

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

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Using state-space modeling to identify areas of persistent winter activity and their associated environmental conditions in Northern Gannets

Satellite telemetry data provide an understanding of the spaces birds use throughout the year as well as individual movement behavior. This behavioral data can be an overlooked component in satellite telemetry studies, but can provide information about what an animal is doing at a given location and that provides additional information for prioritizing marine habitat. In this study, we used three years of satellite telemetry data from Northern Gannets (*Morus bassanus*) wintering on the Atlantic coast of North America to build a state-space model in the JAGS Bayesian modeling environment. This model was designed to: (1) use all telemetry data acquired in a day to determine the most likely daily position of an individual, and (2) employ a correlated random walk model with a behavioral switching component to identify whether a given location was part of a transient or stationary behavioral pattern. We wanted to identify these persistent 'stationary' areas that are likely used for foraging and resting and the environmental covariates (e.g., sea surface temperature and water depth) that were associated with those areas. With 32 individuals tracked over three winters, we found that positions were classified as stationary behavior 67% of the time. Stationary behavior locations were associated with shallower waters, which suggests these areas are likely better for resting or foraging. Lastly, individual variation in movement behavior was high with some individuals traveling long distances, while others were more sessile. Overall, this model has helped us not just identify areas frequently used by Northern Gannets, but also identify areas that were of high value to these birds over the winter and why these areas were selected. **ORAL**

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Abundance, habitat use, and geographic origin of non-breeding oystercatchers in North Carolina

American Oystercatchers (*Haematopus palliatus*) are present in North Carolina year-round—during nesting, migration, and wintering seasons. Range-wide aerial surveys have identified flocks wintering in North Carolina, representing about 6% of the total population. Because the Western Atlantic population of American Oystercatchers is of conservation concern, it is important to know the status of the species and habitats used within North Carolina during non-breeding as well as breeding seasons. From 2009-2012 during fall migration, winter, and spring migration we surveyed four major North Carolina roost sites (consistently >50 birds) which represent the majority of wintering oystercatchers in the state. Mean abundance was greatest during winter and lowest during spring migration at all sites. Peak winter abundance at Ocracoke Inlet was 158, 242 at Back Sound, 115 at Masonboro Sound, and 399 at the Lower Cape Fear River. Most banded oystercatchers at the four sites nested in or were fledged from North Carolina. About 15% of the oystercatchers used wooden docks as roost sites; the rest were on natural sites (shell rakes and sandy shorelines of estuarine islands) and a rock wall constructed in the 1880s. Levels of anthropogenic disturbance were low at all four major sites, though most sites are not in protected areas. Long-term monitoring of oystercatcher roost sites provides information on population trends and can inform decisions regarding land conservation and habitat protection. **ORAL**

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Quantifying the effects of disturbance on staging Roseate Terns (*Sterna dougallii*) on the Cape Cod National Seashore

Despite ongoing management efforts at breeding colony sites, the federally-endangered Northwest Atlantic breeding population of roseate terns (*Sterna dougallii*) (ROST) has declined more than 20% since 2000. The results of a 20-year study of adult survival strongly suggested that post-fledging survival during the first year of life could be a major factor limiting population recovery and driving the decline, and that over 90% of the population stages in and around Cape Cod, MA in the fall. The purpose of this research is to (1) examine geographic and temporal variation in the use of staging sites at Cape Cod National Seashore (CCNS) by ROST, (2) quantify rates and causes of naturally-occurring and human-related disturbances, and (3) document effects that disturbances may have on the behavior of mixed species flocks of common terns (*S. hirundo*) (COTE) and ROST, and their use of CCNS staging areas. We created a means of comparing disturbance levels across staging sites with varying characteristics. Preliminary results indicate that ROST flocks are subject to frequent flushing by human activity at most sites within the CCNS, but there is little evidence of activity budgets differing by site disturbance level. We found a significant difference in flock responses to natural vs. anthropogenic disturbance sources, as well as flight initiation distances. **ORAL**

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Shorebird monitoring in selected sites of Laguna Madre, Tamaulipas.

The current work was carried out on 5 sites within la Laguna Madre of Tamaulipas, located in the municipalities of Matamoros, San Fernando and Soto la Marina, the monitoring was conducted during three wintering periods (2013, 2014 and 2015). Sites were selected through a participatory workshop carried out in South Padre Island, Texas, in October 2013; in which both U.S and Mexican specialists were present. The main objective of this project was to increase knowledge about shorebird species richness and abundance that use the Laguna Madre during migratory season.

Sampling sites were located in beach and intertidal zone habitats. Censuses were performed using count point methods for lagoons and dams, and transects with no distance estimates for coastlines. Each site was visited twice a day (morning and afternoon). Throughout the three years of monitoring 38,513 individuals had been recorded, belonging to 33 species, 13 genera, 4 families and 1 order. The most abundant species was *Calidris mauri* with 6,579 individuals. Priority species for international and national conservation such as: *Charadrius melodus*, *Numenius americanus*, *Haemantopus palliatus*, *Arenaria interpens*, *Calidris alba*, *Calidris canutus*, *Charadrius nivosus* y *Calidris canutus* were also recorded. We found that sites with better habitat for migratory shorebird species were those located in Matamoros and Soto la Marina. Hence we must prevent further deterioration as well as implement public awareness programs among the locals, at last delimitate important breeding and wintering areas for shorebirds. **ORAL**

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Unexpected breeding season dynamics of persistent organic pollutants in Arctic Terns

The goal of this study was to examine whether concentrations of persistent organic pollutants (POPs) in Arctic Terns changed over the course of their breeding season in the Canadian Arctic. Liver samples were taken from 40 Arctic Terns collected on Nasaruaalik Island, just north of Cornwallis Island, Nunavut during four distinct phases of the 2007 breeding season. Despite spending most of the year at each pole, away from point source pollution, POP concentrations were comparable to those of other arctic breeding seabirds. $\delta^{15}\text{N}$ showed that both male and female Arctic terns were feeding at higher trophic levels as the breeding season progressed. Given previous studies showing the strong positive relationship between trophic level and POP concentration due to biomagnification, we predicted that POP concentrations would increase as the breeding season progressed. We also predicted that females may show a decrease in POP concentrations after transferring contaminants to her eggs. Surprisingly, we found the opposite: males arrived on the breeding grounds with higher concentrations of ΣPCB and ΣDDT , which then decreased substantially over the breeding season, while females arrived with much lower concentrations of ΣPCB and ΣDDT , which remained relatively constant. Female seabirds are frequently observed to have lower POP concentrations than males, but these results suggest that explanations beyond transfer to eggs should be considered. The higher concentrations in males upon arrival suggests a possible difference in diet between the sexes during migration. **POSTER**

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Changes in nest site selection and colony distribution on Great Duck Island, Maine

Great Duck Island has supported a significant population of Herring Gulls (*Larus argentatus*) since at least the late 19th century. The population was severely reduced by gull control measures in the 1930's, but subsequently rebounded to approximately 50% of its original size. Gulls nest in a series of sub-colonies around the periphery of the island. The island's lighthouse was abandoned in 1986, at which time no gulls were nesting at the island's southern end. When the light-station was re-occupied in 1999, approximately 100 pairs of Herring Gulls and a single pair of Great Black-backed Gulls (*L. marinus*) nested in the southern sub-colony. Nests in the southern portion of the island are the subjects of regular disturbance by student researchers examining chick growth, trapping and marking adults, etc. In spite of this, the population of this area has increased exponentially, until by 2014 it held over 600 nests –more than 50% of the entire island population. Black-backed gull nests have increased to over 20 nests, most located in discrete areas of the Herring Gull colony. Other sub-colonies on the island have declined or at best held within a margin-of error. We hypothesize that a major factor in these changes is predation by Bald Eagles (*Haliaeetus leucocephalus*) which may be deterred by researchers' presence in the vicinity of the light station. Although the total gull population of the island has increased during the period of study this increase may mask real impact by predators on gull behavior. **ORAL**

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Shorebird hunting in the Caribbean and northern South America

In September of 2011, two satellite-tagged Whimbrels (Machi and Goshen) were shot in Guadeloupe, and their story of navigating a hurricane only to meet their demise after making landfall catalysed action in the Caribbean. The shooting deaths of Machi and Goshen sensitized the hunting public to the international attention now focused on their hunting practice. As part of the Atlantic Flyway Shorebird Initiative, we have been developing a set of strategies to address the shorebird hunting issue, which includes: 1) understanding the diversity of shorebird hunting policies among the numerous jurisdictions within the Caribbean Sea and along the northern coast of South America, 2) quantifying legal and illegal harvest pressure on shorebirds, 3) making hunters and other publics more aware of migrations of shorebirds and the effects indiscriminate hunting can have on shorebird populations, and 4) managing shooting-free shorebird refuges, and increase enforcement of regulations in areas where shorebird hunting is illegal. We believe these strategies will lead to policy changes that lead to a sustainable harvest of shorebirds in Caribbean and South American countries. We will report on the development of a conceptual model of hunting pressures and contributing factors, the strategies to ameliorate the hunting threat, and progress we have made on implementing the strategies. **ORAL**

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Distribution, status, and conservation of flamingo populations in South America.

There are six flamingo species in the world, three of which are found in southern South America. The Chilean Flamingo (*Phoenicopterus chilensis*) has a broad distribution throughout the region, while the Andean Flamingo (*Phoenicoparrus andinus*) and Puna Flamingo (*P. jamesi*) are mainly restricted to wetlands in the Andes Mountains of Argentina, Bolivia, Chile and Peru, though part of the population disperses to lowland wetlands in Argentina in winter. Population estimates are obtained through comprehensive, simultaneous censuses that target over 250 wetlands throughout the range of the Andean and Puna Flamingos. These censuses began in 1997 to establish a baseline estimate and have been conducted at 5-year intervals since 2000. From 30 January-15 February 2015 we carried out the 6th international simultaneous flamingo census. Preliminary results indicate population estimates that are 45% higher for Andean Flamingos and 48% higher for Puna Flamingos than previously recorded. Breeding was successful, with 26,000 Chilean Flamingo chicks hatched in Mar Chiquita, Argentina, and 20,000 Andean Flamingo chicks hatched at Laguna Colorada, Bolivia. We have established that there are wetlands where we consistently find flamingos in significant numbers, and there are a few colonies that are producing the majority of recruits to the population. However, we have observed sites where numbers fluctuate greatly from year to year and have detected sites where breeding activity has increased in the past 5 years. While flamingos are adapted to widely changing conditions, increasing pressure on wetlands from mining, agricultural expansion, and human disturbance, as well as landscape-level processes like climate change, threaten the temporal and spatial dynamics of the regional wetland complex that support these flamingo populations. **ORAL**

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Migration speed of Western Sandpipers from Panama to Alaska

We tracked Western Sandpipers (*Calidris mauri*) for four years from overwintering areas in Panama and Mexico north to Copper River Delta-Prince William Sound Alaska. Migration speeds varied depending on

origin of birds, latitude, date, and year. Wind and bird mass at tagging also influenced migration speed and length of stay in stopover areas. **ORAL.**

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Using Louisiana Waterthrush (*Parkesia motacilla*) and Aquatic Insect Metrics to Gauge Productivity in Two Eastern Hemlock Habitats

Eastern Hemlock trees are declining as a result of the introduced insect pest, the Hemlock Woolly Adelgid. The threat of losing hemlock habitat and its unique biodiversity has become a concern due to ineffective and costly pest control methods. We compared the biological productivity of two hemlock habitats: headwater ravines with steep gradients and fast flowing streams, and benches where streams meander across flat floodplains. Previous studies indicate the Louisiana Waterthrush to be a robust bioindicator of headwater stream ecological integrity. We quantified waterthrush reproductive metrics on 49 occupied territories and also used aquatic macroinvertebrate data to compare productivity among two ravine and two bench streams. Louisiana Waterthrush breeding densities were significantly greater on benches ($p = 0.003$). Greater reproductive output was found on benches compared to ravines. Bench pairs frequently raised double broods while ravine pairs were never observed raising a second brood. All waterthrush pairs exhibited similar nesting chronology and clutch sizes, and no differences were detected among stream types. It was found that mayflies, stoneflies, and caddisflies, collectively known as EPT, and favored as food by waterthrushes, dominated the insect taxa on all streams. The insect phenology data indicates peaks of EPT abundances at various time intervals which may suggest a correlation with waterthrush nesting activity. More study is needed to determine which habitat type should receive priority should an effective HWA treatment become available to use at large spatial scales. **ORAL**

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It's all happening here: Prospecting and settling as behavioral mechanisms to assess prospects of successful breeding

The choice of a colony and a nesting site is an important decision in colonial birds which may take several years. The ultimate aim for the individual is to get information on commodities and their predictability, to maximize reproductive success and fitness. During the prospecting period individuals make the decision to be philopatric or to disperse, and base it on specific environmental cues such as habitat suitability and availability of mates by comparing environmental conditions between colonies. Behavioral mechanisms are conspecific attraction, amenities of large colonies, group adherence, availability of potential mates, and public information. After the decision in favor of a specific site, individuals develop philopatry, site tenacity and preferences for one subcolony to establish a breeding territory as a basis to recruit. These settling decisions are challenging as recruits suffer from delayed laying under high densities and strong competition for territories, and may be forced to nest at poor sites at the colony periphery. As a consequence, in the years after first breeding individuals often show subcolony or mate change. Some examples are presented elucidating how individuals make settlement decisions. Knowledge about behavioral processes regulating settlement is important for understanding life history strategies and demography, including immigration and emigration. It is also the basis of effective conservation efforts, e.g. by creation or management of colony sites, or by enhancement of conspecific attraction through decoys or playback of a colony's background noise. **ORAL**

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Models of Northern Gannet at-sea distribution in Canadian waters using the GeoAviR R package

Knowledge of seabird at-sea distribution is paramount to identify density hotspots and potential effects of anthropogenic and environmental changes. We used the Northern Gannet as a model species for its wide usage of the Canadian waters between April and November. Data were collected between 2006 and 2014 on ships of opportunity using distance sampling. The GeoAviR R package allowed us to build distribution models of gannets using a 100 x 100 km grid, NAFO fishery zones, and density surface modelling. The package use a Bayesian one stage approach to fit both the distance and abundance model at once. The three distribution models and their associated coefficients of variation sometimes showed differences related to both the selected spatial units and environmental covariates. **POSTER**

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The influence of plumage coloration on nesting behavior in Reddish Egrets

Differences in avian plumage colorations can provide a unique opportunity to study behavioral variances in a single species. Foraging behaviors have previously been studied in the plumage dimorphic reddish egret (*Egretta rufescens*), but less is known about nesting behaviors and time budgets during nesting, and what differences exist between the two plumage morphs. Activity engaging in specific behaviors may vary temporally in response to fluctuations in daily temperature changes and nest predation by other avian species. It was predicted that there are distinct behavioral differences between the two plumage morphologies during the nesting season. We tested this hypothesis by developing an ethogram of nesting reddish egret behavior on Green Island, TX based on video recordings of active nests. Eight cameras were placed during the nesting season in 2008. The videos were used to determine the hatching time intervals between the eggs at each nest, keeping in consideration the known time intervals for other Ardeidae species. Additionally, we compared the amount of time individuals engaged in each distinct behavior between daytime and nighttime, and between the two plumage morphs. Results from over 6,600 minutes of observation suggest that dark morphs leave nests unguarded ($\bar{x} = 14.03$ minutes, $s^2 = 9.15$ minutes) for considerably longer lengths of time than white morphs ($\bar{x} = 1.31$ minutes, $s^2 = 0.69$ minutes) while white morphs switch off parental care more frequently. Egg hatching times were determined to be shorter on average, and closer together, than other Ardeidae species. We are currently analyzing additional time from the nesting periods to more fully explore the relationship between daily changes in temperature and predation, and changes in nesting behaviors, for each plumage morph. **ORAL**

Burger, Joanna; Michael Gochfeld

Human activity, avian sensitivity and conservation

A wide range of studies with nesting and foraging birds indicate that they are responsive to the activities of people, and that response appears to differ both in type and intensity. Yet few authors have examined several species using the same methods. We review our studies with nesting colonial birds and foraging birds to examine species differences in approach distance and behavior, response to different types of intruders, and differential return rates following disruptions of behavior. Behavioral responses of nesting birds partly depends upon colony numbers and species-typical defense. Species that have active defense allow closer approach and return more quickly than species without active mobbing. We suggest that behavioral responses of foraging birds also depends on flock size and density, as well as apparent species differences, spatial availability of food, and predator avoidance. That is, smaller birds with more agility allow closer approach, and will approach humans more readily when foraging. If there are feeding alternatives nearby, birds may not return to disturbance areas, while if food is highly localized, they have little choice, and may return quickly, or not until the next tide cycle. Regardless of whether they are breeding or foraging, birds respond to the behavior of intruders (e.g. direct vs tangential approach, noise level, speed of approach, eye contact).

Increasing human contacts between people and birds in coastal habitats increases disturbance frequency and duration. Conserving populations of nesting and foraging birds entails understanding not only the behavioral responses of birds, but the context of the human activities, species-typical differences in tolerance or avoidance, and the particular vulnerabilities of endangered or threatened species. **ORAL**

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Common Tern nesting behavior and colony disturbance on a natural Island in Northern Lake Michigan

Common Terns (*Sterna hirundo*) are a threatened or endangered species across the Great Lakes Region and their population has been declining over the last forty years. This project involved conducting Common Tern population counts, monitoring tern breeding behavior, and determining causes of colony disturbance on a natural island in the Beaver Archipelago of northern Lake Michigan. One large colony was located by boat survey in June of 2015, and a breeding population count was conducted. A total of 188 nests were individually marked and inventoried in June. Multiple flooding events between 27 June and 01 July resulted in the failure and abandonment of many these nests. Some birds did re-nest on site, but these nests, although identified, were not inventoried to avoid further disturbance at the colony. Cameras recorded disturbances including predation and trespassing by other avian species, as well as unknown sources, and these appeared to affect Common Tern incubation effort and the number of adult terns at the nest at any given time. Disturbance frequency and severity appears to impact Common Tern nesting behavior and influences overall breeding success of this threatened/endangered Great Lakes species. **POSTER**

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Essential social, cultural and legal perspectives on cormorant-fisheries conflicts: the European approach.

Only 3,500-4,300 pairs of Great Cormorants *Phalacrocorax carbo sinensis* bred in a core area of Europe by the early-1960s. Through protection and high prey availability, numbers reached 95,000 pairs by 1995. Simultaneously, the population extended into central Europe and the Baltic Sea, returning to areas where it had been extinct for a century or more. By 2006 numbers across 'all' Europe reached approximately 219,400 pairs. Cormorants are accused of damaging fisheries, aquaculture and angling activities, resulting in intense 'human:wildlife' conflicts. Investigations have highlighted the role of socio-cultural issues in these conflicts and their management within legal frameworks and shown that the positions taken often differ between groups (e.g. local stakeholders, policy-advisors, ecologists) and are influenced by people's values, attitudes, experiences and beliefs. Such conflicts are thus better described as 'human:human' ones. Across Europe we explored (1) the processes of moving from a natural-science perspective to interdisciplinary ones incorporating intensive stakeholder engagement, (2) the framing of arguments – from science, law, policy and the media, (3) several case studies - in relation to a number of recurring issues. Cormorants are protected in Europe and deliberate killing/disturbance is only allowed under licence. As well as diverse site-specific management actions, some 10,000 nests were reported destroyed and over 75,000 birds killed annually in the non-breeding season (2006-07). Cormorant management is thus a complex issue in Europe where conflicts are as much a matter of human interests as they are of biology. Continued integrated interdisciplinary scientific research (biological, social, economic) is needed to develop any sustainable form of collaborative management for Cormorant-fisheries conflicts across Europe and to build an effective multi-national conflict management process for such complex human:wildlife interactions. **ORAL**

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Climate-related challenges to the reproductive success of the King Rail

King Rail (*Rallus elegans*) populations are experiencing long-term declines attributable to habitat loss. Sparse breeding populations in coastal areas may represent the last strongholds for this species, but climate change models predict these are at risk from extreme weather events, including rising temperatures and higher frequencies and intensities of storms, with associated risks of storm surge and flooding. A breeding population at Mackay Island National Wildlife Refuge (NWR) in coastal North Carolina likely represents an important source population for the region. We are investigating the effects of elevated temperatures and rising water on the hatching success of King Rails at Mackay Island NWR and whether they have evolved behavioral plasticity in nesting behavior to mitigate these threats. Alternatively, variation among parents in nesting effort may be related to individual differences in body condition. Using Thermochron iButtons inside model eggs, data collected in 2014 suggest that high ambient temperatures contributed to nest failure, and video recordings reveal King Rails adjust their incubation behavior in response to ambient temperatures. Shading their nest may allow King Rails to maintain their clutches below lethal temperatures in hot conditions, though likely at a cost to themselves. Coastal marsh breeders must also contend with water level variation, and rails (family *Rallidae*) add material to their nests throughout incubation to prevent nest flooding. Preliminary video analyses show King Rails spend more time building when water level approaches the top of their nest, regardless of body condition. Analyses are ongoing, but the results will help us understand whether King Rails inhabiting coastal areas exhibit sufficient behavioral flexibility to tolerate extreme environmental perturbations. **POSTER**

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How loons swim: a high-speed, underwater view

Loons (*Gaviiformes*) are arguably one of the most successful groups of swimming birds. As specialist foot-propelled swimmers, loons are capable of diving up to 70 meters and remaining underwater for several minutes. They survive by capturing fish, a skill that requires a high level of maneuverability and speed. Despite the swimming prowess of loons, their locomotion has never been critically investigated. Do loons generate propulsive forces similarly to other foot-propelled divers, or have loons evolved a completely novel way of swimming efficiently? Our study used high-speed underwater cameras to film four captive common (*Gavia immer*) and red-throated (*Gavia stellata*) loons swimming in large rehabilitation pool at the Tufts Wildlife Clinic (North Grafton, MA). Our findings show that loons swim by synchronously paddling their feet laterally, similar to a frog, instead of underneath the body. These motions resemble those used by grebes, despite claims that this swimming strategy is made successful by the grebe's lobate toes. Loons are burst and glide swimmers, paddling their legs between 3 and 5 times per second. Each swim stroke consists of two main phases: propulsion and retraction. Each phase accounts for approximately half of the stroke time, with minimal gliding while the legs are held behind the bird. During retraction the head of the loon remains still while the body continues to travel forward, similar to head bobbing mechanisms observed in terrestrial birds. This strategy has been proposed to aid visual acuity by maximizing parallax during acceleration and increasing motion identification while stationary. Our findings are instrumental for understanding loon performance, habitat selection, and evolution. Our work could contribute to understanding human impact on loons and inform future conservation plans. **ORAL**

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A sliding scale of habitat specialization in tidal marsh birds of the Northeastern United States

Specialist and generalist species react differently to habitat stressors across taxa. We explored the relationship between habitat specialization, relative abundance, and population trends in the bird community in coastal marshes in the northeastern United States. We utilized a 20-year database compiled by the Saltmarsh Habitat and Avian Research Program (SHARP) of point count surveys conducted in tidal marshes to develop a species abundance distribution of birds that utilize tidal marsh habitat either exclusively or incidentally for breeding or foraging purposes. We developed population trend data in the most abundant species across taxonomic families to compare population trends in specialist and generalist marsh birds both within and across phylogenies. We also developed a quantitative method of assessing tidal marsh specialization using the Breeding Bird Survey (BBS) data within 100 km of the coastline as a proxy for terrestrial use in conjunction with contemporary SHARP survey data from the same year. We compared these population trends and specialism index values to relative abundance in tidal marshes and found that both within families and across all bird species, population trend estimates decrease as degree of specialization increases; the more specialized a species is to tidal marsh, the worse it is likely to fare over time, with the strongest family example occurring in the family Emberizidae. **ORAL**

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Tidal restriction drives specialist avifaunal collapse in northeastern tidal marshes

Coastal marshes along the northeastern seaboard of the United States support a significant portion of the world's vertebrates endemic to this habitat. This section of coastline is also densely populated by humans, and as a result has been highly modified, specifically through the installation of tidal restrictions and ditching. Sea-level rise (SLR) and extreme storm events also alter these marshes on a regional scale. The saltmarsh sparrow (*Ammodramus caudacutus*), Nelson's sparrow (*A. nelsonii subvirgatus*), seaside sparrow (*A. maritimus*), willet (*Tringa semipalmata semipalmatus*) and clapper rail (*Rallus longirostris*) breed almost exclusively within these tidal wetlands, and are potentially vulnerable to these anthropogenic agents of change. We combined datasets of historical marsh bird surveys with the regional dataset collected by the Saltmarsh Habitat and Avian Research Program (SHARP) in 2011 and 2012 to generate the first set of population trends for these specialist bird species across five spatial scales. Additionally, we quantify flooding risk and past marsh management practices along the coast to explore possible drivers for this observed change. We find regionally that the saltmarsh sparrow, clapper rail, and Nelson's sparrow are in clear decline, with an approximate 5%, 5%, and 3% annual population loss respectively, while willet and seaside sparrows maintain their populations over this time period. We find that flooding risk, mosquito ditching, and tidal restrictions

affect trends differently for each species, but at a community scale populations in tidally restricted areas are declining significantly faster than those at unrestricted marshes. Further, this trend is stronger than that of ditching or flood risk, indicating that human-developed tidal restrictions, not sea-level rise, may be the dominant driver of specialist avifaunal collapse in northeastern tidal marshes. **ORAL**

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Using an aquatic passerine to assess mercury and other trace element exposure in the Upper Midwest, USA

Tree swallows (*Tachycineta bicolor*) are a small aquatic passerine whose diet is mainly the aerial stage of benthic aquatic insects. Because of this, they can be used to assess the bioavailability of chemicals in contaminated sediments. Whereas the upper Midwest has few known point sources for mercury contamination, there is concern about aerial sources, such as power plants. Because of the prevalence of ephemeral wetlands and lakes with low pH in the upper Midwest, both of which have been shown to increase the bioavailability of some trace elements such as mercury, a series of studies have been done across the northern tier of U.S. states (MN, WI, and ND) to assess trace element exposure at remote locations without known point sources. Concentrations of mercury in tree swallow eggs averaged between 190 and 230 ng/g dry wt. (Lostwood National Wildlife Refuge, ND), 228 and 300 ng/g (Voyageurs National Park, MN), 220 and 250 ng/g (Agassiz National Wildlife Refuge, MN), and 210 and 280 ng/g (10 lakes in northern WI). Mercury concentrations were higher in more ephemeral (ND) wetland nesting sites and at lakes with lower pH (WI). These exposure levels, however, are far below reproductive-effect concentrations. Likewise, at all study sites, exposure to other trace elements including lead, selenium, and cadmium were minimal as well.

ORAL

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Health assessment of Tree Swallow nestlings from the Great Lakes: A terrestrial model for evaluating contaminated aquatic ecosystems

Assessment of ecosystem health is essential when evaluating the effectiveness of remediation actions across the Great Lakes. Evaluations of the impacts of sediment contamination must look at both aquatic and terrestrial ecosystems. Although sediment contamination has been documented to impact benthic macroinvertebrates, fish, and other aquatic organisms, the linkage between sediment contamination and terrestrial ecosystems is less well understood. Tree swallows (*Tachycineta bicolor*) can be used to address this gap. They are a well-established avian model, the adults nest along shorelines, and they feed their nestlings emerging aquatic insects from a small area adjacent to their nest. As a result, toxic responses in tree swallow nestlings have been linked to local sediment contamination. The aim of the current study was to assess biomarkers in tree swallow nestlings collected from contaminated areas across the Great Lakes region. Flow cytometry was used to quantify cell-to-cell variation in DNA content, a measure of chromosomal damage. Ethoxyresorufin-*O*-dealkylase (EROD) activity was used as a biomarker of exposure to select polycyclic

aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Tree swallow nestlings from 31% of sites had significantly elevated levels of chromosomal damage, and 53% had elevated EROD activity. Preliminary analyses suggest a weak, but significant correlation between chromosomal damage and EROD activity. Increased tissue concentrations of PCBs were also documented in nestlings, with PCB concentrations correlating significantly with EROD activity. **POSTER**

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Double-crested Cormorant Population Trends in the North American Great Lakes: 1970s-2014

Efforts to monitor Double-crested Cormorants in the Great Lakes region have been ongoing since the 1970s when the decadal Great Lakes Colonial Waterbird Survey was first initiated. Because wide-spread cormorant population management began in many portions of the Great Lakes early in the current century, a more frequent effort to monitor cormorant numbers was initiated in 2005. This presentation provides an overview of changes in cormorant abundance during a period of approximately 40 years which can be characterized by rapid population growth followed by intensive management to reduce breeding pair numbers. For each census period, we obtained breeding pair estimates from direct nest counts during colony visits or from aerial photographs. Many cooperators from the region contributed data following specific census protocol. Beginning in 1977, DCCO numbers were < 1000 breeding pairs. The estimate jumped to 23,000 pairs in 1989, 86,000 pairs in 1997 and 115,000 pairs in 2005. By the 4th decadal census in 2009, the pair estimate declined to 106,000. Since 2009, Canada has not conducted biennial counts so only U.S. estimates can be reported. As recent as 2014, the U.S. pair estimate declined from approximately 53,800 to 38,000 pairs. Although management has likely resulted in much of the decrease in breeding birds, significant changes in the ecology of the Great Lakes have also occurred and the dual roles of population reduction and invasive species impacts on cormorant abundance are currently not understood. **ORAL**

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Effects of tamarisk (*Tamarix* spp) biocontrol and removal on riparian breeding bird species of the Colorado Plateau

Invasive, non-native tamarisk (*Tamarix* spp.) trees are common along riparian corridors of the southwestern United States. Attempts to eradicate tamarisk include the introduction of the tamarisk beetle (*Diorhabda* spp.) and manual removal of trees. In 2008, immediately prior to the arrival of the tamarisk beetle along the Dolores River in southwestern Colorado, two study areas (MIDO and LODO) were established to investigate the effects of the beetle on local vegetation and riparian bird species. Both sites experienced peaks of 90% defoliation and 25% yearly reduction in tamarisk density during the first three years of beetle presence. Manual removal resulted in tamarisk eradication at MIDO in 2012. As of 2014, the native vegetation had not increased in density at either site following tamarisk decline. Abundance and occupancy of Yellow Warbler (*Setophaga petechia*) did not change at either site, while there was mixed evidence for a decline of Yellow-breasted Chat (*Icteria virens*) and Common Yellowthroat (*Geothlypis trichas*) at MIDO. Blue Grosbeak (*Passerina caerulea*) declined in abundance and had a higher extinction rate at MIDO (0.78 ± 0.13 SE) following tamarisk eradication at that site than at LODO (0.15 ± 0.09 SE) during the same time period (2012-

2014). Willow Flycatcher (*Empidonax traillii*, likely the endangered *E. t. eximus*) was present at both sites in 2013 only. Lazuli Bunting (*Passerina amoena*) disappeared from both sites after 2011 and reappeared in record numbers in 2014, coinciding with a drop in beetle numbers and the resulting tamarisk refoitation. This study suggests that, while some riparian bird species may be resilient to tamarisk control activities, follow-up management may be needed to encourage the regrowth of native vegetation to benefit more sensitive species.

ORAL

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Decision support population modeling for Atlantic Coast Piping Plover recovery: 2015 field season

Nest enclosures are a common management tool used to increase nest success of the threatened U.S. Atlantic Coast Piping Plover (*Charadrius melodus*) population. However, evidence suggests that enclosures can increase nest abandonment rates, and at least some of this abandonment may be caused by adult mortality associated with enclosure use. The objective of the current project is to evaluate the effects of management actions and ecological and demographic characteristics on Piping Plover nest survival and abandonment associated with enclosure use, along with corresponding effects on population growth rate. We are using multinomial logistic exposure analysis in a Bayesian framework to assess the effects of covariates and enclosure use on nest survival and abandonment rates, which will be incorporated into a stochastic population projection model. The prototype population model, developed in 2014 with data from 23 sites, did not include site characteristics but the results indicate that effects of nest enclosures on population growth rate are year- and site-dependent. We developed a standardized data collection protocol that is being used at 14 sites along the U.S. Atlantic Coast during the 2015 breeding season. We will discuss the success of implementing this protocol, the ecological and behavioral covariates to be included in the nest survival model, and the preliminary model structure. This nest survival model will be used to develop a decision support tool for wildlife managers to predict site-specific effects of enclosure use on Piping Plover population growth rate.

POSTER

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Mitigation guidelines for loons on hydropower lakes

The Federal Energy Regulatory Commission (FERC) is responsible for licensing hydropower dams. The current process involves consultation with state agencies which make recommendations for license terms and conditions. The licensing process can take several years, but the final issued license and the associated terms last for the next 30-35 years. Many large hydropower projects in Maine have recently come up for FERC re-licensing and many more are expected in the coming years. The Maine Department of Inland Fisheries and Wildlife's (MDIFW) role in dam re-licensing is to consider the potential impacts to public trust species including the Common Loon (*Gavia immer*), request studies to determine those impacts, and to recommend mitigation measures to avoid or minimize impacts. The impacts of hydropower dam operations on Common Loons have been considered in the past, but not consistently. The information gained from surveys, monitoring, and mitigation efforts for Common Loons done on hydropower projects to date in Maine underscores the need for future consideration. MDIFW has begun to develop a protocol whereby knowledge of Common Loon territorial pairs, certain habitat features, and certain water level regimes are taken into consideration for determining when to request studies and mitigation measures as part of the re-licensing process. Last, MDIFW is interested in the development of a standardized protocol to be used in other states where Common Loons and hydropower coexist. **ORAL**

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Where did the yellow perch go? Analysis of double-crested cormorant consumption in Saginaw Bay, Lake Huron

Stakeholders and fishery managers expressed concern that double-crested cormorant (*Phalacrocorax auritus*) predation in Saginaw Bay may be a factor in the recent poor survival of yellow perch. Therefore, the objective of this study was to quantify cormorant diets from two nesting colonies in Saginaw Bay during April-September in 2013 and 2014, prior to any cormorant management, with special emphasis on any impacts on yellow perch (*Perca flavescens*). Cormorants (n=691) were collected when returning to colonies after foraging. Stomachs were removed and preserved in the field. Dietary items were identified, enumerated, and measured (n=23,373). Round goby (*Neogobius melanostomus*) had the highest frequency of occurrence and consumption by biomass in both years; followed by yellow perch in 2013 and emerald shiner (*Notropis antherinoides*) in 2014. Overall diet composition was more variable at Spoils Island than at Little Charity Island; however in both years round goby consumption was high from May through September at both locations. Emerald shiner, spottail shiner (*Notropis hudsonius*), freshwater drum (*Aplodinotus grunniens*), walleye (*Sander vitreus*), yellow perch, and white perch (*Morone americana*) were seasonally important by biomass in both years. Overall cormorant consumption (estimated using cormorant consumption demand rates) of yellow perch was compared to walleye consumption (estimated using percid stock assessment models) and was 73% as much as walleye consumption of yellow perch in 2013 and 26% in 2014. Cormorants were estimated to cause less of the total mortality of age-1 yellow perch than walleye. Analyses relating cormorant consumption to yellow perch and walleye population metrics will provide context on fish consumption rates and assist in management decision making. **ORAL**

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Creating high-tide refuge habitat for the endangered California Ridgway's Rail

The California State Coastal Conservancy is constructing earthen high-tide refuge islands (refuge islands) to provide high-tide refuge habitat for the endangered California Ridgway's rail (*Rallus obsoletus obsoletus*). This project is part of ongoing efforts by the Conservancy to increase the California Ridgway's rail population in the San Francisco Bay estuary. Predation on rails during extreme high tides has been identified as among the primary sources of adult rail mortality. Much of the historic tidal marsh-upland transition zone habitats that provided cover for marsh species during high tides have been lost to urban development, and the remaining transition zones have become less resilient to sea-level rise due to habitat modification or loss. In response, a team of wildlife and restoration ecologists, land managers, wildlife agency staff, and other stakeholders participated in a collaborative process to design and locate refuge islands that would most benefit rails. Refuge islands mimic natural channel levees that occurred historically in mature tidal marshes. Islands are constructed approximately 1.3 feet above Mean Higher High Water using marsh sediments excavated on-site and planted with salvaged marsh sod and nursery-grown native marsh plants; the islands are designed such that vegetation will provide suitable high-tide refuge for rails when mature. Monitoring of island topography, vegetation cover and survivorship, and rail responses to islands is ongoing and will inform subsequent habitat enhancement projects. **ORAL**

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The effects of haying on wet-meadow birds at Baca National Wildlife Refuge, Colorado

Covering over 4,000 ha, wet meadows are a prominent and important habitat feature at Baca National Wildlife Refuge (NWR). Historically, wet meadows at Baca NWR were sustained by the traditional practice of flood-irrigation during spring, followed by intensive haying in late summer and cattle grazing in fall and winter. The U. S. Fish and Wildlife Service has continued these practices with the goal of maintaining the condition of Baca wet meadows in their historical state, but the implications to avian populations are unknown. In 2009, we studied the effects of haying on breeding the bird community and habitat structure from four pairs of idle-hayed units (229-437 ha). Wet meadows mostly consisted of emergent wetlands dominated by Baltic rush (*Juncus balticus*), sedges (*Carex* spp.), and many species of grass. Bird surveys were conducted using the fixed-radius point count method during late May through July. Twenty bird species were directly associated with wet meadows: Savannah Sparrow (41%), Red-winged Blackbird (32%), Wilson's Phalarope (9%), Brown-headed Cowbird (7%), Western Meadowlark (4%) and Wilson's Snipe (2%) accounted for nearly 96% of all observations. Our results indicated that haying had mostly minor to no impacts on the breeding bird community structure, i.e., species composition, abundance and richness; only the Red-winged Blackbird appeared to be the clear beneficiary from haying. **POSTER**

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Population trends of Double-crested Cormorants on the Atlantic Coast

Since addition of the species to the Migratory Bird Treaty Act in 1972, and restrictions on the use of DDT, the Double-crested Cormorant (*Phalacrocorax auritus*) has experienced population increases. Data documenting the increases as well as subsequent management-related decreases come from interior populations (in the Mississippi Flyway). Every ten years, US and Canadian biologists conduct surveys of waterbirds nesting on the Great Lakes. Little is known, however, about recent trends in the population of Double-crested Cormorants along the North American Atlantic Coast. Since 1987, NYC Audubon has been surveying cormorants nesting in the New York Harbor, when 957 pairs nested on three islands. The number of pairs increased by 20% (n=1179) in 1991. By 1995 the NYC population reached its historical high count: 1806 nesting pairs, nearly doubling the original harbor population. In 1996 the population decreased 24% (n=1368). Since that time, the population size has fluctuated annually by -11% to +27%, from a low of 1046 pairs in 2007 to a high of 1718 pairs in 2015. The current population is approaching the 1995 high count. Biologists from other coastal states have shared their data with us. Boston Harbor supports a stable breeding population of 1,000 pairs during. Virginia currently has 2076 pairs (2013 count), more than double its 2008 nesting population; a 44% increase has occurred during the ten-year period of 2003-2013 (n=1991 and 2876, respectively). Similar fluctuations in breeding populations have been reported for Maine and Rhode Island. Cormorant nesting colonies along the Atlantic Coast have not experienced the logistic increase seen in some of the interior colonies, and some US states are seeing a decline in the population.

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Managing American Oystercatcher population growth by targeting nesting season vital rates

In populations of long-lived species, adult survival probability typically has a very high influence on population growth rates relative to other vital rates. In some instances, however, adult survival is difficult to increase or manage and other component vital rates must be considered to reverse population declines. In North Carolina, management of a long-lived shorebird species, the American Oystercatcher, focuses on increasing population growth rates through targeting component vital rates related to fecundity, specifically nest and chick survival. We assessed the viability of such a management approach to reverse Oystercatcher population declines in North Carolina by first creating a three-stage female-based deterministic matrix model. Component vital rates for clutch size, hatching rate, nest survival, and chick survival were gathered from historical productivity studies of oystercatchers in North Carolina. All other component vital rates were compiled from previous literature on American and European Oystercatchers. From the matrix model, we produced isoclines to evaluate minimum combined nest and chick survival rates necessary to reverse population decline, assuming all other vital rates remained stable at mean values. Assuming accurate vital rates, breeding populations within North Carolina appear to be declining. Nest and chick survival rates required to reverse declines, however, do seem attainable based on historical estimates. Our results are heavily dependent on assumptions of other component vital rates, most notably adult survival. This reveals the need for accurate vital rate estimates to inform management actions to enhance American Oystercatcher populations. Our approach provides valuable insights for managers in evaluating conservation goals for species of conservation concern.

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The use of game cameras to monitor Black Skimmer colonies in Texas

According to a 40 year dataset collected by the Texas Colonial Waterbird Society, the number of breeding pairs of Black Skimmers (*Rynchops niger*) in Texas has declined by around 70% since the 1970's. We suspect that chronically low reproductive success may be a significant cause of this decline. Regular monitoring of skimmer colonies on the central Texas coast from 2007 -2014 found an average of fewer than 0.20 fledged young per nest (unpublished data). Breeding skimmers face many threats across their range including nest predators, severe weather events, abnormally high tides, and increasing anthropogenic disturbance. In an effort to quantify how often and to what extent these threats may affect reproductive success, we used game cameras to monitor skimmer colonies on the central Texas coast in 2014-2015. The cameras were programmed to take a picture once per minute, 24 hours per day for the life of the colony to capture any disruptive or damaging event that may occur. Results from 2 breeding seasons (2014 – 2015) will be presented along with a discussion of adaptive management strategies that may improve reproductive success. **POSTER**

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Variation in Green Heron nesting success in coastal Louisiana marshes

Green Heron (*Butorides virescens*) nests were surveyed in coastal marshes at Audubon's Paul J. Rainey Wildlife Sanctuary, Vermilion Parish, LA, during the breeding seasons of 2013 and 2014 to determine factors affecting nest success that may be contributing to population declines. We located 206 active nests in 2013 and 244 active nests in 2014, and banded 142 chicks in 2013 and 139 chicks in 2014 to refine nest fate determinations. We used program MARK to examine the relationship between nest success and the extent of

nest aggregation, pond proximity, water level fluctuation, navigation canal versus natural bayou habitat, nest tree characteristics, and temporal variation. We built competing nest survival models and used model averaging to estimate daily nest survival rate, which was 0.958 (SE = 0.003). The most parsimonious model was the simplest one, which involved no covariates and no time dependence. However, single covariate models involving nearest temporal neighbor distance (range 5 – 6346 m), canal type (man-made canals versus natural bayous), and year had model likelihoods greater than 0.50 and were within 2 AIC_c units of the top model, suggesting strong support for these competing models. We found a weak negative relationship between nearest temporal neighbor distance and nest survival, and a trend toward higher survival in natural bayous versus canals, although beta estimate confidence intervals for these factors overlapped zero. Results suggest that all factors considered likely had an effect on nest success, and that variation in nest success in this species was not overwhelmingly influenced by any one nest site character considered. **ORAL**

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Shorebird use of wetlands and aquaculture ponds in the Mississippi Alluvial Valley and Gulf Coast region

Historically the Mississippi Alluvial Valley (MAV) was covered by forested wetlands but presently exists as a mosaic of agricultural, aquaculture, and other land uses which have provided new stop-over habitats for migrating shorebirds. Prior to anthropogenic modification, shorebirds likely migrated past the MAV to wetlands along the northern coast of the Gulf of Mexico. In 2010, the Deep-water horizon oil spill impacted coastal marshes of the northern Gulf of Mexico. In response, the Natural Resources Conservation Service implemented the Migratory Bird Habitat Initiative (MBHI) to provide migratory shore- and other waterbirds with wetland habitat inland of oil-impacted coastal wetlands. Our objective was to estimate species relative abundance and composition of migrating shorebirds on MBHI associated wetlands in the MAV and Gulf Coast regions during fall migration. Compared with wetlands not enrolled in MBHI during 2011-2013, mean relative abundance of shorebirds using MBHI enrolled wetlands were ≥ 4 -8 times greater. On average during peak migration across years, MBHI sites had > 7 times more birds/ha than state or federal managed or conserved coastal wetlands in Alabama, Louisiana, and Mississippi combined. Thus, MBHI-managed former catfish production ponds provided important habitat for migrating shorebirds and other waterbirds during summer through fall, especially in drought years when other wetlands may have been limited. Our research will eventually provide conservation planners with tools to predict shorebird abundance and manage wetlands for these birds in the MAV and along the Gulf coast. **ORAL**

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Bird-crocodilian interactions as a keystone interaction supporting nesting wading birds in tropical and subtropical wetlands

Many birds nest near more formidable species in order to gain protection from nest predators. Here, we summarize a series of studies quantifying the consequences of long-legged wading birds in the southeastern United States nesting above alligators. 1) *Egretta* herons nested in larger numbers at locations with bird + alligator decoys than they did at either control sites or sites with bird or alligator decoys alone. In addition, herons at > 100 colonies were never found nesting without alligators below their nests. 2) Alligators appear to offer protection ($< 3\%$ nest predation rates) when water levels allow mobility; when alligators were confined to pools by low water, herons abandoned colonies due to raccoon predation. 3) Similarly, using a 40-yr dataset,

longevity of Wood Stork colonies in the southeastern U.S. was most strongly related to the maintenance of a deep-water moat around the colony. 4) Alligators living within active Everglades colonies were in significantly better body condition at the end of the dry season than those not associated with colonies, probably because they had access to wading bird young falling out of nests. We estimate that colonies in the Everglades could produce enough food in this way to satisfy the energetic needs of hundreds of adult alligators. This information collectively suggests a two-way ecological facilitation in which presence of alligators serves to protect nesting wading birds from mammalian predators, and brood reduction by wading birds contributes significantly to the energy budgets of alligators. This relationship is probably shared by nesting colonial birds and crocodylians in many tropical and subtropical wetlands of the world, and appears to be a keystone relationship for both taxa groups. **ORAL**

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Factors affecting the abundance of wading birds in the intertidal zone: are freshwater models applicable?

Seasonal water level fluctuations in the freshwater Everglades control habitat and food availability for wading birds, but these relationships may not be transferable to intertidal habitat, where water levels fluctuate at multiple periodicities and there are hourly shifts in the location of suitable foraging depths. In the Florida Keys, the Little Blue Heron (*Egretta caerulea*) forages diurnally whereas the Great White Heron (*Ardea herodias occidentalis*), forages both day and night. We conducted quarterly wading bird distribution surveys (N = 38; 2011-2013) by boat along extensive intertidal flats in the lower Florida Keys. Unlike freshwater models, hydrologic characteristics were not the primary determinant of wading bird abundance in the intertidal zone. Moon phase corresponded to a 7-fold change in foraging abundance from quarter (neap tide) to full/new (spring tides) moons for the Little Blue Heron versus a 3-fold change in abundance for the Great White Heron. Area of available foraging habitat, driven by tidal fluctuations, was positively correlated with the foraging abundance of both species and was the second most important factor in explaining changes in the daily foraging abundance. Area of foraging habitat produced a 5-fold increase in abundance over the data range for the Little Blue Heron, versus a 2-fold increase for Great White Heron. Habitat availability for the Great White Heron (day and night feeder) was affected significantly by moon phase. Surprisingly, there was not a significant relationship between habitat availability and moon phase for the Little Blue Heron, a diurnal forager, suggesting that birds were responding to changes in the environment that were strongly linked to the moon phase but not to changes in habitat availability *per se*. **ORAL**

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Breeding locations, migration routes, and staging areas of Red-throated Loons (*Gavia stellata*) wintering in the Mid-Atlantic region.

Red-throated Loons (*Gavia stellata*) are listed by the U.S. Fish and Wildlife Service (USFWS) as a species of conservation concern in much of their Arctic breeding range and wintering grounds in the Atlantic Flyway. However, data gaps exist regarding wintering distributions, including concentration and timing of use, migratory routes and stopover areas. Between 2012 and 2014, as part of a Bureau of Ocean Energy Management, Department of Energy, and USFWS project focused on offshore wind energy development and diving birds, we captured Red-throated Loons at sea on their wintering grounds in the Mid-Atlantic region and tagged them with platform terminal transmitters (PTTs). We used satellite tracking to map migratory routes of individuals ($n = 34$) to and from breeding locations in Quebec, Nunavut, Northwest Territories, and Greenland. We calculated composite kernel density (KDE) maps using GIS from movement data for each loon to identify

core use areas during winter and migration. Kernel density rasters were generated for each animal during one year for each period and all KDE rasters were aggregated and usage was averaged over all animals for the entire utilization area. Primary wintering areas included: Delaware Bay, DE; Chesapeake Bay, MD and VA; and Pamlico Sound, NC. Spring migration stopover sites included Long Island Sound, Narragansett Bay, Nantucket Sound, Buzzards Bay, Bay of Fundy, Gulf of St. Lawrence, and the St. Lawrence River; autumn stopover sites included Hudson Bay, James Bay, Hudson Strait, Ungava Bay, Gulf of St. Lawrence, and Lake Ontario. These results identify key migration habitats for Red-throated Loons wintering in the Mid-Atlantic region and timing of their use for feeding, resting, and molting. **ORAL**

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Hierarchical Bayesian modeling of offshore species and habitat associations in a marine bird and mammal community, using shipboard and digital video aerial surveys on the Atlantic Continental Shelf

Marine spatial planning efforts have recently brought attention to the need for baseline studies of marine wildlife in relation to proposed offshore wind energy development on the US Atlantic Continental Shelf. From March 2012 to May 2014, we collected line transect data from 16 shipboard surveys, and novel high resolution digital videography data from 15 aerial surveys, off the coast of Delaware, Maryland, and Virginia. We implemented hierarchical Bayesian models to evaluate the relationships between marine birds and mammals, while accounting for variation in habitat covariates and observed seabird behaviors. We selected six covariates on avian abundance: three static (distance to shore, slope, and grain size), and three dynamic (sea surface temperature, salinity, and marine mammal density). We hypothesized that aerial foragers would show positive associations with marine mammals, but found both positive and negative bird-mammal associations that varied by survey. Aerial surveys detected more submerged animals compared to boat surveys, which were better at detecting smaller seabird species, and accommodated variability in detection using distance sampling. This resulted in higher abundance estimates than those derived from aerial surveys. Our results are consistent with a growing body of research suggesting that competitive and facilitative interactions occur among pelagic communities, where subsurface predators drive shared prey upwards for increased detectability and accessibility to surface-feeding seabirds. Our study highlights the importance of quantifying behavioral and ecological influences on avian abundance, particularly in predicting the potential exposure of protected marine birds and mammals to offshore development. **ORAL**

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Movement and survivorship of Reddish Egrets across their range: an analysis of long-term banding data from 1930-2014.

Knowledge of the dispersal and subsequent movements made by individuals are vital to the understanding of a species' ecology. Additionally, understanding an organism's dispersal capabilities is also integral to the development of conservation strategies at appropriate scales, especially in birds that may travel great distances. The Reddish Egret (*Egretta rufescens*) is a plumage-dimorphic, medium-sized heron species found along the coastal Gulf of Mexico and Pacific coast of Mexico in North America as well as the Caribbean and parts of

Central America. The primary objective of our research was to examine the movement ecology and estimate survival of juvenile Reddish Egrets through long-term color banding. Between 2006 – 2014, we have color banded Reddish Egrets in Texas (n=656), Great Inagua, Bahamas (n=72), Tamaulipas (n=59), Sonora (n=47), Yucatan (n=105), and Baja California Sur (n=317). We also examined historical banding records of Reddish Egrets (1930 – 1992, n=1559) for movement behavior and survivorship estimation. We conducted comparisons of movement between color morphs, sexes (when known) and breeding concentrations/regions using multi-state models. Overall, variation in dispersal and movement measurements exists among individual birds and within regions. Our results suggest that mortality in juvenile Reddish Egrets is rather high; we postulate that this life stage may be a limiting factor in the overall population growth of the species. We argue that our research underscores the importance of long-term color banding studies and, coupled with telemetry studies, can yield considerable insights into movement ecology and survivorship of a species. This ongoing study and future research on the movement ecology of Reddish Egrets will contribute substantially to the effective conservation of North America's rarest and most unique heron species. **ORAL**

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Double-crested Cormorant tree nesting habitat modification and impacts on invasive European Fire Ants

Double-crested Cormorant nesting activities transform forests through acidification of soil, breaking of branches and reducing photosynthesis, ultimately causing tree mortality. At Tommy Thompson Park, Toronto Ontario invasive European fire ants (*Myrmica rubra*) are present in high nest densities and relative abundance. *M. rubra* is a pest (stinging ant) as well an omnivore with the potential to reduce local park biodiversity. In this study, we examined if *M. rubra* abundance (collected in pitfall traps) and nest density (1m² grid) changed with respect to habitat changes associated with cormorant nesting between 2009 and 2014. We sampled each year along a transect (station every 50 m) which went from open field, mixed field & forest, forest with nesting waterbirds. Over the five year period three stations (A, B, C) changed from dead/dying trees with high cormorant nest density (2009) to open habitat with vegetation (forbs) with little to no cormorant nest nesting (2014) with no resulting change in the presence of *Myrmica rubra*. One station (E) went from living forest low cormorant nest density (2009) to dead/dying trees with high cormorant nest density (2014) with a significant change in the number of ant nests (2009 n = 3 m², 2014 n = 0 m²) and ant relative abundance (2009 = 27,792; 2014 = 10). While cormorants modify their tree nesting habitat understanding the ecosystem dynamics beyond tree mortality is important in determining how sites may change over a longer time frame. At this particular site an invasive fire ant appeared to be negatively impacted in areas where tree mortality occurred. **POSTER**

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Spatial relationships between fledge success and habitat of American Oystercatchers on Fisherman Island National Wildlife Refuge, Virginia, USA

Fisherman Island National Wildlife Refuge, located at the southern tip of the Delmarva Peninsula is considered important habitat for breeding American Oystercatchers. Monitoring of American Oystercatcher breeding pairs has occurred annually there since 2002. Predation by raccoon, mink, crows, gulls and raptors are major inhibitors to fledge success on the site, as well as washouts/ flooding of low lying nests. We analyzed oystercatcher data from 2004-2014 (N= 616 nest events) to examine nest outcomes over the 11 year span. During that time overall fledge success was 15.1%, pairs that incubated successfully to hatch a chick but did not fledge represented 23.9% of nest attempts, and losses due to washouts were 16.7%. We hypothesized

that losses due to predators would occur nearer to upland habitat on the island. We obtained high quality digital orthophotos for 2007, 2009, 2012 and 2014 and created maps of habitat types by running an iso cluster unsupervised classification on each raster file. Upland habitat was selected out and the Euclidean distance tool was run to provide distance from each nest point to the nearest patch of upland habitat. Nests that successfully fledged over those four years were an average of 108 m from upland areas, while pairs that only hatched a chick were an average of 86.77 m. We also ran several hot spot analyses on nests to determine areas that regularly fledged or produced chicks. Understanding relationships between habitat and fledge success will allow managers to better assess the island and target areas for predator management more effectively. **ORAL**

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GIS Analysis and modeling of Galveston Bay Rookery Island erosion risk along the Gulf Intracoastal Waterway

The numerous coastal islands of Texas provide critical habitat for colonial waterbird rookeries. Prior to the extensive Gulf Intracoastal Waterway (GIWW) dredging projects of the early 1900s, birds were dependent on natural rookery islands. Few natural islands remain due to changes in hydrology and erosion rates. When the GIWW was completed in the mid-20th century, dredged material heaped along its sides formed new "islands" that became replacement rookeries sites. We assembled GIS data and built a spatial, habitat-based model to predict the risk of rookery islands along the GIWW becoming unusable for nesting due to poor habitat or erosion damage. Parameters used to estimate site longevity included sea level rise estimates, erosion rates, elevation, habitat type/ conversion, and ship estimated wake damage. Model was used to predict islands most at-risk over a span of 5, 10, 25, and 50 years. High quality GIS data was assembled on all rookery islands within a 2500m buffer of the GIWW centerline (N= 25). Historical data ranged from 2004 to 2014. Colonial waterbird breeding population data was then assembled for this time period for the following species: Brown Pelican, Laughing Gull, Royal Tern, Sandwich Tern, Snowy Egret, Roseate Spoonbill, and Forster's Tern. Survey data was compared with the model results to gain a better understanding of how the island-risk model's predictions will affect different waterbird species and how species have responded to changes in habitat over time. Islands were ranked with "risk categories" of high, medium, and low. With greater funding opportunities coming to the Texas coast for habitat conservation, it is expected that this model will help inform partners on sites most in need of urgent restoration. **POSTER**

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An adaptive management approach to enhancing American oystercatcher productivity on the Georgia coast

Since the American oystercatcher's (*Haematopus palliatus*) 2002 designation as a "highest regional priority" species, coordination between managers and biologists has resulted in a greater understanding of population demography along the U.S. Atlantic coast. Studies of American oystercatchers breeding in Georgia have indicated that fledging success is below replacement and predation is a significant source of nest failure. Yet predator control is costly and potentially unsustainable in the long-term, thus determining the most efficient management strategy is a pressing need for practitioners. This problem fits well into an adaptive

management framework, where our objective is to increase oystercatcher productivity, while accounting for uncertainty in our knowledge of the system and future conditions. To assess oystercatcher productivity, we monitored breeding pairs in 2013 and 2014 at 5 coastal Georgia sites. Simultaneously, we monitored the oystercatcher's primary predator (raccoons) using camera traps. Camera detections were used to develop an abundance index to examine the effect of raccoons on nest success. Additionally, we actively managed raccoon populations at a subset of study sites. To estimate the influence of raccoon relative abundance on oystercatcher productivity, we conducted a hierarchical nest survival analysis. Under our best-fitting model of nest survival, the effect of one additional raccoon translated into as much as a 9% decrease in daily survival. Finally, we conducted a two-way analysis of variance to examine the relationship between raccoon removal and oystercatcher productivity. Results from this analysis indicated that oystercatcher productivity was more than four times higher on managed versus unmanaged sites. Having quantified these relationships among system components, we can now create a decision support tool to determine optimal predator control strategies for maintaining Georgia oystercatcher populations. **ORAL**

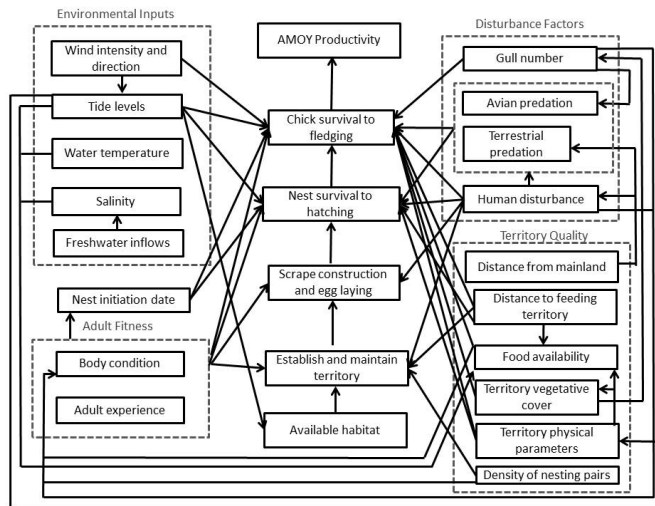
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A Conceptual Ecological Model for Western Gulf American Oystercatcher Productivity

We developed a conceptual ecological system for American Oystercatcher productivity that is partitioned into a serial process including five parameters: available habitat, establish and maintain territory, scrape construction and egg laying, nest survival to hatching, and chick survival to fledging. Each of these parameters is influenced by a number of inputs which we divided into four logical groups including environmental inputs, disturbance factors, territory quality, and adult fitness. We left one input, nest initiation date, on its own because it did not fit into any of the logical groups. We considered each input individually and determined which parameter(s) were influenced by each and how they were influenced. Once the conceptual model was developed we reviewed existing data for each described relationship to determine whether a represented relationship was well documented, presumed but undocumented, and/or entirely hypothetical under our current state of knowledge. Our goal was to determine areas where our knowledge base is lacking and therefore where more investigation into relationships is needed. We determined that the environmental inputs, nest initiation date, and disturbance factors parameters are well documented in the Western Gulf oystercatcher population. Inputs associated with the adult fitness and territory quality parameters are not well documented, however. For American Oystercatchers, there has been no investigation into how adult body condition and adult experience affects nesting success. While some of the territory quality parameters have been at least partially investigated, there has been no work on how vegetative cover, physical parameters, and density of nesting pairs effects productivity. We suggest that future research efforts focus on these areas. **ORAL**

Figure 1 – The conceptual model for oystercatcher productivity in the Western Gulf.



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Habitat variation in density and refueling rates of three *Calidrid* sandpipers during spring migration on the Northern Gulf of Mexico

The coastlines of the northern Gulf of Mexico (NGOM) represent important non-breeding habitats for 28 species of migratory shorebirds. As processes of climate change accelerate, these habitats are expected to experience accelerated and dramatic land loss. Accurate prediction of the impacts of these changes to shorebird populations requires a detailed understanding of the interactions between shorebirds and their habitats. However, the migration ecology of shorebirds on the NGOM has not been well studied. We investigated variation in shorebird densities and refueling rates (as measured by plasma metabolite concentrations) among habitats on the NGOM during spring migration for three species of *Calidrid* sandpipers, the Semipalmated sandpiper (*C. semipalmatus*), the Western sandpiper (*C. mauri*) and the Dunlin (*C. alpina*). Three habitats were identified: barrier island tidal flats, coastal mudflats and coastal remnant wetlands, which we ranked as of high, intermediate or poor quality based on resource abundance, habitat availability, and predation pressure. Bird densities were highest in the barrier island habitats, the habitats with the highest prey biomass, but intermediate predation danger. For the Western sandpiper and the Dunlin birds on spring migration were also refueling at higher rates in barrier island tidal flats, suggesting these habitats may be particularly important for migration success. This finding is significant in the context of continued sea-level rise and anthropogenic modification of barrier island habitats. Effective conservation of shorebird populations year-round may require restoration projects that enhance and protect the intertidal areas of barrier islands preferred by non-breeding shorebirds. Continuing to develop this understanding will allow for better analyses of the costs and benefits associated with future barrier island management practices. **ORAL**

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Nesting effort of least bittern (*Ixobrychus exilis*) on publicly managed wetlands in Missouri.

Least bittern populations have been in decline since the 1970s, most likely due to extensive loss of freshwater emergent wetlands, the primary nesting habitat of least bittern. The decline in nesting habitat emphasizes the need for effective wetland management within the nesting range of least bitterns. The extent to which least

bittern rely on wetlands in Missouri during summer nesting efforts is poorly understood. The objective of this study was to determine effects of hydrologic management and habitat characteristics on nesting effort of least bittern on public wetlands in Missouri. In 2013 and 2014, we performed repeated call-broadcast surveys from April – June within 107 wetland sites spread across 12 managed areas in Missouri. We searched for nests in sites where marsh birds were detected and that remained inundated through the end of the survey period. We found 40 least bittern nests in 2013 and 43 nests in 2014. Daily nest survival probability was 0.64 in 2013 and 0.21 in 2014. We considered a nest successful if at least one chick fledged and over both years, we observed 35 failed and 48 successful nests. Mean water depth at failed nests was 47.2cm and 68.2cm at successful nests. Mean vegetation height at failed nests was 105.5cm and 87.1cm at successful nests. The vegetation density (robel) at failed nests and successful nests was 2.9 and 1.9, respectively. We are currently analyzing whether habitat variables positively correlated with least bittern departure probability during migration influence nest success and speculate that if birds are making nest site selection decisions based on specific habitat characteristics, maintaining these habitat characteristics through the nesting season will likely improve nest success. **POSTER**

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Use of a dynamic occupancy model to evaluate secretive marsh bird response to wetland management practices during spring migration.

The extent to which secretive marsh birds rely on wetlands in Missouri during spring migration is relatively unknown. Our objective was to determine how initial marsh bird occupancy and subsequent colonization and departure probabilities were influenced by wetland management practices, including the duration and initiation date of spring water-level drawdowns, and associated wetland habitat characteristics. In 2013 and 2014, we performed call-broadcast surveys within 107 wetlands across 12 managed areas in Missouri. We used the standardized marsh bird monitoring protocol, returning to each survey point every 7-10 days from April to June. We measured water and vegetation habitat characteristics at each survey point and estimated vegetation and water coverage for the entire site. We used dynamic occupancy modeling to evaluate factors that influence SMB occupancy and colonization/departure probabilities. Sora and American bittern occupancy models indicated a positive relationship between occupancy probability and duration of drawdown, however the top occupancy model for Virginia rail and least bittern was the null model. The top colonization/departure model for sora included vegetation density and percent of a site containing emergent vegetation, with both variables having a positive relationship with colonization probability and a negative relationship with departure probability. The top colonization/departure model for Virginia rail included range of water depth and range of vegetation height, both of which had a negative relationship with colonization and departure probability. The top colonization/departure model for American bittern included vegetation interspersion, whereas the top model for least bittern included the % site inundated and overall area inundated. Our results suggest that water-level drawdowns with duration ≥ 100 days or initiated after peak migration will improve marsh bird occupancy probability during migration. **ORAL**

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Nest site selection of Dunlin near Churchill, Manitoba in a changing environment

The eastern North American subspecies of Dunlin (*Calidris alpina hudsonia*) is a common shorebird that nests in peatland habitats from Nunavut to the Hudson Bay lowlands in Manitoba, Ontario and Quebec, Canada. Climate warming will likely decrease the amount of suitable nesting habitat for Dunlin due to shrub encroachment. We studied nest-site selection of breeding Dunlin in the Churchill, Manitoba region to test

whether predation or favourable microclimates best explains current patterns of nest success. Dunlin chose sites with thicker and taller vegetation cover than what occurred at random locations. At nest cups vegetation was also taller in the predominant NW windward direction than in all others probably to avoid the impacts of evaporative cooling from coastal winds of the Hudson Bay. Nest success was positively related to nest concealment but not to shrub or tree density. The amount of shrubs in territories of Dunlin has increased over the three years of study. Both favourable microclimate and avoidance of predation appear to drive nest-site selection in this sub-arctic nesting species.

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Differential predicted response of two salt marsh specialists to sea level rise: is the indicator species concept useful?

Conservation planners frequently use the indicator species concept to select areas for conservation action, where the presence of the indicator species identifies probable habitat for species with similar requirements. However, it is not clear whether indicator species are useful for tracking habitat as the climate changes. The Clapper Rail (*Rallus crepitans*) is a proposed indicator of healthy salt marsh ecosystems, but it is unknown whether its distribution overlaps with more vulnerable species, such as the Seaside Sparrow (*Ammodramus maritimus*). Both species are salt marsh specialists and are potentially threatened by sea level rise (SLR). We address the questions: can the distribution of Clapper Rails predict good habitat for Seaside Sparrows? And will the distributions of the two species track each other with habitat changes from SLR? We sampled the abundance of these two species in salt marshes throughout coastal Georgia, USA, in 2013-2014, and analyzed count data using a Bayesian N-mixture model. Model predictions were applied to a SLR land cover model to determine distribution shifts over 100 years. Clapper Rails used different habitat than Seaside Sparrows and only 3% of current high quality Seaside Sparrow habitat was predicted by the Clapper Rail distribution. Additionally, high quality Clapper Rail habitat is predicted to increase with SLR by 60%, but high quality Seaside Sparrow habitat will contract by 86%. If conservation decisions were made now using Clapper Rails as indicators of good Seaside Sparrow habitat, critical Seaside Sparrow habitat would be lost. Furthermore, monitoring Clapper Rail distributions would not indicate changes to Seaside Sparrow habitat from SLR. Even with two ecosystem specialists, the indicator concept does not aid conservation planning under rapidly changing conditions. **ORAL**

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First satellite tracks of the endangered Black-capped Petrel

The Black-capped Petrel is an endangered seabird with fewer than 2,000 breeding pairs. To date, use areas at sea have been determined entirely from vessel-based surveys and opportunistic sightings and, as such, spatial and temporal gaps in our understanding of the species' marine range are likely. To enhance our understanding of marine use areas we deployed three satellite tags on three Black-capped Petrels breeding in the Sierra de Bahoruco National Park in the Dominican Republic along the border with Haiti, representing the first tracking study for this species and one of the first tracking studies for any breeding seabird in the Caribbean. During chick-rearing, petrels primarily used marine habitats in the southern Caribbean Sea, between the breeding site

and the coasts of Venezuela and Colombia. Maximum distance from the breeding sites ranged from ca. 500 – 1500 km during the chick-rearing period. During the post-breeding period, each bird dispersed north and used waters west of the Gulf Stream offshore of the mid- and southern Atlantic coasts of the USA, as well Gulf Stream waters and deeper pelagic waters east of the Gulf Stream in the vicinity of the Blake Spur and Charleston Bump. Maximum distance from the breeding sites ranged from ca. 2000 – 2200 km among birds during the nonbreeding period. In total, petrels used waters located within 14 different exclusive economic zones suggesting that evolving management strategies for this species will be benefitted by continued international collaboration. **ORAL**

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Use of game cameras in monitoring Leach's Storm Petrel

Leaches Storm Petrel (*Oceanodroma leucorhoa*) is a common but elusive nesting seabird in the North Atlantic. Traditional monitoring techniques include highly invasive nest grubbing, playbacks, and opportunistic encounters. I examined the feasibility of using conventional game cameras placed in the immediate proximity of nesting burrows. Camera placement proved crucial as units placed too close to the nest produced poor quality pictures with the flash unit washing out details of the image. Cameras placed too far from the nest either failed to capture a flying bird or prevented association of particular birds to their nesting burrow. Burrow occupancy was confirmed by using conventional methodologies, with the cameras providing good information about patterns of nest entry and nest departure. I examined the relationship between arrival and departure times to weather factors including cloud cover, rain, and phase of moon. I believe this method is a useful addition to our overall techniques for monitoring burrow nesting seabirds. **POSTER**

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Applications of a model-based U.S. Atlantic coast-wide synthesis of at-sea marine bird distributions to ocean energy spatial planning

The rapid increase in interest in and development of ocean-based renewable energy sources worldwide, along with technological advances that allow these installations to be placed further and further offshore, have sparked a number of efforts to map and model marine bird distributions in order to avoid conflicts between ocean energy installations and important bird areas. Here we present the results of an ongoing effort to synthesize and model all science-quality at-sea marine bird datasets available for the U.S. Atlantic coast, from the Straits of Florida to the northern Gulf of Maine, from nearshore to the 200 nautical mile U.S. Exclusive Economic Zone, and from the late 1970's to the present, for the purpose of making spatial predictions of seasonal long-term relative occurrence probability and relative abundance distributions of more than 40 species of marine birds of particular concern for non-governmental, state, and federal entities. We discuss how these models have been and are anticipated to be used in a variety of marine spatial planning processes with a focus on siting and environmental assessment of offshore renewable ocean energy installations. We discuss specific examples of the role these models have played in planning processes and environmental assessments at the state, federal, and regional level, and consider additional roles that models may play in future planning processes. We also discuss the limitations of models and the importance of using multiple approaches to identify and confirm important bird areas, determine habitat usage, migration, and behavioral patterns, and anticipate changes; all important considerations in planning processes. **ORAL**

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A spatiotemporal assessment of Reddish Egret (*Egretta rufescens*) foraging habitat in the Laguna Madre, Texas

The Laguna Madre of Texas supports the highest densities of breeding Reddish Egrets in the United States. Important breeding colonies have been identified; however, little is known about specific foraging habitat requirements of Reddish Egrets and the availability of foraging habitat throughout the annual cycle. In order to assess the foraging habitat of Reddish Egrets, water depth and seagrass cover were measured at locations within the Laguna Madre where birds ($n = 372$) were observed foraging. Once requirements were established, the spatial and temporal distributions of foraging habitat were quantified. Water depth and mud flat exposure in the Laguna Madre are influenced by wind driven tides, therefore the availability of foraging habitat can vary within a relatively short time period. Using digitized habitat data and observational data, a GIS model was created to assess the distribution of foraging habitat in the Laguna Madre for 120 weeks during 2012–2014. The amount of available foraging habitat was relatively high during the spring and summer of each year, and lower throughout the winter months. Foraging locations ($n = 6,385$) of 8 adult Reddish Egrets marked with GPS satellite transmitters were used to assess the efficacy of the model; 90% of the locations occurred within 50 m of overall available habitat. This is the first large scale analysis of foraging habitat dynamics of Reddish Egrets, and will be useful for identifying important foraging areas for the species, which is a current conservation need. **POSTER**

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Breeding ecology of the Reddish Egret in Texas

The Reddish Egret is a species of conservation concern throughout much of its range, and is listed as threatened in Texas where it is estimated that nearly half of the breeding population occurs. We attached GPS satellite transmitters to 30 adult Reddish Egrets breeding in the Laguna Madre, Texas, and have obtained locations since 2010. Fifty-six breeding attempts were made (based on locations), and 13 islands were used for nesting. Twelve Reddish Egrets nested for > 1 year and adults exhibited relatively high levels of breeding colony fidelity. Three adults used the same island each breeding season and 9 nested in >1 colony across years, but used colonies within the same area of the Laguna Madre. A habitat availability model was created in ArcGIS using foraging locations of 372 Reddish Egrets and the model was used to calculate the amount of available foraging habitat around breeding colonies. Preliminary analyses show that adults flew an average distance of 12.7 (± 11.0) km from the colony to forage. The amount of available foraging habitat within 10 km of the colonies ranged from 3,601 to 4,682 ha ($\bar{x} = 4,195$). Distance from the colony to the mainland ranged from 0.8 to 2.5 km ($\bar{x} = 1.2$ km). Future analyses will quantify colony stability in relation to the availability of and proximity to foraging habitat in the Laguna Madre, Texas. **ORAL**

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Variation in Brown Pelican energy provisioning rates across a range of juvenile forage fish availability

Although prey availability is considered a key driver of seabird nest productivity, it is often difficult to quantify since many forage fish species and life stages are not targeted by commercial fisheries. In the northern Gulf of Mexico, breeding Brown Pelicans (*Pelecanus occidentalis*) have been shown to rely heavily on Gulf Menhaden, which range throughout the northern Gulf but spawn only between northern Texas and Alabama. This limited spawning range produces a natural gradient in availability of juvenile menhaden across pelican breeding habitat. In the summer of 2014, we monitored fledging success and chick condition at pelican colonies along the Texas coast, including sites within, at the edge of, and outside menhaden spawning range. At the same time, we measured diet composition, meal mass, and provisioning rates, and assessed proximate composition and energy density of common prey items using fresh bait samples. We combined these values to model variation in energy provisioning rates (EPR) for the focal colonies, which we then correlated to fledging success and chick condition at the colony level. Energy content did not vary widely between prey species, and variation in EPR was driven primarily by provisioning rates and proportion of menhaden. EPR proved to be a strong predictor of both fledging success and body condition of nestlings, and EPR, fledging success, and body condition were highest where juvenile menhaden were most prevalent in chick diets. We suggest that availability and accessibility of juvenile menhaden are the key factors driving energy provisioning rates and fledging success of Brown Pelicans in the western Gulf of Mexico. **ORAL**

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Should I stay or should I go? Conservation implications of individual variation in Brown Pelican migratory strategies

Although Brown Pelicans (*Pelecanus occidentalis*) are resident throughout their range, some individuals regularly undertake postbreeding migrations of up to 3,000 km. Variation in migratory strategies could expose different subsets of the population to differing risk factors and play a substantial role in population dynamics of the species; however, little information exists on the prevalence or distribution of long-distance migrants. To address this information gap, we used GPS loggers to track postbreeding movements in 85 Brown Pelicans breeding across the northern Gulf of Mexico. For all individuals for which we obtained a complete migration cycle (n=66), we modeled migratory strategy (resident, medium-distance, or long-distance) as a function of sex, body condition, breeding location, and reproductive success during the most recent breeding season. We found that females were more likely to migrate long distances, while males were more likely to be resident. Body size was a significant predictor for males, with larger males more likely to remain resident, but was not significantly different between resident and migrant females. Likelihood of migration also increased with colony size. Neither body condition nor breeding success influenced migratory strategy, and migration is highly consistent within individuals. Based on differences in migratory strategies, we predict that male pelicans will be more vulnerable to changing winter climate in the northern Gulf, while risks to females wintering in the southern Gulf remain largely unknown. Several migratory routes encompassed over-land portions, increasing vulnerability to terrestrial threats such as hunting and wind turbines. We conclude that differential migration patterns significantly influence the distribution of mortality risk in Brown Pelicans, particularly during the non-breeding season. **POSTER**

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Loon productivity and site fidelity in the Greater Kejimkujik Ecosystem

As an indicator of aquatic health, the Common loon has been a focus of research and monitoring in and around Kejimkujik, Nova Scotia, Canada for many years. Studies have shown that loons here have high concentrations of mercury as a result of bioaccumulation, and that this may negatively affect survival and reproduction in the long term. Since 1988, researchers have been monitoring the reproductive success of loons on more than 20 lakes. Reproductive success varies from year to year because of changes in water levels, weather, and predation. Between 1993 - 1997 the mean number of large young fledged on 23 study lakes was 6.6/year but on the same lakes it declined to 5.5/year between 2007-2012. A total of 58 Common loons have been banded by Environment Canada in the study area and 21 of these have been re-sighted in 2013 and 2014. The oldest re-sighted bird was 18 years old. There was high site fidelity; most birds were observed on the same lakes where they were originally banded. **ORAL**

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Non-breeding abundance, distribution and habitat use by American Oystercatcher in Sinaloa, México

The American Oystercatcher *Haematopus palliatus frazari* (AMOY) is federally listed as endangered in Mexico, due to habitat loss and low population size. Recent surveys indicate that Sinaloa supports about half of the breeding AMOY population in Mexico. No information is available on the wintering ecology of this species in Mexico. During the 2014 non-breeding season six bays along Sinaloa were surveyed: Bahía de Lechuguilla, Bahía de Topolobampo-Ohuira, Bahía de Navachiste, Bahía de Santa María, Bahía de Ceuta, and Bahía de Mazatlán in order to assess AMOY distribution, abundance, and habitat use. We surveyed a total of 60 sites (islands and coastline portions). A maximum of 1,351 adult was estimated to use this area (using maximum count per site, standardized to high tide). AMOY were found resting in flocks of variable size (3-253), and resting sites were consistently used. Within Bahía de Santa María the largest resting congregations were found during high tide on Isla El Mero (maximum 253 individuals) and Melendres (203). The habitat they use for feeding and resting included sand islands, mangrove islands, mudflats, sand beaches, shrimp farms, rock islands, sandpit, docks, sand barriers, mangrove barriers and shellrakes. Documented threats to the species and its habitat included predators (coyote and raccoons), livestock, ATVs, and tourist activities. Sinaloa population comprises approximately 45.6% of total population estimate (1,351 out of 3,000 adult). Bahía de Santa María alone represented 33.6% of total population estimation, and 74.6% of the non-breeding population of Sinaloa. Sinaloa coast stand out as critical for AMOY conservation. **ORAL**

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Using satellite and digital VHF Telemetry to estimate length of stay, home ranges, and habitat use of American Oystercatchers in coastal Massachusetts

The use of digital VHF telemetry for tracking bird movements is expanding as a lighter-weight and cost-effective alternative to satellite-based tracking technologies. We compared satellite telemetry and digital VHF telemetry for estimating the length of stay, home ranges, and habitat characteristics of American oystercatchers (*Haematopus palliatus*) in coastal Massachusetts, USA, during the breeding and post-breeding periods in 2013. Five oystercatchers were captured at their nest sites and tagged with both a 9.5 gram solar-powered platform terminal transmitter, and a 2.6 gram digitally coded VHF transmitter, and tracked using the ARGOS satellite system, an array of eight automated radio telemetry stations, and periodic land-based and aerial telemetry surveys. Estimates of mean (\pm SE) minimum length of stay in the study area were similar between satellite telemetry data (118 ± 12 days) and digital VHF telemetry data (108 ± 11 days). Overall, satellite and radio telemetry locations produced similar estimates of mean (\pm SE) fixed kernel 95% utilization distributions (22.53 ± 16.87 km² and 27.27 ± 21.58 km², respectively) and 50% core-use areas (4.14 ± 2.99 km² and 4.80 ± 4.05 km², respectively). Mean (\pm SE) percent spatial overlap of kernel density estimates from satellite telemetry and digital VHF telemetry was $50 \pm 11\%$ for 95% utilization distributions and $20 \pm 11\%$ for 50% core use areas. Mean proportion of shoreline habitat type in both 95% utilization distributions and 50% core use areas was similar between satellite telemetry estimates and VHF telemetry estimates and was predominated by coarse-grained sand beaches (0.58 – 0.77), and salt to brackish marshes (0.06–0.29). Although limited by sample size, these results suggest that digital VHF telemetry, when combined with automated radio telemetry stations and manual telemetry surveys, performs similarly to satellite telemetry for tracking shorebirds during the breeding and post-breeding periods. **ORAL**

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Weather and time of day influence post-breeding movements of Common Terns

Individual-based tracking studies are critical for assessing potential effects of offshore wind energy facilities on target bird populations, particularly during times of limited visibility and inclement weather conditions when collision risks with offshore wind turbines may be elevated. In 2014, we attached digital VHF transmitters to 116 adult Common Terns (*Sterna hirundo*) captured from two major nesting colonies in the northwest Atlantic: South Monomoy Island in Nantucket Sound, MA and Great Gull Island in Long Island Sound, NY. We tracked their movements around-the-clock using an array of twelve 40 ft. automated radio telemetry stations erected at strategic coastal and offshore sites ranging from Cape Cod, MA to Long Island, NY. Relative to the estimated fledging dates of their chicks, length of stay at the nesting colonies was significantly longer ($t=4.06$, $p<0.001$) for Monomoy terns (mean 18 days post-fledging, range 1–64 days) versus terns from Great Gull (mean 8 days post-fledging, range -11–30 days, where negative values indicate loss of chicks), and over 50% percent of terns from Great Gull dispersed from the colony following a tropical storm in early July. During the post-breeding period, terns from Great Gull traveled significantly longer distances relative to terns from Monomoy, with long-distance (>50 km) flights occurring predominately during night and early-morning hours ($\chi^2 = 39.217$, $p<0.001$). The eastern Nantucket Sound region was an important pre-migratory staging area for terns from both colonies, where 97% of terns from Monomoy and 58% of terns from Great Gull occurred for up to two months before departing from the study area during mid-

July through early-September. We discuss implications of our findings relative to plans for offshore wind energy development within the region, and our current work with using digital VHF transmitters and automated radio telemetry stations to track Federally-endangered Roseate Terns and Federally-threatened Piping Plovers. **ORAL**

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Breeding biology of the Black Guillemot (*Cephus grylle*)

I examined the natural history and breeding biology of the Black Guillemot (*Cephus grylle*) on Great Duck Island, Hancock Co. Maine. Approximately 400 pairs of Black guillemots nest along the rocky berm in significantly clumped distributions, many in close proximity to Herring gulls and Great black-backed gulls. Nest sites have been mapped periodically since 1999 and entered into a GIS. I analyzed changes in distributions of nesting sites and habitat usage over the past 15 years using these GIS data, placing particular emphasis on areas that also showed shifts in nesting gull populations. I monitored nest sites for hatching, chick provisioning, and adult nest attendance. I recorded feeding rates and interspecies interactions including incidences of klepto-parasitism by gulls. I examined intra-species communications in terms of postures and vocalizations of adult and juvenile birds as well as investigating individual response times to human disturbance. Guillemot numbers declined in areas exhibiting the greatest increase in nesting gulls, and appear to have increased in areas with a declining gull population, however gulls and guillemots continue to overlap in nesting habitat along much of the island's shoreline. Further analysis of Black guillemot breeding biology and behaviors are important in determining appropriate strategies for management and conservation of the species. **POSTER**

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Challenges for quantifying the benefits to fisheries of cormorant management and population control

Cormorants are generalist piscivores that are sometimes perceived to be in conflict with specific prey fish of human interest. In such situations, cormorant population control is often proposed, but projecting benefits from this or other types of management is typically difficult. We use the case study of Double-crested Cormorant (*Phalacrocorax auritus*) predation on threatened Columbia River salmonid (*Oncorhynchus* spp.) populations to describe several significant challenges in estimating prey population benefits that might result from cormorant management: (1) Cormorants often prey on juvenile life history stages, necessitating sometimes data-intensive and assumption-laden fish population modeling to project reductions in predation into prospective prey population growth rates. (2) Analytical frameworks often consider only a two-species predator-prey system, when the availability of alternative prey can significantly influence cormorant predation on a focal prey species. (3) Two-species predator-prey frameworks also do not account for possible compensation for reductions in cormorant predation by other predators. (4) Concurrent natural and anthropogenic ecological changes (e.g., invasive species, habitat modification) can alter the resiliency of focal prey populations to cormorant predation. (5) Climate fluctuations can significantly modulate predation on a focal prey species through a variety of mechanisms. Given these sources of structural uncertainty and stochasticity, projecting benefits from management can be difficult even in cases where cormorant predation is substantial. Consequently, benign and precautionary management actions may be a prudent initial approach, and implementation following an adaptive framework is helpful – to both allow management flexibility and

also to quantitatively relate management actions to realized benefits and enhance understanding of the predator-prey relationship. **ORAL**

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Perceived fighting ability, not territory stability, as communicated by territorial signals of resident males may influence territorial intrusions by prospecting Common Loons.

Male Common Loons (*Gavia immer*) are long-lived waterbirds that exhibit high fidelity and actively defend all-purpose territories in part through a territorial vocalization called the yodel. As a high-amplitude signal that communicates information about the identity of each male across many territories, the yodel also may facilitate group cohesion within local networks of territories. Accordingly, non-breeding floaters prospecting for territories may assess the ‘social stability’ among these territories by flying over them to elicit signals from residents, and may preferentially select territories where yodels are unfamiliar, possibly indicating ‘unstable’ territories where boundaries are changing or disputed and thus more likely to be successfully taken over.

We examined the ‘social stability’ hypothesis of territory intrusion by loons by testing the prediction that prospecting loons should be more likely to intrude upon territories where acoustic playbacks of yodels from unfamiliar, non-resident males are broadcast to them. From a sample of 53 territories from which we broadcast yodels from both the current resident as well as from a non-resident male, we found no difference in the likelihood that a prospecting individual actually intruded upon the territory (McNemar’s $X^2=0.0$, $df=1$, $P=1.0$). However, we did find that prospecting loons were more likely to intrude upon territories when playback yodels of both residents (Logistic regression $X^2=9.6$, $P<0.01$) and non-residents (Logistic regression $X^2=8.9$, $P<0.01$) were of higher peak frequencies (frequencies of greatest amplitude). Because males of poorer condition-dependent fighting abilities often produce yodels having higher peak frequencies, we surmise that prospecting loons do not consider the identity, but rather the perceived condition-dependent fighting ability of the signaler, when deciding whether to further intrude upon a territory. **ORAL**

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Non-traditional management of the largest Great Lakes cormorant colony in Toronto, Canada

The largest Double-crested Cormorant (*Phalacrocorax auritus*) colony in the Great Lakes area nests in Canada’s largest city, Toronto, Ontario. In 2014 12,409 cormorant pairs nested at the Leslie Street Spit/Tommy Thompson Park, a globally significant Important Bird Area located a few kilometres from downtown on Lake Ontario. Toronto and Region Conservation (TRCA) initiated the development of a management strategy in 2007 due to public concerns about the impacts of nesting cormorants on the park’s forest communities and biodiversity. A working group that includes agencies, experts and groups from across the spectrum was established to help guide the development of an adaptive management strategy. The public was consulted via a public meeting, a cormorant webpage and ongoing engagement at the park. The overall goal of the management strategy is to achieve a balance between the continued existence of a healthy, thriving cormorant colony and the other ecological, educational, scientific and recreational values of Tommy Thompson Park. Since 2008 TRCA has been implementing the strategy using non-lethal techniques to prevent tree-nesting expansion, while encouraging ground-nesting. Techniques have included post-breeding nest

removal, pre-nesting deterrents, active nest removal, post-breeding deterrents, ground-nest area structural enhancements and social attractants using decoys and playbacks. The management strategy also supports academic research and encourages public knowledge, awareness and appreciation of cormorants and other colonial waterbirds. To date the strategy has successfully limited the expansion of tree-nesting cormorants and, as of 2014, 63 percent of the population nests on the ground where they are not affecting tree canopy, compared to pre-management when only 15 percent of the colony nested on the ground. **ORAL**

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Monitoring and Status of the Western Population of Double-crested Cormorants

Coordinated, long-term, Double-crested Cormorant (*Phalacrocorax auritus*) monitoring has begun for the Western Population. The information is essential for guiding and assessing management actions pertaining to Double-crested Cormorant depredation on of juvenile salmonids, many of which are listed under the Endangered Species Act or are of State Special Concern. The Pacific Flyway Monitoring Strategy for the western population of Double-crested Cormorants was published in 2013 and implemented for the first time in 2014. We forged a monitoring strategy across British Columbia, Washington, Oregon, Idaho, California, Nevada, Utah, Arizona, and the portions of Montana, Wyoming, Colorado, and New Mexico that lie west of the Continental Divide. We reported data for 43 of the 44 selected protocol sites and 73 additional sites were monitored, for a total of 116 sites. The Nongame Migratory Bird Technical Committee of the Pacific Flyway Council coordinated the collection of colony data by state and federal agencies. The U.S. Fish and Wildlife Service compiled these data from the sampled sites of the western population to derive a breeding population estimate of 76,036 (74,796-77,274; $\pm 95\%$ confidence limit) individuals. This estimate is higher than the ca. 2009 estimate of 62,400; an increase of 22% over five years. This represents an average annual growth rate of the number of breeding birds of 4.37%. Growth of the western population has occurred since ca. 1990 when the population estimate was 41,660 breeding individuals. Annual monitoring is planned for 2015-2018, 2020, and every 3 years thereafter. This information will be used to evaluate and adjust future management within the western population.

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Migratory connectivity in Semipalmated Sandpipers: Implications for conservation

Understanding connectivity among wintering, migrating and breeding populations is critical to developing effective conservation strategies for migratory shorebirds. This is especially true for Semipalmated Sandpiper (SESA), a widespread species that has declined by ~80% at western Atlantic migration staging sites and major

wintering areas in northern South America. To assess connectivity, we attached light-level data loggers (aka geolocators), to ~195 SESA at eight breeding sites across Alaska and Arctic Canada in 2013, of which 45 were recovered in 2014. We used recovered data to produce maps that provide a unique perspective on spatial relationships between distinct breeding and wintering populations and their annual migration routes. We also conducted stable isotope assays on primary coverts collected from SESA captured at major wintering areas in Suriname, French Guiana and Brazil, and across their Nearctic breeding grounds. Adults molt these feathers after arriving on the wintering grounds and retain them throughout the following year, thus can be used to link populations spatially. Using discriminant function analysis (DFA), we assigned known individuals to their wintering areas based on $\delta^{15}\text{N}$ values, which resulted in ~80% correct assignment. $\delta^{15}\text{N}$ is linked to trophic levels of prey items consumed, thus provide insight into site-specific foraging strategies. We used DFA to assign feathers collected at breeding sites to South American wintering areas. Since 2009, we marked ~10,000 SESA in Suriname, French Guiana and Brazil with coded legs flags and 15,000 in Delaware Bay, USA since 2004. Resightings of marked individuals provide additional insight into connectivity between SESA populations throughout the annual cycle. Together, these results provide the spatiotemporal context necessary to develop conservation strategies that are relevant to the hemispheric scale of SESA. **ORAL**

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Species distribution models for Black Rail populations in Texas

The Black Rail (*Laterallus jamaicensis*) is a “species of greatest conservation need” and ranks as the most threatened marsh bird in North America (priority marsh bird species listed by Waterbird Conservation for the Americas). Along the Texas Gulf Coast, the population has never been rigorously surveyed; therefore occupancy rates and overall abundance are lacking for the Texas population. Furthermore, while Black Rails primarily inhabit emergent salt marsh, no information exists on habitat use within this broad area. In 2015, we began a 3-year study to examine population size and distribution, refinement of survey methodology, population demographics (i.e. recruitment) and habitat suitability for the Black Rail in Texas. Call-playback survey and vegetation analyses data are being collected at 350 survey points along the Texas coast. We will relate landscape-scale habitat variables to Black Rail observations to develop species distribution models (SDMs) to predict the distribution of Black Rails in Texas; SDM development is critical for the implementation of long-term monitoring of the species as well as future studies on the effects of habitat (e.g. grazing, prescribed burning) and hydrologic management on Black Rail occupancy and abundance. Our research will yield insight into their occupancy and abundance, identify broad and fine-scale habitat relationships, and identify priority areas for species conservation. Identification of important areas for Black Rails and subsequent long-term monitoring of populations will provide guidance for specific habitat management practices and enables prioritization of future habitat acquisitions and restoration for Black Rails in the face of sea level rise and global climate change. **POSTER**

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Understanding the migration patterns and non-breeding distribution of Great Lakes Common Terns (*Sterna hirundo*) using geolocators

To understand the migration and wintering patterns of Common Terns breeding in the Laurentian Great Lakes, and identify areas of conservation interest, we used light-level data loggers to track adults through their annual cycle. In June 2013, we deployed leg-mounted geo-locators (mass=0.75 g) on incubating adults at Elm Island, Lake Huron (n=30) and Interstate Island, Lake Superior (n=20). Of the 22 units recovered in June 2014, only 7 were still recording data; others failed at various times. Birds departed from the breeding areas from late July to late Aug., staging in the southern Great Lakes. With few exceptions, birds showed similar migration routes and over-wintering distributions. During southward migration, most birds travelled overland from the Great Lakes directly to the Atlantic coastlines of the Carolinas/Florida or the Gulf of Mexico. Birds arrived at wintering areas between early Oct. and mid Dec., which included: (1) the Pacific coastlines of Ecuador to southern Peru, (2) Panama and (3) the coast of Columbia/Venezuela to Hispanola. Departures from winter quarters began in early Feb. By Apr., birds were detected from Ecuador to Florida, with some spending a few days in Honduras and Nicaragua. A different pattern was observed during northward migration: most birds returned up the Atlantic coastline, spending 1-2 weeks (late April to early May) on the coast of Virginia before heading west to the Great Lakes region (first detections there from 03-23 May). The observed migration and wintering patterns in our study contrast those reported for geo-tagged Common Terns breeding at Massachusetts (Nisbet *et al.* 2011) and provide further support for non-breeding segregation of Atlantic and central North American population units. **ORAL**

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Exploring differences in survival and site-fidelity between migratory and non-migratory populations of American Oystercatchers

The conservation of a species is reliant on identifying threats to critical vital rates such as survival and dispersal, and in turn, accurate estimates of these vital rates and the factors that affect them can be used to better manage populations. The Atlantic coast population of American Oystercatchers (*Haematopus palliatus*) is gradually increasing partly due to a large-scaled conservation effort, but this long-lived species remains especially sensitive to fluctuations in adult survival. Given the importance of adult survival to population viability, we used a Barker model and eight years of mark-resight data from three breeding populations with varying migration strategies (migratory: Massachusetts and New Jersey, non-migratory: South Carolina) and related nonbreeding observations from 2005 to 2012. The preliminary findings indicate the SC population is resident with 100% of the breeding population wintering in SC, the MA population is entirely migratory with the majority of individuals wintering in FL (42%), and the NJ population is partially migratory with a portion of the breeding population overwintering in NJ (33%). True annual adult survival (S) averaged 0.89 but with sizeable annual variation (range 0.83-0.98) and did not vary by breeding population. The probability of detecting breeding birds varied by breeding population and was very high. During the nonbreeding season, detection rates fluctuated by year and population. Given strong site fidelity (0.91), reducing adult mortality is critical to the viability of local populations. Although the average estimate of survival is high, there is an apparent decline in adult survival over the study period that suggests the need for additional research to identify the threats to adult oystercatchers along the Atlantic coast. **ORAL**

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Breeding biology and conservation status of the Socotra Cormorant in the United Arab Emirates.

The Socotra Cormorant (*Phalacrocorax nigrogularis*) is a regionally endemic cormorant restricted to the Arabian Gulf and Gulf of Oman. The global population has suffered catastrophic declines (>75%) since the 1980s due to oil exploitation, egg collecting and fishing line entrapment and the species is categorized as Vulnerable. Little is known about the breeding biology of the species. We studied the breeding biology of Socotra Cormorants on Siniya Island, Umm Al Quwain, United Arab Emirates, the largest known population in UAE. We quantified incubation period, clutch size, hatching success and fledging success of Socotra Cormorants in 2011 and 2012/2013 breeding seasons. We also estimated the breeding population of Siniya Island. Breeding was asynchronous in both years with a distinct early peak of breeding, followed by successive nesting activity of smaller groups. Breeding was initiated in mid-September in 2011 and late-September in 2012. Incubation period was 24-27 days, hatching success was 58.7-74% and fledging success was 65-87%. Breeding activities in 2011 ended by December and the colony was deserted. In 2012/2013 the breeding continued in smaller batches until May 2012. Total breeding population was estimated to be 32,615 pairs in 2011 and 35,509 pairs in 2012/2013. Thus the population has increased since the 1996 estimate of 15500. I propose that breeding birds from permanently altered breeding colonies may be recruited in the Siniya Island breeding population. Further studies and monitoring are required to better understand the status of the Socotra Cormorant in the Arabian Gulf. **ORAL**

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Acadian Flycatcher response to deteriorating eastern hemlock conditions in two hemlock dominated riparian habitats in Northeastern Pennsylvania.

Eastern hemlock is an important tree found normally along riparian corridors whose stands create distinct communities and govern ecological functions. The biggest threat to these hemlock forests is an invasive insect from Japan, the hemlock woolly adelgid, which is spreading rapidly and killing hemlock stands throughout the eastern United States. The Acadian flycatcher, a neotropical migrant that breeds in the eastern United States, demonstrates a preference for nesting in hemlock in the northeastern United States. To understand the response of the Acadian flycatcher to changes in hemlock condition, comparisons were made to a previous study conducted in the same locations (Sheehan 2003) between two habitat types, ravines and benches. Results indicate a significant decrease in overall hemlock health between study years as well as in Acadian flycatcher pair density. An increase in nesting in various deciduous tree species was also found, as was a significant increase in nest height in hemlock trees. Ravines were found to have significantly lower pair/fledgling densities, greater understory mean density, and greater abundance of hemlock in poor health. These results reveal that hemlock health has and continues to deteriorate in the Delaware State Forest and the Delaware Water Gap National Recreation Area, and that bench sites are generally more productive and contain healthier stands of hemlock than ravines. This study suggests that benches have a higher ecological value, thus making them a higher priority for hemlock woolly adelgid management, and that the Acadian flycatcher may be an indicator of how other hemlock dependent songbirds may respond to hemlock deterioration. **ORAL**

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Double-crested Cormorants and Conservation Ethics: targeting one species to benefit another.

Decisions to kill one species to benefit another, or to benefit humans in some way, are like all of our conservation decisions – they require justification. Such justifications will – by force of logic – require two kinds of claims: empirical scientific claims about the way the world is, and normative value claims about what is of value. Given that the lives and deaths of thousands of animals is at stake, decisions about killing cormorants to supposedly benefit some other species, or because humans decide not to share with cormorants, requires not only our best scientific knowledge but also our best moral reasoning. Using the tools of conservation ethics and argument analysis we can both articulate and evaluate arguments employed in this debate to understand whether killing cormorants is morally justified. We will formally and systematically assess some of the most pervasive arguments for killing cormorants. **ORAL**

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Effects of low level exposure to oil on hematological parameters and reproductive success in Common Terns

Hematological parameters and reproductive success were measured in Common Terns (*Sterna hirundo*) exposed to low levels of oil following an oil spill in Buzzards Bay, MA on 27 April 2003. Exposure occurred during the periods prior to and during egg-laying, but only small spots and streaks of oil were found on the plumage of birds trapped soon after egg-laying. Hematocrits, total leukocyte counts and %lymphocytes (L) were severely depressed and %heterophils (H) and H/L ratios were markedly elevated when terns were first sampled 14-20 days after the spill. These parameters returned almost to reference levels by day 39. Productivity at this and two other breeding sites in Buzzards Bay was lower than that expected based on levels measured in previous and subsequent years, compared to levels at an unoiled control site in the same years. Reduced productivity resulted from delayed laying, low clutch-size and reduced hatching success. These effects probably resulted from immune suppression and anemia during the physiologically demanding periods prior to and during egg-laying. **ORAL**

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Potential techniques for increasing American Oystercatcher hatch success through shell rake enhancement

In an effort to test techniques for reducing overwash and increasing hatch success of American Oystercatchers (*Haematopus palliatus*; AMOY), we selected two geographically similar sets of oyster rakes that had successful and unsuccessful nests determined by previous AMOY nesting season data in north eastern Florida, USA. One technique (February 2014) involved the deployment of three oyster reefs in an attempt to dissipate wave energy and protect future nests from overwash. The second technique (March 2015), on a rake with documented nest failure, involved oyster mining and elevating the oyster rake in an area previously susceptible to overwash. Physical alterations at the enhanced shell rake have been observed including change in shape, oyster shell disbursement, and vegetated area. **ORAL**

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Enigmatic, premature feather loss among common tern chicks at Presqu'ile Provincial Park, Lake Ontario

We report contemporary, premature feather loss (PFL), whereby developing chicks lose all their wing, tail, head and body feathers, among common terns (*Sterna hirundo*) at a small colony in northern Lake Ontario, Canada. Rarely observed in wild birds, to our knowledge PFL has not been reported since 1974 (despite the banding of tens of thousands of tern chicks across North America since then). In the early 1970s, it was documented both in eastern North America and at islands in the Indian Ocean. At Presqu'ile Provincial Park, ON in July 2014, PFL first occurred in chicks at between 2 and 4 weeks of age, consistent with the ages of chicks in historical reports. However, PFL was more extreme and more common than in previous reports and was not accompanied by other aberrant developmental or physical deformities. All affected chicks quickly began to grow replacement feathers and, unlike in historical reports, all but one most likely fledged 10-20 days after normal fledging age. There was a striking association between the onset of PFL in chicks at Presqu'ile and persistent, strong southwesterly winds that caused extensive mixing of near-shore, surface water with cool, deep lake waters. While contaminants have been previously associated with PFL, to our current knowledge it seems most probable that PFL at Presqu'ile was caused by unidentified pathogens (viruses, bacteria, algal toxins) welling up from deeper waters. **POSTER**

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Conservation implications of Ridgway Rail use of artificial floating islands in San Francisco Bay

Intensive management of wildlife populations and their habitats is increasing worldwide. Whether management objectives are to increase resource values of ecosystem services or to preserve conservation-reliant species, three characteristics are common to most plans: 1) ease of implementation and cost effectiveness; 2) targeted impact to a species or habitat with a minimum of non-target effects; 3) sufficiency of actions or a large magnitude of effect. Generally, large gaps in our understanding of species biology or ecological processes exist and conservation strategies directed at habitat specialists may be considered more straightforward than conservation for generalists because a narrow ecological niche is assumed to be easier to understand and manipulate. Recovery of the California Ridgway rail (*Rallus obsoletus obsoletus*) represents such a situation. The rail was listed as endangered in 1972 following turn of the century market hunting and habitat loss, fragmentation, and degradation coinciding with agricultural development then urbanization. Recent and proposed tidal marsh restoration in San Francisco Bay has been threatened by an invasive hybrid plant species (*Spartina alterniflora x foliosa*). Controlling *Spartina* is complicated by heavy use of the invasive plant by rails and evidence that invasive *Spartina* enables higher rail survival rates, particularly during the winter and periods of greater tidal inundation. Artificial floating islands, designed to supplement tidal refuge cover, were developed as temporary mitigation for eradication effects and as another conservation tool to support rail populations. However, despite a solid mechanistic understanding of the rail's biology, the behavioral traits of the bird and patterns of selection limited the usefulness of artificial floating islands as a conservation tool and exposed a potential behaviorally mediated paradox in predator-prey relationships.

ORAL

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Population and conservation status of the Pacific American Oystercatcher

The western race of the American Oystercatcher (*Haematopus palliatus frazari*) is a resident and endangered shorebird of western Mexico. Its ecology and conservation problems are poorly known, but recent information indicates extremely low numbers and discrete breeding distribution. Because of loss and degradation of sandy beaches by coastal development, disturbance from human recreational activities, and hybridization with the Black Oystercatcher (*H. bachmani*) the American Oystercatcher is a priority species in the Shorebird Conservation Plans of US and Mexico. We evaluated its breeding distribution and abundance in 2009 and found 2,319 adults in northwest Mexico. Although the population is higher than previous estimates, its distribution is more restricted than expected. It is distributed almost exclusively in northwest Mexico, and 80% of the total population is found in the barrier islands of Sinaloa and Baja California Sur. Based on these results we did the listing petition and the subspecies was included as Endangered in the Mexican List of Endangered Species (NOM 059). This legal mechanism will promote the management and protection of this priority species and their habitats, and it will benefit other waterbirds that share its habitat. **ORAL**

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Introduction to the symposium: Behavior and conservation

Since the mid-1990's there has been growing awareness of the importance of the link between behavior and conservation. Before that time, conservation and management of waterbirds had already incorporated behavioral research. The pioneering work of Kress on conspecific attraction and translocation in colony-site restoration and of Archibald on behavioral techniques in captive breeding are key early examples. In addition, Burger and Gochfeld (and others) have long worked on a variety of aspects of behavior with relevance to conservation. There are many areas where knowledge of behavior can inform conservation. Effective habitat modification requires knowledge of habitat selection cues and avoidance of ecological traps. Population dynamics are affected by behaviors that influence the frequency of movement among colony sites: site fidelity, natal and breeding dispersal, and group adherence. Knowledge of the behavior of predators can contribute to management plans, because predator behavior can sometimes be manipulated and predation is often performed by only a few specialized individuals. Other examples of links between behavior and conservation include the relationship between behavior and effective population size, behavioral toxicology research, and studies of behavioral responses to human disturbance and manmade structures. More work is needed on behavior away from breeding colonies in both the breeding and nonbreeding seasons. More cooperation is also needed between behavioral ecologists and applied practitioners. This symposium on behavior and conservation includes speakers studying a range of waterbird species, various aspects of behavior, and diverse conservation issues. **ORAL**

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Roseate Tern (*Sterna dougallii*) population decline: The case for prey base competition with Grey Seal (*Halichoerus grypus*)

The Northwest Atlantic population of the Roseate Tern (*Sterna dougallii*; ROST) was listed in 1987 as "endangered" under U.S. and Massachusetts Endangered Species Acts. In 1988, the population stood at approximately 3,000 breeding pairs and with protective management, peaked in 2000 at 4,300 pairs. After a decade of decline, recent data suggest the population may be stabilizing, however to reach the recovery goal of 5,000 pairs, the current population must increase by 43%. Demographic studies do not provide evidence

that ROST population losses since 2000 result from changes in fledgling production or adult survival; both are estimated to be at levels that would sustain a stationary population. Survival of juveniles and sub-adults has not been quantified, and scientists have not identified factors limiting recruitment. Preliminary field studies suggest that 60-80% of fledged (HY) ROST disperse from breeding sites in mid-summer to staging habitats located on Cape Cod and Nantucket MA. The decline in ROST abundance coincides with exponential growth (700% increase; 2000-2010) of the Grey Seal (*Halichoerus grypus*; GRSE) population on Cape Cod and Nantucket. Both species are sand lance (*Ammodytes sp.*) specialists (ROST 85% of diet; GRSE 63%) whose prey size selection in MA overlaps significantly (53% of ROST diet; 67% GRSE). The southeastern MA population of GRSE consumes more than 6.7M sand lance daily and feeds preferentially at inlets and other areas of sand lance concentration. A meta-analysis examines the evidence of direct competition between Roseate Tern and Grey Seal. **POSTER**

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American Oystercatcher (*Haematopus palliatus*) nesting in urban estuaries: Role in population recovery

Up to 15% of the US northeast population of American Oystercatcher (*Haematopus palliatus*) nests in urban estuaries, including in metropolitan areas around New York City, NY and Boston, MA. Number of nests at Breezy Point, New York increased by 22% from 2011-2014 (n=33 in 2014). Nesting pairs in Boston Harbor increased by 29% from 2008-2014 (n=22 in 2014). Abundance in non-urban areas of southeastern Massachusetts increased from 2010-2014 by 20% (n=36 in 2014). Hatching success in 2014 at Breezy Point was 1.6 eggs hatched/per nesting attempt; at Boston Harbor 1.4 eggs hatched per nesting pair in 2014. Hatching success in non-urban areas of southeastern Massachusetts was 1.2 eggs hatched per nesting pair in 2014. Behavioral responses to disturbance at Breezy Point—a spit at the western end of Long Island—suggest unusual acclimation. In Boston Harbor, where all nesting is on 14 islands, oystercatcher responses to island landings and other disturbance are typical of non-urban nesting birds in the state. The drumlin islands of Boston Harbor comprise the Boston Harbor Islands National Park Area. Many of the nesting islands are served by public ferries which bring up to 50,000 visitors to each island annually. We evaluate the importance of habitat availability and use by oystercatchers in urban landscapes, and predict future use in the context of increased conservation efforts and population growth. **ORAL**

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Effects of the Deepwater Horizon: Blood PAH concentrations change signature over time and are associated with reduced body mass in juvenile common loons

From 2011-2014, we captured Common Loons (*Gavia immer*) wintering in Barataria Bay, an area off coastal Louisiana that received large amounts of oil from the Deepwater Horizon Event of April 2010. We obtained blood and feather samples and measured polycyclic aromatic hydrocarbon (PAH) levels in their blood. Both adult (n=26) and first winter juvenile (n=55) loons were captured. We found no significant difference in the frequency or concentrations of PAHs between adults (35.5%, 24.5 ± 12 ppb) and juveniles (39.4%, 29.5 ± 7.6 ppb). However, the interaction between adult and juvenile PAH concentrations and body mass was significant. Juvenile loons with high (~100ppb) blood PAH levels were often emaciated and in poorer condition than those with lower blood PAH levels (10ppb), whereas body mass was not related to PAH concentrations in adults. The frequency of loons with detectable concentrations of PAHs in 2011 was 17%, increased to 62% in both 2012 and 2013, then decreased to 0% in 2014. In 2011 and 2012, blood PAH concentrations were low (< 5 ppb), in 2013, they increased significantly (109 ± 16.2 ppb), and in 2014 they

were low again (< 5ppb). The PAH profile also varied by year: in 2011 and 2012 all PAHs were lightweight, but in 2013, the majority of PAHs were heavyweight. The impact of concentrations and types of PAHs on Common Loon breeding success, survival, and health remains to be studied. **ORAL**

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Developing a spatially-explicit approach for the conservation of marine birds: pre-construction planning of offshore wind developments for the Rhode Island Ocean Special Area Management Plan (SAMP)

Integrating complex ecological information to guide the siting of an offshore wind energy development is challenging. The Rhode Island Special Area Management Plan (SAMP) was a federal process that defined use zones for nearshore and offshore waters through a research and planning process that integrated the best available science with public input and stakeholder involvement. Using aerial line-transect surveys ($n = 41$) that were conducted at 76 m elevation in Rhode Island Sound and Block Island Sound from 2010-2012, we estimated the spatial distribution of marine birds throughout a 3800 km² area between Long Island and Martha's Vineyard. To assess the spatial distribution of birds within the SAMP boundaries, we used a combination of density surface models (alcids, gannet, loons, storm-petrels, terns) and presence-absence models (eider, scoters) for seven groups of marine birds that incorporated relevant environmental covariates. We integrated these spatial models, along with uncertainty, using Zonation, a spatial conservation prioritization package, to identify sites of high marine bird conservation priority. Current proposed sites (Block Island Wind Farm, Area of Mutual Interest Lease Blocks) are located in areas of low conservation priority, thus this modelling approach suggests these offshore wind developments would not substantially reduce overall bird distribution in the region. The planning process we used, which incorporated quantitative models of bird distribution, provided a robust framework that meet the requirements of ecosystem-based marine spatial planning. The Rhode Island SAMP received federal approval in July 2011, first in the nation, and construction of 5 turbines off of Block Island will be initiated in the summer of 2015. **ORAL**

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Using satellite telemetry to predict dispersal of Double-crested Cormorants following habitat reduction at the largest breeding colony in North America

East Sand Island (ESI) in the Columbia River estuary is home to the largest known breeding colony of Double-crested Cormorants (*Phalacrocorax auritus*; 13,600 breeding pairs in 2014 *ca.* 40% of the western North America population). Annual consumption of millions of out-migrating juvenile salmonids (*Oncorhynchus* spp.), including individuals from populations listed under the U.S. Endangered Species Act, motivated managers to test methods to reduce cormorant predation, including reducing colony size. In 2013, two visual barriers and limited hazing were used to reduce nesting habitat to 1.6 ha, a 64% reduction in available habitat from 2012, but greater than the 1.1 ha occupied in 2012. The nesting habitat made available

in 2013 also excluded 100% of nest sites used by cormorants in 2012; thus, all returning cormorants were forced to establish nests in different locations on the island, or prospect for nest sites elsewhere. To evaluate cormorant response and potential dispersal, satellite transmitters (Kiwisat 202 & 303 PTTs, Sirtrack Ltd.) were fitted on 83 cormorants during the pre-breeding or nest-initiation period, shortly after their arrival to the colony. Initial dispersal was temporary, but still may have provided information on where cormorants might prospect for alternative nest sites if habitat becomes limiting at ESI. Satellite tracking continued through the entire nesting and subsequent non-breeding seasons. Consistent with prior studies, cormorants migrated both north and south from ESI and their winter range overlapped almost completely with the breeding range of the western population. Tracking data also revealed substantial connectivity between the ESI colony and other colonies within the range of the western population, suggesting the potential exists for widespread dispersal throughout the population's breeding range. **ORAL**

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Dispersal patterns and habitat use of Brown Pelicans (*Pelecanus occidentalis*) along the US Atlantic Coast

The mid- and south Atlantic states of the USA support a suite of colonial-breeding, nearshore seabirds, however, gaps in data exist when birds are off colony. Existing data from band returns may be adequate to estimate range and areas of concentration, but neither are ideal for determining the timing, residency time, and paths of migration to and from nonbreeding sites, and both tend to ignore remote areas. We examined movement patterns of 40 brown pelicans satellite tagged in December 2010 in South Carolina, USA, and tracked until July 2013. Behavioral differentiation at the population level resulted in diverse movement patterns, and birds were capable of long-distance migration. Approximately 25% of individuals remained near the breeding colony year-round. Consistency in behaviour within individuals was high and birds demonstrated interannual fidelity to breeding and wintering sites, migratory routes, and stopover locations. At coarse scales, brown pelicans occupied and moved between tropical and temperate ecoregions, and multiple individuals used the Chesapeake Bay/Delmarva Peninsula region during prebreeding and postbreeding dispersal. At fine scales, brown pelicans primarily used nearshore marine habitat outside of protected areas, and offshore habitat within 10 km of the coast. This study represents a substantial enhancement to our understanding of movement patterns of Brown pelicans along the US Atlantic coast, provides valuable information for marine spatial planning efforts, and serves as a baseline for anthropogenic based threats such as development, pollution, and commercial fisheries. **POSTER**

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Comparative foraging behavior of Masked Boobies and Red-footed Boobies breeding in the Gulf of Mexico

Masked boobies and Red-footed boobies that breed sympatrically may compete for the same resources when foraging at sea. In low productivity environments (e.g. the western Indian Ocean, the central Pacific), where prey are limited, the two species have been shown to avoid competition by partitioning diet and by traveling different distances from the colony, however, whether the same relationship occurs in productive environments is unknown. We examined foraging behavior of GPS-tagged Masked boobies (n=15) and Red-footed boobies (n=5) breeding at a colony located in a moderately productive and highly dynamic oceanic regime in the southern Gulf of Mexico during December 2015. Diet composition and individual prey length, determined from regurgitations, did not appear to vary between species. Red-footed boobies made short-distance foraging trips and searched for prey near the breeding colony; trips lasted 3.7 ± 2.4 hours and occurred in the morning. In contrast, Masked boobies traveled 2.5 times farther from the colony (77.3 ± 32.3 km) and trips occurred throughout the day; birds spent one or more nights on the water during 26% of foraging trips. We also investigated whether individual birds made repeated trips to the same areas and found that behavior is highly consistent within individuals of both species. Our results, when compared with findings from other studies, indicate that the relative behavior of Masked Boobies and Red-footed boobies may differ depending on oceanic regime, therefore conservation actions that account for at-sea behavior should incorporate site-specific interactions between the two species. **ORAL**

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Gavia CSI: the importance of looking at dead loons

Death is part of every species' lifecycle. But for those who love and study loons, nothing could be more disheartening than finding a dead loon. To simply chalk this up to natural events is to ignore a major source of information about this (or any other) species. We will present case examples to illustrate the value of thorough post-mortem examinations in illuminating important aspects of loon biology from intraspecific aggression to toxicosis to disease. To paraphrase Ward Stone, a better understanding of the mortality factors of this species helps to identify historic, present and future threats to this icon of the northern lakes and to the ecosystems in which it lives. **ORAL**.

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Foraging areas and movements of Great Shearwaters in the Gulf of Maine and Bay of Fundy

During the austral winter (May-November) Great Shearwaters (*Puffinus gravis*) migrate to the northwest Atlantic Ocean from the Patagonian Shelf off South America and breeding colonies in the Tristan da Cunha Islands in the South Atlantic. Their general distribution in the North Atlantic has been described but foraging areas and movements within the Gulf of Maine and Bay of Fundy are not well understood. This study combines three separate satellite-based tracking data sets (Argos) encompassing 67 birds spanning from 2006 to 2014 and uses a Bayesian switching state-space model (SSSM) analysis of their Argos locations to define a normalized temporal distribution of estimated locations. Birds were tagged in coastal waters off Massachusetts and Maine and Grand Manan Island in New Brunswick, Canada. Spatial analyses include 'hot spots' or areas of most frequent use and are described using several methods, which include kernel density estimation plots and habitat usage by oceanographically defined polygons. Temporal movements include shifts in distribution from May to November and an age-related (breeder vs. non-breeder) separation in the distribution using differences in timing of when birds start their southern migration back to the South Atlantic in time for egg-laying in November. **ORAL**

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Cormorants and ESA-listed salmonids in the Columbia River estuary: the management conundrum

Two distinct populations of Double-crested Cormorants (*Phalacrocorax auritus*) occur in the conterminous U.S. and southern Canada, and meet at the Continental Divide. The most recent estimate of the size of the western North America population is 31,200 breeding pairs, about 70% of which nest along the Pacific coast. The western population is less than one-tenth the size of the eastern/central North America population. Since 2003 the eastern/central population has been subjected to widespread lethal culling under a Public Resource Depredation Order, whereas the western population has remained protected. Protections for the western population are in transition, however, as U.S. federal government agencies have initiated a program to cull about 42% of the breeding adults at a colony on East Sand Island (ESI) in the Columbia River estuary. This colony includes about 40% of the western population; thus, the planned cull of 11,000 cormorants at this one colony represents about 15% of the western population. The rationale for this population-reducing cull is to reduce consumption of juvenile salmonids (*Oncorhynchus* spp.) from throughout the Columbia Basin, many of which are listed under the ESA. The magnitude of smolt losses to cormorants nesting on ESI has reached 20 million/year, providing strong incentive to manage the colony. Nevertheless, the management agencies' selection of a lethal management alternative over a nonlethal one appears to be motivated at least in part by bureaucratic risk aversion: dispersing cormorants from ESI might cause new fisheries-cormorant conflicts elsewhere. Thus, the management policy of major population-reducing culls of cormorants, which has become entrenched in the last decade across eastern/central U.S., has now established a beachhead in the western U.S. from which it will likely expand. **ORAL**

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Latitudinal trends in Saltmarsh Sparrow (*Ammodramus caudacutus*) fecundity across its global range

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In 1906, Joseph Grinnell hypothesized that the population growth rate of a species should be highest near the center of its geographic range, where environmental conditions are most favorable for that species. Over time, this hypothesis has become deeply entrenched in ecological and evolutionary theory. However, despite the ubiquity of Grinnell's hypothesis, it has rarely been tested across the global range of a species or with demographic data. We present one of the first range-wide demographic analyses of a species as a test of Grinnell's hypothesis. We quantified the fecundity, or reproductive success, of Saltmarsh Sparrows

(*Ammodramus caudacutus*) across their global breeding range. Saltmarsh Sparrows are endemic to tidal marshes and breed exclusively in the northeastern United States. From 2011 to 2013, we conducted intensive demographic surveys of breeding Saltmarsh Sparrow populations in Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey. We calculated fecundity via a Markov-chain approach using programs developed by the U.S. Environmental Protection Agency. We combined daily nest failure probabilities with various other life history parameters, such as number of eggs per nest and number of nesting attempts each year per female, to create a robust estimate of annual fecundity. In contrast to Grinnell's hypothesis, we found that Saltmarsh Sparrow fecundity did not vary with latitude. We discuss the implications of these results to potential species range shifts in response to climate change. **ORAL**

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American Oystercatcher site fidelity in Cape Romain Region of South Carolina

The Cape Romain Region of South Carolina supports one-fifth (1,900) of the wintering American Oystercatcher population on the Atlantic and Gulf coasts of the United States and the majority of South Carolina's breeding pairs. Oystercatchers that breed in the Cape Romain Region remain year round. We studied American Oystercatcher site fidelity or the tendency to stay or return to a previously occupied place in the Cape Romain Region. Additionally, site fidelity within a year or season and the tendency to return to the same area in following years were compared for resident and migratory oystercatchers. Approximately 400 oystercatchers were color banded at the study site and surveys for uniquely marked birds occurred from 2002 to 2014 at least once during the winter and once during the breeding season. We used 3740 observations of marked oystercatchers to calculate the centroid, or center of all locations, in ArcGIS for winter and breeding seasons for each year. The mean distance that an individual oystercatcher moved during one winter was 12.1 km. Mean distance from a winter center point to another winter center in a different year for an individual oystercatcher was 9.5 km and from a breeding center point to another breeding center was 0.2 km. Mean distance from the winter center point to an oystercatcher's breeding center point was 3.8 km. As expected, breeding site fidelity was higher than winter roost site fidelity. This study supports the importance of conservation of winter roost sites near concentrated breeding sites. Examining site fidelity is important for many reasons including evaluating stability of resources available in the environment. **ORAL**

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Ecology of wintering Piping Plovers in coastal Louisiana

Winter habitat quality can affect the annual survival and reproductive success of migratory birds. Banding records show that the interior breeding population of the federally threatened Piping Plover winters predominantly in the Gulf of Mexico. However, little is known about the quality of coastal shorebird habitat or patterns of habitat usage in this region. We assessed the distribution of Piping Plovers on the Isles Dernières Barrier Island Refuge in Terrebonne Parish, Louisiana relative to their invertebrate prey base and identified some environmental factors responsible for distributional patterns of dominant prey items. During biweekly surveys conducted on the refuge from January 2013 to May 2014, 381 unique Piping Plover observations were made and data regarding behaviors and habitat usage recorded. We also quantified the benthic invertebrate prey base by collecting intertidal core samples at randomly placed locations along the shoreline and at targeted locations where Piping Plovers were observed feeding. The infaunal community was dominated by Haustoriid amphipods, which showed highly variable abundance, suggesting a patchy distribution. Strong support is shown for the influence of sediment moisture and interactions among island,

season, and habitat type on amphipod abundance. There was no strong evidence that samples taken at locations of foraging birds differed from random samples in amphipod abundance. Whether Piping Plovers select habitats based on prey abundance in Louisiana remains unclear, and further study is needed. Piping Plovers show high fidelity to their wintering grounds, which in Louisiana are threatened by relative sea-level rise, subsidence, and other factors. An improved understanding of these ecosystems will be critical for conserving the species that use them. **ORAL**

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Salt marsh passerine occupancy and habitat associations in northeast Florida.

Salt marshes and their dependent organisms are subject to a variety of anthropogenic threats. In Florida, the Worthington's Marsh Wren (*Cistothorus palustris griseus*) and MacGillivray's Seaside Sparrow (*Ammodramus maritimus macgillivraii*), both species of concern, inhabit a small, narrow range in northeast Florida in an area of increasing development. Historical data show that these subspecies have undergone significant range contraction and suggest that they may face extirpation from the state. However, no research has been conducted on either subspecies in the region for nearly 15 years, and the causes of extirpation were unknown. In 2014-2015, we conducted point count surveys throughout the historical range of these subspecies to determine their current occupancy, abundance, and distribution in Florida. We also analyzed their associations with habitat features at the point, patch, and landscape scales to understand how conditions in occupied areas differed from unoccupied areas and to examine possible causes of extirpation. During surveys, neither subspecies was found south of the St. John's River. However, densities of both subspecies found north of the river were similar to densities reported during 2000-2001 surveys, suggesting that populations north of the river are relatively stable. Marshes south of the St. John's River had lower stem density, sparser vegetative cover, were nearer to uplands, and more likely to contain mangroves than northern marshes. Unoccupied sites north of the St. John's River were more likely to contain brackish or *juncus* spp. vegetation, have shorter, less dense *spartina* spp., and be closer to uplands than occupied sites. Though the causes of extirpation are not definitively known, these findings suggest that degradation of the southern marshes and mangrove expansion may have played a role. **ORAL**

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Abundance and distribution of American Oystercatchers during the breeding season in North Carolina

The North Carolina coast is >500 km long and includes many types of habitats, including long barrier islands with varying amounts of development, dredged-material islands within sounds and adjacent to the Atlantic Intracoastal Waterway, and natural marsh islands with small areas of sand and shell. Because the Western Atlantic population of the American Oystercatcher (*Haematopus palliatus*) is of significant conservation concern, it is important to know numbers of nesting pairs, the distribution and habitat selection of nesting pairs, and the conservation status of nesting sites. This information is used to determine impacts of conservation efforts and to identify important sites that need increased protection. The size of the breeding population of American Oystercatchers in North Carolina has been estimated four times since 2004. Surveys of beaches, shorelines, and islands were performed by boat, foot, truck, and all-terrain vehicle. Each area was surveyed at least once within a season to detect breeding pairs of American Oystercatchers. Locations of

territories and nests were recorded and mapped, and in 2013, the North Carolina coast was delineated into plots so further assessment of nesting sites by plots can be completed. Estimates indicate that numbers of nesting pairs in North Carolina have remained relatively stable: 337 pairs in 2004, 339 pairs in 2007, 372 pairs in 2010, and 374 pairs in 2013. Most nesting pairs are within protected areas, but key unprotected sites were identified for future conservation efforts. Survey methods and definitions of territories were clarified in 2013 to develop a common protocol for breeding season assessment of the American Oystercatcher throughout its range. **ORAL**

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A summary of Double-crested Cormorant research in the Beaver Archipelago (2000-2015) highlighting a disconnect between science and management practices

Beginning in 2000 and through the present, Double-crested Cormorants (*Phalacrocorax auritus*) have been studied in the Beaver Archipelago of northern Lake Michigan; this presentation will summarize the research findings over this time. The study was initiated to investigate whether cormorants were preying on smallmouth bass (*Micropterus dolomieu*) and causing a perceived decline in this sport fishery. Breeding population estimates were completed each year to record natural population dynamics before management and were continued through an intensive control program that was initiated in 2007. Additionally, the diet of these birds was documented over the years as the fish community changed due to the invasion of the round goby (*Neogobius melanostomus*). Research has also included intensive behavioral studies using telemetry, raft surveys, banding and game cameras, as well as the development of several bioenergetics. Furthermore, the population dynamics, reproductive success and behavior of co-nesting species, including herons, gulls and terns, were studied to investigate interspecific interactions and possible impacts of cormorant control on non-target species. Research indicates that cormorants do not appear to be negatively impacting the smallmouth bass, co-nesters or other aspects the Beaver Archipelago system. However, in spite of these findings, control measures were still initiated and continue in the archipelago due to perceived, but unsubstantiated, conflicts. In turn, it is possible that intensive control has led to breeding site abandonment at traditional colony sites and a switch from ground nesting to tree nesting. In essence, there appears to be some disconnect between science and management decisions in the Beaver Archipelago. **ORAL**

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Managing fisheries-cormorant conflicts in the Pacific Flyway: Perspective from a bird conservation NGO

Audubon understands the need to recover threatened and endangered stocks of salmonids (*Oncorhynchus* spp.) in the Columbia River basin, and appreciates that avian predation, including predation by Double-crested Cormorants (*Phalacrocorax auritus*), is one of many sources of mortality to juvenile salmonids. However, Audubon opposes the current management policy of culling 11,000 adult cormorants and destroying over 26,000 cormorant nests at the breeding colony on East Sand Island in the Columbia River estuary because it finds that this action is not well supported by the underlying science and is premature as a management strategy given that demonstrably successful non-lethal measures have not been implemented and evaluated. The cormorant colony at East Sand Island is the largest known colony of its kind and includes about 40% of the entire western population of the species. A cull of this magnitude would clearly have impacts on the entire western population, which is Audubon's greatest concern. The western cormorant population is at least an order of magnitude smaller today than historically, and the present action will further reduce the population below a level that was previously identified as sustainable. In 2012, the Pacific Flyway Council adopted a

management strategy for reducing cormorant depredation on fishery resources, but the strategy does not address the longer-term issue of how and where to provide for and sustain cormorants in the flyway. The responsible agencies are not offering to mitigate the population impacts of the cull at East Sand Island. More broadly, there is no evident commitment to provide for and sustain viable populations of cormorants during a time of extreme drought and increasing pressure to “manage” cormorants and other fish-eating birds across the West. **ORAL**

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An examination of gene flow among distinct management units of the Reddish Egret (*Egretta rufescens*)

Reddish egret (*Egretta rufescens*) is one of the rarest herons in North America. This plumage dimorphic species ranges from western Mexico including Baja California, to Texas and to the Bahamas, the easternmost portion of its range. The global population has been estimated between 5000–7,000 individuals. Previous research on gene structure (i.e., microsatellites) across the range revealed distinct populations in Baja California, Texas and the Bahamas. The findings of this previous study resulted in the Reddish Egret Working Group dividing the global Reddish Egret population into three separate management units (Western, Central and Eastern); however, important populations in Chiapas, Yucatan, Louisiana and Florida have not been examined. These populations may serve as stepping stones between management units. Furthermore, studies examining mitochondrial DNA (mtDNA) variation have only examined gene flow within Texas; the previous study in Texas population showed no differentiation within Texas and between color morphs. We are using 12 microsatellite loci primers to examine potential gene flow across the range with samples from Baja California (n=20), Chiapas (n=20), Texas (n=20), Louisiana (n=20), Yucatan (n=28), Florida (n=12), and the Bahamas (n=20). We are also using mtDNA to examine population gene flow between regions and also between colonies in each region. Lastly, we are using a sex marker to estimate sex ratio and obtain demographic data for the species. Understanding genetic variation and gene flow structure between colonies and regions will aid in developing management strategies for conserving this rare species. **POSTER**

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Recruitment demographics and philopatry of Black Terns in Wisconsin

Of the 2,433 Black Terns (*Chlidonias niger*) banded as chicks in Wisconsin from 1999 to 2012, only 39 (1.6%) have been recaptured as breeding adults (n = 20 males, 19 females). Mean age at first capture ranged from 2 to 9 years and averaged 4.6 years (± 2.1 sd), with no difference in age of first capture between males and females ($t_{37} = 0.19$, $P = 0.85$). First breeding at age two was confirmed for both sexes (n = 3 each). About 40% of the recruits were captured on nests at colony sites other than their natal colony; there was no evidence of sex-biased dispersal. The age at which recruits were first captured as adults had no influence on the likelihood of dispersal. Among birds that dispersed from their natal sites, nearly half (44%) nested at wetland sites dominated by vegetation different than the type from which they were reared. Dispersal distances ranged from 11 to 71 km from the natal site, with a mean of 23 km (± 16 sd), and no evidence that dispersal distance differed between the sexes. These findings provide evidence against natal-site or habitat imprinting in Black Terns, which might be expected in a species with fairly specific breeding habitat requirements. Conversely, the dynamics of wetland processes may promote flexibility in habitat selection, such that vegetation structure is more important than vegetation composition when deciding where to breed. **ORAL.**

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Does what you eat dictate what infects you? Bird diet groups and their parasites

Birds are host to a myriad of parasites, many of which are transmitted when birds feed on infected intermediate host prey items. Such trophically transmitted parasites should be shared among bird species with similar diets. Bird morphology characteristics like gape size can be an important factor limiting the types of prey items and parasites consumed by birds. Specialization of parasites on particular taxa of host birds can also influence parasite community structure. We have assembled diet information and examined the parasite communities of 26 estuarine bird species from 6 families. We use multivariate analyses to group host birds based on dietary, morphological, and phylogenetic traits and compare these groups to those similarly developed based on parasite communities. We focus on trematode parasites, but also include information on cestodes, nematodes, and acanthocephalans. We test whether there is a general association between bird trophic groups and bird parasite communities. We additionally predict that trophically transmitted parasites, because they last longer in birds than do ingested prey items, will provide further information on diet variability among both bird species and individuals within species and thereby enhance our understanding of bird foraging ecology. **ORAL**

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Is food currently a limiting factor for gulls nesting in the outer Bay of Fundy?

The number of breeding Herring Gulls (*Larus argentatus*) is estimated to have declined by 50% in coastal North America since 1980. However, trends at smaller geographic scales vary in timing and intensity. The ecological changes spurring colony-level fluctuations in Herring Gull numbers are not well understood, but could be related to factors such as winter survival, predation, habitat availability, and food quality or quantity. To test the latter hypothesis, we used GPS tags to track the movements of Herring Gulls in 15-minute intervals at Kent Island, New Brunswick (44°35'N 66°45' W) and Brier Island, Nova Scotia (44°25'N 66°35' W) during the 2015 breeding season, and recorded hatch success and chick growth at 30 nests on each island. A 2014 pilot study indicated that mink farms and other sources of anthropogenic food largely unavailable to gulls nesting on Kent Island are an important part of the diet of gulls nesting on Brier Island (6-17% and 1-7% of Brier Island gull time budgets were associated with mink farms and fish processing plants, respectively). Analysis of 2015 data will explain whether these differences in foraging behavior and diet composition have consequences to reproductive output. Such differences may partially explain the recent movement by gulls to new nesting sites during this time of widespread species decline. **ORAL**

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The American Oystercatcher Working Group - 15 years of collaborative focal species research and management

The American Oystercatcher Working Group formed spontaneously in 2001 as coastal waterbird biologists recognized the potential of this species to serve as a focal species for collaborative research and management. Accomplishments over the past 15 years include; the establishment of range-wide surveys, color-banding protocols, mark-resight studies, a revision of the Birds of North America species account, and new mechanisms for sharing ideas and data. Collaborations among state, federal, and private sector scientists, natural resource managers, and dedicated volunteers have provided

insights into the biology and conservation of oystercatchers in the U.S. and abroad that would not have been possible without the relationships formed through the working group. These accomplishments illustrate how broad collaborative approaches and the engagement of the public are key elements of effective shorebird conservation programs. **ORAL**

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Novel technique to estimate site-specific nesting habitat selection criteria for Piping Plovers and American Oystercatchers

Populations of many beach-nesting birds that occur in North Carolina have declined over the last 30 years. In particular, there is great concern for Piping Plovers (PIPL) and American Oystercatchers (AMOY). North Carolina is the only state that hosts PIPL during all seasons (winter, nesting, and migrations). During summers 2013-14, we developed a new field method protocol and collected terrestrial lidar and high-precision GPS data at recently vacated PIPL and AMOY nests. Microtopography information collected from lidar data in the area immediately surrounding nest site locations will reveal site-specific nesting habitat selection criteria related to topography, substrate (coarseness of sand or cobble), and vegetation cover. Obtaining precise elevation and location data for nests, as well as habitat descriptors and nest histories (success/failure), can populate models and estimate probabilities of success relative to habitat, probability of presence of focal species or predators relative to habitat features, and future likelihood of nesting sites being available given sea-level rise and storm impacts. In 2015-16, we will expand analyses of lidar data to estimate shorebird nest elevation and microtopography using several years of existing airborne lidar. The resulting time series of high-resolution elevation datasets will be analyzed to quantify geomorphic change on the Outer Banks to identify regional-scale changes in habitat suitability for PIPL and AMOY. These data will be used in models to assess impacts of storms on nest locations, predict long-term population impacts, and influence landscape-scale habitat management strategies that might lessen future impacts of hurricanes and sea-level rise on coastal wildlife. Results will provide guidance for long-term management of Outer Banks barrier islands and dredged-material islands in the sounds. **ORAL**

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Expanding the Seabird Ecological Assessment Network (SEANET) into the Southeastern United States: Lessons learned

The Seabird Ecological Assessment Network (SEANET) is a citizen science program that brings together researchers and members of the public in a long-term collaborative effort to collect data on seabird mortality along beaches up and down the eastern seaboard. SEANET was initiated by the Tufts Center for Conservation Medicine during the autumn of 2002. Since this time, the project has expanded to beaches throughout New England, New York and New Jersey and most recently, to the southeastern U.S., with beaches added in North and South Carolina. Through a series of three regional workshops held in NC (2011-12) and SC (2013), the SEANET program expanded from one active and six inactive survey routes to 47 active routes largely run by citizen scientists in the Carolinas. In addition, the development of a *field guide to beached birds of the southeastern United States* was completed in 2014 to assist citizen scientists completing these surveys. A total of 1,087 and 561 surveys in NC and SC respectively have been completed since 2006 that reported an encounter (i.e. carcass or remains observed). The number of beached birds encountered by month ranged from three to 70. The most commonly encountered species of beached birds are Common Loon, Laughing Gull, Double-crested Cormorant and Northern Gannet in NC and Laughing Gull, Common Loon, Greater

Shearwater and Black Scoter in SC. Since the concerted effort to expand SEANET (2011-2013), the number of active routes declined from 47 to 29. Future efforts will focus on providing more workshops, educational opportunities and feedback (e.g. data summaries and reports) to SEANET citizen scientists to slow this decline and continue to expand SEANET coverage along the southeastern seaboard. **POSTER.**

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Managing native predators to protect nesting shorebirds: Evidence from an experimental removal of raccoons on the Outer Banks of North Carolina

Raccoons (*Procyon lotor*), common North American generalist predators, have been identified as a primary cause of American Oystercatcher (*Haematopus palliatus*) nest failure on North Carolina's barrier islands. Concerns over the long term effects of raccoon predation, and evidence that a reduction of raccoons following a hurricane resulted in higher oystercatcher productivity, led to an experimental raccoon removal study at Cape Lookout National Seashore. Half of the raccoons in a closed population on South Core Banks, NC were experimentally removed in 2008. We examine oystercatcher reproductive success in the context of the removal. Results suggest a short-term response, but a Before-After-Control-Impact (BACI) analysis using an adjacent island without raccoon removal indicated no significant response. This could result from an inadequate experimental control, too few raccoons removed, compensatory reproduction following removal, or other predators "released" by the reduction in raccoon abundance. However, long-term productivity data illustrate that periodic reductions in predator populations, combined with protection of nests and chicks, can support conservation goals for American Oystercatchers. **ORAL**

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Novel non-lethal approaches to managing fisheries-cormorant conflicts

Fisheries managers in western North America are concerned about impacts of predation by Double-crested Cormorants (*Phalacrocorax auritus*) on juvenile salmonids (*Oncorhynchus* spp.) and other fish of conservation concern. Management to reduce the size of the large cormorant breeding colony on East Sand Island in the Columbia River estuary is currently underway. To help inform management agencies, we conducted feasibility studies of non-destructive techniques for managing this fisheries-cormorant conflict: (1) non-lethal methods to reduce the size of the cormorant colony and (2) habitat enhancement and social attraction to restore or enhance alternative cormorant colonies. We tested the combination of on-colony privacy fences and human hazing at East Sand Island to reduce the area of available nesting habitat without causing colony abandonment. Privacy fences were used as visual barriers to partition areas with and without active hazing. The area of nesting habitat was reduced by 75% and moved a short distance without causing colony abandonment or impacting nesting success. Habitat enhancement and social attraction (decoys and audio playback systems) at previously unoccupied plots adjacent to the East Sand Island colony were quickly colonized and young were successfully raised. Cormorants were also attracted to nest and raised young on similar plots at two islands ca. 25 km from East Sand Island, one with a history of successful nesting and the

other with a history of unsuccessful nesting attempts. Our results suggest that nonlethal dissuasion of nesting cormorants and concurrent attraction of cormorants to nest at alternative sites where fisheries-cormorant conflicts are unlikely could be effective in redistributing nesting cormorants away from areas where fish stocks of conservation concern are susceptible to cormorant predation, thereby resolving some conflicts.

ORAL

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Ecological segregation between two closely related species: exploring Atlantic Puffin and Razorbill foraging hotspots.

Niche theory states that a species range is restricted first by physiological tolerances and second by biotic interactions. The competitive exclusion principle builds on niche theory, remarking that two species cannot coexist if they overlap in all dimensions of their niche. Machias Seal Island is a migratory bird sanctuary bordering the Gulf of Maine and the Bay of Fundy. This island is home to several seabird species during the breeding season, including the Atlantic Puffin and Razorbill. Puffins and Razorbills, belonging to the auk family, are long-lived, pursuit-diving, central place foragers that feed on a similar diet. Relatively little is known about how these two species are partitioning resources in the Gulf of Maine/Bay of Fundy area. Generally, seabirds partition resources by foraging habitats, foraging depths, and/or interspecific differences in prey. Using a mix of GPS technology and long term data collected over the past 20 years, my thesis project aims to determine which of these strategies are being used by these seabirds in order for them to exist sympatrically during the breeding season. In addition, locating and describing foraging hotspots could serve as a valuable base for delineating marine protected areas in the Gulf of Maine and the Bay of Fundy. **ORAL**

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Poised on the brink: A comprehensive evaluation of Bermudian Common Terns

For at least 100 years, a small population of Common Terns has nested on islets around Bermuda. In earlier studies (2010, 2012) we reported a severe female-biased adult sex ratio, a demographic bottleneck with significant loss of genetic variability, and significant population structure following hurricane Fabian in 2003. Hereafter, we observed high productivity and encouraging recruitment producing a rapidly increasing population 2005 through 2009. This led to optimism for the recovery of this population, which we emphasized in the conclusion of our demographic paper. Here we resume the story by reporting demographic and genetic patterns of the population between 2010 and 2015. We sampled most chicks during this time period to report sex ratio and to infer the genetic variability of seven microsatellite loci in the breeding population. The number of post-hurricane Fabian breeding pairs grew to six in 2010 but has steadily decreased since then. In 2015, only one pair of Common Terns was observed. We fear that the low productivity documented since 2009 and increasing frequency of damaging hurricanes leaves this population on the brink of extinction. **POSTER**

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Phenological mismatch in Hop, Skip and Jump Migrants: a theoretical approach

Declines in migratory birds have been linked to anthropogenic climate change through the phenological mismatch hypothesis, which suggests that populations of migratory species are declining because the timing of their arrival on breeding grounds does not track advancing phenology of resources. We suggest that the frequency of stopover will play a role in whether a population will be subject to phenological mismatch since the ability of migrants to update the timing of migration based on changing environmental cues may depend critically on stopover frequency during migration. We describe a novel modeling framework for migratory species, the Migratory Flow Network (MFN), in which the seasonally varying attractiveness of breeding, winter and stopover regions drives the direction and timing of migration based on a simple general flux law. We use a MFN to investigate, theoretically, how populations respond to shifts in breeding site phenology based on their frequency of stopover and ability to detect and adapt to these changes. With perfect knowledge of advancing phenology, ‘jump’ migrants (low frequency stopover) require more adaptation to recover than ‘hop’ and ‘skip’ (high or medium frequency stopover) migrants. If adaptation depends on proximity to the next site, hop and skip migrants’ populations can recover but jump migrants cannot adjust and decline severely. These results highlight the importance of understanding migratory strategies and maintaining stopover habitat to buffer migratory populations from climate-induced mismatch. **ORAL**

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Non-breeding habitat use of reintroduced Whooping Cranes (*Grus americana*) in the southeastern United States

In the late 1940s, the endangered wild population of Whooping Cranes (*Grus americana*) numbered ca. 15 individuals which nested in northern Canada and wintered in coastal Texas. To safeguard this species from extinction, an Eastern Migratory Population (EMP) of 100 individuals was reintroduced in 2001 at breeding grounds in Wisconsin. Initially the population wintered along the Florida Gulf coast but beginning in 2007, the winter range expanded north to include areas from Florida to southern Indiana. While a general understanding of migratory routes and wintering sites has been obtained for the EMP, a thorough assessment of wintering habitat use has not been conducted. The objectives of this study were to identify and describe wintering and stopover sites used by reintroduced migratory Whooping Cranes. Landscape-scale habitat characteristics of wintering and stopover sites were described using a remotely-sensed national land cover dataset. Satellite telemetry data have been collected from 85 individuals from 2002 – 2015. Each year, 2 - 9 transmitters were deployed on juvenile cranes. Each transmitter collected data for an average of 392 days, and recorded approximately 613 locations per bird. Whooping Cranes in the southeastern United States occupied wintering areas that included coastal marshes, riverine wetlands, and flooded agricultural fields and appeared to avoid forested and developed areas. Few individuals appeared to show strong site fidelity to their juvenile wintering areas, and most wintered in multiple locations. Ongoing analyses include measurements of migration distances, and winter home range sizes. This research will aid in the understanding of non-breeding Whooping Crane habitat use, the management of wintering and stopover sites, and eventually in the recovery of this endangered species. **ORAL**

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Black Rail occupancy and abundance in Texas

The Black Rail (*Laterallus jamaicensis*) is a secretive marsh bird which occurs in North, Central, and South America. In North America the California Black Rail (*L. j. courturnicops*) is listed as threatened by the state of California and the Eastern Black Rail (*L. j. jamaicensis*) is declining throughout the Atlantic seaboard. Eastern Black Rails occur in Texas and little research has been done on their distribution and abundance. To assess the status and conservation need of the Black Rail in Texas we conducted call broadcast surveys at six study sites along the Texas coast: Anahuac National Wildlife Refuge (NWR) (n=98), Brazoria and San Bernard NWRs (n=145), Mad Island Wildlife Management Area and Clive Runnel's Mad Island Marsh Preserve (n=66), and Powderhorn Ranch Preserve (n=41). We detected Black Rails at five of the six study sites and used all surveys to assess occupancy of Black Rails at the six study sites. Results represent preliminary analysis for a two year study. Surveys will be performed at the study sites in 2016 to continue assessing abundance and distribution of the Black Rail.

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Beach Restoration at Southern Seven Mile Island, Cape May County, NJ

Stone Harbor Point, an Atlantic coast barrier island in Cape May County, NJ, consists of an undeveloped beach preserved by a perpetual deed restriction for wildlife habitat. It is a highly dynamic site that experiences changes in length, width and height on an annual basis and is one of few unimproved inlets along the New Jersey and mid-Atlantic coastline. It is also favored by residents and visitors for recreational activities, including fishing, birding, photography, walking, and jogging. With funding from a DOI/NFWF Sandy resiliency grant, we are restoring and enhancing beach at this site and increasing coastal resiliency. In winter 2015, we created three elevated habitat areas by removing sand along the high intertidal zone and depositing it on the beach berm to benefit beach nesting birds, such as Piping Plover, American Oystercatcher, Least Tern and Black Skimmer. In addition, we built a resiliency dune connected to an existing dune constructed by Army Corps of Engineers. This provides protection to Stone Harbor from storm surge from the southeast, the track taken by Hurricane Sandy. We have been collecting pre- and post-restoration data on beach nesting bird productivity, use by migratory shorebirds and abundance of intertidal benthic invertebrates. Through beach restoration, targeted management activities, and community outreach we are improving the overall suitability of habitat for birds and developing a plan for continued maintenance of this restoration as a long-term community resiliency strategy. **POSTER**

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Fitting highly individual migration pathways of Black Tern, Arctic Tern and Purple Heron into conservation policy

Migration pathways of many long distance migrants are in general rather idiosyncratic. This means the diversity in routes, stopovers and staging sites vary among individuals and years. Recent studies with transmitters and loggers contributed significantly to the migration behavior of migrants but as sample sizes are still small, the individual patterns are not necessarily in conjunction with the general patterns if these are present at all. But we see clear differences between species. For instance the few Arctic Terns with geolocators show clear and shared marine staging sites and routes. The movements of the population of a predominantly marine and coastal migrant, like the Black Tern are less consistent. Individuals choose different staging sites and stopovers as well as routes between those. In species without clear staging sites en route, like the inland freshwater migrant Purple Heron, the routes seem to be even more diverse. This makes the flyway concept, with well-defined routes and staging sites, as used in the traditional conservation policy less applicable. Can we still use a simplified flyway concept? How can we define important staging areas

based on studies with transmitters or loggers on a few individuals? Should we need to focus on new aspects if we need to use data for a conservation policy? Scientific research on migrant waterbirds should combine data derived from transmitters or loggers with habitat and ecological processes in order to define IBA's. An example for the Black Tern is presented. **ORAL**

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Predicting American Oystercatcher breeding distribution in an urbanized coastal ecosystem using Maximum Entropy Modeling

Species distribution modeling has seen widespread use in ecology and conservation over the past two decades, and as a result many questions regarding the predictive capabilities of new techniques have been raised. One modeling method that has gained popularity is a maximum entropy approach using the MAXENT software, which uses presence-only data to model species' distributions. Although MAXENT is ordinarily used to model a species fundamental niche at large scales (e.g., continental-scale), we have used this technique to model the realized niche and local breeding distribution of the American oystercatcher (*Haematopus palliatus*) at a fine-scale. We examined the transferability of our predictive model to areas outside the training areas in an effort to locate new breeding populations in previously unsurveyed areas. We then evaluated model performance with an independent validation dataset, which is rare in species distribution modeling. Our results showed that the MAXENT model provided predictions that were useful to locate new populations. Ground surveys based on our model located 185 previously unknown breeding pairs of oystercatchers in coastal New Jersey, which more than doubled the estimate of the local breeding population. However, validation of the MAXENT model with independent data provided by our ground surveys proved difficult. We attributed this to source-sink dynamics that affected the actual distribution of oystercatchers at a local scale rather than to errors in our modeling technique. We suggest that future researchers attempting to validate species distribution models with ground surveys take into consideration metapopulation and source-sink theory in the design of surveys and interpretation of results. **ORAL**

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Increased distance to open water reduces nest success of Black Terns in areas under predation risk by Great-horned Owls

Several hypotheses exist to explain reduced recruitment and variation in breeding success of Black Terns (*Chlidonias niger surinamensis*), such as water level fluctuations, reduced food supply, and predation. We examined whether the hypothesized factors were associated with variation in nest fate of Black Tern colonies in five waterbodies in southern Ontario, Canada. From 2013-present, we monitored nest fate of all detectable nesting pairs, and measured water depth around the nest, distance from nest to open water, extent of vegetation types near the nest, interspecific nest distance, and prey density. We built generalized linear models to determine which independent factor(s) described the proportion of nests hatching at least one chick.

The top model retained only distance to open water, which was negatively related to the proportion of nests with at least one chick ($z = -2.155$, $p = 0.0312$). When open water was within 2.5 m, 76% of nests had a chick; this was reduced to 48% when open water was between 2.5-5m, 38% when between 5-10 m, and 29% when open water was further than 10 m away. We then hypothesized this relationship could be driven by predation, because less vegetation around the nest reduces access of various predators to eggs and chicks and open water also represents an escape route for chicks. To test this, we deployed motion-sensitive trail cameras at a sub-set of nests, which revealed depredation events by Great-horned Owls (*Bubo virginianus*) on both eggs and chicks. The relationship between distance to open water and risk of predation by owls may be compounded in some areas by possible population declines of muskrats (*Ondatra zibethicus*), which feed on and reduce emergent vegetation. **POSTER**

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Geolocators reveal migratory patterns of Arctic Terns nesting in Maine

Although conservation agencies have been actively managing seabird colonies in the Gulf of Maine for over 30 years, we knew little about the migratory behavior or migratory routes utilized by state threatened Arctic terns (*Sterna paradisaea*). In 2010, Maine Coastal Islands National Wildlife Refuge and the National Audubon Society deployed 30 geolocators on Arctic terns breeding on two islands in Maine. Geolocators estimate location based on the length of daylight and the time of sunrise and sunset. Terns were recaptured the following summer when they returned to the breeding colonies. We observed 16 tagged terns and recovered 11 geolocators. We recovered two additional units in 2012, after terns relocated to a tern colony located 25km from the original tagging location. Our most recent geolocator, recovered in 2014, contained almost three years of migration data. All the terns departed the Gulf of Maine and flew towards northeastern Nova Scotia; however three distinct migration patterns were observed during the remainder of the fall migration. Some terns were observed utilizing coastal waters off the coast of West Africa, several traveled into the Indian Ocean, while others traveled to the coast of South America. All birds wintered along the Antarctic icepack before returning to Gulf of Maine in the spring. This is the first time researchers have been able to follow individual Arctic terns for more than one migration cycle. In addition, this project confirmed that Arctic terns have the longest known annual migration, with the birds traveling an average distance of 88,915 km. **ORAL**

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Tracking seabird migration and foraging ecology in the Gulf of Maine

Maine Coastal Islands National Wildlife Refuge and our conservation partners have been working to manage and restore populations of colonial nesting seabirds to islands along the Maine coast for more than 30 years. These 10 managed colonies now support over 90% of the common (*Sterna hirundo*), Arctic (*S. paradisaea*) and roseate (*S. dougallii*) terns nesting in Maine. In addition, these islands also support all of the Atlantic puffins (*Fratercula arctica*) and more than 50% of the razorbills (*Alca torda*) breeding in the United States. Despite these management efforts, we have recently documented significant declines in several species of seabirds breeding in the Gulf of Maine. There is concern that reductions in forage fish availability could be a significant contributing factor to these declines. Recent changes in the circulation patterns and productivity rates within the Gulf of Maine have highlighted the connection between forage fish abundance and a rapidly changing marine environment. In addition, potential development of offshore wind facilities could further limit seabird access to foraging habitat or result in increased mortality rates. Resource managers need to understand how and when seabirds are utilizing the offshore environment of the Gulf of Maine. Information

on foraging “hotspots” and migration corridors could also help inform siting decisions for offshore wind facilities. To address these concerns, the Refuge is currently utilizing nanotags, geolocators, and satellite tags to study the foraging and migration patterns of several species of seabirds. **ORAL**

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Dispersal, migration and wintering areas of juvenile Great Egrets marked in Ontario

There has been little study of the Great Egret (*Ardea alba*) in Ontario, near the northern limit of its range in eastern North America. Since 2010, we have individually marked over 625 flightless juvenile egrets with numbered PVC laminated patagial wing-tags. The objectives of the current study were to identify the pre-migratory dispersal period for juvenile egrets marked on Nottawasaga Island (Georgian Bay, Lake Huron, Collingwood, Ontario), their migratory route and their wintering areas. Using 284 records, we determined the median location (latitude/longitude) of re-sightings for each half month from August through the following January, 2010-2015. From August through October, the bimonthly median locations were all in Ontario and the average distance from the colony in late October was 336 kms; we assume this reflects their pre-migratory dispersal. Dramatic movement out of Ontario commenced in early November; mean distance away from the colony increased to 1069 kms. From November through January, the bimonthly median locations progressed through New York, North Carolina, Delaware, South Carolina, North Carolina and then South Carolina again, reflecting the centre of the winter distribution of juvenile egrets in the Carolinas. However, juveniles did winter as far south as Georgia, Florida, Cuba and the Dominican Republic. The egrets showed two migratory routes out of southern Ontario: a main route E to SE to the NY-NJ area and then south along the coast, and a secondary route W and S to Michigan, Indiana and Ohio and then S to SE through the interior (Tennessee and Kentucky), perhaps not reaching the coast until South Carolina. **ORAL**

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Survival rates and population dynamics of American Oystercatchers in Virginia

We present survival and emigration rates for American Oystercatchers in Virginia based on ten years of mark-recapture data generated from individually marked birds in the state. We also constructed a population model to estimate immigration rates and age at first breeding and to identify important demographic thresholds necessary to effectively manage the population in Virginia. Survival varied by stage class and natal region, defined as the barrier islands, the seaside lagoon system and the Chesapeake Bay islands. The ranges of stage-specific survival rates for oystercatchers from these three coastal regions in Virginia were 0.613 – 0.677 for hatch-year birds, 0.893 – 0.917 for subadults and 0.866 – 0.896 for adults. Most birds that originated in Virginia returned to Virginia to breed. First breeding for some birds occurred during their fourth year and for most birds the greatest transition from nonbreeding to breeding occurred between the fourth and fifth years. When region-specific emigration rates were included in population models for each of the three coastal

regions, all populations were projected to decline. These model predictions are in contrast with observed population trends in some of the coastal regions throughout the study period and suggest that factors such as immigration rates and movements among regions may explain these population dynamics. The breeding population of oystercatchers in Virginia is dynamic, complex and linked to the broader Atlantic Coast population. A collaborative, range-wide analysis of mark-recapture data is needed to fully understand this population's dynamics and potential response to local threats and management efforts. **ORAL**

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Spatial variation in polycyclic aromatic hydrocarbon exposure in Barrow's Goldeneye in coastal British Columbia

Despite the history of industrial activity in coastal British Columbia, hydrocarbon exposure among marine bird populations remains nascent. BC supports ~60% of the global population of Barrow's Goldeneye (*Bucephala islandica*). In winter, Barrow's Goldeneye congregate along sheltered coastline to forage on blue mussels (*Mytilus spp.*). Goldeneyes feeding along industrialized coastlines are more likely to ingest mussels contaminated by chronic hydrocarbon releases and may be particularly susceptible to sub-lethal effects from sustained exposure.

We characterize the spatial variation in contemporary hydrocarbon availability by measuring the concentration of polycyclic aromatic hydrocarbons (PAHs) in mussels across industrialized and reference sites in coastal British Columbia. PAH concentrations are then evaluated against biomarker indications of exposure in Barrow's Goldeneye from those same areas.

In spring of 2014 and 2015, goldeneye were captured at two coastal sites in British Columbia. Liver biopsies from each bird were analyzed for hepatic enzyme 7-Ethoxyresofurin-O-deethylase (EROD) activity as an indicator of cytochrome P450 (CYP1A) expression induced by PAH exposure. Composite mussel samples also were obtained at each capture site and analyzed for presence of compounds that induce CYP1A expression in avian liver, including PAHs. To evaluate the relative support of specific parameters to estimate variation in goldeneye EROD activity, an information-theoretic approach is applied to model selection and inference. Support for each model configuration is compared using Akaike's Information Criterion. This study provides a contemporary reference point of hydrocarbon contamination in coastal British Columbia, using a biologically representative marine bird species. Results will be useful for guiding long-term monitoring programs and informing recovery endpoints for marine bird populations in the event of an accidental hydrocarbon release associated with existing and future industrial development. **POSTER**

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Avian densities, movements, and habitat use across spatial and temporal scales on the mid-Atlantic Continental Shelf (USA)

By using baseline information on avian movements and habitat use, U.S. regulators can make informed siting decisions and use best practices to minimize potential conflicts with future offshore wind farms on the Atlantic continental shelf. A large collaborative baseline study of seabirds and other wildlife was recently completed in the mid-Atlantic USA, focused on three federally designated Wind Energy Areas. Study components included: two years of boat surveys and high resolution digital video aerial surveys; comparison of aerial and boat-based survey methods; satellite telemetry studies; examination of nocturnal avian migration patterns; identification of persistent hotspots of avian abundance; and modeling the oceanographic factors that influence wildlife abundance. Boat and digital video aerial surveys each had strengths and weaknesses for assessing wildlife populations. Distribution and abundance of seabirds was largely driven by environmental variables, including prey biomass and other factors, but species responses to these factors varied widely. Delaware Bay and Chesapeake Bay have strong influences on avian distributions in the mid-Atlantic region, likely related to gradients in salinity, water temperature, primary productivity, and other factors offshore of the mouths of the bays. There were strong seasonal and interannual variations in community composition and distributions, and with only two years of data included in this study, observed patterns may not be representative of longer-term trends. However, this study is an important first step towards understanding the implications of offshore wind energy development for bird populations in the mid-Atlantic United States. It will be important to further refine results from this baseline assessment as development activities continue, to focus on species most likely to be affected due to their behaviors, conservation status, or other factors. **ORAL**

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Federal regulations and the model of cormorant management in the Eastern U.S.: the need for knowledge-based solutions.

Although lethal and other destructive methods are frequently employed to manage cormorants in the eastern US, science-based evidence is not required for management decisions. To examine the basis for cormorant management under the Public Resource Depredation Order (PRDO), in effect in 24 eastern states, I reviewed the evidence presented in various assessments and reports prepared by agencies undertaking cormorant control to enhance or benefit fisheries. This review indicated that social values, assumptions and beliefs about cormorants, rather than knowledge of their impacts, frequently drove management decisions. Moreover, regulations under the order are loosely written and liberally interpreted, and oversight has been minimal. These issues have resulted in: 1) uses of the PRDO for which it was not intended and that do not comply with federal regulations; 2) uses that are contrary to the purpose of the Migratory Bird Treaty Act and other conservation and protection efforts; and 3) large scale reductions under the guise of adaptive management but in which key prerequisites and essential criteria for this approach are not met. This review indicates that most management under this model does not lead to knowledge-based solutions or represent sound wildlife policy. To move towards knowledge-based solutions, regulations for cormorant management should be revised to include a requirement for scientific evidence or adaptive management that meets essential criteria, stricter regulations with less opportunity for liberal interpretation, and greater oversight by the USFWS. **ORAL**

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Regional patterns in impacts of Double-crested Cormorant (*Phalacrocorax auritus*) population growth and management on co-nesting waterbirds in the US Great Lakes

Lethal and non-lethal management of Double-crested Cormorant (*Phalacrocorax auritus*) breeding colonies has become widespread in the US Great Lakes over the past decade, primarily due to concern over the species' impacts on fisheries and nest-site vegetation. Double-crested Cormorants rarely breed in isolation from other colonially nesting waterbirds, including some species that are declining or otherwise of conservation concern. Previous research has identified local behavioral impacts of Double-crested Cormorants on co-nesters, but management activity also has potential to disrupt co-nester breeding through disturbance of the colony site. We quantified region-scale impacts of Double-crested Cormorant abundance and management on colony growth rates of four common co-nesting species in the US Great Lakes: Black-crowned Night-Heron (*Nycticorax nycticorax*), Great Blue Heron (*Ardea herodias*), Herring Gull (*Larus argentatus*), and Ring-billed Gull (*L. delawarensis*). We used data from the Great Lakes Colonial Waterbird Survey and USDA Wildlife Services to model growth in nest abundance as a function of Double-crested Cormorant abundance and presence of management, while controlling for various other factors that potentially affect colony growth rates. Growth rates of co-nesters were lower at colonies with larger Double-crested Cormorant populations. Application of management produced variable responses among colonies, but on average, management did not have a substantial impact, either negative or positive, on co-nester growth rates. Only Herring Gulls did not follow this pattern; Herring Gulls responded positively to both Double-crested Cormorant abundance and management, perhaps due to new opportunities to depredate nests that were temporarily abandoned during management activities. Continuing work will attempt to determine whether management type and intensity affect the relationship between Double-crested Cormorant management and co-nester growth rates. **ORAL**

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Habitat creation for waterbirds in southeast Florida

Waterbird roosting, foraging, and nesting habitat is very limited in coastal Florida due to waterfront development and disturbance from human recreation. Habitat restoration and enhancement is limited due to the lack of remaining natural areas. As a result, habitat creation is having more success in highly urbanized areas such as southeast Florida. A project completed in 2005 by a local government, originally built to create habitat for marine species and recreational fishing opportunities, resulted in unintended benefits for waterbirds. Since then local and state governments have partnered in two additional projects, building more islands for nesting shorebirds, seabirds, and ducks and sub-tidal habitats that promote sea grass beds for foraging wading birds. Artificial oyster reefs and shoreline saltmarsh and mangrove plantings have provided habitat for marsh birds, wading birds, and shorebirds. Additionally, man-made mudflats and sandbars are being used by migrating and wintering shorebirds and seabirds for feeding and resting. Over 60 waterbird species including state and federally listed species such as the American oystercatcher (*Haematopus palliatus*), piping plover (*Charadrius melodus*), least tern (*Sterna antillarum*), and red knot (*Calidris canutus*) have been recorded on these islands and wetlands. These projects will not only serve as models for future habitat creation and restoration projects for declining species but will also promote education and outreach to the public. **ORAL**