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Getting the most from your data: Predictive statistics can be used to develop a better understanding of foraging ecology in northern gannets
Seabird island conservation: Are we rearranging the deckchairs on the Titanic?

The vast and opaque nature of the oceans has in the past hidden the ecological consequences of the “Tragedy of commons”. The accumulation of plastic, increasing fishing effort to feed the burgeoning population, and prey distribution shifts from climate change are taking a heavy toll on seabirds. More than half (53%) of Procellariiform seabirds are experiencing population declines. Despite impressive conservation efforts on land, through predator eradication and ecological restoration, the impact of marine based threats are inflicting pressures on seabirds at sea that are outweighing land-based conservation efforts. This raises the question “are we rearranging the deckchairs on the titanic when it comes to seabird conservation?” While there is an urgent need to expand seabird island conservation globally, we need to better understand the extent and impact of marine based threats to seabirds if we are protect and enhance seabird populations in the future.
Seabirds are the most threatened of all birds and penguins are the second-most threatened seabird taxonomic group. The dependence of krill in Southern Ocean penguin diets - resulting in a relatively short food-web - and their sensitivity to environmental factors such as sea ice extent, mean that Adelie, chinstrap, and gentoo penguins serve as important bioregional indicator species for CCAMLRs Ecosystem Monitoring Program (CEMP).

Globally, the establishment of Marine Protected Areas (MPAs) have been effective at conserving seabird species and central to the preservation of intact ecosystems, evidenced by increased biodiversity. In ecosystems where top predators are depleted, there can be detrimental, cascading impacts to lower trophic levels. As Antarctica is the only continent where no country has a sovereign claim, it is the responsibility of the international community to establish a network of comprehensive MPAs aimed at protecting penguins and the ecosystems in which they establish an ecological niche.
Adapting a PhD to bad luck: insights from a study on kittiwake breeding behaviour.

I am currently carrying out a PhD which was initially aimed at identifying phenotypic traits related to individual variation in kittiwake breeding success. Lack of kittiwake breeding success across both of my field seasons has resulted in me changing my approach. I explain how it has been necessary to be adaptable and how I have still ended up with a wealth of data which should give novel insights into seabird biology.
Hannah Grist       Twitter:@hgloki

Patterns and consequences of partial migration in European shags

We used a combination of intensive nest monitoring and winter volunteer colour ring resightings to link summer and winter behaviour and demography in a breeding population of European shags (Phalacrocorax aristotelis). The population was found to be partially migratory over the winter, with individuals showing high site fidelity among years to winter locations across 600km of coastline, and with both sexes equally likely to migrate. Overall, residents hatched broods earlier and were more likely to successfully fledge chicks, suggesting that individual variation in migratory behaviour can impact fitness and subsequent population dynamics.
Procellariiform seabirds link chemical ecology to marine biogeochemistry: implications and future directions.

Studies illustrating how infochemicals mediate tritrophic interactions are common in plant-insect systems, but are relatively unexplored in marine environments. Through their sensitivity to dimethyl sulfide (DMS), procellariiform seabirds play an analogous role to carnivorous mutualistic insects in terrestrial systems. Also, seabirds may provide benefits to growing phytoplankton by recycling trace nutrients in their guano. This provides a mechanism by which phytoplankton and top predators chemically communicate with one another, inciting an interaction where both parties receive a benefit that may have global consequences. In similar studies on whales, researchers provide empirical evidence that whale fecal fertilization may benefit oceanic productivity, but they fail to connect these observations with an ecologically relevant process underpinning their data. Seabirds' sensitivity to DMS provides this ecosystem-wide link. This conclusion connects the global sulfur, iron, and carbon cycles to biotic interactions between the base and the top of marine food webs.
Status and Conservation of Coastal and Sea Birds of Bangladesh

This paper deals with the coastal and sea birds diversity and their present status of conservation activities in Bangladesh. The existing data base and scientific research on the diversity, habitat and ecology of coastal and sea birds in Bangladesh is very little. Bangladesh is the habitat of 628 species of birds while about 130 species are coastal (including sea birds) and wetland dweller. The common sea birds are laridae (5 types of gulls), accipitridae (white-breasted sea eagle), phalacrocoracidae (2 types of cormorants), sternidae (12 type of terns) and rhynchopidae (1 type of skimmer) while the rests are coastal and estuarine birds i.e., herons, bitterns, plovers, lapwings and sandpipers. These coastal and sea birds can be observed at all over the coastal and marine environment of Bangladesh which offers suitable habitat for feeding and breeding of birds. In Bangladesh, coastal and sea birds conservation activity starts first in 1974 under the Bangladesh Wildlife (Preservation) (Amendment) Act, 1974. Notwithstanding, illegal hunting of coastal and sea birds and destruction of their habitat is still common practiced in the coastal and marine environment of Bangladesh. These activities have resulted in declining coastal and sea birds numbers as well as degradation of coastal and island ecosystems. Therefore, to address these issues a long term monitoring and integrated research on diversity, ecology and feeding habitat of coastal and sea birds is needed to develop a sustainable long-term conservation and management plan on coastal and sea bird resources in Bangladesh.
Spatially explicit prioritization of conservation actions for seabirds

Decisions about the spatial location of conservation actions are starting to use rigorous decision science approaches that deliver the greatest conservation outcome for the least impact on other human activities. However this return-on-investment thinking, is not common for seabird conservation. Most spatially explicit prioritisations for seabird conservation make one or more of the six common mistakes of conservation priority setting (Game et al. 2013 Conservation Biology 27:480-485). In this paper we define the six common mistakes of conservation priority setting, provide examples from the seabird conservation literature, and give some indications of ways to logically integrate information about seabirds into spatially explicit priorities for conservation action and policy.
You Are Where You Ate: Direct Tracking and Compound-Specific Stable Isotope Analysis Identify the Winter Movements of Antarctic Penguins

Animal dispersal behaviors have both ecological and evolutionary significance. However, due to the logistical challenges of tracking animals in the Antarctic marine environment little is known about the winter dispersal of many Antarctic seabirds. We used a combination of direct tracking and stable-isotope analysis to describe the winter distribution of Adélie and chinstrap penguins from breeding sites along the Antarctic Peninsula. GLS tracking identified two general migration strategies, with animals overwintering to the east or west of the Antarctic Peninsula. Unlike bulk carbon and nitrogen stable isotope analysis, compound specific stable isotope analysis of carbon in essential amino acids (CSIA-AA) was able to discriminate between migration strategies across and within penguin species. CSIA-AA also provided us the ability to assign non-tracked individuals from other breeding sites in the Antarctic Peninsula to specific over-wintering areas and conduct the first ever, regional-scale analyses of the winter movements and distributions of these species.
Elevated levels of plastic ingestion by a high-Arctic seabird: the northern fulmar (Fulmarus glacialis)

Plastic pollution is of worldwide concern, however increases in international commercial activity in the Arctic are occurring without knowledge of the existing threat posed to the local marine environment by plastic litter. Here, we quantify plastic ingestion by northern fulmars, Fulmarus glacialis, from Svalbard, at the gateway to future shipping routes in the high Arctic. Plastic ingestion by Svalbard fulmars does not follow the established decreasing trend away from human marine impact. Of 40 sampled individuals, 35 (87.5%) had plastic in their stomachs, averaging at 0.08g or 15.3 pieces per individual. Plastic ingestion levels on Svalbard exceed the ecological quality objective defined by OSPAR for European seas. This highlights an urgent need for mitigation of plastic pollution in the Arctic as well as international regulation of future commercial activity.
Spatial variation in herring gull egg colour

As top predators, seabirds have the potential to monitor the state of marine ecosystems. However, detecting significant changes in seabird population can be difficult. Instead seabird traits reflecting conditions over shorter time periods could provide an early warning that a colony is experiencing adverse environmental conditions. We therefore aim to investigate the effectiveness of egg attributes, which can be readily measured in the field, to monitor the marine environment. Here we explore spatial variation in egg colour of Herring Gulls Larus argentatus from nine sites across Northern Ireland and south-west Scotland that have experienced different population trends over the last few decades. We show that there is spatial variation in egg colour which is associated with the local populations’ demographic parameters. The results from this study may help identify potential drivers of Herring Gull population changes as well as providing information on the state of the coastal environment.
Bianca Viera       Twitter: @biancapvieira

Aves marinhas e costeiras: a facebook page to spread the word about sea and shorebirds.

Good part of human population does not know that some bird species can live in the middle of the ocean for months or that the biggest flying bird alive is an albatross. However, this public also influences the survival of species and therefore spread knowledge to them is a meaningful step to achieve conservation success. In 2014, the facebook page "Aves marinhas e costeiras" was created to spread the word on sea and shorebirds in Brazil. Posts were about images, researches, opportunities and curiosities from all over the world. In six months, people from more than 23 countries followed the page. The pick of access was 9,000 views in only one post. After the fast spread, the page expanded to three languages (Portuguese, Spanish and English) and started receiving suggestions from many researchers. Results show that social networks are successful in making science closer to the general public.
Changes in non-breeding diet in Herring Gulls

Resource availability in the breeding and non-breeding season is one of the most important factors that determine animal populations. For many seabirds, however, we know very little on the resources used during the non-breeding season. Stable isotope analyses of gull feathers that are grown during different times in the annual cycle allow evaluating differences in foraging niche between the breeding and non-breeding season. Including feathers from museum skins allowed us to look at changes over time. Over the past ca 40 years, the non-breeding diet has become less marine and gulls moved into more terrestrial habitat. Gulls also used to feed on a higher trophic level in the non-breeding season than in the breeding season but this is not any more the case. Changes in resources during the non-breeding season may be at least partly responsible for the recent declines in Herring Gulls.

I present naturalist sightings from seabird and marine mammal surveys made during research cruises off Iceland, the Faroe Islands, the North Sea, West and mid-Atlantic during falls 2011 and 2014. Northern Fulmar (Fulmarus glacialis) and Northern Gannet (Morus bassanus) were the most recorded species. Atlantic Puffin (Fratercula arctica) and Common Murre (Uria aalge) were only seen very rarely, other auk species were virtually missing. Often more passerines were detected on the ship than seabirds and sea mammals combined. These findings are discussed in regards to recent anthropogenic changes on Iceland and in the North Atlantic overall.
Inferring behavioural states from foraging trajectories of little penguin (Eudyptula minor)

Movement trajectories of seabirds provide information regarding their responses to environmental changes and potential human disturbances. Little penguins (Eudyptula minor) are well distributed around the coasts of New Zealand and Australia, however, little is known about what factors influence their micro-scale patterns of movement and behaviour. We collected foraging trajectories of breeding-stage little penguins from two distinct colonies in New Zealand: Burgess Island (175°E 36°S) located offshore the North Island, and Matiu/Somes Island (174°E 41°S) located within the heavily urbanised Wellington Harbour. We present a simple framework with combined behavioural change analysis and k-means clustering for inferring mutually exclusive behavioural states within the geospatial lifelines of animals. Results show most individual little penguins exhibited three unique behavioural states (resting, commuting/active searching, area-restricted foraging), with variation in the timing and locations appearing to be related to ambient light, bathymetry, and proximity to coastlines and river mouths.
Tropical seabird foraging in association with sub-surface predators.

Seabirds are well known to feed in association with other marine top predators. For tropical seabirds, inhabiting waters where resources are unreliably and patchily distributed, reliance on foraging in association with sub-surface predators is thought to be a highly important strategy for finding food. Known as facilitated foraging, the phenomenon occurs when sub-surface predators, such as tunas and cetaceans, drive forage fish to the surface of the water where seabirds can access them.

To investigate facilitated foraging within the Coral and Tasman seas of Australia, we compare dietary and spatial data from several tropical seabird species with complimentary data from sub-surface predators. By testing spatial and dietary overlap between seabirds and numerous sub-surface predator species we can ask: do they forage in the same areas? do they eat the same prey? and do they occupy the same trophic niche?
Sarah Burthe  Twitter:@SarahBurthe

Overwinter migration strategy influences individual level survival of seabirds during extreme winter wrecks

The frequency of extreme weather events is predicted to increase, which may have immediate and long term effects on seabird fitness. Here, we evaluated survival of a marked population of European shags (Phalacrocorax aristotelis) during a winter wreck (>700 corpses recovered) in the UK. We investigated whether individual-level data on overwintering strategy or intrinsic factors such as sex and age were linked to survival, and whether there were downstream effects on breeding behaviour and success. We found that females, older age classes and birds that overwintered locally had significantly lower survival over the wreck winter. Moreover, there was significant social disruption in the returning breeding population after the wreck with high levels of divorce. Our study clearly demonstrates links between intrinsic factors, including winter migration strategy, and survival, and highlights the implications of future increases in the frequency of extreme weather events on populations of mobile species.
Non-linear relationships between diet and demography in European shags signal environmental change in the North Sea

The North Sea is one of the most rapidly warming marine ecosystems on the planet, with a particularly marked change since the 1980s, and profound biotic changes observed in the region. Reductions in key seabird prey species have been recorded and here we investigate the relationships between diet and demography in European shags Phalacrocorax aristotelis breeding on the Isle of May, Scotland using a dataset spanning three decades. Their traditional classification as sandeel specialists has been revised with our data suggesting that they now select a more catholic diet. We propose that summer diet is linked to return rates in the European Shag and demonstrate, for the first time in this species, that variations in diet composition relate to breeding phenology. This study suggests that a detailed understanding of the links between seabird diet and demography can reveal underlying environmental state, allowing us to monitor changes in the marine environment.
Katherine Booth Jones       Twitter:@KatBoothJones

Quantifying intra-population variation in the year-round distribution of a tropical, pelagic seabird.

Understanding intra-population variation in seabird distributions throughout their annual cycles is important for facilitating seabird conservation. Here we present a novel approach for quantifying intra-population variation in seabird distributions. We used location data from 116 geolocators deployed on Round Island petrels and the R package TripEstimation to generate migratory and colony-based distributions. To quantify the amount of between-individual variation in these seasonal distributions we developed a bespoke Bayesian mixtures analysis that groups individuals into mixtures based on similarities in the distribution of locations across pre-defined regions of their range. The identification of mixtures in the individual distributions of Round Island petrels provides evidence for substantial intra-population variation. Our approach can be applied at a range of spatial scales and stages of the species’ annual cycle, making it a flexible tool for quantifying variation in seabird distributions, and could be useful for prioritising areas for protection.
Passive Acoustic Monitoring as a Scalable Seabird Monitoring Tool.

Although seabird conservation actions have increased globally in number and complexity, the lack of scalable, cost-effective monitoring methods limits adaptive management and the evaluation of conservation efficacy. Automated sensors and computer-aided analyses provide a scalable and increasingly cost-effective tool for seabird monitoring. A key assumption of automated acoustic monitoring of birds is that measures of acoustic activity at colony sites are correlated with the relative abundance of nesting birds. We tested this assumption at seven Forster’s terns (Sterna forsteri) colonies in San Francisco Bay for 2 breeding seasons. Acoustic activity explained 71% of the variation in nest abundance between breeding sites and 88% of the change in colony size between years. For terns, acoustic activity is correlated to relative abundance, a fundamental step toward designing rigorous and scalable acoustic monitoring programs to measure the effectiveness of conservation actions for colonial birds and other acoustically active wildlife. We discuss exciting new extensions of these findings with new species and new acoustic approaches, as well as important limitations for designing acoustic monitoring programs.
Are there more yelkouan shearwaters than we thought?

Yelkouan shearwater is one of the least known endemic species in the Mediterranean Basin. Its breeding behaviour hinders to make precise population estimation from breeding colonies. Land based count data from the Bosphorus reveal that remarkable numbers of yelkouan shearwaters are passing along the site just before the egg-laying period. Ninety thousand birds counted in four hours and this total is well corresponding the global population estimates. Continuous passage after four hours draws attention to reconsider the estimates derived from breeding colonies and gives rise to a discussion on how accurate these estimates are and are there any possibility to make more precise estimates with land-based counts. The aim of this paper is to emphasize the value of the Bosphorus in monitoring Yelkouan shearwaters and call for standardised land-based counts during the February passage of the species in order to support global population estimates.
Environmental and intrinsic drivers of population change – an energetics approach

Energetics is crucial for understanding the effects of environmental change on life-history decisions. We used accelerometers to derive Overall Dynamic Body Acceleration a rapidly growing approach to estimating energy-expenditure. ODBA is as effective as the established approaches in the laboratory, but its suitability as a robust proxy for energy expenditure across all natural behaviours in seabirds is untested. By deploying bio-loggers that monitored heart rate and acceleration we undertook the first comparison of heart rate and ODBA-derived energy expenditure across all behaviours in a free-ranging animal. Validating the ODBA method allows us to ask questions about individual life-history decisions. We combined estimates of energy expenditure with endoparasite load to explore the energetic costs of parasitism on individuals. This is the first time that this technique has been validated at fine scale in a field setting and we consider it a powerful method for elucidating life-history decisions under environmental variability.
Sarah Gutowsky       Twitter:@birdnerd_seg

Individual-level variation and colony-level interpretations of spatial patterns for wide-ranging species

A major priority in conservation planning for seabird species-at-risk is to assess the variability and extent of the at-sea areas most frequented by birds. Defining colony-specific distributions can help to identify the source or severity of common or distinct threats among colonies at different periods in the annual cycle. This is often accomplished by estimating the distribution of a colony based on a sub-sample of tracked individuals. A major assumption then is consistency in individual movements among members of a colony. The implications of scaling up individual-level tracking data to assess spatial patterns among colonies (i.e. differences in the size of areas used, overlap or segregation in distributions) is not well known for wide-ranging pelagic species, especially during non-breeding when individual variation in space use can be high. I present a case study assessing the impacts of sampling sensitivity (i.e. number and identity of individuals contributing to an analysis) on inter-colony comparisons of spatial patterns using year-round multi-colony tracking data from two highly vagile species, the Laysan (Phoebastria immutabilis) and Black-footed (P. nigripes) albatross. Overall, the results emphasize the importance of considering individual variation when defining and interpreting colony-level spatial patterns. Once sampling sensitivity has been evaluated for a given dataset and analytical approach, it may be reasonable to describe colony-specific space use for wide-ranging species while maintaining transparency in respect to the potential limitations of the data. This information can in turn inform management decisions in the most useful and reliable way possible.
Using the fluttering shearwater (Puffinus gavia) as an ecological indicator for marine ecosystem health in northern New Zealand

Marine ecosystems in northern New Zealand are increasingly being challenged by human induced stressors (e.g., overfishing, pollution, shipping). In order to understand and evaluate these stressors there is an urgent need to develop indicators that summarize large quantities of complex information into few policy relevant signals. The fluttering shearwater Puffinus gavia is an endemic but abundant seabird along the coast of northern New Zealand, yet its breeding biology, diet and offshore ecology remain poorly described. In this study, I will examine if fluttering shearwaters are suitable as an ecological indicator for inshore ecosystems of northern New Zealand. The scientific basis for this objective will be established through: a. describing summer and winter feeding areas using geolocators, b. examining dive depth from time-depth recorders, c. providing demographic data, and d. analysing shifts in diet preference over a time scale of 100 years through stable isotope analysis from alive and archived specimens.
Avoidance Behaviour of Seabirds at Offshore Wind Farms

Collision between birds and turbines is seen as one of the key issues in relation to offshore wind farms. Collision risk models can be used to estimate the number of birds believed to be at risk of collision prior to wind farm construction. However, these models are sensitive to a number of key parameters, in particular avoidance rate. Despite this, the evidence base used to justify the use of particular avoidance rates is weak. We reviewed the literature in order to identify robust avoidance rates for five priority species believed to be at high risk of collision.
Optimising translocation efforts of Mottled Petrels (Pterodroma inexpectata): growth, provisioning, meal size and the efficacy of an artificial diet for chicks

Mottled Petrels, Pterodroma inexpectata, are endemic to New Zealand and are considered "near threatened" due to recent anthropogenic impacts. Mottled Petrels are popular candidates for restoration projects, though before these translocations can proceed critical knowledge of Mottled Petrel biology and assessment of the appropriateness of translocation techniques are required. This study aimed to characterise previously unknown aspects of breeding biology critical for the successful translocation of Mottled Petrels. Mottled Petrel chicks that underwent translocation fledged in good condition. Results indicated that the optimal age to translocate Mottled Petrel chicks is 20 - 15 days before fledging, equating to a wing length and weight greater than 224mm and 490g respectively. Translocated chicks should be provisioned with one 35g meal every three days until fledging, with a target fledging weight of approximately 350g. It is expected that these findings will benefit the conservation management of Mottled Petrels and other species of Pterodroma.
Investigating individuality in the foraging behaviour of European Shags: flexibility, consistency and constraint.

There is a growing body of work exploring consistent behavioural patterns in seabirds. So far, most studies have focused on long-ranging species that feed close to the water's surface. Here we examine the foraging patterns of a short-ranging pursuit-diving predator; the European shag (Phalacrocorax aristotelis). In 2014 birds nesting on the Farne Islands(UK) were fitted with GPS and TDRâ€™s. Combined locational and dive information was gathered for 460 trips made by 32 individuals. Simultaneous data on location and diving behaviour will be analysed using a higher number of repeated measures than most previous studies report. We plan to examine levels of consistency and flexibility in individual foraging behaviour and explore factors which could affect repeatability. This work represents the first in depth examination of individual repeatability in P.aristotelis behaviour on a fine-scale. Results will provide a baseline for further investigations into the plasticity of foraging behaviour over time.
Large scale seasonal patterns of seabirds distribution fuels Pelagic MPA’s designation.

Pelagic MPAs designation often faces a lack of knowledge on species distribution. We investigated spatio-temporal variations in seabirds by conducting aerial surveys in winter and summer 2012 over the French EEZ (560,000 km²). Following a strip-transect method, we travelled 98,500 km above the sea and collected more than 33,000 sightings. Density maps for both seasons allowed to identify key areas for seabirds. This unprecedented study provides a synoptic view of the seabird community in French waters, highlights the pelagic distribution of many species and the importance of winter for conservation plans. This study resulted in the designation of 10 areas forming a new network of pelagic Marine Protected Areas in France.
Kittiwakes balance flexibility and spatial consistency during their winter migrations.

Marine environments are inherently dynamic, while marine predators are often long-lived and employ strategies where consistency and spatial memory are key components to their foraging and life-history strategies. Here, we attempt to understand the interaction of these factors on the winter migrations of a surface-feeding seabird in the North Pacific. Between 2008 and 2011, we tracked 17 black-legged kittiwakes (Rissa tridactyla) from the Pribilof Islands, Alaska over two consecutive winters, and 99 black-legged kittiwakes total using geolocation dataloggers. Black-legged kittiwakes primarily wintered in pelagic sub-arctic waters, however, distributions spanned seven ecoregions of the North Pacific. Birds tracked for two consecutive years showed higher fidelity to wintering routes than occurred at random. Although individuals showed a degree of spatial fidelity, our results suggest that under current conditions black-legged kittiwakes have a high capacity to alter winter migrations relative to local environmental conditions.
Brown pelican fledging success and diet in the Western Gulf of Mexico: potential drivers of changing regional distribution

In recent years, nesting numbers of Brown Pelicans have grown exponentially in northern Texas, while remaining stable or declining elsewhere in the state. Because little demographic information has been reported in this portion of their range, we assessed fledging success and chick condition in the four largest Texas colonies. We also measured frequency, size, and content of chick meals as potential drivers of differences in demographic rates. Chick condition, fledging success, provisioning rates and meal masses declined from north to south. Northern breeders produced nearly twice as many fledglings per nest as breeders in the southernmost colony. While northern nestlings received more Gulf menhaden, particularly in small size classes, our energy density analysis suggests that energetic content is similar across main prey species and regions. We conclude that higher nest productivity at northern colonies, driven more by prey availability than prey quality, may be contributing to their rapid growth.
Storm petrel project: building a link between conservation and cities in Peru

We are a Peruvian project involving conservation, research and education of the Ringed Storm Petrel (Oceanodroma hornbyi). Our main focus are rescue and recovery actions of these ocean birds found lost in urban areas outside their natural habitat. While rescuing them, we can collect information, contributing to learn more about this little known species and its habitat, and to generate proposals to reduce the possible causes of their findings in cities.
GPS tracking for mapping seabird mortality induced by light pollution

Light pollution and their consequences on ecosystems are increasing worldwide. Knowledge on the threshold levels of light pollution at which significant ecological impacts emerge and the size of dark refuges to maintain natural nocturnal processes is crucial to mitigate its negative consequences. Seabird fledglings are attracted by artificial lights when they leave their nest at night, causing high mortality. We used GPS data-loggers to track the flights of Cory’s shearwaters Calonectris diomedea from their nest-burrows to grounding locations, and to evaluate the light pollution levels overflow using nocturnal high resolution satellite imagery. Birds were grounded at locations closer than 16 km from colonies, 50% of individuals being rescued in a 3-km radius from the nest-site. Breeding habitat alteration by light pollution is more severe for inland colonies. We provide scientific-based information to create dark corridors facilitating that fledglings from inland colonies reach the sea successfully.
Is the decline of Yellow-eyed penguins a result of anthropogenic modifications of the benthic environment off the New Zealand coast?

On the Otago Peninsula in Southern New Zealand the population of the endemic Yellow-eyed penguin has undergone significant declines since the mid-1990s. Years of increased chick starvation occur with increasing frequency indicating problems at sea. We tracked Yellow-eyed penguins using GPS dive loggers. The penguins foraged almost exclusively at the seafloor. Although some of the birds ranged up to 25 km from their nest sites, the majority of penguins tended to forage either within 10km from the shore or in two narrow bands some 15km from the coast. Few penguins foraged in the region 10 to 15 km from the coast which coincides with the commercial shipping lane. Offshore foraging penguins targeted areas heavily modified by bottom fisheries that attract scavenging fish species. We conclude that modification of the Yellow-eyed penguins' benthic foraging habitat by noise pollution and fisheries likely restrict foraging ranges and prey diversity negatively affecting breeding success and population developments.
Differential migratory responses of closely-related dietary generalist and specialist marine predators to long-term climate change

Climate change has resulted in widespread and rapid shifts in the distribution of many marine species, and ocean warming is causing poleward redistributions of cold-water zooplankton. If marine predators reliant on copepods are to adapt to these changes, they will need to modify both foraging behaviour and migration strategies. Small petrels are major consumers of zooplankton in the Southern Ocean, and species differ in bill morphologies depending on the degree of specialisation on oceanic copepods. In this study we focus on the Antarctic prion Pachyptila desolata, a dietary generalist, and the broad-billed prion P. vittata, a copepod specialist. Our findings suggest Antarctic prions, not broad-billed prions, have shifted their non-breeding distribution southward over the last century. Broad-billed prions migrated ~ 1000 km east of the breeding colony to target a seamount generated upwelling, behaviour that could mitigate the impact of climate-induced prey shifts by providing refugia for this planktivorous species.
Intra-population variation in foraging behaviour of great skuas (Stercorarius skua) indicates differential effects of marine renewable energy developments and fisheries activity.

Human activities, such as marine renewable energy developments (MREDs) and fisheries, are increasing in the marine environment and have the potential to affect seabirds. Considering the influence of breeding status and intra-population variation on seabird responses to marine conditions can improve predictions of the effects of human activities. The great skua Stercorarius skua is in decline and vulnerable to impacts of MREDs and changes to discarding policies. To assess great skua foraging behaviour during breeding we used GPS data loggers to investigate consistency in behaviour, and population- and individual-level relationships with environmental variables. Breeding birds were more consistent than failed breeders in their foraging behaviour and appeared to target predictable foraging habitat. Great skuas showed individual variation in relationships with environmental conditions, which could indicate individual dietary specialisms. Differing behaviour throughout the breeding season, and between individuals, suggests differential impacts of human activities on subsections of great skua populations.
5 ways RSPB Scotland is working to conserve our seabirds

Rspb Scotland has a significant programme of work progressing seabird conservation. Five short case studies will be presented including island restorations; biosecurity; site designations; work to restore prey base; and marine spatial planning.
Exceptionally long provisioning trips to the mid-Atlantic and western Scotland by Manx Shearwaters (Puffinus puffinus) breeding on the edge of Europe

GPS tracking of Manx Shearwaters (Puffinus puffinus) off the west coast of Ireland reveals a maximum travelled foraging distance up to four times greater than previously suggested for the species during chick rearing (max.3322km return). Kernel density estimation and areas of restricted search (ARS) show that key foraging sites are located in three distinct, independent locations: Galway Bay (short,<200km, N=26), Outer Hebrides in Scotland (medium,<1000km, N=2) and Reykjanes Ridge in the mid-Atlantic (long,>1000 km, N=2). Although even greater foraging ranges have been recorded in Procellariiformes during incubation, this is the furthest one recorded for coastal breeding birds during chick provisioning in the Northern Hemisphere. Compared with foraging ranges previously observed in the same species and other Procellariiformes, our results suggest that differences in the geographic location of colonies do not only influence the ratio between short and long trips but can also significantly alter foraging ranges.
Preserved in salt: two charadriiform seabirds show few signs of ageing

A substantial proportion of mortality in long-lived wild animals is believed to be associated with senescence. However, several studies have failed to detect physiological senescence in long-lived wild animals, especially seabirds. Most studies to date have examined only a single parameter or parameters associated with only a single physiological system. I assessed 29 physiological traits and seven behavioural traits alongside five demographic parameters in two species of long-lived wild charadriiform seabirds (thick-billed murres and black-legged kittiwakes). For many of the parameters, I obtained values three years later from the same individual, demonstrating that patterns occurred longitudinally within individuals and were thus not attributable to the selective appearance or disappearance of individuals. Mortality increased with age, whereas reproductive success peaked at middle ages. Although all individuals faced the same overall energy ceiling, birds from different age classes directed that energy towards different components (resting metabolism, antioxidants, immunity). In general, many of the biomarkers of mammalian ageing did not vary with age in seabirds.
One method does not suit all: variable settlement responses of three procellariid species to vocalization playbacks

Attempts to establish seabird colonies at restoration sites using artificial visual and auditory social cues have had varying success rates. The biological mechanisms responsible for this variation are poorly understood. We used experimental call playback to test the attraction of three sympatric procellariid species to auditory social cues in New Zealand. To test whether the size of nearby colonies affected the response to vocalization playback, we chose three similar experiment locations with varying densities of breeding conspecifics within 1 km. Grey-faced Petrel were attracted to playback at all three sites; Fluttering Shearwater were attracted at only two locations; while Flesh-footed Shearwater were not attracted. Response to playback increased with increasing densities of nearby breeding conspecifics, suggesting there may be a relationship between attraction and the size of nearby source populations. Vocalization playback may represent an alternative to other active restoration approaches. However, we caution that its effectiveness for individual species at different sites should be assessed at the outset of restoration initiatives.
Sjurdur Hammer       Twitter:@sjurdur

Strengthening online social cohesion between seabird researchers and public awareness through the #seabirdersaturday campaign

One of the primary aims of the World Seabird Union is to promote inter-regional and inter-hemisphere collaboration between scientists. While social media is in science widely recognised as a tool for public engagement, we have promoted a campaign which intends to serve the dual function of connecting seabird researchers and also creating public interest around seabird related conservation issues. Since launching the first #seabirdersaturday, there have on average been 900 tweets with this hashtag each month. A detailed analysis will be made of a subset of saturdays with presentation detailed of geographic and demographic features. I propose that social media is a worthwhile activity to create public awareness around your work, and #seabirdersaturday can be especially useful for inexperienced social media users to become familiar with the ongoing seabird research environment.
Ensemble ecological niche models identify preferred foraging habitats of grey-headed albatrosses *Thalassarche chrysostoma*

For highly mobile species, such as pelagic seabirds, at-sea habitats are not static but characterised by environmental conditions that may shift with oceanographic dynamics. The integration of biologging, Earth Observation remote sensing and ecological niche modeling can provide insight into preferred conditions. We used an ensemble ecological niche model (EENM) to identify preferred foraging habitats of the grey-headed albatross *Thalassarche chrysostoma*. A combination of GPS and geolocation-immersion loggers was used to determine movements and behaviours of 55 adult birds from Bird Island, South Georgia during the brood-guard period of two breeding seasons. A suite of remotely-sensed oceanographic variables, including novel ocean front metrics, were used as predictors in niche modeling. The resultant EENM combines outputs of multiple modeling algorithms (Generalised Additive Models, MaxEnt, Random Forest, Boosted Regression Trees) to identify conditions characterising foraging locations. EENM could prove valuable in predicting the locations of critical habitats for species of conservation concern.
Grant Humphries  Twitter:@granthumphries

Creating spatial models without the spatial data: How long term ecological data can help identify important oceanographic regions for top predators

Advances in GPS tracking technologies have allowed for rapid assessment of important oceanographic regions for seabirds. This allows us to understand seabird distributions, and the characteristics which determine the success of populations. It many cases, quality GPS tracking data may not be available however, long term population monitoring data may exist. In this study, a method to infer important oceanographic regions for seabirds will be presented using breeding sooty shearwaters as a case study. Chick size and harvest index data derived from a long term dataset of Maori 'muttonbirder' diaries were obtained and used as response variables in a gridded spatial model. It was found that areas of the sub-Antarctic water region best capture the variation in the chick size data. Oceanographic features including wind speed and charnock (a derived variable representing ocean surface roughness) came out as top predictor variables in these models. Previously collected GPS data demonstrates that these regions are used as "flyways" by sooty shearwaters during the breeding season. It is therefore likely that wind speeds in these flyways affect the ability of sooty shearwaters to provision for their chicks due to changes in flight dynamics. These methods can be applied to any long-term time series to identify regions of importance for seabirds
Getting the most from your data: Predictive statistics can be used to develop a better understanding of foraging ecology in northern gannets

The miniaturization and reduction in cost of GPS loggers has led to a proliferation of studies on seabird foraging ecology. However, Time Depth Recorders (TDR) are still comparatively expensive, so in the majority of studies foraging events are based on GPS track metrics such as Area Restricted Search (ARS). We used concurrent deployments of GPS and TDRs (n=9) to train a model to reliably predict seabird foraging events (plunge dives) based on GPS tracks alone, in northern gannets (Morus bassanus). When applied to a dataset of gannets not equipped with TDR devices (n=7), we predicted approximately 600 foraging events. Diet of instrumented birds was investigated using Stable Isotope Analysis, with 9 birds classified as low users and 7 birds classed as high users of fisheries discards. Track data and predicted foraging events from the two groups was analysed in relation to fisheries data using the Vessel Monitoring System. The overall rate of plunge diving was slower in areas of high fisheries activity for all birds. However, high users of fisheries discards had a higher rate of diving than birds of lower discard use which supports the ‘junk food hypothesis.’ Adopting the use of predictive statistics and combining multiple data sources gains a better understanding of foraging ecology, and this approach can be used to make better predictions from existing datasets or in studies with limited resources.