

Alphabetical List of Abstracts for Oral and Poster Presentations



A skimmer chick next to the name indicates that the presenter is a student. Bolded names are the presenters

ALPHABETICAL LIST OF ABSTRACTS FOR ORAL AND POSTER PRESENTATIONS An * next to the name indicates that the presenter is a student. Bolded names are the presenters

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Behavioral characterization and energy expenditure estimation among Great Egrets (*Ardea alba*) using accelerometry data (Oral)

State-of-the-art satellite GPS transmitters, (48-g Bird Solar; e-obs) in addition to providing unprecedented details regarding movements of free-ranging animals, also measure overall body position and acceleration along x-y-z axes. Tags were programmed to collect 4 sec pulses of continuous accelerometry data every 4 minutes. Teachable algorithms are presented that scan very large data sets and classify accelerometry traces into the most common behaviors; resting/alert (vertical and horizontal), flying, and walking. Over 80% of the traces fall into identifiable patterns and are consistent with location; i.e. walking on foraging grounds, flying between colony/roost and foraging grounds, and resting horizontally (during egg incubation) and vertically at colonies or roosts. Less common behaviors (striking at prey, preening) are explored and matched with field observations. Summing behavior categories allows an estimation of both activity budgets and daily/annual energy expenditure. Overall dynamic body acceleration (ODBA) is presented as a unitless index of energy expenditure which is easily derived from accelerometry data and compares well with actual energy expenditure (joules).



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Skin pentosidine does not covary with age in four species of wild seabirds (Oral)

The process of aging is progressive, unavoidable and universal to all organisms. Unlike in many other animals (fish otoliths, clam growth rings, mammal tooth wear), there is no known technique for accurately aging birds in the wild. For the last century, banding remained the only alternative to obtain a bird of known age. This method, however, requires continuous effort on a large scale with uncertain return rate. Recent studies identified pentosidine as a potential biomarker of chronological aging in several bird species. The objective of this study was to verify whether pentosidine accumulation is applicable as an aging biomarker in four species of long-lived seabirds. Skin biopsies were collected from foot webs of previously banded known-age seabirds from four species: black-legged kittiwakes (*Rissa tridactyla*) in Alaska, Atlantic puffins (*Fratercula arctica*) and razorbills (*Alca torda*) in New Brunswick, and thick-billed murrelets (*Uria lomvia*) in Nunavut. Samples were analysed with High performance liquid chromatography (HPLC) to quantify pentosidine levels. Collagen levels were estimated through hydroxyproline assays to normalize pentosidine content across individuals. Kittiwakes displayed a weak correlation ($r^2=0.39$, $P=0.009$) between age and pentosidine concentration (pmol pentosidine/mg collagen). Puffins ($r^2=0.02$, $P=0.65$), razorbills ($r^2=0.08$, $P=0.49$), and murrelets ($r^2=0.04$, $P=0.20$) did not show any associations with age. We concluded that although determination of an individual's exact age would have invaluable applications, pentosidine does not appear to be a reliable method in these species.

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Time-activity budgets of Masked Ducks and Ruddy Ducks in Puerto Rico (Oral)

Masked Duck (*Nomonyx dominicus*), migratory Northern Ruddy Ducks (*Oxyura jamaicensis*), and non-migratory West Indian Ruddy Ducks (*Oxyura jamaicensis*) are stiff-tailed ducks whose populations are declining due to habitat loss and degradation. Little research has been conducted on Masked Ducks or West Indian Ruddy Ducks. West Indian Ruddy Ducks and Northern Ruddy Ducks are considered the same species, but we evaluate them separately to see if their migratory behavior impacts their activities. We recorded 24-hour time-activity budgets on Masked Ducks ($n = 142$), Northern Ruddy Ducks ($n = 1,401$), and West Indian Ruddy Ducks ($n = 3,765$) on the Laguna Cartagena National Wildlife Refuge in Lajas, Puerto Rico from January through April 2015 and 2016. Behaviors varied among taxa, between sexes, and between diurnal and nocturnal sampling periods ($P < 0.01$). Resting and sleeping were common behaviors observed during the day and night. West Indian Ruddy Duck (Diurnal: mean = 10.1% (SE = 0.7); Nocturnal: mean = 12.6% (SE = 0.8)) spent more time feeding than the Northern Ruddy Duck (Diurnal: mean = 5.3% (SE = 0.8); Nocturnal: mean = 4.6% (SE = 1.6)). Northern Ruddy Duck and West Indian Ruddy Duck time-activity budgets varied with 7 of 8 behavioral categories during the day and 5 of 8 behavioral categories at night differing. Female Masked Ducks spent more time feeding at night (mean = 41.0% SE = 5.3) than males (mean = 29.5% SE = 4.8). Male and female Masked Ducks spent substantially more time resting during

the day than the Ruddy Ducks. All 3 taxa of stiff-tailed ducks varied substantially in their time activity budgets. Ecological parameters including body size or migratory patterns may account for observed differences in behavior.



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Shorebird parental nesting behaviors in response to research activities: implications for nest monitoring programs (Oral)

For federally listed species, such as Piping Plovers (*Charadrius melodus*) and Least Terns (*Sternula antillarum*), monitoring productivity is crucial to understand population dynamics and improve recovery plans. However, research activities may increase parental absences, causing prolonged exposure of unattended eggs to high sand temperatures, decreasing their survivability. Therefore, the objective of this study was to evaluate the influence of research activities on parental nest attendance. We installed miniaturized surveillance cameras at 65 of 294 Least Tern and 89 of 551 Piping Plover nests under observation on the Missouri River in North Dakota from 2013-2015. Video was reviewed to record start and stop times of incubation until the nests hatched or failed. We used PROC MIXED in SAS 9.4 to analyze the total time parents spent off of the nest one hour before, during and one hour after research activities. We used an information-theoretic approach to assess a set of models based on covariates including research activity type and length, time period (pre, during or post activity), year, date, clutch age and species. We found that the total time spent off of the nest increased during all research activity types (time off nest = 19.8 min, SE = 0.87) compared to before (time off nest = 5.04 min, SE = 0.98) and after periods when researchers were absent (time off nest = 4.54 min, SE = 1.02). Adult trapping had the greatest influence on total time spent off of the nest (time off nest = 27.2 min, SE = 1.54) compared to targeted searches (time off nest = 10.3 min, SE = 3.04), which had the least effect. Parental time spent off of the nest was positively correlated with the length of the research activity. Piping Plovers spent less time off the nest during research activities (time off nest = 15.2 min, SE 1.07) compared to Least Terns (time off nest = 24.7 min, SE = 1.38). The results from this study may be used to improve monitoring procedures for plovers and terns, as well as other shorebirds, in order to decrease potentially negative impacts from researcher activities.

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Status and trends in the Norwegian Atlantic puffin population (Oral – Puffin Symposium)

Most seabird populations in Norway are currently in decline and have dropped by >30% over the last three decades. Pelagic species are suffering most, with many auks and kittiwake colonies having lost 70-90% of their initial numbers. Among them is the Atlantic puffin. Although still numbering almost 1.5 million pairs and is >15 times more numerous than any other seabird breeding on the Norwegian mainland coast, the population has declined dramatically. The largest decreases (up to >11% p.a. in the last ten years) are found in colonies along the Norwegian Sea while numbers have remained relatively stable on the Norwegian Barents Sea coast. In the Barents Sea, capelin and, recently, gadoid fry are important constituents of the diet whereas along the north-central coast of Norway, first-year Norwegian spring-spawning (NSS) herring has been the key prey since the 1960s. Puffins in north-central Norway, especially at Røst that once was the largest colony in mainland Europe have long suffered a succession of breeding failures that seem primarily to be linked to the transport and survival of first-year NNS herring with the coastal current towards their nursery grounds in the Barents Sea. Young haddock have been taken in significant amounts, but this non-schooling prey is a poor alternative and rarely sustained successful breeding. First-year saithe were common early in the seasons in the 1980s but have since disappeared from the diet. There is now increasing concern that herring productivity is being impaired by NE Atlantic mackerel stock, which has recently expanded its summer feeding range far northward. While adult survival rates have been shown to be related to sea surface temperatures around the colony at Røst (and elsewhere in Europe), Norwegian birds have recently been shown to gather in the Barents Sea in autumn before most of them move west in winter. Further research is now warranted to explore how environmental conditions (weather, ocean climate, productivity and prey) on the puffins' non-breeding grounds affect their survival and have carry-over effects on their productivity.

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A simple device to measure microclimates as experienced by birds (Poster)

Climate change is a major current threat to avian populations. Birds directly encounter climate at the scale of microclimates which can vary rapidly in time and space and so understanding potential vulnerability requires fine-scale measurements that accurately track thermal exposures. However, few options exist to record the microclimates as experienced by birds. To quantify the microclimates experienced by chicks of a ground-nesting bird, we developed attachment protocols for band-mounting thermochoch iButtons on Ring-billed Gull *Larus delawarensis* chicks. We tested these mounted, temperature-logging devices for 20 chicks weighing > 200 g (gross device weight was 4 g), attaching devices for 48 h and observing detailed behavior in 45-min watches before and after both attachment and removal. Devices recorded temperature immediately surrounding the leg at high resolution (2-min intervals). Recorded temperatures were strong predictors of observed thermoregulatory behaviors (panting and sitting), greatly outperforming predictions from air temperatures measured by standard approaches. Through comparison with matched controls (chicks carrying just a band), we detected no adverse physiological effects of devices, no effects on social or feeding behavior, and only a short-term decrease in inactivity immediately following device attachment (likely as a result of increased preening). Our devices provide a direct index of heat-stress exposure, integrating both air temperature and solar radiation at microclimatic scales. At ~\$25 USD per

device, our simply-implemented approach facilitates experimental protocols with robust sample sizes, even for relatively modest budgets. Such fine-scale measurements are vital for our understanding of the direct effects of climate change on birds.

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Part 2 of Least Terns in Hawaii - Galapagos Finches or Great Auks? (Oral)

We have been following the entire population of least terns nesting on the Big Island since they began to nest there in 2012, and in 2016, we attached geolocators to two of the six breeding adults. We also collected their feathers. The other four birds were extremely trap-shy, and could not be trapped by either box-drop or Potter traps. In 2017, we were able to find just two of the three pairs, but only found one with a geocator. Currently we have half of the adult population uniquely marked: one with plastic color bands and two with field-readable bands, so in future years a marked population will be of benefit for any foraging and behavior studies if the colony expands- the Galapagos Finch evolutionary direction. The Great Auk evolutionary direction however is a real possibility. Various environmental factors might prevent the establishment of a permanent colony on Hawaii. The eggs are quite fragile, and many of the eggs in prior years have not hatched, unheard of in California least tern colonies. Causes of egg death or lack of development might be pesticides from the golf course adjacent to their nests the past three years, as well as lack of essential nutrients in their prey. Adults do not forage in the ocean the way that California least terns do, either during courtship or chick feeding, and instead, they forage in anchialine fish ponds filled with *Gambusia affinis*. In California, highest success is when adults feed on sardines and anchovies with high omega-3 fatty acids. In 2017 we collected eggs for pesticide, lipid, and elemental analysis, which will answer these questions. And finally, unlike mainland least terns, nests of Hawaiian least terns have been attended by 3-4 birds each year, and with a marked population, many questions can be answered, such as do the same birds help at the nest each year, and what is the mate fidelity. This year, having perfected a ring noose trap that catches them, we will then be able to trap adults in 2018 to find relatedness among the attending adults from collected blood samples. How long we can continue to study them depends on which direction they go – extirpation or expansion.

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Genetic variation in Kittlitz's Murrelet in Alaska (Oral)

Kittlitz's Murrelet (*Brachyramphus brevirostris*) is a unique seabird that breeds in solitary nests on remote scree slopes, and is specialized to feed where glaciers and glacial streams enter the ocean. It breeds primarily in Alaska but is rare and declining. Information about both the genetic relationships among murrelets breeding in different regions, as well as dispersal of breeding birds between regions, is urgently needed to determine the extent to which local populations must be managed separately or combined into regional units. Length variation in 18 microsatellite loci was compared among 270 Kittlitz's Murrelets from most of the breeding range. The global index of population differentiation was low but statistically significant. Pairwise comparisons suggested that murrelets sampled from the North and from Kodiak Island eastward and southward to Glacier Bay are genetically similar to each other, and different from those sampled from Attu, Agattu and the Andreanof islands. Those sampled from Attu, Agattu and the Andreanof islands also tended to differ from each other. The most likely number of genetic populations as inferred by STRUCTURE was 2. Almost all individuals from Attu, Agattu and the Andreanof islands assigned to one ('Western') genetic cluster with high probability, and almost all individuals from Kodiak Island to LeConte Bay assigned to a second ('Eastern') genetic cluster. Most individuals from the North assigned to the Eastern population with high probability. Nine individuals appeared to have mixed ancestry, suggesting recent migration. The mitochondrial control region indicates the existence of two highly distinct lineages, corresponding to the two genetic populations identified from microsatellite variation. Overall, Alaskan Kittlitz's Murrelets appear to comprise two evolutionarily significant units for management purposes: the Western and Central Aleutian islands, versus Chukchi Sea south and east to the Alexander Archipelago.

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MPAs for breeding terns: science, lines on maps, and management implications (Oral)

The UK is currently identifying and classifying marine Special Protection Areas (SPAs) for marine birds, as a requirement of the EU Birds Directive. The Joint Nature Conservation Committee, in collaboration with the UKs statutory nature conservation bodies, has undertaken a programme of work to identify the areas of sea of greatest importance as foraging grounds around breeding tern colonies. This presentation will describe the main elements of the work including the collection of empirical survey data on the foraging activity of breeding terns around the UK using visual tracking method which provides data analogous to that obtained from GPS tracking devices; the development of habitat-association models based on those data; the verification of the predicted patterns of usage generated by those models using a k-folds cross validation approach; and the application of a law of diminishing returns to those patterns to define boundaries for SPAs at sea. The status of these sites across the UK will be presented and the implications of these new sites for the management of ongoing and planned activities will be discussed. This presentation takes the audience through the whole process of conservation as provided by means of protected areas at sea for a specific example, highlighting scientific process, implications, limitations and outcomes.



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Individual specialisation in the great black-backed gull *Larus marinus*: consistent foraging patterns during the breeding period (Oral – Gull Symposium)

Research on individual specialisation in birds has been increasing with recent advances in technology, which has greatly broadened our understanding of their movements and foraging ecology. Many GPS tracking studies on large gulls confirm their high degree of adaptability and flexibility in foraging on a variety of resources. At the same time they reveal specialisation in habitat use and foraging routines at an individual level. While other species have been well researched over the last decade, much less is known about great black-backed gulls. Hence, the goal of our study was to investigate the ecological niche and individual spatial behaviour of the great black-backed gull in the Wadden Sea. We equipped seven breeding individuals with GPS/GSM transmitters using a Teflon harness in 2016. Our results show that foraging trips were undertaken within a maximum range of 28 km from the colony. All individuals spent most of their time on intertidal flats, in areas of shallow water and in salt marshes. Although they used similar types of habitat, there was no overlap among individuals in core foraging areas. Nor did spatial patterns change between incubation and chick-rearing. The observed behaviour contrasts closely related species of large gulls breeding in the same region, which show more variation in foraging destinations, and also greater overlap among individuals. Our findings suggest a high degree of individual specialisation and spatial segregation in great black-backed gulls during the breeding period, which may be related to the avoidance of intra-specific competition. Food resources in the Wadden Sea seem to be sufficiently abundant and reliable to support the current breeding population of great black-backed gulls, which may explain the establishment of highly consistent foraging patterns.

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Full annual cycle tracking reveals the migratory routes and non-breeding distribution of a declining waterbird (Oral)

Waterbirds are showing widespread declines globally and face threats on both breeding and non-breeding grounds. In North America, the Common Tern is a species of conservation concern because inland-breeding populations on the Great Lakes and in Manitoba are in decline. In contrast, populations breeding on the Atlantic coast are stable. Based on band-recoveries, coastal and inland populations have largely non-overlapping wintering areas, with the former wintering on the east coast of South America and the latter wintering farther west. However, inferences from banding data are limited as they provide only a snapshot in time. A migration tracking study of five terns from an Atlantic coastal population supported the findings of banding data and provided greater detail on the population's migration routes and non-breeding distribution. A more detailed understanding of the migration patterns of declining inland populations is critical to assessing threats and prioritizing areas for conservation. In this study, we used light-level geolocators to track the migration of 47 terns from five colonies spread across the Great Lakes region and Manitoba. Across all colonies, the most common wintering location was coastal Peru. Important staging sites included Florida and the Gulf of Mexico. Although most birds' southward migration routes were similar among colonies, there were notable differences in routes used during northward migration, which varied by breeding colony along a longitudinal gradient. Our results have important implications for where to prioritize conservation efforts for inland-breeding terns and complement recent genetic work that indicates differences in dispersal between inland and coastal populations.



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Regional serial habitat selection by Wood Storks across hydrodynamic wetlands (Poster)

Long-legged wading birds in the southeastern United States are dependent on temporally hydrodynamic wetlands across broad spatial scales. Understanding and linking the large-scale movements and resource selection of wading birds to interannually dynamic wetland conditions, while critical to conservation, has received little attention thus far. We investigated the serial habitat selection of federally-threatened Wood Storks (*Mycteria americana*) on their large-scale annual movements in the southeastern United States. To explore serial habitat selection along movement pathways, we outfitted storks ($n = 115$) with GPS satellite transmitters and tracked their movements for 10 years (2002-2011). We modeled hydrodynamic wetland inundation conditions across seven southeastern states as a function of monthly *modified*-Normalized Difference Water Index (*mNDWI*) applied to mosaicked Landsat 7 ETM+ imagery spanning 11 years (2001-2011). From these, we derived monthly image scenes ($n = 120$) reflecting "months since dry" (*msd*; up to 12 months) for each 500-m raster cell across the southeast during 2002-2011. Using a step selection function framework, we applied a conditional (case-control) logistic regression model to compare used and available habitat conditions along the storks' long-distance movement pathways. For each telemetry location, availability was generated randomly from elements (e.g., step lengths and turning angles) of the

empirical trajectories. Preliminary results show that Wood Storks selected wetlands with longer inundation histories (3.62 ± 0.75 msd) relative to available points (2.81 ± 0.82 msd) along long-distance movement pathways. These results suggest that while making long-distance movements storks may be selecting wetlands with wetter conditions relative to what is available. Further research is underway to determine whether adults and juveniles fundamentally vary in their serial habitat selection along movement pathways. Finally, we seek to understand how interannual variability in weather and concomitant wetland hydrodynamics impacts Wood Stork serial habitat selection between extreme wet and dry years. This research will further our understanding of the effect of large-scale spatiotemporal fluctuations in resource availability on wading bird movements and habitat selection.



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Geographical, environmental and anthropogenic factors affecting the occurrence of wintering Eurasian Spoonbills *Platalea leucorodia* in Morocco (Oral)

Determining factors affecting habitat selection is a major topic in avian ecology, with implications for conservation purposes. Studies dealing with the impacts of ecological factors on wintering Spoonbills are overall scarce. Here, we used Principal Component Analyses (PCA) and Generalized Linear Mixed Models (GLMM) to test the relevance of geographical, environmental and anthropogenic factors in predicting the occupancy and abundance of the Eurasian spoonbills (*Platalea leucorodia leucorodia*) during 2008-2011 within 30 wetlands in Morocco. The mean annual occupancy rate of wetlands by *P. l. leucorodia* was 59.2% ($\pm 1.5\%$ SE; 95% CI: 56.3%-62.1%). Among the occupied wetlands, 15 (83.3%) were regularly occupied. We found that wetland site occupancy was negatively correlated with distance to coastline, altitude and human presence, whereas abundance was positively correlated with mudflat areas. These findings highlight the role of human presence in selecting wintering sites, but not in the prediction of abundance. Management strategies should therefore address specific attributes of coastal wetlands and should carefully consider the effects of habitat use especially those related to mudflats. We further suggest guidelines for future studies to understand the dynamic of Eurasian spoonbills wintering in the region.



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Using flight initiation distances of waterbirds for bird management at the Barberspan Bird Sanctuary, South Africa (Oral)

With tourism in South Africa expanding, the number of avitourists increases. The increase in infrastructure and human activities in protected areas, if not managed properly, can be harmful to birds. Flight initiation distances (FID) can be used as a method to monitor response to disturbances and assist in the development of appropriate management practices. This study was performed at the Barberspan Bird Sanctuary, North West Province, South Africa, a Wetland of International Importance, and Birdlife Important Bird and Biodiversity Area. Our objectives were to determine the FIDs of 33 water- and shorebird species, and derive recommendations regarding the management of the reserve by combining spatial data with FIDs by means of suggesting approach distances as buffer zones. Our results showed a 0.29 m/g mean bird biomass increase in FID. Compared with conspecific or congeneric birds from Australia, Europe, and North America, South African birds seem to have relatively larger FIDs to human disturbance which may indicate lower habituation and/or higher predation pressure. We recommend that the mean FID of 62 m for the Blacksmith Lapwing *Vanellus armatus* be used as minimal approach distance for all birds outside the breeding season, and a 104 m approach distance during the breeding season at breeding sites. A large buffer of 200 m is suggested for areas with threatened, sensitive, and skittish species. However, it is still preferable for avitourists to use the bird hides along the shores. We also propose several ideas for the practical implementation of approach distances among hikers.

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30 years of environmental monitoring in herring gull eggs: new insights from GPS telemetry? (Poster)

Since 1988, samples of different organisms from the German North and Baltic Seas are taken regularly to monitor the status quo of the marine food web. These samples are archived in the German Environmental Specimen Bank. The marine specimen include bladder wrack (*Fucus vesiculosus*), blue mussel (*Mytilus ssp.*), eelpout (*Zoarces viviparus*) and herring gulls (*Larus argentatus*), each of it representing a certain trophic level of the marine food web. As omnivorous top predators, herring gulls are often used as indicator for changes in the respective ecosystem. Eggs are collected at three different breeding colonies in the North and the Baltic Sea during incubation, measured and then tested for their levels of several contaminants as well as of stable carbon and nitrogen isotopes. The stable isotope ratios give information about the food choice of herring gulls about three to six days before egg-laying. The long-term trends provide insights into the extent of the pollution and other possible changes in the marine food web. Nevertheless, it is unclear, when and where the gulls potentially take up contaminants. As a first step to answer these open questions, 17 adult herring gulls breeding at the island of Trischen (Germany) were equipped with GPS data loggers during incubation 2016. The recorded data indicate important foraging grounds of the tagged individuals and together with stable isotope analyses of the birds' blood they can help to understand the way of accumulation of pollutants in the marine ecosystem. In the current poster, long-term trends of stable carbon and nitrogen isotopes are presented, and compared to the spatio-temporal foraging patterns of the tagged herring gulls to quantify their usage of different coastal habitats.

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Assessing the effects of legacy contaminants on egg and nestling survival of Tree Swallows in Great Lakes Areas of Concern (Oral)

Great Lakes Areas of Concern (AOCs) are affected by many stressors, some of which are environmental contaminants including PCBs, PBDEs, persistent organochlorine pesticides, dioxins, benzenes, and other chemicals. These toxicants can accumulate in aquatic biota and then transfer to insectivorous birds that use the aquatic areas within AOCs. We used a relatively new multistate survival modeling approach to examine the relationship between avian egg and nestling survival and 11 contaminant concentrations in eggs of tree swallows (*Tachycineta bicolor*) nesting at reference (n=10) and contaminated sites (n=59) within 27 AOCs on all 5 Great Lakes. A total of 1,303 nests and 7,752 eggs were included in the modeling effort. Our analyses controlled for other common sources of variation in egg survival, including female age, date within season, year, and both site and AOC. Site, date within season, year, and female age all proved to be important variables in explaining egg survival. Total dioxin furan toxic equivalents (TDFTEQs) was significantly and positively associated with egg failure, but significantly negatively associated with nestling death. Across the full dose response for this contaminant, empirically observed values of TDFTEQ were concentrated at the low end, with only a few values at the higher end. Site, as an explanatory variable, proved much more valuable, as judged by AIC_c, than AOC, suggesting that sites within AOC can vary considerably in stressors and/or response to stressors. Overall, concentrations of the 11 contaminants examined here, appear to be at concentrations low enough to cause few problems for tree swallow reproductive success.

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Contributions of feather microstructure to eider down insulation properties (Oral)

Insulation is an essential component of nest structure that helps provide incubation requirements for birds. Many species of waterfowl breed in high latitudes where rapid heat loss can necessitate a high energetic input from parents and use down feathers to line their nests. Common Eider (*Somateria mollissima*) nest down has exceptional insulating properties but the microstructural mechanisms behind the feather properties have not been thoroughly examined.

Here, we hypothesized that insulating properties of nest down are correlated to down feather (plumule) microstructure. We tested the thermal efficiency (fill power) and cohesion of plumules from nests of two Icelandic colonies of wild Common Eiders and compared them to properties of plumules of wild Greylag Goose (*Anser anser*). We then used electron microscopy to examine

the morphological basis of feather insulating properties. We found that Greylag Goose down has higher fill power (i.e. traps more air) but much lower cohesion (i.e. less prone to stick together) compared to Common Eider down. These differences were related to interspecific variation in feather microstructure. Down cohesion increased with the number of barbule microstructures (prongs) that create strong points of contact among feathers. Eider down feathers also had longer barbules than Greylag Goose down feathers, likely increasing their air-trapping capacity. Feather properties of these two species might reflect the demands of their contrasting evolutionary history. In Greylag Goose, a temperate, terrestrial species, plumule microstructure may optimize heat trapping. In Common Eiders, a diving duck that nests in arctic and subarctic waters, plumule structure may have evolved to maximize cohesion over thermal insulation, which would both reduce buoyancy during their foraging dives and enable nest down to withstand strong arctic winds.

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Foraging distribution, habitat preferences and diet of Antarctic petrels, cape petrels and southern fulmars – inter-specific overlap or segregation? (Oral)

Ecological theory predicts sympatric species to show different habitat or dietary preferences as a strategy to avoid competition. In a world with rising CO₂ concentrations, knowledge about the foraging habitat and diet of species is crucial to understand potential impacts of climate-change on populations, species and communities. Antarctic fulmarine petrels form a group of closely related, sympatrically breeding species which are predicted to face changes in sea ice dynamics, ocean temperatures and wind conditions in the future, while little is known about their current summer foraging behaviour. In 2015/16 we investigated the foraging behaviour and diet of southern fulmars (*Fulmarus glacialisoides*), Antarctic petrels (*Thalassoica antarctica*) and cape petrels (*Daption capense*) breeding sympatrically on Hop Island (68.82°S, 77.68°E) in the Prydz Bay region (East Antarctica). Using lightweight GPS loggers, we recorded a total of 270 foraging trips, covering the entire 2015/16 breeding season from incubation to late chick-rearing in all three species, including multiple foraging trips made by several individuals. Blood, feather and egg membranes were collected from the same species, and complemented by prey items obtained in the foraging area during a marine science voyage in the 2015/16 austral summer. Foraging locations were identified using wet/dry data recorded by the GPS loggers and Expectation-Maximization binary Clustering (EMbC). We present the species' foraging distribution during the different breeding stages and identify habitat characteristics (bathymetry, sea ice concentration, chlorophyll a among others) to determine whether these Southern Ocean predators share foraging 'hot-spots' or if they segregate their foraging activities. Consistency of individuals in their foraging behaviour (e.g. to visit specific areas or show preferences for specific environmental conditions) was also investigated. In addition, stable isotopes were used to explore the dietary overlap between the three seabird species using isotopic niche parameterisation and estimates of resource use through mixing models. Preliminary results

suggest a strong overlap of the foraging locations of all three species at the population level throughout the entire breeding season. Similarly, stable isotope values reflecting the birds' diet during pre-laying, incubation and chick-rearing show a strong overlap among species.

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Declining trends in the puffin population of Machias Seal Island (Oral – Puffin Symposium)

The Atlantic Puffin (*Fratercula arctica*) colony of Machias Seal Island (MSI) sits in the "Grey Zone" between the Bay of Fundy and the greater Gulf of Maine, and between Canada and the U.S. It is one of only two colonies that survived human depredation in the 19th and early 20th centuries. At 5-6,000 pairs MSI is the largest colony in the region and provides recruits to all the other colonies in the Gulf. I review results of systematic monitoring supplemented with short-term research projects since 1995. The population is stable or declining slightly, likely constrained by burgeoning populations of both Common Murres (*Uria aalge*) (since 2003) and Razorbills (*Alca torda*). Diet has decreased in quality, notably by reduced size and availability of Atlantic herring (*Clupea harengus*) without replacement by other high-energy species. Hatch and breeding success have declined since the mid-2000s, coinciding with halving the proportion of herring in chick diet. Herring in chick diet does not affect breeding success, but does predict adult survival in the following winter, suggesting a carry-over effect from breeding to winter. Spring plankton blooms are now two weeks earlier, and the fall bloom three weeks later, than twenty years ago; puffin laying dates are extremely variable among years but are about eight days later than in the 1990s, and chicks fledge later and in poorer condition. The two least productive seasons, with 10-12% breeding success, occurred in the last four years. Puffins here are more resilient to researcher disturbance than has often been found; breeding adults subjected to blood-sampling in early incubation and late chick-rearing showed equal or superior productivity, return rates, and breeding in subsequent years, to control birds. A DNA perspective on puffin diet reveals a more invertebrate diet than previously suspected. Natal recruitment is inversely proportional to the number of other islands visited in the first four years, and is greatest to the largest and fastest-growing colony in the Gulf of Maine.



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Within-individual repeatability of abnormal color and egg size for the Common Tern (*Sterna hirundo*): Female-driven anomalies (Poster)

Egg size for Common Terns is known to reflect physiological condition. However, data are lacking on the repeatability and significance of abnormal egg characteristics, such as very small or unusually colored eggs, because these tend to be rare (< 0.1% of individuals). Over the past 9 years, we observed a larger-than-average proportion (~1%) of blue eggs laid by Common

Terns at a small breeding colony in Lake Ontario, allowing a unique opportunity for their study. We hypothesized that abnormal blue egg coloration and abnormal small size were determined through the female line (representing a genetic trait rather than environmental impacts) and may have negative fitness consequences. Following individually marked birds through a 9-year data set, we investigated the incidence of blue eggs and small eggs (< 16 cm³) in relation to identity, sex, physiological condition, reproductive parameters and divorce. Abnormal egg characteristics were consistent within females but not males, suggesting these anomalies are female-driven. Preliminary data indicated that birds incubating small eggs were of smaller-than-average size, and that both these and birds incubating blue eggs laid generally smaller clutches than normal. The main cause of nest failure at this colony was widespread predation by Black-crowned Night Herons and thus no differences in reproductive success were evident between individuals with abnormal eggs and other birds, although divorce rates for these individuals were slightly higher than the colony average. Egg size, but not color, was found to change (increase) with nesting experience for some, but not all, individuals. These preliminary results suggest that laying small eggs may be tied to poor physiological condition in some cases (although full clutches of very small eggs may be genetically determined) but egg-color anomalies reflect genetic characteristics of females independent of environment or experience. Although preliminary results point to negative fitness consequences of both traits, further study is needed to confirm this.



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Population viability of the Reddish Egret (*Egretta rufescens*) in Texas: An analysis of management actions and implications (Oral)

Reddish egrets are a threatened waterbird species that inhabit the Gulf Coast of the U.S. and Mexico, as well as, the Bahamas, Cuba, the Mexican Pacific Coast, and the Yucatan peninsula. The plume trade of the late 1800s drastically reduced global population numbers of reddish egrets. By the 20th century, the species was decimated and possibly extirpated in many parts of its range. While much of the historical range has been recolonized, the reddish egret remains North America's least abundant heron species. An estimated one-third to one-half of the global reddish egret population occurs in the United States, with Texas having approximately 75% of the breeding pairs. While egret population numbers may be increasing throughout portions of the range, many factors continue to threaten the persistence of the species. Population viability analyses (PVAs) are a common method of predicting a species' persistence into some future time. The purpose of developing a population viability analysis for *E. rufescens* is to identify possible factors impeding the growth of Texas populations. By assessing the relative threat of each contributing factor and identifying vulnerable life stages, a robust PVA can estimate how different management actions will affect population demographics. The outcome of this analysis will help guide the management of Texas populations of *E. rufescens*. If successful in improving depressed vital rates, this model will serve as the backbone for the creation of a range-wide PVA.

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Plasma metabolites redefine “staging” in Eared Grebes (*Podiceps nigricollis*) (Oral)

Staging is typically seen as a period of fueling or refueling for a migration. The Eared Grebe literature is replete with references to their post-breeding period at either Mono Lake, California or Great Salt Lake, Utah as “fall staging.” During this period, the grebes become flightless due to pectoral muscle atrophy, undergo a wing molt, and become hyperphagic, gaining weight due partly to putting on fat. These seem to be hallmarks, or at least correlates, of a staging bird. But the birds remain on these lakes often for two to four or more months before migrating to wintering grounds. The key to that migration is a collapse of their food supply, not some threshold related to daylength, temperature, or fat acquisition. We compared plasma metabolites of birds at Mono Lake in the fall with Eared Grebes that were clearly on a migratory stopover at Salton Sea, California in late winter or early spring. In particular, we looked at triglycerides (TRIG), which is an indicator of fat deposition. We found TRIG levels much higher at Salton Sea. We also found that TRIG positively correlated with body mass in the fall, suggesting synchrony in the population at Mono Lake. TRIG showed no relationship to body mass at Salton Sea, as would be expected since they are entering and departing the sea in pulses. A similar situation existed with uric acid (URIC) in the two locations, though less clearly. On the other hand, TRIG and URIC levels in grebes at Mono Lake in the fall were indistinguishable in level and body mass correlation from those in grebes at Great Salt Lake prior to their migration to breeding grounds. We conclude that fall birds are not staging at Mono Lake or Great Salt Lake, but are simply living there until they can no longer remain. They should be considered “sedentary”. The only grebes we believe show the signs of staging are those at Salton Sea.



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The environmental context of predator-specific rates of predation on Snowy Plover nests (Oral)

Predators are a dominant driver of reproductive failure in avian populations. Identifying predators can help explain variation in nest survival. However, most studies have grouped predation events together which may obscure predator-specific impacts. We used remote cameras to monitor 344 Snowy Plover nests at Great Salt Lake, Blue Lake, Fish Springs National Wildlife Refuge, and Dugway Proving Ground between 2011 and 2016. We constructed competing models of overall and predator-specific rates of predation as a function of site, Julian date, distance to roads, and nesting substrate. Overall rates of predation varied by

site, nesting substrate, and Julian date. The probability of nest predation was greater at Great Salt Lake (0.58, 95% CI = 0.50 – 0.65) than in western Utah (0.35, 95% CI = 0.28 – 0.42). Predator-specific models revealed that Gulls (*Larus spp.*) and Common Raven (*Corvus corax*) had greater odds of depredated plover nests at Great Salt Lake than in western Utah (10.7, 95% CI = 3.0 – 33.3; and 10.9, 95% CI = 3.1 – 38.9, respectively). However, nests in western Utah had greater odds of being depredated by kit fox (*Vulpes macrotis*) and coyote (*Canis latrans*; 5.3, 95% CI = 1.6 – 17.8; 2.0, 95% CI = 0.8 – 5.5, respectively). Gulls, Common Raven, and coyote all had lower rates of predation during the middle of the breeding season, whereas depredate of nests by kit fox peaked midseason. Additionally, Gulls were more likely to depredate nests located on barren substrates compared to vegetated substrates. Estimating the contribution of specific predators can increase our understanding of how nest predation influences bird populations, and help direct management in more appropriate and focused directions.



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Influence of hydrological variation on wading bird nest numbers in a prey-rich littoral wetland (Oral)

Wading birds are focal species for wetland monitoring programs because they are top-level predators, and therefore provide insight about the productivity of lower trophic levels under different hydrologic conditions. Lake Okeechobee is a highly productive system, therefore the response of wading birds to hydrologic variation may differ when compared to the nearby Everglades, which has low secondary productivity. We developed models of Great Egret (*Ardea alba*), Snowy Egret (*Egretta thula*), and White Ibis (*Eudocimus albus*) nest numbers related to hydrologic variation using 30 years of hydrologic data and nest numbers from aerial surveys. The variables that best explained variation in nest numbers were mean water levels during the peak nesting month (a surrogate for habitat and prey availability), and water levels during the two years preceding the nest year (a surrogate for nest substrate availability). The effect of water level differed by species. Great Egret nest numbers peaked when water levels were moderate to high, Snowy Egret nest numbers increased as water levels dropped, and White Ibis responded weakly to water levels. Recession rate did not influence Snowy and Great Egret nest numbers, suggesting that prey density does not limit nest effort for these species at Lake Okeechobee. These models support previous ecological studies at Lake Okeechobee that suggest that a water management regime aiming to keep lake levels between 3.6 m and 4.6 m, with occasional drying events below 3.9 m, will benefit the ecosystem by promoting the availability of foraging habitat and by allowing for willow regeneration.



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Drivers of Atlantic puffins' migratory strategies across their breeding range, and implications for colony productivity (Poster – Puffin symposium)

The non-breeding movements and behaviour of Atlantic puffins *Fratercula arctica* are poorly known, but may affect their reproductive performance and survival during breeding, and as such their knowledge is critical to the conservation of the species. Furthermore, the extent to which factors such as intra-specific competition or environmental conditions shape population-specific winter distribution is unknown; and whether and how these factors can affect migratory behaviour, and ultimately fitness, remains to be understood. Here we present a large collaborative study using a large dataset of 259 geolocator tracks of puffins collected at 13 colonies across their whole breeding range to address these questions on a global population scale. We reveal the non-breeding distribution of puffins across the North Atlantic, show that there is substantial overlap between colonies' winter distributions, and identify important hotspots, such as the entrance of the Labrador Sea and an area around the Charlie Gibbs fracture. Migratory strategies vary greatly between colonies, in terms of total distance covered, distance from the colony, but also daily activity budgets and energy expenditure (estimated using immersion data). We find that some of these differences are in fact ocean-wide patterns which can be driven by environmental variables, colony size and wintering latitude, and that they are also reflected in colony breeding productivity. Our results may not only have important implications for the conservation of puffins but may also help understand the drivers of seabird colony distribution on large oceanic scales.



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Parental investment in Atlantic puffins: changing priorities with changing resources (Oral – Puffin Symposium)

The Witless Bay Ecological Reserve in Newfoundland and Labrador is home to the largest breeding colony of Atlantic puffins *Fratercula arctica* in North America. Puffins in this study population have successfully endured deteriorating foraging conditions; however, long-term shortages or mismatches in prey availability during chick rearing could potentially impact future

populations, as observed in European breeding populations. Studying parental investment over several years of fluctuating prey abundance can help determine how puffins are adjusting to ecosystem changes and can show the potential consequences of these changes for long-term survival and reproductive success. Parents need to balance their own survival and self-maintenance while taking care of offspring needs, which can be more challenging when food resources are low. Chick begging behaviour and parental provisioning were observed during a supplemental feeding experiment using infrared video/audio cameras. Prey availability during the several years of this study were variable, allowing us to observe how different natural foraging conditions interact with supplemental feeding to affect parental investment. Several physiological measures were taken to determine the fitness consequences of parents to changing food availability and Passive Integrated Transponder (PIT) tags were used to identify sex differences in provisioning effort and how each parent responded to chick begging. Control females had higher beta-hydroxybutyrate levels than both control males and adults with food-supplemented chicks, suggesting that females invest more time in provisioning effort. These results indicate that energetic demands of chick rearing may be greater for females than for males. The behavioural and physiological responses to variations in food availability has demonstrated the ability of adults to adjust to changing environmental conditions while balancing self-maintenance and reproductive success. Although puffins in this population appear to be adapting to these changes in their environment, there could be potential long-term impacts if food resources continue to be poor.

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Common eiders in their German wintering grounds: Space use, diel activity patterns and conflicts with human activities (Oral)

Survey data indicate that total numbers of common eiders *Somateria mollissima* wintering in both the Baltic and the Wadden (North) Sea have declined steeply in recent decades. Although several factors are known to be involved in the observed decline of the species, likely causes particularly in wintering areas are not well understood and identified. 39% of the biogeographic population are estimated to utilize wintering sites in the German parts of the Baltic and the North Sea, areas which are heavily impacted by human activities. It is therefore crucial to assess the influence of factors such as shellfish fisheries, ship traffic, offshore wind energy or set net fisheries on the common eider population wintering in Germany to provide information for management decisions, nature conservation regulations or marine spatial planning. As a first step, it is necessary to characterize the space requirements, diel activity patterns and habitat associations of the species in the studied area. For this, we 1) use long term monitoring data from aerial and ship-based surveys to describe the development of the winter distribution and to determine the biotic and abiotic factors linked to winter habitat selection; and 2) plan to equip a total of 24 common eiders in both Baltic and North Sea waters with back-attached GPS/GSM transmitters to identify home ranges and diel activity patterns in the wintering area. We present here the results of the analysis of the monitoring data and from the first four individuals carrying GPS devices and discuss possible conflict areas with human uses. Studying the interactions between the species' space use and human activities will shed light on the underlying causes of

the population decline and provide information for a more effective protection of the common eider in its wintering grounds.

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Population trends of seabirds wintering in Kodiak Alaska - A 29 year study (Oral)

We conducted shipboard surveys of marine birds in Uyak and Uganik Bays on the western side of Kodiak Island each February from 1980 to 2008 sampling approximately 19 percent of the 564 km² area. We also conducted shipboard surveys of marine birds in Sitkalidiak Strait and Kiluda Bay on the eastern side of Kodiak Island each February from 1980 to 1985 and from 1991 to 2008 sampling approximately 17.5 percent of the 592 km² area. Birds were counted within 300 m strip transects of 10 minutes duration run from shore to shore. Roughly the same cruise tracts were counted each year. Population increases were seen in loons, cormorants, glaucous-winged gulls, mew gulls and common murre. Relatively stable populations were found for grebes while marbled murrelets and pigeon guillemots have shown a slight decline over the study years. We believe increase in numbers of most fish eating birds is in response to increased forage fish populations.

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Successful tree-nesting Double-crested Cormorants: earlier nesting birds more likely to have post-fledging parental care (Oral)

Post-fledging parental care in seabirds is predicted to be partially constrained by season duration in temperate latitudes. In this study, we test whether Double-crested Cormorants (*Phalacrocorax auritus*) that nested earlier, and successfully fledged chicks, were more likely to have post-fledging parental care compared to those that initiated nesting later. We also describe patterns of nest attendance in the post-fledging period. For seven years we annually tracked the fate of a sample (range 35-172 nests) of tree-nesting cormorants throughout the breeding season. Nests were visually checked each week and their status (e.g., adult sitting on a full nest) recorded. We could not see nest contents during incubation or early hatching so their timing was estimated, as was chick age to determine fledging success of each nest (chicks 42 days or older and chicks had to be observed for a minimum of 4 weeks to be considered successful). Post-fledging parental care was primarily inferred by the presence of adult(s) at a nest after chicks had fledged but also supported by focal and opportunistic observations. Using this approach, 50.1% of successful nests had post-fledging parental care. A preliminary analysis of 451 successful nests showed a significant difference in nest initiation date (average \pm SD Julian date) between nests with (n=229; Julian date 112.4 \pm 10.5) and without (n=220;

124.8± 16.4) post fledging parental care ($p < 0.000$). Nests with post-fledging parental care also had small, but significant, increases in the number of fledglings (2.29 ± 0.65 chicks) compared to nests without (2.15 ± 0.64) ($p=0.02$). These findings support the hypothesis that post-fledging parental care is constrained by season duration, but variation in the occurrence of the behavior may be driven by number of fledglings.

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Is parental care the dominant mechanism by which mercury exposure affects avian nest success? (Oral)

Reproduction in birds is thought to be one of the most sensitive processes to be affected by mercury (Hg) exposure. Many mechanisms may be involved, including teratogenesis, endocrine disruption, and effects on parental care. Partitioning these effects has proved elusive in part because it has often been difficult to distinguish parental exposure and nestling exposure in the same nests. We used nondestructive microsampling of Great Egret egg albumin to assess female parental exposure. We subsequently sampled the resultant chicks from those eggs using blood and feather tissue through fledging. Samples were taken from the 2nd laid egg (0-5 days, 102 eggs, 7 colonies) and subsequently from blood ($\approx 35-45$ days) and feathers ($\approx 46-60$ days) from the same individuals. We found no correlation between Hg concentration in albumin and hatching success, suggesting embryonic death and exposure of young was not a primary mechanism by which Hg affected nest success. We also found no correlation between nest success and Hg concentrations in blood or feathers of chicks. However, colony-averaged nest survival was negatively correlated with albumin Hg concentrations (GLM; $p = 0.0016$). Nests with average albumin Hg concentrations lower than 0.4 mg/kg had nest survival probabilities of 90-95%. In contrast, nests with average albumin Hg concentrations over 0.75 mg/kg had survival probabilities of 42-57%. This information collectively suggests that egg Hg concentrations are not affecting nest success through embryonic death. Instead, we suggest that Hg effects on nest success resulted primarily from mercury exposure-induced deficits in parental behavior.

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50 years of observations on three anatids in a southern hardwood swamp and beyond (Oral)

Two breeding species of anatids, (wood duck *Aix sponsa* and hooded merganser *Lophodytes cucullatus*) and one wintering species (mallard *Anas platyrhynchos*) regularly use forested wetlands in North America to meet annual cycle needs. Compared to other natural systems, southern bottomland hardwoods have limited use by anatids, but in North America two of the three species are in great demand for recreational hunting and are harvested more than any other duck. One of the species, Hooded merganser, is a seaduck in the Tribe Mergini, but few

would be consistently found in salt water. The three species use habitats based on geomorphic and hydrologic features as well as their diverse needs to meet annual cycle events. Protein resources in the form of diverse invertebrate communities are especially important to all species for successful completion of life cycle events in a timely manner. Mergansers focus their distribution on the wetter portions of the system where hydroperiods are longer and water deeper. Thus, abandoned and active stream channels and back swamp habitats are most important where they fed on fish and large invertebrates, particularly crayfish.. In contrast, wood ducks and mallards regularly use higher elevations within the system for certain aspects of their annual cycles including point bars, natural levees, alluvial fans and crevasse splays as well as vernal pools wherever they occur. Mallards use wetter more densely vegetated sites for pair formation where they can court on water with greater security from avian predation. Wood ducks use the wetter areas with good overhead cover for brood rearing. Both mallards and wood ducks select smaller invertebrates than mergansers. Mallards filter feed whereas the bill structure of the wood duck makes it more of a picker. Although all three species overlap in timing of use for short periods in late winter, their foraging strategies and food needs reduces the potential for heavy use for the same resources simultaneously. All three species also use prairie and the boreal forest habitats in summer. The importance of cross-seasonal effects is demonstrated by all three species and is suggestive of the linkage of wetland resources across large scales. Female mallards acquire needed protein and lipid resources for nesting from southern swamps and carry them as endogenous reserves to the breeding ground. Breeding male hooded merganser return to prairie habitats for spring, summer, and fall during or shortly after egg laying. Female and young mergansers move northward after nesting is complete. Wood ducks also commonly move to more northern wetlands after nesting in southern swamplands. These ecological relationships with habitats require wetland managers to recognize the importance of their actions to assure each species has the diversity of resources needed to be successful across the large spatial scale each species uses on an annual basis.

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A hitchhiker's guide to genomics (Oral – Plenary)

What is all the hype about 'genomics'? What *is* 'genomics' anyway? How is it different from 'genetics'? And what new insights can it provide into waterbird ecology, behaviour and conservation? I will explore questions such as these in a non-technical format, using case studies from colonial waterbirds. 'Genomics' may be defined as the study of the sequences, functions and interactions of genes. The recent rapid decline in sequencing costs and turn-around times, and the increasingly sophisticated methods for sequence analysis mean that genomic techniques provide a variety of powerful, cost-effective tools for ecology and conservation. Three general approaches are available: (1) "Targeted gene sequencing" involves sequencing genes whose functions are known from studies of model organisms. (2) "Reduced-representation sequencing" such as genotyping-by-sequencing enables thousands of genes to be screened for hundreds of individuals at relatively low cost. (3) Whole genomes can now be sequenced and assembled within months. These approaches together can enhance studies of ecology and behaviour in many ways, and can also provide important information for

conservation. For example, they can provide interesting insights into the genetic basis of various adaptations, such as disease resistance or migratory behaviour. They can be used to track seasonal or lifetime movements of individuals, e.g., to study migratory routes or inter-colony dispersal. The large number of loci allows generation of pedigrees going back multiple generations. They can provide sensitive tests for inbreeding and inbreeding depression. This can let us estimate the heritability of quantitative traits, such breeding phenology. Genomic techniques enable us to test for contemporary and historical hybridization. They can help define management units for management and conservation, and provide population markers to help determine the colony-specific impacts of mortality during migration or winter. Finally, they can help us infer resilience to anthropogenic change.



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Opportunistic feeders as sentinels for the circulation of infectious agents in spatial contexts (Oral)

The dynamics of infectious agents is a complex process involving the ecology of the host, the parasite, and, in the case of vector-borne infections, the vector as well as their interactions. Efficiently tracking and anticipating the dynamics of parasites in wild population requires the gathering of large number of samples, if possible at several locations and points in time, which can be challenging for some species. Due to their opportunistic diet, large gulls may be exposed to a wide range of infectious agents and thus provide information on the circulation of various pathogens in a given environment. Moreover, in abundant and widespread species such as large gulls, the detection and quantification of specific maternal antibodies in egg yolks sampled on breeding colonies could represent an efficient way to track the exposure of females to various infectious agents. Using this approach, we explored spatio-temporal patterns of exposure of yellow-legged gulls (*Larus michahellis*) to a set of infectious agents: the protozoan *Toxoplasma gondii*, avian influenza viruses and tick-borne flaviviruses. Samples gathered from 2008 to 2016 in 20 Mediterranean colonies from France, Spain, Tunisia and Algeria were analysed using immunoassays detecting antibodies specifically directed against these infectious agents. These analyses revealed that yellow-legged gulls were widely exposed to *T. gondii* and various serotypes of avian influenza viruses while the Meaban-like flavivirus circulated only in one of the colonies. We discuss how inferences on the ecology of both the host and the vector, in particular their respective movements, can be made from these results. We conclude suggesting that (1) species like large gulls could potentially be used as wildlife sentinels for the tracking of certain infectious agents and (2) serological data may represent a valuable source of information for host and vector movement quantification.

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Changes in populations and foraging strategies of gulls: Insights from studies in northern Germany (Oral – Plenary)

Gull populations in the North Atlantic have shown substantial increases but also declines over the last decades, often coinciding with substantial changes in their feeding ecology. In this talk, I will highlight how breeding populations of gulls in northern Germany developed over the last 80 years, and how choice of food and foraging habitats altered over time. Strong emphasis will be put on modern telemetry techniques, which allow to follow individual movements over several weeks or even months. Trends in breeding populations of gulls in northern Germany differ between species and regions, lacking a consistent pattern. Common, Herring and Lesser Black-backed Gulls share the phenomenon of breeding on buildings, which enables them to settle in places where natural breeding habitats have disappeared. Long-term data on diet show a general trend with declining proportions of marine prey and increasing proportions of terrestrial prey. By GPS-tracking Common, Herring, Lesser Black-backed and Great Black-backed Gulls during the breeding period in recent years, I will demonstrate and compare the extent to which the species use the main foraging habitats 'open sea', 'intertidal zone' and 'land'. In contrast to results from seabird at sea counts and historic analyses of prey remains, tracking data show that many individuals nowadays intensively use terrestrial sites. This is most obvious in Common Gulls at the Baltic Sea that almost exclusively foraged at the mainland. In contrast, Herring and Lesser Black-backed Gulls at the North Sea coast exhibited a dual foraging strategy using terrestrial sites, and intertidal mudflats and the open sea, respectively. Only Great Black-backed Gulls foraged mainly on intertidal flats or tidal creeks. Overall, the study species differed in diet, foraging behaviour and foraging habitat choice. Additionally, colony location played an important role in shaping their feeding ecologies. Individuals of most species were able to exploit the anthropogenic landscape and seascape by making use of certain agricultural practices and fishing trawlers, respectively. In conclusion, I will discuss in which ways the different gull species exhibit a generalistic and opportunistic life style in an environment that is increasingly dominated by anthropogenic activities both on land and at sea.

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Nestling diet of Gull-billed Tern (*Gelochelidon nilotica*): Similarities and differences between years and localities (Poster)

Food habits are essential in understanding several aspects of bird ecology. The gull-billed tern shows a wide distribution, and predated on many animal types, varying from insects and other invertebrates to small vertebrates. The aim of this study is to analyse the diet of gull-billed terns breeding in saline temporary lakes in Central Spain (Castilla La Mancha). We collected 217 pellets from three lakes (Longar, Manjavacas and Mermejuela) and three breeding seasons (2007, 2014 and 2015), in order to 1) compare diet composition between years and localities, and 2) evaluate similarities between 22 samples from 11 localities around the Mediterranean Sea. We expected highest similarities in diet among nearest sites. Our results show that diet differs between saline lakes in Central Spain. In Longar Lake, the basic prey includes crickets and other orthopterans while in Mermejuela beetles were the most consumed prey. A cluster analysis, using the samples of the Circummediterranean region, showed no consistent pattern of highest similarities between nearest colonies. For instance, diet of Longar gull-billed terns was more similar to the diet of colonies from Greece than to the nearest colony of Mermejuela. This pattern was also observed comparing the nearest colonies of Greece or Morocco.



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Effects of predator exclosures on nest success of Wilson's Plovers (*Charadrius wilsonia*) (Oral)

The effect of predator exclosures on nest success of Wilson's Plovers (*Charadrius wilsonia*) was studied on Little St. Simons Island, Georgia during the 2016 and 2017 breeding seasons. Wilson's Plovers are listed as a "Species of High Concern" on the U.S. Shorebird Conservation Plan due to their constricting breeding range. Predation is a leading cause of nest failure among shorebirds, and a threat that limits plover breeding distribution. Predator exclosures have been used as a technique to increase breeding productivity among Piping Plovers (*Charadrius melodus*) and Snowy Plovers (*Charadrius nivosus*), but studied minimally with Wilson's Plovers. In 2016, predator exclosures were deployed at nest sites within the first three days of initial incubation, and monitored with trail cameras for predator disturbance. Unexclosed (n=54) and exclosed nests (n=18) were monitored until eggs hatched or failed, and the cause of failure was recorded for failed nests. Chicks hatched from exclosed and unexclosed nests were color-banded, and resighted until fledgling through bi-weekly resighting surveys. Exclosed nests had a higher daily survival rate (0.984, SE=0.182) than unexclosed nests (0.938, SE=0.425) in 2016, and the treatment effect was significant (p=0.00108). No mammalian or avian predators depredated exclosed nests in 2016, however ghost crabs (*Ocypode quadrata*) were responsible for partially and fully depredating exclosed and unexclosed nests. Fish Crows (*Corvus ossifragus*) were observed perching on or circling four exclosures, but did not cause the incubating adults to abandon nests. This study examined if predator exclosures are a successful management tool to increase Wilson's Plover breeding productivity.

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Occupancy and abundance estimates of Black Rails in Texas (Oral)

Eastern black rails (*Laterallus jamaicensis jamaicensis*) are of conservation concern. These birds vocalize infrequently and inhabit dense vegetation making them difficult to detect. We conducted the first large scale study of black rail occupancy and abundance in Texas. We repeated point count surveys at 308 points spread across six sites along the Texas coast in 2015 and 2016. Each point survey was a six-minute call-playback broadcast where birds were detected acoustically. We estimated the fit of 19 occupancy and 19 abundance models while accounting for imperfect detection. Detection increased with moon phase and temperature but decreased with wind speed and ambient noise. Occupancy and abundance increased with woody, *Spartina*, non-*Spartina* herbaceous, and intermediate marsh cover. Estimates were similar between years. We estimated that 16 repeated surveys could establish black rail presence at survey points. We reached two main conclusions. One, black rail management during the breeding season, in Texas, should focus on *Spartina* cover as occupancy and abundance estimates were highest when *Spartina* cover was high. Two, effort to establish black rail presence from naïve occupancy estimates is impractical. Monitoring efforts of black rails should design studies that estimate distribution and abundance while accounting for imperfect detection.



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Parasitic indicators of foraging strategies in wading birds (Poster)

Feeding ecology and trophic interactions of wading birds in southeast Florida were explored through a combined analysis of stable isotope profiles and endoparasite communities. Stable isotopes broadly characterize the feeding preferences of individual birds: stable carbon isotopes ($\delta^{13}\text{C}$) indicate the primary source of carbon in a food web and stable nitrogen isotopes ($\delta^{15}\text{N}$) correlates with trophic level. Parasite communities reflect long-term trends in diet, feeding ecology, movements and environmental changes. By characterizing the endoparasite fauna and combining it with stable isotope analysis, this project provides novel information on wading bird feeding ecologies and trophic interactions. We obtained deceased wading birds from South Florida wildlife rehabilitation organizations: green herons (n=9), great blue herons (n=29), great egrets (n=20), yellow-crowned night-herons (n=2), black-crowned night-herons (n=3) and white ibis (n=18). Three types of feathers, primary flight (n=16), retrices (tail; n=12) and contour feathers (n=8), as well as muscle, were analyzed for carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) stable isotopes. No significant difference exists between stable isotope values and feather type (ANOVA; $\delta^{13}\text{C}$: F (2,33), p=0.75; $\delta^{15}\text{N}$: F (2,33), p=0.85). Preliminary $\delta^{13}\text{C}$ values for great egret feathers (n=18) range from -27.87 to -14.46‰ and range from -24.87 to -14.33‰ for muscle (n=11), which indicate the egrets are likely feeding from two different sources of carbon. Preliminary $\delta^{15}\text{N}$ values range from 10.32 to 14.56‰ for feather and from 8.45 to 10.70‰ for muscle, signifying that the egrets are eating across one trophic level and keratinized feather is

more enriched than muscle. This corresponds to other studies comparing muscle with keratinous tissues. Preliminary parasite identifications indicate that wading bird parasite communities are diverse and include at least 14 different species of digeneans and 5 different species of nematodes. Host and range extensions were noted for several parasite taxa. Broad, interspecific differences exist in parasite community structure. Preliminary analysis shows the great blue herons have the highest infection rate while the white ibis has the lowest. Internal parasite communities can be indicative of foraging habitat so the combined knowledge on trophic structure and ecological interactions will enable scientists and conservationists develop strategies for protecting bird populations and maintaining biodiversity.

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Common Loons in Iceland: morphometrics and migration (Oral)

Despite extensive research on the Common Loon (*Gavia immer*) in North America, very little is known about the population in Iceland, the species' only breeding site in Europe. In 2015, a pilot study was launched in Iceland, with focus on morphometrics, migration, pollutants, genetics and health factors, with help from experts at the U.S. Geological Survey Upper Midwest Environmental Sciences Center and Biodiversity Research Institute. So far, seven loons have been measured and color-banded, of which three have received geolocator-tags which will hopefully be recovered in 2017. Initial data suggests conformity with published models connecting bodyweight and migration distance, but Iceland's unique position poses questions that may be answered with further geolocator studies.

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Changes in Atlantic Puffin productivity in Iceland (Oral – Puffin symposium)

Sea surface temperature (SST) in Icelandic waters fluctuate >1 °C in tune with the Atlantic Multidecadal Oscillation. SST increased rapidly 1996-2003 followed by a collapse of the lesser sandeel (*Ammodytes marinus*) population, the Puffin's key prey. Since 2010 productivity has been studied in 12 Puffin colonies around Iceland by measuring burrow occupancy (BO eggs/burrow) and nesting success (NS chicks alive in late July/egg) with IR video probes. Mean BO and NS 2010-2016 has been around 0.8 in the Arctic waters in north and east Iceland while in the sub-Arctic waters in the south and west (S&W) mean BO has ranged between 0.4-0.6 and mean NS has been ~0.4 or less. Productivity has been below sustainable levels in the S&W and a large part of the surplus production in the North is harvested. Population projection 2002-2016 indicates -1.6% annual total population decrease or -22.7% decline, from 3.5 to 2.7 million pairs. Production index was produced from the Westman's puffin harvest record (1880-2016) corrected by harvest age structure. The index is strongly negatively correlated to winter SST but also to summer SST when winter SST is also high. This relationship is hypothetically explained

by a bottom-up population control by 0-group Sandeels, via SST direct effect on their metabolic rate. Sandeel life history is composed of summer growth period, and dormant winter period. Increased SST, accelerates the sandeel's metabolism and their rate of reserve depletion (and ultimately survival) in winter, but reduces energy allocation to growth and reserves during summer. In the cold winter of 1981 >60% of sandeels attained van Deurs et al. 2011 critical length threshold L_{th} which they need to attain to "survive" their first winter SST profile, but the opposite since 2006, supporting the metabolic hypothesis. Furthermore spring bloom time has never been as late since 2005, contracting the sandeel's growth period and expanding the wintering period, together likely amplifying the negative influence of the increased SST. Since 2005 Puffin fledging's body mass has been low and departure dates latest on record since 1959. Strong positive relationship exists between chick body mass and survival.



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Does timing of nest initiation impact nesting success of the Hawaiian stilt? (Poster)

The Hawaiian stilt (*Himantopus mexicanus knudseni*) inhabits wetlands across the Hawaiian Islands. Nest initiation of waterbirds is known to be correlated with water depths, which are influenced by precipitation events. In the Hawaiian Islands rainfall varies seasonally and temporally, and in recent years sea level rise has increased the elevation of groundwater tables, contributing to increases in flooding events during heavy rainfall, particularly in wetland environments. The island of O'ahu experiences heavy rainfall events on its windward side during the months of March and April, during which Hawaiian stilts begin to breed. Timing of nest initiation may have a great impact on nesting success, particularly in wetlands that experience frequent flooding early in the breeding season. We utilized observational surveys and camera traps to determine nesting success of Hawaiian Stilts in wetland habitats on the windward and leeward side of O'ahu. High precipitation events were found to be positively correlated with nest failures in all wetlands, with flooding contributing more to nest failures in windward wetlands than leeward wetlands. The results of our study may be used to inform decisions for managing hydrological conditions of Hawaiian waterbird habitat given future climate predictions.

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The exceptional egg – Unscrambling insights into toxicology, ecology, and physiology (Oral)

“Яйца курицу не учат” is a Russian proverb roughly translated as, “Eggs don't teach a hen.” If we, as scientists are the hens, then I fear this proverb is mistaken as waterbird eggs can, and

have, taught us much. In this presentation, I will focus on the many endpoints that can be measured in waterbird eggs that provide insights into the state of aquatic environments. For example, eggs have been used for decades to assess levels and trends of chemical contaminants. These include not just legacy contaminants such as DDE, but many new and emerging chemicals that currently pose risks to the environment. Biochemical endpoints in eggs are being used to assess food web change in aquatic ecosystems. Stable isotopes of carbon and nitrogen in eggs along with egg fatty acid patterns provide insights into waterbird diets and how these diets vary spatially and temporally. These dietary indicators can be related to food web changes demonstrating the inextricable link between waterbirds and their ecosystems. Recent developments using amino acid – compound specific stable nitrogen isotope analysis will also be discussed. This approach has the potential to revolutionize the use of stable isotopes in ecology. Finally, I'll present an example of a physiological endpoint, i.e. corticosterone, that we are currently measuring in waterbird eggs and discuss how physiological stress in waterbirds may be linked to environmental factors. All in all, eggs offer amazing opportunities to better understand the environment around us. They are not just for breakfast anymore!



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Using nanotags and GIS technology to understand the landscape and anthropogenic effects on the winter survival of a declining migratory shorebird in South America (Oral)

The annual survival of migratory Nearctic shorebirds depends on numerous factors they encounter during their annual cycle. A significant knowledge gap exists concerning the winter survival for many species that winter in South America. Aerial survey data has suggested that since the 1980s, up to an 80% decrease has occurred to the wintering semipalmated sandpipers (*Calidris pusilla*) population in the Guianas, which is the crucial winter habitat for semipalmated sandpipers. Observed habitat loss and change of coastal habitat is a potential explanation to lower population numbers. Additionally, illegal hunting of shorebirds is prevalent and may have a significant role in the winter survival of many shorebird species. In this study, we intend to measure the apparent winter survival of semipalmated sandpipers in Suriname, French Guiana, and Brazil. In 2016, we installed three Motus towers and attached 129 Nanotags to semipalmated sandpipers at three different sites in Suriname. Using Nanotag detections as a surrogate for apparent winter survival, we will spatially relate winter survival estimates to known hunting rates, land cover, food availability and soil type. This will be the first study to use radio tags to investigate winter survival, and the first to investigate winter survival for semipalmated sandpipers in South America. Our findings will increase the understanding of the semipalmated sandpiper annual cycle and improve conservation efforts for this species.

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The potential impacts of anthropogenic sound sources on foraging Double-Crested Cormorants (*Phalacrocorax auritus*) (Oral)

The behavior of a population of double-crested cormorants (*Phalacrocorax auritus*) that regularly visit Dodge Pond in Niantic, CT was observed in May through October of 2015 and 2016. The Dodge Pond Acoustic Measurement facility is located on a test platform in the center of Dodge Pond. Various types of Navy sound systems such as transducers, arrays, and airguns are deployed from this platform and tested underwater. The behavior of double-crested cormorants was observed during sound testing and in the absence of sound testing to determine if their behavior is significantly altered in the presence of underwater sound. In order to record cormorant behavior, individual cormorants were observed for five minute intervals by one scientist using binoculars while another scientist records the behavior on a personal laptop computer. Statistical results indicate that there was no significant change in diving behavior when cormorants were diving in ambient noise conditions and when they were diving when exposed to various underwater sound sources. However, more studies are recommended to determine if these results are site and/or species specific.

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On bait buckets and Boreal ducks: Associations between migrant duck physiology and a wetland-ecosystem engineer (Oral)

The capacity of a migrating bird to accumulate and maintain sufficient lipid reserves to fuel migration and facilitate subsequent reproduction is the ideal currency for gauging the contribution and quality of individual migration stopover habitats. We used concentrations of lipid metabolites circulating in plasma of spring-migrating female lesser scaup (*Aythya affinis*) and blue-winged teal (*Anas discors*) to evaluate the consequences of variation in biotic and abiotic attributes of stopover wetland habitats on their lipid dynamics, or refueling performance. Indexed refueling performance of both species was negatively correlated with high densities of fathead minnows (*Pimephales promelas*). Lesser scaup refueling performance was also positively associated with density of Chironomidae in foraging locations, density of submersed aquatic vegetation in wetlands, relative density of conspecifics using the wetland during migration, and size and shape of surrounding wetlands. Taken collectively, the biotic factors associated with improved refueling performance of lesser scaup are known from previous work to respond negatively to high densities of fathead minnows, suggesting changes in wetland

trophic structure coincident with the introduction and proliferation of fathead minnows were the primary attribute affecting lipid dynamics of lesser scaup, and to a reduced extent blue-winged teal, during migration. Such impairments to lipid accumulation during migration could manifest in cross seasonal and cross ecosystem effects as breeding ducks recoup lipid deficits accrued during migration on the breeding grounds. Accordingly, restoration and management actions aimed at reducing the impacts of fathead minnows on stopover habitats used by spring-migration ducks may have positive impacts on migration performance and ultimately population productivity of these species. Accordingly, restoration and management actions aimed at reducing the impacts of fathead minnows on stopover habitats used by spring-migrating ducks may have positive impacts on migration and ultimately population productivity of these species.

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Interspecific territorialism in rallid species: song playback experiments with little crane and water rail (Poster)

Many Rallidae species are known for their aggressiveness and antagonistic behavior especially during the breeding season when access to the limited resources as food, shelters, nest sites or mates is crucial. Territory exclusion is usually assumed to be a mechanism of intraspecific competition, and individuals that defend their territories gain benefits by obtaining necessary resources for themselves. However, some species seems to defend their territories not only against conspecific individuals but also against heterospecific. Such interspecific territoriality and aggression against other species are one of the most neglected aspects in ecology. We would like to find out whether territorial species as rallids display aggressive interactions towards a) most related species (only members of Rallidae family), or b) species that breed in the neighborhood and have a similar ecological niche (different marsh-nesting species). In the present study, conducted in the Masurian Lakeland (north-eastern Poland), we test these hypotheses on the example of the relationship between three Rallidae species – water rail *Rallus aquaticus*, little crane *Zapornia parva*, spotted crane *Porzana porzana*, and little grebe *Tachybaptus ruficollis*. After finding a nest of water rail or little crane playback experiment was conducted – intrusion of four above species was simulated to each pair. The preliminary results, based on data collected in 2016-2017, showed that the tested species are most aggressive against conspecifics, followed by interspecific aggression towards species that nested on the same small mid-field pond. Water rail exhibited strong antagonistic behavior towards little crane and less towards little grebe, while little crane was aggressive similarly towards water rail and little grebe. Finally, both water rail and little crane did not display aggressive interactions towards spotted crane, species that characterize by similar ecological requirements as water rail but nested only at one pond within the study area.



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Parental care strategies and parental cooperation in Lesser Black-backed Gulls (Poster)

Parental care increases offspring survival, but comes at a cost for the parents. However, in biparental species an individual only has to pay the costs for its own parental investment, while the contribution of the partner comes for free. The decision on the relative contributions by each parent is consequently a battleground for a substantial evolutionary conflict of interests, as each parent benefits if its partner works harder. Parents are therefore initially reluctant to provide care, but they may become more trustful with increasing pair bond duration. We study the division of care within couples of Lesser Black-backed Gulls, a long-lived monogamous seabird species, and our research focuses in particular on the equality in care for offspring growth and reproductive output. We combine longitudinal and cross-sectional approaches to see whether parental cooperation increases with pair-bond duration, while at the same time manipulating parental effort via brood size manipulations. We found a high variability in the proportions of care within couples. However, the level of cooperation only had an effect on offspring development, when the brood size was enlarged. The longitudinal part of this study is still ongoing.



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Estimating migrating populations of scoter and loon species through the Bay of Fundy (Oral)

Hundreds of thousands of Atlantic-wintering waterfowl travel through the Bay of Fundy (BOF) every spring on their annual migration to summer breeding grounds in Northern Canada. This migration has been documented in New Brunswick by the Saint John Naturalists' Club at the Point Lepreau Bird Observatory (PLBO) since 1996 but a comparative lack of afternoon migration monitoring (post 1000h AST) has limited how this database is used in current Atlantic waterfowl population estimation. The statuses of many Atlantic populations of North American waterfowl species, including the three endemic scoter (Black, Surf and White-winged) and Red-throated Loons, remain critical data gaps. Additionally, currently employed monitoring techniques (e.g. aerial surveys) prioritize other waterfowl species and are often ill-timed to capture peak scoter and loon activity at breeding sites. Fixed location point counting at PLBO provides an effective and economic means to generate minimal population estimates for coastal migrants of these species. In spring 2016, we began afternoon migration observations at PLBO to supplement standard morning data collection and more completely monitor daily migration

rates over the course of the migration season as part of a new multi-year initiative. Using GLMMs, we model relationships between daily mean afternoon and morning migration rates of scoter and loon species over 134 days with continuous all day monitoring (0600-1400h AST) between 2001-2016. We use these models to estimate species' afternoon migration rates for days without afternoon data collection. Using both these afternoon estimates and collected morning data, we generate annual migrating population estimates (MPEs) for these species for each of the past 16 years. We use GLMMs, AICc scores and weights to compare these MPEs to others derived from morning only data extrapolated over diurnal hours. We predict a statistically important difference between MPEs among calculation methods and predict the proposed technique will generate lower and more defensible estimates. Information from our research will highlight the underutilized potential of coastal point counting and citizen science in the monitoring of waterfowl species while helping giving industry and wildlife managers more effectively track changes and manage migrating populations of waterfowl moving through the BOF.

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Use of archival geolocator tags to document movements and foraging patterns of common loons (Poster)

Common loons (*Gavia immer*) breeding in the Upper Midwest were equipped with archival geolocator tags during summers 2009-2012 to provide information on migration, wintering ground affiliations, and foraging patterns. Geolocator tags (Model 2500, Lotek Wireless Inc.) were attached via leg bands to 176 loons and programmed to record a light-based daily location estimate, temperature, and pressure (to provide information on dive depths). Because the data stored on geolocator tags is not transmitted, the marked loon must be recaptured to recover the tag and data. We recaptured 109 (62%) of the geotagged loons, yielding 80 tags that provided data through at least one fall migration. Template-fit error estimates were used to filter aberrant geolocation estimates. Sea surface temperature (NASA MODIS imagery) across inland lakes, Atlantic coastal waters, and the Gulf of Mexico, coupled with diving depth information, were used to improve or obtain location estimates and timing of migration movements when geolocation estimates were unreliable. Recorded dive depths of marked loons, together with fine-resolution satellite telemetry location data, suggest that much of loon foraging activity on the Great Lakes and wintering areas occurred along the bottom at depths of up to 60 m and usually well offshore. Movement and foraging results contribute to understanding potential routes of exposure to botulism toxin in the Great Lakes and contaminants while on the wintering grounds.

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Satellite telemetry coupled with archival geolocator tags provide insight into the distribution and foraging patterns of common loons during fall staging on Lake Michigan (Oral)

Common loons (*Gavia immer*) staging on the Great Lakes during fall migration appear to be particularly at risk to periodic outbreaks of type-E botulism. Information on distribution, foraging patterns, and exposure routes of loons is central to developing a better understanding of the physical and ecological factors that contribute to avian botulism outbreaks. Satellite telemetry and archival geolocator tags were used to determine the distribution and foraging patterns of individual common loons while using Lake Michigan. Movements of marked loons suggest a seasonal pattern of use, with early fall use of Green Bay and Northern Lake Michigan followed by a shift in distribution to Southern Lake Michigan. The average length of stay on Lake Michigan was about 27 days, but variable among individuals and negatively related to arrival date on Lake Michigan. Common loons tended to occupy offshore areas and, on average, spent the majority of daylight hours foraging. Dive depths were as deep as 60 m and dive characteristics suggested that loons were primarily foraging on benthic prey. A recent study concluded that round gobies (*Neogobius melanostomus*) are an important prey item of common loons and may be involved in transmission of botulism neurotoxin type E. Loon distribution coincides with the distribution of dreissenid mussel biomass, an important food resource for round gobies. Our observations support speculation that energy transfer from dreissenid mussels to higher trophic levels via gobies may occur in deep-water habitats, along with transfer of botulism neurotoxin.

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Energetic differences in heating of various clutch sizes for Common Terns (Oral)

Incubation increases the overall metabolic cost for birds. Reproductive effort increases positively with clutch size. For species with variable reproductive tradeoffs, such as Common Terns (*Sterna hirundo*), increased adult energy allocation is easily seen when brooding and feeding a larger number of young. However the amount of energy allocated during incubation as clutch size changes for many species is unclear. Additional energy costs may exist in the heat required to incubate the eggs of various clutch sizes. The goal of this study was to determine the amount of heat Common Terns dedicate to various clutch sizes. Common Terns have a flexible clutch size with a fixed brood patch. With the same surface area for incubation, terns could physiologically adjust their heat output to warm clutches differently. In 2015 Common Terns nests on Eastern Egg Rock supervised by National Audubon Society's Seabird Restoration Program were manipulated to determine if incubation variation existed. Thermochron I-buttons were placed in fluid filled, copper eggs molded and painted to match

Common Tern eggs. Egg models were placed in 1 or 2 egg nests, increasing clutch size by one. Thermochrons measured temperature to 0.5C every minute over 4 days. Results show no large differences in heating time between modified 2 and 3 egg clutch size. As larger clutch sizes require more energy to heat, terns are giving extra energy to heat the larger clutch sizes. This is indicated by the similar rates in clutch heating. More energy dedicated to heating eggs in incubation is an added energy expenditure increasing reproductive effort in Common Terns with larger clutch sizes.

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Migratory strategies of Atlantic Puffins *Fratercula arctica* breeding in Witless Bay, Newfoundland (Oral – Puffin symposium)

Information about the over-wintering areas of North American Atlantic puffin populations is largely unknown. We tracked the migration of 12 adult puffins from Witless Bay, Newfoundland and Labrador, which supports over half of the North American Atlantic puffin population. We supplemented tracking data with stable isotope analysis (SIA) of winter-grown feathers, genetic sexing, and physiological measurements taken during the breeding season to help interpret differences in migratory strategies and test for device effects. Tracking data revealed that individuals in this colony have two distinct strategies: stay near to the colony and forage on the Grand Banks of Newfoundland or travel further southwest to winter on the Eastern Seaboard from the Scotian Shelf as far south as New Jersey. Eastern Seaboard migrants had lower mass than Grand Banks migrants when they returned to the colony. Chicks from Eastern Seaboard migrants had lower mass than Grand Banks migrants at the beginning of the season but gained mass at a greater rate throughout chick-rearing, suggesting that there is a carryover signal from winter that disappears during the breeding season. The d15N and d13C values of Grand Banks migrants were significantly higher than Eastern Seaboard migrants, suggesting different diets and/or different timing of moult for these two groups. There were no apparent device effects, suggesting that this data is representative of the migratory patterns of puffin populations in Newfoundland. Although Newfoundland puffin populations are generally stable, populations in the eastern Atlantic are declining, so knowing where North American puffins winter and the potential threats they might encounter there (e.g. oil and gas development, changes in prey populations) are important for any future conservation efforts.

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Changes in the diet of Atlantic Puffin chicks at the southern edge of their North American range (Oral – Puffin symposium)

To assess the effects of climate change and impact of fisheries on Maine puffin colonies, we analyzed changes in: chick diet, chick condition, productivity and cohort return rates over time. We examined the diet of Atlantic Puffin (*Fratercula arctica*) chicks at three mid-coast Maine, USA colonies during the years 2005-2016 and found that the puffins at each island have a distinct diet that has changed in recent years. White hake (*Urophycis tenuis*) is by far the most frequently delivered prey at each island. Atlantic herring (*Clupea harengus*) is the second most frequently delivered food, but has declined in recent years on two islands. In contrast, butterfish (*Poronotus triacanthus*), haddock (*Melanogrammus aeglefinus*) and redfish (*Sebastes spp.*) have increased in the puffin diet on all islands, but more so on some islands than others and with great variation in the proportion of chick diet from one year to the next. The condition of puffin chicks, represented by the weight/wing chord ratio, declined significantly from 1993-2016. We demonstrate that puffin chicks with greater body weight experience a higher chance of post-fledging survival when compared to chicks with lower body weight. The years 2012-2013 were a period of extreme sea surface warming, during which time puffin hatching success and productivity sharply declined. This study provides new insight into changes in marine communities by examining changes in puffin chick diet. We discuss our findings in relation to warming sea surface temperatures, recent climate-related decline in productivity of the Gulf of Maine and the impact of commercial fisheries on forage fish.

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Tracking semipalmated sandpipers from Jamaica Bay, NY, NY - a stopover site along their migration (Poster)

Jamaica Bay is a 21,000-acre estuary and globally Important Bird Area located in New York City, the most densely populated city in the United States. Does the Jamaica Bay Wildlife Refuge provide resources needed by shorebirds during their spring and fall migration? NYC Audubon conducted a pilot study to begin addressing aspects of this question: how long do birds stay in Jamaica Bay during migration stopover; where do the migrants breed and winter? To track bird movements, we attached NanoTags to Semipalmated Sandpipers (*Calidris pusilla*) during their fall (2016) and spring (2017) migrations. Birds were captured at the East Pond, West Pond, and Big Egg Marsh, Jamaica Bay, Queens, New York, USA. NanoTags are small, individually coded radio transmitters that allow researchers to track the movements of individual birds over a large geographic scale. We used Lotek brand NanoTags (model #NTQB-3-2) weighing 0.67 grams and deployed on birds > 25 grams (2.6% body weight). Tags transmitted a signal every 10.1 seconds which was picked up when in the range of automatic receiving stations in the Motus Wildlife Tracking System (Motus) network. While not a new technology, the recent advancement of small-sized tags enables tracking of shorebirds. Modeling our pilot study after similar research by NJ Audubon and the U.S. Fish and Wildlife Service, NYC Audubon deployed 5 NanoTags in 2016. At least one bird was detected, providing valuable information about its short-term movements from Jamaica Bay. In 2017, we deployed 19

NanoTags in late-May and early-June and tracked the birds' movements during spring and fall migration. Data from birds within Jamaica Bay indicate their length of stay at the site, local movements within the Bay, and site fidelity between spring and fall. These data will help NYC Audubon make meaningful management recommendations to local resource managers. On a global scale, our research will contribute to data being collected by others who have or currently are deploying NanoTags on Semipalmated Sandpipers in places such as New Jersey, Maine, Massachusetts, South America, and more.

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Movement patterns and habitat selection of Brown Pelicans in the Gulf of Mexico (Oral)

In marine environments, where animal movements usually occur far from land and out of sight, remote tracking data offers a useful tool for investigating individual behavior, habitat associations, and risk factors. We assessed year-round habitat selection and use by Brown Pelicans in the northern Gulf of Mexico based on three years of GPS data from 85 individuals. Using a Hidden Markov Model, we separated resident behavior, defined by slow movement through limited areas, from transient states in which animals moved quickly across large areas. We then evaluated resident habitat characteristics using a marginality analysis of remotely sensed environmental variables. Most (> 98%) of resident locations were less than 10 km from the nearest coastline. Within coastal regions, pelicans selected habitats with below-average salinity and above-average primary production. Selection on these characteristics was strongest during the breeding period, decreasing during non-breeding. Conversely, non-breeding pelicans selected waters with below-average temperatures, while breeding-season locations reflected region-wide mean temperatures. Throughout the year, pelicans consistently preferred relatively shallow habitats close to coastlines and river mouths. Although previous studies have suggested that nearshore seabirds are influenced by both temperature and productivity of oceanic waters, salinity is an unusual component of seabird habitat selection and may be driven by an abundance of estuarine-dependent prey. This study offers insight into habitat features selected by nearshore seabirds in a subtropical environment, and provides a baseline for predicting occupancy, spatial overlap, and risk exposure across a regional metapopulation.

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Foraging of Masked Boobies in Motu Nui, Easter Island, Chile, during the breeding season 2016 (Oral)

Studies on the foraging ecology of seabirds have shown that foraging parameters may differ among colonies. Such differences can be generated by particular oceanographic mesoscale features and the plasticity of seabirds to adapt to those conditions. Identifying local mesoscale features of importance for seabirds is fundamental for management decisions. Motu Nui on Easter Island is 3700 km away from continental Chile. No information on the foraging ecology of seabirds from this island had been attempted before. We studied the foraging of Masked Boobies by attaching GPS data loggers and TDRs in October and November 2016. 96 complete foraging trips from 19 breeding individuals were obtained. Maximum foraging range was 119.3 km; maximum total distance traveled in a trip was 301.8 km. Trip duration ranged from 0.95 to 11.3 h. Maximum depth of a dive was 5.0 m, and diving rate was 3.9 ± 3.5 dives/h. These foraging parameters lay among normal ranges reported for this species. Around Easter Island, there are several seamounts. In oligotrophic waters, seamounts are considered important mesoscale features that enhance primary productivity. Nevertheless, seamounts around Easter Island do not increase productivity in their peak or surroundings, and the large thickness of the photic zone cause that the highest productivity occurs in sub-surface waters. As a result, instead of flying specifically to seamounts, Masked boobies were foraging widely dispersed in the areas around their colony. This is the first report on the foraging ecology of seabirds from Easter Island and we demonstrate that even when the foraging parameters of Masked boobies were not significantly different from previous studies - Masked boobies adapt their foraging to the particular conditions of Easter Island.

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Migration ecology of Piping Plovers in the U.S. Atlantic: Implications for offshore wind energy facilities (Oral)

Assessing the migratory movements of the federally-threatened Atlantic Coast Piping Plovers (*Charadrius melodus*) from breeding to wintering grounds is a high management priority. Understanding flight trajectories and altitudes is needed to assess potential impacts of offshore wind energy developments in the U.S Atlantic Outer Continental Shelf on potentially vulnerable species. In 2015 and 2016, we attached 1.0 g digitally-coded VHF transmitters to 100 adult Piping Plovers (<2% of plover body mass) in Rhode Island ($n = 50$) and Massachusetts ($n = 50$). Transmitters emitted a coded signal every 5-6 seconds for ~160 days, thus we were able to track plover movements around-the-clock using 35 automated telemetry towers extending along the U.S. Atlantic coast, from Cape Cod, Massachusetts to Back Bay, Virginia. We tracked tagged individuals for a mean duration of 45 days (range = 3 to 90 days) in 2015 and 61 days (range = 5 to 156 days) in 2016. A meta-analysis found no evidence that transmitters affected nest or chick survival between tagged and control pairs (Stantial et al. in press). The majority of tagged Piping Plovers initiated migration from breeding grounds within 3-hrs of local sunset

(range = 14:00 to 21:00 hrs Eastern Standard Time). Migration was primarily offshore, with nocturnal flights ranging from 250 to over 525 km at speeds of 60 to 80 km per hr. We present results of a novel modeling approach that uses data collected by automated radio telemetry towers to estimate the trajectories and altitudes of offshore flights. Results of this study will inform models to assess collision risk of Piping Plovers with offshore wind turbines.



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Climate impacts on breeding tern productivity and phenology (Oral)

Since the late 1800s, the oceans have been warming, with > 0.5 inch sea level rise per decade. Ocean heat content has been rising since the 1950s, and sea surface temperature has been higher in the last 30 years than in any time documented from the late 1800s onward. These warming effects in the world's oceans have concomitant effects on marine life. Here, we seek to determine how much climate change has affected reproduction of common terns and roseate terns on Bird Island, MA. We analyzed forty-seven-years of data on clutch size, number of breeding pairs, hatch success, productivity, and reproductive phenology collected by the state of Massachusetts, and assessed whether North Atlantic Oscillation - as an index of climate change - from June and the previous fall accounts for temporal changes in tern reproduction. Though climate change is not directly related to reproductive lives of Common terns, it does show an association with clutch size, hatching success, and overall productivity for roseate terns. We further test for indirect effects on tern reproduction via climate effects on food resources.

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Inter-colonial and intraspecific differences in diet composition for herons and egrets (Poster)

It is widely believed that each species in mixed-species foraging groups becomes specialized to reduce competition among competing species. But even without niche specialization at the species level, members of a guild could coexist if they have niche flexibility at the individual level. Six species of colonial Ardeidae, Grey Heron *Ardea cinerea*, Great Egret *A. alba*, Intermediate Egret *Mesophoyx intermedia*, Little Egret *Egretta garzetta*, Cattle Egret *Bubulcus ibis* and Black-crowned Night Heron *Nycticorax nycticorax*, breed in mixed-species colonies in

Japan. Previous studies showed no clear difference in diet among them except Cattle Egrets. To examine whether there are intraspecific variation in diet among six species, regurgitated food items were retrieved from a collection net positioned under the target 28 nests in four colonies in Ibaraki Prefecture, eastern Japan, during breeding period in 2008. There were no diet features seen across all six species, but diet composition differed among 28 surveyed nests. Negative correlation between diet variations and *per capita* available foraging areas among colonies indicated that diet variation was larger in colonies with higher inter- and intraspecific competition. Herons and egrets could shift their diet in accordance with food availability and degree of competition, and thus substantially allow themselves to breed in mixed-species colony.



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Foraging ecology of North American large gulls: factors causing variation during the breeding season (Oral – Gull foraging symposium)

Foraging behaviour involves an animal searching and exploiting food resources. One main assumption underlying foraging theory is that factors, internal or external to the foraging animal, can influence the relationship between resources and the process of decision-making. Solutions to foraging decisions are broad in generalist species, such as large gulls (genus *Larus*), because they consume a wide variety of prey types collected in many habitat types. I investigated the influence of internal (i.e. individual specialization) and external (i.e. availability of high quality prey) factors on the foraging behaviour and diet of herring gulls (*Larus argentatus*) and great black-backed gulls (*Larus marinus*) on the North American east coast. When the biomass of high quality fish prey (capelin *Mallotus villosus*) shifted from low to high, stable isotope analysis ($\delta^{15}\text{N}$, $\delta^{13}\text{C}$) revealed that trophic position (i.e. $\delta^{15}\text{N}$) increased (low mean \pm SD = 13.42 ± 0.75 ; high = 14.57 ± 0.49) and the isotopic niche breadth (i.e. standard ellipse area, SEA) decreased (low SEA = 1.02; high SEA = 0.57). Using at-sea experiments, the total number of gulls responding to supplemental food supply decreased at high prey biomass (4.14 ± 6.05) versus low (6.33 ± 18.49). Using tracking devices on great black-backed gulls, we found that variation in foraging trip parameters (e.g., trip duration, maximum distance) was greater among individuals than within, suggesting individual specialization. Our study highlights the importance of individual specialization in the foraging behaviour of North Atlantic large gulls, but also reveals population-level shifts under changing prey availability. Further studies are needed to assess the importance of the individual, prey availability and other factors on foraging behaviour and diet in large gulls.

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Using long-term citizen science data to examine trends in Common and Pacific Loon demography in southcentral Alaska (Oral)

For 30 years the Alaska Loon Watch (1985-1999) and the Alaska Loon and Grebe Watch (2000-2016) engaged citizen scientists to record over 10,000 observations of Common (*Gavia immer*) and Pacific Loons (*G. pacifica*) at 346 lakes in five regions of southcentral Alaska. We used generalized linear mixed models (GLMM) to estimate long-term trends in adult loon abundance and chick survival for each region. We also correlated environmental variables with loon abundance. Our analyses were conservative, given high annual variability in participant effort common to many citizen science programs. Common Loons increased significantly in all southcentral regions of Alaska by 0.6–3.6% (median=2.2%) per year, whereas Pacific Loons exhibited no clear trend. Lake area was positively associated with abundance of Common Loons, but not Pacific Loons. Environmental variables indicative of the magnitude of lakeside development and human or natural disturbance accounted for only a small fraction of the total variation in adult loon counts. Annual chick survival was estimated to be 0.64–0.85 (median=0.80) for Common Loons and 0.38–0.95 (median=0.55) for Pacific Loons, with little evidence for a trend in annual survival over time. Lastly, Common Loon presence on a given lake in one year was a strong predictor of Pacific Loon absence in the next year, consistent with the notion of competitive exclusion. We discuss these patterns in the context of trends in loon abundance observed in other parts of the U.S., and describe the benefits and challenges of using citizen science data to estimate demographic parameters for long-lived species like loons.

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20th century history of human-driven impacts on waterbirds and their habitats in a tropical coastal lagoon in southern Mexico (Oral)

Laguna Cuyutlán, a large tropical wetland in southern Mexico, currently looks similar to its depiction in the descriptions and maps from the late XIX and early XX centuries. However, the composition of the waterbird assemblages that use it exhibit three major periods, which can be linked to overall original hydrological and two later anthropogenic modifications, punctuated with smaller-level changes. The first period, from original conditions until the 1950s, had wintering waterfowl as its most obvious waterbird feature, and the lagoon was one of their major sites along the southern coast of Mexico. The lagoon's dynamics was that of closure of the mouth during the dry months, and piling up of fresh water during the rainy season until water pressure broke through the sandbar resetting the mouth removing sediments and lowering water levels. Starting in the 1920s, but completing in the 1950s, most of fresh water reaching the lagoon was re-directed to create the large Tecomán agricultural district, after which little fresh water reached the lagoon, the mouth closed and water levels permanently dropped. In addition, sediments from agriculture-induced soil erosion to the lagoon increased. It caused the almost disappearance of waterfowl in the winter, and favored ground-nesting waterbirds (terns, Black

Skimmers, Laughing Gulls). As a result, Cuyutlán became one of the most important sites for ground-breeding waterbirds in southern Mexico, supporting species with conservation problems (Gull-billed tern) or with few colonies in western North America (Black Skimmer, Laughing Gull). The value of the lagoon for this group ceased in 2012 when a large opening with the sea was established for port development, causing water levels to rise and inundating the colony sites. During this period, although not necessarily as a result of the same process, breeding numbers of Great Egrets and White Ibis increased substantially, and Wood Storks began nesting. Our data indicate that, to evaluate true conservation value and potential of tropical coastal lagoons for waterbirds and to define conservation strategies, assessing waterbird history, rather than only determining current populations and assemblages, as is often done, is imperative. Otherwise, conservation efforts might be shortsighted.

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Population dynamics, roosting behaviour, food and feeding habits of Little Cormorant *Phalacrocoax niger* in Periyakulam lake Tiruchirappalli District, Tamil Nadu, Southern India (Oral)

Population dynamics, roosting behaviour, food and feeding habits of Little Cormorant (*Phalacrocoax niger*) were studied in a roost on a live tree *Prosopis juliflora* at the Periyakulam lake Tiruchirappalli District, Tamil Nadu, Southern India. The population was fluctuating in response water availability in the monsoon and post monsoon seasons. The Little Cormorant later in the morning and returned to the roost earlier in the evening as the season changed from Monsoon (October-December) Post Monsoon (January-March). Totally 86 Pellets were collected in the study area. The fish was the most predominant item in the prey remains collected from the roost site. The otoliths of 10 species of fish viz., *Catla catla*, *Labeo rohita*, *Punctius filamentosus*, *Cirrhina mrigala*, *Ctenopharyngodon idella*, *Oreochromis mossambicus*, *Chela bacaila*, *Ictalurus punctatus*, *Electrophorus electricus*, *Desmodema polystictum* were recovered from the pellets of Little Cormorants. *Oreochromis mossambicus*, *Cirrhina mrigala*, *Ctenopharyngodon idella* was the most preferred prey item with the most preferred size being of weight range 30-70g.

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Migration patterns and overwintering distribution of Black Terns using geolocators (Oral)

Limited information exists on the migration and wintering biology of Black Terns (*Chlidonias niger*) breeding in North America. The objectives of this project were: (i) to fill gaps in our basic understanding of the migratory and non-breeding ecology of this species and (ii) identify critical habitat and timing of its use within and outside of North America. Ultimately, this information will be used to identify and assess potential causes of long-term population declines in the Laurentian Great Lakes region and inform conservation planning. We deployed leg-mounted geolocators (light-level data loggers) on 40 adult Black Terns breeding on the Great Lakes at: (i) Tiny Marsh, near Midland, ON (in 2016; n=31) and Lake St. Clair, near Harsens Island, MI (in 2017; n=9). For the tags recovered so far (n=5), the general pattern is: southward migration to the Atlantic coast with staging in Florida and the Caribbean Sea; individual variation in winter quarters (the coasts of Panama, northern Peru and central Peru respectively); and northward migration to the Gulf of Mexico and up the Mississippi flyway to the breeding site. There was also individual variation in the timing and speed of migration. We will present further information on the timing of migration and routes taken, the locations of and the duration of residency at staging areas and stop-over sites, and the non-breeding distribution of adults. We will also examine whether there are gender-related differences in migration patterns.



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Chasing shadow birds: determining the Black Rail's distribution in Texas (Oral)

The Black Rail is arguably the most secretive marsh bird in North America. The first records of the species in North America were from the east coast as far back as 1810 and the first Texas record of the bird was in 1879. Nevertheless, the distribution and life history information of the species in the state of Texas, as well as elsewhere in the species' range, is still seen as somewhat unknown. The citizen science website eBird has allowed for a new way to view and help determine the distribution and range of the species in the state. The vast majority of the Texas observations of Black Rails come from Anahuac National Wildlife Refuge in Chambers County. There are upwards of 300 observations here and in the areas surrounding the refuge. The number of Black Rail observations slowly decreases as you move down the coast towards Mexico, and terminate in Nueces County. While most observations are clustered along the coast of Texas, there are also numerous inland observations that are of interest. These types of records reiterate how little we know about the distribution of the bird and stress the need for more widely-spread surveying efforts.

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Impacts of heronries on water quality as evaluated through *Escherichia coli* and fecal sterol analyses (Oral)

We used fecal sterol analysis to determine the potential contribution of *E. coli* from heronries to waterbodies in east-central Texas. We analyzed *E. coli* and fecal sterol concentrations in samples from four heronries during the breeding seasons in 2011–2013. The most common species in the heronries were cattle egrets (*Bubulcus ibis*), snowy egrets (*Egretta thula*), and little blue herons (*E. caerulea*). The highest *E. coli* concentrations were in water samples from the two largest heronries established directly over water. The main sterols in fecal samples were cholesterol and stigmasterol, and in water, cholesterol, coprostanol, and cholestanol. Total sterols ranged 979 to 5838 ng/g dry weight in fecal samples, and 13 to 600 ng/L in water samples. There was a positive correlation between *E. coli* and the sum of bird sterols in water exposed directly to fecal deposition, but not in water surrounding the heronries. We used various sterol ratios to distinguish potential human and non-human sources. The sterol ratios in water for CHOA/(CHOA+COP+ECOP) were close to the proposed 0.5 threshold in about 80% of the cases indicating potential avian sources. Similarly, PCA analysis indicated that over 50% of the variance could be explained by positive associations of *E. coli* with β -sitosterol and stigmasterol, the main sterols present in bird feces. The strong association between *E. coli* and stigmasterol, suggests that the presence of stigmasterol in water could be used for predicting *E. coli* sources from heronries nesting close to waterbodies.

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Directional migration in the threatened Socotra Cormorant: potential oceanic drivers and conservation implications (Oral)

Seabirds are abundant apex predators that can exert top-down control over marine food webs. Worldwide declines in seabirds, therefore, represent an important threat to marine ecosystem stability. Conservation of seabirds necessitates better understanding of their migratory ecology due to their wide ranging annual movements. Socotra cormorants (*Phalacrocorax nigrogularis*) are locally abundant, but vulnerable seabirds limited primarily to the Arabian Gulf and the Gulf of Oman regions. We studied migration of cormorants breeding on Siniya Island, Umm Al Quwain, United Arab Emirates in the eastern Arabian Gulf to help identify areas of high conservation value. We deployed Platform Transmitter Terminals (PTT) in 2013 (n= 8) and 2014 (n=9) on adult cormorants using a harness. After breeding during August-January, birds moved westwards from Siniya Island and over-wintered for four months on islands in western UAE, including Bu Tinah Shoals. Birds moved eastwards after May towards the Musandam Peninsula

before returning to Siniya Island to breed. Movements remained restricted to the Arabian Gulf supporting the hypothesis that the populations breeding in Oman are isolated from those in the Gulf. Cormorant distribution matched with phytoplankton productivity (measured as Chlorophyll a concentration, CHL) only during the breeding period, when high CHL is recorded in the areas surrounding Siniya Island. Subsequent to breeding, phytoplankton blooms declined causing a mismatch in distribution of cormorants and CHL. We suggest that cormorants moving west into Abu Dhabi waters could be following westward migration and dispersal of forage fish. Cormorants breeding on Siniya Island span over three management jurisdictions (two different Emirates of UAE and Oman) with comparable conservation mandates. Islands in Abu Dhabi, Siniya Island, and the cliffs around the fjords of Musandam Peninsula are identified as areas of high conservation priority for the species. Effective conservation of the species will therefore require conservation action covering all three jurisdictions.

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Long-term changes in resource use of gulls in the British Isles (Oral – Gull foraging symposium)

Environmental change will affect resource availability for many species. If a preferred food resource becomes less abundant, species with a generalist foraging strategy may have the opportunity to switch to alternative prey. However the alternative prey could be of a different quality that has consequences on the individuals' performance. Here I want to focus on one group of opportunistic foragers, herring and lesser black-backed gulls around the British Isles. I will look how the gulls' diet varied over time and space using both records from the literature on what food they consumed as well as stable isotope analyses on museum skins. Differences in consumed prey will then be related to the gulls' population status at the time. This analysis will provide insight into the flexibility of resource use under changing environmental conditions.

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Seasonal reproductive success of Semipalmated Plovers (Oral)

The 1980's were the heyday for long-term research on birds and other organisms. The take-home message from many of the studies of the time was that natural selection acted on lifetime, rather than seasonal reproductive success and that, within populations, there were big winners and losers among individuals in their contributions to future generations. The cautionary tale was that short-term, 1-3 year studies on a species' reproductive success might miss the boat in understanding the evolutionary forces that shaped an animal's life history. The big lessons from my 25-year continuous research program in Churchill, Manitoba, partially confirmed results from earlier studies, that lifetime reproductive success is not necessarily correlated with seasonal

reproductive success, and that individuals with high fitness comprise a small but important part of the total population. Who these highly successful individuals are and why they are so successful is still a mystery, but examining plovers throughout their annual cycle and developing methods for establishing seasonal survival estimates, has helped to clarify at what stage the most important selective pressures on survival occur. As with other species for which this has been attempted, survival of Semipalmated Plovers is lowest during the migratory period, the most difficult stage of the annual cycle to study.

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Seabirds and marine plastic debris in the Northeast Atlantic: a synthesis and recommendations for research and monitoring (Oral)

The presence of plastic in the marine environment is a globally recognised issue, with far-reaching economic, aesthetic, and environmental consequences. Numerous marine species interact negatively with plastic debris through entanglement, nest incorporation, and ingestion. However, in the Northeast Atlantic, an area of international importance for seabirds, we have little understanding of the spatial and temporal variation of how marine plastic affects different seabird species. To improve our understanding of active interactions between Northeast Atlantic seabirds and marine plastic we reviewed the published and grey literature to obtain information on all known documented cases of plastic ingestion and nest incorporation. We found that of 69 seabird species that commonly occur in the Northeast Atlantic, 34 (49%) had evidence of ingesting plastic. However, information from multiple countries and years was only available for 18 of these species (26%). We found only one published study on nest incorporation, for the northern gannet *Morus bassanus*. For many species, sample sizes were small or not reported, and only 39% of studies were from the 21st century indicating that we actually know very little about the current prevalence of plastic ingestion and nest incorporation for many species. Furthermore, in the majority of studies, the metrics reported were inadequate to carry out robust comparisons among locations and species or perform meta-analyses. This synthesis highlights important gaps in our current knowledge, and can be used to prioritise future research to obtain a more comprehensive and current understanding of how marine plastics are affecting seabirds in the Northeast Atlantic.

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Effects of weather on the timing of migratory departure in fall-migrating ducks (Oral)

Throughout migration, birds make important decisions including where to go, how long to stay, and when to leave, which in turn contributes to the fitness of the individual. The decision of when to migrate requires forfeiting existing conditions, enduring conditions aloft, and assuming risk regarding an unseen destination. Previous studies have failed to identify strong effects of weather on migration, likely because the methods used to quantify timing of departure were inadequate. We monitored specific dabbling duck (*Anatidae*) departures from a 14,431-ha wetland complex in central Illinois from 1 Oct to 31 Dec 1996-1998, 2003, and 2006-2009 using weather surveillance radar to identify and enumerate emigrating ducks. We used standard weather variables known to influence avian migration to develop candidate models explaining the timing of dabbling duck departures (0 [no departure] or 1 [departure]). We then modelled relationships between the timing of departures and weather and parameterized models to understand the magnitude of the effects of weather variables on individual emigration events. Over our study period, ducks departed on an average of 30% of nights each year, with a total of 216 departures out of all 723 nights. The best approximating model of migration timing captured all the model weight ($w_i = 1.0$; $R^2 = 0.42$) and included variables accounting for favorable direction of winds aloft, precipitation, and cloud cover. Based on parameter estimates for the best model, ducks were more likely to depart with following (favorable) winds, no precipitation, and less cloud cover. Our results suggest conditions associated with favorable flight conditions may in some contexts be equally or more important than conditions associated with the dynamic environment immediately occurring at a stopover. However, 58% of the variation in timing of departure was unaccounted for by our best model; thus, many aspects of departure decisions by migrating ducks remain unknown. For example, direction of winds aloft was a key factor in departure decisions in our models, but how ducks perceive or sample wind conditions aloft prior to departure is not understood. Experimental research and individual-based models may elucidate the ultimate factors driving departure decisions in migrating avifauna.



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Are Burmese pythons attracted to tree islands with wading bird colonies? Using eDNA to determine occupancy rates of pythons at wading bird breeding sites in the Everglades (Poster)

Burmese pythons (*Python bivittatus*) may pose a predation threat to nesting long-legged wading birds in the Everglades, but detection and ensuing conservation and management efforts are hampered by the extreme crypticity of this exotic apex predator. Small mammals have hitherto constituted around 75% of python diets; now that mammals like raccoons and marsh rabbits have declined by 95% due to pythons, we may see a shift in diet towards birds. Wading bird nesting colonies, which range from dozens to thousands of breeding pairs, represent an

energetically dense, attractive food source. Pythons may impact colonies by preying upon adults, juveniles, and eggs, as well as potentially causing abandonment of breeding pairs or colony failure. We are testing a new method of harnessing the directionality of flowing water in the Everglades to more efficiently detect Burmese pythons using environmental DNA (eDNA). Environmental DNA originates from cellular material shed by snakes into water, via their skin and excrement and can be used for species identification. Sampling aquatic eDNA has been an effective way to detect Burmese pythons throughout south Florida and along their northern range limit. Compared to detection rates using traditional survey methods (<1%), detection rates using eDNA are vastly improved (91-100%). In a 2016 pilot study, we sampled eDNA from 12 tree islands within Water Conservation Area 3A, north of Everglades National Park. Seven islands contained active wading bird colonies and five islands were controls, comparable in size and vegetation type. We sampled both downstream and upstream of all islands to account for snake DNA originating upstream of the focal island, and we only sampled sites with neighboring islands more than a mile upstream. Using a hierarchical occupancy model, we will estimate python detection and occupancy rates at each island to compare differences between islands with wading birds versus empty islands. Confirming the presence of pythons is the first step in assessing the potential impact of this invasive snake on wading bird reproduction and survival.

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Breeding seabirds of Eastern Mediterranean islands and the current status of Audouin's Gull (*Larus audouinii*) (Oral)

Islands are essential for seabird life cycle as they provide breeding habitats. These sensitive habitats face strong anthropogenic pressures. Very little is known about East Mediterranean islands, their breeding seabird fauna and current pressures. We conducted a breeding bird survey in May-June 2016 covering 200 km of Turkish coastline that harbours almost all the island in North East Mediterranean. A total of 21 islands larger than 300 m² and host vegetation were surveyed for breeding birds and habitat characteristics. We estimated total seabird population and quantified the nest/juvenile density by standardized transects. We also conducted a transect-based standard breeding bird survey for terrestrial birds. The main habitat types were quantified on the transects and the physical characteristics, vegetation type and any evidence for the presence of mammals were recorded. Furthermore, the entire coastline was surveyed during the cruise for any colonies on the coastal cliffs. The survey revealed that three seabird species have colonies in the East Mediterranean islands. The most abundant was Yellow-legged Gull with a total population of c. 175-250 pairs on 6-12 islands. European Shag had a total population of c. 15-30 pairs in 3-5 colonies (1-3 on coastal cliffs). Audouin's Gull colonies in previously recorded islands disappeared and only a single colony with approximately 6-8 pairs in Yılanlı Ada was found. This island was shared with a c. 20 pairs-strong Yellow-legged Gull colony. 2 Cory's Shearwater was observed close to potential breeding habitats during the coastal cruises but no breeding evidence could be gathered. The survey revealed that grass/herb habitat hosted the highest gull nest density, however it had the least coverage on islands. The habitat surveys indicated that the introduced mammals like rabbits and goats promoted shrub like habitat over the grass/herb vegetation and probably indirectly affected

seabird breeding habitat quality. We also observed 11 potentially breeding species during the terrestrial breeding bird surveys with very large and widespread population of Alpine Swifts.

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Low recruitment of Common Terns in the declining Barnegat Bay USA population (Oral)

Common Tern (*Sterna hirundo*) populations have declined in the southern portion of their breeding range along the Atlantic coast of the United States. The Barnegat Bay (New Jersey) population has been declining since about 2010, probably due to sea-level rise increasing the frequency of flooding of salt marsh islands. Productivity is typically very poor and previous analysis suggests permanent emigration of breeding adults out of Barnegat Bay. I present data focused on a long-term study site, Pettit Island, but also include limited data from other islands in the bay. The number of banded chicks recaptured as adults was extremely low, even when accounting for detection probability and mortality prior to fledging. Of 1215 chicks banded at Pettit Island from 2006 through 2013, only 21 have been recaptured as adults through 2016 (1.7%, or 3.9% of presumed fledglings). Although the colonies in the bay act as an interconnected metapopulation, it is unlikely that the small number of returns at Pettit Island simply reflects natal dispersal within the bay, because no terns banded as chicks at Pettit were recaptured as breeders at other islands. Whether poor recruitment reflects low post-fledging or subadult survival or emigration out of the population is unknown.

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Significant numbers of pre-migratory Roseate Terns stage on Cape Cod and Nantucket, Massachusetts (Poster)

The Northwest Atlantic population of the Roseate Tern (*Sterna dougallii*; ROST) was listed as “endangered” in 1987 under the US Endangered Species Act. Despite intensive efforts to protect nesting colonies, the population has sustained significant losses and gains over three decades, and has not yet achieved the abundance recovery goal of 5,000 pairs. Although historical records document large, pre-migratory flocks of ROST staging in July and August at sites in southeastern Massachusetts, spatial and temporal use of this region has not been systematically quantified. In addition, many important staging sites occur within the Cape Cod National Seashore (CCNS), a unit of the US National Park Service providing recreational opportunities for 4M visitors annually. We investigated the spatial and temporal distribution of Roseate Terns at staging sites in CCNS and Nantucket during Jul-Sep 2014-2015. We surveyed tern flocks at 16 staging sites, and recorded observations of field-readable bands used on pre-fledglings (HY) and adults at nine colony sites in the population’s breeding range. We

recorded maximum mixed-species tern flocks of 8,000 terns (8% ROST) in 2014 and 10,000 terns (25.6% ROST) in 2015. The largest number of ROST documented at one location was 2,560 (12.5% HY). Approximately 76% of banded HYs (n=2,322) from all colonies was resighted at CCNS and Nantucket staging sites during 2014 and 2015. We resighted proportionally fewer HYs from colonies south and west of the staging grounds than from other colonies. Maximum flock counts and band resights show the critical importance of staging sites in CCNS to the Northwest Atlantic population of Roseate Tern. Identification of key sites within the Seashore used by terns throughout the 3 month staging season will assist CCNS in developing management strategies for protecting ROST flocks and habitat.

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Winter site fidelity and winter movements in Common Loons (*Gavia immer*) across North America (Oral)

In many avian species, breeding site fidelity has been more thoroughly investigated than winter site fidelity, yet the latter may have a greater impact on survivorship. The Common Loon (*Gavia immer*) is an example of a species whose breeding site fidelity has been well established, but whether it exhibits winter site fidelity remains unknown. Because loons primarily winter in marine waters off coastal shores, winter site fidelity has been challenging to document. We investigated winter site fidelity in Common Loons across North America using satellite transmitters, recaptures, and resightings of previously color-marked individuals. Adult color-marked loons returned in consecutive years to the same wintering coastal locations of California, Washington, Louisiana, Maryland, and Massachusetts. We estimate adult annual apparent survival as 77% (0.48, 0.93) and adult winter site fidelity as 85% (0.35, 0.98). This finding has important conservation implications in the aftermath of recent marine oil spills; if loons return to the same contaminated wintering areas annually, decreased fitness and survivorship could result in population level impacts.

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Integrating birds, threats, and socio-economic factors to identify conservation priorities in the mid-Atlantic Coast, USA (Oral)

Healthy and resilient coasts conserve biodiversity and sustain local economies, yet conservation science is often disconnected from socio-economic analyses. With sea-level rise and urban growth increasingly threatening coastal resources, including waterbirds, a broad approach is

needed to account for multiple resource benefits of coasts. Our objective was to use systematic conservation planning to identify where conservation actions benefit birds and people as well as potential trade-offs. Bird distributions included colonial nesting seabirds and species inhabiting beaches, mudflat, and marsh ecosystems. Social criteria included data on commercial fisheries, wetland storm protection value, social vulnerability, tourism, and coastal-related gross domestic product from industries such as ship building and seafood markets. Threats were represented by marsh transition projections from sea-level rise models and projected urban growth by 2050. We used Zonation conservation planning software to determine the optimal spatial configuration to achieve a balance of these conservation targets. The results show that prioritizing areas for conservation of birds can complement many human uses of coastal ecosystems. Conservation and management of salt marshes may provide for storm protection and commercial fisheries while conserving habitat for marsh birds and shorebirds. Locations of synergy between the conservation of species and coastal economies occur near Charleston, South Carolina and Wilmington, North Carolina. Areas with both high tourism and high conservation value should be managed appropriately to minimize negative human-wildlife interactions, such as beach tourism disrupting shorebird nesting.

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Factors affecting nest survival of Eurasian Bittern in eastern Poland (Poster)

Nest predation is the basic reason for the lack of reproductive success in most bird species. This factor is thought to be responsible for an average of 80% of all nest losses. Reproductive success in birds depends to a large extent on the intensity of predator activity and pressure on the one hand, and on the abilities of both parent birds and nestlings to cope with this threat on the other. This study analyses the effects of nest-site selection on predation risk of Eurasian Bitterns *Botaurus stellaris* nests. The study was conducted in fishponds of eastern Poland during six breeding seasons. The habitat characteristics of 103 nest sites were investigated. The risk of Eurasian Bittern nests being predated was the highest at the start of the breeding season. Because the reedbed stem density at this time is still rather low, females have only a small number of potential sites to choose from, where they can effectively conceal their nests from predators. Among the habitat parameters analysed here, two – water depth and vegetation density – were of the greatest significance. Predators destroyed Eurasian Bittern broods in nests built over shallow water and in thin vegetation. Plans for the management of this endangered species should focus on ensuring a stable, high water level in structurally diverse reedbeds. This will limit predation pressure and improve the daily nest survival rate of Eurasian Bittern. Ensuring safe nesting sites for female Bitterns is particularly important during the most crucial period of reproduction, i.e. at the beginning of the breeding season.

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Evaluation of digital aerial survey methods for seabird and marine mammal monitoring (Oral)

To ensure an effective protection of seabirds and marine mammals, it is essential to record population densities as well as their spatial distribution patterns. Commonly used monitoring methods are observer-based ship and aircraft surveys. Observer-based aerial surveys have recently been forbidden within offshore wind farms due to their low flight altitudes and the resulting safety concerns. Digital surveys are performed in significantly higher altitudes and have substituted observer-based surveys in OWF areas. Although digital aerial survey methods are already commercially applied, they have not been evaluated thoroughly. We initiated a comprehensive direct comparison between two methods on offer: a video- and a photo-based method. One important aim was to test if digital methods meet the requirements of the large-scale vertebrate monitoring program in the German North and Baltic Sea. We selected two study areas with different seasonal sets of seabird species, one in the south-eastern North Sea and the other in the Pomeranian Bay, Baltic Sea. In order to cover the different seasons and to reach a sufficient sample size for statistical comparison, we intend to perform eight comparison surveys in total: four North Sea surveys (two in spring and two in summer) and four Baltic Sea survey (two in spring and two in winter). The survey set-up consists of two aircrafts following each other on the same transect design with a time lag of approx. 1 minute. Each aircraft is equipped with a photo or video system recording the sea surface. To assess the effect of aircraft position, aircrafts change the lead position after every second transect line. In parallel, comparative data are collected with observer-based ship and aerial surveys on several occasions. Our study design allows for a comparative analysis of various scenarios, such as large accumulations of sea ducks, inconspicuous species (e.g. black guillemot) or frequently diving species like harbour porpoises. In addition, the project generates valuable information on logistic properties of digital surveys that are needed to assess the applicability within monitoring programmes. Here we present the first results of our analysis as well as a first assessment of species-specific detectability.

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Striking and rapid community changes of canopy-nesting waterbirds in a tropical coastal lagoon in southern Mexico (Oral)

Often, the only information on breeding waterbirds in tropical coastal lagoons derives from surveys in one or two seasons, whose results are thought to reflect stable communities. However, waterbird community composition can vary, sometimes rapidly, even when no obvious

habitat changes exist. We documented a nearly-complete turnover in bird species composition nesting on a small islet in Laguna Cuyutlán. In 2003 and 2005 the nesting community was dominated by Neotropic Cormorants and Cattle Egrets (100s of nests each), followed by Black-crowned Night Herons, Roseate Spoonbills and Tricolored Egrets (~40-50 nests), Great Egret and White Ibis (~20), and Yellow-crowned Night Herons and Little Blue Herons (<10). In 2010 the most conspicuous nesters were Great Egrets and White Ibis, with several dozen nests each. In 2014 Neotropic Cormorant and Cattle Egret still had 100s of nests, but numbers of Black-crowned Night Heron, Roseate Spoonbills had plummeted, Tricolored Heron had relocated 1.3 km away, and Snowy Egret and Little Blue Heron did not nest. In contrast, there were 100s of nests of Great Egret and White Ibis, while Wood Storks were newly-arrived nesters (30-40 nests). This pattern continued into 2015, except for a substantial reduction in Cattle Egret nests. In 2016 all species diminished or did not breed, except for the Wood Stork which had >100 nests. (Data for 2017 will be available for the conference). The reason for such changes is unclear. At least, some of these changes started before the 2012 construction of a large connection with the sea, which caused a raise in the lagoon's water level; deeper waters now may promote further changes. The relocation of the Tricolored Heron colony and reduction of those of small egrets may suggest competition from Great Egret and/or White Ibis. The 2016 nesting failure of most species coincided with a strong 2015-2016 ENSO event which did not affect the Wood Storks, maybe because of different feeding sites. Thus, tropical communities of nesting waterbirds can be very dynamic and driven by subtle changes which might not be evident, and/or by species interactions. This calls for periodic surveys, depending on management or conservation objectives.

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Humans and gulls: a conservation conundrum (Oral – Gull foraging symposium)

Media headlines in the UK in the summer months have become increasingly dominated by tales of 'killer seagulls' terrorising towns and cities. Similar coverage has occurred in other countries, and it seems likely that such stories are contributing to the apparently growing public perception that gulls are a nuisance and a danger, and should be lethally controlled. In the UK, as in other countries, gulls are legally protected, and the species that are generally the focus of the headlines, Herring Gulls and Lesser Black-backed Gulls, are in decline. The Herring Gull has been on the UK's Birds of Conservation Concern Red List since 2009, and the Lesser Black-backed Gull is on the Amber List (similar population trends are observed elsewhere in their ranges). Moreover, these species can be, and are regularly, lethally controlled. Given the mismatch between these species' conservation status and the perception that they are taking over our urban spaces and making them unsafe, it is important to find ways to resolve this issue. One of the major obstacles in solving the 'gull problem' is the relatively scant information on the number of gulls in urban areas, where these gulls breed and how they actually use urban space. For example, the declines underpinning gulls' conservation status are largely based on birds nesting in rural, coastal colonies, while urban censuses are much less frequent and accurate. The population trends of gulls living in urban and rural areas will be discussed, along with the results of tracking studies providing an insight into the behaviour of birds nesting in different environments (such as a recent study of Herring Gulls breeding in a coastal town in England where gulls regularly get bad press, which showed that the tagged birds did not forage

in town, so are not those responsible for stealing food from tourists). Ways to increase the public understanding of gulls and how effective these are will also be presented, alongside the knowledge gaps we still need to plug to ensure that any decisions on the control of gull populations are effective, and based on sound science instead of fake news.

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One, two, three, ... How much do we have to count? Estimation of the survey effort needed to census seabirds at sea (Poster)

In the German North Sea, standardized counts of seabirds are conducted since the early 1990s. These counts provide information on distribution, abundance and population development of species regularly occurring in German waters. Previous studies have shown that distribution of seabirds is highly variable and so their abundance is difficult to estimate. Therefore, the question is: How much counting effort is needed to receive reliable bird numbers? To investigate this question we simulated distribution patterns of different seabird species in the North Sea on the basis of real bird count data from line transect counts; i.e., the number of total birds in the study area was known for the simulated data. Afterwards, we conducted repeated virtual bird counts with different percentage of coverage of the study area. The results clearly showed that for common species with a more or less regular distribution pattern (for example loons *Gavia spec.* in spring and auks in winter) a relatively small error in the estimation of bird numbers can already be reached with a coverage of 10 % of the study area: 95 % of the virtual counts were between 67 % and 150 % of the real total number of individuals (i.e., error factor ≤ 1.5). For rare species with a more patchy distribution pattern (like little gulls *Hydrocoloeus minutus* in spring) a very high coverage of up to 70 % of the study area is needed to reveal numbers with a reliability that lies in the same range. It was always known that due to the high variability in bird distribution the calculation of bird numbers has a relatively high statistical error. Based on the results of this study we are able to estimate this error in more detail for different percentages of coverage and the study design can be adapted better to the species of concern.

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An invasive bivalve species changes the foraging ecology of sea ducks in the German Wadden Sea (Oral)

Common Eiders (*Somateria mollissima*) and Common Scoters (*Melanitta nigra*) occur in high numbers in the eastern German Wadden Sea. Both species show stable population trends over the last decades. Long-term data series derived from regular seabirds-at-sea and aerial surveys showed that Common Eiders inhabit mainly inshore subtidal areas in the Wadden Sea, while

Common Scoters are largely distributed several km off the Wadden Sea islands. While distribution patterns are well documented over decades now, factors driving these patterns are still insufficiently known. Therefore, we investigated prey composition, abundance and biomass in areas intensively used by the two sea duck species. These analyses were supplemented by examining stomach contents and faeces samples. Furthermore, we set up a habitat model to explain the distribution patterns of Common Scoters. We found high amounts of benthic biomass in areas used by both sea duck species in contrast to areas that were not used. The most common prey item sampled below feeding common scoters and in stomach samples were American Razor Clams (*Ensis leei*). This species made up by far the highest proportion of available biomass particularly in areas with high abundances of Common Scoters. American Razor Clams invaded the Wadden Sea during the early 1980s. Based on its optimal flesh to shell ratio, this species is a rich energy resource for sea ducks. The abundance of Razor Clams explained the distribution of common scoter to a high degree. Furthermore, there was a negative correlation between scoter abundance and water depth as well as a positive correlation with bed shear stress intensity. Our data show that the neobiotic Razor Clam has become an important part of the diet for sea ducks nowadays, whereas Trough Shell (*Spisula subtruncata*) for Common Scoters as well as Blue Mussels (*Mytilus edulis*) for Common Eiders were of substantially lower importance than known from historical data. Our study shows parallel developments in bivalve prey stocks and avian diet, indicating that an increasing neobiotic prey species might compensate for the declines of traditional prey, Trough Shells and Blue Mussels, in the eastern German Wadden Sea.

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How do environmental stressors affect different colonies in a seabird metapopulation? (Oral)

The Gulf of Maine (Canada-USA) supports a metapopulation of Arctic Terns, which has been monitored intensively since the mid-1990s. Although the metapopulation has been relatively stable for decades, in recent years, complete reproductive failure at individual colonies has been more common. The regional population declined by 57% between 2004-2014, driven especially by the collapse of the largest colony in 2006. We examined the influence of food, weather, and predation on breeding success at five colonies during 1992-2013 (n=88 colony-years). We found a general decline in clutch size and the number of two-chick-fledged nests after 2003, but the influences were not consistent across colonies. At three colonies, declines were driven by increased rainfall and predation by large gulls, as well as complex food relationships that varied by colony. The other two colonies did not show clear patterns, but our analyses suggested that changes in the available prey base and an increasing number of mesopredator Laughing Gulls were major influences. Our results indicate that despite consistent patterns of decline across colonies, the driving force behind these changes is determined largely by local factors; a single metapopulation-wide explanation is insufficient to inform management.

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Common Terns nesting on natural islands in northern Lake Michigan: reproductive success at highly vegetated colony sites (Oral)

Understanding changes in colony size, habitat use and reproductive success of breeding Common Terns (*Sterna hirundo*) in the upper Great Lakes is imperative to the long-term conservation of this regionally threatened/endangered species. This presentation summarizes changes in colony location, population size, and breeding success of terns in the Beaver Archipelago of northern Lake Michigan (2007-2016). Each year, colony phenology and reproductive success of tern colonies were monitored on natural islands in the archipelago. Contrary to other locations, terns here typically nest in dense vegetation as opposed to more typical open habitats with sparse plant cover. Colony visits, remote cameras and the re-sighting of color-banded chicks indicate that breeding terns are successful only at densely vegetated sites; sites with sparse vegetation are abandoned each year due to more frequent disturbance events, including predation and flooding. Vegetated colony sites show similarities in the total amount of plant cover, but differ in plant community composition and vegetation height. When lake levels rose and flooded other sites, Common Terns colonized a densely vegetated area on larger, permanent island at the periphery of a Caspian Tern (*Hydroprogne caspia*) colony in 2014. Caspian Terns have since abandoned this location allowing for expansion of the Common Tern colony. As this new site is not subject to flooding, Common Tern reproductive success has increased and the colony has continued to grow. Successful use of densely vegetated sites on natural islands may indicate that Common Terns are responding to environmental factors (e.g. changing lake levels, competition for breeding sites, predation, etc.) in the upper Great Lakes and that this species may show greater plasticity in breeding site requirements than previously reported.

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Solar reflectivity by Lesser black-backed gull eggs (Oral)

The vibrant colors and color patterns of bird eggs have amazed and interested scientist for centuries. It has been hypothesized that eggshell colors have evolved for crypsis, species recognition or to protect embryos from solar radiation. In ground-nesting birds eggs can be exposed to solar radiation for extended periods of time. Coloration in this context is important because it might determine the amount of energy absorbed or reflected at different wavelengths and thus, egg temperature and the risk of overheating, might be affected by the eggshell color. In this study we investigated whether color (visible reflectance) is correlated to solar reflectivity and temperature of eggshells in the Lesser Black-backed Gull (*Larus fuscus*). First we measured reflectance of eggshells within the UV-Visible-Infrared range (350 – 2600 nm) using spectrophotometry and we calculated eggshell solar reflectivity. We then performed a heating

experiment to test whether infrared radiation can heat the interior of eggshells and whether darker eggshells (i.e. with lower reflectivity) heat more rapidly. We show that egg coloration has important effects on the heating load of eggs and we discuss the implications of these results for our understanding of the evolution of egg color and incubation behavior in birds.

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Prevalence and abundance of parasites and plastics in the diets of seabirds from the western Aleutian Islands, Alaska (Oral)

Plastic consumption and parasites appear to be nearly ubiquitous in seabirds, and both may be a significant cause of mortality. However, little is known about how plastics and parasites interact in birds. Further, microplastics are poorly documented in avian diets, and in some cases, can be passed through the digestive system – causing sub-lethal effects that are not easily observed or quantified. Here, we document the frequency of two types of microplastics (nurdles and microfibers) and parasitic helminths in the digestive systems of seabirds collected from the Alaska Maritime National Wildlife Refuge in the western Aleutian Islands. We test whether larger birds (and those with larger intestinal volumes) contain more plastics and larger pieces of plastic, and whether the diversity of plastic types relates to the diversity of parasites. We also examine how trophic position and diet composition relate to the plastics found in the gastro-intestinal tract, as some plastics are likely to be consumed directly (intentionally), while others are acquired by eating prey items with plastics inside of them. Infections by parasitic helminths are also acquired via trophic interactions among seabirds and their prey items and could be directly impacted by plastics in the digestive tracts of their hosts.

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Causes of nest loss in American Oystercatchers; an analysis of video-monitored nests (Oral)

Observations of 3,894 nesting attempts by ~2,500 breeding pairs of American Oystercatchers (*Haematopus palliatus*) in coastal North Carolina, U.S.A. between 1997 and 2016 indicate that approximately one third of clutches survive to hatch at least one egg. Nests fail due to a variety of causes including storms, predation, and abandonment. Even with regular nest monitoring (visual nest checks every 1-3 days) it is often difficult to assign a cause of nest failure because

evidence disappears quickly after nest failure. Historically we have been able to assign a cause of nest failure to approximately 40% of failed nests based on periodic visual observations. Between 2010 and 2015 we monitored 113 nesting attempts using continuous digital video recordings at Cape Hatteras and Cape Lookout National Seashores. From a total of ~44,000 hours of recorded video, we documented the causes of nest failure at all 65 nests that failed. In general, causes of nest loss at video-monitored nests; raccoon (51%), abandoned (15%), coyotes (11%), fox (9%), overwash/wind (8%), crow (5%), opossum (1%) were similar to those determined by traditional nest monitoring methods. Causes of nest loss identified at 904 visually-monitored nests between 1997 and 2016 included; raccoon (24%), abandoned (10%), coyote (4%), fox (6%), overwash/wind (36%), avian predator (5%), cat (5%), ghost crab (3%), mink (1%), opossum(1%), rat (1%), colonial nesters (1%), and human disturbance (3%).

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Status, distribution and threats of five breeding species in Sečovlje Salina Nature Park : prescription of biodiversity conservation for the area (Poster)

Mediterranean Salinas are national areas of exceptional cultural, economic and aesthetic values, where biodiversity can be regulated and maintained. Active salt pans are a good example of cohabitation between economic activity, tourism and conservation needs. And it is perhaps this very fact that keeps them alive, given that economic aspirations are more than negligible in these areas. The Sečovlje Salina Nature Park is a national territory of high natural, cultural, economic and aesthetic value, and its biodiversity is maintained and regulated through sustainable management. The management of the area for biodiversity and cultural heritage protection subordinates the purely economic goal of salt production and sale. Our long-term objectives of the Park's management are directed towards protection and sustained conservation of natural beauties and thus biodiversity of Sečovlje Salina, as well as towards protection of cultural heritage and the characteristics of littoral cultural landscape of Slovenian Istria. Results of long-term bird monitoring and management of water regimes for salt-production and biodiversity were used to set up management prescriptions for the area. Altogether, 304 bird species were registered at least once at Sečovlje Salina within the 1870–2017 period and data on their occurrence and locations were collected and analysed. The results obtained from monitoring birds and salt-production were transferred in the management prescriptions. The success of those prescriptions was measured on five indicator bird species (Kentish Plover *Charadrius alexandrinus*, Blackwinged Stilt *Himantopus himantopus*, Common Tern *Sterna hirundo*, Little Tern *Sternula albifrons* and Pied Avocet *Recurvirostra avosetta*). It has been demonstrated that the populations of all indicator species are stable or even increasing which confirms that traditional salt-making could be at the same time economically viable and support bio-diversity and cultural heritage protection. In our study the threats and impacts of traditional salt-making processes, predators, visitation and inundating on selected biodiversity indicator species are analysed. The results of the analyses were used to define a zoning of the area, provide management prescriptions for biodiversity conservation and adapt measures to guide visitation of the area with a minimum disturbance for wildlife and habitats. However climate change is expected to result in an acceleration of current rates of sea level rise, inundating many low-lying coastal and intertidal landscapes. This could have important implications for

many coastal habitat types and related organisms that depend on these habitats, including shorebirds that rely on them for feeding, overwintering and breeding. Potential change in the availability of suitable breeding area according to linear and modelbased sea level rise scenarios was modeled for four breeding birds (Kentish Plover, Little Tern, Common Tern and Black-winged Stilt) in Sečovlje Salina Nature Park, based on precise mapping of nests over a period of 10 years and on present environmental predictors. Different breeding niches for the studied bird species were identified, which indirectly indicates different responses to environmental change, in this case triggered by climate change induced sea level rise.

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Positive response to native wetland plants and historic hydrologic and geomorphic conditions by five species of endangered Hawaiian waterbirds (Oral)

The fauna and flora of the Hawaiian Islands have been under siege since the arrival of Captain Cook in January 1778. All flightless birds are now extinct and exotic vegetation has dominated much of the islands up to the 4000-foot elevation by the mid-20th century. Wetlands have received the blunt of invasion by exotic plants and animals because of their distribution at low elevations. By the end of the 20th century all too many wetlands were overgrown with dense robust exotic vegetation. There was little evidence of native nut grasses and other plant species characteristic of tropical wetlands on lands managed by the state or federal government. A more concerted effort to understand the importance of native plant species for endemic wildlife and how to manage these wetland plants was initiated in the 1990s on the Hanalei and Huleia National Wildlife Refuges on the island of Kauai. The site of the studies focused on 43 acres of intensively managed wetlands on the 346 acre refuge within the Hanalei River floodplain on the North Shore of Kauai. Small numbers of four endangered Hawaiian waterbirds used these managed wetlands on Hanalei Refuge before 2000 including Hawaiian duck or Koloa (*Anas wyvilliana*), Hawaiian coot (*Fulica alai*), Hawaiian Moorhen (*Gallinula chloropus sandvicensis*), and Hawaiian stilt (*Himantopus mexicanus knudseni*). Koloa numbers revolved around 15 to 25, 2 or more moorhens were encountered consistently, but coot and stilt were rarely present amongst the dense exotic vegetation from 1972 to about 2005. As exotic vegetation was gradually removed through aggressive mowing, tilling, and herbicide treatment, more bare mineral soil was exposed where newly germinating native tropical wetland plants were encountered with greater frequency. With recognition that the endangered avifauna responded well to native plant communities an effort was made to reconfigure units so that native plant communities could be managed more effectively to meet the diverse needs of these four-endangered species. The fifth endangered species the Hawaiian goose or Nene (*Branta sandvicensis*) was reintroduced to Kauai in 1985 and 24 were released on Hanalei Refuge in 2000. The species also responded positively to improved habitat conditions. By reconfiguring management units to match geomorphic and hydrologic conditions, focusing on promoting native wetland plants, and recognizing the importance of invertebrates for protein, all five-endangered species responded favorably to the structure as well as food abundance and distribution created by a carefully crafted sequence of habitat conditions across the limited area of intensive management. Contemporary surveys suggest as many as 700 Koloa, 600 moorhens, 350 coots, 350 stilts, and 150 Nene are now associated within the refuge habitat