



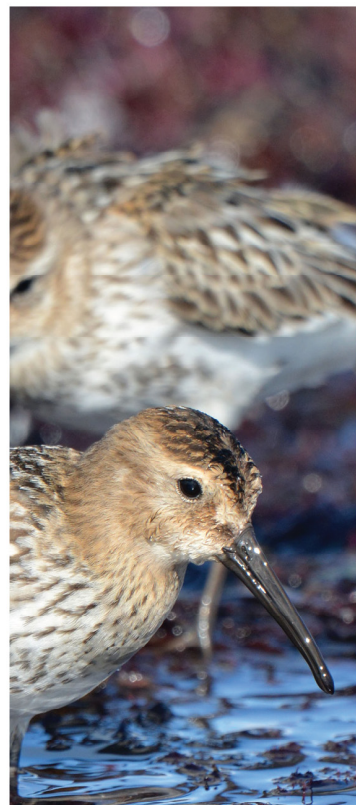

**8<sup>th</sup> Irish Ornithological  
Research  
Conference**

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Book of Abstracts

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*10th & 11th March 2023*





**UCC**

University College Cork, Ireland  
Coláiste na hOllscoile Corcaigh

School of  
**Biological, Earth and  
Environmental Sciences**



# 8<sup>th</sup> Irish Ornithological Research Conference

UNIVERSITY COLLEGE CORK  
10<sup>TH</sup> & 11<sup>TH</sup> MARCH 2023



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*The organisers would like to thank all of the people who helped with this conference.  
Photos throughout by Richard Mills & Anthony O'Sullivan*



**EVENT**

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**INFORMATION**

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## Current Ornithological Research in Ireland 8<sup>th</sup> Ornithological Research Conference

University College Cork  
10<sup>th</sup> & 11<sup>th</sup> March 2023

This is the eighth conference on Irish ornithology to be held at University College Cork, 38 years after the first event in this series took place in 1985. All researchers working on Irish ornithology have been invited to submit a brief abstract of their current work for each conference, and the number submitted has ranged from 97 this year to the peak of 159 submitted in 1997 (Figure 1). The aim of this event is twofold: first, to help researchers at home and abroad keep track of current research in Ireland; and second, to enable all those involved in ornithology to work together effectively. The profile of ornithology in Ireland is increasing, not just among non-government organisations, government agencies, academia and citizen scientists, but also in the private sector, where the demand for experienced fieldworkers continues to increase in line with the growing need for ornithological research in climate change science.

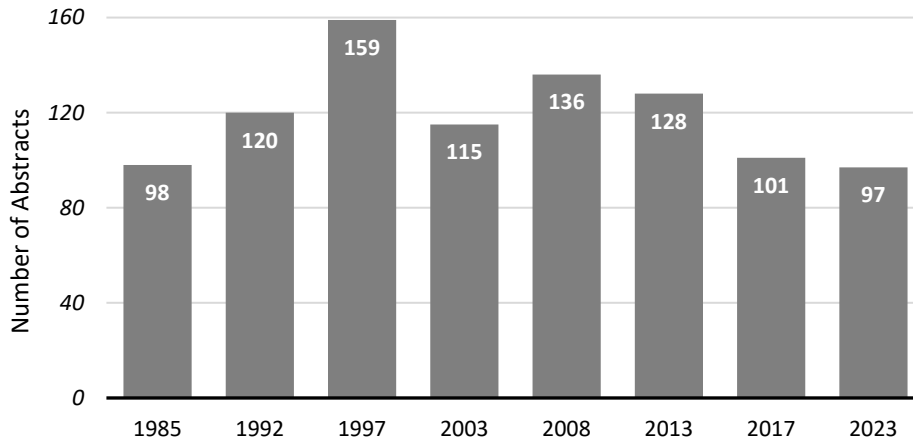


Figure 1. Number of abstracts submitted for each conference in this series 1985-2023.

Many of the projects described in these abstracts provide an update on findings from long-term monitoring programmes. BirdWatch Ireland celebrates the 30th and 25th anniversaries of the Irish Wetlands Bird Survey (I-WeBS) and Countryside Bird Survey (CBS), respectively, this year. The latest analysis of I-WeBS data indicates that half of all species show large or moderate declines. Much of this is likely to be caused by migrant species short-stopping for milder winters in northern and eastern Europe, but we know little about whether declining quality of their northern breeding grounds also has a role. The most recent trends for the CBS will undoubtedly also show a mixed picture, as has been the case in recent times. The national picture for wetland bird species is supplemented by several papers that focus on trends at specific locations, including the Lakes of Killarney and the Tolka Estuary.

The renewable energy sector continues to be a driver for ornithological research, aiming to ensure that future development has minimal impact on bird populations. This includes ongoing studies on some of our most vulnerable upland species, such as the Hen Harrier *Circus cyaneus*. Seabird and wetland bird research also continues to grow as windfarm development offshore is poised to expand. Aerial surveys and global positioning system (GPS) technology are key to many of these studies. Once restricted to medium-sized birds, GPS tags can now be applied to the smallest of seabirds, which is shedding new insights into species such as the European Storm Petrel *Hydrobates pelagicus*. An abstract on Gannet *Morus bassana* mortality caused by avian influenza demonstrates how rapidly new conservation challenges can emerge.

Many of the studies presented here focus on bird species whose populations continue to fare badly across Ireland. Breeding of the Ring Ouzel *Turdus torquatus* now appears to be confined to County Donegal. Several studies included focus on the plight of breeding Curlew *Numenius arquata* populations: only 105 pairs bred nationally in 2021. Other studies focus on breeding waders in specific areas. The EU funded 'Co-operating Across Borders for Biodiversity' project reports declines in breeding waders in Counties Donegal and Sligo, albeit over a short time-period, but on the upside, we are beginning to see evidence that intervention does work. In general, the potential of habitat management, particularly in agriculture, to enhance conservation is a theme across many abstracts. One abstract assesses the value of nestboxes in farmland, while another examines how critical stubble is for over-wintering passerines.

Thankfully, for many bird species in Ireland, there is good reason to be optimistic. The first national estimate of breeding Woodcock *Scolopax rusticola* is presented and it appears there are more than we might have expected, often occurring in areas where they were thought to be absent. Year-on-year wardening on Rockabill (Dublin) has led to an increase in the population of the Roseate Tern *Sterna dougallii* from less than 200 pairs in the early 1990s to over 1,800 pairs in 2022. The Common Buzzard *Buteo buteo* continues to expand its range naturally and is now well known to the public, perhaps partly because of more time to enjoy nature during the COVID-19 lockdown. The great work led by the Golden Eagle Trust and National Parks and Wildlife Service in raptor reintroductions deserves special mention. White-tailed Eagles *Haliaeetus albicilla* continue to do well and their range is slowly expanding.

Perhaps the most positive and exciting story among these abstracts is the report of the first successful breeding of Common Crane *Grus grus* in Ireland since the 16th century. This species has not only captured the imagination of the public, but also underscores the value of returning cut-away bogs to nature, the bird communities of which also feature in several other abstracts.

Most of the abstracts in the proceedings describe applied ornithological research, based on monitoring and understanding habitat requirements for a range of species, while others report on basic or fundamental research. One of these concerns the genetic divergence in Irish species (the Coal Tit *Periparus ater* and Wren *Troglodytes troglodytes*) from those in Great Britain and continental Europe; another concerns the genetic divergence within Red Grouse *Lagopus lagopus* populations in Ireland. A study on the Corncrake *Crex crex* attempts to separate populations in Ireland based on vocalisation. The interplay between environment, gut microbiome, and behaviour in the Great Tit *Parus major* is explored in another. An abstract on the Barn Owl *Tyto alba* uses pellets to map strontium isotope compositions in County Galway for bioarchaeological applications.

This collection of abstracts for the 8th Irish Ornithological Conference reaffirms the healthy state of ornithology in Ireland, and we look forward to seeing how this research develops into the future.



## KEYNOTE PRESENTATIONS

### THE BIRDS OF COUNTY CORK

Patrick Smiddy, Ornithological researcher, School of Biological, Earth & Environmental Sciences, UCC



Biography: Patrick Smiddy has studied Dippers, Grey Wagtails, Barn Swallows and *Acrocephalus* warblers and his subjects of interest include wetland and river birds, breeding biology, feeding ecology and migration. He was a member and secretary of the Irish Rare Birds Committee (1985–96) and editor of the journal *Irish Birds* (2010–17). He was lead author (with Mark Shorten and Russ Heselden) of *The Birds of County Cork* (2022, Cork University Press). He has published widely in national and international peer reviewer journals and books and is an honorary research associate with the University College Cork Ornithology Group.

### THE POPULATION DYNAMICS OF AN ARCTIC BREEDING GOOSE

David Cabot, Adjunct Professor, School of Biological, Earth & Environmental Sciences, UCC



Biography: David Cabot was born in Boston and moved to England in 1946. He studied Zoology at University College Oxford and then TCD, where he started his long-term population studies on barnacle geese, fulmars, cormorants and other seabirds. After working for the BBC for three years he took a junior lecturing post in NUIG, where he completed his PhD on helminth parasites in Charadriiform birds. He worked for almost 20 years at An Foras Forbartha and following its abolition, set up a documentary film company before working as an environmental consultant in Eastern Europe. He has published several books and numerous scientific papers. He continues his primary research interest into the population dynamics of the Greenland barnacle goose which has led him three times to NE Greenland and recently to Iceland to study their breeding biology.

### FIFTY YEARS OF BIRD IDENTIFICATION

Killian Mullarney, Irish ornithologist and bird illustrator



Biography: Internationally, Killian Mullarney is Ireland's best-known ornithologist, largely due to his outstanding skills as a bird illustrator and how he has used his artwork to advance field identification. He, Dan Zetterstrom and Lars Svensson authored and illustrated the *Collins Bird Guide* which is widely regarded as one of the finest bird guides ever produced. Killian was invited by An Post to produce a set of stamps of bird species in Ireland between 1997 and 2004. With the late Peter Grant he produced "*The new approach to identification*" and this work continues. Killian and his co-authors are revising the Little, Least and Saunders Tern complex. Lately Killian has addressed issues relating to aging different bird species in the field, which will be of considerable use to those working on recruitment and survival. An outstanding field ornithologist Killian has recently added the Greater Sand Plover and the Vega Gull to the Irish list.

**ORNITHOLOGICAL RESEARCH, SURVEY AND MONITORING IN NPWS**

Sinéad Cummins, Scientific Advice and Research Directorate, National Parks and Wildlife Service,  
Department of Housing, Local Government and Heritage.



Biography: Sinéad Cummins is an ornithologist within the Birds Unit of the Scientific Advice and Research Directorate of the NPWS. A former graduate of University College Cork, one of her first jobs was with BirdWatch Ireland on the Upland Breeding Wader Survey back in 2003 where she learned just how challenging wader surveys on blanket bogs can be during an Irish summer. Sinéad and her colleagues in NPWS have responsibilities which include providing support for bird monitoring and surveys, species management and protection and provision of specialist scientific advice. NPWS has also fostered close links with researchers in Ireland and further afield. Such collaboration is incredibly beneficial in helping bridge knowledge gaps (e.g. on species ecology, population, distribution), and to inform targeted bird species management and conservation, protected area designations and to underpin policy decisions.

**SCIENTIFIC COMMITTEE**

- John Quinn (Chair)
- John O'Halloran
- Pat Smiddy
- Tom Kelly
- Sandra Irwin



**LOCAL ORGANISING TEAM**

- Emma Caulfield
- Jamie Darby
- Astrid Dedieu
- Katie Grice
- Emma Murphy
- James O'Neill
- Shane Somers
- Darren Wilkinson



## GENERAL INFORMATION

### Conference Venue

The conference will take place in the Hub Building and the Boole Basement on the main campus of University College Cork (see map).

### Registration and information desk

We recommend picking up your registration material as soon as you arrive at UCC. Registration is required for all participants and the registration desk will be open until 10am on Saturday March 11<sup>th</sup>. Registered participants will receive a badge giving them access to the conference venue, which must be worn visibly during the event.

### Internet access

Wi-Fi is available for conference participants as follows: Guest Username: research-mar-23; Password: Ku2rssza

### Twitter

Please use #CORC2023 to tweet about this event. If you do not wish for your oral or poster presentation to be mentioned on twitter please let the conference organisers know in advance.

### Posters

Posters should be displayed in the Atrium of the Hub Building for the duration of the conference and attached to the correct numbered poster board (see poster section at the end of this document) using the Velcro attachments provided. Please remove posters by 6pm on Saturday 11<sup>th</sup> March.

### Student prizes

Prizes for best oral presentation by a student and best poster presentation by a student have been jointly sponsored by Atkins. Prizes will be awarded during the closing of the conference.

### Best Presentation Award Selection Criteria

- Quality of visual presentation
- Effectiveness in communicating the desired message
- Quality and/or impact of the research

### Best Poster Award Selection Criteria

- Visual appeal
- Clarity of the aims and conclusions
- Quality and/or impact of the research

### Refreshments and Lunch

Coffee and tea will be served during the poster sessions at morning and afternoon breaks, and lunch will be served in the Atrium of the Hub Building. Teas, coffees and lunch are included in the conference fee.

In keeping with *Plastic Free UCC* reusable water bottles will be available at registration which you can fill at the water access points in the Hub building and the Boole Basement or you are welcome to bring your own to use.

### Photos/Videos

Please note photographs and videos will be taken during this event for use on the conference website or for inclusion in archives of the event. If you do not wish to have your photo taken, please let conference organisers know.

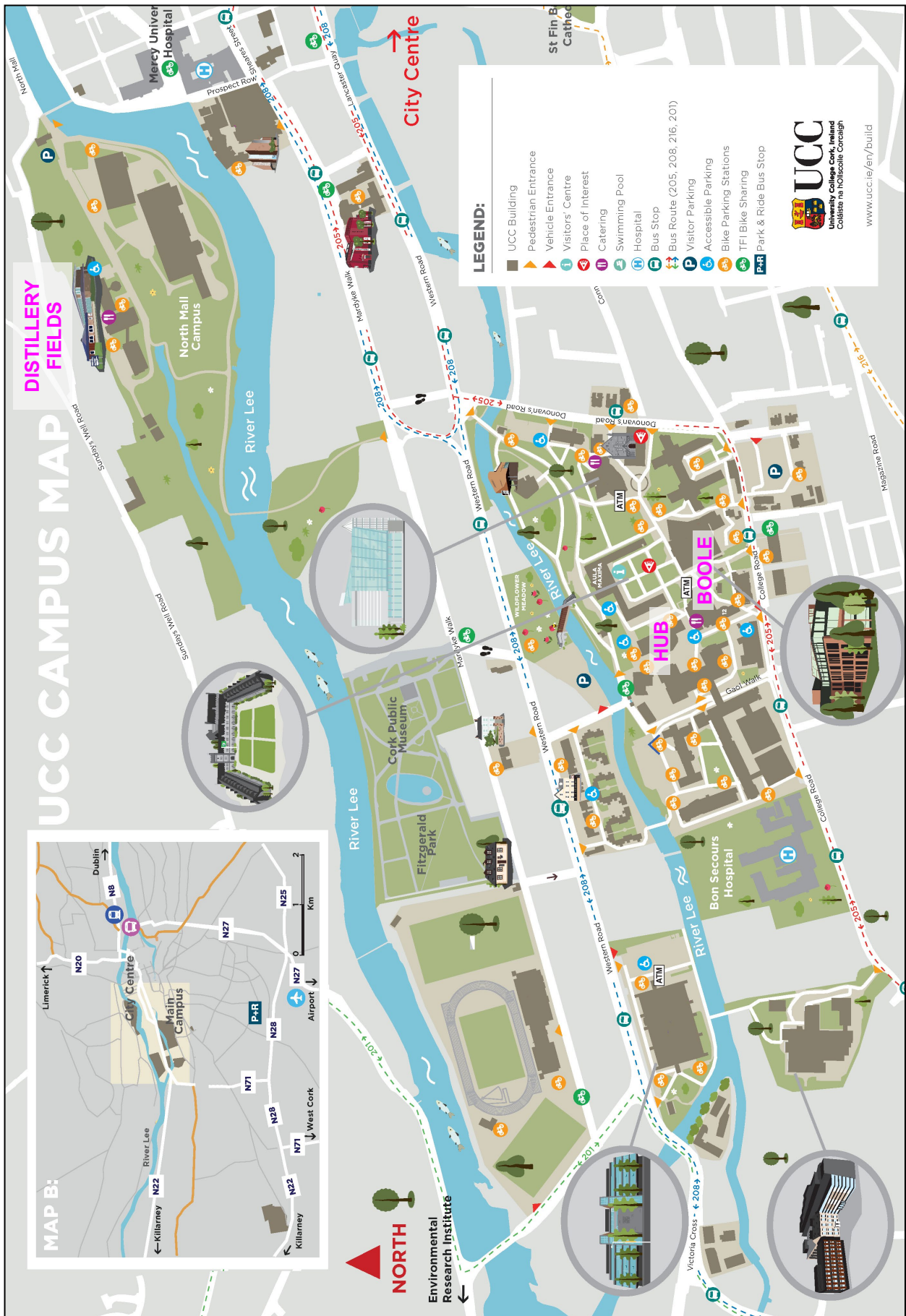
### Parking at UCC

There is limited public parking available on campus (see map). UCC is well served by public transport.

### Annual Irish Ringers Meeting

All conference delegates are welcome to attend the Annual Irish Ringers Meeting which will take place at UCC's Distillery Fields Campus, North Mall, Cork on Sunday 12 March 2023 from 09:30 to 16:15. There is no additional charge for the Ringers Meeting but we would ask all participants to also register.

UCC CAMPUS MAP



## CONFERENCE PROGRAMME

Friday 10<sup>th</sup> March 2023

19:00 – 20:00 **Keynote address** The birds of county cork  
Pat Smiddy

20:00 – 20:30 *Welcome Reception*

Saturday 11<sup>th</sup> March 2023

09:00 – 09:30 **Registration**  
Hub Building, UCC

09:30 – 09:40 **Welcome address**  
John O'Halloran

09:40 – 10:20 **Keynote address** The population dynamics of an Arctic Breeding Goose  
David Cabot

10:20 – 11:00 **Session 1: Waders & Wildfowl**  
Chair: Olivia Crowe

**Jackie Hunt**, Catherine A. Farrell, Caitriona Maher and Séan B.A. Kelly Breeding waders on LIFE on Machair project sites: an overview of trends from the 1980s to present [10 mins]

**Áine Ní Shúilleabháin**, Kathryn Freeman and Ciarán Ó Súilleabháin Forty years of changing waterfowl use of Lough Leane, Killarney National Park, Co. Kerry [7 mins]

**Helen Boland**, Tara Adcock, Brian Burke, Niamh Fitzgerald, Stephen Newton, Niall Tierney and Ricky Whelan Terns nesting in Dublin Port between 1995 and 2022: responses to nesting structure availability in a dynamic industrial setting [7 mins]

**Tess Handy**, Kendrew Colhoun, Steve Votier and Stuart Bearhop Understanding patterns of urban habitat use in overwintering Light-bellied Brent Geese in Dublin [7 mins]

**Kerry Mackie**, Graham McElwaine and Stuart Bearhop Farming for Whooper Swans - efficacy of a mitigation program for a road development in Northern Ireland [7 mins]

11:00 – 11:30 *Tea/Coffee and poster session*

11:30 – 13:00 **Session 2: Ecology & Conservation Part I**  
Chair: John O'Halloran

**Brian Burke** The Irish Garden Bird Survey: Overview and recent changes in species distribution [10 mins]

**Tom Gittings** Distance effects on detection rates in wind farm vantage point surveys and their implications for collision risk modelling [10 mins]

**Lesley J. Lewis**, Richard Coombes, Brian Burke, Niamh Fitzgerald, John Kennedy, Andrew Lynch, Sinéad Cummins, Seán Kelly and John O'Halloran Celebrating 30 years of bird monitoring in Ireland [10 mins]

Barry J. McMahon, **Susan Doyle**, Aimée Gray, Seán B.A. Kelly and Steve M. Redpath The role of abundant generalist predators in European bird declines [10 mins]

**James O'Neill**, Paul Holloway, Jamie Darby, Andrew Hoodless and John Quinn Modelling the breeding distribution and abundance of a cryptic bird species: the Eurasian Woodcock in Ireland [10 mins]

**Seán Doyle**, Chris Cullen, Paidi Cullinan, John Hehir, Mark McCorry, Sorcha Cahill, David McNicholas and Julie O'Sullivan First breeding success of Common Cranes in Ireland since the 16th century [7 mins]

**John Lusby**, Alan McCarthy, David Tosh, Michael O'Clery, David Watson, Tony Nagle, Colin Lawton and John O'Halloran Changes in the diet of Irish Barn Owls in response to invasive small mammals [7 mins]

## 8<sup>th</sup> Irish Ornithological Research Conference

|               |   |  |
|---------------|---|--|
|               | <b>Kieran Buckley</b> , Shane Sweeney, Therese Kelly and Barry J. McMahon   | The survival of the Curlew as a breeding species in Ireland: is it time triage? [7 mins]   |
|               | <b>Chris Cullen</b> , Sorcha Cahill, Seán Doyle, Mark McCorry, David McNicholas and Julie O'Sullivan                      | Breeding season habitat associations of birds on former industrially cutaway Raised Bogs [7 mins]  |
|               | <b>Conor Graham</b> , Gerard McCormick, Heather Lally, John Lusby and Cólín Minto   | Surrounding habitat composition strongly influences the occupancy rate of bird boxes [7 mins]  |
|               | <b>Alex Copland</b> , Sam Bayley, Howard Williams and Barry O'Mahony  | Biometrics of Dunlin wintering in Ireland [7 mins]   |
| 13.00 – 14.00 | <b>Lunch Break and Poster Session</b>   |  |
| 14:00 – 14:40 | <b>Keynote address</b><br>Sinead Cummins  | Ornithological research, survey and monitoring in National Parks and Wildlife Service  |
| 14:40 – 15:20 | <b>Session 3: Seabird Ecology</b><br>Chair: Lesley Lewis  |  |
|               | <b>Niamh P.G. Esmonde</b> , Paul Caplat, Paul M. Thompson and Neil Reid   | From take-off to touch down: How has wind impacted migration timing in a long-distance and long-lived migratory seabird, the Manx shearwater? [7 mins]     |
|               | <b>Oriol G. Paradell</b> , Tiffany Goh, Dimitar Popov, Emer Rogan and Mark Jessopp  | Highly Pathogenic Avian Influenza in Northern gannet colonies in southwest Ireland [7 mins]  |
|               | <b>Darren Wilkinson</b> , Jamie Darby, Oriol Giralt Paradell, Ashley Bennison, Emer Rogan, Mark Jessopp and John L. Quinn | Aerial surveys reveal spatial and temporal variation in the distribution of the European storm petrel at sea during breeding [7 mins]                      |
|               | Niall T. Keogh, <b>Alan Lauder</b> and David Tierney  | National Urban Gull Survey 2021 [7 mins]   |
|               | <b>Simon Berrow</b> , John Collins, Megan Keville, Sibéal Regan, Mariona Sardá-Serra and Sally O'Meara                    | Distribution and abundance of seabirds in a sheltered estuary: feasibility study in the Shannon Estuary using a Rigid Inflatable Boat [7 mins]             |
| 15:20 – 15:50 | <b>Tea/Coffee and poster session</b>  |  |
| 15:50 – 16:30 | <b>Keynote address</b><br>Killian Mullarney   | Fifty years of bird identification   |
| 16:00 – 17:10 | <b>Session 4: Ecology &amp; Conservation Part II</b><br>Chair: Tom Kelly  |  |
|               | <b>Gary Colclough</b>   | GPS tracking reveals wide variations in home range size during the breeding season of the Eurasian Curlew in Ireland [10 mins]                             |
|               | <b>Alan McCarthy</b> , Allan Mee, Sinéad Cummins, Anthony Caravaggi and John O'Halloran                                   | Patterns of Hen Harrier juvenile dispersal, survival, breeding population recruitment and habitat use as revealed by satellite tracking [10 mins]          |
|               | <b>Allan Mee</b> , Clare Heardman, Damian Clarke, Torgeir Nygard, Lorcan O'Toole and Philip Buckley                       | White-tailed Sea Eagle reintroduction to Ireland: restoration of a large avian apex predator [10 mins]   |
|               | <b>Tom Reed</b> , Eileen Dillane and Sam Bayley   | How genetically distinctive are Irish coal tits and wrens compared to other European populations? [10 mins]  |
|               | <b>Niamh Daly</b> , John Lusby, Saskia Ryan, Peter Ditchfield and Petrus J. le Roux                                       | The use of Barn Owl pellets to map biologically available strontium isotope compositions in Co. Galway for bioarchaeological applications [7 mins]         |
|               | <b>Andrea Parisi</b> , Joanne O'Brien, James Moran and John Carey   | Geographical variation of corncrake calls in the Irish context [7 mins]  |
|               | <b>Grace Walsh</b> , Barry J. McMahon, Filip Thörn, Patrik Rödin-Mörch, Martin Irestedt and Jacob Höglund                 | Whole genome data provides evidence of divergent selection and gene flow between two populations of red grouse with implications for conservation [7 mins] |
| 17:30 – 18:00 | <b>Close of meeting &amp; presentation of prizes</b><br>John O'Halloran   |  |

## CONFERENCE POSTER PRESENTATIONS



|    |   |  |
|----|---|--|
| 1  | Brian Burke, Niamh Fitzgerald, Sean B.A. Kelly and Lesley J. Lewis  | A preliminary assessment of the movements and usage of Dublin Bay by wintering waders  |
| 2  | Alfie Cavaliero, John Carey, Joanne O'Brien, Dolores Byrne and James Moran  | Improving conservation value of Corncrake sites: the contribution of various early and late cover (ELC) types and quality to invertebrate diversity and abundance    |
| 3  | Kendrew Colhoun, Eimear Rooney, John Collins, Niall Keogh, Alan Lauder, Clare Heardman & Sinéad Cummins   | Status of Chough in Ireland: results of a national survey in 2021  |
| 4  | Kendrew Colhoun, Fidelma Flannelly, James O'Neill, Eoghan Phelan, Hubert Servignat, Barry O'Donoghue & Sean Kelly   | Curlew in Ireland in 2021: status and distribution   |
| 5  | Christina Hunt, Kendrew Colhoun, Lucy Mason, Gillian Gilbert, Claire Barnett and Will Peach   | Positive responses of breeding waders in Northern Ireland to voluntary conservation action when deployed alongside existing wader conservation                       |
| 6  | Kendrew Colhoun, David Miley, P.J. Maguire, Tess Handby, Sinead Cummins and David Tierney   | A National Survey of Red Grouse in Ireland 2021/22   |
| 7  | Andrea Soriano-Redondo, Richard Inger, Richard Sherley, Eileen Rees, Fitsum Abadi, Graham McElwaine, Kendrew Colhoun, Olafur Einarsson, Sverrir Thorstensen, Julia Newth, Kane Brides, David Hodgson and Stuart Bearhop | Do protected areas in the wintering range help conserve migratory birds? A case study interrogating demographic rates of Icelandic Whooper Swans wintering in the UK |
| 8  | Kendrew Colhoun, Ewan Weston, Kenny Graham, Richard Inger, Gerry Murphy, Tess Handby, Bernadette Guest and Francis X. O'Beirn   | Winter habitat use of Grey Plover in relation to aquaculture structures  |
| 9  | Kendrew Colhoun, Michael Casey, Trevor Fisher, Alan Lauder and Daniel Moloney   | Ireland's newest and most northerly Bird Observatory – Inishtrahull Island, Donegal  |
| 10 | Kendrew Colhoun, Mariona Sarda Serra, Jamie Latimer and David Tierney   | Foraging behaviour of European Shag and terns in NW Ireland: preliminary findings of a GPS tracking study  |
| 11 | Kendrew Colhoun, Ewan Weston, Stephen Vickers and Stuart Bearhop  | Colour-marking waders across Ireland   |
| 12 | John Collins, Richard Collins and Simon Berrow  | The diet of the Raven on the Loop Head Peninsula, Co Clare   |
| 13 | Chris Cullen, Sorcha Cahill, Seán Doyle, Mark McCorry, David McNicholas and Julie O'Sullivan  | Breeding birds of Conservation Concern on former industrially cutaway Raised Bogs  |
| 14 | Chris Cullen, Sorcha Cahill, Seán Doyle, Mark McCorry, David McNicholas and Julie O'Sullivan  | The breeding season bird assemblage of former industrially cutaway Raised Bogs   |
| 15 | Jamie Darby, Manon Clairbaux, John Quinn, David Cabot, Paul Thompson, Lucy Quinn and Mark Jessopp   | Decadal-scale increases in vessel interactions by a scavenging seabird   |
| 16 | Astrid Dedieu*, Emma Murphy*, Sam L Cox, Emer Rogan, Oriol Giralt Paradell and Mark Jessopp *Joint first Authors  | Assessing impacts of offshore wind energy developments on breeding seabirds in Ireland   |
| 17 | Amy Duclaux and Kevin Healy   | If you've got it, flaunt it: Higher levels of dichromatism found in bird species with higher adult survival  |
| 18 | Clare Heardman, Sam Bayley, Declan O'Donnell, David Rees, Kendrew Colhoun and Sinead Cummins  | Chough in County Cork: the use of buildings for nesting  |

## 8<sup>th</sup> Irish Ornithological Research Conference

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| 19 | John Kennedy, Kathryn Finney, John Lusby, Daniel Moloney, Oonagh Duggan and Anita Donaghy | Mapping farmland bird hotspots in Ireland: a method to assist targeting of agri-environment measures                        |
| 20 | John Kennedy, Brian Burke, Niamh Fitzgerald, Seán Kelly, Alyn Walsh and Lesley Lewis      | National and site-level trends of Ireland's wintering waterbirds 1994/95 – 2019/20  |
| 21 | John Kennedy, Dick Coombes, Lesley Lewis and Martin Charlton                              | An exploration of Yellowhammer data: Distribution, presence, relative abundance and associated factors in Ireland           |
| 22 | Áine Ní Shúilleabháin, Séan O'Brien, Sean Forde and William Hunt                          | Comparative distribution of selected waterbird species, aquatic plants and human activity at Ross Bay, Lough Leane Co Kerry |
| 23 | Áine Ní Shúilleabháin, Séan O'Brien, Sean Forde and Sam Bayley                            | Preliminary study of Tufted Duck activity time budget as a tool to maximise count efficiency                                |
| 24 | Sean O'Brien, Áine Ní Shúilleabháin and Sam Bayley  | A Review of Territorial Behaviour in Breeding Mute Swans at Ross Bay, Lough Leane, Killarney National Park, Co. Kerry       |
| 25 | Courtney Redmond, Caoimhe Doyle, Grace Walsh, Jonathan Rushton and Barry J. McMahon       | Living with antimicrobial resistance and avian influenza within wild bird populations                                       |
| 26 | Courtney Redmond, David Cabot, Susan Doyle and Barry J. McMahon                           | Relative body weight as a determinant of breeding success in the Greenland Barnacle Goose.                                  |
| 27 | Mariona Sardà-Serra, Mohamed Henriques and Kendrew Colhoun                                | Tracking devices to assess distribution and habitat use of large gulls in Republic of Ireland                               |
| 28 | Steph Trapp   | Understanding patterns of terrestrial habitat use in Dublin's wintering waders  |

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RESEARCH

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ABSTRACTS

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### **The significance of the Tolka Estuary for waterbirds at low tide**

**T. Adcock and H. Boland**

*BirdWatch Ireland, Unit 20, Block D, Bullford Business Campus, Kilcoole, Co. Wicklow*

Corresponding author: hboland@birdwatchireland.ie

The Dublin Bay Birds Project (DBBP) – co-ordinated by BirdWatch Ireland and funded by Dublin Port Company – carries out monthly waterbird surveys of Dublin Bay, including the Tolka Estuary, at low tide (year-round) and at rising tide (April to August), with additional species-specific and roost surveys, to attempt to fill existing gaps in knowledge. The resultant DBBP low-tide data shows that the Tolka Estuary area within the bay supports markedly higher numbers of waterbirds at low tide, when compared to a rising tide. The peak January low tide count in the Tolka Estuary between 2013/14 and 2019/20 was 17,371 waterbirds (representing 52% of all waterbirds recorded in Dublin Bay on that date). By comparison, the peak January count of the same area recorded during a rising tide survey is just 601 waterbirds. Eleven of the 18 wintering waterbird Qualifying Interest species of the Dublin Bay Special Protection Area (SPA) – the species for which the site is designated – occurred in numbers of national importance in the Tolka Estuary at low tide during the survey period, with two species occurring there in numbers of international importance. The Tolka Estuary is within the SPA boundary and therefore receives the same legal protection as all other parts of the overall Dublin Bay designated site regardless of the number of waterbirds using it throughout the tidal cycle. However, this study reinforces the need to consider how waterbirds use all parts of the designated site, both temporally and spatially, when carrying out environmental assessments for developments proposed for areas adjacent to tidal habitat, and to ensure no significant impact on the integrity of these critical areas for waterbirds. The availability and quality of waterbird habitat is impacted by factors such as increased development, recreational pressure, disturbance, and sea-level rise, with Dublin Bay subject to all these pressures.

### **Distribution and abundance of seabirds in a sheltered estuary: feasibility study in the Shannon Estuary using a Rigid Inflatable Boat**

**S.D. Berrow, J. Collins, M. Keville, S. Regan, M. Sardá-Serra and S. O'Meara**

*Irish Whale and Dolphin Group, Merchants Quay, Kilrush, Co. Clare*

Corresponding author: simon.berrow@iwdg.ie

The European Seabirds at Sea project provide standardised methodologies for surveying seabirds at sea. However, this methodology requires a minimum platform height of 5m and a survey speed of around 10 knots, which necessitates relatively large survey vessels. Surveying relatively narrow estuaries with shallow depths and limited manoeuvrability provides extra challenges. As part of a risk assessment to identify bird species exposed to shipping traffic, including exposure to incidental spills and disturbance, we were requested to carry out a survey of birds using the shipping channel in the Shannon Estuary. Local vessels included angling boats and passenger ferries, but with limited availability. We used a 6m Rigid Inflatable Boat (RIB) to carry out a survey with a platform height of <0.5m above sea-level. Here we present the results of this survey and perceptibility trials to test for perception biases when detecting seabirds at sea. A total of 23 surveys was carried out over a 12-month period from May 2021 to April 2022. One survey was carried out on the flood tide and one on the ebb tide to explore the influence of tide on distribution and abundance. A total of nearly 7,500 individuals comprising at least 28 species was recorded including seven species of Laridae, three Procellariidae, two Phalacrocoracidae as well as waders, ducks, and passerines. Perceptibility trials were carried out using painted decoys moored in the survey area and the distance of first detection recorded using a hand-held Global Positioning System device during different angles of approach. These showed that a decoy the size of an adult Gannet *Morus bassanus* on the water was detected at a mean±SD distance of 310±88m, a Gull at 184±115m and an Auk at 106±31m. These results demonstrate that data useful for risk assessment can be collected from an 'unsuitable' platform if the limitations of the methodology are measured and the area surveyed modified.



**Terns (*Laridae*) nesting in Dublin Port between 1995 and 2022: responses to nesting structure availability in a dynamic industrial setting**

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Common Terns *Sterna hirundo* and Arctic Terns *Sterna paradisaea* have been observed nesting on man-made structures in the Dublin docklands since at least 1949, with numbers increasing from a recorded 38 pairs in the late 1960s to a peak of 645 pairs of both species combined in 2019, the majority of which are Common Terns. Since regular monitoring began in 1994, two permanent mooring dolphins have been used annually, one of which is now included in the South Dublin Bay and River Tolka Estuary Special Protection Area due to its significance for breeding terns. Since 2013 Dublin Port Company has funded the monitoring work carried out by BirdWatch Ireland's Dublin Bay Birds Project. In addition, Dublin Port Company deployed two purpose-built pontoons specifically to provide additional nesting space for this growing tern colony. Predation, both avian and mammalian, is currently the greatest threat to the overall colony, with losses incurred annually. In addition to annual monitoring and habitat management, colour-ringing of both adults and chicks is providing useful information about the Dublin Port terns within the breeding season as well as during post-breeding migration, and from the wintering grounds. Dublin Port handles close to 50% of all trade in the Republic of Ireland, and the associated round-the-clock activity and vessel traffic makes it a highly dynamic environment with constant potential disturbance. Co-operation between, and support from, stakeholders has allowed crucial adjustments to relieve some of the pressures at the nesting sites. Co-operation and support are critical to the continued success of the colony. While the number of pairs of terns has increased notably in the port since records began, it is the developing nature of the port area that makes continued monitoring vital for assessing how changing conditions may affect the colony.

**A preliminary assessment of movements and usage of Dublin Bay by wintering waders**

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In November 2016, a total of 14 wintering waterbirds – including three Curlew *Numenius arquata*, five Redshank *Tringa totanus* and six Oystercatcher *Haematopus ostralegus* – was caught in Dublin Bay and fitted with Global Positioning System (GPS) tracking devices. The project was funded under the OEDU Prototype Fund of the Sustainable Energy Authority of Ireland. The project aimed to assess the efficacy of deploying tracking technology on coastal waterbirds on the Irish east coast to help inform marine renewable energy development in Ireland. The scope of the study was limited to the GPS fixes collected for the 14 individuals ranging from periods of four days to 105 days and was the first in Ireland to deploy GPS technology on wintering wading bird species. The longest data capture period was from an Oystercatcher fitted with a tracking device on Bull Island on 29 November 2016, with fixes successfully downloaded up to 16 March 2017, when the field element of the study concluded. Both Curlew and Oystercatcher showed inland movements, using terrestrial areas for feeding, but there were individuals within both species that did not stray from their intertidal habitats. The analyses revealed the specific locations of several terrestrial (grassland) feeding sites used by the waders and emphasised the usefulness of GPS technology for assessing the importance of urban grasslands for waterbirds and for informing any associated future management measures. Many of the terrestrial sites used by wintering birds during this study are not afforded legal protection, although they make up an important component of the activity budget of some wintering waterbirds that are on the list of Qualifying Interests of nearby EU-designated Special Protection Areas.

**The survival of the Curlew *Numenius arquata* as a breeding species in Ireland: is it time triage?**

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The results of the most recent survey of breeding Curlew *Numenius arquata*, published in 2021, indicate that the national population continues to decline despite management actions. At very low densities, breeding Curlews are exposed to the catastrophic effects of stochastic process in which one random event can extirpate a local population. One such event is nest predation. To inform the predator management strategy, the Irish Grey Partridge Conservation Trust undertook a predator survey in 2017 in six habitat types in five geographically separate locations where Curlew are known to breed. These surveys were carried out during the breeding season of the Curlew. Each site was ground-truthed to determine the average density, presence, or absence of avian and mammalian predators and to examine the challenges of predator management at each site. Based on two decades of empirical knowledge gleaned from protecting the nests of ground-nesting birds, each site was assessed to measure the likelihood of success in terms of the survival of broods to the fledgling stage. Each site was also assigned a traffic light colour system: red, the likelihood of success zero; amber, the likelihood of success possible; green, the likelihood of success achievable. Mammalian and avian predators were abundant at all Curlew breeding sites on the mainland. Only the offshore islands were assigned a green status, where success was achievable. Two bog sites were assigned amber. All other bog sites and wet grasslands were assigned red. Managing predators effectively is impossible over large areas. Therefore, a predator management system based on the principle of triage is more likely to produce fledged chicks because a more systematic approach is possible. Moreover, where breeding Curlew are below three pairs in any one county, head-starting should be prioritised ahead of predator management before these populations are extirpated.

**The Irish Garden Bird Survey: overview and recent changes in species distribution**

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The Irish Garden Bird Survey has run in its current format since winter 1994/95 (28 seasons). Observers submit weekly peak counts of each species seen in their garden during December, January, and February. Additional information is gathered to classify gardens by size, location and foods provided. Around 500 gardens took part in the late 1990s and early 2000s, generally increasing thereafter to >1,000 gardens since 2017/18. Ninety-three gardens have taken part for ≥20 years, 423 gardens for 10–19 years and 708 gardens for 5–9 years. From 2011/12 to 2020/21 the species more frequently recorded in Irish gardens (annual average) were Robin *Erithacus rubecula* (99%), Blackbird *Turdus merula* (98%), Blue Tit *Cyanistes caeruleus* (96%), Chaffinch *Fringilla coelebs* (91%), Great Tit *Parus major* (90%), Magpie *Pica pica* (90%), Coal Tit *Periparus ater* (84%), House Sparrow *Passer domesticus* (82%), Goldfinch *Carduelis carduelis* (82%) and Wren *Troglodytes troglodytes* (77%). Of the 30 most common species, the greatest decreases from the previous ten-year period were seen in Redwing *Turdus iliacus* (-44%), Mistle Thrush *Turdus viscivorus* (-30%), Greenfinch *Chloris chloris* (-21%), Siskin *Spinus spinus* (-21%) and Song Thrush *Turdus philomelos* (-18%). Largest increases were seen in Feral Pigeon *Columba livia domestica* (28%), Hooded Crow *Corvus cornix* (24%), Lesser Redpoll *Acanthis cabaret* (14%), Bullfinch *Pyrrhula pyrrhula* (9%) and Woodpigeon *Columba palumbus* (8%). In winter 2020/21 a new survey question was added to record sick birds seen in gardens to help identify patterns in infectious diseases, such as *trichomonosis*. This survey plays a valuable role in monitoring changing numbers and distribution of a range of species within and between years during the non-breeding season, complimenting surveys such as the Countryside Bird Survey and providing useful data on urban bird assemblages which are not otherwise monitored.

**Status of Icelandic-breeding and feral Greylag Geese *Anser anser* in Ireland, 2017/18–2019/20**

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This study provides an update of the status of Greylag Geese *Anser anser* in the Republic of Ireland, from both the Icelandic and Irish-breeding feral populations, during the winters from 2017/18 to 2019/20. We compare recent records with the last complete assessment in 2007/08. A peak count of 2,176 Icelandic Greylag Geese were recorded at five sites during the International Goose Census in November 2019, which constitutes around 2% of the flyway total. Although their range is largely the same, total numbers have declined by 42% since 2007/08. This coincides with a ca 45% decline in the flyway population over the same period. The population of Irish-breeding feral Greylag Geese is estimated at 3,579–4,218 individuals during the winter period. This represents an increase of 109–147% since 2008. These estimates assume a high level of site fidelity between the breeding and winter seasons. Twenty-seven extant flocks of feral Greylag Geese were recorded. Since 2007/08, three flocks decreased in number, nine flocks increased, and two remained stable. Three flocks recorded in 2007/08 have not been seen in recent years but feral Greylag Geese have expanded their range into 13 new areas. Recommendations are made for the future monitoring of Irish feral Greylag Geese to better account for changes in numbers and distribution of both populations, movements between breeding and non-breeding seasons, establishing their origins, and identifying possible impacts at sites important for rare and scarce breeding waterbirds.

**Nestboxes augment seabird breeding performance in a high-density colony: an insight from 15 years of monitoring data**

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The provision of artificial nest structures is used in the conservation of a broad range of bird groups, including raptors, owls, ducks, passerines, and seabirds, with varying degrees of success. Artificial nestboxes have been provided to increase the density and breeding success of Roseate Tern *Sterna dougallii* pairs at colonies in northwest Europe and the eastern seaboard of the USA and Canada, but their effect on breeding productivity has never been comprehensively quantified. Using 15 years of monitoring data, based on daily nest monitoring visits, we carried out a comparative analysis of the breeding performance of Roseate Tern pairs utilizing artificial nestboxes with those in open nests, on Rockabill Island (Dublin), to evaluate the effectiveness of nestbox installation as a conservation measure. Nestboxes were used before open sites early in the season, likely by the experienced breeding pairs. Hatching success and fledging success were higher for pairs in nestboxes compared with those in open nest sites. Earlier clutches were more successful than later ones, independent of the effects of nest site type. The results of this study show definitively that Roseate Terns nesting in nestboxes perform better than those using open nest sites at their largest European colony and that nestboxes are chosen ahead of other sites, likely by the experienced breeding pairs. We recommend the continued and expanded use of nestboxes to help maximise the densities and breeding performance of the Roseate Tern.

**The role of weather in the occurrences of the Red-eyed Vireo *Vireo olivaceus* in Ireland**

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The Red-eyed Vireo *Vireo olivaceus* is the most frequently recorded Nearctic passerine or near-passerine species in Ireland, and indeed in the Western Palearctic. As reviewed recently by the authors in *Irish Birds*, some 80 individuals have been recorded so far in Ireland since the first occurrence in 1951. Although the number of records appears to be increasing, all sightings have been confined to September and October. However, the identification of trends in the number and distribution of Red-eyed Vireo records in Ireland is confounded by parallel, and not fully quantified increases in the number and efforts of observers in this country. There is, moreover, clear evidence of weekend bias in the recorded patterns of

sightings. Most records of the species occur in the southwest – particularly in County Cork – but an emerging trend is for increasing numbers to be discovered in Counties Galway and Mayo. The focus of this study is to find the most frequently occurring set of weather conditions associated with the occurrences of the species in Ireland. Although autumn hurricanes moving through the Gulf of Mexico are widely supposed to be the main drivers of Red-eyed Vireo, and other American passerine and near-passerine occurrences in Ireland and the UK, the rapid passage of a series of trans-Atlantic depressions as being the more likely explanation of the records pattern has been identified (Dr Norman Elkins). These and other aspects of autumnal Atlantic weather events (including, for example, the position of the Jet Stream) will be addressed in this study which will also, broadly speaking, look at possible correlations with Nearctic shorebirds which however appear to migrate at different altitudes to passerines and near-passerines.

**Improving conservation value of Corncrake *Crex crex* sites: the contribution of various early and late cover types and quality to invertebrate diversity and abundance**

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The Corncrake *Crex crex* is listed in Annex I of the EU Birds Directive. It is also on the Birds of Conservation Concern list in Ireland on account of its large decrease in numbers and range. This MSc project is part of the EU LIFE funded Atlantic Crex Project, which aims to improve the conservation status of Corncrake in Ireland by enhancing the Special Protection Area network and surrounding farmland. The contribution of high quality early and late cover (ELC) to successful Corncrake breeding is well known, but the ecological mechanisms which underpin its contributions are not well understood. This project will investigate invertebrate abundance, diversity, and size across a suite of ELC plots and adjoining breeding habitats. The project will focus on sites with a range of trial ELC cover types and those identified for development and demonstration of a ELC habitat scoring system. Passive sampling of invertebrates will be undertaken, and detailed habitat structure and composition analyses will be conducted from March to October of 2023. Data collected will be compared to ELC scorecard data and Corncrake locations to inform decisions related to ELC establishment and restoration. The data will provide information on the management of ELC plots to maintain and enhance abundance and diversity of Corncrake prey species. This will facilitate improved guidance and enable identification of key factors that influence invertebrate prey abundance in ELC plots for Corncrake.

**Global Positioning System tracking reveals wide variations in home range size during the breeding season of the Eurasian Curlew *Numenius arquata* in Ireland**

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The population of breeding Eurasian Curlew *Numenius arquata* in Ireland has declined rapidly over the last 40 years with an estimated 105 pairs remaining by 2021. The Curlew Conservation Programme (CCP) was set up to reverse this decline. The National Parks and Wildlife Service, as part of the CCP, together with BirdWatch Ireland have carried out two years of tagging to track the movement of Curlew in Ireland with 30 birds tagged to date. Understanding how Curlew use space across the breeding season is essential for their conservation. I employed a method based on revisitation rates to determine the nest site to assist CCP teams locate and protect nest sites. I then estimated the home range of the birds across the breeding season to gauge how their area of use fluctuates according to different stages of the life cycle. Historical home range estimates tend to include unused areas (Minimum Convex Polygon) or underestimate range size due to autocorrelation (Kernel Density Estimation). Given the cost of monitoring and protection of landscapes, accurate estimates are critical. I modelled home range size using autocorrelated kernel density estimators which provides a more accurate picture of space use. The results showed significant variation between individuals (0.4 km<sup>2</sup>–10.5 km<sup>2</sup>, median 2.3 km<sup>2</sup> during incubation). The potential causes of the variations are manifold, including fragmentation of habitat. I plan further investigations utilising high resolution land cover maps to determine the environmental drivers that underpin this variation

and high resolution accelerometry data to investigate Curlew behaviours. A significant proportion (44%) of the tagged Curlew were unpaired and included one that made several trips to the UK, probably in search of a partner.

### **Ireland's newest and most northerly bird observatory: Inishtrahull Island, County Donegal**

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Bird observatories have historically provided a range of important functions for bird conservation, including migratory behaviour and long-term species monitoring. The logbooks of long-running observatories (such as Cape Clear, County Cork) are an important resource to document the changes in migratory behaviour of species which may be driven by changes in global climate and species' range and abundance. A further important role of observatories is the focus and opportunity they create for long-term monitoring of breeding species, such as seabirds. There are only two bird observatories on the island of Ireland (Cape Clear and Copeland, County Down). Supported by National Parks and Wildlife Service and the Commissioners of Irish Lights, we formed a small founding committee to establish a new bird observatory in 2020. This was formalised in 2022 through securing a lease for use of the former lighthouse-keepers accommodation on Inishtrahull. The year 2022 was also the second year of detailed seabird population and productivity monitoring on the island. The island holds 11 species of breeding seabird plus Eider *Somateria mollissima*. The island is ideally located for the recording of migratory birds. Partly due to its inaccessibility, it has been largely neglected as a bird habitat. It was manned for just 43 days in autumn 1965 as part of a series of years of manning of the Malin Head Bird Observatory, during which time Short-toed Lark *Calandrella brachydactyla*, Barred Warbler *Curruca nisoria* and Common Rosefinch *Carpodacus erythrinus* were recorded. Some 50 years later there is some scope to put the island on the migration map. From spring 2023 onwards we hope to be able to offer accommodation for visitors to the island, to participate in seabird monitoring and ringing work and undertake migration studies. Here we describe the island and its facilities, and some findings on its natural history.

### **Curlew *Numenius arquata* in Ireland in 2021: status and distribution**

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The Eurasian Curlew *Numenius arquata* was once a ubiquitous breeding bird of the Irish landscape, occurring in lowland wet grassland, lowland raised bog and upland blanket bog across all counties. The species is declining throughout its range and the severity of the decline in Ireland has been especially acute. The Curlew is on the International Union for the Conservation of Nature, and the Birds of Conservation Concern in Ireland Red Lists. To provide an update on the status of breeding Curlew in Ireland, the National Parks and Wildlife Service commissioned a survey in the 2021 breeding season. Surveys were conducted across 167 sites in each of 17 counties during the period April–July. Of the 167 sites surveyed, the Curlew was absent from 52 sites (31%) recorded as previously occupied. The remaining 115 sites held a total of at least 58 confirmed breeding pairs, 47 probable breeding pairs, and 14 possible breeding pairs. Thus, the estimated size of the Irish breeding population in 2021 was 105 breeding pairs (confirmed and probable pairs only, as per 2015–17), or 119 if possible breeding pairs are included. This constitutes a further decline of 24% (33 pairs) from the 2015–17 estimate of 138 breeding pairs (confirmed and probable only), and a decline of 98% since the 1980s.

### **A national survey of Red Grouse *Lagopus lagopus* in Ireland, 2021/22**

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Recent genetic evidence suggests that Red Grouse *Lagopus lagopus* is a separate species from Willow Grouse, and that the Irish Red Grouse may be distinct from the British population. Strongly associated with heather-dominated habitats, the widespread abundance of blanket and raised bogs meant that Red Grouse occurred in many counties. Reductions in the

extent of intact bogs since the mid-1990s, however, has resulted in significant loss of available habitat. Unsurprisingly, the species has undergone significant declines in range and abundance. A survey carried out in 2006–08 estimated a population of over 4,200 birds, concentrated in the western counties of Donegal, Mayo, and Galway with pockets in several other upland regions, notably the Wicklow Mountains. Here we present the results of a national survey commissioned by the National Parks and Wildlife Service (NPWS) in 2021/22 to assess the size and distribution of the current population, changes since the previous survey and to gain a better understanding of drivers of population change. In the period December–April 2021/22 NPWS regional conservation staff, volunteers and contracted fieldworkers surveyed around 490 one-km squares across Ireland. These were resurveyed from a random stratified sample of 1 km squares generated in 2006–08, based on habitat and geographical characteristics. The full results of the survey will be published later in 2023.

### **Status of Chough *Pyrrhonorax pyrrhonorax* in Ireland: results of a national survey in 2021**

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The Chough *Pyrrhonorax pyrrhonorax* is a charismatic bird primarily of Ireland's Atlantic coasts. Successive national surveys since the 1960s have indicated the population in Ireland lies in the range 560–906 breeding pairs. The most recent national surveys of 1992 and 2002/03 recorded totals of 904 and 838 breeding pairs, respectively. The National Parks and Wildlife Service commissioned a national survey in 2021, the primary aims of which was to determine the size of the breeding and non-breeding component of the national population, and to examine trends in populations with previous surveys at regional and national scales. Surveys were undertaken from Inishowen (Donegal) to Saltee Islands (Wexford) during April–June 2021. Over 2,000 one-km squares were surveyed, and the population was estimated at around 900 breeding pairs. The largest concentrations in terms of numbers of pairs were in Counties Cork and Kerry which, combined, held 57% of the breeding population. An additional 727 non-breeding birds nationally were counted. The overall breeding population does not differ from that recorded in 1992 and was 7% higher than in 2002/03. However, regional changes are apparent with numbers down in five counties and up in six. Changes since 2007–11 are evident; the range of the population has contracted, with fewer 10 km squares showing evidence of occupation in 2021. These declines are most apparent in some areas of the northwest (i.e. north and west Donegal, and inland Leitrim and Sligo) and west (Clare). Whilst the number of non-breeding birds is lower than in both previous censuses, the proportion of non-breeders in the population has remained highly consistent at about 31%.

### **Foraging behaviour of European Shag *Gulosus aristotelis*, Sandwich Tern *Thalasseus sandvicensis* and Common Tern *Sterna hirundo* in northwest Ireland: preliminary findings of a Global Positioning System tracking study**

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Coastal zones provide a wide range of ecosystem services and are widely recognised as of considerable economic and ecological value. Sitting at the interface between human settlements and the open sea, coastal systems are highly vulnerable and subject to a range of anthropogenic pressures. Some of these have resulted in threats to a wide range of marine species, including seabirds. Marine Protected Areas are one mechanism to afford some level of protection to seabirds, primarily during the breeding season. Tracking data can provide useful information to assist with such designations. Much attention in Ireland has been focussed on investigating the foraging patterns of pelagic long-range foraging species; coastal species with more restricted foraging ranges (such as terns, Shag *Gulosus aristotelis* and Black Guillemot *Cephus grylle*) have been relatively understudied. A study commissioned by the National Parks and Wildlife Service in 2022 involved tracking the movements of breeding Shag (two offshore islands) and breeding Sandwich Tern *Thalasseus sandvicensis* and Common Tern *Sterna hirundo* at a single colony in northwest Ireland. We quantified utilisation, distribution, and aspects of foraging behaviour such as flight speeds, distance, and orientation of movements from the colony. Space use differed markedly between the two tern species, and between Shags from the two study

colonies, reflecting, respectively, the different ecology of the terns, and probably the nature of sediments, bathymetry, and food supply at the two Shag colonies.

### **Winter habitat use by Grey Plover *Pluvialis squatarola* in relation to aquaculture structures**

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Previous research has shown varying within-site effects of aquaculture activities on space use by inter-tidal foraging waterbirds, with some species showing negative and others no apparent negative effects. Possible consequences of aquaculture activity could include direct habitat loss or indirect 'loss' such as via the effects of disturbance by those engaged in aquaculture activity. To examine the potential impacts of aquaculture trestle structures on individual species, we compared trends of selected species at several spatial scales – testing the hypothesis that trends which were different (positive or negative) to those at regional and national scales may indicate whether site-specific factors might be contributing to population trends, or not. We also used Global Positioning System tracking data to generate Resource Selection Functions (RSFs) to compare real locations with randomly-generated pseudoabsences, to model resource selection or avoidance (specifically if habitat use is more, less, or as expected, in relation to availability). Comparison of long-term trends indicated that for most species, population trends at Dungarvan (Waterford) were consistent with those from other sites at regional and national levels, indicating that there is little evidence for in-site effects on abundance. Individual Grey Plovers *Pluvialis squatarola* tracked in 2020 and Brent Geese *Branta bernicla* tracked in 2021 showed varying RSFs in relation to aquaculture structures. Brent Geese showed evidence of utilisation of trestles which was most likely due to foraging on *Ulva* on the trestles themselves normally at or near high water. Grey Plover avoided usage of the areas where aquacultural activities occurred and unexpectedly widely used inland sites for terrestrial foraging.

### **Colour-marking waders across Ireland**

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Ireland holds significant numbers of wintering waders, but relatively small numbers of breeding waders – in both cases numbers are declining significantly, particularly in the last few decades. Unlike many other parts of Europe, large-scale colour-marking of waders in breeding or wintering sites in Ireland has been limited. Arising primarily from increased capability associated with cannon-netting of Brent Geese *Branta bernicla*, we initiated colour-marking programmes of a variety of wader species, beginning in 2010. A separate BirdWatch Ireland initiative – the Dublin Bay Birds Project – began in the mid-2010s. Elsewhere, our group has undertaken work on a wide range of wintering waders across several counties and all coastlines, including Clare, Waterford, Dublin, Louth, Down, Londonderry and Donegal. Breeding waders using our schemes have targeted Curlew *Numenius arquata* nationally and Lapwing *Vanellus vanellus* and Redshank *Tringa totanus* at selected sites. While the overall objectives of individual projects differ, colour-marking has and will provide useful information on flyway connectivity, site fidelity and a range of demographic rates. Managing and maintaining these large datasets in the long-term provides challenges for both project leaders and the observer network who provide re-sighting data. In 2023, we launched an online ring re-sighting data management system (via a Shiny app hosted on a new Irish Brent Goose Research Group website) to enable user-friendly observation uploads to a database and immediate feedback to observers. This has built-in validation checks and, whilst somewhat impersonal has the benefit of being a sustainable long-term data management system with minimal human intervention. Here we summarise our various projects, and main findings with respect to in- and between-season movements by waders at national and flyway scales.

### **The diet of the Raven *Corvus corax* on the Loop Head Peninsula, County Clare**

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The ecology and diet of the Raven *Corvus corax* has been the subject of relatively few studies and is poorly understood. Partly digested regurgitated pellets containing identifiable food items were collected from eight out of nine nest sites on the Loop Head peninsula. A total of 335 pellets from eight coastal breeding territories were sampled during the breeding seasons of 2016 and 2017. Qualitative analysis showed their diet consisted mainly of small mammals including rodents and lagomorphs, bird's eggs, beetles, birds, and plant material. However, the diet varied significantly between territories which was thought to be associated with food availability. A territory located beside a Guillemot colony *Uria aalge* had a significantly higher frequency of occurrence of green eggshell in pellets, typical of guillemots. This suggests that coastal breeding Ravens nesting close to auk colonies, and perhaps other seabird colonies, exploit this seasonally available and energy-rich food source. In contrast, a territory located on an island within the estuary had lagomorph fur in over 90% of pellets which suggests the abundant Rabbit *Oryctolagus cuniculus* population on the island was a significant food source for this breeding pair. Pellet analysis showed that throughout all territories the food materials that had the highest frequency of occurrences were, as expected, grass, fur, loose hairs, and mammal bone. However, breeding Ravens exploited locally abundant food resources, including seabird eggs and Rabbits, which showed a significant difference in their diet between territories on the Loop Head peninsula.

### **Investigating the occurrence of summering Knot *Calidris canutus* at Dundalk Bay**

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Knot *Calidris canutus islandica* which nest in high arctic Canada and in northern Greenland winter in western Europe. Adults return to their breeding grounds in spring, but at some sites second-year birds remain close to their wintering grounds in summer. In Ireland, Knot populations are censused from September to March annually, and until very recently they were considered either rare or absent outside this monitoring period. The purpose of this study was to investigate potential patterns of occurrence of summering/moulting Knot at Dundalk Bay (Louth). In 2018, up to 500 mostly moulting second-year birds were discovered summering at Dundalk Bay. In addition, up to 1,000 post-nuptial adults were recorded at the same site in August 2018. Age classes were identified by differences in plumage. This was the first occasion that Knot were documented summering in Ireland. Moreover, the number of adult birds present in August was exceptionally high. To establish whether these were isolated events or part of a frequent or even annual pattern, systematic observations have been carried out annually from April to August in 2019–2022. Fieldwork focused on weekly counts, recording of coloured or coded leg rings and determination of the percentage of adults and second-year birds in the flocks. Results to date show that both age classes of Knot moult at Dundalk Bay annually, but also that there is considerable inter-annual variation in the numbers that occur. Monitoring in summer will continue to establish long-term population trends and site fidelity. Since 2019, other sites on the east and west coasts have been surveyed occasionally, but no obvious patterns have been identified.

### **The status of summering waders at Dundalk Bay**

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While populations of over-wintering waders are monitored regularly in Ireland, there has been little focus on summering birds to date. This study investigated the populations of fifteen non-breeding wader species in summer at Dundalk Bay (Louth). The presence or absence of each species was recorded weekly and at least one count was made each week in June from 2018 to 2022. June (weeks 23 to 26) was chosen for this study because it is a period when species diversity and populations at coastal wetlands in Ireland are likely to be at their lowest. Results have shown that the five-year mean for Oystercatcher *Haematopus ostralegus*, Knot *Calidris canutus*, Black-tailed Godwit *Limosa limosa* and Bar-tailed Godwit *Limosa lapponica* exceeded their respective 1% threshold for national importance. Curlew *Numenius arquata* and



Redshank *Tringa totanus* were present continuously but in lower numbers. However, the populations of both species did exceed their respective threshold for national importance at the end of June (week 26), with the arrival of post-nuptial migrants. Eight other species occurred with varying degrees of regularity, but in very small numbers and only one, Golden Plover *Pluvialis apricaria*, was absent. Most summering waders were second-year birds identified by their lack of summer plumage, but a small number were assessed to be non-breeding adults in summer plumage. For some species, over 90% were second-year birds. In conclusion, while Dundalk Bay is known to be one of Ireland's most important sites for wintering waders, these results demonstrate that it is also an important site for summering/moulting immature birds.

### **Biometrics of Dunlin *Calidris alpina* wintering in Ireland**

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The aim of this research is to improve our knowledge and understanding of the ecology of passage and wintering Dunlin *Calidris alpina* in Ireland, with special reference to potential climate change impacts. In Ireland, three subspecies of Dunlin are thought to occur. *C.a. schinzii* has a small breeding population on the bogs in north and west Ireland, Scotland Iceland, and northern Scandinavia, migrating south in August and September to winter in west Africa (although some may winter in Europe). *C.a. arctica* breeds in Greenland and probably migrates through Ireland to winter in the Mediterranean basin and north Africa. *C.a. alpina* breeds in northeast Europe and Siberia and is the main sub-species wintering in Europe, including Ireland. For this study, Dunlins are captured (under a Section 32 licence issued by National Parks and Wildlife Service and subject to British Trust for Ornithology permits) at three study sites. Capture methods follow established guidelines to ensure appropriate legal and ethical treatment of all birds captured. Each bird is ringed, aged and biometric data (wing, tarsus, bill, head and bill length and weight) collected following standard methods. Wing length and bill length are recommended as the most appropriate measurements to separate subspecies (notably *C.a. schinzii* and *C.a. arctica* from *C.a. alpina*). Results to date (for the months September to February inclusive) indicate that wing lengths are very highly significantly shorter in September than in all other months (October to February inclusive); ( $t(946) = -8.47, p < 0.0001$ ) and also very highly significantly shorter in October than in the months November to February inclusive ( $t(716) = -5.97, p < 0.0001$ ). Similarly, bill length are very highly significantly shorter in September than in all other months ( $t(803) = -5.97, p < 0.0001$ ) and in October compared to November to February inclusive ( $t(631) = -3.89, p < 0.0001$ ). Size differences are likely to relate to different sub-species compositions within the autumn (migrating) and wintering populations.

### **Estimating Dipper *Cinclus cinclus* populations and performance using mark-recapture methods**

**A. Copland and M. Whelan**

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Intensive studies of Dippers *Cinclus cinclus* have been undertaken in two river catchments in the midlands of Ireland (River Little Brosna and upper River Nore) since 2011. Survey work covers both the nesting and winter period and has multiple aims, one of which is to determine the total breeding population of Dippers in each of the two study catchments. During the nesting season, all known nesting sites are visited. These are typically at bridges but other sites (e.g. banks that have previously been located) are also checked. If time is available, river sections where no nests are located may also be 'cold-searched'. All nests located are monitored and, where appropriate, chicks are ringed (under licence from National Parks and Wildlife Service and subject to British Trust for Ornithology permit requirements). The outcome of all nests is also recorded. Approximately 200 sites are checked in the two catchments, with ca 100 nesting attempts recorded annually. During winter (between November and mid-February), roosting sites are visited, full-grown Dippers captured and, if required, fitted with rings. Adults (i.e. birds confirmed to be one year old or over) may also be fitted with colour rings to assist in future recording and identification. Approximately 100 full-grown Dippers are captured annually during winter roost surveys. Based on previous studies on Dipper ecology, it is assumed that the level of immigration into the two study catchments approximately equals emigration. Therefore, by using mark-recapture methods, it is proposed that annual population levels within each of the two study catchments can be estimated. These data, together with metrics on water

quality within each of the two catchments, will allow wider monitoring of the health of Dipper populations and their freshwater aquatic ecosystem.

### **Estimating survival of Irish Dippers *Cinclus cinclus***

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Intensive studies of Irish Dippers *Cinclus cinclus hibernicus* have been undertaken in two river catchments in the midlands of Ireland (River Little Brosna and upper River Nore) since 2011. Survey work covers both the nesting and winter period and has multiple aims. Recent records of very old Dippers (including British Trust for Ornithology longevity records) might suggest that Irish Dippers are longer-lived than Dippers in the UK, although previous studies on this subspecies have not confirmed that this is the case. Nevertheless, one focus of this project is to determine survival data for Irish Dippers in these two midland catchments. Survival is determined through the resighting of Dippers ringed as nestlings during the breeding season and full-grown birds ringed during the winter. Originally, survival estimation was attempted through recording adults in the nesting season (i.e. breeding pairs) as part of a Retrapping Adults for Survival (RAS) project. However, this proved very time consuming in relation to catching nesting adults and/or reading rings at active nests. Due to the greater rate of recapture (or resighting) data available from winter roosting birds, recording at winter roosts has become the principal focus of this part of the project. An initial evaluation of survival of Dippers in the two catchments is proposed following the completion of winter-season fieldwork in 2023/24 (to allow three full years after the interruption to ringing activities associated with COVID-19 restrictions).

### **Breeding Birds of Conservation Concern on former industrially cutaway raised bogs**

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It has been acknowledged in the latest Birds of Conservation Concern review (BOCCI4) that appraisal of status in Ireland is heavily reliant on the availability, or not, of data on species abundance. In this respect the occurrence and/or abundance, or not, of many species has to date been relatively poorly known in respect of certain habitats. Industrially cutaway raised bog is one such habitat. Although industrial peat extraction by Bord na Móna officially ceased in 2020, many Bord na Móna extraction sites are currently at various stages of pioneer habitat development and succession with mosaics of pioneering vegetation, bare peat, wetlands or emergent scrub and birch dominated woodland, which all have the potential to support species of conservation concern. Additionally, marginal habitats often comprise various mosaics of bird habitat. To investigate the relative importance (if any) of these habitats for potential species of conservation concern we have reviewed data from transects (n = 37 totalling 37 km in length) for which bird species data was collected as part of monitoring under the 'Peatland Climate Action Scheme'. Transect distribution was across 15 cutaway raised bogs located in Counties Offaly, Galway, Kildare, Roscommon, and Longford. Of the 72 species recorded, 70 have been assigned a BOCCI4 conservation status of either Green, Amber, or Red. The two exceptions are Pheasant *Phasianus colchicus* and Eurasian Crane *Grus grus*. For those species assigned a BOCCI4 conservation status, they comprise by percentage 57% Green-listed, 26% Amber-listed and 14% Red-listed. Habitats at the study sites support a substantial number of species of conservation concern, directly or indirectly, during the breeding season. It is hoped that ongoing monitoring will establish whether the proportions of these species change following peatland rehabilitation.

**The breeding season bird assemblage of former industrially cutaway raised bogs**

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Bord na Móna have been extracting peat in the midlands of Ireland to generate electricity, for fuel and as a growing media for nearly 80 years. Industrial peat production officially ceased in 2020 and many of the former Bord na Móna cutaway sites (comprising up to 33,000 ha) are now scheduled to be rehabilitated under a scheme titled the ‘Peatland Climate Action Scheme’ (PCAS). Bord na Móna ecologists have been carrying out breeding bird surveys since 2021 on selected cutaway bogs. Standardised breeding bird monitoring (as part of this scheme) now being undertaken is establishing a baseline which can then be examined to inform an appraisal of the changes (if any) to the existing breeding assemblage post rehabilitation. This effectively comprises the largest breeding bird survey of this habitat type in Ireland to date. To investigate species richness, a transect methodology is utilised to generate a representative sample of breeding birds at each study location. An abundance index is derived from the data based on maximum transect counts per species during the period April to June inclusive. We recorded 72 species in 2022 across 15 cutaway bogs included in the PCAS. Relative abundance was highest for Willow Warbler *Phylloscopus trochilus*. Other species for which relative abundance was considered noteworthy was Meadow Pipit *Anthus pratensis* (ranked second overall), and Sand Martin *Riparia riparia* (ranked sixth overall). The monitoring described here will be carried out at several study sites for multiple years and is proposed to be expanded to include further bogs in the above rehabilitation scheme, which is due to run for five years. It is hoped to report further on the baseline data and on any increases or variation in the species assemblage following rehabilitation.

**Breeding season habitat associations of birds on former industrially cutaway raised bogs**

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A breeding season survey of birds on industrially cutaway raised bog was carried out in 2022. The study sites comprised 15 different Bord na Móna bogs now at various stages of pioneer habitat development and succession post the cessation of industrial peat extraction. Species recorded during the period April to June inclusive have been assigned a habitat association code from one of two categories namely ‘open’ or ‘non-open’. Associations were interpreted following Nairn and O’Halloran (2012, *Bird Habitats in Ireland*. Collins Press, Cork). In broad terms, the category ‘open’ was applied to those species most strongly associated with pioneering habitats found on cutaway bog whilst species generally associated with scrub and woodland are assigned to the ‘non-open’ category. We estimated the species density of the 15 cutaway bogs studied comprised by percentage, 67% of open habitats and 33% of non-open habitats. Notable open habitat species recorded included waders such as Curlew *Numenius arquata*, Redshank *Tringa totanus*, Lapwing *Vanellus vanellus*, Ringed Plover *Charadrius hiaticula* and Snipe *Gallinago gallinago*, along with passerine species such as Skylark *Alauda arvensis* and Meadow Pipit *Anthus pratensis*, whilst notable non-open habitat species included Willow Warbler *Phylloscopus trochilus*, Goldcrest *Regulus regulus*, Starling *Sturnus vulgaris* and Sparrowhawk *Accipiter nisus*. Certain species recorded (an example would be Swift *Apus apus*) associate with open areas of cutaway during their respective breeding season, but do not breed on cutaway itself. Therefore, the relative importance of cutaway raised bog for breeding season foraging or as a refugium may be underestimated for certain species. As further data is collected over the lifetime of the current rehabilitation scheme, we hope to monitor and report further on habitat associations across these bogs. This will support evaluations of the importance of rehabilitated cutaway bog habitats in contributing to future biodiversity or nature restoration initiatives.

**The use of Barn Owl *Tyto alba* pellets to map biologically available strontium isotope compositions in County Galway for bioarchaeological applications**

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Paleodiet and paleomobility studies in bioarchaeology (scientific study of human remains in archaeology) rely on the observation that strontium isotope compositions ( $^{87}\text{Sr}/^{86}\text{Sr}$ ) within the biosphere vary geographically, primarily based on the age and composition of the local bedrock. As such, strontium isotope ratios recorded in archaeological human skeletal tissues, mainly tooth enamel, can be effective biological measures of residential change and, in some cases, place of origin across geological landscapes. Common practice in this field is to compare the  $^{87}\text{Sr}/^{86}\text{Sr}$  isotope signature obtained from the tooth enamel under study to the 'local signal', a representative range in strontium isotope values that exist in the biosphere of that region. This critical local signal can be achieved by using several different media: tooth enamel from archaeologically recovered fauna and/or modern small mammals such as mice, molluscs such as land snail shell, soil leachates, water, and modern vegetation, all with varying outcomes of success. Here, we present the first-known interdisciplinary study in Ireland to use modern Barn Owl *Tyto alba* pellets which intends to produce a strontium isotope biosphere database that can be applied to archaeological questions concerning ancient residential human diet (paleodiet) and mobility (paleomobility). Samples for Sr analysis were collected from modern small mammals (Wood Mouse *Apodemus sylvaticus* tooth enamel) contained within the owl pellets from nesting sites in County Galway, without any disturbance to the Barn Owls themselves. Notably, this innovative approach offers new comparative data when conducting isotope analysis on archaeological human remains, including those held within the repository collection at the National Museum of Ireland. The project is funded by Galway County Council through the Local Biodiversity Action Plan Fund.

**Decadal-scale increases in vessel interactions by a scavenging seabird**

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Fisheries by-products are used by many seabirds as a supplementary source of food, but seabirds interacting with fishing vessels are at increased risk of bycatch in fishing gears. As a result, bycatch is one of the leading contributors to seabird declines worldwide. Changing prey availability may lead to more seabirds targeting fishing vessels to substitute natural prey species, thereby increasing bycatch risk. Biotelemetry provides tools to study seabird-fisheries interactions. Light level geolocators can be used to detect nocturnal seabird-vessel encounters, with the longevity of these devices giving us the opportunity to explore long-term trends. The Northern Fulmar *Fulmarus glacialis* interacts extensively with fishing vessels and is the most common seabird species taken as bycatch in the North Atlantic. Here, we explore two geocator timeseries separated by a decade from Fulmars at Little Saltee (Wexford). The rate of fishing vessel encounters increased over this time, despite a reduction in fleet sizes and fisheries waste over the same period. Vessel encounter rates were heavily influenced by individual differences, and males were roughly twice as likely to encounter vessels than females. In addition, we found that higher encounter rates correlated with lower time spent in foraging-type behaviour and a reduced distribution. We suggest that the increase in fishing vessel attendance may signal an increased reliance on associated food sources, suggesting that natural prey may be less available over decadal timescales. Regardless of cause, increases in vessel encounters place Fulmars at greater risk of bycatch, and there is an increasing urgency to improve and implement mitigative measures in bycatch-prone fisheries.

**Assessing impacts of offshore wind energy developments on breeding seabirds in Ireland**

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With the expansion of offshore windfarm (OWF) developments, uncertainties persist surrounding the potential impacts of these developments on sensitive and protected marine species. Seabirds can be affected by windfarms through direct collision, or indirectly through habitat loss, barrier effects and disturbance within their preferred foraging grounds. Furthermore, cumulative effects from multiple developments with the generally large foraging range of seabirds can impact populations over large scales. Two complementary research projects will focus on the potential impacts of future OWF developments on breeding seabirds, particularly on the southern and eastern coasts. At-sea distribution data from breeding and non-breeding seasons are available from the Irish government's ObSERVE programme of aerial surveys (conducted in 2015, 2016, 2021 and 2022) and will be used to identify areas of high density and overlap between at-risk species and OWF development. Tracking studies are scheduled for the 2023 breeding season in areas of high spatial overlap to identify foraging areas, flight heights, and estimate turbine collision risk for Black-legged Kittiwake *Rissa tridactyla*, Sandwich Tern *Thalasseus sandvicensis*, Common Tern *Sterna hirundo* and Northern Gannet *Morus bassanus*. Analysis will include distribution modelling and individual-based models to assess population effects of collision mortality and displacement. The results of this work will inform strategic marine spatial planning and mitigation measures in support of the sustainable development of offshore energy generation.

### **First breeding success of Common Cranes *Grus grus* in Ireland since the sixteenth century**

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Breeding attempts by a pair of Common Crane *Grus grus* (hereafter Crane) have been monitored by Bord na Móna on a cutaway-bog site in the midlands of Ireland since 2020. The first confirmed breeding attempt by a pair at the site occurred in 2019, with further attempts in 2020 and 2021. The purpose of this abstract is to provide an update on the breeding success of a pair of Cranes at the same location as previous attempts during the 2022 season. A pair of adult Cranes was first observed in mid-March. Low frequency monitoring (at a suitable setback distance) by a single observer only was undertaken through the nesting and incubation period, and in late May the pair was observed near the nest location with two recently hatched chicks. Chicks were not observed further until late June, likely due to the preferential selection of birch scrub habitat for foraging which makes detection difficult. Following several instances where Cranes were heard vocalising, fledging was confirmed in late July 2022 when the family party was observed flying close to the nest location. Post fledging, the initial territory continued to be used, but observations indicate that agricultural land outside the Bord na Móna landholding was also used, which aligns with usage patterns from other jurisdictions (Scotland, for instance). The last observation of the Cranes during the 2022 breeding season was in mid-September. This update describes the first known successful breeding attempt of Crane in Ireland since the sixteenth century. Bord na Móna will continue to monitor and report on the status of breeding Cranes throughout their landholding.

### **If you've got it, flaunt it: higher levels of dichromatism found in bird species with higher adult survival**

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As a sexually selected trait, sexual dichromatism, the presence of colour disparity between males and females of a species, is expected to be strongly linked to life-history. Yet, while dichromatic species are predicted to be associated with fast-paced life histories, this has yet to be directly tested. Here we test whether non-passerine birds with fast life histories are associated with higher levels of dichromatism. We quantified sexual dichromatism levels using Colour Distance Matrices (CDM) values for 377 species and using phylogenetically comparative analysis tested whether species with short lifespan, fast generation times and high reproductive rates were more associated with higher levels of dichromatism. We found that higher levels of dichromatism were found in dichromatic species with higher adult survival rates. Our results indicate that higher levels of sexual dichromatism is an honest signal of fitness in dichromatic bird species. Bird species only acquire high levels of sexual dichromatism as a trait once a species can afford it without compromising survival. We also looked at the relationship between sexual dichromatism and breeding grounds, hypothesising that males in solitary breeding species

may have less competition acquiring a mate compared to species which mate in groups. We found that this was the case: group breeders had higher CDM values than solitary breeders, indicating that group breeding bird species are more dichromatic than their solitary counterparts. This indicates heightened sexual selection pressures in group breeders for colourful visual displays, with solitary and colonial breeders relying on other types of behavioural displays (such as vocal or dance).

### **Farm management in the historic stronghold of Red-billed Chough *Pyrhocorax pyrrhacorax* and Corncrake *Crex crex* in Northern Ireland**

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We carried out a survey exploring farming practices and farmer opinions in an area where Chough *Pyrhocorax pyrrhacorax* and Corncrake *Crex crex* historically bred along the north coast of Northern Ireland. The purpose of the study was to gain an understanding of relevant farming practice as a starting point for 'what next?' for these species in this area. A similar survey had previously been carried out among farmers who had Chough feeding on their land across Great Britain, and we compare these results. More than 80% of those approached did not wish to complete the interview and there were a variety of reasons for that. Twenty interviews were completed, and this compares to 23 from Scotland, 22 from Wales, 15 from Cornwall and three from the Isle of Man. Along the north coast of Ireland, we found farmers in general open to changes in management practices if they can be engaged in the planning process. From the practices recorded, there are changes that could be discussed for the benefit of Chough and Corncrake. On the mainland Causeway Coast there were greater differences than on Rathlin Island between farming practices, and those more beneficial to Chough and Corncrake. On the mainland, recovery of these species would necessitate a strategic plan, consultation over a wide area and a significant shift in farming practices.

### **From take-off to touch down: how has wind impacted migration timing in a long-distance and long-lived migratory seabird, the Manx Shearwater *Puffinus puffinus*?**

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The timing of avian migration plays a key role on survival and recruitment, which depends on synchrony with seasonal peak food availability and optimal weather conditions. Evidence suggests that the changes in climate-driven phenology (the timing of biological events that depend on climate) is rapidly increasing at all trophic levels. However, our current lack of understanding of the many mechanisms controlling bird migration limits our ability to understand and predict the impacts of climatic change for migratory birds. In this study, we extract key phenological migration dates from capture-mark-recapture ringing data over a 68-year period (1953–2020) to examine the scale at which weather impacts timing of migration of an Amber-listed seabird species, the Manx Shearwater *Puffinus puffinus*. Migration timing does not change over time but as wind speed increases arrival to the breeding colony is earlier, thus demonstrating how the timing of migration is influenced by local climatic conditions. We will discuss the risks associated with extreme winds and the importance of it for landing, flying, taking off, and how it effects migration duration, thereby enhancing our understanding of species' responses to changes in the weather and the potential impact it has on survival and breeding success. We highlight the importance of long-term time-series data collection in ecology and the significant effort made by duty officers, volunteers, and citizen scientists in maintaining consistent data recording over a remarkable seven decades.

**Interactions between harrier species and wind energy: a global, bilingual, systematic review highlights limited accessibility and biases in wildlife-wind energy knowledge**

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Wind energy is a key component of climate action strategies aimed at reducing dependence on fossil fuels. Despite the provision of environmental benefits, there are increasing concerns surrounding the impact of wind farms on wildlife, with research indicating that effects on wildlife can be highly variable between species, regions, and sites. In the light of this variability and the accelerating growth of the wind energy sector globally, a comprehensive understanding of wind farm effects on wildlife and ease of access to this knowledge are pivotal to inform best practice if wind energy is to become a truly sustainable source of energy. This review evaluates interactions between a globally distributed bird genus (harriers, *Circus* species) and wind farms to assess broader patterns in wildlife-wind energy knowledge accessibility and bias. A systematic review of grey and peer-reviewed literature across two multidisciplinary and two field-specific databases in two languages (English and Spanish) yielded 235 relevant sources, covering 12 harrier species and 31 countries. Findings indicate that harriers are considered to have high sensitivity to wind farms, with greatest impacts expected from habitat effects rather than from turbine collisions. In the broader wildlife-wind energy context, this study underscores (i) the predominance of grey literature and of sources solely documenting species-wind farm overlaps; (ii) limitations in grey literature availability and peer-reviewed publication accessibility; (iii) lack of standardised research and monitoring practices; and (iv) evidence of language, taxonomic, and geographic bias in literature sources. Overall, findings demonstrate that limited accessibility to wildlife-wind energy knowledge risks widening the research-implementation gap. Widespread implementation of open practices that allow researchers and practitioners to build on existing knowledge (e.g. national and international online repositories and databases, knowledge sharing and collaborative initiatives, open access publications) is crucial if ongoing wind energy development efforts are to be successfully aligned with conservation priorities (DOI: [10.1016/j.scitotenv.2020.140238](https://doi.org/10.1016/j.scitotenv.2020.140238)).

**Expert knowledge assessment of threats and conservation strategies for breeding Hen Harrier *Circus cyaneus* and Short-eared Owl *Asio flammeus* across Europe**

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Hen Harrier *Circus cyaneus* and Short-eared Owl *Asio flammeus* are open-country birds of prey with overlapping distributions. Although both species face similar conservation threats across their ranges, work to date has largely been undertaken at a national scale with few attempts to collate and assess factors relevant to their conservation at an international scale. Here we use an expert knowledge approach to evaluate the impact of conservation threats and the effectiveness of conservation strategies for each species across Europe. We report results of responses to a questionnaire from 23 Hen Harrier experts from nine countries and 12 Short-eared Owl experts from six countries. Most responses for both species reported declines in breeding numbers. The perceived impact of threats was broadly similar for both species: ecological factors (predation, extreme weather, prey availability), changes in land use (habitat loss, agricultural intensification) and indirect persecution (accidental nest destruction) were considered the greatest threats to breeding Hen Harrier and Short-eared Owl. Short-eared Owl experts also highlighted lack of knowledge and difficulties associated with monitoring as a major conservation challenge. Despite broad-scale similarities, geographical variation was also apparent in the perceived importance of conservation threats, with some threats (e.g. direct persecution, large-scale afforestation, habitat degradation) requiring country-specific actions. Implementation of different conservation strategies also varied between countries, with the designation of protected areas reported as the most widespread conservation strategy adopted, followed by species and habitat management. However, protected areas (including species-specific protected areas) were perceived to be less effective than active management of species and habitats. These findings highlight the overlap between the conservation requirements of these two species, and the need for collaborative international research and conservation approaches that prioritise pro-active conservation strategies subject to continued assessment and with specific conservation goals (DOI: [10.1017/S0959270920000349](https://doi.org/10.1017/S0959270920000349)).

**Stress hormones outperform long-term body condition and body size data as an indicator of land use effects in a river passerine**

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Changes to land use are driving habitat loss and species declines worldwide. Understanding how species respond to these changes before effects are apparent at a population- or species-level is crucial for pro-active and effective conservation strategies. While land use effects have been documented at the individual scale as changes in body size or condition, such analyses necessitate extensive data sets requiring significant collation effort and time. Stress physiology can provide a useful approach to detect the effects of land use on individuals before these have cascading effects at higher levels. Here we show how the loss of riparian forest and increase of agricultural cover results in higher concentrations of nestling feather corticosterone (n = 39 nests) in a sentinel river passerine, the White-throated Dipper *Cinclus cinclus*, despite remaining undetected in a long-term data set on nestling body size and condition spanning 25 years (n = 571 nests). We also found an effect of brood size on stress hormones and body condition mediated through sibling competition, and that nest boxes had a negative effect on body condition. Our findings underscore the importance of combined approaches to assess how species are affected by environmental change and the value of stress physiology as an early-warning approach to identify and understand hard-to-detect effects of global change.

**Breeding densities and habitat associations of Yellowhammer *Emberiza citrinella* in their core range in an arable landscape in east Cork**

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Farmland birds have undergone a dramatic decline in recent times, both in terms of range and abundance. The change from traditional farming practices to more intensive management of the landscape is believed to be one of the principal drivers of this decline. The Yellowhammer *Emberiza citrinella* was formerly widespread and abundant on farmland throughout Ireland, but now has a more limited breeding range relating to the distribution of tillage cover, on which it is highly reliant. The objective of this study was to determine breeding densities and habitat associations of Yellowhammer in an arable landscape in their remaining core breeding range in Ireland. For this purpose, two breeding bird surveys took place along predefined transects in 54 survey squares (1 km x 1 km) in the study area. The recorded breeding density of 4.67 pairs per km<sup>2</sup> provides a population estimate of 215–289 pairs. Of 48 breeding territories analysed, 50% occurred in areas of tillage cover above 75%, with 8% occurring in tillage cover below 25%, showing that the number of singing males is related to the percentage cover of tillage. Yellowhammer showed a preference for sympathetically managed, rather than intensively managed hedgerows. The presence of drainage ditches and treelines had a negative effect on the number of singing males. These habitat associations indicate that greater tillage cover and suitable linear features is fundamental to the establishment of high-quality breeding habitat. This information is important to inform targeted conservation measures in arable landscapes to maintain and restore Yellowhammer populations.

**Curlew *Numenius arquata* conservation success in the Antrim Hills**

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Curlew *Numenius arquata* numbers in Northern Ireland have declined by 82% since the late 1980s, due to changes in agriculture and landscape which have resulted in low reproductive success. With a current estimated 150 breeding pairs, we are facing a local extinction within the present decade. The Antrim Hills is one of the last two population hotspots with 55 pairs (36% of the population); the other being Lough Erne (51 pairs, 34% of the population). The Royal Society for the Protection of Birds (RSPB) has focused conservation efforts in these two areas for several decades. The RSPB farm focus



area at Glenwherry in the Antrim Plateau is a 14,700ha mosaic of upland habitats and is a known biodiversity hotspot. RSPB's major role in the last twenty years has been one of partnership working with farmers, offering advice and support for agri-environmental schemes to encourage nature friendly farming. With the addition of Curlew LIFE (EU LIFE project), awarded in November 2020, more hands-on conservation efforts have taken place; landscape-scale predator control, increased habitat management and survey effort, as well as nest protection fencing. The 2021 season produced the most Curlew fledglings to date: 28 from 14 broods with a productivity of 0.72 (39 pairs), which surpasses the recognised (0.6) population growth threshold for the first time. In 2022, we doubled the nest protection fences (22 up from 9), increased overall site hatching rate (from 43% to over 70%), and fledged 69 chicks from 22 broods. This resulted in a productivity of 1.86 (37 pairs). With the 97 fledglings produced in the last two years, we would anticipate a return of 40 new pairs to the Antrim Hills within the next five years, a 25% population increase to a population on the brink.

### **Highly pathogenic avian influenza in Northern Gannet *Morus bassanus* colonies in southwest Ireland**

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Highly Pathogenic Avian Influenza Subtype H5N1 (HPAI), or 'bird flu', infected bird species in many European countries in 2022. The disease also affected several seabird species with Northern Gannets *Morus bassanus* particularly impacted. We undertook fine-scale aerial surveys in waters that encompassed the core foraging area of Ireland's two largest Gannet colonies, the Little Skellig and Bull Rock (determined through previous Global Positioning System tracking studies) located in southwest Ireland. Surveys were conducted in summer when outbreaks were occurring across Europe and high levels of mortality were found in UK colonies. During that period, we detected a single dead Gannet, but no other signs of HPAI-associated mortality. Surveys were repeated towards the end of the breeding season in September and large numbers of dead birds were recorded around the Little Skellig and Bull Rock. A total of 184 dead Gannets was recorded on survey effort, likely representing an underestimate of dead birds given advection from the area by currents, sinking of carcasses, or birds dying in the colony that were not encountered during the surveys. Overall, 4% of all sighted individuals were dead birds, suggesting a minimum population level impact of 4% of the local breeding population, or 3,126 individuals based on the latest census figures from 2013. This study provides the first insights into the impact of HPAI on Gannet colonies in Ireland based on observations at sea. This highlights the need for more frequent monitoring of Ireland's most important Gannet breeding colonies to determine the extent of this and future outbreaks of disease, providing better knowledge for informed management and conservation.

### **Distance effects on detection rates in wind farm vantage point surveys and their implications for collision risk modelling**

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Vantage point surveys are carried out to collect flight activity data for assessments of wind farm projects. These surveys typically cover viewsheds extending to 2 km from the vantage point. The data collected are used to assess occurrence patterns in the wind farm site and to predict the risk of collisions to bird populations from development of the wind farm. However, most assessments do not consider the effects of declines in detection rates with distance from the vantage point. I used vantage point datasets from various Irish wind farm projects to assess how detectability effects may bias collision risk models, and the factors that affect the degree of bias. There were strong declines in detectability (measured as flightline density) with distance from the vantage point in all the datasets, particularly at distances of more than 1 km from the vantage points. The declines in detectability were greater for smaller species. Corrections for under-detection of distant flightlines resulted in significant increases in the predicted collision risk: e.g., in one wind farm project, an increase of 1.6 times for large species, 2.6 times for medium-sized species and 3.1 times for small species. Corrections for detectability effects should be included as a routine part of collision risk modelling for all wind farm assessments. Detectability effects should also be considered as part of the planning and design of vantage point surveys. Current guidance and practice emphasise the achievement of 100% spatial coverage using viewshed arcs of 2 km radius. This often involves selection

of vantage points that are distant from the wind farm site. However, most flight activity is detected within 1 km of the vantage point. Therefore, vantage point surveys should aim to achieve representative coverage of the survey area using viewshed arcs of 1 km radius.

### **Surrounding habitat composition strongly influences the occupancy rate of bird boxes**

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Agri-environmental schemes, such as GLAS (Green Low-Carbon Agri-Environment Scheme), aim to promote environmentally sustainable methods of farming and protect biodiversity in agri-ecosystems. The erection of bird nest boxes to replace natural nesting sites for birds lost through agricultural intensification is one such action under GLAS, which resulted in approximately 150,000 bird boxes erected on Irish farms by 2019, at a cost of €4.27m to that date. However, there has been no research in Ireland on the factors that influence the occupancy rate of these bird boxes. In autumn 2017, we examined the occupancy rate of 206 bird boxes across 20 sites in County Roscommon, and recorded the following parameters: height box was placed from the ground; percentage shrub and tree cover in a 10m radius around each box; number of trees present in a 10m radius around each box; trunk circumference of every tree that contained a bird box; orientation of each bird box; number of bird boxes present within a 10m radius of each box; distance each box was situated from another box; distance each box was situated from the nearest occupied box; and the orientation of each bird box. Thirty-five per cent of the 206 bird boxes had been utilised in the previous breeding season. Results from a model-averaged binomial Generalised Linear Model indicated that shrub cover and height off the ground had significant strong positive impacts on occupancy rates, while tree cover had a significant negative effect. The effect of size of each of these significant variables was calculated and showed that the probability of bird box utilisation can be significantly increased if they are erected 4–5m off the ground, on trees that have at least 40% shrub and no more than 50% tree cover within a 5m radius.

### **Understanding patterns of urban habitat use in overwintering Light-bellied Brent Geese *Branta bernicla* in Dublin**

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The population of Brent Geese *Branta bernicla hrota* wintering in Ireland, stage in Iceland and breed in the northeast arctic Canadian archipelago. Numerically – in terms of the proportion of the flyway population which occur in Ireland – they are our most important wintering waterbird species. As part of a long-term study running since 1998, the Irish Brent Goose Research Group have supported a University of Exeter-led research project funded by Fingal County Council. Brent Geese are an integral part of the winter urban landscape across the Dublin biosphere, where around 6,000 birds use the intertidal areas of Dublin Bay and a range of adjacent suitable terrestrial habitats. The aims of this study were to measure spatio-temporal patterns of habitat use, investigate factors influencing foraging site selection and dispersal, understand the cultural component of habitat use and site fidelity, and promote community engagement. Over the winters of 2018/19 and 2019/20 we deployed 80 Global Positioning System tags out of a sample of 348 colour-marked individuals. Data were received from 65 individuals covering 2,581 foraging days and equating to more than 50,000 individual date/time stamped locational fixes. Brent Geese made daily foraging trips up to 14 km from six main coastal roosts and we identified twelve heavily utilised sites. Roost-site fidelity was high, and the main determinant of foraging distances was likely to be the extent and characteristics of the terrestrial habitat adjacent to roost sites; this includes the levels of human utilisation of urban greenspaces. Habitat selection was influenced by the type of habitat Brent Geese were encountering within their core ranges and which roost site birds utilised. This varied across sub-populations with, for example, central Dublin birds selecting sports grounds. A lack of overlap in home ranges of birds utilising different roosts suggests a strong social component influencing the daytime dispersal of individuals seeking foraging locations.

### **Chough *Pyrrhonorax pyrrhonorax* in County Cork: the use of buildings for nesting**

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Chough *Pyrrhonorax pyrrhonorax* breed in the south, west and northwest of Ireland from County Wexford to County Donegal. The majority nest in crevices in sea cliffs, less commonly using sea caves, inland cliffs, and buildings. In recent years, our casual observations suggested an increasing number of Chough were nesting in buildings in County Cork, therefore from 2020 to 2022 we began examining the extent to which breeding pairs were using artificial structures. Potential sites were identified using (a) existing records, (b) targeted publicity campaigns, and (c) searches of likely suitable breeding areas. A total of 78 active nest sites in man-made structures were identified, the majority (83%) of which had not been previously recorded. The structure types were stone cottages/outbuildings (n = 24), modern cattle sheds (n = 16), hay barns (n = 16), castles/towers (n = 13), abandoned industrial buildings (n = 5), unfinished modern houses (n = 2), a church and a bridge. Distances of nest sites from the coast ranged from 0 km to 16 km (average 2.6 km), with 53% (n = 41) within 1 km of the coast. Altitude of sites ranged from 5 m to 204 m above sea level. Where the precise locations of these nest sites in buildings were identified, 67% (n = 49) were in open situations, e.g. on ledges or rafters, while the remainder were in semi-enclosed locations such as alcoves or barn owl boxes that more closely mimicked traditional cliff crevice nest sites. In terms of human activity, the buildings varied from remote and largely undisturbed to active agricultural buildings close to occupied dwellings. Nest sites were situated between Dursey Island in west Cork and Ballycreehan in east Cork, with the highest density recorded on the Mizzen peninsula. However, this may reflect the survey methodology and further survey effort is required to ascertain the true extent of Chough nesting in buildings in County Cork.

### **Positive responses of breeding waders in Northern Ireland to voluntary conservation action when deployed alongside existing conservation measures**

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Breeding wader populations are declining throughout Europe, largely driven by the direct and indirect effects of agricultural intensification. Agri-Environment Schemes (AES) are one of several potential tools to help populations recover, especially outside protected areas such as nature reserves. However, such schemes are expensive, and their effectiveness for waders outside of nature reserves is limited. Alternative methods of delivering conservation action in the wider countryside are therefore urgently needed. In this study we describe the outcomes of a multi-year project in which habitat prescriptions were delivered through site-specific habitat management advice, training, and practical assistance to landowners (via the Halting Environmental Loss Project; HELP), at a range of upland and lowland sites across Northern Ireland. HELP did not provide direct financial incentives to landowners, but provided advice and management, in addition to existing conservation measures (AES or reserve funding) at most sites. We found that trends in breeding densities were more positive during HELP for three species and continued to be positive during HELP for a fourth species. We observed more positive density changes on sites that conducted high-quality management, whilst lower-quality management had no effect on wader densities. Our results demonstrate that targeted advice and practical assistance can lead to improvements in habitat management and subsequent increases in wader breeding densities inside and outside of nature reserves.

### **Breeding waders on LIFE on Machair project sites: an overview of trends from the 1980s to the present**

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LIFE on Machair is an EU LIFE funded project (Code LIFE20 NAT/IE/000263) running from 2022 to 2028. Machair is a coastal habitat unique to the north and west of Ireland and Scotland, characterised by a species-rich grassland plain, developed on wind-blown sand. Alongside other coastal habitats such as sand dunes, machair provides an important

refuge for pollinators and threatened breeding wader bird species, such as Dunlin *Calidris alpina*, Lapwing *Vanellus vanellus* and Redshank *Tringa totanus*. Breeding waders are in significant decline in Europe, with many listed as being of conservation concern on the European Red List. As one of the most threatened bird groups in Ireland, breeding waders including Oystercatcher *Haematopus ostralegus*, Snipe *Gallinago gallinago*, Dunlin, Lapwing and Redshank, are on the Red List. Ireland's 2019 Article 12 Birds Directive reporting showed breeding populations of Dunlin, Lapwing and Redshank have declined by over 90% since ca 1980. Focussing on nine Special Areas of Conservation and four Special Protection Areas in Counties Donegal, Mayo and Galway, LIFE on Machair will trial conservation actions to address the current declines at site level, while also working with other projects to work at landscape and wider coastal network levels. The actions include temporary fencing of breeding areas, stock exclusion fencing, predator control and habitat management (largely focused on the grazing regime). The project will seek to build on the successes of locally adapted programmes, including European Innovation Partnerships and will work alongside the Agri-Climate Rural Environment Scheme. In this paper we present an overview of the trends between machair surveys in the 1980s and in 2022, focusing on eight wader species: Dunlin, Lapwing, Snipe, Redshank, Oystercatcher, Ringed Plover *Charadrius hiaticula*, Common Sandpiper *Actitis hypoleucos* and Red-necked Phalarope *Phalaropus lobatus*.

### **The impacts of peat extraction on the presence and distribution of breeding birds on blanket bogs in Ireland**

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We carried out a breeding bird survey in the Connemara Bog Complex Special Protection Area, to determine the presence and abundance of bird species and how species composition varied across the complex and in relation to areas where peat has been extracted and areas where there was no evidence of such disturbance. We employed a line transect survey using 22 transects with a total length of 35 km, which were surveyed twice between April and June 2022. The line transects were selected to represent areas where evidence of recent peat extraction was visible and areas where there was no evidence of peat extraction. A total of 18 species were recorded on the line transect surveys, which included four Red-listed Birds of Conservation Concern (Meadow Pipit *Anthus pratensis*, Golden Plover *Pluvialis apricaria*, Snipe *Gallinago gallinago* and Kestrel *Falco tinnunculus*). We recorded 0.03 bird species per hectare and 0.20 birds per hectare, with Skylark *Alauda arvensis* (0.28 per ha), Meadow Pipit (0.24 per ha) and Golden Plover (0.02 per ha) the most common species. There was a similar number of species per hectare in the areas affected by peat extraction and the areas where there was no evidence of peat extraction, but a higher number of Red-listed species in the latter compared to the areas where peat extraction was evident. There were four times more birds per hectare where there was no evidence of peat extraction compared to the areas where there was peat extraction. We estimated breeding densities of Skylark and Meadow Pipit using distance sampling techniques and discuss these findings in relation to the impacts of turf-cutting and other forms of peat extraction on breeding birds on blanket bogs.

### **From models to actual epidemics: Avian Influenza in seabird colonies**

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Avian flu is caused by viruses of the Family Orthomyxoviridae (Genus: *Alphavirus – Influenza A Virus*). Following the emergence of the novel strain (HPAI) H5N1 in 1996 (now known as Goose/Guangdong virus: Gs/Gd virus, per T. Kuiken 2022), models were developed by members of the author team, including the late Professor Alexei V. Pokrovskii, beginning in 2006, to estimate its possible effects in seabird colonies. Recently, due to the complex nature of the genetics of the subtype clade 2.3.4.4b, the virus underwent an important change in its biology in 2021–2022. This has resulted in the expansion of infection beyond its previously effective confinement to winter months, where it primarily infected ducks and geese as well as domestic fowl, into the spring and summer periods. In turn, this widening of the timeframe of its infectivity has coincided with an increase in host species as the virus has been recorded in seabird colonies. Consequently, during

2022, the virus caused a major and unprecedented pandemic in seabird colonies on both sides of the North Atlantic. This has resulted in mass-mortalities among Great Skua *Stercorarius skua*, Northern Gannet *Morus bassanus*, Common Guillemot *Uria aalge* and assorted white-headed gull species – especially Great Black-backed *Larus marinus* and Herring *Larus argentatus* and terns, such as Sandwich *Thalasseus sandvicensis* and Roseate *Sterna dougallii* and, in the USA, the Caspian Tern *Hydroprogne caspia*. In this study, we will revisit the mathematical models to incorporate the present major widening of the range of host species being infected. We will also seek to establish if more precise estimates of key parameters such as  $R_0$ , lethality and the length of the Latent Period, can be obtained.

### **Flying gulls vocalising during encounters with diurnal raptors**

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It has been noticed – in this ongoing study – that gulls (mostly white-headed species, e.g. Herring Gull *Larus argentatus* and Lesser Black-backed Gull *Larus fuscus*) when flying to, or from, their urban roost sites vocalise loudly when they encounter a flying diurnal raptor. Most gull-raptor encounters have been with Herring Gull flocks, and either Common Buzzard *Buteo buteo* or Sparrowhawk *Accipiter nisus*, more rarely Peregrine Falcon *Falco peregrinus*, were the raptors involved. The typical behaviour that alerts the observer is loud calling by the gulls – usually a flock. The flock then begins to circle in what might be a Selfish Herd effect. Sometimes, one or more birds may detach from the flock and actively confront the predator, in most cases causing it to flee. At other times the flock may move from its initial direction of flight and continue, but away from where the predator is positioned. To date, all these observations have been made in urban environments, well away from maritime or roof-top gull colonies. We will continue to monitor (a) the time of day of the encounters (b) the ambient conditions (c) the species and ages of the gulls (d) the Flight Initiation Distance (FID) of both the gulls and/or the predator and (e) the outcome of the encounter with respect to the gulls and the predators.

### **The numbers of breeding landbirds on Ireland's offshore islands: a census on Cape Clear, County Cork**

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While inventories of breeding landbird species richness are available for many of Ireland's offshore islands, data on the numbers nesting are scanty. Following a detailed survey of Clare Island (Mayo) in June 2013, we conducted a census of the breeding landbirds on Cape Clear Island (Cork) on 10–17 May and 16–22 June 2014. We used the line transect ( $n = 16$ ) sampling methodology. We used two distance bands, i.e. 0–50m and 50–100m, along each transect route. We used the program *Distance* 6.2 Release 1 to analyse the data. This allowed detection curves to be compiled for the more common species. We encountered over 40 species but the breeding status of several could not be confirmed, e.g. Chiffchaff *Phylloscopus collybita*, Cuckoo *Cuculus canorus*, House Martin *Delichon urbicum* and Sparrowhawk *Accipiter nisus*. Woodpigeons *Columba palumbus* were mostly only registered off-transect and there were two sightings of non-breeding Common Swift *Apus apus*. It is probable that due to sampling error we failed to detect breeding Grasshopper Warbler *Locustella naevia* (Sam Bayley personal communication). Surprisingly, there was no sighting of a Kestrel *Falco tinnunculus* but Sparrowhawk and Peregrine Falcon *Falco peregrinus* were seen on several transects, albeit overflying. Common Whitethroat *Sylvia communis* was numerous and widespread, whereas Rock Pipit *Anthus petrosus* appeared to have decreased since earlier surveys.

**The birds of Clare Island: what difference does 100+ years make?**

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The first Clare Island Survey commenced in 1909 and concluded in 1911. Richard Ussher's paper on the birds was published in 1912. Our survey began in 1999 but continued, somewhat haphazardly, until 2013 and the results were published in Volume 9 of the New Clare Island Survey in 2020. There were, of course, other surveys which, however, did not begin until 1945. This presentation reviews these data and asks the question what has changed over the 100+ year interval? In addition, we address issues such as the Species Area Relationship in respect to the birds of the offshore islands of Ireland, and the Equilibrium Theory of Island Biogeography in respect to the birds of Clare Island. We also ask the question why is one of Ireland's most numerous and widespread birds, i.e. the Rook *Corvus frugilegus* absent as a breeding species from all Irish offshore islands, which we argue might be due to the Allee Effect.

**Trends in bird numbers at an airfield in north County Dublin, 1989–2019**

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Birds were regularly counted at the airfield at Dublin Airport over the 30-year period 1989–2019. Two methods were used (a) species and numbers, detected from a 26 km road circuit, were plotted on an alpha numeric map (from 1994 onwards) and (b) the extent of birds overflying the active runway – mostly 28L – was quantified from two main vantage points. These data were correlated with the pattern of confirmed bird strikes. Distinct trends emerged. There was a sharp and sustained decline in Northern Lapwing *Vanellus vanellus* numbers but 'hard weather movements' continued to occur. Initially, there was a very steep decrease in Herring Gulls *Larus argentatus*, but recently this trend has been reversed and occasionally the species has attempted to breed on the rooftops of the airport campus. Eurasian Curlew *Numenius arquata*, Common Starling *Sturnus vulgaris*, Jackdaw *Coloeus monedula* and Hooded Crow *Corvus cornix* have all increased, whereas the Kestrel *Falco tinnunculus* has decreased – mainly it seems since the arrival of the Common Buzzard *Buteo buteo* for the first time in 2000. Rare sightings include Ring-billed Gull *Larus delawarensis*, Mediterranean Gull *Ichthyaetus melanocephalus*, Hobby *Falco subbuteo*, Black Kite *Milvus migrans* and Montagu's Harrier *Circus pygargus* – the latter seen and photographed by an observer outside the perimeter fence. The picture with respect to the Woodpigeon *Columba palumbus* is more complex. There was a steep increase in numbers overflying the manoeuvring areas beginning in the early 1990s – a trend that was significantly correlated with a higher incidence of confirmed bird strikes involving this species. Overall, this trend slowed under the influence of colder winters beginning in 2009/2010.

**National and site-level trends of Ireland's wintering waterbirds 1994/95–2019/20**

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Many of Ireland's wintering waterbird populations have undergone significant declines in recent decades. National monitoring of wintering (non-breeding) waterbirds has been undertaken annually by the Irish Wetland Bird Survey since winter 1994/95. National and site-level trends have now been calculated for 35 wintering waterbird species at 97 sites with the most comprehensive count coverage between winters 1994/95 and 2019/20. Imputation of missing or poor-quality counts was performed using the Underhill process to model the raw monthly counts using a Generalised Linear Model (GLM). An annual index for each site was calculated based on total counts and duration of within-season usage. This index was smoothed using GLM, and the percentage change over the most recent five, 12 and 23 years calculated to produce short-, medium- and long-term trends respectively. The long-term trend results reveal that at a national level Scaup *Aythya marila*, Pochard *Aythya ferina*, Goldeneye *Bucephala clangula*, Lapwing *Vanellus vanellus*, Grey Plover *Pluvialis squatarola*, and Golden Plover *Pluvialis apricaria* have all experienced a large decline with a loss greater than 50%. Dunlin

*Calidris alpina* and Curlew *Numenius arquata* show a moderate decline of between 25% and 50%. Twelve species have had an intermediate decline of between 1% and 25%. The remaining species analysed are stable or increasing at a national level. Of the site-level results, further analysis may reveal local or regional drivers and patterns of change. The full report is available online at [https://birdwatchireland.ie/app/uploads/2022/04/iwebs\\_trends\\_report.html](https://birdwatchireland.ie/app/uploads/2022/04/iwebs_trends_report.html).

### **An exploration of Yellowhammer *Emberiza citrinella* data: distribution, presence, relative abundance and associated factors in Ireland**

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The distribution of Yellowhammer *Emberiza citrinella* on the island of Ireland declined by 61% between 1968–1972 and 2007–2011. To further explore population changes in this species, records of Yellowhammer from 21 ornithological datasets were gathered, prepared, consolidated, analysed, and visualised. The distribution, presence, and relative abundance between 1968 and 2020 were then investigated. Additionally, a selection of complementary datasets including CORINE Land Cover, Dominant Leaf Type and Small Woody Features published by the Copernicus Land Monitoring Service, and habitat data gathered by the Countryside Bird Survey and Breeding Bird Survey, were analysed to identify any environmental factors associated with the presence and relative abundance of this species. Possibly novel visualisations of the consolidated data were developed. The value of consolidating datasets was observed. Continuing declines of the species in the last 20 years were identified in both presence and relative abundance. The analysis of over 500 environmental factors revealed statistically significant positive correlations with landscapes featuring arable farmland and hedgerows with trees, and, notably, with the presence of horses.

### **Mapping farmland bird hotspots in Ireland: a method to assist targeting of agri-environment measures**

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Farmland birds are one of the most threatened species groups in Europe. BirdWatch Ireland has developed a set of maps to help target conservation measures for these species. The maps indicate important areas or 'hotspots' for 28 farmland bird species on the Red and Amber lists of Birds of Conservation Concern in Ireland. The maps are based on an analysis of over 130,000 records extracted from 27 scientifically validated data sources focused on the period 2007–2021. The analysis involved transforming all records into a consistent format and co-ordinate reference system. The records were scored over national grids at 10 km and 1 km resolution. Scoring considered species-level factors such as the relative conservation status of the species (compared to other species included), and the typical home-range of the species per season. Scoring also reflected record-specific factors such as the season, the level of breeding evidence recorded (if any), and the age of the record. The maximum record score of each species in each cell contributed to the overall cell score. Top scoring cells were deemed to be hotspots. A map of all species, the Farmland Bird Hotspot map, was produced, together with maps of specific species groups including Breeding Farmland Waders. These maps are now available to assist the targeting of conservation measures through agri-environment schemes and other initiatives which aim to protect and support farmland birds in Ireland.

### **National Urban Gull Survey 2021**

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The first national survey of urban nesting gulls was carried out in the Republic of Ireland in 2021 as part of the Seabirds Count project. A ground-based count method was used for 730 one-km survey squares, in a stratified sample of urban, suburban, and industrial habitats. One visit was made to each square between 1 May and 15 June 2021 and results were collected online using a digital platform supplied by the Joint Nature Conservation Committee. The survey focused on Herring Gull *Larus argentatus* and Lesser Black-backed Gull *Larus fuscus*, with additional seabird species recorded if detected. Adult gulls interacting with urban nesting habitat were recorded in count units, Apparently Occupied Nest (AON), Apparently Occupied Territory (AOT) and Individuals (IND), relating to confirmed, probable and possible breeding respectively. These methods follow those of recent surveys in Britain and allowed for comparable analyses across the biogeographic region. Of the 730 squares, 594 priority squares (81.3%) were randomly allocated, data from which will be used for production of national population estimates in the final publication of the Seabirds Count project. An additional 136 squares (18.6%) were allocated to selected urban areas. This provided higher coverage where areas were identified as having well-documented cases of gull-human conflict or were located at inland towns suspected to hold gull populations, allowing comparison with coastal sites. Confirmed or probable breeding was recorded in urban habitats of twelve counties for Herring Gull (observed 942 AON; 1,606 AOT; 4,193 IND), and in thirteen counties for Lesser Black-backed Gull (observed 54 AON; 157 AOT; 552 IND). The largest concentrations of both species were found in Dublin, followed by Louth, Galway, and Waterford. Insights gleaned from surveyor experience were recorded. This included observations of public engagement with urban gulls and on the apparent efficacy of deterrent measures.

### **Celebrating 30 years of bird monitoring in Ireland**

**L.J. Lewis, R. Coombes, B. Burke, N. Fitzgerald, J. Kennedy, A. Lynch, S. Cummins, S.B.A. Kelly, A. Walsh, D. Tierney, J. Wilson and J. O'Halloran**

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The Irish Wetland Bird Survey (I-WeBS) and the Countryside Bird Survey (CBS), both funded by the National Parks and Wildlife Service, are Ireland's longest running bird monitoring schemes. Monitoring of wintering (non-breeding) waterbirds has been undertaken by I-WeBS since winter 1994/95, while CBS has monitored the trends of common and widespread breeding birds since 1998. This presentation therefore marks the thirtieth and twenty-fifth anniversaries, respectively, of these two important surveys. The scientific outputs from both surveys have been well documented and the scientific value of the data collected at site, local, national, and international levels cannot be underestimated. The resulting datasets are two of the most important national resources for understanding changes in Irish bird populations. This presentation, however, leaves the birds aside for a moment, but rather focuses on celebrating the army of volunteer and staff surveyors who have collected this enormous amount of data over the years. In addition, the projects could not have succeeded without the dedicated project team behind the scenes. It is no exaggeration to say that both surveys simply could not function without the huge commitment of an enormous body of dedicated people every year. We honour their contribution and look forward to the next 30 years!

### **Breeding bird communities and habitat associations on raised bogs at different stages of restoration**

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Peatlands provide important habitats for bird communities and support many species of conservation concern. Although the status of raised bog and degraded raised bog habitats in Ireland is poor and deteriorating, restoration efforts have been initiated which aim to increase the area of actively growing raised bog. It is important to understand the effects of these



habitat changes on breeding bird communities associated with raised bogs to inform restoration and management for sensitive species. We assessed breeding bird composition using a range of survey methodologies (line transect, point count and vantage point surveys) on six Special Area of Conservation raised bogs at different stages of restoration. The habitat associations of the birds present were assessed in relation to high bog and cutover bog with regards to the spatial distribution of active raised bog and non-active raised bog, and eight ecotopes and habitat features defined on high bog. A total of 62 bird species was recorded of which eight are Red-listed (Meadow Pipit *Anthus pratensis*, Snipe *Gallinago gallinago*, Curlew *Numenius arquata*, Redshank *Tringa totanus*, Kestrel *Falco tinnunculus*, Woodcock *Scolopax rusticola*, Swift *Apus apus* and Barn Owl *Tyto alba*). High bog supported lower species diversity, but a higher proportion of red- and Amber-listed species and open-habitat specialists compared to cutover bog. Meadow Pipit was the most abundant species on high bog, making up over half (53%) of all birds recorded, followed by Skylark *Alauda arvensis* (27%). We discuss the bird distributions, breeding densities and habitat preferences on restored raised bogs in the context of documented changes of the ecotopes, area of active raised bog and further predicted habitat changes.

### **Does Wild Bird Cover provide suitable habitat for small mammal populations and their predators**

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The provision of Wild Bird Cover (WBC) is a measure implemented under successive agri-environmental schemes in Ireland to improve farmland biodiversity, including small mammal populations. Small mammal communities play a vital role in ecosystem functioning, and changes in their populations can have wider repercussions throughout the food chain, including for avian predators of conservation concern. Understanding the response of small mammal communities to WBC is necessary to recognise the biodiversity value of this measure and to inform its future management. We assessed small mammal abundance and species richness in two types of WBC (i) Oats and Linseed and (ii) Barley and Linseed, and in control sites (grassland) in east Galway using live-trapping techniques, with traps set both along hedgerows and 15m from hedgerows at each site. We recorded 346 small mammal captures of five species: Wood Mouse *Apodemus sylvaticus*, House Mouse *Mus musculus*, Bank Vole *Myodes glareolus*, Greater White-toothed Shrew *Crocidura russula* and Brown Rat *Rattus norvegicus*. The Wood Mouse (n = 235) was most frequently trapped, representing more than two-thirds of all captures (68%), followed by the Bank Vole (n = 76; 22%). We showed that WBC supports a significantly greater abundance and species richness of small mammals compared to grassland. The WBC crop of Oats and Linseed had the greatest abundance of small mammals, significantly greater than the control but not significantly greater than Barley and Linseed. Additionally, the results show that small mammal abundance and diversity is much greater in the hedgerow habitats of all sites, and thus outlines the importance of good quality hedgerows in the landscape. This study provides the first evidence that WBC is an important refuge for small mammal populations in Ireland and indicates that the presence of this habitat provides wider benefits, including for avian predators of small mammals.

### **Changes in the diet of Irish Barn Owls *Tyto alba* in response to invasive small mammals**

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Prey availability and diet has important consequences for predatory birds and may impact on individual life histories and population dynamics. In Ireland, small mammal communities have changed considerably due to the colonisation and range expansion of invasive species and the decline and displacement of native species. To understand the effects of such changes on a small mammal predator, we carried out the most extensive assessment of Barn Owl *Tyto alba* diet in Ireland, which involved identification of >22,000 prey items from 148 breeding and roost sites over a 15-year period (2007–2021). We assessed Barn Owl diet before, during and after colonisation of invasive species at individual sites and compared contemporary Barn Owl diet with available data from earlier studies (1980–1995). Small mammals dominated the diet (97% of prey items), however the prey species composition varied significantly over time and by region. The changes and variation in the diet were primarily influenced by the presence of invasive small mammals. Greater White-toothed Shrew

*Crocidura russula* is now the dominant prey item of Barn Owls, followed by the Bank Vole *Myodes glareolus*, where both invasive species are established. This has resulted in a decline in native and long-established small mammals in the diet, particularly of Pygmy Shrew *Sorex minutus*, which is now completely absent in the diet where Greater White-toothed Shrew is established. The importance of Brown Rat *Rattus norvegicus* and Wood Mouse *Apodemus sylvaticus* in Barn Owl diet have reduced over time. Notwithstanding the potential for other small mammal introductions, our data indicates similar shifts in diet in areas not yet colonised by invasive small mammals as their range expansion continues. We discuss the consequences of these shifts in diet in relation to Barn Owl distribution, breeding density and breeding performance.

### **The first survey of breeding Merlin *Falco columbarius* in the Special Protection Area network in Ireland to assess population size, breeding density and nesting ecology**

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The Merlin *Falco columbarius* is a species of conservation concern on the island of Ireland due to reported declines across its breeding range, with a small and dispersed population. Member states of the European Union are obliged to take appropriate measures to conserve Merlin populations (Annex I-listed species under the European Birds Directive), which includes the designation of Special Protection Areas (SPAs). This is the first survey of breeding Merlin in Ireland to determine the population size across those SPAs listed for the species which will allow future changes in the population to be measured. The survey was undertaken between 1 April and 15 July 2018 and involved 60 trained surveyors and over 1,950 hours of survey effort to census the defined area of 667 km<sup>2</sup> across six SPAs. The survey area included 19 survey squares (5 km x 5 km) selected at random in five SPAs and the entire Connemara Bog Complex SPA, which together represent 29% (494 km<sup>2</sup>) of the area of the six SPAs. Overall, the total Merlin population for the six SPAs was estimated to be 28 to 41 pairs extrapolated using the total numbers of confirmed and possible pairs in the area surveyed. Ten breeding pairs were confirmed and eight occupied territories, of which eight breeding pairs (80%) and four occupied territories (50%) were within the SPAs, and two breeding pairs (20%) and four territories (50%) in lands adjacent to the SPAs. Merlin breeding densities in the six SPAs were estimated at 1.6–2.4 pairs per 100 km<sup>2</sup>. The recorded breeding performance was higher than previously reported for most Merlin populations in Ireland and Britain. Based on our findings, we provide recommendations for the future monitoring of the species and the management of these six SPAs for breeding Merlin.

### **Unexpected post-glacial colonisation route explains the white colour of Barn Owls *Tyto alba* from the British Isles**

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The climate fluctuations of the Quaternary shaped the movement of species in and out of glacial refugia. In Europe, most species followed one of the described traditional postglacial recolonization routes from the southern peninsulas towards the north. Like most organisms, Barn Owls *Tyto alba* are assumed to have colonised the British Isles by crossing over Doggerland, a land bridge that connected Britain to northern Europe. However, while they are dark rufous in northern Europe, Barn Owls in the British Isles are conspicuously white, a contrast that could suggest selective forces are at play on the islands. Yet, our analysis of known candidate genes involved in colouration found no signature of selection. Instead, using whole genome sequences and species distribution modelling, we found that owls colonised the British Isles soon after the last glaciation, directly from a white coloured refugium in the Iberian Peninsula, before colonising northern Europe. They would have followed a hitherto unknown post-glacial colonization route to the British Isles over a westwards path of suitable habitat in now submerged land in the Bay of Biscay, thus not crossing Doggerland. As such, they inherited the white colour of their Iberian founders and maintained it through low gene flow with the mainland that prevents the import of rufous alleles. Thus, we contend that neutral processes likely explain this contrasting white colour compared to

continental owls. With the Barn Owl being a top predator, we expect future research will show this unanticipated route was used by other species from its paleo community.

**Farming for Whooper Swans *Cygnus cygnus*: efficacy of a mitigation programme for a road development in Northern Ireland**

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Infrastructure development and the associated encroachment of urbanisation over natural or rural landscapes is a global phenomenon, the ecological impact of which is rarely perceived to be positive. Although legal frameworks exist to protect features or species of importance, the baseline information collected for assessment may have limitations when predicting long-term change, notwithstanding the potential cumulative effect of successive development episodes. As part of planning consent, a PhD study was funded by the Department for Infrastructure (Northern Ireland) to study the response to the Toome road development on Whooper Swans *Cygnus cygnus*, a feature species of the adjacent Lough Neagh Special Protection Area. The sensitivity of this locality has brought together multiple agencies in a bid not only to mitigate for the direct impact of the development to swans, but also to build additional capacity through the enhancement of foraging opportunity. By improving livestock management and with a variety of field-improvement prescriptions, swan abundance has now surpassed historic levels. This holistic approach endeavours to optimise mitigation at multiple levels while minimising mortality risk through line collision. With this positive outcome, the road development at Toome may become recognised as an exemplar of best practice for future development in areas of high conservation importance.

**Landscape and temporal influences on the size and composition of Hen Harrier *Circus cyaneus* winter roosts in Ireland**

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Winter roosts represent an important focal point of Hen Harrier *Circus cyaneus* distribution and behaviour during the non-breeding season. The breeding biology and breeding season conservation requirements of Hen Harriers have been the focus of much previous research, but little is known about their non-breeding ecology, particularly their winter roosting requirements, which is an essential aspect of their year-round conservation. The purpose of this study was to examine the impact of surrounding habitat on numbers of Hen Harriers using roosts (size) and the ratio of adult males to adult females and juveniles (composition) at winter roosts in Ireland. We also examined short- and long-term temporal trends in roost size and composition and described the protected status of lands used for roosting and foraging by Hen Harriers in winter. We undertook Hen Harrier roost surveys across the winters of 2019/20 and 2020/21, completing 413 roost watches at 56 roosts. Our results showed the importance of surrounding habitat as a factor influencing the size and composition of Hen Harrier winter roosts, with adult male dominated roosts occurring in upland and peatland areas, while ringtail (juveniles of less than one year old and adult females) dominated roosts occurring in lowland and wetland, scrub, and arable areas. We also demonstrated temporal variation in the number of Hen Harriers attending roosts and the long-term temporal stability of roost composition. We found that 53% of roosts occurred in areas with statutory protection, however only 9% of roosts occurred within the European Natura 2000 Hen Harrier Special Protection Area network. Foraging grounds around winter roosts may be particularly vulnerable to anthropogenic land use change due to lack of protection. Our results demonstrate that the current network of protected areas does not provide adequate protection for wintering Hen Harriers in Ireland.

**Individual life histories and movement of satellite-tagged Hen Harriers *Circus cyaneus* in Ireland**

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Two female Hen Harrier *Circus cyaneus* nestlings were fitted with satellite tracking devices in July 2017 in the southwest and midlands of Ireland. One bird (Female A) was tracked until her death in November 2018 and the other (Female B) until the end of this study in January 2023. Both females occupied post-fledging dependence areas within 2 km of their natal nest for three weeks prior to the onset of sudden, long-distance (>25 km) juvenile dispersal at 58 and 62 days old. Both birds used temporary settlement areas in arable croplands during juvenile dispersal, from where they undertook brief exploratory movements before settling on their first-year wintering grounds during October 2017. Female A used the same primary wintering area on the Wexford coast during both of her winters. Female B used a primary wintering area in Kilkenny during her first winter, and a different primary wintering area in Offaly during her five subsequent winters. Both female Hen Harriers departed their first-year wintering grounds at the end of March 2018. Female A made an unsuccessful nesting attempt during her first and only breeding season in 2018, with a natal dispersal of 17 km. Female B made her first breeding attempt during her second breeding season in 2019, which was also unsuccessful, with a natal dispersal of 109 km. After her first two full years, Female B largely remained in the midlands of Ireland, using lowland cutover regenerating bogs during the non-breeding season, and nesting each year in different territories between 2020 and 2022 in the Slieve Bloom Mountains where she was hatched in 2017. Female B successfully fledged chicks for the first time on her fourth breeding attempt, from the same territory where she herself originated. This study provides the first description of the movement of individual female Hen Harriers that were recruited into the Irish breeding population across the full annual cycle, and across multiple years. Movement patterns of individual Hen Harriers can determine survival and reproductive success, and their investigation is critical to informing conservation actions.

**Patterns of Hen Harrier *Circus cyaneus* juvenile dispersal, survival, breeding population recruitment and habitat use as revealed by satellite tracking**

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Hen Harriers *Circus cyaneus* are an Annex-I species that have experienced continuous declines in breeding populations in recent decades across their western European range. Research and conservation efforts have primarily focussed on their breeding ecology, while our understanding of their requirements throughout the rest of the year is poor. In this study, we analysed tracking data from 31 Hen Harriers satellite-tagged in Ireland between 2009 and 2019, in addition to two Scottish satellite-tagged birds which overwintered in Ireland during this time, to gain an understanding of their year-round movements, survival and habitat use. These data comprised 3,581 transmission days with 15,261 individual high quality location fixes. Juvenile dispersal typically involved a sudden, long-distance (>25 km) initial movement away from the natal area, followed by shorter exploratory movements and the use of Temporary Settlement Areas. Hen Harrier survival was lowest during the first three months of life, with over half of the satellite-tagged birds dying during this period. First-year survival was estimated as  $17.7 \pm 7.5\%$ . Two of the Irish-tagged Hen Harriers were recruited into the Irish breeding population, with one successfully fledging chicks on her fourth breeding attempt. There was considerable variation in natal dispersal between individuals. Habitat use varied throughout the year, and between years, for individual birds, with arable areas being particularly important during juvenile dispersal. The findings of this research will inform specific conservation management strategies and policies to improve habitat suitability, and thus population trends for Hen Harriers in Ireland and throughout their range.

**Landscape and temporal influences on the winter diet of a threatened diurnal raptor, the Hen Harrier *Circus cyaneus***

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The aim of this study was to determine Hen Harrier *Circus cyaneus* winter diet and examine temporal and spatial variations in diet composition. A total of 1,117 Hen Harrier pellets was collected from 11 winter roosts between 2017 and 2021 in Ireland. Winter diet was dominated by avian prey (95.9% of pellets), with mammalian prey found in 12.0% of pellets. Occurrence of small birds and small mammals in the diet was positively associated with the proportion of arable, wild bird cover and low-intensity agriculture around the roost sites. The frequency of medium-sized birds (primarily Redwing *Turdus iliacus* and Snipe *Gallinago gallinago*) in the diet was positively associated with the proportion of bog and young conifer forests surrounding roost sites. Diet also varied across regions, with pellets from roosts in lowland coastal areas having a greater prevalence of small birds and small mammals, and pellets from roosts in upland areas having a greater prevalence of medium-sized birds. Investigation of temporal changes revealed that the proportion of medium-sized birds in the diet changed across months, with that of small birds and small mammals remaining stable. Variation in the proportion of small and medium-sized birds in the diet was also observed between winters. The results of this study suggest that habitat, along with region and time, are important drivers of variation in diet. Our findings highlight an opportunity for the enhancement of Hen Harrier habitat through land management and can be used to inform effective conservation strategies for wintering birds on the landscape scale.

**The breeding gulls of Lough Mask and Lough Carra, County Mayo**

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Since 2012 and 2016 respectively, a census of breeding gulls has taken place annually on Loughs Mask and Carra in County Mayo. These adjacent lakes contain a significant proportion of the inland-breeding population of Black-headed Gull *Chroicocephalus ridibundus*, Common Gull *Larus canus* and Lesser Black-backed Gull *Larus fuscus* in Ireland; the former two species are of conservation concern. Between 2016 and 2022 the combined Black-headed Gull breeding population has ranged between 1,647 and 741 Apparently Occupied Nests (AONs), with lower numbers on Lough Mask often corresponding with higher numbers on Lough Carra in years with high water levels. Since 2010, the breeding population of Common Gull on Lough Mask has decreased from 228 to 57 AONs, whilst that on Lough Carra has decreased from 65 to 17 AONs between 2016 and 2022. The Lesser Black-backed Gull only breeds on Lough Mask and their breeding population has ranged from 247 AONs in 2010 to 608 AONs in 2021. Interspecific competition resulting from this increase may be having a negative impact on the smaller gull species. The overall fluctuations in population size within these species may be due to external causes although it is noteworthy that the sites that consistently hold breeding gulls every year are on islands that are at a maximum distance from the mainland. Therefore, mammalian predation is likely to be an issue on more vulnerable sites, such as those on Lough Carra. In tandem with this study, a colour-ringing scheme targeting these three species was carried out between 2006 and 2015 to obtain information on dispersal patterns, survival rates, site fidelity and longevity. A small number of Great Black-backed Gulls *Larus marinus* (3–7 AONs) also breed annually on Lough Mask, while breeding has also been confirmed on Lough Mask by single pairs of Mediterranean Gulls *Ichthyaetus melanocephalus*.

### **The role of abundant generalist predators in European bird declines**

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Bird populations are declining across Europe. Current conservation policies are focused on habitat management but have not halted these declines, indicating that other factors are at play. One plausible factor that receives little attention is the proliferation of generalist predators in modern landscapes. If generalist predators are a factor in declines, we might expect ground-nesting bird species, which are more vulnerable to predators, to be declining more than other nesting strategy species. We might also expect ground-nesting species declines to be more pronounced in Britain and Ireland, where generalist predators occur at higher densities, than in the rest of Europe. Using existing long-term monitoring datasets, we analysed whether ground-nesting species were in greater decline compared to other species and found that, across Europe, 74% of ground-nesting species were in decline compared to 41% of other species. Declines were more pronounced in Britain (66% compared to 31%) and Ireland (71% compared to 20%). In all cases, ground-nesting species were declining or undergoing range contraction significantly more than other species. These patterns are consistent with the hypothesis that declines are at least partially related to abundant generalist predators. Our analysis also found that while Birds Directive Annex I designation (a proxy for habitat management) reduced the extent of declines in ground-nesting species, the reduction was not statistically significant. Current European conservation policy is clearly insufficient to prevent widespread declines in ground-nesting species as it does not consider generalist predator management as a way of reversing declines. Large-scale habitat restoration will be necessary in the long term, but large-scale experiments are also urgently required to establish causality in the impact of generalist predators on ground-nesting species in different landscapes. If we value our ground-nesting bird species, consideration needs to be given to the management of widespread generalist predators, at least until landscapes are restored.

### **White-tailed Sea Eagle *Haliaeetus albicilla* reintroduction to Ireland: restoration of a large avian apex predator**

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White-tailed Sea Eagles *Haliaeetus albicilla* were extirpated on the island of Ireland in the early twentieth century largely due to human persecution. Following research and consultation into the feasibility of reintroduction, 100 chicks were collected under licence from nests in Norway, translocated and released in Killarney National Park (Kerry) between 2007–2011. The fitting of patagial, Very High Frequency and Global Positioning System satellite-tags allowed tracking post-release, determination of timing of dispersal and range use, location of breeding pairs as well as identification of mortality factors by recovery of dead birds for post-mortem examination. Tagging at nests since 2013 has allowed us to track Irish bred birds with the first of these now reaching breeding age. Birds made large-scale movements within Ireland, but also to northern Scotland and England. Timing of dispersal (>10 km without return) varied widely between individuals: 6–280 days (mean 153±SD = 86) for birds of Norwegian origin post-release, and 65–320 days (mean 181±SD = 79) for Irish-bred birds post-fledging. Birds returned to breed predominantly south to southwest of the release area despite large-scale dispersal in their second to fourth calendar years. Most birds settled to breed <30 km of the release area with a smaller cohort settling 120–160 km from the release area. Forty-two Irish bred young have fledged to date (2013–2022) but productivity (mean 0.33 young/territorial pair) and fledged brood size (mean 1.2 young/successful nest) remains lower than the reintroduced Scottish population. Restoring a top avian predator/scavenger requires long-term commitment. Re-establishment is threatened mainly by anthropogenic factors (e.g. deliberate poisoning, windfarms) but other threats (e.g. avian influenza, lead poisoning) may arise to impact population recovery and viability. A second phase of release of young birds of Norwegian origin, managed by the National Parks and Wildlife Service, began in 2020 at sites in southwest Ireland to bolster the existing population.

**Decline to near extinction of a mountain passerine: the Ring Ouzel *Turdus torquatus* in Ireland**

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The Ring Ouzel *Turdus torquatus* is one of the most threatened breeding bird species in Ireland. The most recent breeding atlas (2007–11) revealed a 57% decline in range in Ireland since 1968–72. However, atlas methodologies are not suited for surveying difficult-to-detect species. In 2021, we undertook the first national survey of Ring Ouzel in Ireland, focussing on upland areas in Counties Donegal, Sligo, Kerry, Waterford, and Wicklow where birds have been recorded in the last 20 years. In total, 62 tetrads (2 km<sup>2</sup>) across 26 ten-km squares were visited: 24 tetrads each in Donegal and Kerry, six in Waterford, five in Wicklow and three in Sligo. Ring Ouzels were detected in nine tetrads with probable/confirmed breeding in four and possible breeding in five, all in Donegal. Habitat at breeding sites (139–530 m above sea level) was predominantly heath, blanket bog, and scree. Sheep-grazing (87%) was the most widespread land use followed by recreation (46%), forestry (40%), national park (17%), wind energy (1.5%) and others (3%). Sheep density was highest in southeast Ireland and was higher in tetrads lacking Ring Ouzel. Intensive grazing (89%) was the most significant pressure recorded in all survey tetrads, followed by recreational disturbance (48%), and roads and tracks (25%). Ring Ouzel are at imminent risk of extinction in Ireland with a small population now confined to north and southwest Donegal. The loss of the remnant population in Kerry within the last few years is particularly significant. Conversion of dry heath to grass moorland, as well as a decline in berries (especially Bilberry *Vaccinium myrtillus*) for fledged young and adults, allied to increased predation risk, appear to be important drivers of decline while extrinsic factors (range contraction due to climate change) may also play a role. Urgent conservation action is needed to prevent the species' imminent extinction.

**Winter distribution, abundance and habitat associations of farmland birds in southeast Cork: how critical is winter stubble and other tillage crops?**

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Habitat loss and land use change are primary drivers of biodiversity loss and species extinction. Agricultural intensification in Europe has led to significant declines in populations of bird species characteristic of extensive, low-intensity farming systems. Intensification has also influenced declines across most farmland bird species in Ireland, including the extinction of Corn Bunting *Emberiza calandra*, in recent decades. We identified 66 one-km squares in southeast Cork to assess the winter distribution, abundance, and habitat associations of farmland birds. We hypothesised that winter stubble would be of critical importance to the occurrence of seed-dependent farmland birds, while other tillage crops, particularly wild bird food and cover crops, would also be important. Shallow cultivation of winter stubble, a new measure introduced in 2022 under the Nitrates Directive, was also investigated in relation to its impact on farmland bird use. We identified 53 one-km transects to include winter stubble, shallow cultivation, and cover crops, but excluded winter cereals. We identified 34 one-km transects in grassland as controls. Bird surveys were carried out from November to December 2022 (early visits) and January to February 2023 (late visits). Survey data was recorded in the field using QField software. Habitat data included field/crop type, hedgerow (% cover, width, management). Bird data included transect, start time, section (1–200m, etc.), British Trust for Ornithology code, number, and distance band (0–25, 25–100, >100m) of observations. When complete (March 2023), this dataset should allow us to determine species diversity indices, abundance, and density in relation to habitat features. These data will be one of the most extensive on wintering farmland birds in Ireland to date which we hope will inform the impacts of the shallow cultivation measure, which results in a substantial reduction of winter stubble available to farmland birds.

## **A baseline survey of birds in the MacGillycuddy's Reeks, County Kerry**

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The MacGillycuddy's Reeks (Kerry) holds an important community of upland birds. In 2022 we surveyed upland birds in the MacGillycuddy's Reeks European Innovation Project (EIP) area to establish the distribution and abundance of Birds of Conservation Concern in Ireland (BoCCI). Transect routes ( $n = 38$ ) were identified and digitised using QGIS (an open-source cross-platform geographical information system application). Transect length ranged from 889–5,654m. In addition, twelve 1 km transects were sited within commonages to determine bird diversity and abundance there. Red Grouse *Lagopus lagopus* were surveyed in early spring (January to March) in ten 1 km squares, using playback every 250m on four 1 km transects within each square. During surveys, 62 bird species were recorded across 34 tetrads in the project area, including 27 listed in BoCCI. These included nine Red-listed species: Kestrel *Falco tinnunculus*, White-tailed Eagle *Haliaeetus albicilla*, Red Grouse, Golden Plover *Pluvialis apricaria*, Snipe *Gallinago gallinago*, Woodcock *Scolopax rusticola*, Grey Wagtail *Motacilla cinerea*, Meadow Pipit *Anthus pratensis*, and Ring Ouzel *Turdus torquatus*. The Red Grouse survey found grouse or grouse sign (droppings) in seven 1 km squares (15% of tetrads). Ring Ouzel was the rarest breeding bird recorded, with a singing male heard at one site. White-tailed Eagle (3% of tetrads), and Woodcock (3%) were also rare, Kestrel (6%) and Snipe (21%) were scarce, while Grey Wagtail (51%) and Meadow Pipit (91%) were widely distributed. Golden Plover (6%) was recorded in late winter during grouse surveys. Amber-listed species included Common Sandpiper *Actitis hypoleucos* (24% of tetrads), Skylark *Alauda arvensis* (58%), Spotted Flycatcher *Muscicapa striata* (9%), Linnet *Linaria cannabina* (9%) and Wheatear *Oenanthe oenanthe* (30%). Meadow Pipit were by far the most abundant species (21% of all birds recorded), with highest densities on some of the commonage transects. Other upland BOCCI species were rarer, including Kestrel (0.1% of all birds recorded), Red Grouse (0.2%), Snipe (0.4%) Common Sandpiper (0.7%), Grey Wagtail (2%), Skylark (3%), Linnet (0.2%), and Wheatear (1.3%). The 2022 Reeks EIP area bird survey results provide a baseline for monitoring population changes and trends into the future.

## **Breeding Great Cormorants *Phalacrocorax carbo* in County Wexford**

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The Saltee Islands and the Keeraghs Islands are designated Special Protection Area's for Great Cormorant *Phalacrocorax carbo*. The first record of the Great Cormorant breeding in County Wexford dates from 1893 when 'many' were recorded breeding on Makestone Rock, off Great Saltee Island. Breeding numbers then fluctuated on Great Saltee until the island was abandoned and the population moved to Little Saltee. The population at Little Saltee has been censused annually since 1960. Great Saltee was recolonised in 2005, possibly by birds from the Little Saltee colony that had been under pressure from cattle, sheep and deer which had been introduced to the island. The Keeragh Islands were monitored from 1968 to 1991, with monitoring recommenced in 2008. Since 2008, all colonies have been monitored on an annual basis, except 2020 due to Covid-19 restrictions. In that period (2008–2022) the combined number of pairs has ranged between 302–587. The colony on Little Saltee has declined from 297 pairs in both 2013 and 2014 to a low of ten pairs in 2022. Great Saltee numbers have ranged from a low of 29 pairs in 2014, rising slowly to 76 in 2021, then doubling in 2022 to 157. The Keeragh Islands have also fluctuated between 131 pairs in 2008 to 242 pairs in 2009. Overall, the Wexford metapopulation shows a downward trend.



**Ecology and conservation management of Lady's Island Lake Special Protection Area, County Wexford**

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Lady's Island Lake Special Protection Area (SPA) is designated for Black-headed Gull *Chroicocephalus ridibundus*, Sandwich Tern *Thalasseus sandvicensis*, Roseate Tern *Sterna dougallii*, Common Tern *Sterna hirundo*, Arctic Tern *Sterna paradisaea* and Gadwall *Anas strepera*. Management and protection of Ireland's largest tern colony at Lady's Island Lake by the National Parks and Wildlife Service is ongoing. The two islands within the lake support the qualifying interests, and other regularly breeding birds such as Shelduck *Tadorna tadorna*, Mallard *Anas platyrhynchos*, Shoveler *Spatula clypeata*, Oystercatcher *Haematopus ostralegus*, Ringed Plover *Charadrius hiaticula* and Redshank *Tringa totanus*. All breeding species benefit from the SPA conservation project which begins with predator management early in the year. Terrestrial mammalian and avian predators are controlled under licence and monitored throughout the breeding season. Liaison with lake users throughout the season has generated goodwill for the project and the terns suffer minimal human disturbance. Black-headed Gull numbers have been greater than 2,000 pairs since 2015 (except in 2021 due to predation), peaking at 2,752 pairs in 2020. Mediterranean Gull *Ichthyaetus melanocephalus* began breeding in 1996, and numbers peaked at 82 pairs in 2020. Sandwich Terns have remained stable over the last few years with 1,736 pairs in 2022. There were 1,112 pairs of Common Tern, 715 pairs of Arctic Tern and 313 pairs of Roseate Tern in 2022, the highest number ever for the latter species at this site.

**Conservation and breeding biology of Roseate Terns *Sterna dougallii* on Rockabill: the largest European colony, 2018–2022**

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The Roseate Tern *Sterna dougallii* colony at Rockabill (Dublin) is widely considered one of BirdWatch Ireland's most successful conservation projects. It has been operating since 1989 with funding and support provided by National Parks and Wildlife Service (through the EU LIFE and INTERREG programmes). Rockabill is located 6.5 km off the north Dublin coast and comprises two small granite islands with one largely covered by a lighthouse, out-buildings and 'gardens', and this supports most of the tern population. Roseate Terns nest in association with an approximately equal number of Common Terns *Sterna hirundo* and a lesser number of Arctic Terns *Hirundo paradisaea*. Kittiwakes *Rissa tridactyla* and Black Guillemots *Cephus grylle* are the only other seabirds regularly nesting in significant numbers. Tern management actions include removal of most of the near-invasive Tree Mallow *Lavatera arborea*, which dominates the flora on the soil-covered parts of the island, and the provision of about 1,000 tern nesting boxes. Five hides are erected around the colony from which ring-reading of adult birds is undertaken and diet is monitored. Virtually all chicks are ringed, and a large proportion of the adult population are thus of known age and origin (ca 95%+ from Rockabill). In the period 2018–2022 Roseate Tern numbers have increased by 12% from 1,642 pairs to 1,834 pairs; Common Terns have declined over the same period by 26% from 2,039 to 1,503 pairs. The Arctic Terns nest on the fringes of the main colony and on the second, unmanaged island, the Bill. Numbers have been approximately static at about 50 pairs since 2018. Breeding productivity of Roseate Terns, the number of young fledged per pair, has been 0.98, 1.07, 0.39, 1.23 and 0.89 (2018–2022), but poorer in Common Terns, 0.76, 1.03, 0.11, 0.87 and 0.68. Diet is dominated by clupeids (Herring *Clupea harengus* and Sprat *Sprattus sprattus*) and sandeels (Ammodytidae) and is rather similar for both species. Arctic Tern productivity is very poor, with most losses due to depredation by Herring Gulls *Larus argentatus* and Great Black-backed Gulls *Larus marinus*. The rising number of large gulls that loaf on the islands, especially the Bill, is the most significant threat to the nesting terns and some new approaches to their management are urgently required.

**Conservation and breeding biology of Little Terns *Sternula albifrons* at their largest Irish colony, 2018–2022**

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The conservation of Little Terns *Sternula albifrons* at Kilcoole (Wicklow) is a National Parks and Wildlife Service project, carried out by BirdWatch Ireland between 2018 and 2022, under tender. This shingle beach has hosted Ireland's largest colony of the species for many years. Predator-proof fencing is erected at the beginning of May as birds return and the project finishes at the end of July as the last chicks fledge. Continuous 24-hour wardening begins when the first eggs are laid and has been vital to minimising human disturbance and avian and mammalian predation. A more systematic approach to predator management (Foxes *Vulpes vulpes*, Mink *Neovison vison*, Corvidae) was implemented during this period and has been instrumental to the continued success of the colony, coinciding with successive years of good productivity and increases in breeding pairs at Kilcoole and other Irish Sea colonies. The number of nesting pairs at Kilcoole increased annually, from 142 in 2018 to 245 in 2022, the highest on record and representing more than half of the Irish population. Mean clutch size ranged from 2.0–2.5 annually, alike previous years. First eggs were laid on or before 16 May in four of the five years (21 May in 2018), in contrast to the previous period when first eggs came after 21 May in four of five years. Average annual productivity was 1.1 (range 0.8–1.4) which should be sufficient to continue the increase in the breeding population on the east coast, where sufficient conservation measures are put in place. We have put an increased focus on ringing and colour-ringing at Kilcoole and other east coast colonies, which has already highlighted patterns of natal site fidelity and dispersal to other colonies in the Irish Sea, post-breeding dispersal and migration habits, and is helping to better account for survival and age-structure of the population.

**Cliff-nesting seabird productivity at the Cliffs of Moher (Clare), Downpatrick Head (Mayo) and Rockabill (Dublin), 2018–2022**

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Numbers and breeding productivity of cliff-nesting seabirds are monitored at several colonies by BirdWatch Ireland staff. These include the Cliffs of Moher (CoM, Clare), Downpatrick Head (DpH, Mayo) and Rockabill (ROC, Dublin). Black-legged Kittiwakes *Rissa tridactyla* are monitored at all three, Black Guillemots *Cephus grylle* at ROC and Northern Fulmars *Fulmarus glacialis*, Common Guillemots *Uria aalge* and Razorbills *Alca torda* at CoM. Data are available for all years at ROC, 2018–2021 at DpH and 2020–2022 at CoM. Kittiwake: Breeding numbers at DpH averaged about 1,000 pairs (AON) between 2002 and 2012. Numbers have since decreased and have ranged between 400 and 600 AON. Productivity, chicks fledged per pair, was moderate 2018–2020 (0.62, 0.78, 0.51) but was very good at 1.55 in 2021, the highest ever recorded there. The 20-year average is 0.72 which should be sufficient to sustain the local population. The small colony at ROC supported 133 AON in 2018 but over the last four years numbers have been stable at between 165 and 173 AON. Productivity was moderate between 2018 and 2020 (0.61, 0.72, 0.54), high in 2021 (1.11) but dropped again in 2022 (0.62). At CoM productivity was high in 2020 and 2021 (0.84, 0.92) but was very poor in 2022 (0.20) probably due to a likely outbreak of Highly Pathogenic Avian Influenza (H5N1). Black Guillemot: Breeding numbers at Rockabill have ranged between 59 and 69 AON (2018–2022), averaging 65. Over these five years, productivity has been reasonably stable: 1.34, 1.22, 1.24, 1.11 and 1.24. This is the only monitoring data for this species in the Republic of Ireland. Fulmar: Productivity of this species at the large CoM colony was relatively good in 2020 and 2021 (0.52, 0.62) but significantly lower at 0.33 in 2021. Common Guillemot: Productivity at CoM was relatively poor in 2020 (0.35), improved somewhat in 2021 (0.52) and was very low in 2022 (0.24). Razorbill: Productivity at CoM has been poor and decreasing year on year between 2020 and 2022 (0.30, 0.21, 0.12). This work complements seabird productivity data gathered by National Parks and Wildlife Service staff on Skellig Michael (Kerry) and Wicklow Head (Wicklow) and is the Republic of Ireland's contribution to the UK/Irish Seabird Monitoring Programme.

**Forty years of changing waterfowl use of Lough Leane, Killarney National Park, County Kerry**

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Significant changes have been recorded in use by waterfowl of Lough Leane (Kerry) over the last four decades. Lough Leane is the largest of the three Killarney valley lakes, being five miles long and two miles wide. It is relatively deep, and the water levels vary significantly, depending on rainfall in the catchment. It forms part of Killarney National Park which is designated under the EU Habitats and Birds Directives. Long-term data collection commenced in 1979 and continues to the present with some gaps throughout the decades. Waterfowl counts are carried out primarily by boat, throughout the year. Counts are also carried out from the shore. Numbers of waterbirds and their locations are recorded. Since the study began, 60 species of waterbird have been recorded. Count data indicates seasonal variation in numbers. Significant changes in populations were noted from the mid-1990s on. This included reduction in numbers of some species, involving loss of breeding populations of Tufted Duck *Aythya fuligula*, Coot *Fulica atra* and Great Crested Grebe *Podiceps cristatus*, in addition to decline in wintering populations of Tufted Duck, Coot and Pochard *Aythya ferina*. Changes also include more regular presence of some species since the 1990s that were not recorded or rarely recorded prior to that date. Species now recorded regularly on Lough Leane throughout the year include Gadwall *Anas strepera*, now confirmed breeding, and Little Egret *Egretta garzetta*. Teal *Anas crecca*, which had been winter visitors, are now recorded throughout the year. These changes highlight the importance of on-going research and monitoring into potential causes for these changes, which may include disturbance, predation, climate change and food availability both here and across their range.

**Preliminary study of Tufted Duck *Aythya fuligula* activity time budget as a tool to maximise count efficiency**

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When feeding, Tufted Duck *Aythya fuligula* repeatedly alternate between diving for food and surfacing to breathe. This means that they are often out of sight during periods of feeding activity. Therefore, there is a risk of under-recording both their presence during waterbird counts from shore, and their numbers feeding during activity time budget observations. This preliminary study aims to assess the length of time Tufted Duck are out of sight when diving versus the time spent on the surface during periods of active feeding. The study was carried out at Ross Bay, Lough Leane, Killarney National Park (Kerry) and is linked to a broader on-going study of waterbird activity time budgets and use of the bay. Continuous observations of Tufted Duck were carried out. The time spent both under the water and on the surface was measured and recorded using a stopwatch. Length of time spent actively diving varied. Results from observations, on four dates in March and April 2021, indicate that the maximum time spent under water was between 26 and 43 seconds with the median ranging from 16 to 19 seconds. The maximum time spent on the surface was between 15 and 28 seconds with a median range of six to fifteen seconds. Based on these values, it appears that scans should likely extend for a minimum of 26 seconds. However, additional observations and data are needed before a recommendation can be made as to the length of time needed to scan an area at different times of the year. It is therefore suggested that further focused studies of Tufted Duck activity time budgets be carried out to assess the variation in time spent under water during periods of active feeding at different times of the year and under a range of environmental conditions.

**Comparative distribution of selected waterbird species, aquatic plants and human activity at Ross Bay, Lough Leane, County Kerry**

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Waterbird distribution on Lough Leane, Killarney National Park (Kerry) is influenced by several factors. These include food availability, shelter, predation, water levels, weather conditions and disturbance. Balancing the needs of ecological protection with human access to the National Park creates on-going challenges. A study began in 2018 to assess these

factors on the lake. Ross Bay was chosen for this study due to year-round accessibility as a vantage point, including during high water levels, the presence of a variety of waterbirds throughout the year as shown by long-term monitoring, and the importance of this bay for boating and other human activity. The use waterbirds make of the bay and key factors influencing that are recorded every month, from early morning to 12.30 GMT. The bay is scanned every 15 minutes, location, number, and activity of all species is recorded and their positions mapped. Activities recorded are feeding, swimming, resting, preening, alarm, and swim/fly. Similarly, boating is recorded by boat type focusing on boat and oars, boat and engine and boat drifting (fly fishing). Potential food availability is assessed via aquatic plant surveys. Dominant species present and percentage cover are recorded and marked on maps. Preliminary assessment of data indicates two major influences on use of the bay by waterbirds. The first is feeding, at certain times, by people, of Mallard *Anas platyrhynchos*, Mute Swan *Cygnus olor* and Black-headed Gull *Chroicocephalus ridibundus* near the castle which is a main attraction. The second is the presence, in a different part of the bay, of a sheltered corner, enriched by an inflowing stream, which has the greatest abundance of macrophytes, least boating disturbance and is the area most used by waterbirds. It is suggested that an exclusion zone be created, to support undisturbed waterbird use of the bay.

**A review of territorial behaviour in breeding Mute Swans *Cygnus olor* at Ross Bay, Lough Leane, Killarney National Park, County Kerry**

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Mute Swans *Cygnus olor* exhibit territorial behaviour during certain times of year. During on-going surveys of Ross Bay, Lough Leane, Killarney National Park (Kerry), it was noted that one pair of Mute Swans appeared to occupy the bay all year round and to defend it as their territory during the breeding season. This led to a focused study of Mute Swans in the bay in 2022. It involves continuous observations by one surveyor of the swan's activity and location in the bay in parallel with a second surveyor observing all waterbird and boating activity. Numerous instances of territorial behaviour have been recorded. These include the male Mute Swan busking and chasing groups of moulting Mute Swans out of the bay and a fight, lasting several minutes between two pairs of Mute Swans, each with a cygnet. These were the pair that occupy Ross Bay and a pair that occupies the adjacent Bunrower Bay. These bays are connected by a canal. Both pairs of Mute Swans were marked with rings during the summer of 2022, facilitating identification. The cygnet with the Ross Bay pair was also ringed. The fight ensued due to high water levels, causing the surrounding land to be flooded, leading to a blurring of boundaries. The Bunrower pair of Mute Swans and their cygnet were on flooded ground near the canal. The Ross Bay pair defended their territory, proving the stronger. They drove the Bunrower pair and their cygnet back towards Bunrower Bay. A similar outcome was noted several weeks later. Results to date suggest that Mute Swan territorial boundaries are determined by lines of sight and hearing; the boundaries set by a fight between breeding pairs can last at least one month; and territorial behaviour is associated with rearing offspring.

**Modelling the breeding distribution and abundance of a cryptic bird in Ireland: Eurasian Woodcock *Scolopax rusticola***

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Establishing a basic understanding of the distribution, abundance and population trend of a species is fundamental to informing a response for conservation or management. In Ireland, the Eurasian Woodcock *Scolopax rusticola* is a ground-nesting bird species strongly associated with woodlands. It is culturally important as a hunted gamebird, but due to its cryptic habits, its breeding status, distribution, and habitat requirements are poorly understood. A volunteer-based species-specific survey of breeding Woodcock was conducted in the years 2017, 2019 and 2021 at 209 sites selected randomly across forest habitat in the Republic of Ireland. Survey data was used to produce Species Distribution Models to estimate the current national distribution of breeding Woodcock, using land cover and climate data as predictor variables. Using a Generalised Additive Model, relationships between Woodcock abundance and important environmental variables were

modelled and projected across the estimated distribution to generate a national population estimate of breeding male Woodcock for the Republic of Ireland for the first time. Our results suggest that breeding Woodcock occupy a greater range in Ireland than previously reported, with abundance explained by bioclimatic and landscape-scale habitat variables, such as forest cover extent and forest composition. The data establishes a baseline against which future surveys may be compared to detect population trends and provide a basis for further research on the ecology of breeding Woodcock in Ireland.

### **Geographical variation of Corncrake *Crex crex* calls in the Irish context**

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Understanding geographical variation of vocalisations is critical in species conservation. For instance, reintroducing individuals of a species within the wrong vocal subpopulations may negatively affect breeding success, as communication between the reintroduced and resident individuals is impaired. The Corncrake *Crex crex* in Ireland is Red-listed, and population numbers are dramatically low compared to the past. A previous study found differences in vocal pattern among Irish subpopulations of Corncrakes, although since then some of them have gone extinct, and relative consistencies have changed. We recorded 51 Corncrakes during the breeding season in 2022 along the west coast of Ireland using a high-spec parabolic microphone. We also collected environmental metadata such as temperature, weather, wind speed and moon phase. Recordings were attributed to four subpopulations: Galway, Mullet Peninsula, west Donegal, and east Donegal. We analysed ten syllables from each recording to retrieve pulse-to-pulse distance and macro-temporal vocal features, such as syllable duration and interval, and call duration and interval. When we fed these variables into a flexible discriminant analysis, we found that the model could classify the individual birds into the correct subpopulations at least 69% in every attempt. This preliminary analysis demonstrates a degree of geographical variation of calls in subpopulations with potential implications for their conservation. Moreover, we analysed the relationship between vocal pattern and environmental factors with linear mixed-effect models. We found significant negative associations between call duration and temperature as well as moon phase, suggesting environmental factors may play a role in defining the vocal pattern also. Further research will focus on collecting more recordings from the southern subpopulations and more field variables to investigate the effect of habitat structure on vocal patterns.

### **Breeding wader populations in northwest Ireland, 2017–2021**

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Surveys of breeding waders were undertaken as part of the Cooperating Across Borders for Biodiversity project (through the EU INTERREG VA programme) to monitor populations in Donegal and Sligo and assess changes between 2017 and 2021. Potential factors influencing trends were also assessed. Thirty-seven sites were surveyed in both years; Generalised Linear Mixed Models were applied to the data to identify significant temporal changes in the number of breeding pairs. Associations with selected factors, such as the presence of predator control fences, insularity of the site (comparing island sites to mainland sites) and weather were also examined, though it was not possible to evaluate fully other factors also likely to be influencing trends. The total population was 443 pairs in 2017 and 390 pairs in 2021, a decline of approximately 10%. Tory Island held the largest population in both years with 164 pairs in 2017 and 133 in 2021. It was the only site to support breeding Dunlin *Calidris alpina*. The highest percentage loss was recorded at Inch West, where populations declined by 78% from eighteen pairs to four. The most substantial increase occurred at Rinmore, where breeding pairs increased by 39% from 23 pairs to 50. The presence of a predator-proof fence had a significant positive influence, as did an island location. Intense rainfall had an impact on Lapwing *Vanellus vanellus* productivity in some years. Overall, the number of Lapwing pairs declined, but the productivity index increased from 0.80 in 2017 to 1.17 in 2021. The presence of a predator-proof fence was significantly correlated with productivity. This study highlights the importance of sites in the northwest of Ireland for breeding waders. Protecting the remaining populations from the impacts of predation and ensuring optimum habitat conditions are likely to be the minimum key requirements to safeguard these populations into the future.

**Relative body weight as a determinant of breeding success in the Greenland Barnacle Goose *Branta leucopsis***

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Larger body size correlates to increased breeding success in many bird species across a variety of taxa. Barnacle Geese *Branta leucopsis* are Arctic-breeding migrants with subpopulations that breed in several locations, including Greenland, Svalbard, and the Baltic. In the Svalbard and Baltic subpopulations, larger body size has been linked to increased fitness through larger clutch size, social dominance, better overall health, and more efficient feeding, but this has not yet been shown in the Greenland population. The Greenland goose population breeds in remote, inaccessible areas, therefore, observation on the wintering ground can provide important insight. To determine the influence of larger relative weight on breeding success in the Greenland Barnacle Goose population, a dataset with 60 years of observations and measurements taken from the wintering ground in Ireland was analysed. A significant relationship was detected between relative weight and breeding success. As this relationship was not seen with mating success, relative weight may have a more direct influence on the ability to raise offspring. While the Barnacle Goose populations showed a dramatic increase in the past 60 years, they are susceptible to pressures on both breeding and wintering grounds (e.g. human-wildlife conflicts, avian influenza), necessitating an understanding of the factors that contribute to their population trends.

**Living with anti-microbial resistance and avian influenza within wild bird populations**

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The emergence and transmission of disease in wild birds has concerning implications for animal and human health, as well as agricultural and economic consequences. Anti-microbial resistance (AMR) renders common bacterial infections untreatable. Wild birds, especially those living near humans and livestock, may act as reservoirs for resistant genes and vectors for the transmission of AMR bacteria. Current AMR dissemination into the environment attributable to wild birds is unclear but could represent a potential public health threat if not assessed. Similarly, there are growing concerns about Avian Influenza, a contagious and often fatal viral disease. Waterfowl may have a higher resistance to the disease and perpetuate transmission to other birds by acting as viral reservoirs. Migratory species have also been implicated in transmitting the virus. Highly Pathogenic Avian Influenza (HPAI) can have up to 100% mortality in affected flocks. The 2021–2022 epidemic season is the largest HPAI epidemic so far observed in Europe, with a total of 3,573 HPAI virus detections in wild birds, 2,467 outbreaks in poultry with 47.7 million birds culled in response. Domestic poultry are especially susceptible to HPAI, raising economic concerns. Cases of HPAI are not limited to birds and have been found in mammals including seals, Foxes *Vulpes vulpes*, and even humans. The threats to human health to date have been relatively minor with these outbreaks, and the problems caused have largely been concentrated in the losses in production and costs of control. The aim of this scoping review is to synthesise the relevant published literature regarding wild flocks in Ireland existing with AMR within a landscape of increasing HPAI risk. Mapping this information is important in assessing potential human and animal health risks that may be emergent in Ireland.

**How genetically distinctive are Irish Coal Tits *Periparus ater* and Wrens *Troglodytes troglodytes* compared to other European populations?**

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The uncertain origins of Ireland's wildlife have long intrigued biologists. While flight in birds enhances their colonisation capabilities, dispersal across open bodies of water might be uncommon in some passerines. Coal Tits *Periparus ater* and

Wrens *Troglodytes troglodytes* are relatively sedentary in Ireland, but also occur across much of Eurasia, with 19 subspecies recognised for Coal Tits (including the putative Irish *P.a. hibernicus*) and eight for Wrens. No genetic investigation into either species in Ireland have yet been undertaken – a gap we aimed to fill. Thus far, we have sequenced feather samples from 23 Coal Tits (Ireland, England, Spain) and 29 Wrens from a range of Irish locations, each at two mitochondrial genes (Coal Tits: CO1 and control region; Wrens: CO1 and ND2). These datasets were then combined with published information from other locations. For the Coal Tit, little could be inferred from the CO1 gene as it showed very low genetic variability. The control region was highly variable, with three haplotypes (distinct sequences) found in Irish birds, none of which occurred anywhere else. However, these Irish haplotypes were closely related to several other haplotypes found across western Europe, suggesting relatively recent isolation of *P.a. hibernicus* from British and continental Coal Tits. For the Wren, haplotype sharing with other European populations was observed for both CO1 and ND2, but variants unique to Ireland were again found. Irish Wrens are surprisingly genetically diverse and show as much genetic affinity with birds from Iceland and St. Kilda as they do with the putative British or continental subspecies. Collectively, our findings point towards complex genetic origins of Coal Tits and Wrens in Ireland, both of which appear somewhat, but not strongly, genetically distinct from other Eurasian populations, at least at these mitochondrial markers.

### **Use of tracking devices to assess distribution and habitat use of large gulls in the Republic of Ireland**

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Determining space use by seabirds, especially in the breeding season, is fundamental to implementing effective conservation planning via mechanisms such as Marine Protected Areas. Large gulls in Ireland have been in decline and many are assumed to be primary marine foragers. Several studies in Ireland have, however, shown a considerable reliance on inland and coastal areas by breeding birds. In this study, undertaken as part of the EU INTERREG VA MarPAMM project, we aimed to quantify the reliance of large gulls on marine habitats and the degree of interaction with fisheries. We deployed Global Positioning System and Global System for Mobile communication tracking devices over three years (2019–2021) to Herring Gulls *Larus argentatus* and Lesser Black-backed Gulls *Larus fuscus* at two colonies in the northwest of Ireland. Breeding season foraging activity was focussed on inland and coastal areas, where anthropogenic resources were abundant. Herring Gulls foraged almost exclusively inland and along coastal areas while Lesser Black-backed Gulls made more (though still limited) use of pelagic foraging areas. Both species heavily utilised coastal and inland habitats including piers, agricultural grasslands, and urban areas. We also tracked the gulls in the non-breeding season, revealing the long-distance movements (via Iberia south to north Africa) of Lesser Black-backed Gulls and the shorter dispersal distances of Herring Gulls within Ireland. Overall usage of the marine environment by foraging gulls was highly limited as was the degree of interaction with fishing vessels.

### **Surveys of the Rook *Corvus frugilegus* population in east Cork, 1975 to 2023**

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The Rook *Corvus frugilegus* is one of Ireland's most ubiquitous farmland birds, yet very little has been published about its ecology and population structure. The breeding population of a 77 km<sup>2</sup> area of coastal east Cork, using apparently occupied nests as the count unit, was surveyed six times between 1975 and 1991. These surveys showed a relatively stable population with between 1,512 and 1,903 nests recorded per survey (mean of 1,671 nests). Most were nesting in colonies that did not exceed 100 nests. Many colonies were of fewer than ten nests, but these were very unstable and often did not survive longer than one or two breeding seasons. Some of the larger colonies also fluctuated in size from year to year, and this could often be related to activities nearby, such as tree-felling, which often also led to the establishment of new colonies nearby. A survey in 2015 revealed a population of over 2,000 nests for the first time. It is proposed to repeat this survey in April 2023, before analysis and final publication of the results given preliminarily here.

### **The Birds of Ireland**

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Status reports on the *Birds of Ireland* have appeared as landmark publications at long intervals in the past (e.g. William Thompson's *Natural History of Ireland* (1849–51), Richard Ussher's and Robert Warren's *Birds of Ireland* (1900), Patrick Kennedy's (with others) *Birds of Ireland* (1954), Robert Ruttledge's *Ireland's Birds* (1966), and Clive Hutchinson's *Birds in Ireland* (1989)). It is now 34 years since the latter work appeared in print. Since that time the amount of new information available on Irish birds has grown exponentially. The same time-period has also revealed the vulnerability of Irish bird populations to internal and external influences, for example, through human-driven climate change, the search for renewable energy resources, and through national and European-wide policy changes in infrastructural development, agriculture, forestry, and fisheries. The authors, over the next year or so, intend to bring together the different and diverse strands of information relating to birds in Ireland and to bring forward a statement of the current situation (early 2020s) regarding the conservation status of each species, while taking into consideration the latest international position on taxonomy and nomenclature.

### **Individual variation in the avian gut microbiota: the influence of host state and environmental heterogeneity**

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The gut microbiome has important consequences for fitness and yet the complex, interactive nature of ecological factors that influence the gut microbiome has scarcely been investigated in natural populations. We sampled the gut microbiota of wild Great Tits *Parus major* at different life stages allowing us to evaluate how gut microbiota changes related to a diverse range of key ecological factors of two broad types: (1) host state, namely age and sex, and life history variables, timing of breeding, fecundity and reproductive success; and (2) the environment, including habitat type, the distance of the nest to the woodland edge, and the general nest and woodland site environments. The gut microbiota varied with life history and the environment in many ways that were largely dependent on age. Nestlings were far more sensitive to environmental variation than adults, pointing to a high degree of flexibility at an important time in development. As nestlings developed their microbiomes from one to two weeks of life, they retained consistent (i.e. repeatable) among-individual differences. However, these apparent individual differences were driven entirely by the effect of sharing the same nest. Our findings point to important early windows during development in which gut microbiota are most sensitive to a variety of environmental drivers at multiple scales, and suggest reproductive timing, and hence potentially parental quality or food availability, are linked with the microbiome. Identifying and consolidating the various ecological sources that shape individual gut bacteria is of key importance for understanding the role of the gut microbiome in animal fitness.

### **Do protected areas in the wintering range help conserve migratory birds? A case study interrogating demographic rates of Icelandic Whooper Swans *Cygnus cygnus* wintering in the UK**

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Protected areas at regional, national, and global scales are often, but not always, successful at conserving populations of species they are designed to protect. The efficacy of such protective measures is, however, difficult to measure, especially for highly mobile species (like migratory birds) that may move between protected and unprotected areas during their lifespans. In this study, we assess the value of nature reserves (NRs) for the conservation of Whooper Swans *Cygnus cygnus*. We used a 30-year dataset of colour-marked individuals to assess how demographic rates vary at sites with varying levels of protection and how they are influenced by movements between sites. Whooper Swans had a lower



breeding probability when wintering inside NRs than outside, but better survival for all age classes, generating a 30-fold higher annual growth rate within NRs. There was also a net movement of individuals from NRs to non-NRs. By combining these demographic rates and estimates of movement (into and out of NRs) into population projection models, we show that the NRs could potentially double the population of swans wintering in the UK by 2030. Our results highlight the major effect that spatial management can have on species conservation, even when the areas protected are relatively small and only used during short periods of the life cycle.

### **Understanding patterns of terrestrial habitat use in Dublin's wintering waders**

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Dublin Bay hosts globally important populations of overwintering wading birds, which has led to its designation as a Biosphere reserve. However, rapid urbanisation and rising demand for development is putting ever-increasing pressure on intertidal and terrestrial habitats in and around the city. In this project, with Fingal County Council, we aim to assess spatial and temporal patterns of winter habitat use of four species of wader, both in protected areas within the Biosphere reserve, and in unprotected terrestrial sites such as urban amenity grassland and farmland in north County Dublin. We are investigating the environmental and anthropogenic drivers of these patterns and their downstream fitness consequences, as well as inter-individual differences in movement behaviour within species. We have been using back-mounted Global Positioning System (GPS) devices and colour-marks since 2021 to track the winter movements of Oystercatcher *Haematopus ostralegus*, Redshank *Tringa totanus*, Black-tailed Godwit *Limosa limosa*, and Curlew *Numenius arquata*, and to identify important sites and corridors. We deployed 67 GPS devices on Oystercatcher, 47 on Redshank, 33 on Black-tailed Godwit, and 47 on Curlew, and colour-marked a total of 752 birds across three estuaries in Fingal. All study species have shown use of coastal, estuarine, and terrestrial habitats during the winter, with considerable variation in home range size between individuals and between species. Redshanks and Curlew appear to favour amenity grassland habitats for nocturnal foraging, while Oystercatcher and Black-tailed Godwit make extensive and far-ranging use of terrestrial habitats for foraging at high tide during the day, sometimes travelling several miles into the city. A detailed knowledge of habitat use, movement behaviour and connectivity between sites will be critical for future planning and development in Fingal, if the full range of habitats required by these protected species are to be conserved.

### **Whole genome data provides evidence of divergent selection and gene flow between two populations of Red Grouse *Lagopus lagopus* with implications for conservation**

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Rescuing locally endangered populations through translocation is a contentious issue in conservation biology. While translocation may increase genetic diversity (genetic rescue), introduction of maladapted alleles may lead to outbreeding depression. Red Grouse *Lagopus lagopus* are endangered in Ireland but are widespread in parts of Great Britain. Their decline in Ireland is attributed to increases in generalist predators and habitat loss due to changing land use. Once widespread in Ireland, its population is now reduced and fragmented. For the effective conservation of this species, an understanding of genomic diversity and local adaptation can be important. In this study whole-genome sequencing of contemporary and historic samples of Red Grouse was used to assess the level of differentiation, inbreeding and population structure between two populations, as well as to identify candidate genes putatively under divergent selection. Clear population structure was found between English and Irish Red Grouse, with evidence of admixture into the Irish population. This is evidence of gene flow from the English to the Irish population. There were signs of recent inbreeding in the contemporary Irish population more so than in the historical or English samples. The contemporary Irish population has significantly more long runs of homozygosity than the other two populations. Outlier analysis between the contemporary samples identified 661 candidate genes under putative divergent selection. These were involved in a large variety of processes including immune response, pigmentation, and food intake. This study provides more evidence that

Irish Red Grouse are locally adapted and stressed that conservation efforts should focus on conserving the Irish population as one unit.

**Assessing the status, distribution and nesting ecology of Common Swifts *Apus apus* in urban areas to inform conservation management and the protection of nesting colonies in Ireland**

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The Common Swift *Apus apus* is a widespread breeding bird across Ireland. However, the species has undergone major declines of up to 58% (relative abundance) in recent decades and is now Red-listed on Birds of Conservation Concern in Ireland. Reasons for the declines are not fully understood but the loss of nest sites and declines in prey abundance are thought to be significant factors. The Swift nests in colonies in natural and man-made structures where suitable cavities exist. The species has adapted to largely nesting in built structures in villages, towns, and cities. We undertook surveys of nesting Swifts within 16 local authority boundaries across 15 counties between the 2017 and 2022 nesting seasons. Survey visits were conducted across all 'localities' defined as any settlement cluster that contained potentially suitable nesting structures. Rural areas were not surveyed or any structure outside/radial of settlements. Survey visits took place between mid-May and mid-August during bright and calm weather with surveying extending into dusk to capture peak activity at active colonies. The colony size, building type and location were recorded with each nest site entrance catalogued by photographs. Existing records and local knowledge played a large part in locating colonies in many counties/localities. Nesting Swifts were confirmed within all local authority boundaries with a total of 2,518 active nest sites confirmed in a total of 1,074 individual structures. Swifts were present in an average of 37% of localities surveyed with nests confirmed in an average of 29%. The number of colonies confirmed per county and the size and distribution of colonies varied greatly with the largest colony confirmed containing 30 active nests. These data are important to inform conservation measures to ensure the long-term protection of Swift nesting colonies.

**Aerial surveys reveal spatial and temporal variation in the distribution of the European Storm Petrel *Hydrobates pelagicus* at sea during the breeding season**

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Ireland is an internationally important breeding location for the European Storm Petrel *Hydrobates pelagicus*, with an estimated 20% of the global breeding population. Storm Petrels can travel hundreds of kilometres on foraging trips during the breeding season. However, the extent of their distribution in Ireland's offshore and coastal waters, especially during the summer and autumn months when they are breeding, is largely unknown. As part of the Irish government's ObSERVE programme, seasonal broad-scale and fine-scale aerial surveys were conducted to assess the occurrence and abundance of seabirds and cetaceans in Irish waters. Surveys were conducted in 2015, 2016, 2021, and 2022, employing a strip-transect methodology. Over the survey periods there were 2,783 sightings totalling 4,535 individual Storm Petrels. Distribution was modelled using environmental variables, bathymetric features, and observer-recorded measures of viewing condition. The results revealed hotspots along the south and southwest coasts close to known breeding colonies, while offshore, areas along the continental shelf break had increased densities. Models were also used to estimate the likely numbers of breeding and non-breeding Storm Petrels using Irish waters during summer and autumn. This represents the most comprehensive survey of this species in Ireland and one of the most intensive in any country.

