

5th World seabird
TWITTER
CONFERENCE

9-11th
April 2019

Conference Summary
and
Abstract Book



Another Seabird Twitter Conference has come to an end and we hope you all enjoyed it as much as we did! During the conference, the hashtag #WSTC5 was used 3,400 times by 700 contributors, with a potential reach of over 1.3 million users (try fitting that into a conference hall!). We had over 100 presenters tweeting about their work from over 20 countries, some even presenting in multiple languages, and people got involved from all around the world by asking questions, re-tweeting and following the presentations, making it a truly global event. You can have a look at the map of hashtag use [here](#).

Session Summaries

The great thing about Twitter conferences is that you can catch up on the presentations afterwards! This document includes a full list of abstracts to give you a taste of what was covered but you can also look at the session summaries created using Wakelet (listed below), which include all presentations in each session along with any post-presentation discussions. You can also find the Wakelet summaries for each session collated as PDFs on our Google Drive: <https://tinyurl.com/y6y3ngss>

Session	Wakelet Link
Foraging Ecology 1	https://wke.lt/w/s/1IKGcA
Conservation Biology 1	https://wke.lt/w/s/R9PBLI
Tracking and Distribution	https://wke.lt/w/s/MBHs0c
Foraging Ecology 2	https://wke.lt/w/s/nJV8qA
Population Biology 1	https://wke.lt/w/s/FwFOMa
Conservation Biology 2	https://wke.lt/w/s/QLHfwP
Behaviour	https://wke.lt/w/s/auzLaD
Foraging Ecology 3	https://wke.lt/w/s/Nz6J7J
Population Biology 2	https://wke.lt/w/s/iAL89E
Tools and Techniques	https://wke.lt/w/s/zzu7Xq
Contaminants and Marine Debris 1	https://wke.lt/w/s/gB1Y_a
Conservation Biology 3	https://wke.lt/w/s/-x_GDY
Fisheries	https://wke.lt/w/s/XPmpRB
Contaminants and Marine Debris 2	https://wke.lt/w/s/QqmxYc
Genetics	https://wke.lt/w/s/nk0cpD

Plenaries

The first day we had Dr Rachael Orben ([@RachaelOrben](#)) present on the topic of “A sense of scale: connecting the dots of seabird movement ecology”, which gave an impressive overview of how the development of advanced tracking techniques has helped to provide us with much better knowledge of seabird space use and foraging behaviour, from the scale of individuals to populations, and how important this knowledge is in the context of spatial variability in by-catch risk and contaminants. You can catch up on the presentation [here](#).

The second day we had Professor Jacob González-Solís ([@SeabirdEcology](#)) give a presentation on “Conserving the double life of seabirds in Cape Verde islands”, describing an impressive body of work on understanding the multiple threats to the rich seabird community, which includes several endemic species. You can catch up on the presentation [here](#).

For our final plenary, on the third day we had Dr Nic Rawlence ([@nic_rawlence_nz](#)) give a presentation on “Sentinels of change: Ancient DNA shows seabirds are key indicators of a dynamic world”, which covered how DNA samples from museum specimens and other sources can be used to understand past population changes, showing results from some very unique and interesting projects on shags and penguins. You can catch up on the presentation [here](#).

Prizes

[The Seabird Group](#) sponsored a special **ECR prize**, which was awarded to Federico De Pascalis ([@fdepa1](#)) for his presentation “Sex and wind conditions influence foraging tactics in a dimorphic seabird”. Federico used incredible animated slides and videos to illustrate his work on Scopoli’s shearwater foraging behaviour.

[The Pacific Seabird Group](#) sponsored a special **Pacific prize** which was awarded to Montserrat Vanerio ([@Monse](#)) for her presentation “Diet of the pink-footed shearwater, *Ardenna creatopus*: Natural and fisheries-related prey in south-central Chile”. Montserrat used beautiful graphics to illustrate her tweets and impressively tweeted the content in both English and Spanish!

The [World Seabird Union](#)’s “**Best Sci-Comm**”-prize was awarded to Anicee Lombal ([@Anicee_Lombal](#)) for her presentation “Historical and physical dominate biotic processes as determinants of seabird genetic differentiation”, which included fantastic animations.

We are incredibly grateful for the sponsorship given by The Seabird Group, The Pacific Seabird Group and the World Seabird Union and we also want to acknowledge the support given by the British Ornithological Union, providing useful resources and great help in increasing the reach of the conference.

Volunteers

I also want to acknowledge all the incredible work done behind the scenes. The World Seabird Twitter Conference is run entirely by volunteers, most of who are early-career researchers, and they have all made a huge effort organising, advertising and running the conference.

[Grant](#) made our fantastic website (with some upkeep help from [Kelly](#)) and also provided some veteran insight together with [Sjurdur](#), [Laura](#) and [Saskia](#). Saskia also made most of our beautiful graphics! [Kirsty](#) deserves a special mention, having helped out with securing and co-ordinating sponsorship, advertising the conference and everything else you can think of. [Nati](#), [Virginia](#) and [Elodie](#) were also hugely helpful with all sorts of things running up to and during the conference (such as the daunting task of putting the schedule together), while [Debra](#) has provided much-needed proofreading assistance. Finally Saskia, Virginia, Elodie, Nati, Kirsty, [Anthony](#), [Anouk](#) and [Stephanie](#) all helped out chairing the sessions. The conference couldn't have run without you all!

#WSTC6

If you are craving more seabird tweets you will be glad to hear that plans for the 6th Twitter conference are already underway. Taking place in 2020, it will be chaired by Virginia Morera-Pujol ([@sk8sbd](#)) and Elodie Camprasse ([@ECamprasse](#)). If you follow them on Twitter, together with [@Seabirders](#), you will be sure to be kept up to date. If you want to get involved with #WSTC6, or if you have any questions or comments at all, you can always reach us on wstc.seabirds@gmail.com

Abstracts

Behaviour Session

#WSTC5 #Behasesh

Albatross encounter: Bird-borne camera shows capture of a live squid at sea

Stefan Schoombie (@sschoombie1)

University of Cape Town

Advances in biologging technologies allow researchers to study the behaviour of seabirds in ways that were not previously possible. Advances in consumer electronics have made such devices affordable to a wide range of researchers. One example is the use of animal-borne video cameras, which are now small enough to be deployed on some flying seabirds. We deployed video cameras on breeding wandering albatrosses (*Diomedea exulans*) between 2013 and 2018 as part of a larger project on seabird behaviour. Footage shows one bird catching a large live squid from < 1m below the surface of the ocean. The bird was soon joined by several other Procellariiformes as it fed on the squid. Wandering albatrosses are mostly assumed to scavenge large squid. We show how video footage can be used to observe behaviours that were previously only inferred.

Patterns of moulting in the Cape gannet

Oluwadunsin Adekola (@holuwadunsin)

FitzPatrick Institute of African Ornithology, University of Cape Town

Moult is one of the energy-demanding activities in birds. This is challenging and poorly understood in seabirds. The Cape gannet is endangered and endemic to southern Africa. This project will be carried out in the three gannet colonies in South Africa. The aim is to determine the timing, duration and sequence of moult in the Cape Gannet. Primary, secondary and tail moult scores will be recorded using the British Trust for Ornithology techniques (Ginn 1975); old feathers will be scored 0, new feathers 5, and growing feathers 1-5 depending on their stage of growth. Primary moult scores will be transformed into moult indices following the relationship given by Underhill and Zucchini (1988). All moult estimates will be obtained using the software described in Erni et al. (2013).

Sharing the burden: On the division of parental care and vocalisations during incubation

Marwa Kavelaars (@MarwaKavelaars)

University of Antwerp

In biparental species, both pair-members contribute to parental care to enhance offspring growth and survival. The cost of care should be equally distributed between them. Parents are therefore expected to adjust their parental investment to their partner's contribution. We found that lesser black-backed gull pairs that vocalised more, divided their incubation stints more equally.

Furthermore, pairs that shared incubation more equally raised offspring of higher quality when experiencing more challenging conditions.

Does the diurnal timing of copulations vary with laying date in the great skua on Skúvoy, Faroe Islands?

Sjúrdur Hammer (@sjurdur)

Faroe Marine Research Institute

In great skuas, copulations are often preceded by courtship feeding and occur in the morning and afternoon. We surveyed copulations in a colony on Skúvoy, Faroe Islands, in 2013. The afternoon copulation frequency peaked 2.5 weeks after the peak in laying dates, which is unexpected as literature suggests that a pair copulates most frequently around a week before egg laying. Several explanations are possible. If these afternoon copulations were pre-laying copulations, it suggests that they were mostly performed by pairs laying late in the season. It could be that fish-eating pairs make longer foraging trips and therefore feed their mate, and thus copulate, later in the day. Alternatively, if these copulations were post-laying copulations, they may be a response to mate feeding that continues during the incubation phase. We argue that potential individual and population differences should be taken into account when describing copulation behaviour at the species level.

Where the wind blows: constraints on foraging habitat selection in herring gulls (*Larus argentatus*)

James Scarlett (@jvascarlett)

University of Glasgow

Most environmental change research focuses on temperature and rainfall in terrestrial ecosystems. However, marine ecosystems are equally important, and wind is an important factor that is shifting not only in direction but in strength. For flying animals like birds, changing wind patterns affect flight costs and therefore may play an important role in determining where they can forage efficiently. This project aims to investigate how selection of foraging habitats is related to wind conditions and alternative sites used in unfavourable situations. Tracking data and wind data will be used to understand if/how wind influences foraging habitat use and flight characteristics. The hypothesis is that rocky intertidal zones will be primary foraging sites but, as wind strength increases, birds will be forced to forage at less optimal locations. This research will give greater understanding on the interplay between resource availability and environmental conditions.

The fine-scale flight performance of a pelagic seabird

Jennifer Howard (@jenny_howard9)

Wake Forest University

Although growing evidence indicates that actuarial and reproductive senescence is almost universal in long-lived birds, the underlying processes remain elusive. A decline in physiological ability with age may manifest in aspects of foraging behaviour, and be an important mechanism

for senescence. We tested the prediction that old Nazca boobies (*Sula granti*) show reduced flight performance during level flapping flight compared to young or middle-aged birds. Accelerometer and GPS units were deployed on birds with ages matching transitions in reproductive success: young, middle-aged, old and oldest categories. We extracted flight measures during the commuting outbound and inbound period of a trip. Mixed effects models were used with age, sex, mass, and a component of wind support as fixed effects, and departure date as a random effect. We found evidence of an age effect in airspeed only during the inbound, suggesting a reduction in stamina for older birds.

Gull'ization in the Antarctic Peninsula: How far has global urbanisation reached?

Falk Huettmann (@FalkHuettmann)

EWHALE lab- Uni of Alaska Fairbanks

Many gull species are known to follow urbanisation. Entire ecosystems and their species have already been largely modified – worldwide – due to urbanisation and subsidised predators. Here I show for a remote but sensitive wilderness land- and seascape – the Antarctic Peninsula – observations, numbers and impacts from two Southern Hemisphere summers of 2018 and 2019. Apart from ‘skuas’, the kelp gull (*Larus dominicanus*) and its numbers are of major interest. My sightings show that gull numbers are ‘large’ around penguin colonies, but that actual predation events are not apparent. However, the ‘ecology of fear’ needs to be considered, and also that kelp gulls can move large distances and that quality long-term baseline data are usually lacking. Arguably, human activities in Antarctica will have urban-type impacts and leave this ecosystem largely modified, just like elsewhere in the world, with devastating outcomes.

Food supplementation during the breeding season influences migration in blacklegged kittiwakes

Shannon Whelanelan (@killerwhelan)

McGill University

Resource availability affects investment towards reproduction and maintenance. Large investments into maintenance during the breeding season could influence subsequent non-reproductive behaviour. We used a food-supplementation experiment to test the effects of resource availability during the breeding season on subsequent migration behaviour. Black-legged kittiwakes breeding on Middleton Island, Alaska, were hand fed an unlimited supply of fish throughout their breeding season. To track migration, light-level geolocators were attached to the tarsus of 31 fed and 32 unfed individuals. Fed birds left the colony earlier and migrated shorter distances during the non-breeding season. Our results demonstrate that food availability during the breeding season can carry over to influence non-breeding behaviour.

Conservation Biology 1 Session

#WSTC5 #ConsSesh1

Identifying light-induced stranding hotspots for Maltese petrels

James Crymble (@MaltaSeabirds)

BirdLife Malta

Light pollution is a well-documented threat to petrels (Procellariiformes) worldwide. Light pollution in the Maltese Islands has been attributed to the contraction of petrel breeding colonies and the direct cause of stranding events. Using a long-term database of reported stranding cases, we have identified the major locations or 'hotspots' for petrel strandings in the Maltese Islands. Four main hotspots accounting for almost half of all stranding cases were identified. More than 90% of all stranding cases involved fledglings. Identification of these areas will serve as a valuable tool in the conservation of Maltese petrels through focusing rescue efforts and light pollution mitigation measures around the breeding colonies.

Investigating movement ecology of the African penguin (*Spheniscus demersus*) during immature life phases to inform conservation

Jennifer Grigg (@jennifer_grigg)

University of Exeter

In seabirds, immature individuals can represent ~50% of populations and are important drivers of population dynamics. Yet we know little about their ecology, which has hindered the design and implementation of management strategies for species of conservation concern. The endangered African penguin (*Spheniscus demersus*) has undergone a drastic population decline since 2004 and conservation interventions are urgently required. We will carry out the first study of the at-sea behaviour of immature (2-3 year-old) African penguins, to investigate their habitat use and determine if they use current and proposed protected areas. We will use GPS-GSM loggers to track the movements of up to 28 individuals from two colonies in the Western Cape of South Africa, Robben Island and Stony Point. We will also utilise remotely-sensed environmental data and existing datasets on fishery catches and prey biomass. Here we will present our proposed methodology and hypotheses prior to beginning fieldwork.

Beach-nesting birds selecting areas with high off-road traffic during pre-breeding season

Marcello D'Amico (@MaD_OnTheRoad)

IDAEA-CSIC

Beaches of protected areas are used by humans for harvesting/recreation, often using motor vehicles. With the aim to investigate habitat selection for a beach-nesting bird (i.e. the Kentish plover) during the pre-breeding season, in the winter/spring of 2010 we surveyed the coastline of Doñana National Park (Spain). We detected 63 flocks (282 individuals), selecting beach sections characterised by high off-road traffic and food availability. Preliminary observations suggested that plovers selected vehicle tracks for feeding and to protect themselves from wind. This unusual

selection of pre-breeding habitat has relevant consequences on the selection of nesting sites, depicting a possible habitat mal-assessment.

A seabird of prey: On the dependence on the ocean of an island raptor

Ulises Balza (@UlisesBalza)

Centro Austral de Investigaciones Científicas

Seabirds are defined as birds that depend on the ocean, while raptors are characterised by feeding on other animals in a variety of different habitats. Neither seabirds nor raptors are monophyletic, taxonomically valid groups, but respond to clustering through ecological resemblance, which is useful in ecological studies and to promote direct conservation efforts. The striated caracara is a member of the Falconidae family and occurs only on islands in southern South America. In a four-year study in the Fuegian archipelago, we found a high ecological dependence of the caracaras on the resources that the ocean provides. They build their nests close to the seabird colonies incorporating marine debris and feed mainly on eggs and chicks. During the winter, they forage over larger areas but are still associated with sea lion stands. Conservation of this seabird of prey is therefore highly dependent on the management and conservation of the ocean environment.

Individual tracking informs exposure of the endangered black-capped petrel to marine threats

Yvan Satgé (@YvanSatge)

Clemson University, SC Cooperative Research Unit

The Diablotin or black-capped petrel (*Pterodroma hasitata*) is a gadfly petrel endemic to the Caribbean. The species has a fragmented and declining population and is considered endangered throughout its range. Interactions with anthropogenic activities at sea have been under-studied although they are likely to impact the survival of the species. During April-November 2014 and April 2018 we tracked six adult petrels nesting in the Dominican Republic using satellite and GPS technology. Tracked petrels travelled between 2,000 and 4,000 km during chick-provisioning trips. Foraging areas appeared to be associated with physical processes such as the Guajira upwelling, and climatological fronts in the outer continental shelf of the South Atlantic Bight. Foraging areas overlapped with fishing effort for commercial longline and trawling. In the Caribbean Sea, use areas of black-capped petrels also overlapped with oil and gas activities offshore of Colombia.

Future breeding and foraging sites of black guillemot in the Baltic Sea

Anouschka Hof @AnouschkaHof

Wageningen University

One of the southernmost populations of the black guillemot is currently endangered, and the risk may be exacerbated by climate change. We evaluated its future vulnerability by predicting the impact of climate change on the geographic distribution of its breeding and foraging range in the Baltic Sea. We used a species distribution modelling technique to predict the current and future

breeding grounds and foraging sites. We found that, although the foraging range is expected to increase in the southern Baltic Sea in future, these areas will no longer be suitable as breeding grounds due to a changing climate, creating a spatial mismatch. Our predictions indicate where threats to the species may be most severe and can be used to guide conservation planning. We advocate conservation measures which integrate potential future threats and focus on breeding sites across the current and future potential geographic range of the black guillemot.

Procellariiformes affected by light pollution in Chile. An update on the current knowledge and challenges for management

Rodrigo Silva (@elrodrigossilva)

Red de Observadores de Aves y Vida Silvestre de Chile

Light pollution is an emergent threat for seabirds throughout the world, affecting especially petrels and shearwaters. A global review of this issue shows at least 56 Procellariiformes species are affected. In this work we present evidence for three other species being affected in Chile (Oceanitidae and Procellariidae) and show some remarkable findings such as: (i) the massive fallout events recorded for Markham's storm petrel (*Hydrobates markhami*) near Arica and Iquique, which seems to be one of the world's largest in terms of individuals affected and (ii) the effect on the Peruvian diving petrel (*Pelecanoides garnotii*), listed as an endangered species locally and globally, even without considering the light pollution threat. Although most of our records are consistent with published experience, an interesting finding is that several fallout locations occur on the mainland, even as far as 100 km from the shore. These pose new challenges for impact management and policy development.

Conservation Biology 2 Session

#WSTC5 #ConsSesh2

Plenary

Jacob González-Solís (@SeabirdEcology)

University of Barcelona

Seabirds breed on land but forage mostly at sea, thus being exposed to both terrestrial and marine threats. In Cape Verde, the seabird community was once composed of nine breeding species, however, one species, the frigatebird, has recently gone extinct in the area, and the remaining species represent only a relic of their former populations. Our team started working on Cape Verde seabirds 15 years ago, when we knew little about the threats they faced. Since then, our knowledge of these species and their main threats has increased enormously, particularly over the last two years, thanks to the support of a large project on seabird conservation, funded by MAVA Foundation and coordinated by BirdLife International. In my plenary, I will present some major results achieved over the last 15 years as well as recent advances in our knowledge and the threats, both on land and at sea.

Spatial and temporal consistency in migration routes of seabirds

Kirsty Franklin (@kirstyyfranklin)

University of East Anglia

There is growing evidence that migratory species are particularly vulnerable to rapid environmental changes arising from human activity. However, assessing the ability of a species to adjust to these changes in the environment relies on understanding the degree of individual flexibility (or, conversely, consistency) in migratory routes and timings. This individual-based approach has been made possible by recent advances in remote-tracking technology. Here, I present preliminary results from an extensive literature search on all papers estimating repeatability of avian migratory strategies, as well as my planned PhD research investigating the consistency of migration in the Round Island petrel using light-level geolocators. This petrel breeding on Round Island in the Indian Ocean is a hybrid complex of at least three species of *Pterodroma* petrel and is the focal species of my PhD – the first PhD to be funded by the BOU's John and Pat Warham Studentship Fund.

The effect of artificial nest boxes on the ectoparasite communities of burrow-nesting seabirds in West Wales

Sarah Morgan (@turtlehats)

Cardiff University

Procellariiform species (albatrosses, petrels and shearwaters) are of conservation concern, with 46% of species classified as 'threatened', and as many as 12% considered critically endangered. To attempt to boost population sizes, artificial nest boxes have been introduced as a conservation measure for petrel species in west Wales. Despite the potential conservation benefits of artificial nest boxes, the temperature and humidity differ from natural nest sites. Avian ectoparasites are highly sensitive to changes in both humidity and temperature and the use of nest boxes could alter ectoparasite communities of burrow-nesting seabirds, with impacts on host fecundity. This study aims to provide a baseline description of the ectoparasitic communities infesting a mixed-species colony of Atlantic puffins (*Fratercula arctica*), European storm petrels (*Hydrobates pelagicus*) and Manx shearwaters (*Puffinus puffinus*) and to assess the impacts of the provision of artificial nest boxes on these ectoparasite communities.

Tropicbirds in Sal: From almost unknown to one of the largest colonies in West Africa

Albert Taxonera (@ProjetoBioSal)

Associação Projeto Biodiversidade

Red-billed tropicbirds (*Phaethon aethereus*) are a pantropical species breeding on several islands and islets of the Cape Verde archipelago, NE Atlantic Ocean. Sal Island, a flat, semi-arid and very touristic island, was thought to hold just a few pairs. However, our recent surveys verified that Sal possibly holds the largest population in West Africa, with $N \approx 500$ pairs. Tropicbirds breed year-round in three different habitats: an off-shore islet, steep cliffs, and inland soft slopes, with a peak during the months of January to March. Since 2017, we have ringed 194 chicks, captured 485 adults and recaptured 95 adults to perform demographic studies; we obtained 113 GPS trips to

study the foraging ecology and help identify mIBAs and 21 geolocator trips to assess migratory patterns. This is an amazing example of how the collaboration between scientific institutions and local NGOs is fundamental for the conservation of seabirds.

Being smart about wind and birds

Jordan Rutter (@ABCbirds)
American Bird Conservancy

In 2010, the American Bird Conservancy (ABC) developed a Bird-Smart Wind Energy Program to advance the sustainable development of wind energy while minimising risk to affected bird life. ABC supports the effort to combat climate change through responsible renewable energy development. However, we have concerns regarding the impacts of offshore wind turbines on seabirds. We are working with partners to implement our Bird-Smart Wind Energy Policy, which promotes: compliance with a strong regulatory framework; proper siting of turbines away from high-bird-collision risk areas; independent, transparent, pre-and-post-construction monitoring; effective mitigation by wind energy facilities to minimise bird mortality; and compensation for the loss of protected birds. For more information on ABC's Bird-Smart Wind Energy Campaign, please visit abcbirds.org/program/wind-energy-and-birds/.

Future research for conservation of petrels and shearwaters

Airam Rodriguez (@Airam_Rguez)
Estación Biológica de Doñana CSIC

Anthropogenic alterations on land and at sea have led to a poor conservation status of many petrels and shearwaters. Some species are well-studied, even being used as bioindicators of ocean health, yet for others there are major knowledge gaps regarding their breeding grounds, migratory areas or other key aspects of their biology and ecology. We assembled 38 petrel conservation researchers to identify knowledge gaps that must be filled to improve conservation and management. We highlight research advances on the main threats for petrels (invasive species at breeding grounds, bycatch, overfishing, light pollution, climate change and pollution). We propose an ambitious goal to reverse at least some of these six main threats, through active efforts such as restoring island habitats (e.g. invasive species removal, control and prevention), improving policies and regulations at global and regional levels, and engaging local communities in conservation efforts.

Illuminating the hidden lives of seabirds

Abby McBride (@sketchbiologist)
National Geographic and The Fulbright Program

Field biologists who are willing to communicate creatively can play a unique and effective role in bringing visibility to seabirds and convincing people to care about seabird decline. I will share some techniques I used during a year of sketching and writing about seabirds all over New Zealand (home to the most diverse and endangered seabirds in the world) as a roving research assistant and Fulbright-National Geographic Digital Storytelling Fellow.

Predator control of Cape fur seals (*Arctocephalus pusillus pusillus*) that predate on Cape gannets

Zanri Schoeman (@SeabirdLady)

Nelson Mandela University

Cape gannets (*Morus capensis*) on Penguin (Bird) Island, South Africa Worldwide, the six remaining Cape gannet (*Morus capensis*) breeding populations experience predation that limits both their breeding density and breeding success. In 2006, the entire breeding population deserted Penguin (Bird) Island due to predation by Cape fur seals (*Arctocephalus pusillus pusillus*). The Cape gannet population has subsequently recovered, whereafter in 2014, 2015 and 2018 some predatory Cape fur seal individuals were culled in an attempt to temporarily reduce the predation rate on the fledglings. A logistic regression model was run and found that an increase in predation was significantly related to the likelihood of the year in which culling was implemented than when compared to the non-culling years. Culling decreased the predation on an intra-annual scale but the effect of culling on an inter-annual scale was negligible. Increasing fish biomass was associated with a reduction in predation rate; therefore, we suggest that management focus should rather be placed on fish conservation.

Conservation Session 3

#WSTC5 #ConsSesh3

Low seabird occurrences in the Bay of Bengal, concomitant with significant marine productivity and longline fishing activity

Ravichandra Mondreti (@rav12319)

National Centre for Sustainable Coastal Management (NCSCM), India

At-sea observations of seabirds provide essential baseline information with respect to their biogeography and behaviour, facilitating marine spatial planning and management. Much of the world's oceans have been surveyed, yet some regions remain particularly data-poor for seabirds, including the Bay of Bengal. We performed 39 days of vessel-based observations within the Bay of Bengal in 2012 to 2014, surveying over a total distance of 4722.3 km. We observed 2697 seabirds of 17 species. Sooty terns (*Onychoprion fuscatus*, n = 2282, 84.6 % of all seabirds) and wedge-tailed shearwaters (*Ardenna pacifica*, n = 327, 12% of all seabirds) predominated during our surveys. Other seabird species accounted for only 4% of all sightings. The diversity of seabirds was low compared to other tropical areas. We propose that low top predator abundances result from long-lasting disturbance, overexploitation of marine resources, and the near absence of seabird breeding sites in the Bay of Bengal.

Feet, farts and fishermen: How the storm petrels got their names

Rob Thomas (@RobThomas14)

Cardiff University

Storm petrels have been called by many names at different times and in different parts of the world. These names can speak to us, not just about the birds themselves, but about the people who have shared islands and oceans with storm petrels down the ages. The origin of the name 'petrel' itself is controversial, and may be derived from (i) the birds' 'pitter-pattering' with their feet as they forage, or (ii) 'Peter', the disciple who walked on the water, or (iii) an old English word, 'pet', a fart, referring to the strange sounds and smells of breeding petrels. Other traditional names for storm petrels in English and the Celtic languages refer to aspects of the birds' behaviour, ecology and utility to humans, as well as a wide range of superstitions and folklore.

Success and failures using artificial colony site enhancement and simple artificial structures for nesting terns in the Solent

Wez Smith (@WordsFromWez)

RSPB

Good-quality natural nesting habitat is limited in the Solent by high disturbance, increasing spring tide flooding and intensive colonisation by other species of the most secure sites. The provision of artificial site enhancements and simple artificial structures has provided a mixture of successes and failures over half a decade of trial and error. Methods looked at include raising beach height, substrate provision, coastal lagoon rafts and raised platforms.

Seabird surveys in the Gulf of Mexico: Preliminary results from pelagic cruises

Patrick Jodice (@SCCoopUnit)

Clemson University

Seabird surveys associated with the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS) are uncovering previously unknown aspects of the distribution and abundance for these apex predators. From April 2017 – October 2018 we conducted >200 survey days on 12 NOAA cruises in the northern Gulf of Mexico. Using standard, transect-based methodology we amassed ~ 5,700 detections of 36 seabird species totalling ~25 k seabirds. Although commonly associated with tropical coastal environments, surveys have observed brown boobies (*Sula leucogaster*) to be widespread in pelagic waters. Finally, black-capped petrels (*Pterodroma hasitata*) have regularly been detected in the offshore area, a most notable finding as this threatened species is currently petitioned for protection under the Endangered Species Act. These novel insights provide an important ecological context for current regional activities and can inform the development of future activities.

A new success story for Mascarene petrel conservation, Reunion Island

Patrick Pinet (@LIFE_Petrels)

Parc National de La Réunion

Since the discovery of the first Mascarene petrel (*Pseudobulweria aterrima*) colony in November 2016, and the massive increase of the breeding success in 2018 (from 0% to 60%) thanks to our predator control programme, the LIFE+ Petrels project has reached a milestone. For a long-term conservation perspective, for the first time ever, two Mascarene petrel artificial breeding colonies were created in 2017 and 2018. Surprisingly, artificial sites were quickly visited by birds at night, and we also recorded artificial burrow occupancy in less than one year. Moreover, the first bird controlled in February 2019 in a burrow was banded as a fledgling rescued when grounded in the first year of the project, in 2015. This unbelievable story confirms that our ambitious and multi-faceted LIFE+ project gives hope to succeed in saving this endemic and critically endangered petrel.

Revisiting the first breeding bird atlas of Chile: The seabirds

Fernando Medrano (@FmedranoM)

Red de Observadores de aves y vida silvestre de Chile

The first breeding bird atlas of Chile was launched in 2018, gathering more than 675,000 observations using eBird. One of the main characteristics is that it assesses how much is known about the birds that breed in Chile. This exercise was useful to learn about how much we ignore about birds, and was also the case in seabirds. We do not have complete information about colonies for most of the species, nor current information about population estimations, which means that we take blind decisions. This atlas is expected to be a milestone for prioritising future studies on Chilean seabirds.

Conflicts abound: How future development threatens critical migratory bird habitat around Farmington Bay of the Great Salt Lake

Aubin Douglas (@AubieDouglas)

Utah State University

The National Audubon Society considers the Great Salt Lake and its associated wetlands to be North America's "single most important interior wetland for birds". Unfortunately, the Lake and its wetlands face the ever-increasing risks of degradation and destruction from future development and expansion of the adjacent urban area in Utah, known as the Wasatch Front. Through a spatial conflict analysis between current migratory bird habitat and planned future development projects, I determined that critical migratory bird habitats for shorebirds, waterbirds and waterfowl are all expected to decline by several thousand acres by 2040. Based on my findings, I have several recommendations for stakeholders and planners to accommodate more critical habitat while allowing for the expected population growth in the region.

Small achievements to reduce the effect of light pollution in Markham's storm petrel in Chile

Rodrigo Silva (@elrodrigossilva)

Red de Observadores de Aves y Vida Silvestre de Chile (ROC)

In Chile at least 12 species of tubenoses are affected by light pollution including five globally threatened or data-deficient species. Markham's storm petrel (*Hydrobates markhami*) is one of the most impacted species locally. From 2015 to date, volunteers have led the rescue and release of birds, but there are large uncertainties about the effectiveness of this approach. Since 2018 we have been promoting an update of light pollution national regulations but some faster actions have been boosted in addition: a new big salt mine is not going to work at night, to reduce fallout; Iquique's airport is turning-off their land lights when no nocturnal flights are scheduled; and some music concerts in Arica were rescheduled to avoid fallout peak season. The results of these actions need to be assessed but we have already identified these small achievements as a success on their own.

Globally threatened seabirds share traits which increase their vulnerability to fishing gear

Cerren Richards (@CerrenRichards)

Memorial University of Newfoundland

Seabirds are the most threatened group of birds and their status is deteriorating rapidly. Trait-based approaches have the potential to offer new insights into the vulnerability of species to stressors and inform conservation management priorities. Here we compiled and imputed the same eight traits across 341 seabird species from multiple databases. We used these traits to compute functional uniqueness, identify whether IUCN-classified globally threatened and non-threatened seabird species have distinct traits, and test if trait combinations increase seabird vulnerability to fishing gear. We found that traits differ significantly between globally and non-threatened seabirds. Furthermore, globally threatened species are more functionally similar and non-threatened species are more functionally unique. We suggest that fishing gear selects species which share similar traits – large, long-lived, pelagic surface feeders with small habitat breadths – thus, a functionally similar suite of seabirds will be lost due to fishing practices if management strategies are not adopted.

Contaminants and Marine Debris 1 Session

#WSTC5 #ContSesh1

Marine debris incorporation in sulid nests

Megan Grant (@OceanGirl_Megan)

University of Tasmania. University of the Highlands and Islands

Marine debris is pervasive worldwide, and affects many seabird species negatively. We compared the characteristics of debris incorporated within brown booby (*Sula leucogaster*) nests throughout their pantropical distribution by assessing the type, colour and mass of debris items within nests

and in beach transects at 18 sites, to determine if nests are indicators of the amount of debris in local marine environments. Debris was present in 14.4% of nests surveyed, with the proportion of nests with debris varying among sites (range: 0–100%). There was minimal overlap between the type or colour of debris found in nests and on adjacent beaches at individual sites. This suggests that brown boobies do not select debris uniformly across their distribution. We propose that the nests of brown boobies can be used as a sentinel of marine debris pollution of their local environment.

Microplastic extraction method development and application

Isabel Connell (@issieconnell)

Nottingham Trent University

Seabirds suffer negative consequences due to directly and indirectly ingesting plastic and microplastics. There are a number of invasive ways to see whether or not they are ingesting plastic, including post-mortem gut analysis and stomach flushing. This research looks at faeces analysis as a less invasive way to find microplastics. A simplified, replicable method was designed to extract plastic from bird faeces in the laboratory, then applied to seabird faeces collected from four species across different sites in Australia: pelicans in Perth, brown boobies in the Lacepede Islands and Christmas Island, shy albatross' in Tasmania and red-tailed tropicbirds on Christmas Island. All these species have been found to have plastic in their gut content in previous studies; however, little research has been done into their faecal matter. Analysis showed all species' samples contained microplastics, including fishing line and bits of drinking straw.

Do European herring gulls (*Larus argentatus*) ingest specific types of plastic?

Roselle Smith (@RoselleSmith_)

University of Glasgow

This study will focus on the endangered European herring gull (*Larus argentatus*), a species in which there has been little research into plastic ingestion. The ingestion of plastics will be investigated through the examination of pellets. Plastic debris found inside the pellets will be categorised into groups, e.g., Industrial/User plastic. Also, the research will record: the weight, size, quantity and colour of the plastic. Prey identified in the pellet analysis and tracking data will determine the key habitats where gulls forage. Surveys will be conducted at the different habitats and record: the type, sizes and colours of plastic available there. The type of plastic available in the environment will be compared with the ingested plastic; this will test if herring gulls ingest some types of plastic more than other types of plastic. This study will help demonstrate that pellet analysis is an appropriate method for tracking plastics in the marine environment.

A study of the plastic ingestion and associated diet of the great skua (*Stercorarius skua*) through the dissection and analysis of regurgitated pellets

Elizabeth Holmes (@Liz_EHolmes)

University of Reading

Six hundred and thirteen great skua pellets from Fair Isle, Shetland, were collected and dissected; 3.1% of pellets contained plastic; 58.8% of these consisted of bird remains, half of which were fulmar (*Fulmarus glacialis*). This may reflect the high rate of accidental ingestion of plastics of this species, and thus the vertical movement of plastic through the food chain. A study by Hammer et al. (2015) on the Faroe Islands found more plastic associated with all prey types, with approximately 6% of all pellets containing plastic debris, suggesting these skuas are consuming more prey contaminated with plastic. Analysis of the plastics using FT IR spectroscopy has allowed for the identification of plastic types found. This, in conjunction with the study of ocean currents and foraging areas of great skuas and their prey, may allow for the identification of the sources of plastics found.

Mapping nest incorporation of anthropogenic debris by seabirds across the north-eastern Atlantic

Nina O'Hanlon (@Nina_OHanlon)

University of the Highlands and Islands

The presence of anthropogenic debris in the marine environment can impact species through entanglement and ingestion, particularly seabirds. Despite widespread knowledge that seabirds incorporate such debris into their nests, quantitative studies are lacking. To improve our understanding on how this issue affects seabirds, and where, we are collecting data on nest incorporation of debris by seabirds across the north-eastern Atlantic. Here we present preliminary results on the prevalence of debris incorporated into seabird nests from across the UK, collected during the 2018 field season in collaboration with the 'Seabirds Count' national census, and from targeted fieldwork focused on the northern gannet. Over the next two years we are looking to collect data from species and locations not currently covered. If any seabird researchers, surveyors, ringers or birders can help, then please get in touch!

Identifying the source of nest plastic in herring gulls

Danni Thompson (@scottishseabird)

JNCC

Some seabird species incorporate plastic debris in their nests, but there is little evidence detailing the source of nesting material for different species and populations. Using both spatial and pellet analysis, this study aimed to discern whether herring gulls (*Larus argentatus*) on Lady Isle, Scotland, gather nesting material where they forage, or whether nesting material was more likely gathered from their local nest environment. Plastic was found in more than one-third of all nests and pellets. Spatial clustering and analysis of pellets suggests that nesting material is collected locally from the tideline. Targeted beach cleans therefore have the potential to reduce the quantity of plastic available to herring gulls, reducing a potential environmental stressor.

Contaminants and Marine Debris 2 Session

#WSTC5 #ContSesh2

Family matters – phylogenetically informed predictions of seabird vulnerability to plastic ingestion

Stephanie Avery-Gomm (@saverygo)

University of Queensland

Seabirds are among the most broadly documented marine animals to ingest plastic, with unknown implications for individual and population health. We present an approach to infer plastic ingestion risk that expands upon previous regionally or taxonomically focused studies. We first analyse nearly 50,000 records of plastic ingestion documented over ~60 years to identify the life-history predictors of plastic ingestion risk for seabirds. Then, we use these factors to generate predictions of ingestion risk for all seabird species, including those that have never been studied. Our results, which identify seabirds that are at high risk of ingesting plastics, may be used to prioritise species for further study and help to link plastic ingestion research to wildlife conservation.

Occurrence of plastic ingestion in great shearwaters from 2008 to 2018

Gwen Emery (@gwenemery_5)

University of Rhode Island

Global plastic production and use is expected to increase, and ocean plastic pollution stands as a growing threat to seabirds. Great shearwaters (*Ardenna gravis*) are a common pelagic seabird, foraging in the North Atlantic and breeding in the South Atlantic during the boreal winter. Their transequatorial migration means these birds are prone to elevated levels of plastic ingestion across the expanse of the Atlantic, due to their surface-foraging techniques. In this study, we screened GI tracts from bycatch juvenile great shearwaters collected over an 11-year time period to quantify and classify plastics found in the ventriculus, or 'gizzard'. Plastic debris is measured, weighed and classified; plastic characteristics are compared to bird characteristics including age, size and various morphometric measurements of the individual. Future analysis is planned to determine exact polymer type of found debris to aid in conservation and pollution prevention efforts.

Health assessments of brown pelicans from the Gulf of Mexico

Patrick Jodice (@WSUChair)

Clemson University - WSU Chair

The northern Gulf of Mexico supports a diverse array of nearshore and pelagic seabirds. The region also supports substantial levels of oil and gas activity. We collected blood samples and feathers from brown pelicans breeding throughout the northern Gulf. We conducted complete blood counts (CBCs) and also measured concentrations of polycyclic aromatic hydrocarbons (PAHs) of adults and chicks. We assessed the influence of regional levels of energy development, home range size and individual characteristics on CBCs (n = 30 blood analytes) and PAHs (n =

24 species). CBCs were most frequently influenced by home range size followed by individual body condition. Alkylated PAHs were more common compared to parent PAHs. Sixty-three percent of individuals had detectable levels of PAHs and 33% of individuals had > 1 PAH. Results are also interpreted within the context of developing plans for long-term monitoring within the northern Gulf.

Occurrence of plastic marine debris at Hawaiian petrel and Newell's shearwater burrows on the island of Kaua'i, Hawaii

Erin Pickett (@picketterinp)

Kauai Endangered Seabird Recovery Project

The Hawaiian petrel and Newell's shearwater are the primary study subjects of a long-term monitoring programme of endangered seabirds on the island of Kauai, Hawaii. Unlike terrestrial threats, little is known about how at-sea impacts such as marine debris affect these species. We recorded all plastic found at monitored burrows over two breeding seasons (2017-2018). We monitored a total of 677 Hawaiian petrel burrows and found that 14.4% of active burrows contained plastic debris. Ninety-one percent of these observations consisted of single pieces of thread-like fibres, the majority of which (72%) were green or blue-coloured. Conversely, no plastic was found at any of the 154 Newell's shearwater burrows monitored during the study period. This study presents the largest set of observations of plastic consumption by Hawaiian petrels published to date, and serves as an important reminder of the potential threat of marine debris to endangered seabirds throughout the Hawaiian Islands.

Legacy and emerging poly- and perfluoroalkyl substances (PFASs) in seabirds from Atlantic offshore and coastal environments

Anna Robuck (@annaruthski)

University of Rhode Island Graduate School of Oceanography

Poly- and perfluoroalkyl substances (PFASs) have been produced since the 1940s for use in commercial and industrial applications, and demonstrate remarkable environmental persistence and bioaccumulative capacity. PFASs have been found globally in drinking water, surface water, and biota, including birds from diverse habitats. Here, PFASs were measured in juvenile birds from the US Atlantic seaboard. Bird liver samples were obtained from deceased juvenile herring gulls, great shearwaters, terns and pelicans from Narrangansett Bay, Massachusetts Bay and the Cape Fear River Estuary. Liver extracts were analysed for 24 ionic and neutral PFASs using liquid chromatography/mass spectrometry. Coastal birds and offshore birds did not significantly differ in sum PFASs, yet birds from near a fluoro product production centre contained significantly higher sum PFASs. Observed concentrations indicate abundant PFASs are present in birds from both developed and remote Atlantic systems, contributed by uncertain pathways, as trophic indicators suggest atypical bioaccumulation mechanisms.

Tracking and Distribution Session

#WSTC5 #DistSesh

Plenary

A sense of scale: connecting the dots of seabird movement ecology

Dr. Rachael Orben (@RachaelOrben)

Oregon State University

Tracking technology has exploded in the last 20 years, but there is still the need for continued miniaturisation and sensor development. Through tracking, we gain the perspective of individual birds on their central-place foraging trips or migrations. Considering scale, in both time and space, is important, from overall distributions to fine-scale behaviours. Fine-scale data can help disentangle foraging events and seabird-boat interactions while species distributions offer insights into multi-individual hotspots. Seabirds are declining globally, and the climate is changing. Maximising data collected by loggers, and its subsequent use for ecology, conservation and policy, is integral to understanding how long-lived seabirds may fare as the oceans continue to change.

Gull tracking in Belfast takes flight: Reviewing data from the first breeding season

Katherine Booth Jones (@BT O_NIreland)

BT O Northern Ireland

Lesser black-backed and herring gulls are listed as Birds of Conservation Concern in Ireland, but nothing is known about roof-nesting gulls in Northern Ireland. Key questions remain on how urban gulls differ from their declining rural and coastal counterparts in their habitat-use, particularly since roof-nesting appears to be on the rise. Here we use GPS GSM tags to track lesser black-backed gulls nesting in the city centre of Belfast, investigating their ranges during the breeding season and identifying areas of potential human-gull conflict in the city. Using Time-In-Area analysis we found that roof-nesting gulls rarely use areas outside the urban area, and individuals appeared to have particular areas they consistently visited. Future tracking and data collection will help to characterise areas of potential human-gull conflict in Belfast, and provide a comparison of how lesser black-backed gulls and herring gulls use urban areas during the breeding season.

Effects of wind on seabirds: Implications for assessing the impact of offshore wind farms

Hannah Meinertzhagen (@HannahMeinertz)

University of Exeter

Wind is a fundamental component of marine ecosystems, utilised extensively by seabirds to enable low-cost travel over vast distances. This wide-ranging, pelagic life style makes seabirds particularly vulnerable to offshore wind farms. Coupled with this, climate change has already and will continue to alter wind regimes with uncertain consequences for seabirds. This study will use GPS tracking data coupled with remotely sensed wind data to investigate how changes in wind

patterns affect the movements and behaviour of UK seabirds. This information will then be used to inform the vulnerability of seabirds to offshore wind farms, particularly in the context of collision risk.

Tracking meets tidal: Seabird use of tidal flow areas and potential interactions with marine renewables

Natalie Isaksson (@nattenstein)

The UK is committed to increased electricity production via renewable energy. However, many questions remain regarding the effects of marine renewables on seabirds, with chief concerns being collision and displacement. Tracking devices such as GPS and time-depth recorders (TDRs) provide information about seabird space use in both horizontal and vertical dimensions. This kind of data can therefore greatly increase our understanding of how seabirds use areas with strong tidal currents, and consequently what the potential is for interactions with tidal-stream marine renewable energy devices. Old and new tracking data from species identified as particularly at risk, including common and black guillemot, razorbill and European shag, will be used to explore these questions and inform the consenting process. The project aims to yield guidelines for how to effectively use tracking in impact assessments of tidal marine renewables on seabirds.

Crowdsourcing seabird surveys: combining traditional methods and citizen science to map Southern Ocean bird distributions

Michael Schrimpf (@MBS_Science)

Mapping the at-sea distribution of marine birds with high enough spatial and temporal resolution to distinguish relationships to meso-scale oceanographic features generally requires large volumes of data, which could potentially be generated by the increased popularity of citizen science. Effective use of citizen science data for such purposes currently requires the use of more traditional survey techniques to model the range of detection probability. By using both strip-transect surveys and the collection of passenger/staff bird surveys aboard tour vessels in the Scotia Sea, we are building a database capable of regional distribution modelling. Preliminary results of the strip-transect surveys suggest interesting differences between species that prefer warmer vs. cooler oceanographic features. Future data collection will allow us to compare professional surveys with citizen science data, and we encourage participation among Antarctic tourists through involvement with the Polar Citizen Science Collective.

Annual variation in spatial use of the Gulf of Maine by great shearwaters (*Ardenna gravis*)

Tammy Silva (@trackseabirds)

The Gulf of Maine (GOM) (northeast US) is a primary foraging area for great shearwaters. As a potential ecological indicator and the most frequently by-caught species in the northeast US gillnet fishery, great shearwater habitat use data is critical for ecosystem management and conservation. We satellite-tagged birds in the GOM from 2013-2017 and used Time Local Convex Hull analysis to quantify: core and home ranges, overlap between birds, revisitation and duration of stay. Birds

used the entire GOM as their home range each year, but spent 65% of time foraging within 24% of that area. Core range was consistently located within the southwest GOM, but use of other areas varied. Duration and revisitation were highest where individual core ranges overlapped. We suggest that great shearwaters exploit the same foraging spaces, but the focus within ranges changes annually, emphasising the need for long-term data to understand habitat use.

Fisheries Session

#WSTC5 #FishSesh

Impacts of EU fishing activities on seabirds in West African waters

Justine Guiny (@BirdLifeEurope)

BirdLife Europe and Central Asia

The EU's Distant Water Fleet (DWF) pays to fish under 'sustainable' fisheries partnership agreements in non-EU waters, without any real knowledge of the environmental impact on the marine environment. This lack of scientific research is to the detriment of seabirds that get bycaught in fishing gear without mitigation measures put in place to prevent it. BirdLife advocates in the EU and West Africa for better controls of EU fishing activities and data collection on board of all the EU DWF, including through capacity building of local partners to engage on the content of these agreements between the EU and their country. Our MAVA West Africa Bycatch project has allowed the training of observers from seven West African countries, developed a data collection protocol to understand seabird bycatch in the region, and will start testing adapted bycatch mitigation measures that could be added as conditions in the next fisheries agreements.

BirdLife's Seabird Task Force: Tackling seabird bycatch

Daniel Mitchell (@BirdLifeEurope)

BirdLife Europe and Central Asia

Seabirds forage in highly productive areas of the ocean, which are also targeted by commercial fishing vessels. It is estimated that every year more than 200,000 seabirds die from being accidentally caught on hooks or entangled in fishing nets in European waters. This represents one of the most significant threats to these species. Effective bycatch mitigation measures exist and have been demonstrated in some parts of the world; however, much less work has been carried out in Europe. Through its Seabird Task Force, BirdLife has been training observers, establishing on-board observation programmes, and engaging with the fishing sector to develop and test solutions to seabird bycatch. We have also been active in advocacy work to create a supportive policy framework and ensure adequate funding to address the issue of seabird bycatch.

Best restaurant at sea: Seabirds and humans sharing space and food

Sophie de Grissac (@SGrissac)

Swansea University

Seabirds and fisheries, seeking their prey, tend to exploit shared 'hotspots' at sea, which leads to indirect (competition) or direct (bycatch) interactions that are often to the disadvantage of the birds. The discarding, by vessels, of non-marketable species and offal increases the likelihood of these interactions by attracting seabirds that take advantage of the readily available food. Using novel fine-scale tracking datasets, we investigate when and where multiple pelagic seabird species and humans are likely to interact in their shared favourite fishing grounds, by quantifying space use and potential interactions in the Irish and Celtic seas. Examining these relationships adds the human dimension to our understanding of inter-specific competition in seabirds and is of crucial importance to inform marine policy management in the context of seabird-fisheries sustained competition and the ongoing discards ban in the EU waters.

Future resilience scaled by surveillance: High sensitivity of albatross to regional illegal, unreported and unregulated fishing effort

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South Carolina Cooperative Fish and Wildlife Research Unit

For Kerguelen black-browed albatross, warmer near-colony sea-surface temperatures during incubation have promoted chick survival. However, bycatch from the illegal, unreported and unregulated (IUU) demersal longline fleet caused a historical population decline. The virtual removal of this fleet from the region allowed the population to rebound, yet these albatross are susceptible to bycatch in many fleets and future fishing behaviour is uncertain. We project albatross demographics assuming forecast SST and five future fishing-effort scenarios. Our results indicate a high sensitivity to shelf/slope versus pelagic effort. The only scenario estimating high bycatch and projecting a population decline assumed the re-emergence of the IUU fleet. This result is driven by intense overlap of albatross and IUU effort on the Kerguelen shelf/slope during the breeding period. This contrasts diffuse, non-breeding overlap with pelagic fleets and moderate overlap with trawl and demersal fleets. Our results underscore the importance of continued surveillance and management of bycatch.

A comprehensive assessment of fisheries bycatch risk to threatened seabird populations

Tommy Clay (@tommyturtleclay)

University of Liverpool

Incidental mortality (bycatch) in fisheries remains the greatest threat to many marine vertebrates and a major barrier to fisheries sustainability. Robust assessments of bycatch risk are crucial for informing effective mitigation strategies, but are hampered by missing information on distributions of key life-history stages (adult breeders and non-breeders, immatures and juveniles). Here, we combine long-term biologging datasets comprising all major life-history stages, with demographic models, to assess spatial overlap of four threatened seabird populations from South Georgia with longline and trawl fisheries in the Southern Ocean. Specifically, we examine where and when

birds are at greatest potential bycatch risk, and from which fishing fleets. The results of this study will able a better targeting of bycatch mitigation measures and monitoring of compliance across fisheries, fleets and ocean basins.

Lessons from seabird conservation in Alaskan longline fisheries

Rob Suryan (@rob_suryan)

Alaska Fisheries Science Center, NOAA Fisheries

Although bycatch of seabirds is a critical conservation issue in world fisheries, case studies documenting significant bycatch reductions in fisheries are rare. We studied progress towards seabird conservation in the Alaskan longline fisheries, one of the largest and most diverse demersal fisheries. We generated annual seabird bycatch rates (BPUE) from 23 years of fisheries observer data. Following adoption of streamer lines, at first voluntarily, seabird BPUE was reduced by 77–90%, preventing mortality of thousands of birds per year. Despite this, BPUE increased significantly in two of four target fisheries after streamer lines were adopted. Night setting yielded significant reductions (74–97%) in seabird BPUE while increasing target fish catch; however, night-time setting also increased BPUE of northern fulmar (*Fulmarus glacialis*) and non-target fish species. Our results illustrate that successful conservation requires fishery-specific solutions, strong industry support, vigilance in analysis and reporting of observer data, and continued outreach to fleets.

Foraging Ecology 1 Session

#WSTC5 #ForSesh1

The diet of two storm petrel species breeding in sympatry:

Jess Hey (@jesshey94)

Cardiff University

Seabirds are sensitive to anthropogenic pressures placed on marine ecosystems, such as climate change, over-exploitation and waste disposal practices. These pressures can cause ecological changes which cascade through trophic levels. Dietary studies are crucial to understanding how species and populations may respond to such changes; the level of dietary specialisms and preferences, as well as niche overlap between closely related species, can influence a species' resilience in the face of environmental change. We investigated the diet of Leach's storm petrels (*Oceanodroma leucorhoa*) and European storm petrels (*Hydrobates pelagicus*) on Mykines, Faroe Islands; the Faroe Islands are thought to hold the largest European storm petrel breeding population in the world, as well as a significant breeding population of Leach's storm petrel. Using DNA techniques to analyse regurgitates, we aim to gain a baseline understanding of these populations' diet, to allow us to understand how they may respond to future environmental changes.

Environmental conditions related to foraging site fidelity in black guillemots

Daniel Johnston (@TystieDan)

Environmental Research Institute/British Trust for Ornithology

Black guillemots have been suggested to be at risk from tidal stream turbines, as individuals have been found to associate with strong tidal currents and eddies during foraging. As a polyphagous species, the use of tidal streams may not be uniform across a population, and the extent of this risk may vary between individuals related to differing target prey species and foraging sites. Individualistic behaviour is a common occurrence in foraging ecology and can be exhibited through Individual Foraging Site Fidelity (IFSF), occurring when an individual consistently returns to a previous foraging location. This can lead to dietary specialism and niche partitioning between individuals. In this study, we used GPS tracking of black guillemots nesting on islands in close proximity to tidal streams to examine the relationship between environmental covariates and individual foraging-site fidelity. We also investigate the factors influencing the degree of overlap between foraging individuals.

Foraging behaviour of Razorbills during chick-rearing at the largest colony in the Baltic Sea

Natalie Isaksson (@nattenstein)

ERI, University of the Highlands and Islands

The responsiveness of top predators such as seabirds to changes in ecosystems makes them good indicator species. Before that can happen, baseline foraging behaviour data needs to be collected. At the largest colony of razorbills and common guillemots in the Baltic Sea, Stora Karlsö (57°17'N, 17°58'E), we fitted razorbills with tracking (GPS, TDR) devices. Data from 12 razorbills were retrieved and 7399 dives analysed. Foraging behaviour was broadly consistent with other colonies. Maximum and mean foraging range: 72.7 km and 13.1 ±13.5 km; mean dive depth and duration: 15.3±2.4m and 53.1±8.5s. Dive depth was bimodally distributed and there was a diel foraging pattern. Unexpectedly, dives were U-shaped. The razorbills spent 31% of their overall time activity budget flying or diving, with great variation between individuals. As the guillemots breed sympatrically, there is great potential for future research on auk ecology at this site!

Nocturnally active gulls: Need to 'top-up' for insufficient foraging during daylight?

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University of Glasgow

Seabirds are often active and forage not only during the day but also during the night. Little is yet known about factors explaining variation in nocturnal activity. As primarily visual predators, foraging in the dark may appear less profitable, although some diel vertically migrating prey may become more accessible in the night. Alternatively, nocturnal activity may occur when daytime feeding has been inadequate to meet the birds' requirements (supplementary hypothesis). We studied nocturnal activity of herring gulls (*Larus argentatus*) to test the supplementary hypothesis using GPS tracking. Herring gulls rely very little on diel vertically migrating prey, but we expect

that individuals with higher requirements (late nestling stage) show more likely nocturnal activity than individuals with lower requirements.

Urban vs non-urban foraging trips in urban-nesting gulls

Anouk Spelt (@AnoukSpelt)

University of Bristol

Worldwide urbanisation negatively affects animals, decreasing their diversity and numbers. Some species, however, are able to take advantage of the urban environment. An example of these species are gulls – traditionally seabirds – that use urban environments for nesting and foraging. We have shown that urban gulls in the city of Bristol, United Kingdom, spent the majority of their time in suburban and urban areas, and that this time differs per breeding stage. However, they are not exclusively foraging in suburban and urban areas as one-third of their time is spent in rural areas, such as agricultural lands. Our aim is to assess if foraging trips of gulls to these rural areas differ in terms of time spent away from the nest, time spent foraging, distance and energy expenditure. These results might explain the change in habitat use during the breeding season.

Stable isotope analyses of multiple tissues of great shearwaters (*Ardenna gravis*) indicate pre/post-migratory and short-term changes in diet

Peter Hong (@PeterHo62453093)

NOAA Stellwagen Bank National Marine Sanctuary

Comparison of stable isotope ratios of tissues with different turnover rates can provide information on how diets do or do not change over time or location. Great shearwaters (*Ardenna gravis*) are a common pelagic bird and have a wide distribution that spans almost the entire Atlantic basin, which, in conjunction with their relatively high abundance, make them an effective bioindicator. We compared $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values from the feathers, red blood cells (RBCs) and plasma of great shearwaters collected in 2014 and 2015 from the Gulf of Maine. The $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values of RBCs were quite constant, making RBCs a good baseline for comparison, the $\delta^{13}\text{C}$ of the feathers indicates a change in their diet from 2014 to 2015 probably before migration or shortly after arrival in Massachusetts Bay, while the $\delta^{13}\text{C}$ of plasma indicates a small, seasonal change in diet between July and September for both years.

Foraging Ecology 2 Session

#WSTC5 #ForSesh2

Moonlight affects colony attendance and nocturnal foraging behaviour of the wedge-tailed shearwater (*Ardenna pacifica*)

Andreas Ravache (@Andreas_Ravache)

Moon phase and illumination are known to affect nocturnal behaviour of many organisms. Nocturnal seabirds can tune their foraging trip duration according to moon phase. This has been mostly perceived as a predation-avoidance strategy. But it could also be related to a higher

nocturnal foraging ability during moonlit nights. Miniaturised GPS-loggers allowed us to track wedge-tailed shearwaters breeding in New Caledonia and to investigate moonlight effects on individual behaviour. Moon phase significantly predicted self-feeding trip duration. However, adults did not significantly return to the colony during moonless periods. Nocturnal foraging activity was positively correlated with moonlight. Stable isotope analyses revealed that adults fed on different prey when foraging during the day or at night whereas their foraging areas were similar. This study showed that lower colony attendance by shearwaters during moonlit nights might rather be linked to a higher foraging opportunity at sea than a higher predation risk on land.

Mercury exposure indicates sex-based foraging differences during El Niño-Southern Oscillation (ENSO)

Morgan Gilmour @MorganEGilmour

Reverse-size sexual dimorphism (RSD) can result in behavioural differences that help avoid sex-based competition for limited prey resources. Here, GPS-tracking data were combined with a novel foraging tracer, blood-based mercury concentration, to assess whether boobies (*Sula* spp.) exhibited dimorphic foraging ecologies during low prey availability (2015-2016 El Niño) in five colonies in western México. Tracking data demonstrated equivocal support for the maintenance of RSD: foraging ranges of male and female boobies had low-medium degrees of overlap; females foraged in larger areas; but foraging behaviours (e.g. trip lengths, durations and distances) differed more among colonies than between sexes. However, females had higher mercury concentrations, suggesting sex-based diet differences – a difference in foraging ecology not evident from GPS-tracking data alone. RSD appears to be maintained via foraging ranges and diet, but not most foraging behaviours. Behavioural similarities may be linked to foraging plasticity, not body size, in response to colony-specific prey availability.

Within-colony spatial segregation leads to foraging behaviour variation in a seabird

Sonia Sanchez (@SonSanchez9)

Increased competition for food resources in large seabird colonies often leads to between-colony spatial foraging segregation. However, little is known about how colonial living influences foraging behaviour of conspecifics within the same colony. We simultaneously tracked 63 little penguins (*Eudyptula minor*) from two breeding sites located 2 km apart within a large colony, Phillip Island (Australia). We combined GPS, diving, acceleration, bathymetry and breeding data to investigate within-colony differences in foraging behaviour and breeding success. We located prey encounters along foraging trips, which showed a strong foraging spatial segregation between sites. Bathymetry use, prey encounter depth, prey encounter rates and foraging efficiency differed between sites. The site with lower foraging efficiency produced fewer chicks over the last 10 years, suggesting differences in foraging behaviour might ultimately lead to within-colony asymmetries in breeding success. We highlighted the importance of understanding small-scale spatial segregation within large colonies when investigating seabirds' foraging behaviour.

Mate similarity in seabirds

Elodie Camprasse (@ECamprasse)

Similarity or dissimilarity between two individuals that have formed a pair to breed can occur in morphology, behaviour and diet. Such patterns influence partners' cooperation when rearing offspring, consequently influencing reproductive success. They may confer different benefits, depending on species and contexts. However, the extent to which breeding partners are more similar in morphology, behaviour and diet is poorly documented. Furthermore, the relationship between behavioural consistency and mate choice is particularly poorly understood. To investigate these issues, two monogamous seabird species with high mate fidelity across years, were studied. Partners were equipped with GPS and diving behaviour loggers, and the numbers of chicks and masses at fledging were recorded. Generalised linear mixed effects models and permutation tests were used to investigate pair similarity in morphology, foraging behaviour and behavioural consistency, and mates' overlap in foraging areas. The results on pair similarity and its consequences on reproductive success are discussed.

Sex and wind conditions influence foraging tactics in a dimorphic seabird

Federico De Pascalis @fdepa1

Flexibility in seabird foraging behaviour is a key trait in individuals' life history, allowing an adaptative response to changing conditions. Therefore, divergent foraging tactics between and within populations can evolve. Tactic adoption is modulated by a complex mixture of factors, but sex and wind conditions could be major drivers. We tracked 44 chick-rearing Scopoli's shearwater (*Calonectris diomedea*) to identify intra-population differences in tactics and their drivers. We found two foraging tactics, whose adoption was heavily sex-based. Males were more likely to adopt a tactic characterised by less flight and smaller distances reached while females tended to adopt a tactic characterised by more flight and greater distances reached. However, when wind intensity increased, males switched tactic, suggesting a reduction of the energetic costs associated with dynamic soaring. We hypothesise that tactic adoption could be the result of an interplay between energetic costs, linked to different wing loading, and inter-sexual competition.

Geographic variation in isotopic signatures of Scopoli's shearwater colonies from three water basins in the Central Mediterranean

Letizia Campioni @letiziacampion1

Tracing the use of trophic resources made by marine top-predators at different spatiotemporal scales is crucial to understand their interactions with marine environment and human activity, offering an important support to investigate mechanisms behind population dynamics across a species' distribution range. Scopoli's shearwater (*Calonectris diomedea*) is a long-distance migrant, breeding in the Mediterranean Sea and spending the non-breeding period mainly along the western coast of Africa, in the Atlantic Ocean. Albeit detailed information is available for Scopoli's shearwater populations in the west Mediterranean, the use of trophic resources during the breeding and non-breeding periods is still unknown for most of the central- and east-Mediterranean populations. In this study we took advantage of the known moulting pattern of the

Scopoli's shearwater to characterise and compare the isotopic niche during both breeding and non-breeding periods of three geographically distinct populations breeding in the central Mediterranean.

Use of tidal environments by seabirds: Novel methods to address potential biases in vantage point survey data

Melissa Costagliola-Ray (@CostagliolaRay)

Tidal-stream turbine installations are increasing rapidly. This is in response to the European Union target, set to obtain 20% of energy from renewable sources by 2020. These installations occupy high-energy environments, also known to provide unique foraging habitats for deep-diving seabirds. Yet, owing to the infancy of the tidal-stream energy sector, the potential impacts upon seabirds remain largely unknown. Therefore, regulators need to quantify the distribution of seabirds to understand the potential for interactions with tidal-stream developments. A widely used technique for such site characterisation is vantage point surveys from the shore. However, the ability of data from vantage point surveys to inform impact assessments or monitor for post-construction effects can be compromised by a number of biases. This research aims to produce a standardised methodology for quantifying seabird use of these habitats, addressing current limitations through developing data collection protocols, data analysis techniques and model simulations.

Early implications of the fishery discard ban on great skua diet

Susanna Quer (@QuerSusanna)

Great skuas are generalist predators, scavengers and kleptoparasitic seabirds. In Shetland, the fish discarded by fishers have formed the major part of their diet. However, given that discarding is a wasteful practice, a ban is currently being applied through EU fisheries policy. We analysed great skua diet by dissecting pellets from four colonies from Shetland and one from St Kilda. We tested the change in the proportion of bird and fish in the diet from 2014 through 2017. Results show that, since the fish discard ban process began in 2015, the bird component in the diet of Shetland skuas has slightly increased while the fish component has dramatically decreased, supporting our prediction of a prey-switch in skuas, from discarded fish to other seabirds. This has implications for the seabird species on which the skuas are increasingly preying, especially those that are already suffering population declines such as puffins or kittiwakes.

Foraging Ecology 3 Session

#WSTC5 #ForSesh3

“To boldly go where no bio-logger has gone before”: GPS tracking of red-legged cormorants

Francis van Oordt (@francisvolh)

Red-legged cormorants (RLCOs; *Phalacrocorax gaimardi*) are distributed along the Pacific coast of South America, from Peru to Chile, and restricted to southernmost Argentina along the Atlantic coast. Population monitoring of RLCOs is scarce and research on their ecology has been limited to Argentina, where maximum foraging distance was 4 km. Foraging ecology of this species is not yet described for Pacific populations. The Peruvian Humboldt Current Upwelling System sustains high pelagic abundance of Peruvian anchovy (*Engraulis ringes*), a common and high-quality prey for many seabirds. We predicted that RLCOs would forage beyond benthic zones for pelagic anchovies. As part of a larger seabird ecology project, we deployed a GPS device on one RLCO in Punta Atico (MPA for guano production and marine biodiversity), Peru, in June 2018. Foraging trips were up to 10 km from the colony and into the pelagic area, two times further than previously observed in Argentina.

Diet of the pink-footed shearwater, *Ardenna creatopus*: Natural and fisheries-related prey in south-central Chile

Montserrat Vanerio (@Monse__)

The pink-footed shearwater (*Ardenna creatopus*) (PFSH) is endemic to Chile, and is also threatened by pelagic purse seine fisheries. Diet composition and its proportion is key during the study of their ecology and population dynamics. The objective of this study was to determine the identity and proportion of diet of PFSH through stomachs of 20 individuals bycaught in purse seine fisheries in south-central Chile. Our preliminary results showed the presence of cephalopods in all samples, followed by fish (77.8%). In this latter, the most frequent was sardine (*Strangomera bentincki*), also targeted by purse seine fisheries. These results are aligned with tracked PFSH, which are strongly overlapped with the seasonal purse seine fleet where forage fish is highly concentrated. This strong link with fisheries through food facilitation from purse seine fisheries might influence the long-term viability of populations of PFSH also including bycatch and competition by the same fish species.

Location, location, location: An inter-colony comparison of common murre breeding in northeastern Newfoundland

Julia Gulka (@julia_gulka)

During the breeding season, colonial seabirds are central-place foragers strongly influenced by prey availability and the presence of conspecifics and heterospecifics. As such, birds from nearby colonies often partition their niche to reduce intraspecific competition. To understand the impacts of colony size and distance from shore, we compared a large offshore colony (500,000 breeding

pairs) with a small inshore colony (10,000 bp) of common murres (*Uria algae*) on the northeast Newfoundland coast. Using GPS loggers and stable isotopes, we examined differences in foraging behaviour, space use and diet. Murres breeding at the large offshore colony travelled farther to forage along the coast, but there was a lack of spatial segregation between colonies coupled with high similarity in diet. Limited niche partitioning may relate to the high availability of their primary prey species, capelin (*Mallotus villosus*), at spawning sites along the coast which are located within foraging ranges of both colonies.

Diet-tissue discrimination factors ($\delta^{15}\text{N}$, $\delta^{13}\text{C}$) for blood components in adult common murres (*Uria aalge*) and Atlantic puffins (*Fratercula arctica*)

Edward Jenkins (@pterodromas)

Studying the diet of a consumer over multiple timescales using stable isotopes ($\delta^{15}\text{N}$, $\delta^{13}\text{C}$) provides insight into their foraging ecology. In this study, captive adult Atlantic puffins (*Fratercula arctica*) and common murres (*Uria aalge*) were fed a two-prey source diet (capelin, *Mallotus villosus*, and silverside, *Menidia menidia*) to determine the diet-tissue discrimination factors (DT DFs) for the cellular component of blood and plasma. Our calculated DT DFs were compared to other published values to reconstruct the diet of wild breeding murres and puffins in coastal north-eastern Newfoundland using Bayesian mixing models. Modelled dietary proportions supported a priori understanding of auk diet, with wild murres consuming predominantly capelin, while wild puffins consumed sandlance, snailfish and smaller fish. Findings iterate the importance of using species- and tissue-specific DT DFs to deepen our understanding of niche partitioning between the sympatric puffin and murre and when interpreting foraging ecology of animals.

Diving In! First report of the underwater behaviour of Christmas shearwaters on Kure Atoll

Ilana Nimz (@puffinimz)

Morphologically, Christmas shearwaters (*Puffinus nativitatis*) are highly aquatic tropical shearwaters with laterally compressed tarsi and high wing loadings for their body mass. While this species engages in pursuit plunging and diving, there are no published reports quantifying their sub-surface foraging behaviour. We obtained information from Lotek-1500 time-depth-recorders deployed on eight chick-rearing Christmas shearwaters on Kure Atoll, during June-August of 2017. We recorded 1,519 dive events during 33 tagging days. While the deepest and longest recorded dive reached 24 metres and lasted 31 seconds, the majority of the dives were shallower than three metres (64%), and lasted three seconds or less (53%). Diving occurred exclusively during daylight hours, with peak hourly diving activity (13%) during the evening (1700-1800 HST). This study provides the first insights into the diving behaviour of the Christmas shearwater, and highlights the epipelagic foraging habitat of this species of concern within the Papahānaumokuākea Marine National Monument.

Genetic Session

#WSTC5 #GenSesh

Plenary

Sentinels of change: Ancient DNA shows seabirds are key indicators of a dynamic world

Nic Rawlence (@nic_rawlence_nz)

University of Otago

Aotearoa, New Zealand, is considered the seabird capital of the world. However, this island ecosystem is a relic of its former self. The New Zealand archipelago is unique in that the often confounding impacts of climate change and humans can be clearly separated, allowing for a more nuanced view of how bird-dominated ecosystems change after human arrival. While the majority of ancient DNA research has focused on more charismatic avian megafauna, a growing number of studies on penguins and cormorants/shags are highlighting how seabirds can be powerful sentinels of change. In this plenary, I will talk about our lab's research on seabirds that has discovered human-driven extinctions of previously unrecognised species, consequent biological turnover events linked with the Little Ice Age, population bottlenecks, and differential human impacts across time and space. These discoveries show the past is the key to the present, and feed directly into evidence-based conservation management of our seabird *taonga*

Population genetic differentiation in the northern fulmar with conservation concerns

Lila Colston-Nepali (@LilaMayaCN)

Queen's University

Arctic species are under threat from increasing human activities and climate change. Examining the population genetic structure of Arctic species can aid conservation practitioners in assessing species-specific vulnerability and informing management strategies. Last year, I described potential stressors for the northern fulmar (*Fulmarus glacialis*), a seabird that breeds in colonies throughout the North Atlantic and North Pacific Oceans, including elevated levels of toxins, increased rates of ingested plastics, unintentional capture in commercial fishing activities and climatic variation. I outlined my plans to use genomic tools to contribute to management plans. This year, I will describe my results concerning the population genetic structure of Atlantic northern fulmar populations. As northern fulmars are migratory, mortality often occurs away from the breeding colony, and the impact of these sources of mortality on specific colonies is unknown. Therefore, I will further outline my use of colony-specific genetic markers for population assignment.

Historical and physical dominate biotic processes as determinants of seabird genetic differentiation

Anicee Lombal (@Anicee_Lombal)

University of Tasmania

Understanding factors leading to genetic differentiation of populations is crucial to maintain viability of species. In this meta-analysis, we evaluated a candidate set of generalised linear models to identify determinates of population differentiation in mitochondrial DNA for 73 seabird species. Lack of mutation-drift equilibrium observed in 19% of species coincided with lower estimates of genetic differentiation, suggesting that dynamic demographic histories are highly influential. Presence of land across the sampling range of species or sampling of breeding colonies representing ice-free Pleistocene refuge zones were the best predictors of genetic differentiation within Tropical and Southern Temperate species, respectively, and were supported by phenotypic variation. Conversely, biotic factors such as variation in non-breeding distributions among colonies were not significant. In light of these results, we recommend that mtDNA studies should consider potentially influential historical factors to avoid overestimating the impact of biotic determinants when identifying determinants of genetic differentiation among populations.

Intraspecific genetic structure and low but directional gene flow in the southern rockhopper penguin

Nicolás Lois (@NicolasLois)

University of Buenos Aires - CONICET

Rockhopper penguins, a group of endangered crested penguins (*Eudyptes* spp.), have been recently proposed to correspond to three species based on molecular evidence. However, it has not been studied whether finer-scale population structure can occur. We explored genetic divergence among southern rockhopper penguin (*E. chrysocome*) colonies from the Southwestern Atlantic Ocean through high throughput genomic sequencing. We found two main groups with low but directional gene flow from the Northern to the Southern genetic cluster. We assigned both a recent colony foundation and all individuals in a mass mortality event in the Patagonian coast to the Northern cluster. The genetic clusters and the uneven movement of individuals found in this species need to be taken into account when designing conservation actions, especially considering the differences in oceanographic conditions and population trends between colonies.

Exploring the population genomic structure of the glaucous gull (*Larus hyperboreus*) in the Canadian Arctic

Emma Lachance Linklater (@Emma_LaLink)

Queen's University

Climate change poses a significant threat to the future of the Arctic. To effectively conserve Arctic species, genetically-differentiated populations must be defined so that unique genetic material can be managed. The glaucous gull (*Larus hyperboreus*) is a circumpolar Arctic species which has experienced some precipitous local population declines in recent years. The aim of this study

is to determine the extent of genetic differentiation between populations of glaucous gull in the Canadian Arctic. To address this question, DNA will be extracted from blood samples collected from across the glaucous gull range and the extracted material sequenced using RADseq. The study will identify genetic markers, assess sequences for genetic diversity and determine the extent of population differentiation. If some or all glaucous gull populations are genetically differentiated, this may indicate that there are barriers to gene flow between populations and that differentiated populations should be managed as separate units.

Using population genomics to disentangle the Leach's storm petrel species complex (*Hydrobates* spp.)

Katie Birchard (@KatieB314)

Queen's University

In a time when climates and environments are constantly shifting, population connectivity can have a significant effect on overall species' persistence through exchange of genes and promotion of population stability. Thus, wildlife management agencies can use this information to assign separate designatable units to significantly differentiated populations and ensure resources are allocated effectively. My proposed research aims to determine the population connectivity and genetic differentiation between colonies of Leach's storm petrels (*Hydrobates* spp.), a declining seabird species complex with a wide geographic distribution. Using high-throughput sequencing, I will estimate the extent of connectivity and genetic differentiation between both spatially- and temporally-isolated Leach's storm petrel colonies across their entire range. If populations have low connectivity and are significantly genetically differentiated, this may indicate the need for a revised plan for resource allocation to prevent further genetic diversity loss. Last year I presented my proposed research; this year I plan to present preliminary findings.

Population Biology 1 Session

#WSTC5 #PopSesh1

Reproductive performance of black guillemot in the Baltic Sea

Andre Allen (@AndrewM_Allen)

Radboud University

Black guillemot in the Baltic Sea are listed as near-threatened and face new threats with climate change. We monitored reproductive performance on two island groups in the Baltic Sea during the breeding seasons of 2014 and 2015 to fill knowledge gaps. Clutch size varied substantially as 72% of nests had two eggs in 2014 but this was only 45% in 2015. Hatching success was 0.89 and 0.73 in 2014 and 2015, respectively, and fledging success was very high (0.95 and 0.97). No predation events were observed. Chicks fledged at night and viviparous eelpout (*Zoarces viviparus*) made up 95% of the prey items brought to them. Although hatching and fledging rates were high, the large year-to-year variation requires further investigation to understand variation in reproductive performance. Furthermore, juveniles seemed highly dependent on the availability of

eelpout. Changes in the abundance of this species may therefore have negative effects on chick survival.

Kittiwake phenology in the context of climate change

Klaudyna Maniszewska (@m_klaudyna)

University of Glasgow

In recent decades, climate change has caused shifts in phenology in many seabird species as they adjust their breeding dates to changing environmental conditions and the availability of prey. Here, we examine trends in phenology in kittiwakes in Shetland, an area where kittiwakes have shown steep declines in recent decades. We also assess the effect of timing of breeding on breeding success, making use of data from 11 colonies from 1986 to the present year. Our results suggest a significant delay of breeding, and that this shift may be linked to smaller clutch sizes and lower reproductive success. For further studies, we will examine potential drivers of this shift, considering environmental factors such as the winter North Atlantic Oscillation, sea surface temperature, physical dynamics of the sea and food availability. This work provides key information for understanding the decline of kittiwakes in Shetland and beyond.

Census of Leach's storm petrels (*Hydrobates leucorhous*) on Elliðaey Island, Iceland

Zoe Deakin (@Zoe_Deakin)

Cardiff University

Leach's storm petrels are wide-ranging, burrow-nesting seabirds that breed on islands across the Atlantic and Pacific oceans. Population declines have been identified at colonies in the western Atlantic and the UK, resulting in the species being up-listed from Least Concern to Vulnerable by the IUCN in 2016. Burrow-nesting seabirds are notoriously difficult to accurately census and population estimates for many colonies are lacking. The Westman archipelago in Iceland is thought to hold the majority of the eastern Atlantic's breeding Leach's storm petrels. In 2018 we carried out a population census of Leach's storm petrels on the Westman archipelago's Elliðaey Island, which was previously surveyed in 1991. In addition to providing estimates of the current population size and population change for Leach's storm petrels on Elliðaey, we hope to improve the census methods for species.

Cohorts experiencing harsh early life conditions show higher survival in adulthood

Ana Payo-Payo (@anapayopayo)

University of Aberdeen

Early life conditions have both immediate and long-lasting effects, generating cohort variation in several traits. Harsh early conditions can negatively influence individuals' future fitness, the silver spoon hypothesis. However, harsh early conditions can also act as severe mortality filters removing frail individuals, the viability selection hypothesis. We analysed 18 years of data on adult Audouin's gulls (*Ichthyaetus audouinii*) at a large spatial scale (i.e. absorbing the potential bias caused by dispersal) to assess whether first-year environmental conditions (i.e. rearing period and first winter) and first reproduction act as selection filters removing frail individuals. We

demonstrate that survivors of cohorts experiencing poor early life have higher survival in adulthood. Our study highlights the importance of early development, first winter and reproduction as potential factors generating between-cohort survival heterogeneity. Disentangling the mechanisms driving differential responses to early life conditions is fundamental to understand long-term population dynamics.

Roseate Tern LIFE Recovery Project

Daniel Piec (@RoseateTernLIF)

RSPB

The Western European metapopulation of roseate terns has been increasing since the mid-1980s, reaching a 2,000 pairs mark in 2018 with record numbers in the two Irish and one UK colony, while the French population has never recovered from the dramatic declines throughout the 1960s and 70s. This recovery has recently been boosted by the LIFE project (2015-2020) coordinated by the RSPB in partnership with North Wales Wildlife Trust and BirdWatch Ireland. The project aims to improve nesting conditions at the current and several former roseate tern colonies and in Ireland and the UK, including biosecurity, habitat creation and predation control. Management is underpinned by research actions: demography, migration (geolocators), GPS/boat tracking of Arctic and roseate terns as well as a two-year survey investigating illegal tern trapping in Ghana. The project is entering into a strategic phase leading into the development of regional strategies and International Action Plan.

In it for the long term: The value of monitoring the Shiant Isles seabird population over the decades

Liz Scott (@birdmaps)

Shiants Auk Ringing Group

The breeding population of seabirds on the Shiant Isles has been monitored annually by the Shiants Auk Ringing Group since the 1970s using a number of survey methods including ringing and colony counts. Since 2008 the group of skilled volunteer seabird fieldworkers has increased its standardised surveys to include more rigorous methods ensuring constant effort, as well as augmenting the data collected within key surveys with additional studies during each annual visit. Following the success declared in 2018 from a two-year rat eradication programme intended to encourage storm petrels to breed, there are early positive signs of a returning population of this species. The data collected by the group demonstrate the value in having a baseline from before the eradication project started with which to compare populations of all species now and in the future, as an ongoing source for demonstrating the success of such schemes.

State of Antarctic Penguins Report

Grant Humphries (@GrantHumphries)

Black Bawks Data Science

For the past 25 years, the Antarctic Site Inventory (run by the non-profit organisation Oceanites) has been collecting penguin population data that can be used by scientists and managers to make

decisions on resource management in Antarctica. For the three Pygoscelid penguins (Adelie, chinstrap and gentoo), population trends are a mixed story ranging from drastic increases and geographic shifts to drastic declines. We will present numbers and trends from the latest State of Antarctic Penguins report and briefly discuss how those numbers get to relevant stakeholders.

Linking Sooty shearwaters to upcoming shifts in Southern Oscillation

Grant Humphries (@GrantHumphries)

Black Bawks Data Science

Previous work has shown relationships between population indices derived from the sooty shearwater (*T. ita*) harvest in New Zealand and upcoming values of the Southern Oscillation Index. Could it be possible that sooty shearwaters can predict El Niño or La Niña? We explore possible mechanistic relationships through the lens of a machine learning analysis looking at oceanographic conditions prior to shifts in the Southern Oscillation and how they relate to the foraging ecology of sooty shearwaters.

Increasing breeding and wintering numbers of Mediterranean shag (*Phalacrocorax aristotelis desmarestii*) in the south Black Sea coast of Bulgaria

Ralitsa Georgieva (@RalitsaGeorgg86)

Calidris Ltd.

In the period 2013-2018, we explored a new colony of 'Mediterranean' shag (*Phalacrocorax aristotelis desmarestii*) on the Black Sea coast, on an island near the city of Sozopol, Bulgaria. In 2013, we found the new colony on St. Peter Island approximately 122 km south from the existing colonies in the north. The following year, the colony was spread both on St. Peter and on the neighbouring St. Ivan Island. We also found that the same islands are important night roosts for shags in the winter period. From three pairs in 2013, this new colony reached 117 pairs in 2018, increasing the national population by 46.8%. The maximum number of roosting shags in the winter months is 640 individuals, which is the absolute maximum number of shags found in one place in the country. This new data highlights the importance of St. Ivan and St. Peter islands for the 'Mediterranean' shag.

Population Biology 2 Session

#WSTC5 #PopSesh2

Breeding colony predation in Leach's storm petrels (*Oceanodroma leucorhoa*)

Rielle Hoeg (@RielleHoeg)

Acadia University

Many seabirds nest on islands with few mammalian predators, and some nest underground and move to and from colonies at night to avoid diurnal avian predators. This research investigates predation rates of Leach's storm petrels (*Oceanodroma leucorhoa*) at island breeding colonies. In 2018, six two-metre-wide transects were monitored biweekly, and 12 quadrats were checked

approximately five times on Bon Portage Island, Nova Scotia, Canada, and at least one transect was monitored on Country Island, Nova Scotia. Leach's storm petrel remains were counted and removed from transects. A total of 159 individual petrel remains were found on Bon Portage, amounting to between 1500 and 4500 individuals lost to predation throughout the breeding season. When transect data is received from Country Island, predation rates between the two colonies will be compared. In 2019, this study will be expanded to other western Atlantic colonies to contribute to population modelling.

Effects of a changing coastline on Louisiana's brown pelican nesting populations

Juita Martinez (@JuitaMartinez)

University of Louisiana at Lafayette

Over two decades of coastal restoration in Louisiana has helped to mitigate land loss although evaluation of these projects has been limited. Barrier islands provide crucial habitat to brown pelicans (*Pelecanus occidentalis*), a species reliant on these unique habitats to reproduce. We utilised spatial mapping tools and historical aerial imagery to analyse island characteristics of barrier and bay islands in coastal Louisiana. We modelled year surveyed, area, perimeter, distance to mainland, elevation and restoration status on the presence and absence of brown pelican colonies on any given island. Our model for brown pelican colony presence showed an increase on islands further from the mainland ($p=0.01$) as well as a significant difference in population size throughout the various years ($p=0.0009$). Further modelling and monitoring of restored and unrestored islands is needed to have a better understanding of these effects and inform future management decisions.

Integrating habitat and partial survey data to estimate the regional population of a globally declining seabird species, the sooty shearwater

T.J. Clark (@teejclark1873)

University of Montana

Many seabird populations are in flux due to anthropogenic impacts. Censusing seabirds to understand such changes is often impractical. For example, many pelagic seabirds breed in burrows or on cliffs, in remote colonies, making them difficult to count. Burrow-nesting sooty shearwaters (*Ardenna grisea*) are abundant but declining in their South Pacific breeding range, potentially due to introduced rodents and habitat loss. In contrast, Kidney Island, Falkland Islands, may have grown substantially since the mid-1900s. This island is rodent-free, and native tussock grass (*Poa flabellata*) has increased following cessation of historical exploitation. To estimate the sooty shearwater population on Kidney Island, we sampled burrow density and occupancy and modelled these as functions of habitat. We estimate there are ~140,000 (95% CI: 90,000–210,000) breeding sooty shearwaters on Kidney Island. Our study shows that habitat selection functions not only improve population estimates but provide biological insights needed to reverse declines in seabirds.

High and dry and round: Characteristics of high-quality nesting habitat for Adélie penguins

Annie Schmidt (@ae_schmidty)

Point Blue Conservation Science

We used four years of data from two Adélie penguin colonies on Ross Island, Antarctica, that differ in size and physical habitat characteristics, to investigate two questions: 1) what characteristics define high-quality nesting habitat? And 2) are high quality individuals (i.e. those that have higher than average breeding success over time) associated with high-quality habitat? We found the large Cape Crozier colony had consistently higher and less variable breeding success than the much smaller Cape Royds. At both colonies, groups of nests that were more round in shape, had shallower slopes, lower surface flow and were further away from South Polar Skua nests, raised more chicks. Differences in nesting habitat explained much more variability at Cape Royds compared to Cape Crozier. Finally, individuals of high intrinsic quality were not influenced by the quality of the habitat in which they nested, but lower-quality individuals were.

Impacts of climate change on breeding Common Eiders

Rebecca McGuire (@ArcticWCS)

Climate change is directly impacting both the people and wildlife of Alaska today. These impacts are easily seen in northern Alaska. The Wildlife Conservation Society has been assessing the breeding population of Pacific common eiders (*Somateria mollissima v-nigrum*) nesting on barrier islands in the Chukchi Sea to understand how climate change impacts population. Pacific common eiders declined by 50-90% between 1957 and 1992, and have stabilised at these reduced numbers. The decline of common eiders has occurred across their range. Those breeding on barrier islands are especially susceptible to direct and indirect effects of climate-mediated sea-level rise, higher, more frequent storm surges, and erosion and/or restructuring of barrier islands. The combination of rising waters and storm surges during nesting may flood nests and devastate productivity. Overwash of the barrier islands may also ultimately result in complete loss of the islands if erosion exceeds accretion.

Who has the last laugh: Seasonal nesting trends in laughing gulls

Nik Snyder (@CuriousGull)

North Dakota State University

Organisms are inherently complex, with their fitness and persistence tightly tied to the phenotypes that emerge from genetic and environmental influences. Currently, we cannot reliably predict how individuals integrate genetic and environmental cues affecting phenotypes, suggesting we cannot predict changes in offspring survival and reproductive success, critical for successful seabird conservation. Using a seasonally breeding seagull, we examined three different life stages across the nesting season. We investigated how adult condition and investments in offspring could be used to adjust offspring phenotypes to mitigate seasonal effects on reproductive success. We found female adult condition declined across the nesting season and male offspring laid later in nesting season were smaller. In this gull colony, evidence suggests quality of female partially

predicts when during nesting season a female will initiate egg laying and, in late season breeders, male chicks are paying a higher cost for mom's timing of breeding than female chicks.

Stressed petrels – using physiology to monitor populations

Edin Whitehead (@edinatw)

The University of Auckland

Grey-faced petrel (*Pterodroma gouldi*) colonies on the east and west coasts of Auckland, New Zealand, show marked differences in reproductive success, with east coast birds performing poorly. We sought to profile physiological indicators of sub-lethal stress in these populations and determine if bird age influenced any of these parameters. Compared to west coast birds, grey-faced petrels on the east coast had higher initial and response levels of the stress hormone corticosterone during incubation, weighed less, and had haematological profiles indicative of poor body condition and higher energy expenditure during breeding. None of the physiological parameters were influenced by bird age, which means these methods can be used to assess condition in colonies that have not been monitored in the past.

Nesting ecology in the Hawaiian population of an endangered seabird, the band-rumped storm petrel (*Oceanodroma castro*)

Carmen Antaky (@HiBiologist)

University of Hawaii at Manoa

The first confirmed nesting location of the Hawaiian population of the band-rumped storm petrel (*Oceanodroma castro*), an endangered seabird, was recently discovered on Hawai'i island after decades of searching. Following the discovery, we analysed nest site preferences of the band-rumped storm petrel at this site using a paired design. Band-rumped storm petrels preferred deeper crevices compared with those available within 100 m of the nest-sites. Physical and environmental characteristics of Hawaiian band-rumped storm petrel nest sites may aid conservation efforts including on-the ground searches, removal of invasive mammalian predators, identification of potential translocation sites, and habitat restoration for this endangered species.

Pelagic citizen-science data reveal declines of seabirds off south-eastern Australia

Simon Gorta (@GortaBirds)

UNSW, Sydney

Seabird declines are frequently linked to climate change and human impacts on habitat and prey. Time-series observations are rare away from breeding colonies, limiting our understanding of long-term trends. We analysed a dedicated citizen science dataset of pelagic seabird abundance off south-eastern Australia collected by citizen-science birdwatchers (385 trips) from three locations over 17 years (2000-2016). To estimate temporal trends and environmental drivers, we used generalised additive modelling and species archetype modelling. Almost half (43%) of the most abundant species declined in our study area over the 17 years. Winter-dominant archetypes were often negatively associated with SST-anomaly and composed of species rarely frequenting warmer water, while summer-dominant archetypes showed the reverse. Declines may be

associated with human-induced ecosystem change, and represent a distribution shift out of our study area or a change in population abundance. Long-term citizen-science datasets will continue to provide valuable insights into seabird ecology and conservation.

Threats to northern New Zealand seabirds

Stephanie Borelle (@NNZST)

University of Toronto

Anthropogenic activities on land and at-sea have led to poor conservation outcomes for many species globally. In this presentation we summarise a recent and extensive review of the current and further threats to seabirds in New Zealand (NZ), and where conservation and research should be focused – providing species-specific examples. Some threats, and how to mitigate them, are well known, while others are more ambiguous in both how they affect seabird populations and what can be done about them. Given that predators have been removed from > 100 islands where seabirds breed, NZ is in a unique position to evaluate the population-level impacts of at-sea threats, such as climate change, fisheries, light and plastic pollution, etc., and how to manage them to ensure the continued recovery and conservation of our unique seabird fauna.

Tools and Techniques Session

#WSTC5 #ToolSesh

Public engagement with seabird research: Introducing young people to seaducks and population modelling

Alex Nicol-Harper (@alexnicolharper)

University of Southampton; Wildfowl & Wetlands Trust

I'm a first year PhD candidate studying population dynamics of the common eider https://www.southampton.ac.uk/oes/postgraduate/research_students/anh1n18.page.

Last semester I attended a 'public engagement with research' course, through which I've been awarded funding to create an exhibit at Southampton's Science and Engineering Day in March – which I would love to be able to share with the seabird research community at #WST C5! I'm planning to share multimedia with each Tweet: photo of an eider duck, 'painting an eider decoy' timelapse, an infographic explaining my matrix population model game (using Playmobil ducks!), and pictures of my evaluation sticker wall ("Had you heard of eider ducks before?") and Likert scales ("Is maths useful in the real world?") before and after. I attended a 'Tweeting Bird' Twitter-for-ornithologists workshop last year, so have been building a couple of hashtags (#TheNotSoCommonEider #SeaduckTales) which I would love to share with the #WSTC5 audience – as well as starting #TeamSeaduck!

Recurrent biases in tracking studies

Virginia Morera-Pujol (@sk8sbd)

University of Barcelona

Movement is a central characteristic of animal ecology, but its study has been neglected so far due to the difficulties in obtaining detailed data. In the past decades, the coming of age of tracking technologies has allowed the acquisition of abundant and increasingly precise data on individual movement. Such large datasets have outgrown currently available analysis techniques, introducing challenges and biases to the estimation of higher-level distributions from individual movement data. The most important of these biases involve the presence of individual site fidelity, changes in environmental conditions over time, and failing to consider the entire breeding range of a species. In the context of globalisation in science, there is a dire need for an objective protocol to deal with these sources of error, since public repositories of tracking data from multiple species, years, and breeding statuses and phases augur a proliferation of this sort of study in the near future.

Validation and performance testing of a laser rangefinder for estimating avian flight in 3D

Nicola Largey (@nmlargey)

Environmental Research Institute, University of the Highlands and Islands

Accurate estimation of bird flight characteristics in 3D is useful for the assessment of bird responses to man-made structures such as wind turbines. Although built and optimised as an optronic device for military and civil applications, the ornithodolite (based on a pair of binoculars with integrated laser rangefinder, inclinometer and digital magnetic compass) can also be used to track bird activity in space and time. However, before tracking instruments are used, validation and performance testing should be carried out to ensure quality of final data. We assessed the accuracy of the ornithodolite in estimating bird position in 3D space and tested the performance of the ornithodolite under different operational scenarios, using a UAV test target. Analysis shows the accuracy and precision of the ornithodolite's positional estimates vary with distance and height. Although testing was undertaken in a terrestrial context, these results are applicable to the collection of seabird flight data.

Can drones count gulls?

Matt Wood (@wood_mj)

University of Gloucestershire

Rapidly advancing technologies present great opportunities in seabird monitoring, particularly Unmanned Aerial Vehicles (UAVs) or drones. Here, we show that breeding gulls can be surveyed using UAVs at an altitude of just 15 m, but careful flying is key, and behaviour must be monitored by an ornithologist. We also present semi-automated image processing, which is essential to handle large amounts of imagery and unlock the future potential of drone surveys.

Wettability of juvenile Barau's petrels

Jérôme Dubos (@LIFE_Petrels)

Université de La Réunion

Seabirds spend most of their time at sea and have to possess a waterproof plumage. Using 5 g solar PTTs, we tracked juvenile Barau's petrels when they left their birth colony. Surprisingly, we found that half of the transmitters stopped soon after their first landing on the water off Reunion Island. We set up a protocol that estimated the quantity of water logged in the plumage. We found that 54% of chicks ready to fledge seemed not to be fully waterproof. Within a sample of rescued grounded birds, a similar proportion was discovered. For the tracked birds, only those with waterproof plumage successfully dispersed after their first touch on the sea surface. We provide evidence of a potential cause of mortality of juvenile seabirds that has not been previously described. This could exist in other species.

Spying on seabirds: A review of time-lapse photography capabilities and limitations

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University of Zurich

Remote monitoring of wildlife has a long history in ecological research but recent advances in technology have extended the possibilities of remote sensing methods, making camera systems more easily accessible, of higher resolution and more relevant to a greater range of research interests. Time-lapse photography is most applicable to study animals frequently present at a photographed location or to study frequently repeated behaviours. Therefore, time-lapse photography methods are particularly relevant to study colonial animals at fixed locations. Cameras can be used to observe seabird behaviour in places or during times when human observation would be nearly impossible, including in remote locations, at night using infrared and during harsh weather conditions. However, cameras are prone to mechanical failures and programming errors and need regular maintenance. Researchers can expand their study aims by examining how research on other taxa has used camera traps.