring and evolutionary stability of the biparental care system. Focusing on a pelagic species, the Little Auk, and using long-term data collected in the system I will consider two issues related to parental behaviour: 1) parental labour division between the sexes– who, how much and why is involved into particular activities? and 2) coordination of parental performance between the breeding partners - how much the parents coordinate their activities and what are mechanisms behind the coordination? Considering the issues I will point out the challenges related to the investigation of parental behaviour in seabirds and will show some examples of possible solutions.

# POLLUTION, TOXICOLOGY AND DISEASES

Talk 19

## Assessing the impact of trace element contamination in the physiological condition and health of coastal and oceanic seabirds breeding along the Portuguese coastline.

Ivo D. Santos, Vitor H. Paiva, Ana C. Norte, Carine Churlaud, Filipe R. Ceia, Joana P. Faria, Jorge M. Pereira, Lara R. Cerveira, Maria I. Laranjeiro, Sara N. Veríssimo, Jaime A. Ramos, Paco Bustamante
*University of Coimbra, Portugal.

Coastal seabirds are valuable indicators of ecosystem health due to their susceptibility to contamination from human activities. However, our understanding of how contaminant exposure affects seabird physiology and health remains limited, leading to uncertainty regarding species vulnerability versus tolerance. In this study, we analyzed 15 trace elements (TEs) in the blood of Yellow-legged Gulls *Larus michahellis*, Audouin's Gulls *Ichthyaetus audouinii*, and Cory's Shearwaters *Calonectris borealis* from five colonies along the Portuguese coast. Stable isotopes of carbon and nitrogen were also measured to assess foraging habitat and trophic ecology. We used haematological parameters to evaluate the impact of TE concentrations, stable isotopes, and breeding colony on adult health. Notably, we observed blood mercury and lead concentrations above toxicity thresholds in 25% and 13% of individuals, respectively, highlighting ecotoxicological concerns. Breeding colony significantly influenced variation in haematological parameters. Moreover, we found a negative relationship between aluminium, copper, and zinc with haemoglobin concentrations across all colonies. Further research is needed to determine if essential TE concentrations, particularly copper, exceed normal ranges for gulls or meet species-specific requirements. Continuous monitoring of non-essential TE concentrations, including mercury and lead, is essential due to their potential hazardous effects.

Talk 20

## Hg and PFAS contamination in seabirds: a multispecies and multisite study in metropolitan France.

Prescillia Lemesle, Alice Carravieri, Gauthier Poiriez, William Jouanneau, Manrico Sebastiano, Ignacio Martinez-Alvarez, Frédéric Angelier, Christophe Barbraud, Romain Batard, Coraline Bichet, Aurélie Blanck, Hélène Budzinski, Karine Delord, Armel Deniau, Gilles Faggio, Jérôme Fort, Fabrice Gallien, Pierre Labadie, Gilles Le Guillou, Carole Leray, Karen D. McCoy, Samuel Peroteau, Pascal Provost, Marie-Catherine Santoni, Olivier Scher, Alain Ward, Olivier Chastel, Paco Bustamante
*University of La Rochelle, France

Pollutants such as mercury (Hg) and perfluoroalkyl substances (PFAS), a group of man-made chemicals, require urgent monitoring across large geographical ranges. As apex predators, seabirds are good bioindicators for marine pollution, but Hg and PFAS contamination in seabirds from France is still understudied. Hg and 14 PFAS were analyzed in the blood of chicks of nine seabird species from 33 sites in France. Mean Hg concentrations ranged from 0.1 ± 0.1 to 2.9 ± 1.3 µg/g dry weight in Herring and Great Black-backed Gulls, respectively. Hg concentrations were mainly driven by trophic position and were uniform along the French Atlantic coast. Most chicks exhibited low Hg concentrations, with 74% categorized at no risk, according to established toxicity thresholds. Two to 13 PFAS were quantified per individual and 10 PFAS were detected in more than 70% of individuals. Perfluorooctanesulfonic acid (PFOS), the dominant PFAS, was detected in all individuals, and ranged from 21.4 ± 13.5 to 77.4 ± 21.8 ng/g wet weight in Herring Gulls and Scopoli's Shearwaters, respectively. Relations between PFAS and trophic ecology are currently being investigated but seem to be species and compound specific. Overall, chicks appear to be at low risk from Hg, while 88% of chicks were above the lowest PFOS concentrations reported to have sublethal effects. The impairments reported in seabirds with Hg and PFAS burdens considered harmless call for further studies on the impact of these pollutants.

Talk 21

## Plastic ingestion, accumulated heavy metals, and health metrics in four gull species feeding at an urban landfill in Newfoundland and Labrador, Canada.

Kerry Schutten, André Morrill, Akshaya Chandreshaker, Brian Stevens, E. Jane Parmley, Joshua Cunningham, Greg Robertson, Mark Mallory, Claire Jardine, Jennifer F. Provencher
*Ontario Veterinary College, University of Guelph, Canada

The objectives of this research project were to assess 1) ingested plastic in four gull species; and 2) the relationships between ingested plastic, year, demographic factors (species, age, sex), and health metrics (scaled mass index (SMI), presence of gross gastrointestinal (GI) lesions, and heavy metal accumulation). At the urban landfill site, there is ongoing, permitted kill-to-scare operations related to aircraft safety at the adjacent international airport. Consequently, 105 non-breeding birds (46 American Herring Gulls *Larus argentatus smithsonianus* (HERG), 39 Great Black-backed Gulls *Larus marinus* (GBBG), 16 Iceland Gulls *Larus glaucoides* (ICGU), 4 Glaucous Gulls *Larus hyperboreus*(GLGU) were killed between 2020 and 2021. All birds were necropsied, during which the contents of the upper GI tract were processed using standard techniques, and livers analyzed for heavy metals. The relationships between ingested plastics and demographic and health metrics were assessed in HERG and GBBG using generalized linear models. Across all four species, 85% of birds had ingested at least one piece of anthropogenic debris, with 79% ingesting at least one piece of plastic. We detected interspecific differences in plastic ingestion, with increased plastic mass and abundance detected in GBBG compared with HERG. For GBBG, plastic ingestion (mass and abundance) was greater for birds with higher SMI, while HERG with more ingested plastic had higher liver lead concentrations.

Talk 22

## Infectious disease ecology of seabirds: tales of gannets, skuas, albatrosses and penguins.

Thierry Boulinier, Mathilde Lejeune, Augustin Clessin, Tristan Bralet, Amandine Gamble, Maëlle Connan, Paulo Carty, Teresa Militao, Pascal Provost, David Gremillet, Hubert Gantelet, Jérémy Tornos
*University of Montpellier, France

Infectious diseases have the potential to dramatically affect populations of seabirds and marine mammals that aggregate for breeding. This has been exemplified recently in the case of Highly Pathogenic Avian Influenza. Avian cholera, due to the bacterium *Pasteurella multocida*, is also a disease perceived as a threat to populations. Various microbiology and veterinary approaches have been applied in host-pathogen systems involving seabirds, but determining the factors affecting the emergence and circulation of diseases, and their potential management implications, requires complementary approaches integrating ecological immunology, demography, movement ecology, phylodynamics and community ecology. We will illustrate that by presenting results obtained following surveys conducted at hierarchies of scales, and field experiments. Serological surveys at the scale of the Southern Indian Oceans showed that some infectious agents are more broadly distributed than previously known, and that scavenger species like skuas could be used efficiently as sentinels. Moreover, temporal persistence of antibody levels varies among species, with potentially strong implications for disease dynamics and the interpretation of serological results. We will also outline ongoing projects based on study designs involving immune challenges (vaccination) and introduced species removal to illustrate how further inferences can be made about eco-epidemiological processes of basic and applied relevance.

Talk 23

## More than meets the eye: a detailed eco-epidemiological investigation of highly pathogenic avian influenza on a Subantarctic archipelago sheds light on transmission dynamics.

Julia Emerit, Augustin Clessin, Mathilde Lejeune, Amanda Kuepfer, Luca Nelli, Léo Streith, Paulo Catry, Thierry Boulinier, Zoe Fowler, Amandine Gamble
*University of Cornell, USA.

Since 2021, a Highly Pathogenic Avian Influenza (HPAI) virus has been spreading globally, massively killing wild birds. Seabirds, which breed in dense colonies in which viruses can quickly spread, have been particularly affected. In October 2023, the virus eventually reached the Subantarctic region. Subsequently, three HPAI outbreaks, mostly affecting penguins on two islands and albatrosses on another, were reported in the Falkland Islands, as well as several individual cases across the archipelago. In parallel with intense mortality event surveillance, systematic sampling of both dead and live birds allowed us to obtain new insights on the mechanisms driving HPAI transmission in seabird communities. Immunological data suggest an earlier introduction and wider transmission than graspable with symptomatic case detection only, highlighting the potential importance of asymptomatic carriers. They also indicate that terrestrial scavengers might acquire immunity against the virus, while pelagic seabirds might remain susceptible to future outbreaks. The rise in cases over the breeding season suggests nestlings could be major drivers of epizootic amplification, highlighting timing of introduction as a likely critical factor in outbreak initiation. This study showcases successful community-led wildlife health monitoring and collaborative research on wildlife disease, involving local populations, local governmental and non-governmental organisations, and international research teams.

Talk 24

## Predicting foraging areas of European Storm-Petrels: conservation implications in the Western Mediterranean.

Sofia B. Roda, Andreu R. Vallespir, Andrea Santangeli, Giacomo Tavecchia, Alfonso Sola, Santi Catxot, Daniel Tarry, Gotzon Basterretxea, Simon Ruiz, Ignacio Catalán, Ana Sanz-Aguilar
*IMEDEA, Spain

Seabirds' distribution is influenced by the ecological dynamics of marine environments, but understanding how oceanographic features shape seabird foraging behaviour remains a challenge. We combined GPS tracking locations (n = 2,883) of 39 European Storm-Petrels *Hydrobates pelagicus* breeding in four West Mediterranean colonies during incubation over multiple years (2019-2021) with near-real-time remotely sensed oceanographic drivers. We model habitat selection using GPS tracking data from one colony, Benidorm Island, and use data from other three colonies for validation. We show that suitable foraging areas are strongly characterised by low sea surface temperature (SST), high chlorophyll-a (Chl-a) concentration and eddy kinetic energy (EKE). Based on this model, we predict habitat suitability maps for 2018-2022. Cross-validation using data from the other three colonies highlights that suitable areas are universally applicable across other storm-petrel colonies in West Mediterranean. We identified the Alboran Sea, the North African coast, the Gulf of Lion and the Ebro River Delta as the most suitable regions. These areas coincide with regions of high mesoscale variability, suggesting the importance of dynamic oceanographic features in determining foraging habitat. However, they are largely unprotected by Marine protected areas (MPAs), leaving them vulnerable to anthropogenic threats such as overfishing and energy infrastructure development. Our study underscores the urgent need for expanding and effectively managing MPAs to safeguard these vital habitats.

Talk 25

## How does foraging in two different environments influences the fatty acid profile of two close-related shearwater species?

Maria I. Laranjeiro, Tiago Simões, Ivo dos Santos, Jaime A. Ramos, Jorge M. Pereira, José M. Reyes-González, Marco F. L. Lemos, Vítor H. Paiva, Sara C. Novais, Joan Navarro, Filipe R. Ceia
*University of Coimbra, Portugal

Cory's *Calonectris borealis* and Scopoli's *Calonectris diomedea* Shearwaters are two close-related species adapted to different water regimes: the Northeast Atlantic Ocean and the Mediterranean Sea, respectively. Here, we compared the fatty acid profile, the trophic habits, and the spatial ecology of Cory's and Scopoli's Shearwaters breeding at Berlenga (Atlantic Ocean) and at Chafarinas (Mediterranean Sea) Islands. We anticipated lower omega-3 fatty acids concentrations (e.g., DHA and EPA) and higher concentrations of odd-chain (characteristic of bacteria) and trans fatty acids (potential tracers of pollution) in Scopoli's Shearwaters, due to the Mediterranean semi-enclosed nature, low productivity, and pollution. This was partially supported by our results, which showed higher concentrations of odd-chain fatty acids and trans-palmitoleic acid in Scopoli's compared to Cory's Shearwaters. Unexpectedly, omega-3 and oleic acid concentrations were also higher in these species. Together with differences in the trophic ecology (stable isotope analysis) and spatial behaviour (GPS tracking), these results can reflect diverse prey availability and selection between colonies, as well as different foraging efforts and energetic demands during chick-rearing. More studies are needed to better understand the bioaccumulation patterns of fatty acids in these two marine ecosystems, influenced by different ecological features and anthropogenic pressures.

Talk 26

## Overnight foraging trips in a diurnal seabird, the Australasian Gannet *Morus serrator.*

Aurore Counilh, Luc Lens, John P. Y. Arnould
*University of Deakin, Australia

Chick-rearing seabirds are faced with the need to provision their chicks while at the same time ensuring self-maintenance. Gannets usually conduct 1-2 day trips, resting on the sea surface at night which may incur greater metabolic costs than resting on land. Previous studies of Australasian Gannets *Morus serrator* have documented that a substantial proportion of individuals undertake overnight trips, with foraging at night being recorded. The factors influencing the prevalence of this behaviour are unknown. The present study used GPS data collected between the 2011/12 and 2022/23 breeding seasons in two colonies in South-Eastern Australia to assess the characteristics, foraging behaviour, and habitat-use of individuals undertaking day and overnight foraging trips. In total, 49% of all foraging trips involved overnight periods away from the colony, which were more common near the full moon and undertaken more by younger, female individuals during incubation. Of these, 60% started in the morning, involving individuals foraging throughout the day and returning to the colony early the following day. Overnight trips starting in the afternoon showed higher foraging activity around sunset and sunrise, with some foraging throughout the night that peaked around midnight. In general, there were no spatial differences in foraging locations between individuals undertaking overnight or day trips.

Speed 12

## What's for dinner? Using DNA metabarcoding to investigate the diet of Manx Shearwater chicks and adults.

Lauren Evans, Amy Ellison, Kristen Crandell, Stephanie Harris, Peter Robins, Line Cordes
*University of Bangor, UK

As sentinels of ocean health, investigating seabird diet is essential to further our understanding of marine trophic webs. Understanding the sources of variation in diet and the consequence for reproductive success is key to predicting the impacts of changes in lower trophic levels on seabird populations. Determining the diet of wide-ranging pelagic species is challenging; the efficacy of established techniques is limited by low taxonomic resolution (e.g., stable isotope analyses), invasiveness (e.g., stomach flushing) and low amplification success (e.g., analysis of faecal samples). In this study, we investigated the novel use of buccal swabs and DNA metabarcoding to overcome these limitations and determine the diet of a highly pelagic seabird, the Manx Shearwater *Puffinus puffinus*. We deployed GPS loggers on chick-rearing adult Manx Shearwaters on Bardsey Island, North Wales. Following a foraging trip, we swabbed both adult birds and their chicks after feeding. All swabs provided dietary DNA, identifiable to species level. Initial results indicated high similarity between adult and offspring pairs in their diet composition. European Sprat *Sprattus sprattus* was the dominant species, identified in 90% of swabs, but other prey species were also detected. This study is, to the best of our knowledge, the first application of buccal swabbing for dietary metabarcoding in seabirds, and we suggest this method has strong potential to be widely applied to future seabird diet studies.

Speed 13

## Stalking Terns: Spatial and trophic ecology of an estuarine species and the effect of human disturbance.

Lara R. Cerveira, Sara N. Veríssimo, Jorge M. Pereira, Jaime A. Ramos, Vitor H. Paiva
* University of Coimbra, Portugal

Lagoon and marine coastal habitats are vital for biodiversity but face global threats. Little Terns *Sternula albifrons*, estuarine birds, make intensive use of urbanised coastal areas, facing human-induced stressors. During two consecutive years (2021-2022) we GPS-tracked Little Terns from two breeding colonies (Praia de Faro and Fuseta) at Ria Formosa Natural Park, exposed to different human disturbance levels. We also studied the impact of human activities on breeding and foraging successes and study their diet and physiological condition through regurgitates and blood samples. Overall, individuals from both colonies mostly foraged surrounding their breeding colony. Yet, individuals from highly disturbed areas made longer trips and showed preference for the interior Lagoon channels and Barra habitat. Barra and Ocean were the most used habitat for foraging by individuals from the less disturbed colony. All individuals showed higher foraging behaviour during the day with no significant differences in the use of different tidal phases. Main prey present in diet were *Atherina* spp. and *Pomatoschistus* spp. and we found no differences in $\delta^{13}C$ and $\delta^{15}N$ isotope values between colonies. Similarly, physiological condition did not vary significantly between the two colonies, although breeding success was lower in the most disturbed colony. Human disturbance impact both foraging behaviour and breeding success of this species. More efforts should be made to protect their breeding areas.

Speed 14

## To dive or not to dive: flight-cost versus foraging strategy in the Manx Shearwater and the Atlantic Puffin.

Astrid Dedieu, Jamie Darby, Manon Clairbaux, Sam L. Cox, Mark Jessopp
*University College Cork, Ireland

In the marine environment, prey resources are patchily distributed. Diving predators must move between areas and regularly 'sample' the water column to locate prey patches before commencing a series of foraging dives that occur within a dive 'bout'. The spatial scale and frequency of dive bout will therefore be a proxy for habitat sampling and represents a trade-off between the scale of prey patchiness and the energetic cost of movement between patches. We investigated the movement strategies of two diving seabirds with contrasting flight costs, the Manx Shearwater *Puffinus puffinus* and the Atlantic Puffin *Fratercula arctica*. A total of 22 shearwaters and 18 puffins were tracked during the breeding season between 2021 and 2023 using PathTrack nanoFix-GEO tags with TDR along the South coast of Ireland. 8,210 shearwater dives and 9,735 puffin dives were classified using diveMove into 692 and 564 dive bouts respectively. Shearwaters, having a much lower cost of flight, travelled further (mean = 12.6 Km) between successive bouts compared to puffins (mean = 3 Km). Interestingly, despite differences in scale, the frequency distribution of distance and time between bouts was similar for both species, suggesting an optimal relocation distance that maximises patch encounter rate relative to flight cost. Results suggest that species with high wing-loading such as auks may be less able to adapt to changes in prey distribution than more efficient flyers.

Speed 15

## Fine-scale foraging behaviour of European Shags in kelp forests.

Nina Dehnhard, Svein-Håkon Lorentsen
*NINA - Norwegian Institute for Nature Research, Norway

Kelp forests act as nursery grounds and hiding places for fish and form important foraging areas for seabirds. Marine heatwaves, outbreaks of sea urchins and commercial harvesting pose threats to this ecosystem and seabirds that utilise it. Previous studies have highlighted the importance of shallow coastal areas and kelp forests as foraging sites of European Shags *Gulosus aristotelis* in Norway, but also showed significant overlap in areas used by shags and commercial kelp harvesting. To understand better how shags use kelp forests, we deployed video-, GPS- and TDR-loggers simultaneously on 24 shags at Sklinna, central Norway. Total dive time and time spent in different underwater habitat types were quantified from videos, and video-data were linked with dive locations (GPS) and dive depth (TDR). Preliminary results show that 83% of all dives were associated with kelp. On average, 27% of total dive time was spent under the canopy of kelp forests formed by *Laminaria hyperborea*, with shags diving among the kelp stilts, typically just above the seabed. 20% of the total dive time was spent over the canopy of kelp forests formed by *L. hyperborea*, while 18% of dive time was associated with sugar kelp *L. saccharina*. Only 12% of the dive time was spent over gravel, and <2% over rocky or sandy seabed. Our results highlight the importance of kelp forests for shags and for the first time quantify the fine-scale use of this habitat.

Speed 16

## Fine-scale movement data of the Bermuda Petrel highlights surface foraging and greater nocturnal flight activity.

Paolo Becciu, Allison Patterson, Carina Gjerdrum, Jeremy Madeiros, Letizia Campioni
*Ornis Italica, Italy

Foraging behaviour plays a fundamental role in animal fitness and population dynamics. In marine ecosystems seabirds like petrels showcase a diverse array of foraging strategies some of which are still poorly understood. We deployed multi-sensor biologgers to collect fine scale movement data and investigate the at-sea behaviours of the Bermuda Petrel *Pterodroma cahow*, a highly threatened gadfly petrel, specialised on mesopelagic prey. GPS-tracking revealed extensive foraging trips, in consistent directions, over remote oceanic regions. Accelerometer-data analysis classified three flying-related and three water-related behaviours. Flying behaviour reflected the dynamic soaring flight strategy of Procellariiforms; birds spend > 3/4 of their time in flight with non-flapping flight being the most common behaviour under all conditions. The remaining time was spent in three water behaviours with "intense-water" likely reflecting scavenging and prey seizing. Almost all behaviours changed with sun elevation angle. Flight-related behaviours increased with negative sun elevation values suggesting greater activity at night. Water-related behaviours showed an opposite trend being more frequent in daylight. Time-depth-recorders indicated that petrels have very limited diving capacity suggesting that the capture of their meso-bathypelagic prey must occur in the very upper layer of the water surface. Our work offers valuable insights for a better understanding of gadfly petrel foraging behaviours.

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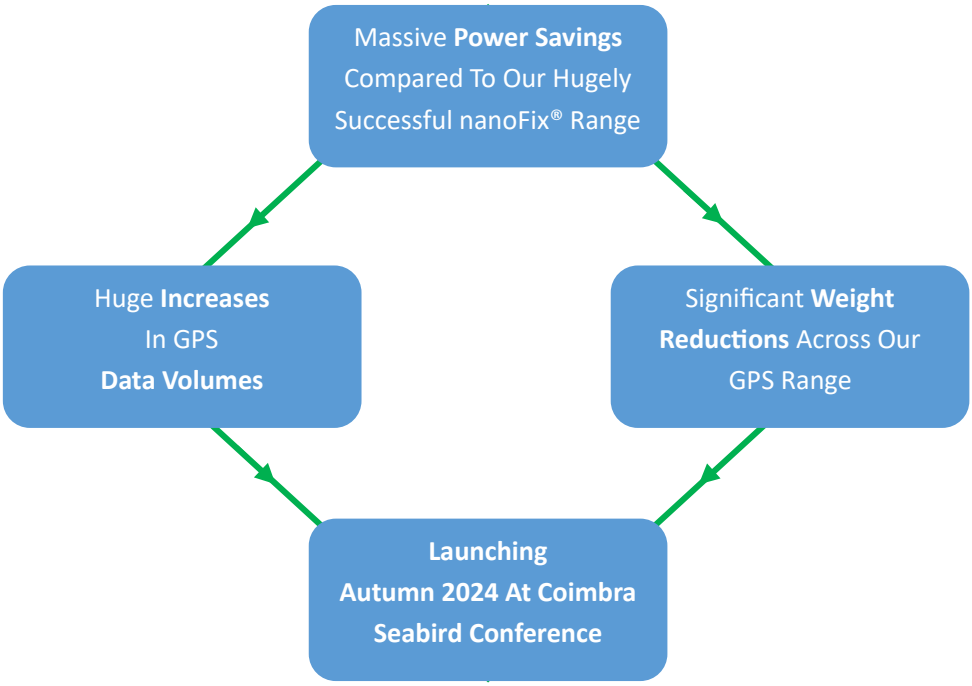


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Talk 27

## The importance of mesopelagics in the diet of pelagic seabirds in the Atlantic Ocean.

Mónica C. Silva, Paulo Catry, José P. Granadeiro, Vera L. Nunes, Ewan Wakefield, Silke Waap, Jéssica Ribeiro, Letizia Campioni, Maria P. Dias
*University of Lisboa, Portugal

At a time when we are only beginning to understand the full faunal diversity of oceanic deep waters, studies of the diet of pelagic seabirds, facilitated by the latest DNA metabarcoding technologies, are revealing the importance of mesopelagics in shaping the dynamics of marine communities. The Deserta's Petrel *Pterodroma deserta* and Zino's Petrel *Pterodroma madeira* are endemic to Madeira. Despite their threatened conservation status, key aspects of their ecology, such as their diet, are still poorly known. DNA metabarcoding, applied to regurgitate and faecal samples collected in the breeding season, revealed that they are generalist predators, consuming an extraordinary diversity of prey (up to 19 species in a single diet sample). However, they appear to subsist mostly on deep water fish (Myctophiformes and Stomiiformes) and cephalopods (Oegopsida). A literature review showed that other Atlantic *Pterodroma* spp. and small petrels also rely heavily on mesopelagics despite being shallow divers. Many identified prey species undertake daily vertical migrations, which must bring them closer to the surface than previously supposed. Such results highlight the importance of this resource in the food webs of one of the most mesopelagic biomass-rich areas of the world. We anticipate both that the future development of fisheries moving into deeper waters and targeting smaller species, together with climate change, will therefore have a major impact on Atlantic communities relying on this resource.

Talk 28

## Pelagic seabird chases cyclones to improve foraging efficiency.

Francesco Ventura, Neele Sander, Paulo Catry, Ewan Wakefield, Federico De Pascalis, Philip L. Richardson, José P. Granadeiro, Mónica C. Silva, Caroline C. Ummenhofer
*Woods Hole Oceanographic Institution, USA

In late Summer and Autumn, tropical cyclones profoundly disturb oceanic and coastal ecosystems. Direct negative effects on individuals and marine communities can be dramatic, but cyclones can also enhance pelagic primary and secondary production. Here, we investigate the effects of cyclones on the movements of a wide-ranging seabird, the Desertas Petrel *Pterodroma deserta*, foraging in the mid-latitude regions affected by the North Atlantic hurricane season. Approximately one-third of the tracked petrels interacted with approaching cyclones. Contrary to previous studies, the petrels did not avoid cyclonic systems by altering their course but, rather, birds approached the cyclones. Furthermore, petrels made extensive use of the areas perturbed by the passage of cyclones: one-quarter of the birds followed the wakes for days and over thousands of kilometres, a behaviour documented here for the first time. Within these wakes, tail wind support was higher than elsewhere. Furthermore, at the mesoscale, surface chlorophyll sharply increased and sea surface temperature dropped, suggesting a direct effect of upwelling and wind induced mixing on ocean stratification and prey availability. We hypothesise that cyclone wakes provide both predictably favourable wind conditions and foraging opportunities. As such, cyclones may play a currently overlooked role in shaping the foraging ecology and demography of many mid-latitude pelagic seabirds and, likely, other marine top-predators.

Talk 29

## Population size and foraging movements of penguins at the world's largest colony.

Norman Ratcliffe, Klemens Putz, Gemma Clucas, John Dickens, Andy Lowther, Tom Hart
*British Antarctic Survey, UK

Zavodovski Island is an active volcano at the Northern end of the South Sandwich Archipelago that hosts the largest penguin colony in the world, comprising ~600,000 pairs of Chinstrap Penguin *Pygoscelis antarcticus* and 90,000 Macaroni Penguins *Eudyptes chrysolophus*. However, accurate counts and assessment of trends have been hampered by the scale of the task, the remote location and difficulties of landing and working on this hazardous site. In this talk we describe a challenging expedition to the island supported by a yacht and the deep-field camp. Despite numerous setbacks, almost all penguin colonies were surveyed during peak nesting using a multicopter drone and an A400M aircraft operating out of the Falkland Islands. We present the first accurate census of the island's penguin population and compare these with previous estimates to assess the effects that the 2016 eruption of the island may have had on their numbers. We also present the first data on the year-round foraging trips of both species of penguin, using PTTs to track movements during the incubation, chick rearing and pre-moult stages and GLS tags to reveal winter migrations. We will discuss the implications of our findings for the global conservation status of Chinstrap Penguins, future monitoring strategies and the management of the South Georgia and South Sandwich Islands Marine Protected Area.

Talk 30

## Bird-borne cameras reveal gannet diet and social foraging.

Evelyn Alexander, Robin Freeman, Stephen Votier
*University of Heriot-Watt, UK

Predators searching for food in a dynamic environment, such as seabirds feeding on pelagic fishes, must employ a variety of behavioural strategies to optimise foraging success. Colony-nesting birds, such as Northern Gannets *Morus bassanus*, must balance the costs of intra-specific competition with the potential benefits of social information about prey location, a phenomenon known as local enhancement. These benefits are likely to be prey type-dependent: Little Penguins *Eudyptula minor*, for example, forage socially more often when feeding on shoaling prey. Gannets are observed to forage both socially and alone, but little is known about the circumstances which provoke strategy switching, or whether one method results in more efficient foraging. Here, I used bird-borne cameras to record video evidence of foraging and time-matched the resulting activity logs with tracks from co-deployed GPS loggers. Preliminary results suggest that gannets forage socially about 70% of the time, but there is no clear difference in the prey types targeted. Within trips, individuals are highly repeatable for natural vs. fishing vessel scavenge foraging, and different foraging strategies show marked spatial segregation. Analysis is ongoing to determine the spatial overlap of gannet foraging grounds with anthropogenic disturbance in the Celtic Sea, the relative effort of social foraging compared to solo foraging, and the ultimate and proximate drivers of foraging strategy selection.

Speed 17

## Biochemical and molecular biomarkers in Manx Shearwaters *Puffinus puffinus* and associations to marine pollution.

Patricia Serafini, Barbara Righetti, Ralph Vanstreels, Leandro Bugoni, Daína Lima, Jacó Mattos, Clei Piazza, Cristiane Kolesnikovas, Alice Pereira, Marcelo Maraschin, Isadora Piccinin, Tim Guilord, Luciana Gallo, Marcela Uhart, Rafael Lourenço, Afonso Bainy, Karim Lúchmann
*Universidade Federal de Santa Catarina, Brazil

Seabirds are key indicators for understanding the combined effects of biotic and abiotic factors on the integrity and health of marine ecosystems. As top predators moving over vast marine areas, and under many stressors such as chemical pollution and global climate change, they are ocean sentinels. In this study, we evaluated the presence of plastics in the digestive tract of 155 Manx Shearwaters *Puffinus puffinus* stranded along the coast of southern Brazil, quantified contaminants in liver and the mRNA transcript levels of xenobiotic response biomarkers for the birds. We also measured the enzymatic activity of two classical detoxification biomarkers, ethoxy-resorufin O-deethylase, EROD and Glutathione S-transferase - GST. Transcript levels for aryl hydrocarbon receptor (AhR), cytochrome P450 1A-5 (CYP1A5), UDP-glucuronosyl-transferase (UGT1), estrogen receptor alpha 1 (ESR1), and heat shock protein 70 (HSP70) were measured to investigate their relationship with plastic ingestion and xenobiotics. Macroplastic debris were found in the digestive tracts of 29% of shearwaters sampled. Generalized Additive Models (GAMs) showed that transcription of UGT1 and CYP1A5 was significantly associated with HCB and PCBs levels. ESR1 was associated with HCB and Mirex, and GST was associated with Drins and Mirex. While pollutants affected shearwaters more than plastic ingestion, reducing plastic availability remains crucial as xenobiotics potentially are also adsorbed onto plastics.

Speed 18

## Cory's Shearwater as a key bioindicator of plastic contamination for North East Atlantic hotspots of marine litter.

Yasmina Rodríguez, Airam Rodríguez, Willem M.G.M. van Loon, João M. Pereira, João Frias, Emily M. Duncan, Sofia Garcia, Laura Herrera, Cristina Marquês, Verónica Neves, Cristopher Domínguez-Hernández, Javier Hernández-Borges, Beneharo Rodríguez, Christopher K. Pham
*OKEANO - Institute of Marine Sciences - University of the Azores, Portugal

The relevance of plastic pollution in the world's oceans has intensified the search for new and effective species to act as bioindicators to monitor marine litter. The susceptibility of Procellariforms seabirds to plastic contamination has prompted extensive research into this threat, with some species already being proposed as promising sentinels. In this study, plastic ingestion was investigated in 1,238 dead Cory's Shearwaters *Calonectris borealis* collected over eight years from breeding areas of the Macaronesia region. Despite their remote and typically pristine nature, those oceanic islands face significant pressure from marine litter, occasionally exposed to substantial amounts of degraded plastic items. Our analyses defined this bioindicator's essential parameters, including target age, sampling approach, and a pollution threshold value. Our results suggest that fledglings from the Azores would monitor changes in the composition of plastics floating in the North Atlantic Subtropical Gyre, and those from the Canary Islands would monitor litter inputs from fishing grounds in Northwest Africa. In addition, plastic retention times were also investigated in this species. Overall, our outcomes support the use of Cory's Shearwater fledglings as an applicable species for monitoring plastic litter in an area of the North Atlantic that accumulates critical concentrations of marine litter, but that so far does not have an effective bioindicator to control this type of contamination.

Speed 19

## Gulls as spreaders and sentinels of Antibiotic Resistant Bacteria in farmland environments.

Víctor Martín-Vélez, Tomás Montalvo, David Giralt, Francisco Ramirez, Joan Giménez, Clara Morral-Puigmal, Raquel Planell, Sara Sabate, Gerard Bota, Joan Navarro
*Institut de Ciències del Mar (ICM - CSIC), Spain

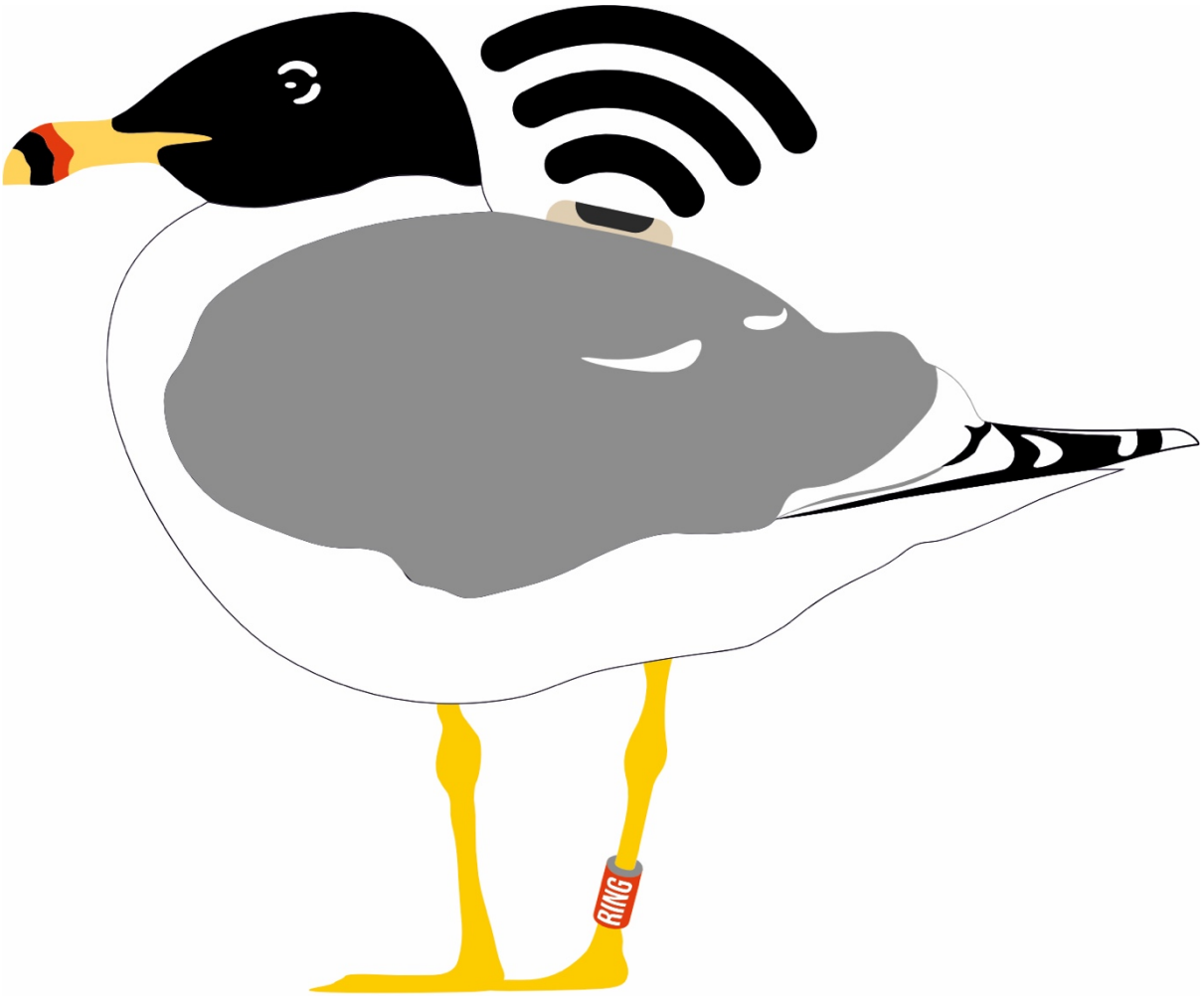
Human-transformed environments are involved in the emergence of Antibiotic Resistant Bacteria (ARB), especially human waste (dumps), agricultural and livestock production. Wildlife (e.g., gulls) can act as vectors for dispersal, but also can act as sentinels to detect the early circulation and anticipate the risks derived from ARB to humans and livestock. We provide a model study based on GPS tracking information, clinical testing and network analyses from the Yellow-legged Gull that shows the spatial patterns of ARB dispersal within an agricultural context. We tested and tagged 26 breeding individuals from 2022 to 2024. Seven of them tested positive for *Escherichia coli* (one of them was co-infected with *Listeria monocytogenes* and *Salmonella* spp.). Potential pathogen dispersal distances were 1.16 Km from the breeding colony, with maximum distances of 23.17 Km. We also created a connectivity network based on all 26-tagged individuals to determine the main sources of ARB in the area (associated with three habitats: dumps, livestock facilities and irrigation ponds). The network showed a high connectivity between the lake and the nearby dumps. The combination of GPS movement data, network analyses, and pathogen determination to create spatial risk maps and networks for ARB sources can become an important tool for managing human-transformed ecosystems and improving animal health and public health with a One Health approach.

Speed 20

## Per- and polyfluoroalkyl substances (PFAS) in breeding shearwaters from the central Mediterranean Sea.

Lucie Michel, Junjie Zhang, Alexandros Asimakopoulos, Martin Austad, Paco Bustamante, Jacopo G. Cecere, Marco Cianchetti-Benedetti, Roger Colominas-Ciuró, Giacomo Dell'Omo, Federico De Pascalis, Veerle L.B. Jaspers, Petra Quillfeldt
* University of Justus Liebig Giessen, Germany

Per- and polyfluoroalkyl substances (PFAS) are a group of synthetic compounds used in numerous applications, are extremely persistent in the environment and may pose risks to wildlife health. We investigated blood pellet concentrations of PFAS in Scopoli's Shearwaters *Calonectris diomedea* from three colonies located in the Mediterranean during the chick-rearing phase in 2020; La Maddalena Archipelago, Linosa and Malta. Birds from these colonies have distinct foraging areas that are largely consistent throughout the breeding seasons but foraging areas and food sources may vary according to sex and breeding phase. For Linosa birds we had additional samples from the incubation phase in 2020 and the chick-rearing phase in 2016, enabling us to compare breeding phases and years for birds from this colony. We compared PFAS blood concentrations to the exploited foraging areas (GPS tagged birds) and dietary tracers (stable isotope values of carbon and nitrogen). PFAS were detected in all samples, with ΣPFAS and PFAS profiles differing among colonies. In Linosa birds, PFAS concentrations differed between breeding phases and sexes but not between the two study years. Incubating males had both the highest trophic position and PFAS concentrations. Our results suggest that if sampling is carried out during the same breeding phase, regional differences in PFAS concentrations can be identified. Hence, shearwaters can be biomonitors of PFAS burdens in top predators of remote marine environments.




# INTERREX - RINGS & TELEMETRY

## EQUITY, DIVERSITY AND INCLUSION (EDI TALKS)

EDI Talk 1

### The contribution of each scientist to promote diversity, equity, inclusion, and belonging in science.

Claudia Cavadas
*University of Coimbra, Portugal

The promotion of diversity, equity, inclusion, and belonging (DEIB) is essential to ensure a representative, ethical, and effective scientific community. In this seminar, I will elaborate on the role each scientist plays in advancing DEIB within a research team and institution. Additionally, I will discuss the activities developed within the action-research project GendER@UC, which delves into practical strategies aimed at promoting diversity within research centers. Furthermore, I will present my professional and personal experiences and contributions as a former vice-rector of the university, a team leader in a research institution, and a professor.

EDI Talk 2

### Toileting and menstruation during seabird fieldwork.

Eleanor M. Honan, Lila Buckingham
*NINA - Norwegian Institute for Nature Research, Norway

Seabird fieldwork frequently occurs in remote areas, often involving challenging environmental conditions including limited access to running water and/or conventional toileting and sanitation facilities. Based on surveying and consultation with members of the Seabird Group, in this talk, we will explore why it is essential for seabird scientists, particularly those with a leadership role, to learn about and openly discuss the realities of dealing with toileting and menstruation during remote fieldwork with their field team. We will focus on toileting and menstruation with regards to accessibility and environmental considerations. We present practical knowledge and tools for more comfortable, responsible, and sustainable fieldwork practices.

## OTHERS

Talk 31

### Variations in the time interval between feral Domestic Cat *Felis catus* eradication and the recovery of tropical seabird populations on Ascension Island in the South Atlantic.

John B. Hughes, James S. Reynolds
*Army Ornithological Society, UK

On Ascension Island the introduction of cats in 1815 resulted in the extirpation from the mainland of large seabird colonies. Cats were eradicated by The Royal Society for the Protection of Birds (RSPB) in 2004 and since then relict seabird populations that persisted on overcrowded offshore islets have returned to the mainland. Before and after cat eradication (i.e., between 1990 and 2018) we collected census data that allow us to document the recolonization/recovery of seabird populations. Area surveys of breeding colonies, satellite imagery and field observations were used to report that Sooty Terns *Onychoprion fuscatus* nesting on the mainland were first to respond to cat eradication with population size increasing in 2003 and plateauing in 2008 as predation by Black Rats *Rattus rattus* escalated. Remnant breeding populations of Brown Boobies *Sula leucogaster*, Masked Boobies *Sula dactylatra* and Brown Noddies *Anous stolidus* recolonised the mainland in 2005. Endemic Ascension Frigatebirds *Fregata aquila* were slow to respond to cat eradication and first nested on the mainland on 5th December 2012. Red-footed Boobies *Sula sula* occupied vacated nest sites on offshore islets in 2008 but none returned to the mainland. Removal of cats as the apex predator from Ascension Island has met with mixed success. Hundreds of Ascension frigatebirds have now recolonised the mainland but, in contrast, the Sooty Tern population is experiencing the ill-effects of a major change in the dynamics of the predator community.

Talk 32

## Following those who follow seabirds. Geography of marine ornithologists mobilities to the field site in and around the Arctic.

Mayline Strouk
*University of Edinburgh, UK
*University of Leiden, Netherlands

Between 2021 and 2024, I conducted 25 interviews with seabird scientists to answer an apparently simple yet complex question: how do researchers choose their field sites? I aimed to understand how some seabird colonies and ecological areas are better understood than others, and what are the geographical gaps in seabird research. As a geographer and specialist in Science and Technology Studies (STS), I explored the social factors behind the choice of a field site. In this presentation, I share the mapping of seabird research based on the geographical coordinates of field sites extracted from publication data. More importantly, I explain this distribution of research by drawing from interviews with scientists based in and around the Arctic region, and observations from two pieces of ethnographic fieldwork I conducted in 2023. I structure my research around two main ideas. (1) Collaborations and personal encounters shape the geography of field sites and the trajectories of researchers to the field. Accessibility is key, but the social aspect of science is also crucially shaping the choice of a specific location for fieldwork. (2) Technologies appear as a disruptive factor in the conduct of fieldwork, notably toward a reduction of the time spent in the field. However, these technologies emerge in practice as a solution against the increased pressure from funding actors toward short-term evidence-based studies.

Talk 33

## Silent bird cliffs - a photographic journey through shifting baselines.

Signe Christensen-Dalsgaard, Tycho Anker-Nilssen, Rob Barrett, Juliet Landrø
*NINA - Norwegian Institute for Nature Research, Norway

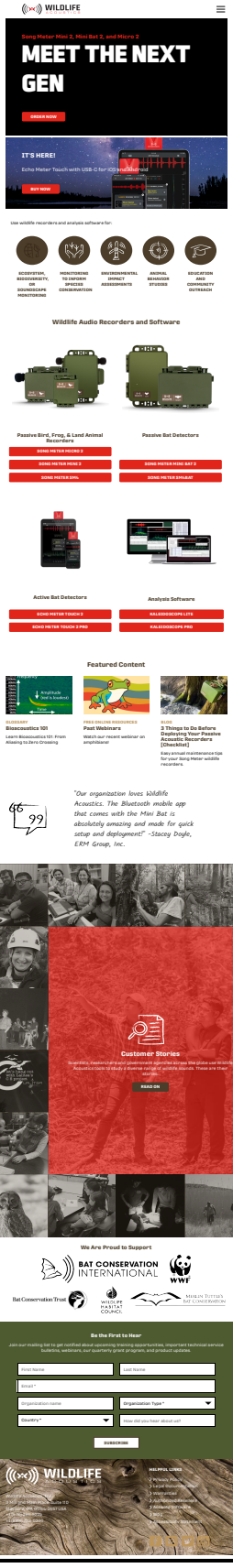
In the 1970s, more than a million kittiwakes nested along the Norwegian mainland. Today there are fewer than 50,000 pairs. Along the entire coast a great many colonies have completely disappeared. The bird cliffs have become silent. For those who did not experience how they looked, or sounded, just a few decades ago, it is almost impossible for them to comprehend the extent of these changes. We all have our own reference points based on what we have experienced, and it is thus difficult to create a common understanding of the changes that have occurred over different time periods. This is known as ”shifting baselines” and describes how our perception of what may look natural today is in fact a result of changes through time. As years pass, we lose track of how profoundly the world around us has changed and accept a continued destruction of nature through each passing generation. To document and communicate the drastic changes in the once huge Norwegian seabird populations, we collated photo and video documentation illustrating the density of birds in different colonies in the 1980s and 1990s. We then recreated the exact same photo motifs. Here we present the results of the project and show how the information was shared with the public through cooperation with national news media. This liaison between researchers and media not only made these worrying findings more easily available to a broader audience but also helped the public to understand the magnitude of the trends.

Speed 21

## Intensive shipping disturbance pushes common scoters around and away from their food in the main Dutch staging area in Spring.

Martin Poot, Peter van Horssen, Ib Krag Pettersen, Els van der Zee, Sjoerd Dirksen, Mardik Leopold
*Wageningen Marine Research, Netherlands

Based on aerial surveys covering the North Sea coastal zone off the Wadden Sea Islands in the Netherlands, we investigated the disturbance effect by shipping on the numbers and the distribution of Common Scoters in March and April, 2009-2021. Scoter data were combined with information on the availability of benthos species of ingestible size and the Automatic Identification System (AIS) data of shipping. To account for the large proportion of zeros in the count data we used a hurdle model to explain Scoter presence and abundance with nonlinear effects for disturbance and food availability, as well as depth and a spatial random field. Surprisingly, we could not find a relationship between the Scoter and food distributions. Shipping disturbance, largely by shrimpers and cargo vessels explains this. At some days dozens of shrimp fishing vessels were active, mostly moving coast parallel, substantially diminishing the area without disturbance. We used the AIS data to determine the distances between groups of common scoters to the nearest ships, revealing that the scoters kept a minimal average distance of 3 Km. We suggest that this distance must be regarded as a result of the birds' avoidance behaviour as this distance is larger than known flushing distances in reaction to ships. We hypothesise that disturbed birds fly off and tend to land at locations away from shipping, but, unavoidably, also with less available food.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PLENARY SPEAKER 3

## Moving from examining conservation issues separately to considering cumulative effects; a case study of bringing it all together when assessing the threats to Northern Fulmars in the Canadian Arctic.

Jennifer Provencher
*Environment and Climate Change Canada, Canada

Seabird populations are under pressure from multiple threats; legacy contaminants, plastic pollution, emerging diseases, invasive species, oil spills, fisheries bycatch, etc. etc. etc. A species shown to be under multiple types of threats is the Northern Fulmar in Northern Canada. Contaminants have shown to be at some of the highest levels in this species in the region, with emerging chemicals of concern often detected in this group. Plastic pollution has been documented in fulmars at such high levels that they have been designated indicator species for plastic particles across their range in the North Atlantic. Oil pollution from increased vessel traffic is an emerging concern. At the same time bycatch of fulmars in gillnets used in the region have recently been shown to have potential population level impacts. These conservation concerns have been reported in Northern Fulmars nesting in the Canadian Arctic Archipelago since the early 2000s, but almost exclusively as independent stressors. With fulmar populations in some regions of the Arctic showing a declining trend, there is an immediate need to work with a range of conservation tools in order to influence emerging policies and practices. To address concerns, and inform emerging policies, we employed a series of exercises that used expert opinion (both Indigenous and western-based knowledge) to assess both the threats, and their manageability to help direct conservation actions and prioritize research needs. By harnessing social science methods to an applied conservation challenge, we can better contextualise decades of work on seabird issues to better inform the complex policy landscape of multiple threats on seabird populations.

Talk 34

## Investigating the temporality of reproductive trade-offs in two albatross populations breeding under contrasting environmental conditions.

Bertille Mohring, Richard Phillips, Henri Weimerskirch, Jonathan Potts, Denis Réale, Alastair Wilson, Christophe Barbraud, Ashley Bennison, Karine Delord, Andrew Wood, Samantha Patrick
*University of Liverpool, UK.

Life-history traits of long-lived species such as albatrosses are thought to be canalised against environmental fluctuations. However, allocating resources to reproduction is costly and resources are often limited, raising a trade-off between investment in current reproduction and survival. Surprisingly, the temporality at which individuals pay the cost of reproduction and its link with the resource predictability have been overlooked. Using extensive monitoring datasets from two populations of Black-browed Albatrosses *Thalassarche melanophris* breeding in contrasting environments, we assessed the temporality of such trade-offs. Individuals breeding at Kerguelen, under highly predictable environmental conditions, displayed a higher and less variable annual reproductive success than individuals breeding at Bird Island, in a nearly three times more variable environment. Individuals breeding in a predictable environment seemed to delay the cost of reproduction until late life, mirrored in an earlier onset of senescence and a stronger rate of decline in reproductive performance, compared to individuals breeding in an unpredictable environment. The two populations also differed in the temporality at which they paid reproductive costs over a shorter period of time, suggesting a role of environmental predictability in shaping life-history strategies. Understanding the drivers of temporality of reproductive trade-offs is key to predict seabird responses to climate change.

Talk 35

## Prospecting behaviour in a tropical seabird, the red-footed booby.

Alice Trevail, Ruth Dunn, Robin Freeman, Malcolm Nicoll, Stephen Votier
*University of Exeter, UK

Immature dispersal is fundamental to seabird population connectivity and demography. During this time, individuals can gather social information and foraging experience at potential breeding colonies prior to recruitment, however the decision processes underlying such prospecting behaviours remain unclear. Here, we evaluate intrinsic and extrinsic drivers of prospecting in a tropical seabird, the Red-footed Booby *Sula sula*, within the remote Chagos Archipelago, tropical Indian Ocean, which supports 22,871 breeding pairs of this species across 33 out of 55 islands. Using GPS-PTT tracking data from 27 individuals across two age classes (1-2 and 2-3 years old), we firstly investigate intra-specific variability in movement parameters and island visitation rates during prospecting and central-place foraging. Secondly, we test the island characteristics that attract prospectors, including seabird abundance and diversity, presence of invasive predators, availability of native vegetation for nesting, and suitability of surrounding foraging habitat. In the Chagos Archipelago, red-footed booby colonies segregate at-sea during breeding and show low migratory connectivity with populations elsewhere in the Indian Ocean, and so our results underscore the primary role of immature dispersal for local demographic changes. Furthermore, as terrestrial management actions restore breeding sites, our results highlight the importance of immature dispersal for seabird population recovery.

Talk 36

## Pervasive hybridisation throughout the evolutionary history of Mediterranean Puffinus Shearwaters prevents inbreeding depression.

Guillem Izquierdo-Aranega, Cristian Cuevas-Caballé, Joan Ferrer Obiol, Francesco Giannelli, Josephine R. Paris, Jacob González-Solís, Marta Riutort, Julio Rozas
*University of Barcelona, Spain

Hybridization between endangered species is a double-edged sword: while it can lead to the erosion of evolutionary distinct lineages, it can also introduce genetic diversity and adaptive potential into dwindling populations. This dilemma is aggravated in the Critically Endangered Balearic Shearwater *Puffinus mauretanicus* by the limited understanding of the extent and effects of hybridisation with its sister taxon, the Yelkouan Shearwater *Puffinus yelkouan*. This knowledge gap hinders the adoption of science-based conservation strategies for this seabird, whose imminent extinction is predicted to occur before the end of the century. We use whole-genome resequencing data to investigate the evolutionary relationships of these taxa and estimate population genetics parameters relevant to their conservation. Our findings delineate two poorly-differentiated lineages, whose evolutionary history has been shaped by Pleistocene glacial cycles. We show that widespread hybridization has been a recurring phenomenon during interglacial periods, and is currently most prevalent in the islands of Menorca and Cabrera. We demonstrate that gene flow has led to the exchange of adaptive genes that are potentially driving interspecific differences in migratory strategy. Finally, we show that introgression has likely prevented increases in homozygosity and genetic load and we use forward simulations to illustrate how the preservation of hybridization can enhance species persistence.

Talk 37

## Insights into kittiwake population connectivity derived from host-parasite microsatellite analyses.

Chloe P. Cargill, Kara Layton, Beth E. Scott, Elizabeth A. Masden, Julie Miller, Lise Ruffino, Karen D. McCoy, Ana Payo-Pay
*University of Aberdeen, UK

New data on the population connectivity of seabirds are required to reduce uncertainty in population viability analyses by the incorporation of metapopulation dynamics. Here, we focus on the Atlantic Black-legged Kittiwake, *Rissa tridactyla tridactyla*: a wide-ranging, long-lived seabird. Quantifying kittiwake population connectivity is of particular interest as the total number of kittiwake breeding pairs is in decline, but with contrasting population trends regionally. We used a Bayesian Markov-chain Monte Carlo analysis of genotyped hypervariable microsatellite loci to update our knowledge of population connectivity between cliff-nesting kittiwake colonies at different spatial scales. Kittiwakes were sampled at six colonies in Northeast Scotland and seven colonies in Northeast Norway during the breeding seasons of 1998 to 2001. We used microsatellite genotypes from both the kittiwake and an obligate tick parasite, *Ixodes uriae*, which relies upon within-breeding season movements of its host for dispersal. We found uni- and bi-directional connectivity within both Scotland and Norway, and across the North Sea. From this host-parasite approach, we present insights as to the roles of pre-breeding sub-adults and breeding adults in driving kittiwake population connectivity. These outputs will guide further research towards generating robust empirical data on kittiwake population connectivity.

## CENSUS, MONITORING AND DEMOGRAPHY

Talk 38

### Arctic Skua *Stercorarius parasiticus* ocean scale migration and population level processes.

Katherine Snell, Inês Santos, Jón Aldarà, Rob van Bemmelen, Nina O'Hanlon, Sjúrður Hammer, Børge Moe, Hans Schekkerman, Greg Conway, Sveinn Hansen, Elina Mäntylä, Olivier Gilg, Gunnar Hallgrimsson, Dorothée Ehrich, Chris Thaxter, John Calladine, Helen Aiton, David Aiton, Dawn Balmer, Sarah Harris, Johannes Lang, Sölvi Vignisson, Yann Kolbeinsson, Kimmo Nuotio, Matti Sillanpää, Benoît Sittler, Aleksandr Sokolov, Raymond Klaassen, Richard Phillips, Elizabeth Humphreys, Ingrid Tulp, Kasper Thorup
*Max Planck Institute of Animal Behaviour, Germany

Arctic seabirds have experienced dramatic population declines, with migratory species particularly impacted. We investigated the migration routes and strategies of multiple populations of Arctic Skuas *Stercorarius parasiticus* to understand phenological carryover effects and connectivity. Birds consistently exhibited complex migrations of multiple discrete staging and wintering sites over an ocean-basin scale distribution. We found that breeding and wintering site influenced timing of reproduction and migration, and speed of migration; which overall resulted in synchronisation of arrival with others in their population. Spatial connectivity indicated different populations overlapped extensively throughout the non-breeding period. Those nesting on the Faroes (Southern extent of their breeding range) are experiencing some of the largest declines. Having determined migratory phenology and distribution, we utilised ringing data to estimate the effects ocean scale climatic events on survival. We found a substantial decrease in survival, which may account for the declines, and a potential effect of El Niño conditions on young birds. During the breeding season we investigated the proximate and ultimate effects of the thermal environment on parental physiology and behaviour. Incubating birds are likely operating near their upper thermal tolerance limit, suggesting constraints during breeding. We highlight the importance of longitudinal studies and interrelationships between environmental factors, migration and fitness.

Talk 39

## Highly pathogenic avian influenza in Sandwich Tern *Thalasseus sandvicensis*: impact on population size and demography.

Wouter Courtens, Eric Stienen, Ulrich Knief, European Sandwich Tern Working Group
*Research Institute for Nature and Forest, Belgium

In 2022 and 2023, the emergence of highly pathogenic avian influenza (HPAI) A(H5N1) virus clade 2.3.4.4b caused widespread devastation among seabird populations worldwide. In Europe, Sandwich Tern *Thalasseus sandvicensis* was particularly affected and suffered significant losses. Our study aims to elucidate the repercussions of this mass mortality event on population size and demography by collecting comprehensive data from all European Sandwich Tern colonies during the last two years, allowing us to present detailed spatiotemporal patterns across the continent. The toll of HPAI on adult mortality in 2022 was substantial, with records showing over 20,500 deaths, culminating in a 27% reduction in the European breeding population compared to pre-HPAI levels. The resurgence of HPAI in 2023 further exacerbated the situation, claiming approximately 1000 adult terns and leading to almost complete breeding failure in many colonies. Employing a demographic analysis that incorporates data from Irish, British, Belgian, Dutch, German, and Danish metal- and colour-ringed birds, we assess mortality rates across various age cohorts in 2022 and their subsequent impact on colony composition in 2023. The integration of detailed survival, emigration, and immigration estimates into population models enhances the predictive power of these models, providing valuable insights into the dynamics of Sandwich Tern populations amidst disease outbreaks and into the chances of population recovery.

Talk 40

## Adult survival in the seabird Leach's Storm-Petrel *Hydrobates leucorhous* covaries with the Atlantic Multidecadal Oscillation over the past six decades.

Sarah E. Gutowsky, Robert A. Ronconi, Gregory J. Robertson, Charles E. Huntington, Robert A. Mauck, Patricia L. Jones
*University of Acadia, Canada

The annual survival of seabirds is influenced by numerous factors, but oceanic conditions are likely one of the most significant. The indices used to monitor these conditions typically span periods of decades. Using the longest time series available for the species (1955-2023), we estimated apparent adult survival of Leach's Storm-Petrels *Hydrobates leucorhous* from Kent Island, New Brunswick, and assessed whether survival covaried with large-scale oceanographic indices reflecting conditions at various periods in the life cycle. We used Cormack-Jolly-Seber capture-mark-recapture models to estimate the annual survival rate. Mean apparent annual survival (φ) was 0.84 ± 0.01 SE over the 68-year study period, and was variable across years (range: 0.62 ± 0.06 to 0.97 ± 0.05), with a concentration of high values between 1979 and 1989. The apparent annual adult survival rate was inversely proportional to the Atlantic Multidecadal Oscillation (AMO) index, meaning low survival rates were associated with high AMO values that indicate positive sea surface temperature (SST) anomalies over the North Atlantic. Such trends could only have been detected with extended long-term study since the Atlantic Multidecadal Oscillation has a period of 60-80 years. Despite the challenges of maintaining long-term studies, they are more than ever essential in population ecology.

Talk 41

## A review of the ecology and conservation status of gadfly petrels in the world: gaps and priorities for research and management.

Maria Dias, Elizabeth J Pearmain, Steffen Oppel, Mónica C. Silva, Tammy E. Davies
*University of Lisboa, Portugal

The gadfly petrels (genera *Pterodroma* and *Pseudobulweria*) are among the most threatened seabirds, but this group has received little attention by international agreements such as the Convention on Migratory Species (CMS). We reviewed the current knowledge on the breeding distribution, migratory movements, foraging ecology, conservation status, population trends and main threats of the 38 species of gadfly petrels, using information available in BirdLife databases (including the Seabird Tracking Database), complemented with a literature review. 66% of the species are classified as threatened, mostly due to their very small population sizes. Almost 60% of the species have declining trends, including most of the non-threatened species. New Zealand, Chile and UK are the countries of highest relevance for gadfly petrels, followed by Portugal and France. At-sea, each species visits an average of eight countries' waters and spends the majority of their time in the high-seas, preying mostly upon mesopelagic species. Invasive alien species are, by far, the most serious threat, followed by light pollution and climate change. Major conservation priorities include control/eradication of invasive species and long-term monitoring, including of the current non-threatened species. The highly mobile nature of most of these species, along with their poor conservation status, justifies a coordinated international mobilization for their conservation, including their listing on the CMS Appendices.

Talk 42

## Quantitatively Assessing the Sensitivity of Seabirds to Anthropogenic Pressures Using PVA.

Eve Merrall, Cat Horswill, Leonie Robinson, Francis Daunt, Julie Black, Jonathan Green
*University of Liverpool, UK

Seabird populations are exposed to a plethora of threats from anthropogenic marine activity, and many are undergoing rapid decline. To effectively guide conservation efforts and implement compensatory measures, it is crucial to understand how various levels of impact on demographic rates influence population dynamics and trajectories across different seabird species. In this study we investigate the consequences of a wide range of impacts to productivity and survival in five representative UK seabird species (Black-legged Kittiwake, Common Guillemot, European Shag, Northern Fulmar and Northern Gannet). Ultimately, this work will contribute to the creation of a semi-quantitative sensitivity assessment framework for comparing seabird species' vulnerability to anthropogenic activities. Using PVA, we project population responses at different sizes and under varying density-dependent regulation scenarios. We provide evidence for how changes in demographic rates as a result of anthropogenic activity alter population size, and how this varies between species. This approach also allows us to quantify the effectiveness of different potential interventions in order to design strategic compensation measures that will sustain declining populations. We find that species vary in their response to similar impacts, and also in their sensitivity to reductions in survival compared with breeding success. We also find species differences in degree of response to density-dependent regulation.

## FORAGING AND FEEDING ECOLOGY

Speed 22

### Foraging strategies in anthropogenic landscapes modulate pathogen load and antioxidant status in an opportunistic predator.

Roger Colominas-Ciuró, Jordi Figuerola, Isabel Afán, Francisco Ramírez, Manuela G. Forero, Montserrat Solé, Joan Navarro
*University of Barcelona, Spain

Diet composition and quality are essential to maintain health and to meet physiological needs in wildlife. Seabird physiological status might be challenged by trophic ecology with high-quality diet and optimized foraging usually implying better health. Nevertheless, opportunistic predators such as gulls foraging in anthropogenic ecosystems may ingest infected trophic resources increasing pathogen load and triggering adverse physiological consequences. However, the influence of trophic ecology on pathogen's presence and physiological status in wildlife inhabiting anthropogenic ecosystems is not well known. Thus, we analysed how foraging ecology (diet assessed by stable isotopes) at different periods (breeding and wintering) influence the presence of zoonotic bacteria (*Campylobacter* spp., *Chlamydia* spp., *Salmonella* spp.) and antioxidant status (activities of catalase, superoxide dismutase, glutathione reductase and glutathione peroxidase, and levels of thiobarbituric acid-reactive substances and glutathione) in Yellow-legged Gulls *Larus michahellis* from the South of Spain. Our results revealed (i) that the type of trophic resources affected the presence of specific zoonotic bacteria, and (ii) that feeding strategies influenced antioxidant status depending on life-history stages. Thus, the health and physiological status of opportunistic predators in anthropogenic ecosystems such as gulls are modulated by their trophic ecology during particular life-history stages.

Speed 23

## Niche Segregation of Sympatric storm-petrels in the Eastern Pacific: A GPS Tracking and Prey DNA Metabarcoding Study.

Wiebke C. Schäfer, Yuliana Bedolla-Guzmán, Ariana Duarte, Petra Quillfeldt
*University of Justus Liebig Giessen, Germany

Studying the mechanisms of resource partitioning and niche segregation is crucial for understanding animal communities and their coexistence. Colonial seabirds, such as storm-petrels, are central place foragers and face significant competition for resources during the breeding season. In this study, we investigated the inter- and intraspecific niche segregation of two sympatric storm-petrel species, the Black Storm-Petrel *Hydrobates melania* (BLSP) and Leach's Storm-Petrel *H. leucorhous* (LESP), breeding in the Eastern Pacific on the San Benito Islands, Baja California, Mexico. Through GPS tracking of chick-rearing adults, we recorded foraging movements and identified main foraging areas. Moreover, we collected faeces and regurgitated samples for DNA metabarcoding analysis to determine the consumed prey. Our findings reveal insights into the resource partitioning strategies pursued by these sympatric storm-petrel species: BLSP used more neritic waters to forage while LESP foraged in oceanic waters, and the dietary analysis revealed interspecific differences at prey family level. BLSP showed also intersexual segregation, with females foraging more Northwest and further away from the colony than males, who mainly went southeast. This study contributes to our understanding of competition dynamics and niche segregation in colonial seabirds. The results highlight the importance of considering both spatial and dietary aspects when studying resource partitioning in avian communities.

Speed 24

## Non-breeding strategies and genetics of the northernmost population of subtropical Brown Skua *Stercorarius antarcticus.*

Karine Delord, Laura Martinez Anton, Anne-Sophie Bonnet-Lebrun, Yves Cherel, Yann Dorant, Célia Lesage, Sabrina Le Cam, Eric Pante, Christophe Barbraud, Amélia Viricel-Pante
* Centre d´Etudes Biologiques de Chizé | France

Invasive non-native species are a major threat to seabirds, leading to the implementation of numerous eradication campaigns. However, eradication can also affect non-targeted species. There are concerns over the fact that the invasive mammals eradication planned on Amsterdam Island in the Indian Ocean might affect the local population of subtropical Brown Skua *Stercorarius antarcticus*. Here, we aimed to use tracking (GLS + immersion) and genetic data to provide conservation-relevant information on this population prior to the eradication program. We found high variability in the skuas' non-breeding strategies (with spatial strategies reflected in activity), ranging from long-distance migration to fully resident strategies (most time spent on land). Based on the skuas' migratory phenology, we identified the period of May-July as appropriate for the eradication campaign (<15% of tracked birds present on the island). The genetic data revealed strong differentiation between the skua population of Amsterdam and two other populations from the Indian Ocean. In addition, genetic diversity and effective population size were lower for skuas from Amsterdam Island. compared to other populations. Taken all together, these results suggest that skuas from Amsterdam constitute a distinct evolutionary unit that is vulnerable given its low population size, a vulnerability that might be exacerbated by the existence of a resident strategy in some individuals.

Speed 25

## Social interactions beyond near neighbours: the influence of spatial nest distribution on Atlantic Puffin's social network.

Antoine Morel, Pierre-Paul Bitton
*Memorial University of Newfoundland, Canada

Research on insects, mammals and birds has argued that social information could optimise foraging behaviour, reduce predation, and improve offspring survival, particularly when resources are unusually scarce. Many seabirds live in high-density colonies where social information is likely to play ecological roles. Knowing how spatial distance influences information flow could help predict population response to environmental challenges and thus improve seabird conservation. However, no studies have yet investigated how spatial distribution affects network structures. In this study, we looked at how the social network of Atlantic Puffins *Fratercula arctica* is affected by distance between nests. We conducted 200 hours of behavioural observations on 124 colour-banded adults captured in a 15x15-metre area on Great Island, Newfoundland. Associations between individuals were evaluated through social network analysis and complemented with high-resolution GPS coordinates of the individual's burrow location. Our results demonstrate that most relationships are formed by relatively closely nesting individuals. However, some strong dyads exist between distantly nesting individuals reflecting that association is not only related to geographical position. This talk will discuss why they are willing to travel locally to maintain social bonds and the importance of neutral areas such as rocks in gathering distant individuals.

Talk 43

## Habitat modelling of aerial survey data reveals the displaced coastal distribution and at-sea population size of an elusive seabird: the European Storm-Petrel.

Darren Wilkinson, Jamie Darby, Ashley Bennison, Hélder Araújo, Oriol Giralt Paradell, David Tierney, Emer Rogan, Mark Jessopp, John L. Quinn
* University College Cork, Ireland

Knowledge of the distribution and population sizes of marine species is crucial for conservation. Many seabird species are now well-studied but the at-sea distribution of storm-petrels breeding in the North-East Atlantic is poorly known, and population estimates rely on colony censuses, the reliability of which has been questioned. Large-scale aerial surveys were conducted over four years in the North-East Atlantic waters off Ireland. Generalised Additive Models were produced to assess the suitability of this surveying method for storm-petrels and to model their abundance and distribution. No difference in storm-petrel detectability between the survey altitudes (183 m and 76 m) was identified and population estimates of 143,600 and 103,100 Storm-petrels were produced for the pre- and post-laying stages, respectively. Although the continental shelf edge was highlighted as an important feature in the distribution of storm-petrels, more prominent hotspots were identified 30-50 Km off the South, Southwest, and West coasts of Ireland in areas of high offshore chlorophyll-a concentration. A displaced coastal distribution is also suggested which we speculate is linked to avoidance of large coastal avian predators. Our results show that aerial surveys are not just a valuable tool for determining the at-sea distribution of small seabirds to help define future conservation efforts, but they also provide insights into how at-sea population abundances change during the breeding season.

Talk 44

## Collaborative monitoring, tracking and modelling to improve the conservation outlook for declining Leach's Storm-Petrels in the north Atlantic.

April Hedd, Laura A. McFarlane Tranquilla, Katharine R. Studholme, Sabina I. Wilhelm, Alexander L. Bond, Vegard S. Brøthen, Neil M. Burgess, Rachel Bryant, Anna M. Calvert, Sydney M. Collins, Joshua T. Cunningham, David A. Fifield, Gail S. Fraser, Carina Gjerdrum, Sarah Gutowsky, Erpur S. Hansen, Stephen J. Hurling, Patricia L. Jones, Mark L. Mallory, Robert A. Mauck, William A. Montevecchi, Ingrid L. Pollet, Isabeau Pratte, Jennifer C. Rock, Robert A. Ronconi, Janet Russell, Dave Shutler, Gregory J. Robertson
*Environment and Climate Change, Canada

Despite its widespread distribution and relative abundance, the highly pelagic, burrow-nesting Leach's Storm-Petrel has declined rapidly across the North Atlantic in recent decades. It was listed as Vulnerable globally by IUCN (2016), assessed as Threatened in Canada (COSEWIC 2020), and is Red-listed in Iceland (2018) and the UK (2021). While the cause(s) of population decline are poorly understood, threats vary regionally and include predation at colonies, light pollution on land and at-sea, high mercury burdens and impacts of climate and marine ecosystem change. We study demography and track birds year-round at key Northwest Atlantic colonies to understand the characteristics and consequences of habitat use, including exposure to threats at-sea. Leach's Storm-Petrels are active nocturnally and depend on deep-water, offshore habitats year-round, including during trans-equatorial migrations. We are developing dynamic species distribution models to identify critical habitat at a metapopulation level. Between 2003-2022, adult survival was low (0.81-0.88) and varied among colonies. Colonies with limited predation had higher survival and survival declined with increasing colony-specific mercury burden. Integrated population modelling is helping us rank potential drivers of decline by relative importance and better understand cumulative impacts. Regional and international collaborations are key to the collective goal of improving the conservation outlook for this declining species.

Talk 45

## I'll be back ... or not: Survival of juvenile Adélie Penguins continues to decline across the species range.

Téo Barracho, Gaël Bardon, Rémi Choquet, Aymeric Houstin, Cindy C. Cornet, Robin Cristofari, Thierry Raclot, Sebastian Richter, Alexander Winterl, Daniel P. Zitterbart, Nicolas Lecomte, Céline Le Bohec
* Centre Scientifique de Monaco, Monaco

As the extent of summer sea ice around Antarctica continues to dwindle, hitting historically low levels for the third year in a row in 2024, quantifying the demographic response of polar species becomes more urgent than ever. Tightly associated with sea ice, Adélie Penguins are considered reliable indicators of environmental changes in Antarctica. However, the pathways through which sea ice and other environmental factors shape their population dynamics are still poorly quantified, especially for juveniles. Using a 17-year time series of electronically marked Adélie Penguins from Pointe Géologie archipelago (Adélie Land, Antarctica), we estimated juvenile survival for the first time in this region and investigated its temporal trend and relationships with intrinsic and environmental parameters. Juvenile survival probabilities fluctuated greatly and were positively related to dense sea ice near the natal colony in the months following fledging. Like the two other Adélie Penguin colonies around Antarctica where temporal trends in juvenile survival have been investigated so far, we report a serious decline in juvenile survival at Pointe Géologie, with an annual rate of -2.5% between 2007 and 2020. As such effects have already cascaded into population declines elsewhere on the continent, our results underscore the need for continuous range-wide monitoring for this species, especially as climate change may induce earlier-than-predicted shifts in population trends.

Talk 46

## Fitness consequences of pre- and post-fledging environmental conditions in King Penguins.

Gaël Bardon, Flavia N. Fernandes, Téo Barracho, Nicolas Lecomte, Lana Lenourry, Robin Cristofari, Emiliano Trucchi, Céline Le Bohec
*University of La Rochelle, France

Pre-breeding traits and survival significantly contribute to individual variation in lifetime reproductive success. Environmental pressures experienced during growth can impact phenotypes and future survival. Fledgling traits like body size or condition relate to environmental conditions during early life environmental conditions, such as (e.g., food availability) and post-fledging survival. Using a 25-year time series of electronically marked King Penguins *Aptenodytes patagonicus* from the subantarctic Crozet archipelago, we assessed multiple spatiotemporal drivers of pre-and post-fledging juvenile survival. Early-born chicks outperform late-born ones in pre-fledgling winter survival, exhibiting larger size at fledging and slightly better body conditions. However, late-born chicks that survived seem to be able to compensate for the negative effects of their delay, with a post-fledging survival comparable to that of early ones. Interestingly, late-born chicks with higher body condition at fledging appear to have greater chance to survive their first years at sea. Post-fledging survival is influenced by primary productivity around Crozet during the first year of growth before fledging, and by sea surface temperature and primary productivity during the spring and winter of their first year at sea. Our study highlights the complex interplay between species-intrinsic early life constraints and environmental forcings on later life-history traits, shaping population dynamics and viability.

# FISHERIES

Talk 47

## Trends, threats, knowledge gaps, and global political responsibility for the conservation of priority populations of albatrosses and large petrels.

Richard A. Phillips, Paulo Catry, Maria Dias, Steffen Oppel, David J. Anderson, Christophe Barbraud, KarineDelord, Graeme Elliott, David Nicholls, Kath Walker, Ross Wanless, Henri Weimerskirch, Martin Beal
British Antarctic Survey, UK

The Agreement on the Conservation of Albatrosses and Petrels (ACAP) identified eight Priority Populations (PPs) of albatrosses and large petrels, each representing >10% of the global species total, and declining rapidly (>3% p.a.) mainly because of bycatch in fisheries. We assessed their trends, threats, knowledge gaps and key management needs. In all cases, recent count data indicated ongoing steep declines. Bycatch was the major driver, although invasive predators or disease was also important for two PPs. The key management action on land is therefore eradication of house mice on Gough Island. As bycatch is the paramount threat, we used tracking data to determine global political responsibility for fisheries and other marine threats by identifying jurisdictions where most time is spent, year-round. Six PPs spent more time in the High Seas than any European Economic Zone (EEZ), with one or more PPs spending >5% of time in the waters of four tuna Regional Fisheries Management Organisations (RFMOs), three non-tuna RFMOs, and Commision for the Conservation of Marine Living Resources (CCAMLR). Other than the breeding range states, one or more PPs spent >5% of time in the EEZs of Chile, Australia, Namibia, South Africa and Peru. Our results highlight the urgent conservation actions required for these flagship populations, emphasise the importance of coordinated efforts to minimise bycatch in EEZs and the High Seas, and provide compelling justification for states to prioritise management efforts in their own jurisdiction and to coordinate advocacy at international level.

Talk 48

## Evaluating the interaction between marine food subsidies and the main scavenging seabird species in the Bay of Biscay (Northeastern Atlantic).

Mathilde Huon, Ghislain Dorémus, Vincent Brétille, Matthieu Authier, Jérôme Spitz
*University of La Rochelle, France

Interaction between scavenging seabirds and fishery discards has been of significant interest in understanding relationships between wildlife and human food subsidies, particularly since the introduction of the landing obligation. In the Northeastern Atlantic, the Bay of Biscay (BoB) is an area of particular interest, as it is one of the major fishing zone and wintering ground for migrating seabirds in Europe. We studied 1) the influence of fishery activities compared to the oceanographic conditions on scavenger distribution; and 2) the discard selection and consumption rate. Data on scavenging seabird distribution, foraging behaviour, and discard composition were collected during scientific trawling operations over the continental shelf. We focused on the main scavenging species in this area, the Northern Gannet and large gulls, in Spring and Autumn, from 2014 to 2018. Our results suggested that the distribution of scavenging seabirds was better predicted by oceanographic conditions than by fishery activities at large scale and in offshore areas. Seabirds had a preference for rounded fish smaller than 30cm; and consumed less than 2% of discarded fish in Spring and less than 5 % in Autumn per discard event. This study shed new light upon scavenging seabird ecology in the BoB. In the future, our results could be supplemented by the deployment of telemetry survey to obtain distribution data at a finer scale, as well as the replication of consumption model on other metiers.

Talk 49

# Reducing seabird interactions with bottom set-nets: Lessons learned from the Project LIFE + Ilhas Barreira.

Ana Marçalo, Magda Frade, Flávia Carvalho, Ana Almeida, Nuno Oliveira, Joana Andrade, Jorge Pereira, Vitor H. Paiva, Jorge M.S. Gonçalves
*University of Algarve, Portugal

Bycatch is a significant threat to seabird populations globally. Under the LIFE Ilhas Barreira project, mitigation measures were tested to deter seabirds interacting with bottom set-nets in Southern Portugal. The study evaluated visual (scarybird) and acoustic (megaphone) deterrents, alongside implementing best practices (net cleaning and discard avoidance during operations) onboard fishing vessels to minimize seabird interactions during hauling and net setting. Visual device experiments yielded mixed outcomes, with no significant differences observed on bird presence between control and experimental treatments across most distance bands. However, when analysing by mesh size, a significant increase of seabirds was observed in the experimental treatment at longer distances when using mesh 220 mm. Megaphone use showed no significant differences in abundance of seabirds around fishing vessels between treatment and control. Implementing best practices onboard fishing vessels, yielded somewhat promising results. This led to a significantly decreased abundance of *Larus* spp. around vessels at shorter distances, particularly in nets with 220 mm and 120 mm mesh sizes. Overall, these findings offer valuable insights into the effectiveness of measures in reducing seabird interactions and likelihood of bycatch at bottom set-nets. Further research and refinement of strategies are crucial to develop more effective conservation measures for seabird populations.

Speed 26

## Automatic identification of interactions with boats is limited by individual variations in behaviour in Wandering Albatrosses.

Ewen Le Scornec, Marianna Chimienti, Alexandre Corbeau, Adrien Pajot, Henri Weimerskirch, Julien Collet
*Centre d´Etudes Biologiques de Chizé, France
*University La Rochelle, France

Fisheries attract huge numbers of foraging seabirds worldwide, and remain a threat because of bycatch. Automatic Identification System (AIS) data can now be used to document the fine-scale interactions of GPS-tracked seabirds with boats, but not all boats are declared in AIS data. The use of bird-tied radar detectors allows to overcome this limit, but it is recent and remains expensive. We used radar detections as a training dataset for classification algorithms, to extend the identification of interactions in tracks without radar detectors. We had 206 tracks spread over three years of GPS data combined with radar detectors on Wandering Albatrosses *Diomedea exulans* from the French Southern Territories that interact with toothfish and tuna longliners. We calculated movement variables over various scales (e.g., First Passage Time, step length) and used either Random Forest (RF) or Hidden Markov Models (HMM) to distinguish behavioural responses to the presence of fishing boats. RF reached high accuracy to classify the training dataset (75 to 80%). However, we lost predictive power (50%) when predicting on the remaining datasets. Our HMM also showed no effect of boat on the probability of switching behaviours between foraging and transiting. Our modelling set-up allowed to quantify how the high intra and inter-individual variability in responses to fishing boats played a role in our results. Wandering albatrosses have complex and flexible trajectories requiring either a larger training dataset or higher resolution metrics.


Ornitela

# Acceptance type: Poster presentation

## Poster Session 1

### BEHAVIOUR AND EVOLUTION

Poster 1
**Signals of quality or identity? The colourful bills of Atlantic Puffins are both.**

Pierre-Paul Bitton, Katja Kochvar, Rebecca Foote, Amy Wilson, Samira Saki, Oscar Meruvia-Pastor, Lourdes Peña-Castillo
*Memorial University of Newfoundland, Canada

Seabird breeding colonies are perfect environments to study animal social interactions. Many species are long-lived and philopatric, presenting the opportunity for stable long-term relationships between neighbours. Social interactions are often mediated through vocalisations. In a classic model, King Penguins, the rich harmonic calls permit individual recognition, and perfectly classify their sex and age. However, not all high-density colonial seabirds vocalise. For example, Atlantic Puffins are relatively non-vocal, at least above ground. What then is used to mediate social interaction among neighbours and mated pairs? Using visual model corrected colour analyses, geometric morphometrics, and machine learning, we demonstrate that the colours of the Atlantic Puffin bills are temporally variable while their shape are temporally fixed, allowing assessment of individual quality and identity. Siamese neural networks can accurately recognize ~90% of individuals with little training, and geometric morphologies confirm that the shape of the bills is temporally consistent. Furthermore, the colours of the bill change within the breeding season, and female colouration is correlated with chick growth.

Poster 2

**Juvenile Ascension Frigatebirds *Fregata aquila* learn foraging skills by depredating Sooty Tern *Onychoprion fuscatus* chicks on Ascension Island in the South Atlantic.**

John B. Hughes, James S. Reynolds, Lucy Garrett
*Army Ornithological Society, UK

Ascension Frigatebirds depredate >2,500 Sooty Tern chicks each breeding season on Ascension Island. Few (<30 Frigatebirds) out of a population of 12,500 birds regularly hunt for chicks. We investigated why adult and juvenile fragatebirds depredate chicks as they feed routinely on fish and squid. Frigatebirds forage by dipping and kleptoparasitism, and this requires exceptional flying skills. Rather than chick prey providing significant nutrients to juvenile Frigatebirds, we hypothesised that juveniles hone their flying skills by endeavouring to depredate chicks. We predicted that: (a) only a small proportion of the Frigatebird population will depredate chicks; (b) adult Frigatebird success rate of chick capture will be greater than that of juveniles; and (c) juveniles will be over-represented in counts of Frigatebirds depredating chicks. To test these predictions, we monitored the predatory behaviour of Frigatebirds on 112 occasions during 18 Sooty Tern breeding seasons between 1996 and 2016. We found that only 0.23% of the Frigatebird population depredated chicks. Adult success rate of chick capture was over five times greater than that of juveniles. Chick predation was largely age-specific with juveniles over-represented by a ratio of 10:1. Our observations support the hypothesis that juvenile Ascension Frigatebirds hunt Sooty Tern chicks not to gain primarily nutritional benefit but to perfect flying skills upon which their lifelong foraging success ultimately depends.

Poster 3

**Behavioural variability and responses to nutritional stress in a wide-ranging seabird.**

Freddie C. Mckendrick, Alexander S. Kitaysky, Sebastien Descamps, Kathryn E. Arnold, Alexis P. Will, Samantha C. Patrick
*University of Liverpool, UK

Quantifying how individuals vary behaviour following exposure to environmental stressors is important for understanding the maintenance of homeostasis. In unpredictable and varied environments, maintaining physiological state is particularly challenging as energetic demands regularly fluctuate. Exhibiting highly variable foraging behaviour may benefit individuals by balancing resource acquisition with the demands of their current environment. Here, we investigate relationships between variance in foraging behaviour and changes in feather corticosterone, a key indicator of physiological state correlated with reproductive success and survival in avian species. Feather corticosterone is elevated through nutritional stress and we predict individuals will vary behaviour following these periods to restore energetic balance. Using 10 years of movement and physiological data from Arctic-breeding Black-legged Kittiwakes *Rissa tridactyla* we first explore the extent nutritional stress during the breeding season correlates with variance in foraging during the non-breeding period, the most energetically demanding and variable time for Arctic seabirds. We then quantify whether behavioural variance during this non-breeding period correlates with reductions in feather corticosterone and therefore has positive fitness benefits. Although understudied, as environments become more variable we expect behavioural variability to become a key strategy for surviving under future climate scenarios.

Poster 4

## Individual and environmental influences on the breeding phenology in Scopoli's Shearwaters.

Beatrice Berardi, Vittoria Roatti, Giacomo Dell'Omo, Claudio Carere, David Costantini
*University of Tuscia, Italy

In birds, the laying date is a trait whose variation depends on the interaction between genetic and environmental components. Changes in laying date are likely to influence recruitment and ultimately population trends, since individuals reproducing at the optimum time contribute more surviving offspring to the next generation compared to those that reproduce too early or too late. Here we investigated the plasticity of laying date in Scopoli's Shearwater (*Calonectris diomedea*) females aged between five and 30 years, using data collected from a population breeding on Linosa Island (Italy) during the period 2011-2023. We used generalized linear mixed models to explore the relationship between laying date and age, year, and weather conditions. To test the individual component, we computed an intra-class correlation coefficient. We found that (i) the laying date was highly and significantly repeatable within females between years and (ii) the mean laying date at the population level falls around the 26$^{th}$ of May, with a range of 20 days from the 18$^{th}$ of May to the 6$^{th}$ of June. Our results show that shearwaters have a high consistency of egg laying synchrony irrespective of the year, and that each female tends to lay the egg at about the same time every year. This study indicates that the laying date in shearwaters might be weakly plastic, raising concerns on the potential adaptive consequences of such behavioural rigidity, particularly in the light of the ongoing climate change.

## Seabird Rescue and Rehabilitation

Poster 5

**Public participation and Atlantic Puffin rescue: involving citizen volunteers to identify stranding hotspots and identify factors leading to strandings.**

Fiona Le Taro, Suzanne Dooley, Sabina Wilhelm, Pierre-Paul Bitton
*Memorial University of Newfoundland and Labrador

The goal of this project is to identify stranding hotspots and to identify the environmental factors at play based on data collected by citizen volunteers. Every year, up to 500 Atlantic Puffin *Fratercula arctica* fledglings are found grounded onshore in communities adjacent to the Witless Bay Ecological Reserve, in Newfoundland (Canada). Once on land, they are unable to take flight again and their survival becomes compromised. Since 2011, hundreds of citizen volunteers take part in the "Puffin Patrol" to search and rescue stranded birds throughout the night. Every year, citizen volunteers record where each fledging is found using a mobile phone app. For this project, they also tracked their search effort using a handheld GPS. Volunteers spend more time searching for puffins in brightly lit areas but it is possible that more birds remain to be found in darker places. Topographic factors such as elevation, proximity to water, and location from the breeding colonies may also play a role in the occurrence of strandings. Better understanding the factors leading to increased strandings is key to allow rescuers to better allocate their search efforts and maximize the recovery of stranded puffins. This project highlights how citizen participation in data collection can contribute to seabird conservation research.

## CENSUS, MONITORING AND DEMOGRAPHY

Poster 6

### Comparison between digital and observer -based aerial surveys for monitoring seabirds at sea.

Miriam Lerma, Henriette Schwemmer, Kai Borkenhagen, Moritz Mercker, Nele Markones
*DDA - Federation of German Avifaunists, Germany
*FTZ - Research and Technology Centre, Germany

Monitoring seabirds at sea allows the detection of changes in species composition, abundance and distribution. Traditionally, monitoring is carried out by observers on ships or planes. Recently, cameras on planes are increasingly used because they allow surveying above the average wind turbine height. However, information on the comparability of the results between observer-based and digital surveys is still scarce. Six parallel surveys were carried out in Spring (April and May) between 2017 and 2019 in the German North Sea to compare species composition, density estimates and spatial distributions. We found that some species were equally detected by both methods, whereas other species were more likely to be detected either by digital or observer-based surveys - this was attributed to the size, colour and behaviour of the species. Density estimates were comparable for Northern Gannets, auks and Lesser Black-backed Gulls. For gulls however, there were differences in spatial distributions, which were attributed to the behaviour of the species, e.g. forming aggregations around ships. Our results on differences between digital and observer-based surveys are highly relevant for studies impaired by a shift in survey methodology, such as the impact analyses of offshore windfarms, and allow adequate future survey planning.

Poster 7

## Seabird and sea duck monitoring in the Canadian Arctic.

J. E. Baak
*Canadian Wildlife Service, Canada

The Canadian Arctic contains most of Canada's coastal and marine zones, and thus supports substantial populations of seabirds and sea ducks. However, as a region that is logistically challenging to monitor, many of these areas have not been surveyed in decades and the abundance of birds in these regions are unknown. Many species, such as King Eiders *Somateria spectabilis* and Common Eiders *Somateria mollissima*, are culturally and nutritionally significant for nearby communities. However, as climate change continues to shift access to open water and sea ice, increasing development and marine traffic, the marine birds that rely on this region may be at an increased risk. Thus, from a community and a conservation perspective, understanding the abundance of these species in the Canadian Arctic is important to inform conservation and management. Here, we review information on seabirds and sea ducks across the Canadian Arctic to develop a mapping tool and prioritisation plan for future monitoring in this region. This tool combines information on the species present at each site (e.g., conservation status, population size and trends, timing of use of key site), previous surveys at the site (e.g., previous survey timing and methods) as well as characteristics of the site itself (e.g., protection status, anthropogenic activities and threats) to prioritise sites for monitoring. We present preliminary results and discuss next steps for monitoring seabirds across the Canadian Arctic.

Poster 8

# Do seabirds have memory? Breeding movements and population dynamics of a colonially nesting seabird species, the Sooty Tern.

Lucy Garrett, Julia Myatt, Johnathon Sadler, John Colbourne, Roger Dickey, Sam Weber, James S. Reynolds
*University of Hartpury, UK

Temporal variation in population size and movements of organisms can be related to disturbance with increases in both indicating ecosystem instability. Long-term data are required to study trends in such variables given that not all individuals in a population breed at any given time. Seabirds are an ideal study system to investigate demographic trends and breeding movements given that they are K-selected species that generally exhibit high breeding site fidelity. We investigated the population trends of the largest breeding population of Sooty Terns *Onychoprion fuscatus* in the Atlantic Ocean on Ascension Island at two colonies. This population has undergone severe declines in size (by 84%) over the last 60+ years. We used multi-state modelling to assess the impact of past decisions on future movement choices in breeding adults and dispersal of known first time breeders. Although population size remained stable between 1997 and 2015, we observed a dramatic shift in intra-colony population size. This compensatory change in population size between breeding sites was likely a result of the observed movement of breeders together with recruitment of first-time breeders. Our findings indicate a shift in intra-colony level habitat stability which has implications for conservation management, such as predator control, and highlights the importance of intrapopulation-scale analyses together with the inclusion of memory when modelling long-lived, site-faithful species.

Poster 9

**A novel method to census King Penguins in UAV survey data via a Digital Elevation Model (DEM).**

Tara Cunningham, Norman Ratcliffe, Peter Fretwell, Ruth King, Stuart King
*University of Edinburgh, UK

As a key indicator species, penguins provide critical insight into the health of the Southern Ocean ecosystem. Accurate population counts of colonies are therefore integral to conservation management of the species and wider Antarctic research. Furthermore, identifying the demographic distribution within a colony is required for effective predictive population modelling with constrained errors. The use of Unmanned Aerial Vehicles (UAVs) for monitoring penguin colonies has become common practice due to the speed of data capture relative to traditional manual ground counts. Due to the time-consuming nature of manual image labelling, developing semi-automated methods to analyse the large volumes of data is a key area of research. We present a novel methodology for obtaining counts of adult breeding King Penguins from UAV survey data through construction of a Digital Elevation Model (DEM) and unsupervised clustering. The method is significantly less computationally expensive and data intensive than deep learning models for object detection and has a detection accuracy comparable to expert manual counts. We additionally show that the overall accuracy is significantly improved by including an automatic delineation of the breeding colony area within the analysis via the regular spatial structure of the breeding adults. Furthermore, this method could assist in standardising UAV survey operating procedures to ensure maximum information is gained from resource-intensive fieldwork.

Poster 10

## Wildlife Iris Identification - Non-invasive Key for animal monitoring.

Christophe Sauser, Børge Moe, Sveinn Are Hanssen, Puneet Sharma, Sebastien Descamps
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Monitoring wildlife at the individual level, using methods such as capture-mark-recapture, is crucial to understanding the effects of environmental change or human impact on populations. Tagging and monitoring individuals over time provides important demographic data, informing us about how animals adapt to changes and revealing population trends. However, collecting such data is complex and costly. Traditional techniques such as bird ringing remain relevant, but new technologies offer opportunities for innovation. Biometric recognition has revolutionised human identification, but has not yet been applied to wildlife research. The use of biometrics in ecological research opens up new avenues, reducing the need for physical handling of animals, facilitating automated monitoring and minimising disturbance. It also allows more individuals to be monitored, improves demographic estimates and deepens our understanding of environmental impacts on wildlife. This study evaluates the feasibility of identifying individual seabirds using biometric criteria, in particular unique iris patterns. It aims to assess the repeatability of iris patterns and explore deep learning for iris recognition, laying the foundations for a non-invasive, ethical, efficient and minimally invasive wildlife monitoring tool using eye images.

Poster 11

## Using citizen science image analysis to examine interannual variability in Black-legged Kittiwake breeding success.

Alice J. Edney, Carlos Arteta, Jóhannis Danielsen, Sébastien Descamps, Jón Einar Jónsson, E Owen, Flemming Merkel, Róbert A. Stefánsson, Matt J. Wood, Mark J. Jessopp, Tom Hart
*University of Oxford, UK

Measuring seabird breeding success is important for managing their populations and understanding marine environmental change. However, collecting such data at scale and in a standardised way is challenging. At a time when seabird populations are globally threatened, the number of sites recording breeding success may actually be decreasing. This lack of coverage limits progress in understanding how changes in breeding success vary between locations within a time period, and how extrinsic factors, like changing global temperatures and food availability, affect these processes. We addressed this gap using time-lapse images analysed by citizen scientists. Our project, Seabird Watch, hosted on the Zooniverse platform, has engaged over 18,000 volunteers who identified Black-legged Kittiwake *Rissa tridactyla* in more than 200,000 images taken across the species' North Atlantic range (52-79°N). We developed a standardised method to extract breeding success from this data and compared results from citizen scientists and researchers. Breeding success ranged from 0 to 1.6 chicks fledged per nest, with variation between sites and years likely driven by local conditions. We show for the first time that time-lapse imagery combined with citizen science, can provide high-quality breeding success data at relatively low cost, even in remote locations. This advance will allow researchers and wildlife managers to scale-up seabird monitoring to meet a growing need to understand marine environmental change.

Poster 12

## Atlantic Puffin demographics in relation to environmental change.

Anne N.M.A. Ausems, Sjúrður Hammer, Dariusz Jakubas, Jens-Kjeld Jensen, Katarzyna Wojczulanis-Jakubas
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Atlantic Puffins *Fratercula arctica* are some of the most numerous seabirds in the Faroe Islands. Across their entire Atlantic breeding range, puffins have experienced decreases in food availability, often leading to population declines. In the Faroe Islands, puffin populations decreased considerably, due to multiple years with limited to no breeding success. Why the Faroese puffins have such dramatically low breeding success has not been studied, but is likely linked to local food shortages. Here, we present 20 years (1989-2008) of data collected from 5,476 individuals, describing population age and sex structures. We aim to explore the relationships between changes in population demographics and environmental variation linked to food availability over the Faroe Shelf. The results of this study should deepen our understanding of puffin responses to environmental change, thus providing valuable information necessary to efficiently direct protection efforts. Further, we show preliminary results of resumed age determination in Faroese puffins from 2023 (n = 130).

Poster 13

## Using a nesting habitat suitability model to estimate the Short-tailed Shearwater population size.

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For burrow nesting seabirds, many of which breed on remote offshore islands, acquiring accurate population estimates from ground surveys can be logistically and financially prohibitive. Habitat suitability modelling provides an alternative approach. The Short-tailed Shearwater *Ardenna tenuirostris* (STSW) is Australia's most numerous seabird, with a breeding distribution restricted to approximately 285 island colonies along the continent's Southern coast. Its population was estimated over 30 years ago through, at times cursory, ground surveys to be 23 million individuals (~11.5 million burrows). In view of anticipated environmental change, there is an urgent need to obtain a more precise estimate. The present study used ground survey quadrat counts of STSW nesting density on 13 islands in Northern Bass Strait, in conjunction with remote-sensed data (digital surface models; multi-band orthoimages) on their physiographic features, to develop nesting habitat suitability models for the species. The most parsimonious model, accounting for 21% of the variance, was Number of burrows ~ vegetation index + aspect + elevation + slope + distance to water. This model was then applied to all known STSW colonies across the species' range, providing estimates ranging from 655,000 to 1.8 million individuals per colony. The total predicted number of burrows, ~41 million, far exceeds previous estimates. Assuming an average burrow occupancy rate of 60%, the STSW population size is estimated at ~49 million individuals.

Poster 14

## First systematic survey of seabirds in the Republic of Cyprus.

Georgios Karis, Chloé Espinosa, Eleftherios Sakalis, Ργιάκι Μπαϊρακτάριδου, Matthew-Stephen Smith, Petroula Botsidou, Stamatios Moschous, Marios-Dimitrios Voulgaris, Marianna Pappa, Panicos Panayides, Haris Hadjistyllis
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Over the period 2021-22, the first national systematic recording of seabirds surrounding the Republic of Cyprus was carried out, funded by the "Operational Programme 'Thalassa' 2014-2020". Information was gathered about their spatiotemporal presence, abundance, and behaviour using the European Seabirds At Sea (ESAS) methodology, focused on a buffer zone from the coastline up to 12 miles offshore. In order to designate areas with high density of seabirds, the non-parametric Kernel Density Estimation method was applied. Additionally, Generalized Linear Models were used on presence data of Mediterranean Shag *Gulosus aristotelis desmarestii* and Yellow-legged Gull *Larus michahellis*, both breeding in Cyprus, so as to identify oceanographic parameters and human activities that have significant impact on their spatial distribution using the Akaike's Information Criterion. According to our findings, the most important areas for seabirds are located in the Cyprus coastal zone up to the 200 m isobath, where islets for breeding and/or resting are located. Spatial modelling showed that distance from colonies and aquacultures affect the distribution pattern of Mediterranean Shag, while distances from ports and colonies as well as sea surface temperature affect the Yellow-legged Gull dispersal. These findings highlight also the importance of considering seasonal variations in understanding the distribution patterns of seabirds in the Republic of Cyprus.

Poster 15

## Is Los Roques Archipelago a safe place for seabirds in the Venezuelan insular Caribbean?

Daniel Serva, Josmar E. Marquez, Oscar Riera, Adrián Naveda-Rodríguez
*AveZona, Venezuela

Despite being one of the 76 Important Bird Areas (IBA) of the Venezuela Caribbean, Los Roques Archipelago National Park is threatened by human activities such as the construction of new hotel infrastructures, the occurrence of human-introduced invasive species, the expansion of an airport runway, and the governamental indifference toward environmental law enforcement. These activities jeopardise and increase the vulnerability of this important IBA and the seabird communities in the Caribbean. Our field efforts suggest that population abundances of Brown and Red-footed Bobbies *Sula leucogaster* and *Sula sula*) are declining in this IBA. With the support of the Betty Petersen Conservation Fund, AveZona outreach activities look forward to involve local settlers in the ecological monitoring of rare seabird populations, such as Audubon's Shearwater *Puffinus lherminieri*, to better understand how the current instability in Venezuela would impact the long-term persistence of seabirds in Los Roques Archipelago.

Poster 16

**Remote sensing of Emperor Penguin abundance and breeding success.**

Alexander Winterl, Sebastian Richter, Aymeric Houstin, Téo Barracho, Matthieu Boureau, Clément Cornec, Douglas Couet, Robin Cristofari, Claire Eiselt, Ben Fabry, Adélie Krellenstein, Christoph Mark, Astrid Mainka, Delphine Ménard, Jennifer Morinay, Sussie Pottier, Elodie Schloesing, Céline Le Bohec, Daniel P. ZitterbartFriedrich-Alexander
*University of Erlangen-Nürnberg, Germany

The Emperor Penguin *Aptenodytes forsteri*, a key predator in the Antarctic, is facing increasing environmental changes that necessitate reliable population monitoring. Traditional methods rely on satellite imagery to assess colony sizes, though this approach suffers from a high uncertainty because data can only be collected during times when colony occupancy fluctuates greatly due to brooding behaviour. Here we present a new robust method to estimate abundance and breeding success from satellite imagery. This method employs a phenological model capable of predicting key lifecycle events such as breeding pair arrivals, egg hatching, and chick fledging times, with minimal data inputs. Utilising as few as six satellite-derived observations from a single breeding season, our model effectively corrects for occupancy variability, enhancing the accuracy of population estimates. This innovation is particularly crucial for remote colonies where ground-based observations are sporadic or non-existent. Our findings not only enhance our comprehension of Emperor Penguin demographics but also provide a scalable framework for monitoring other remote seabird populations.

Poster 17

## A review of seabird demographic rates for population models.

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*HiDef Aerial Surveying Limited, UK

This work funded by the Joint Nature Conservation Committee was tasked with updating the 2015 published review of seabird demographics by Horswill and Robinson. A literature search for papers and reports available since 2014 (the cut-off year for the first review) used keywords based on the species names in combination with a range of demographic terms. We also searched for published evidence of density-dependence in seabirds. As the focus of the work was British and Irish seabirds, demographic studies from within the region were prized more than those from elsewhere and demographic values from related or proxy species were mostly not sought. Within Britain and Ireland the British Trust for Ornithology (BTO) and JNCC coordinate and largely fund the Seabird Monitoring Programme (SMP) which gathers seabird data from hundreds of colonies into a central database. We included results from data added since 2014 to the SMP database. Attention was paid to trend in seabird populations as the influence of demographic values on trend is clear and we also considered the recent impact of Highly Pathogenic Avian Influenza (HPAI) on seabirds with respect to modelling and predicting seabird population change. Here we present the report of this work. Survival, productivity, incidence of missed breeding, recruitment age and philopatry rates are shown where available at a range of scales for 35 marine bird species from Britain and Ireland.

Poster 18

## Digital aerial surveys as an indirect method to track seabird deaths from Highly Pathogenic Avian Influenza (HPAI) H5N1.

William Peden, Glen Tyler, Kelly Macleod, Jaz Harker
*HiDef Aerial Surveying Limited, UK

In 2022, the Highly Pathogenic Avian Influenza (HPAI) H5N1 outbreak led to significant mortality among UK seabird populations. Typically, mortality rates have been determined through observations at breeding colonies, which pose challenges due to their remote and inaccessible locations, and the potential influence of variables like sabbatical birds. This study explores the potential of Digital Aerial Surveys (DAS) to track the spread of the H5N1 outbreak and assess seabird mortality. HiDef Aerial Surveying Ltd conducts surveys of offshore windfarms (OWFs) using high-resolution video imagery data, generally at monthly intervals over two years, covering ~90,000 $Km^2$ in 2022. Dead birds on the sea surface are recorded as standard during survey, with 2022 seeing an unprecedented increase. Dead gannets were the most recorded and were easily identifiable, large auks were the second most common recorded but identification to species level was challenging. 1,542 dead gannets and 907 dead large auks were detected in 2022, with peak mortality occurring from June to September and sporadic observations throughout the year. Our findings indicate a higher proportion of dead adult birds, aligning with observations made at breeding colonies. Here, we demonstrate there is potential for routine DAS of OWFs to provide rapid insight into mortality events and quantify otherwise undetected levels of mortality occurring offshore.

## CLIMATE CHANGE AND EXTREME EVENTS

Poster 19

### Foraging ecology of south polar skuas breeding at the Antarctic Peninsula: importance of sea ice and glacier fronts.

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*University of Cambridge, UK

Antarctic marine ecosystems are highly sensitive to climate change, with shifts in sea-ice dynamics impacting habitat utilisation and species distributions. As Antarctic habitats are undergoing major modifications, these changes may have impacts on Antarctic marine predators. South Polar Skuas *Stercorarius maccormicki* predominantly feed on fish and penguins around coastal Antarctica however, foraging activities tend to be gathered from observations at the nesting sites in terms of diet/prey analysis. This is the first detailed study of their foraging behaviour and habitat selection during breeding in the western Antarctic Peninsula, a region experiencing rapid warming due to climate change. The results highlight south polar skuas forage for marine resources within habitats such as fast ice edges and glacier features. Furthermore, in a year of reduced sea ice, skuas made shorter foraging trips to areas in front of sea-terminating glaciers. Additionally, these results are the first to establish seabirds foraging at areas of subglacial tidewater plumes in the Antarctic. These findings reveal important foraging habitats and help ascertain the drivers of their distribution and track environmental changes, providing insights into their role as indicators of wider marine ecosystem health. Climate-induced sea-ice shrinking and glacier retreat may reduce favourable foraging areas and concentrate foraging at subglacial meltwater plume, increasing competition for marine resources.

Poster 20

## Seabirds in hot water: year-round effects of ocean warming on survival and productivity are associated with cross-species population declines.

Kate Layton-Matthews, Charlotte Reagan, Kate R. Searle, Francis Daunt, Manuel Ballesteros, Sigurd Benjaminsen, Ingar Støyle Bringsvor, Signe Christensen-Dalsgaard, Nina Dehnhard, Sebastien Descamps, Kjell Einar Erikstad, Annette Fayet, Kevin Hodges, Magdalene Langset, Svein-Håkon Lorentsen, Tycho Anker-Nilssen, Geir-Helge Systad, Hallvard Strøm, Tone K. Reiertsen
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Ocean warming is impacting seabird population dynamics. Spatial differences in rates of ocean warming are likely driving divergent population responses, influenced by variations in seabirds' foraging ranges. Year-round tracking, and monitoring of seabirds at breeding colonies, means we can determine the impacts of climate change in the breeding and non-breeding season, on different species and across a large geographic range. We assessed cross-species effects of ocean warming on productivity and survival of adult seabirds for populations breeding in Norway and predicted future ocean warming impacts on population trajectories. There were declines in adult survival and productivity rates across the five species. Warming Sea Surface Temperatures (SST) had strong negative effects on survival, especially in Autumn, and mostly on seabird populations in the Barents Sea, a hotspot for ocean warming and seabirds. Effects of SST on productivity were more uncertain, pointing to a more complex relationship between oceanographic climate drivers and productivity in the breeding season. Using population and SST forecasts, we show that ocean warming, based on a high emissions future, may contribute substantially to continued population declines.

Poster 21

## Winter havoc: investigating the 2023/24 mass mortality event of European Shags *Gulosus aristotelis* in the North Sea.

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The frequency and severity of extreme weather events is predicted to increase in future. Such events can affect seabirds by causing immediate mortality and carry-over effects on subsequent seasons. One species that is vulnerable to extreme weather events is the European Shag *Gulosus aristotelis*. Shags have a partially wettable plumage and limited fat reserves, and their coastal foraging is strongly affected by turbulence during storms. Accordingly, shags may experience mass mortality during prolonged inclement weather. In the 2023/24 winter in Eastern UK, associated with two severe storms (Babet and Ciarán), shags were displaced away from their usual wintering sites, and high levels of mortality were recorded. Of 565 ringed shags reported dead, 381 were ringed on the Isle of May. First- and second-year birds accounted for ~50%, suggesting that younger birds are most susceptible. The sexes were affected equally (n=261; 48% female; 52% male). Mortality was focussed on the Moray coast and Firth of Forth. However, corpses were recovered from Shetland to Norfolk. Evidence from the 2024 season suggests that numbers on the Isle of May are severely depressed and breeding is very late, demonstrating that both immediate and carry-over effects were apparent. Mass mortality events are likely to increase in line with predictions on the frequency and severity of extreme weather. Our study suggests they may have damaging effects on the resilience of populations in future.

Poster 22

## Seabirds in hot water: year-round effects of ocean warming on survival and productivity are associated with cross-species population declines.

Kate Layton-Matthews, Tone K. Reiertsen, Charlotte Regan, Kate R. Searle, Tycho Anker-Nilssen, Vegard Sandøy Brøthen, Francis Daunt, Sebastien Descamps, Manuel Ballesteros, Sigurd Benjaminsen, Signe Christensen-Dalsgaard, Nina Dehnhard, Kjell Einar Erikstad, Annette Fayet, Hálfdán H. Helgason, Kevin Hodges, Malin Kjellstadli Johansen, Svein-Håkon Lorentsen, Børge Moe, Geir-Helge Systad, Hallvard Strøm, Arnaud Tarroux

*NINA - Norwegian Institute for Nature Research, Norway

Ocean warming is impacting seabird population dynamics. Spatial differences in rates of ocean warming are likely driving divergent population responses, due to differences in seabirds's foraging ranges. Year-round tracking data from SEATRACK, and monitoring of seabirds at breeding colonies from SEAPOP, means we can determine the impacts of climate change in the breeding and non-breeding season, on different species and across a large geographic range. We assessed cross-species effects of ocean warming on productivity and survival of adult seabirds for populations breeding in Norway and predicted future ocean warming impacts on population trajectories. There were declines in adult survival and productivity rates across the five species. Warming Sea Surface Temperatures (SST) had strong negative effects on survival, especially in Autumn, and mostly on seabird populations in the Barents Sea, a hotspot for ocean warming and seabirds. Effects of SST on productivity were more uncertain, pointing to a more complex relationship between oceanographic climate drivers and productivity in the breeding season. Using population and SST forecasts, we show that ocean warming, based on a high emissions future, may contribute substantially to continued population declines.

Poster 23

## Multiannual environmental forcing shapes breeding phenology and success in a subantarctic seabird.

Gaël Bardon, Téo Barracho, Nicolas Lecomte, Joël M. Durant, Nils Chr. Stenseth, Robin Cristofari, Céline Le Bohec
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Climate-driven phenological mismatches threaten avian breeding success by disrupting the synchrony between food abundance and availability at critical breeding stages. In an understudied marine food web, the time lags between environmental changes and the cascading effects are particularly difficult to model, yet they can have a profound influence on the breeding success of top predators. Here we disentangled how oceanic and climatic conditions have impacted the breeding initiation phenology and breeding success of King Penguins over the past 24 years (2000 - 2023). We used a sliding-window analysis to identify which environmental conditions, and where and when they might have had an impact on the reproduction of this seabird. We measured an advance in breeding seasonality of one week per decade, which coincided with an average annual increase in breeding success of 0.8% (45% in 2000 to >60% in 2023). The strong inter-annual variability in these two responses was linked with indices of sea temperature and primary production in the population's foraging areas, with time lags spending from a few weeks to almost two years. For now, King Penguin seems to be keeping pace, matching its needs with available resources, and responding to environmental conditions, but for how long? Since King Penguin breeding success results from the integration of two years of environmental conditions, the species may become more vulnerable to unpredictable and extreme conditions.

Poster 24

## Navigating climate change and extreme events in the Southern Hemisphere through penguins' eyes.

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Climate change is threatening marine ecosystems worldwide, presenting significant challenges for wildlife. Among marine species, seabirds are ideal sentinels of the marine environments they inhabit. Spanning from the equatorial Galapagos Islands to the polar expanse of Antarctica, penguins provide a unique opportunity to identify key marine regions and analyse changes in different ecosystems through the whole Southern Hemisphere. While previous research has highlighted the adverse effects of long-term climate change and extreme events on penguins, impacting foraging patterns and reproductive success, a systematic analysis aimed at compiling spatially explicit assessments of these stressors is lacking. Here, we combine the available penguin occurrence information from Global Biodiversity Information Facility (>800,000 occurrences) with long-term changes in environmental conditions, along with extreme events at sea but also at land (on the breeding colonies). By mapping spatially explicit assessments of these stressors, our research aims at identifying regions and species most exposed to climate-related challenges. Ultimately, our findings can inform targeted conservation strategies to mitigate ecological disruptions and safeguard penguin populations in the face of ongoing environmental change.

## CONSERVATION PHYSIOLOGY

Poster 25

**Dummy eggs as a tool to investigate gulls' physiological stress in relation to human disturbance and plastics in nest structure.**

Sara N. Veríssimo, Giulia Bocelli, Filipe Veloso, Francisco Neves, Ester A. Serrão, Jaime A. Ramos, Vitor H. Paiva, Ana C. Norte
*University of Coimbra, Portugal

Increasing anthropogenic pressures in coastal areas related to urbanization, human presence, plastic pollution, and extreme temperature events, underscore the importance of understanding how these factors might affect incubation behaviour of birds breeding in those areas. We developed dummy eggs equipped with temperature loggers and a heart rate recording systems to address how anthropogenic stressors affect gulls' behaviour, clutch temperature, and heart rate of the incubating parent, through (a) the simulation of human intrusion in breeding colonies of two gull species and (b) the manipulation of plastic content of the nest material. Results showed an increased heart rate (proxy of physiological stress) for both *Larus michahellis* and *Ichthyaetus audouinii* incubating adults when disturbed by human presence, leading to unattended nests. Moreover, variations in the duration of adults' absence from the nest depended on ambient temperature and differed between species. Nests with higher plastic content exhibited elevated incubation temperatures and incubating *L. michahellis* showed increased heart rates presumably due to heat stress. Differences in the number and duration of absences from the nest were noted in relation to the presence of plastic. The use of these eggs dummies is a valuable improvement to obtain important information on incubation processes, bird's behaviour, and responses to changes in the environment.

## FISHERIES

Poster 26

**Spatial overlap between penguin foraging grounds and purse-seine fishing is likely an underestimation of fishery impact.**

Jacqueline S. Glencross, Andrew S. Brierley, Debbie J. F. Russell, Richard, B. Sherley
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Competition between commercial fishing and seabirds can often occur when they target mutual prey sources, but it is often difficult to disentangle the true impacts of fishing from other factors (e.g., climate change). A unique field experiment off South Africa has provided the opportunity to study the foraging behaviour of African Penguins *Spheniscus demersus* with and without fishing activity within 20 Km of breeding colonies. Using GPS data from breeding penguins and vessel location data acquired from Global Fishing Watch, we investigated spatial overlap and - using a new method - quantified overlap intensity which also describes the direction of intensity (i.e., fishery- or penguin-dominated). We then simulated foraging tracks to a population level to quantify population-level fishery overlap. We concluded that spatial competition at a population level was occurring on a very small scale. However, where overlap did occur, there was a high level of overlap intensity. Certain locations stood out as having a high penguin-dominated overlap intensity, suggesting overlap is occurring in key foraging areas for the population. We suspect overlap with fishing vessels will be impacting the foraging efficiency of foraging penguins making it harder to meet energetic requirements. Fishing pressure within 20 Km of breeding colonies appears to be one of multiple stressors contributing to the decline of this endangered seabird.

Poster 27

## Spatial segregation of seabirds at South Georgia during the non-breeding season.

Victoria Warwick-Evans, Elizabeth J. Pearmain, Richard A. Phillips
*British Antarctic Survey, UK

Seabirds are amongst the most globally threatened birds, often as a consequence of bycatch in fisheries. Many populations of albatross and petrels around South Georgia are declining, and the rate of decline varies among these different populations. It is likely that this variation is due to the different populations interacting with different fishing fleets at sea. Until recently the only tracking of flying seabirds around South Georgia has been from birds breeding at Bird Island. We deployed geolocator loggers on non-breeding Wandering Albatrosses *Diomedea exulans* at Prion Island and at Bird Island. Our results suggest that there are differences in the non-breeding distributions between the colonies. More specifically, we show that Wandering Albatrosses at Prion Island are more likely to spend time in ocean sectors further from South Georgia than those tracked from Bird Island. Consequently, Wandering Albatrosses from Bird Island have higher overlap with fisheries than those from Prion Island. We discuss the results in terms of the potential impacts from fisheries and how this may lead to variation in population declines around South Georgia. The results indicate which fisheries are of higher risk to the populations breeding at different sites, and whether the difference in the overlap with fisheries might explain the spatial variation in population trends.

Poster 28

## Immersion regularity predicts vessel following by albatrosses.

Jonathan D. Rutter, Ana P. B. Carneiro, Paulo Catry, Louise Maurice, Oliver Padget, Katrina J. Davis, Tim Guilford
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Seabird bycatch risk assessments benefit from quantifying individual seabird interactions with fishing vessels, including their frequency, duration, and behavioural impacts. However, interaction analyses are often limited by low-resolution seabird tracking data and incomplete fisheries tracking data. Here, we examine the potential of leg-borne geolocator-immersion loggers to detect seabird-fishery interactions from simple wet-dry patterns when tracking data are lacking or incomplete. We first identified 46 discrete seabird-vessel interactions by spatiotemporally matching high-resolution GPS data (0.0024-1 Hz) from 45 Black-browed Albatrosses *Thalassarche melanophris* breeding in the Falkland Islands to Automatic Identification System (AIS) data from vessels near their trajectories. We subsequently observed highly regular patterns of landing and taking off when birds were following trawler vessels. Then, using only wet and dry durations derived from immersion data (0.1667 Hz), we developed a temporal metric to identify these periods of behavioural regularity. This metric alone successfully identified 1/3 of vessel following events with no false positive detections. Thus, we demonstrate the potential of immersion loggers to detect vessel following by seabirds, even in the absence of tracking data for both seabirds and vessels. This result provides a foundation for more comprehensive seabird bycatch risk assessments that quantify previously hidden seabird-vessel interactions.

Poster 29

## Hooked on data: analysing bycatch risk of the European Shag in artisanal fisheries integrating highly resolved geospatial data.

Isabel García-Barón, Arkaitz Pedrajas, Javier Franco, Amaia Astarloa, Beñat Iglesias, Maria Mateo, Estanis Mugerza, Maite Louzao

*AZTI- Marine and Food Research Tecnhological Centre, Spain

Bycatch remains a critical issue in marine conservation efforts, particularly in artisanal fisheries where unintended capture of non-target species poses significant threats to several species. In this study, we focus on assessing the bycatch risk of artisanal fisheries for the European Shag *Gulosus aristotelis*, classified as endangered in the Red Book of the Birds of Spain, in Northern Spain. Our approach integrates data from GPS-GSM tracking devices coupled with a time-depth recorder sensor deployed on 14 juvenile European Shags (2022-2023) and Automatic Identification System (AIS) data of artisanal longliners and netters to elucidate the spatiotemporal overlap between fishing activities and European Shag high-use areas. Based on a kernel density analysis, the results showed that high-use areas of GPS-tagged shags were located in the inner Bay of Biscay and along the Cantabrian and Northern French coasts. The distribution and scale of potential bycatch risk differed among fishing gears, with predominantly low and medium-risk areas. This study highlights the utility of integrating species tracking and AIS data to enhance our understanding of bycatch risk, inform targeted conservation strategies, and promote sustainable fisheries management practices.

## FORAGING AND FEEDING ECOLOGY

Poster 30

**Stable isotope and stomach content analyses reveal Black-legged Kittiwakes *Rissa tridactyla* heavily rely on Arctic Cod *Boreogadus saida* in the Canadian Arctic.**

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The Arctic is warming faster than the rest of the globe, causing rapid declines in sea ice concentrations and changes in Arctic ecosystems. The diet of a common seabird, the Black-legged Kittiwake *Rissa tridactyla*, has been used as an indicator of these ecosystem changes in the European Arctic, yet little is known about their diet in the Canadian Arctic. We quantified the stomach contents of Black-legged Kittiwakes in the Canadian Arctic and used stable isotope analysis to assess if stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) in the birds differed from that of the dominant prey type in their diet. Based on stomach contents, prey type did not differ between areas, where the dominant prey in both regions was Arctic Cod *Boreogadus saida*. However, $\delta^{13}C$ and $\delta^{15}N$ values of Black-legged Kittiwake liver were at a lower trophic level with more freshwater input than that of Arctic Cod muscle, after accounting for dietary discrimination. Thus, while Black-legged Kittiwakes do heavily consume Arctic Cod, stomach content analysis may underestimate the number of soft tissue (i.e., more easily digested) prey species in their diet, such as invertebrates. Future research should focus on regurgitate and faecal samples to better understand Black-legged Kittiwake diet in the Canadian Arctic in a manner that is not biased against soft parts. Nevertheless, this study provides important benchmark information for monitoring how climate change may impact these Arctic-breeding seabirds in Canada.

Poster 31

## Spatial consistency affects foraging effort in a benthic diving seabird, the Black-faced Cormorant.

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For animals exploiting predictable food resources, a higher foraging site fidelity has been hypothesised to lead to increased foraging efficiency. However, evidence for this in free-ranging species is limited. In the present study, foraging site fidelity, the factors influencing it, and its effect on foraging efficiency were investigated in the Black-faced Cormorant *Phalacrocorax fuscescens*, a predominantly benthic forager occurring in Southeastern Australia. While the study population had a relatively large foraging range, individuals were highly consistent in the smaller foraging areas they used. Foraging effort was lower in individuals with a higher foraging site fidelity, likely indicating increased foraging efficiency. While the level of foraging site fidelity differed greatly between individuals, none of the assessed factors were found to have a significant influence. This might indicate that intrinsic factors which could not be assessed, such as personality or experience, may influence the degree to which individuals exploit known habitats. The findings suggest disturbances to foraging habitats, either by anthropogenic factors or environmental perturbations, could result in reduced foraging efficiency and, consequently, negative impacts for the species. However, further investigation is required to assess within individual foraging plasticity to predict potential responses to changing prey availability and distribution.

Poster 32

## The impact of environmental factors on the breeding and foraging ecology of Scopoli's Shearwater *Calonectris diomedea* in Greece.

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One of the aims of the 6-year LIFE22-NAT-EL-LIFE MareNatura project (2023-2029) is to enrich our knowledge on the ecology of nine EU priority species of seabirds in Greece. One of the target species, namely Scopoli's Shearwater *Calonectris diomedea*, is a long-lived seabird with delayed maturity and low annual reproductive rate. As a top predator, it can also be a good indicator of organic contamination as well as pollution by microplastics (MPs) in its habitat. Three annual visits at four breeding sites of the species will be conducted in the Ionian and Aegean Sea, identifying active nests and examining their reproductive success. Adult birds and fledglings will be ringed and tagged with GPS-GSM transmitters aiming to identify their core feeding grounds. Ectoparasites and blood samples will be collected for parasites' identification as well as feathers and blood serum samples for per- and polyfluoroalkyl substances (PFAS) determination. Additionally, live-bird regurgitates and faeces for examining microplastics ingestion will be taken. The outcome of this study will be delivered through a combined methodology based on monitoring the breeding performance and modelling spatial distribution pattern from telemetry data as well as PFAS, MPs and blood parasite detection methodologies and ectoparasite fauna characterisation. It is expected that the acquired knowledge will provide vital information to mitigate threats for the conservation of the species.

Poster 33

## The death of a transatlantic migration strategy: Irish Puffins are no longer wintering in Canadian waters.

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When not breeding, seabirds can avail of the lack of central-place constraints to position themselves in areas of abundant resources and favourable conditions. Atlantic Puffins *Fratercula arctica* tend to follow colony-specific routes to overwintering areas, with migration paths usually consistent across years. Puffins from Skellig Michael in Ireland have some of the longest puffin migration paths recorded, with previous research showing some crossing the North Atlantic to spend early Winter around Newfoundland (NF), Canada. We investigated the long-term consistency of this migration route using geolocators attached to puffins between the periods 2010-2013 and 2020-2023. While ~30% (9/28 tagged birds) of puffins wintered around NF in 2010-2013, none of the birds tagged in more recent years did so (n= 27), opting for a more Central Atlantic wintering area. Using broken stick regression, we show that the timing of departure and speed of westward migration has remained remarkably similar across time, suggesting that changes in wind fields have not impacted migration strategies. The transatlantic migration of Irish Puffins may have originally developed to exploit highly abundant capelin stocks in NF. However, these stocks experienced a precipitous decline in 1991, followed by fluctuations at low levels since. Capelin biomass estimates 2005-2010 were twice as high as 2015-2020, suggesting that the reduced reliability of this resource has rendered their transatlantic migration unviable.

Poster 34

## Intrinsic and extrinsic factors affecting the foraging behaviour of breeding Mediterranean Gulls.

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During foraging, wild animals negotiate information with the surrounding environment, adopting specific behaviours to maintain an overall positive energy budget. To do so, generalist species exhibit a plastic foraging behaviour including flexible diet and habitat use, affected by both intrinsic (e.g., internal) and extrinsic (e.g., environmental) drivers. The Mediterranean Gull *Ichthyaetus melanocephalus* is a generalist feeder that can forage both at sea and on land during breeding. We investigated the drivers of choosing marine *vs.* land foraging by GPS tracking 20 breeding individuals across more than 1,300 foraging trips. The average proportion of GPS fixes at sea per trip was 13%. Overall, birds foraged at sea more during chick-rearing compared to incubation stage, and males were more prone to face at-sea trips than females. Both weather conditions and timing were found to be key drivers for foraging habitat choice, with at-sea foraging being more likely during late morning, under conditions of low precipitation, minimal wave activity, and at intermediate wind speeds. Our results highlight that the habitat foraging choice of this species depends on the interplay between both extrinsic and intrinsic factors and provide a novel insight into the fine-scale foraging movements of a generalist feeder.

Poster 35

## Birds of a feather don't always flock together: Colony and individual level variation in foraging behaviour.

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Individual-level mechanisms are important for understanding ecological, demographic and evolutionary processes. This variation between individuals can be driven by differences in both competitive abilities and environmental opportunities and, if sustained, results in individual specialisation. The Falkland Islands Shag *Leucocarbo atriceps albiventer* is an understudied nearshore, colonial species. Their distribution across the archipelago in colonies of varying size, and with access to either oceanic or more inshore waters, allows for a natural experiment to differentiate between the effects of environmental heterogeneity and intraspecific competition as drivers of individual specialisation in the dietary niche. We deployed GPS and TDR tags on breeding adults at seven differently sized colonies (137 - 4,000 pairs) to identify the key parameters determining the strength and extent of individual specialisation between and within colonies. We found high levels of individual variation in foraging behaviours except at the smallest and largest colonies, and some between-colony segregation in space use. Physical environmental parameters also played a key contribution in determining the extent of specialisation across colonies. This illustrates the extent of interactions between these factors, and such information is central to informing the development of Marine Managed Areas by identifying key drivers of foraging choice for an important but poorly known nearshore predator.

Poster 36

## How to forage in changing environment: Little Auks diving tactics in Svalbard.

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Due to the rapid warming of the Arctic, plankton communities are shifting toward species living in warmer waters, having repercussions on higher trophic level predators. Little Auks *Alle alle* are the most numerous zooplanktivorous seabird breeding in the High Arctic, feeding on cold-water zooplankton during the breeding period. They may react to changes in zooplankton communities by showing a flexible foraging strategy. We investigated how Little Auks exposed to different oceanographic conditions adapt their diving behaviour. We expect different diving tactics in various foraging microhabitats, such as cold-water shelf zone, frontal zone, and marginal ice zone. We investigated dives of Little Auks using GPS-loggers and TDR (Temperature-Depth Recorders) in four field seasons and in three different colonies in Svalbard (Bjørnøya, Hornsund, Magdalenefjorden). We found that Little Auks use three different diving tactics which differ in their diving depth, dive duration, and the time spent at the bottom part of the dive. The comparison of diving tactics among years in one colony (Hornsund) revealed that despite interannual differences in oceanographic conditions, Little Auks appeared to favour one diving tactic over the other. However, the rate at which each diving tactic is used differs between the northernmost colony (Magdalenefjorden) and the two others. Our study indicates some flexibility in Little Auks diving tactics especially when comparing various colonies.

Poster 37

## Responses of coastal seabirds (European Shag, *Gulosus aristotelis*) to fine-scale meteorological variation within a dynamic coastal environment.

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Extreme weather events are predicted to increase in frequency and severity due to climate change, impacting marine environments and thus seabird communities. Individual movement decisions are known to be sensitive to local (<10 Km) and acute (daily) environmental conditions. However, few studies have examined seabird responses to meteorological variability at fine spatial and temporal scales. Our study investigates the responses of breeding European Shags *Gulosus aristotelis* to fine-scale meteorological variation within the dynamic coastal environment of Conwy Bay and the Menai Strait, North Wales. Shags were tracked across four consecutive breeding seasons (2021-2024), with biologgers recording GPS and Time-Depth Recorder (TDR) data at fine spatiotemporal scales (metres, minutes). Foraging locations are identified using Expectation-Maximization binary Clustering (EMbC) and validated using known dive locations for years where TDR data are available (2023 and 2024). Concurrent environmental data are provided by a combination of *in-situ* instrumentation and high-resolution models. Thus, we explore the extent to which individuals display routine foraging behaviours, aligning with tidal and diurnal cycles, and whether deviations from routine are influenced by meteorological conditions, leading to switches in habitat selection and foraging strategy.

Poster 38

## Endless bounty or fading paradise? Examining Ashmole's hypothesis in the zooplanktivorous Little Auk *Alle alle.*

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As central-place foragers, chick provisioning seabirds should minimise the time spent travelling to foraging grounds. However, according to Ashmole's hypothesis, many colonially breeding seabirds deplete local food sources over the breeding time, creating a halo of depleted resources, and birds must increase the distance of foraging trips to find food for their chicks. This hypothesis has been tested for some piscivorous species but never in zooplanktivores. The Little Auk or Dovekie *Alle alle* is a small colonially breeding, and the only zooplanktivorous, Alcid in the North Atlantic. We hypothesised that Little Auks experience Ashmole's halo, resulting in the extension of trip duration over the course of chick rearing. Using video data of parental visits to the nest, we compared the duration of foraging trips at early, middle, and late stages of the chick rearing period in two years: 2021 and 2022. For 2021, we found longer trip durations at the middle compared to early stage. Trips durations did not differ during 2022 and were similar to the duration of the 2021 middle stage. We suggest the effects of Ashmole's halo may not be apparent when birds are already operating at their maximum trip range in early chick rearing. While these results partly support our hypothesis, we also explore other explanations for this difference in behaviour. We suggest seabirds can display a limited response to initially low or depleted local resources when they cannot forage beyond the halo.

Poster 39

## Novel approaches to dietary analysis in a diving seabird: implications for offshore wind development.

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Understanding the role of different prey species in trophic food webs is crucial for deciphering population dynamics in marine top predators as both quality and quantity of prey is important for survival and breeding success. Seabird prey species face ongoing threats from anthropogenic activities and are potentially facing escalating pressures due to climate change-induced marine heatwaves and marine renewable energy development. While current diet studies of Common Guillemot *Uria aalge* predominantly rely on chick feeding observations, the dietary habits of adult birds remain understudied. Other traditional seabird diet studies often rely upon opportunistic or degraded samples with mixed success. This study utilises complementary dietary analysis methods to compare diet at different temporal scales and resolutions and offers a thorough examination into the diet of adult guillemots on Puffin Island, North Wales, UK. DNA metabarcoding of novel sample types (buccal and cloacal swabs) is used to explore short-term diet variation. Stable isotope analyses ($\delta^{13}C$ and $\delta^{15}N$) of spatiotemporally overlapping predator and prey samples are used to investigate trophic niche width and longer-term variation in diet. By correlating dietary data with foraging behaviour derived from bio-loggers, we aim to enhance understanding of the potential impacts of offshore wind farm development on diving seabirds.

Poster 40

## Using stable isotope analyses of museum skins to investigate the migration strategies of an Antarctic seabird.

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Stable isotope ratios of feathers are routinely used to investigate the diets and distributions of adult seabirds during the non-breeding period. Once grown, feathers are metabolically inert, and so samples from museum specimens can act as isotopic archives of trophic ecology from previous centuries. We measured bulk stable isotope values of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) in body feathers of Brown Skuas *Stercorarius antarcticus lönnbergi*. These were collected from living birds (2010-present) and museum skins (1905-2000), and originate from breeding populations on the Antarctic Peninsula, South Orkneys, South Shetlands, and South Georgia. We compare our stable isotope data to those from birds that were tracked with geolocators in the early 2000s and 2010s, and discuss whether migration strategies might have changed over the past 100-120 years. We also discuss how differences in migration strategies among individuals and populations could have repercussions for exposure to anthropogenic threats (e.g., pollutants and fisheries bycatch), or have carryover effects on body condition, behaviour or performance in the subsequent breeding season.

Poster 41

## Anthropogenic debris ingestion in a tropical seabird community: Insights from taxonomy and foraging distribution.

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Oceans have been considered as an unlimited supply of goods and services, but resource extraction and waste disposal became ubiquitous and have been damaging the health of marine ecosystems. Finding suitable sentinel species of the human impacts on the oceans is thus imperative, since they may work as early warnings of disruptive situations. In this study, we investigated how taxonomy and foraging distribution influenced the occurrence of anthropogenic debris among five seabird species inhabiting the tropical Atlantic region. Occurrence of anthropogenic debris was assessed using faeces of breeding individuals as a proxy of ingestion. A total of 268 particles were extracted from all samples. The categories “fragments” and “fibres”, as well as the colour “blue”, were the most prevalent characteristics across all species. There was a high diversity of polymers from cellulosic particles to synthetic plastics (Anthropogenic Cellulosic 26.9%; Polyester 7.7%; Varnish 5.8%; Polypropylene 1.9%). Species with a more coastal foraging strategy exhibited higher occurrence and number of anthropogenic debris when compared to species foraging comparably more in pelagic areas. This suggests that anthropogenic debris are more prevalent in coastal foraging areas, where human activities occur in higher number and frequency (e.g., fisheries), and sources of freshwater input from inland are at close distance. These results provide more evidence to the growing perception on the ubiquity and diversity of anthropogenic debris in the marine environment, and further support the usefulness of using seabirds as bio-indicators of anthropogenic pollution in both neritic and oceanic reg

Poster 42

## The role of fisheries discards in foraging behaviour adaptations in Scopoli's Shearwater in relationship with chick development.

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Scopoli's Shearwaters *Calonectris diomedea* is a flexible forager that are known to use fisheries discards as a food resource. Despite this, the role of discards on the foraging behaviour of shearwaters during different breeding stages remains unclear. In this study, we investigated the foraging behaviour adaptations of shearwaters in relationship with their chick development. We combined GPS tracking of both birds and fishing vessels with accelerometer data of birds to assess if they interacted with a fishing vessel. Then, we monitored the response of parental birds to the body condition of their chick. Our findings reveal that Scopoli's Shearwaters' parents increased discard consumption when chicks were in poor body condition. Moreover, the total number of dives undertaken by the birds did not correlate with the chick's body condition, suggesting a specific shift in foraging behaviour in response to the nutritional state of their chick. This study represents the first comprehensive exploration of the connection between chick growth and parental foraging behaviour, shedding light on the adaptive responses of Scopoli's Shearwaters to environmental challenges and their reliance on fisheries discards. These insights have implications for the conservation and management of these seabirds in the context of changing marine ecosystems and fisheries practices.

## MOVEMENT ECOLOGY

Poster 43

### Biologging effects: Heavier tags sink Manx Shearwater diving behaviour.

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Biologging studies rely on the assumption that equipped animal behaviour are representative of natural ones. Determining tagging effects is therefore necessary to correctly interpret biologging data. The majority of studies on seabirds report an absence of tag effects using broad metrics such as breeding success or foraging trip duration/range. However, animals may compensate for tag effects through increased effort or behavioural responses to the presence of tags. We compared foraging trip and dive characteristics of 42 breeding Manx Shearwaters *Puffinus puffinus* equipped with a range of biologging tags representing 0.9 - 3.3% body mass. Increasing tag weight did not affect trip duration or % of time spent resting and travelling, but individuals equipped with lighter tags travelled further and spent less time in Area Restricted Search behaviour. While dive rate was not influenced by tag weight, individuals with heavier tags conducted shorter and shallower dives with slower ascent rates. Furthermore, birds equipped with heavier tags increased resting time between dives suggesting compensation for greater physiological cost to dives from attachment of biologging devices. While we do not have data on successful prey capture, our results demonstrate a subtle but likely cumulative tagging effect on foraging success. We suggest that biologging deployments on seabirds, even within the 3% rule, should be limited in duration to limit impacts that over time may affect life-history characteristics.

Poster 44

## Behavioural responses of a trans-hemispheric migrant to climate oscillation

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Large-scale climatic fluctuations, such as the El Niño-Southern Oscillation (ENSO), can have dramatic effects on ocean ecosystem productivity. Many mobile species breeding in temperate or higher latitudes escape the extremes of seasonal climate variation through long-distance, even trans-global migration, but how they deal with or are affected by such longer-phased climate fluctuations is less understood. To investigate how a long-lived migratory species might respond to such periodic environmental change we collected and analysed a 13-year biologging dataset for a trans-equatorial migrant, the Manx Shearwater *Puffinus puffinus*. Our primary finding was that in El Niño years, birds over-wintered at more northerly (lower) latitudes than in La Niña years, a response attributable to individual flexibility in migratory destination. Daily time spent foraging in winter varied in concert with this latitudinal shift, with birds foraging less in El Niño years. Secondarily, we found that in subsequent breeding, a hemisphere away, El Niño years saw a reduction in foraging time and chick provisioning rates: effects that could not be attributed to conditions at their breeding grounds in the North Atlantic. Thus, in a highly migratory animal, individuals may adjust to fluctuating overwinter conditions, but still experience cascading carryover effects on subsequent behaviour. These methods in understanding behaviour from GLS data will prove vital for future offshore wind assessments.

Poster 45

## Individual differences in foraging movements and responses to prey availability in a generalist seabird, the Great Black-backed Gull *Larus marinus*.

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Generalist populations may contain specialist individuals that exploit only part of the population's ecological niche. Consequently, conspecifics may show differences in foraging strategy and responses to environmental conditions within the same population, potentially driving population dynamics. Examining individual variation in foraging behaviour is therefore key to understanding species ecology and determining populations' responses to environmental change. We used GPS data from Great Black-backed Gulls *Larus marinus* breeding on the Isle of May, Scotland, to quantify individual differences in foraging effort, specialisation in foraging movements, and area use. Furthermore, we assessed individual and group (i.e., all birds combined) responses in these foraging metrics to a sudden increase in natural prey availability. We found extreme differences in home range size (range 0.009 – 1,491 Km²) and foraging effort among individuals due to individual specialisation, and individuals responded differently to an increase in prey availability. Notably, some individuals were highly specialised on seabirds and rabbits, and exclusively foraged within the colony. We found a high degree of phenotypic plasticity in Great Black-backed Gulls, with high individual specialisation and inter-individual variation in foraging strategy. Given that individual variation may have consequences for demography, further studies should aim to link foraging behaviour to breeding success and survival.

Poster 46

## GPS-tracking of Black-legged Kittiwakes breeding on an offshore platform in the Dutch North Sea.

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Black-legged Kittiwakes *Rissa tridactyla* increasingly breed on man-made structures, both in coastal towns and on offshore platforms. Potential advantages of breeding on man-made structures include lower predation risk and more efficient foraging trips. Furthermore, the potential to venture in all directions from a platform may reduce competition at sea close to the colony compared to coastal colonies of the same size, allowing shorter foraging trips. Using GPS-tracking data of nine kittiwakes breeding on an offshore platform in the Dutch North Sea, we found evidence for shorter trips than expected during early chick-rearing, but not during late incubation. We suggest this reflects constraints during chick-rearing that amplify the reduced competition around the colony compared to coastal sites. We observed an increase in maximum trip distance during the late chick-rearing and post-fledging periods, and a subsequent return to shorter trips and more time spent in the colony from mid-August until late September, whereafter birds did not return to the platform. Kittiwakes regularly visited one to seven other platforms, including platforms previously documented to host breeding kittiwakes, suggesting prospecting behaviour. Remaining major knowledge gaps are how many kittiwakes breed on platforms in the (Dutch) North Sea, their productivity and survival, and their role in the meta-population dynamics of the dwindling North Sea population.

Poster 47

## Homing navigation is optimised to diurnal constraints in a tropical seabird, the Red-footed Booby.

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Tropical waters, characterised by fewer food resources than temperate or polar waters, consistent day lengths, and short twilight periods, pose challenges for seabird foraging. Given these constraints, tropical seabirds are expected to navigate differently to temperate species. This study investigates the homing strategies of Red-footed Boobies *Sula sula rubripes* in the Chagos Archipelago, central Indian Ocean. Using GPS tracking data from 207 breeding adults across four colonies, we explore the homing duration, bearing, and trajectory straightness during central-place foraging, shedding light on navigational constraints and temporal dynamics. Homing points were defined as the last foraging location on a trip, calculated using a Hidden Markov Model. Return distances and orientations were modelled in relation to time of day and distance to the colony, to assess the efficiency and precision of homing trajectories. Further analyses on bearing distribution will reveal whether tropical seabirds use visual landmarks as a cue to navigate back to their colony on low lying reef atolls. We found that Red-footed Boobies adjust the timing of their trip to return to the colony before dusk, as dusk approaches. These findings contribute to our understanding of seabird navigation in tropical environments, offering insights into the adaptive mechanisms underlying successful navigation over expansive oceanic territories.

Poster 48

## Quantifying long-term energy balance of a key Antarctic sentinel species, the Adélie Penguin, in relation to changes in environmental conditions.

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The balance between energy intake and energy expenditure is a fundamental parameter in ecology. Extrinsic factors (i.e., varying environmental conditions) affect this energetic balance, hence affecting individual fitness, life history strategies, and population processes. Studying individual fine-scale foraging performance across decades provides a unique opportunity to better understand how environmental variations affect individual and population levels of energetic balance. We focus on the Adélie Penguin *Pygoscelis adeliae*, the most abundant seabird in Antarctica and a sentinel of environmental changes such as sea-ice extent, which plays a critical role for biodiversity, affecting all trophic levels. We analyzed a bio-logging dataset spanning over 25 years collected on "Ile des Pétrels" (Terre Adélie) with Time-Depth Recorders (TDRs). We combined machine learning (Random Forest) and eco-physiological approaches (energy expenditure validation via Doubly Labelled Water) to estimate variation in energy expenditure and time spent foraging by Adélie Penguins from depth data. We investigated mechanisms underlying variations of these energetics proxies in relation to 1) sea-ice concentration and 2) fledging success. This work allows us to describe and better understand the relationships between past and current environmental variations and the energy balance of Adélie Penguins, setting a robust mechanistic approach to better predict the effects of global changes on marine top predators

Poster 49

## Searching for food in the Southern Ocean: Foraging behaviour of Antarctic Storm-petrels during incubation and chick-rearing.

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The Wilson's Storm-Petrel *Oceanites oceanicus* (Procellariformes), the smallest endotherm breeding in Antarctica, is a surface-feeding species that preys on small fish and zooplankton, with Antarctic Krill *Euphausia superba* often reported as its main prey. Earlier studies on stomach contents and stable isotopes revealed that foraging and diet shift depending on the breeding phase. The proportion of krill decreased between incubation and chick rearing. This seasonal shift in prey composition in breeding Wilson's Storm-petrels could be related to changing nutritional requirements of adult birds (e.g., female birds after egg production) and for optimal provision of their offspring (chick growth). In our project, we used miniature GPS dataloggers (NanoFix GEO-Mini GPS tag, PathTrack) to obtain information on the foraging behaviour, such as location and trip duration, of Wilson's Storm-petrels during their breeding period on King George Island, South Shetland Islands. We present first results from two breeding seasons (Antarctic Summers of 2022/2023 and 2023/2024) of individuals with nest burrows close to the Argentinian Carlini station. We compare the incubation phase (January - February) with the chick-rearing phase (February - April), in combination with molecular diet analysis and records of breeding parameters. We test for seasonal differences in foraging area and trip duration, which are expected due to the reported seasonal shift in diet composition.

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## Sex differences in the migratory behaviour of the Little Auk and its potential carry-over effects.

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Studying sex-specific strategies in winter distribution may provide information on how survival, phenology, and reproductive performance may be affected. But as seabirds only come to land during the breeding period to reproduce, they are difficult to study through the rest of their annual cycle spent in the vast ocean. In this study, we tracked male and female High Arctic Little Auks *Alle alle* from multiple breeding colonies using Global Location Sensors (GLS) to assess their spatiotemporal distribution during the non-breeding season. We tested for sex-differences in wintering strategies and assessed the potential carry-over effects of individual differences in the winter distribution. Our study confirmed that little auks from south Svalbard (Hornsund) have two distinct wintering areas around Southwest Greenland and Northern Iceland, exhibiting sex differences in their wintering areas. We found this pattern of spatial segregation also in other breeding colonies in Svalbard (Isfjorden and Kongsfjorden) but not in the population breeding in Greenland. It is of importance to further explore revealed patterns, investigating them at a broader geographical scale, and considering pair bonds of the tracked individuals. Thus, this study on migratory behaviour reveals that little auks display intra-population variations in their overwintering areas.

Poster 51

**ExMove: An open-source toolkit for processing and exploring animal tracking data in R.**

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Technological advances have led to a rapid increase in the number, type, and scope of animal tracking studies. In response, many software tools have been developed to analyse movement data, but the steps required to clean raw data files from different tracking devices have been largely ignored. Such pre-processing steps are crucial for the creation of high quality, standardised, and shareable data. Moreover, decisions made at this early stage can substantially influence subsequent analyses, and in the current age of reproducibility crisis, the transparency of this process is vital. Here we present an open-access, reproducible toolkit written in the programming language R for processing raw data files into a single cleaned data set for analyses and upload to online tracking databases (https://exmove.github.io/). The toolkit comprises well documented and flexible code to facilitate data processing from different device types. Additionally, we provide a Shiny app to help users visualise tracking data and determine data cleaning parameters. Overall, by collating all steps from data collection to archiving on open access databases into a single, robust pipeline, our toolkit provides a valuable resource for anyone conducting biologging analyses to facilitate sharing of open data and transparent code and represents an important step towards increased standardisation and reproducibility in movement ecology.

Poster 52

## Non-breeding distribution is spatially consistent in Razorbills in the Northwest Atlantic.

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Individuals from several seabird species display consistent non-breeding distribution and there can be large variation between individuals that may be related to personality. Animal personality is defined as consistent between-individual differences in behavioural traits (e.g., docility-aggression) that persist through time and across contexts. We aimed to investigate inter-annual consistency in distribution, diving and dietary metrics during the non-breeding period across years for personality-tested Razorbills *Alca torda* breeding in coastal Newfoundland, Canada. To do this, we tagged personality-tested individuals with light-level geolocator/time-depth recorder tags and collected feather samples across multiple years (2017-2023). EMD (earth movers distance) analysis showed individuals to have significant spatial consistency in their movement across years but this consistency was not related to personality. Furthermore, preliminary analysis also suggests varying levels of dietary (feather stable isotope ratios) consistency among individuals across years, high repeatability of diving behaviour (e.g., depth) within and between years, and that these behaviours are associated with personality. Overall, this study represents a first step in investigating the relationships between personality and non-breeding behaviour in this species.

Poster 53

## Assessing degree of similarity and overlap between GPS and GLS contours in seabirds.

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Telemetry is an important tool in understanding seabird population dynamics and movements. Typically, seabirds are tracked using highly accurate GPS loggers during the relatively short breeding season. However, longer-lasting and smaller GLS tags are necessary to track individuals during other life stages. GLS tags approximate location based on light levels and have reduced accuracy compared to other tags, with an average GLS point to GPS or satellite point error of around 200 Km. However, tracking data is often presented as Kernel Density Estimates (KDEs) showing home ranges and core area use. It is unclear how point-to-point error estimates should influence interpretation of GLS KDE contours and, to date, there is a limited understanding of how GLS KDE contours relate to true locations of birds, such as would be represented by GPS or satellite data. To address this, we analysed data from double-tagged birds and calculated a similarity index and percent overlap between all possible combinations of GPS and GLS contours between 25 and 95%, inclusive. We then used this data to determine what size contours maximise overlap and similarity. This analysis aims to enhance our understanding of how factors such as scale of movement and length of time tracked influence the relative accuracy of GLS kernels compared to GPS kernels and offer recommendations for calculating and reporting GLS KDE contour data in future studies.

Poster 54

## Shearwaters make efficient navigational decisions, even at very fine scales.

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Shearwaters are extremely efficient wide-ranging navigators, commuting long distances over open ocean with pin-point accuracy. Little is known, however, about their navigational abilities over short distances where the pay-off to making efficient navigational decisions is very small. Over larger distances, the refinement of navigational routes could be facilitated by learning associatively which navigational decisions resulted in efficient homing, since making poor decisions may result in large homing inefficiencies However, this refinement is less clear over short distances since the absolute difference between potential routes will be negligible. By displacing Manx Shearwaters to proximal sites along the coast of their home island and GPS-tracking their return routes around the island, we show that shearwaters choose the shortest homing trajectories even when the disparity in distance is negligible. These findings suggest that shearwaters understand the geography of their home island, and that this familiarity allows them to make efficient navigational decisions in their local area.

Poster 55

## A multi-species comparison of annual spatial consistency in chick-rearing seabirds to inform area-based conservation.

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A crucial consideration when estimating spatial distributions from tracking data is whether the sample of tracked animals is representative of the population. However, it may also be important to track animals in multiple years to capture changes in distribution. Using GPS-tracking data from 23 seabird species, we assessed the importance of multi-year sampling for identifying at-sea sites for conservation during the chick-rearing period, when seabirds are most spatially constrained. We found a high degree of spatial overlap among distributions from different years in most species. Multi-year sampling captured a significantly higher portion of reference distributions (based on all data for a population) than sampling in a single year in 34 of 46 comparisons. However, we estimated that data from a single year would on average miss only 5% less of the full distribution of a population compared to equal-sized samples collected across three years (range: -0.3 to 17.7%, n = 23). We suggest two key considerations for identifying important sites from tracking data are (1) whether enough individuals were tracked to provide a representative estimate of the population distribution during the sampling period, and (2) whether concurrent conditions were typical of the region and time of year. By providing an unprecedented multi-species perspective on annual spatial consistency, this work has relevance for the application of tracking data to informing seabird conservation.

Poster 56

## Understanding the mechanistic link from the predictable physical environment to diving seabird distribution via their marine prey.

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Due to the acceleration in deployment of offshore renewables and climate warming there are increasing, often cumulative, pressures on marine environments. Seabed sediments provide habitat for predictable prey concentrations for marine top predators, and so changes to these habitats have impacts on the wider marine ecosystem. Both offshore renewables and climate change have the potential to alter seabed sediment composition and stability, but the implications of these changes have barely been considered. Whilst many studies measure the ocean's physical environment in relation to predator behaviour and productivity, the link between seabed, habitat, and prey and the role this plays is overlooked. To make the relationship explicit from seabed habitat to prey to predator, we concurrently measured fine scale substrate and topography, the distribution, community, size, and energetic content of prey fish, and distribution, behaviour and energy use of the diving seabird. Path analysis in a habitat selection model framework links these components together, allowing us to quantify the ecologically relevant mechanistic link from habitat to predator via their prey. This new evidence base will allow better prediction of the consequences of a changing physical environment on marine top predators and help deliver conservation advice on protecting seabed and seabirds with more ecological certainty. This will aid efficient regional strategic planning and environmental improvement plans.

## POLLUTION, TOXICOLOGY AND DISEASES

Poster 57

### Elusive Borrelia circulating in soft ticks infesting coastal birds in Portugal.

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*Borrelia burgdorferi s.l.* circulates in marine cycles involving mainly the hard tick Ixodes uriae and the bacteria *Borrelia garinii*. However, there are relatively few studies on soft bodied ticks (Argasidae) infesting seabirds and the infectious agents they carry. We aimed to: (1) identify the species of ticks infesting the Yellow-legged Gull *Larus michaehellis*, (2) assess if these ticks carried *Borrelia burgdorferi s.l.* bacteria and, (3) evaluate the prevalence of anti-Borrelia antibodies in several seabird species. In 2019, we collected four larval ticks infesting two Yellow-legged Gull chicks from Berlenga Island and Peniche, Portugal. These ticks were tested for *B. burgdorferi s.l.* infection. Between 2019 and 2022, blood samples were collected from 43 adult Yellow-Legged Gulls at Berlenga Island, Peniche and Porto, from 14 Audouin's Gull *Ichthyaetus audouini* at Deserta Island, Algarve, and from eight Cory's Shearwater *Calonectris borealis* at Berlenga Island. The serum was screened for anti-Borrelia IgG antibodies by IFA using *B. burgdorferi s.l* as antigen. The ticks were genetically identified as *Alectobirus capensis* through 16S sequencing. One specimen was positive for *B. burgdorferi s.l* by real time PCR targeting the 23S region, and sequencing of the flaB gene allowed the identification as *Borrelia turdi*. Prevalence of anti-Borrelia antibodies was 66%, and gull species from the high-density colony of Deserta Island were more likely to carry anti-Borrelia antibodies.

Poster 58

## Oil exposure patterns and diet in seabirds following a diesel spill in Nunatsiavut, Canada.

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Expanding oil development and shipping in Arctic marine ecosystems are expected to increase seabird environmental exposure to oil pollution, with a potential for health effects. While most studies to date on oil pollution have focused on large spills, studies into sub-lethal oil exposure in seabirds are limited. More research is needed to establish long-term exposure patterns and effects on seabird health after an oil spill, especially with the context of diet. The goal of this Indigenous-led program was to examine the diet-based routes of oil exposure in seabirds breeding at a diesel spill site (Postville, Nunatsiavut) and a non-spill site (Nain, Nunatsiavut) over a 3-year post-spill period (2020-2022). The focal species for this project, Common Eider *Somateria mollissima*, Black Guillemot *Cepphus grylle*, and Great Black-backed Gull *Larus marinus*, are of cultural significance in Nunatsiavut as the eggs are harvested for consumption. Preliminary results show a significant increase in oil found in guillemot eggs at the spill site during the year of the spill (2020), and the following year (2021). Eider and gull eggs had significantly less oil compared to guillemots, related to diet and breeding strategy (capital vs income breeders). Oil levels then declined in 2022. Notably, high oil levels found in these eggs informed human health risk assessments, in collaboration with Health Canada, that were communicated by the Nunatsiavut Government to beneficiaries in June 2023.

Poster 59

## Infestation of Yellow-legged Gulls *Larus michahellis* nests by soft ticks *Ornithodoros maritimus* in Western Mediterranean colonies.

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Soft ticks *Ornithodoros maritimus* are typical parasites of Mediterranean seabirds, including gulls. They can affect the health status of seabirds by both blood sucking and pathogen transmission. From 2019 to 2024 we looked for ticks and collected data on tick presence and abundance on eight Yellow-legged Gull *Larus michahellis* (YLG) breeding colonies in the Western Mediterranean. We analysed whether tick abundance was related to colony characteristics. Our results show a higher spatial than temporal variability in the infestation of YLG nests by soft ticks.

Poster 60

## The role of mercury exposure on the stress landscape of a wintering Arctic seabird species, the Brünnich's Guillemot *Uria Lomvia*.

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Winter represents a critical period for Arctic seabirds, during which they can be exposed to harsh environmental conditions (e.g., low temperatures, storms) and to high levels of chemical contaminants, especially mercury (Hg). However, exposure to these stressors may largely vary spatially in the marine environment, leading to contrasting exposition to acute stressors and bear various effects on bird fitness and population dynamics. Given that seabirds are a very threatened group of birds, and Hg pollution is a major threat to the marine environment, understanding the link between Hg exposure and stress levels is thus essential for conservation of species and marine ecosystems. Here, we focus on the Brünnich's Guillemot *Uria Lomvia*, a seabird species with breeding colonies widespread all over the Arctic, and a wintering distribution covering most of the Northern Atlantic Ocean. By combining measurements of mercury concentrations in bird feathers with individual winter distribution (extracted from bird-borne tracking devices), we first mapped the large scale distribution of bird contamination during Winter. We then apply the same approach to map the stress landscape (i.e., distribution of bird stress level) of birds during the same period. Comparison of Hg spatial variations with the stress landscape, as well as with other environmental parameters (e.g., SST, Chl a) allows a better understanding of the drivers of seabird stress at very large spatial scale and the role played by Hg.

Poster 61

## Using two close-related shearwater species as sentinels of marine chemical pollution.

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Cory's Shearwater *Calonectris borealis* and Scopoli's Shearwaters *Calonectris diomedea* are two close-related pelagic species with similar feeding habits, breeding in the North Atlantic and Mediterranean Sea, respectively. We compared the concentrations of chemical elements (As, Br, Ca, Cd, Cl, Cr, Cu, Fe, Hg, K, Mn, Na, Ni, P, Pb, S, Se, Sr, Ti, V, Zn) in these two marine environments. Feathers and blood were collected to assess long- and short-term exposure to chemical elements, respectively. Plasma fatty acids were analysed to establish connections between element concentrations and the ecology of the species within each environment. Results showed greater susceptibility of Mediterranean birds to long-term accumulation of most elements. No significant differences were observed in the blood. However, the pollution legacy of the Mediterranean Sea may have led to adaptive responses in this population. In Chafarinas, a positive correlation was observed between metals (Cd, Cr) and short-chain saturated and monounsaturated fatty acids, involved in the activation of liver enzymes related to metal detoxification processes, as well as omega-3 fatty acids, known for their anti-inflammatory functions. This may suggest a response to chronic stress in this population due to the history of exposure to higher levels of metals. This study underscores the varying degrees of vulnerability to chemical elements among shearwater populations, influenced by their trophic ecology and respective environments.

Poster 62

## Occurrence of novel and legacy per-/poly- fluoroalkyl substances (PFAS) in Scopoli's Shearwater *Calonectris diomedea* on Strofades Island group (Ionian Sea/Greece).

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Per- and polyfluoroalkyl substances (PFAS) are contaminants of great concern due to their ubiquitous environmental occurrence in the environment, and the potential adverse effects on organisms. There is currently limited information regarding PFAS exposure in Scopoli's Shearwater *Calonectris diomedea*. In this study, two feather samples per bird were obtained from 26 adults on Strofades colony (Ionian Sea/Greece) during the early phase of chick-rearing (late July 2019). The samples consisted of barbs and barbules of the primary feathers P1 and P10 reflecting pollution pressures at the time and place of feather growth, being at the species breeding and wintering grounds for P1 and P10 respectively. There were 25 PFAS detected in the feathers, with a detection rate ranging from 1.92 (9-chlorohexadecafluoro-3-oxanonane-1-sulfonate; 9Cl-PF3ONS and 3,3,3-tetrafluoro-2-(heptafluoropropoxy) propanoic acid; Gen-X) to 98% (sodium 1H,1H,2H,2H-perfluorooctane sulfonate; 6:2 FTS). The highest mean concentration (19.4 ng/g, dry weight) was reported for perfluorononanoic acid (PFNA). Precursor PFAS were significantly different between P1 and P10 primary feathers ($p < 0.05$), with higher concentrations found in the former, reflecting that breeding grounds in the Mediterranean are higher contaminated with precursor PFASs. No significant differences in PFAS concentrations were found according to the sex or size of the bird.

Poster 63

## Estimating the impacts of Highly Pathogenic Avian Influenza on UK seabird species of conservation concern.

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The current H5N1 strain of Highly Pathogenic Avian Influenza (HPAI) has affected seabird populations around the world on an unprecedented scale since late 2021. The extent of reported mortalities attributed to HPAI across Europe in 2022 indicated that HPAI had become one of the biggest immediate conservation threats faced by multiple seabird species, including some for which the UK population is of global importance. To assess how such mortalities translated into impacts at the breeding population level in the UK, RSPB led a collaborative programme of colony counts of 13 priority seabird species. Nine of the 13 species showed declines in breeding numbers of >10% at surveyed sites. The few species that previously had increasing populations in the UK (Roseate Tern, Northern Gannet and Great Skua) suffered serious declines following the 2021-22 HPAI outbreak, with Great Skua by far the worst impacted, with raw counts indicating declines of >75%. However, most of the other priority species were already declining prior to the HPAI outbreak and survey coverage was variable, with 22-98% of the population counted depending on species. We therefore estimate the overall change in UK population of selected seabird species using a modelling approach to account for gaps in survey coverage, and use time-series data at regularly surveyed sites to compare the observed population change to what would have been expected in the absence of the disease based on existing background trends.

Poster 64

## Influence of vegetation charcateristics on thermal stress and breeding success of Audouin's Gull *Ichthyaetus audouinii*.

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Seabirds in exposed habitats suffer heat stress during breeding, impacting success and population demography. Vegetation cover is crucial for ground-nesting seabirds' breeding habitat suitability. This study evaluated the role of vegetation cover on the breeding performance of Audouin's Gull *Ichthyaetus audouinii* and chick condition on Deserta Island, Algarve, Portugal. We monitored laying dates, egg volume, hatching success, and chick survival up to five days old in three nesting areas differing in vegetation cover (high, medium, low). We also evaluated chick growth, tick infestation rates, incubation temperature, and parental stress (heart rate) using egg dummies, and chicks' haematological and biochemical parameters in high and medium vegetation areas. In low vegetation cover areas, eggs were laid later, hatching success and chick survival were lower. Adults' heart rates during incubation were higher in medium vegetation cover areas and were significantly influenced by ambient temperature. Incubation absences were significantly affected by vegetation cover and its interaction with ambient temperature. In medium vegetation areas, parents were absent less frequently, but absences were longer and increased with temperature. During absences, mean egg temperature was higher in low vegetation areas, with the temperature-vegetation interaction reducing mean egg temperature. First-hatched chicks from medium vegetation nests showed more nuclear abnormalities in immature erythrocytes than those from high vegetation areas. No significant differences in tick prevalence or intensity were found between high and medium vegetation areas. This study highlights the importance of vegetation cover in influencing trade-offs between ectoparasitism and the reproductive performance of Audouin's Gulls, providing important information for the conservation of seabirds nesting in coastal areas subject to high thermal stress.

Poster 65

## Quantitative photography for measuring macro-plastic pollution ingested by seabirds.

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Plastic waste is a now ubiquitous form of anthropogenic pollution in marine environments and are routinely ingested by seabirds and other marine fauna. Monitoring plastic ingestion and measuring plastic size, shape, and colour is typically done by hand, which is labour intensive, unreliable, and prone to observer bias. There is a clear need for a standard, automatable method for data collection on ingested plastics. We present a new method for quantitative photography of marine plastics in the 1-100 mm size range. Open-source code processes images containing up to 250 objects per photo, ensuring properly calibrated colour reproduction between photos taken at different times or locations, detecting individual plastics and instantly measuring their size, shape, and RGB colour. We demonstrate the method on 3,793 fragments of debris ingested by Flesh-footed Shearwaters *Ardenna carneipes*, showing it has a 98% success rate at detecting objects, RGB colour measurement is a significant improvement over colour categorisation by human observers, and comparing the usefulness of different output size and shape parameters. The quality, accuracy, and reproducibility of the data we can produce using this method should encourage uptake of this method into efforts to catalogue macro-scale plastic pollution, and we hope that it may find uses in other studies that require measurement of size, shape, and colour of objects beyond plastics.

Poster 66

## Spatial variation in plastic ingestion by Cory's Shearwater *Calonectris borealis* fledglings in the Canary Islands.

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Millions of tons of plastic are produced and discarded into the ocean every year, making plastic pollution an ongoing global issue. Procellariiformes are highly vulnerable to plastic ingestion and using seabirds as bioindicators for monitoring plastic pollution offers a cost-effective and informative approach to assessing the health of marine ecosystems. We focused on Cory's Shearwater *Calonectris borealis* fledglings from the Canary Islands to assess colony-specific differences in plastic ingestion (three islands: Tenerife, Gran Canaria and Lanzarote), and explore potential correlations with feeding habits using stable isotope analysis. Isotope analysis indicated foraging niche of birds from Tenerife and Gran Canaria overlaps, reflecting similarities in feeding areas or trophic levels, but showing higher niche differences with Lanzarote birds. The mean number of plastics per individual varied slightly between islands. No differences were found in plastic ingestion occurrence. Plastic types mainly comprised threadlike plastics (69%) and white or transparent plastics were the most common (45%), but no clear differences were observed among islands. Our results point out that differences in plastic ingestion among islands are due to the availability of plastics in the foraging areas used by parents during their foraging trips. More standardised plastic monitoring programmes and ecological niche modelling will provide insights for understanding how and why plastics are ingested by seabirds.

Poster 67

## Comparative assessment of heavy metal contamination between sympatric seabird species with distinct foraging strategies.

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Heavy metal pollution, intensified by human activities, poses a significant global environmental threat due to its potential to accumulate in food webs via bioaccumulation. Seabirds, as top-level consumers, serve as effective bioindicators of heavy metal contamination. This study assesses heavy metal contamination in the Northeast Atlantic by examining both pelagic (Cory's Shearwater) and coastal (Yellow-legged Gull and Lesser Black-backed Gull) seabird species breeding sympatrically on Berlenga Island. A multidisciplinary approach was used, combining heavy metal concentration measurements, trophic niche analysis using stable isotope analysis (SIA), and the investigation of foraging spatial use with GPS loggers during the 2021 and 2022 breeding seasons. Cory's Shearwaters were exposed to higher levels of heavy metals compared to Gulls, indicating higher concentration levels in pelagic/marine environments. Specifically, Cory's Shearwaters had significantly higher levels of Br, Pb, Se, Sr, and Zn in feathers, and As, Fe, Hg, Ni, Pb, Se, and Zn in blood. Conversely, gulls showed significantly higher levels of Cu in feathers and Br in blood. Post-egg-laying, sex differences in gulls revealed no significant variation in most metals, except for higher Se levels in males, indicating potential Se transfer to eggs by females. This study underscores the influence of foraging behaviour, diet, and environmental exposure on heavy metal accumulation in seabirds.

Poster 68

## Exposure to PFAS and egg patterning in an Arctic seabird.

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Environmental pollution affects all ecosystems, and the Arctic is no exception. Arctic top predators, such as seabirds, are particularly contaminated. But the effects of certain contaminants, such as PFAS (per-polyfluoroalkyl components), are still poorly documented. Some studies showed that PFAS can have negative effects on survival and reproduction, can disturb some physiological mechanisms, and can be transferred to the egg from the mother. Seabird eggs show many intraspecific variations in colour, maculation and shape. Several hypotheses have been suggested to explain this variation. One of them is that these patterns may reflect the quality of the female, since the two main pigments involved in egg patterning are also involved in the immune system and in the oxidative balance. Other studies have shown that some contaminants can affect the appearance of eggs, but the effect of PFAS has never been investigated so far. Our study tested association between PFAS levels and parameters derived from measurements and egg picture analyses, in an arctic population of Blacklegged Kittiwakes *Rissa tridactyla* located in Svalbard. We found that females with higher PFAS levels produced greener and brighter eggs with a more intensive colour and with more spots. In addition, PFAS levels were negatively correlated with shell thickness. We proposed several hypotheses to explain these associations as well as for the potential consequences at the individual and population levels.

## RENEWABLE ENERGY

Poster 69

### The ProcBe Project - Assessing impacts of Offshore Wind Farms (OWFs) on Manx Shearwaters, European Storm-petrels and Leach's Storm-petrels in the Celtic and Irish Seas.

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Offshore wind farms (OWFs) have the potential to impact seabirds through collision, displacement, and barrier effects. Interactions of procellariiform species with OWFs have not previously been the focus of targeted research in UK waters. In comparison with other species, relatively little is known about at-sea behaviour (e.g., flight height, flight speed, nocturnal activity) and demographic rates of shearwaters and storm-petrels. This is mainly because these species are difficult to study and are thought to have been at low risk of interacting with recent OWF developments in UK waters. However, this is set to change with the proposed Round 5/Floating Offshore Wind (FLOW) developments in the Irish and Celtic Seas. The aim of the ProcBe project is to fill critical evidence gaps around how Manx Shearwaters and storm-petrels interact with OWFs (impact pathways) and improve demographic rates and population modelling approaches to allow adequate assessment of potential impacts. This will be achieved by a combination of strategic tracking of birds from key locations (to identify areas of potential interaction), behavioural observations (to access information on flight heights), and population modelling (to access key demographic rates). The project will build on existing efforts to improve baseline data, provide critical evidence around impact pathways, and reduce uncertainty in required impact assessment parameters.

Poster 70

## U-AVES: Uncrewed Aerial Vehicles for Ecological Surveys.

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Digital aerial surveys have become a key tool for offshore surveying of seabirds, marine mammals and other megafauna, progressively replacing traditional boat-based or visual aerial surveys. They are increasingly used for both large scale surveys and more local site assessments, notably driven by the rapid rise of the marine offshore renewable energy sector. Traditionally, high-resolution aerial photographs or videos are collected using cameras fitted on small aircraft flying predefined track lines. The U-AVES project assesses the feasibility of using long endurance fixed wing VTOL (Vertical Take-off and Landing) Uncrewed Aerial Vehicles (UAV) instead of crewed aircrafts to conduct similar surveys. Such an approach would improve safety while reducing resource requirements, logistics, and costs as well as lowering CO2 and noise emissions. The project will undertake a series of test flights followed by two proof of concept surveys to optimise sensor settings and flight operations and to validate the use of UAVs for long range offshore ecological surveys. Data quality and suitability for abundance estimations and reliable species identification will be compared against traditional crewed aircraft digital datasets to assess the utility of the data collected. Findings will be disseminated to relevant stakeholders to encourage future application and refinement of this, to support both the sustainable development of offshore energy and other monitoring programs and bespoke research.

Poster 71

## Corridor use by seabirds in an offshore wind farm.

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Offshore wind farms may have negative effects on birds, for example causing collisions, cause habitat loss, and form barriers. Corridors have been suggested as a potential mitigation measure to counter these effects. In such a corridor the spacing between wind turbines is larger than in the rest of the windfarm. Thus far, the use of a corridor by birds has not been quantified yet. We studied whether birds use a corridor (in this case in the form of a shipping lane) more than the rest of the windfarm area in the Borssele offshore wind farm in the Netherlands. Using standard ESAS methodology, we mapped densities of birds during 20 ship-based surveys over two years. No differences in seabird densities were found between the corridor and the windfarm for six studied species for which sample sizes were sufficient. These species included both mainly swimming and mainly flying species (Common Guillemot, Razorbill, Lesser Black-backed Gull, Black-legged Kittiwake, Northern Gannet, and Common Gull). Putting our results in the context of similar research in other wind farms and corridors is needed to substantiate whether a corridor is a suitable mitigation measure for reducing barrier and/or collision risk, and which characteristics of a corridor determine its preferential use by seabirds, such as its width, orientation and use by shipping traffic.

Poster 72

## Assessing changes to seabird distribution in association with present and future offshore wind farm developments in the North Sea.

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Seabirds in shelf seas navigate a dynamic seascape, which has been increasingly impacted by human activities in recent decades. In European waters, offshore wind farms have been increasing in number and magnitude, with continued rapid upscaling expected in the near future. While attention has predominantly focused on the collision risk between seabirds and turbine blades, the broader ecological consequences of these large-scale installations remain less explored. With potential hydrodynamic effects in both near and far-field habitats, it is expected that the physical processes governing locations of enhanced prey availability are likely to also be affected by the presence of offshore wind farms, and ultimately have the potential to influence seabird distribution. By combining long-term seabird and prey surveys, with high-resolution hydrodynamic and ecosystem modelling, this study adopts a stepwise, mechanistic approach to assessing seabird distributions in association with offshore wind developments. By focusing on critical seabird hotspots in the North Sea, this research seeks to further understand the mechanisms driving changes in seabird distribution and examine how these key hotspots respond to the upscaling of offshore wind installations. Preliminary results from this modelling approach will be displayed, aiming to offer insights into the sensitivities of seabird populations to large-scale anthropogenic alterations in the marine environment.

Poster 73

## Modelling the consequences of displacement for non-breeding seabirds (DisNBS).

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The non-breeding season is the least studied and understood component of seabird life cycles. While this is understandable due to limitations in our ability to study the non-breeding season, it is also problematic since it tends to occupy the greater proportion of the annual cycle. This is now an acute problem as we evaluate the impacts of the rapidly expanding offshore windfarm sector on the behaviour and ecology of seabirds. In response to an industry-led need to better understand potential consequences of seabird displacement in the non-breeding season, we are developing an individual-based model (IBM). Our model will simulate how day-to-day variation in location, environment and interaction with windfarms can lead to consequences for adult seabirds in terms of their location, foraging, behaviour, and body condition. These influences act via a bioenergetic understanding of how birds use, gain, and store energy during the non-breeding season. Further demographic consequences in the breeding season can then be assessed. Our IBM is flexible in accommodating both a variable quality of inputs, and a diverse range of windfarm and displacement scenarios. Here we will show the outline of our model and progress to date and welcome feedback and ideas for its development and implementation.

Poster 74

## How do cumulative effects of offshore wind farms scale with increasing exposure to seabird breeding colonies?

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Offshore wind farm (OWF) developments represent a key component of global strategies to reduce impacts of anthropogenic climate change. However, such developments are often located on habitat used by protected seabirds, potentially altering movement patterns, and causing displacement. Predicting the potential sub-lethal impacts of proposed OWFs is complex, and the resulting uncertainty in assessments can lead to challenging consenting decisions. Further complications are introduced when considering cumulative effects of multiple OWFs (i.e., the proposed development and existing OWFs). We used a process-based Individual-Based Model (IBM, SeabORD) to predict the impacts of displacement and barrier effects of OWFs. By simulating the time/energy budgets of individual seabirds during the chick-rearing period, we estimated adult mass loss and breeding success in both the presence and absence of OWFs. Our approach allowed us to predict the demographic consequences of simultaneous developments on a population of interest. We found that impacts scale with the foraging area occupied by OWFs, and the number of developments. By running experimental simulations of North Sea Black-legged Kittiwakes *Rissa tridactyla*, we explore the demographic impact of various hypothetical OWF development scenarios to demonstrate the potential scaling of impacts from large-scale implementation, in line with current energy policies in this region.

## OTHERS

Poster 75

**Mining social networks to track the irruption of a boreal seabird in the Mediterranean.**

Flavio Monti, Emiliano Mori, Andrea Viviano, Roberto Vento, Adriano Minichino, Carola Murano, Raffaella Casotti, Letizia Campioni, Francesco Tiralongo, Rosario Balestrieri
*Ornis Italica, Italy

Climate changes are inducing increasing surface water temperatures and frequent extreme events, with negative effects on seabird communities. In Winter 2022-2023, an exceptional irruption of Razorbills occurred in the Mediterranean Sea likely triggered by Atlantic storms. By conducting a data-mining campaign on social networks we collect data on the occurrence of Razorbills in the central Mediterranean and estimated the relative magnitude of the irruption. Nine Italian regions were interested by the irruption (n=238 records). The highest number of individuals (n=747) was recorded at the end of November 2022 in Liguria. Thirty-one records were in Tunisia, Algeria, Corsica, Malta, Libya and Greece, while 716 in Italy. The irruption followed a North-to-South direction. In the following, another irruption event occurred, albeit smaller in number (20 records) and in the opposite direction (South-North). By analysing 32 pictures, seven videos and seven dead individuals we identified Razorbill prey that included 12 small-medium-sized fish from the neritic zone (e.g., *Belone belone*, *Trachinotus ovatus* and *Engraulis encrasicolus*). Dead individuals mostly had empty stomachs, low weight and low fat levels. The presence of 41 plastic items was detected in the stomach content, gut, liver and pectoral muscle of three dead birds. Monitoring the particular movement patterns of birds in response to adverse weather conditions is crucial to understanding the response of seabird populations to global climate change.

Poster 76

## Combining bio-logging, stable isotopes and DNA metabarcoding to reveal the foraging ecology and diet of the endangered Bermuda Petrel *Pterodroma cahow.*

Letizia Campioni, Francesco Ventura, José Pedro Granadeiro, Jeremy Madeiros, Carina Gjerdrum, Mónica C. Silva
*Ornis Italica, Italy

Under central-place foraging constraints, pursuit of prey for wide-ranging predators is challenging due to highly variable environmental conditions and available prey. Gadfly petrels (*Pterodroma*) leverage sustained wind conditions to travel vast distances to maximise prey encounter, but our understanding of their foraging ecology and spatiotemporal distribution remains limited. Here, we studied foraging behaviour, ecological niche, and diet of the Bermuda Petrel *Pterodroma cahow* endemic to the Western North Atlantic. We used GPS-loggers to track foraging trips during incubation (INC) and chick-rearing (C-R) in 2019 and 2022, and employed DNA metabarcoding and stable isotope analyses to reveal dietary habits. We found petrels reduced their foraging ranges and time at sea during C-R by foraging closer to the colony than during INC. Their choice of where to forage was affected by a different set of environmental variables during INC compared to C-R, but included mesoscale oceanographic features, distance to colony, and wind speed. Petrels had narrow isotopic niches, and the range of $\delta^{15}N$ and $\delta^{13}C$ values suggested consistency in trophic habits. We found high taxonomic diversity of prey, including exclusively meso-bathypelagic fishes and cephalopods. These insights into gadfly petrels' foraging ecology highlight their behavioural plasticity, essential for predicting responses to anticipated changes in wind regimes and oceanic processes expected in the North Atlantic Ocean

Poster 77

## Variation in egg length of Sooty Terns *Onychoption fuscatus* nesting at different times of the year on Ascension Island, South Atlantic.

John B. Hughes, A. Patricia
*Army Ornithological Society, UK

Sooty Terns *Onychoption fuscatus* on Ascension Island breed sub-annually (every 9.6 months). We investigated variation in the length and breadth of Sooty Tern eggs between breeding seasons. The length and breadth of 1,869 Sooty Tern eggs, that were laid in ten different months between 1994-2018 were analysed. We found that mean egg size varied between seasons and that eggs laid close to the Austral Summer solstice in December were significantly shorter than eggs laid close to the Austral Winter solstice in June, but we found no significant differences in the breadth of eggs laid during Winter and Summer months. Egg size is known to vary greatly within a species and is primarily governed by the age and condition of the laying female. We found large intra breeding season variations with the largest egg four times longer than the smallest. Despite an increase in mean ambient temperature of 0.5°C on the island in the last half century we did not find that the mean size of Sooty Tern eggs has altered over this period. We correlated environmental factors with egg length and found the only correlation was between egg length and day length and this was negative and highly significant r(df) = -0.782 and p = 0.008. Further research into why egg length but not egg breadth varies during the year and why egg length and day length are correlated is needed.

Poster 78

## A feathered past: Colonial influences on bird naming practices, and a new common name for *Ardenna carneipes* (Gould 1844).

Alexander L. Bond, Jennifer L. Lavers
*Natural History Museum, London, UK

Recently, there has been increased focus on the origins and history of common names for organisms, especially birds. Of particular interest are eponymous common names that reflect of our colonial past. While identification of alternative names can be straightforward for some species, for those that migrate across jurisdictions including the lands of multiple Traditional Owner groups, reaching consensus on a single name that reflects the features of the species and cultural importance can be substantially more complex. Using the migratory *Ardenna carneipes* as a case study, we propose a new common name for the species and discuss the many challenges that others will need to consider when navigating this important yet sensitive space.

Poster 79

## Assessment of land-based threats to Atlantic seabirds.

Ioannis Kalaitzakis, Ana S. L. Rodrigues, Maria P. Dias, Tammy Davies, Marie-Morgane Rouyer
*University of Montpellier, France

Highly mobile seabirds are exposed to numerous threats during their life-cycle. During their breeding season, they face land-based threats - such as invasive alien species, diseases, or light pollution - that can result in strong population declines. Here we assess the timing, scope, and severity of land-based threats to seabird populations of petrels, albatrosses, storm-petrels and alcids in the Atlantic Ocean, in order to guide priorities for the conservation of their breeding areas, which are mostly located on islands. By combining our own field expertise of these species with a literature review, we built a dataset characterising each of 18 threats for 49 species (143 populations) across 38 Large Marine Ecosystems (LMEs). We then quantified the impact of each threat as the estimated population loss it has caused, highlighting the most impactful threats, the most impacted species and populations, and the most impacted LMEs. Invasive alien species account for the greatest population losses among the studied species, with the most impacted LMEs in island systems such as Bermuda and the Canary Current. Addressing invasive alien species in Tristan da Cunha & Gough is the single intervention with the greatest potential for population recovery. Our results support seabird conservation efforts by highlighting priorities for targeted management action.

Poster 80

## New studies to minimize fatal attraction of seabirds to artificial lights.

Airam Rodríguez
*The National Museum of Natural Sciences, Spain

Artificial lights at night cause high mortality of seabirds. Fledglings of burrow-nesting seabirds are attracted to artificial lights and then forced to land (grounded) when they fly from their nests to the ocean at night. Once grounded seabirds are vulnerable to fatal injuries, vehicle collisions, or predation. Seabirds grounded by lights have been found worldwide, mainly on oceanic islands but also at some continental locations. At least 72 seabird species are grounded by light pollution, being Procellariiformes the most affected seabird group. Rescue programs of grounded birds offer the most immediate and employed mitigation to reduce the rate of light-induced mortality and save thousands of birds every year. These programs also provide useful information for management of elusive and shy species. However, rescue programs are palliative actions as they rescue already grounded birds. Therefore, more research is critical to find seabird-friendly lights to reduce attraction and minimise mortality. I will briefly review the current state of knowledge of seabird attraction to light and I will focus on new studies to fill the information gaps and eventually mitigate this emerging source of mortality.

# Poster Session 2

## BEHAVIOUR AND EVOLUTION

Poster 81

**Breeding partners are dissimilar in their foraging strategy in a long-lived Arctic seabird.**

M. Gousy-Leblanc, A. Patterson, V.L. Friesen, K. Elliott
*University of McGill, Canada

For bi-parental care animals, the combination of traits within mates may be key for pair-bond formation and cooperation to successfully rear offspring. Studies investigating the similarity or dissimilarity in behaviour between partners, and the associated effects on fitness, are lacking for seabirds. Foraging behaviour is known to influence reproductive success and coordination of foraging efforts between partner could also influence fitness. Behavioural compatibility and coordination within partners are mostly important when individuals are constrained by environmental conditions and resource availability. The Thick-billed Murre (*Uria lomvia*) is an interesting bi-parental care species to study mate selection and its influence on fitness. This monomorphic species showed high partner fidelity and a low divorce rate. Using GPS-accelerometers (AxyTrek ™, Technosmart, 18 g, 1.9% of body mass) data from both individuals of 40 Thick-billed Murre breeding pairs from Coats Island (Canada, 2022-2023), we will investigate foraging strategy characteristics of Thick-billed Murres to determine if mating is non-random. We found that Thick-billed Murres pairs exhibit difference in the number of dives and the foraging trip distance. They also mate with partner that are similar in wing length. Knowledge of breeding pair formation is essential for understanding population dynamics, as partner choice influence many aspects of the reproductive success of animals.

Poster 82

## Adélie Penguin colony structure in space and time: identifying selection pressures that shape seabird colonies.

Lana Lenourry, Francesco Bonadonna, Jean-Yves Barnagaud, Téo Barracho, Adélie Krellenstein, Aymeric Houstin, Isabelle Brandicourt, Gaël Bardon, Nicolas Lecomte, Sebastian Richter, Alexander Winterl, Daniel P. Zitterbart, Céline Le Bohec
*University of La Rochelle, France

The determinants of colonial reproduction in seabirds emerge from evolutionary trade-offs and selective pressures shaping population dynamics. Breeding success of many colonial seabirds has been associated with both nesting site and parental quality. To our knowledge, there are no studies that integrate individual, topographic, and colonial factors to explain reproductive parameters. Here, we investigate how these factors influence nest distribution, nest and mate fidelity, and breeding success in Adélie Penguins at Pointe Géologie (Adélie Land, Antarctica) over nearly 15 years. Using centimeter-scale topographic modeling, we found that altitude, slope, and roughness determined nest spatial distribution. However, these topographical variables did not appear to play a role in individual reproductive success or in mate and nest retention. Individual and colonial parameters like age, structural size, and the distance between the nest and the periphery all influence individual reproductive success to the same extent. Our findings suggest that habitat selection occurs at a broader spatial scale than microhabitat. Future research should integrate social structure effects, such as kinship and neighborhood stability, to enhance models and our understanding of colonial breeding ecology.

Poster 83

## Movements of gulls breeding in an urban environment.

Giacomo Grosso, Claudio Carere, Giacomo Dell'Omo
*University of Tuscia, Italy

While many animals are negatively affected by habitat loss and cannot adapt to urban expansion, there are some cases of animals thriving in urban environments. Several species of gulls all around Europe have adapted living in cities. The Yellow-legged Gull *Larus michahellis*, a generalist seabird, is an example of such species. Its population has increased steadily in the city of Rome, since the 1980s. Not much is known about the movement ecology of these birds during their breeding period in the cities. During the breeding seasons in 2017, 2019 and 2024 we equipped 18 adults with GPS devices at their nests in the city centre of Rome, a highly touristic area. We calculated the gulls's home ranges during breeding and analysed the patterns in their movement at different time scales, focussing on their use of urban and non-urban features during foraging and roosting. We identified their key foraging sites and discussed the relative importance of different sites. Furthermore, we analysed the trips in relation to sex. The results highlight a preference for specific sites and large individual differences in this opportunistic species use of resources in the urban environment.

## Seabird Rescue and Rehabilitation

Poster 84

### Assessing threats to seabirds in the Southern Bay of Biscay: valuing admissions to Wildlife Rehabilitation Centres.

Isabel García-Barón, Javier Franco, Amaia Astarloa, Arkaitz Pedrajas, Beñat Iglesias, Jose Miguel Escribano, Manena Fayos, Daniel Fernández, Aitor Lekuona, Céline Maury, Álvaro Oleaga, Maite Louzao
*AZTI- Marine and Food Research Tecnhological Centre, Spain

Seabirds are one of the most threatened groups of marine fauna and are therefore good indicators of long-term and large-scale changes in marine ecosystems. Each year, numerous seabirds are admitted to Wildlife Rehabilitation Centers (WRCs), which play a crucial role in rehabilitating sick and injured individuals before releasing them back into their natural environment. This study assesses the admissions and causes of mortality of seabirds in the Southern Bay of Biscay (SBoB). Over a 19-year period (2004 - 2023), 8,986 seabird admissions were recorded in six WRCs. The main causes were cachexia (33.3%), storm weakening (17.5%), trauma (14.2%), crude oil exposure (6%), and interaction with fishing gear (5.1%). When all threats were combined, the Yellow-legged Gull (*Larus michahellis*; 33.6%), the Common Guillemot (*Uria aalge*; 28.7%) and the Northern Gannet (*Morus bassanus*; 15.3%) were the most frequently admitted species. On admission or during the rehabilitation process, 49% of the individuals died while 51% were released after rehabilitation. Considering the success rate of rehabilitation and the high number of individuals admitted, the importance of the WRC in strengthening seabird conservation efforts is highlighted. This study helps to fill existing knowledge gaps on the severity of different threats (e.g., climate change, fishing) to seabirds in the BoB, while contributing to the Marine Strategy Framework Directive for the assessment of Good Environmental Status.

## CENSUS, MONITORING AND DEMOGRAPHY

Poster 85

### Long-term Trends in Seabird Numbers in the Dutch Part of the North Sea Based on Monitoring from Aircraft (1991 – 2022).

Martin Poot, Ruben Fijn, Floor Arts, Rob van Bemmelen, Menno Hornman, Marc van Roomen, Hans Schekkerman, Cas Retel, Mervyn Roos, Leo Soldaat
*WMR - Wageningen Marine Research, Netherlands

In the Dutch sector of the North Sea the largest numbers of seabird species occur during the non-breeding season. Large numbers of cliff-nesting birds, e.g. guillemots, razorbills, gannets, and kittiwakes Winter in Dutch waters. Seabirds have been monitored by visual aerial surveys since 1990, conducted six times per year. In 2013, major changes in survey design, flying altitude and observation methodology were introduced. Transects were more evenly spread within the study area than before 2013, surveys were flown at considerably lower altitude to improve species recognition, and the counting method changed from a strip band registration to distance sampling from an aircraft that was newly equipped with spherical (bubble) windows allowing observers to look straight down. This shift was made “overnight” from one year to the next, but such changes pose a considerable risk of a trend break in the data. Here, we analyse how the two time series 1991-2013 and 2014-2022 can be linked and how the trend break is best overcome. We then place the species trends for the full range of years in a broader perspective by reflecting on trends in breeding populations, nationally and internationally. This exercise gave us confirmation that the trend break could be handled appropriately and yielded ecologically interesting results. We found large scale changes in seabird numbers that can be linked both to historical recoveries of populations, and to climate change.

Poster 86

## Towards a fully automated HiDef aerial seabirds at sea survey method with AI.

Martin Poot, Hendrik de Villiers, Jeroen Hoekendijk, Freek Daniels, Jim Hoekstra, Guruprasad Hegde, Hans Verdaat, Mardik Leopold, Anne Grundlehner, Steve Geelhoed, Anna Kersten, Dylan Verheul, Afra Asjes, Lydia Meesters
*WMR - Wageningen Marine Research, the Netherlands

A transition is underway in seabird monitoring from aircraft visual observations to high-definition digital camera image collection. Currently, the object detection and identification of the birds in the imagery is carried out by specially trained ornithologists. To make this more time- and cost-efficient, the apparent option is to automate this processing step through an AI setup. An international consortium is currently carrying out a project to develop an AI approach to automatically process digital HiDef aerial images for seabird surveys. The AI models are trained using images collected at two offshore windfarms in the Dutch part of the North Sea. For this project we implemented a two-step approach, where first objects of interest are detected in the imagery (now only seabirds, in future also marine mammals), followed by object identification/classification. Our approach performs well on species commonly encountered in the available images, such as guillemot, razorbills and Lesser black-Backed Gulls. However, to extend the applicability of our approach and to further improve the performance of our models, more training-images are needed, particularly of (1) both flying and sitting individuals, (2) juvenile/immature and adult animals (which differ in plumage, mostly dark versus light) and (3) images which are collected under different observation conditions (i.e., sun, clouds, waves). In this poster, we report our latest results and provide an outlook for the future.

Poster 87

## Discovery of a new North Sea European Storm-petrel colony.

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*Centre for Hydrology & Ecology, UK

Globally, the European Storm-petrel *Hydrobates pelagicus* has a population between 438,000-514,000 breeding pairs. Breeding sites occur along Western European coasts with smaller populations in the Mediterranean. However, there are no known colonies in the North Sea or along the UK's eastern coastline South of the Orkney Islands, despite tape luring along eastern coasts resulting in frequent captures at many sites. In this study, we employed a variety of methods to survey for European Storm-Petrel breeding activity on the Isle of May, Scotland between 2019 and 2023 after two individuals were heard calling in 2019. Using smell, visual observations, mist-netting and play-back surveys we confirmed European Storm-petrel breeding activity on the Isle of May. Our study revealed a new breeding site for the European Storm-petrel, extending their breeding range significantly further south into the North Sea than previously realised. Based on historic records, it is possible that this species has been breeding undetected on the island for at least a century. Given that the Isle of May is one of the most intensively studied seabird colonies in the world and yet this secretive species avoided proof of breeding for so long, where else might it be breeding?

Poster 88

## An evidence review of Marine Bird Spatial Use in the Celtic Seas.

Hannah F. R. Hereward, Hala El Haddad, E. M. Humphreys, Rachel C. Taylor, Chris V. Wernham, Andrew J. Upton
*BTO, UK

The health of Northern Ireland's marine ecosystems can affect a large number of biological, social, and commercial processes. Seabirds are an indicator of marine health thanks to their function as top predators in marine ecosystems. The UK and Ireland hold an internationally important number of seabirds, which makes monitoring those populations key to their conservation. Gathering distribution data for seabirds can help in understanding the factors affecting them. Whilst there have been various reviews of seabird distribution, their results remain in different data repositories and other datasets are yet to be combined in a meta analysis. Therefore, a report was commissioned by NIEA to scope the evidence available on the movements and spatial distributions of certain marine birds in and around Northern Ireland waters in order to identify knowledge gaps. We focus on 37 marine birds found offshore, away from the coastline, that utilise the Celtic Seas (Ospar Region III) and Ireland Exclusive Economic Zone marine environments only. We compiled metadata from ten different sources (including directly contacting researchers, a literature review and accessing various known archived datasets). Observation types were grouped into 12 categories which ranged from remote tracking technologies to direct observations. The occurrence of each species within each tracking method was compiled. Foraging hotspots were also identified for nine of the 37 species.

Poster 89

## From rocks to rafts: enhancement of the UK's Seabird Monitoring Programme.

Nina O'Hanlon, Sarah Harris, Niall Burton, Elizabeth Humphreys, Dawn Balmer.
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The Seabird Monitoring Programme (SMP) aims to ensure that sample data on breeding numbers and productivity are collected both regionally and nationally, for 25 species of seabird that regularly breed in Britain and Ireland, to enable their conservation status to be assessed. At present we cannot produce robust trends for all those species. Having taken the lead in coordinating this scheme, alongside partner JNCC and associate partner RSPB, we present plans to improve coverage of sites/species and data submission. This includes approaches to prioritise sites to ensure an adequate proportion of populations are monitored, quantify uncertainty (i.e., in site occupancy and observer error, and build on the scheme's engagement with the UK's network of dedicated seabird surveyors. We also consider enhancements and modernisation of monitoring methods and data recording capabilities of the scheme and across schemes collecting complementary data. This includes how best to incorporate data from remote technologies (such as time-lapse photography, audio monitoring, UAV surveys) to improve coverage and data collection. This is particularly pertinent for Manx Shearwater, Great Skua and Northern Gannet for which the UK holds internationally important breeding populations. Having robust data on seabird demographics is vital to identify key stressors acting on populations, detect population impacts of known stressors and identify and implement necessary conservation and management actions.

Poster 90

## Estimating Yelkouan and Scopoli's Shearwater colony size from number and duration of calls detected with a species specific algorithm.

Ricardo R. Fernandes, Martin Austad, Louie Taylor, Dries Engelen, Steffen Oppel, Konstantinos Psaroulakis, Nikolaos Stefanakis
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It is particularly challenging to estimate population size for burrow-nesting seabirds, especially in areas with difficult access. Autonomous Recording Units (ARUs) are progressively used for monitoring purposes, as they record colony soundscapes for long periods of time and can be especially useful for vocal colonial species such as procellariform seabirds. We trained a Deep Neural Network algorithm, implemented in Python, using recordings of Yelkouan Shearwater *Puffinus yelkouan* and Scopoli's Shearwater *Calonectris diomedea* from different colony sites in Malta and Croatia. The training dataset comprised a total of ~3 hours of calls for each shearwater species and ~16 hours of noise. At a probability threshold of 0.75, the resulting detection rates on a test set were 88% of *C. diomedea* calls and 53% of Yelkouan Shearwater calls, with a false detection rate of 0.4%. We then used the resulting model to detect calls in a multi-year dataset of sound recordings. Number and duration of detections showcase differences between years, while also displaying expected variation of calls between moon phases. Finally, we successfully modelled the number of nests within 100 m of some sound recorders to number and duration of calls as well as moon variables and used the models to predict colony size on areas with challenging access. We propose that the combination of ARUs and our model, enhanced with any additional site-specific noise sources, can better inform population size and trends across the species' Mediterranean range.

Poster 91

## Climatic variables and kittiwake phenology in the Celtic Sea.

lanor A. Knight-Rolfe, Matt J. Wood
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Seabirds are increasingly threatened by climate change, including weather pattern changes and rising ocean temperatures. Long-term population studies offer an opportunity to study the impacts of climate change on seabirds, and to gain an understanding of which factors might be affecting timing of breeding, survival and reproductive success. Long-term studies of Black-legged Kittiwakes *Rissa tridactyla* have observed changes in breeding phenology, related to changing ocean temperatures and the phenology of their forage fish food supply. Here, we focus on the phenology of the Black-legged Kittiwakes on Skomer Island, Wales, in the Celtic Sea; an area that has seen recent declines in the kittiwake population despite no apparent change in sea surface temperature (SST). Using long-term monitoring data dating back to the late 1980s, which became part of the Seabird Monitoring Programme in 1995, we examine associations between breeding phenology and environmental variables (SST, rainfall, storms, air temperature). Further work will move on to examining reproductive success and nest survival rate. This is, to our knowledge, the first study of the phenology of kittiwakes in the Celtic Sea, an area planned for extensive offshore wind development. This additional potential threat emphasises the importance of understanding the impact of climate historic climate change on breeding seabirds, to give a clearer context for offshore wind devices and other threats such as overfishing and pollution.

Poster 92

## Effect of environmental conditions on the survival of the most abundant Arctic seabird.

Marta Cruz-Flores, Jérôme Fort, Chirstophe Barbraud, Ann A.M. Harding, David Grémillet, Paco Bustamante
*LIENSs - Littoral Environnement et Sociétés, France

Environmental modifications due to climate change have various consequences on marine organisms' abundance, phenology, distribution, and demography. These consequences are especially evident for the Arctic region, which is warming four times faster than at other planet regions. Effects of environmental changes propagate from primary producers to top predators making seabirds a vulnerable group. In this study, we evaluated the influence of environmental conditions on Little Auk *Alle alle* survival, the most abundant Arctic seabird. We collected capture-mark-recapture data at the colony of Ukaleqarteq (East Greenland), during the breeding season (late-June to mid-August) from 2006 to 2022, and we determined how environment characteristics faced year round influence their annual survival. Specifically, we evaluated the influence of the Atlantic Oscillation, Sea Surface Temperature Anomaly (SSTA), Surface Ice Covering (SIC) and Chlorophyll-A as proxies of climatic conditions; as well as mercury and selenium concentrations as proxies of environmental pollution. SSTA and SIC encountered during breeding had respectively negative and positive effects on Little Auk survival after a three-year lag, while no effect of environmental pollution was found. This suggests impacts of raising temperatures on copepod early developmental stages with later effects on Little Auk food availability. This study shows how Little Auks, and thus other Arctic species, can be influenced by climate change

Poster 93

## Thermal (IR) drone imaging as a non-invasive application to monitor avian influenza outbreak in Northern Gannets.

Johan Henrik Funder Castenshiold, Sjurdur Hammer, Morten Frederiksen
*Aarhus University, Denmark

Prompted by the 2022 outbreak of avian influenza (HPAI), which highly impacted Northern Gannets, we utilised UAS flights to monitor the outbreak on the only Faroese Gannet Colony. Surveys were conducted at the peak of the breeding season (late July) and at the presumed introduction or early onset of HPAI in the colony. Moreover, surveys were repeated in 2023 for comparison. Our study, i) explored the use of a UAS equipped with both RGB and IR sensors to document the size, condition, and state of the gannet colony, and ii) evaluated the applicability of this dual sensor approach to detect and quantify the number of dead and sick birds in the colony. Furthermore iii), we used drone imaging (RGB and IR) to investigate if the number of deceased gannets in the colony occurs in non-random clusters, suggesting nest-to-nest transfer of HPAI. We found that thermal imagery showed great potential to enable detection and analysis of areas affected by dead or sick individuals. Moreover, creation of preliminary 3D models with layered imagery of both IR and RGB was successful in reconstructing the colony area, which consists of cliff sides with complex topography. Our findings so far suggest that transmittance of HPAI happens at close quarters within the colony, with highly clumped distribution of affected areas. It is our opinion that UAS surveys with thermal imaging can be used as a significant and promising tool in early detection and monitoring of current and future disease outbreaks.

Poster 94

## Refining estimates of demographic rates for Procellariiformes in the Irish & Celtic Seas.

Katie Bickerton, Catharine Horswill, Matt Wood
*University of Gloucestershire, UK

Understanding seabird demographics is challenging due to the intensity of monitoring needed for many analytical approaches, in addition to field logistics. Estimates are further limited in nocturnal burrowing species due to their cryptic behaviours. However, accurate estimates of demographic rates are crucial for Population Viability Analyses (PVAs), which are commonly used in environmental impact assessments for Offshore Wind Farms (OWFs). We aim to refine key demographic rates in seabird ecology, particularly breeding adult and juvenile survival for Manx Shearwaters and European Storm-Petrels in the UK, to better inform PVAs for proposed OWFs in the Irish and Celtic seas. Over the 3-year project, we will use long-term mark-recapture ringing datasets from key UK breeding colonies to estimate breeding adult survival. We will use Integrated Population Models to estimate juvenile survival, making comparisons with empirical estimates from ringing data. Then, we will assess different approaches to PVAs, comparing derived estimates with historical ringing data and evaluating the adequacy of the PVA approaches, including stationary vs. non-stationary demographic rates. This project is part of the wider ProcBe project (Procellariiform Behaviour and Demographics) which aims to improve understanding of at-sea behaviour, distribution and demography of UK Procellariiform species, to facilitate effective Environmental Impact Assessments for planned OWFs in the Celtic and Irish Seas.

Poster 95

## Not a Gull-ible traveller! Colony itinerancy in Audouin's Gull.

Massimo Sacchi, Barbara Amadesi, Marco Zenatello, Bernard Recorbet, Camilla Gotti, Gilles Faggio, Arnaud Ledru, Adriano de Faveri, Nicola Baccetti
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One of the most important determinants of the successful conservation of highly mobile marine birds like the Audouin's Gull *Ichthyaetus audouinii* is understanding the dynamics related to the intermittent occupation of breeding sites. This species often shows itinerancy of colonies from one breeding season to the other. Movements between sites may be linked to source-sink dynamics between larger and smaller colonies. Still, the mechanisms for movement between them or between sub-areas within the same breeding areas are unclear, likely due to multifactorial phenomena. Variables that have been hypothesised to be correlated to this behaviour could be the productivity or size of the originating colony, as well as environmental variations and repeated perturbance over time (including human disturbance and predation). In this sense, the behaviour of Audouin's Gull could be an adaptive response to environments with unpredictable variations. Our study was conducted over 25 years on a metapopulation of Audouin's Gulls covering the NW Tyrrhenian range (Corsica, Sardinia, and the Tuscan Islands), using a multi-event capture-recapture analysis to investigate natal site fidelity of young breeders and subsequent fidelity to breeding sites. The dataset consists of 3,500 ringing records of chicks and 11,000 resight events collected systematically during the breeding season in all known colonies in the study area. The analyses quantify the probability of changing breeding sites, stratified by age, and examine variables significant in the individual or group choice regarding the annual variation of breeding locations, such as increasing individual survival probability or seeking favourable geographic, structural, or environmental conditions.

Poster 96

## Impact of oceanographic fronts on diversity of seabird, fish, and marine mammal species.

William T Schneider, Beth E Scott, and James J Waggitt
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Tools are required for the planning of offshore windfarm development to avoid them being placed in highly sensitive areas for marine life. Offshore windfarms may change the locations and dynamics of oceanographic fronts which are important to many marine animals, including seabirds. Using observation data spanning over 40 years, the FRONTWARD project aims to investigate the link between oceanographic fronts and marine biodiversity. A spatial biodiversity index in waters around the UK will be built comprising of observations of > 50 species of seabirds, as well as fish and marine mammal species. Associations between the biodiversity index and oceanographic fronts will be explored. Maps of any resulting associations as well as of hotspots of marine biodiversity will be used to help inform offshore wind development.

## CLIMATE CHANGE AND EXTREME EVENTS

Poster 97

**Massive wreck of Atlantic Puffins and other seabirds in Iberian Peninsula and Canary Islands during January-February 2023.**

Nuno Oliveira, Inês C. Varanda, Michael P. Harris, Ana Almeida, Hany Alonso, Alexandre Bouça, Marisa Ferreira, Maren Georg, João P. Lopes, Marina Sequeira, Francisca Hilário, Paulo Lago, Ludovico de Vega del Val, José Manuel Arcos, Juan Antonio Lorenzo, Manuel Fernandez Pajuelo, Nicolás López-Jiménez, Kiko Álvarez, Joana Andrade
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In Winter 2023, a large number of dead and live seabirds, particularly Atlantic Puffins *Fratercula arctica*, washed up along the coast of Iberian Peninsula and Canary Islands. These massive mortality events can be associated with different causes (e.g., extreme weather conditions, food shortages, pollution or bycatch) and, when occurring frequently or at a large spatial scale, can have a significant impact on seabird populations. After a first alert during mid-January 2023, a collaborative effort was put together to rescue and collect stranded seabirds in Portugal and Spain, including public authorities, recovery and research centres and NGO with the support of hundreds of volunteers. During January and February, we recorded 5,057 stranded seabirds of 25 different species, 80% of which were Atlantic Puffins (N=4,054). The top peak occurred in the 2nd fortnight of January, when nearly 90% of all birds were reported. From a subsample of birds, most puffins were adult birds (78%, n = 242) and 98% (n = 224) showed conditions to fly. Ten ringed puffins were birds from UK breeding colonies, including three birds >20 years old. Several hundreds were rescued alive and transported to wildlife recovery centres but the survival rate was low. Necropsy of the birds were inconclusive regarding the cause of death but most birds were emaciated, showing gastrointestinal vacuity and atrophy of internal organs. All puffins tested for H5N1 were negative.

Poster 98

## Atlantic Puffins *Fratercula arctica* mortality in the Portuguese West coast in early 2023.

Rute A. Costa
*University of Aveiro, Portugal

This study presents data on a mortality event of the species *Fratercula arctica* in the central region of Portugal and data was also used to improve reporting of species biometrics. More than 500 seabirds were collected from beaches in the central coast of Portugal, in January/February of 2023, as casualties of a massive wreck. We were able to thoroughly analyse 444 Atlantic Puffins (171 live and 273 dead birds). From the live birds that entered the Ecomare Marine Rehabilitation Centre, only 18 birds survived the rehabilitation process and were successful release. It was possible to perform 426 post-mortem examinations and to collect 288 individual photographs to analyses wing feather condition. The presence of ringed birds suggests that the birds originated mainly from colonies on Scotland. Most of the birds were female adult and were emaciated, with significant low-fat deposits, and had presumably starved to death. This study also revealed differences in wing length and bill depth between different age and sex categories. Further long-term studies are necessary to verify the significance of this mortality event on the population levels.

Poster 99

## The potential impact of climate and its consequences on seabird distribution in Ghana.

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In this work, we examine data on the abundance and distribution patterns of ten seabird species that breed in Ghana. The populations of six species that primarily eat rock lobster, sardine, or anchovies dropped significantly. The distributions of these three forage resources have recently shifted to the South and East, most likely due to environmental change, while fishing may also have had an impact. In Ghana, the total populations of the four remaining species saw significant declines due to their confined foraging ranges during breeding and behavioural inertia. It is believed that dependent seabirds' prey distributions off the Western coast of Ghana and the northern islands are out of balance as a result of the migration of forage supplies away from those islands. The distributions of three seabird species, which do not compete with fisheries for prey, have also shifted to the South and East, indicating the presence of environmental forcing. However, the declines of these species off the Northwest coast of Ghana were less severe, and over the long run, the populations in Ghana either remained stable or grew. Possible measures to lessen the negative effects of seabird distribution shifts include establishing new colonies closer to the current food source, restricting fishing around affected seabird colonies, and allocating permissible catches of shared forage resources at the regional level.

## CONSERVATION PHYSIOLOGY

Poster 100

### Diversity of seabird species between protected and unprotected areas of the wetlands of Ghana.

Emmanuel Frimpong, Ntow Ofori Enoch
*Institute of Agriculture, Education and Rural Development Research, Ghana

One of the most intricate and captivating aspects of bird behavior is their extended, ceaseless migration. Though the wetland Ramsar sites are significant seabird wintering area, very little is known about the diversity and utter lack of density of these birds. Purpose of this study was to evaluate the migratory bird population in the wetland's Unprotected Areas (UPAs) and Protected Areas (PAs). From 14 wetlands, a total of 99 census points (48 point count stations in the PAs and 51 in the UPAs) were surveyed at a distance of 400 m and a radius of 100 m. Eighty different species of migratory birds from 13 orders and 25 families were identified. Of the eighty species, 20 were migrants inside Africa, while 34 spent the Winter in the Palearctic, two of which are threatened worldwide: the European Turtle Dove and Streptopelia. The results indicated that there was no significant difference in the density of birds between the two areas ($p = 0.9443$), while protected wetlands had a substantially larger species diversity ($H' = 1.84$) than unprotected ones ($H' = 1.28$) ($p = 0.0053$). The species composition of the two regions was 81% comparable. The wetland was home to both Palearctic and Intra-African migrating birds, demonstrating the significance of the Ramsar site as a seabird wintering area. Given that Ghana is a signatory to numerous international treaties aiming at the conservation of these birds, the government of Ghana ought to safeguard these wintering marine birds.

# FISHERIES

Poster 101

## Evaluating the bycatch of endangered, threatened, and protected species in the artisanal and industrial Basque fleet.

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Fisheries bycatch, defined as the unintended catch of non-target species while fishing, has been identified as one of the main threats to the populations of many species around the world, some of them considered endangered, threatened and protected (ETP) species. This interaction turns especially worrying in the case of seabirds, as their conservation and long-term viability can be dramatically affected by fisheries bycatch. For this reason, this study evaluates seabird's bycatch occurring in both the artisanal and the industrial basque fleet operating in the Bay of Biscay during 2018-2022. Up to five ETP species were reported as bycatch, from which one was classified as critically endangered. For these species spatio-temporal patterns were assessed, and when possible, mortality rates were estimated. For the species most frequenty caught, the Northern Gannet *Morus bassanus*, a further analysis was conducted consisting of modelling the number of individuals bycaught. As explanatory variables the information collected by scientific observers onboard was used, which included information of the fishing operation (position, depth, duration) as well as catch-related information (biomass of target and accessory species). Results obtained here provided insights on the main drivers leading the incidental catch of this species, which may be used to identify potential mitigation measures contributing to develop more sustainable fisheries.

Poster 102

## Spatial assessment of the interplay between fishing activity and marine protected areas during the Atlantic phase of the critically endangered Balearic Shearwater.

Maite Louzao, David García, Gemma Carrasco, Isabel García-Barón, Marina Ramírez, José M. Arcos
*AZTI- Marine and Food Research Tecnhological Centre, Spain

Invasive alien species, fisheries bycatch and climate change are the main global threats to seabirds, including the critically endangered Balearic Shearwater *Puffinus mauretanicus*. At sea, bycatch emerges as the primary conservation concern. The present work aims to assess the spatial overlap of this species with the main industrial fishing gears during the non-breeding period in the NE Atlantic, also considering the interplay between fishing activity and Marine Protected Areas (MPAs). The information recorded by 53 geolocation devices was analysed during 88 annual cycles (2017-2022), defining two main non-breeding areas (kernel UD 75%): the Western Iberian Peninsula (WIP) and the Bay of Biscay (BoB). The total fishing activity overlapped with these areas (63%, 25.7%, 7.7% and 3.6% respectively for bottom trawling, fixed gears, pelagic trawl and purse seine, and bottom seine), while 93.5% of the total industrial fishing effort occurred in the BoB. In addition, 48% and 54% of the fishing effort within MPAs occurred in the BoB and WIP, respectively. In terms of human impacts within MPAs, general fisheries impacts such as "professional active fishing" and "recreational fishing" with medium-high impacts were identified in 24% and 23% of MPAs, respectively (out of a total of 120). Such spatial fisheries information should be incorporated into MPA management and monitoring to effectively conserve priority species and ensure minimal impact from potentially problematic fishing gears.

Poster 103

## Seabird bycatch assessment in Northwest Spain through fisher's involvement.

Paulo Lago, Vero Cortés, Lucía Soliño, Jose M. Arcos
*SEO/BirdLife, Spain

Bycatch in fishing gear is a major threat for several seabird species. It is particularly difficult to assess when small-scale fisheries are involved, given their usual large number of vessels, limited opportunities to get onboard, and irregularity of bycatch events, making traditional observer programmes unpractical. The highly productive area of Rías Baixas (Galicia-NW Spain) holds a large fishing fleet, mostly small-scale and polyvalent. Here we describe work conducted by SEO/BirdLife in 2020-2023 to evaluate seabird bycatch in the area using two methodological approaches in collaboration with fishers: (1) structured interviews; and (2) logbooks filled daily by the fishers with the regular support of observers in port. 108 vessels from 18 ports were interviewed (2020) providing a general overview of gears involved and species affected, being bycatch in trammel nets the major concern. 13 vessels from six ports monitored with self-reporting logbooks (2020-2023) reported 1,666 fishing trips (74% corresponding to trammel nets). 56 birds of five species were captured, the main concern being the bycatch of European shags (26) in trammel nets. Shag bycatch occurs along the year, affecting both sexes and all ages, with a bycatch rate of 0.021 individuals by fishing trip, that highly varies depending on depth of operation, location, and vessel. This study suggests that the level of bycatch poses a serious threat for the declining local shag population (~850 bp).

Poster 104

## Environmental conditions shape fishery attendance rate and foraging strategies of Scopoli's Shearwaters in the Western Mediterranean.

José M. Reyes-González, Fernanda De Felipe, Virginia Morera-Pujol, Andrea Soriano-Redondo, Leia Navarro-Herrero, Laura Zango, Salvador García-Barcelona, Raül Ramos, Jacob González-Solís
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Resource availability at sea is patchily distributed and also fluctuates over time. The dynamic marine environment leads to varying availability of feeding resources for seabirds, impacting their foraging strategies, breeding success, and eventually population dynamics. Human fishing activities further influence resource availability by providing discards, an easily accessible and predictable resource for seabirds. Understanding how the interplay between fisheries and environmental conditions may shape seabird ecology is crucial, especially in the context of climate change. We studied the role of fisheries in shaping the foraging strategies of Scopoli's Shearwater *Calonectris diomedea* over four years with contrasting environmental conditions. Between 2012 and 2015, we tracked a total of 635 foraging trips from 78 adults breeding in the Western Mediterranean Sea, a region under intense fishery pressure. We found that birds showed lower fishery attendance and increased foraging effort in years with unfavourable environmental conditions compared to the year with the most favourable conditions. Our results also revealed that environmental conditions influenced space use, feeding resources, and fishery attendance differently in males and females. These findings underscore the importance of accounting for environmental variability over time in seabird-fishery interactions, particularly given the projected environmental changes expected under future climate change scenarios.

# FORAGING AND FEEDING ECOLOGY

Poster 105

## No bird is an island: Understanding the role of pair behaviour in responses to the environment.

Natasha Gillies, Richard Phillips, Jonathan Potts, Denis Réale, Henri Weimerskirch, Alastair Wilson, Frédéric Angelier, Christophe Barbraud, Ashley Bennison, Karine Delord, Prescillia Lemesle, Samuel Peroteau, Andrew Wood, Samantha Patrick
*University of Liverpool, UK

In the face of rapid climate warming, the ability to respond by changing behaviour may be a key determinant of species resilience. This is particularly true of seabirds, which experience diverse environmental conditions over their long lifespans. Individual foraging behaviour, which influences resource acquisition, is known to respond to environmental variation and affect breeding success, but there are two major gaps in our understanding of the process. First, despite the role of biparental care in resource acquisition, which ultimately influences fledging success, many analyses focus on the individual level. Second, while changes in foraging behaviour are commonly proposed as a mechanism linking environment and fitness, the direct and indirect pathways by which foraging mediates this relationship are poorly resolved. Using a long-term dataset comprising several hundred pairs of Wandering and Black-browed Albatrosses from four populations, we use structural equation models to partition the effects of individual and pair behaviour, environment, and their interaction on reproduction, shedding light on whether and how foraging behaviour mediates environmental impacts on breeding. We use this approach to test whether species and populations differ in their response to the environment and implications for resilience. With some populations exhibiting concerningly low reproductive success, these analyses reveal whether foraging behaviour holds the key to adapting to a changing climate.

Poster 106

## Trophic ecology of Wintering alcids in Southern Europe.

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The Bay of Biscay (Southwest Europe) serves as a crucial Wintering area for seabirds, offering essential resources and refuge during harsh weather conditions. However, every year, many seabirds are beached along the French and Spanish coasts of the Bay of Biscay, often as a result of extreme weather events or accidental bycatch in fisheries. Our study delved into the dietary habits of three prevalent auk species in the Bay of Biscay during the Winter season using Bayesian isotopic mixing models. To achieve this, we analysed the stable isotope ratios of carbon (δ13C) and nitrogen (δ15N) in muscle samples taken from beached individuals of Razorbills *Alca torda*, Atlantic Puffins *Fratercula arctica*, and Common Guillemots *Uria aalge*. Additionally, stable isotopes were measured in six species of fish and crustaceans previously identified as prey species based on dietary observations. The results revealed clear resource partitioning among the Auk family. Common Guillemots exhibited a piscivorous preference feeding predominantly on small pelagic fish, particularly Sprats *Sprattus sprattus*. In contrast, Razorbills and Atlantic Puffins displayed a preference for crustaceans, with the former targeting primarily hyperiids and the latter favouring Krill *Meganyctiphanes norvegica*. These findings provide valuable insights into the wintering diets of these seabird species within the Bay of Biscay, improving our understanding of their ecological dynamics.

Poster 107

## Mapping seabird and forage fish interactions to inform conservation strategies.

Sabiya Sheikh
*University of Exeter, UK

Understanding links between seabirds and their prey is key for establishing effective spatial protection. Seabird population declines have been linked to climate and fisheries-induced prey changes, despite increase in onshore conservation efforts such as rat eradication. Here, we aim to address fine-scale responses of seabirds to prey distributions in the Isles of Scilly, an archipelago off the southwest coast of England that hosts an internationally important assemblage of 13 breeding seabird species. We will use GPS tracking data collected from two seabird species of conservation concern; Lesser Black-backed Gulls *Larus fuscus* and European Shags *Falacrocorax aristotelis* to map their foraging grounds during the breeding season. In addition, we will compare seabird hotspots to prey-fish distributions, collected using baited remote underwater video (BRUV) deployments and acoustic prey biomass surveys to compare prey availability among species and foraging sites. In the face of local declines in seabird abundance and productivity on the Isles of Scilly, this study will enhance our understanding of marine ecosystem ecology on the Isles of Scilly and our ability to mitigate human impacts on their populations.

Poster 108

## Optimal foraging at multiple scales by a tropical seabird.

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To forage optimally, predators must seek to maximize their energy gain whilst minimizing the associated costs. We investigated whether Redfooted Boobies *Sula sula rubripes* from the Chagos Archipelago, Central Indian Ocean, foraged optimally at different scales by using accelerometry data, validated by bird-borne video cameras, time-depth recorders, and GPS loggers, to infer behavioral and energetic budgets. Firstly, we investigated factors determining the larger-scale decisions that Red-footed Boobies made regarding whether to return to their centrally-placed breeding colonies after a single day or to engage in multi-day foraging trips, thereby spending nights at sea, with associated predation risks. Red-footed boobies are adept at foraging on pelagic prey (like flying fish; Exocoetidae), and so secondly, we investigated the finer-scale decision-making process that determined whether they captured prey either via shallow plunge-dives and costly take-offs from the sea, or more skilled aerial capture just above the water's surface. At both scales, there was a trade-off between the benefits of catching more prey and the costs of spending more time and energy in doing so. We therefore identified when Red-footed Boobies foraged optimally, maximizing their energy intake against the backdrop of tropical oceanic waters, as well as when they got it wrong, causing their energy budgets to fail.

Poster 109

## Trophic plasticity of a tropical seabird revealed through DNA metabarcoding and stable isotope analyses.

Alberto Piña-Ortiz, Vladislav Marcuk, José Alfredo Castillo-Guerrero, Juan F. Masello, Paco Bustamante, Sven Griep, Petra Quillfeldt
*University Justus Liebig Giessen, Germany

DNA metabarcoding and stable isotope analysis have significantly enhanced our understanding of marine trophic ecology, aiding systematic research on foraging habits and species conservation. This research used the aforementioned methods to analyze fecal and blood samples to compare trophic characteristics and dietary variation between two colonies of Red-billed Tropicbirds *Phaethon aethereus* along the Mexican Pacific. Trophic patterns among different breeding stages were also examined at both sites. Red-billed Tropicbirds primarily consumed epipelagic fish, with some intake of cephalopods and small crustaceans. Dietary preferences varied between colonies, with distinct prey items predominating at each site. Furthermore, diet variations between breeding stages were observed at both sites; temporal changes in diet were attributed mainly to the inclusion of transient prey. $\delta^{15}$N and $\delta^{13}$C values agreed with DNA metabarcoding results, showing differences between sites and breeding stages. The widest isotopic niches were observed during incubation stages at both colonies, and pairwise comparisons of niche breadth between breeding stages mirrored differences in prey consumption. The variation in dietary profiles between colonies is primarily linked to contrasting environmental conditions affecting local prey availability, while trophic plasticity between breeding stages results from changing physiological requirements and environmental changes affecting prey availability.

Poster 110

## Tracking of Emperor Penguins in Snow Hill colony.

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The Emperor Penguin *Aptenodytes forsteri* is an iconic species and a top predator in Antarctica, serving as a bioindicator of ecosystem health. From November 2023 to February 2024, we conducted one of the first scientific expeditions to Snow Hill colony during the chick-rearing period. Equipped with PTTs tags, 15 adult penguins (breeders and non-breeders) were tracked. Our analysis revealed four breeders with distinct behaviors, showcasing specialization during chick provisioning trips. In contrast, 11 non-breeders showed eastward meandering trips, later looping south and west along the path of the Weddell Sea Gyre. These non-breeders did not return to Snow Hill or visit other colonies. During post-fledging, breeder tracks followed the same paths, with observations of moulting on sea ice south of Snow Hill colony. Our data will show detailed analyses of trip metrics and sea ice habitat use by Emperor Penguins across different lifecycle stages (i.e., breeding, non-breeding, and moulting). Furthermore, the poster presentation will discuss these findings for marine spatial planning and for conservation management, contributing to the development of policies towards the Emperor Penguin, a specially protected species under the Antarctic Treaty.

Poster 111

## Are there links between diet, population trajectories and pollutant exposure in Giant Petrels?

William F. Mills, Tim I. Morley, Stephen C. Votier, Danielle L. Buss, Paco Bustamante, Francisco Ramírez, Manuela G. Forero, Richard A. Phillips
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Northern and Southern Giant Petrels *Macronectes giganteus* are the dominant avian scavengers in the Southern Ocean. South Georgia hosts globally important breeding populations of both species, which increased from the 1980s to 2000s, though far more rapidly for Northern Giant Petrels. We investigated the links between Giant Petrel diets and both population trajectories and mercury (Hg) exposure at South Georgia. Here, we: (1) compared chick stomach contents from the mid-2010s and 1980s; and (2) analysed total Hg (THg) concentrations and δ13C and δ15N values in chick feathers from 2013-2020. Stomach contents were similar between species in the 2010s, though female parents delivered more penguin and Antarctic Krill *Euphausia superba*, and males more Antarctic Fur Seal *Arctocephalus gazella* carrion and flying seabirds. Differences in stomach contents between the 2010s and the 1980s were no greater than typical annual variation (i.e., among recent years), and there were no clear links with the differing population trajectories. Mean feather THg concentrations were similar between species, but decreased from 2013 to 2020 in Southern Giant Petrels, whereas there was no clear trend for Northern Giant Petrels. In both species, THg concentrations were positively related to δ13C values, potentially reflecting increasing Hg contamination with greater consumption of Fur Seal carrion. We discuss our results in relation to the conservation status of Giant Petrels and changing resource availability in the region.

Poster 112

## Why are puffins bringing in less herring to their chicks than other sympatric species?

Tristan Sanford, Tony Diamond, Heather Major
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Sea surface temperatures are rapidly rising in the Gulf of Maine, which has already impacted many seabirds' breeding success mostly due to reduced availability of good-quality prey, notably Atlantic Herring *Clupea harengus*. This study investigates why adult Atlantic Puffins *Fratercula arctica* from Machias Seal Island present reduced herring in chick diets compared to Razorbills *Alca torda* and Common Murres *Uria aalge*. Understanding this is key to effective conservation in a changing climate. Tracking and pressure data from these three seabirds corresponding to the chick-rearing period were collected alongside chick diet and herring fishery landings and areas. Puffins foraged in open waters further south from the colony in 2022 than in 2023, when they remained around the island. Razorbills and murres foraged close to the coast of Maine and New Brunswick and the island of Grand Manan. We found a correlation between chick herring consumption and herring fishery landings. Additionally, Razorbills' and murres' foraging areas overlapped with fisheries, whereas puffins' foraging areas did not. This suggests fishery activity near herring spawning grounds may be reducing prey accessibility for puffins around the colony. In contrast, Razorbills and murres may be coping by feeding closer to the spawning areas where herring densities are higher. This study emphasizes the need for comprehensive approaches to address the ecological consequences of climate change on seabirds.

Poster 113

**Diet metabardoing as a tool to assess reliance on anthropogic resources in Lesser Black-backed Gulls *Larus fuscus*.**

Alice Risely, Naiara Sales
*University of Salford, UK

Diet metabarcoding is a promising tool for quantifying foraging strategies and feeding responses of wildlife urbanisation and wider land/sea-use change. However, metabarcoding has its challenges and biases, and is often difficult to implement, especially in birds which tend to have high levels of uric acid in faeces. Here we present results from a preliminary study that compared diet metabarcoding results from (non-paired) faecal and regurgitate samples collected from juvenile Lesser Black-backed Gulls *Larus fuscus* in order to quantify reliance on anthropogenic resources.

Poster 114

**New insights into the diet of Scopoli's and Yelkouan Shearwaters through DNA metabarcoding.**

Martin Austad, Lucie Michel, Juan F. Masello, Jacopo G. Cecere, Giacomo Dell'Omo, Federico De Pascalis, Petra Quillfeldt
*University Justus Liebig Giessen, Germany

The Mediterranean Sea is under considerable pressure from overfishing while climate change is affecting marine food webs. Studying the diet of top predators such as seabirds can reveal shifts in prey availability and deviations from preferred prey. We identified and compared the diet of two sympatric shearwater species, the Scopoli's Shearwater *Calonectris diomedea* and Yelkouan Shearwater *Puffinus yelkouan*, in the central Mediterranean through DNA metabarcoding. Faecal and regurgitate samples were collected opportunistically or by cloacal swabs in breeding colonies on Linosa, La Maddalena, and Malta. We applied metabarcoding using universal and specific primers (metazoan, fish, and cephalopods) to identify prey at the family, genus, or species level. While we successfully applied genetic techniques to identify prey with high taxonomical detail, we show that several samples did not have sufficient prey DNA material, and swabs are not necessarily suitable to obtain the diet of specific individuals (e.g., on tag retrieval). We present a list of identified fish species/prey families and compare the diet composition between the species and study sites. Our results contribute to the management of forage fish stocks within protected areas and fish-revival zones.

Poster 115

## Diving into Yelkouan Shearwater foraging behaviour with time-depth-recorders.

Martin Austad, Danae Portolou, Dimitra Christidi, Angelos Evangelidis, Benjamin J. Metzger, Hannah R. Greetham, Rita Matos, Manya Russo
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Diving behaviour in seabirds can help understand what prey species are being targeted during dives, dependent on depth, habitat, and time of day. Knowledge of seabird species diving depths is also important for understanding susceptibility to bycatch in fishing gear. The Yelkouan Shearwater *Puffinus yelkouan* has been extensively tracked in parts of its range, but we lack knowledge of its diving behaviour, with maximum dives recorded at 30 m in France. The miniaturisation of logging devices has allowed for both GPS- and time-depth-recorders to be built into the same device. We deployed Axy-Trek ~8 g loggers from TechnoSmart on Yelkouan Shearwaters breeding on Malta and Greece as part of the LIFE PanPuffinus! project. GPS position was recorded every 5 minutes, while pressure was measured at 1 Hz. We obtained 17 tracks and analysed them with the R package 'diveMove', resulting in over 15,000 dives. The maximum dive depth was 51.56 m, while the mean was 6.65 m and only around 7% were deeper than 20 m. We further compare diving behaviour between colonies, analysing the pelagic and benthic habitat of dives. Our results also support previous findings that Yelkouan Shearwaters forage mostly during the day, with only 378 dives registered between sunset and sunrise. A next step for this study is to use these data to calibrate accelerometer data, which is more widely collected, and to understand how many of these dives might be occurring in interaction with fishing vessels.

Poster 116

**A method to estimate avoidance distance of Common Scoters to ship traffic.**

Peter van Horssen, Martin Poot, Ib Krag Pettersen, Els van der Zee, Sjoerd Dirksen, Mardik Leopold
*GreenStat Company, Norway

Absract:
This poster describes and illustrates a method to estimate the avoidance distance of Common Scoters to ship traffic. For the North Sea coastal zone of the Wadden Sea Islands, we used AIS (automatic identification system) data and exact locations of (groups of) Common Scoters *Melanitta nigra* to estimate distances between ships and Common Scoters. Since AIS data also includes different types of ship traffic (coasters, fishery, leisure), we determined avoidance distances per type of ship traffic. We determined distances to the nearest five (different) ships per sea duck group, facilitating a sensitivity analysis. Compared to traditional disturbance measures where distances are recorded for scoters actively flushed by ship traffic, avoidance distance also includes groups of Common Scoters still resting or feeding in relatively undisturbed habitat. The avoidance distance is used with statistical analysis to investigate the effect of ship traffic on the numbers and distribution of common scoters in the North Sea coastal zone off the Wadden Sea Islands in the Netherlands (Poot et al., talk at this conference).

Poster 117

## The foraging ecology of chick-rearing Snow Petrels from two colonies in Dronning Maud Land, Antarctica.

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Antarctic sea ice is an important component in global climatic and biogeochemical cycles, providing critical habitat for some of the world's most abundant taxa. Snow Petrels *Pagodroma nivea* are fulmarine petrels endemic to Antarctica, where they feed predominantly in association with sea ice. As such, they are potential indicators of climate change. Little is known about their foraging ranges, spatiotemporal variation in habitat use, or the effects of the central-place constraint during the breeding season. This hinders our understanding of the species' response to a changing Antarctic environment. To quantify foraging behavior and habitat use, we tracked Snow Petrels using GPS loggers from two colonies, Svarthamaren and Utsteinen in Dronning Maud Land, during the 2021- 2022 Austral Summer. Concurrently, we collected tissue and diet samples from breeding adults. Prey were identified using conventional diet analysis of visible remains alongside genetic markers to assess inputs from poorly preserved remains. We compare these results to stable isotope signatures ($\delta^{13}C$, $\delta^{15}N$) and stomach oil lipid distributions to explore how habitat use links to diet between sites, sexes, and through the breeding season. We find variations in the diet and habitat use of breeding adults supported by qualitative prey estimates and biochemical signatures.

Poster 118

## How variation on Omega-3 may affect breeding performance of marine avian species?

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Global temperature increase was particularly prevalent at high latitudes, where it affected the phenology and distribution of food resources, upon which Arctic breeding birds relied to provide for their chicks. Likely due to the declining availability of high-quality resources (e.g., fish), some avian marine species were recorded providing terrestrial food items (e.g., insects). However, such substitute diets reduced chick growth, which depressed productivity. In this study, we assessed the role of polyunsaturated fatty acids (PUFAs), such as omega-3, which is particularly abundant in fish, on the growth rate of Arctic Tern *Sterna paradisaea* chicks. We sampled two colonies (coastal vs. inland) and supplemented chicks with omega-3 to evaluate the effect of diets with varying PUFA levels on chick development. Additionally, we equipped the parent birds with GPS loggers (Global Messenger tags - 2.0 g) to evaluate their behaviour during incubation and chick rearing periods. These results anticipated the effects of reduced fish availability on the population resilience of Arctic breeding marine birds.

Poster 119

## Varying consistency in foraging behaviour is related to personality and has fitness consequences in chick-rearing Razorbills.

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Individuals within populations can vary in their behaviour and reproductive success, and these differences can be related to personality. Animal personality is defined as consistent between-individual differences in behavioural traits that persist through time and across contexts. After identifying personality in Razorbills using observer ratings (docile-aggressive trait), we aimed to identify whether Razorbill foraging behaviour was consistent (i.e., repeatable) during chick-rearing and if the consistency and behaviour of individuals was related to personality. To do this, we carried out nest monitoring to determine reproductive success and we tagged chick-rearing Razorbills with GPS-TDR tags (2019, 2020 and 2023) to record foraging trip (e.g., duration, location) and dive metrics (e.g., dive depth) in coastal Newfoundland, Canada. Analyses revealed that repeatability of foraging trip metrics differed within and among years with varied presence and biomass of their main fish prey species (Capelin), while dive depth was highly repeatable in all contexts. Additionally, docile birds were more consistent than aggressive birds in foraging trip duration and total trip distance. Reproductive success was influenced by a combination of personality and prey availability. Overall, this study represents a first step in investigating the fitness consequences of personality in this species.

## MOVEMENT ECOLOGY

Poster 120

### Territory size and habitat use in the Falkland Steamer Duck *Tachyeres brachypterus.*

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The Falkland Steamer Duck *Tachyeres brachypterus* (FSD) is one of only two endemic vertebrate species in the Falkland Islands. Yet, while known to hold territories (both in land and at sea) on the entire coastline, very little is known about its ecology. The aim of the present study was to investigate territory size and use in breeding pairs from two contrasting environments (harbour and offshore island). A total of 43 individuals were GPS tagged across two breeding seasons (harbour n = 20; offshore island n = 23). Territory size was estimated using the standard home range (UD95%) for Bleaker Island (86.3 ± 38.9 ha) and Stanley Harbour (84.4 ± 28.3 ha). There was no significant difference between the locations (P = 0.08). Using Hidden Markov Models, the GPS tracks were categorised into three states: resting, foraging, and travelling. The outputs predicted individuals to be resting along the coastline and foraging both in shallow areas near the coastline and along the edge of kelp forests. These findings were validated by direct observations and kernel outputs of territory use. They highlight the importance of kelp forests as foraging habitats. However, further investigation on their diet is needed to better understand the link between kelp forests and FSD, both ubiquitous of the archipelagos' coastline. A fine understanding of the ecology of the FSD is key as the species could be a useful sentinel species for the coastal ecosystems, especially in the context of climate change.

Poster 121

## Partial migration in the West African Crested Tern.

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West African Crested Tern *Thalasseus albididorsalis*, a new species recently split from the Royal Tern *Thalasseus maximus*, is the most numerous breeding tern in West Africa. Yet, it presents a restricted breeding distribution (from Mauritania to Guinea), wherein most individuals breed in Senegal and Guinea-Bissau. During the non-breeding season this species has been recorded from Morocco to Namibia but very little is known about its ecology during the non-breeding period, and no studies have focused on migratory movements and strategies. We GPS tracked six West African Crested Terns breeding in Guinea-Bissau over one year (from April 2021 to April 2022). We found that while three individuals remained resident, spending the non-breeding season between 170 to 340 Km from the colony, the other three performed long distance migrations, spending the non-breeding season between 3,000 and 5,000 Km from the breeding colony. Resident birds mostly used coastal areas of Guinea during the whole non-breeding season, while migratory individuals used distinct non-breeding sites, from Guinea to Angola. These are the first results on the non-breeding movements and distribution of West African Crested Tern, revealing partial migration within individuals of the same breeding population.

Poster 122

## SEATRACK: A decade of multi-species, multi-population tracking of seabirds on an ocean-basin scale.

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Many seabird species undertake extensive seasonal migrations, traversing vast marine ecosystems and often migrating between territories under different national jurisdictions. With the advent of electronic tracking, particularly light-level geolocators, researchers gained the ability to study the seasonal movements of seabirds and connect breeding populations and non-breeding habitats. To leverage this advancement for management and conservation efforts the SEATRACK program was initiated in 2014. Its primary objective is to delineate the year-round distribution and movements of seabirds breeding across the North Atlantic. Now in its third phase, this international initiative has expanded significantly since its inception, growing from 32 partners from five countries in 2014 to 69 partners based in 15 countries in 2024. By 2023, over 23,000 loggers had been deployed across 16 species at more than 75 field sites, with data from over 12,000 retrieved loggers undergoing standardization and analysis. The project models and maps important marine habitats for different populations, studies the potential impact of multiple stressors, including human activities, and investigates how changes in environmental conditions in non-breeding areas affect demography and population trends. We will look back at a decade of successful international collaboration, the value of standardization, and the production of key data outputs to date, as well as ongoing and future endeavours.

Poster 123

## High-resolution tracking of fledged Yelkouan Shearwaters *Puffinus yelkouan* exposes post-fledging migration.

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Procellariiformes spend most of their life at sea, and remain offshore for several years before recruiting into the breeding population. While the advent of GPS and GLS data loggers have allowed us to gain meaningful insights into the foraging and migratory behaviour of adult shearwaters and petrels, the movements of juvenile birds remain largely a mystery. Here we present high-resolution movement data from the first flight of fledged Yelkouan Shearwaters *Puffinus yelkouan f*rom the Central Mediterranean. We deployed GPS-GSM devices on 15 juveniles and 5 adults from a breeding colony in Malta, including family parties, during the fledging period. We obtained positional data from all but one juvenile for 4 - 40 days (mean = 18 days). Adults abandoned the nest site up to 8 days before their young fledged, and foraged in the Central Mediterranean without returning to the colony before starting active migration. Conversely, juveniles embarked on their migratory trajectory on fledging. Females had earlier fledging dates than males in this colony. While adults and juveniles appear to have similar migratory destinations, moving towards the Black Sea and, less commonly, into the Adriatic, it is possible to identify differences in movements within this dataset, shedding light onto the orientation mechanisms of naive shearwaters.

Poster 124

## Capture of Yelkouan Shearwaters *Puffinus yelkouan* at geographic bottlenecks at sea.

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*Independent Researcher, Malta

Shearwaters perform long trips, both during foraging and on migration, during which they may regularly pass through narrow stretches of sea in large numbers. Counting passing birds at such geographic bottlenecks is an established method for population size estimates. However, such counts do not inform on the origin of the individuals observed, thus limiting directed conservation efforts. Alternative approaches, such as the capture of birds at sea, have been limited to date. In late Winter 2024 at-sea captures of Yelkouan Shearwaters *Puffinus yelkouan* were carried out as part of two distinct tracking projects: one in the Istanbul Strait, Türkiye (CIESM, TÜBİTAK), and the other in the entrance to the Gulf of Kalloni, Lesvos, Greece (LIFE PanPuffinus, HOS). Birds were captured by setting up a fishing net at sea across part of their flight path. This methodology had been developed and successfully trialled once in the Istanbul Strait by Asaf Ertan (TUDAV) in 1996. Here we present this methodology for capturing shearwaters at sea. Overall, 43 birds were captured, of which 39 were fitted with GPS-GSM tags. Tagging birds away from their nest sites highlights the importance of this approach to gather information on the synchronous distribution of several breeding populations as well as to locate unknown breeding sites and important foraging areas. This is crucial for the improved protection of this vulnerable seabird endemic to the Mediterranean basin.

Poster 125

## Quantifying the potential for rapid evolution of early-life partial migration in European Shags.

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Rapid environmental changes are reshaping seasonal environments and movements of numerous bird populations, as migrations are altered to avoid seasonally harsh conditions and thereby increase population persistence. In partially migratory systems, variation in early-life expression of migration and associated survival in the presence of available heritable genetic variation may drive rapid micro-evolution, thereby shaping spatio-seasonal population dynamics. However, such properties have not yet been quantified in any wild population, precluding prediction of eco-evolutionary outcomes. We fitted advanced multi-state capture-recapture-models to an 11-year dataset of 9,359 pedigreed color-ringed European Shags *Gulosus aristotelis* to quantify temporal variation in seasonal migration, survival selection, and additive genetic variance in migration across the first year of life from fledging. We demonstrate strong fluctuating survival selection on migration across years, with strongest selection occurring during late Winter. Meanwhile, additive genetic variance and heritability underlying juvenile migration were highest during the Autumn, when selection for migration was lowest, indicating that these mechanisms are temporally decoupled. These results imply that, despite the presence of strong survival selection on early-life migration and non-zero heritable variation, the potential for rapid evolution may be highly constrained, impeding spatial responses to seasonal environmental changes.

Poster 126

## Individual migratory patterns of the critically endangered Balearic Shearwater in the Northeast Atlantic.

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Disentangling the migratory patterns of declining species is essential to guide spatial conservation efforts. We studied the migratory dynamics of the critically endangered Balearic Shearwater *Puffinus mauretanicus*, for which GLS data were collected from 88 annual cycles (53 individuals, 2017-2022). We examined the non-breeding period in the Northeast Atlantic, where the species moves from the Mediterranean right after breeding. Of all annual cycles, 90.9% migrated to the Atlantic and 9.1% (corresponding to birds from Menorca) stayed in the Mediterranean. In the Atlantic, 46.6% and 38.6% of the individual core areas (kernel 50%) were found in the Bay of Biscay and the Western Iberian Peninsula, respectively, while 2.3% used both. In addition, the core areas of some cycles were in the Gulf of Cadiz (3.4%). Annual differences were found in departure dates from the Mediterranean: while the median departure date was late June in 2018 and 2021, it was one month earlier (late May) in 2019 and 2020. In terms of individual spatial consistency, 27 individuals carried GLSs for two or more consecutive non-breeding periods and 81.5% visited the same area. The time spent in each core area was highly variable, from 1 to 7 months, with globally longer time spent in the Bay of Biscay. The earlier they arrive to the core area, the longer the stay. Our results highlight the importance of long-term monitoring programmes to consider individual variability in the conservation of declining species.

Poster 127

## Evaluating the movement patterns of a breeding population of Yellow-legged Gulls subjected to a culling program: Implications for the efficiency of large gull controls.

Gonzalo M. Arroyo, José Manuel Reyes-González, Laura Rollón, Miguel González, Marina García-Alfonso, Isabel Afán Asensio, Francisco Ramírez, Manuela G. Forero, Andrés De la Cruz
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Population control programs for large gull species are often implemented to reduce human interactions, yet their effectiveness is often poorly assessed. A key challenge lies in the lack of comprehensive data on the movements and population dynamics of managed individuals. We investigate the foraging and dispersal behaviours of breeding Yellow-legged Gulls *Larus michahellis* within a population that has undergone recent culling efforts, involving egg removal on the island of Tarifa (Strait of Gibraltar, Spain). We captured 10 breeding individuals of neighbouring nests and equipped them with GPS-GSM transmitters. Subsequently, we randomly removed clutches from five nests (Treatment), while at the other five nests, gulls completed their breeding cycle (Control). During the breeding season (April to July), the proportion of locations into the colony area were slightly but significantly lower for treated gull (37.4%) than control ones (47.1%). Most gulls locations, regardless of treatment, were concentrated around the Strait of Gibraltar and Moroccan coast. Some treated gulls reached Algarve (Portugal), while control gulls extended to the Mediterranean coast. Differences in movement and dispersal were observed, with treated birds showing narrower ranges and dispersing closer than untreated ones. Alternative hypotheses based on energy needs for offspring rearing are suggested, and the implications for the effectiveness of the management programme are discussed.

Poster 128

## From Europe to Africa and back daily: movements and behaviour of Yellow-legged Gulls from the most Southwestern point in continental Europe.

José M. Reyes-González, Gonzalo Muñoz-Arroyo, Andrés De la Cruz, Laura Rollón, Marina García-Alfonso, Isabel Afán Asensio, Francisco J. Ramírez, Manuela G. Forero
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Large gulls represent a particular group of seabirds adapted to extensively exploit a variety of habitats and different resources beyond marine prey, taking advantage of landfills and other disposals of anthropogenic origin. The Strait of Gibraltar (SoG) in Southern Europe is a paramount ecological area. Besides representing a critical challenge for migratory birds and being a major biogeographic boundary between Europe and Africa, SoG constitutes a remarkable political border between the European Union and Morocco. These two regions have contrasted differences in the policy realm, with potential consequences for wildlife management. We used highly resolved data from GPS-GSM devices over two complete year-round cycles to investigate the movements of 30 Yellow-legged Gulls *Larus michahellis* breeding in Tarifa (Spain). Situated on the Northern border of SoG, Tarifa is the most southwestern locality of continental Europe. As the most relevant result, we found these gulls to regularly cross SoG heading south almost daily while breeding to forage in landfills and coastal areas in Morocco. Moreover, some birds depart Spain after the breeding season and spend weeks or even months in Northern Africa. We will discuss these transcontinental movements and point out the need for international cooperation for waste management, fishing practices and wildlife management, as this species may carry a diverse array of elements such as plastics, contaminants and pathogens.

Poster 129

**Moulting while surviving: strategies during the non-breeding season in a threatened species.**

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To optimise survival and breeding success, migratory birds must strategically schedule significant life events such as breeding, moulting, and migration, within the annual cycle, trying to minimise the overlap between them. Many seabirds moult their feathers on the non-breeding grounds that they reach through wide migratory movements. However, the moulting phenology and daily activity budget of birds during this period remain largely unknown. This study focuses on the Bermuda Petrel *Pterodroma cahow*, an endangered and understudied gadfly petrel which migrate over the North Atlantic Ocean. Using light and wet-dry data from GLS devices deployed on 25 Bermuda Petrels, we described the migration routes and phenology of the species and investigated the timing and the location of the moulting, as well as its duration. The Bermuda Petrel has two main non-breeding areas, one located in the middle of the North Atlantic in an area defined as a seabird hotspot, and the other in the Western North Atlantic in the oceanic area that surrounds the breeding colony. This species starts its migration in June and returns in October to the Bermudas and it is during this period that petrels complete their moult. Through these methods, we identified primary areas of habitat utilisation during the non-breeding season, contributing to the conservation efforts of a species under threat while providing ecological insights with broader applicability to seabirds as a whole.

Poster 130

## Year-round distribution and foraging behaviour of Icelandic Leach's and European Storm-petrel populations revealed.

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Though two storm-petrel species breed sympatrically in Iceland, research suggests the globally red-listed Leach's Storm-petrel *Hydrobates leucorhous* (LSP) population is in decline while European Storm-petrel *Hydrobates pelagicus* (ESP) appears stable. With an apparent lack of population-level threat on-land, there is an urgent need to understand exposure to risks at sea, including artificial lights, contaminants and shifts in prey availability. However, the at-sea distribution and foraging ecology of Icelandic LSP and ESP is poorly known. To address this critical data gap, GPS loggers were deployed during breeding (<1 g, 2 h resolution) and GLS loggers year-round (<0.5 g, 12 h resolution). In 2022-23, we retrieved GPS from 39 LSP and 21 ESP; foraging trip metrics were compared between species and Hidden Markov Models used to classify behavioural states (intensive foraging, extensive foraging, transit). GLS have been retrieved for 26 LSP since 2020 and 2 ESP in 2023; locations were generated and kernel densities used to estimate winter utilisation distributions (50, 75 and 90%). Consequently, the at-sea habitat use and core foraging areas of Icelandic LSP and ESP are identified for the first time, revealing notable segregation: LSP forage year-round in deeper waters off the continental shelf, ESP in more shallow, coastal areas. These findings can benefit the assessment of at-sea risk, helping conserve populations of LSP and ESP both in Iceland and throughout their Atlantic range.

Poster 131

## Moult strategy and the individual variation in migratory movements of Maltese Yelkouan Shearwaters *Puffinus yelkouan.*

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The non-breeding period for Procellariiformes has the most gaps in knowledge for both location and behaviour. The Yelkouan Shearwater *Puffinus yelkouan* is a vulnerable species with known low adult survival during the non-breeding period. The aim of this study was to identify locations and behaviour for the non-breeding period and where possible, flight feather moult. 40 Yelkouan Shearwaters were fitted with geolocators in Maltese colonies, and location and immersion data were extracted for each track (n=20). We performed stable isotope analysis (SIA) of $\delta^{13}C$ and $\delta^{15}N$ on the 1$^{st}$, 5$^{th}$ and 10$^{th}$ primary feathers from 38 adult birds. We discovered a new migration route for Yelkouan Shearwaters to the Levantine Sea, with birds utilising areas in the Mediterranean Sea and the Black Sea. We found high individual variability in migration strategy that did not correspond to sex. Behavioural data corresponded with primary isotopic signatures, suggesting shearwaters moulted in similar areas independent of mitigation strategy. Our research also demonstrates the continuous moult strategy of Yelkouan Shearwater, with birds moulting in several locations, and the difficulty of obtaining non-breeding locations from sampling isotopes in P1-P5, with several individuals moulting all Primaries in the Mediterranean before entering the Black Sea. This study identified key areas were Yelkouan Shearwater are vulnerable and therefore of conservation priority.

Poster 132

## Tackling marine conservation through collaboration: the Seabird Tracking Database

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The Seabird Tracking Database (STDB) was established by BirdLife International in 2004 with the aim of collating data to help address the threat of incidental mortality (bycatch) of albatrosses and large petrels in fisheries. By 2014, the STDB's initial aims were extended to address multiple conservation issues faced by all seabirds and to promote data sharing– turning the database into one of the biggest marine conservation data collaborations in the world, supported by over 250 researchers. Almost 20 years after its establishment, the STDB has become a powerful tool to support marine conservation, with analysis of robust datasets helping to bridge the gap between scientists and decision-makers. The continuous engagement with and from the scientific community has been key to the success of the STDB, alongside the BirdLife partnership of organizations working nationally in more than 115 countries and territories. This study presents an overview of 1) how the STDB started and gained traction, 2) current status in terms of data coverage and major gaps, 3) methods development (frameworks to analyse tracking data; e.g., identifying important sites and assessing at-sea threats for seabirds) and 4) conservation successes (e.g., marine protected areas and adoption of bycatch mitigation measures). This review also documents the opportunities and challenges faced in managing this global database and discuss research priorities and future directions for the STDB.

## POLLUTION, TOXICOLOGY AND DISEASES

Poster 133

### Infection by antibiotic-resistant *Escherichia coli* affects the movement behaviour in Yellow-legged Gulls.

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The emergence, spread and potential zoonotic importance of pathogenic resistant bacteria (e.g., *Escherichia coli*) has fuelled the research on epidemiology and vector movement dynamics. However, little is known on the effects that apparently asymptomatic infections may have on vector behaviour. Here, we analysed and compared movement patterns and habitat use (focused on the different risk of exposure to Antibiotic Resistant Bacteria) of YellowlLegged Gulls *Larus michahellis* infected (n=10) and uninfected (n=29) by Antibiotic Resistant *Escherichia coli*. Using data from GPS devices coupled with accelerometer, we found the first evidence that infected individuals, although previously considered asymptomatic, reduced their speeds, accelerations, and moved over smaller areas as the breeding season progresses and reproductive duties increase. Infection may affect movement patterns to some extent, as in this case, potentially reducing pathogen dispersal over large areas.

Poster 134

## Physiology and fertility of two gull species in relation to plastic additives' exposure.

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The increased presence of plastics and associated additives, such as Polybrominated diphenyl ethers (PBDEs), in the environment makes it imperative to understand their impact on seabirds. PBDEs are now restricted due to their toxicity but persist in coastal environments. Methoxylated PBDEs (MeO-BDEs) may induce similar effects due to structural similarity to PBDEs. This study aimed to assess the presence of PBDEs and MeO-BDEs in eggs and preen oil from two populations of Yellow-legged Gull *Larus michahellis* inhabiting natural and urban areas, as well as a population of Audouin's Gull *Ichthyaetus audouinii* from a natural site; and relate the tissue concentration of these compounds with physiological parameters of adults and chicks, as well as with egg fertility. Adult Audouin's Gulls exhibited higher levels of MeO-BDEs, while Yellow-legged Gulls breeding in natural areas exhibited lower PBDE levels compared to those breeding in urban areas. Yellow-legged Gull chicks from natural sites showed elevated PBDE concentrations. Urban Yellow-legged Gull adults exhibited impaired health parameters likely due to PBDE exposure, while chicks from natural areas exhibited inflammation and oxidative stress that could be related to high levels of MeO-BDEs. These findings underscore the widespread presence of plastic-associated compounds and suggest detrimental effects on gulls.

Poster 135

## Detection of a panel of infectious agents in seabird populations of Southern Ocean Islands using a multiple microfluidic PCR tool.

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Understanding eco-epidemiological processes in seabirds populations requires a combination of complementary information, starting from detecting the occurrence of infectious agents (IAs) in host populations. To this end, we developed a microfluidic high-throughput technique to perform 48 simultaneous real-time PCRs to detect a set of a priori selected IAs on 48 samples. This low-cost, DNA-saving system make it possible to get a first snapshot of patterns of exposure before further investigation. We describe its application to perform a multi-agent, multi-host, multi-scale analysis on vertebrate populations of the Southern Indian Ocean. We analysed 497 swabs from healthy seabirds from Crozet Archipelago, including high-density breeding species (sheniciforms), scavengers and burrowing petrels, and from native and introduced mammals. We also included necropsy samples from a passive surveillance program. Forteen IAs were detected, including Chlamydiaceae, which could involve novel taxa. Widespread detection of *Pasteurella multocida* and *Erysipelothrix amsterdamensis*, known to be associated with mortalities in albatrosses on Amsterdam Island, raises the question of their effects on seabirds at other locations. Prevalences and diversity of IAs were significantly higher in scavenger species, reinforcing their interest as epidemiological sentinels. These results open important perspectives for the disease ecology and conservation of seabirds.

Poster 136

**The age-specificity of mercury pollution - a longitudinal study in a long-lived seabird.**

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The environmental presence of mercury has dramatically increased over the past century, exposing organisms across taxa to increased uptake of this pollutant. Due to their high trophic position and longevity, many seabirds are among the most exposed organisms, predisposing them to accumulate mercury as they age and thereby increasing their susceptibility to its adverse impacts. Across 7 years, we collected 1,314 blood and 693 eggshell samples from individually marked Common Terns *Sterna hirundo* of known age to investigate within-individual changes in mercury levels, as well as potential transfer to the offspring. Our analyses show that Common Terns indeed accumulate mercury as they age, with females exhibiting lower mercury levels and slower accumulation than males. Variation in clutch size explained part of the variation in female blood mercury concentrations and mercury concentrations measured in eggshells revealed a dose-dependent female mercury transfer to eggs, with potential effects on embryonic development and fitness.

Poster 137

## Emergence and spread of High Pathogenicity Avian Influenza (HPAI) H5 in seabirds of South America and Antarctica.

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The emergence of Highly Pathogenic Avian Influenza (HPAI) virus, particularly subtype H5, poses a significant threat to wildlife health and conservation efforts. Initially detected in 1996, this virus has caused outbreaks across Eurasia and Africa for decades. Its spread to North America in December 2021, followed by South America in October 2022 and confirmation in Antarctica by February 2024, underscores its global impact. In this overview, we focus on its spread and impact on seabird populations in South America and Antarctica. Following its introduction to South America, the virus spread along the Pacific and Atlantic coastlines. Between November 2022 and December 2023, HPAI infected at least 83 wild bird species and likely caused the death of over 667,000 wild birds in South America. By October 2023, it reached the Falkland Islands (Islas Malvinas) and South Georgia (Islas Georgias del Sur) and was confirmed by February 2024 in the Antarctic Peninsula. In this work we will present the full list of species and also highlight the taxa with high-risk conservation status affected. The impact of HPAI H5 on Antarctic wildlife could be severe, given the potential impact on endemic taxa and that the dense colonies of large numbers of seabirds facilitate efficient virus transmission. The outbreak underscores the risk of pathogen spillover from farmed animals to wildlife and emphasises the responsibility of human society to protect wildlife from anthropogenic diseases.

Poster 138

## The impact of mercury, trophic niche and migration strategies on the breeding success of the endangered Bermuda Petrel *Pterodroma cahow.*

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The Bermuda Petrel *Pterodroma cahow* is an endangered migratory gadfly petrel endemic to the Western North Atlantic, slowly recovering from a severe bottleneck, but still experiencing low levels of breeding success. The reasons behind this are not yet understood. This study aims to assess the potential impacts of migration strategies, mercury (Hg) bioaccumulation and trophic niche during the non-breeding period on the *P. cahow* breeding performance. We combined telemetry data with stable isotope analysis and Hg analysis in body feathers and related them with breeding parameters. Differences between sex and age classes were also tested. *P. cahow* presented a dual migration strategy: some individuals migrated to the Northeast Atlantic, while others remained in the western North Atlantic. No differences were observed in the trophic niche between the non-breeding areas or between sex. Males and older individuals exhibited higher levels of Hg, while females with lower Hg concentrations showed a higher probability of hatching success. Higher concentrations of Hg were also related with smaller eggs. The increased levels of mercury in the North Atlantic, in addition to the naturally mercury-rich mesopelagic diet of *P. cahow* might be a threat to its successful recovery. This study contributes to improving our understanding of gadfly petrels' non-breeding trophic ecology and the sublethal effects of oceanic Hg contamination on seabird health, with implications for their conservation.

Poster 139

## Presence of microplastics and endocrine-disrupting chemicals on subantarctic seabirds.

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Despite the remoteness of their breeding sites, Antarctic and subantarctic seabirds are susceptible to chemical stressors and anthropogenic pollutants that are released from ships and research stations, arrive in ocean currents, are transported in the atmosphere, or are ingested when the birds feed North of the Antarctic Polar Front closer to human settlements and industry. The pollutants include microplastics, which after ingestion may release endocrine-disrupting chemicals that were added during manufacture or adsorbed from surrounding seawater. Polybrominated diphenyl ethers (PBDEs) and methoxylated polybrominated diphenyl ethers (MeO-PBDEs) have the potential to bioaccumulate with known toxic effects. We analysed the presence of microplastics and levels of PBDEs and MeO-PBDEs in seven seabirds that breed at South Georgia: *Diomedea exulans*, *Thalassarche melanophris*, *Thalassarche chrysostoma*, *Procellaria aequinoctialis*, *Pelecanoides urinatrix*, *Pachyptila desolata* and *Stercorarius antarcticus*. We observed the presence of plastic fibres and fragments in the guts, which were chemically identified via FTIR. PBDEs (e.g., BDE47, BDE154, BDE153) and MeO-PBDEs (e.g., 6M47, 5'M99) were observed in the liver and muscle samples analysed via GC-MS/MS. Results are discussed in terms of diets and distribution of each species, as the prey range from zooplankton to squid, fish, and at-sea distributions from subtropical waters to the ice edge during the breeding or nonbreeding seasons.

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## Investigating the impact of anthropogenic pollution on seabird communities in West Africa: Insights from Cabo Verde Archipelago.

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Marine pollution, resulting from anthropogenic debris, poses a significant threat to marine ecosystems. Identifying suitable sentinel species to assess human impacts on oceans is imperative. Seabirds, as predators, are regarded as sentinels of the marine environment. In regions like West Africa, where pollution data is lacking, seabirds offer valuable insights into the impacts of anthropogenic pollution. This study investigates the effects of plastic and chemical pollution on a tropical seabird community in the Cabo Verde Archipelago using a multilevel approach. The occurrence of anthropogenic debris was assessed using faecal analysis as a proxy for ingestion, while preen oil and serum samples were analysed for Endocrine-Disrupter Compounds (EDCs). All seabird species exhibited anthropogenic debris ingestion, with coastal species exhibiting high susceptibility. The presence of EDCs was observed in all species, with concentrations linked to their trophic and foraging ecology. *Bulweria bulwerii* exhibited particularly high exposure to EDCs. Additionally, seabirds with specific foraging behaviours, exploring oceanographic features like the Cape Verde Frontal zone and West African upwelling, faced high chemical exposure risks. Overall, anthropogenic pollution affects all species, encompassing particle ingestion and chemical exposure. It is imperative to continue monitoring the impacts of global anthropogenic pollution, considering the declines in seabird populations.

Poster 141

**Biomagnification of mercury along Southern Ocean foodwebs.**

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Under the climate change context, warming Southern Ocean waters may allow mercury (Hg) to become more bioavailable to Antarctic marine foodweb (i.e., ice-stored Hg release and higher methylation rates), whose biomagnification processes are poorly documented. Biomagnification of Hg in the foodweb of the Scotia Sea and the Antarctic Peninsula, one of the world's fastest-warming regions, were examined, using carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope ratios for estimating feeding habitat and trophic levels. Hg and stable isotope signatures were measured across different trophic levels, from particulate organic matter (POM), zooplankton, squid, fish, seabirds, and marine mammals. As expected, significant differences in $\delta^{15}N$ values among species were found due to interspecific variations in diet-related to their trophic position. A significant positive relationship was found between Hg concentrations and trophic levels, biomagnifying nearly two times its concentrations at each level. Scotia Sea Hg concentrations were lower in 2016/17 than 2007/08 for mid-trophic level species, but the opposite was found for high predators (higher in 2016/17). This may reflect an interannual shift in the Scotia Sea, caused by the reduced availability of Antarctic krill *Euphausia superba*. In 2016/17, seabirds would have been forced to feed on higher trophic level prey, with higher Hg burdens. Results suggest that changes in the foodweb are likely to affect the pathway of Hg to Southern Ocean high predators. The trophic magnification was similar between Antarctica Peninsula (2010/11) and the Scotia Sea from (2016/17), indicating that besides the site-specific variables, such as the proximity to the coast and ice the uptake of Hg is affecting the different habitats in a similar way. Our results stress the impact that climate change on the uptake of contaminants to high predators, Southern Ocean fauna will have to cope not only with the stress do reduce prey availability, but with a concomitant increase in Hg exposure.

## RENEWABLE ENERGY

Poster 142

### Life-cycle impact assessment of offshore wind energy development on migrating seabird diversity in the North Sea.

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As offshore wind energy development rapidly expands, seabirds on migration are increasingly likely to encounter multiple wind farms and experience cumulative impacts within their migration paths. We adapted life-cycle impact assessment tools to assess cumulative collision, disturbance, and barrier impacts of offshore wind farms (OWFs) in the North Sea on migrating seabirds and gulls from Norway. The potentially disappeared fractions of species (PDF) - a measure of the potential loss of species richness in an area - due to OWF impacts was calculated for migrating birds within functional groups. Bird distributions were modelled using a Brownian bridge movement model, based on ring recoveries from countries surrounding the North Sea Basin, identifying core migration paths per group. PDF values were calculated for existing and planned OWFs (up to 2030) separately and then summed for each category. For both migrating seabirds and gulls, potential impacts from disturbance and barrier effects were higher than impacts caused by collision. Maps highlight areas where cumulative PDF values for combined collision, disturbance and barrier effects are expected to be highest, for example for gulls crossing between Southern Norway and Denmark or seabirds migrating from Norway to Scotland. We show how these results will be used to inform siting of future OWFs in Norwegian waters.

Poster 143

## ProcBe - Remote monitoring of flight height of European and Leach's Storm-petrels to refine collision risk assessments for offshore windfarm development.

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As renewable marine energy development expands into new areas in UK waters, including previously inaccessible deeper waters, interactions between Procellariiformes and offshore wind turbines are likely to increase. Flight height is a critical parameter for modelling the risk of collisions with rotating turbine blades. Storm-petrels are generally thought to fly at low altitudes, typically <10 m above the ocean surface which is below the rotor swept zone where birds are at risk of collision. However, much of the data on storm-petrel flight height are typically collected by direct observations of birds, and such observations can only be made during daylight when visibility is adequate. Very little is currently known about the behaviour of storm-petrels at night, when the birds may be attracted to artificial lights, or during adverse weather conditions, when sea swell may affect flight height. Recent developments in the remote monitoring of bird flight heights using bird-borne devices can help fill this knowledge gap. We will be presenting preliminary results from trials of lightweight (~1 g) archival devices designed to provide accurate flight height information for European Storm-petrel and Leach's Storm-petrel. This research is part of a three-year project (ProcBe) to refine our understanding of risk to UK Procellariiformes from future offshore energy development in the Celtic and Irish Seas.

Poster 144

## How can sensitivity mapping help avoid negative environmental impacts associated with offshore wind farms in emerging markets?

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As part of efforts to mitigate the impacts of climate change, the offshore wind industry is projected to expand rapidly in coming years, with much of that growth coming in emerging markets like Brazil, Colombia and the Philippines. However, the territorial waters of these countries are used by many threatened species during their annual cycles, such as the Black-Capped Petrel (Colombia) and Christmas Island Frigatebird (Philippines). Without careful application of the mitigation hierarchy, interactions between these species and a rapidly expanding offshore wind industry risks exacerbating ongoing declines and contributing to extinction risk. The first step in the mitigation hierarchy is to avoid impacts. To facilitate this, sensitivity mapping can be used as an early input to inform robust marine spatial planning (MSP). However, key challenges in emerging market contexts include limited understanding of the marine environmental context in general, and the species concerned, which often have no obvious surrogates in established markets to draw inferences from. We developed guidance on the application of sensitivity mapping in data limited situations. Through this guidance, we highlight potential data sources, both for the species concerned and for vulnerable marine habitats, like mangroves and coral reefs. We discuss the process for developing sensitivity maps from these data sources and demonstrate how they can be refined and integrated into effective MSP for offshore wind.

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## Inter-annual variation in space use of breeding seabirds: implications for assessment of offshore wind farm impacts.

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Predicting population level impacts of offshore wind farms (OWFs) on breeding seabirds requires understanding the extent to which local populations interact with the developments. Seabird space use may vary extensively between years and thus result in differing magnitudes of impact from OWFs. Yet this variation is not well understood and is not typically incorporated into assessments for OWFs, adding to uncertainty in the assessment process. We used 5-8 years of GPS tracking data from guillemots, razorbills, puffins and kittiwakes breeding on the Isle of May, Scotland to quantify inter-annual variation in space use and its consequences for overlap with proposed OWFs. Variation in population distributions was apparent in all species both in size and location of areas used, but the extent of this variation differed among species, with 3 to 45-fold difference in area size between years. Guillemots, razorbills and kittiwakes had more variable distributions, whereas puffin distribution was relatively consistent across years. Consequently, the extent to which the four species used the proposed OWF areas also varied. Overall, the proportion of time spent within the OWF footprints was very low, however there were notable exceptions involving specific wind farm-species-year combinations. Our findings highlight the value of long-term studies in making robust inferences regarding seabird distributions and assessing the potential impact of marine developments on protected populations.

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## The potential of turbine shut-down approaches to minimize impacts on seabirds.

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The offshore wind industry is projected to expand rapidly over the next decade, with much of that growth in emerging markets, where, typically, the seabird communities are less well understood than in established markets. Onshore, once impacts have been avoided as far as practicable, then shutting down turbines to prevent fatalities from collision with turbine blades remains the primary approach to reduce impacts and has proven extremely successful where it has been well implemented. There are now increasing examples of shut-down approaches being implemented or required at offshore facilities, although almost always for terrestrial or migratory species rather than seabirds. We will provide a future-oriented review of shut-down approaches and how they may be applied to, or modified for, the unique characteristics of seabirds and the marine environment. Issues discussed will include how and why shut-down is currently applied offshore, and which seabird species or marine locations are likely to require shut-down in the future as offshore wind expands into new geographies. We will then consider which onshore approaches to shut-down might be transferable to the offshore environment. Finally, we will identify some key gaps for future research and highlight scenarios for discussion where shut-down may not be appropriate or is not likely to achieve the desired outcomes.

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## Effects of operating and proposed offshore wind farms on seabird species in the Southern North Sea.

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Large-scale offshore wind farms (OWFs) are currently approved worldwide. Seabirds are prone to interfere with OWF while foraging, resting and migrating at sea. We assessed the cumulative effect of all operating and proposed OWFs on the occurrence of six seabird species in the German North Sea. A Before and After Control Impact (BACI) analysis was applied to estimate the relative change of the seabird density in the area influenced by operating OWFs, as well as to evaluate the response range to the OWFs. For Common Guillemots *Uria aalge*, Razorbills *Alca torda*, Northern Gannets *Morus bassanus* and Northern Fulmar *Fulmarus glacialis* the BACI approach revealed significant and strong avoidance behaviour. Blacked-legged Kittiwakes *Rissa tridactyla* and Lesser Black-backed Gulls *Larus fuscus* showed variable reactions depending on the season that reached from attraction to avoidance. To estimate the potential effect of proposed OWFs on seabird occurrence we applied the effects of operating OWFs revealed by the BACI approach in combination with the current German plans for OWF implementation on the known distribution of the seabird species. For most of the studied species large parts of the individuals occurring in the German North Sea would experience habitat loss or collision risk through the planned OWFs. Our study clearly illustrates the pressure to seabirds in the Southern North Sea by an implementation of the current plans of the German government.

## OTHERS

Poster 148
**Evaluation of hunting as a seabird species threat.**

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Seabirds are considered sentinels of the marine ecosystem. Changes in their demography, abundance, phenology and distribution provide information about changes on the marine organisms they rely on. However, their biological traits can be affected by different anthropogenic threats, including bycatch and alien species, which has received great attention in recent decades leading to the implementation of mitigation measures to prevent population declines. Nevertheless, despite hunting (together with trapping) being an identified threat affecting many seabird species (97 species), its study is underrepresented with respect to other threats. As part of service contract No 09.0201/2022/886665/SER/D.3 for the European Commission, we aimed to assess the sustainability of harvest levels for seabird species included in Annex II of the Birds Directive in a non-secure conservation status, which includes ducks (common eider, Long-Tailed Duck, Velvet Scoter, and Red-breasted Merganser) and gulls (Black-headed Gull, Mew Gull, European Herring Gull and Great Black-backed Gull). For each species we collected hunting and abundance data from the different Member States (MS) of the European Union, and we implemented the Potential Take Level method using the package popharvest in R to assess the likelihood of current harvest levels being sustainable in the context of management objectives of population recovery. Results will inform the debate among MS about management actions for recovery.

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## How public awareness contributes to behaviour change of tour visitors in a natural area - the case study of Barreta Island within Ria Formosa Natural Park.

Marion Rossi, Ana Almeida, Isabel Fagundes, Tânia Nascimento, Nuno Oliveira, Miguel Tapadas, Joana Andrade
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The increase in eco-tourism may bring opportunities but also challenges for nature conservation. A higher financial income may support the implementation of nature conservation and monitoring activities, which will benefit wildlife and habitats. Conversely, perturbation of breeding seabirds and trampling of native vegetation might increase. Public awareness may contribute to inverse those negative effects. Under the Life Ilhas Barreira, an awareness campaign was put in place to reduce the visitor negative effects on Barreta Island, Portugal. The main goal of this study was to assess the changes in visitors' behaviour following that campaign. Using an array of 22 automatic cameras set in a grid, visitants' activity was measured continuously from January 2020 to April 2024. Pre implementation was defined as the period before April 2023, while post implementation was set as the following period. Data was corrected for the COVID-19's effect on visitation. Season was also included in the analysis since visitation varies throughout the year. Overall, visitors walking outside the marked trails decreased after the implementation of awareness activities, even considering the COVID-19 period in the analysis or not. However, the same pattern is not so clear if only Summer season (the busiest period) is considered. Here, we present a useful tool to evaluate the efficacy of awareness campaigns in a very practical outcome, but also to identify priorities for forthcoming campaigns.

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## Human influence on Yellow-legged Gulls: Anthropogenic resource utilization and food limitation testing in Ria Formosa, Portugal.

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The availability of food of anthropogenic origin is one of the main causes for the increase of the Yellow-legged Gull *Larus michahellis* population and their establishment in urbanised areas. We tested the efficiency of food limitation measures in reducing the number of Yellow-legged Gulls attending and feeding on the landfill and fishing harbours in Ria Formosa, during incubation and the first days of hatching. The limitation measures took place between the first 15 days of May 2022, and during May 2023, and included the use of falconry at the landfill and awareness campaigns aimed at fishermen in the fishing harbours of Olhão and Culatra Island. To monitor the effectiveness of the tests, several counts were performed at different periods of the day, before, during, and after the implementation of measures. The use of falconry on the landfill was efficient in reducing the number of gulls attending and feeding on human subsidiaries, although it must be adapted to the activity of gulls on the landfill. On the contrary, the presence of gulls in the fishing harbours increased, probably as a consequence of the use of falconry in the landfill, but with fewer gulls feeding on the area. The awareness campaigns directed to fishermen to limit the availability of food to gulls are highly dependent on the participation of fishermen but proved not to be enough to change behaviour in the long term.

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## For the people and for the birds-Celebrate Urban Birds.

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Celebrate Urban Birds (CUBs), a bilingual community science project from the Cornell Lab of Ornithology, strives to co-create inclusive, equity-based citizen science projects that serve communities that have been historically excluded from birding and citizen science. The project seeks to improve quality of life and promote better science by including missing voices, perspectives, and experiences. CUBs works to co-create birdwatching and environmental education programming through the arts, local culture, and a focus on well-being and participatory science. In the last decade, CUBs engaging more than half a million people in the sciences and birdwatching, developed its methodology through years of community-led equity, diversity, and inclusion research funded by the National Science Foundation. We share our methodology and key research results. We highlight CUBs community partners, AveZona, Green Jay Bird Conservancy, and share our collaborative, co-created approach in Venezuela and Mexico. Including the co-created local materials, supporting workshops with community leaders, and integrating the arts in impactful ways to reach communities not represented in the sciences. This approach applies to all of Latin America, North America and Ghana where CUBs is working side-by-side with local communities to build trust and together with the partners create better impact.

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## The impact of light pollution and mitigation actions to protect seabirds in Macaronesia.

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Light pollution is a growing threat that disrupts natural rhythms in ecosystems, with both short and medium-term effects, ranging from hormonal alterations to disorientation. The group of Procellariiformes is specially affected by light pollution; species are attracted to artificial lights, becoming disoriented and can fallout, getting exposed to risks of injury or mortality. Started in 2021, the project LIFE Natura@night is increasing knowledge about the impact of light pollution on seabirds, through the inventory of species, monitoring colonies of Cory's Shearwater and Bulwer's Petrel and prospecting for new breeding areas. These data, in parallel with the mapping and monitoring of light pollution in protected areas (with innovative methodologies, such as remote sensing, photography, sky quality meters and autonomous photometers) and inventory of public lighting have already allowed the identification of sensitive areas in targeted areas. These actions make it possible to draw up master plans and a legal framework that will allow a significant energy saving and improve the conservation status of local species, with solutions tailored to the needs of citizens. The awareness of coastal communities, stakeholders and citizens themselves, through training and awareness actions, has already reached hundreds of people and reinforces that the multilevel approach designed to guarantee the success of the project and sustainability in the long term it is already a winning bet.

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# Thank You!