# BOOK OF ABSTRACTS

## 6th Irish Ornithological Research Conference

University College Cork | 23rd November 2013

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# SIXTH IRISH ORNITHOLOGICAL RESEARCH CONFERENCE

UNIVERSITY COLLEGE CORK
23RD NOVEMBER 2013

Marine Institute
Foras na Mara

epa
Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

ATKINS

*The organisers would like to thank all the people who helped with this conference*
*Photos by Nick McCarthy*

# EVENT

# INFORMATION

# Current Ornithological Research in Ireland
# 6th Ornithological Research Conference

## University College Cork
## November 2013

It has been five years since the fifth conference on ornithological research in Ireland was held at University College Cork in November 2008. Since then a number of research projects have been completed and a comprehensive synthesis of bird habitats in Ireland '*Bird Habitats in Ireland*' by Nairn & O'Halloran has been published. The importance of research in both Irish habitats and their birds in an international context was identified during the last conference in this series. Naturally there is still much to be done, and with new projects started and some long-term studies concluding, it is now appropriate to provide an up to date summary of recent ornithological research activities. Thus, the sixth conference in the series is being held at University College Cork on November 23rd 2013. As before, all workers in Irish ornithology, at the universities, institutes of technology, government departments and conservation organisations have been invited to submit abstracts detailing their current research activities. In addition a keynote presentation will be delivered at the conference by Stephen Votier, University of Exeter in Cornwall, United Kingdom on the '*Potential consequences of fishery reforms for seabird communities*'.

A total of 128 abstracts were received for this conference compared with 135 in 2008, 115 in 2003, 159 in 1997, 120 in 1992 and 98 in 1985. Researchers from University College Cork, BirdWatch Ireland and RSPB NI constitute the majority of submitting researchers, with a number of studies also from universities and institutes in the UK. Three obvious patterns have emerged in the research, which is detailed in the abstracts below. Firstly, it is clear that a number of breeding wader species have undergone severe population declines, and many of these may disappear completely from some sites, despite the conservation measures that have been put in place. Secondly, several populations of farmland birds (including some waders) have declined, in response to the continued intensification of agriculture, and highlighting the relative ineffectiveness (at least up to now) of conservation measures, particularly of agri-environmental schemes. Thirdly, many raptor populations appear to be stable or increasing, though there are notable exceptions and gaps of knowledge. This collection of abstracts hopefully provides a status review of existing knowledge, and also identifies gaps in our knowledge in certain areas. A range of exciting opportunities and topics are now awaiting ornithologists for further research.

## SCIENTIFIC COMMITTEE

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

## CONFERENCE PROGRAMME

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|---|---|---|
| 09:00 – 09:30 | **Registration**<br>Western Gateway Building, UCC | |
| 09:30 – 09:45 | **Welcome address**<br>John O'Halloran | |
| 09:45 – 10:45 | **Keynote address**<br>Stephen Votier | Potential consequences of fishery reforms for seabird communities |
| **Session 1: Seabird ecology**<br>Chair: John Quinn | | |
| 10:45 – 11:00 | **Thomas W. Bodey**, Adam Kane, Stephen C. Votier, Keith C. Hamer, Andrew L. Jackson, Samantha C. Patrick, Ewan D. Wakefield and Stuart Bearhop | Individual behavioural interactions explain colony specific habitat use in Gannets |
| 11:00 – 11:15 | **Mark Jessopp**, Thomas Bodey, Ewan Wakefield, Keith Hamer, Ian Cleasby, Stephen Votier and Stuart Bearhop | Effect of vessel type and activity on Gannet foraging behaviour in Irish waters |
| 11.15 – 11.45 | *Tea/Coffee and poster session* | |
| **Session 2: The ecology and biology of raptors**<br>Chair: Mark Wilson | | |
| 11:45 – 12:00 | **Brian Burke**, Damian Clarke, Ann Fitzpatrick, Tim Carnus and Barry J. McMahon | Breeding Peregrine Falcons of Co. Wicklow |
| 12:00 – 12:15 | **Darío Fernández-Bellon**, Mark W. Wilson, Nora Lewon, Sandra Irwin, Thomas C. Kelly, Barry O'Mahony and John O'Halloran | Hen Harrier nesting behaviour: data from nest cameras |
| 12:15 – 12:30 | **Eimear Rooney**, Neil Reid, Mathieu Lundy and W. Ian Montgomery | The recovery of the Common Buzzard in Ireland |
| 12:30 – 12:45 | **John Lusby**, Richard Shore, David Tosh, Gloria Pereria, Elizabeth Sharp, Áine Lynch and John O'Halloran | Identifying the main factors which directly impact on and cause mortality of Barn Owls in Ireland |
| 12:45 – 13:00 | John Lusby, **David Tosh**, Daelyn Purcell, Julie Grant, Peter Turner and Catherine O'Reilly | The feeding ecology of Kestrels in Ireland and a review of current best practice dietary analysis methods |
| 13.00 – 14.00 | *Lunch Break* | |

**Session 3: Human impacts on birds**
Chair: Alex Copland

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|---|---|---|
| 14:00 – 14:15 | Conor T. Graham, Mark W. Wilson, Tom Gittings, Thomas C. Kelly, Sandra Irwin, Oisín F. Sweeney, J. Quinn and **John O'Halloran** | Differential impacts of afforestation on bird diversity are dependent on previous land use |
| 14:15 – 14:30 | **Allan Mee** | Status and ecology of Ring Ouzels in southwest Ireland |
| 14:30 – 14:45 | **Richard Nairn**, John O'Halloran and John Quinn | Do wind turbines disturb non-breeding waders |
| 14:45 – 15:00 | **Thomas C Kelly**, Sorcha Sheehy, Alice D'Arcy, James Finn, Mark Wilson, Michael O' Callaghan, Padraig Maccarron, Eileen Dillane, Neil Coughlan and Brendan Keogh | The changing pattern of bird strikes at an Irish airport – causes and consequences |
| 15:00 – 15:15 | **Kieran Buckley**, Conor O'Gorman, Tim Carnus, Jacob Höglund, Brendan Kavanagh and Barry J. McMahon | The recovery of the wild Grey Partridge in Ireland |
| 15:15 – 15:45 | *Tea/Coffee and poster session* | |

**Session 4: Bird distribution and monitoring**
Chair: Pat Smiddy

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|---|---|---|
| 15:45 – 16:00 | **Brian Caffrey** | Bird Atlas 2007-11 – Some key findings |
| 16:00 – 16:15 | **Olivia Crowe** | Bird monitoring in Ireland: 40 years on and what have we learned? |
| 16:15 – 16:30 | **Lesley J. Lewis**, Sinéad Cummins and David Tierney | The NPWS Low Tide Waterbird Survey Programme 2009/10 – 2011/12 |
| 16:30 – 16:45 | **Kendrew Colhoun**, Kevin Mawhinney, Michael McLaughlin, Claire Barnett and Will J Peach | Testing the effects of AES options on farmland seed-eating bird populations in Northern Ireland |

**Session 5: The ecology of geese**
Chair: Thomas C. Kelly

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| 16:45 – 17:00 | **Mitch D. Weegman**, Stuart Bearhop, Geoff Hilton, Alyn Walsh and Anthony David Fox | Cohort-specific reproductive success in an Arctic-nesting goose population |
| 17:00 – 17:15 | Xavier Harrison, David Hodgson, Richard Inger, Kendrew Colhoun, Gudmundur Gudmundsson, Graham McElwaine, Tom Tregenza and **Stuart Bearhop** | Breeding season weather modifies the strength of winter driven carry over effects in Light-bellied Brent Geese. |
| 17:15 – 17:30 | **Matthew Silk**, Andrew Jackson, Kendrew Colhoun, Gudmundur Gudmundsson, Graham McElwaine, Darren Croft and Stuart Bearhop | Facebook for geese: What are the causes and consequences of differences in social position in a fission-fusion social system? |
| 17:30 – 17:45 | **Close of meeting**<br>John O'Halloran | |

## KEYNOTE ADDRESS

### POTENTIAL CONSEQUENCES OF FISHERY REFORMS FOR SEABIRD COMMUNITIES

Dr Stephen Votier, Senior Lecturer in Natural Environment, University of Exeter

Biography: Stephen Votier is an ornithologist with a particular interest in seabirds. He has a BSc from the University of Newcastle and a PhD in zoology from the university of Glasgow. His research interests include seabird conservation, climate change impacts, marine predator distribution and behaviour environmental impacts of fisheries and marine ecosystem function. The aim of his research is to understand the impact of global change on marine top predators. Most of his work is field-based, where he studies how key stressors, such as fish extraction, climate change, pollution and industrial development, have impacts at the individual, population and community levels. This work is also influenced by the recently emerging fields of bio-logging and analysis of intrinsic biogeochemical markers. Stephen is also a member of the Biosciences department in the College of Life and Environmental Sciences.

# RESEARCH ABSTRACTS

## Pioneering Galway Little Egret *Egretta garzetta* colony study

Chris Benson* and John Lusby
*Illaune, Milltown, Tuam, Co. Galway

In 2009 the first breeding record for Little Egret *Egretta garzetta* in County Galway was recorded at a known Grey Heron *Ardea cinerea* colony located approximately 4km south of Oranmore. Monitoring has been conducted on an annual basis since to record clutch and brood size and fledging success at all nests, and all data has been entered into electronic BTO nest record cards. In addition, to assess post-natal dispersal and survival, all nestlings have been fitted with standard BTO metal and two single-letter colour rings, the latter fitted above the tarsus on both legs for ease of reading in the field. To date, from a total of 41 nests monitored since 2009, 86 nestlings have been ringed, 77 with colour rings. Of this sample, 31% (24 individuals) have been re-sighted, all (except one) within Ireland, and up to a distance of 185km from the ringing site. The single bird re-sighted outside of Ireland was observed some 2,133km south in the Azores. Nesting success has been extremely high with 35 (85%) of the nests known to have produced young that survived to fledging. Situated in an isolated small copse of maturing deciduous and Yew *Taxus baccata* trees close to inner Galway Bay, nest heights vary between 3.5 and 6.5m. Clutch sizes have averaged 4.5 eggs per nesting attempt (range, 4 to 6). The colony size (number of nests) has varied from 19 (2009), five (2010), eight (2011), two (2012) and seven (2013). Apart from the exceptional Azorean record, re-sightings have come from as far as Sligo Bay (113km north), Kerry (119km south) and Dublin Bay (185km east). Nearby Rahasane Turlough (12km east) appears to be an important area pre- and post-breeding with multiple reported sightings there of colour-ringed birds during early spring and mid to late summer.

## Individual behavioural interactions explain colony specific habitat use in Gannets *Morus bassanus*

Thomas W. Bodey*, Adam Kane, Stephen C. Votier, Keith C. Hamer, Andrew L. Jackson, Samantha C. Patrick, Ewan D. Wakefield and Stuart Bearhop

*Centre for Ecology and Conservation, University of Exeter, Cornwall Campus, Penryn, Cornwall, TR10 9EZ
Colonial breeding is a widespread phenomenon, and there is increasing evidence that colonies of non-related individuals, including seabirds, maintain broadly discrete foraging ranges despite an absence of territoriality. Mechanisms to explain this are poorly developed, but central-place foraging provides a number of opportunities for individuals to gather information on the foraging success of others. However, there is a time-limited trade-off for individuals between observing others versus actively searching, and there is an additional trade-off between increasing public information use and increasing competition. These trade-offs between the use of information types, and their impact on competitive interactions, are predicted to greatly impact on spatial foraging patterns. Here we empirically demonstrate through the use of tracking data from 80 Gannets *Morus bassanus* at six colonies around the Irish landmass that colony specific foraging occurs. We then demonstrate mechanistically that intra-specific competition and public information transfer combine to facilitate colony separation. We show that public information transfer, both at-sea and at-colony is a key to the population-level patterns observed. This supports the potential for cultural transmission of foraging locations. Such separation of foraging grounds by colony may occur in many central-place foragers, and has important implications for the ecology and conservation of numerous charismatic species.

## The recovery of the wild Grey Partridge *Perdix perdix* in Ireland

Kieran Buckley*, Conor O'Gorman, Tim Carnus, Jacob Höglund, Brendan Kavanagh and Barry J. McMahon
*National Park and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, 4 Claremont Road, Sandymount, Dublin 4

In recent decades there has been a widespread and rapid decline in bird species considered farmland specialists across Europe. One of these species, Grey Partridge *Perdix perdix*, has been in decline in Ireland since the late 1950s. The causes of this decline are thought to be linked to the loss of extensive agriculture and the consequential dismantling of the farmland ecosystem. By the early 1990s naturally occurring populations had retreated to the

cutaway peatlands of Counties Kildare and Offaly. By the mid-1990s the species was on the brink of extinction in Ireland. Although the management of Grey Partridge as a quarry species is well established in other countries, the unique nature of the cutaway peatland habitat in Ireland, where the last remaining wild population sought refuge, represented a distinct conservation challenge. Population dynamics, as captured by yearly autumn counts of Grey Partridges, over 21 years (1991-2011) were described using state-space models. These demonstrated that specific targeted and systematic conservation actions brought about a partial population recovery from an estimated 17 individuals in 1991 to an estimated 391 individuals in 2011. A combination of habitat manipulation, systematic predator management and population augmentation with captive-bred wild Grey Partridges brought about this partial recovery through an increase in the carrying capacity of the site. This project demonstrates that when a conservation objective is clearly defined the applications of specific targeted actions can lead to relative success, even when a species is at the western edge of its continental range and residing in sub-optimal habitats. The future conservation of Grey Partridge in the study area is dependent on continued management of the site. The application of these results to the rest of Ireland will require targeted agri-environment schemes with specific measures to benefit Grey Partridge.

## Breeding Peregrine Falcons *Falco peregrinus* of County Wicklow

Brian Burke*, Damian Clarke, Ann Fitzpatrick, Tim Carnus and Barry J. McMahon
*UCD School of Agriculture and Food Science, University College, Dublin

The Peregrine Falcon *Falco peregrinus* is an Annex I species under the EU Birds Directive as it is considered rare and vulnerable to specific changes in habitats, thus requiring Specially Protected Areas for its conservation. This study reports survey data of breeding Peregrine Falcons in County Wicklow for the period 2008-2012. On average, there were 57 adults involving 27 territory-occupying pairs in each year. A total of 42 different nest sites were utilised during this study. Success rate of breeding attempts ranged from 47% to 96% per year, with a mean of 72%. Breeding performance did not significantly vary by year or by location, suggesting that the population was stable. The County Wicklow population was both stable and self-sustaining during this study. Densities and productivity compared favourably to populations all over the world. It is expected to grow in the near future and is likely to act as a source population for neighbouring counties, underlining its importance as a Peregrine Falcon stronghold in Ireland.

## High densities of Skylark *Alauda arvensis* at Boora: a positive result of habitat management for Grey Partridge *Perdix perdix* – towards appropriate management for Ireland's declining farmland birds?

Éabhín Byrne*, Shane P. Sweeney and Kieran Buckley
*Leamore Farmhouse, Blueball, Tullamore, Co. Offaly

There is widespread evidence suggesting the change from extensive to intensive agriculture effectively destroyed the farmland ecosystem. This evidence is most pronounced in the decline of farmland birds, which are regarded as the most conspicuous indicators of the ecological health of farmland. Given the cost of 'greening' measures for Irish agriculture, it would be expected that agri-environmental schemes should provide the resources that deliver the maximum benefit for farmland birds with a 'fixed list' approach. However, when we examined the evidence in terms of the response of farmland birds to agri-environmental schemes in operation for nineteen years, it appeared that these schemes have been ineffective at reversing a downward trajectory in farmland bird populations. One of these farmland birds, the Skylark *Alauda arvensis*, has undergone a decline of 46% in Europe since 1980, and a 34% decline in the Republic of Ireland between 1998 and 2010. In contrast, it appears that densities of breeding Skylark on National Parks and Wildlife Service lands at Boora, County Offaly have responded positively to habitat management for wild Grey Partridge *Perdix perdix*. To test the hypothesis that the current management for Grey Partridge at Boora has a measurable effect on breeding Skylark density, two study areas in Boora and an additional two control areas were surveyed for calling male Skylarks. Here we present the findings of these surveys. We suggest that if straightforward habitat options similar to those in Boora are integrated into forthcoming agri-

environmental schemes, then they could potentially deliver the necessary ecological resources for farmland birds to recover.

## Bird Atlas 2007-11: some key findings

Brian Caffrey
BirdWatch Ireland, Midlands Office, Crank House, Banagher, Co. Offaly

Now that the fieldwork period of the *Bird Atlas 2007-11* is complete, the dataset fully validated and the final species maps produced, some intriguing patterns and trends are emerging. Perhaps the most striking finding is a recurring relative abundance change pattern for many breeding migrant species. For the affected species a line can be seen at varying locations across Britain and Ireland, showing a predominant pattern of loss in relative abundance to the southeast of the line and contrasting gains to the northwest of the line. The pattern is particularly pronounced for the Willow Warbler *Phylloscopus trochilus* and House Martin *Delichon urbicum* maps, but can also be clearly seen with other species such as Cuckoo *Cuculus canorus*, Swallow *Hirundo rustica*, Spotted Flycatcher *Muscicapa striata*, Sedge Warbler *Acrocephalus schoenobaenus* and Grasshopper Warbler *Locustella naevia*, notably all sub-Saharan migrants. Although the drivers behind this change are not yet clear, climate change is certainly a potential cause. Other significant findings include the confirmation that many of our farmland bird species continue to decline at alarming rates. Latest data shows that the range for the nine lowland farmland bird species listed on the Birds of Conservation Concern in Ireland (BoCCI), has halved since 1970. The Corn Bunting *Miliaria calandra*, Corncrake *Crex crex* and Grey Partridge *Perdix perdix* have all recorded declines of over 90%, with the Corn Bunting becoming extinct in Ireland between the last two atlas periods. Twite *Carduelis flavirostris* and Whinchat *Saxicola rubetra* have also experienced declines of 80% and 77% respectively. Breeding waders are also struggling, showing marked declines in both range and abundance, none more so than Curlew *Numenius arquata* which has declined in range by 73% in the last 20 years and is showing significant declines in relative abundance nationwide. On a more positive note, some increases have taken place in Jay *Garrulus glandarius*, Blackcap *Sylvia atricapilla*, Siskin *Carduelis spinus* and Tree Sparrow *Passer montanus* numbers.

## Swift *Apus apus* conservation project

Brian Caffrey*, Dick Coombes and Olivia Crowe
*BirdWatch Ireland, Unit 20, Block D, Bullford Business Campus, Kilcoole, Co. Wicklow

The Swift *Apus apus* is a summer migrant that breeds throughout Europe and much of Asia and winters in southern Africa. Because of its extremely large range it is not classified as of poor conservation status. However, in recent decades there has been much concern for Swifts as their numbers have been in decline throughout many parts of their range. Here, the Swift is an iconic urban bird, nesting in holes in walls or under eaves of buildings. It has shown a decline since monitoring of common birds began in 1998. The recent bird atlas shows that there has been a substantial loss in range in Ireland since 1970 and a decline in abundance throughout Britain and Ireland since 1990. Reasons for their decline remain unknown, but it has been suggested that loss of available nest sites due to renovations of old buildings could be a significant factor. With the support of Dublin City Council, a small-scale survey of Dublin city was initiated in 2013. Follow-up work in 2014 will focus on gathering more details on the success of nests and on advising and monitoring the success of management action throughout the city. This work draws on the support of a number of individuals and groups with expertise in managing Swift breeding habitats, such as the Northern Ireland Swift Group and other local projects such as that on the Castlebar campus of Galway Mayo Institute of Technology. It is hoped there will be scope to extend the survey nationwide from 2014.

## Reintroduction of Red Kites *Milvus milvus* in Ireland

Damian Clarke, Tony Cross, Adam McClure*, Marc Ruddock and Robert Straughan
*RSPB, Belvoir Park Forest, Belfast, BT8 7QT

Historical and archaeological evidence indicates that the Red Kite *Milvus milvus* was once present in Ireland, becoming extinct most likely as a result of persecution and deforestation, in the mid-eighteenth century. Despite sporadic records of vagrant birds since the mid-twentieth century, the Red Kite was absent from Ireland as a breeding bird for over 200 years and although nest building was recorded in County Antrim in 2002, it was considered that the species would not naturally re-colonise the island of Ireland. This led, in 2007, to the Golden Eagle Trust, RSPB and Welsh Kite Trust embarking on a large-scale re-introduction project, which has seen the Red Kite successfully return to the Irish countryside. The project teams extensively reviewed the suitability of habitat, prey and presence of indicator species (i.e. Buzzard *Buteo buteo* and Raven *Corvus corax*) in advance. Over the subsequent five years, 240 young Red Kites were removed, under licence, from nests in Wales at four to five weeks of age and translocated to sites in Counties Wicklow (2007-2011), Down (2008-2010), Dublin (2011). The young birds were held in specially designed aviaries until nine to ten weeks of age, when they were released. A combination of radio and satellite tracking, patagial wing-tagging and monitoring by a team of staff and volunteers since the initial releases, has allowed an insight into the birds' movements, population dynamics and interactions, including the first recorded instance of Red Kite polygamy in Britain or Ireland. Nest observations and visits have allowed monitoring of breeding pairs, productivity, prey items and unusual nesting materials. Since 2010, when breeding was first confirmed, a minimum of 123 Red Kite chicks have fledged in Counties Down (42) and Wicklow (81).

## Population ecology of the Peregrine Falcon *Falco peregrinus* in the east of Ireland

Damian Clarke* and Ann Fitzpatrick
*Wicklow Mountains National Park, Laragh, Co. Wicklow

The Peregrine Falcon *Falco peregrinus* is listed on Annex 1 of the EU Birds Directive and is protected locally under the Wildlife Act (1976). The population in Britain and Ireland has largely recovered from declines caused by organochlorine pollutants. Despite this, in some areas, including Northern Ireland, the population is in decline. Persecution and, to a lesser extent perhaps, contamination are seen as the main threats to Peregrine Falcon population stability. There is good knowledge of population dynamics and productivity from decadal surveys. There is, however, limited information on individual breeding parameters and recruitment into the breeding population, or dispersal and survival of individuals or age classes. This study, initiated in 2008, involves a programme of annually monitoring Peregrine Falcon breeding sites and marking nestlings with individually identifiable colour rings. Marking juveniles will provide some insight into the dispersal and survival of the birds through ringing recoveries, but primarily will allow knowledge of the rate at which known age Peregrine Falcons are recruited into the breeding population, and identify when there is turnover of the adults at the territory. This is coupled with an annual programme of inspection of territory-holding falcons and their legs and rings to determine annual rates of turnover and recruitment at territories. In addition, throughout the project data on occupancy, breeding parameters (e.g. clutch size and fledging success), nest site selection, diet and biometrics are collected simultaneously. Survey work is currently carried out in Counties Dublin, Kildare, Kilkenny, Laois, Wexford and Wicklow. To date, 226 territories have been surveyed and 209 nestlings colour ringed. There have been ten ringing recoveries, three due to deliberate persecution (two shootings and one poisoning) the others largely due to collision. Currently four colour ringed birds are known to have been recruited into local breeding populations.

## Sex-specific foraging behaviour in the Gannet *Morus bassanus* results from differences in habitat use between the sexes

Ian R. Cleasby*, Ewan D. Wakefield, Thomas W. Bodey, Rachel D. Davies, Samantha C. Patrick, Stuart Bearhop, Peter Miller, Jason Newton, Stephen C. Votier and Keith C. Hamer
*Meadowbank, New Road, Ingleton, North Yorkshire

Sexual segregation in foraging behaviour occurs in a wide range of animal species, but is particularly common in central-place foragers, such as seabirds, during the breeding period. However, although sexual segregation has previously been described for a number of species, very few studies have been able to combine analyses of foraging behaviour with information on sex-specific habitat use. Here we examine how sex-specific foraging behaviour in the Gannet *Morus bassanus* results from niche divergence between the sexes in terms of their habitat use and spatial distribution by combining fine-scale movement, dive and habitat data, along with stable isotope analysis. Over three breeding seasons (2010-2012) females made longer trips, foraged further offshore and fed at a lower trophic level than males despite being the larger sex. Additionally, in each year of the study the foraging home-ranges of males and females showed only a restricted overlap. During the study, the sub-mesoscale habitat distribution varied markedly, but there was evidence for habitat segregation. Males showed greater usage of areas with higher net primary production (NPP) and lower sea-surface temperature (SST), a pattern consistent with foraging predominantly in coastal, tidally mixed waters. Females tended to forage in warmer, stratified waters, but exhibited no consistent response to NPP. Analysis of diving data suggested that differences in habitat use between the sexes corresponded with sex-specific differences in foraging behaviour. In particular, males performed more long and deep U-shaped dives, which were characteristic of inshore foraging. In contrast, shorter and shallower V-shaped dives occurred more often in offshore waters and females were able to reach deeper depths during V-shaped dives than males. Together, these results suggest that sexual segregation in Gannets is reflected in sex-specific patterns of habitat use and foraging behaviour.

## Positive effects of agri-environment interventions in mixed arable farmland landscapes in Northern Ireland

Kendrew Colhoun*, Claire Barnett, Kevin Mawhinney, Michael McLaughlin and Will J. Peach
*RSPB Conservation Science, Belvoir Park Forest, Belfast BT8 7QT

Declines in farmland birds have been well documented throughout Europe. Ascribed principally to changes in farming practices, including loss of winter stubbles and increased use of pesticides, agri-environment schemes (AES) have the potential to halt declines chiefly through provision of winter and summer food sources. We measured the effects of a combination of AES scheme options over a five-year period in a mixed arable farming landscape in County Down, testing the hypothesis that AES options would lead to an increase in populations of seed-eating farmland birds at AES treatment farms relative to control farms at which AES options were not implemented. Surveys of farmland birds at the farm-scale focussing on Yellowhammer *Emberiza citrinella* were carried out at 55 farms (33 AES treatment and 22 control) in the breeding seasons of 2006 and 2011. Changes in the abundance of territorial Yellowhammer, Tree Sparrow *Passer montanus* and House Sparrow *Passer domesticus* were significantly greater on AES farms, indicating a positive effect of AES management. Predicted mean counts of Yellowhammer increased by 79% on AES treatment farms, while those on control farms increased by 20%. We suggest that AES intervention with advisory inputs has resulted in positive impacts of options at a farm-scale. Further work is required to understand if such an effect can be implemented at a larger spatial scale towards recovery of Yellowhammer and other priority farmland seed-eaters.

## Irish Light-bellied Brent Geese *Branta bernicla hrota* in the Canadian Arctic: range and breeding biology

Kendrew Colhoun*, Stuart Bearhop, Sean Boyd, Gudmundur Gudmundsson, Josee Lefebvre, Austin Reed and Alyn Walsh
*WWT, Castle Espie Wetlands Centre, Comber, Co. Down BT23 6EA

With the Canadian/Icelandic/Irish flyway being described as late as the early 1970s, knowledge of the migration of East Canadian High Arctic Brent Goose *Branta bernicla hrota* populations is relatively poor. This study describes the usage of the breeding range, reviewing existing sources of information and recent sources including satellite telemetry, aerial surveys, as well as observations and recoveries of ringed birds. The migration from Iceland typically initiates at the end of May, with birds arriving in the breeding range within two to seven days. Data on the breeding biology of this flyway population remains very scant indeed, based primarily on one published paper. Expeditions in August 2005 and June and July 2007 have added to our knowledge base. In June 2007 we discovered an unusually high density of breeding birds, mainly in two colonies on small offshore islands in Eureka Sound, Axel Heiberg Island (80° N). In 35 nests examined clutch size varied from one to six eggs, with a mean of 4.15 (SD = 0.85, n = 33). Estimated hatching dates varied from 8 to 14 July with a distinct peak on 11-12 July. When compared with other studies on *B. b. hrota*, all of which occurred at lower latitudes (64-70° N), we found no evidence of delayed nesting or reduced clutch size attributable to the extreme northerly location of our study area. We conclude that our population benefits from a local microclimate which attenuates Arctic summer temperatures and provides a reduced spring snow pack, allowing early nesting. Knowledge of distribution, feeding ecology of adults and goslings remains very limited and is the subject of proposed work in 2014 and 2015.

## Declines in breeding wader populations in Northern Ireland over 26 years: 1987-2013

Kendrew Colhoun*, Kat Coupland, Anne Guichard, Laura Smith and Kevin Mawhinney
*RSPB, Conservation Science, Belvoir Park Forest, Belfast BT8 7QT

Throughout Europe breeding waders have been declining for at least four decades. In Ireland, there is evidence of significant declines in Lapwing *Vanellus vanellus*, Curlew *Numenius arquata*, Snipe *Gallinago gallinago* and Redshank *Tringa tetanus*. Numbers and ranges of these species have declined markedly over several decades and, where some were widespread in the past, there is a serious threat that these species will be largely lost from the wider countryside. In Northern Ireland, for example, the vast majority of Curlew, Lapwing and Redshank occur at just a handful of sites. Following on from survey work carried out in 1987 and 1999, the Northern Ireland Environment Agency supported an NI-wide survey of breeding waders in 2013. This entailed repeat multi-season visits to about 150 tetrads focussing on Lapwing, Curlew and Redshank numbers and general habitat measures. We report continuing declines of all three species and we provide updated assessments of the sizes of the breeding populations and outline the range of factors which have contributed to these declines. The Curlew population is particularly precarious and is in danger of disappearing completely in coming decades.

## Birds of Conservation Concern in Ireland 2014-2019: a review of the Red, Amber and Green lists

Kendrew Colhoun*, Sinead Cummins and Olivia Crowe
*RSPB Conservation Science, Belvoir Park Forest, Belfast BT8 7QT

Periodic reviews of the population status of the Irish avifauna are required to identify conservation priorities and provide direction for conservation activities. This is the third all-Ireland review of birds of conservation concern. Covering the period 2008-2013, we collate and review all contemporary data sources to provide a comprehensive assessment of the current status of breeding and wintering populations of about 200 species of Irish birds. The availability of improved datasets from well-established monitoring programmes including the Countryside Bird Survey (CBS) and Breeding Bird Survey (BBS), the Irish Wetland Bird Survey (I-WeBS) and Wetland Bird Survey (WeBS) and the latest BTO/JNCC/BWI *Breeding Bird Atlas* has assisted with the refinement of the list. The new list contains

some predictable species and species groupings, including the suite of breeding waders whose populations are clearly in serious decline with ranges contracting to relatively few key strongholds. Declines in some widespread and commoner species are identified, whilst some species such as Blackcap *Sylvia atricapilla*, Buzzard *Buteo buteo* and Little Egret *Egretta garzetta* have shown significant increases. We highlight data gaps and suggest improvements for BoCCI and future assessments.

## Population development and breeding success of Light-bellied Brent Geese *Branta bernicla hrota*: 1960-2012

Kendrew Colhoun*, Gudmundur Gudmundsson and Kerry Mackie
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The East Canadian High Arctic breeding population of Light-bellied Brent Goose *Branta bernicla hrota* has a trans-Atlantic migration, detailed monitoring of which is principally limited to counts in the autumn and spring period in Iceland, Ireland and other parts of northwest Europe as far south as western France. Here we present an historic overview of autumn (September/October), mid-winter (January) and spring (May) counts and annual productivity assessments. There were few estimates of the size of the population prior to the middle of the twentieth century, but it appears likely that the population declined due to hunting pressure between 1850 and 1900, then remained at fewer than 10,000 birds until *Zostera* recovered and hunting was banned around 1950. The first complete census in 1960/61 estimated the population at about 11,900 individuals and subsequent surveys showed the population fluctuating between 8,000 and 16,000 through the 1960s and 1970s. A series of highly successful breeding seasons during the early 1980s probably contributed to peak counts at that time of 20,000-25,000 birds, dropping thereafter to mid-1990 peaks of about 16,000 birds. In the 15 years since, the population has shown a sustained increase, firstly towards about 30,000 birds in the early 2000s to more than 40,000 birds in the early 2010s. Although productivity has remained highly variable throughout this time (1960-2010; mean 14%, range: <1-46%) part of the explanation for the growth since 2000 has been the above-average productivity (21%) in seven of the eleven years 2000 to 2010).

## Testing the effects of AES options on farmland seed-eating bird populations in Northern Ireland

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Changes to farming practices have been widely implicated in the dramatic declines in farmland seed-eating birds evident across Europe since the 1970s. The loss of breeding habitat and reduced availability of summer (seed and insect) and winter (seed) food sources have been the principal proximate causes of these declines. There has been some evidence that carefully targeted and well implemented agri-environment scheme (AES) options can lead to increased densities of some species. In Northern Ireland, the Countryside Management Scheme is the primary AES mechanism for delivering improved habitats for these species. Since the early 2000s RSPB have worked closely with the farming community to assist with the implementation of AES options in mixed-arable farmland in County Down. We have tested the efficacy of different AES options through comparing densities of priority farmland bird species in AES option (treatment) and unmanaged (control) habitat patches. Studies undertaken between 2011 and 2013 assessed the efficacy of summer and winter AES options. Seed-eating passerines made greater usage of low-input CMS cereals during summer than conventionally-managed cereals. This effect was most pronounced in the margins of whole fields containing conservation cereals which held significantly higher densities of finches and Tree Sparrows *Passer montanus* than control margins. Seed-eating passerines made significantly greater usage of CMS winter food options (wild bird covers and cereal stubbles) than equivalent control habitats. Wild bird cover was the most heavily utilised crop, holding significantly higher densities of granivorous and small insectivorous species. Yellowhammers *Emberiza citrinella*, Reed Buntings *Emberiza schoeniclus* and Tree Sparrows were most likely to use one-year wild bird cover mixes, while Linnets *Carduelis cannabina* preferred the second winter of a two-year mix.

## Nearctic passerine migrant trends and climatic variability

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Long distance migrant bird trends from North America to Ireland and Britain are being analysed to establish potential relationships with climatic variables. However, quantifying the impact of climatic variability alone on transatlantic migrant birds can be difficult due to confounding factors. To reduce bias due to local changes in observer numbers two independent datasets from Ireland and Britain are being examined. In addition the oceanic route used by vagrant passerines also eliminates land-based confounding factors, while passerine population data from North America indicate that there had been no consistent population trends over the time period assessed (1966-2002). Although this research is at a very early stage, preliminary results using multiple regression analysis indicate that regional climate indices for October accounted for 35-40% of Nearctic passerine bird occurrences. These relationships were apparent to a similar extent in both the combined Irish and British datasets and in the dataset for each country. Indices of large-scale climatic phenomena integrate weather conditions and therefore allow the overall response of birds to climate change to be quantified. In the absence of confounding factors, this analysis may confirm that climatic variability can have a significant impact on the occurrences of migrant birds to regions beyond their normal ranges.

## Survey of breeding birds on North Bull Island, Dublin Bay

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The first complete survey of all breeding birds in Ireland's oldest bird sanctuary, North Bull Island, was carried out between mid-March and mid-July 2012 and 2013 and may be repeated in 2014. The survey area covered 240 hectares including two golf courses. The objectives were to (1) establish the range of breeding species, (2) establish baseline population data for each species and (3) produce breeding distribution maps. Territory-mapping was used for the majority of species however Meadow Pipit *Anthus pratensis* and Skylark *Alauda arvensis* populations were based on data extrapolated from sample hectares. Preliminary analyses of the results indicate that up to 27 species nest regularly, of which 11 are Amber List species. In addition, the data also confirms that the island holds a very significant population of breeding passerines. Compared with an account of the breeding birds published in the early 1950s it is clear that substantial changes have occurred and are likely to be linked to (1) the provision of new habitats in the golf courses, (2) the general maturation of existing natural habitats and (3) the increased size of the island. Species that were once scarce or unknown on the island are now common residents e.g. Magpie *Pica pica* and Reed Bunting *Emberiza schoeniclus*. On the negative side excessive levels of disturbance from amenity activities and the lack of protection have led to the abandonment of the island by once regular breeding species such as Little Tern *Sternula albifrons* (since 1990s) and Ringed Plover *Charadrius hiaticula* (since 2010). On the basis of results from this survey a number of temperature sensitive species have been selected for annual monitoring with specific attention being paid to their responses to short and long term climate change.

## Survey of wintering land birds on North Bull Island, Dublin Bay

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A survey of all land bird species wintering on North Bull Island was carried out between November and February 2011/2012 and 2012/2013 and may be repeated in 2013/2014. The objectives were to (1) establish the range of land bird species that occur in winter and (2) produce distribution maps for the most common species. The survey area covered 330 hectares and included salt-marshes and areas liable to flooding by tidal waters. To date 35 fieldwork days have been completed. Of the 32 species recorded in winter 16 are known to nest on the island. Initial results indicate that some species e.g. Wrens *Troglodytes troglodytes* and Reed Buntings *Emberiza schoeniclus* have notably different summering and wintering ranges on the island. Other species that are rare breeders on the island (e.g. Robins *Erithacus rubecula*) are considerably more common and widespread in winter which suggests

immigration by populations from the mainland or further afield. When winter fieldwork has been completed the bird data and maps will be compared with recently generated data on the breeding birds. A number of species have been selected for future monitoring in winter.

## Population size, habitat selection and conservation requirements of Whinchat *Saxicola rubetra* at two population strongholds in Ireland

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The Whinchat *Saxicola rubetra* has shown a dramatic range decline (-77% since 1970) to the extent it now qualifies as Red-listed as a species of conservation concern in Ireland. There have been few studies on the Whinchat in Ireland, although its distribution is closely linked to High Nature Value farming elsewhere in Europe. Fieldwork for the current study was undertaken in 2012 in the two main strongholds for Whinchats remaining in Ireland; the Shannon Callows and Wicklow Mountains. Shannon Callows sites (consisting of hay meadows, pasture or a mixture of meadow and grazing land) or 1km squares in the Wicklow Mountains were the survey unit. Within survey sites, all areas were walked to within 100m (where practical) and a look-see method was used to determine the number of pairs (or breeding territories). Broad-scale habitat data were collected at all survey sites and detailed habitat data collected within 50m of assumed nest sites (determined by observation of bird behaviour). In total, 17 territories were identified at 15 Shannon Callows sites, and five territories were located in 12 1km squares in the Wicklow Mountains. Tall vegetation in meadows in the Shannon Callows and unmanaged upland grasslands in the Wicklow Mountains was preferred, with trees, scrub and watercourses featuring in most occupied territories. Due to huge population declines and the current scarcity of Whinchats, it is recommended for inclusion as a species monitored by the Irish Rare Breeding Birds Panel. Future studies are needed to estimate population sizes, breeding ecology and more detailed habitat associations in order to determine what are the key factors driving its decline. However, consideration of conservation measures for Whinchats in the short term, particularly through reform of the Common Agricultural Policy and agri-environment schemes with protection of High Nature Value farming systems, is urgently required.

## Breeding waders on cutaway peatlands in County Offaly

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Breeding waders in Ireland are undergoing huge population declines and range contraction. Previous surveys in 1998, 2002 and 2006 demonstrated the importance of cutaway peatland habitats for these species, particularly Lapwing *Vanellus vanellus*, Redshank *Tringa totanus*, Ringed Plover *Charadrius hiaticula*, Common Sandpiper *Actitis hypoleucos* and Snipe *Gallinago gallinago*. A repeat survey of breeding waders was undertaken at 11 cutaway peatland sites in west Offaly in 2013. Standardised breeding wader survey methods were used. Briefly, two visits were made to each site where transects were walked with a maximum spacing between each of 200m (to ensure that all parts of the sites were surveyed to within 100m). All breeding waders seen or heard from these transects were recorded on maps. A total of 71 pairs of breeding waders were recorded including Lapwing (40), Redshank (15) Ringed Plover (10) and Common Sandpiper (6). Also, 45 audible Snipe were recorded, in addition to single Dunlin *Calidris alpine* and Ruff *Philomachus pugnax* (presumably non-breeding birds on passage). Since 1998 numbers of Lapwing, Redshank and Ringed Plover have declined, Common Sandpiper have remained stable and Snipe have increased (although Snipe are difficult to census accurately with the methodology used). The population declines are almost certainly due to the succession of habitats on the cutaways, with increasing encroachment of scrub. With appropriate management, such as scrub removal, ditch profiling and re-wetting, wader numbers will respond positively, as demonstrated at the Drinagh cutaway bog, where breeding numbers rose for Lapwing (+20%), Redshank (+67%), Snipe (+129%), and where Common Sandpiper now breeds. Ringed Plover declined from three to two pairs, although this species is associated with drier habitats on the cutaways. Additionally newer cutaway sites, which are still relatively open, may be attracting breeding waders away from sites that have been cutaway for over fifteen years.

## Variation in the breeding bird community at Cabragh Wetlands from Constant Effort Site ringing data

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Constant Effort Site (CES) mist netting has been undertaken at the Cabragh Wetlands, near Thurles in County Tipperary, since 2006. The CES methodology standardises ringing between sites and years to allow comparisons to be made. Briefly, it requires that the same nets be operated in the same locations for the same time in each year. A total of 12 visits are undertaken each year between early May and late August. There is typically a ten-day window within which a visit can take place, and visits have to be spaced a minimum of six days apart (for full detail of the CES methods, see www.bto.org/volunteer-surveys/ringing/surveys/ces). The Cabragh Wetlands is a Natura 2000 site, forming part of the Lower River Suir SAC. Habitats vary with amenity grassland, scrub and trees on the drier parts of the site, with the wetland area comprising extensive *Phragmites* reedbed, swamp and wet grassland habitats. The bird community at the site reflects this diversity of habitat, with a total of 36 species captured to date. Of these, Sedge Warbler *Acrocephalus schoenobaenus* is the commonest species caught, with 601 individuals captured since 2006, followed by 220 Wrens *Troglodytes troglodytes*, 137 Reed Buntings *Emberiza schoeniclus*, 126 Blackbirds *Turdus merula*, 125 Blue Tits *Cyanistes caeruleus* and 107 Robins *Erithracus rubecula*. The standardised nature of the methodology allows comparisons for a range of population metrics for common species, such as over-winter survival (the number of adult birds present on the site in the first six visits) and breeding performance (by looking at the ratio of adults to juveniles). It is planned to undertake a full analysis of these data after ten years of recording has been completed.

## Broad-scale habitat preferences of summer bird communities in cutaway peatlands

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Cutaway raised bogs in the Irish midlands have been shown to provide valuable habitat for birds, such as breeding waders and Grey Partridge *Perdix perdix*. However, to date, much of this work has focused on sites in west Offaly, particularly in the Lough Boora Parklands. A number of other sites in the midlands have recently been cutaway, and habitats that may be valuable to wildlife are becoming established. Extensive data have been collected on the habitats present at these sites. This study collected baseline bird data from ten cutaway peatland sites in Counties Offaly, Kildare, Roscommon and Tipperary. The data can be related to the habitats present to determine their current conservation value and monitor changes to the bird communities over time. All sites were surveyed during the summers of 2010 or 2011. Transects were established and at least two bird counts (early and late) undertaken between April and July. All birds seen or heard were recorded, along with a note of any breeding behaviour. A total of 62 species were recorded, of which 22 species were confirmed breeding. Of the remainder, breeding was considered probable for 21 species and possible for a further 12 species. Of the species that are listed as Birds of Conservation Concern in Ireland, a total of five Red List species were recorded, along with 21 Amber List species. The data confirms the value of these habitats for birds at present, and suggests the increasing value that this area may have for these and other species of conservation concern as the rehabilitation of the cutaway bogs continues. The establishment of a monitoring programme is recommended to build upon the data presented here to study the value of the changing habitats for bird species.

## Response of bird populations to conservation management for breeding waders on cutaway peatlands

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Bord na Móna cutaway peatlands have already been shown to provide valuable habitat for many bird species of conservation concern. These habitats have typically been created following industrial harvesting operations by drain blocking, allowing sites to rewet thereby creating wetland habitats. At Drinagh, a cutaway peatland in County Offaly, scrub was removed and drains re-profiled on about 21 hectares in autumn 2010, prior to rewetting about 9 hectares. Similar management work on an approximate further 20 hectares was undertaken in autumn 2011, and the whole area (about 41 hectares) rewetted. During summer (April-August) 2011, eight visits were made to record birds present on and within 100m of the management site according to standard territory mapping methodology. A total of 39 species was recorded within the survey area, of which 20 species were considered to be breeding. The commonest species were Willow Warbler *Phylloscopus trochilus* (45 territories), Sedge Warbler *Acrocephalus schoenobaenus* (16), Skylark *Alauda arvensis* (10), Lesser Redpoll *Carduelis cabaret* (10) and Reed Bunting *Emberiza schoeniclus* (8). Two Red-listed species, Lapwing *Vanellus vanellus* (4 territories) and Redshank *Tringa totanus* (2) were recorded, along with six Amber-listed species: Teal *Anas crecca* (1), Little Grebe *Tachybaptus ruficollis* (1), Ringed Plover *Charadrius hiaticula* (1), Snipe *Gallinago gallinago* (4), Skylark (10) and Grasshopper Warbler *Locustella naevia* (2). Although scrub habitats held the highest territory density, open habitats are the most important for species of conservation concern. The speed of occupancy by breeding waders (from single pairs of Lapwing and Snipe in 2010 to four pairs of Lapwing and Snipe, two pairs of Redshank and one pair of Ringed Plover in 2011) indicates that the creation of open wetland habitats can have substantial, short-term benefits. Further work is required to understand longer-term impacts of this work on birds and its application to other sites.

## Fine-scale habitat use by breeding birds in cutaway peatlands

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The cutaway peatlands around Boora, County Offaly have long been recognised as important habitats for breeding waders. This study aimed to identify other breeding bird populations and their habitats on these cutaways. Bird and habitat data were collected in summer 2009. The survey sampled 30, 100m x 100m squares for birds and habitats in six cutaway areas in the larger Boora complex. Four visits were made each month from April to July, and all birds seen or heard within each survey square mapped using a modified Common Bird Census methodology. A total of 372 individuals of 40 species were recorded. The commonest breeding species (i.e. the greatest number of identified territories) was Willow Warbler *Phylloscopus trochilus*, followed by Reed Bunting *Emberiza schoeniclus*, Wren *Troglodytes troglodytes*, Blackbird *Turdus merula*, Skylark *Alauda arvensis*, Sedge Warbler *Acrocephalus schoenobaens* and Lesser Redpoll *Carduelis cabaret*. Four species of wader were recorded (Ringed Plover *Charadrius hiaticula*, Lapwing *Vanellus vanellus*, Snipe *Gallinago gallinago* and Common Sandpiper *Actitis hypoleucos*) and other priority (listed as birds of conservation concern in Ireland) wetland species (Mute Swan *Cygnus olor*, Tufted Duck *Aythya fuligula*, Water Rail *Rallus aquaticus*, Little Grebe *Tachybaptus ruficollis* and Black-headed Gull *Chroicocephalus ridibundus*) were also present. The data indicates that the wetlands and the openness of the landscape (i.e. the absence of trees) are the two most important features for the species of conservation concern. Maintenance of these open areas is therefore required to benefit priority bird species. However, scrub (at various stages of establishment) offers valuable habitats for certain species (such as Cuckoo *Cuculus canorus*), with Grasshopper Warbler *Locustella naevia* using open scrub habitats and Lesser Redpoll in denser scrub and woodland areas). Maintaining a diversity of habitat types, at varying stages of succession, is therefore likely to deliver the most benefits for wildlife on the cutaways.

## Identifying and delivering conservation requirements for farmland birds in Ireland

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As a group, farmland birds remain threatened in Ireland. Data from the *Bird Atlas 2007-11* confirms continuing declines for eight (Grey Partridge *Peridx perdix*, Quail *Coturnix coturnix*, Corncrake *Crex crex*, Lapwing *Vanellus vanellus*, Curlew *Numenius arquata*, Redshank *Tringa totanus*, Twite *Carduelis flavirostris* and Yellowhammer *Emberiza citrinella*) out of the nine Red-listed farmland birds, confirming that pressures driven by agricultural intensification and land use change observed in the 1970s and 1980s on these species are continuing. The only species to have increased is Barn Owl *Tyto alba*, but this increase is likely due to intensive efforts associated with on-going work that has located the majority of the few remaining active nests. Other farmland bird species in the Irish countryside, such as Skylark *Alauda arvensis* and Stock Dove *Columba oenas*, have also been shown to be in decline from Countryside Bird Survey monitoring. Agri-environment schemes (AES) have been suggested as a way to arrest farmland bird declines. Adequately-funded and properly targeted AES have delivered for certain species where adequate ecological inputs to the design of the schemes and measures have been present. However, data from the joint BirdWatch Ireland and University College Cork "Farmland Birds Project" has shown that existing Irish AES have delivered very little for farmland birds. Nevertheless, data from this study is being used to offer research-based recommendation for the conservation of farmland birds in Ireland. These data can be applied at many levels, from single species requirements (e.g. Skylark) to management of important habitats (e.g. hedgerows). Additionally, a simple and rapid approach to assess biodiversity at the whole farm level has been put forward for incorporation into certification schemes. With on-going reform of the Common Agricultural Policy, coupled with the agri-food industry "Food Harvest 2020" vision, this research is urgently required to deliver for threatened farmland birds in Ireland.

## Tree Sparrow *Passer montanus* population dynamics in Ireland: why is this seed-eating farmland bird increasing?

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Tree Sparrow *Passer montanus* populations are considered to undergo dynamic cyclical fluctuations the reasons for which are poorly understood. The re-colonisation of Ireland in the 1960s followed a marked increase in Britain in the 1950s, and it is assumed that the Irish birds were overspill from Britain. However, the current expansion in Ireland, as documented by *Bird Atlas 2007-11* data, is taking place against a background of population decline in Britain. Additionally, other seed-eating farmland birds, such as Yellowhammer *Emberiza citrinella* and Stock Dove *Columba oenas* are all declining substantially in Ireland. The Irish Tree Sparrow Enquiry (ITSE) therefore seeks to study aspects of the population dynamics of the Tree Sparrow population in Ireland. This project comprises three elements: (1) assessment of nesting ecology and breeding productivity, (2) adult survival rates and (3) juvenile dispersal. Nesting ecology, including productivity, will be assessed by recording clutch and brood sizes, laying dates, multiple brooding and fledging success of box-nesting birds. Colour-ringing of full grown birds will be used to determine adult survival rates and movements at core monitoring sites. Colour-ringing will also be used to determine dispersal of nestlings. With the support of the County Council Heritage Officers in Meath, Kildare, Kilkenny and Fingal, 60 nest boxes have been provided for Tree Sparrows, in addition to existing colonies in Laois, Kildare and Dublin. A total of 95 full-grown birds have been colour marked, and have generated in excess of 2,000 re-sightings (all at the original ringing sites). Issues over colour-ring size have restricted ringing of nestlings, although fledged and dependent young have been colour-ringed. Future work will continue the colour-ringing programme and expand on the collection of nesting ecology data.

## From plantation to peatlands: impacts of raised bog habitat restoration on bird communities

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Although present at low densities, bog habitats contain some of the most threatened bird species in Ireland, including Red Grouse *Lagopus lagopus*, Golden Plover *Pluvialis apricaria* and Curlew *Numenius arquata*. Other species regularly encountered in these habitats, such as Teal *Anas crecca*, Snipe *Gallinago gallinago* and Skylark *Alauda arvensis* are also of conservation concern in Ireland. Baseline bird surveys (using transects) were surveyed in summer 2012 on four raised bog sites where restoration work is currently being undertaken through the EU LIFE 09/222 Project "Demonstrating Best Practice in Raised Bog Restoration in Ireland". The restoration work aims to restore raised bog habitats at the study sites using established techniques such as tree removal and drain blocking. Monitoring species at the project sites will allow an evaluation of the impact (rather than an evaluation of the results) of the restoration work, particularly for mobile species that will only occupy habitats with ecosystems that will support them. A total of 246 birds from 23 species were recorded from transects on the four sites. The species composition largely reflected the habitats present at the time of survey. Bog specialists such as Curlew, Snipe, Skylark and Meadow Pipit *Anthus pratensis* were found on the site with intact raised bog. The bird communities on sites with woodland were dominated by Coal Tit *Periparus ater*, Lesser Redpoll *Carduelis cabaret* and Goldcrest *Regulus regulus*. Recently clear-felled sites had large numbers of Wren *Troglodytes troglodytes* and Blackbird *Turdus merula*, but on older clear-fell sites, open-habitat species, such as Meadow Pipit, were recorded. This work was funded by the LIFE Project – LIFE 09 NAT/IE/000222 "Demonstrating Best Practice in Raised Bog Restoration in Ireland" which is funded by the EU, NPWS and Coillte. A re-survey of the sites (subject to funding) is planned towards the end of the project.

## Aspects of the ecology of Dippers *Cinclus cinclus* in the Slieve Blooms

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The main aim of the project is to study nest box provisioning on Dipper *Cinclus cinclus* populations using rivers arising in the Slieve Blooms in Counties Offaly and Laois, although it is hoped that additional ecological data, primarily from monitoring roosting adults in winter and nesting sites (both including ringing) will contribute to our knowledge of this Irish subspecies. Dipper nest boxes were first installed in winter 2010/11 at four bridges, to ensure the design used was suitable. Three boxes were occupied in the 2011 nesting season, successfully fledging four broods. A further nine boxes were erected in winter 2011/12, and ten (of the 13 boxes in place) used in the 2012 nesting season. Twelve nesting attempts were recorded, of which eleven successfully fledged, producing 35 chicks (2.92 young per nesting attempt). Of non-nest box sites monitored in 2012, 26 of 30 nests fledged 84 young (2.80 per nesting attempt). Two additional boxes were erected in winter 2012/13 and 12 of the 15 were used in the subsequent breeding season. Thirteen nesting attempts were made in boxes, of which 12 successfully fledged 48 young (3.69 per nesting attempt). A total of 45 nesting attempts were recorded at non-nest box sites, of which 36 successfully fledged 136 young (3.02 per nesting attempt). Of the nine failed nests in 2013, five were due to physical loss of the nest. Given the high occupancy rate (78% over the three years) and the rate of nest collapse, nest boxes have the potential to benefit Dipper populations. Studies are on-going to investigate impacts of nest box provisioning on a Dipper population within a river system, and to study whether nest boxes are chosen in preference to traditional sites.

## Impacts of weather on population size, breeding success and timing of migration in Sedge Warblers *Acrocephalus schoenobaenus*: local, national or global drivers?

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Although there has been substantial debate on recent weather patterns in Ireland it is clear that extremes of weather, and particularly localised flooding, have become increasingly regular in recent years. This is against a backdrop of global climate change, the effects of which are uncertain. This study looks at likely impacts of changing weather patterns on a trans-Saharan migrant bird breeding in Ireland, the Sedge Warbler *Acrocephalus schoenobaenus*. Information on the size and breeding productivity (by comparing the ratio of adults to juveniles) and the amount of body fat for a population of Sedge Warblers at the Cabargh Wetlands, near Thurles in County Tipperary have been collected since 2006. Data from 941 captures from 734 individual Sedge Warblers have been collected to date. These will be compared to daily rainfall data at the Cabragh Wetland site and the closest Met Éireann recording station (at Gurteen Agricultural College, near Birr in County Offaly) and national weather data for Ireland to test the strength of associations between Sedge Warbler population parameters and rainfall. Additional international data during peak migration periods will also be sourced to evaluate impacts. Identification of additional study sites within Ireland is currently underway to improve the quality of the Sedge Warbler data (notably to remove effects that may be unique to the Cabragh Wetlands site).

## An investigation into the surface temperatures and relative humidity in the plumage of Mallard *Anas platyrhynchos*

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The surface temperature and relative humidity found within the plumage of Mallard *Anas platyrhynchos* was investigated in the context of dispersal of the aquatic macrophyte *Lemna minor*. Captive wild-strain birds were chosen at random, with care taken to minimise stress. Readings were taken beneath the feathers as close to the skin as possible, using a dual hygrometer/thermometer. Multiple areas were examined on all individuals in order to depict an overall image of the temperature and humidity ranges found on the bird. Examined areas comprised the breast, base of neck, middle back, either side of the tail within the undertail coverts (crissum), both wings under the postpatagium, and the inner thigh of each tarsus. Temperature was determined to range from 21$^{o}$C to 26.8$^{o}$C. The determined relative humidity ranged from the mid 50's to mid-80s (%RH). Actual vapour density was calculated for all areas examined. The actual vapour density was calculated in respect to the mean of both temperature and relative humidity determined as a range from the lowest possible to the highest possible vapour density (g/m$^{3}$). Actual vapour density was found to range from 10.3 to 21.89 g/m$^{3}$. The postpatagium was found to display the highest range of actual water vapour density. The middle back displayed the lowest. All other areas presented very similar ranges. Plumage density and depth both appear to contribute to variations in surface temperature and humidity. Deep, dense plumage presented increased temperature and relative humidity over that of shallow and dense, which in turn displayed greater over that of more shallow/sparse plumage.

## The epizoochorous dispersal of native and invasive macrophytes by Mallard *Anas platyrhynchos*

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As macrophytes of predominantly vegetative reproduction, Lemnaceae (duckweed) require suitable vectors to facilitate dispersal between isolated water-bodies. Waterfowl may be such a vector. It is therefore hypothesised that Mallard *Anas platyrhynchos* can facilitate the epizoochorous (i.e. on the surfaces or within plumage) dispersal of Lemnaceae. The dispersal potential of native *Lemna minor* and invasive *Lemna minuta* was examined. Firstly, the

engagement of Mallard with *L. minor* upon a water-body was observed. The potential for *Lemna* to remain lodged within the plumage beyond a two-hour period was also assessed. Secondly, the ability of the Lemnaceae to survive, removed from the aquatic environment, under various relative humidity ranges was investigated. Thirdly, relative humidity was examined within Mallard plumage. Fourthly, using a cadaver bird, the survival of *L. minuta* was examined, under a humidity range equal to the lowest observed within live Mallard plumage. Mallard were found to feed upon, bath, and preen amongst, the duckweed. *Lemna minuta* was retained within the plumage post the two-hour period. Lemnaceae were found to readily entangle with plumage. Humidity was determined as essential to the survival of Lemnaceae; higher humidity resulted in greater survival and reproductive output. Mallard plumage presented humidity ranges adequate for considerable duckweed survival. *Lemna minuta* displayed ample survival and reproduction post exposure to the cadaver. Given the ecology of Mallard and Lemnaceae, the speeds at which Mallard may fly and the potential for duckweed survival, Mallard are highly likely to be effective vectors in the epizoochorous dispersal of the macrophytes over both short and long distances.

## Bird monitoring in Ireland: 40 years on and what have we learnt?

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Bird population monitoring data are essential for tracking the status of populations which allows us to prioritise where action is most needed. Ireland is obliged to report on the status of bird populations as part of its obligations under the European Birds Directive. The status of bird populations also informs on the condition of their habitats, and there are many examples where birds are proven indicators of the status of other biodiversity. The first monitoring schemes in Ireland began at national scale during the late 1960s and early 1970s, with seabirds (Operation Seafarer 1969-70), non-breeding waterbirds (Wetlands Enquiry 1971-74), and the first breeding atlas (1968-72). These seminal works have served as a yardstick upon which we have measured many of the significant changes that have taken place since. The most remarkable declines have been in farmland birds, including the loss of Corn Bunting *Emberiza calandra* caused by agricultural intensification, and in breeding wader populations from habitat loss and predation. We have also seen many changes caused at least partially by climate change, such as declines in numbers of wintering waterbirds migrating from the east, most notably Bewick's Swan *Cygnus columbianus bewickii*. In contrast, there have been many increasing trends, and Ireland has gained several new species from re-introductions and through natural colonisation. Monitoring programmes now established include annual surveys of breeding terns at select colonies, and of Corncrakes *Crex crex*, wintering waterbirds, common breeding birds and rare breeding birds nationally. Additionally, cyclical surveys are undertaken for seabirds (15-yearly), and for a selection of species such as Hen Harrier *Circus cyaneus* (five-yearly) and Chough *Pyrrhocorax pyrrhocorax* (ten-yearly), among others. This paper discusses some of the key achievements of bird monitoring projects in Ireland to date, and highlights the priorities for improved bird monitoring into the future.

## Birds as indicators of biodiversity in Ireland

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Biodiversity indicators should be ecologically relevant and sensitive to specialised habitats, and respond quickly to the changes to their environments. This project aimed to explore the development of bird indicators in Ireland and to promote the concept among key stakeholders. Key habitats were identified and formed the basis for this work. They include farmland, woodland, peatland, the marine and wetlands. The datasets identified that have the potential to deliver on indicators for these habitats are largely from long-term monitoring schemes. They include the Countryside Bird Survey (since 1998), Corncrake *Crex crex* monitoring scheme (since the 1980s), three seabird surveys undertaken 15 years apart between 1968 and 2000, Rockabill tern monitoring and the Irish Wetland Bird Survey (since 1994/95). The annual indices of each species within the habitat indicator were compiled and were combined across species by a geometric mean to generate the composite indicator. Most of the indicators generated were stable or showed increase over the respective periods examined. However, a number of warnings were issued with

respect to interpreting the data. The gap in knowledge of the trends of some key species with scarce distributions within the respective groupings was one limitation present in all groups. Most of the monitoring schemes are in place a relatively short time (since the 1990s) hence, they fail to accurately describe some significant changes that have taken place in the longer term. A workshop was held which was attended by representatives of organisations that are involved in compiling and or analysing environmental indicators. The indicators should be communicated effectively, and the next phase will be to make some of the improvements that were recommended at the workshop and to generate confidence in the quality and value of the indicators.

## Irish Wetland Bird Survey 1994/95-2010/11

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The Irish Wetland Bird Survey (I-WeBS) is the national scheme for monitoring wintering waterbird populations and their wetland sites over time. It has been running since 1994/95 and follows on from two earlier wetland surveys (1971-74 and 1984-86). Each year, between 250 and 300 wetland sites are surveyed nationwide between September and March by 350 survey participants. The survey facilitates several key functions, including an assessment of wetland site status and thereby the justification for the designation of more than 80 sites as Special Protection Areas for wintering waterbirds. It also delivers the ongoing status of 42 species in Ireland, and the production of population estimates on a regular basis which are used to evaluate the important of sites nationally and internationally. Additional species-specific surveys are included to improve coverage for wetland species whose distributions occur away from wetland sites (e.g. swan surveys every five years). Based on the most recent five-season period 2006/07-2010/11, some 59 internationally important and 79 nationally important sites were identified. Dundalk Bay, Wexford Harbour and Slobs, Lough Foyle, Dublin Bay and Lough Swilly were the top five most important sites, each supporting more than 30,000 waterbirds. Trend analyses showed that 17 species have shown increasing trends since 1994/95, with greatest increases in Little Egret *Egretta garzetta*, Barnacle Goose *Branta leucopsis* and Sanderling *Calidris alba*, while nine have declined, especially Bewick's Swan *Cygnus columbianus bewickii* and Scaup *Anas marila*. The exceptionally cold winters of 2009/10 and 2010/11 are thought to be responsible for some notable increases and declines of more than 25% that have taken place in 18 species in recent winters.

## The Countryside Bird Survey 1998-2010

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The Countryside Bird Survey (CBS) has been in operation since 1998. Its primary aim is to monitor breeding bird populations in the Republic of Ireland. A random sample of 10km squares was selected, and within each, the most southwesterly 1km square is surveyed twice during each breeding season. Bird numbers are counted along two roughly parallel 1km transects in each square. This report summarises the results for the 13-year period between 1998 and 2010. Some 396 squares were surveyed in two or more seasons and were included in trend analyses. Some 53 species occurred in 30 or more squares and these are eligible for meaningful trend analyses. Wren *Troglodytes troglodytes*, Robin *Erithacus rubecula*, Blackbird *Turdus merula* and Chaffinch *Fringilla coelebs* were the most widespread occurring species, being found in 90% or more of squares, while Rook *Corvus frugilegus*, Starling *Sturnus vulgaris*, and Wren were the most abundant. Overall, 17 species showed increasing trends, 13 species declined, while the remaining 23 species remained relatively stable. Greatest increases occurred in Blackcap *Sylvia atricapilla*, Goldfinch *Carduelis carduelis*, Redpoll *C. cabaret*, and Bullfinch *Pyrrhula pyrrhula*. Greatest declines were in Swift *Apus apus*, Grey Wagtail *Motacilla cinerea*, Kestrel *Falco tinnunculus* and Greenfinch *Carduelis chloris*. The index in 2010 for 15 species was the lowest ever recorded during the CBS, and for most seems to have been due to the impact of the cold-weather spell during the previous winter, 2009/10. Species that were impacted greatest include Grey Wagtail, Stonechat *Saxicola torquata*, Long-tailed Tit *Aegithalos caudatus* and Meadow Pipit *Anthus pratensis*.

## Impacts of sea-level rise on the birds and biodiversity of key coastal wetlands

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Predicted changes to the Irish coastline are expected to result from a combination of sea-level rise, increasing frequency of storm surge events and from coastal erosion. Flooding at coastal locations is likely to be exacerbated by predicted increases in rainfall and consequent enhanced river flow. Management methods to minimise the impacts of flooding in coastal regions have been traditionally based on a hard-engineering approach, where defences are erected to maintain the existing shoreline. Alternative approaches tested elsewhere include managed realignment, where the shoreline is allowed to move naturally, but managed to ensure that flooding is directed to certain areas. This review, supported by an Environmental Protection Agency STRIVE grant, focuses on 52 bird species with significant concentrations at coastal sites in Ireland and likely to be affected. Increasing sea levels are expected to result in decline in the spatial and temporal availability of intertidal habitats for wintering waterbirds that will result in a long-term decline at coastal sites, including several which are of international significance. A total of 71 sites were identified that regularly support significant concentrations of waterbirds and that are low-lying and vulnerable to increasing sea levels. The level of risk will be especially high for species with wholly coastal distributions and which rely on intertidal habitats (such as Shelduck *Tadorna tadorna* and Sanderling *Calidris alba*). Managed realignment is recommended where there is a risk posed by rising sea levels at a site that is also of importance for birds. The effectiveness of managed realignment is described in a case study (Wallasea). It demonstrates the successful development of a new intertidal wetland complex, and the targets of this project (waterbird numbers) were exceeded by significant margins. A similar demonstration project is needed in Ireland to highlight the benefits of this soft-engineering approach to the environment and to the economy.

## The wider application of data gathered during the Countryside Bird Survey

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The data gathered during the Countryside Bird Survey (CBS) offer a much wider application than national trends alone. A recent detailed study explored wider uses of CBS data. Trends are possible for a selection of species at finer regional scales which facilitates comparisons across the island of Ireland and improves the interpretation of data and the causes of change. A comparison with a national landcover map CORINE (Coordination of Information on the Environment) has shown that at a broad scale, the habitat types represented during CBS are broadly consistent with those at national scale. An assessment of habitat usage helped to identify some 44 bird indicator species whose trends reflect the status of these key habitats, as well as other finer-scale habitat types. The status of these habitat indicators since 1998 is broadly favourable. Application of distance sampling techniques to CBS data has facilitated generating density estimates, and thereafter population estimates. This represents the most robust mechanism available to date for generating estimates of common breeding bird populations in Ireland.

## The Garden Bird Survey 1994/95-2011/12

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The winter Garden Bird Survey (GBS) has operated in its current format since 1994/95. Observers are asked to submit the peak count of each species they see in their gardens over 13 weeks beginning in early December. Interest in this survey has increased, with almost 1,000 participants taking part in recent winters. The primary focus of this survey is to encourage birdwatching and participation in surveys, further developing citizen science. This survey has served to highlight some of the key findings regarding winter bird populations. It has tracked the decline in Greenfinches *Carduelis chloris* since 2005 from the outbreak of Trichomoniasis. The impacts of recent cold winters were also reflected in the results, especially large-scale increases in reports of winter thrush numbers, especially Redwings *Turdus iliacus* and Fieldfares *Turdus pilaris* and other groups not usually associated with gardens such as

waders. In contrast, some of the small-bodied residents were adversely affected by the cold weather, with a decline in reports of Wren *Troglodytes troglodytes*. Recent advances in the GBS include an online data submission facility which is now used by more than 50% of participants, while significant promotional efforts were made to establish GBS in schools during the 2012/13 season.

## An assessment of the effects of arterial drainage maintenance on birds dependent on riparian habitats

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This project, supported by the Office of Public Works was designed to assess the potential impacts of arterial drainage maintenance works by OPW machines on bird diversity and numbers along several river channels which were scheduled for maintenance work in the summer of 2009. A total of 21 channels across seven rivers were selected for survey using linear transect methodology. It was intended that channels be surveyed before and after planned drainage works commissioned by the OPW. Along each waterway, sections ranging from 400-2,400m in length were covered. Up to three visits were made to each site. All birds seen or heard were recorded in three distance bands which included the channel itself, up to 5m from the channel on either side, and greater than 5m from the channel to no greater than 100m from the channel where applicable. A total of 67 bird species was recorded, including 18 riparian species and the Annex I listed Kingfisher *Alcedo atthis*. Several migrant species such as Sand Martin *Riparia riparia*, Swallow *Hirundo rustica*, House Martin *Delichon urbica*, and several warblers, most notably Sedge Warbler *Acrocephalus schoenobaenus*, Blackcap *Sylvia atricapilla* and Willow Warbler *Phylloscopus trochilus* were also recorded. Among the waterways species, Sedge Warbler, Mallard *Anas platyrhynchos* and Sand Martin were among the most abundant and widely recorded species. Results showed that disturbance caused by the OPW works was short-lived, although the impact of these works on bank-nesting species (e.g. Kingfisher, Sand Martin, Dipper *Cinclus cinclus* and Grey Wagtail *Motacilla cinerea*) could not be taken into account as it was beyond the remit of the survey. However, such impacts are likely to be localised given that the machines work through the channels at a rate of 250-500m per week for long reach machines and up to 1km per week for short reach machines.

## Baseline surveys for breeding Curlew *Numenius arquata* in the north and west of Ireland 2011-13

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In 2009 the Curlew *Numenius arquata* was added to IUCN Red List of Threatened Species. The most recent published population estimate for Ireland is 5,000 pairs in 1993. Between 2011 and 2013, BirdWatch Ireland, as part of the Halting Environmental Loss Project (HELP) funded by INTERREG IVA, undertook base-line surveys in five counties. Suitable habitat within selected tetrads with probable or confirmed breeding from the 1988-91 and 2007-11 bird atlases were resurveyed following standard methodology. Other data sources included records from the Countryside Bird Survey and local reports. In total 119 tetrads with just over 10,300ha of suitable habitat within these were surveyed. Eighteen pairs of breeding Curlew at 14 sites were confirmed, seven pairs in Donegal, five in Leitrim, three in Mayo and two in Monaghan. No Curlews were recorded in Cavan. The estimated density of breeding was one pair per 10km$^2$ of suitable habitat. Of 27 breeding attempts observed at the 14 sites over the three years, 23 were successful at least to the chick stage; at four sites, covering 11 successful breeding attempts, intervention measures such as predator control and or habitat measures to limit stocking and field operations were in place. Three attempts failed for unknown reasons, possibly due to predation and one attempt was believed to have failed due to flooding. These data indicate that the population in Ireland is likely to have crashed since 1993, if the estimate of 5,000 pairs is accurate. Results from the bird atlas (2007-11) indicate range declines in the region of 80%. Combining the number of probable or confirmed records from the atlas, together with the results of this survey and known confirmed recent reports from other areas, suggest a minimum population of around 100 pairs in the Republic of Ireland.

## Factors affecting breeding success of key wader species at selected sites on the Shannon Callows in 2007 and 2008

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In the late 1980s the Shannon Callows held one of the three largest populations of lowland breeding waders (Lapwing *Vanellus vanellus*, Redshank *Tringa totanus*, Curlew *Numenius arquata* and Snipe *Gallinago gallinago*) in Britain and Ireland at just over 1,500 pairs. This had declined to 326 pairs by 2002. In 2007/08, National Parks and Wildlife Service funded a research programme to investigate reasons for the declines. Nest survival was monitored primarily through the use of temperature loggers and a small number of nest cameras. Nest outcomes were recorded and where predation was the cause of failure, the species involved was assessed. When temperature profiles from data loggers showed that predation happened at night, mammals, in particular Foxes *Vulpes vulpes* were assumed to be the main predator and when during the day, avian predators were assumed, mostly Hooded Crows *Corvus cornix*. Predation accounted for over 85% of all nest failures and mammals accounted for over 85% of all predation events. Five broods were also monitored through radio tracking one or more of the chicks. Only one brood survived to fledging; the other broods survived for between one and nine days before being predated and the indications were that Mink *Neovison vison* was the most likely predator. The high rates of nest and chick losses to predation on the Callows are likely to lead to further significant declines. Urgent intervention measures to enhance habitat and control the impact of predators are required if the breeding wader population on the Callows is to survive.

## A preliminary desktop review of corpse searching and bird fatalities on Irish windfarms

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I undertook a preliminary desktop review of bird corpse searching design and fatalities on Irish windfarms (NI and ROI) between November 2012 and November 2013. Due to the resource and commercial sensitivity constraints associated with obtaining corpse search reports, data was collected by consultation. Published literature was also reviewed. Standardized questionnaires were distributed at the *British Trust for Ornithology* conference (November 2012), and the *Irish Raptor Study Group conference* (February 2013). Follow-up calls investigated submitted records. Calls were also made to ecological consultants, including members of the *Institute of Ecology and Environmental Management* from the online “Professional Directory”. Respondents and windfarm names were treated anonymously. Most data was provided by consultants, and others (such as NIEA) involved in designing, conducting or assessing corpse searching. Consultation facilitated rapid access to unpublished and/or commercially sensitive data. Respondents were asked: if dogs were used; if scavenger rates and searcher efficiency were assessed; and what intervals separated searches. In total, searches were conducted at 24 windfarms in 15 counties. Of these, dogs were employed on 13%; scavenger trials were conducted on 16%; and searcher efficiency was tested on 29%. Search intervals varied widely (weekly, fortnightly, monthly, quarterly, bi-annually). Where bird corpses were found, distance from nearest turbine, species, age, and sex was requested from respondents. Combining responses with the published literature, fatalities were categorised as “possible” (injuries unknown/carcass scavenged); “probable” (severed/broken body parts); or “confirmed” (strike observed or indicated by post-mortem). Searches yielded 12 “possible”, 21 “probable” and just 3 “confirmed” fatalities. Probable/confirmed fatalities were most reliable and, together, these comprised 25 carcasses (15 species). Within this small sample size, Kestrel *Falco tinnunculus* (20%) and Hooded Crow *Corvus cornix* (12%) were most numerous. Other species accounted for only one or two carcasses. The proportion of fatalities by order/family are; Accipitriformes (Accipitridae) 28%, Accipitriformes (Falconidae) 24%, Passeriformes (Corvidae) 20%, Passeriformes (Non-Corvidae) 16%, and Charadriformes 12%. Due to varying survey effort, fatalities are probably under-recorded, and biased toward larger birds. Relative proportions of fatalities by order/family are probably unrepresentative of total fatalities due to small sample size. The Irish ecological community is small. Therefore, the preliminary estimate of 24 windfarms searched (c.12% of total number of Irish windfarms) may be reasonably accurate. Further research to address inherent biases, and provide corrected estimates of windfarms searched, and recorded fatalities would be welcomed. This would require review of c.193 windfarm planning files, and disclosure of unpublished data by windfarm operators.

## Changes in breeding wader populations at selected machair sites in Donegal and Mayo, 2011

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In 2011, National Parks and Wildlife Service funded a survey of ten mainland machair grassland sites (four in Donegal and six in Mayo) important for breeding waders, to monitor population and assess factors limiting breeding success. At each site, the number of pairs of each species was recorded; Lapwing *Vanellus vanellus* nests were monitored by deploying nest temperature loggers. Data on habitat characteristics and density and activity of potential predators (mainly Hooded Crow *Corvus cornix* and Fox *Vulpes vulpes*) were assessed, together with the results of predator control measures undertaken at three sites. Overall, results indicate widespread declines in wader numbers and densities at all sites since 2009. Decreases in breeding Lapwing numbers were recorded at seven sites, with the three remaining sites recording slight increases. Snipe *Gallinago gallinago* populations suffered declines at all sites since the previous survey. Of the five selected sites where Dunlin *Caladris alpina* bred in 2009, two recorded declines in 2011 and three appeared to have lost Dunlin as a breeding species. Lapwing nest survival and productivity was low overall, though three sites had productivity values approaching those sufficient for population stability. Results indicate that intensification of farming and grazing activities and human originated disturbance are the main factors likely to threaten habitats of machair breeding waders. The relative importance of predation appeared to be site specific but generally low levels of Lapwing productivity were recorded at sites with high Fox density and activity. No relationship was found between Hooded Crow densities, nest disturbance rates and Lapwing productivity. Based on the findings of this study, it is clear that breeding wader numbers at machair sites are critically low. Actions to protect habitat, limit human disturbance and control the impact of predators are required to ensure the long term survival of breeding waders at these sites.

## Hen Harrier *Circus cyaneus* nesting behaviours: data from nest cameras

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Hen Harriers *Circus cyaneus* are listed as an Annex I species by the EU Birds Directive and are a species of conservation concern in Ireland. Accurate knowledge of the species' nesting ecology is essential for the design and successful implementation of management and conservation actions. It can also provide valuable information to optimise fieldwork and survey methodologies. Nest cameras were deployed at Hen Harrier nests in the Ballyhoura Mountains, West Clare and Slieve Aughty Mountains (Counties Cork, Clare and Galway) during three breeding seasons (2008-2010). Nest camera footage was analysed to quantify adult attendance, incubation and brooding, prey delivery rates and other behaviours (n = 13 nests; footage covering 10 days prior to and 15 days after hatching). Throughout the observed period, average attendance and incubation and brooding rates varied by up to 30% and 50% respectively. Prey delivery rates increased over the observed period. Diurnal variations in these behaviours were also analysed. Our results highlight temporal variations in behaviours and provide valuable insight into aspects of Hen Harrier ecology which are difficult to assess using traditional fieldwork methods.

## The effect of habitat management measures on breeding waders in the Shannon Callows

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The Shannon Callows is an area of approximately 4,500ha of seasonally flooded grassland beside the middle Shannon and Little Brosna Rivers. Designated as both a Special Area of Conservation (SAC) and a Special Protection Area (SPA), it is internationally important for its wintering wildfowl and wetland and grassland habitats. It also holds important populations of breeding Lapwing *Vanellus vanellus*, Redshank *Tringa totanus*, Curlew *Numenius arquata* and Snipe *Gallinago gallinago*, with over 1,500 pairs recorded in 1987. By 2002, this had declined to just over 300 pairs. A research project carried out in 2007/08 recorded high levels of nest predation, mostly by mammalian predators. National Parks and Wildlife Service have funded a range of management measures since 2006 aimed at protecting and enhancing the wader populations. Measures include the Breeding Wader Grant Scheme (BWGS) offered to farmers, *inter alia* to restrict grazing and field operations during the breeding season. A predator exclusion fence was also erected in 2009 on Inishee Island. Monitoring of the populations and habitat condition indicate that stocking levels and vegetation height are consistently within recommended limits on fields entered into the BWGS, compared with similar fields not in the scheme. Populations showed an initial recovery, against a backdrop of further declines in the wider Callows, but in 2011 populations crashed, probably as a result of the severe winter of 2010/11. However, since 2011, there has been a steady overall recovery in the total number of pairs. On BWGS land, populations on Inishee Island are recovering more quickly than elsewhere, almost certainly as a result of the predator exclusion fence. On BWGS land out-with Inishee Island, Redshank and Snipe populations have shown an upward trend since the crash in 2011; Lapwing continued to decline until 2012, but in 2013 showed some recovery.

## Assessment of the impact of cockle harvesting on Eurasian Oystercatcher *Haematopus ostralegus* in Dundalk Bay

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Dundalk Bay SPA supports internationally important numbers of Oystercatcher *Haematopus ostralegus* with numbers generally in or around 8,000 to 10,000 wintering birds (international threshold, 8,200 birds). In Dundalk Bay, cockles *Cerastoderma edule* represent a significant component of Oystercatcher diet; however, Dundalk also supports a significant cockle fishery, with licensed extraction of cockles from the sandflat by boat mounted suction dredging and by limited hand picking. The fishery is therefore the subject of an Appropriate Assessment under Article 6(3) of the EU Habitats Directive of its impact on the SPA and more specifically its potential impact on the Oystercatcher population. Due to the importance of cockles to over-wintering Oystercatcher a programme of annual monitoring of Oystercatcher numbers, feeding behaviour and low-tide spatial distribution within the bay has been developed (on behalf of the Marine Institute), which together with other monitoring data, such as that from the Irish Wetland Bird Survey, allows the Oystercatcher numbers at Dundalk to be monitored and also informs the annual decision as to whether a fishery should be licensed. This includes monthly low-tide counts of the entire bay, focal observations on individual birds to determine what the Oystercatchers are feeding on, and collection of predated cockle shells to determine the size distribution of the cockles predated by Oystercatchers. This allows us to track the relative importance of cockle and other prey items within the diet both spatially and temporally. This, together with the numbers and spatial data, inform the annual licensing decision process. This study has found that there appears to be an autumn recruitment of cockles (which has occurred in two of the three winters covered by this study). This results in Oystercatchers feeding intensively on very small cockles (below the size ranges typically reported in the literature) and exploiting the high availability of this very abundant age class. Oystercatchers also feed on sea squirts washed in by winter storms, which is the first recorded instance of sea squirts in the diet of Oystercatchers.

## Impacts of aquaculture on protected areas: a case study of the effects of intertidal oyster culture on the spatial distribution of waterbirds

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The potential impact of aquaculture activities on Special Protection Areas for birds (SPAs) necessitates Appropriate Assessment under Article 6(3) of the EU Habitats Directive. The culture of the Pacific Oyster *Crassostrea gigas* takes place within 16 SPAs. This study, undertaken on behalf of the Marine Institute, examined the spatial association between waterbird species and oyster trestles, in order to assess whether the spatial distribution of waterbirds is affected by the presence of oyster trestles. The study included an extensive study across six sites (Poulnasherry, County Clare; Castlemaine, County Kerry; Ballymacoda, County Cork; Dungarvan and Woodstown, County Waterford and Bannow, County Wexford) and an intensive study at one site (Dungarvan). Oystercatcher *Haematopus ostralegus*, Redshank *Tringa totanus* and Turnstone *Arenaria interpres*, and probably also Curlew *Numenius arquata* and Greenshank *Tringa nebularia*, showed a neutral or positive response to the presence of oyster trestles. Grey Plover *Pluvialis squatarola*, Knot *Calidris canutus*, Dunlin *C. alpina* and Bar-tailed Godwit *Limosa lapponica*, and probably also Shelduck *Tadorna tadorna*, Ringed Plover *Charadrius hiaticula*, Lapwing *Vanellus vanellus*, Sanderling *C. alba*, Black-tailed Godwit *L. limosa* and Great Black-backed Gull *Larus marinus*, showed negative responses. The species that showed a neutral or positive response included waders that tend to feed in small flocks or as widely dispersed individuals in loose flocks. The species that showed a negative response mainly tend to feed in large flocks of tightly packed individuals. These species also generally favour open mudflats or sandflats and usually do not occur in large numbers in mixed sediment or rocky shores. Therefore, selection of mixed sediment or rocky shore sites for intertidal oyster culture would be likely to reduce the potential impact on waterbirds. The results of this study have been used to develop an evidence-based approach to the assessment of the potential impact of intertidal oyster cultivation in the context of Appropriate Assessment of aquaculture activities in coastal SPAs.

## Differential impacts of afforestation on bird diversity is dependent on previous land use

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Increasing human population and consumption are placing unprecedented demands on the world's natural resources. One consequence of these demands is an accelerated rate of land use change, which frequently occurs at the expense of biodiversity. Despite extensive deforestation in many countries across the world, afforestation (establishment of forestry on previously unplanted land) of commercial plantation forest is increasing, and these forests are now the dominant forest type in many countries. Many studies have suggested that preceding land use plays an important role in determining the consequences of land use change for ecological communities but this has not been adequately quantified. Here we investigate how the impact of land use change on biodiversity varies according to previous land use. Specifically, we used paired sites to examine how bird communities change after the establishment of exotic conifer plantations on three open preceding land-use types: agriculturally improved grasslands (high management intensity), wet grassland (intermediate management intensity) and peatland (low management intensity). Conifer afforestation had negative impacts on bird assemblages of peatland, little impact in wet grassland and positive effects in agriculturally improved grassland habitats. These differences are related to intensity of management and associated vegetation structure of the preceding land use. Peatland bird assemblages were negatively impacted when forest plantations displaced open habitat birds of conservation importance. However, afforestation benefitted birds in agriculturally improved grassland sites by increasing the complexity of vegetation structure. These findings demonstrate that the impact of land use change on biodiversity depends on the preceding land use. However, in areas where forest specialist birds are rare due to extensive historic deforestation, such as in Ireland, it is likely that the observed benefits of afforestation in intensively managed habitats are restricted to the early stages of the forest cycle.

## Factors affecting bird diversity in planted and semi-natural oak forests in Ireland

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The role of plantation forests in the conservation of biodiversity has been the focus of considerable discussion. Plantation forests are commonly perceived to be ecologically degraded landscapes that do not provide habitat for valued organisms. However, such conclusions are often drawn from comparisons between plantations of exotic species and natural forests, often without consideration of how appropriate such comparisons are. Plantation forests can provide valuable habitat to birds and a range of other taxa in landscapes where natural forests are rare. Here we investigate the factors affecting bird diversity in planted and semi-natural oak forests in Ireland. Bird surveys were conducted and vegetation data collected in commercially mature oak plantations (n = 4), semi-natural oak woodland (n = 10) and semi-natural oak woodlands that are subject to intensive grazing by ungulates (n = 4). Bird diversities in plantation oak and semi-natural forests were similar, with no difference in species richness, total bird density or density of warbler and hole nesting species. However, grazed natural oak woods had lower species richness than either of the other two study site types, and lower density of warbler species than oak plantations. These observed differences in bird communities appear to be as a result of browsing mediated differences in habitat complexity between the site types. It appears that plantation forests of native species can support comparable bird communities to semi-natural woodlands in areas with a generalist bird fauna, lacking forest specialists, whereas plantations of exotic conifer cannot. Management of ungulates is required in woodlands subject to high levels of grazing and browsing in order to promote the development of a more complex vegetation understorey upon which bird diversity relies.

## Long term study of Black Guillemots *Cepphus grylle* at Bangor Co. Down

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This long-term study in Bangor marina has been on-going for 29 years. Long-term studies are valuable as they enable comparisons to be made on breeding statistics for instance. In 1985 only 7 pairs of Black Guillemots bred: since then new next-boxes have been provided and in 2013 a record 38 pairs bred. Overall the average success has been 0.94 young fledged per pair although there has been considerable variation between sites and between years with some parts of the marina averaging 1.16 young fledged per pair and other parts averaging just 0.63 young, whilst in some years in parts of the marina all eggs have produced fledged young and in other years breeding was a total failure. Food supply certainly has an influence upon success and food supply is influence by sea-water temperature and this has been shown to affect the timing of breeding as well.
Both colour-ringing and conventional ringing have been valuable in tracking the breeding habits of birds. Black Guillemots are generally regarded to be site and partner faithful but ringing has shown that infidelity between partners and sites is not uncommon. As a result of intensive ringing of both adults and young post-breeding dispersal shows birds move northwards to Donegal and southwards to the south coast of Ireland (though most remain closer than this); this is much more extensive than the *Migration Atlas* might suggest. There are no ringing recoveries on the Irish west coast – so this is a plea to ringers in the west – please ring some young Black Guillemots there. And a second plea to birders in general – please send me details of colour-ringed Black Guillemots. One Bangor bird now holds the longevity record within the British and Irish ringing scheme – over 23 years old.

## Satellite tagging of Woodcock *Scolopax rusticola* wintering in Ireland

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The Eurasian Woodcock *Scolopax rusticola* is an important quarry species in Ireland, where a relatively small breeding population is swelled in winter by large numbers of birds arriving from continental Europe. Woodcock has unfavourable conservation status in Europe with numbers declining in many countries. Despite this, we know little about this species' behaviour, ecology and migration. Information on the routes and timing of migration is necessary to ensure that hunting regulation and conservation management are appropriate and effective. The majority of existing information on Woodcock migration has derived from ringed birds that have been trapped at ringing sites or shot by hunters. These records afford glimpses into the movements of individual Woodcock but the location and behaviour of birds between trapping events remain unknown. The resulting picture of Woodcock migration is skewed by the uneven distribution of hunting and research efforts across the Woodcock's range. The development of light-weight satellite tags enables us to follow the movements of individual birds across vast distances in near-real time. We undertook a pilot study to assess the use of this technology to study the migratory behaviour of Woodcock wintering in Ireland. Birds were captured in Cork and Galway in March 2013 by "dazzling" foraging birds at night using a spot-lamp and catching them in a landing net. Birds were ringed and solar-powered satellite tags were attached by means of an elasticated leg loop harness. Results show that birds continued to forage in the areas where captured until they started migration. Birds had brief stop-off periods in Britain and central Europe prior to reaching their breeding grounds in Latvia and Russia. The data obtained from these tags will continue to provide valuable information about Irish wintering Woodcock migrating to and from their breeding grounds overseas.

## Breeding season weather modifies the strength of winter driven carry over effects in Light-Bellied Brent Geese *Branta bernicla hrota*

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In many animals, processes occurring in one season carry over to influence reproductive success and survival in future seasons. The strength of such carry-over effects is unlikely to be uniform across years, yet our understanding of the processes that are capable of modifying their strength remains limited. Here we show that female Light-bellied Brent Geese *Branta bernicla hrota* with higher body mass prior to spring migration from Ireland successfully reared more offspring during breeding, but only in years where environmental conditions during breeding were favourable. In years of bad weather during breeding, all birds suffered reduced reproductive output irrespective of pre-migration mass. Our results suggest that the strength of selection on individuals to accrue large body mass stores to fuel breeding fluctuates markedly among years in concert with conditions during the breeding season, as does the degree to which carry-over effects are capable of driving variance in reproductive success among individuals.

## Colonisation and extinction in the Irish breeding bird fauna

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About fifteen species (including those absent for a period since previous breeding and those which only began to breed on an irregular basis), namely Whooper Swan *Cygnus cygnus*, Goosander *Mergus merganser*, Black-necked Grebe *Podiceps nigricollis*, Little Egret *Egretta garzetta*, Marsh Harrier *Circus aeruginosus*, Goshawk *Accipiter gentilis*, Little Ringed Plover *Charadrius dubius*, Red-necked Phalarope *Phalaropus lobatus*, Great Skua *Stercorarius skua*, Mediterranean Gull *Larus melanocephalus*, Short-eared Owl *Asio flammeus*, Great Spotted Woodpecker *Dendrocopus major*, Reed Warbler *Acrocephalus scirpaceus*, Lesser Whitethroat *Sylvia curruca* and Bearded Reedling *Panurus biarmicus* have colonized Ireland as breeders since 1988, whilst the Yellow-legged Gull (*Larus michahellis*) has hybridised with Lesser Black-backed Gull *Larus fuscus*. In the same period, we have lost the Corn

Bunting *Miliaria calandra* and probably the Nightjar *Caprimulgus europaeus*, whilst the Grey Partridge *Perdix perdix* has only been rescued by the introduction of continental birds, but several rare species (e.g. Common Scoter *Melanitta nigra*, Ring Ouzel *Turdus torquatus*, Twite *Carduelis flavirostris*), have still declined and continue to decline at an alarming rate. This paper examines these changes, seeks to identify their underlying causes and suggests some measures which could assist conservation of the affected species in the future.

## Bird connections between Ireland and the Nearctic

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Records of Nearctic birds (North America and Greenland) in Ireland have been known since the early 1800s. Emphasis has always been on the rare misdirected migrants from the East coast North American migration system. Relevant species to this study are those breeding in Greenland and Nunavut, Canada, which are regular winter visitors to Ireland, with over 135 having interconnections between Ireland and the Nearctic. In the early years of ornithological research it was thought that all passerine migrants needed ship assistance to reach Europe. Recent research on long-range passerine migrants such as Bobolink *Dolichonyx oryzivorus*, Northern Wheatear *Oenanthe oenanthe* and Blackpoll Warbler *Dendroica striata* shows that 3000km flights are well within their long-range flight capabilities. Waders and waterfowl have far greater long-range non-stop flight capabilities proven to be over 11,700km for Bar-tailed Godwit *Limosa laponnica*. Thus crossing the North Atlantic from Nunavut to Ireland is no big feat for a wader. To identify the potential origins of Nearctic migrants extensive research on available literature was carried out by the author, on theoretical and proven (satellite transmitters and data loggers) long-range flight capabilities of waterfowl, waders and passerine migrants. For waterfowl and waders using northern routes from Canada and Greenland (74°N to 59°N) (2,483km-4,870km) to Ireland, these distances are well within their flight range capabilities. For most passerines their main migration routes are at lower latitudes (46°N to 32°N), where the distance is greater (3,127km-4,870km), and without favourable tailwinds, ship assistance might be necessary. Comparisons were made with the known migration times of waders on the Canadian prairies and the east coast North American wader sites. Passerines generally have later southward migration times and many fly offshore, especially over hurricane prone areas such as Sable Island, Nova Scotia and Bermuda. Most Nearctic birds misdirected to Ireland occur during the hurricane season (June-November). For waders the timing of many occurrences suggests they are first-winter birds, as adults migrate to South America from late June to early August. The author gathered data from literature going back to the 1800s and used ten years of fieldwork, and published and unpublished sources.

## Mediterranean Gulls *Larus melanocephalus* in Dublin Bay

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I monitored Mediterranean Gulls *Larus melanocephalus* year round for the past ten years. My main study areas were the roost and feeding areas at the new peninsula at Booterstown, and Scotsman's Bay at Dun Laoghaire. Colour ring combinations found were reported to the Mediterranean Gull Research Group. The Mediterranean Gulls were monitored all the year on North and South Dublin Bay, and on the Grand Canal. Birds flying to, and from inland areas were observed at Sandycove and Booterstown. The number of Mediterranean Gulls recorded has increased considerably over the ten year period. Observations of their colour ring combinations show they come from a number of countries in North-western Europe. A summary of my ten years work will be provided to the Co-ordinator of the Mediterranean Gull Research Group.

## Wader communities of Dublin Bay

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During the past ten years, over 722 systematic wader counts, were made by the author on North Bull Island and South Dublin Bay. Over 2-300 additional counts were made of Turnstone *Arenaria interpres* habitats in these areas. Counts took place every week of the year with special emphasis on previously often neglected periods of mid-May to mid-August. These periods proved to be very productive as suspected from the author's 35 years wader research on Canadian prairies. The first Lapwing *Vanellus vanellus* are moving back to the North Bull Island before high Arctic nesting Sanderling *Calidris alba* have migrated North. Every summer, a population of non-breeding immature Oystercatcher *Haematopus ostralegus*, Bar-tailed Godwit *Limosa lapponica*, and Curlew *Numerius arquata* are present on the Bull. The distribution curve for waders in Dublin Bay shows that the lowest numbers of birds occur in mid-June, but five species of waders on average are always present. The earliest birds to return are Lapwing, followed by five more species by the first week of July. One of the earliest returning species is the male Bar-tailed Godwit, in full summer plumage from North Norway. Peak wader numbers occur from late November to late February. Thirteen principal wintering waders have different times for migrating out of staging areas, prior to breeding, depending on whether they breed to the north-west, i.e. Iceland, Greenland or Canada, or the north-east, the Baltic region and Scandinavia. Many of the Dublin Bay waders stage at Waddensea, as proved by colour ring re-sightings by the author. Many hours were spent to prove that waders feed at night, how long birds spend on high tide roosts, high tide feeding cycles, and flight paths from North to South Dublin Bay, all of which they do. Disturbances by humans, free running dogs, lack of conservation of Dublin Bay, and the nominal or non-existing conservation by local authorities were all studied by the author.

## Bird surveys at the Atlantic Marine Energy Test Site (AMETS)

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The Atlantic Marine Energy Test Site (AMETS) is located off the north coast of County Mayo, Ireland. Monitoring surveys to assess bird use at this site began in September 2009 and ended in June 2013. Offshore areas (up to 15km offshore) were surveyed by boat on 21 occasions. Inshore habitats were surveyed from land and 34 monthly land based surveys were completed. Bird use of the offshore AMETS area was found to be complex, with year round site use by different species at different times, and with between-year fluctuations. Bird distribution across the site was found to be relatively consistent, though with some evidence of increased use across bathymetric contours, particularly the 50m isobath. Strong indications of diversity hotspots were not found, however there were more locations of high diversity within 5km of the shore than in areas further off. For some species patterns of distribution are emerging, such as Storm Petrel *Hydrobates pelagicus*, more commonly observed in the outer reaches of the study site and Manx Shearwater *Puffinus puffinus*, more commonly observed within 5km of shore. However, for most species patterns of temporal and spatial use remain complex. Such complexity is due to natural variability in seabird distribution and is compounded by patchiness in survey coverage. While survey design was adapted to include test and control transects for BACI analysis this has been limited by small sample and study zone size. Land based surveys gave complete year round monthly counts of the bay. Three years of surveys have established a base line of data in terms of species presence and number, monthly occurrence and spatial distribution. Gathering meaningful seabird data within an extreme offshore environment with proportionate survey effort remains a key challenge.

## Common Scoter *Melanitta nigra* – a rare Irish breeder in decline

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A Common Scoter *Melanitta nigra* survey of Ireland was carried out in 2012. This rapidly declining breeding bird was found to have its British and Ireland stronghold in Lough Corrib where 28 pairs bred in 2012. The population has declined from the 1995 survey which found 100 pairs. The 2012 survey only recorded 39 pairs. This paper will explore the possible reasons for decline and the history of this rare breeding bird in Ireland.

## Black-headed Gull *Chroicocephalus ridibundus* use of urban core traffic lanes during an episode of exceptionally cold weather

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This study describes the pattern of use by Black-headed Gulls *Chroicocephalus ridibundus* of urban core areas – including traffic lanes – during an interval of exceptionally cold weather. The data was collected early in the morning (from 0730 to 0830hrs) along two transects in Cork city, namely Washington Street and Grand Parade in December 2010, which was the coldest on record, and also in January 2011 when conditions became demonstrably milder. Numbers of Black-headed Gulls rose dramatically in the study area during the interval of exceptionally cold weather when in excess of 70 birds were counted. By contrast during the relatively milder interval the numbers of gulls halved and on some occasions no *C. ridibundus* was detected. The results of this study are discussed in the context of the probable exclusion – due to exceptional freezing conditions – of Black-headed Gulls from their preferred urban riparian habitats and their opportunism and flexible feeding behaviour which enabled them to exploit urban core foraging areas, albeit at high risk.

## Studies on the behavioural ecology of the Black-headed Gull *Chroicocephalus ridibundus* in urban habitats

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Although a familiar member of the urban bird community relatively little research has been undertaken into the behavioural ecology of the Black-headed Gull *Chroicocephalus ridibundus* in these habitats in Ireland. This study undertaken over a 12-month period from the spring of 2011 to that of 2012, investigated a number of different aspects of the biology of the population in Cork City and its environs. Scan and focal animal sampling was used to compare the behavioural repertoires of adults and juveniles with particular reference to time allocated to foraging and comfort behaviours. The flight behaviour of birds entering the urban habitat in the early morning was compared to that of individuals and groups leaving the city in the evening. Although the numbers of adult and juvenile gulls were highly correlated the former always outnumbered the latter except in the late spring when breeding birds had departed. In general while adults devoted more time to preening than did juveniles the latter allocated more time to foraging. These and other results are discussed in the context of the ephemeral nature of the food supply in many urban situations.

## Effect of vessel type and activity on Gannet *Morus bassanus* foraging behaviour in Irish waters

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There is increasing evidence that Gannets *Morus bassanus* are reliant on fishery discards, yet behavioural responses of Gannets to fishing vessels has yet to be demonstrated. We tracked 62 Gannets from six colonies foraging in Irish waters using GPS dataloggers to investigate the effects of fishing vessels on Gannet foraging behaviour. Gannet locations (approximately every two minutes over multiple foraging trips) were appended with information on Gannet behaviour (foraging, travel) and fishing vessels (distance to nearest vessel, vessel type, and vessel behaviour) from Vessel Monitoring System (VMS) data. Markov multi-state modelling was then used to determine the frequency of transitions between foraging and travel in Gannets, and investigate if there was any effect of fishing vessels on these behaviours. When fishing vessels were in visual range (~10km), Gannets were significantly more likely to switch from travel to foraging, and significantly less likely to switch from foraging to travel. Vessel-specific effects on transitions were also recorded. When the nearest fishing vessel was a trawler, Gannets were significantly more likely to switch from travel to foraging than if the nearest vessel was a non-trawler. Fishing vessel behaviour significantly affected Gannet foraging behaviour, with Gannets less likely to switch from foraging to travel when the nearest vessel was hauling gear, but more likely to switch from foraging to travel when the vessel was steaming. With increasing distance to fishing vessels, Gannets were also significantly less likely to switch from travel to foraging. Understanding the links between foraging behaviour and environment is crucial to addressing fundamental questions about seabird ecology, and we suggest that the dependence of Gannet foraging behaviour on fishing vessels is likely to be related to discarding practices.

## Trans-Atlantic migration by post-breeding Puffins *Fratercula arctica*: a strategy to exploit a temporarily abundant food resource?

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The distribution of Puffins *Fratercula arctica* from southwest Ireland was investigated using geolocation loggers between the 2010 and 2011 breeding seasons. All tracked birds travelled rapidly west into the North Atlantic at the end of the breeding season in August, with the majority undertaking trans-Atlantic trips from Ireland to Newfoundland. The furthest distance from the colony reached by each bird was not influenced by body mass or sex, and was achieved in approximately 20 days. By October, all birds had moved back to the mid-Atlantic where they remained resident until returning to the breeding colony. The most parsimonious explanation for the rapid, directed long-distance migration is that birds exploit the seasonally high abundance of spawning Capelin *Mallotus villosus* off the Canadian coast, which is also utilised by large populations of North American seabirds at this time. Once this short-term prey resource has diminished, the tracked Puffins moved back towards the northeast Atlantic. A relationship between relative abundance of Puffins and zooplankton was found in all winter months, but after correcting for spatial autocorrelation, was only significant in November and January. Nevertheless, these results suggest a potential switch in diet from mainly fish in the early winter, to zooplankton. This study suggests that Puffins from southwest Ireland have a long-distance migration strategy that is rare in breeding birds from Britain, and identifies a key non-breeding destination for Puffins from Ireland. This has implications for the susceptibility of different breeding populations to the effects of possible climatic or oceanographic change.

## The interaction between a 'long grass-adapted species' – the Curlew *Numenius arquata* – and a 'short grass' specialist – the Starling *Sturnus vulgaris* at an airfield

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The Curlew *Numenius arquata* is a large wading bird (body mass of males and females can exceed 1kg) which outside the breeding season is typically found on estuaries and comparable coastal wetlands. However, it is also known to feed in fields and recently, from 2006 onwards, it has become a regular and increasingly numerous visitor to the grasslands at Dublin Airport, which is situated approximately 8km from the coast. Over the 2007 to 2012 period there have been eight bird strikes involving the Curlew at Dublin Airport, of which three (38%) have caused damage to the aircraft involved. Conventional management protocols, including the rigorous implementation of a 'long grass' policy, have been largely unsuccessful. An unexpected and unwelcome development has been the fact that the Curlew has attracted flocks of Starlings *Sturnus vulgaris* into the long grass sward – from which they were previously completely excluded, and thereby considerably increase the risk to moving aircraft. This presentation reviews the development of the Curlew and Starling problem and tests different hypotheses concerning the association between the two species. The evidence suggests that Starlings use Curlews as 'look-outs' and are thus able to exploit a heretofore unsuitable habitat.

## The changing pattern of bird strikes at an Irish airport – causes and consequences

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Avian fatalities caused by collisions with moving aircraft are known as "bird strikes". Alterations in the trend of these independent data points are of interest and may reflect parallel fluctuations in the numerical abundances of the affected bird species induced by, for example, 'global warming', as well as other causes such as habitat loss resulting from land-use changes. In this paper we review changes in the species composition of birds struck by aircraft at Dublin Airport over the 24 year period from 1990 to 2013 but with particular emphasis on the 2007 to 2013 interval when the Curlew (*Numenius arquata*), Starling (*Sturnus vulgaris*), Woodpigeon (*Columba palumbus*) and the Common Buzzard (*Buteo buteo*) have emerged, in some cases unexpectedly, as the major hazards. The causes and consequences of the changes are discussed.

## Seabird monitoring in Northern Ireland

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A Northern Ireland Seabird Co-ordinator role, provided by the British Trust for Ornithology and funded by the Northern Ireland Environment Agency (NIEA), has been created. The main aims of the role are to facilitate an increase in annual seabird monitoring, act as a regional co-ordinator for the collection and dissemination of seabird data, encourage and manage the involvement of volunteers in the collection of data, and champion the evolution of Northern Ireland towards becoming a role model region within the Seabird Monitoring Programme (SMP). The co-ordinator will work closely with JNCC to create a definitive register of Northern Ireland seabird sites. The co-ordinator will publish an annual report on the state of seabird populations, monitoring and research in Northern Ireland. A Seabird Steering Group (NISSG) is advising on the development of a 5-year strategy, the evolution of a Northern Ireland wide group of volunteers, and the programme of activities that the Seabird Co-ordinator will undertake. The membership of the NISSG has been agreed with NIEA. The Northern Ireland Seabird Network, an informal network of seabird surveyors and researchers, has been established.

## The NPWS Low Tide Waterbird Survey Programme 2009/10-2011/12

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Ireland's coastal wetlands support thousands of migratory waterbirds that use these wetlands as wintering grounds or as stop-over places along migratory pathways to wintering areas further south. The Irish Wetland Bird Survey (I-WeBS) has provided the principal data from which to assess the importance of sites and the size of their non-breeding waterbird populations since its initiation in the winter of 1994/95. Given that I-WeBS surveys are undertaken primarily on a rising tide, there has remained a gap in our knowledge as to how waterbirds are distributed during the low tide period, when many waterbirds, especially waders, are feeding. This information gap was addressed recently when the National Parks and Wildlife Service initiated a programme of low tide surveys across coastal Special Protection Areas (SPAs). Surveys were undertaken by fieldworkers and staff of BirdWatch Ireland at a total of 33 SPAs during the period 2009 to 2012. In addition to counts, the survey methodology included the recording of behaviour (foraging or roosting), location (intertidal, subtidal, supratidal, terrestrial), and activities that may cause disturbance to waterbirds. The resulting dataset is an extremely valuable tool. As foraging is one of the most important activities for overwintering waterbirds we can now identify key areas of importance within a site, and examine how patterns change as winter months pass. Low tide data, in addition to I-WeBS data, can therefore help us to have a better understanding of how various waterbird species use these important sites, and can inform the conservation management of them. This survey data is used to inform the production of site-specific conservation objectives that are being produced for coastal SPAs (see www.npws.ie). This dataset represents a valuable resource to those undertaking further research on the ecology of Irish coastal wetlands and their waterbirds.

## The low tide spatial distribution of estuarine wading birds

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There are relatively few long-term low tide datasets for wintering waterbirds at Irish estuaries. Clonakilty Bay in west Cork is one exception. Low tide surveys using fixed count subsites and standardised methodology commenced in 2000/01 and have been undertaken regularly up to the present day. The long-term data collected were recently analysed and published (*Irish Birds* 9: 375-384) to explain the spatial and temporal variability in the numbers and densities of selected wader species over the time period. The continuation of these surveys is extremely important. While a long-term dataset is valuable in pure research terms, and in informing the management and conservation of a site, these data also have the potential to be used in assessing impacts and environmental change upon the estuarine system, examples include a reduction in nutrient inputs to the system that is likely to occur following the proposed upgrade in waste water treatment at Clonakilty town, and in the longer-term, climate change and associated features such as sea level rise.

## The status and ecology of island nesting Merlin *Falco columbarius* in Connemara

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Merlin *Falco columbarius* are an Annex 1 species on the Birds Directive and Amber-listed on Birds of Conservation Concern in Ireland. Despite this, current knowledge of Merlin ecology and population status in Ireland is limited. A pilot Merlin survey was carried out by BWI and NPWS in 2010 to evaluate survey methodologies in the Irish context. This study revealed numerous difficulties regarding monitoring Merlin in Ireland. Further research on experimental survey techniques including playback and use of decoys were tested in 2011. The findings of these studies recommended that an effective future monitoring protocol should focus on defined study areas to establish information on Merlin status, trends and breeding success over time. The Connemara Bog Complex SPA is designated for Merlin, and Connemara was also the focus of an intensive survey in the 1980s which located 12 nest sites. Connemara was therefore selected as a suitable study area for future monitoring efforts. Survey work was initiated in 2012 to locate Merlin nesting sites, assess nest site suitability, availability and habitat requirements and to

collate baseline data on breeding parameters and occupancy rates. Survey work has primarily focused on small vegetated islands on inland lakes which are traditional nesting areas for Merlin in this region. Eight nests were confirmed in 2012 and 2013, all of which were on islands in old Hooded Crow *Corvus cornix* nests. Seven successfully fledged young and three broods were ringed. The availability of nest sites on 75 island sites on 20 lakes was assessed, which revealed 23 suitable corvid nests as well as 13 active Hooded Crow nests. In addition 30 artificial nest baskets were installed at suitable and traditional sites in 2012. None of these have been occupied by Merlin, suggesting the local population is not limited by lack of nesting sites.

## The nesting ecology of Kestrels *Falco tinnunculus* in Ireland

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Although the Kestrel *Falco tinnunculus* is one of the more common raptors in Ireland, it has received limited attention in terms of specific research and monitoring. There are concerns over its conservation status in parts of Britain where reductions in range and breeding success have been recorded. In Ireland the atlas project (2007-11) has indicated a moderate increase of 12.9% over the past 20 years. However, contrary to this, Countryside Bird Survey results revealed losses of 6.9% per year over the first ten years of the survey (1998-2007). Focused survey work and monitoring is required to accurately determine population size and status, and to complement existing data from multi-species surveys. As a widespread and relatively sedentary 'indicator' species Kestrels are also a beneficial species for long-term monitoring. A study was initiated in 2009 to locate and monitor Kestrel territories and determine occupancy and breeding success on an annual basis. A total of 256 breeding territories have been recorded between 2009 and 2013. A success rate of over 80% from 198 breeding attempts was recorded. There has also been a high occupancy rate between years, with many territories remaining active over the six year monitoring period to date. Accurate clutch counts have been obtained from 79 nests (range 1-6 eggs) and brood size at, or close to fledging from 118 nests (range 1-6 young). A total of 326 nestlings from 88 broods have been fitted with BTO metal rings to monitor dispersal and survival. Nest site characteristics have been collated for all active sites. The most common site types were buildings, followed by trees, quarries and cliff faces and the most frequent nest sites were in corvid stick nests, within cavities, on ledges and in specific nesting boxes.

## The importance of vehicle collisions as a mortality factor impacting Barn Owls *Tyto alba* in Ireland

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The Barn Owl *Tyto alba* is categorised as a Red-listed *Bird of Conservation Concern in Ireland* due to extensive declines in its breeding population in recent decades. The specific factors which have brought about these widespread declines in Ireland are not fully understood. Several studies have linked the increase in major road networks to Barn Owl declines, however there is limited evidence available on the relative importance of vehicle collisions as a mortality factor for Barn Owls in Ireland, or data to determine how this aspect may have contributed to the population declines. To assess the relative importance of vehicle collisions as a cause of death for Barn Owls in Ireland we collated all mortality records over an 80 month period from January 2006 to August 2013. Of 232 recorded mortalities, the most frequent cause of death was vehicle collisions (60.7%), of which the majority (73%) were reported along major roads including motorways and national routes. There was a strong bias towards the south of the country with 78% of road casualties reported from Munster, particularly Counties Tipperary, Cork and Limerick. Vehicle collision victims were recorded across all months but most frequently encountered in February, October and April which reflects trends from other studies and is likely influenced by the dispersal phase of juveniles. The majority of the birds were in their first or second calendar year and had an average weight below that of a representative sample of live adults. A total of 21 birds which were ringed as nestlings (under NPWS licence) between 2006 and 2012 and which were recovered at least 3km from the natal site showed a lower proportion of road casualty victims (43%). A detailed survey of a 152km section of the M8 motorway was also conducted to relate physical road characteristics to susceptibility of collision.

## Breeding densities, nesting success and habitat selection of Long-eared Owls *Asio otus* in Ireland

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Available evidence indicates that Long-eared Owls *Asio otus* are faring well in Ireland, with the atlas project (2007-11) highlighting an increase in range of 105% since the previous atlas (1989-1991). However, due to their nocturnal nature and the potential for surveyor bias, multi-species surveys may not provide an accurate reflection of trends, and there has been limited specific research and monitoring to assess population size, status and ecological requirements in Ireland to date. In 2012, detailed survey and monitoring work was undertaken in Duhallow in north Cork, and West Offaly to determine breeding densities, habitat selection and nesting success. A comprehensive 'strategic' survey was carried out across six selected 10km squares. A total of 543 points were selected within these survey squares to cover all suitable habitats. An early season visit undertaken over 28 survey nights between 21 March and 15 April involved broadcasting a recording of Long-eared Owl vocalisations to elicit a vocal or behavioural response from resident birds. Three additional acoustic visits were conducted over 41 survey nights between 21 May and 22 August using the same points to listen for calling young. A total of 17 breeding sites and 14 apparently occupied territories were recorded, providing a minimum of 2.8 and maximum of 5.2 territories per 100km$^2$. A total of 32 playback trials at 12 active territories revealed a response rate of 53%. A 'general' survey incorporated appeals for information and revisiting traditional breeding sites outside the strategic 10km survey squares, which located a further nine active territories. A total of 26 active territories were accurately monitored, of which 17 (65%) were successful, and an average brood size of two young per nest was recorded (n = 17). Data on nest site selection and characteristics were also collated.

## Breeding densities, nest site selection and availability for Barn Owls *Tyto alba* in Ireland

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Barn Owl *Tyto alba* breeding densities, nest site selection and availability were assessed between 2007 and 2013 using two different survey techniques. 'General' survey methods have included collating all existing data on traditional Barn Owl nest and roost sites, extensive cold searching of suitable buildings and widespread appeals for information on sightings and potential sites to inform survey work. 'Strategic' methods involved comprehensive survey work within 85 randomly selected 10km survey squares to locate all Barn Owl nest and roost sites within buildings. All buildings within each survey square were assessed and rated on a scale of 0-3 based on their suitability to provide roosting and nesting opportunities for Barn Owls. Additional acoustic survey work was conducted in six of these 10km squares to locate all successful tree nesting pairs and determine the proportion of the population which use tree. Over 1,000 suitable buildings have been registered. Site availability varied across the country, ranging from 0-25 suitable sites per 100km$^2$, however this work revealed that in general Barn Owls are not limited by the availability of suitable nesting sites. Over 200 breeding sites which have been active in the last 15 years have been confirmed, with 139 active sites registered in 2013. Breeding densities varied considerably throughout the country, ranging from 0-5 nesting pairs per 100km$^2$. A range of site types were used by Barn Owls including ruined and modern buildings, trees, quarries and artificial nest boxes. This work has considerably improved Barn Owl national population estimates and also provided essential information on nest site suitability and availability.

## Nesting success and productivity of Barn Owls *Tyto alba* in Ireland

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Knowledge of breeding success, survival and recruitment is essential to determine health and viability of a population. Despite concerns over the conservation status of Barn Owls *Tyto alba* in Ireland, there has previously been little information available on aspects of their breeding ecology, trends or the factors which influence nesting

performance. Barn Owls are a suitable species for long term monitoring studies, as they are a useful 'indicator' species being largely sedentary and faithful to specific nest sites. A monitoring protocol was initiated in 2006 to determine trends, breeding success and survival rates for Barn Owls on an annual basis and to assess the factors which influence nesting performance. Over 200 breeding sites have been confirmed over the seven year period between 2006 and 2013, with a sample of over 80 sites now visited each year. A total of 410 breeding attempts have been accurately monitored. A success rate of over 75% has been recorded from all breeding attempts; but nesting success has varied considerably between years. Accurate clutch counts have been obtained for 42 nests (range 1-8 eggs) and brood size at, or close to fledging for 274 sites (range 1-5 young). A total of 227 broods have been ringed (under licence from NPWS) and over 500 young have been fitted with BTO metal rings, of which 35 have been recovered or controlled to date, which has facilitated information on dispersal and survival.

## The habitat selection and foraging requirements of Barn Owls *Tyto alba* in Ireland

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The intensification of agriculture, which has led to a reduction in prey rich foraging habitat, has been widely implicated as the most influential factor causing extensive declines in the Irish Barn Owl *Tyto alba* population in recent decades. However, knowledge of Barn Owl habitat and foraging requirements in Ireland is limited, which has compromised an effective overview of the aspects which impact the population and reduces the ability to develop effective conservation plans to stabilise the population. Specific research on habitat use and home range has facilitated a good understanding of Barn Owl ecological requirements Britain. However, due to differences in prey availability there is significant variation in the foraging ecology of Barn Owls in Britain and Ireland, which warrants specific investigation of Barn Owl habitat use in the Irish context. Between 2007 and 2009, 13 adult Barn Owls were fitted with specialised leg-mounted (n = 11) and back-pack (n = 2) transmitters during the breeding season. Radio telemetry, with the use of night vision equipment was carried out for between 10 and 20 nights for each bird to map their movements, habitat use and home range. The findings revealed that Barn Owls in Ireland have substantially larger home ranges compared to Britain. Important foraging habitats included rough grassland, woodland edge and arable land. In addition, data on home range will be used to relate data on breeding success to habitat variables within defined home ranges at selected traditional sites to assess the effect of habitat quality on occupancy and breeding performance.

## Identifying the main factors which directly impact and cause mortality of Barn Owls *Tyto alba* in Ireland

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There are concerns for the conservation status of Barn Owls *Tyto alba* in Ireland due to extensive declines in their breeding range and numbers over recent decades. The specific factors which impact on the status and trends of Barn Owls, and which have brought about these widespread declines are not fully understood. To facilitate an accurate assessment of the aspects which influence Barn Owl population levels, we investigated the main causes of mortality as well as the factors which have been implicated in contributing to the declines, with particular emphasis on vehicle collisions and exposure to rodenticides. To assess the relative importance of all recorded causes of mortality of Barn Owls we collated mortality records over an 80-month period from January 2006 to August 2013. Of 232 recorded mortalities, the most frequent cause of death was vehicle collisions (60.7%). The road type and characteristics were assessed in relation to the finding location of road fatalities, and the time of year, age class and condition of road casualties was also determined. Other causes of death were attributed to drowning, predation, human related disturbance, unknown trauma, and shooting and trapping as well as unknown causes. Possible bias in interpreting the relative importance of each category was also assessed. A representative sample (n = 69) of the carcasses collected were also tested to determine exposure to second generation anticoagulant rodenticides (SGARs), which revealed that over 85% had detectable levels of one or more SGARs. The residual concentrations of the four main

SGAR compounds were three times higher than comparable findings from Britain. The mortality data was assessed in relation to population size and breeding parameters to investigate the potential influence at a population level.

## Exposure of Barn Owls *Tyto alba* in Ireland to second generation anticoagulant rodenticides

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Second generation anticoagulant rodenticides (SGARs) are widely used within agriculture to control commensal rodents. Although essential to minimise the negative impacts of rodents, their use can result in the unintended exposure of non-target species. In particular, the use of SGARs can pose an indirect risk to predators of small mammals via secondary poisoning. To date, the exposure of non-target avian predators in Ireland has not been quantified. Therefore, this study aimed to determine whether predatory birds in Ireland were exposed to SGARs. We hypothesised that the risk of exposure in Irish avian predators may be more enhanced compared with Great Britain (GB) due to differences in rodenticide use patterns and a greater dependence on commensal rodents in the diet, and that exposure in Ireland may be influenced by the distribution of introduced small mammals. The Barn Owl *Tyto alba* was selected as the most appropriate "sentinel" species to assess patterns and exposure levels to SGARs in Ireland. Toxicology analysis of 69 Barn Owl carcasses collected between 2006 and 2011 revealed that over 85% had detectable levels of one or more SGARs. Multiple compounds were found in 71% of birds tested. Brodifacoum was the most frequent compound detected, confirmed in greater than 90% of positive samples, followed by flocoumafen. The median summed concentration residue for all compounds was 0.129 ug/g wet wt. The number of birds with detectable SGAR residues was similar to comparable data for GB, however the residual concentrations were three times higher in the Irish sample. The relative occurrence of the SGAR compounds indicates significantly greater exposure and accumulation of brodifacoum and flocoumafen in Irish birds. The data also indicates a significant difference in residue magnitude in birds between three different small mammal zones in Ireland.

## Using raptors as indicators to monitor the spread and impacts of introduced small mammals in Ireland

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After habitat destruction, invasive species are considered the second greatest threat to global biodiversity. Invasive species can impact on biodiversity by outcompeting native species or by affecting ecosystem processes. The impacts of two non-native small mammals on local ecosystems in Ireland are not well understood. The Bank Vole *Myodes glareolus* was introduced from Germany to the south-west in the 1920s. The Greater White-toothed Shrew *Crocidura russula* was first discovered in County Tipperary in 2007. Both species have limited but expanding distributions. The impact of Greater White-toothed Shrews on other small mammals has been recorded in Switzerland, and there are concerns regarding the impacts on the Pygmy Shrew *Sorex minutus* in Ireland. The phenomenon of an interspecific 'invasional meltdown' has also been proposed where the presence of one invading species facilitates another and compounds negative impacts on indigenous species. As top predators, raptors are effective biological indicators for monitoring the health and diversity of ecosystems as well as subtle changes and processes within our environment. We propose a novel approach to determining the distribution and range expansion of introduced small mammals, as well as assessment of the impacts within small mammal communities via standardised raptor monitoring techniques. A minimum of 20 prey items were identified from 72 raptor nest and roost sites (2007-2013) to determine presence or absence of introduced species. Bank Vole was confirmed at 58 sites, Greater White-toothed Shrew at 16 sites. This data has confirmed numerous previously undocumented locations for each species. Bank Vole was confirmed at an additional 29 sites where less than 20 prey items were identified, Greater White-toothed Shrew from an additional 12 sites. Raptor diet composition across three distinct small mammal zones was also assessed. The complete absence of Pygmy Shrew from raptor diet at several sites in south Tipperary has been recorded.

## The feeding ecology of Kestrels *Falco tinnunculus* in Ireland and a review of current best practice dietary analysis methods

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There has been no published research on the diet of the Kestrel *Falco tinnunculus* in Ireland in over 25 years. Previous studies in the 1960s and 1970s showed a marked variation in diet compared with other European countries. As Kestrels are apex predators which take a diverse range of prey, data on their dietary intake can provide an indication of species diversity, assemblages and interactions in the local environment. There have been significant changes to the Irish environment since the last assessments of Kestrel diet, most notably the introduction and spread of the Bank Vole *Myodes glareolus* and Greater White-toothed Shrew *Crocidura russula*, neither of which were previously detected. To assess composition and variation in Kestrel diet we employed several techniques including traditional pellet analysis, identification of prey remains, specialised nest cameras and DNA testing between 2009 and 2012. The combined range of techniques employed also served to evaluate and refine best practice methods. A total of 550 pellets from 19 nest and roost sites across five counties were analysed by standard identification of the pellet matrix and skeletal remains. In addition a sub-sample of 50 pellets was analysed using hair identification techniques. A total of 234 prey items were identified from nest cameras installed at eight sites in four counties. Nest visits recorded a further 28 prey items at 20 sites in six counties. DNA testing for six small mammal species was also conducted on 92 pellets. All methods confirmed small mammals to dominate the diet, however birds, Frogs *Rana temporaria* and Lizards *Lacerta vivipara* were locally important and invertebrates and a single crab also featured. The diet varied considerably between sites, particularly in relation to the presence of the introduced small mammals, and both Bank Vole and Greater White-toothed Shrew were the most important elements of the diet at specific sites.

## The importance and impacts of introduced small mammals for raptors in Ireland

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Ireland has a reduced small mammal fauna in comparison to the rest of Europe. There are four indigenous species which occur throughout the island, and two additional non-native species which have restricted distributions. The Bank Vole *Myodes glareolus* was introduced from Germany to the south-west in the 1920s and now occupies approximately a third of the island incorporating the south-west, mid-west and parts of the midlands. The Greater White-toothed Shrew *Crocidura russula* was discovered in County Tipperary in 2007 and has a known range which includes Counties Tipperary, Limerick and Cork. Therefore three distinct geographical zones with different small mammal species assemblages have been formed, which include (1) indigenous species only, (2) indigenous species plus Bank Vole and (3) indigenous species plus Bank Vole and Greater White-toothed Shrew. Investigations into the diet of Barn Owls *Tyto alba* and Kestrels *Falco tinnunculus* in these zones has revealed that non-native small mammals are now important prey items for Ireland's predators, however the wider ecological impacts of these introductions on avian predators is not well understood. To investigate the influence of Bank Vole and Greater White-toothed Shrew and the potential implications for the future conservation status of Barn Owl and Kestrel, we collected data on specific breeding parameters across the three defined geographical zones. Data on breeding success, time of breeding and productivity were recorded for 410 Barn Owl breeding attempts between 2006 and 2013 and 208 breeding attempts for Kestrel between 2009 and 2013. This work is on-going; with the findings to date indicating that introduced small mammals are having a significant impact on the breeding ecology of avian small mammal specialists in Ireland.

## Black-headed Gulls *Chroicocephalus ridibundus* in Northern Ireland

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The breeding population of Black-headed Gulls *Chroicocephalus ridibundus* in Northern Ireland has declined by 74% since the mid-1980s. This has been part of a wider decline throughout the island of -70% in numbers (1985/88-1998/2002) and -95% in range (1968/72-1998/2002) resulting in the species being on the all-Ireland Red list, while it is on the Amber list in Britain. In the absence of detailed ecological data, a colour-marking study was initiated in 2012 at wintering and breeding sites in Northern Ireland. The aims of the project include understanding (1) movement patterns of individuals between wintering and breeding grounds, (2) local dispersal, (3) adult and juvenile survival rates and (d) wintering and breeding site fidelity. To date 138 birds have been fitted with colour-rings at six sites in Counties Antrim and Down and 20 observers have reported 197 re-sightings of 44 individual birds. This represents a re-sighting rate of 32%, compared to 0.7% if relying solely on recoveries of standard metal rings. Notable results have already revealed a Polish breeding origin of an individual ringed in County Antrim. Through collaboration with other colour-marking studies elsewhere we hope to gain a better understanding of large-scale migratory patterns of the population throughout Europe. Colour-marked individuals have been observed in Northern Ireland from studies on the breeding grounds in Norway, Poland and Lithuania and from Scotland, England and Mayo. While there is some evidence to suggest that our Black-headed Gull population is augmented by birds from continental Europe during the winter months, the precise origins of these birds is largely unknown. Further work will seek to extend the network of observations from around Ireland and include detailed comparisons of the ecology of inland and coastal-nesting Black-headed Gulls. Progress of the project can be monitored via a project blog www.bhgullsni.blogspot.co.uk.

## Development of a long-term mark and re-sightings programme for Light-bellied Brent Geese *Branta bernicla hrota*

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In 2001 the Irish Brent Goose Research Group, Wildfowl and Wetlands Trust and Icelandic Institute of Natural History embarked on a long-term colour-marking and re-sightings programme on the Canadian-Irish flyway population of Brent Goose *Branta bernicla hrota*. As with similar schemes elsewhere the central aims have included understanding survival rates, migratory movements and site fidelity. By mid-August 2013, a total of about 3,650 individual geese (i.e. excluding retraps) have been caught and marked with coloured leg-bands, and a total of about 130,000 re-sighting records have been entered in the database. Here we describe the aims and some outputs of the project over the 11 year period (2001-2013) which include those associated with the long-term study of individually marked birds. Constant-effort ring-reading data from Strangford Lough and Dublin Bay are used to examine the phenology at these two major, yet very different, sites. An overview of the distribution, staging and movement of the geese within the flyway is given. We attribute the continuing success of our project to recognition of the potential of 'citizen science' in making a valuable contribution, promoted through educational and outreach activities and backed up by a small team of dedicated 'staff'. Our well-established links with academic institutions provides both motivation and direction to the overall delivery of an AEWA conservation programme. Some of the practical issues involved in handling very large volumes of data and in ensuring that the project momentum can be maintained are also discussed.

## The breeding gulls of Lough Mask, County Mayo

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Breeding Black-headed *Chroicocepahalus ridibundus*, Common *Larus canus* and Lesser Black-backed Gull *L. fuscus* populations have contracted in both breeding range and population size in Ireland over the previous 30 years and are now considered to be species of conservation concern. Lough Mask is an inland breeding site that holds nationally

important breeding numbers of all three species and which is now designated as a Special Protection Area (site code 004062). Between 2006 and 2010 totals of 1,200 Black-headed Gull and 300 Common Gull nestlings were colour-ringed at the site, and colour-ringing of Lesser Black-backed Gulls was initiated in 2013. The primary aim of the study is to obtain information on dispersal patterns, survival rates, site fidelity and longevity and to monitor annual fluctuations in breeding numbers. Initial analysis of re-sighting data has shown that Common Gulls from Lough Mask winter predominantly along the west coast between Clew Bay and the Shannon Estuary and, to date, more than 11% of colour-ringed nestlings have returned to their natal site as breeding adults. Black-headed Gulls have been shown to disperse much more widely and at greater distances and the percentage of colour-ringed nestlings returning to their natal site is much lower, but is difficult to quantify due to difficulties in obtaining ring readings at the breeding colony.

## The breeding seabirds of Inishturk and associated islands, County Mayo

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An annual census of breeding seabirds has been undertaken since 2008 in early June on Inishturk, an inhabited island located some 9km off the south Mayo coast. This has revealed breeding populations of 11 seabird species of which Fulmar *Fulmarus glacialis*, Shag *Phalacrocorax aristotelis*, Black Guillemot *Cepphus grylle* and Great Black-backed Gull *Larus marinus* occur in nationally important numbers. Less frequent census monitoring has also occurred on the associated islands of Mweelaun, Caher, Inishdalla and Ballybeg. Auk and Kittiwake *Rissa tridactyla* populations have shown an increase in numbers since the Seabird 2000 census followed by a dramatic decrease in 2013. It is hoped that productivity monitoring will be initiated for Shag, Fulmar and Kittiwake populations in 2014. The relative accessibility of the seabird colonies, their high species diversity and the existence of a regular ferry service makes Inishturk a very suitable west coast location for long-term seabird monitoring studies.

## Northern Ireland Twite *Carduelis flavirostris* survey 2012/2013

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The Twite *Carduelis flavirostris* is a small seed-eating finch found across Britain and Ireland with highest densities in Scotland. In Ireland, the species' strongholds are chiefly along the north coast of Northern Ireland and the west and northwest coast of the Republic of Ireland. Twite associate with coastal grassland, dry heath and cliff-top habitat in these regions. Significant declines in its breeding range have been recorded between 1800 and 1995, and they are Red-listed in Birds of Conservation Concern in both Ireland and Britain, and are a Northern Ireland Priority Species under the Northern Ireland Biodiversity Strategy. A SCARABBS survey was carried out in 1999 in 23 (1km) squares. This estimated a minimum of ten breeding pairs in Northern Ireland. The RSPB co-ordinated a breeding survey in 2012 and 2013 on the north coast and on Rathlin Island, respectively. More squares were added to the 1999 surveyed squares, based on historical records. This was in an effort to create a more complete baseline against which population change can be measured and to locate further breeding locations. Sixty-nine 1km squares were visited three times during the breeding season and 18 probable pairs were recorded. In addition to survey, basic information on habitat availability was collected. Outside the breeding season large flocks occur at various locations along the north coast, especially Lough Foyle. More work is planned to establish the species wintering distribution and origin. The survey and assessment of habitat availability carried out in 2012/13 underpins our ability to appropriately target conservation advice on the north coast and Rathlin Island. This will be done through targeted face-to-face advice to landowners given by RSPB staff and by advocating for inclusion of a seed-bearing wild bird cover style option in future agri environment schemes available to landowners in Twite breeding and wintering hot spots.

## Delivering bird conservation objectives through schools: a case study of Twite *Carduelis flavirostris*

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Twite *Carduelis flavirostris* are one of only three Red-listed passerine species in Ireland. The 2005-2008 estimate of the breeding population in Ireland was between 54 and 110 pairs, and numbers are declining. The majority of these birds occur in north Mayo and west Donegal. Current research suggests that these birds over-winter within 30km of their breeding areas which leaves them extremely vulnerable to changes in land use in these distinct bio-geographical areas. Breeding Twite populations in Ireland are moving towards extinction despite several published papers and reports detailing their ecological requirements and measures for their conservation. This is a 'hungry gap' for ornithological researchers between written conservation recommendations and their practical implementation. This project aims to implement active conservation measures through schools on a bio-geographical basis, using Twite as a test case. A pilot project in 2012/2013 focuses on four Primary Schools in the Mayo and Donegal breeding areas. Experienced ornithologists delivered an introduction to the Twite through interactive games, visits to breeding and wintering grounds, ringing activities, sowing of targeted sacrificial cereal plots, and the regular monitoring of these plots. It is hoped over the next four years to incorporate this scheme into the school curriculum on a bio-geographical basis, being delivered to the students by teachers under their Social, Environmental and Scientific Education guidelines for Primary Schools as set out by the Department of Education and Skills. Although it may take some years to demonstrate results, an instilled consciousness of Twite, biodiversity, and general nature conservation will be guaranteed in future landowners in these areas. This project directly translates an applied academic approach towards nature conservation into an empowerment of the next generation who could otherwise be without such species as Twite in their adulthood.

## Aspects of of the breeding biology of Twite *Carduelis flavirostris* in Ireland

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The Twite (*Carduelis flavirostris*) is one of only three passerine species on the red list of Birds of Conservation Concern in Ireland. Previous work on Twite in Ireland has focused on their status, movements, and foraging behaviour. In this study we target some aspects of the nesting ecology of Twite in Co. Mayo, including the 2010 breeding status, breeding success and nest-site selection. It is thought that up to 50% of the national population of Twite breed in this area. The overall breeding estimate for the 2010 breeding season was 16-23 pairs (confirmed and probable), with 16 nests found. This shows a decline of between 18 and 42% in breeding pairs on 2008 surveys. Although this apparent decline may be partly attributed to some variation in survey effort, a *bona fide* drop in numbers seems to have occurred. It is possible that this is related to the prolonged cold period during the winter of 2009/2010. Due to the steep sea-cliffs on which birds were found, of the 16 nests confirmed, only five were accessible during the breeding season. These five nests showed a relatively high success rate with a mean of 5.4 fledglings/nest. Despite long Heather (*Calluna vulgaris*) accounting for just 1% of the total study area, all of the 16 confirmed nests occurred in this vegetation type. In terms of aspect, 15 of these nests faced between northeast and southeast in direction. This highlights the important combination of long Heather and east-facing slopes for nesting Twite in Ireland. Within the breeding areas, Heather depth, slope and change in slope all have high likelihood of influencing nest site selection. Twite nests occur in areas that have steeper slopes, deeper Heather and also seem to be more likely to be positioned above a drop-off (ground gets steep immediately below the nest).

## Breeding Lapwing *Vanellus vanellus* in Boora, County Offaly: an unintended consequence of effective conservation

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Five of the 19 Red-listed breeding species of conservation concern in Ireland are waders. One of these species, Lapwing *Vanellus vanellus*, has experienced substantial declines throughout Europe and Ireland. The most probable underlying cause is considered to be the intensification and specialisation of agricultural practices. A management programme for Grey Partridge *Perdix perdix* which principally involved habitat manipulation and systematic predator management has been in place at Boora, County Offaly since 1996. In 2002, there was an estimated three pairs of Lapwing breeding in an area known as the Marl-Square, a 75ha block of cutaway bogland owned and managed by the National Parks and Wildlife Service. Similar surveys were conducted in 2009, 2011, 2012 and 2013. Within this 75ha the number of nests recorded had increased to approximately 45. In addition, the number of nests recorded over the years of the surveys has remained consistent; suggesting the breeding population of Lapwing at Boora has remained relatively stable. The increase in breeding Lapwing is remarkable and is quite an unexpected consequence, probably associated with the Grey Partridge management. Extensively managed cutaway peatland may be more suitable to Lapwing than traditional agricultural habitats. If managed correctly cutaway peatland could act as a reservoir to populate former breeding strongholds for this species, but only when a more focused approach to the implementation and delivery of agri-environmental measures is realised. In addition, the application of game management techniques for the conservation of ground nesting birds needs to be seriously considered in conjunction with the appropriate implementation of agri-environment policy if regional extinctions of certain species are to be prevented.

## Change in status and distribution of non-breeding waterbirds in Ireland 1970-2008

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Waterbird numbers in Ireland were first monitored at national level during the 1970s, and again during the 1980s, and on an ongoing basis since the mid-1990s. This study, supported by a Heritage Council Research Grant is the first to combine datasets from all periods and examine long-term status and distribution of wintering waterbirds in Ireland between 1970 and 2008. Some 118 internationally and nationally important sites were selected to form a basis for this assessment. Overall trends in numbers were examined by comparing previously published population estimates between the 1970s, 1980s and two five-year periods 1994/95-1998/99 and 1999/00-2003/04. Overall, there were increases in Mute Swan *Cygnus olor*, Whooper Swan *C. cygnus*, Greylag Goose *Anser anser*, Barnacle Goose *Branta leucopsis*, Light-bellied Brent Goose *B. bernicla hrota*, Shelduck *Tadorna tadorna*, Ringed Plover *Charadrius hiaticula*, Grey Plover *Pluvialis squatarola*, Sanderling *Calidris alba*, Black-tailed Godwit *Limosa limosa islandica* and Redshank *Tringa totanus*, and declines in Bewick's Swan *Cygnus columbianus bewickii*, Greenland White-fronted Goose *Anser albifrons flavirostris*, Wigeon *Anas penelope*, Pintail *A. acuta*, Shoveler *A. clypeata*, Knot *Calidris canutus* and Curlew *Numenius arquata*. At site level, percentage changes in indices for the four time periods were categorised as severe decline (>50%), medium decline (25-50%), stable population (-25% to +33%) medium increase (33-100%) or strong increase (>100%). Site trends for each period were mapped to illustrate geographical patterns of change. Most species fell into one of three main categories, those which are faring well compared with all periods since the 1970s, those which are showing some recovery from previous large-scale declines, and those which are showing declines compared with all periods since the 1970s. The large-scale declines in this group of species relative to all former periods is of particular concern given these trends are consistent at flyway level.

## Birds feeding on berries of three species from the southern hemisphere

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This study, based in County Wicklow, examines three exotic plants from the southern hemisphere that are widespread in Ireland and which provide, at least locally, useful food supplies for birds. Fuchsia *Fuchsia magellanica*, one of the commonest exotics in Ireland, readily produces fruit and this is taken regularly by Blackcaps *Sylvia atricapilla* and Blackbirds *Turdus merula*. New Zealand Privet *Griselinia littoralis*, while normally grown as a screening hedge, can grow to a tree of up to 15m and produces fertile seeds. The small, black berries are taken by Blackcaps and Song Thrushes *Turdus philomelos* and, to a lesser extent by Blackbirds. Cordyline or Cabbage Palm *Cordyline australis* is a frequent tree along the east coast and flowers profusely when mature. The masses of small white berries are fed upon by a wide range of birds, including the resident thrushes, Blackcaps, Starlings *Sturnus vulgaris*, Woodpigeons *Columba palumbus*, Hooded Crows *Corvus cornix* and Magpies *Pica pica*. Of interest is that white berries are absent from the native Irish flora (and also the British flora other than Mistletoe *Viscum album*) and nearly all of bird dispersed fruits in Ireland are red or black when ripe. Thus a colour such as white may not act as an effective signal to fruit eaters unused to the colour. As Cordylines have been widely planted in Ireland (at least Dublin) since the 1880s and 1890s it is interesting to speculate when birds first adapted to taking this exotic fruit on a regular basis.

## Testing the effects of agri-environment options for a declining breeding wader: trial management of habitat for breeding Lapwing *Vanellus vanellus* in Northern Ireland

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Lapwings *Vanellus vanellus* have a widespread but localised distribution in marginal upland grassland habitats and lowland wet grassland in Northern Ireland. Like many other breeding waders, populations have declined throughout much of Europe. Changes in agricultural practises have been largely implicated in declines and there is some increasing evidence of the important role of predation. In an attempt to stabilise or increase the Lapwing in the wider countryside, an agri-environment measure was developed as part of the Northern Ireland Countryside Management Scheme (CMS). We evaluated the utility of this option through running a trial management project between 2006 and 2011, comparing abundance and productivity at AES managed and unmanaged sites. Although breeding Lapwing were significantly more abundant on treatment sites during two years (2008 and 2011), the average rate of decline in abundance between 2006 and 2011 was similar at treatment and control sites. Changes in abundance at individual sites differed quite markedly between 2007 and 2011. While the number of sites with stable numbers was marginally higher at unmanaged (n = 4) than managed (n = 3) sites, increases in abundance were restricted to managed sites (n = 3). The vast majority of both managed and unmanaged sites showed declines in abundance during the study period (managed n = 13; unmanaged n = 14). Overall, there was little evidence of any sustained impact of AES management on the abundance of adult Lapwings. We must have concern for the viability of this species in the wider countryside and further measures are required to understand and halt the decline.

## Status and ecology of Ring Ouzels *Turdus torquatus* in southwest Ireland

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The Ring Ouzel *Turdus torquatus* is one of the most poorly known and threatened bird species in Ireland. The species has suffered a precipitous decline in population size and range with breeding largely confined to just two counties. Population changes in Ireland appear to mirror widespread declines in the species' range in Britain. In 2008 I initiated a study of Ring Ouzels in the MacGillycuddy's Reeks, County Kerry. Ring Ouzels are summer migrants, wintering mainly in North Africa, and returning to Ireland in late March-April. Tetrads ($2km^2$) were used as the basis for survey work. Potential breeding habitat was identified from ordnance survey maps and efforts made to visit

potential sites within tetrads at least twice early in the year to locate singing males. Further visits were made to occupied sites. Where birds were detected and visually located, habitat characteristics were assessed. In early 2008 ten singing males were detected early in the breeding season but this declined to seven birds suggesting some were passage migrants. Ring Ouzel numbers remained stable at five to seven pairs from 2008-12. Singing males and breeding pairs were largely confined to high elevation sites (500-1,000m asl) on steep and sheer slopes with extensive rock and boulders. Males used exposed rocks and boulders as singing perches. Song peaked in early morning (0500-0700 hrs) and declined thereafter. Males sang from arrival up to at least late June suggesting that some pairs may be double-brooded. Nest sites were on largely inaccessible cliffs and crags with greater vegetation cover (heather, woodrush) than apparently suitable but unoccupied sites. Ring Ouzels are at risk of extinction in Ireland. Habitat change in the uplands, loss of heather cover, low survival rates, effects on wintering grounds, hunting pressure on migration, and climate change have been cited as driving declines. Habitat management at key sites should be an important conservation measure.

## Dispersal in a re-introduced population of White-tailed Sea Eagles *Haliaeetus albicilla*

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Dispersal in long-lived raptors with delayed maturity is poorly known due to the difficulty of marking and tracking individuals over long distances and the often low resighting and recovery rates. One hundred young White-tailed Sea Eagles *Haliaeetus albicilla* were released between 2007 and 2011 into the wild in Killarney National Park (KNP), County Kerry, in the first phase of a re-introduction programme for the species in Ireland. All birds were wing-tagged and fitted with radio or satellite transmitters before release. Individuals were tracked after release to determine timing of dispersal and, where possible, the direction and dispersal distance. Fifty two males and 48 females were released over five years at 12-17 weeks old. Although there was some diversity in timing of dispersal most young eagles overwintered within 25km of the release site before dispersing more widely the following spring (March-May). Birds tended to return to their 'natal' area (KNP) in their second and third autumn and winter before dispersing again. Birds began to settle on future breeding territories by their third and fourth calendar year. Long-distance movements were predominately in a northerly direction. In 2007-2009 several birds wintered in Northern Ireland while at least six birds wintered in Scotland. In 2009 two satellite tagged birds (male and female) dispersed within 11 days of release and reached the Sligo (279km NNE) and Northern Ireland (415km NE) coasts 17-18 days after release. One satellite tagged male remained in southwest Ireland in its first winter before moving north the following April, reaching the Orkney Isles in late May (908km NE) and summering in northwest Scotland. This bird returned to Ireland in mid-winter before dispersing north again in its third year. One exceptional male circumnavigated Ireland several times over two years travelling 8,600km over 653 days.

## Manx Shearwaters (*Puffinus puffinus*) on Little Saltee: population estimation and habitat selection

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Britain and Ireland are home to most of the world's population of Manx Shearwaters *Puffinus puffinus* and yet we do not have accurate colony size estimates for many areas. The aim of this project was to estimate the size of the breeding Manx Shearwater population on Little Saltee Island, Co. Wexford and to examine habitat selection on the island. Population size was estimated at 718 pairs of Manx Shearwaters using the playback method, more than 7 times the previous estimate. Resampling and bootstrapping the data identified that stratified sampling of at least 30% of the colony needs to be conducted in order to get a relatively accurate estimate of the total population. Shearwaters on Little Saltee selectively preferred to nest in short vegetation or in bare eroded soils, and within 10m of the shoreline. Smaller numbers nest in tall vegetation inland and some nest at the base of rock walls. Our study shows that nesting habitat is not limiting the current population size on Little Saltee. It also suggests that estimates for many

existing colonies that have not been formally surveyed are likely to be highly inaccurate, and provides an effective sampling approach for future monitoring efforts.

## Breeding Cormorants *Phalacrocorax carbo* in County Wexford

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Both the Saltee Islands and Keeraghs Islands are designated Special Protection Area's for Cormorants *Phalacrocorax carbo*. Little Saltee Island has traditionally been the main site and has been monitored annually since 1960. The Keeragh Islands were monitored from 1968 to 1991, and monitoring recommenced in 2008. It is clear that numbers have fluctuated at the two main sites, Little Saltee and Keeragh Islands over the years. However numbers fell steadily on Little Saltee from 2003 for the next eight years, levelling out in 2009-2012 at numbers lower than at levels over the past 50 years of monitoring on this island. During this drop in numbers, re-colonisation of Great Saltee was noted, with nine pairs in 2005. The number of pairs increased rapidly here, with 92 pairs the following year and peaking at 187 pairs in 2009, when there were significantly more pairs on Great Saltee than Little Saltee. However, numbers have declined thereafter to levels slightly less inter-annually on Great Saltee than Little Saltee. Numbers at Little Saltee recovered in 2013 to 297 pairs, while Great Saltee numbers dropped to 78 pairs. The numbers on the Keeragh Islands when monitoring was restarted were at levels comparable to the previous period of surveys some 16 years earlier, and 131 pairs were found between the two islands in 2008, but 242 pairs and 240 pairs were found in 2009 and 2010 respectively. During the 2008 to 2013 period when all sites were monitored annually numbers remained stable and varied in the range 418 to 587 pairs.

## Population estimates of Red Grouse *Lagopus lagopus* in the Owenduff/Nephin complex Special Protection Area, County Mayo

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In 2012, a repeat survey of twelve 1km squares that had been surveyed in 2002 was carried out in the Owenduff/Nephin complex Special Protection Area (SPA) in County Mayo. This survey estimates the number of Red Grouse *Lagopus lagopus* at 790-832 individual birds within the SPA, representing 3.08-3.25 individual birds per km². Recent studies estimate the number of birds in the Republic of Ireland at 4,200 birds with 202 pairs in Northern Ireland. A decrease in the population of Red Grouse of 66.41% for Ireland had been recorded between the 1968/72 and 1988/91 bird atlases. The most recent data continues to show a decline nationally. This repeat survey shows an increase in the Red Grouse population since 2002. When the survey was first carried out, six of the 12 squares (50%) had no evidence of grouse and in 2012 this survey showed indications of grouse in all of the 12 squares (100%) surveyed. In 2002 the population of Red Grouse was estimated at 362 to 426 individuals within the 25,622.2 ha of the Owenduff/Nephin SPA complex, representing 1.416-1.666 individual birds per km². The results indicate almost a doubling of the population in the 2012 survey. This can be attributed to management prescriptions in the intervening period. Off-wintering of livestock from 2006 allowed an improvement in the habitat condition within the Owenduff/Nephin SPA to the extent that in 2010, of the 76 habitat stations surveyed, 68 showed positive recovery since the 2005 habitat assessment.

## The status of the Mediterranean Gull *Larus melanocephalus* at Lady's Island Lake, County Wexford

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Mediterranean Gull *Larus melanocephalus* was first recorded nesting in Ireland in 1995 (County Antrim), and in 1996 an adult was seen attending a near fledging chick at Lady's Island Lake, Co Wexford. For the next seven or eight years at Lady's Island Lake, breeding was usually confined to a single pair attempting to breed, occasionally successfully but quite often failing. The number of breeding pairs increased to five pairs in both 2003 and 2008. Some pairs which bred contained one or both adults in their second summer and this was attributed to explaining failures, as it was their first breeding attempt. The number of breeding pairs has steadily increased and reached double figures in 2010. Monitoring of nests has shown productivity to be low, particularly in 2012, when the exceptionally wet summer resulted in most chicks dying. However, the dry summer of 2013 resulted in good productivity, and most of the breeding pairs were considered to have had chicks that fledged. In the spring of 2012 an adult Black-headed Gull *Chroicocephalus ridibundus* and an adult Mediterranean Gull were noted displaying, and that July two hybrid chicks were noted by birdwatchers. In 2013, an adult Mediterranean Gull was also seen attending two just fledged hybrid chicks at the colony. The hybrid nests were not identified as it is likely they were counted during census work to whichever species the eggs most closely resembled. Nineteen chicks have been colour ringed on the site, and there have been re-sightings in France, the Netherlands and in Britain, as well as back on Lady's Island Lake as adults. In addition, birds ringed as chicks in Belgium, the Netherlands, France and Poland have been seen at Lady's Island Lake and in the general locality of the lake.

## The breeding ecology of Sandwich Tern *Sterna sandvicensis* and Roseate Tern *Sterna dougallii* at Lady's Island Lake, County Wexford

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This study aims to obtain a clearer understanding of the breeding biology and ecology of Sandwich *Sterna sandvicensis* and Roseate Terns *Sterna dougallii* at Lady's Island Lake, County Wexford. The key aims are to identify the key breeding measures (i.e. onset of breeding, clutch and brood sizes, fledging rates, site and mate fidelity). A sample study was undertaken in 2010 and 2011, with chick weights and wings measured and these measurements in turn enabled comparisons to be made between the two species and to quantify inter-annual variation in these variables. We aim to establish if chick provisioning rates vary from year to year or within a season, and whether prey sizes vary similarly. We also aim to establish if food provisioning is egalitarian in the Roseate Tern. Both species are increasing at this site. Sandwich Terns arrive early and engage in nest-site selection with nest commencement over a month from first arrival. Roseate Terns arrive later but commence nesting within a week and their colony grows rapidly. Sandwich Terns do not appear to be site faithful while Roseate Terns displayed site specific and mate fidelity. The two breeding seasons of 2010 and 2011 were contrasting with differences in mean clutch sizes, provisioning rates, mean prey sizes and productivity and fledging rates. Roseate Terns which begin nesting at the start of the season have larger clutches than those that begin later in the season. Male Roseate Terns take the majority role of provisioning and also do so at a faster rate than females. It appears that breeding at this site begins earlier than at the colony at Rockabill (County Dublin). Following rapid growth the Lady's Island colony is well established before mean first egg dates occur at the Rockabill colony. The results of this study suggest a different breeding strategy between these two species in virtually all aspects of their breeding ecology. These differences suggest the Sandwich Tern is an 'income' breeder, whereas the Roseate Tern is a 'capital' breeder. Despite the different strategies in their breeding ecology, both species are increasing at Lady's Island Lake.

## 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 4009, S.I. No. 69 *of* 2010) is designated for Black-headed Gull *Chroicocephalus ridibundus*, Sandwich Tern *Sterna sandvicensis*, Roseate Tern *Sterna dougallii*, Common Tern *Sterna hirundo*, Arctic Tern *Sterna paradisaea* and Gadwall *Anas strepera*. The management and protection of Ireland's largest tern colony at Lady's Island Lake by the National Parks and Wildlife Service (NPWS) has been ongoing. The two islands within Lady's Island Lake support the qualifying interest breeding species and other regularly breeding birds such as Shelduck *Tadorna tadorna*, Mallard *Anas platyrhyhnchos*, Shoveler *A. clypeata*, Oystercatcher *Haematopus ostralegus*, Ringed Plover *Charadrius hiaticula* and Redshank *Tringa totanus*. All breeding species benefit from the SPA conservation project which starts early in the year with predator management. Terrestrial mammalian and avian predators are controlled under licence and monitored throughout the breeding season. Liaison with lake users has generated goodwill for the project and the terns suffer minimal human disturbance. NPWS has commissioned an appropriate assessment on water level management systems and has also commissioned engineering solutions for alternative systems as well as an appropriate assessment on preferred engineering solutions as we strive for favourable water level management and conservation status for the Special Area of Conservation (SAC) and the SPA. Black-headed Gull numbers have increased in each of the last five years, with 1,768 pairs in 2013, the highest ever recorded since the project commenced in 1993. Sandwich Terns have remained stable over the last seven years, but declined from close to 2,000 pairs in each year between 2008 and 2011, to closer to 1,700 pairs in both 2012 and 2013. Common and Arctic Tern have remained stable in recent years with 1,310 pairs in 2013. Roseate Terns have also grown over the last 12 years from a low of 46 pairs in 2001 to 143 pairs in 2013 after a record 155 pairs in 2011. Ring reading suggests that this increase is, at least in part, the result of previous good productivity years on the site.

## Common Buzzard *Buteo buteo* re-colonisation of County Cork, their habitat preference and an analysis of diet

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A survey of Common Buzzards *Buteo buteo* based on territorial display was carried out in 32 x 10km squares in County Cork during March and April of 2011 and 2012. Information on Buzzard presence was sought from individuals in an additional 4 x 10km squares. Habitat preferences were noted in the field and a desktop study of these habitats was undertaken. Prey remains and pellets were collected and subsequently analysed in a laboratory. The Buzzard population in County Cork has increased from approximately eight pairs in 2004 to a minimum of 75 pairs in 2012. During the survey in 2011 and 2012 a total of 209 Buzzards were seen. The population has begun to spread from the three core areas of north Cork, east Cork and south Cork. Buzzards have shown a strong affinity to mixed farmland with a high proportion of arable land in the three core areas. Rabbits *Oryctolagus cuniculus*, Common Rats *Rattus norvegicus*, corvids and Woodpigeons *Columba palumbus* appear to be the main prey species and Bank Voles *Myodes glareolus* are also significant in the diet. Buzzards are likely to increase substantially in future years.

## Do wind turbines disturb non-breeding waders?

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Previous studies have suggested that waterbirds may be displaced by operating wind turbines in their non-breeding habitats by distances up to 800m. A study of two windfarm sites in Ireland (both close to intertidal areas) found that, where suitable habitats exist, 14 species of non-breeding waders may forage or roost within 500m of the nearest wind turbines. A total of eight wader species were found to forage and roost regularly within 100m of the operating

turbines. The distribution of two wader species, Oystercatcher *Haematopus ostralegus* and Bar-tailed Godwit *Limosa lapponica*, on a sandy beach at one windfarm site, was correlated with the density of their principal prey, polychaete worms, and was unrelated to the proximity of the turbines. The foraging behaviour of these two species of waders was studied at the two windfarm sites to determine if there were any significant effects of the operating turbines on the foraging efficiency of the birds. Probing and pecking rate and prey capture rate were recorded by focal sampling within 500m of the nearest operating turbines and at two control sites for each windfarm. Probing efficiency in Oystercatchers showed no significant difference between windfarm sites and control sites in either sandy shore or rocky shore habitats. In the sandy shore, Bar-tailed Godwits also showed no significant difference in their probing efficiency between the windfarm and control site. On the face of it these results suggest that the presence of the turbines does not have any major effects on the foraging behaviour of waders in the immediate area, though the possibilitiy that more subtle effects are in operation remains.

## Assessing impacts of windfarms on birds in Ireland

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This paper presents a case study of the assessment of impacts on birds of a large scale wind energy project covering seven Irish midland counties. Climate change is widely regarded as the greatest threat to biodiversity, including birds. Renewable energy generation, including wind power, is the key to reducing our emissions of carbon dioxide and our dependence on fossil fuels. Proper planning of windfarms requires informed site selection which must take account of important habitats for birds and other biodiversity areas. Good quality baseline information is the key to site selection. All relevant existing datasets have been imported to a GIS and used to define the level of survey required in this study. An understanding of the vulnerability of different bird species to windfarm development is also necessary. Impacts can include disturbance during construction, permanent habitat loss, collision with turbines and displacement from the area occupied by the turbines. Some groups of birds have been shown to be affected by new developments while others can readily habituate. A matrix is presented which takes account of vulnerability of birds to windfarms and their conservation status. Priority species including wintering Whooper Swan *Cygnus cygnus*, breeding raptors and breeding waders are given greater attention because they are of high conservation concern. Standard survey methods have been used to map bird distribution, establish breeding status, document flight lines and inform the selection of sites for development. There is a clear need for published guidance on survey methods and best practice in impact assessment relating to birds and windfarms in Ireland.

## Potential impacts of flood risk management methods on birds in Ireland

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Mitigation for flooding must take into account the impacts on the environment to ensure compliance with European Birds and Habitats Directives. This review provides an assessment of the potential impacts and benefits of flood risk management methods on birds. It identifies the priority species that are at risk, and identifies key bird sites that are located close to probable and possible Areas for Further Assessment (AFAs), or areas that have been identified as being at greatest risk of flooding in Ireland. Of the 131 species that are of conservation concern in Ireland and or Europe, 69 are identified as being at risk from flooding and or the implementation of flood risk management methods in Ireland. They are predominantly breeding birds, especially those nesting on the ground. Flood risk management methods that might impact on greatest numbers of priority risk species are flood walls and embankments, existing regime, floodplain flow retardation, and increased conveyance, while the creation of wetlands or small storage areas, doing nothing, and the four online and offline storage methods would potentially benefit the greatest numbers of species. The methods that create wetland habitats, if in suitable areas, may be of benefit to non-breeding waterbirds, e.g. construction of habitats that would be used by nesting Kingfisher *Alcedo atthis*. It is recommended that future management methods on the coast consider managed realignment at some sites. This will permit suitable intertidal habitats to generate on areas that would otherwise be lost due to sea-level rise and coastal walls. When selecting

flood risk management methods, it is recommended that priority risk species and key bird sites located near AFAs be considered. For some of these species, there is relatively little information, and prior survey work will be essential.

## The Peregrine Falcon *Falco peregrines* in the northwest of Ireland

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A study of the Peregrine Falcon *Falco peregrinus* was initiated in northwest Ireland in 2012. The initial study area encompasses the counties of Sligo, Mayo and north Galway, including Connemara, an area approximately 1,395 km² in size. The study area comprises a range of habitat types including coastal cliffs, quarries, uplands and inland sites. Some of the study areas were considered 'core' areas for Peregrines in previous decadal surveys. However, some of these core areas, such as the Ox Mountains, have a low occupancy rate, while there is a greater uptake of manmade sites such as tower houses and quarries in Connaught than was previously known. Currently limited data exists on the demography of the Peregrine Falcon in the northwest of Ireland. It is anticipated that this study will establish a detailed long term monitoring programme in the region providing a more complete picture of the breeding population. A total of 52 sites were surveyed. Thirty seven sites were occupied (71%) and 14 successfully fledged young (27%). A total of 33 young are known to have fledged giving a mean for all sites combined of 0.63 (n = 52) and a mean productivity per territorial pair of 0.89 (n = 37). The mean number fledged per successful pair was 2.36 (n = 14). A total of 18 coastal sites were surveyed, 13 were occupied (72%), and two successfully fledged young (11%). Twenty-four upland sites were surveyed with 17 (71%) occupied and seven successful (29%). A total of eight quarry sites were surveyed, five were occupied (62%) and three successfully fledged young (37%). Two disused buildings at inland locations were occupied, and a minimum of four young are known to have fledged successfully, giving a mean productivity per territorial pair of 2.00 (n = 2).

## Tau-theory and the avoidance behaviour shown by birds to moving aircraft

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Although collisions regularly occur, birds are known to actively avoid moving aircraft. However, the cue, or cues, that enable birds to initiate and perform elaborate avoidance movements are poorly understood. Over the 2000 to 2012 interval, avoidance manoeuvres to aircraft performed by birds at Dublin Airport, have been investigated. It has been suggested that birds use the 'looming' image of an approaching aircraft to estimate the 'Time to Collision' or TTC, and thus commence the avoidance manoeuvre in time to avoid being fatally injured. In this presentation we test the hypothesis that the optical expansion parameter tau (τ) explains spatio-temporal avoidance responses of birds to moving aircraft. By identifying the positions of the bird and aircraft it is possible to estimate (1) the distance to the probable point of collision (i.e. centreline of the active runway) at which the bird commences its avoidance manoeuvre and (2) the simultaneous location of the approaching aircraft. The results are discussed by reference to simple mathematical models and in the context of what is now referred to as tau-theory.

## The first study on the diet of the Black-headed Gull *Chroicocephalus ridibundus* in Ireland

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The first study on the diet of the Black headed Gull *Chroicocephalus ridibundus* in Ireland was carried out by analysing regurgitated pellets from the breeding colony at Inish, an island at Lady's Island Lake County Wexford (52.20182N,-6.39112W). Pellets were collected between 20 April and 14 June 2011. Vegetation was recorded in 97% of pellets, Coleoptera in 84% and earthworms (*Lumbricus* sp.) in 79% of pellets. In terms of the number of individual prey, Coleoptera were the most abundant. Pellets also contained rodents, tern and gull chicks, Frog *Rana temporaria* and fish, including the catfish *Arius* sp. Prey switching from one dominated by marine prey in the early part of the breeding season to one dominated by terrestrial invertebrates in the later interval was found to occur. The amount of terrestrial prey suggests the terrestrial environment represents a significant feeding resource for Black-headed Gulls. Of interest was the number and frequency of Coleoptera in the diet which may suggest a super-abundance of this group in the area around Lady's Island Lake. Earthworms were also very abundant, in contrast to other recent 'white-headed gull' studies in Counties Cork and Kerry.

## Aquaculture and shorebirds

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The potential impact of aquaculture activities on Special Protection Areas for birds (SPAs) requires Appropriate Assessment under Article 6(3) of the EU Habitats Directive. To date, Appropriate Assessments have been undertaken on behalf of the Marine Institute in Castlemaine Harbour SPA, County Kerry (004029), Dundalk Bay SPA, County Louth (004026), Donegal Bay SPA, County Donegal (004151) and Lough Swilly SPA, County Donegal (004075). Each site is designated for a unique set of wintering shorebirds, wildfowl, grebes, divers and breeding species such as terns, which must be considered against an equally diverse array of aquaculture activities. As there have been few detailed assessments of the impacts of different types of aquaculture in Ireland this has resulted in the need to design and undertake a range of studies and monitoring projects to examine links between numbers and spatial distribution of shorebirds in relation to different aquaculture practices (e.g. oyster trestles, bottom mussel culture, clam culture). For example, in Castlemaine Harbour SPA a study was undertaken to examine the effect of an intertidal mussel relay bed on waterbird utilisation of intertidal habitat in the SPA; in particular to test whether species showed positive or negative associations with mussel beds. Other studies ranged from, e.g. a preliminary assessment of the spatial distribution of shorebirds with respect to clam beds (Castlemaine Harbour SPA) to targeted studies of the numbers and spatial distribution of specific species such as Sanderling *Calidris alba* and Light-bellied Brent Geese *Branta bernicla hrota* in Donegal Bay SPA.

## Effects of management practices on breeding birds in Irish forests

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Ireland's forest landscape is dominated by commercial plantations of non-native conifer tree species, typically considered a poor habitat for biodiversity when compared with native woodlands. Research has shown however, that planted forests can provide useful habitat for biodiversity when appropriately managed. An extensive programme of research on breeding birds in Irish forests has been undertaken since 2001 to identify ways in which commercial forest plantations can be managed to improve their value for birds and to enhance avian diversity in the Irish landscape. In addition to comparisons with native woodlands, forest management factors were also investigated. These included site choice for afforestation, planted tree species (including mixed tree species plantings) and plantation age. Point counts (six per site) were used to census breeding bird communities at 115 forest sites across the island of Ireland. Bird assemblages of native oak and ash woodlands are more diverse than those of

commercially mature conifer plantations and provide a reference against which to compare plantation forests. The bird communities of some open habitats, including low intensity agricultural land and peatland, can be negatively impacted by afforestation, but afforestation does have the potential to impact positively on the bird communities of intensively managed grasslands. The inclusion of a native broadleaved component in conifer plantations is beneficial for bird communities. This is related, at least in part, to the diversification of forest vegetation structure which is associated with higher bird species richness. Shrub cover, which also positively impacts bird communities, is also prominent in young plantation forests, particularly in the second rotation. The loss of understorey structure after canopy closure leads to a less diverse bird assemblage in the later stages of the forest cycle. We conclude that forest management practices that promote growth of non-crop vegetation and the presence of deadwood enhance the structural complexity of forests and include a mix of forest age classes will increase the quality of planted forest habitats for bird communities.

## The population dynamics of Dippers *Cinclus cinclus hibernicus* in southern Ireland

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Our studies of Dipper *Cinclus cinclus hibernicus* populations entered its 24th year of continuous data collection in 2013, with some data dating back to 1982. Our main study area focuses on rivers in east Waterford, east, north and south Cork. Our main objective is to look at long-term population trends in Dipper populations through estimating each of the demographic parameters annually. During that period considerable data have been generated on a range of ecological and biological attributes of the species in Ireland. Breeding parameters (timing of breeding, clutch size and brood size at hatching and fledging) provide the main data, while roost counts and numbers of breeding attempts give us some estimate of population size. We have also calculated nest survival for the nesting, incubation, and fledging period of the breeding cycle. We have found some evidence of earlier breeding, but a full analysis will be underway when we complete 25 years of data collection and analysis. We have found no evidence of a decline in the roosting or breeding populations, although patterns within and between rivers vary annually. Further analyses are underway to examine the breeding biology at the individual rivers. This study sets out to examine existing data as well as generating new field data to test a range of hypothesis on environmental attributes and Dipper ecology.

## The breeding biology of Paridae in southern Ireland: a comparison between two habitat types

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Paridae are among the most widely studied avian families in Europe. Their widespread distribution and their use of artificial nest-holes make them an ideal study species for many types of ecological research. To date few published studies have examined the breeding biology of Parid populations in Ireland and none in southern Ireland. We investigated the breeding biology and ecology of Great Tits *Parus major* and Blue Tits *Cyanistes caeruleus* in two different habitat types in west Cork. Approximately 350 nest-boxes were installed across three coniferous monoculture sites and five mixed mature woodland sites in winter 2012. While Great Tits and Blue Tits will readily breed in almost any shrubby area with suitable nesting cavities, preferred habitat is mature deciduous woodland with a developed understory. Studies have indicated that habitat quality can have a significant impact on the reproductive success of tits. Our results show higher breeding densities of tits in woodland containing deciduous trees, regardless of the density at which nest-boxes were provided. When common parameters of reproductive success were analysed (i.e. lay date, clutch size, fledgling mass, fledgling success), there were no significant differences between tit populations breeding in coniferous or mixed mature habitats. Our results are discussed in an international context and compared with breeding data from other studies across the species ranges.

## Habitat management for breeding waders; halting and reversing the decline of key species in Northern Ireland

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Breeding wading birds have been in steep decline across Ireland since at least the mid-1980s. Recent work has shown that Curlew *Numenius arquata* has declined to the point where extinction is becoming a possibility, whilst Lapwing *Vanellus vanellus*, Redshank *Tringa totanus* and Snipe *Gallinago gallinago* have all declined significantly. On the Lower Lough Erne Islands RSPB Reserve in County Fermanagh rates of decline of these species between 1985 and 1999 were at similar rates to those in the wider countryside. However, since 2000 targeted habitat management and predator control measures have halted and then reversed declines. The reserve currently supports more than 200 pairs of waders on 180ha of grassland across ten islands. Some individual islands have breeding densities of three pairs per hectare and evidence suggests good levels of breeding success. The area has thus become amongst the most important sites for breeding waders in Ireland. Management approaches include the use of variable grazing regimes (cattle, sheep and ponies), large-scale removal of scrub and field boundary trees. Predator control includes Mink *Neovison vison* trapping, Fox *Vulpes vulpes* control using night-vision equipment and the installation of predator-proof, solar-powered fences. Some islands have subsequently been designated as Areas of Special Scientific Interest for breeding waders and species-rich grassland. Five areas are managed within the Department of Agriculture and Rural Development for Northern Ireland agri-environment Countryside Management Scheme. In addition the reserve also supports breeding Dunlin *Calidris alpina*, Oystercatcher *Haematopus ostralegus* and Common Sandpiper *Actitis hypoleucos*.

## The recovery of the Common Buzzard *Buteo buteo* in Ireland

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The Common Buzzard *Buteo buteo* population is increasing and expanding across Western Europe, having previously suffered local extinctions through persecution and prey loss. Ecology and breeding biology of the Buzzard were studied over three years in an area of expansion in the north east of Ireland where prey diversity is low to determine why the recovery has been so successful where some other raptor species remain scarce or absent. In addition, the spread of invasive mammals in Ireland may contribute to population increases as ranges of both the predator and its non-indigenous prey increasingly overlap. A supplementary feeding experiment was carried out to determine the impact of increased biomass availability on productivity before and during the breeding season.

## Republic of Ireland Hen Harrier *Circus cyaneus* survey 2010

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The Hen Harrier *Circus cyaneus* is a species of high conservation concern. It is listed on Annex I of the EU Birds Directive which provides a legislative framework for assessing and ensuring the conservation of species. This framework includes monitoring, research and the designation of Special Protection Areas (SPAs). A national survey of Hen Harriers was carried out during 2010 with the aims of quantifying the size of the breeding population and examining changes in national, regional and SPA populations since the previous national survey in 2005. Survey effort and results were organised according to a grid of 10km squares which were stratified according to suitability of habitat and historical Hen Harrier occupancy. Over 4,000 hours of fieldwork were carried out in these squares by a team of volunteers and full-time fieldworkers to establish the breeding status and occurrence of Hen Harriers in all suitable breeding habitats. An estimated 128 to 172 breeding pairs were recorded within 69 10km squares. The national population appears to be stable since the last national survey although the accuracy of estimates of change are complicated due to more than double the survey effort during 2010 from the 2005 survey. Regardless, there were severe regional declines noted in the Slieve Aughties and in the Stack's, Glanarudderies, Knockanefune,

Mullaghareirks, North of Abbeyfeale complex. Numbers of hen harriers in other areas were observed to have increased, largely a reflection of additional field effort. The hen harrier populations within the six SPAs have declined overall by 18.1%; although these changes varied regionally; with three SPAs declining and three increasing. The number of breeding pairs in a subset of 113 10km squares surveyed in both 2005 and 2010 surveys had decreased by 6.4%. The Northern Ireland population was estimated, in a separate survey as, 59 proven and probable territorial pairs, providing an All-Ireland estimate of 158 to 231 pairs.

## Northern Ireland raptor monitoring

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Data derived from monitoring of wildlife populations is essential to inform management and or legislative decisions, and to understand population dynamics. Birds of prey are important indicators of biodiversity and environmental health and can also act as flagship species for education and public awareness programmes. Raptors are protected under national and European legislation, and as such it is important to survey and monitor their populations. Several species including Hen Harrier *Circus cyaneus*, Merlin *Falco columbarius*, Kestrel *Falco tinunnculus*, Red Kite *Milvus milvus* and Golden Eagle *Aquila chrysaetos* are species of conservation concern in Britain and Ireland and several are priority species for conservation action in Northern Ireland. There is often a paucity of survey data and knowledge of breeding parameters from raptor species within Ireland. Thus, the data required by managers for monitoring distribution, breeding success and habitat usage is dictated by the quality and quantity of data available to inform management decisions. As a result of recommendation by the United Kingdom Raptor Working Group to improve monitoring and recording, Scotland have developed the Scottish Raptor Monitoring Group (SRMG) and appointed a Raptor Monitoring Officer. The NIRSG has been working on the development of a more comprehensive and inclusive monitoring scheme mirroring the SRMG within Northern Ireland since 2007. In pursuance of such an objective the NIRSG applied for funding which has been awarded annually since 2008 by the Northern Ireland Environment Agency for the monitoring of raptors. The project has provided an extensive database of raptor records (>2,500 records) with more than 450 records obtained and collated each year. This information is useful to inform practical planning and development application decisions, forest harvesting operations and facilitates the analyses of population trends. The scheme works in collaboration with several organisations and an extensive network of volunteer fieldworkers and continues to grow each year.

## Evidence of effective Red Grouse *Lagopus lagopus* conservation in Ireland: the Boleybrack Red Grouse Habitat Management Project, north Leitrim

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The results of the most recent Irish Red Grouse *Lagopus lagopus hibernicus* survey indicate that the population in the Republic of Ireland is just over 4,200 birds (average 1.1 per 1km$^2$ surveyed). This suggests a 50% decline in range in the last 40 years. Recent genetic research also suggests that the Irish Red Grouse population (*hibernicus*) is distinct, and moreover that regional populations lack genetic variation, thus are at serious risk of extinction. Drawing on a successful multi-stakeholder project as a case study, this paper discusses the various management strategies aimed at improving the ecological conditions for Red Grouse and other peatland bird species on Boleybrack Mountain in the north of County Leitrim. These include habitat management, predator control, reduction of disturbance, provision of grit, improving public awareness and population monitoring. Between 2008 and 2013, population surveys have shown an increase in Red Grouse spring densities from 0.4-3.9 pairs per km$^2$ and autumn densities of 0.3-11.0 birds per km$^2$. The impacts on other peatland bird species, for example, Golden Plover *Pluvialis apricaria* and birds of prey are also discussed. The paper concludes by presenting recommendations towards a national conservation strategy for Red Grouse in Ireland. These strategies include the development of a targeted Red Grouse species action plan, incorporating specific agri-environmental measures into Ireland's next Rural

Development Programme (2014-2020), continued monitoring of key populations, and a continuity of management necessary to ensure that existing populations are maintained and improved.

## Swift *Apus apus* survey: monitoring and protecting the populations of Belfast

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The Common Swift *Apus apus* is an Amber-listed species that has undergone dramatic declines over the past decade in Britain and Ireland. Swifts migrate from Africa to breed across Britain and Ireland, returning to the same nesting site each year. Whilst the causes of their decline remains unclear, the loss of nesting sites in urbanised areas as a result of building renovations or demolitions is one potential factor. The RSPB's Belfast Swift City Project aims to help protect, increase and promote the Swift populations within the city. It involves a multi-faceted approach to Swift conservation through scientific survey, liaison with the construction industry, education, direct community engagement, protection and provision of nesting sites. Establishing the population size and distribution of Swifts within Belfast was an initial project objective. However, no widely-adopted method has yet been developed to monitor species such as the Swift. In summer 2013 trained volunteer surveyors undertook a survey across 32 1km squares in Belfast. In parallel with a survey of fixed routes in 1km squares birds were recorded at fixed vantage points, the aim being to calibrate the methods with a view to refining methodologies for wider application. This survey data will enable us to produce an index of change in Belfast and at a wider spatial scale over time. The survey results highlight Swift 'hot spots' where targeted advice can be delivered to protect existing colonies and promote the provision of artificial nesting sites where colonies are at risk or have the capacity to expand.

## Facebook for geese: what are the causes and consequences of differences in social position in a fission-fusion social system?

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Light-bellied Brent Geese *Branta bernicla hrota* have a fluid fission-fusion social system during non-breeding periods. There has been negligible research on fission-fusion sociality in avian systems, and little is known about the causes and consequences of variation in an individual's social environment in unstable social systems more generally. We use social network analysis to examine social structure in staging populations of this species and determine whether there are individual differences in social position. We can then use supplementary behavioural, body condition and reproductive data to investigate the correlates of different social strategies, and whether these differ across the annual cycle. We will discuss our knowledge of the factors contributing to population-level social structure and individual social position in this study system using data collected from both a key winter staging population in Dublin Bay and from spring staging sites around Reykjavik (Iceland). We will then present evidence that variation in social position has important consequences at an individual level. Understanding how an individual's social environment interacts with its phenotype and condition has important implications for understanding social behaviour and decision-making in this system, as well as making predictions about social structure in migratory bird species more generally.

## Waterbird monitoring on the Munster River Blackwater

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Waterbird monitoring by the author has been ongoing on the River Blackwater since 1974. The area involves the river downstream from the town of Fermoy to include the estuary at Youghal (Youghal Harbour). The entire system is a candidate Special Area of Conservation, and two areas have been designated as Special Protection Areas; one in the estuary and one on the floodplains between Lismore and Ballyduff, both designated for their waterbird populations. Special survey efforts have concentrated on Whooper Swan *Cygnus cygnus*, Bewick's Swan *C. columbianus*, Cormorant *Phalacrocorax carbo*, Little Egret *Egretta garzetta* and Black-tailed Godwit *Limosa limosa*, as well as on the distribution throughout the tidal cycle of the birds of the estuary. Little Egrets have significant breeding populations on the river, and Kingfishers *Alcedo atthis* and Reed Warblers *Acrocephalus scirpaceus* also breed. Notable changes over this timescale have been the disappearance of Bewick's Swan and the increase in Brent Goose *Branta bernicla* as winter visitors, and the arrival of Little Egret and Reed Warbler as breeders.

## Waterbird monitoring at Ballymacoda, Co. Cork

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Waterbird monitoring has been ongoing at Ballymacoda since 1972. The site is a candidate Special Area of Conservation and a Special Protection Area for its waterbird populations. The bay also now has an important shellfish industry. Chief among the changes over the years have been the arrival and expansion of Brent Goose *Branta bernicla* (700+) and Little Egret *Egretta garzetta* (50+), but many others have decreased in tandem with national trends (Golden Plover *Pluvialis apricaria*, Lapwing *Vanellus vanellus*, Dunlin *Calidris alpina*) while others have remained stable (Bar-tailed Godwit *Limosa lapponica*) or increased (Lesser Black-backed Gull *Larus fuscus*).

## Body fat accumulation in the Barn Swallow *Hirundo rustica* at a south coast site; Ballyvergan Marsh, Co. Cork

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About 2,500 Barn Swallows *Hirundo rustica* were trapped and ringed at Ballyvergan Marsh during 2003-2006. All birds were aged, weighed and measured, and body fat and muscle scores recorded. Catching took place each year from 1 July until the last birds had migrated (usually about 1 October). Irish birds show similar trends in body fat accumulation to those in Britain and continental Europe, differing only in the extent of fat acquired at any point in time. In general, Irish birds acquired less fat than more southerly and easterly populations. This is presumably because these birds were at a very early stage in their migrational route, and had no need to acquire significant fat until they had travelled further south.

## Ornithological research and scientific monitoring on breeding waders and terns on the Inishkea Islands, Co. Mayo in 2012 and 2013

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Breeding wader populations on machair islands increased by 66% between 1996 and 2009 with the largest increases noted on Inishkea North (344% since 1996). In 2009, the Inishkea Islands supported 95 pairs of Lapwing *Vanellus vanellus*, 38 pairs of Dunlin *Calidris alpina* and 23 pairs of Redshank *Tringa totanus*. Since 2007, however, productivity has been very poor and, worryingly, in 2012 it was found that these populations had declined by over 55%. In 2008 the predation of Dunlin eggs by Common Gulls *Larus canus* was noted as an increasing phenomenon;

30% of nests as opposed to <5% in 2006 and 2007. Overall, however, the impact of gull predation on these breeding waders was relatively unknown. Indeed, it was thought the presence of nearby breeding terns, in those years when they were present, would benefit the breeding waders. In 2012, however, it was found that although breeding Lapwings and Little Terns *Sternula albifrons* actively mobbed a potential predator, 26% of observed Common Gull searches were successful in predating wader eggs. Similarly in 2013, 33% were successful. Intrinsically linked with this is the increasing numbers of sheep and the resultant short vegetation height thus exposing nests to predation. In 2013, nest protectors were tested on a selection of wader species as a mitigation measure, and initially these worked well. No eggs were lost from 'protected nests' for 19 days. In contrast, 'unprotected nests' during this period saw continued losses. Unfortunately, thereafter, a Lesser Black-backed Gull *Larus fuscus* worked out how to steal the eggs from the 'protected nests'. The impact of gull predation on breeding waders at the egg stage is high, and overall productivity levels are low. This will, inevitably, lead to further declines.

## Protecting breeding Lapwings *Vanellus vanellus* and other wader species at BirdWatch Ireland's Annagh Marsh reserve, County Mayo

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Annagh Marsh reserve has been surveyed in each of the national machair breeding wader surveys as well as on an annual basis since 2002. Between 1985 and 2009, breeding wader species declined from four to two with the loss of Redshank *Tringa totanus* and Dunlin *Calidris alpina*. Both these are recent losses having not been recorded since 2008. Lapwing *Vanellus vanellus* has been the commonest breeding wader, with their populations remaining 'stable' up to 1996, after which they declined in the order of 45% by 2002. Thereafter BirdWatch Ireland implemented a habitat restoration project (EU LIFE funded) after which the population increased by an order of 58%, to 19 pairs by 2004. These increases were as a response to active management. However, between 2002 and 2010, productivity monitoring recorded only four chicks fledging; this has, primarily, been because of egg predation by Foxes *Vulpes vulpes*. This lack of recruitment has caused a decline in breeding numbers; in 2011 no breeding Lapwing were recorded. In an attempt to reverse these declines, BirdWatch Ireland erected a predator-proof (primarily fox proof) boundary fence (approximately 2.5km in length) around the fields encompassing the Annagh Marsh complex, and created additional pools and muddy edges, in 2011. This received support funding from Dublin Zoo, Fiontar Chomhraic Teo and The Heritage Council. This has proved very successful with Lapwings responding positively and, over the past two breeding seasons, productivity levels have been at over two chicks per breeding pair which has resulted in increased breeding numbers being recorded. In addition, Dunlin has returned and is breeding successfully.

## Resurvey of breeding wader populations of machair and associated wet grasslands in 2009

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Breeding waders occurring on machair grasslands and associated habitats were re-surveyed in 2009. Fifty-five sites, covering 3,904ha surveyed in either 1985 or 1996, within Counties Donegal, Sligo, Mayo and Galway were visited at least once over the breeding season. Seven species were recorded breeding. These were Lapwing *Vanellus vanellus*, Redshank *Tringa totanus*, Dunlin *Calidris alpina*, Snipe *Gallinago gallinago*, Oystercatcher *Haematopus ostralegus*, Ringed Plover *Charadrius hiaticula* and Common Sandpiper *Actitis hypoleucos*. Thirty sites held at least one territorial pair. In total, 714 territories were recorded. Of these, 327 were recorded on machair whilst the rest were recorded on the adjacent areas. Significantly, 65% (464 pairs) were recorded from four sites (Inishkea North (35%), Inishkea South (17%), Roonagh Lough (7%) and Trawmore (6%)). Lapwing was the most numerous species with a total of 230 pairs at 23 sites with the key site being Inishkea North (84 pairs). Dunlin, being an Annex I listed species is of key conservation concern. A total of 52 pairs at seven sites were recorded with the key site being Inishkea North (34 pairs). Comparisons with previous surveys indicated a 30% decline since 1996. At mainland sites

alone, they declined by up to 63% whilst on the offshore islands they increased by 66%. The key site was Inishkea North where the total number of breeding pairs increased by 344% since 1996. Based on these findings it is estimated that Lapwing and Dunlin may become extinct as breeding species by 2015 at the mainland sites, whilst the island sites may follow soon after. Urgent intervention is required to protect these remaining populations and bring about their recovery, without which key breeding wader species may be lost from the Irish machair grasslands altogether in the near future.

## Dublin Bay Birds Project

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Dublin Bay is an internationally important site for waterbirds year-round. At its peak, more than 30,000 migrant wintering waterbirds are recorded each winter during I-WeBS, and the site has consistently remained among the top ten most important sites in Ireland since monitoring began at a national scale during the late 1960s. The bay also supports a significant winter gull roost with occasional counts in excess of more than 40,000 Black-headed Gulls *Chroicocephalus ridibundus* alone. Dublin Bay also functions to support significant concentrations of breeding terns during the summer months. The tern colony that occurs within the Liffey estuary (on the Dublin Port and ESB Dolphins) supports internationally important numbers of breeding Common *Sterna hirundo* and Arctic Terns *S. paradisaea*, while later in the season (August and September), post-breeding aggregations upwards of 10,000 terns can be seen roosting on Sandymount Strand. In January 2013, the Dublin Port Company funded a 3.5-year programme of work, the Dublin Bay Birds Project (DBBP), which aims to describe spatial and temporal patterns of usage of Dublin Bay by waterbirds, including across a variety of tidal states. These objectives will be achieved through an intensive programme of counts and observations. Birds will be marked with colour rings and in some cases, radio transmitters, which will allow fine-focussed observations at the individual scale which will be used to support conclusions drawn from observations of larger flocks. These marked birds will also facilitate assessments of the importance of particular areas within the bay for feeding and for roosting, and possible variation throughout the season, as well as the extent of movement throughout the winter. This will improve our interpretation of the impacts of disturbance on wintering waterbirds in Dublin Bay and will facilitate decisions regarding developmental activities around Dublin Port and the wider Dublin Bay area.

## Cohort-specific reproductive success in an Arctic-nesting goose population

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Long-term capture-mark-recapture studies of long-lived organisms enable comparisons of basic demographics of cohorts through time. We examined cohort-specific reproductive success amongst marked Greenland White-fronted Geese *Anser albifrons flavirostris*, which breed in west Greenland, stage in Iceland and winter in Britain and Ireland. After increasing from the early 1980s, the population peaked at 35,700 in 1999, but declined to 22,400 in 2012, hypothesised as the result of declines in reproductive output. To test this hypothesis, we analysed life histories of 784 known-age birds marked at Wexford from 1983 to 2009, using generalized linear models and AIC model selection to examine differences in age at first breeding, first brood size and the proportion of breeders in each cohort. Of 784 birds examined, 703 never bred, 81 bred once, 15 bred twice and two bred three times. Age at first breeding increased over time, but did not influence first brood size, suggesting no apparent fitness disadvantage to breeding later in life. Top models explaining variation in age at first breeding included cohort (year effect), population size in the winter prior to breeding and 'breeding quality index' (BQI), a cumulative metric that scored breeding conditions from maturity (second summer) to the time they bred (mean Nagelkerke $R^2$ = 0.60). Top models explaining variation in first brood size did not differ from the null. Variation in the proportion of breeders in each cohort was explained by a weak BQI effect (mean Nagelkerke $R^2$ = 0.16). Thus, age at first breeding and the proportion of breeders in each cohort is likely driven by cumulative breeding conditions. Delayed age at first breeding appears related to a

combination of cohort effects, increased weather variability during the breeding season (i.e. lower BQI) and the previous winter's population count, suggesting density dependence could be a contributory factor.

## The effects of fieldwork on Hen Harrier *Circus cyaneus* breeding success

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Breeding biology data collected from wild Hen Harriers *Circus cyaneus* is essential to the effective conservation of this species in Ireland where population levels are currently very low. To this end a long-term study was undertaken in Ireland between 2007 and 2011. As part of this project, fieldworkers visited nests to collect information on breeding biology, to ring and wing-tag nestlings, and to deploy cameras at nests and GPS tags on adult Hen Harriers. All of these activities were carried out under licence. In this paper, we present a study on the effects of nest visits on the breeding success of the birds by comparing the success of 166 visited and unvisited nests. Nest success was significantly higher at visited nests than at nests where no visits were carried out. However, controlling for biases due to nests failing before they could be visited, the apparent effect of nest visits on nest success was greatly reduced. At visited nests, further fieldwork such as installation of cameras at nests, or deployment of GPS loggers on adults, had little or no apparent effect on overall levels of nesting success. At a few nests where fieldwork may have had a negative effect, we discuss the relative importance of predation and the response of breeding adults in determining outcomes at nests. These findings should be considered in the context of the study, which involved highly trained, experienced staff adhering to detailed fieldwork protocols that ensured that the welfare of birds and their nests was the main priority.

## Mismatches between breeding success and habitat preferences in Hen Harriers *Circus cyaneus* breeding in forested landscapes

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During the past century, the upland breeding areas of Hen Harriers *Circus cyaneus* in Ireland have been extensively afforested. There is no evidence that this species avoids breeding in heavily forested landscapes and, indeed, young commercial forests in their second rotation are often selected as nest-sites. However, Hen Harriers have coexisted with these forested areas for only a few decades and it is possible that such landscapes are suboptimal. We examined the relationship between breeding success and habitat using a dataset spanning three years and four study areas in the south and west of Ireland. We assessed whether nest success and fledged brood size were related to habitat type, both at the nest-site and in the surrounding landscape. Neither measure of breeding productivity was related to total forest cover or to percentage cover of closed canopy forest in the landscape. However, in a subset of areas, high cover of second-rotation pre-thicket (young forests planted on land from which a first rotation has already been harvested) forest in the surrounding landscape was associated with low levels of breeding success. This may be due to factors related to predation, disturbance or prey availability. The fact that second-rotation pre-thicket forest is a preferred habitat for nesting in Ireland suggests that Hen Harriers may be making suboptimal decisions in the landscapes available to them.

## A simple system for detachment and retrieval of archival devices deployed on birds

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Global Position System (GPS) units afford ornithologists a means to remotely gather spatially and temporally precise positional data on free-ranging, wild birds. Because GPS is an archival technology, the data collected by GPS tags are stored on-board the unit. However, recapture of individual birds is difficult or undesirable for many species,

making it is difficult to recover such archival tags from them. The most common means of retrieving GPS data is, therefore, by combining GPS with another technology that is capable of remotely transmitting the data to researchers, such as satellite, GSM, VHF or Bluetooth. However, such combination tags are substantially heavier than stand-alone GPS units, and therefore unsuitable for many medium-sized birds. Many studies have shown that carrying loads above a certain proportion of body weight can have negative consequences for several aspects of a bird's fitness, imposing weight-related restrictions on the equipment that can be deployed on birds. Here we describe a low-cost system that can be used to retrieve GPS units, deployed for periods of days or weeks, without the need for recapturing birds. This system comprises a harness that incorporates a weak-link that breaks to release the harness after a predetermined period of time has elapsed. Tags are then retrieved using a receiver to locate a small VHF transmitter attached to the GPS unit. We describe the design of this system, and its use on breeding Hen Harriers *Circus cyaneus*, weighing between 300 and 600g. No serious negative effects due to the attachment of the harness and device were apparent in the tagged adults. However, delays in resumption of provisioning activity were observed at some nests, and in some cases devices were not retrieved. The causes of these problems, and possible solutions for them, are discussed.

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Marine Institute
Foras na Mara

epa
Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

ATKINS