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Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland



CONFERENCE ABSTRACTS

3RD ECOLOGY AND EVOLUTION IRELAND CONFERENCE

Irish Ecological Association
UNIVERSITY COLLEGE CORK | 7-8TH JANUARY 2021

THURSDAY 7TH JANUARY

TALKS: MORNING SESSION

09:20 Plenary: Yvonne Buckley

The Biogeography of Population Dynamics

10:00-10:55

Andrew Mooney

Trinity College Dublin

Trevor Hodkinson; Sara Webb; Yvonne M. Buckley

A conservation project efficiency approach to the prioritisation of plants for de-extinction research

Recent technological advancements mean that a suite of genetic tools can be deployed to reverse global biodiversity loss and even result in species de-extinctions. Despite the ease of plant cloning, their central role in ecosystem functioning, and their reduced ethical concerns compared to vertebrates, plants are conspicuously absent from the de-extinction discussion. We prioritise for de-extinction research the 122 “Extinct” plant species under the IUCN Red List and implement a de-extinction project efficiency ranking framework to incorporate species values (such as medicinal, economic and scientific value), while also considering indicators for the probability of project success and associated costs through an identification of suitable herbarium and ex situ samples, extant congeneric relatives and key habitat and threat information. Nearly all species have herbarium specimens and extant relatives, however none are represented within any of the seed banks assessed. Nineteen species have already been rediscovered, including four of the top five ranked species, leaving the Hawaiian lobelioid *Delissea subcordata* as the highest-ranking species for de-extinction research. Although not seen since 1934, this species has numerous herbarium specimens, published DNA sequences and extant genus-specific relatives, increasing the probability of project success. We encourage more detailed IUCN Red List assessments, seed and tissue collection for newly rediscovered species, and highlight a lack of available quantitative data for extinct plant species, particularly with regards to their ecological role and interspecific interactions. As our framework prioritised numerous species which have been rediscovered, we suggest further field studies are required for other high-ranking species to identify possible extant populations prior to the initiation of de-extinction research.

Cian Luck

University College Cork

Mark Jessopp, Debbie Russell, Cecile Vincent, Sam Cox, Matt Carter, Emer Rogan, Michelle Cronin

The co-occurrence of seal foraging behaviour and static net fishing activity

Grey seal (*Halichoerus grypus*) interactions with static net fisheries are a contentious issue, as seals are known to depredate catch and become entangled as bycatch. Previous studies of overlap between grey seals and fishing activity at broad spatial and temporal scales have identified significant overlap with fishing vessels using passive gears in the Celtic and Irish Seas. In this study we applied Hidden Markov Models (HMMs) to tracking data from over 160 grey seals tagged in the UK, Ireland, and France, to identify the likely location of seal foraging activity. Using vessel tracking data we identified locations where static nets were potentially left to soak, and included distance to the nearest net as a covariate effect on state transition probabilities. In doing so, we aimed to examine the co-occurrence of foraging and fishing effort by seals and static net fishing vessels in near-real time, and the potential effect of proximity to fishing nets on grey seal behaviour. We used both the Akaike (AIC) and Bayesian Information Criterion (BIC) in model selection, and presented the models selected by each as a confidence set of plausible models. All models converged on three behavioural states inferred as “foraging”, “travel”, and “rest” which was included as a known state. The model selected by BIC retained distance to net as the only covariate effect on state transition probabilities, and showed that grey seals were increasingly likely to switch from travel to foraging behaviour closer to static nets. The AIC-selected model included a three-way interaction between distance to net, sex, and region, and showed that the effect of distance to net varied with sex and region. This study shows that grey seals are likely to forage near static nets which may increase the risk of direct fishery interaction, but this effect may be influenced by intrinsic factors, such as the sex of the seal, and extrinsic factors, including the distribution of fishing effort in a given area.

Ciara L. O. McGlade

Queen's University Belfast

James W. E. Dickey, Richard Kennedy, Jaimie T. A. Dick

Quantifying the ecological impacts of invasive freshwater fish through a controlled release experiment.

Rainbow trout are considered the most widely introduced salmonid in the world. In 2017, flooding across Northern Ireland resulted in the escape of at least 300 000 farmed rainbow trout into the River Strule, prompting investigation into the ecological impacts of this and other mass escapes. Upstream stretches of the River Bush in County Antrim, Northern Ireland, represent a unique opportunity for simulating a mass escape, without risk of spread into other rivers. The upstream portion of the River Bush is isolated from other rivers by the Altnahinch Dam. Furthermore, a concrete platform and wall isolates upper stretches of the river from the lower stretches, allowing a controlled environment with which to compare results. In May 2019, rainbow trout were released into the River Bush, upstream of the Altnahinch Dam but downstream of the separating wall. Before and after this release, the benthic invertebrate community and the native brown trout were monitored. In addition to this, riverside predator density was recorded using camera traps, and the positions of 20 rainbow trout recorded using an acoustic receiver system. We found that rainbow trout abundance declined exponentially. Only five of the tagged individuals were detected ten days after the release, and only one individual after 74 days. Despite this, native brown trout numbers and condition were immediately impacted, and condition was still impacted 3 months later. There was also an increase in heron occurrences along the experimental stream but no effect on invertebrate diversity and abundance or on the feeding behaviour of the native fish. These results suggest that energy expenditure rather than competition over food items may have driven the decline in condition factor. This study shows that farmed Rainbow trout don't cause immediate impacts via feeding behaviour when they are released or escape, but they may still adversely affect native fish condition and fish densities in streams.

Jamie Darby

University College Cork

Sophie de Grissac, Gavin Arneill, Enrico Pirotta, James Waggitt, Luca Borger, Emily Shepard, David Cabot, Ellie Owen, Mark Bolton, John Quinn, Mark Jessopp

Commercial fisheries drive the behaviour and foraging distribution of northern fulmars

Species distribution and habitat-use models are essential tools of conservation biology. For many wide-ranging species, these models often rely on environmental proxies of prey availability, because prey availability itself is difficult to quantify in continuous time and space. Despite the use of anthropogenic food sources by many top predators, distribution models rarely account for this interaction. We assessed the utility of commercial fishing effort as a proxy for the availability of anthropogenic food in foraging distribution models for northern fulmars (*Fulmarus glacialis*), a species known to feed on fisheries waste. First, we established fulmar-vessel foraging interactions using concurrently tracked fulmars and fishing vessels in Irish and UK waters. We then assigned likely foraging/non-foraging states to fulmar tracks and modelled the distribution of foraging behaviour using a range of covariates. Persistent fishing effort was a significant predictor of foraging distribution, more important than environmental covariates (chlorophyll-a concentration, sea-surface temperature, distance to colony, depth and tidal current speed). Extrapolated predictions of foraging habitat largely explain the current distribution of fulmar colonies. The vessel-associated foraging by fulmars, as well as the occurrence of high-use foraging areas with low fishing effort suggests that fulmars and fisheries are not simply targeting the same areas. This study demonstrates the effect of an anthropogenic activity on the foraging ecology and distribution of a marine top predator and provides important context for mitigation of fisheries bycatch.

Constance M. Schéré

King's College London

Kate Schreckenberg, Terence P. Dawson

To what extent are marine protected areas in the Irish Sea equitably governed and managed? A case study approach

It is not enough to simply designate a protected area; according to the Convention on Biological Diversity's Aichi Target 11, these sites should be governed and managed effectively and equitably. Equitable (i.e. fair and inclusive) conservation is vital to ensuring effective protection of natural resources while maintaining human well-being, yet equity tends to be overlooked in protected area assessments. Equity issues arise when protected areas have a disproportionate effect on stakeholder groups and this can influence biological conservation outcomes. The Site-level Assessment for Governance and Equity (SAGE) toolkit was developed by the International Institute for Environment and Development (IIED) to address the gap in equity assessments and is currently in the pilot-testing phase. Based on the three dimensions of equity (recognition, distribution, and procedure), SAGE contains Likert-scale questions to assess good governance by evaluating how different stakeholder groups perceive their protected area's legitimacy and management and to what extent they feel included in decision-making. Irish Sea marine protected areas (MPAs) were the first marine sites selected to test out this new tool, the other protected areas being largely terrestrial. Three MPAs in

Great Britain, Northern Ireland, and the Republic of Ireland were selected to assess equitable governance and management in the Irish Sea. Quantitative data from SAGE is complemented by qualitative data from online survey comments and semi-structured interviews with stakeholders to understand the impact MPA management has on stakeholders and assess the overall equitable governance and management of Irish Sea MPAs. The transboundary nature of two of these MPAs (the Solway Firth and Carlingford Lough) also allows for a comparison of the effect of different governance and management approaches on equity to identify gaps and highlight best practices.

Grace Nolan

University College Dublin

Dr Adam Kane

Comparing media portrayals of Mountain Lions across three distinct regions of the United States of America

Global wilderness is in decline forcing humans and wildlife into closer cohabitation. As cohabitation increases coexistence often turns into conflict. Such human-wildlife conflict (HWC) incidents are often poised as “man vs beast”; scenarios, positioning nature and humans at war with one another. This man vs beast narrative is not only prolific in academic literature but permeates into the mainstream media. This is problematic as the media plays a key role in connecting people and nature as well as a formative role in the development of people’s perceptions of nature. Current research in this field has focused on how the media portrays HWC either at a highly localised and species-specific level or on a broader, multi-species global scale. My interdisciplinary study takes a novel approach, comparing species-specific local coverage across a broader spatial scale. Mountain lions (*Puma concolor*) in the USA present a unique opportunity for comparison as populations are established in the western states, recolonizing in the mid-west, and isolated and endangered in Florida. By comparing media portrayals of this species across these three regions (West, Mid-West, and Florida) my study explores whether HWC is experienced universally and seeks to identify what factors influence any geographic differences in portrayals. Utilising topic modeling and media content analysis methods I analysed 5423 print news articles from the Nexis Advance UK database. Preliminary results indicate that media portrayals of human-mountain lion conflict are not universal across the USA. Floridian portrayals show a higher sensitivity towards conservation topics, whilst western states favour more polarising man vs beast narratives. Some local common names for the species also hold stronger associations with negative sentiments than others. Analysing how the media portrays HWC is essential to understanding sentiment towards ‘problem’; and developing effective coexistence and management strategies.

Marina Reyne

Queen’s University Belfast

Ferdia Marnell, Aurelie Aubry, Mark Emmerson, Sarah Helyar and Neil Reid

Conservation of an endangered amphibian: the case of the Natterjack toad in Ireland

Amphibian declines are of major conservation concern worldwide. The Natterjack toad (*Epidalea calamita*) is the rarest amphibian in Ireland, regionally Red-listed as Endangered. The species is subject to substantial conservation efforts, including regular monitoring, a pond creation agri-environment scheme, and a head-start and translocation programme to facilitate pond colonisation.

Unfortunately, conservation practices did not manage to halt the decline of the Natterjack toad in Ireland and fecundity has decreased by 23% over a 14-year period. Natterjack toads were perceived to be at greatest threat from poor water quality and lack of suitable terrestrial habitat maintenance. Habitat restoration practices managed to offset further declines by only 4%. While artificially created ponds provided a less favoured environment for breeding toads, we did find substantial positive effect on the aquatic invertebrate diversity. The Natterjack toad population in Ireland retains high genetic diversity, despite substantial declines. We did not find evidence of genetic bottlenecks or high levels of inbreeding suggesting that the effective population size has not dropped below census size. A mark-recapture study showed that the census size could have been underestimated by up to 83% due to converting egg string counts into population estimations. Landscape genetic analysis revealed that the Irish population experience significant spatial genetic structuring with presence of barriers to Natterjack toad metapopulation dispersal best explained by Isolation-by-resistance. Analysis of the impact of climate change suggested that the species has the potential to be a climate change winner as a result of increased environmental suitability and fecundity in the future. The apparent high levels of genetic variation, errors in calculating populations size and climate change predictions give hope for the conservation of Ireland's rarest amphibian if appropriately protected and managed.

Sarah Ryan

University College Cork

Joshka Kaufmann, Catherine Waters, Karl P. Phillips, Brian Boyle, Jamie Coughlan, Elizabeth Ryder, Ronan Grealis, Caroline Bradley, Brendan McHugh, Thomas Reed, Paulo Prodöhl, Philip McGinnity

Escaped farm Atlantic salmon (*Salmo salar*) can impact negatively on the bioenergetic integrity of wild populations

Atlantic salmon have a suite of adaptations to help them survive the food scarcity of winter. The different selection regimes in farm environments have resulted in phenotypes divergent from those evolved to survive winters in the wild. Further, farmed salmon lineages predominantly originate from northern rivers, and will likely have winter survival strategies different from those of local wild salmon when reared in southerly latitudes. When farmed fish escape and breed with wild fish, these differences in energy budgeting may carry significant costs for hybrid offspring. To assess how domestication and geography may affect winter energy adaptation, we released the progeny of Norwegian farmed, local wild, and reciprocal hybrids into an Irish river. The progeny groups differed significantly, consistent with farm fish being mismatched to the novel wild environment, in a number of performance related metrics, including survival. Survival, in turn, might be expected to relate to variations in winter energy syndrome, e.g. size, condition, suspension of growth, and accumulation, use and restoration of energy reserves. The two hybrid groups showed intermediate values for all of the measured trait responses, suggesting additive genetic variation, but there were also large differences between the reciprocated hybrid progeny when analysed separately, suggesting some form of parental effect. While it has been shown previously that the progeny of farm and wild salmon have different survival rates in the wild, this is one of the first demonstrations of the mechanisms underpinning those differences. In bioenergetics terms, these insights provide huge value for eco-genetic modelling as a means of predicting how climate change might exacerbate the impacts of farm escapes on wild populations.

TALKS: AFTERNOON SESSION

14:00 Plenary: Kristine Bohmann

Environmental DNA in Biodiversity Studies

14:40-15:30

Enrico Pirotta

Washington State University

Cormac Booth, David E. Cade, John Calambokidis, Daniel P. Costa, James A. Fahlbusch, Ari S. Friedlaender, Jeremy A. Goldbogen, John Harwood, Elliott L. Hazen, Leslie New, Brandon L. Southall

Context-dependent variability in the predicted daily energetic costs of disturbance for blue whales

Assessing the long-term consequences of sub-lethal anthropogenic disturbance on wildlife populations requires integrating data on fine-scale individual behavior and physiology into spatially and temporally broader, population-level inference. A typical behavioral response to disturbance is the cessation of foraging, which can be translated into a common metric of energetic cost. However, this necessitates detailed empirical information on baseline movements, activity budgets, feeding rates, and energy intake, as well as the probability of an individual responding to the disturbance-inducing stressor within different exposure contexts. Here, we integrated data from blue whales (*Balaenoptera musculus*) experimentally exposed to military active sonar signals with fine-scale measurements of baseline behavior over multiple days or weeks obtained from accelerometry loggers, telemetry tracking and prey sampling. Specifically, we developed daily simulations of movement, feeding behavior and exposure to localized sonar events of increasing duration and intensity, and predicted the effects of this disturbance source on the daily energy intake of an individual. Activity budgets and movements were highly variable in space and time and among individuals, resulting in large variability in predicted energetic intake and costs. In half of our simulations, an individual's energy intake was unaffected by the simulated source. However, some individuals lost their entire daily energy intake under brief or weak exposure scenarios. The shape of the exposure-response functions also strongly influenced predictions, reinforcing the need for contextually explicit experiments and improved mechanistic understanding of the processes driving behavioral responses to disturbance. This study presents a robust approach for integrating different types of empirical information to assess the effects of disturbance at spatio-temporal and ecological scales that are relevant to management and conservation.

Jacob Davies

British Trust for Ornithology

Liz Humphreys, Rich Howells, Tom Evans & James Pearce-Higgins

Predicting seabird abundance responses to both marine and terrestrial climate change

Seabirds are exposed to climate change in both the marine and terrestrial environment, but the relative effects of both are rarely compared. The Marine Protected Area Management and Monitoring Project (MarPAMM) is an EU funded project focused on the delivery of Management Plans within the shared seas between Northern Ireland, Ireland and Western Scotland (the INTERREG VA region). Here, we analyse the relationship between marine (SST, stratification) and terrestrial (temperature, precipitation) climate variables and the abundance of 19 seabird species in UK and Ireland using Bayesian spatial models. The effect of terrestrial climate variables on seabird abundance was typically higher in magnitude than that of marine variables, but this varied considerably between species. Having accounted for location, the proportion of variation in abundance explained by climate was typically low but varied between species. We then projected abundance of breeding seabirds both in the INTERREG VA region and for the whole of the UK and Ireland in 2050 under climate change (RCP8.5 model scenario). All but five species are projected to decline, although there is considerable spatial variation in projected trend across the study area. These outputs were then used to inform vulnerability assessments, which will in turn be used to inform how these populations are managed in the future. Including terrestrial climate in the model often changed the magnitude or even the direction of the projected change in seabird abundance by 2050 from that predicted using marine climate alone. Therefore, to make accurate future projections of seabird abundance and inform management, we must consider climate change in both terrestrial and marine environments.

Emma Campbell

Agri-Food and Bioscience Institute (AFBI) and Queen's University Belfast

Fraser D. Menzies, Andrew W. Byrne, D. Michael Scantlebury, Maria O'Hagan, Georgina Milne, Siobhan Porter, Kathryn R. McBride, Carl M. McCormick, Neil Reid

Cattle and badger indirect contact and potential bovine tuberculosis transmission

The transmission of *Mycobacterium bovis* between and among cattle and badgers represents an area of research which continues to pose many questions in the pursuit of disease eradication in the UK and Ireland. Queries remain over when and where both species become infected, how likely infection is to occur, and how transmission risk can be minimised. This study aimed to assess 1) the number of indirect contacts between the species, 2) locations where indirect contacts occur, 3) the behaviour of badgers in relation to cattle and 4) management of cattle at pasture in relation to bTB transmission risk. Data were collected using camera traps, GPS collars deployed on badgers and cattle grazing locations recorded by farmers at 35 farms in County Down. Setts and latrines were focal points for indirect contact between badgers and cattle. Not only did camera traps find cattle investigating these locations but fields containing such feature were not actively avoided when turning cattle out to grass. Since *M. bovis* can survive in the environment it is pertinent to ensure cattle cannot access these locations, ideally by avoiding fields containing such features or preventing cattle access using fencing. Badgers avoided fields with cattle present, confirmed using camera traps and GPS-tracking with fodder and rough pasture fields preferred by foraging badgers. Implementing changes to cattle management at grass could reduce contact between neighbouring cattle herds, therefore, reducing nose-to-nose across-the-hedge contact. A total of 18% of days cattle were grazing were spent in fields directly adjacent to neighbouring herds with cattle moved on average 28km between pastures during the summer. Reducing contact with neighbouring herds could include; avoidance of grazing boundary fields, double fencing to prevent direct contact, minimising the use of outlying land fragments and/or moving cattle locally only.

Jenny Coomes

University College Cork

John Quinn

DNA metabarcoding reveals individual niche specialisation of diet in great tits that differ in innovation and exploration behaviour

Individual niche specialisation, when animals specialise on particular prey items, can reduce competition between individuals for food. Individual diet specialisations have received recent attention as researchers realise the importance of not treating all individuals as homogenous. Two behavioural traits in which individuals show substantial individual variation are personality and cognition, both of which influence foraging success and could lead to individual differences in foraging tactics and diet. Determining dietary specialisations is challenging because of the difficulty in identifying the food items consumed but DNA metabarcoding can overcome this challenge through high-resolution identification of prey via DNA sequences. We used DNA metabarcoding to establish the diet of great tits and investigated if individuals of different personalities and cognitive abilities showed differences in diet, potentially leading to individual niche specialisation. We used exploration behaviour as our personality measure and innovation as our measure of cognition as both may be linked to foraging success. We looked at both the composition and richness (number) of invertebrate and plant genera present in the diet. We found that birds that solved a multi-access problem-solving device, the innovators, had a different composition of plants in the diet compared to those that did not solve the task. Ten genera were eaten solely by innovators, five by non-innovators and more non-innovators ate oak than did innovators. Additionally, birds with higher exploration scores had a higher invertebrate richness. Our results show that both cognition and personality may be drivers of individual niche specialisation, with cognition likely to be important for diet composition and personality important for diet diversity. Investigating the extent of dietary specialisations provides insight into how animals may adapt to changing environmental conditions, particularly if food resources change.

Lucy Harding

Trinity College Dublin

Andrew Jackson, Adam Barnett, Ian Donohue, Lewis Halsey, Charles Huveneers, Carl Meyer, Yannis Papastamatiou, Jayson Semmens, Erin Spencer, Yuuki Watanabe, Nicholas Payne

Endothermy in marine fishes: does it expand their thermal niche, make them faster, or both?

Regional endothermy has evolved several times in marine fishes, and two competing hypotheses are generally proposed to explain its significance; thermal niche expansion and elevated cruising speeds. Evidence to support either hypothesis is equivocal, and the ecological advantages conferred by endothermy in fishes remain debated. By compiling published biologging data and collecting precise speed measurements from free-swimming fishes in the wild, we directly test whether endothermic fish encounter broader temperature ranges, swim faster, or both. Our analyses avoid several complications associated with earlier tests of these hypotheses, as we use precise measurements of the thermal experience and speed of individual fish. Phylogenetically-informed analyses of 89 studies reporting temperature ranges encountered by tagged fish reveal that endotherms do not encounter broader temperature ranges than their ectothermic counterparts. In contrast, speed measurements from 51 individuals (17 species, of which 4 were regional endotherms) show that endothermic fish cruise ~ 1.8 times faster than ectotherms, after accounting for the influence of body temperature

and body mass on speed. Our results, therefore, suggest that, contrary to previous studies of endothermy's role in thermal niche expansion, the significance of endothermy lies in the advantages it confers to swimming performance rather than facilitating occupation of broader thermal niches. Further, given speed's major influence on metabolic rate, our updated speed estimates (which are lower than those estimated previously) imply endotherms have lower routine energy requirements than thought previously. Our findings shed light on the evolutionary drivers of regional endothermy in fish and question the view that the trait confers resilience to climate change through broader thermal tolerance than that of ectotherms.

Ronan James O'Sullivan

University College Cork

Tutku Aykanat, Susan E. Johnston, Ger Rogan, Russell Poole, Paulo A. Prodöhl, Elvira de Eyto, Craig R. Primmer, Philip McGinnity, Thomas Eric Reed

Captive-bred Atlantic salmon released into the wild have fewer offspring than wild-bred fish and decrease population productivity.

The release of captive-bred animals into the wild is commonly practised to restore or supplement wild populations but comes with a suite of ecological and genetic consequences. Vast numbers of hatchery-reared fish are released annually, ostensibly to restore/enhance wild populations or provide greater angling returns. While previous studies have shown that captive-bred fish perform poorly in the wild relative to wild-bred conspecifics, few have measured individual lifetime reproductive success (LRS) and how this affects population productivity. Here, we analyse data on Atlantic salmon from an intensely studied catchment into which varying numbers of captive-bred fish have escaped/been released and potentially bred over several decades. Using a molecular pedigree, we demonstrate that, on average, the LRS of captive-bred individuals was only 36% that of wild-bred individuals. A significant LRS difference remained after excluding individuals that left no surviving offspring, some of which might have simply failed to spawn, consistent with transgenerational effects on offspring survival. The annual productivity of the mixed population (wild-bred plus captive-bred) was lower in years where captive-bred fish comprised a greater fraction of potential spawners. These results bolster previous empirical and theoretical findings that intentional stocking, or non-intentional escapees, threaten, rather than enhance, recipient natural populations.

Debs Allbrook

University College Cork

John Quinn

The effectiveness of regulatory signs in controlling human behaviour and Northern gannet (*Morus bassanus*) disturbance during breeding: an experimental test.

Human disturbance to wildlife is on the rise and disturbance management is a key activity in conservation. Although disturbance can be controlled with relative ease in nature reserves that are properly resourced and managed by employed staff, most reserves do not fall into this category, and most wildlife exists outside managed reserves entirely. Thus, developing and demonstrating the effectiveness of simple, low-cost approaches to minimising disturbance is an important objective in conservation. In this study we examine the effectiveness of regulatory signs in controlling the behaviour and impacts of visitors on a colonial island-nesting bird, the Northern gannet (*Morus*

bassanus), on an unmanaged island. First, we found that the percentage of successful nests declined with proximity to the disturbed edge of the colony, and was much higher in an undisturbed control area. Second, the number of birds displaced by visitors correlated negatively with the minimum visitor approach distance. Third, visitor proximity to the colony was dramatically reduced in the presence of a regulatory sign in comparison to periods without signs, which resulted in fewer birds being displaced from their nests. Photographers were the only visitor group who didn't always comply with the sign. Our results show that breeding success in a species often thought to be well adapted to human presence, suffers from tourist pressure, and that simple and informative regulatory signs can be a cost-effective way of reducing the disturbance caused by visitors at unmanaged wildlife sites.

POSTERS: SESSION ONE

16:00-17:30

Room 1 Poster 1: Alan McCarthy

University College Cork

Patrick Smiddy, Allan Mee, Tony Nagle, Sandra Irwin, Anthony Caravaggi, John O'Halloran

Winter diet of Hen Harriers (*Circus cyaneus*) in Ireland

The Hen Harrier (*Circus cyaneus*) is a bird of prey that breeds across upland areas of Ireland, with a large portion of the population moving to lowland and coastal areas during the winter. This species has experienced continual declines in breeding numbers over recent decades. Conservation and research efforts to halt this decline require a deep understanding of the species ecology. To date, these efforts have mostly focussed on the breeding season, with much of this work investigating the effects of anthropogenic land-use change, including forestry, wind farm developments and agriculture, on Hen Harrier breeding ecology and productivity. However, a significant knowledge gap remains regarding Hen Harrier ecology outside of the breeding season, particularly their winter diet. During the winter of 2019/20, over 400 Hen Harrier pellets (indigestible prey remains) were collected from eight winter roost sites throughout Ireland. These pellets were analysed by dissection and visual identification of hair, feather and bone fragments in order to identify prey items and diet composition. Preliminary results indicate a wide variation in diet across winter roosts, with bird and small mammal prey items making up most of their diet. The findings are discussed in the context of the habitat composition of the surrounding landscape. The results reveal the dietary requirements of overwintering Hen Harriers, and the outputs from this study will inform the development of targeted management practices for the conservation of Hen Harriers in Ireland and further afield.

Room 1 Poster 2: Arrian Karbassioon

University College Dublin

Dara A. Stanley

The effect of weather on the foraging activity of honeybees (*Apis mellifera*) and bumblebees (*Bombus terrestris*) in Ireland

Insect pollination by both managed and wild bees is a highly valued ecosystem service that ensures genetic diversity and reproduction among plants and the production of high-quality crops. Bee flight and foraging has been shown to be influenced by a variety of weather conditions, and as global climate continues to change, the degree, frequency, and duration of these conditions may shift as well. In order to develop farming practices that maximize the benefits of pollination it is important to understand how specific weather variables or combinations of these variables drive or hinder the activity of bees. This is particularly important in a country like Ireland, where variable weather conditions are often sub-optimal for bee foraging. By observing honeybees (*Apis mellifera*) and buff-tailed bumblebees (*Bombus terrestris*) simultaneously in the same sites, we observed how weather variables affect the flight activity of both species. We observed positive relationships between honeybee activity and both temperature and solar radiation, but reduced activity as relative humidity increased. The relationship between weather and buff-tailed bumblebee activity was weaker, possibly because the range of observed conditions in the field was not wide enough to capture any effect. However, this may also suggest that bumblebees are more resilient to inclement conditions. Both species were observed to increase pollen foraging activity in warmer, drier conditions, whereas high humidity was negatively associated with such behavior in both species. We may preliminarily conclude that the presence of bumblebees will compensate for losses in honeybee activity in humid and rainy conditions.

Room 1 Poster 3: Bismark Ofosu-Bamfo

University of Energy and Natural Resources, Sunyani Ghana

Patrick Addo-Fordjour, Ebenezer J.D. Belford

How does road-edge influence liana community structure and liana-host interactions in evergreen rainforests in Ghana?

Lianas are woody climbing “disturbance adapted” plants common in tropical forests. Their response to forest edge creation could have significant outcomes on forest ecosystems. Not much attention has been given to research on this subject. Thus, the objective of this study was to investigate the effects of road-edge on liana community structure and liana-host interactions in two evergreen rainforests in Ghana (Ankasa Conservation Area, Cape Three Points Forest Reserve). A total of twelve 50 m × 50 m plots were laid out in each forest. These were distributed evenly in edge (0-50m), interior (200m) and deep-interior (400m) habitats. Lianas species and supporting trees were identified and enumerated. Whereas no edge effect was registered on liana diversity in Ankasa Conservation Area, edge habitat of Cape Three Points Forest Reserve supported significantly higher liana diversity. No significant edge effects were observed on liana species composition, abundance, and basal area in both evergreen rainforests. In all the three habitats of the two evergreen rainforests, liana species showed random species co-occurrence pattern, with no nested structure in liana-tree interaction network. Overall, our data suggest that road-edge did not mainly affect liana community characteristics possibly due to the narrow width of the edge.

Room 1 Poster 4: Conor Meade

Maynooth University

Cliff Bueno De Mesquita, Steve Schmidt, Katharine Suding

Soil microbial interactions in trailing-edge migration in Arctic-Alpine plants.

Ongoing climate change is altering the distribution of ideal bioclimatic niches for species, with ecotypes from southerly or warmer areas increasingly suited to the abiotic temperature conditions of northern, previously cooler areas. More data is now emerging on the biotic interactions that arise when southerly ecotypes colonise habitats previously occupied by more cold-tolerant populations. Here we examine responses in two ecotypes of *Silene acaulis* (moss campion) from a warmer habitat (Europe) and a cooler habitat (North America), grown in each other's soil, profiling changes in root microbial community composition and diversity. Root microbial interactions appear to have a significant impact on fitness and recruitment of migrant ecotypes in novel soil habitats.

Room 1 Poster 5: Darren P. O'Connell

Newcastle University

Marco Fusi, Rignolda Djameluddin, Bulfrit B. Rajagukguk, Fihri Bachmid, James J. N. Kitson, Zoe Dunnet, Agus Trianto, Aiyen B. Tjoa, Karen Diele and Darren M. Evans

Network ecology as a tool to assess restoration - using plant animal interactions to measure the success of different mangrove restoration techniques in replicating natural forest

Mangrove forests are unique intertidal ecosystems that provide habitat to terrestrial and marine species, sustain the livelihoods of millions of people, and are priority habitats in climate change mitigation strategies. Mangroves forests are degraded globally, with land use change the most serious threat. Successful restoration/rehabilitation of mangrove forests is a major challenge in many countries, particularly in the Wallacea region. There is a critical information gap in understanding how successful these projects are in recreating diverse, resilient mangrove systems. This research investigated community-based mangrove restoration projects in Sulawesi, Indonesia. We compared plant-animal networks of the natural and restored mangroves, using direct observation and video data. We found that mixed-species hydrological restorations most closely matched the network structures of natural forest, while mono-species planted restorations were distinctly different. This finding has important policy implications, as mixed-species hydrological restorations are also more cost-effective, as they allow natural succession to regenerate the forest.

Room 2 Poster 1: Dulaney Miller

Galway Mayo Institute of Technology

Sara Fernandez, Luke E. Holman, Arjan Gittenberger, Alba Ardura, Marc Rius, Luca Mirimin

Development of environmental DNA (eDNA) metabarcoding protocols for the detection and surveillance of marine Non-Indigenous Species (NIS) in Irish coastal waters

Marine alien invasions pose a threat to an already declining global biodiversity. An essential step to the early detection and containment of these invasions is the establishment of effective monitoring programs. Environmental DNA (eDNA) metabarcoding is an emerging tool that, when used in conjunction with existing methods, leads to increased sensitivity and probability of early detection of Non-Indigenous Species (NIS). Initial validation is critical when developing eDNA approaches because of the effect of varying parameters (e.g. salinity, UV exposure, sediment composition) in environmental samples. In this study, twelve locations were chosen in four main areas around the Irish coast (Galway, Dublin, Waterford, Carlingford), where the effectiveness of detecting eDNA was tested across four independent field sampling methods (sediment, tow net, low-volume water filtration, and autonomous high-volume water filtration). Sampling using the tow net protocol proved

to be the most effective with a total of 256 Operational Taxonomic Units (OTUs) or 76.4% overall species detected. Sediment samples showed the least diversity recovering only 33.1% of the total OTUs followed by high-volume water filtration recovering 39.7%. Low-volume water filtration recovered the least amount of species specific to one method. The community recovered by tow net samples was richer in Annelida, Arthropoda, and Mollusca species compared to other sample types. Sediment samples detected the most species from Rhodophyta and Ochrophyta taxa. When looking at the species level, a total of 16 NIS were detected and varied among sampling methods. All methods detected NIS with four unique NIS recovered using the tow net and two unique NIS using sediment. These findings highlight the importance of optimization of eDNA pipelines before implementing long-term monitoring programs, as environmental parameters and the chosen sampling protocols can significantly affect the detection power of such techniques.

Room 2 Poster 2: Elena Aitova

National University of Ireland, Galway

Terry Morley, Florence Renou-Wilson

Maximising carbon sequestration using novel rewetting techniques and technologies at two former active raised bogs

Peatlands are unique ecosystems and despite covering only 3% of our planet, they store twice as much carbon as global forest cover. Over time, natural or intact peatlands act as a sink for greenhouse gases (GHG), but once they are degraded, they emit GHG to the atmosphere. Restoring our peatlands is now at the heart of high-level national and international climate policy. This project is part of a larger INTERREG project 'Care-peat' investigating ways to bring back peatlands functions and associated ecosystem services throughout Western Europe. The principal aim is to investigate the environmental response of two degraded Irish raised bogs to different restoration techniques expected to encourage the establishment of peat forming plant species. Restoration works at Cloncrow NHA (Co. Westmeath) include the installation of peat dams in drains and an innovative bunding technique which have never been implemented in the Republic of Ireland. We will measure environmental parameters and GHG emissions (CO₂ and CH₄) in both the rewetted and control 'drained' areas. At All Saints Bog (Co. Offaly), the effects of various inoculation treatments with Sphagnum mosses will be investigated. Using expertise from the Irish Peatland Conservation Council, treatments will include: straw cover, straw cover with Sphagnum inoculation, Sphagnum inoculation as well as control. Thirdly, we aim to link the GHG fluxes to vegetation signatures acquired by Unmanned Aerial Vehicle (UAV) surveys to improve GHG estimates at relevant management scales. Our research will enhance our understanding of carbon fluxes from drained and rewetted peatland, identify the potential of various restoration techniques for carbon emissions reduction and assist in evidence-base climate policy across Europe.

Room 2 Poster 3: Gabriel F. Tucker

Trees that 'aim' high: the conifer shade tolerance hypothesis

Trait-based analyses of plant fitness, including those addressing the fast-slow continuum hypothesis, are increasingly popular and accepted. However, a robust species-specific measure of the rate of plant growth is still lacking. I derived such a metric, median annual height increment, year 20-50 (MAHla20-50), from site index equations for 61 North American conifer and angiosperm tree species. A new database of species' maximum height (Hmax) was also compiled and both variables were

hypothetically regressed, one versus the other and each versus shade tolerance (Tshade), drought tolerance (Tdrought), and polytolerance (Tpoly = Tshade + Tdrought), plus wood density (SG), using the 'speed matrix', which leads to MAHla20-50 and the 'dominance matrix' leading to Hmax. Conifers alone, connect the two matrices with an extremely significant positive correlation ($H_{max} = 163.75MAHla20-30 - 3.12$, $P = 4.9E-10$, $r^2 = 0.71$). Multiple other novel findings involved significant correlations ($P < 0.95$) of the Tshade of conifers versus MAHla20-50 (positive correlation), Hmax (positive correlation), and SG (negative correlation). These results, in addition to those regarding the Tpoly of angiosperms, then led to the conifer shade tolerance hypothesis. It holds that shade tolerance, as a plant strategy, is disproportionately influential in conifers and could be considered the 'holy grail' for the evolutionary biology related to the vegetative function and structure of this relatively unique phylogenetic group of mostly monopodial evergreen trees; explaining much of their, frequently, superior growth and productivity, in comparison to angiosperm trees. The net primary productivity of different tree species will be a crucial factor for promoting carbon sequestration, as Ireland and other nations strive to meet goals for reducing greenhouse gas emissions to mitigate climate change and particularly under continuous-cover forestry using shade tolerant species.

Room 2 Poster 4: Gill Weyman

Dr Fidelma Butler, Dr Pádraig Whelan, Sean McKeown

UCC/Fota Wildlife Park

The Global Distribution of *Harmonia axyridis* and future impacts for Ireland

The harlequin ladybird (*Harmonia axyridis*) is an Asian ladybird that has been used in Europe as a biocontrol agent. As a result of deliberate introductions it has now become a successful invader (Camanch-Cervantes, 2017). *H. axyridis* was first introduced into Europe in 1982, where tests were undertaken in France for its use as a biological control agent. Several releases subsequently took place in France, Belgium and the Netherlands in the 1990s (Brown et al, 2008). Since then it has established in the wild and has been recorded in 35 European countries. In 2007, the first record of *H. axyridis* was recorded in Antrim, on fruit from a supermarket (Murchie et al., 2008). In 2010, the first records were reported in County Carlow and Cork City. It is now established in Cork city and records of larvae of *H. axyridis* in 2018 have been followed by an increase in reported occurrences. *H. axyridis* is the most recorded invasive ladybird species in the world. Records show that it is now present in most continents by Antarctica. The current trends suggest that *H. axyridis* will continue to spread in Ireland.

Room 2 Poster 5: Harrison J O'Rourke

National University of Ireland, Galway

Karen L Bacon

Predicting the extinction risk of Irish vascular plants using leaf traits.

Many plants species are being pushed to their survival limits by numerous threats, including climate change, habitat loss and invasive species. In recent years Ireland has experienced substantial cultural, societal and economic changes which have influenced the range, size and quality of the habitats that support its native vascular flora. This has led to the possibility that species may go extinct before their extinction risk is adequately assessed and fuelled the search for plant traits that allow the

extinction risk of a species to be accurately predicted in a time and resource-use efficient manner. Leaf traits were measured for the Irish flora from online herbaria samples and then compared with their national Red List threat status to identify correlations. These traits include leaf area, lobed or unlobed, compound or simple, toothed or entire margins, apex form, base form, length to width ratio, maximum leaf lamina length, and overall leaf shape. As several traits were measured for the same leaf a principal component analysis was undertaken using the “vegan” package in the statistical software R in order to explain the relationship between leaf traits and extinction risk. The distribution of species was also assessed according to their threat status. Maps were produced based on threat status to identify areas of Ireland where the species most vulnerable to extinction exist. These results will enable accurate estimates of extinction risk to be made for species which lack a detailed IUCN Red List assessment, help Ireland meet Target 2 of the Global Strategy for Plant Conservation, and allow conservation practices to be put in place within an acceptable timeframe for species most at risk from extinction. More broadly, the results obtained from this research may allow species most at risk from extinction to be identified for less well described floras, for example in the tropics, as it is feared that 40% of plant species are currently threatened with extinction.

Room 3 Poster 1: Karen L Bacon

National University of Ireland, Galway

Matthew Haworth; Jennifer C McElwain

Effects of sulphur dioxide exposure on leaf mass per area of selected gymnosperms and implications for interpreting the plant fossil record

The role of sulphur dioxide on plant responses to large igneous province volcanism is difficult to determine but important in relation to understanding ecosystem responses during mass extinction events. Leaf mass per area is an important leaf measure for tracking plant responses to environmental pressures in the fossil record, but how it responds to SO₂ exposure is unclear, particularly for non-angiosperm taxa. Five gymnosperm species were grown in simulated palaeoatmospheric conditions that included SO₂ to determine how the plants responded. All plants growth in high SO₂ showed a significant decrease in LMA compared to the control (with no SO₂). When grown in a high CO₂, low O₂ and high SO₂ treatment most plants continued to show a decrease in LMA compared to the control but an increase compared to the high SO₂ treatment with ambient CO₂ and O₂. These findings suggest that exposure to SO₂ significantly decreases LMA, potentially reducing preservation potential in the fossil record. Exposure to combined SO₂ and high CO₂ reduces this effect but this may also obscure the effects of SO₂, leading to interpretations that ecosystem instability is primarily driven by increasing CO₂, which may not be the case.

Room 3 Poster 2: Kerry B. Ryan

Teagasc and National University of Ireland Galway

Alexandre De Menezes, John A. Finn and Fiona P. Brennan

Understanding the effect of multi-species grasslands on the diversity and function of the soil microbiome for improving resource use efficiency and mitigating the effects of climate change.

Population growth is leading to the intensification of agriculture globally, driving the need for more efficient agricultural systems that enable increased, climate-resilient food production, while minimising environmental impacts. Multi-species grasslands have been shown to be more productive

and have greater nitrogen use efficiency than less diverse grasslands yet, it is less understood how they affect soil microbial diversity and function. This study aimed to provide a better understanding of how multi-species grasslands and climatic stress, affect the diversity and function of the soil microbiome. Soil samples were taken from a site; before and during a drought treatment, and 24 hours and 6 weeks after re-wetting. A series of functional assays (potential denitrification and nitrification, substrate induced respiration, decomposition, nitrogen mineralisation) were performed to investigate microbial potential nutrient cycling ability. Molecular assays assessed the abundance of phylogenetic and functional N-cycling microbial communities across treatments, and sequencing approaches were used to assess microbial community composition. Community function was found to be primarily affected by plant species presence rather than interactions between species. Potential nitrification and denitrification differed between species and drought treatments. Plantain monocultures had the lowest potential denitrification rates while leguminous monocultures had the highest rates of biological N mineralisation. The 16S *rRNA* bacteria gene was most abundant in chicory monocultures, whereas there was no difference in the abundance of the 16S *rRNA* archaea gene between monocultures. Fungi were most abundant in grasses. This work provides an enhanced understanding of the impact of aboveground diversity on belowground diversity and function, and of the potential use of diverse forage mixtures to enhance the resistance/resilience of soil microbial communities in response to climatic stress.

Room 3 Poster 3: Kieran Cowhig

UCC

Simon Harrison, Timothy Sullivan

Lake-dwelling freshwater pearl mussels (*Margaritifera margaritifera*) - A unique Irish phenomenon?

The freshwater pearl mussel *Margaritifera margaritifera* L. is critically endangered throughout its range. Direct pressure from pearl fishing and indirect pressures from river pollution and physical modification, has caused a steep decline in almost all populations, leading to extinctions in some countries. The optimal habitat for pearl mussels is almost universally described as well-oxygenated, fast-flowing oligotrophic rivers and streams. Although adults can tolerate a range of habitat conditions, juvenile mussels require extremely clean waters with little or no anthropogenic impacts. Very few if any rivers currently support self-sustaining pearl mussel populations in Ireland due to poor juvenile recruitment. We report here the discovery of a large population of freshwater pearl mussels living at between 1m and 8m depth in an oligotrophic lake in southwest Ireland. Within the lake, pearl mussels were found in two contrasting habitats - a relatively shallow (ca 1m) stretch of lake littoral, and a more extensive benthic area of 2-8m depth. The maximum depth at which a living pearl mussel was found was 9m - to our knowledge the greatest depth yet described for this species. We estimate that the population of *M. margaritifera* in the lake is between 150,000-200,000 individuals. This constitutes a significant proportion of the known pearl mussel population in Ireland. We observed occasional juveniles (ca 1cm length) within the population, indicating that at least some juvenile recruitment is occurring. Our discovery of Irish lake-dwelling freshwater pearl mussels challenges our current understanding of the biology of *M. margaritifera*, and suggests that Ireland may represent a unique and special part its worldwide range.

Room 3 Poster 4: Kristina Steinmetz

GMIT

Izzy Langley, Emma Hague, Proinsias Herson, Luca Mirimin, Oliver Ó'Cadhlá, Sinéad Murphy

Improving harbour seal (*Phoca vitulina*) photo-identification based monitoring in Irish Special Areas of Conservation (SACs) via the use of the semi-automated pattern recognition software ExtractCompare

Requirements under the Habitats Directive necessitate Member States to carry out extensive monitoring within SACs and to take measures towards the protection of species both within and beyond designated SACs. One well established, cost-effective and non-invasive method for monitoring protected species is the use of photo-identification capture-mark-recapture techniques using natural markings. With the development of computer-aided software for pattern recognition, such as ExtractCompare, the current study assessed the applicability of this photograph matching system for monitoring harbour seals within Irish SACs. Photographs, taken within the Lambay Island SAC on six days during May 2017 using DSLR cameras at a distance of >150m to seals, were assessed for parameters stated hereafter, and individuals were manually matched prior to software evaluation. Test catalogues of 30 individuals were created in ExtractCompare using images of the head, neck and flank area separately, and 20 known matches and 20 known non-matches were used to assess pattern recognition. Performance was assessed with regards to the following parameters: area (head, neck, flank), angle of the photograph, percentage of obstructed area, pelage pattern (light, dark, intermediate), and pelage state (wet, dry, mixed). False rejection rates of ExtractCompare were low (0.2-0.3, correct identification was considered for a match displayed within the top 10 ranks), and no parameter was found to significantly impact correct matching on rank 1. However, pelage state was found to significantly affect matching within the top 5 ranks ($p=0.04$), indicating that the algorithm may have difficulties comparing pattern extracts (e.g. dry vs. wet or mixed pelage). Findings show that ExtractCompare is suitable for identifying individual harbour seals using photographs of the head, neck and flank - though flank images were difficult to obtain - enabling assessments of abundance and habitat use using such techniques.

Room 3 Poster 5: Linzi Jay Thompson

University College Dublin

Jane Stout & Dara Stanley

Effects of Colony Level Exposure to Non-Insecticidal Pesticides on the Bumblebee *Bombus terrestris*

Fungicides and herbicides are pesticides designed to target non-insect pests, including fungal diseases and plants. They are some of the most bought and applied pesticide groups, globally, being commonly used in agriculture, landscaping and for domestic pest control. Since these pesticides are not designed to target insects, they have generally been considered safe however increasing research suggests that fungicides and herbicides could have potentially harmful effects on non-target organisms, including bees. Sub-lethal doses of some pesticides have been found to alter important bee behaviours, such as their ability to forage and learn, which could be contributing to pollinator declines. Therefore, more research is required to understand how and why fungicides and herbicides could be causing harm to non-target organisms, so that appropriate mitigation strategies can be developed to ensure future sustainable pesticide use. In this study, commercial colonies of *Bombus terrestris* were chronically dosed with either the fungicide prothioconazole or the herbicide

glyphosate, based on field realistic residue data. Colonies were then placed in green spaces and allowed to forage freely whilst their growth and activity levels were monitored for a 4-week period. Here we show the preliminary results showing differing effects of both pesticides - including trends in foraging activity, colony production and reproductive output.

Room 4 Poster 1: Maria McGuinness

University College Cork

Hannah Brownlow, Katie E. Costello, Rob McAllen, Thomas K. Doyle

Hidden in plain sight: phoronid worms more abundant than previously thought.

It is often the case that the more charismatic and economically important a species is the more likely it is to be studied. However, this taxonomic chauvinism leads to many other species being overlooked. The horseshoe worm, or phoronid, is a classic case of this. Thought of as a cosmopolitan species with a worldwide distribution, there is little research on its actual occurrence, abundance and geographical distribution. Its presence has been noted in Ireland, but to our knowledge, there is no in-depth analyses of its presence. In this study, data on the occurrence, abundance and distribution of the horseshoe worm in Ireland are presented for the first time. Initially this study set out to examine gelatinous zooplankton occurrence, however, upon the discovery of a phoronid larvae in one sample, this triggered a re-examination of other samples to assess the abundance of this seemingly rare worm. What we found is that they are much more common than we had previously thought. The phoronid worm was found to occur in three sites along the southwest coast of Ireland - the Celtic Sea, Lough Hyne marine reserve and Bantry Bay. *Phoronis* sp. were seen to occur throughout the summer months, from May to September, with abundances ranging from 0.25 individuals per m³ to a high of 6.12 individuals per m³ in Lough Hyne. These densities are similar or equal to those of fish larvae encountered in Lough Hyne samples. Given that these three sites show varying ecological characteristics, it is likely that the phoronid is present in many other sites along the Irish southwest coast. This study demonstrates the influence that our innate biases have on the choice of species we study and that many species may be overlooked simply because we ourselves have never seen them before.

Room 4 Poster 2: Micheál Fitzgerald

University College Cork

Dr Mark Jessopp, Dr Sharon Lynch

Stress levels and body mass of chick rearing northern gannets (*Morus bassanus*) vary significantly throughout the nesting season.

Seabird populations are currently in global decline, with approximately 30% of species now listed as threatened. Higher predators such as seabirds are useful indicators of ecosystem health, and an improved understanding of the condition of seabird populations, and how this varies over time, for example throughout the breeding season, would be of value to the conservation of marine ecosystems. Haematological analyses can provide an effective means of assessing animal health, for example by quantifying stress levels and identifying pathogens, and in conjunction with other methods, such as body mass measurements and hormone assays, can provide insight as to the condition of individual birds, and thus populations. This study used haematological methods in conjunction with body mass indices and measurements of circulating stress hormones, to assess the

condition of breeding northern gannets (*Morus bassanus*), at three distinct stages throughout the 2020 nesting season. Using the heterophil to lymphocyte ratio of birds as a measure of stress, differences were found in the stress levels of chick rearing individuals between nesting stages. Gannets were found to be most stressed in July, when provisioning for recently hatched chicks, compared to June when birds were incubating eggs, and September when fully grown chicks were fledging. This pattern was mirrored by the body mass of the birds, and it is predicted that such a trend will also be exhibited in concentrations of the stress hormone corticosterone, to be quantified using an ELISA assay. The results of this study provide novel insights into the changing condition of northern gannets during the nesting season, with implications for their conservation, for example, allowing future studies involving the capturing of these birds to do so in such a way that will minimize the negative impacts upon them.

Room 4 Poster 3: Nicole Todd

University College Cork

Mark Jessopp, Emer Rogan, Ailbhe Kavanagh

Investigating the spatio-temporal dynamics of harbour porpoise foraging behaviour using passive acoustic monitoring

Understanding the distribution of marine mammals is important for effective conservation through designation of protected areas as required under European and National legislation. However, identifying high-use areas using at-sea surveys, biologging, or visual monitoring often fails to differentiate between areas used for activities such as breeding, feeding, or resting. Protecting the 'wrong' areas (e.g. transit areas as opposed to important feeding areas) could result in ineffective measures being implemented, undermining faith in conservation initiatives. For echolocating species such as dolphins and harbour porpoise, passive acoustic monitoring can be used to determine patterns of occurrence as well as identify feeding activity through classification of feeding buzzes, where prior to a prey capture attempt, the rate of echolocation clicks drastically increases. We use a nine-year acoustic data set from Broadhaven Bay, Co. Mayo, to examine the occurrence of foraging behaviour of harbour porpoise and investigate habitat characteristics associated with it. Feeding activity was found to vary both seasonally and interannually, with a greater proportion of buzzes recorded in autumn and winter months. Within the bay, areas of greater importance for feeding were identified by examining the proportion of feeding buzzes within periods where echolocating porpoises were detected. Strong diel foraging patterns were also detected throughout the bay, with 59% of buzzing activity recorded at night. Tidal state was not shown to have an effect on foraging activity, suggesting that spatio-temporal dynamics of prey are a much stronger driver than local environmental conditions. The approach used here was successfully employed to identify important foraging habitats for harbour porpoise, and can be implemented for multiple species and locations resulting in more effective designation of protected areas.

Room 4 Poster 4: Robert Runya

Ulster University

Chris McGonigle, Rory Quinn, Alex Callaway

Modelling the spatial distribution and habitat suitability of sand eels *H. lanceolatus* in multijurisdictional linked habitats of Ireland and United Kingdom

Acoustic mapping is central to providing wide-reaching information about the geographical range and extent of features and habitats on the seafloor with wider applications in various disciplines including geology, hydrology, and military. However, the ecological use of multibeam bathymetry and backscatter data has been hampered by the lack of temporally coincident ground truth data, poorly calibrated acquisition systems and the differences in resolution between acoustic and ground truth data. In this study, we assess the spatial distribution, structure, and habitat suitability of sand eels in an area with a strong geomorphological gradient at the Hempton's Turbot Bank Special Area of Conservation (SAC). Hempton's Turbot Bank is a relatively shallow sandbank (20-70m) that is a habitat for sand eels (*Hyperoplus lanceolatus*), a critical forage fish species that support predatory seabirds, piscivorous fish and marine mammal populations. Besides, *H. lanceolatus* is closely linked to sandy substrates into which they bury to protect themselves from predators. The fine scale horizontal distribution of this particular species is not well understood owing to limited availability of high-resolution data. In this current study, we combine multifrequency (30, 95, 300-kHz) backscatter and sediment grain size data as abiotic proxies to model the densities of *H. lanceolatus* across a range of spatial scales, making inference about their habitat preference with respect to substrate. We further examine the volume scattering response of sand eel densities and whether a frequency dependence for discriminating this sand eels exists. Our final results will be synthesized into a fine-scale sand eel model of distribution and density showing suitable habitats that favours post-larval settlement. Information and recommendations derived from this study will enhance the ecological value of backscatter data as a tool for monitoring and managing biodiversity in marine protected areas.

Room 4 Poster 5: Sara Albuixech-Martí

University College Cork

Sharon A. Lynch; Sarah C. Culloty

“Co-occurrence of complex parasite assemblages in the cockle *Cerastoderma edule* in the Irish coast”

Coinfections by different parasites occur frequently in many shellfish, including cockles, and their interactions may have a dramatic effect on disease susceptibility. However, certain parasites may co-occur more frequently than expected simply because the same factors promote their presence, not because they are interacting synergistically. This study examines the diversity and prevalence of parasites well-known to cause bivalve mortalities -Haplosporidia, *Vibrio* spp., Ostreid herpesvirus type 1 (OsHV-1) and Microsporidia- as well as the associations of the different infectious agents at an individual and population level in *Cerastoderma edule* along the Irish coast. The role of abiotic (temperature and salinity) and biotic (cockle size and age) factors in the risk of coinfection is also assessed. Cockles (735) from the intertidal were sampled from April 2018 to April 2019 at three sites with no commercial fishing activity on the south coast (Celtic Sea) and one site on the northeast coast (Irish Sea) with an active commercial fishery. Screening of the cockles by molecular techniques and by histopathology was carried out. Haplosporidia was the most frequent pathogen group detected in the study (37.7%), followed by *Vibrio* spp. (25.3%). However, no Microsporidia nor OsHV-1 were detected. Coinfections with haplosporidian and *Vibrio* species in wild and fished *C. edule* populations were detected throughout the year. Nevertheless, single infected individuals were more common than coinfecting individuals (9.5%), which may more easily succumb to parasite load. Being the anthropogenic disturbances, the seawater temperature, as well as the host condition, pointed as potential confounding factors triggering the co-occurrence of both parasites in the cockle populations through the year. These results highlight the complexity of the parasite assemblages within a host, which are the product of processes occurring not only within individual hosts but also across space and over time.

Room 5 Poster 1: Shane Somers

University College Cork

Gabrielle Davidson, Niamh Wiley, Crystal Johnson, R. Paul Ross, Catherine Stanton, John Quinn

Host and Environmental Drivers of great tit gut microbiome - contrasting development across habitats

That phylogeny and local environment drive broad patterns of microbiome community assembly has been established, however there are a wide variety of other factors that play a role which must be determined if we are to elucidate the functional, and hence evolutionary, significance of host-microbe interaction. Understanding the timing and patterns of microbial colonisation during development is important as timing is critical for certain developmental processes and hence host fitness. The timing of microbial exposure and colonisation during key developmental windows affects adult phenotypes. The gut microbiome may additionally increase its host fitness due to its plastic nature, by facilitating the rapid acclimation or adaptation of the host to its environment. This study set out to examine the influence of different habitat types on the development of the gut microbiome of the wild great tit, as well as other host and environmental factors.

Room 5 Poster 2: Simon Harrison

University College Cork

Tim Sullivan, Brendan McSorley

Dumbing down to scale up? A novel biomonitoring protocol for non-experts - the Citizen Science Stream Index.

Despite 2-3 decades of the European Nitrates and Water Framework Directives, the water quality of many of Ireland's river and lakes remains stubbornly unsatisfactory. The cause is largely due to inputs of nutrient-rich organic matter of agricultural and municipal origin. Despite this depressing state of affairs, the vast majority of Ireland's waterways - especially smaller streams - are not routinely monitored in terms of water quality. A spatially-extensive biomonitoring programme involving non-expert citizens would provide valuable data on how - and where - streams are being polluted. It would also give citizens a much greater stake in the quality and health of the streams in their neighbourhood. Current biomonitoring protocols - even those targeted at non-experts - require advanced levels of taxonomic expertise, which are likely to discourage citizens from engaging in the important issue of local stream water quality. Here we report on the development of a Citizen Science Stream Index (CSSI) - a simplified macroinvertebrate biomonitoring protocol, based on a small number of commonly occurring, easily identifiable and distinct taxa that are strong indicators of clean or polluted waters. We show that despite the basic nature of the protocol, it relates well to other more complex and established schemes. We believe that the CSSI can be a practical and important tool in the effort to improve water quality in Ireland.

Room 5 Poster 3: Tapiwa Nyakauru

Waterford Institute of Technology

Catherine O`Reilly, Orla O`Donovan, David O`Neill.

An investigation into the genomic and proteomic effects of heavy metal exposure to the hyperaccumulator plants *Eichhornia crassipes* and *Pistia stratiotes*.

Water quality refers to the chemical, physical, and biological state of water with respect to its suitability for a particular purpose. Water pollution refers to the degradation of water quality by chemical, physical or biological contaminants. Heavy metals are natural components of the earth's crust and can be involved in water pollution. Heavy metals such as copper and lead can enter water bodies as a result of anthropogenic activities such as mining and industrial discharge, or through natural processes such as weathering of rocks. Heavy metal pollution has a negative impact on the ecological status of water bodies around the globe and can result in a loss of ecosystem diversity. The metals can accumulate in tissues of fish and aquatic plants, and can lead to organ dysfunction in humans. Water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*) are aquatic plants native to South America and have the capability of accumulating heavy metals to levels that are thousands of times greater than other plants, thereby reducing heavy metal pollution in water bodies. In plants, proteins such as enzymatically-synthesized phytochelatin (PCs) and gene-encoded metallothioneins (MTs) are involved in heavy metal accumulation. However, PC Synthase (PCS) genes, required in PC synthesis, and MT genes have not been intensively characterized in both plants. The aim of this research is to improve our understanding of the molecular mechanisms that take place during heavy metal accumulation in both plants. The work presented here outlines the design, optimization and application of conventional PCR tests to detect putative, novel PCS and MT genes in *E. crassipes* and *P. stratiotes*. Novel real-time PCR tests targeting these sequences and suitable endogenous control genes were also developed and optimised for relative quantification of up/down regulation of these putative novel genes in the study plants under heavy metal exposures.

Room 5 Poster 4: Thomas Curran

Allan McDevitt, Samuel Browett, David O'Neill, Ignacio Ruiz Arrondo, Barry John McMahon, Aidan O'Hanlon, Catherine O'Reilly, Andrew Harrington, Denise O'Meara

Molecular identification of mosquitoes from direct and indirect sources of DNA

Insects are pivotal to life on Earth as they aerate soil, pollinate plants as well as control pests; contributions known as ecosystem services. Insects can also be a cause of concern, particularly those that are vectors for disease such as some of the 3500 species of mosquitoes that occur worldwide. Across Europe, cases of mosquito-borne diseases have been recorded and are associated with changes in climate, land use, urbanisation, trade and travel. It is important to monitor mosquitoes to create informed mitigation measures in advance of potential disease outbreaks. Identification of mosquitoes typically involves morphological identification of larvae and adults which requires a high level of skill and expertise, particularly for similar species, resulting in potential ambiguity for species identification. DNA-based identification methods can overcome some of these difficulties, while also having the potential to be applied to environmental samples containing traces of mosquito DNA. In this study, we demonstrate the application of DNA technology to identify mosquitoes directly from adults and larvae and indirectly from the diet of a mosquito consumer, the lesser horseshoe bat (*Rhinolophus hipposideros*) using a combination of DNA-based techniques including Sanger sequencing, DNA metabarcoding, and real-time PCR. We discuss the development and application of

each technique to different DNA sources and how the combination of these molecular techniques can be used to monitor mosquito distribution and diversity.

Room 5 Poster 5: Willson Gaul

University College Dublin

Dinara Sadykova, Hannah J. White, Paul Caplat, Jon M. Yearsley

Modeling the distribution of rare millipedes in Ireland

We used opportunistic biological records to model the distributions of millipede species in Ireland. Biological records contain few observations of rare species and many observations of common species, resulting in strong “class imbalance” in the data. This class imbalance can make it difficult for predictive species distribution models (SDMs) to correctly predict new observations of rare species. We tested a recently proposed method to simultaneously improve class balance and reduce spatial bias in the data using “spatial under-sampling” to sub-sample data using a spatial grid. This method was previously tested with large bird datasets, but our application to millipedes uses a dataset an order of magnitude smaller. Spatial under-sampling improved prediction performance for rare millipede species in Ireland, but not for common species. Our SDMs of rare millipede species “fill in the gaps” about species distributions in poorly sampled regions of Ireland, and provide information about the seasonal phenology and location of rare millipede species, which can inform future surveys for these species. Our results demonstrate that spatial under-sampling can improve predictive SDMs even when datasets are small, as is often the case for invertebrates and other un-charismatic taxa. SDMs using spatially under-sampled data can improve knowledge of rare invertebrates and can contribute to the evidence needed for red listing and other conservation assessments.

FRIDAY 8TH JANUARY

TALKS: MORNING SESSION

09:00 Plenary: John Finn

The Ecology of Multi-species Swards for Agricultural Production

09:40-11:00

James Orr

Trinity College Dublin

Dr. Jeremy J. Piggott, Dr. Andrew Jackson, Dr. Jean-François Arnoldi

Why scaling up uncertain predictions to higher levels of organisation will underestimate change

Uncertainty is an irreducible part of predictive science, causing us to over- or underestimate the magnitude of change that a system of interest will face. In a reductionist approach, we may use predictions at the level of individual system components (e.g. species biomass), and combine them to generate predictions for system-level properties (e.g. ecosystem function). Here we show that this process of scaling up uncertain predictions to higher levels of organisation has a surprising consequence: it will systematically underestimate the magnitude of system-level change, an effect whose significance grows with the system's dimensionality. This stems from a geometrical observation: in high dimensions there are more ways to be more different, than ways to be more similar. Here we will focus on the ecological implications of this effect. We apply our theory to predictions of change of the functioning, diversity and stability of ecosystems and we explain that scaling up predictions of the combined effect of multiple stressors can introduce bias towards synergism. However, these counter-intuitive dimensional effects, causing us to underestimate system-level change, will occur in any field of science (e.g. economics, demography, finance) where a reductionist approach is used to generate predictions.

Joshua P Twining

Queen's University, Belfast

Montgomery, W. Ian, Reid, Neil, Marks, Nikki, Tosh, David G., Scantlebury, M.D.

All forests are not equal: population demographics and denning behaviour of a recovering small carnivore in human modified landscapes

Landscapes occupied by recovering carnivore populations in Europe are highly modified by human activity. It is unclear how recovering predators will adapt and sustain populations in highly altered landscapes, with most existing research focused on large carnivores. To address this we contrast population demographics and denning behaviour of a small carnivore, the pine marten *Martes martes*, in a semi-natural wooded landscape and a human-modified landscape with limited forest cover composed of conifer plantation, using radio-telemetry on 20 free-ranging individuals in Northern

Ireland. In the semi-natural landscape, martens selected old growth, native forest making almost exclusive use of arboreal dens in living trees and standing deadwood. Martens persisted in the human-modified landscape but with lower population density and recruitment, with a male-biased sex ratio. In the human-modified landscape martens denned in marginal habitats such as scrub, heath and property boundaries, while making use of subterranean or man-made structures for dens in response to a lack of above ground denning opportunities. We demonstrate landscape change-induced differences in behaviour and population structure in a recovering carnivore. The results highlight the importance of evaluating the availability of denning sites in carnivore conservation and provide valuable management considerations, key to mitigating human-wildlife conflict as carnivores continue to recover and recolonise Europe.

Adam Kane

University College Dublin

Darío Fernández-Bellon

The role natural history films play in conservation

The natural world is collapsing all around us, yet our increasingly urbanized society is so disconnected from this world - an extinction of experience - that we hardly seem to notice. This is a disastrous mix given the importance of functioning ecosystems to our survival. Thus, it is vital to reconnect people with nature before it is lost. Natural history programmes appear to offer one route to showcasing the plight of the natural world but, their critics contend, these shows tend towards the spectacular, painting a pristine view of nature that is far from reality. We dissect one of the most popular natural history documentaries ever made, BBC's Planet Earth 2, and ask how it affects its audience. We set out a framework of public reaction and engagement that can be measured through activity at online resources such as Twitter and Wikipedia as well as donations to conservation charities. We show that, although there are few explicit conservation messages, Planet Earth 2 does stimulate its viewers to discuss and learn more about the species it presents. Time dedicated to a species on screen drives this signal and it persists for months after the documentary has aired. Though conservation donations are not affected, our results suggest nature documentaries provide their audiences with a vicarious appreciation of nature, an essential step to reconnecting us to the natural world.

Amy Arnott

Queen's University Belfast

Mark Emmerson, Paul Caplat, Gillian Riddell, Neil Reid

Upland grassland agri-environment schemes affect the abundance, diversity and function of above- and belowground invertebrates

Agricultural grasslands are the main target for EU subsidized agri-environment schemes (AES), designed to prevent biodiversity loss. Landscape-wide agricultural intensification has led to fragmentation of natural habitats. Marginal upland areas support a wide range of taxa with invertebrates delivering ecosystem services including decomposition, nutrient recycling, pollination, and pest biocontrol. Thus, invertebrates are particularly suited as bioindicators to monitor the impact of agricultural management not least because they encompass a wide range of trophic guilds and functional groups with rapid generation times capable of indicating impacts of short-term effects in management change. Upland grasslands are disproportionately impacted by intensification including

drainage, artificial fertiliser use, soil compaction, and erosion. This study used a spatially paired factorial experimental design to examine patterns in terrestrial invertebrate abundance and functional diversity between upland improved and semi-improved grasslands under AES or conventional management (n=90 fields). We show that AES management of upland grasslands was associated with higher terrestrial invertebrate richness in pitfall traps compared to conventional management. In contrast, aerial invertebrate abundance from sticky traps was unrelated to management; however, total aerial invertebrate SDI and detritivore SDI were significantly higher under AES management. For belowground taxa, the impact of AES measures on soil biota were context-dependent (differing between contrasting grassland types), and taxa specific, rather than leading to general increases in biodiversity *per se*. The responses of soil microarthropods were driven by environmental variation caused by overall management of grassland fields. This research provides recommendations for future agri-environment scheme measures to maximize biodiversity and ecosystem service delivery.

Francesco Golin

Galway-Mayo Institute of Technology

Dr. Katie O'Dwyer

The ecological and economic impacts of parasites: the case of *Bopyrus squillarum* and the Irish *Palaemon serratus* fishery

The shrimp fishery of Ireland is an important source of revenue for local fishermen. *Palaemon serratus* is the target species, and population stability is expected to heavily rely on recruitment due to isolated populations. The limited knowledge we have on the processes that regulate *Palaemon serratus*' population size combined with local exploitation and limited conservation measures have sparked worries about the sustainability of the fishery. Another important impact on shrimp population stability may be posed by the parasite *Bopyrus squillarum*, observed to reach high prevalence rates in Irish shrimp populations. This parasite renders shrimp sterile, thus having a direct negative impact on recruitment. It also adds weight to the produce and creates a lateral swelling on the carapace, aspects that increase the shrimp's price, making it heavier and displacing smaller shrimp to higher price grades due to the parasite-induced swelling. In order to examine *B. squillarum*'s ecological and economic impact, samples of shrimp were collected from six different localities across the west coast of Ireland. The results show a negative correlation between parasite prevalence and the percentage of berried females per site, providing evidence for interrupted *P. serratus*' recruitment in the presence of high levels of *B. squillarum*. In addition, *B. squillarum* influences *P. serratus* produce price, leading to an estimated 5% increase on landings' value. In conclusion, *B. squillarum* has the potential to impact *P. serratus*' recruitment in several ways, and with direct economic consequences. These findings will pave the way for evidence-based population management of *P. serratus*' and focused assessments on the economic impact of *B. squillarum*.

Hannah White

Trinity College Dublin

Robin Pakeman, Yvonne Buckley

Contribution of rare and common species to spatial patterns of functional diversity

Within macroecology, we are still uncertain how the distribution patterns of individual species contribute to overall biodiversity patterns, particularly functional diversity (the diversity of ecological traits present within a community). Although multiple studies show that common species contribute more widely to patterns of species richness than rare species, their relative contribution to patterns of functional diversity has never previously been explored. Using a multiscale survey of plants from the Machair system on the Western Isles of Scotland, I show that common species contribute disproportionately to local spatial variation of both functional diversity and species richness. This approach highlights the species that may be adequate indicators of biodiversity patterns, which will facilitate targeted surveying and trait data collection, and will, ultimately, contribute to our understanding of the distribution of functional diversity in space.

Michelle Larkin

Dara. A Stanley

Insights into the ecology of a rare species (*Bombus sylvarum* L.) within a wider bumblebee community

Ecological communities consist of common and rare species. In order to develop conservation actions to protect rare species, it is important to understand both their ecology and how their ecological requirements compare to coexisting common species. Here we use a case study of a nationally rare bumblebee, *Bombus sylvarum*, to compare general ecology in comparison to common bumblebee species to inform the development of conservation strategies. The habitat and foraging preferences of *B. sylvarum* were investigated in relation to three common bumblebee species (*B. lucorum agg.*, *B. lapidarius* and *B. pascuorum*). Bumblebees were sampled from April-October 2018 in the Burren Region in Ireland using transects across nine sites, which represented a variety of different habitats. *B. sylvarum* exhibited a preference for semi-natural calcareous grassland while the common species were ubiquitous across all habitat types. Interestingly, while *B. sylvarum* did display floral preferences, these preferences did not differ significantly from common species. These results highlight the importance of semi-natural calcareous grasslands for the conservation of this rare bumblebee as well as facilitating their coexistence with more common species.

Rosie Mangan

University of Stirling

Matthew Tinsley, Luc Bussière

Fluctuating selection and enhancing diversity to overcome insecticide resistance evolution.

The rapid evolution of resistance to synthetic insecticides is a fascinating example of an unintended evolutionary response with significant consequences for global food security. Limiting the emergence and spread of insecticide resistance is challenging. Consistent and homogeneous use of crop protection products in agricultural cropping systems can generate strong directional selection driving rare resistance genes to spread rapidly through pest populations. Despite extensive research on insecticide resistance management, resistance remains a serious escalating problem. To combat resistance evolution and the ecological damage associated with some synthetic insecticides there is an urgent need for new pest control technologies that conserve our natural environments while sustainably safeguarding crop protection. Biopesticides offer one potential solution as they often have higher target specificity and have been argued to be less likely to drive resistance evolution in pests. Here, we present new data demonstrating the potential of pests to evolve resistance to fungal biopesticides; then we propose a new approach to sustainable pest management that minimises the

likelihood of resistance evolution. We investigated how multiple fungal biopesticide strains could be used in a spatial matrix across agricultural landscapes, so that selection for resistance varies in different locations, preventing a uniform evolutionary response in the direction of pest resistance. We demonstrate that resistance selection is inconsistent between fungal isolates, furthermore, when these isolates are applied to pests feeding on different crop species, resistance evolution is further constrained. This provides exciting evidence that heterogeneous agricultural landscapes could prevent rapid biopesticide resistance evolution even if these agents are used intensively.

John Devaney

Maynooth University

Diatta Marone, Jennifer C. McElwain

The impact of soil salinity on mangrove forest restoration in a semi-arid region

Along tropical, sub-tropical, and semi-arid coastlines mangrove forests provide multiple ecosystem service benefits to local communities, including fisheries maintenance, wood production, and storm/tsunami protection. Ongoing losses to mangrove forests globally have prompted increased interest in restoration programs that seek to restore these vital ecosystem functions and services. However, in many cases, data on local-scale environmental tolerances of mangrove species used in reforestation efforts is lacking, and failure of restoration projects has been attributed to incorrect species selection in plantations. Funded through the Irish Research Council/Marie Skłodowska-Curie Actions CAROLINE programme, Future Mangroves is an interdisciplinary project that aims to assess impacts of climate change on mangrove forests in semi-arid regions and inform sustainable management of mangrove forests. In collaboration with the Mary Robinson Foundation for Climate Justice, the Senegalese Institute for Agricultural Research, and local community groups, we assessed the impact of soil salinity on the early establishment success of monospecific red mangrove *Rhizophora mangle* reforestation projects in the Saloum Delta, Senegal, a region where widespread mangrove restoration efforts are ongoing. At soil salinities 60 ppt, stomatal conductance, photosystem II (PSII) operating efficiency, and growth of planted *R. mangle* seedlings were severely reduced. Similarly, after 1 - 3 years, survival of mangrove seedlings decreased in soil salinities of 60 ppt. In contrast, we recorded naturally occurring black mangrove *Avicennia germinans* growing in hypersaline conditions (90 ppt), representing some of the most saline vegetated ecosystems on earth. The findings reported herein can be used to inform species choice in reforestation projects and help improve success rates of coastal wetland restoration projects in semi-arid regions.

Joshka Kaufmann

BEES, UCC

Sarah Ryan, Jamie Coughlan, Karl P. Phillips, Fintan Egan, Elizabeth Ryder, Catherine Waters,
Ronan Grealis, Caroline Bradley, Paulo Prodöhl, Philip McGinnity

Deviation from Fisherian sex ratio in domesticated Atlantic salmon

The evolution of sex ratio is a major question in evolutionary ecology. Fisherian (actually Darwinian) sex ratio theory predicts that natural selection will lead to equal sex ratio and equal investment in males and females. Parents can, however, adaptively adjust offspring sex ratio depending on their condition. In Atlantic salmon, smolt and adult sex ratios have been shown to vary between and within populations but nothing has been reported about primary or secondary sex ratio. Using a

microsatellite marker at the master sex genetic determination locus, we investigate the sources of variation in secondary sex ratio in wild and domesticated Atlantic salmon, putting fundamental evolutionary biology theories to the test. In domesticated animals, industrial artificial selection pursuing the development of commercial viable strains might have disrupted the equilibrium imposed on offspring sex ratio by natural selection. Using a reciprocal cross design between a native Irish population and an artificially selected domesticated stock, we assessed sex ratio in 50 half-sib families for 1149 alevin. We associated sex-ratio to egg and embryo mortality, relative female reproductive investment and genetic variation at the family and origin level. Overall, sex ratio is at Fisherian equilibrium (1:1) but pure domesticated families produced significantly more males than other families. Substantial variation in sex ratio stems from genetic variation within and across genetic origins, confirming a central tenet of adaptive sex ratio theory. Trivers-Willard hypothesis was partially supported as maternal condition did not significantly affect sex ratio whereas investment towards increased body condition in the rarer sex was found in wild but not domesticated families. We demonstrate for the first time that secondary sex ratio in Atlantic salmon is at equilibrium but that domestication selection can alter this natural equilibrium.

POSTERS:SESSION TWO

Room 1 Poster 2: Beverly Genockey

Trinity College, Dublin

Marcus Collier, Yvonne Buckley

Exploring the Suitability of Abundant Urban Plant Species for Use as Nature-Based Solutions.

This project aimed to determine abundant urban plant species across Dublin City in order to infer these species' suitability for use as nature-based solutions. Nature-based solutions is a newly-proposed concept for simultaneously regreening cities through the use of nature to combat socio-environmental and climate-related problems. Surveys of urban flora were carried out at ten sites across the five administrative boundaries of Dublin City council in order to determine the most abundant species. These species were then further analysed in terms of the ecosystem services that they provide to infer how these ecosystem services can be suitably engineered to implement nature-based solutions. Upon completion it was determined that of the 23 most abundant species studied, 87% provided provisioning ecosystem services as their primary use, with 26% and 17% providing regulating and cultural services, respectively. In the cases where primary uses aligned with multiple ecosystem service groups, the species was allocated to all relevant groups. These ecosystem services were then examined based on their potential to implement nature-based solutions on a scale ranging from fine scale implementation through to local and city-wide implementation, examples of which were considered for each ecosystem service provided. Project funded by the Laidlaw Undergraduate Research Leadership Programme.

Room 1 Poster 3: Darío Fernández-Bellon

MKO Research, MKO, Galway

Limited accessibility and bias in wildlife-wind energy knowledge: A bilingual systematic review of a globally distributed bird group.

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

Room 1 Poster 4: Dennis van der Pouw Kraan

Galway-Mayo Institute of Technology

Conor Graham, Fiona Kavanagh, Luca Mirimin

Revolutionising monitoring with a novel technological approach for rapid and cost-effective DNA-based bioassessment.

In order to cultivate effective and sustainable management strategies, it is essential to systematically review and understand the trends in distribution and population of different taxa. Bioassessment of some taxa is severely hampered due to conventional methods that are reliant on morphological identification. It is time-consuming, labour-intensive and expensive to monitor; cryptic taxa, micro-organisms, difficult life stages (e.g. larvae), and rare/endangered species, which poses significant constraints to monitoring programs. The rate of current data acquisition is often not appropriate to effectively serve national management strategies (Harnessing Our Ocean Wealth) and international obligations (e.g. Water Framework Directive, Marine Strategy Framework Directive). The newly proposed European Green Deal Biodiversity Strategy highlights the importance of using genetic resources linked to biodiversity. Emerging technological advances that support DNA-based methodologies to identify species, show great promise in corroborating existing bioassessment programs. While high-throughput-sequencing is the focus of modern biomonitoring, microfluidic platforms have received little attention in this context. The Biomark™ HD (Fluidigm) system, uses microfluidics technology to process DNA-samples at nanoliter-scale volumes. This system enables the quantification of up to 96 different DNA targets, in up to 96 samples in as little as 4 hours. Recently this novel technological approach showed to be effective in the screening of plankton samples for crustacean and bivalve larvae around the Irish Coast. Due to the ubiquity of DNA, molecular techniques are highly transferable between organisms, making this approach useful for many other taxa. This novel technological approach has the potential to revolutionise monitoring by providing unprecedented amounts of data, that can play a critical role in evidence-based conservation and management strategies.

Room 1 Poster 5: Emma Gray

Galway-Mayo Institute of Technology

Giovanni Cappelli, Martin Gammell, Cillian Roden, Heather Lally

Using multiple biological indicators to characterise and monitor the conservation condition of oligotrophic lakes in Ireland

The ecological conservation status of protected oligotrophic isoetid (3110) lakes is bad and inadequate for acid oligotrophic (3160) lakes in Ireland under the European (EU) Habitats Directive. Currently limited information exists on the baseline ecological conditions of these lake types which hinders effective management and restoration efforts. The PeAT Lakes project aims to identify 3110 and 3160 lakes in Ireland which have been minimally impacted by anthropogenic activities in order to effectively describe the reference conditions for these lake types. The project aims to produce a holistic view of the ecosystem by sampling benthic (diatoms), pelagic and epiphytic (desmids) algae, in addition to macrophytes and macroinvertebrates (Odonata & Coleoptera). Sampling multiple biological indicators is advantageous as they are impacted in different ways by stressors and they have different response times. The sampling will encompass large and small lakes in both upland and lowland settings for each habitat type. By sampling multiple lakes, it is anticipated that the abundance of rare species that these habitats support will be captured which is an important component of the EU Habitats Directive. Statistical analysis will determine differences between habitat types (3110 and 3160) and within habitat types due to lake size (large and small) and altitude (upland and lowland). This information will be used to advise priority environmental and biological conditions and measures necessary for the immediate monitoring and improvement to favourable conservation status of 3110 & 3160 protected lake habitats in Ireland under the EU Habitats Directive.

Room 2 Poster 1: George Short

Galway-Mayo Institute of Technology (GMIT)

Russell Poole, Luca Mirimin, Heather Lally, Martin P. Gammell, Jose M Farinas-Franco, Elvira de Eyto, Conor Graham

A multi-disciplinary approach to investigating fish community composition and food-web dynamics in a stratified coastal lagoon

Coastal lagoons are dynamic habitats due to their variable marine and freshwater inputs. These habitats have been identified as vulnerable to climatic and anthropogenic impacts; and as such are classified as Annex I priority habitats under the EU Habitats Directive. In order to adequately protect and conserve these complex ecosystems, it is essential to understand the spatiotemporal variability and trophic ecology of the species which inhabit them. Lough Furnace in County Mayo (SAC site code 1482) is considered to be a good example of a deep, stratified coastal lagoon, a habitat type that is particularly rare on the macrotidal North Atlantic coast. The present study aims to use a multi-disciplinary approach to construct a baseline food web for Lough Furnace and identify the relative energy contributions derived from freshwater and marine inputs. This study will determine the fish community composition of Lough Furnace, using a combination of fish netting and environmental DNA (eDNA) surveys, and the plankton and macroinvertebrate species assemblages within the lagoon over two sampling periods (winter 2020 and summer 2021). The first of two sampling periods has been completed and preliminary results show a moderate level of diversity through the food web, with cooccurrence of marine and freshwater fish species at the time of sampling. Further results regarding

the composition of species assemblages, at varying trophic levels, will be presented. A combination of stable isotope and fish stomach content analysis will elucidate the trophic interactions of fish species inhabiting the lagoon, including keystone species such as Atlantic salmon, brown trout, and the critically endangered European eel. These data will inform the management of this lagoon in a changing world.

Room 2 Poster 2: Jacinta D. Kong

Trinity College Dublin

Amanda E. Bates, Simon A. Morley, James A. Smith, Andrew L. Jackson & Nicholas L. Payne

Thermal tolerance limits track metabolic rates

The role of plasticity in ectotherm thermal responses is a key evolutionary question to understand responses to climate warming. Temperature has a profound effect on biological rates of ectotherms, yet many ectotherms examined to date have limited scope to increase their critical thermal maximum (CT_{max}) to match increasing acclimating temperatures and maintain thermal performance. Processes that remodel physiology to elevate CT_{max} require energy and the cost of most biological processes increases exponentially with temperature. It could therefore be expected that the cost of elevating CT_{max} increases exponentially as animals are acclimated to higher temperatures leading to an energetic constraint on elevating CT_{max}. We re-scaled data on acclimation temperatures and corresponding CT_{max} for aquatic and terrestrial ectotherms to account for the non-linear increase in metabolic costs toward higher temperatures. Re-scaled thermal tolerance data revealed that, on average, ectotherms contribute the same amount of energy to resist acute heat failure when acclimated to low or high temperatures. This likely explains why ectotherms appear to be “incomplete acclimators” in terms of energy transfer, ectotherms are near perfect acclimators. By linking metabolic scaling to acclimation capacity, our results provide a new perspective on the factors that regulate thermal tolerance limits and the capacity of organisms to respond to climate change.

Room 2 Poster 3: Katherine Booth Jones

British Trust for Ornithology

Chris Thaxter, Gary Clewley, Shane Wolsey, Phil Atkinson, Niall Burton

How GPS tracking and monitoring are informing human-gull conflict issues in Belfast

Although Herring Gull *Larus argentatus* and Lesser Black-backed Gull *L. fuscus* are listed as Birds of Conservation Concern in Ireland, populations are thought to be increasing in urban areas, with associated concerns over the perceived nuisance they pose. Despite this, nothing is known about how individuals use the urban environment in Northern Ireland and how this may differ from their declining coastal counterparts. We used GPS GSM tags to track Herring and Lesser Black-backed Gulls nesting in Belfast during the breeding season to investigate their space-use and identify areas of potential human-gull conflict, providing information to the Northern Ireland Environment Agency and Agri-Food and Biosciences Institute. Comparison was made with Herring Gulls from a nearby natural-nesting population. Time-In-Area and resource selection function analysis showed that roof-nesting gulls of both species predominantly used urban areas, travelling on average 4km from their nests. Individuals showed preferences for foraging in specific areas that were consistent between years, minimising overlap in their space use. In contrast, Herring Gulls from the natural-nesting population travelled further, exploiting agricultural habitats as well as urban areas. Although gulls have the ability to

travel large distances to find food, gulls tracked around Belfast did not travel far from their nests and tended to focus their time in urban areas. Our tracking data show that urban areas in Northern Ireland provide safe nesting habitats for gulls and food resources which are used throughout the breeding season, both by roof-nesting individuals and by those from natural-nesting populations. The presence of foraging gulls within the urban environment may be a symptom of poor waste management in certain areas and these are issues that can be addressed to minimise human-gull conflict issues in the future as urban gull populations increase across the island of Ireland.

Room 2 Poster 4: Kilian Murphy

University College Dublin

Sarah Keenan, Barry J. McMahon, Maarten Nieuwenhuis, Simone Ciuti

SMARTDEER: A data-driven framework for evidence-based management of large herbivore populations at the national level in the Republic of Ireland.

Evidence-based management of wildlife populations is becoming increasingly important as human populations grow and proliferate further into wild spaces. Long-term monitoring schemes are pivotal to capture data on wildlife populations over time to understand slow, episodic, and rare events. These data can inform managers of complex and subtle ecological phenomena that affect wildlife population dynamics and equip them to face the challenges of wildlife management in a continuously changing world, for example, human-wildlife conflict, land-use change, and disease breakdowns. Unfortunately, barriers exist in establishing long-term monitoring schemes such as lack of coordination, funding, maintenance of large amounts of data, and establishing a workforce for governing such a scheme. For species groups like large herbivores which are economically significant as they are managed as pest species and as game species, long-term monitoring schemes are pivotal for up-to-date information on species distribution and density, and how populations respond to changing environments. We discuss the development of a framework to rapidly and cheaply establish a long-term monitoring scheme of large herbivores at the national level. We describe the framework developed under the SMARTDEER project for evidence-based deer management in the Republic of Ireland. Using the Republic of Ireland as a case study we discuss the ecological landscape and societal attitudes to large herbivores prior to the project, the project inception, and the aims and objectives. We give a thorough overview of our framework and detail the challenges and opportunities which have arisen throughout the establishment of the framework. Finally, we discuss how these data can be used to inform evidence based management relevant to epidemiology, agriculture, forestry and human-wildlife conflicts.

Room 2 Poster 5: Laura Adams

Anthropogenic noise is a recognised global pollution, affecting a wide range of fauna. However, most research considers only whether noise has an impact, ignoring that individuals within a species or population may exhibit substantial variation in response to this stressor. These variations can be due to proximity to the stressor or variation in the animals' disposition. This could influence how the individual will respond to a stressor. Species undoubtedly differ in their sensitivity to disruptive sounds, but individuals within a population also show such differences (Bejder et al. 2006). The variation between individuals may explain the variation in their ability to cope with environmental change (Sih et al. 2004). The redistribution of sensitive and tolerant individuals across the landscape may not appear to be a problem, however, it can affect predator risk due to the more vigilant sensitive individuals abandoning the site, leaving others open to predator attack, genetic diversity

may be reduced because traits that govern risk averse (shy/sensitive) and risk prone (bold) behaviours can be heritable (Dingemanse et al. 2002). Animal personality, which consists of several personality traits, are potentially important in the functioning of the food webs by inducing behaviourally mediated cascade effects. This could influence how the individual will respond to a stressor. Species undoubtedly differ in their sensitivity to disruptive sounds, but individuals within a population also show such differences (Bejder et al. 2006). The variation between individuals may explain the variation in their ability to cope with environmental change (Sih et al. 2004). The redistribution of sensitive and tolerant individuals across the landscape may not appear to be a problem, however, it can affect predator risk due to the more vigilant sensitive individuals abandoning the site, leaving others open to predator attack, genetic diversity may be reduced because traits that govern risk averse (shy/sensitive) and risk prone (bold) behaviours can be heritable (Dingemanse et al. 2002). Animal personality, which consists of several personality traits, are potentially important in the functioning of the food webs by inducing behaviourally mediated cascade effects. Proximity to a stressor can determine how an animal behaves. The closer the stressor the more reactive the animal. We are interested in how differing personalities of the shore crab (*Carcinus maenas*) will react to an approaching vessel.

Room 3 Poster 1: Maja Ilić

Queen's University Belfast

Lupe León Sánchez, Hannah White, Willson Gaul, Dina Sadykova, Matthew Magilton, Mark Emmerson, Jon Yearsley, Paul Caplat

Multiple measures of ecological stability demonstrate cascading effects of a perturbation on different components of an ecosystem

Food security depends on the resilience of agro-ecosystems that is defined here as their capacity to withstand extreme climatic events. This depends upon above- and below-ground components of the ecosystem, yet a detailed understanding of how these different organisational levels will respond to perturbations is lacking. We describe a climatic perturbation of an ecosystem (a drought experiment conducted across large spatial scales in four bioclimatic regions) using three measures of stability (resistance, recovery completeness, and recovery rate) to quantify the ecosystem's response at three organisational levels (soil moisture, soil invertebrate community structure, and above-ground plant biomass). We found cascading effects of drought on these different organisational levels of the ecosystem: while all three ecosystem components showed similar resistance to drought, soil moisture and soil invertebrates reached full recovery more often than plant biomass. Observed patterns suggest a strong interaction between biotic and abiotic pathways, translating into regional differences. We explore the consequence of these differences for agro-ecosystem resilience at large spatial scales.

Room 3 Poster 3: Marie Louise Heffernan

Aster

Jackie Hunt Sean Kelly

Status Breeding Common Scoter in Ireland

The 2020 All Ireland Common Scoter results show 50 breeding pairs - a rise from 39 in 2012. The breeding success is 28% and productivity is 0.58. These results will be discussed in relation to previous surveys.

Room 3 Poster 3: Sam Belton

National Botanic Gardens

Erica Fox, John Connolly, Colin T. Kelleher

GeneNet: mapping the genetics of Ireland's native forests in a European context.

Of Europe's 265 native tree species, 42% are at a high risk of extinction. The severity of this risk partly depends on the abundance of its forest genetic resources (FGR). If the FGR for a given species are low, its adaptive potential against future environmental challenges will also be low. Characterising and mapping Europe's FGR is therefore critical for understanding which populations need to be prioritised in future conservation efforts. GeneNet, a 2-year DAFM-funded collaborative project between The National Botanic Gardens and Trinity College Dublin, sets out to map Ireland's native FGR for the purpose of updating the European FGR database, EUFGIS. This database was initiated by the European Forest Genetic Resources Programme (EUFORGEN), an EU-wide network that promotes and shares information on FGR conservation. Currently, EUFGIS contains 17 populations (conservation units) from Ireland, although most of these have yet to be characterised genetically. The two main aims of GeneNet are to: (1) update the Irish EUFGIS section with a more detailed geographical information system (GIS) using the most up-to-date Irish Woodland surveys and forestry databases (e.g., the 2003-2008 National Survey of Native Woodlands), and (2) genetically characterise the 17 initial conservation units along with a further 25 units. Genetic characterisation will involve genotyping seven 'high-priority' species, including black alder, ash, downy birch, silver birch, sessile oak, common oak and Scots pine. Genotyping will mainly be achieved using established chloroplast DNA markers, nuclear microsatellite and SNP markers which have been used to characterise other European populations. Molecular analysis is underway with over 600 individual trees sampled across 20 woodland sites. The results of GeneNet will be used to phylogeographically situate Irish populations within Europe and to elucidate the contribution of Ireland's native trees to the overall FGR of Europe.

Room 3 Poster 4: Signe Martin

Galway-Mayo Institute of Technology

Katie O' Dwyer, Fiona Swords, Ian O' Connor

Investigating the disease status of velvet crab (*Necora puber*) in Galway Bay, with a focus on the microparasites

Velvet crab are an important commercial species, with 2015 landings in Ireland worth €419K. An apparent decline in velvet crab was reported in 2016 by fishermen in Galway Bay to the Marine Institute. Following this, a study was carried out by the Marine Institute, and the presence of various microparasites in the tissues of velvet crab was discovered, with a particularly high incidence of a protozoan parasite *Paramarteilia* sp. This finding required further investigation due to the negative effects parasites can have on commercial crustacean species and their associated fisheries, from affecting appearance and marketability, to causing death. We investigated the presence and prevalence of microparasites in velvet crab in Galway Bay monthly for one year. As part of this

ongoing work twelve months of biometric data has been collected. Crab size, sex ratio, and the proportion of berried females (those carrying eggs) varied throughout the year. Overall, more males were sampled than females. Twelve months of tissue samples were collected for histological analysis and confirmation by molecular methods. The parasites *Paramarteilia* sp. and *Hematodinium* sp. have been identified following histological preparations of velvet crab tissues. Of the crabs analysed so far, around half of crabs were infected with the parasite *Paramarteilia* sp., while several had a co-infection of both *Hematodinium* sp. and *Paramarteilia* sp. Infection rates varied by month as well as between males and females. Further work will involve investigating the pathobiome of these crabs. This will be done by using next generation sequencing to describe the microbial community within the hepatopancreas tissue of velvet crabs and compare those infected and uninfected by *Paramarteilia* sp. This project expands on the knowledge of velvet crab and microparasites. Findings from this study will contribute to the effective management of velvet crab fisheries in Ireland.

Room 3 Poster 5: Teagan Reinert

National University of Ireland, Galway

Dr Karen L Bacon

Human Impacts Drive the Extinction Risk of the Podocarpaceae

It has recently been found that it is likely that two in five species of plants on the Earth are threatened with extinction. The gymnosperm family of Podocarpaceae are the second largest conifer family and have a high rate of species being threatened with extinction. In order to determine whether leaf traits are predictive of extinction risk, the leaf area, leaf width, leaf length, compactness, and leaf mass per area were measured of recent digitized herbaria specimens of all 178 species of Podocarps as described by the IUCN. There was no significant difference of leaf traits between species relating to the IUCN threatened statuses, however other human impacts such as land use change may be correlated with extinction risk categories. It is likely that for the Podocarpaceae, human impact on ecosystems is the main driver of extinction currently.

Room 4 Poster 1: Tom McCloughlin

Dublin City University

Ecological pressures in Rogerstown Estuary, Co. Dublin

Rogerstown Estuary, a 'habitats directive' designated site for birdlife is important for many reasons. Besides the said designation, within its catchment lies pockets of 'Salicornia and other annuals colonising mud and sand', 'Atlantic salt meadows (*Glaucopuccinellietalia maritima*)'; and Mediterranean salt meadows (*Juncetalia maritimi*). In addition, at its mouth, there are 'shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)' and 'fixed coastal dunes with herbaceous vegetation (grey dunes). In addition, there are large expanses of mussel 'beds' consisting of clusters of mussels on soft sediment with sponge intrusions. The estuary is inputted by the Ballyboughal river, although this is typically slow-moving and narrow at the entry. A railway embankment bisects the estuary, and a large extant landfill overlooks the inner estuary. Multifaceted degraded riverine feeds enter at numerous points, many of which are classed 'poor' on the traffic-light system or not classified at all. Work by the author has sought to examine the quality of the undesignated streams and found them to be poor also. Such streams (e.g. lower arm of the Palmerstown stream) are characterized by deep sediment bottoms sometimes extending to more than one metre in-depth and completely anoxic, and an extremely low flow rate. *Gasterosteus* sp.

are the only fish species found, with insect life confined to aquatic surface dwellers (Corixidae and Gerridae). In the upper arm of the Palmerstown stream, Gammarus sp. may be found. The aim of this paper is to highlight the aforementioned issues and suggest remediation through inputting gravel/stones, adjusting concrete structures at bridges to permit oxygenation, and upstream movement of fauna. Future research will involve mesocosm modelling of the degraded ecosystem with a view of providing data for the proposed remediations.

Room 4 Poster 2: Caroline McKeon

Trinity College Dublin

Anna Csergo, Santiago Ordonez, Antoine Guisan, Olivier Broennimann, Yvonne Buckley

Functional traits affect range occupancy of European plant species

The dual pressures of human land use and climate change are affecting populations, reducing suitable habitat, and changing patterns of occupancy within species' ranges. Range occupancy of European plant species reflects not just current land use patterns and climatic suitability, but the ability of a plant to disperse and recolonise following the last glaciation. Species' current range occupancy may therefore indicate ability to cope with fragmentation driven by future climate change and land use. But what is it about a species that underpins this ability? For over 800 species, we test the relationship between current spatial patterning and 10 functional traits related to dispersal, colonisation, regeneration and persistence. Preliminary results suggest traits such as plant height and pollen vector correlate positively with range occupancy. With further study, these findings could contribute to a predictive understanding of species' ability to respond to fragmentation, an important indicator of vulnerability under global change.

Room 4 Poster 3: Ellie Roark

Willson Gaul

Monitoring migratory birds in stopover habitat: assessing the value of extended duration audio recording

Conserving bird populations requires knowledge of bird distribution and habitat use at all stages of their life cycle, including during migration. Automated digital audio recording units (ARUs) can be deployed in the field for long periods of time to efficiently increase both spatial coverage and total amount of monitoring effort, especially at places and times where access is difficult and costly for human observers. ARUs have been evaluated for comparability to human observers during the breeding season in many habitats. However, birds behave and vocalize differently during migration. We compared in-person point count observations to extended duration ARU observations during spring migration on the southern shore of Lake Superior, to assess and refine the applications of ARUs in migratory stopover habitat. We analysed recordings by conducting desk-based "listening point counts" which can be completed by any observer with the skills to identify species aurally. We found that when ARUs sampled 1-minute intervals randomly from a five hour survey window, they detected multiple species never found during in-person point counts. Temporal trends in species richness and relative abundance that reflect spring migration timing were detectable using both ARUs and in-person point counts. We demonstrate a relatively easy, immediate application for ARUs during migration, offering increased monitoring possibilities in remote locations.

Room 4 Poster 4: Jessie Dolliver

Trinity College Dublin

Where did it come from, where did it go? A systematic review on the fate of macroalgal carbon

Although macroalgae are some of the most efficient photosynthesizers in the world and draw down large amounts of atmospheric carbon, the literature has hesitated to call them carbon sinks. This is because most macroalgal beds overly hard substrata which can not accumulate deposited carbon as soft sediments do. This, paired with the difficulty of tracking material between marine environments, has meant that the fate of carbon from macroalgal productivity remains a decades old mystery. A systematic review was conducted to determine the fate of macroalgal derived carbon. The types of studies conducted to answer this question will be discussed, along with an introduction to the relevant data which does exist and the types of experiments which could determine the fate of macroalgal carbon from any given macroalgal community.

Room 4 Poster 5: Sammy Ball

UCC

Thomas C. Kelly, Fidelma Butler

Endoparasites of the endemic Irish hare

The Irish hare (*Lepus timidus hibernicus*) is a distinct endemic subspecies of the mountain hare (*Lepus timidus*) and Ireland's only native lagomorph. It has undergone rapid population declines and despite its cultural, ecological and economic significance, this is the first known study of the endoparasites of this endemic. The endoparasite community composition of the Irish hare was examined from 22 carcasses opportunistically sourced from wildlife strike events (with aircraft and vehicles) from three counties in the Republic of Ireland (Dublin, Cork and Tipperary). In total, three endoparasite taxa were recorded in the Irish hare with 50% being host to at least one taxon. *Trichostrongylus retortaeformis* was the most prevalent helminth (43%) followed by *Graphidium strigosum* (20%) and a tapeworm belonging to the *Mosgovoyia* genus (14%). There was a mean burden of 292.7 (SE \pm 163.64) and all three parasite taxa were aggregated ($\sigma^2 \geq \mu$), which can influence individual fitness, parasite transmission and population regulation. Data on the helminth fauna of the Irish hare are important for agricultural and resource management as well as to inform conservation efforts for this iconic endemic.

Room 5 Poster 1: Paula A. Tierney

Trinity College Dublin

Joe M. Caffrey, Celia V. Holland

Between a river and a lake: filling some knowledge gaps in the parasitology of freshwater fish in Ireland

A big question in parasite ecology in recent decades is: what shapes the structure of parasite communities? Helminth parasite communities are often variable in space and time, subject to stochastic and local effects and prone to variation in host factors such as diet and life history. This also makes helminth communities vulnerable to changes in host communities such as introduction of invasive species. Although brown trout, *Salmo trutta*, is one of the most widely parasitologically

studied freshwater fish in Ireland, almost all previous work has taken place in the West of Ireland in lake systems. We aimed to address this knowledge gap and examine variation in helminth community among freshwater systems. We described the helminth parasite community of brown trout over two sampling years in two previously unstudied river systems in Ireland, the Munster Blackwater and the upper River Barrow, and compared our results to the previous 40 years of helminth surveys in Irish rivers and lakes. We also compared our results to the helminth community of an invasive fish species, common dace, *Leuciscus leuciscus*. We found that parasite community structure among brown trout was similar; helminth communities were isolationist and dominated by autogenic Salmonid specialists. However, the composition of helminth communities varied over space and time, influenced by the type of freshwater system. Cestode and digenean trematode species which use copepods and molluscs as intermediate hosts dominated helminth communities in lake studies whereas acanthocephalans and nematodes which utilise amphipods and mayflies were more common parasites of brown trout in river studies. The helminth community structure of invasive dace was much different to brown trout, being dominated by a single generalist and comprising a nested subset of the helminth community of co-occurring brown trout. Our results underline the importance of habitat and host effects on the structuring of parasite communities.

Room 5 Poster 2: Sam L Cox

University College Cork

Michelle Cronin & Mark Jessopp

Post-release behaviour & movements of rehabilitated juvenile harbour seals

Seal rehabilitation programs are widely used for the temporary care of individuals prior to re-release into the wild. Rescued animals are typically those abandoned by the mother prior to weaning, often as a result of human disturbance. Despite the common existence of these programs, little is known about the post-release survival, behaviour, and movement of rehabilitated seals. As part of the EU INTERREG VA SeaMonitor project, we track the movement patterns and dive behaviours of rehabilitated juvenile harbour seals from Exploris Aquarium, Northern Ireland. Preliminary analyses from tracked individuals (n = 10) show that pups rapidly develop dive and forage abilities, and within the first few weeks at sea can already travel upwards of tens of kilometres per day and dive to depths exceeding 80m. A range of dispersal strategies are evident. Two pups made large exploratory trips across the Irish Sea to the waters around the Inner Hebrides, West England and Wales, whilst others remained in coastal waters (~15km from land) along the Irish coast. One individual repeatedly visited multiple offshore wind-farm sites, including long-term (+10 weeks) residency at one site, alternating between foraging within the wind-farm and hauling out on a nearby beach in Wales. Together, these initial findings suggest high survival of rehabilitated seals post-release, and provide important information on distribution and interactions with human activities at sea to help understand the risks encountered during this vulnerable life history stage.

Room 5 Poster 3: Thomas Gorman

NUI, Galway

Terry Morley, Gesche Kindermann

Development of a Rapid Habitat Assessment Methodology for Annex I Habitats in Ireland

Rapid Environmental Assessment (REA) methods have been developed to require less time in the field and reduce the need for taxonomic expertise; potentially reducing costs and increasing the number of monitoring locations available to survey. For several of the recently implemented Results Based Agri-Environmental Payments Schemes (RBAPS), scorecards are the chosen method of REA, including for example the Hen Harrier Project, Pearl Mussel Project, and Blackstairs Farming Futures. Our project is assessing current scorecards to develop a framework for additional habitats. We carried out a pilot study in the Blackstairs Mountains comparing the results from five heathland scorecards on nine sites. Site scores rarely matched, with the difference ranging from 20 points to 59 points (based on 100-point score), giving an average difference of 36. While scorecards are based on a standardized maximum of 100 points, variable choice and weighting differed substantially. Given that these scorecards are developed for specific project goals, we compare the difference among scorecards to help arrive at a more holistic mechanism to reflect actual ecological condition. Our intent is to further compare achieved site scores against in-depth ecological assessments of heathlands and expand this to several other habitats including raised bogs, machair, woodland and lowland hay meadows.

Room 5 Poster 4: Veronica Farrugia Drakard

University College Dublin

Paul Brooks, Tasman Crowe, Hannah S. Earp, Bryan Thompson, Nathan Bourke, Ruby George, Chloe Piper, Pippa J. Moore

Fucus vesiculosus populations on artificial structures have reduced fecundity and are dislodged at greater rates than on natural shores.

Artificial structures are widespread features of coastal marine environments. These structures, however, are poor surrogates of natural rocky shores. Little is known about the influence of such structures on the dynamics and long-term viability of populations. Such understanding is particularly important for ecosystem engineer species, such as the intertidal seaweed *Fucus vesiculosus*. In this study, *F. vesiculosus* was sampled on eight artificial structures and eight natural shores along the east coast of Ireland and the west coast of Wales. Algal percentage cover, biomass, density of individuals, and growth rate did not differ between artificial and natural shores. Growth and reproductive cycles were consistent with previous studies for this species. While there was considerable variation from site to site, on average, populations on natural shores had higher fecundity during the peak reproductive period, and lower rates of dislodgement than on artificial structures. As *F. vesiculosus* reach peak reproductive output after 24 months, this suggests that individuals may be removed from populations on artificial structures before reaching their full reproductive potential. In this case, this did not influence density, percentage cover, or biomass, which suggests that *F. vesiculosus* populations on artificial structures may function similarly to those on natural shores if supported by suitable source populations, but potentially may not persist otherwise.

TALKS: AFTERNOON SESSION

14:30 Plenary: Xavier Harrison

Ecology at Multiple Scales: Investigating Drivers of Reproduction Success in a Long-distance Migratory Bird

15:10-16:40

Samuel RP-J Ross

Trinity College Dublin

Jorge García Molinos; Osamu Kishida; Atsushi Okuda; Ian Donohue

Predator extinctions compromise compositional but not functional stability in response to aquatic heatwaves

Ecosystems around the world are under threat from multiple biotic and abiotic stressors simultaneously. Projections estimate an increase in the frequency, intensity, and duration, of extreme weather events such as heatwaves in coming years. Yet, whether species extinctions compound the effects of extreme events on ecological communities is largely unknown, despite efforts to understand the consequences of global biodiversity change. Moreover, studies aiming to experimentally mimic the effects of climate change most often over- or underestimate the temperature changes projected for the region in which their experimental communities reside. Here, I use 48 aquatic flow-through mesocosms to investigate the combined effect of predator extinctions and heatwaves—current and projected future heatwaves—on aquatic community dynamics in a subarctic stream in Hokkaido, Japan. I show that predator extinctions increase the vulnerability of macroalgal composition to aquatic heatwaves, as mediated through trophic cascades—increased abundance of macroinvertebrate consumers. Algal biomass was less affected than composition, indicating that predatory fish stabilise algal communities but not their productivity in response to extreme events. However, predator effects on algal biomass established later in the experiment, highlighting differences in the speed with which predator extinctions alter algal biomass and composition. Critically, my heatwaves were informed by downscaling regional climate projections, allowing unprecedented insight into the likely future consequences of climate change and aquatic heatwaves on subarctic freshwater communities in Japan.

Cynthia Barile

Galway-Mayo Institute of Technology

Simon Berrow, Gareth Parry, Joanne O'Brien

Temporal acoustic occurrence of sperm whales (*Physeter macrocephalus*) and long-finned pilot whales (*Globicephala melas*) off western Ireland

Long-finned pilot whales (*Globicephala melas*) and sperm whales (*Physeter macrocephalus*) are the most abundant species among the community of deep-diving cetaceans occurring off the west coast of Ireland, North-east Atlantic. To address a knowledge gap on these elusive species in an area subject to increasing levels of anthropogenic noise, fixed bottom-mounted autonomous acoustic recorders were deployed from 2014 to 2016 at thirteen locations. Acoustic data were collected across 2,410 cumulative days, for a total of 9,179 hours of recordings, with pilot whale whistles and sperm whale clicks detected on 53% and 79% of the days monitored, respectively. Diel, lunar and seasonal effects on the acoustic occurrence of sperm and long-finned pilot whales were investigated for individual sampling sites and for each recording year using Generalised Estimating Equations (GEE-GAMs). Large differences in acoustic occurrence across stations for both species highlighted the existence of more critical locations throughout the year, especially to the north of the shelf edge. Temporally, significant modulations were found for both species at all scales investigated, but the lack of consistency across the study area emphasizes the need to exercise great caution when inferring general tendencies based on local patterns. The variability of spatio-temporal patterns indicates a

flexibility in the distribution of sperm and long-finned pilot whales off the west coast of Ireland, highlighting the challenge in establishing management and mitigation measures and stressing the need of long-term, year-round monitoring.

Alicia Mateos Cárdenas

University College Cork

John O'Halloran, Frank N. A. M. van Pelt and Marcel A.K. Jansen

Rapid fragmentation of microplastics by the freshwater amphipod *Gammarus duebeni* (Lillj.)

Microplastics have become ubiquitous in all environments. Yet, their environmental fate is still largely unknown. Plastic fragmentation is a key component of plastic degradation, which is mostly caused by abiotic processes over prolonged time scales. Here, it is shown that the freshwater amphipod *Gammarus duebeni* can rapidly fragment polyethylene microplastics, resulting in the formation of differently shaped and sized plastic fragments, including nanoplastics. Fragments comprised 65.7% of all observed microplastic particles accumulated in digestive tracts. Higher numbers of fragments were found in response to longer exposure times and/or higher microplastic concentrations. Furthermore, the proportion of smaller plastic fragments was highest when food was present during the depuration process. It is concluded that *G. duebeni* can rapidly fragment polyethylene microplastics and that this is closely associated with the feeding process. These results highlight the crucial role, currently understudied, that biota may play in determining the fate of microplastics in aquatic ecosystems. This study was published Open Access in Scientific Reports in 2020, <https://doi.org/10.1038/s41598-020-69635-2>

Karzan S. D.Ahmed

National University of Ireland Galway

Alessio Volpato, Michael F. Day, Collette J. Mulkeen, Aidan O'Hanlon, John Carey, Christopher Williams, Sara Ruas, James Moran, Roser Rotchés-Ribalta, Daire Ó hUallacháin, Jane C. Stout, Simon Hodge, Blanaid White, Michael J. Gormally

Evaluating different linear farm habitats for selected dipteran families: Implications for diversity and associated ecosystem functions

Semi-natural linear habitats such as hedgerows and drainage ditches are important farmland habitats. However, little is understood about their contribution to Diptera, particularly those species with different ecological requirements and ecosystem functions. Two such taxa are Syrphidae, which have a range of ecosystem functions (pollination, biocontrol and nutrient cycling), and Sciomyzidae (biocontrol of molluscs). Using bi-directional malaise traps, we investigated the impact of different linear farm habitats, across a gradient of farming intensities, on Syrphidae and Sciomyzidae community dynamics. Species richness and abundance of both taxa were measured from May to September 2018 on grassland farms of different levels of intensity. In each intensity category, five different linear habitat types (dense and gappy hedgerows with/without adjacent watercourses and watercourses only) were selected for evaluation. Significantly greater species richness for both families were detected on extensive farms. Significantly more species and individuals of Sciomyzidae were recorded in gappy hedgerows adjacent to watercourses and watercourses only. Syrphidae, on the other hand, showed no significant difference between linear habitat types. It is likely that different ecological requirements for each taxon apply, with Syrphidae species richness correlated with linear habitat

flowering plant species richness, while Sciomyzidae species richness is correlated with adjacent grassland vegetation structure, encroaching scrub and plant litter. Our results suggest that while low intensity farming appears to support species richness of both taxa, universal management prescription for a farmland linear habitat (such as a hedgerow) may not benefit all dipteran taxa which utilise various linear habitats on farmland. This has implications for future agri-environmental schemes in the context of how we assess the conservation value of linear habitats on farmlands.

Luca Mirimin

GMIT

Sam Desmet, David López Romero, Sara Fernandez Fernandez, Dulaney L Miller, Sebastian Mynott, Alejandro Gonzalez Brincau, Sergio Stefanni, Alan Berry, Paul Gaughan, Jacopo Aguzzi

DON'T CATCH ME IF YOU CAN - Combining non-invasive underwater video and environmental DNA (eDNA) data reveals local marine fish communities at the SmartBay cabled observatory

The Marine Institute's SmartBay Ireland site is a cabled observatory equipped with oceanographic sensors as well as video and audio equipment, which is located at 25 m depth and 1.5 km offshore of An Spidéal in Galway Bay. Such sites provide unprecedented opportunities to study marine biotic and abiotic components both in situ and in real-time. The recent emergence of DNA-based non-invasive monitoring approaches, such as environmental DNA (eDNA) metabarcoding, has further enhanced the ability to characterize marine life. Despite the great potential of such approaches, these techniques are rarely used in parallel and understanding their limitations is still a major focus of research. Thus, this study combined Underwater Video (UV) with eDNA metabarcoding data to produce marine fish community profiles over a two-month period at the SmartBay site. By combining both approaches, a total of 22 teleost fish species could be identified to the species level, including ecologically and economically important species such as Atlantic cod, whiting, mackerel and monkfish. The eDNA approach proved to be the most effective approach, successfully identifying a higher number of species (59%) compared to the UV approach (18%), while 23% of species were detected by both methods. Thanks to this multi-disciplinary approach, this study led to the following conclusions: (i) UV data is most effective in determining relative abundance, age/size class and biorhythms, but this is applicable only to a sub-group of species; and (ii) while eDNA approaches are more effective at detecting higher number of species, their resolution power can be further enhanced by improving reference DNA data as well as choosing more sensitive and targeted molecular markers, so that the false negatives identified in this study can be resolved. Overall, this study showed the corroborative benefits of a non-invasive multidisciplinary approach for future monitoring of marine life.

Natasha McGowan

Queen's University Belfast

Testing consistency of modelled predictions of the impact of climate change on bats

Climate change and its corollary effects on species are predicted to be the biggest threats to global biodiversity. Various modelling approaches are available to make projections regarding the impacts of a changing climate on species biology and ecology, but the validity of predictions cannot be verified until future time periods. One way by which to assess the robustness of predictions contemporaneously is to fit multiple different models and compare their consistency, with more confidence placed on results that are consistent between models and with current population trajectories. We compared the predicted impacts of climate change on the range and activity of nine

Irish bat species across their European ranges and on localised populations in Ireland using Species Distribution Modelling (SDM) and mixed modelling (GLMM) approaches. Whilst SDMs modelled the effects of climate and habitat across their European ranges on bat species presence (from GBIF), GLMMs examined the impacts of localised Irish climate and habitat variables on species activity (number of bat passes per night or number of bats per roost) from over a decade of surveys. Generally, both sets of models performed well (SDMs: mean AUC and sensitivity -0.7, specificity -0.6, and omission rate -0.2; GLMMs: mean adjusted $r^2 = 0.683$). There were largely consistent results between the two model sets for five bat species with predicted stability or increased ranges and increased activity. For two species, ranges were predicted to be stable, but populations were predicted to undergo declines. We propose that there is utility in implementing different modelling approaches (e.g. SDMs and GLMMs) and comparing their predictions of the impacts of climate on different facets of populations (e.g. range versus activity). The results of this approach should instil more confidence in conservation policy making than relying upon single model analyses.

Samuel Browett

University of Salford, United Kingdom

Rachael E. Antwis, Stephen Browett, Thomas Curran, Naiara G. Sales, Rebecca Synnott, Denise O'Meara, Kevin J. Bown, Joseph A. Jackson, Jon M. Yearsley, Ian W. Montgomery, Jeremy B. Searle and Allan D. McDevitt

Know your enemy: identifying resource competition and microbiome changes driving an invasion-extinction event amongst shrews in Ireland

Ireland's smallest resident mammal, the pygmy shrew (*Sorex minutus*), is rapidly being displaced by the invasive greater white-toothed shrew (*Crocidura russula*). This invasive shrew was first recorded in 2007 and has been spreading rapidly across the island at a rate of ~5km per year. Considering these two species co-inhabit other regions of Europe, this raises the question of why they seemingly cannot coexist in Ireland. This study applies DNA metabarcoding to shrew gut contents to investigate the roles of resource competition and gut microbial community structure in this invasion-extinction event. This was applied to over 300 shrews of both species sampled across radial transects in Ireland, two seasons, and a natural 'control' site in Belle Île (France) where both species occur together in high abundance. The results show that during the initial stage of colonisation there is little resource competition between the species allowing their ranges to overlap. Over time, interspecific competition increases as the following 'waves' of *C. russula* switch their diet to the core prey of *S. minutus*. The Belle Île population of *S. minutus* can co-exist with *C. russula* by exploiting locally abundant key taxa, but the Irish *S. minutus* are not adapting their diet in response to the invader. In addition, Irish *S. minutus* have a different microbiome structure with a significantly reduced abundance of microbes associated with host immunity which may have left them susceptible to newly introduced stresses. This diet-microbiome analyses demonstrates that Irish *S. minutus* have not adapted to compete with another shrew species and could be replaced by *C. russula* in Ireland over time. This multi-faceted approach on this invasive system has demonstrated that subtle differences between populations of shrews can have significant effects on their ability to co-exist.

Maude Baudraz

Trinity College Dublin

Dylan Childs, Olivier Broennimann, Antoine Guisan, Yvonne M. Buckley

Predicted environmental suitability affects vital rates in *Plantago lanceolata*

Species Distribution Models (SDM) are used to predict environmental suitability for species from occurrence data. Suitability values are often assumed to be correlated with abundance, vital rates or population performance; however, there is little empirical support for these assumptions. We used individual observations of plants in 19 populations of *Plantago lanceolata* over three years along an SDM suitability gradient to test this assumption. We found that suitability was a significant predictor of survival and reproductive investment and in interaction with plant size suitability also significantly affected growth and probability of flowering. We provide evidence to support the correlation of environmental suitability with important demographic rates. However, the effects of suitability varied between vital rates, and as there was no relationship between suitability and observed population growth rate (λ) we hypothesise that compensatory responses of different vital rates to suitability maintain population persistence along this suitability gradient.

Rebecca Synnott

Waterford Institute of Technology

Allan D. McDevitt, David O'Neill, Craig Shuttleworth, David Everest, Catherine O'Reilly, Denise B. O'Meara

Identification of re-invasion pathways of grey squirrels (*Sciurus carolinensis*) into Anglesey following previous eradication

Invasive species can cause major ecological and economic impacts. In the British Isles, the invasive North American grey squirrel (*Sciurus carolinensis*) has contributed to the decline of the native red squirrel (*S. vulgaris*) since its introduction to Britain from the United States (US) in 1870. The grey squirrel competes with the red squirrel for limited resources e.g. food and habitat and the spread of viral diseases, some of which are carried by the grey squirrel asymptotically and are lethal to red squirrel. As a result, the grey squirrel has been subjected to extensive control efforts that temporarily reduce the population size, but if control efforts are not sustained the population can recover. In the case of the Isle of Anglesey, an island connected to mainland Wales via two man-made bridges, complete eradication of the grey squirrel occurred in 2013. However, in 2015, several individuals were found in the area, likely having recolonised from the surrounding areas through natural dispersal or were intentionally released by people. The aim of this study was to identify re-invasion pathways into Anglesey from surrounding areas following control efforts. This was achieved using genetic approaches on ~300 grey squirrels sampled between 2011 and 2019. Mitochondrial DNA (mtDNA) analysis identified a likely re-invasion pathway from the adjacent woodlands in the county of Gwynedd due to the presence of shared haplotypes or strains between both areas. This new mtDNA data was also compared to previously published data from grey squirrels across Britain and the US. This has allowed us to trace the 150-year genetic footprint of grey squirrels from their original source in the US, to their contemporary distribution in Britain today. Comparisons are currently being made using nuclear DNA markers (microsatellites) to determine which method provides the best resolution to understand invasion dynamics on Anglesey.

Sammy Ball

UCC/ DAA

Fidelma Butler, Anthony Caravaggi, Neil E. Coughlan, Gerry Keogh, Michael J.A. O'Callaghan, Ricky Whelan, Thomas C. Kelly

A hare-y situation; Increased aircraft related mortality of the Irish hare at Ireland's largest civil airport

Collisions between wildlife and aircraft are a serious and growing threat to aviation safety. Understanding the frequency of these collisions, the identity of species involved, and the potential damage that can be inflicted on to aircraft aid mitigation efforts by airfield managers. Despite mammal strikes increasing in frequency in many places worldwide, there has been relatively little research into the management of mammals on airfields or on mammal strike mitigation. Here we report on the unique opportunity to study mammal strikes in Ireland. A record of all animal carcasses recovered from Dublin International Airport, Ireland's largest civil aviation airport, has been maintained since 1990 where strikes with the endemic Irish hare (*Lepus timidus hibernicus*) are of particular concern. Over a thirty-year period, a total of 320 strike events with the Irish hare have been recorded at the airfield and have been increasing annually by an average of 14%. To date, no strike event with a hare has resulted in damage to an aircraft, but here we demonstrate that the kinetic energy of such an event (7,391 ft-lbs) has the potential to cause significant damage. Strike events also have the potential to attract avian scavengers, pose as a FOD (foreign object debris) hazard and cause disruptions. Hare strikes are discussed in the context of the rate of civil aircraft movements, possible direct and indirect damage to aircraft as well as current population monitoring efforts at Dublin Airport.

Tamara Hochstrasser

University College Dublin

Stephen Mulkearn, Barbara O'Brien, Julia Jones

Pollinator sites in the urban area of Dún Laoghaire-Rathdown County

Restoration of biodiversity - or at the very least - halting biodiversity loss is essential to our health and well-being. In urban areas the demands for biodiversity restoration have to be carefully weighted with current human use and thus finding vegetation types and management approaches that seem to be particularly effective at consolidating these needs is of great importance. Over the past three years. Dún Laoghaire-Rathdown has implemented a reduced mowing regime and herbicide use across their urban greenspaces to enhance restoration of plant and insect diversity under the all-Ireland pollinator plan. The objective of this study was to assess what the current plant species composition of sites with a changed mowing regime is. For this purpose, sites were randomly chosen from the over 100 sites where management was changed and plant composition was determined using relevés at two scales: 1m² and 4m². This allowed us to compare the species composition of these urban sites to other semi-natural vegetation as found in the Irish Vegetation Classification system (IVC). We found that these urban sites do not clearly correspond to currently defined vegetation types in the IVC and that not all sites in Dún Laoghaire-Rathdown classified as 'pollinator sites' are grasslands. A closer investigation of some of the larger parks/ park areas also showed that bumblebees use a wide variety of habitats including weed patches and flower beds, and the 'pollinator sites', that are only at the beginning of the restoration process to species rich grasslands, are often species poor and do not support a high abundance of bumblebees. This work will help to develop a typology of sites and

management regimes, that can be used by local authorities to better understand the trade-offs and synergies between the restoration of biodiversity and human use and thus enhance the health of both.