ABSTRACTS

Abstracts are arranged in programme order.

X(TWITTER)-ONLY | 0910

Overview of the impacts of renewable energy infrastructures on birds in India

Ramesh Kumar S (he/him)
Independent Researcher | @Rameshwild

India ranks fourth globally in renewable power capacity, with 191.67 GW installed as of April 2024. However, this rapid expansion impacts bird populations, particularly in western and southern regions of the country where wind farms are common, affecting habitats like open grasslands that house endangered species such as the Lesser Florican and Great Indian Bustard. Species affected from collision with wind turbines includes Painted Stork, Dalmatian Pelican, Bonelli's Eagle, Changeable Hawk Eagle. Bird collisions and electrocutions with powerlines are another significant issue. Through the literature review it was found that at least over 60 bird species from 33 families are affected in India. Tools like the strategic bird sensitivity maps (AVISTEP) can help in selecting safer locations for new wind farms, minimizing impacts on avian populations.

Ramesh Kumar S obtained his Ph.D on the Impacts of renewable energy infrastructure on birds in India. He was involved in development of 'AVISTEP' tool for India developed by Birdlife international. His interest lies in understanding and addressing various threats to the migratory birds mainly on the Central Asian Flyway.

X(TWITTER)-ONLY | 0920

A novel approach to SPA screening for offshore wind migratory bird collision risk assessments

James Slingsby (he/him/his)
GoBe Consultants, UK | @JESlingsby

Migratory collision risk modelling (mCRM) is a tool to estimate potential collision mortalities of migratory birds from offshore wind developments. To assess impacts to individual Special Protection

Area (SPA) populations within a HRA, a decision has to be made on which SPAs and features to include (i.e. screened in). Current guidance on this process is unclear and somewhat subjective. An improved, quantitative, approach to screening was developed utilising aspects of the MigroPath tool, a widely accepted modelling tool approved by Natural England. Using QGIS, migratory pathways were drawn from SPAs to migratory endpoints pre-determined by MigroPath. The percentage of pathways intersecting with any proposed array can then be calculated to provide a proxy measurement for connectivity. A percentage intersection threshold can then be applied to screen SPAs into mCRM assessments. Future work will look to incorporate species-specific data to allow for increasingly accurate apportionment of migratory impacts to SPAs.

James Slingsby is a Senior Ornithologist at GoBe Consultants, and a marine ecologist (PhD) with advanced knowledge in statistical and quantitative research. His main focus is around carrying out and improving data analysis, statistical modelling and assessments for EIA and HRA for offshore wind developments.

X(TWITTER)-ONLY | 0930

ProcBe: assessing Impacts of offshore wind farms on Procellariiforms in Celtic and Irish Seas

Orea R.J. Anderson (she/her)
Joint Nature Conservation Committee, UK | @AndersonSeabird

Offshore wind farms have the potential to impact seabirds through collision, displacement and barrier effects. Interactions with procellariiforms 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 Floating Offshore Wind developments (FLOW) in the Irish and Celtic Seas. The aim of ProcBe is to fill critical evidence gaps around how these species interact with OWFs (i.e. through distributional and flight height data) and improve demographic rates and population modelling approaches to allow adequate assessment of potential impacts.

Orea Anderson has worked in the field of offshore wind and marine ornithology for over 10 years. She has worked on commissioning novel science to understand the interaction between (and consequences of) offshore wind and seabirds in UK waters. She currently acts as Technical Lead for the ProcBe project.

X(TWITTER)-ONLY | 0940

The appropriate use of bird tracking data for renewable energy developments

Natalie Isaksson
University of the Highlands and Islands, UK | @nattenstein

The emergence of affordable bird-borne biologging and telemetry devices has resulted in increasingly large tracking datasets. These data are potentially useful in renewable energy siting, consenting, and monitoring as they often provide fine-scale, three dimensional insights into individual habitat use and behaviour. Such information can be used to predict species vulnerability as well as assess barrier effects, displacement, disturbance, and collision risk. This potential is acknowledged by both developers and governments with calls for increased use of archival datasets as well as in the generation of new data. However, the use of such data varies widely between interested parties, with little to no standardization or best practice guidelines available. This has the potential to lead to the misuse and misinterpretation of results. We therefore invite colleagues to provide insights on the appropriate use of biologging and telemetry data in the context of birds and renewable energy developments.

Natalie Isaksson is a marine ornithologist, ecologist and environmental scientist. Natalie is currently investigating the effects of offshore wind on marine wildlife and has a background in seabirds, conservation efforts for them, their movements, and interactions with human activities and infrastructure. Natalie's interests include conservation biology, foraging/movement ecology, just transition, and interactions of marine wildlife with fisheries and renewable energy.

X(TWITTER)-ONLY | 0950

Revised framework Acceptable Levels of Impact: assessing probability of unwanted decline to unimpacted scenario

Astrid Potiek (she/her)
Waardenburg Ecology, the Netherlands | @WaardenburgEco

The Acceptable Level of Impact (ALI) methodology can be used to assess predicted impacts of mortality from offshore wind farms on bird populations for permitting. Using population models, trajectories are projected for unimpacted and impacted scenarios. The ALI tests whether the

probability of an X% decline compared to the unimpacted scenario exceeds Y%. The original ALI methodology (2021) was updated based on a sensitivity analysis and reviewer comments. The revised methodology (2024) directly compares impacted and unimpacted scenarios, while keeping constant all other processes affecting the predicted population development. The relative difference between the impacted and unimpacted population size after 30 years is calculated for 100,000 simulations, while incorporating uncertainty in the impact. The distribution of these differences is used for assessing the ALI violation. X and Y are policy decisions. While we advise for Y a fixed value, X can be chosen species-specific based on at least conservation status.

Astrid Potiek is a researcher and advisor in bird ecology at Waardenburg Ecology. Her main focus is on population-level impact of wind farms on birds as well as data analysis.

KEYNOTE | 1005

From individual turbines to a global scale: overcoming evidence gaps to deliver an environmentally sensitive energy transition

Aonghais Cook
The Biodiversity Consultancy, UK | @AonghaisC

The energy transition is accelerating as we attempt to address the climate crisis, but there are concerns that renewable energy projects risk exacerbating the biodiversity crisis. Consequently, quantifying project impacts on biodiversity is crucial in Environmental and Social Impact Assessments (ESIAs). ESIAs are often beset by considerable uncertainty, leading to a need for a precautionary approach. This has contributed to projected cumulative impacts that pose challenges to continued industry expansion in established markets.

Uncertainty in ESIAs should be acknowledged and, where possible, reduced through evidence. We have built a substantial evidence base through a combination of post-construction monitoring and strategic research. Innovative and novel approaches to data collection and analysis have been central to this. The application of technology like GPS tracking has enabled us to quantify the response and exposure of birds to wind farms from the scale of individual turbines to whole flyways. Analytical advances enable us to consider the energetic consequences for individual birds, and the impact of this at the population-level. Better use of evidence produced by these studies offers the potential to reduce uncertainty in ESIAs, enabling less precautionary approaches to be applied.

While most advances have come in established renewable energy markets, the key industry growth will take place in emerging markets. Limited biodiversity data availability and differences in the species at risk pose significant challenges. It is vital we consider how evidence and approaches developed in established markets can be applied in emerging markets to deliver a just and environmentally sensitive energy transition.

Aonghais Cook is a Principal Consultant at The Biodiversity Consultancy. He works closely with developers, lenders, regulators and other organisations to better understand how to avoid, minimise and offset the impacts of renewable energy, particularly offshore wind farms, on biodiversity. He is particularly interested in investigating how to make better use of data and technology in order to support a sustainable and environmentally sensitive energy transition.

OFFERED TALK | 1035

Characterization of the North American aerial migratory niche

Silvia Giuntini
University of Insubria, Italy | @SilviaGiuntini2

Earth's lower atmosphere is a vital ecological habitat, home to trillions of organisms that live, forage, and migrate through this medium. Despite its importance, this space is seldom considered a primary habitat for ecological or conservation prioritization, making it one of the least studied environments. However, it plays a crucial role as a global conduit for the transfer of biomass, weather, and inorganic materials. Fundamental research is essential to address core ecological questions related to the ecological consequences of this habitat's intricate spatial and temporal structure. To advance our understanding of these niches, we analyzed over 108 million 5-minute radar observations from 143 NEXRAD sites, focusing on 24-hour diel cycles across the contiguous United States. This extensive dataset, spanning from 1995 to 2022, allowed us to quantify aerial niche space by systematically identifying peak activity times, the portion of the airspace that contained the majority of migration activity, and the percent of migrants passing across diurnal and nocturnal diel cycles. We reveal that airspace is used predominantly during nocturnal periods during both spring and fall (88%), while summer exhibited a more balanced distribution (54% nocturnal). Additionally, the percent of nocturnal activity increased with latitude in spring and fall but decreased in summer. Peak aerial activity typically occurred about four hours after local sunset in both spring and fall, with variations based on latitude and longitude. During these peak times, on average, half of the aerial movement was confined within a vertical band of 516 meters, starting around 355 meters above ground level. Our research underscores the need to view the lower atmosphere as a structured habitat with significant ecological importance.

Silvia Giuntini is currently a Ph.D. candidate at the University of Insubria working on a project focused on new techniques to study the movement ecology of birds. Prior to this, Silvia earnt a Master's degree in Conservation and Evolution from the University of Pisa with a thesis on interspecific competition between bats and alien parakeets.

OFFERED TALK | 1050

Framework for assessing species vulnerability to spatially explicit anthropogenic pressures whilst on migration

Ros M.W. Green (she/her)
University of Liverpool, UK | @r_green24

Increasing anthropogenic activities to meet net zero targets may heighten pressures on birds and the biodiversity crisis, especially for migrant species. We present a unifying assessment framework for quantifying vulnerability to spatially explicit pressures on migrating species groups. Standardised terminologies, methods for consistently scoring sensitivity and exposure, and for quantifying the role of uncertainty on the vulnerability index, are outlined. We tested this framework using the 29 Anatidae populations that migrate over UK waters and may be exposed to collision risk from offshore wind farms. Sawbills and seaducks are more vulnerable than swans, geese and other ducks. Even with data uncertainty accounted for, the five most vulnerable species remain consistent, indicating future research and conservation could focus on these species. Practitioners can use this framework to effectively guide research and conservation efforts, enabling the acceleration of renewable energy development whilst minimising impacts on migrant species and the biodiversity crisis.

Ros M.W. Green is a part-time PhD student at the University of Liverpool researching the migration of common shelduck in relation to offshore wind farms, and also works as a Research Ecologist for the British trust for Ornithology. She is also the BOU Council Early Career Researcher Representative.

KEYNOTE | 1135

Predicting the impacts of offshore wind farms on seabird populations

Catharine Horswill
ZSL Institute of Zoology & University College London, UK | @CatHorswill

The expansion of offshore wind farms is pivotal in the global shift towards renewable energy. However, this development is also likely to impact marine species, especially seabirds. Assessing potential impacts to protected seabird populations is necessary to gain consent for wind farm development. However, uncertainty in seabird demography, behavioural attributes and levels of impact means that these assessments are principally based on theorical models, rather than empirical evidence. Whilst these models provide valuable insights into relative impact, they often fail to accurately predict observed mortality rates. Improving the accuracy of these models will make the planning and consenting processes of offshore wind farms quicker, simpler and less risky. It will also improve the efficacy of proposed compensatory measures.

Seabird impact assessments for offshore wind farms typically evaluate how a single wind farm will impact a specific seabird population based on its breeding season distribution. Furthermore, the focal seabird population is usually assigned a national average demographic profile and assumed to be independent of any additional environmental pressures, immigration, emigration or density-dependent regulation.

In this talk, I will highlight research demonstrating the importance of considering how populations spatially and temporally overlap with different wind farms throughout the annual cycle. I will also review studies examining how seabird impact assessments may be influenced by spatial variation in demography, ongoing drivers of change, dispersal processes and density-dependent regulation.

The aim of this talk is to highlight the necessity for national and international strategies for seabird conservation when considering the population-level impacts of future offshore wind farms.

Catharine Horswill is a seabird population ecologist whose work focuses on understanding the processes that drive spatial and temporal variation in seabird population dynamics. Her research aims to link ecology, demography, and statistical analysis to develop innovative methods for assessing seabird responses to climate change and human pressures, particularly in data-limited scenarios.

OFFERED TALK | 1205

Feeding events and potential risk of wind turbine collision of Griffon Vultures in Sardinia, Italy

Ilaria Fozzi (she/her)
University of Sassari, Italy | @lullula_3

Griffon Vulture (*Gyps fulvus*) (GV) is highly vulnerable to collision with wind turbines (WTs) and in areas with high densities this can lead to high mortality rates. The presence of carcasses near WTs can lead to an increase in collision risk, considering that feeding events (FEs) involve changes in height and flight trajectories. Starting from these premises, also considering the increasing expansion of renewable energy infrastructures, we analysed FEs through accelerometer data of GVs in Sardinia, Italy, and overlapped their locations with existing and potential future WTs. We counted 124 existing and 245 potential WTs inside the whole area covered by all the FEs, the latter WTs representing a 197.58% increase only for the area covered by the FEs. A careful zonation of wind energy development and measures to avoid carcasses occurrence near existing WTs are needed to ensure the conservation of GVs in Sardinia and to mitigate potential risks.

Ilaria Fozzi is a PhD student at the Department of Veterinary Science in the University of Sassari, Italy, with a project on the analysis of the feeding behaviour of Griffon Vulture (*Gyps fulvus*) to develop a sustainable eco-touristic model to increase the economic sustainability of livestock farms in Sardinia.

OFFERED TALK | 1220

How do cumulative effects of offshore wind farms scale with increasing exposure to breeding seabirds?

Christopher J. Pollock
UK Centre for Ecology & Hydrology | @Tony_Auk

Offshore wind farm (OWF) 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 further complications are introduced when considering cumulative effects of multiple 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, allowing us to predict the demographic consequences of simultaneous developments on populations of interest. We found that impacts scale with the foraging area occupied by OWFs, and the number of developments. By running experimental simulations on Black-legged Kittiwakes and Common Guillemots, we explore the demographic impact of various hypothetical OWFs to demonstrate the potential scaling of impacts from large-scale implementation.

Christopher J. Pollock is a Quantitative Ecologist in the Ecological and Socio-ecological Interactions group at UKCEH. His main role is developing SeabORD; a simulation model used to predict the impacts of offshore renewable developments on seabirds by linking mechanistic understanding of ecology and behaviour to demographics.

KEYNOTE | 1240

An ecosystem approach to assessing the effectiveness of compensatory measures for the effects of offshore windfarms on seabirds

Michael Heath
University of Strathclyde, UK | @IBIS_journal

Large scale offshore windfarms pose a threat to some key species of foraging seabirds, and these concerns are a limiting factor in planning consents for new developments. Hence a range of actions are being considered as possible strategic measures to compensate for these effects. But, how can we assess in advance the relative effectiveness of these measures?

This talk provides some answers to this question through a sensitivity analysis of a North Sea ecosystem model (Strathe2E) to determine which parameters are most sensitive for seabird biomass. Some of these parameters mimic the proposed compensatory actions.

The clear message from the analysis is that climate-sensitive parameters and inputs which affect primary production and the efficiency of energy transfer up the trophic levels are highly sensitive for birds.

The most sensitive bird-specific parameters were those affecting maximum feeding rates. Maximum feeding rate in foraging species is limited by the so called 'handling time' of prey – that is the time it takes for an animal to ingest a prey item once captured. In the context of breeding seabirds we can hypothesis that this handling time includes, e.g. the flight-time to deliver food to chicks in the nest. So, the analysis suggests that measures which subsidise breeding birds by delivering food closer to colonies might be the most efficient form of compensatory measure.

Michael Heath took up his current position at the University of Strathclyde in 2010 after 28 years at the Marine Laboratory in Aberdeen providing research evidence and advice to the Scottish Government on marine ecology issues. At Strathclyde, he leads a research group specialising in

mathematical and statistical modelling of marine ecosystems and a wide range of marine species, and their sensitivity to fishing and climate change.

OFFERED TALK | 1310

Modelling the impact of onshore renewable expansion on nature, food, and carbon

Joshua Copping (he/him)
RSPB Centre for Conservation Science, UK | @joshcopping

Transitioning to renewable energy is crucial for meeting net zero targets. However, widespread deployment of wind and solar technologies raises concerns about their impacts, from food production to biodiversity. Furthermore, net zero cannot solely be achieved by emissions reductions through renewables. Instead, we need the simultaneous active removal of greenhouse gases from the atmosphere through nature-based solutions, such as habitat creation and restoration, which concurrently help biodiversity. In a United Kingdom case study, we show that ambitious renewable energy deployment targets require only a small fraction of land and can avoid protected areas and sensitive areas for birds. We found that even the highest onshore renewable energy ambitions require little land in addition to that needed for nature-based solutions, with little cost to food production, greenhouse gas sequestration, or breeding birds, even under pessimistic modelling assumptions. Therefore, the UK could boost onshore renewables without contributing substantially to future land competition.

Joshua Copping is a Conservation Scientist at the RSPB. His research focuses on the impact of land use on biodiversity, the climate, and food production in the UK. His main interest is in novel land uses and how these can form synergies to tackle future land use challenges.

OFFERED TALK | 1325

Understanding predator-prey interactions in the context of offshore wind farm development

Katherine Whyte (she/her)
Biomathematics and Statistics Scotland (BioSS), UK | @katey_whyte

To quantify cumulative impacts of offshore wind developments (OWD) on seabirds, a key component is understanding how seabird foraging may be altered (e.g. via displacement of seabirds and/or redistribution of prey); however, understanding the mechanisms behind these possible impacts is currently limited. The PrePARED project collects concurrent data on seabirds (GPS tracks) and their prey (dedicated acoustic and trawl surveys) in an area of OWD. Predator-prey interactions are being examined to characterise these relationships, examine how they may alter in the presence of OWD, and incorporate this new quantitative information into impact assessment tools (e.g. SeabORD). We show how we are (1) collecting new evidence on predator-prey interactions, (2) improving understanding of the drivers of seabird movements and foraging behaviour, (3) developing approaches that account for variable spatial, temporal, and ecological scales, and (4) ultimately improving our ability to predict seabird movements as we transition towards net zero.

Katherine Whyte is an Ecological Statistician at BioSS. Her research focusses on quantifying the potential effects of offshore renewables on seabirds and marine mammals, and developing statistical methods for these analyses. She is presenting on behalf of the PrePARED Project, which stands for "Predators and Prey Around Renewable Energy Developments".

KEYNOTE | 1440

Renewable energy in an uncertain world: understanding uncertainty to enable the energy transition

Elizabeth Masden
University of the Highlands and Islands, UK | @eamasden

Renewable energy projects are rapidly increasing in efforts to mitigate climate change, but this should not be at the cost of biodiversity. However, developments are often constrained by a lack of evidence and understanding around the environmental impacts of renewable energy infrastructure. As a consequence, there is uncertainty around the ornithological assessments for renewable energy developments.

There are many ways by which to define uncertainty but generally it is considered as a lack of knowledge or incomplete understanding about a particular subject. In order to manage uncertainty, we must first be able to identify and categorise the uncertainty. Only then will be able to find methods to treat and potentially reduce it.

The aim of my talk is to explore the meaning of uncertainty, discuss why it matters in relation to renewable energy and the energy transition, and provide examples of how we can describe and reduce uncertainty, ultimately to aid the decision-making process.

Elizabeth Masden is a Research Fellow based at the University of the Highlands and Islands. Her research focuses on the potential impacts of human activities, such as renewable energy, on the environment, and in particular seabirds. Elizabeth has an interest in cumulative impacts related to renewable energy, as well as an aspiration to ensure methods developed in data rich situations are applicable and transferable to data deficient scenarios.

OFFERED TALK | 1510

The importance of uncertainty propagation in population models

Emily G. Simmonds (she/her)
University of Edinburgh, UK | @EmilySimmonds10

Predicting future population trajectories is a key challenge for population management, infrastructure planning, and conservation. Matrix population models, which describe the demographic behaviour of a population based on age or stage through discrete time, are one tool that can address this challenge. Uncertainty accumulates at multiple levels in these predictive models and failing to account for all sources leads to a large amount of ignored variability in the model's predicted outcomes. Despite the importance of uncertainty for matrix population models, we have found that complete uncertainty propagation is rarely achieved (31% of papers). But how important is this omission? Our simulation study has demonstrated that even with moderate levels of uncertainty, incomplete propagation introduces bias for predicted population growth rates. We also showed that omitting uncertainty can substantially alter conclusions, particularly for small estimated changes in population size.

Emily G. Simmonds is a Chancellor's Fellow at the University of Edinburgh focussing on forecasting of population trajectories. Her research looks to first understand how populations might respond to environmental changes, and second to improve the robustness and reliability of our model predictions.

OFFERED TALK | 1525

Expert elicitation to investigate effectiveness of compensatory measures for offshore wind impacts on seabirds

Adam Butler (he/him)
Biomathematics and Statistics Scotland (BioSS), UK | @BioSScotland

Some compensatory measures for mitigating the effects of offshore wind (OW) on seabirds are currently implemented. They are becoming increasingly important as the pace of OW development accelerates with concern around the magnitude of cumulative effects. A range of potential compensatory measures have been proposed, but direct empirical evidence on the effectiveness of these measures in improving the survival and productivity of protected seabird populations is typically limited. Expert judgement is therefore crucial in understanding the likely effectiveness of these measures. Within the ECOWings project we used expert elicitation to estimate the effectiveness of a range of potential compensatory measures on UK populations of Black-legged Kittiwake, Common Guillemot, Atlantic Puffin, Razorbill, Northern Gannet, large gulls (Herring Gull, Lesser Black-backed, Great Black-backed) and terns (Arctic, Common, Sandwich), and quantified the uncertainty associated with these estimates. We outline the elicitation approach and results, and highlight implications for the implementation of compensatory measures.

Adam Butler is a statistician whose work is motivated by developing and adapting statistical methods in order to address substantive problems in ecology and the environmental sciences. He has worked at BioSS since 2004, and leads on stakeholder engagement and impact for the BioSS Offshore Renewables group.

OFFERED TALK | 1540

The future of offshore wind ornithology impact assessment? A view on evidence and change

Richard Berridge
Natural England, UK | @IBIS_journal

Over the past twenty years of offshore windfarm consenting in the UK, protocols and systems have become established in response to the evolving challenge of predicted cumulative impacts to seabirds. During this period, new evidence generated has been critical for the sector to deepen knowledge of seabird behaviour and potential impacts. However, whilst our understanding has advanced, it has not led to wholesale changes in the design or speed of impact assessments. As

Government priorities and legislation react to Net Zero targets, the time is ripe for new, evidence-led approaches to measuring, mitigating and compensating seabird impacts from offshore wind. Our presentation asks how we got here, what, in our view, needs to change, and how we go about achieving reforms. Key to this are several initiatives focused on 'strategic solutions' for offshore wind consenting using new techniques and evidence to drive earlier, less contentious and less impactful decision-making.

Richard Berridge is a marine ornithologist with 15 years of wide-ranging experience in the offshore wind sector, from fieldwork and EIA to research on impacts. Richard joined Natural England 3 years ago with a focus on delivering evidence-based advice and strategic solutions to facilitate the deployment of low impact renewable energy alongside thriving nature.

OFFERED TALK | 1625

Utility-scale photovoltaic power plants in the Alps: a Swiss BACI-Study

Christian Schano (he/him)
Swiss Ornithological Institute, Sempach | @christianSchano

Renewable energy development can mitigate climate change at the global scale, and positively or negatively affect birds locally. To combat climate change and to gain more resilience in times of volatile energy markets, Switzerland aims for an additional production of 2 TWh per year by building large, utility-scale photovoltaic plants (PVPs) on south exposed slopes in the Alps. However, no study exists on the effects of PVPs on alpine bird communities. Here we present an ongoing study, where bird, bat and orthopteran communities are surveyed within a robust Before-After-Control-Impact-design, including 15 PVP "Impact" sites and 10 "Control" sites without PVP spread across the Swiss Alps. We present results for birds based on the two first years of distance sampling (spring) and Passive Acoustic Monitoring (spring – summer - autumn). More general, we showcase methodological opportunities of combining both methods to assess the effect of renewable energies.

Christian Schano is an ecologist from Vienna, Austria. He previously studied methodological aspects of breeding bird surveys in the Netherlands, but now focusses on alpine ecology in the Swiss Alps. Next to studying the breeding ecology and population dynamics of snowfinches in Switzerland he mainly focusses on studying the impacts of alpine photovoltaics on biodiversity.

OFFERED TALK | 1640

RE:HARRIER: adaptive or risk-based management of wind farm interactions with Hen Harriers

Nicola Largey
MKO Research, Ireland | @nmlargey

The expansion of wind energy in the upland areas of Ireland raises biodiversity conservation concerns, particularly for hen harrier. The RE:HARRIER project aims to improve our understanding of the effects of wind energy development on the species and to inform best environmental practice. To date, we have leveraged industry data, and compiled a comprehensive database of hen harrier observations, consolidating information from Environmental Impact Assessment Reports for use in future work. We have also assessed the accuracy of flight height estimates used in collision risk modelling. We found that surveyors tended to overestimate height and the provision of annotated maps improved accuracy and collision risk predictions. Consequently, annotated maps could refine collision risk assessments for wind energy developments. Future work will investigate other aspects of hen harrier ecology in relation to wind energy to help inform sustainable wind energy practices and inform conservation strategies for hen harriers in Ireland.

Nicola Largey is Research Ornithologist with MKO Reseach based in Ireland where she is involved in a project aimed at improving our understanding of hen harrier interactions with wind turbines in an Irish context. Nicola previously completed her PhD in better quantifying bird flight characteristics and habitat use to improve our understanding of bird interactions with wind farms.

KEYNOTE | 1655

‘Closing the loop’: valuable insights of displacement and collision risk for seabirds gained from an intensive post-consent monitoring study of an offshore wind farm

Martin Perrow
University College London & UK Centre for Ecology & Hydrology | @IBIS_journal

Industry funded ‘Closing the Loop’ is focussed on applying learning from post-consent monitoring of offshore wind farms. Validation of assessment predictions required by license conditions for Sheringham Shoal (88 x 3.6 MW turbines) in the Greater Wash, is a case in point. The seven-year programme (2009–2016) before, during and after construction is among the most comprehensive conducted in UK waters. Targeted boat-based surveys (n=151) utilising both site-control and site-

buffer gradient designs showed several non-breeding seabirds were displaced; beginning in construction for Razorbill and Common Guillemot, but limited to operation for Northern Gannet. In contrast, Great Black-backed Gull was attracted. The reasons for, and possible consequences of, these patterns are discussed. Navigation buoys installed within 400 m of the site became resting and socialising hubs for Sandwich terns foraging from SPA breeding colonies. Validation of the collision risk of this key receptor employed visual tracking from a high-speed boat (1,858 individual tracks over 22,843 km). Measuring change relative to a pre-construction baseline proved invaluable to tease apart the avoidance response. While 'macro-avoidance' meant that 31–42% fewer tracked birds entered the operational site in different years, 'meso-lateral' avoidance within the array concentrating birds midway between turbines in 'flight corridors', made most (~50%) contribution to total estimated avoidance rate (99.4%). A decline in foraging rate within, compared to outwith, the wind farm emphasises the need for better understanding of the potential impact of wind farms on forage fish spatio-temporal abundance and the wider ecosystem relative to other factors.

Martin Perrow has been engaged in the UK offshore wind industry since its inception, initially leading ECON Ltd, a 'one-stop shop' for EIA, HRA, surveys, monitoring and seabird research, especially developing at-sea methods. Publications include the four-volume Wildlife & Wind Farms series, a global, multi-author treatise of onshore and offshore effects, monitoring and mitigation. Martin currently holds honorary positions at both UCL and UKCEH and continues to seek to promote best practice in planning and assessment.