

Assessing Pacific Coast Double-crested Cormorants: Implications of Recent Surveys, Molecular Genetics Analyses, and Satellite-tracking Results (Oral)

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The most recent status assessment for the entire Pacific Coast population of Double-crested Cormorants (*Phalacrocorax auritus*) was published in 1995 by Carter et al. More recent reports have been completed for the California (Capitolo et al. 2004) and British Columbia (Moul and Gebauer 2002) breeding populations. Since 1995, however, the distribution of this population across its breeding range has changed dramatically, due primarily to the increase in size of the breeding population in the Columbia River estuary, which grew from 6,200 pairs in 1997 to up to 13,800 pairs in 2007. Based on preliminary estimates for British Columbia, Washington, Oregon and California, the current Pacific Coast breeding population of Double-crested Cormorants is ca. 25,000 breeding pairs. This is an increase of ca. 8,000 breeding pairs from Carter et al. (1995).

Most of this increase, however, can be attributed to the Columbia River estuary, which currently accounts for approximately 45% of Pacific Coast breeding pairs. Numbers in coastal British Columbia, Washington, and parts of California, though, have apparently continued to decline.

Increasing bald eagle populations and episodic human disturbance may be important factors causing declines in some regions. Parallel studies on the Pacific Coast population genetic structure and the post-breeding dispersal of cormorants nesting in the Columbia River estuary suggest a high degree of population connectivity from central and northern California to southern British Columbia. Southeast Alaska, southern California, and areas east of the Continental Divide have more limited connectivity to the main Pacific Coast population.

Interspecific Differences in Heat Loss Behavior under Identical Climatic Conditions (Poster)

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Research has indicated that climate can have direct impacts on waterbird breeding behavior and activity budgets in sub-polar regions by increasing the necessity of heat loss behaviors such as bathing. Although temperate breeding species are less well-insulated, they breed under much warmer conditions and rapid climate warming could therefore have serious implications. We studied the bathing behavior of Caspian Terns, *Hydroprogne caspia*, and Ring-billed Gulls, *Larus delawarensis*, in a freshwater, mixed-species breeding colony in Lake Ontario in June and July 2009. Despite being exposed to the same climatic conditions, Caspian Terns bathed for significantly shorter durations than Ring-billed Gulls. Bathing activity of terns was dominated by behaviors that promoted rapid heat loss, but gulls spent more time involved in seemingly less efficient heat loss behaviors, such as preening and resting on the water. We hypothesize that Caspian Terns bathed more efficiently because (i) during these months they may need to spend more time at their nests protecting chicks than Ring-billed Gulls, and/or (ii) given their different breeding distributions they may be morphologically adapted to different climatic conditions. To test these hypotheses, we compared differences between species in attendance patterns at nests and operative temperature of taxonomic mounts. Our results provide evidence that species' distinct ecology and physiology can shape the strategies by which they respond to climate. The limited flexibility of Caspian Tern bathing budgets suggests that certain species may be more susceptible to direct effects of climate change and such impacts are not restricted to high-latitude species.

Maine Seabird Conservation in a Historical and Ecological Context: The Ghost of Predators Past (Oral)

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Conservation biologists and restoration ecologists are constantly faced with the questions of what to conserve and to what point in time a region or landscape should be restored. The Gulf of Maine has been the focus of intensive efforts in seabird management, monitoring, and restoration for much of the past century. A basic assumption of much of this work is that prior to intensive hunting and egging by the descendants of European colonists in the 19th century the region supported an extensive and highly diverse avifauna. Management efforts to restore such a state have focused largely on island acquisition and gull control and have met with initial success. There is growing evidence however, that predators including Bald Eagles (*Haliaeetus leucocephalus*) and American Mink (*Mustela vison*) may be having a devastating effect on in-shore seabird colonies. We suggest that, rather than being the vast productive seabird paradise depicted in some discussions, significant portions of the Gulf of Maine may have been relatively free of any breeding seabirds prior to European intervention, and the densely populated islands exploited by the millinery trade were the unforeseen product of predator control and land-use practices by settlers. A more comprehensive examination of the historical record coupled with the incorporation of knowledge of the ecology of extant and extinct predators provides useful insights for future conservation strategies. A sustainable seabird avifauna may require a much more comprehensive management strategy than was previously thought.

Double-crested Cormorant Consumption of Alewife at a Large Colony on Lake Ontario (Poster)

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The significant increase in the Double-crested Cormorant (*Phalacrocorax auritus*) population in North America has caused much concern in the scientific community about potential negative effects on sport fisheries. The purpose of this study was to determine the level of prey consumption during two breeding seasons (2006 - 2007) by cormorants at a large colony on Lake Ontario, Canada. Regurgitations were collected during the chick rearing season and total consumption of fish as well as consumption of each individual prey species was estimated using a bioenergetics model. Prey availability in the vicinity of the colony was also assessed using electrofishing. Alewife was the dominant prey fish during both years of the study and was also the dominant prey item of cormorants. This forage fish also predominates in the diet of stocked Salmonines in Lake Ontario. In recent years, the alewife population of Lake Ontario has reached historic lows. Cormorants in this study were estimated to consume up to 40% of the lake wide alewife biomass. This level of consumption combined with the fact that alewife is the primary prey for stocked nonnative Salmonines, may cause competition between Salmonines and cormorants for prey. Alewife, although food for a sport fishes, is a non-native forage fish that has had many negative impacts on Great Lakes fish community. The native cormorant may play a role in reducing alewife populations that have caused much damage to the native fauna of Lake Ontario.

Differences in Growth Patterns between Common Terns Nesting in Freshwater and Saltwater Environments (Oral)

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Common Terns (*Sterna hirundo*) maintain large freshwater and coastal populations on several continents, including the Americas. Available data show that several ecological differences exist between freshwater and coastal breeding Common Terns. Here we present the first evidence, to our knowledge, of different chick growth patterns between Common Terns nesting at freshwater (Presqu'île Provincial Park, Lake Ontario) and saltwater sites (Buzzards Bay, MA). At Presqu'île in 2008, 71 chicks were weighed multiple times following peak mass. Of these, 28 (39%) had higher peak mass than adults measured at this colony (up to 18% heavier). Of the chicks that fledged, 32 (65%) showed a 7-24% reduction in body mass over a protracted period between peak mass and fledging (mean = 15.6% of body weight). In Buzzards Bay, only a few chicks that survived to fledging showed protracted mass recession after reaching peak mass. Site-specific differences in growth were independent of hatching date, hatching order, time in the season or eventual fate of chicks. A literature review indicates that the prevalence of mass recession observed at Presqu'île in 2008, and repeated in 2009, is unique among studies of Common Terns and very rare among other tern species. We assess several competing hypotheses to explain this growth pattern observed at Presqu'île. Accumulating evidence for differences between Common Terns nesting in freshwater and saltwater emphasizes the importance of protecting declining Great Lakes populations, particularly if differences result from something other than phenotypic plasticity.

Migration in Western Sandpipers: New Routes, New Sites, Trip Times, and Danger (Oral)

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Radio-tagged Western Sandpipers from Panama and Mexico followed different routes north to Alaska, never occupying the same stopover sites. Some took inland routes and others followed coastal routes, stopping at both large and small wetlands. There was tight group adherence, and tagged birds from Panama always stopped in one small lagoon in southern Mexico. Some birds, once in Mexico, travelled south again and did not continue migration. We also found previously undocumented stopover sites, and varied stopover times, which may indicate predator avoidance. Threats to their overwintering sites in Panama, and stopover sites in Canada, continue to pose difficult management questions and may potentially impact population numbers.

Nesting Success of Colonial Tree-nesting Waterbirds on Selected Wetlands of Northeast South Dakota (Oral)

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The northern Great Plains of North America provides the primary breeding habitat for numerous species of waterbirds. Reproductive status and population parameters of colonial tree-nesting waterbirds are largely unknown within the prairie pothole region. We monitored nesting success of: Black-crowned Night Heron (*Nycticorax nycticorax*), Cattle Egret (*Bubulcus ibis*), Double-crested Cormorant (*Phalacrocorax auritus*), Great Blue Heron, (*Ardea herodias*), Great Egret (*A. alba*), and Snowy Egret (*Egretta thula*) during the 2008 and 2009 breeding seasons on selected wetlands in northeast South Dakota. Objectives were to determine nesting and fledging success, and identify important habitat characteristics required for colonial tree-nesting waterbirds. We hypothesized that nesting success would increase with colony size, percent water edge, and wetland density (within a 6400 m radius), and be inversely related to human disturbances. Colonies were visited once every 6 - 8 days throughout the 2008 (n=28) and 2009 (n=25) breeding seasons, 14 of which were monitored in both years. A total of 1174 and 1376 individual nests were observed in 2008 and 2009, respectively, with a 20-60x82 spotting scope at a distance of 150 m away to mitigate observer disturbance. Nest success was analyzed using the apparent nest success estimator. Percent nest success for 2008 and 2009 were: Black-crowned Night Heron (50.0, 53.1), Cattle Egret (88.9, 61.0), Double-crested Cormorant (62.1, 78.7), Great Blue Heron (41.7, 68.63), Great Egret (46.6, 69.8), and Snowy Egret (88.0, 80.56). Determining reproductive success and habitat parameters of colonial tree-nesting waterbirds are essential to understanding trends in population breeding biology.

Winter Diet of Sandhill Cranes in Northern Mexico: Implications for Foraging Behavior (Oral)

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Sandhill Crane (*Grus canadensis*) diet consists mainly of corn and other agricultural products, but also invertebrates and small vertebrates. However, most diet studies have focused on their feeding habits during migration and breeding and few have examined diet during the winter. We investigated crane diet in Northern Mexico during the winters of 2007 and 2008. We quantified food items consumed based on an analysis of feces, examined the effects of agriculture on diet, and compared our results with studies in the USA and Canada to provide a more comprehensive picture of crane diet. We collected 263 fecal samples from six wetlands. The most commonly occurring food item was corn (47% of samples), followed by oats (22% of samples), and sorghum (22% of samples). Cranes also occasionally consumed grassland seeds (6% of samples), alfalfa (2% of samples), and wheat (<1% of samples). Diet in wetlands surrounded by agricultural fields did not differ from diet in wetlands surrounded by non-agricultural fields. Our results suggest that cranes exhibit a specialized diet of corn and other agricultural products during winter as patterns of consumption did not vary with availability. Our results differ from studies elsewhere, which suggest that cranes are opportunistic and omnivorous.

Habitat Variables Influencing Site Selection of Least Bitterns (*Ixobrychus exilis*) in Northern Lake Erie Wetlands (Oral)

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The Least Bittern (*Ixobrychus exilis*) is a threatened species in Canada and Ontario. The Canadian population occurs mainly within southern Manitoba, Ontario and Quebec and according to the status report is estimated to be 1000 pairs. Long-term data from the Breeding Bird Survey and the Marsh Monitoring Program indicate that abundance of Least Bitterns has declined in many regions due primarily to loss and degradation of habitat. In Ontario specifically, little work has been done on abundance or habitat use; thus, we were interested in the relationship between abundance and habitat variables that influence site selection of Least Bitterns. During the breeding seasons of 2008 and 2009, we conducted 1488, call-broadcast surveys (using the National Least Bittern Survey Protocol) within federal, provincial and private wetlands at Long Point - Lake Erie, Ontario, to estimate abundances of Least Bittern. During 2008 and 2009, respectively, we detected 96 individual Least Bitterns on 22 routes and 211 individuals on 32 routes. In addition to the surveys, we performed habitat assessments which involved walking transects through habitats at survey points, observation sites, and nest sites to collect data on water depth, plant composition, plant height, plant density, and cover at various intervals using 1 m x 1 m quadrats. These habitat assessments will be used to make habitat management recommendations. We made 130 and 236 habitat assessments during 2008 and 2009, respectively. Analyses investigating relationships between abundance and habitat variables currently are in progress and results will be presented at the conference.

Dynamic Resource Selection by Two Wading Bird Species with Divergent Foraging Strategies in a Seasonally Fluctuating Wetland (Oral)

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Seasonal variation in food availability strongly influences the population dynamics of many avian species. Fluctuating resource levels are particularly pronounced in wetlands that dry and flood periodically. In the Everglades, wading birds depend on the process of seasonal drying to concentrate fauna into patches. Identifying the key habitat characteristics of those patches for species with contrasting foraging strategies will provide a range of habitat conditions that can be used to guide the Everglades management and restoration. We quantified the habitat selection of radio-tagged Great Egrets (*Ardea alba*; n = 77) and White Ibises (*Eudocimus albus*; n = 127), two species that are representative of different foraging strategies (searchers versus exploiters), and that have dissimilar population trends. Habitat variables at foraging locations were measured and compared with habitat variables at random locations determined to be available to birds. We calculated resource selection functions using a discrete choice proportional hazards model that allows available resource units to change daily. There was a relationship among resource availability, the temporal scale of the independent variable, and whether the response was similar or different between species. Variables that changed over short time scales (e.g. surface water dynamics) and made prey vulnerable to capture, differed strongly between years as a function of resource availability. These variables tended to produce a similar response by both species. In contrast, longer-term processes affecting the production of prey produced a different response between species. Model validation was assessed using independent records of wading bird distributions from aerial surveys.

Analysis of the Effects of Lead and/or Mercury Toxicity in Wild Avian Species in the Mid-Atlantic Tri-state Region (Oral)

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Lead (Pb) and mercury (Hg) are heavy metals known to be major pollutants in the environment and to have negative effects on wildlife ecosystems. This study provides a retrospective analysis of the Pb and Hg test results of wild bird patients from the mid-Atlantic region by evaluating species tested, entry dates, outcomes, and threshold levels. These test results were generated at the New Bolton Center Toxicology Laboratory from whole blood samples from patients at Tri-State Bird Rescue and Research, Inc. in Delaware using atomic absorption spectrometry. The records analyzed date from January, 1997 through December, 2007. During that time period 562 patients were tested for Pb, and 218 of these birds were tested for Hg. This encompasses 41 species from 12 orders. The birds came from locations within 6 states: MD, PA, NJ, DE, VA, and NY. ArcGIS® was used to analyze data geographically and to look for potential locations of heavy metal environmental contamination. Specific regions were noted as having high Pb contamination. Of the birds tested, 23.5% had >0.20ppm Pb blood wet weight levels, requiring treatment. The Hg positive value used was >0.30ppm blood wet weight and 56% of the birds tested had levels greater than this. One main finding of this study showed that 69% of birds with >0.20ppm Pb blood wet weight concentration entered the clinic from November through March. These dates are significant as they denote the start of hunting season where more Pb shot is available for consumption in the environment.

Roseate (*Sterna dougallii*) and Common Tern (*S. hirundo*) Use of Staging Sites During the Post-breeding Period in Coastal Massachusetts (Poster)

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Despite many studies of tern breeding biology in the northeastern U.S., little attention has been given to behavior after nesting is completed and before fall migration begins, known as the post-breeding period. This is an important time in the avian life cycle and especially critical for the young of species such as Roseate (*Sterna dougallii*) and Common (*S. hirundo*) Terns that remain dependent on adults for weeks after fledging. Specific objectives of this project were: 1). identify, characterize and map important staging sites; 2). document use of sites and influencing factors. In two years of study (2007-2008) and with data from multiple cooperators, terns were observed staging at 35 sites across Cape Cod, Nantucket and Martha's Vineyard between July-September. Four sites (two awaiting confirmation) were identified as roosting sites in 2008. Terns were present in thousands at 15 sites and tens of thousands at four sites; one site at times supported up to 1/3 of the Northwest Atlantic population of the endangered Roseate Tern. Analysis from ground surveys of five sites and four aerial surveys (2008) showed staging site use differed by site, time of the post-breeding period and between years. Similar to patterns of dispersal identified years ago (Trull et al, 1999), terns appeared to congregate in the largest concentrations at sites along the outer Cape in mid to late September, just prior to southward migration. Time of the post-breeding period, time of day and tide accounted for a significant amount of variation in tern abundance at some sites.

Using Range-wide Suitability Models to Predict Habitat Use by Nesting Wood Storks (*Mycteria americana*) in the Southeastern U.S. (Oral)

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Critical habitat for the endangered Wood Stork (*Mycteria americana*) is difficult to delineate due to their wide range, extreme vagility, and opportunistic use of rapidly changing hydrological conditions. However, it remains important to identify regions and habitats that are important to the Wood Stork in order to evaluate the effectiveness of current conservation planning. We used logistic regression (LR) and Mahalanobis distances (MD) to create habitat suitability maps for the Wood Stork across the Southeastern U.S. using locations obtained from satellite telemetry. The models were validated using an independent dataset. We found that the LR model provided the best fit to the data, but that each model had different strengths and weaknesses. We then evaluated how well the models predicted habitat use by nesting wood storks in 2009 and quantified movement distances, habitat use, and foraging patterns of nesting birds. Of the 15 probable nesting attempts in 10 different colonies, 5 are thought to have been successful. The average maximum daily flight distances were highly variable among individuals, ranging from 7.17 to 34.61 km (mean = 20.26). Emergent and forested wetlands received the most use (44% and 29% of locations respectively), followed by marine wetlands (6%) and agriculture (5%). Other habitat types accounted for less than 5% of locations. When we compared actual locations to our model output, we found that the LR model provided the best predictions of habitat use, particularly in Florida, and recommend that finer grained LR models be developed on a state-wide basis.

Mixing by Wood Storks (*Mycteria americana*) from the Mexican and Southeastern United States populations (Oral)

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Avian literature suggests that Wood Storks (*Mycteria americana*) from Mexico and those from the southeastern U.S. form distinct populations and that little geographic overlap between populations occurs. Recent satellite telemetry studies suggest otherwise. Six adult storks captured at a post-breeding site in eastern Mississippi (MS) eventually flew to Florida (FL), while one pre-adult bird captured at this site flew to Mexico. Three storks from a post-breeding site in western MS flew to Mexico/Guatemala while of two storks captured at a post-breeding site in southern Louisiana (LA), one flew to FL and another to Mexico. Most nestlings outfitted with satellite transmitters from the southeastern U.S. population have remained in the Southeast, however one Georgia nestling dispersed to Mexico in 2005. This stork initially took up residence along the coast of Oaxaca and Chiapas before moving inland to the Sierra Madres de Chiapas. In March 2008, this bird travelled northeast to the wetlands of Tabasco, returning to the Sierra Madres and the southwestern coast in June. The following spring the bird repeated this movement pattern and appears to have spent three weeks nesting in Tabasco. Our findings suggest Wood Storks observed in eastern MS are generally from the U.S. population whereas those observed to the west are from the Mexican population. We have established, however, that some mixing between the US and Mexican populations does occur. We seek collaborators in Mexico to pursue opportunities for additional studies of mixing between these populations. Potential approaches include stable isotope and genetic methodologies.

Cross-species Amplification of Microsatellite Loci to Study Whiskered Terns (Poster)

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The Whiskered Tern (*Chlidonias hybrida*) is widely but irregularly distributed across Europe, Asia, Africa and Australia. Whiskered terns nest on floating vegetation in large freshwater wetland systems, perhaps one reason they remain poorly studied. It is assumed that breeding colonies within Europe comprise two distinct populations (East and West) based on their overwintering sites. Across Europe in recent years, colony sizes have fluctuated greatly and there is no clear understanding of whether declines in one region are related to increases in other regions. Consequently, it is imperative to understand connectivity between colonies within Europe in order to inform conservation efforts across international boundaries. In this study we develop protocols for the amplification of polymorphic microsatellite loci in the Whiskered Tern using primers developed for other Larid species. We report indices of genetic diversity and population differentiation of Whiskered Terns sampled in Ukraine and Poland. Building on this preliminary study, we anticipate future analyses to include a population in France and a detailed study of the occurrence of extra-pair fertilizations and conspecific brood parasitism.

Current Biological Status of the U.S. Breeding Population of Wood Storks (Oral)

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The USFWS's 5-Year Review indicated that the U.S. breeding population of Wood Storks was increasing and expanding its breeding range. Population and productivity criteria for reclassification to threatened had been met with three-year averages of 6,000 nesting pairs and productivity at 1.5 chicks per nest/year (2004-2006). The 2001 through 2006 surveys documented 3-year averages of over 6,000 nesting pairs for all combined years: 7,417 pairs (2001-2003); 8,341 (2002-2004); 7,584 (2003-2005); and 8,406 (2004-2006). The 3-year average productivity rate for all colonies for 2004-2006 was 1.5 chicks/nest attempts; 2003-2005 was 1.2; and 4-year average for 2003-2006 was 1.5. In 2006, there were over 11,000 nesting pairs documented and was the first year since the early 1960s that the total was greater than 10,000. Since 2006, drought conditions have been prevalent in the Southeast U.S. and severe in Florida. Wood stork nesting efforts reflected these conditions with nesting pair totals near 5,000 in 2007 and near 6,000 in 2008. With improved nesting conditions in 2009, preliminary assessments indicate Wood Storks again surpassed 11,000 nesting pairs. This includes a record nesting effort over 4,500 pairs in South Florida and several colonies that approached or exceeded 1,000 nesting pairs. Since listing, the total number of nesting pairs appears to be increasing, the number of nesting colonies is increasing, and the nesting range is growing. Even though threats that affect wood storks and wood stork habitat appear to be continuing at the same levels, the conclusion is that the overall population status is improving.

Preliminary Investigation of Factors Influencing Hatch Success of Beach-nesting Birds within Cape Romain National Wildlife Refuge, SC (Poster)

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Cape Romain National Wildlife Refuge (CRNWR) is located along the coast of South Carolina and supports abundant beach-nesting birds during the breeding season. Recently, however, beach-nesting birds in this region have been declining. The Least Tern (*Sterna antillarum*) and Black Skimmer (*Rynchops niger*) both nest in CRNWR and each appears to be experiencing declines in nesting numbers. The purpose of this study was to identify variables which influenced nest success of the Least Tern and Black Skimmer. We measured success during two stages: hatch success, and fledge success, the latter defined as success from hatch to fledge. We assessed each measure of success in relation to nest initiation date, distance from nest to colony edge, nest location within colony (center, middle, edge), colony size (number of nests), presence/absence of predators, adult attendance rate during incubation period, and vegetation characteristics. For the 2009 field season, 101 Least Tern and 169 Black Skimmer nests were monitored at three study sites. Nests were monitored every 2-4 days until nest fate was determined. Apparent hatching success for Least Tern and Black Skimmer nests was 0% at Lighthouse Isl., 5.4% and 62% at Cape Isl., and 83% and 59% at Middle White Banks, respectively. We color banded 38 Least Tern chicks on Middle White Banks and conducted resighting surveys every 2-4 days. Of the 38 individuals banded, 22 (58%) were resighted at least once at 18 days or older. Preliminary analysis suggests predation and washover were major causes of nest failure.

Distances Travelled to Forage by Nesting Wood Storks in the United States: An Overview (Oral)

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Early studies (1960s & 1970s) of Wood Stork foraging ecology in southern Florida suggested lengthy travel (up to 130 km one way) to foraging habitats by storks nesting in this region. Since these early projects, a series of studies over the last two decades employing "follow flights" of nesting storks suggest shorter foraging travel in most parts of their current range. Follow flight studies at 15 Wood Stork colonies have resulted in average distances between the colony and foraging sites ranging from 8-18 km. Multi-year studies at a limited number of colonies suggest that annual differences in weather/rainfall patterns can result in foraging habitat shifts, but do not necessarily result in changes in foraging distances. The results of these more recent studies will be discussed relative to the use of the "core foraging area" concept currently employed by state and federal regulatory agencies in Florida.

Status and Trends in Snowy Egret and Great Egret Ecology: Population, Breeding and Toxicology (Oral)

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A survey of publications listed in Biological Abstracts from 1979 to 2008 reveals that the majority of studies involving Snowy Egrets (*Egretta thula*) and Great Egrets (*Ardea alba*) focused on foraging, colonies & populations, and toxicology. Seven other research areas ranging from parasites, disease, and predators to chick growth characteristics, were less frequently studied. This talk will be organized with the hope of inspiring future research by describing how research foci have changed historically and what information is lacking. We will introduce speakers in the Snowy Egret/Great Egret Status Symposium and provide a general synopsis of their research areas.

Where Did You Get That? Tracking Sources of Cormorant Prey in a Complex Environment (Poster)

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Increasing numbers of Double-crested Cormorants (*Phalacrocorax auritus*) have caused concern for commercial and recreational fisheries in Canada. In the province of Saskatchewan, new cormorant colonies have recently been discovered on and around Lac la Ronge, a once world-class freshwater fishery that has declined in quality. These cormorants are part of a complex ecosystem that includes a variety of lakes and habitats for foraging. The largest local colony (~4,000 pairs) is on Egg Lake, but birds appear to travel long distances from this site to forage on Lac La Ronge. Determining whether cormorants are a threat to the recovery of Lac La Ronge requires understanding how much of the biomass they consume actually comes from this lake. We are examining cormorant diet at several colonies both on and off of Lac La Ronge and modeling fish biomass removal. In addition, we are attempting to use intrinsic markers in fish (stable isotopes, mercury levels, and life history traits) to indirectly infer foraging locations of cormorants. To date we have sampled prey fish from five major cormorant foraging locations in the Lac La Ronge area, and are examining variance in carbon and nitrogen stable isotopes in fish tissue by site. Stable isotopes of other elements may also be added (hydrogen or oxygen). We collected water samples from these same five sites to examine variance in mercury levels that may also be useful for assessing the origin of prey fish. Laboratory work and data analysis are currently in progress.

Nest-Site Selection and Response to Habitat Manipulation by Roseate Terns (*Sterna dougallii*) on Seavey Island, New Hampshire (Oral)

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In the Gulf of Maine, little quantitative research has been conducted on the nesting habitat requirements of Roseate Terns (*Sterna dougallii*), or responses of this species to differing types of vegetation management. I conducted habitat manipulations aimed at creating suitable Roseate Tern nesting habitat on Seavey Island, New Hampshire in 2006. Study plots were located in areas that had previously supported Roseate Terns, but where increased vegetation density was thought to have inhibited their nesting in recent years. Habitat manipulations included (1) weed-whacking and hand-pulling of vegetation (hand-removal) around rocks within each plot, or (2) application of an herbicide to remove vegetation from up to 50% of the plot. Habitat manipulations resulted in a shift from grass to herbaceous species in all of the study plots; plots treated with herbicide showed the greatest change. Hand-removal of vegetation seemed to provide good Roseate Tern nesting habitat, but was logistically difficult in terms of manpower and appropriate equipment. Herbicide and fire treatments conducted after the 2006 breeding season reduced vegetation cover from 93% in 2006 to 78% in 2007. This more open habitat was attractive to Common Terns, which increased in their overall population size between 2006 & 2007. The number of Roseate Tern nesting pairs also increased between 2006 and 2007, suggesting that the habitat manipulation was beneficial. Fire may be a good management tool for a large tern colony, but careful consideration should be given to the timing and frequency of the burn.

Global Change and Responses of Waterbirds in New Jersey (Plenary)

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Changes in sea level have the potential to dramatically change the size, structure and height above the water of coastal islands, which can affect colonially nesting birds forced to nest on low-lying islands. A study of colonial birds in Barnegat Bay, NJ from 1976 to the present indicates that there have been several physical changes attributable to rises in sea level, including 1) disappearance of the lowest-lying islands, 2) decreases in size of some islands, and 3) shifts in vegetation on salt marsh islands. These have resulted in shifts in bird use of Barnegat Bay, including 1) gradual abandonment of some islands as they disappeared, 2) shifts in species of birds nesting on islands, and, 3) concentration of some species on fewer islands. The horizontal and vertical stratification of nesting on salt marsh islands forces the greatest change on nests at the edges of the islands. The greatest shifts have been for Common Terns and Black Skimmers because they nest on the lowest portions of marsh islands, on sand, or on wrack. They also show shifts in microhabitats used. Both species showed a significant decrease in the number of islands they nest on over the last 30 years. Increases in human use have caused disturbance to colonial birds and to migratory shorebirds. Resource depletion can lead to declines in birds, especially shorebirds that stop along Delaware Bay in the spring. Dramatic declines in Red Knots are associated with harvest of Horseshoe Crabs and the decline of available Horseshoe Crab eggs.

Satellite Telemetry Reveals Post-Breeding Movements of Common Murres in the Northwest Atlantic (Oral)

C Burke, WA Montevercchi, A Hedd

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Following departure from natal colonies, male Common Murres (*Uria aalge*) accompany their flightless fledgling at sea for up to 3 months. During this period, the adults undergo simultaneous molt of their flight-feathers. Male-fledgling pairs utilize 'nursery areas' where there is predictable, abundant food and a lack of avian predators. Flightless murres are vulnerable to pollution and disturbance, but the migration pathways and location(s) of nursery areas in the NW Atlantic in relation to industrial activities are not known. We investigate (for the first time) the post-breeding migration of flightless male-fledgling murre pairs using satellite transmitters (Wildlife Computers; 18 g). Four adult males were equipped with external tags at the species' largest colony (Funk Island) during departure with their fledgling, August 2009. The birds were tracked for a mean period of 24 days (range 12 - 51) during which all initiated south-easterly migrations toward the continental shelf edge, across international shipping lanes. The longest track (51 d) documented a southerly movement along the shelf edge to the southeast shoal of the Grand Bank where the pair halted migration and remained (~10 days). This indicates a potential nursery area for murres that overlaps with a significant commercial fishing territory near the Canadian 200 mile limit. Information on marine bird migration and habitat utilization gleaned from satellite telemetry and longer-term geolocation devices provide important new information on the overlap of marine animals with industrial activities that can inform conservation and management decisions.

Breeding Distribution, Abundance, and Species Associations of Franklin's Gulls in Canada (Poster)

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Franklin's Gulls (*Leucophaeus pipixcan*) were identified in the Northern Prairie and Parkland Waterbird Conservation Plan as a species of high conservation concern. Our 2007 region-wide survey indicated a very large and healthy population of 1.18 million breeding Franklin's Gulls scattered in distinct colonies across the prairie, parkland, and boreal ecoregions of the Canadian Prairie Provinces, where >80% of the global breeding range of the species occurs. Although 49 lakes were identified with colonies during the course of a three-year study, it is important to note that Franklin's Gulls were present in high concentrations on only a few select lakes: five had colonies with more than 100,000 breeding adults each, representing >55% of the Canadian population; another 11 had colonies of 20,000 or more breeding adults each. Together, these 16 colonies, out of 36 that were identified as active in 2007, represent more than 95% of the Canadian population. A catastrophic event at a large colony could have a serious detrimental effect on the regional and global population. Franklin's Gulls are instrumental in the overall productivity and health of semi-permanent and permanent shallow wetlands and associated uplands. They readily colonize restored wetlands that have suitable emergent vegetation and forage on crop-damaging invertebrates. They are an essential prey species for raptors such as the Peregrine Falcon, and serve as sentinels for some of the 13 other waterbird species we observed nesting in association with Franklin's Gull colonies across their range. Thus, their conservation would be extremely beneficial to the waterbird ecosystem.

INTERCAFE - Interdisciplinary Initiative to Reduce Pan-European Cormorant-fishery Conflicts (Oral)

Dave Carss

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Previous European work has clearly shown the necessity of applying an integrated, interdisciplinary research approach (biological, social, legal) to cormorant-fishery conflicts - as these are as much a matter of human interests as they are of biology/ecology. Furthermore, there is recognition that different perspectives are needed in the development of any collaborative management strategies. The INTERCAFE network, funded by COST (European Cooperation in Science and Technology), held a series of international meetings, drawing together researchers from diverse disciplines (bird-related and broader ecology, fisheries science/management, sociology, social anthropology, international law) and other experts connected with fisheries production, harvest and management, or regional/national policy and decision-making. Under INTERCAFE's coordination, interested parties (local 'stakeholders' to international policy-makers) thus addressed European cormorant-fisheries issues. INTERCAFE comprised seventy researchers from most EU Member States, other countries in continental Europe and the Middle East. It was divided into three Work Groups - Ecological Databases and Analyses, Conflict Resolution and Management, and Linking Science with Policy and Best Practice. INTERCAFE will be publishing a series of publications and key findings from each will be described and discussed: 1) Cormorants and the European Environment: exploring cormorant status and distribution on a continental scale; 2) the INTERCAFE Field Manual: research methods for cormorants, fishes, and the interactions between them; 3) the INTERCAFE European Cormorant Management Toolbox: methods for reducing cormorant problems at fisheries; 4) Cormorant-fisheries conflicts at Carp ponds in Europe and Israel - an overview; 5) essential social, cultural and legal perspectives on cormorant-fisheries conflicts; 6) INTERCAFE: an integrated synthesis

Evidence for a Genetic Basis to Shorebird Growth (Oral)

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The growth of young birds after hatch is affected by both genetic factors as well as extrinsic factors such as food, habitat, and climate. Determining the contribution to growth from intrinsic factors in wild birds is difficult and usually requires intensive banding over a long period of time to calculate heritabilities. We studied the growth of Piping Plover (*Charadrius melodus*) chicks in the wild and compared these results to captive-reared individuals to determine if similarities in growth among brood mates had an intrinsic or extrinsic cause. Wild-reared individuals were captured for a larger population dynamics study of Piping Plovers nesting on the Missouri River (2005 - 2009), and the captive-reared individuals were measured as a part of a large-scale management action to save piping plover nests from inundation throughout the Missouri River Basin (1995 - 2002). We found that the similarities in growth among brood mates did not change in captive-reared individuals, despite the lack of territory, food, and parental care inequities that would be experienced by the wild-reared individuals. This suggests that the variation in growth among broods has at least some genetic component.

Density-dependent population regulation in Missouri River piping plovers (Oral)

Daniel Catlin, Joy Felio, Jonathan Cohen, James Fraser

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Although density-dependent regulation is widely accepted and supported, most studies do not deal with the specific mechanisms underlying the fluctuations in animal numbers that we see. We studied the effects of density on the reproductive output, emigration, and immigration of piping plovers (*Charadrius melodus*) using experimentally created habitat on the Missouri River from 2005 - 2008. We banded and monitored both adult and hatchling plovers and measured their demographic responses to increasing densities on experimentally created habitat. We used a mixture of capture-recapture models to explore the effect of increased density on reproductive output (measured in terms of juvenile survival to age 1), emigration (juvenile movement and recruitment), and immigration (recruitment of adults and juveniles). Reproductive output and immigration were negatively related to nesting density, and emigration was positively related to nesting density. With each increase in nesting density of 1 pair ha⁻¹, juvenile survival decreased by a multiplicative factor of 0.45, immigration by a multiplicative factor of 0.52, and emigration increased by a multiplicative factor of 1.6. Our results indicate that density-dependent regulation is occurring in the piping plover and highlight the importance of understanding the mechanisms behind some of our most widely held theories.

Population Parameters such as Survival, Recruitment, Age at First Breeding and Rate of Change for the Interior Double-crested Cormorant (Oral)

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Information is lacking about key demographic parameters for the Interior metapopulation of Double-crested cormorants (*Phalacrocorax auritus*). Three geographically distinct breeding areas across the southern border of Ontario [Lake of the Woods (LOW), North Channel of Lake Huron (NChan), and Eastern Lake Ontario (ELO)] were selected to study cormorant population parameters. Beginning in 2000 for ELO and in 2002 for LOW and NChan, over 11,000 pre-fledged cormorants were color banded. During the breeding seasons of 2000 through 2007 in ELO and 2006 and 2007 in LOW, data from re-observation of uniquely banded cormorants were collected. In ELO, 2% of the breeding population are age 1, 26% are age 2, and 72% are age 3 and older. In LOW, zero birds were observed breeding their first year, 22% of the breeding population are age 2 and 78% are age 3 and older. Survival estimates indicate <20% survival for first year birds, increasing to >80% after the second year. Elasticity analysis revealed a 50% reduction in adult survival will reduce the population's finite rate of increase (λ) by 25% for one time step. A 100% reduction in fecundity resulted in a 12 - 15% reduction in λ for one time step. A combined 50% reduction in adult survival and 100% reduction in fecundity resulted in a 41 - 42% reduction in λ for one time step. The information obtained in this study revealed cormorant metapopulation dynamics. These models were used to develop management strategies for reducing cormorant impacts to commercial and natural resources.

Nest Survival and Renesting by Piping Plovers in the Great Lakes Region USA (Poster)

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The potential merits of collecting eggs from first nests of endangered Great Lakes Piping Plovers (*Charadrius melodus*) for captive rearing have been discussed by wildlife managers, yet there is little data available regarding nest survival rates, the role of renesting, and the influences of various factors on Piping Plover productivity. We analyzed Piping Plover nest data from 1993-2008 to estimate renesting propensity, renesting interval, clutch size, daily nest survival rates, and investigate the effects of renesting, clutch initiation date, nest age, and parent age on daily survival rates of first nests and renests. Preliminary results suggest the following: renesting propensity was relatively low. Clutch sizes were negatively correlated with later clutch initiation dates, although clutch sizes between first nests and renests do not greatly differ. Daily nest survival rates were most influenced by renesting, clutch initiation date, and nest age. Parent ages did not strongly affect daily nest survival rates, although male age explained more deviance than female age. Daily nest survival rates declined with later clutch initiation dates and as nest age increased. Renests had lower daily nest survival rates than first nests. These preliminary results suggest that collecting eggs from first nests for captive rearing could have potential negative impacts on productivity of Great Lakes Piping Plovers because most Piping Plovers do not reneest, renests have lower overall survival, and nests initiated later also have lower survival.

Habitat Health, Ptilochronology and Waterbirds: A Tale of Two Estuaries (Oral)

Charles Clarkson

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The use of focal species is a growing trend in conservation and management. In coastal-marine environments, bioindicators have been identified as the most ecologically relevant focal species for guiding coastal monitoring programs. Colonial waterbirds have long been used as bioindicators due to their intimate connection with the hydrologic regime and central place foraging at breeding locations. Population-level observations are frequently used for monitoring the health of near-shore habitats utilized by waterbirds, however these data are often limited to indicating that change has taken place and lend little predictive power to causality. Individual-level observation may serve as a more useful tool for identifying the proximate factors leading to population-level fluctuations. Attributes of the individual that can accurately represent the threat associated with change are useful bioindicator tools and, when coupled with population-level presence and absence data, may serve useful for ecosystem monitoring. I propose the use of ptilochronology to determine the nutritional health of nestling waterbirds at two coastal locations experiencing drastically different disturbance regimes. When coupled with nest-site observations, ptilochronology may accurately reflect local foraging habitat health and further strengthen the use of waterbirds as bioindicators.

Quality of Red Knot Prey in Virginia during the Spring Migratory Stopover (Oral)

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Although Delaware Bay is the most renowned spring stopover site for Red Knots in the United States, 6 - 10,000 birds have been counted on the Virginia Coast. Unlike in Delaware Bay, Red Knots in Virginia do not have horseshoe crab eggs on which to forage. We examined the relationship between the distribution of Red Knots and potential prey items in Virginia, 2006-2008. Red Knots foraging in the sandy intertidal zone selected patches with more crustaceans than random plots, and flock size was positively correlated with abundance and size of coquina clams (*Donax variabilis*). However, the quality of coquina clams was low, as measured by the ratio of energetic content to shell mass. Red Knots foraging on peat banks were associated with patches of blue mussels (*Mytilus edulis*) and false angel wings (*Petricola pholadiformis*). These bivalves were of somewhat higher quality than coquina clams, but still of low quality. To better understand the value of Virginia to Red Knots, future studies should focus on determining the wintering ground origins of Red Knots stopping in Virginia, and their survival and reproductive success.

Wood Stork (*Mycteria americana*) colonies and status in the Usumacinta Delta and Yucatan Peninsula (Oral)

Jorge Correa-Sandoval

El Colegio de la Frontera Sur, Chetumal, Quintana Roo, Mexico

The Usumacinta Delta and Yucatan Peninsula are part of a large complex of coastal wetlands in the Gulf of Mexico and the Caribbean Sea. In the Centla Wetlands in Tabasco there are two major colonies named Pajara1 Primera and Pajara1 Segunda. The numbers are pulled with those of Campeche's Laguna de Términos. No recent numbers but the late 1970's showing up to 6000 to 8000 breeding pairs and 18000 individuals more in these wetlands. Still in Campeche, the region named Los Petenes has only one nesting colony with 300 nests. In Yucatán there are two colonies, one in Ría Celestún with only 10-30 nests. The other is south of San Felipe and has around 200 nests. In Quintana Roo there are two major wetlands; in Sian Ka'an Biosphere Reserve aerial censuses from 1993 a 1999 covering: 1972 km², showed an average of 274 individuals with a density of 0.14 ind/km². However, in Mogote Gaitanes there are records of 700 to 1000 nests. Within the reserve storks nest in 4 keys out of 24 used by aquatic birds. Finally, in Chetumal Bay, storks nest in two keys out of 5 used by aquatic birds. In Ensenada Mainada there are around 40 nests for a total of 120 individuals including 40 juveniles and Isla Pájaros has 100 nests. Aquatic birds seem to be using the entire wetlands system depending year to year variations in local conditions. I suggest to undertake a coordinated census in the region and to initiate a banding program.

A Good Tern for Citizen Science: Caspian Tern Migration Georeferences Discovered by Data Mining Photo Sharing Networks (Oral)

David Craig, Kaeli Swift

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Peer to peer photo-sharing web services, such as Flickr.com, have been extremely useful tools for global communication on behalf of researchers, and bird enthusiasts who are interested in coordinating observations of marked, wild birds. Flickr 'groups' called Caspian Tern (<http://www.flickr.com/groups/caspianterns/>) and Banded Birds & Auxiliary Markers (www.flickr.com/groups/505232@N24/) were organized with the aim of attracting users that would share images of Caspian Terns, *Hydroprogne caspia*, with field readable tags. Presently the two groups include over 250 members and almost 2000 useful images. Photographers typically annotate their records with georeferences using a tool linked to satellite images. In less than 4 months 60 volunteers posted over 400 photos of 54 species. Many other species of waterbirds (e.g. cormorants, swans, geese, gulls, flamingos, godwits, plovers) are also well documented. With additional photo network data mining more than 400 Caspian Tern resightings have been collected including observations in through the Americas, Europe, Africa, and Australia. The data are providing insight into seasonal movements and migratory connectivity as well as contributing to questions of demographics and extended parental care. The relatively large size, conspicuous vocalizations, and roosting habitats used by Caspian Terns make them particularly well suited to citizen science photo sharing networks, but we are certain other species can also be readily studied in this manner. In the pursuit of understanding bird behavior, migration, and conservation photo sharing networks like Flickr provide an opportunity for people of all interest levels to share observations of wild birds on a global level.

New York City Audubon's Harbor Heron Surveys: 24 Years of Colonial Waterbird Nesting in the New York/New Jersey Harbor (Oral)

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Long-legged wading bird populations (herons, egrets, and ibises) exhibited marked increases in the greater New York Harbor after passage of the Clean Water Act of 1977 and reduction of pollution in the New York/New Jersey Harbor during the 1970s. New York City Audubon's Harbor Herons Project monitors the population status of colonial waterbirds on urban island and mainland habitats. Monitoring efforts have focused on wading birds and Double-crested Cormorants, with additional effort devoted to gulls and terns. Between 1986 and 2009, nine species of wading birds nested on 14 islands, with a mean population size of 1,590 total pairs; a mean of 1,100 total pairs of Double-crested Cormorants nested on seven islands. Wading birds reached a peak of over 2,000 nesting pairs in the mid 1990's but subsequently declined approximately 30% by 2002. Following years showed slight increases in numbers of nesting pairs, reaching an average of approximately 1,700 pairs since 2005. There have been substantial shifts in the number of islands occupied by colonial waterbirds within the Harbor. In general, population trends for wading birds in the Harbor have tracked regional trends. Changes in survey leadership and annual survey effort (in terms of the number of islands surveyed) pose challenges for the statistical analysis of population trends. Despite these challenges, the data amassed through the Harbor Herons nesting surveys provide a valuable indicator of colonial waterbird population dynamics in New York Harbor.

Polychlorinated Biphenyls, Dioxins, Furans, and Organochlorine Pesticides in Belted Kingfisher Eggs from the Upper Hudson River Basin, New York, 2004 (Oral)

Thomas Custer, Christine Custer, Brian Gray

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Nesting Belted Kingfishers (hereafter kingfishers, *Ceryle alcyon*) were studied on the Hudson River near Fort Edward, NY south to New Baltimore, NY and three nearby river drainages in 2004. Concentrations of 28 organic pesticides, 160 polychlorinated biphenyl (PCB) congeners, and 17 dioxin and furan (PCDD-F) congeners were quantified in kingfisher eggs. The pattern of organochlorine pesticides and PCDD-F congeners did not differ significantly between 14 eggs collected on the Hudson River and 5 eggs collected on three other nearby rivers. In contrast, the pattern of PCB congeners in eggs collected on the Hudson River differed significantly from the other rivers. The differences in patterns of PCB congeners were associated with a higher representation of lower-chlorinated congeners on the Hudson River than the other rivers. Concentrations in the sample egg collected at each nest were compared to nest survival (the probability of at least one egg hatching in a clutch) and egg success (the proportion of eggs hatching in a clutch if at least one egg hatched) of the remaining eggs in the clutch. Models that predicted nest survival and egg success as functions of contaminant levels were poorly distinguished from models that presumed no such associations. The conclusions and opinions presented here are those of the authors; they do not represent the official position of any of the funding agencies, the Hudson River Trustees, or the United States government.

Common Tern Status and Trends in the U.S. Great Lakes (Oral)

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The Common Tern (*Sterna hirundo*) is one of several colonial waterbird species of special concern in the Great Lakes region. Historical records indicate that numbers have declined since estimates were made in the 1960s. The purpose of this presentation is to (1) summarize historical knowledge, (2) present estimates obtained from four U.S. Great Lakes Colonial Waterbird Census efforts (1970s-2009), (3) identify population trends and distribution patterns, and (4) identify future research and conservation needs. One of the earliest, but incomplete, estimates for US waters suggests that the historic population of Common Terns was at least 6,000 pairs. By the time of the first waterbird census in the 1970s, the total U.S. estimate was 2,600 pairs. During the four waterbird census periods, Common Terns were found nesting at approximately 40-50 locations annually; the number of pairs remained stable at 3300-3500 pairs in the last 3 census periods. Throughout the region, there is little natural habitat for COTEs free from predators and competitors; most sites used for nesting are human created. Navigation cells and markers, pilings, breakwalls, water intakes, power cribs or dredge spoil islands are used commonly. Additionally, COTEs frequently are the only species present at their colony sites. Future research and conservation needs include: survival analyses; knowledge of annual variation in site use and reproductive success, fidelity to site, lake and region, more frequent Great Lakes-wide monitoring, and identification and active protection of sites with consistent high productivity.

Some Observations on Birding along the Coast of Guyana (Oral)

Phillip Da Silva

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The coastline of Guyana is approximately 430km and includes a 145km stretch of beach in the Northwestern region called Shell Beach. Studies within the last five years have shown that Shell Beach has one of the highest diversities of avifauna in the country. This paper focuses on two aspects: firstly the practice of birding--the taking of birds for human consumption, and secondly observations of avifaunal species present within the Shell Beach. "Birding" as a pastime usually takes place during the period of August to October, although in some areas the practice continues year round. Among the bird groups usually targeted are Spurwings (Parridae), Plovers (Oediconnidae), Sandpipers (Scolopacidae), Terns (Laridae), Water trushes (Parulidae) and Egrets (Ardeidae). Most recently one member of the Scarlet ibis (*Eudocimus ruber*) has been targeted and Wood Storks (*Mycteria americana*) could be vulnerable. The species accounts from Shell Beach are based on studies conducted in June-July of 2006, 2008 and 2009. Combined results from this study and the literature have shown that there are currently approximately 207 species of birds documented for the Shell Beach area, indicating that Guyana's coastal areas have diverse ecosystems that support a great diversity of avifauna, including resident and migratory species. Among the species observed were the Jabiru stork (*Jabiru mycteria*), Wood Stork and Maguari Stork (*Ciconia maguari*). It may be said that the Jabiru stork and Wood Stork may be considered common since more than twenty individuals were seen daily during the observatory period. The Maguari Stork was uncommon.

Waterbird Surveying Methodology of the New Jersey Department of Environmental Protection's Ecological Baseline Survey for Ocean/Wind Power (Oral)

Glen Davis, Tony Leukering, Joshua Nemeth

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The Ecological Baseline Survey (EBS) being carried-out by the New Jersey Department of Environmental Protection for the past 20 months is providing a significant extension of the knowledge of waterbird abundance, distribution, and behavior in the state's offshore and coastal waters. The study will provide a pivotal reference point for initial plans to bring wind energy to New Jersey and beyond. We present an overview of the techniques and protocols being employed to create this comprehensive and unique dataset. Avian activity is being determined using visual surveys and remote sensing, and we here provide description of the shipboard visual efforts. Ship-based, line-transect surveys are the backbone of this EBS and many recent seabird abundance investigations. The EBS utilizes a double saw-tooth array of transects to provide maximal coverage by visual surveys within the study area of 1,360 nautical miles². Our line-transect methodology quantifies, continuously, distance sampling of sitting and flying birds in a 300 x 300 meter box in one 90-degree quadrant along each transect. This technique enables observers to record a variety of data including flight direction, altitude, and behavior, and also provides data for density modeling. As wind-energy developments are placed along our coasts, further waterbird studies will be better served by standardization of protocols. Coupling overall abundance and distribution data collection with risk-assessment concerns will create a more valuable and versatile data resource.

Using Throw-traps and Regurgitation Surveys to Assess Egret Foraging Ecology in Narragansett Bay, Rhode Island (Oral)

Elizabeth DeCelles

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I investigated the foraging ecology of Snowy Egrets and Great Egrets during the summers of 2008 and 2009 in Narragansett Bay, Rhode Island. Both species have been declining since 2002 in this region. I employed a prey-based approach to investigate possible causes for this decline. I used throw-traps to estimate nekton abundance at egret foraging and random locations in 8 salt marshes and regurgitation surveys to quantify the diet of chicks. Egrets are opportunistic foragers and exploit a variety of nekton species. Dominant nekton in 2008 detected at random throw-trap locations were Grass Shrimp, Mummichog, and Silversides, while dominant potential prey at egret foraging locations also included Striped Killifish and excluded Silversides. In contrast, regurgitation samples were dominated by Winter Flounder, unidentified flounder parts, and unidentified fish (44%, 20%, 20% aggregate biomass, respectively) in 2008, while Mummichog, Silversides and Grass Shrimp only accounted for 12% of biomass in regurgitation samples. In 2009, the diet of egret chicks switched with Silversides accounting for 83% of the biomass based on regurgitation samples and no flounder detected. In contrast, only 1.6 % of total nekton individuals detected with throw-traps at egret foraging locations were Silversides. Therefore, throw-trap results do not appear to accurately reflect selected nekton species egrets are feeding chicks. This suggests that biologists interested in enhancing egret and nekton populations through habitat manipulation or restoration in the region should exercise caution when using estimates of nekton availability from salt marshes to quantify egret prey availability.

Population Genetics and Mating System in Breeding Colonies of Wood Stork in the North and Pantanal regions of Brazil (Oral)

Silvia Nassif Del Lama

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Wood Stork breeding colonies were accessed in northern Brazil. Genotypes of nine microsatellite loci ($N = 164$) and sequence of mtDNA control region (423 bp, $N = 40$) were determined in nestlings, and compared to Pantanal data ($N = 147$, $N = 48$). Similar levels of diversity were found through nuclear and mitochondrial markers between the North ($H_e: 0.418$; $\pi = 0.0085$; $h = 0.824$) and the Pantanal regions ($H_e: 0.391$; $\pi = 0.0044$; $h = 0.546$). Significant genetic differentiation was detected only by mtDNA data ($F_{st} = 0.078$, $P = 0.027$). The greater effect that drift has on mtDNA due to the low effective population size (N_e) can explain this result. Pantanal has the largest N_e estimated (19,224) through microsatellite data. Management and conservation of the northern population should be prioritized due to its reduced capacity to respond to environmental pressures ($N_e = 175$). The genetic mating system of Wood Stork, classified as socially monogamous, was checked using nine microsatellite loci, four relatedness estimators, and hypothesis testing analyses. A total of 281 nestlings sampled within 124 nests were classified according to their genotypes as full sibs, half sibs, or unrelated pairs. Unrelated pairs were found in 62 nests (75.6%) in the North, and in 29 nests (70.7%) in the Pantanal region. Evidence of a mating system other than monogamy is presented for the first time in this species. The tested methodological approach can be applied to species in which the capture of adults hinders the obtainment of complete family samples.

Food for Thought: Combining Conventional and Novel Techniques to Study Double-crested Cormorant Diet

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Increasing numbers of Double-crested Cormorants (*Phalacrocorax auritus*) in North America have raised concerns regarding consumption of economically valuable fish species; however, we currently have a relatively poor understanding of cormorant diets and how they affect food webs. Stable isotope ratio analyses have become common tools to study food web dynamics because they can verify and provide new understandings about diet in addition to conventional methods. Using a combination of carbon and nitrogen stable isotopes and stomach content analyses, we investigated the diet of breeding Double-crested Cormorants for four years from freshwater lakes in two different habitats - the Great Plains and the boreal forest regions of Saskatchewan, Canada. Stomach content analyses indicated that cormorants are generalists, consuming a wide variety of small forage fish species. While some prey species occurred regularly in cormorant diet (ie. Yellow perch, *Perca flavescens*), there were no consistently dominant prey species across years and/or lakes. Stable isotopes analyses generally supported the findings from stomach contents, and identify cormorants as versatile piscivores. However, discrepancies between stable isotopes mixing models and stomach contents do exist, and they indicate that caution should be taken when making assumptions regarding cormorant diet and the use of stable isotopes for diet studies.

Past, Present, and Future Management of Double-crested Cormorants in the United States (Oral)

Terry Doyle
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In response to rapidly increasing breeding populations of Double-crested Cormorants (DCCO) (*Phalacrocorax auritus*) in the Great Lakes and wintering populations in the Southeastern United States, the U.S. Fish and Wildlife Service (USFWS) adopted two Depredation Orders that allow for the take of DCCOs without a permit. The Aquaculture Depredation Order (AQDO) was established in 1998 to assist aquaculture producers in 13 States control DCCOs at their facilities. In 2003, the Public Resource Depredation Order (PRDO) was established to protect public resources such as fish, vegetation, and co-nesting birds in 24 States. On average, annual DCCO take from all sources in the U.S. has been less than 3% of the continental population.

Additionally, DCCO nests are managed under the PRDO to reduce productivity. The number of DCCOs taken under both the AQDO and PRDO peaked in 2006 and has declined each year since. This decline may reflect ecological changes in the Great Lakes, changing patterns of aquaculture in the southeastern U.S., and/or the impact of management. However, it may be difficult to determine the ultimate cause of population changes due to the number of confounding factors. Nest counts conducted throughout the Great Lakes and southeast U.S. in 2009 will provide additional insight into the extent of population changes. The USFWS has begun taking a structured decision making approach toward DCCO management which should greatly assist in upcoming planning efforts at the local, regional, national, and even international level while addressing the various sources of uncertainty involved with this contentious issue.

Comparing Expert Model Predictions and Field Data for King Rail: Building Better Management Tools for Secretive Marsh Birds (Oral)

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We present final results from our Bayesian Belief Network model predicting King Rail (*Rallus elegans*) breeding distribution in eastern North Carolina and southeastern Virginia. This model was initially parameterized using local expert knowledge and literature review, but is easily updated with local survey data. The purposes of the model are to support (1) the setting of ecosystem- and refuge- scale population and habitat objectives by the US Fish & Wildlife Service, (2) the design of adaptive monitoring strategies that test key hypotheses and uncertainties, and (3) the easy integration of new data from diverse monitoring and research sources in management decisions. The model was field validated by conducting call-back surveys in a stratified random design, where the variables that contributed most to model uncertainty defined the sampling strata. Field data gathered in 2008 updated the original expert-based model and we compared whether the original expert-only or the experts-plus-data model better predicted the second year field observations in 2009. Last, we present population and habitat objectives supported by our model and use sensitivity analyses to assess how different sources of error and uncertainty (e.g. inaccurate maps, incomplete knowledge, or false expert assumptions) each affect the confidence bounds around modeled answers to the common conservation and management questions: "How much?" and "Where?".

Mammalian Predator Removal Reduces Predation Intensity on Artificial Beach-nests on the Virginia Barrier Islands (Oral)

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Does mammalian predation management reduce "predation intensity" on the eggs of beach-nesting birds? We compared predation rates on eggs in artificial scrapes on (1) predator-removal (Metompkin) and control (Parramore) islands in August 2003 and on (2) Parramore Island before (2003) and after (June-July 2004) an intensive predator removal campaign. On each island, we established 100 scrapes at randomly-selected points along a 4-km transect oriented parallel to the beach, above the high tide line. Each scrape was stocked with a "clutch" of 2 eggs, including 1 Japanese quail egg and 1 clay (Plasticene) egg. Each nest was monitored and restocked daily for 4 days. Metompkin was thought to be raccoon- and red fox-free in 2003, while Parramore harbored large numbers of both species. Mammalian predation rates were higher on Parramore (~99% per day) than on Metompkin (~0%). Nevertheless, gulls and ghost crabs depredated ~19% of the nests per day on Metompkin. We repeated this trial in June and July 2004, using the same nest stations. Metompkin harbored 1-2 raccoons at this time, while Parramore still harbored both species even after a large number of raccoons and red foxes had been removed in autumn 2003. Mammalian predation rates on Parramore (18% per day) were still higher than on Metompkin (~0% per day), but were reduced dramatically from 2003. Once again, gulls and ghost crabs depredated ~6% of the nest per day on Metompkin. These results suggest that mammalian predation management has significant potential for reducing nest predation on islands.

Energetics of Black Skimmer Nestlings (Poster)

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To add to the growing body of nestling energetic studies and as part of a broader study examining the reproductive ecology of seabirds in South Carolina, we measured the daily energy expenditure (DEE) of Black Skimmer (*Rynchops niger*) nestlings in the wild using the doubly-labeled water (DLW) method. Skimmers are an interesting focal species for an energetics study as they are one of the few seabirds that are sexually dimorphic with respect to body mass and size. In this pilot study of nine nestlings (female = 6, male = 3), DEE ranged from 218 - 336 kJ/day, less than that predicted for their body mass based on an allometric model for seabird chicks. There was a significant positive relationship between DEE and body mass (range: 140 - 260 g) but not between DEE and sex or the interaction between body mass and sex. Age of nestlings ranged from 19-29 days on the day of injection, thus our results best represents the pre-fledging energetic demands of skimmer nestlings.

Intertidal Habitat Use by Waterbirds on a Coastal Island (Oral)

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Management plans for waterbirds often advise the closure of nesting areas but not adjacent intertidal habitat. Intertidal areas are used by coastal birds during breeding and migration for activities including foraging, loafing, and rearing of young. When intertidal areas are not protected, these activities may be disrupted by recreational use of the beach, which tends to be heaviest during the breeding season of many species. These conflicts of use, and thus their consequences, may be avoided by examining patterns of intertidal bird use and modifying policies to include closure of the intertidal areas most frequented by birds. We conducted 17 low-tide surveys from May to October 2007 and 2008 to measure the variability of bird abundance in intertidal areas of a coastal island in South Carolina. Our objective was to examine the relationships among bird use, human use, and habitat features at different spatial and temporal scales in order to inform management decisions. Over 30 waterbird species were counted, including seabirds, shorebirds, and wading birds and 13 breeding species. Mean species richness in our survey plots was 8.5 ± 5.3 species and ranged from 3-25 species. Mean bird abundance was 25.3 ± 39.8 birds per plot and varied by year. Approximately 70% of birds were located along the water and on the lower portion of the beach during surveys. Human activity appeared to be concentrated in several areas of the island. We address spatial and temporal patterns of bird use and the conservation implications of these findings.

Changing Distributions of Colonial Waterbirds and Mesopredators on the Virginia Coast Reserve Barrier Islands (Poster)

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Colonial waterbirds are known to choose nesting sites that are predator-free when available. The barrier island complex of the Virginia Coast Reserve was established in the 1970s in large part because of the significance of this waterbird resource along the Atlantic coast. Especially since the mid-1990s, increases in the mesopredators red fox (*Vulpes vulpes*) and raccoon (*Procyon lotor*) have apparently resulted in declines in numbers and colonies of 5 species of terns (Royal, Sandwich, Common, Gull-billed, and Least) and Black Skimmers. Here we illustrate the reciprocal relationship between the colony sites of these species and mesopredator presence from 1977 to 1998 and the recent 2008 surveys. From a previously published study in 2001, the numbers of all colonies and the known mesopredator presence on islands from Assawoman south to Fisherman Island were compared with those from the 2008 surveys. Colony sites declined from 1977 to 1998, but have doubled from 13 to 26 from 1998 to 2008, respectively, probably in large part due to extensive controls of these species that began in 2000. Predator control is seldom 100% efficient, and some recolonization of the islands occurs after winter-spring removal; thus, predator removal requires significant costs in time and resources.

Tracking Changes of Environmental Mercury Loads through Waterbirds (Oral)

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Global cycling of available environmental mercury (Hg) loads is in flux. The remobilization of Hg through human activities is responsible for much of this change. In response, regulatory policies for Hg emissions and effluents at multiple geographic scales are happening or are imminent. Because the relationship of Hg deposition and ecological response is challenging to predict through traditional regulatory metrics such as air, sediment and water, high trophic level biotic indicators are needed to directly measure changes in environmental loading. Waterbirds, particularly the Common Loon, are increasingly acknowledged as suitable indicators for measuring environmental health. The Common Loon is one of the few bird species to be used for regulatory monitoring needs. The use of this species reflects an in-depth knowledge of Hg exposure profiles across North America, known adverse effect levels using reproductive endpoints, and the compilation of demographic information based on >4,000 uniquely marked individuals over the past 20 years that provides key variables for modeling such as site fidelity, population age structure, and migration connectivity. National Hg monitoring programs that include the Common Loon are happening in Canada and are proposed for the United States.

Nesting Density and Piping Plover Aggression Levels (Oral)

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Density-dependent effects on population dynamics may be driven by increases in competition for food or increases in predation. For Piping Plovers nesting on the Gavins Point Reach of the Missouri River, there is evidence that predation and competition are increasing with density. The US Army Corps of Engineers has been creating sandbars in the river to increase the amount of nesting habitat. These sandbars were quickly colonized and Piping Plovers nested at some of the highest densities ever recorded in a Piping Plover population. We attempted to determine the effect of density on competition levels by measuring changes in adult Piping Plover behavior during the 2008 and 2009 breeding seasons. We observed Piping Plover adults and recorded the frequency and intensity of aggressive encounters. We modelled the rate at which adult Piping Plovers encountered conspecifics using a delta log normal model. Adult Piping Plovers were more likely to encounter other Piping Plovers during the chick rearing period than in the nest establishment period. We used an events/trials logistic regression to model the proportion of aggressive encounters for adult Piping Plovers and found that adults had 74% more aggressive encounters as density increased (Beta= 1.743, 95% C.I. 1.143-2.658). Understanding the role density is playing in population regulation will help inform both the timing and size of sandbar construction. These factors will become increasingly important as the population grows, as we have observed increased competition among adults, increased chick mortality as a result of agonism and declines in reproductive rates.

Trends in Breeding Densities of Western Arctic Semipalmated Sandpipers (Oral)

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We searched the literature and obtained unpublished data to examine trends in densities of Semipalmated Sandpipers (*Calidris pusilla*) at breeding sites in Alaska and Western Arctic Canada. Specific plots were not always resurveyed, and methods sometimes varied in different time periods, so it is difficult to gauge the validity of most comparisons. However, overall, measured densities of Semipalmated Sandpiper nests or pairs tended to be greater in later years at the sites examined. This included the outer Mackenzie Delta, NWT (1992-3 Gratto-Trevor versus 2005-9 PRISM/MGP, J. Rausch pers. comm.); Prudhoe Bay, AK (1981-91 Troy 1996 versus 2003-9 J. Liebezeit and S. Zack unpubl. data); Barrow, AK (2003-8 R. Lanctot unpubl. data); and Hooper Bay area (1924 versus 2008, B. McCaffery unpubl. data). Semipalmated Sandpipers certainly do not appear to be declining in western breeding areas, and may be increasing.

Nutrient Utilization by and Diet Preference of American White Pelican when Offered Diets of Catfish and(or) Carp (Oral)

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Twelve pelicans captured in northeast Mississippi were used to determine nutrient metabolism when consuming catfish and(or) carp. Another objective was to determine the dietary preference of pelicans when allowed to consume catfish and carp. For the 7-day metabolism trial pelicans were allotted to one of three treatment diets: catfish only, carp only or both (50 % catfish and 50% carp). Feces, samples of fish offered and ors were collected and analyzed for nutrient content to determine nutrient metabolism. Pelicans receiving catfish or both (4.41 % and 5.10 % BW/day, respectively) consumed less ($P = 0.0107$) dry matter as a percent of body weight than pelicans receiving carp (6.06 % BW/day). Pelicans consuming catfish metabolized less ($P < 0.05$) dry matter, organic matter and energy (42.2, 52.0, 74.4 %, respectively) compared to pelicans consuming both (54.8, 64.1, 81.2 %, respectively) or carp (60.0, 68.0, 83.4 %, respectively). Pelicans eating only catfish (2.5 %) tended to metabolize less ($P = 0.0579$) protein than pelicans eating only carp (28.1 %). Pelicans eating both (22.5 %) were intermediate to those eating catfish or carp for protein metabolism. For the 2-day preference trial the four pelicans that were allotted to the diet consisting of both catfish and carp for the metabolism trial were used to determine preference for catfish or carp (based on intake). Pelicans preferred ($P = 0.001$) carp (89 % of diet) compared to catfish (11 % of diet). Pelicans ate more carp and digested nutrients from carp more efficiently than for catfish.

Habitat Selection, Present Threats, and Growing Conflicts with Human Development for Jabiru Storks and Wood Storks in Belize (Oral)

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We studied the conservation biology of Jabiru Storks in Belize as a surrogate species to identify the land-development threats and conservation actions for a broad range of species, including Wood Storks, within the most rapidly developing region of the country. Jabirus are large, long-lived birds with deferred sexual maturity and a protracted breeding season. The Mesoamerican population, genetically distinct from its South American counterparts, is widely scattered with dangerously small subpopulations (the largest in Belize with <180 individuals). We determined habitat correlates of successful nesting and assessed risks of extinction under various scenarios of demographic and environmental variability. Aerial surveys, intensive ground study, and satellite telemetry with GPS capability were used to find and monitor nests ($n = 22$), to characterize the vegetation of nest sites, and to track and determine the survival (and causes of mortality) of six juveniles from five nests. Microhabitat and landscape-level features influenced nest-site selection. First-year survival is critically low and human persecution, particularly in residential and aquaculture sites, is a key factor. The present network of conservation areas in Belize does not provide adequate protection for Jabiru Storks and may not support Wood Storks. Human pressures, possible inbreeding depression, and high juvenile mortality point to an uncertain future and the vital need for a comprehensive regional action plan for this, and associated species. Primary among these is the Wood Stork, which depends on the same large, native foraging landscapes and is severely at risk from the same direct and indirect human-induced impacts.

Radar Observations of Selected Marine Birds at the Avalon Seawatch - What Are We Missing? (Oral)

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New Jersey Audubon Society has conducted sunrise to sunset waterbird migration counts at Avalon, NJ, from 22 September to 22 December since 1995. Observers attempt to count all migrating birds passing to the south within about 5.5 km of shore although the distance varies with visibility. In 2007, over 492,000 black and surf scoters (*Melanitta* spp.) were counted, giving this seawatch a great potential for monitoring over half of the estimated Atlantic populations. The Sea Duck Joint Venture asked us to determine what portion of the seaducks passing Avalon are counted. For 15 days in fall of 2007, we used horizontally-oriented, X-band marine radar 24 hours a day and visual observations in daylight to verify the radar observations of the major migrant seabirds: scoters, loons, gannets and cormorants. Using the radar and 10 hours of visual observations against the moon's reflection on the water, we found very little movement of birds after sunset. We anticipated that the radar would detect birds beyond the visual observations or in fog, but no flocks were observed by radar that were not detected by the observers and we had no days with fog. We found that 4.6% of the scoter flocks and 1.66% of the individual scoters were observed flying north in daylight and no flocks were detected flying north at night. Although proportionately small, daily or multi-day movements of waterbirds to the north could bias migration counts. Large feeding flocks of gannets can make it difficult detect migrant birds with the radar.

How Do We Mitigate the Effects of Offshore Wind Development on Waterbirds? (Oral)

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Thousands of large wind turbines have been proposed on continental shelf and Great Lakes waters of the Northeastern United States. Some will be built. There are over 100 species of waterbirds numbering over 8 million individuals with potential conflicts related to wind development in these waters. The impacts of wind development on birds will be additive to already unquantified impacts from bycatch in gillnets, oil spills, contaminants, introduced or invasive predators, depletion of food resources from over fishing, and sand mining. Effects of offshore wind energy development are difficult to predict and almost as difficult to measure. Migration patterns, concentration areas, and foraging ecology are the most important characteristics of seabird biology to understand when attempting to predict or avoid impacts of wind development. Biologists should play an integral part of the planning process both to lessen the impacts on birds by avoiding important resource areas, and to ensure that the design and operation of the facility will have minimal effects. Collisions are not likely to be the major impact on seabirds, but the structures and associated activity will affect bird distribution and their habitat. Monitoring studies are needed to determine compensatory mitigation. Management should ensure that compensatory mitigation is effective and directed towards the species that are impacted. Possible mitigations include breeding colony restoration or protection, reducing bycatch of birds, restoring forage fish and benthic invertebrate stocks, reducing invasive predatory species, increase law enforcement of illegal fisheries especially those with large bird bycatch, and removal of derelict fishing gear.

Decline of the Least Tern in Southwestern Florida: A Sign of Things to Come? (Oral)

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The Coastal Least Tern (*Sternula a. antillarum*) is a colonial, open-beach nesting seabird that breeds along the U.S coast from the southern tip of Texas north to southern Maine. Due to habitat loss and human-related disturbance, Least Terns in the southeastern United States have used gravel rooftops as an alternative nesting habitat. Currently, gravel rooftops are being phased out because of changes in Florida and Georgia building codes and at the same time, open beach habitat is becoming more crowded with humans. To determine the impact of the decreasing availability of gravel rooftops on Least Terns in Florida, we closely monitored all known ground and rooftop colonies in three southwestern Florida counties from 2002-2009. This region supports approximately 27% of the colonies and 31% of the adult Least Terns in Florida. During this period we saw a decline in the number of rooftop colonies from 41 to 9 and an overall decline of 45% in the total number of adults counted in mid-May at all the ground and rooftop colonies. Productivity (number of fledglings/pair) for ground colonies was extremely low during the past 8 breeding seasons ($X=0.10$, $SD=0.07$), while productivity was relatively high for rooftop colonies ($X=0.38$, $SD=0.21$). We are concerned that without rooftop colonies, Least Terns could decline throughout Florida and perhaps the southeastern United States. Our findings are particularly relevant because the State of Florida is considering removing the Least Tern from its endangered species list during a revision of the listing process.

Avian Avoidance Behavior and Collision Risk: Experiences from Pre- and Post-Construction Monitoring at Offshore Wind Farms at Horns Rev and Nysted, Denmark (Oral)

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We investigated the hazards presented to large, long-lived water birds by the Horns Rev and Nysted offshore wind farms in Denmark during 6 years of pre- and post-construction studies. Aerial surveys, radar, infra-red video monitoring and visual observations showed behavioral avoidance responses caused effective habitat loss (i.e. reduced post-construction bird densities between turbines) of divers *Gavia* at Horns Rev and long-tailed ducks *Clangula hyemalis* at Nysted, despite little effect on habitat. Densities of other species were too low to assess or showed no clear effects. Extent of habitat loss was small and involved small proportions of the populations concerned, so were likely of little biological significance. Flying birds showed species-specific avoidance responses to both wind farms, and differed by day and night. Overall, c.75% of all birds heading for both wind farms at 1.5-2 km distance avoided flying between turbines. Those entering the wind farm showed other avoidance behaviors, such as altitude reduction, further minimizing collision risk. Of the 235,000 common eiders *Somateria mollissima* passing Nysted each autumn, stochastic modeling predicted a 0.02% collision rate (45 birds per migration season), confirmed by the complete lack of detected collisions during infra-red monitoring of one turbine. Whilst these two projects are unlikely to have had any major effects on the avian populations involved, assessing the cumulative effects of these and other human developments remains a future challenge. We remain cautious in applying the results of these studies directly to other offshore wind farms, other species and other areas.

Historic and Current Final Fueling Areas for Northbound Red Knots in the Eastern United States (Poster)

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Northbound western Atlantic Red Knots (*Calidris canutus rufa*) migrate from their wintering grounds to their Arctic breeding sites in a series of long flights interrupted by “fueling stops” where they deposit fat to fuel the next part of the migration. Historic literature indicates that final fueling before the trip from the Atlantic to the Arctic occurred in a large area stretching approximately 750 km from Virginia to Massachusetts where knots fed primarily on mollusks, but also on insect larvae and crustaceans. In the 1800’s Red Knot populations, like the populations of many other birds and mammals, were decimated by unrestricted recreational and market hunting. Later population reductions were likely caused by disturbance and habitat degradation, including reduction of food supplies. A long-term conservation strategy for this species should include conservation of undisturbed beaches with ample food supplies, not only in the Delaware Bay, but also on the Atlantic Coast and in the Atlantic marshes.

How Can Behavioral Ecology Help Contribute towards the Management of Cormorants (Oral)

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In past symposia, many of the identified research needs to inform Double-crested Cormorant management were aimed at quantifying population dynamics. With the exception of a few studies, prior behavioral work has focused on foraging behaviors occurring away from the colony site. Here we examine how examination of behaviors of cormorants, particularly conspecific attraction, nest site selection and nest site fidelity, could contribute towards devising creative and non-lethal management actions. This focus arises from current management scheme at the largest colony of double-crested cormorants in the lower Great Lakes, Tommy Thompson Park. Because of the park’s location in the largest city in Canada, Toronto, management options do not include culling, yet there is on-going concern about cormorant-induced tree canopy loss in the park. We conducted a conspecific attraction experiment using two densities of decoys and different nesting substrates in an area previously deforested by nesting cormorants. Our objective is to move Double-crested Cormorants within Tommy Thompson Park from tree nesting to a ground nesting site. In 2009, the first year of the experiment, we had cormorants visiting, but not nesting, on the plots. In cormorant management often the goal is to either reduce the number of individuals in a colony or relocate a colony. Therefore understanding the proximate factors in which cormorants make decisions about nest sites could assist in situations where culling is not possible.

Survival Consequences of Chronic Exposure of White Ibises to Low Concentrations of Dietary Methylmercury (Oral)

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Methylmercury (MeHg) is known to cause neurotoxic effects, reproductive impairment, immune function impairment, and endocrine disruption. However, it is unclear how cumulative effects of MeHg affect survival, and few experimental studies exist. We experimentally exposed White Ibises (*Eudocimus albus*) to chronic, low concentrations of dietary MeHg from 90 d of age to 3 – 4 yrs of age in a large free-flight aviary. Dietary levels were 0, 0.01, 0.05 and 0.3 ppm MeHg ww. At an age of 3 – 4 yr, adults were fed food not containing MeHg for a period of 3 months, and then soft-released to the wild using a release site where abundant food and safe roosting was provided, within 5 km of prime breeding habitat. Individually marked birds were then resighted at the release site and at large communal roosts nearby over a period of 3 months (140 birds, 25 recapture intervals). We used recapture analysis (Program Mark) to examine the effects of time, sex, age, and MeHg treatment group on survival. Models balancing fit and parsimoniousness indicated time explained survival well. An interactive effect of MeHg treatment group and time on resight probability was indicated in one of the less parsimonious models. These results suggest that effects of chronic exposure at these levels do not result in permanent impairment severe enough to affect survival. However, since these birds had been depurated for 3 months prior to release, we have not tested whether animals exposed currently to MeHg at these levels would show impaired survival.

Spatial and Temporal Distributions of Wintering Sea Ducks on the Atlantic Coast of the United States and Canada (Oral)

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Little is known about the distributions and habitat preferences of sea ducks in North America compared to other waterfowl. To improve understanding of sea duck winter distributions, the United States Fish and Wildlife Service initiated the Atlantic Flyway Sea Duck Survey (AFSDS). Our analysis focuses on 5 sea duck species (Black Scoters *Melanitta nigra americana*, Surf Scoters *Melanitta perspicillata*, White-winged Scoters *Melanitta fusca deglandi*, Common Eiders *Somateria mollissima*, Long-tailed Ducks *Clangula hyemalis*) along the nearshore eastern coast of the U.S. and Canada. A single aerial transect was flown parallel to the coast, a quarter mile offshore in 10 nautical mile segments for 10 years between 1991 and 2002 (~451 segments each year). All sea ducks within 500 meters (250 meters on each side of the route) were counted. We modeled these count data for each segment using a zero-inflated negative binomial distribution. We included 4 segment-level habitat covariates: sea surface temperature, mean depth, maximum slope, and a variable to indicate if the segment was in a bay or not; 1 broad-scale covariate: the North Atlantic Oscillation (NAO); and a temporal correlation component. We modeled the zero-inflation parameter as a function of latitude for each of the species. Our results indicated that all species distributions had strong latitudinal gradients and temporal correlations. Additionally, the number of observed sea ducks was significantly related to NAO for all 5 species. We will discuss these relationships, and the other significant habitat relationships, and offer insight regarding the broad scale versus small scale habitat relationships.

Avian Influenza Virus and West Nile Virus Illustrate How Alteration of the Environment Can Promote Avian Disease Transmission (Oral)

Samantha Gibbs

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Avian influenza virus (AI) and West Nile virus (WNV) both demonstrate how the environmental impacts of land use trends and agricultural trade practices influence disease transmission in wild birds. In their historical geographic ranges, these viruses caused little to no clinical disease in wild birds, which serve as the reservoir species. Expansion from the historical ranges and establishment of the viruses in new areas, however, has brought with it unexpected morbidity and mortality in wild bird populations. This expansion, and subsequent establishment, of AI and WNV has been assisted through human alterations of the environment which benefit hosts or vectors. Current agricultural trade practices, especially in Southeast Asia, have led to the amplification of AI viruses in the domestic bird population, increased interactions occurring between wild and domestic birds, led to the large scale movement of wild birds, and placed evolutionary pressure on the circulating viruses. In the case of WNV, amplification and transmission of the virus in North America has been increased and maintained by creating man-made improvements to habitat for the mosquito vectors while providing food and roosting resources in that same environment for wild birds. Investigation of both diseases illustrates how wild birds can serve as sensitive indicators of environmental health by pinpointing these factors affecting patterns of disease transmission.

Temporal - Spatial Distribution and Abundance of Roosting Sandhill Cranes in the Central Platte River Valley: 2002-2009 (Oral)

Karine Gil, Felipe Chavez-Ramirez

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We analyzed the distribution and abundance of Sandhill Cranes along the Central Platte River, based on aerial surveys from 2002 to 2009. Surveys were conducted weekly from the last week of February (week 1) to the second week of April (Week 8). Roosts were categorized into one of six categories based on crane numbers (A= >30,000 -72,000; B >15,000-29,999; C > 10,000-14,999; D > 5,000-9,999; E > 1000-4,999 and F > 1-999) represented in a GIS map and summarized by bridge segments (BS) from Chapman to Overton. Bridge Segments are: 1. Chapman to US 34, 2. US 34 to US 281, 3. US 281 to Alda, 4. Alda to Wood River, 5. Wood River to Shelton, 6. Shelton to Gibbon, 7. Gibbon to NE 10, 8. NE 10 to Kearney, 9. Kearney to Odessa, 10. Odessa to Elm Creek, and 11. Elm Creek to Overton. Categories showed differences in spatial distribution. Categories from A to C were located historically in specific locations from BS1 to BS5 and BS7. Categories D, E and F extended also from BS8 to BS11. Temporal distribution showed differences in roost locations during weeks in the same year, and among years. However the pattern shows preference from US281 to Wood River at the beginning of the spring. During recent years the first week's distribution pattern was different. Total number of cranes per bridge segments by week by year will be presented, and will be discussed causes of temporal and spatial patterns of distribution.

Ecological Functions and Economic Value of the Neotropic Cormorant (*Phalacrocorax brasilianus*) in Los Olivitos Estuary, Venezuela. (Oral)

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An ecological study of abundance, distribution and diet of Neotropic Cormorants (*Phalacrocorax brasilianus*) was undertaken from 1999 to 2001. Abundance and distribution was discerned from monthly censuses, and dietary composition was obtained via stomach and pellet analysis. An economic study was developed to estimate the economic impact and value of the Neotropic Cormorant population at Estuary Los Olivitos, Lake Maracaibo, Venezuela. We used four ecological-economic functions 1) Harvesting Cormorants for food M(N), 2) Cormorants as contributors to fish diversity FD(N), 3) Cormorants as indicators of presence of fish schools S(N) and 4) Cormorants as contributors to fish biomass due to guano production B(GN). The economic Total Value of Cormorant Population TV (N) was defined as the value of Cormorants to fishermen; changes in Cormorant numbers would imply changes in the fishermen's well-being. Ecological results indicated the population is increasing exponentially (from 17,000 to 40,000). Eighty-three percent of the population fed outside of Los Olivitos. Estimated values of S(N), M(N) and FD(N) were positive, but B(GN) was negative. The Net Value of Cormorant population obtained only from S(N) + B(G,N) was \$6,793,871/year. Cormorant population does not presently compete with artisanal fisheries in Lake Maracaibo, but if habitat is not a limiting factor and numbers of birds continue to increase, future conflicts could arise.

Contaminants in Common Loons (*Gavia immer*) Compared to 22 Other Species of Birds, Maine U.S.A. (Oral)

Wing Goodale

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In 2007 and 2008 we measured 192 contaminants in Common Loon (*Gavia immer*) eggs collected from 11 locations in Maine, spanning the entire state. We compared these results to contaminant levels in 61 egg-composites of 22 other species of Maine birds, representing seabirds, shorebirds, wading birds, raptors, and passerines. We analyzed the egg composites for mercury (Hg), polychlorinated biphenyls (PCB), polybrominated diphenyl ethers (PBDE), perfluorinated compounds (PFCs), and organochlorine pesticides (OCs). We detected all of these contaminants in our loon samples. Out of the 23 species tested, Common Loon eggs ranked seventh highest in contaminant load, with Atlantic Puffin (*Fratercula arctica*), Piping Plover (*Charadrius melodus*), Belted Kingfisher (*Ceryle alcyon*), Great Black-backed Gull (*Larus marinus*), Peregrine Falcon (*Falco peregrines*), and Bald Eagle (*Haliaeetus leucocephalus*) having higher contaminant levels; Virginia Rail (*Rallus limicola*) and Willet (*Catoptrophorus semipalmatus*) had the lowest levels. Out of all species tested, loons had the highest Hg levels and six of the eggs had PFC levels above an adverse effects threshold in chickens. These results demonstrate that historical and emerging chemicals of concern are both persistent and pervasive in Maine.

At-sea Foraging Behavior and Ecology of Common and Roseate Terns (Poster)

Holly Goyert

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Despite numerous studies of Common (*Sterna hirundo*) and Roseate Terns (*S. dougallii*) at their breeding grounds, relatively little is known about their at-sea foraging behavior and ecology. To address this, I used two approaches: first, I quantified the direction of departure and return for terns commuting to and from nests, and second, I conducted shipboard surveys of terns offshore. From May to July 2009, I observed nest provisioning and commuting trajectories at Bird Island, in Buzzards Bay, Massachusetts. I collected data on adult foraging bouts, provisioning rates, and the species and size of prey fed to chicks. Common Terns were generalists in comparison to Roseate Terns, which specialized on sandlance (*Ammodytes*). I also examined what factors determined the non-random trajectories of terns commuting between nests and foraging zones. During the post-breeding season, from August to September, I observed the distribution of Common and Roseate Terns at sea in the Northwest Atlantic. Out of 89 Common Terns identified from Cape Hatteras to the Gulf of Maine, 55 occurred within a period of about three hours on August 24th, 2009, over Davis Bank, on the Southeastern edge of the Nantucket shoals (about 100 km offshore).

Semipalmated Sandpipers: Distribution and Migration Routes of Breeding Populations (Oral)

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The Semipalmated Sandpiper (*Calidris pusilla*) is a small abundant shorebird that breeds primarily in subarctic to low arctic habitat across the Nearctic, and winters along the northern and central coasts of South America. No subspecies has been described, and Semipalmated Sandpiper genetics are little known. However, birds show a cline in bill length across the arctic, with longest bills in the east and shortest in the west. Since females average longer bills than males in a breeding population, there is considerable overlap in bill lengths at migration stop-overs. Birds from the eastern arctic migrate north through the U.S. Atlantic coast, including Delaware Bay. Central and western arctic breeders primarily migrate north through the interior of North America. In fall, most western breeders migrate south through the prairies, along with some birds from central arctic populations. The remaining central arctic breeders, as well as all eastern arctic birds, migrate south through the north Atlantic Coast of North America, particularly the Bay of Fundy. Western arctic breeders appear to winter farther west in South America than eastern breeders.

Status of Reddish Egrets on Great Inagua, Bahamas with Comments on Territoriality in Nesting Pairs (Oral)

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Reddish Egrets (*Egretta rufescens*) have historically nested on an interior hypersaline lake (Lake Rosa) on Great Inagua with estimates around 100 nesting pairs; number of breeding pairs has been considered to remain stable for past 30 years. However, no actual survey of Reddish Egrets on Great Inagua has occurred since the mid 1980s. We conducted nesting surveys of Reddish Egrets on Great Inagua, Bahamas during 2008-2009. We documented 92 total active nesting pairs of Reddish Egrets on Great Inagua between January and June of 2008 and 2009 with the peak of nesting occurring around March-April. The nesting season is prolonged and sporadic with fewer than 50 active pairs nesting at any one time period. Over 70 percent of the nests were from white morph pairs with dark morphs and mixed morph (dark and white adult) occurring ~20 and ~10 percent respectively. We observed territorial aggressive behaviors from adult egrets usually associated more with nesting territoriality of songbirds; this occurred both from breeding pairs actively nesting and with pairs where no nest could be located. Because Reddish Egrets on Inagua nest and forage in an interior lake with relatively stable conditions (i.e. no tidal influence), we hypothesized that stable prey availability results in birds actively defending territories that contain both nesting and foraging resources throughout the year.

Implications for Diet Composition and Learning Behavior in Juvenile Whooping Cranes during Winter (Poster)

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Whooping Cranes (*Grus americana*) spend winter (Nov-Mar) on the Texas Gulf Coast. As mated pairs, they defend territories to ensure access to resources. Young born the previous summer spend winter with their parents, learning behaviors critical for survival. We investigated the learning curve of foraging juvenile cranes, predicting juveniles would receive more parental care and exhibit less independent feeding during early than late winter. During November and March of winters 2004-2005 (1) and 2005-2006 (2), we observed the family group of one territory at Aransas National Wildlife Refuge, Texas. Behavioral data recorded during 14 intensive observations were used to determine several indices of juvenile foraging independence. We used unbalanced ANOVA to determine differences by period (early vs. late winter) and winter (1 vs. 2) for each index. Results indicated that early winter diet comprised wolfberry fruits (*Lycium carolinianum*) in winter 1 and clams (*Rangia* spp.) in winter 2; late winter diet comprised clams during both winters. Moreover, the learning curve of juveniles differed significantly between winters, with independence increasing during winter 2 (as predicted) but not winter 1. Though not statistically significant, parental feeding rate increased and juvenile foraging rate decreased during winter 1. We attributed behavioral patterns in winter 1 to early winter diet. The juvenile observed in winter 1 quickly learned to forage for fruits (least challenging food) but had little advance opportunity to learn tactics of foraging for clams (most challenging and costly food). Implications for supplemental corn-feeding and atypical winters of low food diversity are discussed.

Evidence for Prey Species Spininess as a Factor Affecting Pellet Production in Double-crested Cormorants, *Phalacrocorax auritus* (Poster)

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A proper understanding of factors affecting pellet production in Double-crested Cormorants, *Phalacrocorax auritus*, is critical to the proper management of the species as it pertains to their diet. Researchers and managers have long been concerned with biases associated with the use of pellets for diet analysis of cormorants, but little research exists on possible causes. We investigated the effect of prey species spininess on pellet production through sample collection in the New York Harbor cormorant colonies and a feeding trial in which captive birds were fed diets consisting exclusively of fish with spiny or non-spiny fins. The results of the fieldwork showed a link between prey species spininess and pellet production: 95% of species found in pellets were spiny compared with just 63% in the boli. In contrast, the feeding trial results showed little difference in pellet production between birds fed spiny-finned fish and those fed fish with non-spiny fins. Taken together, our results fail to conclusively show that prey spininess affects pellet production; however, the fieldwork results indicate that other aspects of prey morphology may. Further research is planned to investigate the issue.

Nesting and Brood-Rearing Ecology of Resident Canada Geese in New Jersey (Poster)

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Nesting ecology of resident Canada Geese (*Branta canadensis*) was studied during March - July 2009 in 250 1-km² randomly assigned plot study areas throughout New Jersey, USA. Plots were searched during the laying and incubation periods. Nests were monitored weekly to determine hatch success and causes of nest failure. We collected accompanying land use, habitat, phenology, and behavioral data at each nest. Gosling survival was estimated at high-density nesting and brood-rearing areas. Individually-numbered web tags were applied to goslings during hatch and marked goslings were later recaptured during banding efforts in late June. Measurements of overall body mass, as well as culmen, skull, tarsus, and 9th primary feather lengths were collected to determine gosling growth rate from hatch. Additional observational data was collected during the early stages of brood-rearing using a color-marking technique applied during hatch. These data will be compared with eight years of historic nesting data, spanning a twenty-five year period for the purpose of developing long-term nesting, brood-rearing, and productivity trends of resident geese in New Jersey. These long-term data will be compared to resident goose population size, density, age structure and other variables. These results will help evaluate the efficacy of current resident goose control efforts. Data from this study will be used in the development of a comprehensive population model for this population.

Magnificent Frigatebirds – Why is There Extensive Gene Flow across Most of the Range, but Reproductive Isolation in a Small Part of it? (Oral)

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Populations of tropical seabirds usually show marked geographic structuring, despite their capacity for long-distance flights. Magnificent frigatebirds (*Fregata magnificens*) are extremely well-suited for a life in the air, even compared to other seabirds. We studied genetic variation at three marker systems (mitochondrial DNA, microsatellites and nuclear introns) in samples from Atlantic, Caribbean and Pacific populations. Across genetic methods, we consistently found signatures of extensive gene flow over most of the range. Even the isthmus of Panama, a major barrier to gene flow in other tropical seabirds, does not appear to significantly limit dispersal in this species. In contrast, we found that Magnificent Frigatebirds from the Galapagos are strongly differentiated from all conspecifics, consistent with isolation for several hundred thousand years. We will present data from ongoing investigations of phenotypic differentiation in frigatebirds and discuss possible mechanisms that could lead to the reproductive isolation of the Galapagos population.

Inter-annual Variation in Foraging Behaviour, Food Availability and Prey Consumption by Semipalmated Sandpipers (*Calidris pusilla*) in the Upper Bay of Fundy, New Brunswick, Canada (Oral)

Diana Hamilton, Matthew Ginn, Beth MacDonald
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We investigated feeding ecology of Semipalmated Sandpipers during their fall migratory stopover in the upper Bay of Fundy from 2006-2008. Using a combination of videotaped behavioural observations, prey sampling, and stable isotope analysis of blood plasma, we examined whether sandpiper foraging behaviour was linked to consumption of particular prey, and investigated the extent to which alternate prey were used when availability of their traditional prey, the amphipod *Corophium volutator*, was restricted. Alternative foods include biofilm (a thin benthic layer of microalgae and associated mucopolysaccharides), polychaetes, and ostracods. Stable isotope results suggested a high intake of biofilm in 2006. However, detailed behavioural observations coupled with analysis of prey availability suggest that sandpipers did not target biofilm as a food source, but consumed it as a byproduct of the foraging method used. Birds employed a novel foraging method, "slurping", that was strongly related to the abundance of ostracods at one site where *C. volutator* was very limited, but only weakly related to biofilm availability. In 2007, ostracods were no longer available, *C. volutator* had recovered, slurping disappeared, and isotope results suggested much less consumption of biofilm. In 2008, slurping was observed only at night, and was again coupled with presence of ostracods and absence of *C. volutator*. We conclude that foraging behaviour and diet of Semipalmated Sandpipers in this region is more flexible than previously thought, suggesting that they may be somewhat able to adapt to population fluctuations in their main prey if alternatives are available.

Colony Attendance and Intercolonial Movements of Double-crested Cormorants (*Phalacrocorax auritus*) Nesting in the North Channel of Lake Huron (Poster)

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Double-crested Cormorants (*Phalacrocorax auritus*) have been increasingly involved in human conflicts since their population resurgence. Investigating cormorant movement ecology may provide insights about how disease is spread and when foraging occurs. The majority of published cormorant movement studies have been conducted on cormorant wintering grounds in relation to aquaculture facilities in the southeastern United States. Of the movement studies published for cormorant breeding grounds, few have focused on cormorant colonies on the Great Lakes. The objective of my study is to describe the movements of cormorants between adjacent colonies on the North Channel as well as understand their use of the islands. We radio-tagged cormorants (n=8/island) nesting on two islands in the North Channel of Lake Huron to monitor colony attendance and intercolonial movements from 31 May - 30 September 2009. Cormorant presence/absence data was collected on each colony using a stationary receiving station located on adjacent islands so as to not disturb the colonies. Data loggers scanned all frequencies 24 hours daily. They timed out after three seconds and recorded pulse rates for 12 seconds upon frequency detection. Over 14,000 lines of presence/absence data were recorded. Review of the data indicates that 7 of 8 cormorants on the far island visited the nearshore island both early and late in the breeding season. In August, two cormorants were recovered from Manitoulin Island, 40km southeast of the study area. Understanding cormorant movements will help to determine foraging times and locations, and predict the likelihood of disease transmission to poultry operations.

Watching the Wide-a-wakes: the Truthiness of Climate Change and Western North Atlantic Seabirds (Oral)

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Global warming will lead to climate changes that alter wildlife and ecological communities. These changes are expected to impact seabirds in the western North Atlantic. For some species, impacts may be negative. Despite daunting uncertainties in prognostication, some positive long-term impacts of climate change are expected. These benefits may include: 1) More marine habitat; 2) Rising seas crowd remnant colonies into confined sites, thereby making easier our monitoring and protection studies; 3) Intensified storms displace pelagic species far inland for bird watchers' enjoyment, raising awareness and enhancing public conservation efforts; 4) Melting polar ice increases ocean volume, diluting heavy metal pollution loads; 5) Longer breeding seasons lead to more re-nesting, thus higher annual recruitment; 6) Shorter migrations to hostile "wintering" grounds improve annual survival; 7) Vanishing upwellings improve adaptive capacity through ever more daunting quests to find dispersed food supplies; 8) By-catch and competition with commercial fisheries end as human economies flee to higher ground; 9) Loss of ice bridges in the Arctic, and abandoned buildings from rising sea levels in temperate zones, create more predator-free islands for coastal-breeding species; and 10) Oil spills cease as all fossil fuels become sequestered in the atmosphere. Admittedly optimistic, climate change impacts on western Atlantic seabirds could pose inconvenient challenges to current paradigm(s) pushed by the prophets of doom. (No oil wells were drilled, and no seabirds died, from preparation of this abstract).

Shorebirds and Conservation Issues at Malibu Beach, NJ: A Citizen Scientist's Perspective (Oral)

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Surveys of shorebirds have been conducted at Malibu Beach, New Jersey for the past 5 years. This site supports a diverse group of shorebirds and waterbirds with a maximum of 48 species in the fall and 35 species in the spring. Citizen science surveys and data reporting documented the presence of seven (7) species of birds on the New Jersey endangered and threatened species list including Black-crowned and Yellow-crowned Night Herons, Red Knots, Least Terns, Black Skimmers, Ospreys and Peregrine Falcons. Also present were 17 additional shorebird species, 17 waterbird species and nine additional species of colonial waders. Accumulated data contributed to designation of a portion of the beach as an important feeding, nesting and wintering habitat for shorebirds and beach-nesting birds and closure of that portion to all other uses. The project was a collaborative effort of New Jersey Audubon Citizen Science Shorebird Project and New Jersey Fish and Wildlife Endangered and Nongame Species Shorebird Project.

Management Successes and Growth of Common Tern Colonies on the St. Lawrence River, Niagara River and Buffalo Harbor, New York (Oral)

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We have monitored and managed Common Tern colonies on the St. Lawrence River since 1990 and on the Niagara River and Buffalo Harbor since 2004 with support from the New York State Department of Environmental Conservation, the New York Power Authority, and the U.S. Fish and Wildlife Service. Management methods have included the use of nesting rafts; a nesting barge; gull exclusion grids; gravel substrate additions; nesting sandboxes; relocation of Osprey nests; vegetation control; the use of decoys, shelters, fencing, and a social attraction system; and banding over 15,000 tern chicks. Over 100 tons of gravel has been spread by hand at more than a dozen tern nesting sites. In 2009, approximately 90 tons of pea gravel was spread on a breakwater (2,100 square feet) and on a floating nesting barge (1,200 square feet) in Buffalo Harbor as part of the New York Power Authority's relicensing commitment to fish and wildlife habitat improvement projects. This management has successfully increased the number of nesting pairs of terns at New York's inland colonies. On the St. Lawrence River, the number of nesting pairs of terns has increased approximately 40% in the last five years. In Buffalo Harbor, the increase has been greater, but also due to immigration from other colonies. At present, there are approximately 850 nesting pairs of Common Terns on the St. Lawrence River and 1,750 pairs on the Niagara River and Buffalo Harbor. The long-term viability of New York's inland tern colonies depends on the continuation of these management efforts.

Understanding Sex-specificity in Social and Spatial Behaviors of Australasian Gannets at Cape Kidnappers, New Zealand (Oral)

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Sexual dimorphism in foraging and reproductive behaviors is prevalent in birds, even when plumage dichromatism is apparently cryptic to human observers. The Australasian Gannet *Morus serrator* is a critical species for large scale studies of spatial and reproductive tactics because it is one of few New Zealand native seabirds that is expanding in overall population size. In this talk I overview our ongoing efforts to use genetic, observational, perceptual and remote tracking methods to decipher and discriminate alternative explanations of sex-specific behaviors in size monomorphic seabirds to test general theories for the evolution and function of sex differences in obligately biparental species.

Evaluation of Potential Effects of an Offshore Wind Energy Project on Roseate Terns and Piping Plovers (Oral)

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In November 2008, the U.S. Fish and Wildlife Service provided the Minerals Management Service with a biological opinion concluding consultation, as prescribed by section 7 of the Endangered Species Act, for the proposed Cape Wind Energy Project. Cape Wind Associates has applied to the Minerals Management Service for a federal lease to construct and operate 130 wind turbine generators approximately 5 miles off the shore of Cape Cod, Massachusetts in Nantucket Sound. The Endangered Species Act consultation considered effects of the proposed project on the endangered northeastern population of the Roseate Tern (*Sterna dougallii dougallii*) and the threatened Atlantic Coast Piping Plover (*Charadrius melodus*) population. We review conservation measures incorporated into the project to minimize, mitigate, and monitor potential effects on these two species. We summarize some of the key information considered in our analysis of potential effects. We also describe discretionary conservation recommendations provided to the Minerals Management Service.

Population Trends of Atlantic Coast Piping Plovers, 1986-2008 (Oral)

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The Atlantic Coast population of Piping Plovers (*Charadrius melodus*) has been the focus of rangewide monitoring and recovery efforts since it was listed as Threatened in 1986 pursuant to the U.S. Endangered Species Act. Breeding pairs in the U.S. and Eastern Canada were censused annually from 1986 through 2008, and productivity (chicks fledged per pair) was reported annually for varying proportions of the population. Census totals increased from 790 pairs in 1986 to 1,849 pairs in 2008, concomitant with sustained intensive management. Population growth was greatest in New England and New York-New Jersey and was more modest in the Southern and Eastern Canada recovery units. Overall productivity for the Atlantic Coast population 1989-2008 was 1.33 chicks fledged per pair (annual range = 1.13-1.51) and for recovery units decreased with decreasing latitude: Eastern Canada = 1.54, New England = 1.44, New York-New Jersey = 1.16, and Southern = 1.09. Annual productivity within recovery units was variable and showed no sustained trends. There were significant positive relationships between annual productivity and population growth in the subsequent year for each U.S. recovery unit. Predicted annual productivity needed to maintain stationary populations increased with increasing latitude, from 0.93 chicks fledged per pair in the Southern unit to 1.44 in Eastern Canada. These results are consistent with the hypothesis that survival rates of Atlantic Coast Piping Plovers decline with increasing latitude of breeding sites, and suggest that modified recovery criteria for productivity may be appropriate.

Movements and Wintering Areas of Common Murres from the Species' Largest Colony in the NW Atlantic: Implications for Anthropogenic Risk (Oral)

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We report on the movement, migration and wintering areas of Common Murres *Uria aalge* (n=10) from Funk Island (49°45'N, 53°11'W), Newfoundland, from August 2007 - May 2008, using GLS loggers. Birds departed Funk Island mid-late August and moved rapidly eastward (offshore). The majority remained near the continental shelf edge and slope of the Grand Bank through Fall, Winter and Spring until returning to the colony in May (7/10 birds). The other 3 birds made a similar Fall migration and remained offshore until mid-January. These birds subsequently returned inshore and spent the rest of Winter and early Spring off the north or south coasts of Newfoundland. Two of the 3 made a final brief sojourn offshore in mid-late April before returning to the colony. Breeding birds from Funk Island, then, were surprisingly sedentary during winter. They spent their non-breeding period and, indeed, the entire year over the Grand Bank or in nearshore waters off Newfoundland. Along with providing critical habitat for marine vertebrate predators, the Grand Bank supports a suite of resource extraction (hunting, fishing, offshore oil) and industrial activities (shipping lanes) that pose various environmental risks, particularly for seabirds (mortality from hunting, oil pollution and fisheries bycatch). Our tracking data suggests that while ~30% of breeders entered the area of the winter hunt in Newfoundland, all tagged birds from Funk Island spent significant time within the vicinity of expanding offshore oil activities. Year-round tracking of seabirds can help identify critical habitat and contribute to development of Marine IBAs.

The Timing of Loon Spring Migration off Central California 1994 through 1996 (Oral)

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Four species of loons, Pacific, Common, Red-throated and Yellow-billed, make a spring migration northward along the Pacific coast from their wintering areas to breeding grounds. In 1994-1996 we monitored their migration at Piedras Blancas, CA using 10x and 25x power binoculars as well as eye. In addition to the number of migrants counted by species, effort, wind speed and direction, sightability, and visibility were recorded. Migrants were observed daily from 18 March through 02 June; the peak migration period was during 10 April through 01 May with more than 75% of the migration occurring in this 3-week period. No annual differences in migration phenology were detected. Daily migration rates were heaviest during the morning hours between 0700 and 1200. Regression analysis showed that rate of migration was inversely dependent on wind speed ($r^2 = 0.697$, $P=0.001$). Wind direction did not seem to influence the rate of migration. In 1994, migration occurred primarily when winds were from the SE; in 1996, it occurred mainly when winds were from the SW; in 1995, migration was split between WNW and SW winds. The rate of loons observed varied from year to year: 574 loons h^{-1} in 1994, increased to 727 loons h^{-1} in 1995, and decreased slightly to 655 loons hr^{-1} in 1996. Although our study did not detect variability in loon migration, this time series is valuable for monitoring climate change and its effects.

Sensitivity of Nesting Great Egrets to Reduced Prey Availability (Poster)

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Life history theory suggests long lived bird species will adjust their nesting effort according to current conditions, balancing the costs and benefits of current reproduction with their long-term needs for survival and future reproduction. However, the habitat conditions that produce these responses may differ between species, even within the same ecosystem, producing different nesting and population trends. We examined the nesting responses of Great Egrets in two years (2006 and 2007) that differed greatly in habitat conditions (e.g., prey biomass) in the Florida Everglades. Clutch size of Great Egrets remained constant between years. Model selection identified nest stage, region, Julian date, water depth, and the quadratic form of recession rate, as parameters that most influenced Great Egret DSR. Daily survival for Great Egrets nests was higher during 2006 (DSR = 0.992) than 2007 (DSR = 0.981). Our results support the hypothesis that prey availability and hydrological factors that influence prey availability play crucial roles in regulating wading bird populations in the Florida Everglades. Results also demonstrated that Great Egrets reproduction is less sensitive to changes in hydrological conditions and prey availability, in accordance with long-term nesting trends.

The Migration and Morphometrics of Semipalmated Sandpipers in the Bay of Fundy (Oral)

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¹Canadian Wildlife Service, Sackville, NB, Canada, ²Environment Canada, Sackville, NB, Canada

Over 13 field seasons, approximately 34,000 Semipalmated Sandpipers were captured and banded at Johnson's Mills, New Brunswick, and morphometric data (primarily bill and wing lengths, and fresh weights) collected from approximately half the birds captured. Recapture of banded birds allowed us to calculate annual mark-recapture estimates of the source population. Our estimates suggest a decline of 5% per annum. Mean bill length of measured birds declined over the course of the study, reflecting a disproportionate loss of long-billed individuals known to breed in the more eastern part of the range.

Population Genetic Structure of the Reddish Egret (Oral)

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We examined the global population genetic structure of the Reddish Egret. We analyzed 13 polymorphic satellites and used nine of them to accomplish five goals: 1) to assess range wide population differentiation among Reddish Egret (*Egretta rufescens*) populations, 2) identify extent of gene flow and immigration among populations, 3) determine any historical occurrence of bottlenecks, 4) assess genetic differentiation between color morphs, and 5) clarify subspecies status of *E. r. dickeyi*, a completely dark morph population located in and around Baja, Mexico. We collected blood samples from 223 nestlings, each from a separate nest, from colonies in Texas, Baja California, and the Bahamas. Genetic differentiation was dramatic (global $F_{st} = .155$) throughout the Reddish Egret's range extending from Baja California, Mexico to Great Inagua, Bahamas. Differentiation occurred between 3 distinct regions but not between colonies/islands within regions. Genetic diversity (Alleles per locus, and heterozygosity) is significantly less in Baja, Mexico and Great Inagua populations than the Texas/Mexico gulf populations due to minimal immigration between regions and relatively small population sizes. Dark and white color morphs when present within the same region showed little to no differentiation. No patterns of recent population bottlenecks are evident in each of the 3 regional populations. With evidence of limited gene flow in addition to low genetic diversity and prospects of habitat loss we recommend that Reddish Egrets be managed as 3 distinct or evolutionary significant units (Baja, Texas/Florida, and Inagua). Furthermore, our results do not refute the current subspecies status of *E. r. dickeyi*.

Shorebird surveys at Holgate Unit, Forsythe NWR, New Jersey (Oral)

Mary Humphries

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We have been conducting surveys at Holgate NWR since 2004. Here we present a description of the site along with data from 2006-2008. An average of 15 species were seen during spring and 16 during fall migration. The most abundant species at this site was Sanderling with an average of close to 2,000 individuals per count seen in 2006. Other species seen in significant numbers included Ruddy Turnstone, Semipalmated and Least Sandpiper, and American Oystercatcher.

Evaluation for Carriage of Parasites and Pathogens in Common Tern (*Sterna hirundo*) Chicks (Poster)

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Common Tern (*Sterna hirundo*) chicks on Pettit Island in Barnegat Bay, NJ were evaluated for carriage of parasites and pathogens. Feather samples were examined for ectoparasites. The presence and diversity of ectoparasites was compared to clutch size and density. Of the data gathered to date, ectoparasites, such as feather lice, were found on 7.1% (5/70) of the chicks. To determine if Common Tern chicks carry potential bacterial pathogens, like *Salmonella* spp. and virulent E coli strains, oropharyngeal and the cloacal swabs were inoculated into selective growth media. Of the 100 samples swabbed, 0 have shown the presence of Salmonella. Preliminary data indicate that Common Tern chicks in Barnegat Bay have low carriage of ectoparasites and Salmonella.

Status, Seasonal Colony Abandonment & Roosting Habits of Caspian Terns during the Post-breeding Season on Lake Ontario (Poster)

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Few studies have examined the biology of terns during the post-breeding period. In this ongoing study, after establishing lake-wide population levels, we examine the natural seasonal abandonment of the colony, regional movements and roosting habits of Caspian Terns (CATEs), post-breeding. We colour-banded >300 juveniles at 3 Lake Ontario (LO) sites (2007-09), conducted evening counts of CATEs on a colony/roost site from July-September (Hamilton, ON), and collected overnight observations at a nocturnal roost site (Kingston, ON). From 1976-2009, CATE nesting pairs increased from 47 at 2 sites to over 2,900 at 3 sites. During July-September 2009, tern numbers declined 52.4% at the colony/roost site during the 3rd-4th week of July, and a further 68.4% between the 2nd- 3rd week of August. CATEs colour-banded in eastern or western LO ranged over their half of the lake. Terns banded in central LO ranged to the eastern half of the lake. CATEs roosted on one colony site and several non-breeding islands. At non-breeding sites, they often came in to roost after sunset and left well before sunrise, making the recognition of these sites as roosts very difficult. We conclude: 1) the importance of non-breeding sites as nocturnal roosts has been largely overlooked, 2) juvenile CATEs born on LO range throughout at least half of the lake before migrating and 3) because CATEs come into roost diurnally late and depart prior to sunrise, their roosting habits at most sites may easily go un-noticed.

Movement patterns of Audubon's Shearwaters (*Puffinus Iherminieri*) breeding in The Bahamas (Oral)

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The foraging behavior and movement patterns of Audubon's Shearwater (*Puffinus Iherminieri*) in the North Atlantic have not been studied directly. The majority of the population breeds in the Bahamas and many have been observed off Hatteras Island, North Carolina USA and elsewhere in the Gulf Stream in late summer. As part of a larger effort to examine large-scale movement patterns of Bahamian seabirds, we attached geolocators equipped with a wet/dry sensor to 11 breeding shearwaters with young chicks in June 2008 at the largest known breeding site at Long Cay, Bahamas. We retrieved two of the devices in July 2008 after a deployment period of ca. 5 weeks. Both birds appeared to spend > 50% of each 12 h period at-sea for 3-4 consecutive days, and this tended to be followed by a 3-4 day period where birds appeared to spend < 50% of each 12 h period at sea. This suggests some alternation between short and long foraging trips and is similar to attendance data collected from observations at nest sites of adult shearwaters at the same colony. Locations during this 5 week period were most frequently within the northern Bahamas but estimated locations for both birds also occurred south of Cuba. Additional analyses will link the at-sea activity data with estimated locations of birds tagged with geolocators. During 2009 we recovered 4 additional geolocators from shearwaters and 3 from White-tailed Tropicbirds (*Phaethon lepturus*). These data are being analyzed and will be incorporated into the results from 2008.

Investigating the Relationship Between Breeding Seabirds and Commercial Shrimp Trawlers in Nearshore Waters of South Carolina, USA (Oral)

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Population dynamics of seabirds have been linked to availability of bycatch discarded from commercial fishery operations. South Carolina supports a substantial commercial shrimping industry that operates primarily in inshore waters where locally breeding Brown Pelicans (*Pelecanus occidentalis*), Laughing Gulls (*Larus auritus*), Royal Terns (*Sterna maxima*), and Sandwich Terns (*Sterna sandvicensis*) forage. We examined the relative abundance of these seabirds at shrimp trawlers during the breeding season, measured the consumption fate of fish species collected as bycatch and subsequently discarded, and measured the energy density and proximate composition of these discarded items. Trawlers were attended regularly by all four locally-breeding seabirds out to 30 km from colonies. Laughing Gulls were the most frequently observed followed by Brown Pelicans, Royal Terns, and then Sandwich Terns. Brown pelicans consumed more discards than predicted based on their frequency while the other species each consumed fewer discards than predicted based on their frequency. Seabirds selected smaller items compared to larger items, and selected benthic fish that typically would not be available to this suite of seabirds. Energy density of common discards ranged from 2.9 – 4.1 kJ/g wet mass and there appeared to be no difference in the energy density of the pelagic or demersal fish we measured. Our data suggest that all four locally breeding seabirds forage at trawlers frequently enough that changes in the size of the shrimp fleet would have the potential to affect their foraging ecology.

Habitat Selection and Behavior of Red Knots (*Calidris canutus*) on the New Jersey Atlantic Coast during Spring Stopover (Oral)

Sarah Karpanty, Jonathan Cohen, James Fraser

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Delaware Bay is an important spring stopover site for the recently declined western Atlantic Red Knot (*Calidris canutus*) population. Stable isotope evidence suggests Red Knots that wintered in Tierra del Fuego stop in Delaware Bay itself, while those wintering in the Caribbean and United States concentrate in nearby Atlantic beaches and marshes. There has been little study of Red Knot stopover ecology in the latter habitats. We radio-tracked birds captured on an Atlantic beach in 2006. We collected behavioral data and prey samples at Red Knot locations, and compared the latter to prey samples from random points in their habitat. On rising tides, we were more likely to find Red Knots on Atlantic marshes than would be expected if they were evenly distributed among Delaware Bay beaches, Atlantic beaches, and Atlantic marshes. Red Knots foraged on Delaware Bay beaches on all tides, and in all habitats on falling and low tides. Birds on Atlantic Coast beaches were equally likely to forage and rest on rising and high tides. Red Knot locations in Atlantic habitats had more prey items than random points, but this was not so on Delaware Bay beaches. Red Knots tagged in Delaware Bay in 2004 seldom used Atlantic sites and clearly selected beaches with abundant horseshoe crab eggs. Thus, our results support the notion of partially-segregated stopover groups that rely on different habitat and prey. Conservation of Western Atlantic Red Knots therefore depends on protecting a complex of habitats, rather than a particular resource.

Overview of the Impacts of Harmful Algal Blooms on Waterbirds (Oral)

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Harmful algal blooms (HABs) - algal species which cause harm to humans and the environment through toxin production and excessive growth - are a national concern affecting an increasing number of coastal ecosystems with virtually every state now reporting recurring blooms. Impacts have included the loss of coastal habitats, shellfish bed and beach closures, and illness and mortality of marine species. HAB impacts on waterbirds have been documented on both coasts for decades. Recent significant blooms of the diatom *Pseudo-nitzschia* spp. in southern California have been linked to strandings and mortality of Brown Pelicans (*Pelecanus occidentalis*) and Brandt's Cormorants (*Phalacrocorax penicillatus*). These birds often exhibited symptoms of neurological impairment that have been associated with the toxin domoic acid. Similarly, intoxication of brevetoxins from blooms of the dinoflagellate *Karenia brevis* off the west coast of Florida have led to similar incidences with Double-crested Cormorants (*Phalacrocorax auritus*) and other piscivorous birds. In addition to toxicological effects, HABs have been shown to impact birds through other mechanisms. For example, a 2007 bloom of the dinoflagellate *Akashiwo sanguinea* resulted in a sea foam that impacted the feathers and waterproofing of Northern Fulmars (*Fulmarus glacialis*) and other sea birds off central California. Beyond these basic correlations of avian impacts and HABs, relatively little is known about the direct and indirect effects of HABs on waterbirds, particularly at the population level. This talk will provide an overview of HABs in the US and an overview of their impacts to waterbirds through these and other examples.

DNA mutation rate in Double-crested Cormorants (*Phalacrocorax auritus*) associated with exposure to Polycyclic Aromatic Hydrocarbons (PAH's) in Ontario, Canada (Poster)

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Pollution from steel production is a threat to the health of nearby wildlife and a serious concern near Hamilton, Ontario, Canada, home to two major integrated steel mills. Previous research has suggested that this air pollution can cause higher DNA mutation rates in Herring Gulls and mice, with Polycyclic Aromatic Hydrocarbons (PAH's) as a suspected cause. Further work is necessary to quantify the relative contributions of airborne exposure through inhalation of PAH's, and dietary exposure through the aquatic food web. Cormorants are an excellent species in which to address these issues as they eat almost entirely fish, simplifying the tracing of the aquatic route of contaminant exposure. We collected blood and regurgitated samples from Double-crested Cormorant (*Phalacrocorax auritus*) families in two colonies adjacent to steel mills in Hamilton Harbour (Lake Ontario) and one colony at our reference site on Mohawk Island (Lake Erie), Ontario, Canada, and will continue similarly next season. DNA from blood samples will be used to determine the germline mutation rate in each colony using several microsatellite loci. Sixteen PAH compounds will be measured in opportunistically collected lung tissue to estimate airborne exposure. To understand dietary exposure, we will investigate whether adult cormorants are foraging from littoral or pelagic food webs and whether varying diets can cause differing contaminant uptake. Red blood cells used for analyzing stable isotopes ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) and for essential fatty acids, along with regurgitated samples, will help further our understanding of diet composition in order to better answer these crucial questions.

Body Temperatures of Captive Double-crested Cormorants Using Thermography (Oral)

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Twelve cormorants were captured in winter night-roost sites in the delta region of Mississippi for a bio-energetics study. These birds were transported to our captive research facility and individually housed in 1m x 2m x 1.5m metabolism cages. Each morning for 6 days, we used a FLIR to record daily eye, chest, back, and feet temperatures for each bird. Mean eye and foot temperatures were 24.9 C (0.4 SE) and 31.1 C (0.56 SE) respectively. These thermography data will be incorporated in an energetic model to refine the impact of cormorants to the aquaculture industry.

Post-fledging survival and colony attendance of Least Terns (*Sternula antillarum*): a comparison of rooftop and natural colony sites (Poster)

Alexander Kohorst, Christopher Hill

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In the southeastern United States, most Least Terns nest either on gravel rooftops or on sand, gravel, or shell beaches. Young terns that fledge from rooftops may face different challenges than terns fledging from beach sites. The purpose of this study was to investigate whether survival rates, colony attendance, and fledgling residency time of post-fledging Least Terns differed between a rooftop colony in Conway, SC and an oyster-shell-bank colony in Bulls Bay, SC. Young terns (14 at the rooftop colony and 13 at the shell-bank colony) were equipped with radio transmitters prior to achieving flight. At each colony, dataloggers were placed to record presence or absence of marked terns. Survival calculations of the marked terns were based on data collected by the dataloggers and by field tracking using Yagi antennas and receivers. Kaplan-Meier survival estimates from 19 to 42 days of age for the two colonies were 0.43 (rooftop) and 0.52 (natural). Ages at departure from the colonies were as follows: rooftop colony: 38 +/- 2.53 days, range (33-48), natural colony: 41.5 +/- 1.19 days, range (39-44). No significant differences in survival or patterns of colony attendance between the two colony types were found in 2009. Problems associated with radio transmitter attachment to juveniles and possible causes of mortality will be discussed.

Epidemic Disease on a Colony of Double-crested Cormorants in the Southern Boreal Forest of Saskatchewan, Canada, 1994 to 2009 (Oral)

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Epidemic disease was monitored on a large breeding colony of Double-crested Cormorants (*Phalacrocorax auritus*) in the southern boreal forest of Saskatchewan from 1994 to 2009. The colony was visited 1-3 times each summer between 15 July and 25 August to assess morbidity and mortality and to determine the cause of death when mortality was detected. Diseases were identified by autopsy and subsequent culture and molecular identification of bacteria and viruses. Regular, large-scale mortality was observed in hatch-year birds of near adult size in 12 of the 16 breeding seasons monitored: five due to highly pathogenic strains of avian paramyxovirus-1 (Newcastle disease virus) and 7 due to the *Pasteurella multocida* (avian cholera). No pattern or relationship to annual variation in colony size was discerned in these mortality events. Mortality appeared higher in avian cholera epidemics compared with epidemics of Newcastle disease. Both diseases appeared to kill 40% or more of hatch-year fledglings. Simultaneous occurrences of these same diseases in other colonies in the same year were documented in some years. Such high annual mortality without a cumulative effect on colony size suggests substantial annual recruitment to this colony.

Offshore wind power and high-flying birds in New Jersey waters (Oral)

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Walsh et al. (1999) provide a current summary of avifaunal distribution in New Jersey. However, details of the abundance and distribution of bird species in New Jersey's marine waters is poorly known, particularly in a state that has seen high usage of its marine fish resources (NMFS 2008). The Ecological Baseline Survey being carried-out by the New Jersey Department of Environmental Protection is providing a significant extension of the knowledge of waterbird abundance and distribution in the state's offshore and coastal waters. The study will provide a pivotal reference point for plans to bring wind-energy generation to New Jersey; Davis et al. (2009) have presented at this venue our project methodology and Nemeth et al. (2009) have presented, here, flight-altitude data. Our altitude data have shown that just a few of the 110 species recorded through November 2008 have considerable numbers of individuals (on absolute and/or percentage bases) flying within the rotor-swept zone (100-500' above surface). Using data obtained January through November 2008, we present distributions of Common Loon, Northern Gannet, Double-crested Cormorant, and Herring Gull, relating these distributions to both distance from shore and to presence of shoal areas providing shallower water depths at distance from the shore. We must stress the preliminary aspect of these data; efforts are ongoing and another year's data may alter some or any of these observations.

The calm after the storm: hurricanes help Least Terns (Oral)

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Hurricanes often negatively impact breeding waterbirds by direct mortality and habitat destruction. However, for an island nesting species that prefers open beach habitat, hurricanes may improve nesting conditions in the short term by removing vegetation and nest predators. We monitored nests of Least Terns (*Sterna antillarum*) on Trinity Island, Isles Dernieres Barrier Island Refuge, Louisiana, in 2008 and 2009. During the fall of 2008, two major hurricanes, Gustav and Ike, impacted the island. The breeding season following these storms saw a marked increase in Least Tern nesting colonies on Trinity Island and in their nest success. Nesting was observed in six distinct colonies in 2009, in contrast to only one in 2008. Mayfield nest success in 2008 was 6.7%; in 2009, it was 44%. We examine the likely causes of this improvement and conclude that increased open habitat and declines in predator activity were important factors. As with most disturbance effects, there are winners and losers in both the short and long term. The hurricanes did decrease the size of the island, and all species will ultimately lose if the islands erode away.

Range expansion and preliminary factors influencing the presence of wintering Sandhill Cranes in wetlands in Northern Mexico (Oral)

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The Sandhill Crane (*Grus canadensis*) winters in wetlands of southern US and northern Mexico. While Mexico considers the species to be protected as endangered species, no recent work on the distribution and status of wetlands used by the cranes during the winter is available. This study seeks to identify priority wetlands in Mexico for the conservation of Sandhill Cranes. For this reason, during the winters of 2007-2008 and 2008-2009 we visited 52 wetlands via ground surveys and 83 were checked via aerial surveys in the states of Chihuahua, Coahuila, Durango, Nuevo Leon, Zacatecas and San Luis Potosi. Of those visited we could confirm Sandhill Crane presence in 31 wetlands, eight of which are new location records for Sandhill Crane distribution in Mexico. Three of the new locations are in the southern portion of the range of the Sandhill Crane distribution in the state of San Luis Potosi, Mexico. Several water quality variables (pH $r=-0.111$, $p=0.485$; temperature $r=-0.044$, $p=0.782$; and salinity $r=-0.028$, $p=0.86$) were not correlated with the presence of cranes. We also found that wetland area ($r=0.457$, $p=0.001$) and distance to visual obstruction ($r=0.564$, $p<0.001$) was correlated with the presence of the cranes in those wetlands.

Climate Effects on the Predator-Prey Relationship between Piscivorous Waterbirds and Prey of Conservation Concern (Oral)

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Environmental conditions influence waterbirds, their prey, and the trophic relationship between them. We examined the relationship between climate conditions, primarily the Pacific Decadal Oscillation (PDO), and Caspian Tern (*Hydroprogne caspia*) consumption of juvenile salmonids (*Oncorhynchus* spp.), a prey species of conservation concern, in the Columbia River Estuary over the years 2000 – 2008. We found that negative winter/spring PDO conditions were associated with subsequently larger tern colony size, a greater proportion of salmonids and a lower proportion of anchovies (*Engraulis mordax*) and other marine fishes in the tern diet, and a greater overall consumption of salmonids by terns. Conversely, positive PDO conditions were associated with a smaller tern colony, less diet reliance on salmonids, and reduced salmonid consumption. We hypothesize that along the Pacific Coast, poor near shore ocean conditions may reduce Caspian Tern overwinter survival and/or breeding propensity, resulting in fewer breeders, and may also attract marine forage fish into estuaries earlier and in greater numbers where they provide a prey alternative to salmonids. An additional consequence of climate conditions, summer river flow, was also related to salmonid consumption by estuarine Caspian Terns. In years with high flows, marine prey were less prevalent in tern diets, presumably because high flows prevented these fish from entering, or lingering, in the Columbia River estuary. In summary, climate conditions play an important role in modulating predation on particular prey types by piscivorous waterbirds and understanding these trophic relationships may benefit management of waterbirds and their prey moving into warmer climate conditions.

Diverging Population Trends for Great Egrets and Snowy Egrets: A Possible Explanation (Oral)

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Snowy and Great Egrets exhibit considerable overlap in their diets, foraging habitats, and breeding locations. Despite these similarities, population trends appear to be following diverging pathways. The North American population of Snowy Egrets is > 140,000 birds, and this species is of High Concern; Great Egrets number nearly 2 million birds worldwide, and this species is not at risk. Why should two such similar species be faring so differently? For the past eight years, we have examined the energetics of both species, including foraging behavior, foraging flights, nesting behavior, and a comparison of breeding and non-breeding activity patterns. We hypothesize that aspects morphology, physiology, and behavior are all elements in their population decline. A Snowy Egret's smaller size restricts it to shallower waters. Compared with a Great Egret, a Snowy Egret strikes at prey more slowly, and captures both smaller and fewer prey per unit time. On a per-gram basis, flight is more costly for Snowy Egrets. Snowy Egret activity patterns differ markedly between the breeding and non-breeding seasons, whereas Great Egrets are more consistent in their allocation of energy throughout the annual cycle. We believe that these patterns may shed light on current population trends.

Can Male Loons' Tunes be Used to Croon? (Poster)

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Male Common Loons (*Gavia immer*) often produce vocalizations called yodels in response to territorial intrusions. In addition to a male's resource holding power and willingness to escalate a contest, the yodel is believed to communicate a male's identity to conspecifics. Though preliminary data show that such individual recognition can be beneficial for territorial neighbor/non-neighbor discrimination, we investigated whether such recognition can also facilitate mate recognition by female loons. We conducted an acoustic playback experiment to pairs of individually-banded Common Loons in northcentral Wisconsin where we broadcast a resident's or non-resident's yodel on successive days from the center of the breeding territories. While males quickly and aggressively approached playback yodels regardless of the identity of the yodeler and stage of the breeding season, females that had not yet nested approached a mate's yodel more rapidly than to a non-mate's yodel. This implies that females are able to discriminate a mate's yodel, which can provide a number of functional benefits to females during the course of the breeding season.

Shoreline, Near-shore, and Offshore Wind Energy Development: Tools to Help Avoid or Minimize Take of Waterbirds (Plenary)

Albert Manville

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Land-based commercial wind energy development continues to grow exponentially (>46% in 2007, 50% in 2008) and offshore wind development (e.g., off Massachusetts, New York, and Texas) appears soon to follow, potentially impacting myriad waterbird species through direct collision impacts, habitat disturbance, disruption, and site avoidance--among others. While supporting renewable energy growth, the U.S. Fish and Wildlife Service's goal is to do no harm. To that end, we review the primary potential direct and indirect impacts to waterbirds, and suggest some key research "tools," cutting-edge studies, and recent advances that will help--we hope--to address evolving impacts to waterbirds. Included are promising improvements with NEXRAD and marine radars, thermal imagery, bird activity monitors, acoustics, air and ground surveys, point counts, and an evolving Rapid Assessment Methodology that may help to better evaluate pre- and post-construction site risk. Post-construction monitoring must better align with pre-construction risk assessment, including the performance of studies at a duration and intensity appropriate to the risk of a site (referencing Great Britain's DEFRA offshore wind regulations). We suggest some improvements in assessing and aligning risk. To avoid or minimize collisions, we examine blade "feathering" and changes in blade cut-in speeds, and briefly discuss minimizing habitat impacts where, for example, shorebirds nest, stage, feed and roost, and where sea ducks raft and feed. Where research gaps and needs exist, we recommend next steps. We review guidelines from Minerals Management Service and pertinent recommendations from the USFWS's Wind Energy Federal Advisory Committee.

Factors Influencing Use of Constructed Wetlands by Wood Storks in Northeast Florida (Oral)

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The federally listed Wood Stork (*Mycteria americana*) is dependent on shallow, ephemeral wetlands for foraging, and most of these natural wetlands have been lost in Florida where the increasingly urban human population may reach 28.7 million by 2030. The frequency of use of urban, constructed wetlands by Wood Storks is unknown. Our objectives were to assess use of urban wetlands by storks near a known colony (Jacksonville Zoo colony) and the effect of two covariates, urbanization and distance to colony on stork occupancy. We also investigated the effect of two sampling covariates on the probability of detecting storks: time-of-day and presence of other wading birds. We surveyed 100 random wetlands with multiple visits in July 2008 for stork presence. We used program Presence to fit a set of candidate models to predict stork occurrence in constructed wetlands. Our data exhibit considerable variation because of few stork detections, which suggests widespread use of constructed wetlands by storks was low during the survey period. Although widespread use appeared to be low, stork use can be intense with as many as 30 storks observed at a single constructed wetland. The best fitting model determined by AIC, included urbanization, time-of-day, and presence of other wading birds. Degree of urbanization had a positive effect on stork occupancy; however, confidence intervals included zero. Storks were more likely to be detected during mid-day and with the presence of other wading birds, which is consistent with their social and opportunistic foraging behavior. Funded by USFWS Div. Environmental Quality.

Inter-Annual Variation of Top Predators and Prey Abundance on Georges Banks (Oral)

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We have been monitoring seabird and marine mammal abundance on George's banks since 2006 during the Atlantic Herring surveys (NOAA/ National Marine Fisheries Service). The surveys were conducted in September and October each year aboard the oceanographic vessel RV NOAA Delaware II on Georges Banks. I present here the inter-annual variability of both seabirds and marine mammals observed on the surveys from 2006 to 2009, and relate this variability to the abundance of Atlantic herring, which is a primary prey for most of these predators. I also explored whether increases of species over the past years may be related to increasing ocean temperatures. Georges Banks ecosystem is influenced by hydrographic events such as Gulf Stream warm core rings, which could explain for example increase of Cory Shearwater in northern waters. I have looked at the abundance fluctuation for seabird and mammal species from year to year. We can definitely see an interesting pattern for species composition changes. In a second time, we did overlay Top Predator with Atlantic herring abundance (*Clupea harengus*) to understand the relation between predators and preys during the spawning season of Atlantic herrings.

Migration and Foraging Ecology of Greater Shearwaters (Oral)

Marie C. Martin¹, Robert A Ronconi², Richard R. Veit¹

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Greater Shearwaters breed on Tristan da Cunha islands groups. They complete an extensive transatlantic migration each year to reach our hemisphere. However, they spend wintering/staging period in productive waters such as Gulf of Maine, Bay of Fundy or even Greenland. We will be following 22 greater shearwaters equipped with Satellite tags from Inaccessible Island (Gough Island / South Africa) to the Northern Atlantic from October 2009 to October 2010. Our first objective is tracking foraging trips during incubation/ rearing period, second objective: identifying migration paths and finally, understanding movements of these birds over the Northeast Atlantic until molt period. Greater shearwaters have been observed feeding over tuna school during ship surveys since they share same prey type; subsequently, we will overlay shearwater tracks and tunas distribution to search for evidence of spatial co-occurrence between these 2 top predators to evaluate the importance of this mutual association.

Evidence-based Decisions on the Use of Predator Exlosures in Shorebird Conservation (Poster)

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Conservation practitioners often rely on experience rather than scientific evidence when making management decisions. These experience-based measures can waste limited time and funding if the given conservation practice is ineffective. Unanalyzed conservation strategies may negatively impact the species that is being protected. The use of predator exlosures to increase hatching success in ground-nesting shorebirds has been studied for almost two decades, yet their effectiveness is still debated. In ecosystems where predation pressure is particularly strong, electrified exlosures have been adopted; however, there are no studies on their efficacy or potential negative impacts. We conducted a nest survival analysis for 10 years (1998-2007) of Piping Plover monitoring data to determine: 1) the effectiveness of predator exlosures and electrified predator exlosures, and 2) conditions associated with nest abandonments at electrified exlosures. We found that predator exlosures significantly increase nest hatching success. Electrified exlosures can also be very effective at increasing hatching success under certain conditions, but at sites with high human disturbance and red fox densities, the proportion of enclosed nests that are abandoned by parental adults becomes sizeable. The direct cause of nest abandonments remains unclear since fox behavior on beaches and the dynamics of foxes and plovers at exlosures have not been studied. Our results suggest that such information is necessary if conservation practitioners can make more informed use of this direct management measure.

Avian Influenza Virus Infection Dynamics Among Shorebird Hosts (Poster)

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Prior research has documented annual avian influenza virus (AIV) epizootics in Ruddy Turnstones (*Arenaria interpres morinella*) during spring migration stopover at Delaware Bay. We examined the temporal interactions between AIVs and their shorebird hosts, and particularly the disease dynamics within Ruddy Turnstones. Between 2006-2008, we tested >3000 cloacal swab samples for presence of live virus, and >500 serum samples for antibodies against AIV. Peak AIV prevalence in Turnstones (8.0-22.7%) occurred between 22-25 May with 75% population seroconversion by 29 May. AIV prevalence in Sanderlings (*Calidris alba*), but not Red Knots (*Calidris canutus rufa*), was positively correlated with prevalence in Ruddy Turnstones. Binomial regressions of AIV prevalence and seroprevalence in Ruddy Turnstones over the course of the stopover were consistent with epizootic temporal patterns. Although Ruddy Turnstones are known competent hosts for AIV infection, the marked epizootic prevalence and seroconversion patterns observed indicate that nearly all infected birds acquire infection locally and recover before resuming northward migration. Rare infections in sympatric shorebird species may be due to relatively higher population immunity upon arrival, and likely result from virus spillover events. Additionally, the different habitats used by the three species at night may support variable viral transmission rates.

Common Terns Conservation in the Toronto Harbour: Habitat Management and Creation (Oral)

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The creation of the Leslie Street Spit resulted in increased nesting opportunities for Common Terns (*Sterna hirundo*), the first of several colonial waterbirds to become established at this site. Tern nesting began in 1971 and the population peaked in the early 1980s, but subsequently declined largely due to pressure from Ring-billed Gulls (*Larus delawarensis*) and the change in nesting habitat as the site matured. Conservation efforts to exclude gulls from tern nesting areas, manage vegetation and reduce human disturbance had moderate success; however the creation of new nesting habitat has helped stabilize the tern population in the Toronto harbour. Floating reef rafts designed by Toronto and Region Conservation (TRCA) and the Canadian Wildlife Service simulate natural islands. Reef rafts have been highly successful in increasing and stabilizing local populations, however they need annual repair and maintenance to remain safe and suitable for nesting terns. The current TRCA management approach is to shift the terns from their dependence on reef rafts to constructed islands. A 120 m² island was constructed at Tommy Thompson Park in 2004 and has been successful in attracting and fledging terns. Studies on nesting ecology have been conducted at nesting locations and will be used to guide the long term management of tern colonies in Toronto. These, and additional studies, will be used to develop design criteria for the construction of additional island habitat to support a sustainable tern population.

Cormorant Control on a Shoestring: Assessing the Cost-Effectiveness of Lethal Cormorant Management in the Lac La Biche Area of Alberta (Oral)

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In the last 100 years Lac La Biche, a 22,000 ha lake located in northeastern Alberta, has changed from a system with walleye (*Sander vitreus*) as the top fish-eating predator to one where Double-Crested Cormorants (*Phalacrocorax auritus*) are at the top of the aquatic food chain. Since 1988 cormorant growth in the area has increased by an estimated 11% per year resulting in a peak population size of 16,000 nesting adults in 2004. The need for lethal control of Double-crested Cormorant populations is generally agreed upon by resource managers but the determination of the most effective method of control depends on a number of factors such as the specific program objectives, temporal, spatial, and financial scope of the project, and the social acceptance of different techniques. The objective of our study was to compare the oiling of eggs to the culling of adult birds as lethal control methods for reducing the impact of cormorant populations on local fish communities. A simple Excel model of cormorant consumption for the Lac La Biche area suggests that egg oiling is the most cost-effective method of reduction at \$5.26 (SD=\$0.84) per one tonne reduction in fish consumed. Culling was more expensive, costing approximately \$36.14 (8.90) per one tonne reduction. Since 2005 the combination of control methods reduced the weight of fish consumed by cormorants by an average of 585 (SD=141) tonnes per year. The efficiency of each method ultimately depends on the objective of the management activities.

Behavioral Effects of Nesting Density in Black Guillemots (*Cephus grylle*) Island (Oral)

Renee McManus

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Black Guillemots (*Cephus grylle*) were studied for six weeks during summer of 2009 on Great Duck Island in the Gulf of Maine, USA. The primary focus of studies was on whether or not nesting density among black guillemots affects inter and intra-specific behavior. I hypothesized that birds nesting in a higher density area would spend more time doing what I categorized as relaxed behaviors rather than more alert or aggressive behaviors. After initial observations, active nests were marked with spray paint and mapped using a GPS. Observations were conducted between 8am – 11am, rotating observations between high and low density sites. Each study area was scan-sampled every five minutes and I recorded the number of birds engaged in pre-identified behaviors. I also noted possible interference on behavior (human or avian-related disturbances, change in weather, etc.) Behaviors differed significantly between high and low density sites, most altercations occurring between birds in higher density sites when one landed on a rock that was already inhabited. The Black Guillemot that was first there would lower its head and charge at the newcomer. The four high density sites showed a considerably higher level of this aggressive behavior when compared to the two lower density sites.

Botulism in the Great Lakes: Using a Novel Approach to Track Disease Impacts on Bird Populations (Oral)

Amy McMillan

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In the last decade thousands of waterbirds have died from Type E botulism poisoning in the Great Lakes. The impacts of botulism are especially severe during fall migration, when many waterbirds stage on the Great Lakes during their flight south. Common Loons are particularly hard hit; their fall migration corresponds to lake turnover, the time when botulism toxin seems to be most available in fish and invertebrates. Since it was recognized in 1999, it is estimated that botulism poisoning has killed 500 to more than 2,500 loons each year. This study was undertaken to determine which loon populations were being impacted by botulism deaths and whether we could track these impacts using population genetic assays of dead birds. Between 2001 and 2006, feather or muscle tissues from > 250 dead loons were collected along the shores of Lakes Erie and Ontario and analyzed at five polymorphic microsatellite loci. Genetic analysis indicates that loons dying from botulism on Lakes Erie and Ontario are originating from breeding sites directly north of these lakes. These birds are genetically very different from loons breeding both west and east of the Great Lakes. Over the course of the outbreak, however, genotypes have not changed in dead birds. These results will be considered as a case study in understanding disease and other environmental impacts on ecosystem health. Climate change and invasive species have played a critical role in this disease outbreak and will also be discussed.

New Jersey Audubon Society's Heron Citizen Science Project: Data Collection and Preliminary Findings from 2008 and 2009 (Oral)

Kimberly Mendillo, Katharine Ruskin, Nellie Tsipoura

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Through the efforts of citizen scientists, NJ Audubon Society has been collecting data on wading bird habitat use in wetlands of the NJ Meadowlands District and Raritan Estuary. In 2008, 43 volunteers conducted approximately 350 surveys at 28 sites. In 2009, 34 veteran volunteers returned to the project and an additional 15 volunteers were trained. Data collected are diverse and complex, including basic site and habitat descriptions, tide information, and behavioral observations. Due to the richness of data collected, data entry in 2008 was very time consuming for NJAS staff. For 2009, an online data entry system was developed for volunteers to enter their own data. Quickly digitizing the data collected by volunteers has allowed for preliminary analyses of 2009 data to begin before the end of the field season. As a case study, we examined the effect of tide on number of birds present at Kingsland Impoundment, one of the most important sites in the Meadowlands District. In 2008, results showed significantly more birds of all wader species and Great Egrets specifically at outgoing tides. For 2009, there were no significant differences in number of birds based on tides, and any tidal effects were in different directions than those observed in 2008. Birds may be using the habitat differently as a function of tide, however. Future analyses will examine the effects of tide, time of day, and habitat on numbers of birds and behavior.

Population Genetic Structure in The Double-Crested Cormorant (Oral)

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We examined the genetic structure of Double-crested Cormorants (*Phalacrocorax auritus*) across their range in the United States and Canada to quantify variation within and among breeding sites and to assess the status of traditional subspecies. Sequences of the mitochondrial control region were analyzed for 234 cormorants from 23 breeding sites. Variation was also examined at eight microsatellite loci for 395 cormorants from the same 23 breeding sites. The mtDNA and microsatellite data provided strong evidence the Alaskan subspecies (*P. a. cincinnatus*) is genetically divergent. Our data also suggested strong genetic divergence in the southwest; southern California may represent a zone of introgression resulting from a northward expansion of a unique lineage from the southwestern extent of the species range in Mexico. In contrast, there was little support for recognition of subspecies within the continental U.S. and Canada, outside of Alaska. Rather than genetically distinct regions corresponding to the putative subspecies [*P. a. albociliatus* (Pacific), *P. a. auritus* (Interior and North Atlantic), and *P. a. floridanus* (Southeast)], we observed a distribution of genetic variation consistent with a pattern of gradual isolation by distance. This pattern implies that genetic differences across the range are due to geographic distance, rather than discrete subspecific breaks.

Foraging Follows and Nest Counts for Wood Storks in Florida during 2009 (Oral)

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Over the last 20 years, a large portion of the Wood Stork breeding population has moved north from Florida into Georgia and the Carolinas. This wide-ranging wetland specialist needs large areas to successfully reproduce. However, colony sites and the surrounding foraging habitats upon which breeding depends are threatened by Florida's ever-expanding human population and land conversion, thus raising serious concerns for the conservation and management of this species. Aerial counts of nesting Wood Storks accounted for 3,103 active nests at 22 of 60 colonies surveyed in 2009 (mean: 141.04 per active colony). Following flights (n = 79) to track outbound storks from five (four inland, one coastal) of these colonies to their foraging locations revealed a mean distance of 4.43 km (range 0.49-48.87, SD 5.88), less than half the distance typically found in other southeastern states. Of 18 cover types within minimum convex polygons described by foraging locations around each colony, five were used disproportionately more than expected based on availability: streams and waterways, cypress forest, freshwater marsh, bays and estuaries, and residential/commercial development. A large portion of the feeding sites were small, artificial wetlands (e.g., retention ponds, backyard ponds).

Mass Gain Dynamics and Population Viability in Semipalmated Sandpipers during Spring Migration Stopovers in Delaware Bay, USA (Oral)

David Mizrahi, Kimberley Peters

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Long-term population indices suggest that Semipalmated Sandpiper (SESA, *Calidris pusilla*) has declined significantly since the 1980s, especially populations migrating along the Atlantic Coast to the breeding grounds. Since 1995 we monitored mass gain in SESA and Least Sandpipers (LESA, *C. minutilla*) during northbound migration stopovers in Delaware Bay, USA. Historically, 250,000-500,000 SESA staged in Delaware Bay, but this population has declined by ~75%. Stable isotope analyses suggest that while in Delaware Bay, SESA feed primarily on horseshoe crab eggs during episodes of rapid mass accumulation however, intense harvest pressure from 1995-2005 has dramatically reduced egg availability. Although similar analyses suggest LESA consume horseshoe crab eggs during stopover periods, they likely depart Delaware Bay before peak horseshoe crab spawning periods occur. We found that mean lipid mass and mass gain rates in daily SESA capture cohorts was significantly greater during the "early" (1995-1997) compared with "middle" (2000-2003) and "late" periods (2004-2008). A quadratic function best described lipid mass gain rates during the "early" period, while a linear function performed better during later periods. In LESA, however, we found no significant period effect in size-adjusted mass (SAM). Model selection criteria indicated that linear functions were the best fit for LESA SAM gain rates during all periods. Furthermore, slopes of these functions were not significantly different among periods. Our results suggest that mass gain potential for SESA staging in Delaware Bay has decreased over the past decade and may have contributed to reduced species viability, while this is not evident in LESA.

Southbound Waterbird Migration along New Jersey's Atlantic Coast (Oral)

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Since 1995, NJ Audubon Society has conducted southbound waterbird migration monitoring from a single fixed location along NJ's southern Atlantic coast. Surveys are conducted daily from sunrise to sunset between 22 September and 15 December. On average, we observe 821,318 individuals (\pm SE 37,837) and recorded 102 species during the program's 14 years. Five species comprised 84% of all individuals observed: Red-throated Loon (*Gavia stellata*), Northern Gannet (*Morus bassanus*), Double-crested Cormorant (*Phalacrocorax auritus*), Surf Scoter (*Melanitta perspicillata*), and Black Scoter (*M. nigra*). Approximately 60% of all birds are recorded 17 October-13 November. This appears related primarily to Black and Surf Scoter movements as they comprise 42% of the total individuals recorded and 70% pass 13 October-9 November. Median passage of Double-crested Cormorants occurs one week earlier, and Northern Gannets and Red-throated Loons typically migrate later in the season. Peak daily passage of Double-crested Cormorants, Northern Gannets, and Red-throated Loons occur during the first hour after sunrise and decreases throughout the day. Black Scoter flights typically peak during midday, while Surf Scoters peak in the late afternoon. Preliminary analyses suggest no significant inter-annual trends in total numbers of birds, or in numbers of the five most numerous species. However, and the large inter annual variation in bird counts may preclude meaningful assessment of population trends given the relatively short duration of the study to-date. Future work will focus on the effects of large-scale weather systems and ocean temperatures on seasonal patterns of movement, and population trend assessment.

Tracking Seabirds to Identify Important Marine Habitats, Assess Risks and Implement Conservation Strategies in the Northwest Atlantic (Oral)

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Studies of the movement ecology of seabirds are providing insights into their exploitation of the marine environment. We are using miniaturized bird-borne GPS devices, geo-location loggers and satellite tags to track the movements and to identify marine habitat use by seabirds in the Northwest Atlantic. The spatial and temporal movements of individual animals provide essential information with which to assess areas of occupation and habitat use throughout the year. These studies can enhance vessel and colony-based studies to provide comprehensive assessments of processes and mechanisms that determine the movements, distributions and aggregations of birds at sea, and the factors which influence year-round habitat use by migratory seabirds. Novel examples from studies of the parental foraging and migratory behaviour of free-ranging gannets and murrelets from major colonies in the Northwest Atlantic will be presented. This information can be used in the development of community-, species- and colony-specific conservation management plans. Assessments of the risks associated with parental foraging sites, migration routes and with areas of occupancy during the non-breeding season will be considered, as will the use of these types of information to better identify, understand and protect important marine ecosystem processes and sites.

Preliminary Investigation of the Ecological and Toxicological Constraints on the Breeding Ecology of Lesser Flamingos (*Phoenicopterus minor*) at Kamfers Dam, in Kimberley, South Africa (Poster)

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Lesser Flamingos (*Phoenicopterus minor*) breed in six locations (four in Africa, two in India). Breeding Lesser Flamingos are highly sensitive to disturbances. Many ecological and toxicological stressors have been documented to negatively impact breeding success. Lesser Flamingos are categorized as near threatened due to 20-30% population decreases and mass die-off events that have occurred in recent years. Kamfers Dam, a large wetland situated in Kimberley, South Africa, is home to over 80,000 breeding Lesser Flamingos. For more than 30 years, the Homevale Sewage Works outflow has drained into this once ephemeral pan. This sewage works is operating over maximum capacity due to the rising population in Kimberley and is discharging untreated sewage water directly into Kamfers Dam. The construction of an artificial breeding island on Kamfers Dam in September 2006 resulted in two consecutive successful breeding seasons, producing an estimated 9,000 and 13,000 chicks in 2008 and 2009 respectively. Lesser Flamingos rarely breed in consecutive years, in fact, at other breeding sites in Africa there can be up to 9 years between successful breeding seasons, making this wetland habitat and breeding island especially important. An ecological risk assessment will be used to determine the impacts of key stressors on the breeding success of the Lesser Flamingos residing at Kamfers Dam. The objectives of this project are: 1.) Identify the stressors that impact this breeding colony and 2.) Develop mitigation strategies to insure long-term viability of the breeding colony at Kamfers Dam.

Analysis of Environmental Contaminants in 25 Great Lakes Herring Gull (*Larus argentatus*) Colonies, 2002-2006: CWS and Michigan CMI Programs (Poster)

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Since 1973, Herring Gulls (*Larus argentatus*) eggs have been collected from 15 colonies across the Great Lakes Basin by the Canadian Wildlife Service (CWS). Eggs have been analyzed for organochlorine pesticides, PCBs, dioxins, furans, mercury, and emerging chemicals of concern. Colonies are visited each year to collect 13 eggs from recently completed clutches. Ten eggs are either pooled or analyzed individually, and three eggs are archived. In 2002, Michigan Department of Environmental Quality, under the Clean Michigan Initiative (CMI), began a program to expand upon the current 15 colonies CWS has monitored, by including 10 new colonies within the waters of Michigan. CWS protocols and contract laboratories were used to maintain total compatibility for analyses and QA/QC between the two programs. We report here on the analysis of the first 5 years of the CMI program, including comparison of data from the CWS colonies. Differences for all BCC concentrations in the data set were analyzed using ANOVA. Differences among colonies for BCC concentrations were determined using LSD. General linear models were used to determine relationships by colony among years. Means of several BCCs varied significantly among colonies including PCBs, TEQs, bHCH, and OCS. Means of several BCCs varied significantly among lakes and lakes. We found significant relations for some BCCs both among years by colony, and among years by lake. The CMI and CWS data sets were significantly different from each other in Lake Erie for PCBs, Oxychlor, trans nonachlor, ppDDD, and ppDDT and in Lake Superior for ppDDD.

Population Trends of Common Terns Nesting in the Canadian Waters of the Great Lakes and Connecting Channels (1976-2009) (Oral)

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At approximately 10-year intervals, since 1976, a Great Lakes-wide census of colonial-nesting waterbirds has been conducted jointly by the Canadian Wildlife Service, the U.S. Fish & Wildlife Service, and their partners. Here, we present results of the current (4th = 2008-09) decadal census for Common Terns nesting in the Canadian waters of the Great Lakes system, and compare these data with previous population surveys (1st = 1976-80, 2nd = 1989-90, 3rd = 1997-2000). Currently there are 5,027 nests located at 67 colonies. Most nests occurred on Lake Huron (84% of nests, 52 colony sites) and Lake Ontario (14% of nests, 11 colony sites). Over the past 30 years, there has been a loss of 24% of breeding colonies and a decline of 41.3% of nesting pairs (-1.4%/year). Nest declines occurred on all water bodies. The rate of decline was greatest between the first and second census (-23.5%), but constant thereafter (-12.6% from 2nd to 3rd census, -12.2% from 3rd to 4th census). Nest losses were most pronounced on the lower Great Lakes, with 99.1% and 47.3% declines on lakes Erie and Ontario, respectively (compared to a 20.8% decline on Lake Huron). The marked and long-term decline of this species on the Canadian Great Lakes is cause for concern. However, the factors driving this population trend are poorly understood.

Demography of an Expanding Population of Great Egrets (*Ardea alba*) at the Northern Edge of its Breeding Range (Oral)

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Since 2001, >1,200 nestling Great Egrets (GREGs) have been marked with field-readable colour bands at 4 colonies on Lake Huron, Lake Erie and the Niagara River. One objective of this banding program was to estimate various demographic parameters in order to better understand the factors driving the rapid population growth and range expansion of GREGs in Ontario, at the northern edge of this species' breeding range. Fledging success at Ontario colonies (2.8 ± 0.8 young/nest) was higher than recorded in other studies (average = 1.5-2 young/nest). The mean age of first re-sighting at a breeding site was 2.8 ± 1.1 yr. (N=73). The youngest birds observed at breeding colonies following their first migration were two years old (46.6% of total); no 1-year-old GREGs were re-sighted. We observed a high degree of natal philopatry: 68 of 71 birds returned to their natal colony during subsequent breeding seasons. Once an egret was re-observed at a particular colony during the breeding season, site fidelity was high. All of the breeders observed during multiple years (N=17) remained faithful to the same nesting site. Local survival was estimated at 26% during the first year and 89% thereafter. Several of the life history parameters presented here are the first reported for this species. GREGs breeding in Ontario exhibit demographic parameters that are consistent with a growing population: high annual survival, early age at first breeding, and high fledging success.

Population Trends of Semipalmated Sandpipers (*Calidris pusilla*) in Eastern North America (Oral)

R. I. Guy Morrison

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Population trend analyses of Semipalmated Sandpipers carried out using data from the period 1974-2006 have consistently shown negative trends across wide areas of eastern North America, including the Maritime/Atlantic Provinces of Canada (data from Maritimes Shorebird Surveys and Atlantic Canada Shorebird Surveys), Quebec (Quebec Checklist Surveys), and Ontario (Ontario Shorebird Surveys). Nearly all analyses have shown negative trends, which in many cases are statistically significant. In Atlantic Canada, population declines appear to have been most pronounced during the 1990s. Possible reasons for declines, including climate change, increases in predator populations in eastern Canada, habitat changes, and changes in food resources will be discussed.

Dramatic Declines in Shorebirds in Suriname and French Guiana (Oral)

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The Canadian Wildlife Service "Atlas" studies of shorebird distribution around South America in the 1980s indicated that the coasts of Suriname and French Guiana were of exceptional importance as a wintering area for shorebirds, supporting almost two million, mainly small sandpipers, during surveys in early February 1982. Aerial surveys were again carried out in early December 2008, using the same methods and same principal observers, to determine changes in shorebird numbers. The surveys revealed dramatic declines, with a total of 403,959 in December 2008, only 20.6% of the total of 1,957,163 in February 1982. Declines were seen across all size classes of shorebirds and across a wide variety of species, and proportional declines were generally greater in Suriname than French Guiana. Although some habitat changes were observed, and no information is available on food resources or possible redistribution to other areas, the declines are thought likely to reflect the widespread declines in shorebird populations that have been observed in many parts of the world.

Mortality of Migrant Sandhill Cranes at Powerlines over the Platte River, Central Nebraska, USA (Oral)

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During spring 2006-2009, we investigated mortality of Sandhill Cranes (*Grus canadensis*) stemming from collisions with two 69-kilovolt powerlines above a major night roost of the species on Nebraska's Platte River, and assessed effectiveness of "Firefly" diverters in reducing collisions. Based on ground-searches for carcasses and corrections for associated biases, we estimated about 190 ± 40 cranes were killed each spring before Fireflies were installed, compared to 65 ± 20 each spring afterwards. Using binoculars and night-vision scopes, we directly observed 218 collisions by cranes with one of the powerlines as the cranes returned to their roost during 74 evenings in 2008-2009. Most collisions occurred when flocks of more than 1000 cranes suddenly flushed from their roost within 0.5 km of the powerline after dusk. About one-half of cranes that collided fell to the ground, either dead or crippled; another one-fourth exhibited hampered flight. Cranes reacted sooner to avoid the powerline with Fireflies than to unmarked powerlines in a nearby, prior study. Wires of the powerline were instrumented with bird strike indicators (BSIs) in 2009. BSI records correlated highly with observed collisions by cranes during evenings and indicated a seasonal total of 328 bird collisions with the powerline; likely most were by cranes. Our results might suggest Fireflies reduce the likelihood that a crane will collide with powerlines at the site, but rigorous experimental design incorporating replication is needed to reliably assess and provide broader inference on effectiveness of Fireflies. BSIs should be further evaluated and incorporated into such assessments.

Disentangling the Demographics of an Increasing Population of Shorebirds: the Roles of Survival and Movement (Oral)

Sean Murphy

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The fitness of an individual depends on both fecundity and survival. These vital parameters have the greatest impact on population growth and trends, which guide the design and implementation of management and conservation efforts for wildlife populations. For shorebirds, survivorship may be the single most challenging parameter to accurately estimate under field conditions, because the timing of mortality events is often unknown. The most commonly reported measure of survival is apparent (or local) survival (ϕ). This estimate is relatively easy to calculate, but it is a composite of true survival (S): the probability that a bird survives between two sampling periods, site fidelity (F): the probability that a bird returns to the same sampling area and does not permanently emigrate, if it survives. I provide the first estimates of adult survival and site fidelity for American Oystercatchers (*Haematopus palliatus*) based on new estimation methods that allow for the use of multiple information sources. I estimated the true annual survival and fidelity for 97 uniquely marked oystercatchers breeding in Massachusetts using a mark-recapture model, the Barker model. Results indicated that adult oystercatchers exhibit a high rate of true annual survival (0.943, SE 0.030) and a strong degree of breeding site fidelity (0.937, SE 0.036). Accurate estimates of survival and site fidelity may be combined to understand the underlying plasticity in life-history characteristics that have allowed many oystercatcher species to exhibit rapid shifts in migratory behavior and exploit seasonal environments.

Dabbling Duck and Shorebird use of Managed Impoundments and Tidal Marshes of Coastal South Carolina (Poster)

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In South Carolina, most managed wetlands (impoundments) have traditionally been managed to attract wintering waterfowl (Anseriformes) for hunting opportunities. The use and potential value of these impoundments to other avian species is poorly understood. Because shorebirds (Charadriiformes) are facing declines in the quality and quantity of stopover sites along migration routes, impoundments may provide supplemental habitat. During 2007 and 2008, we quantified the species and numbers of birds present in impoundments and tidal marshes during migration and winter seasons with scan-sample surveys, estimated time-activity budgets of target bird species, and documented target species' selection of food items through collection and oesophageal dissection. Target species were Blue-winged Teal (*Anas discors*), Green-winged Teal (*A. crecca*), Greater Yellowlegs (*Tringa melanoleuca*), and Lesser Yellowlegs (*T. flavipes*). Waterfowl were more abundant in impoundments than tidal marshes, and teal consumed a greater percentage of seeds than yellowlegs ($P = 0.0097$); the percentages of invertebrates consumed by teal and yellowlegs did not differ ($P = 0.8118$). Shorebirds were more abundant in tidal marshes than impoundments, but their use of impoundments increased with improved management (i.e., lengthening draw-down) in 2008 ($P = 0.0004$). Within tidal marshes, the most frequent behavior of yellowlegs was foraging (42-65%). They were observed loafing in impoundments more frequently than in tidal marshes ($P = 0.0127$), indicating that shorebirds use the two habitats differently and may benefit from a complex of impoundments and tidal marshes. Our results suggest an opportunity to effectively manage waterfowl impoundments for multi-species use.

Bird Flight Altitudes at Proposed Offshore Wind Power Sites in New Jersey (Oral)

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Beginning in January 2008, The New Jersey Department of Environmental Protection has been conducting an ecological baseline study in the coastal and offshore waters of New Jersey. As part of this study, we have been conducting shipboard surveys in New Jersey waters for avian species, for which there is a surprising paucity of data. Our methods, presented previously in this symposium, include the collection of a variety of details for each individual bird we record, including altitude, which is a vital point of reference when considering offshore development of wind power. While the final product of these surveys will be a comprehensive dataset, we must stress the preliminary nature of the results presented in this paper. The following preliminary data were collected for the period of January through November 2008, during which we recorded a total of 64,951 flying birds. Of these individuals, approximately 7,200 (11%) were observed flying through the potential rotor-swept zone (101 - 500 ft.).

Infectious Diseases of Double-crested Cormorants, *Phalacrocorax auritus* (Oral)

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Double-crested Cormorants (*Phalacrocorax auritus*) are known to be infected with a variety of pathogens. Some of these pathogens cause large-scale mortality events, particularly Newcastle's disease (NDV) and type E botulism. Whereas other pathogens isolated from cormorants, such as West Nile virus and influenza A virus (AIV), do not appear to cause significant, or any mortality. Here we provide an overview of the potential population impacts of disease outbreaks in cormorant colonies from NDV and botulism. In addition, we present data from blood samples collected from cormorants between May - Sept 2009 where we looked for active NDV and AIV infections as well as evidence of previous exposure to both viruses. Blood samples and swabs were collected from live adult and juvenile cormorants at 3 study sites in Ontario, Canada as well as from dead cormorants killed during culling operations at several colonies in Michigan, United States. We collected samples from a total of 350 individuals, of which none tested positive for active NDV or AIV infections. Preliminary results show that 100 and 70 percent of the adult cormorants birds tested positive for NDV-specific antibodies at Ontario and Michigan sites, respectively. No juveniles tested positive for NDV-specific antibodies and none of the cormorants sampled were seropositive for AIV antibodies.

Fluctuating Asymmetry in Common Tern Chicks Varies With Hatching Order and Clutch Size (Oral)

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Fluctuating asymmetry (FA), small random deviation from bilateral symmetry, often increases with stress during development. Common Terns (*Sterna hirundo*) typically lay two to three eggs that hatch asynchronously. I predicted that C-chicks (last of three) should have greater FA than A- and B-chicks at hatching, and that FA should be higher in chicks from smaller clutches, due to differences in parental quality. Tarsus length of newly hatched chicks was measured across three years, and middle toe length was measured in one year. Sample sizes exceeded 100 chicks in two of three years. Variation in tarsus FA with hatching order and clutch size was statistically significant in one year ($P < 0.01$) and nearly so in another ($P < 0.10$). No significant differences were present for toe FA. A-chicks from 3-egg clutches appeared to have the lowest tarsus FA among categories of chicks in both years, and in one year were significantly more symmetrical than B and C-chicks from 3-egg clutches. As predicted, A-chicks from 3-egg clutches were also more symmetrical than A-chicks from 2-egg clutches and singletons. However, C-chicks did not differ significantly from B-chicks in tarsus FA. FA also varied with hatching date, but no clear pattern emerged. FA was not associated with trait size or body mass, although there was significant variation in body mass and toe size among groups, with C-chicks relatively small and A-chicks and singletons relatively large.

Using Scale, Cover Type, and GIS to Evaluate Nuisance Egret Colony Site Selection

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A phenomenon of large Cattle Egret (*Bubulcus ibis*) breeding colonies in upland residential areas of Central Texas has been observed since the early 1960s. These large concentrations of non-native breeding birds can be a nuisance to nearby residents and their management has been problematic. To help understand why Cattle Egrets choose residential breeding sites, inform planning, and predict where these might occur in the future, the geographic extent of the phenomenon was investigated. In East Texas and along the Texas Gulf Coast, Cattle Egret colonies were found in flooded forests or on islands, as is typical for this colonial nesting species. However in Central Texas, colonies were found to inhabit upland areas. A habitat suitability model was then constructed at multiple scales, outlining land use classes thought to influence upland colony site selection: water, forest, and development/residential. The model classified 78.6% of upland colony locations in high or very highly suitable habitat and 7.1% in low or very low suitable habitat. This distribution of classes was significantly different than expected considering the distribution of land cover suitability classes across the entire study area ($p = 0.036$). Cattle egrets likely choose upland, residential sites to breed when suitable wetland habitats are limited. When flooded tree and shrub or island habitats are absent, egrets may choose the edges of development for breeding sites to limit potential disturbance from ground predators. Integrating suitable wetland or island habitat into residential designs in affected areas is a potential management strategy that has not been attempted.

Evaluation of Two Temperature-Sensing Devices to Detect Incubation Recesses, Nest Abandonment, and Hatch Date of Common Eiders (*Somateria Mollissima*) (Poster)

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In studies of breeding success and incubation behavior of Common Eiders, it often is difficult to observe nest activity and determine hatch date without disturbing the incubating bird, especially when vegetation obscures the view of nests. To address this challenge, we used two temperature-sensing devices (Thermochron iButtons and Hobo temperature loggers with external probes) to remotely monitor incubation activity. We instrumented 114 Common Eider nests during the summers of 2008 and 2009. Hobo loggers recorded a temperature once every five minutes, and iButtons recorded a temperature once every 30 minutes. During 2009 we deployed cameras (Reconyx Inc.) overlooking four instrumented Eider nests and photographed each nest once every five minutes. Photographs recorded activity at the nests such as recesses, hatching, and abandonment. The temperature sensing devices successfully detected hatch and abandonment dates of the photographed nests. Hobo loggers did not detect incubation recesses shorter than 20 minutes, and iButtons did not detect recesses shorter than 90 minutes. These temperature-sensing devices were useful tools for determining abandonment and hatch date without requiring repeated visits to nests; however, they were less useful for accurately measuring recess duration.

Chemical Residues in Cormorants from New York Harbor (Oral)

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Double-crested Cormorant (*Phalacrocorax auritus*) recolonized New York Harbor in the mid-1980s following persecution and local extirpation occurring during the 19th and 20th centuries. Reproductive success in the 1990s was 30% less than highest levels recorded in North America. We investigated toxicological causes of sub-optimum reproductive success and developed benchmark information on exposure and effects to position the species as a potential bioindicator for toxics management efforts in the NY-NJ Harbor Estuary. We assessed productivity endpoints in marked nests at three study sites in coastal New York including inner and outer harbor sites, and a reference site in eastern Long Island. Tissues sampled for evaluation of residue levels included eggs, and blood and feathers of nestlings. Laboratory analytes included metals, polycyclic aromatic hydrocarbons (PAHs), chlorinated pesticides, polychlorinated biphenyls (PCBs), dioxins and furans. Nestling survival was lowest at the inner harbor site. Cormorant offspring at the inner harbor site had significantly higher levels of cadmium, PAHs (eggs), DDT, dieldrin and other chlorinated pesticides, PCB congeners, dioxins (including 2,3,7,8-tetrachlorodibenzo-p-dioxin TCDD) and furans than the reference site. Levels detected in New York Harbor cormorants were above toxic effects thresholds for PAHs, DDT, PCBs, and TCDD.

Is Anybody Home? An Investigation of Occupancy Rates in a Burrowing Seabird (Oral)

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Burrowing seabirds pose numerous challenges to population monitoring programs. Breeding pairs are concealed in inconspicuous and often inaccessible nests, and "false positives" or "false negatives" in terms of occupancy can obscure fluctuations in absolute population size and breeding success. In Leach's Storm Petrel (*Oceanodroma leucorhoa*), unoccupied burrows bias census numbers calculated exclusively from nest counts. This study examines the spatial distribution of occupied Leach's Storm Petrel burrows on Great Duck Island (lat. 44° 8' N, long. 68° 10' W), the largest petrel colony in the eastern United States. Burrow occupancy rates were considered relative to habitat, burrow density, burrow proximity, and nocturnal petrel activity. Four methods were employed to determine burrow occupancy, including: stick lattices, call playbacks, grubbing, and an infra-red video probe. Burrow density differed significantly between open heath and forested habitats, and between forest middle and forest edge. Burrows separated by one standard deviation over the mean nearest neighbor distance did not differ significantly in occupancy rates from burrows one standard deviation below mean. Burrows, regardless of habitat type, were not reliable predictors of the occupancy status of their nearest neighbor. The highest occupancy rates occurred along the forest edge, which also had the lowest mean distance between occupied burrows. A revised population estimate was calculated, including a standardized protocol for future census efforts.

Christmas Cheer Protects Herring Gull Nesting Habitat from Cormorants (Oral)

James Quinn

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Double-crested Cormorants have displaced Herring Gull nesting colonies in Hamilton Harbour. Numbers of breeding Herring Gulls in the harbour have been declining, apparently due to loss of nesting habitat to encroaching cormorants. I noticed a distinct difference in the approachability of Herring Gulls and cormorants during the early breeding season and decided to try a novel method for discouraging ground-nesting cormorants, while allowing herring gull nesting. My field assistants and I placed a 1.6 M singing dancing Santa Claus equipped with a motion detector and powered by a deep cycle 12 V battery through an inverter in the middle of the area being taken over by cormorants. Under permit, cormorant nests were removed on one to three day intervals. The battery was replaced with a fresh battery twice a week and the Santa was shifted on the island once a week to reduce habituation. We compared this treatment with similar disturbance to another cormorant colony combined with nest removals on one to three day intervals. The Santa treatment was effective at repelling nesting cormorants and allowed nesting by herring gulls in close proximity to the Santa. This method is likely adaptable to other situations where a more bold ground nesting bird needs protection from nest-site competition from a less bold ground nesting species.

Habitat Use and Diurnal and Nocturnal Foraging Behaviour of Semipalmated Sandpipers (*Calidris Pusilla*) in the Upper Bay of Fundy, Canada: Links to Prey Availability and Quality (Poster)

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Semipalmated Sandpipers (*Calidris pusilla*) use the upper Bay of Fundy, Canada, as a critical stopover site during their migration to their wintering grounds in South America. While in the area, they gain essential fat reserves by feeding extensively on the amphipod *Corophium volutator*. However, *Corophium* populations fluctuate dramatically among years and locations, and some mudflats have experienced almost complete population collapses. We have recently observed some flexibility in both foraging behaviour and prey selection by sandpipers feeding in areas in which their traditional prey are in limited abundance. Further, we know that habitat use and behaviour at night can vary from that observed during day. However, the degree to which this flexibility extends is unknown, and much more information about night-time activities is required. Quality of alternate prey items has also not been assessed. To address these knowledge gaps, we will examine foraging behaviour and prey selection by sandpipers feeding during day and night at mudflats throughout the upper Bay of Fundy. Diet will be further assessed using stable isotope analyses of blood plasma, and quality of the various prey items will be examined through analysis of both energetic value and fatty acid composition. Data collection was initiated in summer 2009, and will continue through 2010. Results of this work will enhance our understanding of flexibility in Semipalmated Sandpipers, helping to predict the potential effects on them of large changes in habitat and the prey base in this critical staging area.

Wilson's Plover Population Ecology and Habitat Use at Marine Corps Base Camp Lejeune, North Carolina (Oral)

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The Wilson's Plover (*Charadrius wilsonia*) is a high priority species in the U.S. Shorebird Conservation Plan. We studied the population ecology and habitat use of Wilson's Plovers in March-August 2008 and 2009 on the 12 km Onslow Beach at Marine Corps Base Camp Lejeune, North Carolina. In 2008, we located 20 nests and color-banded 20 adults and 18 chicks; in 2009, we found 25 nests, and banded 20 adults and 22 chicks. Nest depredation occurred in both years with rodents and raccoons (*Procyon lotor*) dominating in 2008 and opossums (*Didelphis virginiana*) in 2009. We observed 1.47 ± 0.36 (2008) and 1.67 ± 0.34 (2009) chicks hatched per pair and 0.88 ± 0.26 (2008) and 1.00 ± 0.25 (2009) fledglings per pair. In 2008, adults and chicks foraged primarily on fiddler crabs (*Uca* spp.), and some broods traveled more than 1.8 km from their nest site to the fiddler crab mudflat where they foraged until fledging. Habitat selection differed in 2009 due to factors including, but not limited to, abnormally high sea level elevation coupled with historically high spring tides along the Atlantic coast that flooded fiddler crab mudflats. Topographical changes on the barrier island and an increase in Wilson's Plover breeding pairs may also be contributing factors. Our results are consistent with previous work that fiddler crabs are an important resource for Wilson's Plovers, however; these birds successfully foraged in alternate habitats in 2009 and fledged a greater number of chicks.

Breeding Colonial Waterbird use of Restored Barrier Islands in Louisiana (Oral)

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Louisiana's barrier islands provide critical nesting habitat for several waterbird species of conservation concern. However, this habitat is being degraded because of erosion from wave energy and storms and reduced accretion from the human-altered Mississippi River system. To counteract this degradation, there have been considerable restoration efforts focused on barrier islands, but there has been little evaluation of their use by avian species. Since 1991, Louisiana's Isles Dernieres Barrier Islands Refuge has been augmented via breakwater structures and dredge fill material. In order to understand important barrier island attributes for nesting waterbirds we conducted a study on the Isles Dernieres Barrier Islands Refuge, Louisiana during the breeding seasons (April-July) of 2008 and 2009. The objectives of this study included: (1) determining breeding waterbird species composition and abundance, (2) measuring hatching success of two ground-nesting seabird species; Royal Tern (*Thalasseus maxima*) and Sandwich Tern (*Thalasseus sandvicensis*), and (3) determining important habitat characteristics for hatching success of the two seabird species. We observed 20 species and approximately 45,000 breeding pairs in 2008 and 21 species and 28,000 breeding pairs in 2009 on the barrier island refuge via boat/ground surveys. We monitored 7 colonies of Royal Tern (N=500 nests) and Sandwich Tern (N=307 nests) in 2008 and 5 colonies of Royal Tern (N=472 nests) and Sandwich Tern (N=337 nests) in 2009 to assess their hatching success. We also identified important habitat characteristics related to the hatching success of Royal Terns and Sandwich Terns.

Preferential Utilization of Rocky Coastline Habitat by Herring Gulls (*Larus argentatus*) (Poster)

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Herring Gull (*Larus argentatus*) nesting habitat and potential parameters for nest site selection were examined on Great Duck Island, ME (lat. 44 8'N, long. 68 10'W). Nest-sites of Herring Gulls and Great Black-backed Gulls (*Larus marinus*) were located in two major habitats: vegetated meadows and shoreline granite jumbles. Sixty-four percent of the nests were located on granite slabs or among boulders, although this habitat type represents less than twenty-five percent of total colony area. The highest nest density was recorded on granite, and the nearest neighbor inter-nest distance was significantly smaller in rocky habitat (3.056m, S.D. 1.573m) compared to the vegetated habitat (7.336m, S.D. 2.805m). Three variables were considered as potential influences on site selection: chick survivorship, territoriality, and presence of Great Black-backed Gulls. Significantly higher chick survivorship to at least day ten was found in nests located in rocky habitat. Differences in elevation between nests and the presence or absence of obstructions were measured and not found to affect territory size. Presence of Great Black-backed Gulls during the 2009 and 2008 breeding seasons did not affect Herring Gull nesting density. Analysis of historical nesting distributions shows that gulls settle preferentially on the granite boulder area. A possible explanation for this is better protection from predators, including Bald Eagles (*Haliaeetus leucocephalus*) and corvids.

A Diving Seabird's Fine-Scale Vertical Pursuit of Diel Prey (Oral)

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The spatial and temporal distribution of prey directly influence the foraging behaviour of predators. Diel vertical migration (DVM) by marine organisms represents one of the largest spatiotemporal movements of animals, in terms of biomass, in the World's oceans. To investigate predator-prey interactions through the diel cycle we examined continuous diving activity records from a pursuit-diving marine predator, the Common Murre, *Uria aalge*, in conjunction with fine-scale data on the vertical distribution of their primary prey, capelin *Mallotus villosus*, off northeast coast Newfoundland, Canada. Diurnal patterns in the diving activities of murrees closely reflected changes in the vertical distribution of capelin. During daylight hours, 41% of murre dives were deep (≥ 50 m) when 82% of capelin biomass was in deep water. At night murrees directed diving activity at more shallow depths (84% of dives were < 50 m) when 86% of capelin biomass was in the upper 50 m of the water column. Capelin migrated through the water column during twilight periods, moving up at dusk and down at dawn. At these times murrees showed shifting graduated patterns in diving depths, becoming shallower through dusk and deeper through dawn. Though murrees are constrained by commuting costs, they show exceptional behavioural flexibility in their efforts to access capelin throughout the DVM cycle. Such behavioural adjustments are necessary because in the northwest Atlantic murrees rely heavily on capelin. The various trade-offs involved in such predator-prey interactions are discussed as are the ecological consequences of the DVM pattern across trophic levels.

Wintering Whooping Crane Foraging Activity and Behavior During a Record Dry Year at Aransas National Wildlife Refuge, Texas (Poster)

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A record number of Whooping Cranes (23 cranes, or 8.65% of the flock) died on the wintering grounds in Texas during winter 2008-2009. We studied cranes at Aransas NWR for one week in February, 2009. The objectives were to gather information on Whooping Crane food intake rates and resource conditions and compare these to information available for previous good and bad years. We collected data on probing and progression rates, food capture rates, time activity budgets, and conditions of food resources and salt marshes. In addition, we collected feces samples for stress hormones and collected general observations suggestive of stressed conditions of Whooping Cranes. The salt marsh areas of Aransas had extremely low water levels. We observed several areas of dead wolfberry plants, an important food item. Blue crabs appeared to be in low abundance and of difficult availability. The blue crab consumption rate in 2009 was 1.5 crabs/30 min, as compared to 2.8 crabs/30 min in a bad year, and 7.1 crabs/30 min in a good year. The 2009 data showed less probes per minute than either good or bad years, suggesting food availability was lower in all habitat types relative to previous years. Steps per minute were more similar to the bad year and in the case of uplands actually higher in 2009 than the previously recorded bad year. Stress hormone levels appeared low, but further work is needed to establish baselines for Whooping Cranes. Whooping Crane chicks appeared to be molting at a slower than normal rate.

Seasonal Habitat Requirements of King (*Rallus Elegans*) and Clapper (*R. Longirostris*) Rails--Implications for Management of Impounded Coastal Wetlands in South Carolina (Poster)

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More than 200 years ago, plantation owners within the lower coastal plain of South Carolina established wetland impoundments to capitalize on the daily flow of tidal waters for irrigation of cultivated rice. Now, both existing and remnant impoundments adjacent to natural marsh and wetlands provide habitat for shorebirds as well as wintering and migrating waterfowl through multiple species management techniques. Population numbers of two species of secretive marsh birds, the King (*Rallus elegans*) and Clapper (*R. longirostris*) Rail, have suffered declines due to loss of wetland and tidal marsh habitats. Managed coastal impoundments may supplement rail habitat, if they meet rails' habitat needs. We evaluated seasonal habitat selection of radio-marked King and Clapper Rails in fresh to saline tidal marsh within the Ashepoo-Combahee-Edisto (ACE) Basin, South Carolina. Between February and August 2009, we collected over 1100 radio-locations and defined home ranges for 31 Clapper and 2 King Rails. Home range sizes and movement patterns of both species are variable. Clapper Rails generally do not use impoundments but King Rails do. We plan to capture and track additional rails during Fall 2009 and Winter to Summer 2010 to determine if similar patterns are observed. From this information, we can develop management recommendations for existing coastal wetland impoundments such that rails, in addition to waterfowl and shorebirds, can use and benefit from these areas.

Fish Response to a Reduction in Prey Demand by double-Crested cormorants in Coastal Areas of Lake Huron: Results from a Staircase Experimental Design (Oral)

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A large-scale egg oiling experiment was conducted along the coasts of Georgian Bay and the North Channel, Lake Huron to test a key question regarding Double-crested Cormorants and fish abundance. Does a reduction in prey demand lead to an increase in fish abundance? The staircase experimental design is briefly explained and illustrated. Given assumptions about prey demand, the egg oiling experiment reduced annual fish consumption by approximately 25%. Using a variety of fish monitoring gear, we found that inshore total biomass of small fish increased and total catch of smallmouth bass increased. With respect to inshore total fish biomass, the magnitude of the increase roughly matched ecosystem productivity differences between coastal regions. In some locations, volume of fish shoals as detected by hydroacoustics declined in oiled sites. This counter-intuitive result may be due to an abundance of cormorants tracking fish releases from cage culture facilities in those areas. The staircase analysis revealed an influx of nesting cormorants in areas with cage culture releases. An important feature of the staircase design is its ability to estimate time trends in data separately from treatment effects - an advantage that proved important when a regime shift in the aquatic food web occurred in the midst of this large scale coastal experiment.

Parasitism, Mercury Contamination and Stable Isotopes in Cormorants (Oral)

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Contaminants and parasitism have been positively related in free-ranging birds. One proposed explanation is that contaminants reduce host immunity resulting in a greater susceptibility to parasitism. However, alternative explanations should be addressed to further inform and test hypotheses about relationships between contaminants and parasitism. We investigated whether total mercury and *Contracaecum* spp. were related in Double-crested Cormorants *Phalacrocorax auritus* and whether there was support for contaminants and infective stages of parasites being co-ingested. For breeding cormorants, males had 1.5 times more total mercury in breast muscle than did females and > 2 times more *Contracaecum* spp. in the proventriculus and stomach region. Males responsible for the sex biases in mercury concentration were not the same males responsible for sex biases in parasitism hence separate explanations for each pattern were required. Males foraged in more pelagic areas and at a slightly lower trophic level than did females, as determined by stable C and N isotope signatures, respectively. Sex biases in parasitism but not mercury concentration could be explained by sex differences in use of habitats thereby resulting in differential consumption of intermediate fish hosts. We found similar results in a second sample of cormorants from another lake ecosystem; therefore, we rule out the likelihood that original patterns were due to chance. We suggest that sex differences in exposure be addressed whenever testing contaminant-parasite linkages.

Western Snowy Plovers in the San Francisco Bay: Determining Nest Predators and the Effects of Habitat Enhancements (Oral)

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The Western Snowy Plover (*Charadrius alexandrinus nivosus*) is a federally-threatened species that nests on dry salt ponds in the San Francisco Bay (the Bay). During 2004 - 2009, we monitored plover nests to determine nest success at four sites in the Bay. Overall nest success varied from 49% to 85% between years. The lowest nest success occurred during 2006 - 2008, apparently due to high nest predation rates. In 2009, we determined plover nest predators and experimentally tested the effect of habitat enhancements to reduce nest predation and increase plover nest density. We deployed remote camera systems to identify nest predators, and we captured footage of California Gulls (*Larus californicus*), Northern Harriers (*Circus cyaneus*), Common Ravens (*Corvus corax*) and Red-Tailed Hawks (*Buteo jamaicensis*) depredating Snowy Plover nests and chicks. We used a randomized block design to test the effect of habitat enhancement. The enhancement consisted of oyster shells spread at densities of five to eight shells/m² over seven one ha plots. More Snowy Plovers nested in shell plots (n=24) than in control plots (n = 0; t = 3.86, df = 4, P = 0.02), and nests in shell plots were more likely to hatch than all other nests not in shell plots ($\chi^2 = 4.98$, df = 1, P = 0.03). The highest nest density we recorded was six active nests in one ha shell plot. Our data indicates aerial predators are limiting Snowy Plover nest success in San Francisco Bay and habitat enhancement will increase plover nest success.

Rangewide Estimates of Apparent Survival for the Piping Plover (Oral)

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Geographically isolated breeding populations of migratory shorebirds may be demographically connected through shared overwintering, staging, or stop-over habitats. We used banding data from seven studies of North American Piping Plovers to conduct a range-wide mark-recapture analysis. From this analysis, we estimated after hatch year apparent survival (ϕ AHY) of Piping Plovers over a decade (1998 - 2008). Our objective was to determine if concurrent survival estimates from disparate study sites were correlated, which could take the form of common long term trends, common annual fluctuations, or both, and more specifically to determine if apparent survival was correlated among disparate breeding populations with shared wintering grounds and/or migration stopover sites. Apparent survival declined in 4 out of 7 Piping Plover populations, was constant in 3 populations, and increased in none. There was some evidence that year-to-year fluctuations in annual survival were correlated between the Great Lakes and Atlantic Canada breeding subpopulations, both of which winter primarily along the southeastern U.S. Atlantic Coast. Thus, shared overwintering and/or stop-over sites may influence annual variation in survival, although these disparate studies did not share enough temporal overlap for us to fully investigate this phenomenon. Combining data from small-scale studies in different parts of the species' range proved valuable in discerning large scale patterns in survival. Declines in Piping Plover survival may be cause for concern, and conservation efforts should include habitat used during the migratory and wintering periods.

Reproductive Activity and Success of King Rail (*Rallus elegans*) in Coastal North Carolina and Virginia (Poster)

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The Southeast Region Waterbird plan estimates that the Southeast Coastal Plain Bird Conservation Region hosts approximately 830 King Rail pairs and recommends that this be increased to 6000 pairs. A joint project has predicted and field validated King Rail distribution in eastern NC and southeastern VA during the breeding season. We are now seeking to determine if areas with highest abundance (e.g. high response to call-broadcast surveys) are also areas with highest reproductive activity and success. We present our study design and preliminary results from a pilot field season to address the following questions: (1) How can the effects of marsh management history (year-since-burn) on probability of site occupancy, probability of reproductive activity, and reproductive output (chicks fledged) of King Rail be quantified? (2) Are landscape and microhabitat characteristics predictors of reproductive output? (3) What are the causes of nest failure in this region? Nest success is derived from video surveillance data. Data collected describes parental time spent on versus off the nest and predation events. Microhabitat characteristics compared among nests will include vegetation incorporated into nest, vegetation surrounding nest, depth of standing water underneath nest and density of vegetation determined by year-since-burn. Landscape measurements include dominant landcover within 1 km, marsh-water edge density, and marsh patch size and isolation. Our results will be used to determine the importance of the landscapes and microhabitat characteristics to King Rail population growth and will identify potential management strategies for King Rail habitat.

Improving Wetland Accessibility for Shorebirds and Horseshoe Crabs: Citizen Science in Jamaica Bay (Oral)

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Over 20 million people live in the New York metropolitan region and threats to shorebirds are many. Jamaica Bay (JB) is New York City's largest wetland and home to 325 bird species. JB is a globally significant Important Bird Area, providing critical habitat for shorebirds in New York City. In 2009, NYC Audubon initiated IWASH (Improving Wetland Accessibility for Shorebirds and Horseshoe crabs), a project that trains volunteers as Citizen Scientists to monitor horseshoe crabs and migratory shorebirds on specific segments of beach in JB. To monitor the horseshoe crabs, Citizen Scientists sampled 100 one square meter quadrats along a 900 meter transect on Brooklyn's Plum Beach at high tide for three nights around each new and full moon from early May through early July. Over our 15 sampling nights we recorded a total of 2091 horseshoe crabs (1545 males and 546 females) within the quadrats, a small sub-sample of the total number on the beach. Citizen Scientists also monitored shorebirds on four beaches during the Spring. They visited the four sites a total of 35 times between mid-April and mid-June and recorded a total of 28,942 shorebirds and 19 different species on the Jamaica Bay beaches during their surveys. Comparison of the 2009 data with earlier data sets indicates a trend for shorebirds to be arriving at the bay later during their northward migration. The efforts of the group of 30 Citizen Scientists revealed this trend and helped us leverage funding to continue this work next year.

The potential for using artificial fish refuges to reduce losses of fish to cormorants at inland fisheries (Oral)

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Recent large increases in cormorant populations have raised growing concerns among fishery interests and highlighted the need for effective management tools to address the resulting conflicts. Underwater habitat complexity is known to play an important role in regulating predator-prey dynamics between fish and thus also likely to influence the interactions between fish and cormorants. The hypothesis that the introduction of artificial refuges might provide protection for fish and reduce cormorant impact was tested in a series of experimental trials where the effect of different refuge volumes was assessed in adjacent refuge and control ponds. The trials confirmed significant reductions in cormorant foraging success, bird visits and fish losses in the refuge ponds compared with the controls. However, the relationship between refuge volume and foraging success was not linear, with the greatest relative decrease in foraging success and fish losses occurring in response to the smallest volume of refuge (<1% of pond volume). Refuge deployment configuration was also shown to affect fish losses, with a single larger refuge providing better protection for fish than several smaller refuges of the same overall volume. The results provided clear evidence that, in the absence of other cover for fish and where there are alternative foraging sites for the birds, the presence of even small fish refuges can markedly reduce the quantity of fish eaten by cormorants at a site. Feedback from stakeholders in the UK has been broadly positive and the technique applied at a range of recreational freshwater fisheries.

Citizen Science and Shorebird Monitoring: The International Shorebird Survey and Program for Regional and International Shorebird Monitoring (Oral)

Stephanie Schmidt¹, Stephen Brown¹, Brian Harrington²

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Data from the International Shorebird Survey (ISS) provides a broad view of shorebird behavior and can be instrumental in highlighting changes in migration routes due to climate change and other factors. The focused Program for Regional and International Shorebird Monitoring (PRISM) program is designed to evaluate shorebird populations with higher confidence. These two surveys have been very successful at attracting volunteer cooperators. An important goal is to have sustainable, operational shorebird monitoring programs. Crucial to this goal are low costs, competent and committed personnel, and distribution on a broad geographic scale. The ability to recruit and keep volunteers engaged in helping to collect data has required continued management, personal attention, and stimulating outreach materials. Several tools employed and evolving are newsletters, an interactive website, and recently, an ISS portal in eBird. These efforts provide cooperators and site managers with relevant shorebird information, a convenient data entry system, and tools to visualize data on spatial and temporal scales. Obstacles encountered by these two geographically broad volunteer projects are patchy funding, a limited ability to expand the database to include habitat and environmental variables, and difficulty in recruitment. Funding scarcity directly affects abilities to improve and expand. Regardless, the ISS has proven itself to be sustainable for 30 years and the information collected has been used for several federal, state, and local regulatory decisions, and shorebird plans. The increased need for quality, long-term shorebird data and commitment by the birding community will continue to sustain and improve these citizen science projects.

Snowy and Great Egret Population Changes in Cape May County from 1985-2005 (Oral)

Lisa Schreffler¹, Terry Master²

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Populations of the Snowy Egret (*Egretta thula*) and Great Egret (*Ardea alba*) have been monitored in southern New Jersey for several decades. Methods used to determine population levels have included aerial colony counts, flight line counts and counts of individuals within foraging aggregations. Generally, populations of both species have experienced at least local declines on the East Coast of the United States. Our previous data have shown changes in both the number of Snowy Egrets and Great Egrets inhabiting salt marshes in the vicinity of Stone Harbor, Cape May County, New Jersey, USA from 1985-1999. Evidence derived from foraging aggregation counts showed a 37% decline in Snowy Egrets and a 36% decline in Great Egrets participating in the aggregations, while aerial colony counts indicated the population of white egrets as a group rose 3% over the same time period. Additional foraging aggregation count data gathered from 2004-2005 provides an opportunity for comparison using this metric over the latest time interval and over a longer time span overall for both species. These data show a slight decline in total aggregation size since 1999. Numbers of participating Snowy Egrets have declined, while Great Egret numbers have remained relatively stable. Comparison with state-wide aerial colony counts for both species will help to determine if aggregation counts are a viable indicator of population trends.

The Effect of Harvest on double-Crested cormorant Population Dynamics in the Great Lakes; Implications for Allowable Take (Oral)

Mark Seamans

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I developed a model depicting population dynamics of Double-crested Cormorants in the Great Lakes to assess the effect of harvest on the population. Harvest included shooting individuals and oiling eggs. The integrated population model had two components: estimation of survival using band recoveries, and a disaggregated logistic growth model that accounted for density dependence. I used 29 years (1979-2008) of colony-count from Lakes Erie and Ontario, and band-recovery data from the entire Great Lakes, within a potential biological removal (PBR) framework to assess alternative management actions. PBR uses harvest theory and equilibrium population dynamics to estimate levels of sustainable harvest, and resultant equilibrium population size(s). I used a Bayesian approach with Markov chain Monte Carlo sampling for estimation of parameters. Annual survival of second year (mean = 0.84) and after second year (mean = 0.88) individuals varied over time with no clear temporal pattern while annual survival from birth to first year appeared to decline over time. PBR modeling suggested that recent harvest rates are conservative; current levels of harvest and egg oiling are keeping the population close to but below carrying capacity, and if harvest ceases the population should recover to carrying capacity within a few years. I estimated that annual harvest levels subsequent to 2003 are keeping the population approximately 7% below carrying capacity.

Population Trends of Black Terns in Wisconsin: a 30-year perspective (Oral)

David Shealer¹, Sumner Matteson²

¹*Loras College, Dubuque, IA, United States,* ²*Wisconsin Department of Natural Resources, Madison, WI, United States*

The Wisconsin Black Tern Survey was initiated by the WDNR in 1979 to serve as an index of statewide distribution and abundance and to provide baseline data for long-term monitoring. Systematic surveys were conducted in each year from 1980 to 1982, 1995 to 1997, and again in 2009. Between 1980-82 and 1995-97, substantial declines were noted in most of the census areas, and extirpation occurred in two of them. Overall, numbers of Black Terns had declined nearly 65%, and the frequency of occurrence at individual wetland sites decreased from 43% of all stations in 1980-82 to 18% of all stations in 1995-97. The results of the 2009 survey and nest census indicated clearly that Black Terns have continued to decline in most areas of the state, except for larger managed wetland complexes. However, a long-term study of the breeding performance of Black Terns at one of these managed sites indicates low to variable productivity, and model-based estimates derived from mark-recapture methods have revealed extremely low (~62%) annual adult survival rates, and very little (<2%) natal-site recruitment of young into the breeding population. The drop in numbers statewide between 1980-82 and 1995-97 could have been due to short-term hydrological conditions or to successional changes that occur during the life cycle of a wetland. Extending the survey to cover a 30-year time period greatly reduces the probability that the earlier survey results were confounded by short-term factors. Despite its abundant wetlands, Wisconsin appears to be losing its Black Tern population.

Impacts of Avian Induced Eutrophication on Parasites (Oral)

Kate L. Sheehan^{1,2}, Patrick G.R. Jodice^{3,1}

¹*Clemson University, Clemson, SC, United States*, ²*South Carolina Cooperative Fish & Wildlife Research Unit, Clemson, SC, United States*, ³*USGS South Carolina Cooperative Fish & Wildlife Research Unit, Clemson, SC, United States*

Successful parasite transmission requires specific biotic and abiotic environmental factors to persist for a given location. The most prevalent parasite of the common grass shrimp (*Palaemonetes pugio*) in Alabama was found infecting significantly more hosts in mainland estuarine marshes than the nearby populations located at island rookery marshes. Two islands were visited where thousands of birds (Brown Pelicans, herons, egrets, and ibis) nest each summer on beaches and in marshes. Environmental variables associated with rookery activity (high nutrient concentrations and hypoxia) as well as site-specific environmental parameters (presence of marsh grass or extensive marshlands, salinity, temperature etc.) were correlated with parasite prevalence using univariate tests and multivariate models. Results indicate factors coupled with spatial heterogeneity are more indicative of parasite prevalence than rookery-based environmental factors alone. However, nutrient concentrations influenced by rookeries could not be excluded from our models, thus a potential feedback loop may occur at these nesting sites that reduces parasite loads. Implications of hyper-eutrophication and hypoxia at high density breeding grounds will be discussed for southern coastal colonies and freshwater northern rookeries where future studies will occur.

Northeast Commercial Fisheries and Seabird Bycatch (Oral)

Gina Shield, Melissa Warden

NOAA Fisheries, Woods Hole, MA, United States

The Northeast Atlantic Continental Shelf is a complex, highly productive large marine ecosystem, vital to human and non-human species locally and globally. NOAA's National Marine Fisheries Service (NMFS) is charged with the conservation and management of the living marine resources within this ecosystem. Since 1989, NMFS' Northeast Fisheries Science Center has been monitoring the domestic fisheries of these waters by placing at sea observers aboard vessels to document fishing effort, catch, bycatch, economics, gear characteristics and perform biological sampling. The Northeast Fisheries Observer Program has documented seabird interactions in several fisheries across all years. Since 1991, a total of 3278 takes have been observed comprising 27 species with 95% of interactions occurring among shearwaters, gulls, loons, cormorants and gannets. The first comprehensive seabird bycatch analysis was initiated in 2006 and completed in 2008. This analysis estimated total bycatch for wintering Common and Red-throated Loons in gillnet fisheries for 1996 – 2007; average annual mortality is estimated at 551 for Common Loons and 897 for Red-throated Loons. These estimates are a key component to determining commercial fisheries impacts on seabird populations. More work is needed to continue bycatch analyses on other impacted species, increase observer coverage for more robust bycatch estimates, determine if mitigation measures are needed and educate fisherman on the importance of seabird conservation.

Monitoring of Exposure to Contaminants in Two Penguin Species Using Dried Blood Spots in the DABSE Project (Oral)

Alan Shlosberg¹, Wilson Rumbeiha², Kurunthachalam Kannan³, Andreas Lehner², Tertius Gous⁴, Jonas Bonnedahl⁵, Olga Cuneah¹

¹Kimron Veterinary Institute, Bet Dagan, Israel, ²Michigan State University, MI, United States,

³Wadsworth Center, NY, United States, ⁴SANCCOB, Cape Town, South Africa, ⁵Kalmar County Hospital, Kalmar, Sweden

Manifestations of ill-health, abnormal behaviour, a reduction in population or poor breeding success of a wildlife species may warrant an investigation of whether environmental exposure to contaminants may be the cause. We do such analyses using dried blood spots (DBS), which has several advantages for field work, storage and dispatch. Using DBS, we are developing a Database for Avian Blood Spot Examination (DABSE), which will detail the degree of exposure of wild birds, initially to contaminants. DABSE will allow comparison between "normal values" in healthy birds and exposure values of the same species under investigation. The toxicant component of DABSE is quantitated at the low ppb level. As these analyses are invariably very costly, an effort has been made to lower these charges and so enable more testing, by quantitating marker compounds, which are invariably found in birds' blood at the highest concentration of all the constituents in that group. The toxicant groups that are being tested comprise:- a) Elements - As, Cd, Hg, Pb, Se, Tl; b) Chlorinated hydrocarbon insecticides, markers being β HCH, DDT, DDE, and oxychlordan; c) Polychlorinated biphenyls (PCBs), the marker being congener 153; d) Polybrominated biphenyls (PBBs), the marker being congener 153; e) Polybrominated diphenyl esters (PBDEs), the marker being congener 47; f) Perfluorinated compounds (PFCs), the markers being perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). Results will be presented from healthy African Penguins (*Spheniscus demersus*) and Magellanic Penguins (*Spheniscus magellanicus*), 2 of the 12 of 17 penguin species that are experiencing population declines.

The Everglades Agricultural Area as a Foraging Resource for Wading Birds (Ciconiiformes) (Poster)

Grant Sizemore, Martin Main

University of Florida, Gainesville, FL, United States

Wetlands have been depleted globally, yet flooded rice and fallow fields have been shown to function as a resource and potential surrogate for wildlife, including wading birds. While wading birds in the Everglades of Florida have been well studied, little information exists on the potential role of flooded agricultural fields within the Everglades Agricultural Area (EAA). Our objectives were to assess the value of flooded rice and fallow fields within the EAA as foraging habitat for wading birds during April-June, 2008-2009. We measured wading bird use of the EAA at both regional (macro) and local (micro) scales using aerial surveys, ground surveys, and focal observations. Focal birds included Great Egrets (*Ardea alba*) and Little Blue Herons (*Egretta caerulea*). Wading bird use of the EAA regionally was tied to precipitation within the EAA as well as in the Everglades. Foraging success for both species was greater in 2008 than 2009. Overall, Little Blue Herons were more successful foragers than Great Egrets. June flooded fallow fields and May rice fields were consistently better habitats in terms of overall use and foraging observations. Foraging success within the EAA was also comparable to similar measurements in other locations. These results indicated that the EAA provides comparable foraging habitat for wading birds and that certain agricultural management practices can be incorporated to promote wading bird use.

Ecological Correlates of Ectoparasite Prevalence on Two Larid Species (Poster)

Gregory Smith

College of the Atlantic, Bar Harbor, Maine, United States

Parasites represent a potentially major cost in overall fitness to their hosts. Infection rates are affected by life history traits including seasonality, density and number of hosts and habitat utilization. Seabirds nest at high densities, are long lived, have interannual site fidelity, and therefore present a large potential host population. Ectoparasites on Herring Gull (*Larus argentatus*) and Great Black-backed Gull (*Larus marinus*) nestlings were surveyed on Great Duck Island, Bar Harbor, Maine, USA (lat. 44 8' N, long. 68 10' W) during the 2009 breeding season, and only one ectoparasite species in the order Astigmata. Nesting habitat was divided into two categories: (1) gulls nesting in granite jumbles, and (2) gulls nesting in vegetation, and comparisons were made in levels of infestation between habitats. Mites were found on the bellies of the chicks and usually nowhere else. The overall prevalence of mites on the 101 chicks sampled was 23.9%, the mean number of mites in parasitized chicks was 1.9 mites/bird, and the standard deviation was 1.24. The prevalence of mites on nestlings was significantly higher on chicks that were reared in vegetation compared to those reared in the granite jumble. Although there is as yet no clear relationship between mite infestation and survival, chicks raised in the berm survived to ten days at higher levels than those in the vegetation and data from the past ten years suggest that gulls are preferentially selecting berm areas over more common vegetated habitat.

Distribution and Abundance, Past and Present, of Semipalmated Sandpipers in Arctic Canada (Oral)

Paul Smith¹, Cheri Gratto-Trevor¹, Brian Collins¹

¹National Wildlife Research Centre, Ottawa, ON, Canada, ²Prairie and Northern Wildlife Research Centre, Saskatoon, SK, Canada

The Semipalmated Sandpiper (*Calidris pusilla*) is among the most widespread and abundant arctic breeding shorebirds, yet has shown declining counts at eastern migratory stop-over sites and also wintering areas. Dramatic local declines in breeding densities in the southeastern part of the range have also been noted. Across arctic Canada, evidence for declines is equivocal, but few studies exist. A review of published and unpublished information from the breeding grounds shows that recent surveys have failed to detect the species at several locations where it had been recorded previously (including sites in both the Low and High Arctic), but the species persists at the majority of sites investigated. Analysis of presence/absence data in fact suggests a significant broadening of the distribution in arctic Canada between 1987-2007 at a rate of 6% per year. Few direct comparisons of densities are available from long-term sites, but densities remain high at many locations, exceeding 10 birds / km² in four locations recently surveyed, and reaching 60.8 birds / km² in wetlands of Coats Island. We present new regional population estimates to suggest that the global population size may have been significantly underestimated previously, and that the proportion of Semipalmated Sandpipers breeding in the Central and Western Arctic may be higher than previously thought. These past inaccuracies are likely due to a much lower detection rate for migrants using inland routes versus stop-over sites on the Atlantic coast. Overall, we have insufficient data from Canadian breeding grounds to provide evidence for widespread population decline.

Citizen Science in Secondary School Curriculum: Using Shorebird Conservation and Population Studies to enhance science in the classroom (Oral)

Ron Smith

NJAS, New Jersey, United States

In the fall of 2005 the students of the Environmental Science program at Haddonfield Memorial High School joined the NJAS Citizen Science Migratory Shorebird project. In the first season a dozen juniors and seniors surveyed the beach of North Brigantine Natural Area documenting richness and abundance of shorebirds. Data collected was submitted to NJAS for use in the on-going effort to understand shorebird abundance and distribution during the fall migratory season. Since its inception, the program has expanded to include more students, classroom visits by researchers and additional training and involvement with the project. In addition, the experience serves to enrich the curriculum with a hands-on conservation project that gives insight into how field science is conducted, the complexity of species management projects and the importance of the contributions of the public in the effort to protect natural resources. In 2008 students conducted a pilot investigation of disturbance and impact to birds on the beach. Vehicles on North Brigantine Beach represent the most frequent anthropogenic disturbance to feeding and roosting shorebirds. Working in collaboration with scientists from NJAS, Conserve Wildlife Foundation of NJ and the NJDEP Endangered and Non-game Species Program, the 2009 study season is underway and includes a more intense disturbance investigation and an analysis of shorebird food availability on the beach that will complement the on-going survey of shorebird diversity.

Citizen Science in Secondary School Curriculum: Using Shorebird Conservation and Population Studies to enhance science in the classroom (Poster)

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Nobody Likes Me, Everybody Hates Me, Think I'll Go Eat Worms: Inter-colony Variation in Gastrointestinal Parasite Infestation of Double-crested Cormorants (Oral)

Christopher Somers¹, Heather Fenton², Meghan Wing², Frederick Leighton³, Catherine Soos³, Brent Wagner², Jennifer Doucette¹, Emily Jenkins²

¹University of Regina, Dept. of Biology, Regina, Saskatchewan, Canada, ²University of Saskatchewan, Dept. of Veterinary Microbiology, Saskatoon, Saskatchewan, Canada, ³Canadian Cooperative Wildlife Health Centre, Environment Canada, Saskatoon, Saskatchewan, Canada

Piscivorous birds often carry heavy burdens of gastrointestinal parasites (e.g., nematodes, cestodes, trematodes) that are presumed to negatively impact their health and reproduction. Factors affecting the intensity and type of gastrointestinal parasites in the Double-crested Cormorant (*Phalacrocorax auritus*) have not been well studied. We examined relative nematode and cestode infestation intensities in apparently healthy adult cormorants collected from 4 different breeding colony sites in Saskatchewan during 2006 and 2007: 1 hyper-saline lake, 1 eutrophic prairie lake, and 2 boreal lakes. We found significant differences (up to 3-fold) among colonies in the relative abundance of nematodes and cestodes for both male and female birds. Boreal birds in general had higher levels of parasite infestation. Diet and thus intermediate host communities for gastrointestinal parasites, also differed markedly by colony site. In particular, cormorants on the hyper-saline lake ate a much less diverse diet that contained a large proportion of tiger salamanders. These birds tended to have lower nematode and cestode levels. Level of parasite infestation was not associated with body mass or a body condition index. This finding can perhaps be explained by stable nitrogen isotopes analysis, which revealed that nematodes were feeding on gut contents, rather than the birds themselves. The relationship between infestation levels and bird body condition is perhaps diluted by indirect effects of the parasites on their host. In conclusion, we detected major inter-colony difference in parasite infestation level, but the role of habitat, diet, and intermediate hosts remains unclear.

Ecological Factors Influencing Predation of Waterbirds by Herring Gulls in a Mixed Species Breeding Colony (Poster)

Eunice Son, Stephen Oswald, Jennifer Arnold

Pennsylvania State University, Berks Campus, Reading, PA, United States

Several species of large gull are known to predate other waterbirds. This is often a specialist strategy exhibited by a few individuals nesting sympatrically with other species. Studies indicate that, even among specialists, the degree to which individuals feed on birds differs dramatically. To examine the ecological basis for these differences, we tested hypotheses relating to four factors that may influence predation of waterbirds by Herring Gulls (*Larus argentatus*): breeding territory size, territory location, distance to nearest prey species, and stage in breeding cycle of prey. Work was conducted in 2009 at Gull Island, Presqu'île Provincial Park, ON, Canada, where ~100 pairs of Herring Gulls nest alongside ~30,000 pairs of Ring-billed Gulls (*L. delawarensis*) and smaller numbers of Caspian Terns (*Hydroprogne caspia*) and Common Terns (*Sterna hirundo*). From May to July, we repeatedly searched 21 Herring Gull territories for predated waterbirds and regurgitated pellets. All study pairs fed on waterbirds (predominantly Ring-billed Gull chicks) to some extent, with the proportion of pairs eating waterbirds peaking early and late in the study, when more Ring-billed Gulls chicks were available. Additionally, Herring Gull pairs differed in their exploitation of bird prey: predated waterbirds were found more often in large territories that could encompass more waterbird prey; and pellets containing bird remains were found more frequently in shoreline territories, where chicks may be less able to hide. These results support the idea that opportunistic predation of chicks is responsible for the differences in exploitation of waterbird prey by Herring Gulls at this site.

Habitat Selection by Black Terns in the Prairie Pothole Region (Oral)

Valerie Steen, Abby Powell

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Black Terns are a species of concern due to habitat loss and population declines. They nest in freshwater wetlands and often forage in surrounding wetlands and uplands. To determine the relative importance of landscape- and site-level variables in predicting use of wetlands for breeding and foraging, we conducted surveys at wetlands in the prairie pothole region of North and South Dakota, and used land cover layers in a GIS to estimate the proportion of land cover types surrounding wetlands used by Black Terns. We used a novel algorithmic model, Random Forest, to relate density of Black Terns to the proportion of broad-scale cover types in the landscape and to site-level habitat characteristics, and quantified variable importance based on the decrease in predictive ability of the Random Forest model when the data of a variable were randomly permuted. The most important predictor of breeding density was the amount of floating mats: Black Terns were more likely to nest in a wetland as the amount of floating matted vegetation increased. The most important habitat characteristic predicting foraging density was wetland size: Black Terns were more likely to forage in larger wetlands. In both models, Black Terns also responded positively to the amount of wetland in the landscape; the amount and type of upland in the landscape were not important. Our results demonstrate the efficacy of using Random Forests to look at the relative importance of habitat features across spatial scales, and contribute to a better understanding of Black Tern habitat requirements

Migratory Shorebirds and Sea Level Rise in Cape May County, New Jersey (Oral)

Laura Stern, Nellie Tsipoura

New Jersey Audubon Society, Bernardsville, New Jersey, United States

The objective of the ongoing NJAS citizen science shorebird study is to monitor shorebird populations that migrate through coastal New Jersey during spring and fall on their journey between breeding and wintering grounds. A subset of data from this study was used in conjunction with a case study conducted by the Rutgers University Advanced Environmental Geomatics class (School of Environmental and Biological Sciences), Spring 2009, to evaluate the implications of sea level rise on Cape May County. The Cape May survey data was used to help illustrate the importance of Cape May Peninsula to migratory shorebirds and to demonstrate how potential flooding under several sea level rise (SLR) and storm surge scenarios would impact specific survey sites and shorebird foraging habitat in general. From 2006 to 2008 across ten study sites in Cape May County, a total of 83 surveys were conducted by volunteers in spring (May 1–June 9) and 157 in fall (July 15–October 31). More than 48,000 shorebirds were observed in spring and almost 231,000 were observed in fall. Most commonly seen species were Red Knot and Sanderling in spring and Sanderling and Semipalmated Plover in fall. Under the low end 100-year estimate of SLR (0.6m), 9 of 10 sites would experience at least a partial loss of habitat. Under the high end estimate (1.2m) with a 5-year storm surge (1.8m), all sites would be either substantially or completely inundated, thus demonstrating the highly vulnerable state of existing migratory shorebird foraging habitat in Cape May County.

Migratory Shorebirds and Sea Level Rise in Cape May County, New Jersey (Poster)

Laura Stern, Nellie Tsipoura

New Jersey Audubon Society, Bernardsville, New Jersey, United States

The purpose of the ongoing NJAS citizen science shorebird study is to monitor shorebird populations that migrate through coastal New Jersey during spring and fall on their journey between breeding and wintering grounds. The Cape May Peninsula in particular is a key migratory corridor. The foraging habitats that support the high concentration of migratory shorebirds are vulnerable to predicted accelerating sea level rise. The most severe losses are likely to occur at sites where the tidal zone is not allowed to migrate inland due to development and shore protection. An assessment of the impact of future sea level rise on shorebird habitat is needed to help make informed decisions regarding management and protection of shorebird habitat in Cape May. A case study was conducted by the Rutgers University Advanced Environmental Geomatics class (School of Environmental and Biological Sciences), Spring 2009, to evaluate the implications of sea level rise to Cape May County. To identify areas most at risk, a geospatial dataset was developed with the locations of the existing shorebird feeding habitats, and potential habitat retreat zones, cross-tabulated with predicted inundation areas over the next 100 years. Citizen science survey data collected in Cape May between 2006 and 2008 was summarized and mapped with this spatial dataset to help illustrate the importance of Cape May Peninsula to migratory shorebirds and to demonstrate how potential flooding under several sea level rise and storm surge scenarios would impact specific survey sites.

Population Monitoring of the American Oystercatcher in North Carolina (Poster)

Jessica Stocking, Shiloh Schulte, Theodore Simons

USGS Cooperative Fish and Wildlife Research Unit, Department of Biology, North Carolina State University, Raleigh, NC, United States

The American Oystercatcher (*Haematopus palliatus*) is a common breeding shorebird along the east coast of the US from Maine to Florida. Recent evidence of population declines across much of that range has raised concern over their population status. Studies of breeding birds in North Carolina began at Cape Lookout National Seashore in 1995 and now involve multiple management agencies working along the entire coastline. Management at Cape Lookout and Cape Hatteras National Seashores has focused on cause of nest loss and survival rates at all life stages. We summarize nest success and causes of loss on the seashores. Since 1999, 408 individuals have been banded in the state, and mark-resight evidence indicates these birds winter from Virginia to Florida. In 2009 we placed geolocation devices on the leg bands of ten adult birds to gather information about broad scale patterns of dispersal and movement; we discuss the technique and expectations. In 2010 we will initiate a new study to examine potential reproductive tradeoffs for birds nesting on traditional barrier island nesting habitats and more recently occupied sites on dredge spoil islands, sound-side marshes and shell-rake habitats.

Nest-Activity Patterns by Snowy Egrets (*Egretta thula*) (Oral)

Heather Stone¹, Alan Maccarone¹, John Brzorad¹

¹Friends University, Wichita, KS, United States, ²Lenoir-Rhyne University, Hickory, NC, United States

Snowy Egrets nesting in an urban-based, mixed-species colony in Wichita, KS, were studied from May-July 2009. Observations included >4100 instantaneous observations on 13 random study nests. The results from scan samples showed that the attending parent engaged in low-cost activities such as sitting (59% of the time), standing (13%), and preening (9%). Maintenance activities (nest repair, egg-turning) accounted for 6% of daily activity, whereas food-transfer to chicks comprised <1% of the daily activity budget. For nest activities performed by the attending parent, we found significant differences for nests with eggs compared with those with chicks. Adults with eggs spent more time sitting on the nest but less time standing and away from the nest. The proportion of time spent preening and in nest repair did not differ by nest content. Our previous work examined the energetic costs of foraging activity and foraging flights. Here, we examine the energetic costs of the activities performed by the attending parent as well as those involved in food-provisioning. We relate these costs to a Snowy Egret's overall time-and-energy budget.

Nesting and foraging habitat of Least Terns (*Sternula antillarum*) on the Missouri River (Oral)

Jennifer Stucker^{1,3}, Deb Buhl², Mark Sherfy²

¹USGS - Northern Prairie Wildlife Research Center, St. Paul, MN, United States, ²USGS - Northern Prairie Wildlife Research Center, Jamestown, ND, United States, ³Conservation Biology Graduate Program, U of MN, St. Paul, MN, United States

Within the central USA, Least Terns (*Sternula antillarum*) of the federally endangered interior population nest primarily on barren sandbars created by natural and mechanical processes within river systems. We conducted field research in 2006 through 2008 to quantify and describe Least Tern use of sandbar habitats for nesting and aquatic habitats for foraging on the Missouri River (South Dakota, USA). We visually estimated substrate and vegetation parameters to describe habitat at nest sites and nearby locations at time of nest initiation. Using observations from successful foraging locations and paired random locations, we evaluated the importance of depth, turbidity, substrate, and surrounding habitats for predicting areas of foraging success. Generally, Least Tern nests occur within a sandy substrate matrix, with the majority of nest initiations occurring during June. Our mixed linear models identified significant differences in substrate composition, vegetation, and presence of larger materials at the nest cup, suggesting habitat heterogeneity at a 1m scale may be important. Significant differences were detected among substrate and vegetation characteristics between mechanically created and natural sandbars; linkages between habitat features and productivity have not been established to date but are expected soon. Comparisons of foraging and random locations using multinomial and matched-pairs logistic regression identified depth as a primary predictor of successful Least Tern foraging, followed by substrate and micro-scale habitat descriptors; meso-scale habitat descriptors and turbidity were not as important. This knowledge will aid in understanding the importance of nesting and foraging habitat condition for endangered Least Terns in this managed system.

A Potential Nondestructive Management Technique for Double-crested Cormorant Breeding Colonies (Oral)

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A breeding colony of Double-crested Cormorants (*Phalacrocorax auritus*) on East Sand Island (ESI) in the Columbia River estuary has grown from less than 100 pairs in 1989 to over 13,700 pairs in 2007, the largest-known colony for the species in western North America. Fisheries managers are increasingly concerned about the impact of cormorant predation on ESA-listed juvenile salmonids in the estuary, concerns that may result in population control measures. Because the ESI colony represents as much as 50% of the population of the Pacific Coast subspecies (*P. a. albociliatus*), efforts to redistribute part of the ESI colony to alternative colony sites may be more appropriate than lethal control. We constructed artificial satellite colonies at sites on ESI where cormorants had not previously nested using modified nesting substrate (tires), old cormorant stick nests, decoys, and speakers broadcasting recordings of a cormorant colony. Cormorants were attracted to nest at these satellite colonies, where chicks were successfully fledged. Similar artificial colonies were also established on Rice Island (26 km from ESI) and Miller Sands Spit (30 km from ESI), and chicks successfully fledged at each. Two other artificial colonies, however, were not successful in attracting nesting cormorants, one on scaffolding near a colony in trees and one on a floating platform in a shallow impoundment. These results suggest that habitat enhancement and social attraction may be an effective technique for relocating part of the ESI cormorant colony to some alternative sites, thereby reducing its impact on prey species of special concern.

Analysis of Gene Flow Among common tern Colonies in the Great Lakes Region and the Atlantic Coast

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Results of long-term United States and Canadian monitoring initiatives for Common Terns (*Sterna hirundo*) in the Great Lakes region demonstrate ongoing reduction of both breeding numbers and sites. Concurrently, Atlantic coast populations appear to be stable or increasing. Studies suggest that the ecology of freshwater terns differs from that at coastal colonies and banding recoveries of inland birds are very rare in heavily monitored Atlantic colonies. Thus, terns in these two areas may comprise distinct subpopulations. It is imperative to understand patterns of genetic relatedness between these two regions and throughout the Great Lakes to guide regional management strategies. We genotyped 123 individuals from eight geographic locations using five polymorphic microsatellite loci (n= 8-24 birds per site). Pair-wise tests of genetic relatedness indicate generally greater differences between Atlantic colonies and inland colonies (mean $D_{est} = 0.169$) than within the Great Lakes region (mean $D_{est} = 0.091$). Inland sites show a complex pattern ranging from low levels of gene flow within Lake Ontario ($D_{est} = 0.129$) to higher levels between Oneida Lake and North Channel, Lake Huron ($D_{est} = 0.03$). However, our analyses indicate that most inland sites are significantly differentiated from each other. These results suggest that Common Tern declines within the Great Lakes, even at the level of individual breeding sites, may represent a worrying loss of genetic diversity. These data support regional management strategies that aim to conserve both population numbers and individual nesting sites.

Influences of Seasonality and Oceanographic Features on the Habitat Use of Seabirds in Onslow Bay, NC (Oral)

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At-sea surveys of seabirds can provide important information on the state and dynamics of marine ecosystems if they are conducted in a regular and systematic fashion. To this end, we conducted cross-shelf vessel-based band transect surveys in Onslow Bay, NC between June 2007 and May 2009 to evaluate at-sea distributions of seabirds in relation to local oceanographic factors. This area is of particular interest to studies of seabirds and oceanography for several reasons: dynamic oceanographic features are formed in the region due to Gulf Stream effects; meso-scale eddies and seasonal fronts occur commonly; and the area has been proposed as a future naval training range. We conducted surveys aboard a 53-foot research vessel at a cruising speed of 10 knots and observed 1300 individuals of 22 species of seabirds during 160 hours of survey effort conducted on 41 different days, primarily between June and October of both survey years. Seabird sightings showed seasonal patterns in both years, with the greatest number of sightings per unit effort (SPUE) observed in September and relatively high SPUE values also observed between February and April. Diversity indices were fairly constant year-round, with slightly higher diversity observed during the summer and late fall. Seabird species differed in their affinity for different oceanographic features, particularly with respect to three specific features: fine-scale sea surface temperature fronts, the Gulf Stream front, and Gulf Stream Frontal Eddies.

Identifying Wood Stork Foraging Habitat in Coastal South Carolina, USA (Oral)

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Flight-follows were conducted for three Wood Stork (*Mycteria americana*) colonies in the coastal ACE Basin region in South Carolina during the 2008-nesting season to identify foraging habitat use and selection. Various elements were evaluated for trends based on habitat-selection and include distance, time, colony nesting stage, tidal stage, and flight date. These analyses were done to illustrate any possible habitat use trends during the 2008-nesting season that may provide further insight regarding species management and protection for the US Fish and Wildlife Service and the South Carolina Department of Natural Resources. The coastal colonies of Donnelley Wildlife Management Area (DWMA), Pon Pon Lakes (PPL), and White Hall II (WH II) selected comparable foraging habitats by proportion, and expressed statistically similar habitat-use trends while maintaining minimally overlapping foraging habitat regions. Furthermore, the colonies remained predominately within their own river drainages and used varying proportions of the following habitats: bay/estuary/sandy, forested wetlands, and nonforested wetlands. The varied habitat types provided the nesting Wood Storks with steadily available foraging options, though the primary habitats utilized were forested wetlands and nonforested wetlands. Overall, Wood Storks from our three coastal colonies maintained similar foraging habit-use patterns within their own foraging grounds. The foraging uniformity suggests that the state of South Carolina may apply broad-ranging management guidelines to protect nesting Wood Stork foraging habitat throughout the region during a typical nesting season.

Cormorants in the City: Double-crested Cormorant Management at Tommy Thompson Park (Oral)

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The management of Double-crested Cormorant colonies is challenging regardless of location, but a colony in Canada's largest city poses some unique difficulties. The colony at Tommy Thompson Park (TTP) in Toronto is located in a public park in close proximity to marinas, beaches and walking trails. Many management tools are not feasible due to the location and public access to and around the site. Management is also complicated by a large colony of Black-crowned Night-Herons and several Great Egrets nesting in the same location. Currently the colony numbers 7564 nests, making it the largest known colony in the lower Great Lakes. In 2007, Toronto and Region Conservation developed a publicly driven management strategy, which incorporated an advisory group comprised of stakeholders and experts, including conservationists, academics and interest groups from across the spectrum to provide advice and input. The goal of the 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 the park. The overall objectives are to increase public knowledge, awareness, and appreciation of colonial waterbirds; deter cormorant expansion and limit further loss of forest beyond existing colonies; and continue research on colonial waterbirds. The development of the strategy was transparent, holistic and adaptive, and by using applied research public support is gained and the management goal and objectives become more attainable. This approach can be used as a case study for dealing with cormorants in urban centres.

Boston Harbor Islands Coastal Breeding Bird Monitoring Program (Oral)

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The National Park Service, the Boston Harbor Islands Partnership, and the University of Rhode Island have developed a long term monitoring program for coastal birds breeding in the Boston Harbor Islands National Park Area (BOHA). Several of the waterbird species breeding in the park are species of conservation and/or management concern, such as Least and Common Terns, Snowy Egrets, Black-crowned Night-Herons, and American Oystercatchers. In addition, eiders, cormorants, several other wading and shorebird species, and gulls all regularly nest in the park. Objectives for the program include: determining annual changes and long-term trends in abundance of high priority species, conducting an annual surveillance program to identify future use by threatened or endangered species, determining long-term trends in species composition and abundance, and gathering information to improve our understanding of breeding waterbird - habitat relationships. The survey methods recommended in this protocol focus on obtaining information on the relative abundance of coastal breeding species by estimating or directly counting all nests, incubating adults, or territorial nesting pairs. Methods were selected based on their ability to: accurately detect changes in species richness, relative abundance, and nesting location; create minimal disturbance; be implemented by trained volunteers working with a lead scientist and park staff; and be carried out with a modest annual budget. Volunteer participation enhances community involvement with park islands, provides an opportunity for various stakeholders to participate in long-term monitoring, and is a cost-effective means of implementing this program.

Development of the First Newell's Shearwater Breeding Habitat Suitability Model using Geographic Information (Oral)

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The island of Kauai in the Hawaiian Archipelago is the stronghold of the federally threatened Newell's Shearwater, or 'A'o (*Puffinus newelli*). Numbers of Newell's Shearwaters are in dramatic decline and the species appears to be exhibiting a breeding range contraction on Kauai. Few locations of active breeding colonies are known and the existence of additional colonies is difficult to determine because of inaccessibility due to steep terrain and land ownership. In an attempt to quantify potential breeding habitat for this species and aid future searches, we developed the first breeding habitat suitability model for the Newell's Shearwater using existing distributional data from systematic surveys, a suite of remotely sensed environmental variables, and ArcGIS. The habitat suitability model and maps produced from this effort will aid in prioritizing areas for future surveys and habitat protection, a critical next step in the conservation of this imperiled species.

Survival Of Wood Stork Colonies in Relation to Landscape Habitat Characteristics in the Southeastern United States (Oral)

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Wood Storks (*Mycteria americana*) are federally listed as an endangered species due to breeding population decline in the southeastern U.S. Conservation of breeding habitat and keystone ecological processes are hampered, however, by incomplete understanding of habitat features necessary for breeding. Stork colonies have some degree of turnover; many colony sites have been inactive for many years and we suspect the surrounding landscape may have changed to the extent that it no longer can support nesting. For active colonies, we have no way to prioritize the sites or the supporting habitat. In addition, tools are lacking to identify lands that may be important for future reproductive sites and feeding areas. In this study, we use a 39-year record of colonies in the southeastern U.S. to identify vegetation, physiographic, land use, and hydrologic characteristics that are associated with colony longevity, using a survival analysis framework. The principal assumption is that colony longevity is related to features and events in the surrounding landscape. The distribution of 310 colony observations suggests a good mix of both long- and short-lived colonies. Fifty-seven percent of colonies have consecutive observations and are qualified to be used in survival analysis. Here, we describe the process of winnowing colonies, identifying pertinent habitat features, and performing several levels of analysis to yield guidelines for conservation.

Citizen Science Projects in New Jersey: Shorebird and Harbor Heron Surveys (Oral)

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Using of volunteers in research has grown over the past 20 years and has evolved from having unskilled participants help out scientists in the field to employing skilled and trained citizen scientists to complete all aspects of complex scientific projects. The New Jersey Audubon Society in collaboration with NJ DEP launched a citizen science program in 2004. The purpose of the program was to enable the collection of large amounts of data on bird abundance and distribution state-wide that can be used to inform management decisions. Over 150 volunteers join NJAS research projects each year. Of these, approximately 30 participate in shorebird migration surveys and 50 in Harbor Heron surveys. Protocols have been developed for each of these projects taking into consideration constraints of having research completed by volunteers but also making data collection sufficiently rigorous to allow for hypothesis testing. Projects have become more complex and elaborate as our volunteers gain experience and seek more challenges. Part of the change is driven through the efforts of the scientists involved in this work. However, motivated volunteers have also made great strides both in collecting data to answer specific questions that have arisen during the field work and in reaching in other directions to collect information needed to address management and policy issues at their sites. We have thus expanded our approach from the basic citizen science model to participatory action research.

The value of Chickaloon Flats, Kenai National Wildlife Refuge, Alaska, to shorebird migration and staging: a stable isotopic and bioenergetic evaluation (Poster)

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The overall purpose of this project is to quantify the importance of the Chickaloon Flats, a 70 km² area within the Kenai National Wildlife Refuge, Alaska, as a shorebird migration stopover. Chickaloon Flats has not been studied since 1971, so there is a great need for more baseline information about the site's habitat distribution as well as its value for migrating birds. This will be achieved through two main goals. The first is to conduct a focal stable isotopic study to reconstruct migration corridors that have included Chickaloon Flats in their yearly cycle by analyzing body and flight feathers of 6 shorebird species. The focus species are: Least Sandpiper (*Calidris minutilla*), Greater Yellowlegs (*Tringa melanoleuca*), Lesser Yellowlegs (*Tringa flavipes*), Long-billed Dowitcher (*Limnodromus scolopaceus*), Short-billed Dowitcher (*Limnodromus griseus*), and Pectoral Sandpiper (*Calidris melanotos*). The second objective is to determine the potential shorebird carrying capacity of Chickaloon Flats using a bioenergetics modeling approach. This includes defining the distribution and area of vegetation zones on the Chickaloon Flats, identifying local food resources, qualifying consumption, and estimating spring and fall biodiversity and abundance. Data will be collected during two field seasons; the first was conducted May-August 2009, and the second will occur mid-April-August 2010. The results of this project will assist the wildlife managers of the Kenai National Wildlife Refuge in focusing management strategies and determine any potential harm by human development and activities in the area.

Shift in Winter Range of Alcids off the Northeast US Coast and its Relation to Oceanic Climate (Oral)

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The occurrence of several species of alcids off the northeastern United States has increased substantially during the last two decades, both inshore and at sea as detected from pelagic birding trips. The increases may either represent actual population increases, or a shift in winter distribution towards waters off our coast, or a combination of the two. In this paper, I show how increases in the number of migrant and wintering alcids in New Jersey waters are mirrored in neighboring states, especially New York and Massachusetts, and for some species, by demonstrable increases in population size and range expansion. Recently, variation in the NAO has been shown to influence seabird abundance and reproductive success. There has been a dramatic shift in values of the NAO index beginning in the late 1970s, such that values have been mainly positive since about 1990, while they were mainly negative in the period 1950-1990. Thus an important shift in oceanic climate began in about 1990 and continues to the present. The timing of this shift seems to correspond to changes in alcid abundance off the northeastern U.S. that I describe here. It is not clear how shifting oceanic climate affects alcid distribution, but it is likely through its impacts on the prey base. Perhaps the abundance of fish and/or plankton has changed in ways that our waters are now more attractive to these birds.

Geographic Distribution and Abundance of the Wood Stork *Mycteria americana* in the Llanos of Venezuela (Oral)

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The Llanos region of Venezuela and eastern Colombia contains the second largest wetland complex in South America after the Brazilian Pantanal. This biome is recognized as a significant waterbird site in the Western Hemisphere. The Wood Stork *Mycteria americana* is a common and widespread resident of the Llanos, where they are seen in shallow savannas, marshes, sandbars, and mudflats along rivers. They are highly gregarious and can be seen in groups ranging from a few birds to hundreds. They nest colonially in large rookeries. We used point counts along road routes to determine seasonal patterns in abundance and distribution of waterbirds during 2000-2002 within five ecoregions across the Llanos. We located Wood Storks in all ecoregions sampled (Central Llanos, Ricefields, Western Llanos, Paspalum savanna, and Low Llanos). We recorded a total of 4,051 individuals during our surveys. The Wood Stork was the most abundant of the 3 species of stork found in the Llanos, represented 74.6% of all stork detections and occurred on 70% of all routes. Conversely, the Maguari Stork (*Ciconia maguari*) occurred on only 43% of routes, and the Jabiru Stork (*Jabiru mycteria*) occurred on only 35%. In contrast to ibises and herons, the distribution of storks was largely restricted to the Low Llanos. Detections of Wood Storks increased as the dry season progressed, in contrast to Jabiru and Maguari Storks, which were least detected at the end of the dry season but increased to yearly maxima after the commencement of the rains.

Colony sites of Wood Storks in Costa Rica (Oral)

Johnny Villarreal

University State to Distance of Costa Rica, Sa Jose, Costa Rica

The Wood Stork (*Mycteria americana*) in Costa Rica occurs in lowlands of both coasts. The objectives of the study are to locate the colony sites and to estimate the population of Wood Storks in Costa Rica. I used information from local people to locate the colony sites of Wood Storks, and later I visited each site by to check the presence and to record the species, height, DBH and position of trees used by Wood Storks. I also recorded the numbers of nests in each tree, adults and chicks. In Costa Rica, between 2007-2009, I record four colony sites of different sizes: 1) Pajaros Island (10° 19' 21" N, 85° 19' 07" W) located in Tempisque river, 2) Santa Rosa ranch (10° 12' 39" N, 85° 18' 09" W), 3) Charco River (10° 19' 86" N, 85° 30' 43" W) and 4) Frio River (10° 53' 70" N, 84° 46' 30" W). Pajaros Island, Santa Rosa ranch and Charco River were located in the Tempisque basin (Costa Rica northwest) and Frio River was located in Caño Negro Wildlife Refuge (Costa Rica northern). The Pajaros Island colony was the largest with 765 individuals. The Santa Rosa colony had 309 individuals. The Charco colony had 242 individuals and the Frio colony had 48 individuals. The tree species where Wood Storks built their nests were *Rhizophora mangle*, *Avicennia germinans*, *Bombacopsis quinatum*, *Anacardium excelsum* and *Ficus* spp. In the Pajaros Island colony, the Wood Storks nested from September until April. I concluded that colony sites of Wood Storks in Costa Rica are critically hampered by human agricultural practices.

Hurricane Impact on Brown Pelican Nesting Colonies (Oral)

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Since the 1963 extirpation of the Brown Pelican (*Pelecanus occidentalis*) in Louisiana, and successful restoration, maintaining a viable population of the endangered species has been of concern. Given hurricane threats to barrier island habitat, we are currently attempting to initiate new nesting colonies via translocations of chicks to uncolonized islands and by using decoys to attract nesting adults. For future selection of target islands for new colonies, a better understanding of how fine-scale habitat conditions impact nest selection and success could provide critical information to facilitate colonization. To address these questions, we tracked 603 nests on Raccoon and Wine Islands, LA in 2008-09 to assess relationships between nest success and nest-site characteristics. We also measured habitat characteristics in 289 random plots for comparison to nest sites. Between field seasons, hurricanes Gustav and Ike heavily affected our study sites, which allowed for pre- and post-hurricane assessments of habitat use and availability. We found that when available, Brown Pelicans select woody vegetation as nesting platforms at a greater proportion than its availability. However, the hurricanes reduced woody species and other lower-lying vegetation coverage, while proportions of dead woody vegetation and bare ground increased; these changes in habitat composition lead to a shift in nest platform selection. Finally, an average of 1.1m /wk shoreline loss on Wine Island from May-July 2009 has further reduced nesting habitat. Understanding how hurricanes and vegetation availability affect Brown Pelican nesting can provide useful information for future coastal conservation efforts in Louisiana.

Conservation in Conflict: the Impact of Nesting Peregrine Falcons on the Distribution of Migrant Red Knots Along the Virginia Barrier Islands (Oral)

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We investigated the influence of falcon breeding territories on the distribution of staging Red Knots along the Virginia Barrier Islands. The Virginia Barrier Islands represent a significant staging area for Red Knots, supporting 6000-9000 birds annually during the peak of spring migration. This same system supports one of the highest breeding densities of Peregrine Falcons in North America accounting for 50% of the Virginia population. Falcons (115) were introduced into the area through a hacking program (1978-1985). Pairs nest on artificial towers, migrant shorebirds are their primary prey, and their brooding period coincides with the peak of migration. We flew weekly aerial surveys from late April through mid-June (2006-2009) along the barrier islands to count and map foraging flocks of Red Knots. We investigated the influence of falcons on the density of staging knots by stratifying shorelines according to their proximity to active falcon nests. Three distance categories were used including close (0-3 km), near (3-6 km) and far (>6km). Migrant Red Knots showed a significant response to falcon nests with mean densities varying between 17.0 ± 3.04 birds/km, 95.3 ± 7.31 , and 132.9 ± 4.41 for close, near, and far shorelines respectively. In addition, for 5 nesting territories that changed activity status during the study period, knot density was significantly higher close to nests during years when territories were not active compared to when they were. These results suggest that breeding Peregrine Falcons may be reducing the capacity of the study area to support knots by as much as 30%.

Movement of Red Knots between 2 Spring Staging Areas in the Mid-Atlantic: Delaware Bay and the Virginia Barrier Islands (Oral)

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We used resights of marked Red Knots (*Calidris canutus*) within a multi-strata modeling framework to estimate movement rates between Delaware Bay and the Virginia Barrier Islands during spring migration. Of 562 knots identified in Virginia in 2006, 2007, and 2009, 49.3% were also observed in Delaware Bay documenting 362 movements between years and 88 movements within the same year. Most of the birds identified were either banded in Delaware Bay (53.5%) during passage or on the wintering grounds in Argentina or Chile (45.6%) with much smaller numbers banded in Canada (0.5%) or Brazil (0.4%). All models that were supported by the data allowed for movement rates to vary between Virginia, Delaware Bay, and an unobserved stratum. Estimates of movement rates from Virginia to Delaware Bay were 82% and 14%, while rates from Delaware Bay to Virginia were 42% and 18%, within and between years, respectively. Movement patterns suggest that both sites are part of an open network of interacting staging areas. Birds appear to sample sites before making settlement decisions within a migration year and frequently change sites between years. The prominent inclusion of an unobserved stratum within models implies the existence of other locations within this "neighborhood" of staging areas. These results suggest that local emigration should be considered prominently in the development of future stopover models. A coordinated resight program covering a broader geographic area and spanning several years is needed to unravel condition-specific stopover choices.

Satellite Tracking and Migration Ecology of the Whimbrel (Oral)

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Whimbrel (*Numenius phaeopus*) are large shorebirds that have experienced dramatic declines in recent decades. The North American race includes 2 distinct breeding populations: Alaska and the Northwest Territories of Canada and the Hudson Bay lowlands of Manitoba and Ontario. Both winter primarily in Central and South America. During spring migration, large numbers of Whimbrel stage along the Delmarva Peninsula of Virginia with fewer stopping during fall migration. Our objectives were to identify wintering, breeding, and stopover locations; migration routes; and stopover dynamics for Whimbrel migrating through Virginia. We deployed 11 satellite transmitters in spring (6) and fall (5) of 2008-2009. In spring, 2 Whimbrel departed Virginia on 23 and 25 May and traveled 6170 km (SE=24) to the MacKenzie River, NWT, stopping once (5 days) or twice (24 days) en route. In contrast, 4 Whimbrel departed 22-31 May, flying 2460 km (SE=174) directly to breeding locations in the Hudson Bay lowlands. Western birds initiated southward migrations >7840 km (SE=550), stopping 2-3 times for 29-39 days, while an eastern bird flew 1955 km directly back to Virginia. Western Whimbrel traveled farther and required additional refueling stops for both northward and southward migration than did eastern Whimbrel. In fall, 5 Whimbrel departed Virginia (30 Aug - 20 Sept) and traveled 3660 km (SE=445) to the Antilles Islands and northern South America. Whimbrel traveled 2990 km (SE=296) from Virginia directly to their next stop. Virginia is an important stopover location for both Whimbrel populations during spring and fall migration.

Bird Species Richness and Abundance Associated with Water Availability and Climate in South-Central Nebraska (Oral)

Enrique Weir

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The Central Platte River and Rain Water basins at south-central Nebraska are remarkable habitats for aquatic birds. Birds use these habitats as stopovers during spring and fall migrations, breeding, and wintering grounds. I compared bird richness and abundance between two periods of time: 1983 - 1991 and 1999 - 2007, with the purpose of evaluating changes in bird species richness and abundance in relation to hydrology, climate, and habitat changes. I used historical data from North American Breeding Bird surveys, Christmas Bird counts, and spring and fall surveys (Nebraska Ornithologists Union) from Buffalo, Phelps, Kearney, Hall, Adams, Clay, Polk, York, and Hamilton counties, reports from Sharpe et al (2001) and technical reports (from 80's to 2000's) developed in Platte River Whooping Crane Trust. Bird species richness was reduced by 5 percent in the 2000's and the relative abundance of bird species was reduced as well in this period. Many of the remaining aquatic birds that were abundant, common, or fairly common in the 80's were uncommon, uncommon, rare, or casual in the 2000's. Seven abundant, 56 common, 17 fairly common and 26 rare species decreased in abundance. The long drought period and changes in riparian woodlands during the 2000's could be two of the main drivers of changes in bird assemblage patterns. Directly, due reduction of water availability in Central Platte River and Rain Water Basins and indirectly through changes of the habitat structure, and physiognomy as well as, changes of the land use and policies of resources management.

Garbage Makes More Glaucous Gulls (Oral)

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Glaucous Gulls (*Larus hyperboreus*) are abundant predators and scavengers in northern Alaska. Like other gulls, they are believed to benefit from garbage as a supplemental food source, but this benefit has never been quantified. In summer 2008 and 2009, we studied Glaucous Gull diet and reproduction at 10 breeding colonies (eight in both years and two in 2009 only) in northern Alaska. Colonies were in industrial, residential, and undeveloped areas, ranging between five and 75 km from the nearest landfill. Among colonies, garbage occurred in zero to 85% of pellets and food remains produced during the chick-rearing period, and average fledging success ranged between zero and 2.9 chicks per pair. In both 2008 and 2009, there was a significant positive linear correlation between log-transformed garbage occurrence in diet samples and log-transformed average fledging success ($R^2 = 0.87$, $p < 0.001$, and $R^2 = 0.77$, $p < 0.001$, respectively). Random Forest analysis indicated that garbage occurrence was the most important factor, among 21 variables considered, in explaining variance in fledging success. These results demonstrate that Glaucous Gull reproductive output is enhanced by the garbage available at some human developments. If more garbage becomes available as a result of further development, gull populations may increase. This would have negative consequences for the gulls' natural prey species, including at least 14 species of shorebirds and waterfowl of conservation concern. This study provides one example of how human development can indirectly affect wildlife by subsidizing predator populations.

Seasonal Turnover of Colour-banded Double-crested Cormorants at a Colony/Roost in Eastern Lake Ontario (Oral)

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We searched for colour-banded Double-crested Cormorants (DCCOs) from a blind at a colony in eastern Lake Ontario in 2007-08. Over 19,000 cormorants have been colour-banded on the Great Lakes in recent years. Our goal was to identify the fate/status of colour-banded cormorants that were observed at this site. The season was divided into three periods: spring migration (April), the breeding season (May-July) and post-breeding/autumn migration (August-October). One hundred seventy-nine colour-banded adult DCCOs were observed. Eighty-six colour-banded adults were observed in April, 48 of these (56%) were also observed in May-July, and 21 (24%) also were observed during August-October. However, 38 (44%) were not observed during the breeding season (May-July) but 11(13%) did return during August-October. Of 58 cormorants first observed during May-July, only 16 (28%) were also observed during August-October and 42 (72%) were not seen again. During August-October 35 new, previously unrecorded cormorants were observed on the island. Thus, at least 73 of the 179 (41%) colour-banded adult DCCOs recorded on Snake Island did not breed there nor were they observed there during the breeding season.

Population Growth, Roosting Habits and Post-breeding Dispersal of Great Egrets in the Lower Great Lakes (Oral)

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The breeding population of Great Egrets (GREGs) in Ontario has grown from a single nest at one site in 1952 to 318 nests at 9 colonies in 2009. Since 2001, more than 1,200 flightless, young of year (YOY) GREGs have been colour-banded at 4 colonies in Lake Huron, Lake Erie and the Niagara River. The objectives of this study were to track the growth of the breeding population of GREGs in Ontario and to explore their biology during post-breeding period, especially their roosting habits and dispersal/migration. During September 2008 and April-September 2009, Great Egrets were censused twice weekly at a communal roost at Luther Marsh (Grand Valley, ON). Six other roosting sites, nine breeding sites and various day-use areas were surveyed less frequently. Post-breeding dispersal of YOY GREGs from the colony on Nottawasaga Island, Lake Huron (Collingwood, ON) (154 nests) was southward with very little northward "wandering". Dispersal from the Niagara River colony (Buffalo, NY) (39 nests in 2008) was predominantly eastward toward the Tonawanda WMA and the Montezuma NWR. In 2009, egrets did not begin roosting at Luther Marsh until late June, when 3 birds appeared there. The maximum number recorded was 255 on 16 August, likely making it the largest GREG roost in Canada. In autumn 2009, multiple colour-banded birds from two colonies, > 55 km distant, dispersed to the Luther Marsh roost.

Feeding Ecology of Long-tailed Ducks *Clangula hyemalis* Wintering on Nantucket Shoals (Oral)

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A substantial proportion, perhaps 30%, of the North American breeding population of Long-tailed Ducks (*Clangula hyemalis*) winter in the vicinity of Nantucket Island, Massachusetts. These birds spend the night on Nantucket Sound and commute during daylight hours to the Nantucket Shoals, which extend about 65 km offshore from the southeastern corner of Nantucket. Diet analyses of ten birds collected in February 1999 and five in December 2006 showed that they fed principally (106.6 +/- 42.0 individuals per crop) on *Gammarus annulatus*, a pelagic amphipod that often forms large aggregations, and is consumed by several species of fish and marine mammals. Aerial surveys have revealed that Long-tailed Ducks aggregate along the western fringes and southwest corner of the Nantucket Shoals. High aggregations of Long-tailed Ducks were recorded close to sea surface temperature fronts; in areas of high primary productivity; and along relatively steep bathymetric slopes. We show that Long-tailed ducks winter near the shoals to feed predominately on pelagic gammarid amphipods, a high quality food resource during the winter months. This study is the first to document the distribution and abundance of a major wintering population of Long-tailed ducks that forage on the Nantucket Shoals.

Projected Impacts of Sea-level Rise on the Population Size of Salt-Marsh Breeding Birds within the Chesapeake Bay Region (Oral)

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Because of their low position on the landscape, salt marshes will be one of the first habitats consumed by rising seas. Salt marshes play a critical role in the life cycle of a broad community of birds, particularly for species that rely exclusively on marsh habitats. We projected the impacts of sea-level rise on the population sizes of breeding marsh birds in the Chesapeake Bay region over a 100 yr period using available data on bird density and distribution. Sea-level rise of 0.39 m reduced marsh bird populations 35-42% for the Clapper Rail, Virginia Rail, Willet, Marsh Wren, and Seaside Sparrow, while a 1-2 m rise reduced these populations up to 80%. Sea-level rise of 0.39, 1 and 2 m reduced habitat available for Black Rails and Saltmarsh Sparrows by 51%, 90% and 99% respectively. Accelerated rises in sea level will result in significant losses in marsh habitats and catastrophic declines in many marsh-bird species including possible extirpation of species that rely on high marsh patches.

Habitat Associations of Marine Birds in the Gulf of Maine (Poster)

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As extremely mobile, energy-demanding, top predators in marine ecosystems, seabirds exploit predictable and ephemeral productive habitats. They respond rapidly to environmental change, and their high levels of detectability and vulnerability to both oceanographic and anthropogenic perturbations make them useful bio-indicators. There is a wealth of multi-species data gathered from vessel surveys on diversity, distribution, seasonal changes and the abundance of seabirds in the Gulf of Maine during the late 1970s/early 1980s. Since then, fisheries activities and global climate change have greatly impacted the Gulf of Maine, and decadal comparisons are needed to understand the subsequent changes in seabird biodiversity. This research project is aimed at examining the habitat associations and physical forcing influences on species diversity, seasonal migratory movements, and the behavioral tolerances of seabirds to habitat change. To better understand how top predators use and move between different habitats, we will integrate information from seasonal vessel surveys with the movement patterns of individual birds at sea, using satellite telemetry. We expect to document seasonal changes in the diversity of seabird assemblages, and assess if these changes are associated with seasonally predictable areas of high productivity (hotspots). We will assess decadal differences in seabird diversity, distribution and habitat association in the Gulf of Maine in terms of bio-physical ecosystem changes.

Avian Use of Rhode Island's Ocean Waters: Designing and Implementing a Broad-scale Assessment (Oral)

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The Rhode Island Ocean Special Area Management Plan (RI Ocean SAMP) will define use zones for Rhode Island and Block Island Sound through a standardized research and planning process. These zones are intended to protect or enhance habitat, commercial and recreational uses, while providing for future activities, such as renewable energy development. To quantify phenology, abundance, spatial distribution and local movement dynamics of avian species in the study area we are conducting a combination of land-based point counts, boat-based line transect surveys and radar surveys. Aerial line-transect surveys are also planned this winter to target waterbirds in both nearshore and offshore waters. Following the completion of boat-based and aerial line-transect surveys, detection functions will be modeled for individual species to estimate densities using Program Distance, and species density and spatial distribution will be interpolated across the study area. We conducted pilot surveys from January to July 2009 of boat-based line transects to estimate encounter rates for multiple species. These data will be used to determine transect lengths necessary for reasonable precise density estimates for baseline studies. Preliminary results document considerable seasonal and spatial variation in avian abundance and use of the study area, but further surveys are still needed to fully capture this variation before final use zones are defined.

Characteristics of Double-crested Cormorant Colonies in the U.S. Great Lakes Island-Landscape (Oral)

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The Great Lakes form the largest freshwater island system in the world and provide breeding habitat for a large proportion of the continental population of Double-crested Cormorants. In this area, cormorants have a high profile due to conflicts with humans; management has occurred at most (64%) breeding sites in U.S. waters. This study used data from the U.S. Great Lakes Colonial Waterbird Database and from the The Nature Conservancy's GIS Great Lakes Island database to identify important features of breeding sites in the U.S. Great Lakes and broaden understanding of cormorant presence at the island-landscape scale. Islands 0.5 – 10 ha were used more frequently than expected, and most sites had remoteness values of < 3 km. Colony size was positively correlated with years occupied and large colonies (> 1,000 pairs) developed mostly (95%) on island sites > 1.0 ha. Sites supporting large colonies were more remote than those supporting small or mid-sized colonies. Presence of other colonial waterbird species, particularly Herring Gulls, also characterized cormorant sites. Islands used by cormorants comprised a small proportion (n = 90, 3%) of the U.S. Great Lakes island resource, and < 1% of the total island area. Certain characteristics of breeding sites (e.g., small islands, proximity to mainland) may increase negative attitudes about cormorants. To understand cormorant impacts to island resources (e.g. vegetation; other colonial waterbird species), we suggest cormorant presence in the Great Lakes be considered in the broader context of island science, conservation and known threats, and at a landscape scale.