

PLENARIES

Climate change and prairie wetlands: Implications for migratory birds

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The rapid rates of climate change in concert with land use conversion pose unprecedented challenges to wetland and avian conservation across the North American prairies. Although wetland-dependent bird populations have persisted through millennia of both climate stasis and extreme variability, their future is uncertain. Knowledge of climate throughout the evolutionary history of birds provides long term perspective on modern day conservation issues and allows for refinement of problems and approaches. Climate archives, dating techniques, and emerging climate models assist in understanding past and future climates and elucidate the external drivers and anthropogenic causes of change. Statistical and dynamical approaches to downscaling climate data are helpful to regional-scale forecasts and evaluations. Modeling approaches for projecting ecological and species responses to climate change include niche modeling and derivative ecological models based on the sensitivity of ecosystems and vegetation to temperature or precipitation. Species vary in their sensitivities to climate change because of varying physiology, dependence on sensitive habitats, degree of specialization, reproductive strategy, and other species traits. Strategies for coping with changing climates include adaptation, behavioral flexibility, and migration or redistribution. Current interdisciplinary work at USGS addresses the links between climate, ecosystem processes, wetland management, and waterbird communities in North American prairie wetland systems. This effort is using dynamical approaches to build high resolution climate models, identifying uncertainties, and developing ecological models that forecast climate effects on palustrine wetland landscapes, riverine systems, and their associated bird communities.

The role of the Central Platte River Valley to the mid-continent population of Sandhill Cranes in the 21st Century

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The Mid-continent Population (MCP) of sandhill cranes (*Grus canadensis*) is the largest and most wide ranging population of cranes in the world with major breeding grounds located on 2 continents and 3 nations. I examine underlying factors that have led to development of this exceptionally strong spring staging tradition in the Central Platte River Valley (CPRV), describe temporal and spatial aspects of use by each subspecies and subpopulation, and evaluate factors that are limiting crane use. Cranes have successfully adapted to massive habitat change in the CPRV over the past 70 years and continue to be challenged by new developments which I will address. Aided by new technology, I follow the cranes throughout the annual cycle, identifying major breeding grounds, key spring and fall stopovers, and wintering areas, along with key habitat resources supporting the MCP. We have documented a much larger number and wider breeding distribution of sandhill cranes in northern Russia than previously thought and I will describe a 2009 expedition that led to the discovery of the species breeding westward to near the Lena River Delta. The focus will be primarily on research results having important implication to sandhill crane management. Although the trajectory of MCP growth over the past 70 years reflects a major conservation success story, climate change, energy development, and intensification of agriculture could pose potential long-term threats to the Population which I will discuss.

ORAL PRESENTATIONS

0001

Potential impact of climate change scenarios on Whooping Cranes

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The whooping crane (*Grus americana*), a rare and critically endangered species, is wetland dependent throughout its life cycle. The whooping crane's small population size, limited distribution, and wetland habitat requirements make it vulnerable to potential climate changes. Climate change predictions suggest overall temperature increases and significant changes in precipitation regimes throughout North America. At the individual level temperature changes should have neutral to positive effects on thermoregulation and overall energy expenditure throughout the whooping crane's range. In the breeding grounds, earlier snow melt and increasing temperatures should improve food resources. However, increased precipitation and more extreme rainfall events could impact chick survival if rainfall occurs during hatching. Increased precipitation may also alter fire regimes leading to increased woody plant abundance thus reducing nesting habitat quality. During winter, higher temperatures will lead to a northward shifting of freeze line which will decrease habitat quality via invasion of black mangrove. Large portions of current winter habitat may be lost if predicted sea level changes occur. Stopover wetland availability during migration may decrease due to drier conditions in the Great Plains. Current and future conservation actions should be planned in light of not only current needs but also considering future expectations.

0003

Coastal ecology of Brown Pelican movement and population structure

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Understanding factors influencing movements of individuals across spatial and temporal scales is critical to the preservation of populations threatened by environmental change. The brown pelican represents a prominent member of US coastal systems, particularly on southern barrier islands during breeding season. To better understand population parameters and movement patterns of the species, we banded 1500 chicks in Louisiana and conducted extensive band searches and age structure surveys from 2008-10 within the Isles Dernieres archipelago. We also used blood samples of banded chicks to determine sex using genetic techniques. Preliminary analyses did not indicate that age or sex influenced pelican occurrence across 3 island types (home, other, or non colony islands). However, there was a strong tendency for banded individuals to be found loafing at their home colony. Despite having banded ~15% of the population in our study site we found an extremely low average of 0.43% of birds with bands indicating high levels of either mortality, or dispersal outside our study area. Given 43% of individuals observed were banded outside our study area, dispersal may explain the discrepancy in banded bird presence. Although we did not measure post-natal dispersal, our results seem in conflict with the perception that brown pelicans are highly philopatric. A better understanding of brown pelican movement and population demographics may help guide management to maintain a viable population in the context of the species' 2009 removal from the endangered species list, the rapid degradation of their nesting habitat, and the recent oil spill.

0004

The importance of tail length for sexual selection in Roseate Terns

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Roseate Terns (*Sterna dougallii*) have unusually long outer tail feathers. We tested the hypothesis that these tail streamers have evolved as a result of sexual selection, using data from a 15 year study at Bird Island, Massachusetts, USA. Data on tail length were analyzed for 2511 terns, of which 742 are known-sex individuals. Tail length is correlated with aspects of individual quality, such as laying date and age, and thus can act as an indicator of mate quality. Although the sexes look identical, males have significantly longer tails than females ($p < 0.0001$), and females paired to males have longer tails than those in female-female pairs or other multi-female associations ($p < 0.025$). We also found assortative mating by tail length (correlation among mates = 0.274, $p < 0.0001$). These observations suggest that tail streamers are used by both sexes in mate choice, and may prove useful in discriminant functions for field sexing. Tail symmetry, however, appeared to play only a minor role in mate selection.

0005

Habitat, nutrition, and mercury in waterbirds: Ptilochronology as a novel bioindicator tool

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The use of focal species in determining the condition of a particular habitat type is a growing trend in conservation and management. Colonial waterbirds have long been used as bioindicators of coastal habitats due to their intimate connection with the hydrologic regime, high trophic position, 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 serves 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 data, prove useful for ecosystem monitoring. The novel approach of ptilochronology has been used to determine the nutritional health of nestling waterbirds in two locations of drastically different environmental qualities during the 2009 and 2010 breeding seasons. This approach has been coupled with analysis of diet, mercury burden, and nest-site interactions. Initial results suggest that waterbirds breeding along the Virginia Coast Reserve (VCR) experience superior nutritional condition than individuals breeding in the New York Metro Region. Additionally, birds in New York produce more fault bars, an indicator of acute stress during development, than birds in Virginia. Surprisingly, mercury burden is higher in Virginia birds, but may reflect a diet of prey items that are higher in the estuarine trophic web.

0006

A telemetry-based study of Snowy Egret food-provisioning rates and foraging energetics

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Food-provisioning rates, foraging habitat use, and foraging efficiency were documented for Snowy Egrets (*Egretta thula*) breeding in a mixed-species colony in Wichita, KS. Observations were made from May-July 2009 and 2010 and included the durations of 57 food-provisioning trips made by eight radio-tagged birds; 73 records of foraging locations, and 27 hr of foraging activity and aggressive interactions. Food-provisioning intervals averaged 242 + 22 min (range = 52-539 min). Mean intervals differed among radio-tagged birds, but did not differ by time of day nor did they correlate with Julian date. Flight distances averaged 16.1 + 3.2 km (range = 6-49 km) and also differed among birds. Neither strike rates nor foraging efficiencies differed for egrets that used near (< 3 km from the colony) or distant (> 18 km away) sites; however, birds at distant sites captured larger prey (55 vs. 36 mm) and had higher rates of energy gain (2.3 vs. 1.4 kcal/min). Frequencies of aggression were five times higher at sites close to the colony than at distant ones. Distances to foraging sites were combined with published values of flight costs to estimate the requirements for food-provisioning flights. Energy costs for flight and foraging activity are then compared with energy gains at foraging sites.

0007

Nest-activity patterns by Snowy Egrets (*Egretta thula*)

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Snowy Egrets nesting in an urban-based, mixed-species colony in Wichita, KS, were studied from May-July 2009 and May-August 2010. Observations included a total of 68 hours of scan samples at 34 random nests which yielded >11,000 instantaneous records of nest activity. The results from scan samples showed that the attending parent engaged in low-cost activities such as sitting (41%), standing (18%) and preening (10%). Nest maintenance activities (repair, egg-turning) accounted for 7% 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 to 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 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.

0008

Geographic distribution, densities, and other traits of Siberian Cranes breeding in the Ust-Yana district of Northern Yakutia

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The Siberian crane (*Grus leucogeranus*) is the third rarest crane species in the world with a breeding range largely limited to arctic regions in the Republic of Yakutia in northeastern Russia. We surveyed the eastern part of the Ust-Yana District to determine the species' distribution and status within the Khroma River core breeding ground, a buffer area, and lands lying to the west of the known breeding range during 16 July-2 August 2009. Siberian cranes were sighted at 54 locations with 32 cranes occurring outside of the known breeding range near Sellyaskaya Bay on the Laptev Sea, 41 cranes being in the buffer zone, and 69 cranes in the Khroma River core breeding area. Most of the cranes (108 [78%]) occurred in large class VI wetland basins that were part of wetland complexes. Of the 142 cranes seen, 110 (76%) were paired, 21 (15%) were single birds, and 11 (8%) were in groups of 3-5. Higher than expected Siberian crane densities in the buffer area and outside the known breeding area suggest that the Khroma River core breeding area be expanded westward to include the buffer area and lands outside the known breeding area along the lower Syalah and Syuryuktyah rivers. We suggest that consideration be given to designating major parts of the lands surveyed as nature reserve(s) to help ensure long-term protection for habitats important to the Siberian crane, and many other species of migratory water birds for which these lands serve as a key breeding ground.

0010

Waterbird diversity at a man-made stopover wetland in an urban environment

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Arrivals and departures of six Orders of waterbirds at a man-made, urban wetland in Wichita, Kansas, were documented from March-May 2010 and August-October 2010. A total of 96 h of observations at two ponds, 3 m and 2 m deep, were made four times weekly over the course of 12 weeks for both the Spring and Fall migration. A total of 53 different species were documented, which consisted of 22 species of Charadriiformes, 18 species of Anseriformes, 7 species of Ciconiiformes, 3 species of Gruiformes, 2 species of Podicipediformes, and 1 species of Pelicaniformes. The most common species were mallard (*Anas platyrhynchos*), Canada goose (*Branta canadensis maximus*), and killdeer (*Charadrius vociferous*). The order of appearance and abundance in the Spring migration showed that the species of Anseriformes arrived first, followed by the Charadriiformes, and finishing with the Ciconiiformes; the reverse was true for the Fall migration. Species diversity is consistent with larger, natural wetlands along the Mississippi flyway, which suggests the urban, man-made wetland is a suitable habitat for a stopover location.

0011

Assessing the effects of the *Exxon Valdez* oil spill – Initial and subsequent approaches

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On March 24, 1989, the *TV Exxon Valdez* ran aground in northern Prince William Sound, Alaska (Sound), and released 42 million liters of Prudhoe Bay crude oil into the marine environment. Immediate biological studies focused on assessment of spill effects on fish, wildlife, and subsistence resources, within the context of the Natural Resource Damage Assessment process. I studied the initial effects that the spill had on Black Oystercatchers and persistent effects two to five years after the spill. I will discuss the analytical frameworks and methods I used to isolate spill effects on oystercatchers and to gauge recovery of spill-affected populations. With the settlement of \$900 million dollars to natural resource agencies, attention shifted from damage assessment to population restoration and habitat restoration and acquisition. Concurrently, the biological program made a transition from species-specific studies to a more ecosystem approach. These ecosystem projects integrated biological questions across species, disciplines, and cultures to achieve as complete an understanding of the Sound's processes as possible and to determine if effects of the spill persisted, which is still occurring. A combination of the attention caused by the *Exxon Valdez* oil spill, the understanding gained from ecosystem studies, and the development of bird conservation plans, all translated to greater inclusion of bird conservation concerns in land management plans and NGO conservation efforts.

0012

Do stocking programs result in maladapted populations? Mallard bill morphology after 30 years of massive releases

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Every year since the 1970s, several million captive Mallard have been released in Europe for hunting purposes. This may lead to a spread of unnatural phenotypes into the wild. Two widespread and common migratory ducks were studied: Mallard *Anas platyrhynchos* and Teal *A. crecca*. Mallard is the only duck species for which large-scale stocking programs occur in the region, and Teal hence serves as a control. In a « before-after » design, we compared duck bill lamellar density over the last thirty years. Lamellar density in Mallard, but not Teal, decreased. The observed 10 % decrease occurred in the first (proximate) centimetre of the bill, the most crucial in terms of food filtration. We hypothesized the observed change in bill morphology was due to the propagation of captive Mallard into the wild: captive Mallard mainly eat large items, relaxing the natural selection pressure maintaining high lamellar density for sieving small preys in wild ducks.

0014

Cranes and climate change - a fact sheet

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Due to increasing human activities and climate change, wetland habitats are worldwide disappearing, and many water bird species experience serious population declines. The family of cranes mostly depends on wetland habitats and accordingly sensitive to climatic fluctuations. The objective of our project is to gather information on the 15 crane species, and to summarize actual facts and predictions about climate change effects on cranes. Further, conservation implications shall contribute to wetland conservation, using cranes as flagship species. The preliminary results consist of information on four species. For the Eurasian Crane increasing temperatures lead to a northward shifting of wintering grounds and earlier spring arrival dates, but also to a higher risk of drought on the breeding grounds. The Whooping Crane is affected by reduced precipitation and warmer temperatures leading to habitat loss on breeding, stop-over, and wintering sites. In India and Western China, the Sarus and the Black-necked Crane, respectively seem not as much affected by climate change as by intensification of agriculture. In contrast to the high variability of existing climatic scenarios, the effects of global change on cranes might lead to three major trends: Breeding habitat loss is expected for several species due to decreasing spring precipitations. Wetland loss along the flyways might reduce the survival rates of migratory species. Wintering ranges of several species might shift northward due to warmer temperatures. One major conservation implication to prevent wetland loss is an enhanced water management in all crane habitats.

0015

Avian migration in the face of an altered landscape

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With increasing habitat loss and alteration impacting biodiversity and ecosystem function worldwide, there is increased uncertainty in the ability of avian populations to successfully complete annual migration. The wetlands of the Prairie Pothole region act as important stopover and breeding habitat for a variety of migratory bird species, including 37 species of shorebirds, many of which are declining. The decline of mid-continental shorebird populations may be linked to the severe wetland alteration, driven primarily by land use change that has occurred in the region. Although it is known that shorebirds use highly altered wetlands, it is unclear if they are showing preference for wetlands in certain land use types and what selective forces may be driving stopover habitat selection. Additionally, it is unknown if using highly altered wetlands is an adaptive choice that leads to efficient foraging and ultimately successful stopover. From April to July of 2010, we conducted local and landscape surveys for migrating and breeding shorebirds across three counties in north-central South Dakota to identify habitat preference in relation to varying land use types and wetland phenology. Using a combination of behavioral observations and direct habitat assessment we measured the relative success of these habitat decisions based on the availability of food resources. We observed 22 species of shorebirds totaling 8961 individuals. Of these, 13 species and 7273 individuals were classified as en-route migrants. Preliminary analysis indicates migratory shorebirds use flooded soybeans fields in high densities. Future work aims to determine the adaptive consequences of this apparent preference.

0016

Migration ecology of the Aransas-Wood Buffalo Population of Whooping Cranes

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The Aransas-Wood Buffalo Whooping Crane Tracking Project is a collaborative effort between the Platte River Whooping Crane Trust, U.S. Geological Survey, Platte River Recovery Implementation Program, U.S. Fish and Wildlife Service, and Canadian Wildlife Service. Project objectives include identifying and describing migratory pathways, migration chronology, habitat use, and stopover sites used by Whooping Cranes during fall and spring and assessing potential risks to the birds during migration. GPS-Platform Transmitter Terminals deployed are able to acquire 4-5 locations per day for 2+ years; thus, data gathered using this new technology will be useful for informing future recovery efforts. In the initial year of study, we monitored 2 birds during spring 2010 as they migrated to breeding grounds at Wood Buffalo National Park. After successful marking of juveniles in late summer 2010, we monitored 11 birds during fall migration to their wintering grounds along the lower Gulf Coast of Texas. We will discuss preliminary findings.

0017

Changing rainfall patterns versus wetland attrition: What affects large waterbird breeding success more in the Gangetic floodplains, India?

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Waterbird breeding success, especially in cultivated landscapes, is affected by rainfall and agricultural intensification. Extreme rainfall events and agricultural expansion are predicted to occur in north India following global temperature rise. How will these changes affect breeding success of two resident large waterbirds of conservation concern - Black-necked Storks (BNS) and Sarus Cranes (SC)? I explored this question with observations on territorial pairs (BNS=29; SC=253) over eight years between 1999 and 2010 in the eastern Gangetic floodplains. I used Logistic Regression and Generalized Linear Mixed Models to understand factors (wetland extent and attrition in territories, two variables describing rainfall) affecting breeding success (whether or not pairs succeeded in raising chicks), and employed multi-model selection with Akaike's Information Criteria to make inferences. Annually 7-10% of territories of both species suffered wetland attrition and urbanisation permanently displaced 0.7% of SC pairs. Model selection supported the combination of habitat quality and rainfall as affecting breeding success of both species. Ability of pairs to successfully have chicks improved with increasing territory quality and rainfall, but declined with wetland attrition in territories. Increased cultivation, wetland attrition, and extreme rainfall occurred during the study providing insights into future conditions. Predicted future increase in dry years can reduce waterbird breeding success, and wet years can likely buffer this effect. However, while climate change adaptations are deserving of focus, habitat loss due to agricultural intensification deserves far more urgent attention here if large waterbirds are to continue persisting.

0018

Down to the ground: attracting Double-crested Cormorants to nest in deforested areas at Tommy Thompson Park, Lake Ontario, Canada

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Conspecific attraction is known to attract birds to breeding sites or for re-colonization. Although attraction studies exist for colonial waterbirds, few use rigorous experimental design. Loss of tree canopy due to increases in Double-crested Cormorant populations has led to increasing conflicts over protected areas. A large colony in the lower Great Lakes, Tommy Thompson Park (TTP), is one such area. Due to deforestation from nesting cormorants, there was a need to establish a new ground-nesting colony with a ground-nesting colony already existing elsewhere in the park. In 2009 and 2010, we conducted a conspecific attraction experiment on cormorants to understand key features which attract them to nest on the ground, and ultimately to move cormorants within TTP from tree nesting to a ground-nesting site. For the experiment we used a randomized design consisting of plots with different densities of decoys and nesting substrates. While the cormorant visitation rate was higher in year two (2010, 1.10 ± 0.14 visits/hr; 2009, 0.63 ± 0.12 visits/hr; $p=0.01$), nesting was not observed. In both seasons, cormorants were more likely to visit tires than stakes (2009, tires=63%, stakes=37%; 2010, tires=70%, stakes=30%) and plots with low-decoy densities (2009, low density=39%, high density=35%, control=26%; 2010, low density=40%, high density=28%, control=32%). Understanding the proximate factors in which cormorants make decisions about nest sites could assist in situations where culling is not possible, or desirable and provide alternative management solutions.

0019

The evolution of semi-coloniality and the hidden lek hypothesis: Black Terns do not form groups to cheat on their mates

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Several competing hypotheses have been proposed to explain the evolution and maintenance of colonial breeding in birds. A recent hypothesis, the "hidden lek" hypothesis, proposes that birds form breeding aggregations to seek clandestine extra-pair fertilizations from individuals of higher genetic quality than their putative mates. We tested the hidden lek hypothesis with the Black Tern, a wetland-dependent species that nests semi-colonially. Blood samples were collected from ten putative family groups at several colony sites in Wisconsin and were genotyped at four microsatellite loci. We found no mismatched alleles between any of the nestlings and their putative parents. Heterozygosity was high (> 0.85) in two of the four loci, such that detection probability (probability of finding a mismatched allele in the population if it were present) was $>99\%$. These preliminary results suggest that Black Terns are strictly monogamous, both socially and genetically, and that the hidden lek hypothesis is unlikely to explain group formation in this species during the breeding season.

0021

Variety is the spice of life: Double-crested Cormorants obtain prey from multiple lakes

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In Saskatchewan, Canada, new double-crested cormorant (*Phalacrocorax auritus*) colonies have been discovered at the northern limit of their range on and around Lac La Ronge, site of a large fishery that has declined in quality. Aquatic habitat in the area varies, offering breeding cormorants the opportunity to forage for fish on multiple lakes. Cormorants in large colonies on nearby Egg Lake appear to fly long distances (~17km) to forage on Lac La Ronge, raising stakeholder concern regarding the recovery of its fisheries. Determining whether cormorants are a threat to the recovery of Lac La Ronge, requires understanding how much of their prey actually comes from this lake. To track sources of prey, stable carbon and nitrogen isotopes were used as source markers in fish. Regurgitated fish were collected from nestlings on Egg Lake and compared isotopically to sampled fish from potential foraging locations. Cormorant relative density among lakes was also assessed using line transects. Stable isotopes evidence showed that regurgitated fish originated from various lakes in the La Ronge area, demonstrating that cormorants forage at multiple distinct locations. Cormorant counts support stable isotopes data, with the highest density on lakes other than Lac La Ronge. Thus, cormorant biomass removal is spread out over at least several lakes in the La Ronge area, which must be considered in potential management plans.

0023

Landscape use and movements of Sandhill Cranes using the Horicon Marsh (Wisconsin, USA) during fall roosting and migration staging

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The Horicon Marsh in southeastern Wisconsin is the largest cattail marsh in the lower 48 states, providing important habitat for Sandhill Cranes (*Grus canadensis*) during fall roosting and migration staging. Adjacent agricultural fields, small wetlands, and grasslands offer essential food resources. Eighty-six commercial wind turbines have been erected 2 miles north east of the marsh in areas cranes are known to use. We studied crane movements across this landscape in fall 2009 and 2010 to assess the risk of turbine encounters and habitat avoidance associated with wind energy development. Timing of flights to and from the roost were predictable with sunlight, but shifted slightly during inclement weather. Foraging cranes primarily were found in harvested corn and soybean fields, although cranes habitually used certain areas regardless of crop type. Over 70 % of observations were within 2 miles of the refuge boundary. Using portable marine radar we observed that cranes flew lower than 250m, directly to and from the refuge at about 53 km/hour. Flight directions were mostly east-west in 2009 and more variable in 2010. In 2009 fewer fields were available because very wet weather greatly delayed harvest, whereas 2010 harvest was 30% ahead of normal due to dry conditions. Furthermore, the location of the main roost was static in 2009, and in 2010 the main roost moved several hundred meters north after an extreme windstorm during late October 2010. Cranes seem to perceive and avoid turbine rotors, but were rarely found in fields with turbines.

0024

Historical breeding, stopover and wintering distributions of a Whooping Crane family

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Between 1977 and 1988, 134 Whooping Cranes were banded in Canada's Wood Buffalo National Park (WBNP). The historical information collected from four banded cranes that hatched from the same nest, at NY-1 (nesting area Nyarling 1), allowed us to track the history of a multi-generation family of Whooping Cranes. Nine offspring were banded and other seven banded cranes were related to them. Thirty years of historical records showed 59 unbanded individuals exhibiting bonds to the banded family. In total, 79 cranes related to the same unbanded nesting pair, were reported at WBNP, wintering ground in Aransas National Wildlife Refuge (ANWR, Texas), and along the central flyway during migrations. We integrated this information to build a Whooping Crane family tree, which represents all familial relationships among them up to four generations, the number of mates and offspring, years of hatch and death, and other behavioral information. Spatial and temporal information from this family shows the historical distribution and dispersion pattern of winter territories and nesting areas by all descendents of the same family, and site fidelity was shown by males. Nests were established in the Sass River and Klewi nesting areas, and wintering territories were held in Matagorda Island, and San Jose within ANWR. Banded family members tended to use the same stopovers repeatedly along the central flyway, some of which are not now classified as critical habitat. Evidences of potential inbreeding, adoption, and migration as "extended" family units were obtained. Nesting success and failure synchronicity was observed among family members.

0026

Does re-nesting enhance Arctic-breeding Dunlin productivity?

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Lack of information on re-nesting propensity, chick survival, and juvenile survival present the greatest impediments to estimating Arctic shorebird productivity. We evaluate chick survival, while accounting for re-nesting propensity for Arctic-breeding Dunlin (*Calidris alpina arctica*). We monitored a total of 131 chicks by following adult males and their broods using radio telemetry at Barrow, Alaska, during the 2008 and 2009 breeding seasons. We considered chicks fledged if they survived to 15 days of age. Using nest survival models in program MARK, we estimated chick survival and found that rates were most affected by hatch date, chick age, and daily insect abundance. The earlier a chick hatched, the greater the chance it had of surviving to fledging age. The probability that a chick from an initial nest survived to fledge was 56.3%, while the probability for a chick from a replacement nest was only 20.8%. Thus, chicks from re-nesting attempts contributed less than half as much to productivity as chicks from initial nests. However, our estimate of chick survival likely overestimates the probability of a chick from a replacement nest fledging. Although not directly measured, chicks from replacement nests appeared to have slower growth rates and delayed development compared to chicks from initial nests, meaning their fledging period was longer. We discuss the impact of chick survival rates from initial and replacement clutches on estimates of productivity and the subsequent implications for shorebird management.

0028

Evaluation of the genetic management of the endangered Mississippi Sandhill Crane (*Grus canadensis pulla*)

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The minimization of kinship in captive populations can be achieved through the use of pedigree information. Pedigree knowledge alone, however, is not sufficient if pedigree information is missing, questionable, or when the founders of the captive population are related to one another. If this is the case higher levels of inbreeding and lower levels of genetic diversity may be present in the captive population than those calculated by pedigree analyses alone. In this study, we analyzed the genetic status of the critically endangered Mississippi sandhill crane (*Grus canadensis pulla*) using studbook data from the U.S. Fish and Wildlife Service managed captive breeding and release program. In addition to traditional pedigree analyses, we used microsatellite DNA data to provide information on shared founder genotypes, allowing for refined analysis of genetic variation in the population, and providing a new DNA-based studbook pedigree that will assist in the genetic management of the Mississippi sandhill crane population. The genetic variation observed in the Mississippi sandhill crane was then contrasted with the variation observed for Florida sandhill cranes (*Grus canadensis pratensis*). Results show far less variation in the Mississippi population and suggest that while gene flow no longer occurs between the two populations, the introduction of cranes from the Florida population would increase the genetic diversity of the Mississippi sandhill crane population.

0030

Chromic oxide as a fecal marker to identify individual Whooping Cranes

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Our ultimate goal is to understand reproductive patterns, and infertility, in whooping crane pairs through non-invasive hormone monitoring. Our first step to advancing knowledge is the ability to identify the source of each fecal sample in the enclosures of study pairs. The objective of this study was to determine if chromic oxide (Cr_2O_3), a non-digestible compound previously shown to completely pass through the digestive tract, can be used for such identification purposes in the whooping crane. In our first trial, individual cranes were given a smelt containing a capsule filled with 450 mg green (n=5), yellow (n=5), red (n=4), orange (n=3), or black (n=3) Cr_2O_3 . The appearance of Cr_2O_3 color in the feces was visually determined 8 h later, with color intensity judged on a scale of 0 to 3, 3 being highest and 0 having no change. Chromic oxide in green, orange, red, and black (but not yellow) were visible in feces (green=3; red=2.5; black=1.5; orange=1; yellow=0). In a second trial, we assessed the duration for observing Cr_2O_3 post-feeding. Four whooping cranes were housed in indoor pens and fed smelt containing 450mg of green Cr_2O_3 . The marker first appeared on average (\pm SEM) 1.5 \pm 0.2 h after feeding and remained detectable until 27.7 \pm 0.2 h for a total duration of 26.2 \pm 0.2 h. In conclusion, chromic oxide can be used to determine the identity of fecal samples from individual whooping cranes managed in pairs. This finding will advance the study of hormonal monitoring in successful versus non-successful breeding pairs.

0033

Preliminary observations on avian impacts of the BP oil disaster in the Gulf of Mexico

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The largest ever accidental marine release of oil in United States waters--the BP oil disaster--began on 20 April 2010. Over a period of at least three months, more than 4 million barrels of oil were released from a source 5,000 feet under water, about 48 miles offshore. Through mid-December 2010, the U.S. Fish and Wildlife Service had posted summary data on about 8,000 birds recovered dead or alive during cleanup and response activities; these data are not yet final. About 80 percent of avian recoveries are in the orders Charadriiformes and Pelicaniformes. Based on raw numbers, Laughing Gulls and Brown Pelicans were hit hardest by the oil, but Common Loon, Northern Gannet, Clapper Rail, Least Tern, Royal Tern, and Black Skimmer are among other noteworthy victims. Recovery of Clapper Rails, Common Loons, and Greater and Audubon's shearwaters indicate the presence of oil in coastal marshes, nearshore waters, and marine waters, respectively. It is premature to draw conclusions about actual and ultimate impacts on birds from the BP oil disaster because known mortalities must be adjusted upwards and estimated actual mortalities put into context as proportions of Gulf regional populations. Beyond acute mortality and morbidity, various Natural Resources Damage Assessment studies now underway should yield insights about sublethal, indirect and lingering effects, which may play out over a period of several years. A complete assessment is needed to fully understand what happened, as well as to plan for restoration of the Gulf ecosystem.

0035

Habitat use, migratory behaviour, and vital rates of Sandhill Cranes (*Grus canadensis*) on the North Shore of Lake Huron, Ontario

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The Eastern Population (EP) of Sandhill Cranes (*Grus canadensis*) has increased substantially within the last 30 years. In Ontario, numbers have increased from occasional sightings in the early 1980s to nearly 9,000 birds during fall migration in 2009. This rapidly expanding population is now causing agricultural damage but conservation and management is constrained by the fact that little is known about crane habitat use and migratory movements in Ontario. During July and August 2010, cranes ($n = 9$) were captured on Manitoulin Island, Ontario at baited rocket net sites and fitted with solar-powered GPS transmitters. From July to October 2010, age-ratio data were collected and used as an index to fall recruitment (productivity: proportion of juvenile birds). Data from July and August represent southern breeding birds (local) whereas those from September and October represent northern breeding birds (migrant). Lastly, weekly roost surveys were conducted at focal roost sites ($n = 6$) to determine how roost site characteristics contribute to variation in levels of use (i.e., number of birds). Preliminary results suggest that most local marked birds ($n = 6$) departed the study area prior to the peak in fall migration (i.e., local birds departed earlier). Marked birds travelled west along Manitoulin Island and south through central Michigan to wintering grounds in southern Florida. In addition, local birds showed lower productivity (mean \pm SE) than migrants ($n = 889$; 8.8 ± 0.41 , and $n = 4,674$; 15.0 ± 0.66 , respectively). These preliminary data will provide a basis for future management decisions.

0036

Modeling the effect of landscape and environmental factors on Sandhill Crane distribution in the Central Platte River Valley of Nebraska

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Each spring, most of the midcontinent population of sandhill cranes (*Grus canadensis*) stage in the Central Platte River Valley (CPRV) in Nebraska, due to its importance in their annual cycle. The purpose of this study was to model the landscape and environmental factors effecting observed habitat use by cranes. Habitat use models were developed and ranked using Bayesian Information Criteria (BIC) and discriminated using the Receiver Operating Characteristic (ROC) curve. This study suggests cranes show a high preference for alfalfa fields as feeding habitat, but preferences for corn and sorghum fields are similar. Soybean fields were less likely to be used than both corn and sorghum, while winter wheat was the least likely row crop used for feeding. Cranes also showed a low preference for grassland habitats, however, this is likely due to limited grassland availability in the survey area and sampling protocol. The location of these habitats was also an important factor influencing crane use. Habitat use was greatest within bridge segments 2 to 7 and 9, but use decreased as distance from the river increased. Bridge segments 1 and 8 were used similarly, while bridge segments 10 and 11 had the lowest likelihood of use. Overall, it is evident cranes have a higher preference for certain habitats in certain areas. Models developed in this study provide baseline data with a practical use to directly valuate land for cranes within the CPRV, locate areas with the potential to support cranes, and develop management plans for areas currently used.

0037

Implementation of the Whooping Crane Monitoring Protocol along the Platte River, Nebraska

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Assessment Impact Monitoring Environmental Consultants (AIM) was contracted to assist the Governance Committee in implementing specific monitoring associated with the *Platte River Recovery and Implementation Program*. The specific task was to implement the protocols developed by the Technical Advisory Committee entitled *Monitoring Whooping Crane Migrational Habitat Use in the Central Platte River Valley* during the spring and fall migrations. AIM conducted 14 of the 19 (74%) migration surveys from 2001 through 2010. The goals were:

- 1) detect Whooping Crane stopovers in the Platte River valley,
- 2) document movements, habitat use, and activities of Whooping Crane, and
- 3) measure physical characteristics of use sites.

This paper presents the results of this on-going effort.

0038

Intestinal parasite assemblages of the Double-Crested Cormorant: A comparison of three lake colonies in Minnesota USA

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The Double-crested cormorant, *Phalacrocorax auritus* is a prolific species that is lethally managed in the United States. High population densities of birds within closed lake systems are suggested to encourage increased transmission of infectious agents such as parasites. Furthermore, transmission of diseases over migratory ranges is possible. On the contrary, the stress of long-distance migration could allow for cormorants to rid themselves of parasites, particularly species that infect the digestive tract. Here, we compare assemblages of intestinal parasite in cormorants collected from three breeding colonies in Minnesota. All birds were sampled immediately after arriving to the breeding grounds following spring migration with the exception of birds from Leech Lake, where birds were collected in spring were and also collected in late fall prior to colony dispersal. The fish communities in the lakes sampled are thought to be significantly different (mostly associated with lake morphology and anthropogenic influences), but parasite species composition was similar among lakes. These findings agree with the suggestion that many parasites are removed from the gastrointestinal system during migration. Dissimilar parasite diversity was found between seasons from the Leech Lake colony. The mechanism behind the increased seasonal parasitism within-site may be associated with 1) increased ability to remove parasites during migration, 2) decreased immune function post-migration, and/or 3) a result of increased parasite abundance specific to cormorants in the lakes from the breeding range when compared to wintering locations.

0039

Perfluorinated compound concentrations in Great Blue Heron eggs from a colony near St. Paul, Minnesota USA decrease between 1993 and 2010.

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Perfluorinated compounds have been manufactured for over 50 years and are currently used throughout industry as stain and water repellants, in floor waxes, as coating on paper food containers, as firefighting foams, flame retardants, denture cleaners, carpet spot cleaners, pharmaceuticals, and as pesticides. A Great Blue Heron (*Ardea herodias*) colony at Pig's Eye Island near St. Paul, Minnesota is located near a facility that produces PFCs. PFC concentrations in Great Blue Heron eggs collected in 1993 from Pig's Eye were among the highest reported in bird eggs (geometric mean = 1,015 ng/g wet weight; maximum = 2,031 ng/g wet weight). After PFCs were detected in human populations and wildlife, selected PFC compounds were phased out of production starting in 2000. Great Blue Heron eggs were collected again at the Pig's Eye colony in 2010. Total PFC concentrations in 2010 decreased by more than 65% since the 1993 collection (geometric mean = 340 ng/g wet weight; maximum = 813 ng/g wet weight). Concentrations of the major PFC compounds decreased between 1993 and 2010, however, concentrations of several of the minor PFC compounds increased. PFC egg concentration data from reference Great Blue Heron colonies in both 1993 and 2010 are also presented.

0040

Migratory pathways and migration chronology of Canada Geese wintering at the Santee National Wildlife Refuge

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A study using satellite telemetry was conducted to determine the migratory pathways, migration chronology, and breeding ground affiliation of the cohort of Canada geese (*Branta canadensis interior*) that winter in and adjacent to the Santee National Wildlife Refuge in Summerton, South Carolina. Transmitters (PTT) were fitted to eight geese on wintering grounds at Santee NWR during the winter of 2009-2010. Geese departed Santee NWR between 5 and 7 March 2010 and arrived on the Atlantic Population (AP) breeding grounds on the eastern shore of the Hudson Bay by either 24 May 2010 or 9 June 2010 via two migration routes. Six PTT-marked geese followed an eastern route, stopping in northeastern North Carolina and western New York, with three of those birds completing a spring migration to AP breeding grounds. Geese following the eastern route had a mean distance between stopover sites of 417.3±76.0 km, and a mean total migration distance of 2837.9±345.6 km. Two geese followed a more western route, stopping in northeastern Ohio after departing Santee NWR. Bird F11 had a mean distance between stopover sites of 402.0 km and a total migration distance of 4020.4 km, while bird F12 had a mean distance between stopover sites of 365.1 km and a total migration distance of 3650.5 km. Information on flyway-scale movements and migration stopovers used by geese is beneficial to the understanding of migratory habitats, and better informs the timing of sport harvest seasons of Atlantic flyway goose populations.

0041

Variety is not the spice of life for cormorants in Saskatchewan: Foraging ecology and niche overlap with sport fish

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Double-crested cormorants (*Phalacrocorax carbo*) are one of several cormorant species worldwide that have generated concerns regarding conflict with humans over fisheries. Cormorants are touted to be generalist predators that consume a wide variety of fish species. Their diet may overlap with that of predatory sport fish, raising concern about indirect impacts on predatory fish populations through competition with cormorants. However, there is little information available on dietary overlap, and competition, between cormorant and predatory fish. We examined cormorant foraging ecology with respect to variation in diet and overlap with sport fish at Dore Lake, Saskatchewan, Canada. Using stable carbon and nitrogen isotopes analyses of muscle and liver, we compared the diet of individuals at two time periods during the breeding season. We determined that the diet of individuals during the breeding season is fairly consistent. However, among individuals both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ranged approximately 4‰, suggesting that cormorant diet varies widely among individuals. Variations in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values were not associated with sex. Cormorant diet, inferred from stable isotopes values, potentially overlapped with that of walleye (*Sander vitreus vitreus*), but cormorants tended to have a higher trophic position. Cormorant stable isotope values did not overlap with those of northern pike (*Esox lucius*), suggesting that cormorants and pike are foraging in different habitats and at different trophic positions. Our data suggest that individual cormorants may not vary their diet, but as a population cormorant foraging strategies may vary within lakes, and that potential competition is limited to pelagic sport fish.

0042

Reddish Egret foraging behavior and habitat characterization in the Laguna Madre of Texas

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The Reddish Egret (*Egretta rufescens*) is the rarest species of heron in North America and relies strictly on coastal habitat. The majority of the North American breeding population occurs along the Texas Coast with greatest concentrations occurring in the Laguna Madre of Texas. Successful management of Reddish Egrets depends on having a clear understanding of habitat requirements. Our research objectives were to delineate foraging habitat based on water depth and substrate characteristics and to evaluate the relationship between foraging tactics employed and environmental conditions. We recorded 20-min foraging bouts by 386 Reddish Egrets (198 dark morphs and 188 white morphs) and assessed the types and success of foraging tactics used. We measured water depth, seagrass coverage, ambient light, and wind speed at each foraging site. Water depth at foraging locations ranged from 2.54 to 30.58 cm (mean = 11.68 cm) with no difference between color morphs. The average percent seagrass coverage was 13% with no difference between color morphs; most birds foraged in areas with <10% coverage. We identified eight foraging behaviors and modeled foraging behavior in relation to environmental variables using canonical correlation analysis for 177 individuals. Low redundancy values (< 0.18) indicate that the four habitat variates created were not effective in explaining variation in foraging behavior suggesting other variables, such as prey density, may be better predictors of foraging behavior.

0043

Seasonal survival of Western Gulf Coast Mottled Ducks

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Diminishing habitat combined with a long-term population decline in Texas has caused alarm regarding the status of the Mottled Duck. Despite being a non-migratory game bird, little information is available on seasonal survival of Mottled Ducks along the Western Gulf Coast (WGC). Knowledge of seasonal survival is vital to identifying critical time period within the annual cycle which may constrain population growth. During the summers of 2007-2009, we captured and radio-marked 571 female Mottled Ducks at multiple sites throughout the Gulf Coast region of Texas and Louisiana. Radio-marked individuals were monitored weekly via ground or aerial telemetry to estimate survival. We assessed seasonal survival during 4 different time periods within the annual cycle: post-breeding, hunting, breeding, and late winter. Preliminary estimates of annual survival were similar for all 3 years; 2007-08 (0.43 ± 0.09), 2008-09 (0.49 ± 0.06), and 2009-10 (0.47 ± 0.06). Lowest survival occurred during the hunting (0.75 ± 0.02) and breeding periods (0.74 ± 0.04) and was higher than expected during the post-breeding (molting) period (0.91 ± 0.01). Identification of critical time periods will assist in prioritizing conservation strategies aimed at enhancing Mottled Duck habitat and population status.

0044

Habitat characteristics affecting nest hatching success, brood territory establishment, and foraging site selection of Wilson's Plovers (*Charadrius wilsonia*) in southeastern North Carolina

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Little information is available on Wilson's Plover habitat ecology to guide management actions for this species of concern in the southeastern United States. We examined habitat characteristics affecting Wilson's Plover nest hatching success, brood territory establishment, and foraging site selection at Onslow Beach, North Carolina, 2008-2009. We measured habitat characteristics at the nest site to determine features influencing nest success. Fiddler crabs (*Uca* spp.) are a primary component of Wilson's Plover diets so we sampled prey abundance, vegetation attributes, and area of fiddler crab mudflats to assess which variables influenced foraging territory establishment on fiddler flats. We sampled these same characteristics at focal bird foraging locations in all habitats in which foraging birds were observed (e.g. fiddler flats, interdune sand flats, beach front) and compared these data to paired, non-used sites within the same habitat type. A greater percentage of nests placed in clumped grasses or mixed vegetation (80%) were successful than those placed in low-growing sparse vegetation or open sand (41%; $\chi^2_1 = 6.66$, $P = 0.01$, $n = 42$). Area of a given fiddler flat was the most important factor ($R_i = 0.97$) influencing brood territory establishment, with larger flats having a greater probability of territory establishment. Close proximity to water ($R_i = 0.79$) and vegetation ($R_i = 0.77$) were important factors in where broods chose to forage in all habitats. Managers should maintain a complex of sparsely vegetated interdune sand flats for nesting birds with adjacent accessible beach front and large fiddler flats for Wilson's Plovers broods.

0045

Sandhill Cranes breeding in New England: An update

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Sandhill Cranes (*Grus canadensis*) breeding in New England have slowly increased in abundance and distribution since the first documented nesting in Maine in 2000. At least 6 territorial or nesting pairs were present at 6 sites in Maine in 2010, and single pairs nested in 2009 and 2010 at single sites in Massachusetts and Vermont where nesting has occurred since at least 2007. Of 23 nests observed in 9 wetlands in Maine, Massachusetts, and Vermont between 2001 and 2010, 6 were in lakeside marshes, 5 were in riverine marshes, 8 were in lakeside fens or bogs, and 4 were in beaver-impounded palustrine marshes. Dominant vegetation within 5 m of nests was either cattail (*Typha* spp.), or varying proportions of sedges (*Carex* spp.), leatherleaf (*Chamaedaphne calyculata*), sweetgale (*Myrica gale*), and sphagnum. Wetlands used for nesting ranged in area from 2 to 200 ha. Measures of pH within 50 m of nests ranged from 4.8 to 9.7. At least 22 of 29 (76%) nest attempts between 2000 and 2010 hatched 1 or 2 eggs. In at least 14 instances, chicks survived to at least 8 weeks of age, including 5, 2-chick broods. Chick survival was higher for pairs nesting and raising chicks on large, open wetlands along edges of lakes and rivers than for pairs at smaller palustrine wetlands. Reports of Sandhill Cranes in all 6 New England states have increased in frequency over the past 2 decades. Observed patterns of habitat use suggest that New England can support a large and widely distributed breeding population of Sandhill Cranes.

0048

Estimating adult breeding dispersal/fidelity at different geographic scales to evaluate restoration efforts for Roseate Terns

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Prior estimates of adult dispersal/fidelity rates of the endangered Northwest Atlantic Ocean metapopulation of Roseate Terns (*Sterna dougallii*) were derived from mark-recapture/resighting data from four sites 45-250 (mostly >100) km apart that supported the largest breeding colonies in the 1980s-1990s. Restoration efforts since then have established two more sites within Buzzards Bay, Massachusetts (BBMA), but local populations also have declined at two of the initial study sites. We update previous work to show how analyses of adult movement rates designed to test several hypotheses at different geographic scales can aid in evaluating the success of restoration efforts. Nocturnal predation of eggs/chicks from 1996-2005 at a colony site in Connecticut was associated with a decrease in local apparent survival due mainly to increased breeding dispersal to a large colony in New York. Hazing adults (to prevent them from becoming oiled during oilspill clean-up procedures) at one BBMA site in 2003 resulted in the colonization of a third BBMA site. While intercolony movement rates treating the BBMA sites as a single unit are similar to rates estimated previously, higher within-BBMA movement rates suggest that successful restoration at the third site is still an ongoing process.

0049

Population genetic structure of the Eastern Flyway Population of Sandhill Cranes

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The Eastern Flyway Population (EFP) of sandhill cranes suffered a demographic bottleneck in the 1930's. Currently, this population is growing both in population number and geographic range through diffusion from local concentrations that survived the population bottleneck. To determine how these concentrations were historically connected as well as potential source populations for re-colonized areas, we employed Amplified Fragment Length Polymorphisms (AFLP) to determine population genetic structure. DNA samples were collected from nine areas throughout the range of the EFP. These samples were compared to DNA collected from the Mid-Continent Population (MCP), Central Valley Population (CVP), Pacific Flyway Population (PFP), and non-migratory Florida Population. Within the EFP, there was definite hierarchical structure (average pairwise $F_{st} = 0.1795$). Rather than following an isolation-by-distance model, the concentrations were structured based on latitudinal similarity. Concentrations in Southern Michigan were clustered together and most similar to a cluster formed by concentrations in South-Central Wisconsin and Northern Illinois. Concentrations in Northwest Wisconsin, Michigan's Upper Peninsula, and Southeastern Ontario were also clustered together. Concentrations in Central Wisconsin and Eastern Minnesota were outliers, but still within the overall cluster of the EFP. The EFP cluster was most closely related the MCP and the CVP and PFP formed their own cluster and Florida constituted an outgroup. This latitudinal stratification is interesting considering the belief that Lake Michigan and dense forests in Northern Wisconsin serves as barriers to gene flow. Understanding population genetic structure and interactions between these concentrations can be useful in directing management scenarios for the EFP.

0050

Movements and habitat use of the brolga, *Grus rubicunda*, in south west Victoria, Australia

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The south-western Victorian region of Australia supports a threatened population of the brolga, *Grus rubicunda*. The species is under threat from loss of habitat, poor breeding success and recruitment due to predation and collision with fences and powerlines. A new potential threat has recently emerged due to the proliferation of wind farm developments within the brolga's key habitats. The species is considered to be at risk of collision with wind farm infrastructure. Disturbance and displacement from key habitats may also negatively affect the species. Lack of information on the brolgas' movements makes it difficult to assess the potential impact of wind farms on this population and to develop appropriate management strategies and mitigation measures. This study investigates movements of brolgas to define their spatial requirements, habitat use and movement corridors. Brolgas were captured and fitted with GPS satellite transmitters and colour bands. GPS transmitters were programmed to log the location of the bird four times a day. Preliminary results indicate that brolgas utilise an area of up to 5-6 kilometres at non-breeding sites and 2 kilometres at breeding sites, and that they utilise similar flight paths between non-breeding and breeding areas. The outcomes of this study will be used to design turbine free buffer zones around key breeding and non-breeding areas, thus aiding in wind farm planning to avoid long term population impacts.

0051

Aerial census of brolga, *Grus rubicunda*, nest sites in south west Victoria, Australia

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The south-western Victorian region of Australia supports a threatened population of the brolga, *Grus rubicunda*. The species has suffered from loss of breeding habitat, predation of eggs and chicks and poor breeding success. Little is known about current breeding density and key breeding areas within Victoria. Nest sites of brolgas in south-western Victoria are widely distributed, with majority occurring on private land. The sites are often difficult to access, survey and monitor using ground based survey methods. Aerial surveys were used to locate brolga nest sites for the first time in 2010 as part of a wind farm assessment. The current study employed and refined the methodology used in the wind farm assessment to locate and establish the density of brolga nests in four areas of south-west Victoria. Historical data was used to select survey areas with highest density of previous nesting records. Three blocks of 400km² were surveyed in 2010 and 2011, flying transects at 500 meters apart, at 500 feet high and with a flight speed of 60-70 knots. The results indicate that breeding density differs between survey areas and survey years. Some areas in south-west Victoria also appear to have higher density of nest sites overall than other areas, a result that was consistent over the two survey years, and that will aid in managing and protecting key breeding areas.

0053

Health management for reintroduced Whooping Cranes in Wisconsin 2005-2010: Direct autumn release

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Between 2005 and 2010, 63 (27 male, 36 female) costume-reared whooping cranes were assigned to the Direct Autumn Release project of the Whooping Crane Eastern Partnership for intended release in October of their hatch year. Regular preventive health screening and pre-release evaluations were used to maximize survival and fitness prior to release, and to minimize transfer of potential disease agents to native habitats. A total of 44 clinically normal birds were released at the Necedah NWR in central Wisconsin following extensive hematological, blood biochemical, toxicological, serological, parasitological, and microbiological evaluation. Instances of morbidity during captivity were categorized by primary body system affected (in descending order of occurrence): musculoskeletal, respiratory, systemic, integumentary, gastrointestinal, oral, and ocular. Musculoskeletal abnormalities included linear limb rotation, angular limb deformity, carpometacarpal rotation (angel wing), muscle rupture, and fracture. Five birds were removed from the project prior to scheduled release, all for musculoskeletal abnormalities that prevented normal function. Fourteen birds died or were euthanized prior to release; pre-release mortality was attributed to developmental abnormality, predation, trauma or infectious disease. Cases of infectious disease were dominated by chronic respiratory aspergillosis ($n = 7$). Post-release mortality was caused by predation and trauma; no evidence of infectious disease of captive origin was detected. The data collected from this project have helped produce a picture of captive whooping crane flock health, provided hematological and biochemical reference ranges, elucidated the main causes of project morbidity and mortality, and should aid in evaluating management factors impacting pre- and post-release success.

0054

Monitoring waterbird foraging behavior in an urban estuary: A stable isotope approach

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Stable isotope analysis is a valuable tool in the study of diet and foraging ecology of birds. Isotopic signatures observed in feathers reflect a bird's diet and foraging habitat at the time of feather formation. We used isotopic signatures of carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) to monitor diet, relative trophic position, and foraging habitat of waterbirds nesting in New York Harbor. From 2007 to 2010 we collected feathers from nestlings at four islands colonies within the Greater NY Harbor. We measured $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ in feathers from six of the harbor's most numerically abundant waterbird species, including three wading birds: Black-crowned Night-Heron, Great Egret, and Glossy Ibis; and three seabirds: Double-crested Cormorant, Great Black-backed Gull, and Herring Gull. We found significant inter- and intraspecific differences in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$. For example, five species nesting on Hoffman Island in the lower NY Harbor differed significantly in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ ($p < 0.0001$) suggesting differences in foraging habitat, variability of prey selection, and trophic position of the prey. Also, significant variation was observed within species over time ($p < 0.0001$) and among nesting colonies ($p < 0.0001$). We conclude that stable isotope analysis of feathers is a powerful and non-invasive tool for studying foraging ecology of waterbirds in urban systems. Combining results from this study with foraging behavior observations and diet studies will improve our understanding of the foraging landscape used by waterbird species in the harbor, and will help guide resource managers in protecting important foraging habitat and prey base for these charismatic flagship species.

0055

Factors affecting colony-site occupancy and detection probability of Black Terns: How reliable are point-count surveys?

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We surveyed 298 wetlands in Wisconsin in 2010 to document the distribution of Black Terns (*Chlidonias niger*) throughout the state and to determine factors that influence site occupancy and detection probability. Five-minute point counts were conducted by 2-4 independent observers at each wetland site from 26 May to 25 June. Black Terns were recorded at 67 (22%) of the wetlands surveyed, and nesting was confirmed or suspected at 29 of these sites. Our model selection analysis indicated that detection probability during a single visit was constant among observers ($p = 0.79$). Detection probability increased to 0.95 with two independent observers and was nearly 1.0 with four. The relative abundance of birds at occupied sites had a strong and positive influence on detection probability. Main factors influencing site occupancy were percent of the wetland covered by emergent vegetation (quadratic effect), and whether the site was occupied the previous year (positive effect). However, previous site occupancy was important only in association with the vegetation cover variable. Wetland type, wetland area, and human use of wetlands were relatively unimportant predictors of site occupancy. Our findings indicate that a multiple-observer approach is the most reliable way to estimate site occupancy by Black Terns and suggest that vegetation structure is an important determinant of inter-annual site fidelity.

0056

Winter ranges and movements of American White Pelicans captured in the southeastern United States

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Little information exists on winter ranges and movements of American White Pelicans (*Pelecanus erythrorhynchos*) east of the Rocky Mountains. In 2002, we initiated a long term study to describe pelican movements by attaching solar powered GPS/Satellite transmitters to birds captured near aquaculture facilities in the southeastern United States. Transmitters were attached to 46 pelicans captured in Alabama, Arkansas, Louisiana, and Mississippi. Data from these pelicans are being analyzed to determine home range use and seasonal movement patterns. Comparisons will be made between years, gender, and winter home range size. Preliminary results of these analyses will be presented and discussed. Information from this study will be used to develop conservation and management strategies for the American White Pelican.

0058

Breeding status of Double-crested Cormorants in the southeastern United States

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In the 20th century, the interior population of Double-crested Cormorants (*Phalacrocorax auritus*, DCCO) declined throughout their range due to persecution and the effects of pesticides. In response to pesticide bans and extensive conservation efforts, cormorant populations have shown remarkable increases, especially those breeding in the Great Lakes States and Provinces. In fact, the Interior cormorant population numbered greater than 220,000 pairs in the mid-1990's. Concurrent with the resurgence of Double-crested Cormorants in the mid-western United States and Canada, small colonies of cormorants in the southeastern United States have become more common. An increase in such colonies has been noted in Mississippi since 1998. Recognizing the importance of determining the breeding status of cormorants in the southeast, the USDA/APHIS/Wildlife Services National Wildlife Research Center (NWRC) Mississippi Field Station assisted by Wildlife Services Operations (WS) staff, and biologists at the USFWS Office of Migratory Bird Management proposed the enumeration of cormorant nesting colonies in the southeastern United States. Data were gathered and analyzed from surveys of cormorants breeding in 11 southeastern states. Total numbers of cormorant nests in southeastern states more than doubled from 2006 (847 nests) to 2010 (1869 nests). Detailed survey results and management implications are discussed.

0061

Colonization and abandonment of Missouri River sandbars by breeding Piping Plovers

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For early successional species like the Piping Plover, colonization and abandonment of habitat patches determine their distribution in space and time. The natural rate of patch creation has slowed, causing piping plovers to decline on the Missouri River. The U.S. Army Corps of Engineers is creating sandbars in an effort to mitigate habitat loss. To determine the rate and timing of colonization of new patches, sandbars were surveyed for nesting activity and use by banded individuals during the 2008 and 2009 breeding seasons. The likelihood of a bird moving from one sandbar to another between seasons was found to be a function of sex ($\beta = -0.53$, UCI = -1.046 to -0.008) and the sandbar population ($\beta = -0.02$, UCI = -0.045 to -0.0003). Females were more likely to disperse than males and birds were less likely to leave sandbars with higher populations than those with lower plover populations. Once a bird moved, area and population of the new sandbars were the only factors to significantly affect the probability of colonization (Area: $\beta = 0.23$, UCI = 0.113 to 0.341, Pop: $\beta = 0.11$, UCI = 0.027 to 0.187). Birds that moved were more likely to colonize new sandbars that were larger and contained more birds than to colonize smaller sandbars with fewer birds. In order to effectively manage the piping plover population for recovery, it is important to understand what is driving the colonization and abandonment of habitat patches, both at a small-scale, like that of our study, and at the larger scale of northern Great Plains.

0062

Movements and home range size of Greater and Lesser Sandhill Cranes wintering in Central California

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We assessed landscape use of Sandhill Cranes (*Grus canadensis*) wintering in the Sacramento-San Joaquin Delta region of California and compare movement patterns of sympatric Greater (*G. c. tabida*) and Lesser Sandhill Cranes (*G. c. canadensis*). State-Threatened greater showed stronger fidelity to wintering sites and moved between discrete wintering areas less frequently as 8% of the greater used more than one wintering region compared to 43% of the lessers. Average flight movements (commuting distance) between night roost sites and feeding areas were about half the distance for Greater Sandhill Cranes (2.1 km) compared to Lesser Sandhill Cranes (5.0 km) and winter home ranges were nearly one ninth the size (2.2 km²). These results have application for conservation of wintering cranes at a landscape scale and we recommend that habitat protection and restoration for the Threatened greater subspecies be prioritized for areas within 2 km of existing traditional roost sites to ensure a high probability of use. In addition, providing new roost sites towards the edge of the current range of Greater Sandhill Cranes will allow them access to additional agricultural fields and possibly increase the carrying capacity of their winter range. Conservation of habitat for lessers could take a broader landscape approach, with a focus on sites within 5 km of roost sites.

0064

Nest-site selection relative to landscape features by Wilson's Plovers at Cape Lookout National Seashore, North Carolina

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There have been few studies of Wilson's Plover (*Charadrius wilsonia*) habitat selection. We studied nest-site selection by Wilson's Plovers at Cape Lookout National Seashore. We used ground transects and aerial photography to delineate potentially suitable nesting habitat. Habitat with < 75% vegetative cover was considered potentially suitable; ponds, the intertidal zone, and dense vegetation were considered unsuitable. We classified potentially suitable habitat into 6 types: front beach, bare flat, salicornia flat, dunes, dunelets and high marsh. We recorded habitat type for 36 nests found in 2010, and measured the distance from each nest to 6 landscape features: front beach, wrack line, continuous dunes, dense continuous vegetation and water. We generated 50 random points within potentially suitable habitat and measured distance from these points to the same set of landscape features. We used logistic regression to model the probability a site was used for nesting as a function of distance from landscape features. We used AIC to select the top models from a set of a priori models. Nests were more likely to be placed near dense vegetation and dunes than in other areas. Nests placed near dunes may be less vulnerable to flooding, and access to vegetative cover may increase chick survival immediately after hatching.

0065

Use of the Sacramento-San Joaquin Delta region of California by wintering Greater and Lesser Sandhill Cranes

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The Sacramento-San Joaquin Delta (Delta) region of California provides important habitat for wintering Greater (*Grus canadensis tabida*; CA State listed as threatened) and Lesser (*G. c. canadensis*) Sandhill Cranes, but basic information about species ecology needed to design a sound conservation strategy in the Delta is lacking. During the winters of 2007-08 and 2008-09 we conducted roost counts, roadside surveys, and tracked radio-marked birds to document migration chronology, estimate population size, and define the geographic area used by Sandhill Cranes in the Delta. Cranes first arrived on 6 September, most arrived in mid-October, and the last radioed crane arrived on 10 December. Departure dates ranged from 15 January to 13 March. From mid December through early February in 2007-2008, the population fluctuated between 20,000 and 27,000, with Greater Sandhill Crane population size ranging from 2,100 to 6,800 birds. Population size at our five roosts varied with date as cranes responded to changes in water conditions and food. We located 87 known and potential roost sites and found birds over an area that covered approximately 1,275 km². Roost site availability may affect crane distribution and habitat use. Results indicate that the timing and duration of roost site flooding are important conservation considerations. In each Delta landscape both early (early September) and late (through mid-March) roost site flood regimes would enhance Sandhill Crane habitat use. Our estimate of Greater Sandhill Cranes in the Delta region represents approximately one-third of the Central Valley Population and provides managers with their relative distribution during winter.

0066

Nest success of beach-nesting birds in Cape Romain National Wildlife Refuge, South Carolina, USA

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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 have been declining in this region. Least Terns (*Sterna antillarum*) and Black Skimmers (*Rynchops niger*) both nest within CRNWR and appear to be experiencing declines in nesting numbers. The purpose of this study is to identify variables which influence nest success of Least Terns and Black Skimmers. Variables considered include: location, year, colony size, initiation date, nest stage, nesting period, and clutch. 263 Least Tern and 360 Black Skimmer nests were monitored across four sites over the two year study. Nests were visited every 2-7 days until nest fate was determined. Infrared time-lapse video cameras were installed at several colonies to monitor and document disturbance events. Mayfield daily survival estimates averaged 0.65 and 0.97 for Least Terns and Black Skimmers, respectively. Further survival analysis will include the use of Mayfield logistic regression which allows for the inclusion of explanatory variables into a logistic-regression framework. Video cameras documented American Mink (*Neovison vison*) and Black Vulture (*Coragyps atratus*) entering colonies and consuming Least Tern and Black Skimmer eggs. Great Horned Owl (*Bubo virginianus*) and human were also documented entering and disturbing colonies. Preliminary results identify over-wash and predation as the two principle factors contributing to nest loss of both species.

0069

Photoperiod and nesting phenology of Whooping Cranes at two captive facilities

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Increasing daylight is known to be a breeding stimulus in many avian species breeding in northern latitudes. This is thought to be true for cranes that breed in such latitudes including the Whooping Crane (*Grus americana*). For this reason, the captive breeding centers use artificial light to lengthen daylight hours, but no study has been done to look at the effect of such lighting on the reproductive season. We examined the past light cycles and breeding season results from Whooping Crane pairs at USGS Patuxent Wildlife Research Center and the International Crane Foundation. At Patuxent two lights were used to produce light of 170 lux in the pens. On average, photoperiod lights were turned on Feb. 17 (range Feb. 11-24). With two lights per pen, whooping cranes laid their first egg on average 10 days earlier than when one light was used and 16 days earlier than when no lights were used. At ICF the difference between lights on a pen and no lights was only 8 days difference in first lay dates, but still this was statistically significant.

0070

Potential effects of climate change on the distribution of wetland-associated birds in the Prairie Pothole Region, U.S.A.

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Freshwater wetlands and wetland-associated birds are considered at particularly high risk for negative climate change effects. The Prairie Pothole Region (PPR) of the north-central U.S. and south-central Canada contains millions of small prairie wetlands that provide critical habitat to many migrating and breeding wetland-associated birds. To look at the potential effects of climate change on these birds we predicted current and future distributions of species common in the Prairie Pothole Region (PPR) using bioclimatic species distribution models (SDMs). We created fine-scale SDMs for the U.S. PPR using breeding bird survey occurrence records for 1971-2000 and wetland, upland, and climate parameters. For each species we predicted current distribution based on climate records for 1981-2000 and projected future distributions to four future climate scenarios for 2081-2100. Range reductions were predicted for all species across scenarios. However, individual species projections varied widely and range reductions were as high as 99%. We also projected future distribution to an artificial landscape where wetlands were numerous and constant to control for patterns of wetland loss in the region. Models indicated that many waterbird species would shift to the northeastern portion of the region if wetlands were available. The results of this study emphasize the need to plan and prepare in an effort to mitigate against species habitat loss under climate change.

0071

Genetic variation and population structure of Black Terns in Europe

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Concern over widespread and significant declines in populations of Black Terns (*Chlidonias niger*) during the last century has inspired efforts to understand the cause and consequence of these declines. In order to fully understand population dynamics and make appropriate conservation decisions in this species, it is important to define genetically unique populations and describe their relative genetic diversity. We used eight microsatellite markers to describe genetic variability and define population structure among four locations in Europe. We also use these parameters to make preliminary comparisons between the European and North American subspecies (*niger* and *surinamensis* respectively). This study includes 69 individuals from four breeding sites in Europe: France, The Netherlands, Latvia, and Ukraine. The mean number of alleles per locus ranged from 2.6 (France) to 8.1 (Ukraine) and mean heterozygosity ranged from 0.42 (Ukraine) to 0.55 (Netherlands). Significant ($P < 0.05$) differentiation was clear between all population pairs within Europe: F_{ST} values ranged from 0.03 to 0.14. Comparison of European *niger* to the North American *surinamensis* (37 individuals from two locations) returns a highly significant difference (mean F_{ST} 0.15, $P < 0.001$). This study reports that European populations have retained genetic variation despite population declines and supports banding records indicating that there are several genetically distinct populations in Europe.

0072

Patterns and timing of movements by Least Terns on the Missouri River

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Least Tern (*Sternula antillarum*) foraging habitats are typically aquatic but nesting habitats are terrestrial. During the breeding season, Least Terns regularly move between each habitat type. Although some assessments of prey delivered to colonies have been reported, the importance of duration, distance, and frequency of trips away from colonies is unknown. As Least Terns generally deliver a single item of food to an offspring per trip, a greater frequency and timing of these adult movements away from colony may enhance energetic costs for adults and chicks if adults travel greater distances in search of food. As part of a study on Least Tern reproductive ecology on the Missouri River in South Dakota and Nebraska, we used radio telemetry to document bird presence at nesting colony and movements using remote automated radio telemetry receivers. We attached radio transmitters to nesting adults late in incubation in each year (2006:44; 2007:73; 2008:77) and monitored their movements through fledging and life of the transmitter. Telemetry stations documented bird movement throughout the study area, with evidence of increasing travel distance from the colony during chick rearing into fledging. Telemetry data also documented circadian patterns in activity with greater levels of movement away from colonies from dusk through dawn than during daylight hours. These results suggest common assumptions on species movement and foraging habits may need to be revisited, as their evaluation in the context of management actions are contingent on a solid understanding of basic natural history and ecology.

0073

Protocol and results from the first season of captive rearing Whooping Cranes for a non-migratory release in Louisiana

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During the spring, summer and fall of 2010 we successfully reared 11 Whooping Cranes (*Grus americana*) for a non-migratory release at White Marsh Lake, Louisiana, USA. The last wild whooping crane from the flock that once existed in this habitat was captured in 1951 and brought into captivity, only 60 years ago. The area, once in private corporate hands, is now owned and managed by the Louisiana Department of Wildlife and Fisheries. That organization, along with Louisiana State University, and the USGS Louisiana Cooperative Fish and Wildlife Unit are our partners in this venture. Plans were formulated in 2007 at a meeting in Lafayette, Louisiana, to initiate releases in this area. To begin the releases in the winter of 2011, USGS Patuxent Wildlife Research Center hatched 12 Whooping Crane Chicks in May and June 2010. All chicks were hand reared by caregivers wearing complete white costumes and black boots, similar to techniques used to rear Mississippi Sandhill Cranes (*Grus canadensis pulla*) and Whooping Cranes for both the Florida non-migratory releases and the Whooping Crane Eastern Partnership releases in Wisconsin. Modifications have been made in the earlier rearing protocols and medical care program, and these will be discussed. In addition, extensive behavioral observations were made starting in June and continuing through November 2010 on this group of cranes and summaries will be presented. By the time of the conference the cranes will be in Louisiana and released to the wild.

0074

Microbial water-quality effects of migratory birds in the Platte River, Nebraska 2009-2010

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The U.S. Geological Survey has collected information to investigate microbial water-quality effects of migratory birds in the Platte River during spring bird migration in central Nebraska within a study reach between Grand Island and Overton. The focus of the study was to make comparisons between fecal indicator bacteria (related to crane and waterfowl use of the river) and pathogen concentrations. The study area that is within the Critical Habitat reach of the Platte River is a bottleneck portion of the Central Flyway utilized by cranes and several types of waterfowl. During the height of the migration season, hundreds of thousands of cranes and other waterfowl roost in the river in central Nebraska. Understanding the effects of varying flow conditions on water quality during these migrations is important to aiding managers and researchers of the Central Platte flyway. Samples were collected weekly in the study reach from three sites (upstream, middle, and downstream) during the springs of 2009 and 2010. The samples were analyzed for avian influenza, *E. coli*, *Cryptosporidium*, *Giardia*, *Campylobacter*, and *Legionella*. Analysis indicates that peak *E. coli* and *Campylobacter* concentrations were concurrent with the peak population of migrating sandhill cranes taken from bird counts from the central flyway. Concentrations of *E. coli* were significantly greater at the downstream site compared to the upstream site. Avian influenza was not detected in any sample during the study. To date, data collection has been completed and the analysis and interpretation is currently underway.

0076

Dynamics of wading bird colonies along the Texas coast, USA

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Breeding populations of colonial waterbirds historically have been impacted by predation and human disturbance. Ten species of wading birds were surveyed annually during 1977-2007 along the Gulf Coast of Texas, USA to document changes in breeding populations. We utilized mixed models to account for repeated measures to evaluate long-term trends in wading bird populations. Wading birds were documented to be active breeders on 216 of the 385 surveyed islands along the Texas coast over the 31-year survey period. Great Blue Heron (*Ardea herodias*), Tricolored Heron (*Egretta tricolor*), Snowy Egret (*Egretta thula*), Cattle Egret (*Bubulcus ibis*), Little Blue Heron (*Egretta caerulea*), Black-crowned Night-heron (*Nycticorax nycticorax*), Reddish Egret (*Egretta rufescens*), and Great Egret (*Ardea alba*) populations all exhibited coast wide declines from 1977 - 2007. Roseate Spoonbill (*Ajaja ajaja*) and White Ibis (*Eudocimus albus*) exhibited no trends. We also modeled relationships between wading bird abundance and 3 covariates (prey availability, net freshwater inflow into bays, and distance to the mainland). We found that increases in distance of a colony to the mainland and prey availability each had positive effects on breeding abundance for certain species of wading birds and may provide some insight into the observed population declines. However, a better understanding of the species' ecology and factors limiting populations is required to develop management options for many of these species.

0078

The effect of weather on productivity in a Greater Sandhill Crane population in South Central Wisconsin

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Since 1991 the International Crane Foundation has been marking Greater Sandhill Crane (*Grus canadensis tabida*) breeding pairs and juveniles in a dense population in south central Wisconsin. Currently, 389 individuals have been marked on private lands within a study area of 6,800 ha. In this analysis we focus on the effect of weather on yearly productivity (number of chicks fledged/territory) of marked territorial pairs from 1993-2010. Prior to 1993 the number of marked territories was <13 and too small for analysis. Over 18 years, 84 total territories were marked with an average of 40.17 (range = 13-60) territories observed per year. Marked individuals persisted on territories from 1-18 years (mean = 8.43). The average productivity was 0.32 chicks fledged per year per territory, with yearly variability ranging from 0.14-0.47. Many climatological factors might cause this variation in productivity of Greater Sandhill Cranes. In this study we will show how some specific weather events (snowfall during the previous winter and precipitation, Palmer Drought Severity Index (PDSI), and temperature during the breeding season) influence territory productivity of this dense breeding population.

0081

Increase of the California Gull population in the San Francisco Bay and the impacts on Western Snowy Plovers

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California Gulls first began breeding in San Francisco Bay in 1980, when 24 individuals nested on dry salt pond. In 2010, over 46,000 California Gulls bred in the Bay. The increase of California Gulls in the Bay may be closely related to their use of landfills and other anthropogenic food sources. California Gulls have negative effects on other ground-nesting waterbirds in the Bay through harassment, encroachment on nesting sites, and predation on eggs and chicks. Meanwhile, the breeding population of the federally threatened Western Snowy Plover in the Bay remains at approximately 150 individuals, well below the recovery goal of 500. To determine the extent of gull predation on Snowy Plover nests, we deployed nest cameras in 2009 and 2010 at Eden Landing Ecological Reserve (ELER). California Gulls accounted for 25% of nest predators captured on camera. The growing California Gull population may threaten the recovery of Snowy Plovers in San Francisco Bay. In 2010, over 24,000 California Gulls nested in former salt pond (Pond A6), which was breached in December to begin its restoration to tidal marsh under the South Bay Salt Pond Restoration Project. These gulls will be displaced this coming breeding season, as much of the former colony will be flooded. Our results, and the recent documentation of the first California Gull nest in ELER, where 60% of Snowy Plovers in the Bay nest, suggest that gulls may increase predation on waterbird nests and chicks or encroach on the breeding habitat of waterbirds.

0083

Assessing breeding Whooping Crane habitat use to choose alternative release sites in Wisconsin

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In fall 2010, the Whooping Crane Eastern Partnership (WCEP) began its second decade of introducing a migratory population of whooping cranes (*Grus americana*) to eastern North America. This population has had high sub-adult and adult survivorship but very low productivity (3 fledged chicks over the course of the project), generally thought to be a result of the cranes abandoning their nests part-way through incubation. Using monitoring data from the core reintroduction area of Wisconsin, we analyzed the habitat selection of breeding whooping cranes of the reintroduced eastern migratory flock. First, a spatially based regression was used to model the habitat use of the whooping cranes. Key findings include that breeding whooping cranes are strongly choosing cropland as their preferred habitat outside of Necedah NWR and open water is consistently associated with increased likelihood of breeding whooping crane presence. The results of this model were then used, along with average size of current breeding territories in Necedah NWR (166 ha), to identify potential reintroduction sites in other areas of Wisconsin by looking for wetlands meeting criteria developed from actual crane habitat use. Six areas were identified in the east-central portion of the state that met basic biological criteria we could measure. WCEP will use this analysis to continue to investigate future alternative release sites for whooping cranes.

0085

Using a long-term dataset to investigate time-dependent and environmental factors that influence Black-crowned Night-Heron reproduction

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Despite the importance of the nesting stage in avian population maintenance and growth, the effects of time-dependent and environmental factors on nest survival are poorly understood. We conducted a 21-year survival study on Black-crowned Night-Herons (*Nycticorax nycticorax*) at Alcatraz Island, a critical breeding site for the San Francisco Bay Area population. Histories were recorded from weekly observations of 1,879 nests located during the nesting season (March–July) of 1990–2010. We used information-theoretic criteria to evaluate candidate sets of nest survival models (a priori hypotheses) that included time-dependent effects and meteorological and nest-site covariates. The average daily nest survival probability across all years was 0.966 ± 0.002 , and the cumulative survival rate, derived from maximum likelihood estimation, was $38.7\% \pm 2.7$. We found a model with year as a linear variable to be more parsimonious than polynomial functions ($\Delta AIC > 78.5$). The odds of survival decreased by 10.6% each year. Within years, we found the odds of survival increased 12% each day. Night-Herons nested in a variety of substrates, but nests were most likely to survive in woody vegetation, especially at greater heights. We found the average number of active nests within the subcolony influenced nest survival. For every 10 nests per colony, the odds of survival increased by 13.6%. Lastly, nest survival increased with higher temperatures and greater precipitation. These findings contribute to our overall understanding of variation in nest survival of colonial nesting birds and could be used to make better-informed conservation decisions, especially at Alcatraz Island.

0087

Scientific uncertainty in environmental assessment predictions and lack of follow-up for offshore oil and gas production projects in Newfoundland and Labrador: Implications for seabird conservation

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The Grand Banks off insular Newfoundland, is described as an international cross-road for migratory seabirds; an estimated 40 million seabirds annually rely on the rich productive waters of this region. Offshore oil development has also recently occurred in this region. An environmental assessment (EA) is an important mechanism for determining and mitigating the impacts of development. EA follow-up is a critical component to the process because it provides the opportunity to verify predictions. While most EA predictions have a certain degree of scientific uncertainty, for areas where little data are available, uncertainty is greater and addressing it in EA follow-up programs is crucial to understanding the impacts of development. We evaluated three offshore oil production EAs and their subsequent follow-up programs for linkages between EA predictions and follow-up programs as they pertain to seabird attraction to lights and flares. While all three EAs identified seabird attraction to light and flares as a potential issue, only one EA provided an assessment of scientific uncertainty for each prediction. Four out of four of the predictions associated with seabird attraction to light and flares had high or medium scientific uncertainty associated with their predictions and subsequently warranted follow-up because of the lack of field-based studies on the topic, particularly for the region. However, the EA follow-up did not address the issue of attraction and the topic continues to be a significant gap in our understanding of the interactions and impacts that oil platforms have on seabirds.

0090

A sustainable solution for crop damage by cranes and other bird species to planted seed

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Our objectives were to determine if sandhill cranes (*Grus canadensis tabida*) selected emerging corn (*Zea mays*) within and between Anthraquinone-treated or non-treated fields, and then to evaluate the efficacy of chemical deterrent methods. We studied the location, habitat, number and behavior of cranes in a 6,500 ha study area 2006-2009 in south central Wisconsin. Cranes used corn fields when they were vulnerable to damage (corn emerging day 1-17) more than non-vulnerable corn (emerging day 18-35; $F = 4.39$, $p = 0.04$). Within the period of corn vulnerability to crane damage, no damage to emerging seedlings occurred in treated fields while most non-treated fields were damaged extensively ($F = 45.0$, $p < 0.001$). Crane numbers in treated fields, however, did not differ from cranes using non-treated fields ($F = 0.009$, $p = 0.92$). When in non-treated fields crane numbers correlated inversely with corn seedling density ($R^2=0.84$) but were uncorrelated with seedling density in treated fields ($R^2=0.03$). While cranes generally prefer emerging cornfields (i.e. between field selection), the treatment of planted corn *within* a field effectively reduced damage. Unlike other abatement methods, seed treatments reduce damage to germinating corn without affecting crane distribution. Measuring preference at both scales of selection identified key ecological constraints that damage control activities must incorporate to design successful abatement protocols. Most importantly, this technique has been deployed by individual landowners statewide in relation to crane distribution at an ecologically significant scale. Over 57,000 acres of corn were treated in Wisconsin during 2010 alone.

0091

Response rates of secretive marsh-birds in Iowa

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Call-broadcast surveys are frequently used to elicit responses of secretive marsh-birds. However, little is known about how detection rates differ temporally. The objective of this study was to compare response rates to call-broadcast surveys for four species of marsh-birds as a function of a) time of day, and b) time of season. We conducted call-broadcast surveys at wetlands throughout Iowa from 15 May – 13 June 2010 (early season) and from 15 June – 10 July 2010 (late season). We conducted surveys in the early morning and late evening in accordance with the North American Marsh Bird Monitoring Protocol. We surveyed 136 points at 56 wetlands and visited each point on a consecutive morning and evening both early and late season. We used generalized linear mixed-effects models to examine the effects of time of season, time of day, and wetland size on the number of detections for four species; Pied-billed Grebe, Least Bittern, Virginia Rail, and Sora. We also examined the above effects on all rails pooled and all eight species pooled. We found strong ($P < 0.05$) effects on the number of detections for Pied-billed Grebe (time of season, time of day, and wetland size); Sora, Virginia Rail, all rails, and all species had an effect of time of season only. Understanding seasonal and time-of-day differences in detection rates, as well as area dependence of marsh-birds will aid in the development of an effective monitoring protocol by allowing researchers to maximize detection probabilities of target species.

0092

Black Tern research and conservation in The Netherlands

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The Eurasian Black Tern *Chlidonias niger niger* has its most western population stronghold in the Netherlands. The Dutch population declined considerably in the last decades from 20,000 pairs around 1950 to 1200 nowadays. The decline was mainly the result of constraints in reproduction caused by a lack of nesting vegetation and low chick survival. The first is a result of enthusiastic Dutch water management and the second of disturbance in the chick period (agriculture and tourism) and deterioration of food quality. Conservation efforts currently focus on the supply of artificial nesting rafts and protection from disturbance. About 90% of all terns breed on rafts. This resulted initially in an increase of average breeding success and numbers. However, recently the population increase of Greylag Geese *Anser anser* and the invasive Canada Geese *Branta canadensis* caused a decrease of breeding success again for approximately 40 % of the Dutch Black Tern colonies. The presentation will review Black Tern research and conservation in the Netherlands and will include results from metal and colour ring studies on site tenacity and adult mortality using MARK. An initial population model based on trend and reproduction parameters was used to predict mortality (0.84). The empirical data from ringed birds resulted in a survival of 0.80 (sd 0.06) close to the other model output.

0093

Heron migration revealed by satellite transmitters

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Many heron species breeding in the northern hemisphere migrate long distances to their wintering areas. Still very little is known about their migration strategy. Some species are large and heavy and were expected to make regular stopovers en route for substantial refuelling. Eurasian Purple Herons *Ardea purpurea* are such large, long-distance migrants crossing the Sahara. But, data from Purple Herons, equipped with satellite transmitters, showed that the herons were able to cover the distance of 4,000 km to the Sahel within 5 to 7 days. One individual even flew 5,600 km non-stop, mostly over sea. The herons migrated mostly at night and partly during the day with a high constant travel speed indicative of flapping flight. The herons made few diurnal stops in Europe and North Africa. Substantial 'stopover' time was limited entirely to a period of several weeks before departure, and after arrival south of the Sahara. The spring migration is comparable to autumn migration in speed and general routes. The herons did not aim at larger wetlands en route. Premigratory fat storage sites are more important. Recent data on a Bittern *Botaurus stellaris* with a satellite transmitter showed a comparable strategy although this particular bird did not fly during daylight and rested in the desert during daytime. The advantage and disadvantage of flapping flight migration strategy for a large migrant bird is discussed.

0094

Variation in the abundance, distribution, and habitat associations of Passerines wintering in salt marshes of coastal Mississippi

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Little is known about wintering marsh bird communities along the northern coast of the Gulf of Mexico. To document the abundance, distribution and habitat associations of wintering marsh birds, bi-weekly line-transect surveys were conducted using distance estimation along fifteen randomly selected transects ranging from 200 to 500 meters in length. Surveys were conducted December through March from 2004 to 2010 at the Grand Bay National Estuarine Research Reserve and National Wildlife Refuge. Marsh Wren (*Cistothorus palustris*), Nelson's Sparrow (*Ammodramus nelsoni*), and Seaside Sparrow (*Ammodramus maritimus*) were the three most commonly detected species, and were the species compared in our analyses. Preliminary analysis shows a positive relationship between vegetation diversity and species diversity. Species-specific habitat associations were examined for the three focal species of marsh birds. Relative abundance estimates of Marsh Wrens vary widely between years, while relative abundance estimates of Seaside Sparrows and Nelson's Sparrows remain similar from one year to the next. Temperature variation between winters and the timing of hurricanes and other flooding events were examined as explanations for the variability in Marsh Wren abundance between years.

0095

Detecting genetic clusters of Black Terns in Europe: Can we assign migrating individuals to breeding populations?

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Black Terns (*Chlidonias niger niger*) breeding across Europe and Asia utilize two important staging sites prior to their migration to wintering grounds in Africa. Ringing data suggest that breeding birds from Western, Central and Northeastern Europe stop at Lake IJsselmeer (The Netherlands) while birds from Eastern Europe and Eurasia stop at Sivash (Ukraine). New molecular data indicate strong population structure between breeding populations across Europe, presenting an opportunity to assign migrating individuals to breeding populations. We used microsatellite data and the software STRUCTURE to first estimate the number of genetic clusters represented by breeding birds sampled in The Netherlands, Latvia, and Ukraine. Then we assigned birds sampled at the post-nuptial stopover at Lake IJsselmeer to these genetic clusters. We found that genotypes from breeding populations within Europe do not form strong clusters unless prior population identification is included in the analysis. However, strong clustering of genotypes is evident between Europe and North America even without prior population information. The model does not assign migrating individuals to a single breeding population with any level of confidence (probability of assignment < 0.69). These data suggest that there may be unsampled and strongly differentiated breeding populations in Europe. Low assignment probability to our three breeding locations may not be surprising when considering that perhaps more than 100,000 birds routinely visit this stopover and only 23 of those migrants were included in this study.

0096

Roseate Tern post-breeding staging in southeastern Massachusetts: Local movements of colorbanded fledglings from Nova Scotia

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In 2009, 13 (93%) of 14 colorbanded Roseate Tern chicks from Country Island, Nova Scotia, Canada were identified at least once as fledglings between 14 August and 21 September at nine staging locations about 780 km away in the "Cape & Islands" area of southeastern Massachusetts USA before their eventual departure for South America. Although young from colonies in the Connecticut-New York-Massachusetts area began arriving at the staging sites by mid-July, colorbanded Canadian fledglings did not appear until about a month later, just after the first sustained northeast winds in several months. Despite their relatively late arrival, the minimum length-of-stay in Massachusetts of four Canadian birds exceeded 30 days. Two birds were seen at different sites in one day (one at a third site the next day) and while several were seen two days in a row soon after their apparent arrival, gaps in days between resightings increased in September. There was no consistency in local movements or pattern of staging-site use by the six birds seen 4-8 days, but most later resightings of all colorbanded young were in the Provincetown area where prey fish (sandlance) numbers were presumably high. We also identified similar percentages (about 14-18%) of metal-banded Roseate young from all 10 northern US and Canadian sites where five or more were banded in 2009, suggesting that almost all young and their care-giving parent(s) of the endangered Northwest Atlantic breeding population are using critically important coastal/marine areas of southeastern MA for an extended time during the postbreeding period.

0097

Population genetic structure and history of the Greater Flamingo in the Mediterranean: One panmictic population?

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Knowledge of both population genetic structure and gene flow between breeding colonies is of paramount importance for the conservation of colonial waterbirds. The Greater flamingo (*Phoenicopterus roseus*) is a flagship species for wetland conservation, and, as such, has been extensively studied in the Mediterranean region. Data from capture-mark-recapture have shown high levels of dispersal between close colonies with some long-distance dispersal events, suggesting a metapopulation functioning extending from Mauritania to Turkey. We studied the genetic structure of Greater flamingo population at the scale of the Mediterranean, using both microsatellite and mitochondrial markers. Blood or feathers were sampled on chicks during banding operations on 8 breeding sites between 1995 and 2009, with some sites being sampled on several different years. Results were consistent between mitochondrial and nuclear markers, and showed a single population history, with no genetic differentiation between sampled sites, reflecting high gene flow between Greater flamingo colonies. These results suggest that all the Mediterranean Greater flamingo colonies, from Spain to Turkey, are part of a single panmictic population.

0098

Effects of off-road vehicles on day-time behaviour of migrating shorebirds at a barrier island in Maryland and Virginia

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The ability of shorebirds to accumulate adequate fuel stores is a critical factor limiting shorebird survival during migration. Changes to migrating shorebird behaviour resulting from human disturbance can provide valuable insight into the mechanisms underlying energy acquisition, thereby aiding in effective recovery of declining shorebird populations. From 2007-2008, we examined the effect of off-road vehicles (ORVs) on day-time behaviour of migrating shorebirds at a barrier island off the coasts of Maryland and Virginia. Using instantaneous and focal animal sampling, we compared activity budgets of sanderlings (*Calidris alba*), willets (*Catoptrophorus semipalmatus*), black-bellied plovers (*Pluvialis squatarola*), and ruddy turnstones (*Arenaria interpres*) among sites with and without ORV use. We also assessed shorebird avoidance behaviour and habituation to ORVs through experimental disturbances conducted in sites with and without ORV use. Sanderlings ($p < 0.001$) and willets ($p = 0.02$) spent significantly less time foraging and more time resting in sites with ORV use compared to those without. Sanderlings also avoided areas following vehicle disturbance. ($p < 0.001$). These findings corroborate the hypothesis that ORV use may interfere with the ability of shorebirds to accumulate fuel stores for migration. The management implication is that ORV numbers and distribution should be limited on beaches during migration periods. Future studies should focus on evaluating the energetic consequences of behavioural changes caused by ORV use and explore compensatory mechanisms to disturbance such as night-time foraging.

0099

Evaluation of aerial photography to estimate colony sizes of Double-crested Cormorants in the Upper Mississippi Valley / Great Lakes Region.

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In the Upper Mississippi Valley/Great Lakes Region, control measures for Double-crested Cormorants (*Phalacrocorax auritus*) have been established at multiple colony locations, and breeding numbers are regularly monitored. Ground counts are typically considered the standard for colonial waterbird surveys, but can be labor and time intensive, may disturb nesting birds, and some sites are difficult to access. Conversely, using aerial photography to obtain estimates can minimize many of these issues. Here, we evaluate the use of aerial photography to estimate cormorant colony sizes relative to ground counts. Between 2005-2010, we obtained nest estimates through paired ground counts and aerial photographs at multiple locations in the Great Lakes and Minnesota. Photos of tree- and ground-nesting colonies were obtained from a fixed-wing aircraft from approximately 500 feet above the colony using a hand-held digital camera with an image stabilized lens. Photos were uploaded to ArcMap and individual birds on nests were hand counted. Preliminary results indicate that on average, estimates obtained through high quality aerial photographs were within 10% of estimates obtained from ground counts. Assessment of measurement error (ME) for replicate air and ground counts using nested analysis of variance was 1.1% ($p < .0001$), suggesting a very small percent of variance observed was due to ME. We recommend aerial photography to estimate cormorant numbers in both tree and ground colonies when high quality photos can be obtained and colony conditions allow individual birds on nests to be discerned.

0100

A synthesis of recent studies showing how prey availability affects wading bird habitat selection, physiology, and reproduction

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The physiological and reproductive responses of the Great Egret (*Ardea alba*) and White Ibis (*Eudocimus albus*), two species with contrasting foraging strategies, were compared in years with high and low prey availability. Habitat selection was determined by comparing random and used sites, and in enclosures where water depth, food, and habitat were manipulated. In the year with low prey availability, White Ibises selected a narrower range of habitats, lowered their clutch size, and fledged chicks in poorer physiological condition relative to Great Egrets. Adult ibises, particularly females, showed higher stress levels in response to lower prey availability than did adult egrets. The stronger response of White Ibises than Great Egrets to poor foraging conditions may explain the difference in population trends between the two species in the Everglades. When fish density was controlled experimentally, wading birds selected sites with vegetation, rather than open areas where prey were vulnerable. In marshes, fish density was highest in areas with dense vegetation so it is likely that birds in our experiments selected sites based on expected prey density rather than actual prey density or prey vulnerability. Receding water was more important to both species when prey availability was low than when it was high. Moreover, egrets, which eat primarily fish, were more dependent on receding water than were ibises, which consume primarily crayfish. Indeed, crayfish density did not increase as much as fish density during a drydown. Recession rates below 5 mm per day or above 7 mm per day increased nest failures.

0101

Winter site fidelity in secretive marsh sparrows along the South Carolina coast

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Salt marsh habitats are threatened by sea level rise and development. Populations of salt marsh inhabiting birds may decline as a result. Understanding the threats to populations of species requires data from all life stages. Little is known about the wintering biology of secretive marsh sparrows. Part of understanding the wintering range biology is the ability to assess movement patterns and wintering site fidelity. We examined site fidelity in Seaside (*Ammodramus maritimus*), Saltmarsh (*A. caudacutus*), and Nelson's (*A. nelsoni*) sparrows. We captured sparrows at 5 sites in two salt marshes in South Carolina, monthly, using mist nets set in the high marsh. Within season recapture percentages were high but varied by species: 18.3% of Seaside, 12.6% of Saltmarsh, and 2.5% of Nelson's sparrows were recaptured in the same winter as their original capture. Percentages for across season (from winter 2009-10 to Winter 2010-11) returns were even higher with 37.9% of Seaside, 54.1% of Saltmarsh, and 15.7% of Nelson's recaptures. These results suggest fidelity to wintering grounds in Saltmarsh Sparrows is as high as to breeding sites.

0102

Mountain Plover nest protection and success in agricultural fields

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Mountain Plover (*Charadrius montanus*), a candidate for listing under the Endangered Species Act, breed in arid, sparsely vegetated habitats of the western Great Plains, including agricultural fields where nests are subjected to farming operations. The Nebraska Prairie Partners (NPP), a cooperative partnership between the Rocky Mountain Bird Observatory (RMBO) and the Nebraska Game and Parks Commission (NGPC), has worked to conserve Mountain Plover in Nebraska. NPP has implemented a nest marking program, whereby individual nests were located and marked with flags in agricultural fields so that producers could see nest areas and avoid them during their tillage operations. We monitored fate of marked nests in agricultural fields from 2005-2007, and estimated daily nest survival using the logistic-exposure method. Cumulatively over the three-year period we marked 242 nests and worked with 68 producers to access 50,140ha of agricultural land. Mountain Plover nest survival was 0.73 and it was most strongly affected by temporal variables (e.g. age of nest). In addition, we used artificial nests to evaluate impacts of farming practices on nest survival. Mechanical tillage operations (discing, sweeping, and chiseling) had a negative impact on artificial nests when compared with fields that were chemically sprayed to control weeds. Our results suggest that protecting nests in agricultural fields from mechanical tillage operations is a management strategy that will increase Mountain Plover nest survival. Additional study is needed to determine whether nest marking is an effective conservation tool that will positively impact populations and aid in reversing the decline of the species.

0103

An evaluation of the accuracy and precision of Least Tern (*Sternula antillarum*) survey procedures at Cape Lookout National Seashore, North Carolina

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Common techniques to estimate the total number of nests at a particular colony include direct ground nest counts (GNCs) and incubating bird counts (IBCs). The accuracy and precision of different techniques, and the data from repeated surveys versus window counts, are rarely assessed concurrently. Our objective was to compare the results from these methods. We studied 2 Least Tern colonies at Cape Lookout National Seashore, NC from April-August 2010. We conducted GNCs and IBCs every 4-5 days in a 150 m² section of each colony from initiation (28-April) to end date (13-17 July). We explored inter-observer variability in IBCs, differences between GNC and IBC counts, and variation between the number of nests recorded during the window count period and the actual peak of recorded nests. We found inter-observer variability in IBC surveys despite rigorous training of personnel (mean IBC observer difference (SD) = 3.2 (4.2)). IBC surveys rarely agreed with actual GNCs (mean difference in nest numbers (SD) = 6.8 (11)); the directionality of the differences were inconsistent; 11 IBCs were underestimates, 5 were fairly accurate, and 8 were overestimates of the GNCs. In 2010, the 15-16 June window count occurred 2 weeks after the actual nesting peak. Analyses are ongoing as to the effects of time of day, weather, nesting stage, and colony size on the accuracy and precision of these methods. Initial results suggest that using IBC data in place of GNCs may result in erroneous research or management conclusions dependent on nest numbers.

0104

Ten-year status of the eastern migratory Whooping Crane reintroduction

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From 2001 to 2010, 132 costume-reared juvenile whooping cranes (*Grus americana*) were led by ultralight aircraft from Necedah National Wildlife Refuge (NWR) in central Wisconsin to the Gulf Coast of Florida on their first autumn migration (ultralight-led or UL), and 46 juveniles were released directly on Necedah NWR during autumn of the hatch year (direct autumn release or DAR). Return rate in spring was 90.5% for UL and 69.2% for DAR, the latter attributable to 1 cohort with migration problems. Population survival 1 year and from 1 to 3 years post-release was 81% and 84%, respectively. Survival 1 year post-release was significantly different between UL (86.0%) and DAR (65.7%) cranes. Since summer 2008, DAR migration and wintering have improved, winter distribution of the population has changed, the migration route has shifted westward, and number of yearlings summering in locations used during spring wandering has increased; human avoidance problems resulted in 2 birds being removed from the population. As in earlier years, homing to the natal area and pair formation continued (29 of 31 adult pairs have formed in the core reintroduction area), predation continued to be the primary cause of mortality, and parental desertion of nests during the initial (primary) nesting period continued. During 2005-10, all 43 of these early nests failed; of 15 late nests or renests, chicks hatched from 8 nests, and 3 chicks fledged. As of January 2011, the population contained a maximum 108 individuals (56 males and 52 females) including 18 adult pairs.

0105

Tracking movements of the endangered Hawaiian Goose with satellite telemetry

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After being reduced to less than 50 individuals during the middle of the 20th century, the Hawaiian Goose (Nene; *Branta sandvicensis*) has begun to repopulate its former range and re-establish traditional movement patterns on Hawai'i Island. Satellite telemetry is becoming an increasingly important tool to track these types of movements and habitat use in waterfowl. The application of satellite telemetry to Nene for habitat studies requires a finer scale resolution than for most other species because Nene are restricted to relatively small islands rather than continents. In 2009 and 2010, we outfitted eight Nene ganders on Hawai'i Island with backpack harnesses and 40-45 gram Platform Transmitter Terminals (PTTs) equipped with Global Positioning System (GPS) receivers. Nene accepted the transmitters and provided >3,700 GPS locations in near real-time. One of the most frequently used travel routes in this study has been along the windward slopes of Mauna Kea and Mauna Loa from the northern terminus of Hakalau Forest National Wildlife Refuge (HFNWR) to the southern terminus of the Kahuku Unit of Hawai'i Volcanoes National Park (HAVO). Two subjects at the Kahuku Unit of HAVO revealed subalpine shrubland roosting areas known as Kipuka Nene surrounded by rugged lava flows, where Nene had not been observed since 1949. Subjects also ranged more than 2,400 meters in elevation between leeward Kona and the slopes of Mauna Loa. Actions to further recover Nene will likely include more intensive monitoring and management of previously unknown, but important habitat patches revealed by this work.

0107

Egg manipulation as a management tool to promote reproduction in a reintroduced Whooping Crane population

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Nesting in the reintroduced eastern migratory population began in 2005 but has resulted in only 3 fledged chicks through 2010. All 43 early nests have failed, most due to abandonment of the eggs by the incubating adult cranes. Most pairs have produced fertile eggs, including a pair consisting of full siblings, one pair has been infertile for 3 years, and the fertility of other pairs remains unknown because the eggs were destroyed after the nest was left unattended and before the eggs could be salvaged. Egg manipulation began in 2006 with artificial eggs being left in a nest after intact abandoned eggs were salvaged and placed in mechanical incubators. In some cases cranes came back and incubated the artificial eggs giving field staff the opportunity to possibly switch live eggs back into the nest. Egg manipulation has also allowed the infertile pair the opportunity to hatch a fertile egg switched into their nest in place of their own infertile eggs. Egg manipulation could also be used as a technique to manage the reproduction of the sibling pair or future pairs in the population with undesirable genetics.

0108

An update on the Direct Autumn Release Project of Whooping Cranes into the Eastern Migratory Population

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The Whooping Crane (*Grus americana*) is an endangered species endemic to North America with a native remnant population of less than 270 birds. The International Whooping Crane Recovery Plan has recommended the establishment of two separate self-sustaining populations, one migratory and one non-migratory. In 1999 the Whooping Crane Eastern Partnership (WCEP) was created to implement activities necessary for the establishment of a second migratory population separate from the Wood Buffalo/Aransas flock. In 2005 WCEP approved the development of the Direct Autumn Release (DAR) experiment. Young whooping crane chicks were hatched and costume reared by humans at the International Crane Foundation until they were 3 to 7 weeks old. The young cranes were transferred to Necedah National Wildlife Refuge in central Wisconsin to be raised in the wild and soft released in the fall. The Direct Autumn Release (DAR) experiment released 33 birds 2005-2009. This paper presents the result of the DAR releases thus far. Twenty-five birds (75.7%) survived their first migrations, overwintered and successfully completed their first migration north. Eighteen returned to the core reintroduction area. Although the DAR population is relatively young, two females were in breeding situations in 2010; both successfully laid eggs and incubated full term. One chick hatched and survived for 3-4 weeks. The DAR methodology continues to improve and appears to be a feasible means of reintroducing birds into the wild.

0110

Modeling flexible habitat selection of wading birds in dynamic wetlands

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Variation in food availability during the breeding season plays an influential role in the population dynamics of many avian species. This study quantifies foraging habitat selection of breeding, radio-tagged Great Egrets ("exploiter" species; N=76) and White Ibises ("searcher" species; N=125) to test the hypothesis that population responses in a dynamic wetland ecosystem can be linked to how constrained a species is in its use of habitats, especially when habitat conditions are poor and niche breadth is predicted to contract. Research was conducted during 2006 and 2007 in the Florida Everglades, where fluctuating food resources are pronounced due to seasonal periodic drying and flooding. In both species, low food resource availability impacted the selection for short-term explanatory variables involved in the concentration of prey (e.g. recession rates, and site reversal), suggesting niche contraction. In both years, the "searcher" species was more constrained in its use of habitats than the "exploiter" species. We developed and evaluated spatially-explicit models of daily resource availability and quality for two species (Great Egret and White Ibis) with opposing foraging strategies. In both years, the ibis model outperformed the egret model suggesting either a more accurate model, or alternatively, a consequence of their narrower behavioral niche. Also, as water depths decrease in the Everglades and overall habitat score improves, the models become less predictive. A possible mechanism is that water depth use is more variable later in the breeding season.

0111

The avian community response to constructed treatment wetlands for Everglades restoration

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The use of constructed wetlands to treat polluted runoff water from a variety of sources has been steadily increasing since the 1950s. In the Everglades, Stormwater Treatment Areas (STAs) were constructed to remove phosphorous from surface waters. Although the primary purpose of STAs is to improve water quality and habitat, they may provide quality habitat to various groups of avifauna. We compared avian density, richness, and composition in 6 STAs, the Everglades Agricultural Area (EAA), and in the Everglades. We also compared these metrics between treatment habitats with the STAs. Bird density and species richness were significantly lower in the Everglades than in the other land types in all seasons (both tests, $p < 0.01$). Species richness was always greatest in the STAs compared to the other land types ($p < 0.01$); however avian density in the STAs was greatest in fall and winter, whereas it was greatest in the EAA during summer. The STAs are dominated by aquatic, herbivorous, wintering species whereas the EAA and the Everglades are dominated by insectivorous, resident species. Within the STAs, avian density and richness were significantly greater in dense submerged aquatic vegetation (SAV) than in emergent vegetation ($p < 0.01$). This was especially pronounced during fall and winter due to wintering waterfowl preferring the SAV habitat. To our knowledge, the avian densities in the STAs are the highest reported for any treatment wetland in the US. These results show that the STAs are used heavily by a diverse group of avifauna, particularly wintering species such as waterfowl.

0113

Foraging habitat parameters: Preferences of Everglades wading birds

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The number of wading bird nests in the Everglades has decreased by 70% since the 1930s; however, these trends are species specific. Declines coincide with the construction of massive water-control works in South Florida, which disrupted the natural hydroperiod, sheet flow, recession rate and water depth within the Everglades. The altered hydrology changed the availability of food items, which is believed to have affected the spatial distribution and movement of foraging birds across the Everglades landscape. Elucidating species-specific foraging habitat preferences will be essential to the recovery of the endangered Wood Stork (*Mycteria americana*) and other imperiled wading bird species in Florida. We used foraging data from the Systematic Reconnaissance Flight Survey to generate habitat selection models for the Wood Stork, White Ibis (*Eudocimus albus*) and Great Egret (*Ardea alba*) during the breeding seasons (January to May) 2002-2009. We modeled wading bird abundance on a 4 km² cell-level across the entire greater Everglades basin. Our species-specific models were a function of hydrologic, land use, and soil nutrient parameters comprising a hierarchical Poisson regression model. Results indicate that hydrologic parameters had the strongest affect on Great Egret foraging patterns. Wood Stork and White Ibis foraging patterns were influenced by hydrologic, land use and soil nutrient parameters. Receding water levels were positively associated with Great Egret and White Ibis density, whereas an increase in water levels of 3 cm decreased numbers of Wood Storks. Differences in responses among species underscore the need for developing species-specific models.

0115

Perspectives of a Gulf-wide Citizen Science Oiled Bird-Monitoring Program

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The northern Gulf coast provides essential breeding, wintering, and migratory stopover habitat for dozens of waterbird species. Following the Deepwater Horizon explosion on 20 April 2010, thousands of gallons of crude oil began drifting toward productive coastal marshes and barrier islands. We drafted a Citizen Science bird monitoring protocol to standardize collection of oiled bird data in order to assess the impact of oil on coastal waterbirds. By building a coalition of partners, including National Audubon Society, National Wildlife Federation, LSU Bird Resource Center, and American Birding Association, we organized dozens of bird watchers to collect scientifically-sound species-specific data by quantifying the frequency and extent of oiling for each species encountered. Data from across the Gulf indicate that 2.9% birds observed with oil (n = 749) were heavily oiled, appeared sick, or immobilized. Thus, most oiled birds could evade capture and rehabilitation, but their fate remains unknown. The most frequently assessed birds included Snowy Egret, Laughing Gull, Royal Tern, and Sanderling. From May–August, 4.9% (n = 3642) were oiled in southeastern Louisiana, decreasing to <1% after 1 September. Despite regular surveys west of the Atchafalaya River mouth in central LA, the only oiled birds were seen in early July, immediately after Hurricane Alex, which suggested that hurricanes can influence the distribution of oiled birds in the landscape. We are continuing to gather data from participants, build collaborations, and construct spatially explicit models to understand how water currents, weather, and bird densities interact to influence patterns of oiling frequency.

0116

Mississippi Sandhill Crane update 2009-10

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The Mississippi sandhill crane (*Grus canadensis pulla*) is an endangered non-migratory subspecies found on and near the Mississippi Sandhill Crane National Wildlife Refuge in southeastern Mississippi. We continued conservation efforts for the recovery of this population in 2009-10. To maintain open savanna, we burned 7600 acres, with 76% during the growing season. To restore open savanna, 1109 acres of woody vegetation were removed using mechanical methods. To bolster the population, we released 19 captive-reared juveniles in 2008/9, and 15 in 2009/10. To protect cranes, nests and young, we conducted 2672 trap-nights in 2009, removing 11 large predators and 21 raccoons. In 2010, contractors conducted 4954 trap-nights, removing 50 large predators and 98 raccoons. Crane and habitat monitoring assessed life history parameters including radio-tracking, visual observations, and an annual nest census. We collected 3274 observation records including 1124 radio-fixes. We captured six AHY cranes to band or change out worn or nonfunctional radio-transmitters, all using toe nooses. We discovered 20 AHY carcasses. Of 18 with known or suspected causes of death, 61% were due to predation and 39% were trauma. There were 31 nests in 2009 and 29 in 2010, with five total fledglings. The use of 1-acre nest barriers showed promise in increasing productivity. The population remained stable at 100-110 cranes.

0117

Use of Indian toe nooses to capture Mississippi Sandhill Cranes

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In 1998, Master Bird Trapper Ali Hussain traveled to Mississippi to demonstrate traditional trapping techniques including the clap trap, norbans, and toe nooses. Hussain is the last of a tribe of bird trappers from Bihar. He caught over 500 species of birds using their traditional methods with local materials. Each toe noose consists of a 10 cm diameter fishing line loop tied to a 4-mm thick, 6-cm tall support stick. Each noose line consists of 80-120 nooses tied in series. One or multiple noose lines were deployed around bait or in known walking areas to passively capture one to three target cranes. We captured 76 AHY cranes using nooses. Since 2005, nooses accounted for 86% of captures. There were no known injuries related to the use of nooses. We recommend nooses as an effective passive capture technique.

0118

Effect of rearing technique on age of first reproduction of released Mississippi Sandhill Cranes

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By the 1970s, there were only 30-35 Mississippi sandhill cranes in the wild. To bolster the population of this endangered non-migratory subspecies, 456 captive-reared juveniles were released onto the Mississippi Sandhill Crane National Wildlife Refuge (refuge) from 1981-2011 in the largest crane augmentation to date. Both hand and parent-reared cranes were released using an acclimated technique developed for the refuge. Here we continue an earlier comparison in survival between hand and parent-reared cranes to assess age of first reproduction between the two rearing techniques.

0120

Assessing the impact of oil spills in the context of long-term seabird population monitoring: Shetland Islands, UK

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The decision in 1974 to construct an oil-exporting terminal at Sullom Voe, Shetland, prompted baseline surveys of breeding and wintering seabirds. A seabird monitoring programme (SMP) began in 1978 as part of wider environmental monitoring, supervised by the Shetland Oil Terminal Environmental Advisory Group and funded by the Sullom Voe Association, a consortium of oil industry partners in the Sullom Voe Terminal (SVT) and the Shetland Islands Council. The SMP aimed to assess population level effects of oil spills from the SVT and its tanker traffic, monitor chronic oil pollution around Shetland, and initially comprised: (i) population trends of cliff-nesting seabirds; (ii) inshore surveys of wintering seabirds and waterfowl; (iii) beached bird surveys. The SMP evolved in response to specific incidents, critical review, and new oil developments, including deep-water exploration and production west of Shetland. This paper describes two very different oil spills and their impacts on seabird populations. The *Esso Bernicia* incident of December 1978 involved the release of 1,174 t of heavy fuel oil into the sheltered waters of Sullom Voe. The tanker *Braer* grounded in January 1993 in southern Shetland, releasing 84,700 t of light crude onto a high energy coast during exceptionally stormy weather. Medium-term decreases in resident and migratory species could be demonstrated, but there has been no measureable prolonged impact of either of these spills or of SVT operations, except upon wintering Common Loons, whose numbers remain locally depressed 33 years after the *Esso Bernicia* spill.

0123

Population decline of Black Terns in Wisconsin confirmed by point-count surveys and mark-recapture analysis

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A survey and monitoring program begun in 1980 by the Wisconsin DNR suggests a drastic decline in both the statewide abundance (-75%) of Black Terns (*Chlidonias niger*) and in the number of wetland sites occupied (-30%) over the past 30 years. However, methodological issues with the survey design and environmental changes over this period may confound interpretation of these findings. In 2010, we surveyed 350 Wisconsin wetlands (n = 284 as part of the WDNR survey plus 66 additional wetlands determined by remote sensing to contain suitable nesting habitat). Combined, these surveys produced a total count of 746 birds, which was still 13% lower than counts from the WDNR surveys in the early 1980s. In support of the statewide decline is an ongoing mark-recapture (CMR) study at two of the largest remaining breeding colonies in the state. Over the ten-year period, 2000-2009, the combined estimate of apparent adult survival of birds breeding at these two sites was 0.62 (95% CI: 0.52 - 0.70). Comparisons among competing models indicated the presence of transience in the population, but after accounting for these transients, the survival estimate for non-transients increased only marginally to 0.66 (CI: 0.55 - 0.75). GOF tests indicated heterogeneity in capture rates with respect to trap dependence, but in the direction of trap "happiness," so the low survival rate is not due to previously-trapped birds recognizing and avoiding traps in subsequent years. Together, the population models and survey counts provide compelling evidence that Black Terns are critically imperiled in Wisconsin.

0124

New records of wintering grounds for Sandhill Cranes in Mexico

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Although the Sandhill Crane (*Grus canadensis*) is considered a threatened species in Mexico, there is no detailed information on its present winter distribution and on the description of wetlands where cranes had not been previously recorded. This information would be important for making decisions for management and conservation plans. Our objectives were to update current range and identify new wintering areas for the Sandhill Crane in Mexico; and the characterization of wetlands where they roost in winter. Wetlands were surveyed by ground (52) and by air (83) covering the Chihuahuan Desert in the states of Chihuahua, Coahuila, Nuevo Leon, Durango, San Luis Potosi, Zacatecas, and Guanajuato. Sandhill Cranes were recorded in 31 wetlands of which 13 were new location records for Mexico, and extended the present distribution 237 -km further south. All wetlands have human activities surrounding them and some are near urban centers, which give insights about the threats that wetlands are facing at present. Studies to assess the wintering areas and Sandhill Crane migratory pathways are important, not just for conservation of the cranes, but also to protect other species that depend on the desert wetlands in northern Mexico.

0125

Slow recovery of wading bird populations after a major oil spill

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In January 1990, 2,146,000 l of #2 grade oil were released into a narrow tidal strait separating New York City from New Jersey. Up to 1500 pairs of long-legged wading birds (Ciconiiformes) have migrated to and nested on islands in this waterway annually since the mid-1980s. Using a ten-year dataset, I compare abundance, timing of nesting, productivity and offspring mortality factors of four wading bird species between pre-spill (1986-1989) and post-spill (1990-1995) breeding seasons. Tidal foraging species (Snowy Egret *Egretta thula*, Glossy Ibis *Plegadis falcinellus*) produced 35-50% fewer fledglings in 1990-1993 compared to pre-spill. Greater nestling starvation and lower growth rates characterized tidal wading birds post-spill. In contrast, productivity of generalist and non-tidal wading birds (Black-crowned Night-Heron *Nycticorax nycticorax*, Cattle Egret *Bubulcus ibis*) did not differ before and after the spill. Relative importance of mortality factors of non-tidal Ciconiiformes also did not vary over the study period, although night-heron diet shifted immediately post-spill to include less fish and more human refuse. Reduced productivity of tidal Ciconiiformes resulted from a critical loss of tidal prey resources in the estuary as a result of oil contamination. Snowy Egret was most sensitive to the perturbation. Productivity dropped from 1.7 fledglings per nest during 1986-1989 to 0.5 during 1990-1991 and began to rebound during 1992-1993 (1.2 fledglings/nest).

0126

Factors influencing Greater Sandhill Crane nest success in Nevada

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The Lower Colorado River Valley population of greater sandhill cranes (*Grus canadensis tabida*) that nests primarily in northeastern Nevada, USA, is the smallest population of migratory sandhill cranes and has the lowest reported recruitment rate (4.8%) of any crane population in North America. No studies exist that have estimated demographic parameters for this population. Accurate parameter estimates are vital to management of this population. To identify factors limiting recruitment in this population, we monitored 160 greater sandhill crane nests in northeast Nevada during 2009-2010. We used maximum likelihood based approaches in Program Mark to assess models of nest survival and estimate parameters. We estimated daily survival rates from the best supported model corresponding to Mayfield nest success of 36 and 29% for 2009 and 2010, respectively. We found the best supported model describing nest success contained the explanatory variables, year, water depth, vegetation height, and a trend in daily nest survival over a 30 day nesting cycle. Water depth and vegetation height had a significant positive impact on daily survival rates. We found key factors limiting greater sandhill crane nest success may also have the greatest potential for management to improve recruitment. We suggest landowners to reduce rate of water withdrawal and protect areas of dense vegetation.

0127

Effects of wind farms on wintering Sandhill Cranes in the Southern High Plains of Texas

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Texas has been shown to have a superior annual capacity for wind power and this capacity has led to the erection of multiple wind farms across Texas with many more facilities planned. Wind energy is vital for a shift to carbon-emission free energy, however there has been relatively little research investigating the effect of wind farms as disturbance factors across the landscape. This project examines how wind energy infrastructure affects Sandhill Crane behavior including landscape level habitat uses. Sandhill cranes are known to avoid human disturbance and wind farms have been shown to render surrounding habitat of up to 1 km unsuitable through direct effects (destroying habitat) and indirect effects on bird behavior (avoidance). We examined the distribution of cranes at multiple wind farms in the Southern High Plains of Texas. We evaluated the effects wind farms have on roost occupancy, habitat use and crane behavior by comparing areas with wind turbines to those without for presence of cranes at roosting sites and behavior of cranes at foraging sites. Preliminary findings showed that cranes were found less likely to forage within 2 kilometers of the wind farms and exhibited a clumped distribution when found near wind farms. Additionally, cranes foraging within two kilometers of the wind farms spent more of their time being vigilant and less time loafing than the cranes outside the two kilometers. These findings, along with further analysis can be used to predict areas of avoidance and help preserve important crane habitat in a rapidly developing landscape.

0128

Ecosystem services and playas of the Great Plains

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Playas are the dominant hydrogeomorphic feature within the High Plains portion of the Great Plains. Estimates of the number of these depression recharge wetlands vary but 30,000 to 60,000 occur in the region. Major ecosystem services provided by playas include biodiversity conservation, floodwater storage, biomass accumulation, recreation, contaminant amelioration, and groundwater recharge. Sedimentation has been identified as the major threat to playa services in this intensively farmed landscape. Cultivation of playa catchments promotes erosion which is deposited with runoff into the wetland. Therefore, many playas no longer are recognizable on the landscape and are considered fossils while most remaining playas in cropland have altered hydrology. This loss of wetlands and altered hydrology in remaining playas is negatively impacting services. For example, playas remaining in farmland have less diverse bird and amphibian communities and reduced floodwater storage. Obviously playas with reduced hydroperiods, or fossil playas, can no longer serve as dispersal points or habitat for biota persisting as metapopulations. Despite knowledge of continuing rapid playa loss and calls for immediate conservation action for the past 20 years little sustained conservation has been accomplished in the western High Plains by federal and state agencies or non government organizations. Much more has been accomplished in Rainwater Basin playas. Conservation programs and revenues available to landowners in other wetland regions of the U.S. should be promoted in the western High Plains not only for the ecosystem services they provide to society but also for value they add by diversifying local economies.

0129

A method for estimating productivity during single surveys of wading bird colonies

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Measurements of avian reproductive success can provide valuable information regarding the stability of populations. However, assessing productivity often requires intensive monitoring to follow the fate of marked nests. Such data are associated with significant time commitments and incidence of disturbance—a particular concern when investigating colonially-nesting waterbirds. To develop a productivity index, we investigated the efficacy with which quantitative nest contents data obtained through colony abundance surveys can be used to predict reproductive success. We used abundance survey data and marked nest data from long-term studies of wading bird colonies in the northeastern United States to develop predictive models. Datasets used were a development dataset to compare survey data and measures of reproductive success from intensive nest studies, and a validation dataset reserved for evaluating model performance. Our evaluation of the utility of an index to assess wading bird productivity showed that models developed from data collected during abundance surveys can be reliable predictors of specific nesting outcomes (number of eggs laid, number of eggs hatched and number of nestlings surviving 15 days post-hatch). The models performed well for multiple species over a range of colony sizes, and nest contents data collection during abundance surveys did not entail extra time.

0130

Assessment of the Eastern Population Greater Sandhill Crane (*Grus canadensis tabida*) Fall Survey, 1979-2009

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The Eastern Population of sandhill cranes has been monitored since 1979 with a ground-based survey that involves counting cranes at staging areas throughout their fall migratory range. The fall count suggests the Eastern Population is rapidly increasing, and recently, a management plan was developed that includes provisions for harvesting cranes. We analyzed the fall survey data and compared results to the Breeding Bird Survey and Christmas Bird Count to assess a) the population trajectory of eastern cranes, and b) whether the fall survey is adequate to establish harvest limits in the Mississippi and Atlantic flyways. All three surveys indicate the Eastern Population has increased 3.4 - 10.0% annually. The fall survey seemed adequate for tracking population change but did not portray the geographic expansion of the population as well as either the Breeding Bird Survey or Christmas Bird Count. The fall survey lacks statistical rigor and could be improved by revising criteria for site selection, standardizing protocols, and adjusting for counting bias. An aerial survey similar to that used for Midcontinental sandhill cranes could replace the existing fall survey and provide more reliable results, but would be expensive to implement and maintain. The Christmas Bird Count is an unattractive alternative to the fall survey because Eastern Population cranes cannot be distinguished from the resident Florida population. The Breeding Bird Survey, in contrast, can distinguish and account for both range expansion and varying density within the breeding range, has a long-term history and standardized protocols, and would involve minimal additional cost.

0131

Black Tern Symposium: Summary and synthesis

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Symposium speakers from Europe, Canada, and the US will report on topics as diverse as survey methods and reliability, demography and population models, conservation and management strategies, and genetic studies of mating systems and population structure. Following a short synthesis statement, this session will be an informal discussion of potential collaborations and priorities for research and management in the short- and long-term.

0134

Modeling artificial light viewed by fledgling seabirds

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Artificial light is increasing in coverage across the surface of our planet, impacting the behavioral ecology of many organisms. Attraction to sources of anthropogenic light is a significant threat to certain fledgling shearwaters, petrels (Procellariidae), and storm-petrels (Hydrobatidae) on their first nocturnal flights to the sea. The lure of lights can cause these birds to crash into vegetation or manmade structures, potentially resulting in death from physical injury, starvation, dehydration, predation by introduced predators, or collisions with vehicles. We developed a GIS-based method to model the total intensity of artificial light that fledgling procellariids and hydrobatids could view en route to the ocean and present two models for the island of Kauai as examples. These models are particularly relevant to the federally threatened Newell's shearwater, or `A`o (*Puffinus newelli*), of which >30,000 individuals have been collected in response to light attraction during the past 30 years. Our models suggest that there are few to no dark portions of Kauai from which young birds could fledge and not view light on their post-natal nocturnal flights. In future work using this technique, night light intensity layers could be altered to model the effects of modified coastal light conditions on known and potential procellariid and hydrobatid breeding locations. Certain methods presented herein may also be applicable to other seabirds and additional taxa in which attraction to anthropogenic light poses a serious threat, including migratory passerines and hatchling marine turtles.

0135

Modeling trophic linkages with wading bird prey concentrations: Turning ecosystem attributes into wading bird food

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The trophic hypothesis, a foundation of Everglades restoration, states that restored hydrology will produce higher wading bird prey availability leading to higher nesting effort. Prey availability results from a variety of factors that reorganize prey populations into small, dense patches in conditions that facilitate capture by wading birds. During the dry seasons of 2005-2009, we measured the concentrations of prey that form seasonally as water levels recede across the landscape. Hydrological conditions and wading bird nesting differed markedly among years. Rain during the 2005 dry season caused wading bird nest abandonment. Conversely, the 2006 and 2009 dry seasons had high peak water levels at the start of the dry season and steady recessions with strong wading bird nesting. Drought conditions led to poor nesting in 2007 and 2008. Mean dry season prey biomass (g/m²) at sites was significantly lower in 2007 and 2008 than in 2006 (8, 18, and 48, respectively), likely due to shortened hydroperiods that constrained the growth of prey populations. Favorable hydrologic conditions in 2006 fostered high prey biomass and wading bird nesting. Large numbers of wading birds nested in 2009; however, dry season prey biomass was not correspondingly high (24 g/m²). Model selection showed that dry season prey biomass increased with increased microtopography, rate of water recession, and prey biomass from the preceding wet season. Microtopographical relief and receding water are mechanisms that create shallow depressions and distribute prey into these depressions as the seasonal drying front moves through the landscape.

0136

Large-scale monitoring of shorebird populations using count data and hierarchical models: Black Oystercatcher surveys by land and sea

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Large-scale monitoring of bird populations is often based on count data collected across spatial scales that may include multiple physiographic regions and habitat types. Monitoring at large spatial scales may require multiple survey platforms (e.g., from boats and land when monitoring coastal species) and possibly multiple survey methods. When using multiple survey platforms or methods, it becomes especially important to explicitly account for detection probability when analyzing count data. We evaluated a new analytical framework, binomial mixture models, to estimate actual abundance while accounting for multiple detection biases. We made repeated counts of Black Oystercatchers (*Haematopus bachmani*) from shore in Oregon (n = 56 sites) and from boats in Washington (n = 57 sites). We used a Bayesian analysis of binomial mixture models to (1) assess detection probability as a function of tide height during surveys by boat; and precipitation, wind speed, and number of observers during surveys on foot; and (2) estimate total oystercatcher abundance at all sites. When surveying on foot, probability of detecting oystercatchers was lower during rain, and increased with number of observers. With two observers and no rain, land-based detection probability was 0.51 (95% credible interval [0.25, 0.54]), similar to detection during boat-based surveys (0.51; [0.38, 0.63]). Our estimate of oystercatcher population size was 459 (418, 670) at Oregon sites, and 414 (335, 554) at Washington sites. Binomial mixture models provide a flexible framework for modeling count data and covariates in large-scale bird monitoring programs designed to understand population change.

0137

Predicting wetland use by Black Terns: just "Google©" it

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Remote sensing is a valuable tool for habitat quantification and determination of spatial relationships. Here we show that remote sensing also may be an effective technique to predict wetland site occupancy by Black Terns (*Chlidonias niger*) during the breeding season. We used digital images from National Wetlands Inventory maps and Google Earth© to classify candidate wetlands throughout Wisconsin according to their suitability for providing nesting habitat for Black Terns. Primary criteria used to make the determinations were wetland area, surface vegetation structure and density, and evidence of human encroachment or recreational use. Using these criteria, we evaluated 363 wetlands and classified 112 as suitable, 73 as marginal, and 178 as unsuitable. We then conducted on-site surveys and suitability assessments at each wetland from May to July, 2010, to determine the degree of concordance between the two methods and to determine the utility of remote sensing for predicting site occupancy by Black Terns. The presence/absence of terns differed significantly according to the suitability designation of the wetlands classified by satellite imagery. Terns were present at 47% of the wetlands deemed suitable but only 11% of the sites considered marginal or unsuitable. Of the 42 wetland sites where nesting was confirmed, all were classified by remote sensing as suitable or marginal. We found high concordance between pre-survey and on-site wetland assessments. We propose that remote sensing can be useful in predicting site occupancy by wetland birds that require a specific kind of breeding habitat that is discernable from aerial imagery.

0138

Colony attendance and inter-colonial movements of Double-crested Cormorants nesting on two islands in North Channel of Lake Huron, Ontario, Canada

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Double-crested Cormorant (*Phalacrocorax auritus*) populations in the Great Lakes Basin have increased dramatically in the last 30 years. Despite monitoring and ongoing management efforts to control their numbers little is known about cormorant daily activity budgets, colony attendance and inter-colonial movements. Understanding these basic behaviors is important in developing successful conservation management strategies, and predicting and managing disease outbreaks. During summer 2009 and 2010, on two breeding colonies in North Channel of Lake Huron, Ontario, Canada we radio-tagged 63 adult cormorants. We collected presence/absence data on birds from May – September on these two “home colonies”, two nearby colonies, and a trout aquaculture facility 42km south of the study area. We investigated how gender, breeding stage, moon phase, and weather influence cormorants’ daily activity budgets and intercolonial movements between a home colony and four nearby colonies. We find that colony attendance is negatively correlated with breeding stage progression. Cormorants regularly visit nearby colonies at all hours of the day. The data provides evidence that cormorants may forage nocturnally. Cormorants were unaccounted for on moonlit nights throughout the breeding season for durations of time consistent with previously reported foraging trips by Double-crested Cormorants. We recovered two tags in August 2009 from cormorants culled at a trout aquaculture facility 42km south of the study area. Cormorants visited the aquaculture facility late in the breeding season, suggesting that nearby aquaculture facilities may be important foraging locations for cormorants pre-migration. These and other results will be presented.

0139

Breeding site tenacity and productivity of Common Terns nesting on the North Channel of Lake Huron.

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Common Terns have experienced long-term declines on the Canadian Great Lakes. Currently, the greatest concentration of nests occurs on northern Lake Huron. In June 2010, we surveyed this region, recorded the number of nests at each colony, and compared these results with those of the last complete survey of the area (June, 2008) to assess site tenacity. At each of 5 colonies, from 17-30 enclosed nests/site, we collected data on: egg size, hatching success, morphological measurements (and feather samples) from chicks, and nestling survival to 21 d. There was considerable within-season movement of terns among colonies. Despite a net gain of nests between the first and last week of June, 2008, nest numbers declined at 4 (15%) of 27 colonies, while 8 (30%) colonies were abandoned; during the same period, 7 (26%) new colonies were established. We also observed inter-annual variation in site use, even though the maximum nest count remained similar (2,805 in 2008; 2,983 in 2010). Twenty sites occupied in 2008 (74%) were not re-used and 5 new colonies were established in 2010. There was significant variation in clutch volume ($F_{5,159} = 6.34$, $p < 0.0001$) among sites. Overall, mean hatching success was intermediate (mean = 1.3 ± 1.4 eggs/clutch), but variable (range = 0-2.4). Nestling survival to 21 d was low (mean = 0.1 nestlings/brood, range = 0-0.2). The apparent causes of egg and chick loss were related to weather/storm surge at some sites and avian predation at others. The implications of low site tenacity and poor breeding success on population conservation will be discussed.

0140

Changes in site occupancy and the number of Black Terns breeding in coastal wetlands on the Canadian Great Lakes, 1989-2010

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Complete surveys of Black Terns nesting in coastal marshes, and in wetlands within 5 km of the shorelines of the Canadian Great Lakes and connecting channels, were conducted previously in 1989-1991 and in 2001. In 2010, we began the third "decadal" census of this kind. To date, we have completed surveys at 149 of the 213 sites (70%) identified as having nesting Black Terns previously, either from earlier decadal surveys or from other sources (e.g. Ontario Breeding Bird Atlas, Great Lakes Marsh Monitoring Program). Here we present preliminary results from lakes Ontario and Erie, and sections of Lake St. Clair and Lake Huron, visited during the first year of the census. For the sites visited so far, there was a decline from 263 nests in 1989-91 to 208 nests in 2001 (-21%); we observed a further decline to 79 nests in 2010 (-62%). There was a similar pattern of decline in the number of wetlands occupied by nesting Black Terns: 50 sites had nests in 1989-91, 15 sites had nests in 2001 (-70%), and nesting occurred at 11 wetlands in 2010 (-27%). Based on the sites surveyed to date, we estimate that 70% of breeding pairs and 78% of nesting sites have been lost during the last two decades.

0141

Influence of food and predator abundance on stress levels of Sandhill Cranes wintering in Northern Mexico

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Intense and prolonged stress among birds affects survival and productivity. Stress levels, measured as levels of corticosterone hormones, may be influenced by food resources and predator recognition. However, few studies have explored the effects of such conditions on stress in wild birds. We evaluated the relationship between food and predator abundance on stress levels of sandhill cranes (*Grus canadensis*) wintering in wetlands in Northern Mexico during two winters, 2007-08 and 2008-09. Corticosterone was measured from fecal samples using an Enzyme Immunoassay (EIA). Cranes wintering in wetlands with low food abundance had higher levels of corticosterone ($\bar{x} = 1149.0 \pm 328.0$ SE), than those in areas with high food ($\bar{x} = 99.3 \pm 3.4$ SE). Cranes wintering in wetlands with high predator abundance showed higher levels of corticosterone ($\bar{x} = 1953.0 \pm 373.0$ SE) versus those in wetlands with low predator abundance ($\bar{x} = 116.7 \pm 6.2$ SE). Our results demonstrate the influence of two key environmental factors on stress among wild birds and represent the first account of such influences in cranes.

0142

Whooping Cranes in Florida: weather or not climate matters?

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Historical evidence suggests that numbers of reproductive whooping cranes were never very large in the southern United States. Because the genetic source of cranes reintroduced into Florida originated mostly from much higher latitudes than Florida we might expect that birds would be predisposed to greater reproductive success in cooler climates during laying and incubation. Warmer extremes of temperature and higher humidity might explain the poor reproductive success of reintroduced birds breeding in Florida. A retrospective look at the reproductive parameters of the reintroduced flock indicated that a number of factors were contributing to the overall low success. They include low survival especially of males (high predation, traumatic death), reproductive dysfunction (congenital defects, inappropriate pairing behavior, infertility), and poor nest survival (low hatching rate, nest disturbance, intraspecific aggression). To address the low hatching rate we examined historical weather parameters for any association between hatch failure and extreme temperature, rainfall and humidity events and failed to find them. However, a strong positive association with winter rainfall and water levels prior to nest initiation was discovered. This indicates that physiologic and behavioral condition (neuroendocrine health) of the pair may be more important than the direct impact of weather conditions on the incubation process. In addition to its impact on hatching success, rainfall and water level variations may account for some of the reproductive dysfunction observed. Thus the forecast increase in frequency of periodic droughts is likely to be a significant limiting factor in the survival of reproducing whooping cranes in Florida.

0143

Roosting habits and post-fledging dispersal of juvenile Great Egrets from the lower Great Lakes

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In Ontario, breeding Great Egrets (*Ardea alba*) have increased from one pair in 1952 to over 350 pairs in the 2000s. Since 2000, >1200 YOY have been colour-banded on the lower Great Lakes and in 2010, 118 were marked with orange wing-tags. The objectives of the project were: 1) to track the dispersal of egrets from their natal colonies, 2) to locate and monitor occupancy of post-breeding roosting sites to increase reporting of tagged egrets and 3) to identify wintering areas of Great Lakes GREGs. A large roost (300+ individuals) was located at Luther Marsh, 100 km nw of Toronto, Ontario, and occupied from late June - late September 2009 and 2010; duck hunters caused the egrets to vacate their roost in September. Twenty-eight other roosts were located or suspected. All roosts examined (N=16) were in or adjacent to water in live or dead trees, bushes or on mudflats. Roost size varied from 2 - 400+ individuals. Modal nearest neighbour distance for 24 roosts was 8 km (median = 24 km). For wing-tagged egrets, 126 reports were received on 38 individuals (32.2% re-sighting) during July - October. The maximum number of sightings per individual was 15. The maximum duration of stay in a specific area was 45 days. Most reports came from southern Ontario with a few from western New York, Ohio, Michigan and Wisconsin. There was very little northward post-breeding dispersal reported. Twelve egrets were reported outside the Great Lakes in winter, mostly from coastal Carolinas, Florida and the Caribbean.

0144

Survival of Mountain Plover chicks in agricultural fields of western Nebraska

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Mountain Plover commonly breed on private land. We developed and implemented a program for protecting Mountain Plover nests on privately owned crop fields whereby nests were located and marked to avoid accidental destruction during farming operations. While this program was successful in reducing nest failure, the fate of mountain plover broods post-hatching was unknown. In 2010 we successfully tracked 33 adult Mountain Plover with radio transmitters, counting their young each time the adult was observed. We estimated 71% chick survival over the 36 day period during which juvenile Mountain Plover are dependent on their parents. This estimate is higher than that found for Mountain Plover in eastern Colorado (67%) and Montana (19%; Dinsmore et al. 2010). All broods in our study remained in agricultural fields throughout the dependency period. We found no evidence for a difference in chick survival between organic fields and those exposed to chemical treatments.

0145

Changing climates and changing landscapes: A migrant bird's dilemma

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In migratory birds, numerous accounts highlight phenological shifts in migratory timing in response to changes in seasonality, but considerable variation remains among species and even populations. Due to their implicit dependence on spatially, temporally, and climatically separated habitats, understanding the phenological response of migratory species requires careful consideration of the effects of climate change across multiple temporal and geographic scales. Experimental and observational evidence shows that migration patterns closely track local vegetative phenology because vegetative phenology predicts the food resources birds prefer. The tight correlation between local habitat phenology and migratory patterns and behaviors is important because climate change and habitat alteration are significantly impacting phenological conditions often at different rates for migration and breeding locations. Such differences may increase costs to individual birds by creating discordance in the timing of resource availability at migratory and breeding locations, which may explain limited responses to changing climatic conditions, and ultimately elucidate a new threat to the long-term viability of many migratory populations.

0146

Deepwater Horizon ephemeral data collection: Carcass stranding data to help evaluate acute avian mortality

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In response to the Deepwater Horizon Oil Spill, BP, and state and federal Trustees, worked cooperatively to systematically search shorelines for stranded bird carcasses. Prior to oil making landfall, a series of transects was established along Mississippi, Alabama, and Florida panhandle shorelines. These transects, representing approximately 20 percent of the coast line, were searched for beach cast carcasses once every 3 to 7 days from mid-May through September. The effort was adaptively managed in response to on-sea events and real-time data analysis such that, at various points in time, transects were being systematically searched from Cape Canaveral Florida around the Gulf of Mexico to the Texas/Mexico border. This paper will describe the sampling design and protocols developed to support the data collection effort. Carcass collection rates will be summarized in a series of temporally and spatially explicit figures and compared to data describing carcass collections rates that may have been expected absent any spill-related avian mortality.

0147

Deepwater Horizon ephemeral data collection: Oiling rate data to help evaluate acute avian mortality

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In response to the Deepwater Horizon Oil Spill, BP, and state and federal Trustees, worked cooperatively to determine the proportion of birds in the Gulf of Mexico that were visibly oiled. Prior to oil making landfall, a series of survey locations was established along Mississippi, Alabama, and Florida panhandle shorelines. Birds at these locations, were observed for 15 minutes every 3 to 7 days from mid-May 2010 through January of 2011. The effort was adaptively managed in response to on-sea events and real-time data analysis such that, at various points in time land based observations were being made at locations from Cape Canaveral Florida around the Gulf of Mexico to the Texas/Mexico border and boat based observations were being made throughout the EEZ. This paper will describe the sampling design and protocols developed to support the data collection effort. Visible oiling rates will be summarized in a series of temporally and spatially explicit figures.

0148

Annual habitat of the Rainwater Basin

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Nebraska's Rainwater Basin playa wetland complex provides critical spring migration habitat for millions of waterfowl and other water birds. However, these wetlands have been highly impacted by agriculture, and many have been eliminated or greatly reduced in function. The ephemeral nature of these wetlands, and lack of contemporary data on distribution and condition, prompted the Rainwater Basin Joint Venture (RWBJV) to conduct an Annual Habitat Survey (AHS) covering more than 80% of the complex. One meter resolution CIR aerial imagery was collected during peak waterfowl migration in springs 2004, and 2006-2010. These years characterized a range of precipitation, with 2004 being average, 2006 below average, and 2007 above average. Analysis of AHS data provided new insight into the distribution, function, variability, and habitat quality and quantity of these wetlands. We documented that 20% - 22% of historic wetlands (12,100 - 13,400 ha) were functioning by having hydric vegetation and/or ponded water. Ponded water was present on 1 - 8% (900 - 4,860 ha) of the historic wetland acres. The estimated seed production from these ponded acres provided 4 million to 1.9 billion kilocalories of forage for migrating waterfowl. This is significantly below the estimated 4.4 billion kilocalories from wetland seeds needed to support the target spring migrating waterfowl population. The AHS is a powerful planning tool helping the RWBJV strategically plan and implement conservation strategies such as protection, watershed and wetland restoration, and vegetation management to meet their goal and objectives.

0149

Factors influencing waterfowl habitat use and behavior during migration through the Rainwater Basin

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Conversion of wetlands in the Rainwater Basin (RWB) region to agricultural fields has led to the destruction of over 90% of the wetlands and 88% of the original wetland area. The approximate 400 remaining RWB wetlands provide essential stopover sites and staging areas to migratory wetland birds in the Central Flyway, including 7-9 million waterfowl each spring. The goal of this study was to obtain detailed information on migratory wetland bird habitat use patterns and behavior in the RWB as they relate to local (i.e. area, vegetation patterns) and landscape-level (i.e. surrounding habitat use) factors. We surveyed migratory waterfowl on 40 wetlands in the RWB from February - May in 2002 - 2004 using multiple linear regression. Wetland area, emergent vegetation, and hunting pressure all influenced goose abundance, whereas dabbling duck abundance was influenced by area of wetlands within 10 km, hunting pressure and emergent vegetation. We also examined the effects of year, diel time period, and hunting pressure on behavior of geese and dabbling ducks using multivariate analysis of variance. In 2004 geese fed less frequently on hunted wetlands than unhunted wetlands. Dabbling ducks fed less frequently on hunted wetlands compared to unhunted wetlands. In addition, dabbling ducks were more frequently observed feeding and in aggressive behavior in 2002 and 2003 compared to 2004. Managing for wetland complexes within 10 km and restricting hunting to semi-permanent wetlands will help increase habitat conditions for dabbling ducks during migration.

0151

Using surveys of foraging areas as an indicator of local movements of Great Egrets in the NJ Meadowlands

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'Harbor Herons', herons, egrets, and ibises nesting on islands in the NY/NJ Harbor, have been hailed as signs of improved environmental quality and biodiversity in the Harbor Bight region. We investigated foraging habitat use of Great Egrets within the urban/suburban matrix of this metropolitan region to (1) identify preferred foraging sites within the NY/NJ area, (2) track seasonal abundance of Harbor Herons and (3) examine post-breeding movements. Field work was conducted through the efforts of NJ and NYC Audubon Citizen Scientists, appropriately trained in survey methodology. In total, over 5,000 observations of Harbor Herons were made in 2009 and 2010; Great Egrets and Snowy Egrets were most commonly observed. In New Jersey, the Meadowlands region had the highest average number of egrets. The nearest known breeding colonies to these sites are North and South Brother Islands, 10 km to the East. In New York, highest numbers of both species were recorded in Jamaica Bay, which is also where the Canarsie Pol colony is located. Numbers of egrets peaked at preferred sites during the second half of August, and then decreased by the end of September. This is most likely the result of the influx of the juvenile birds and movement of the adults away from the island colonies. The numbers of Great Egrets and Snowy Egrets recorded at all foraging sites approximated the number of adults and projected young at the NY/NJ colonies and suggest that dispersing birds from the NY/NJ Harbor islands use local wetlands post-breeding.

0152

Spring migration of Mallards from Arkansas as assessed by satellite telemetry

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We used satellite telemetry to assess spring migration movements of mallards marked in Arkansas between 2004 and 2007. Of the 143 marked mallards that migrated from Arkansas, the mean departure date from Arkansas was 19 March (SE = 1.01 days; range 18 February - 20 April). For those mallards that stopped for >1day ('stopover') before entering the Prairie Pothole Region (PPR), the average length was 12 days (SE = 0.90 days, rg = 2 - 54 days). Females made significantly more stopovers in 2007 than in any other year. Mallards migrated on average 1,184 km (SE = 25.8) between Arkansas and next in the PPR and on average spent 18 days (SE = 1.2 days) to do so. Mallards arrived in the PPR significantly earlier in 2006 (Least Squares Mean [LSM] = 30 March) than in 2005 (LSM = 7 April). Females spent significantly more days on migration in 2007 (28 days) than during any other year (rg LSM 2004 -2006 = 8-18 days). Females traveled significantly further during each migration movement (671 km) than did males (573 km). Mallards moved significantly further per migration movement in 2004 (LSM = 757 km) and in 2006 (LSM = 664 km) than in 2005 (LSM = 446 km). Females nested across 10 Breeding Conservation Regions and South Dakota was the most frequented state (n = 9) where nesting occurred. Our data provide chronology and phenology of spring migratory patterns of individually tracked mallards and should be useful in better managing mallards.

0153

Energetics of Greater White-fronted Geese during spring migration

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Waterfowl and other migratory birds commonly store nutrients at key staging areas during spring for later use during migration and reproduction. We investigated nutrient-storage dynamics in the midcontinent population of greater white-fronted geese (*Anser albifrons*; hereafter white-fronted geese) at spring stopover sites in the Rainwater Basin of Nebraska during February-April and in southern Saskatchewan during April-May, 1998 and 1999. In Nebraska, lipid content did not increase, and protein content changed little over time for most age and sex categories. In Saskatchewan, lipids increased 11.4 g/day and protein content increased 1.6 g/day for adult geese collected over a 3-week period. A study conducted during 1979-1980 in the Rainwater Basin reported that white-fronted geese gained 8.8-17.7 g of lipids per day during spring, differing greatly from our results two decades later. In addition, lipid levels were lower in the 1990s compared to spring 1980 for adult geese nearing departure from staging sites in Saskatchewan. Thus, a shift has occurred in the primary location where geese acquired nutrient stores from Nebraska to northern staging sites. This shift coincided with a decrease in availability of waste corn, their primary food source while staging in Nebraska, and an increase in cultivation of high-energy pulse crops in Saskatchewan.

0154

Energetics of waterfowl migrating through the Rainwater Basin of Nebraska in spring

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Wetland habitats in the Rainwater Basin (RWB) of Nebraska provide essential migration stopover habitat for 7 - 10 million waterfowl in the Central Flyway each spring. Among landscape-level variables found to influence waterfowl use of wetland habitats in the RWB are wetland density (number of wetlands on the surrounding landscape) and wetland area (area of wetlands on the surrounding landscape). However, no previous study has attempted to identify the contributions of wetland density and area to dabbling duck energetics during migration. Therefore, the goal of our study was to compare nutrient acquisition and storage of migrating dabbling ducks in habitats with different wetland density and area. We collected female mallards ($n = 60$) and blue-winged teal ($n = 117$) from wetland habitats during spring of 2008 and 2009. Adults of both species had greater lipid mass in habitats with higher wetland densities ($F_{3/23} = 7.45$, $P = 0.01$ and $F_{5/35} = 3.0$, $P = 0.07$, respectively). For mallards in the early stage of migration ($n = 29$), individuals collected in high wetland density habitats had greater mean triglycerides (mg/ml) than those collected in habitats with lower wetland density ($F_{3/28} = 6.40$, $P < 0.02$). If conservation efforts seek to restore or develop wetland habitats for the benefit of migrating dabbling duck populations, our results suggest that special consideration be given to density and area of wetlands on the surrounding landscape.

0155

Hydrology and bird use of Nebraska's southwest playays

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High-quality stopover wetlands are vital to the survival and reproductive success of wetland-dependent migratory birds. In parts of the Central Flyway, the most numerous wetlands are playays: small, ephemeral wetlands threatened by development, excavation, and sedimentation. In addition to direct modifications, playays are also influenced by a heavily agricultural landscape. To guide conservation practices and programs, data are needed regarding the hydrologic conditions of playays in relation to land uses and the attributes of playays related to use by migrating birds. We studied how local and landscape-level factors affected the responses of playays to heavy rain events and bird use of wet playays during migration in southwestern Nebraska. We found that playays in rangeland were more likely to become inundated than playays in cropland, and both were more likely to become inundated than playays in fields enrolled in USDA's Conservation Reserve Program (CRP). Probability of inundation was also positively related to rainfall amount and playa size. Waterfowl and shorebird abundance increased with playa area (logarithmically), area flooded, and proportion of unvegetated habitat. In addition, some shorebirds were more abundant in playays without hydrologic modifications. At the landscape scale, waterfowl increased with the proportion of landscape in CRP. Shorebirds were positively related to the density of playays in the landscape and distance to non-playa wetlands. Management recommendations include planning conservation plantings and buffers to facilitate open, flooded playa conditions, minimizing or restoring damage due to excavations, and considering the size and density of playays when prioritizing areas for conservation.

0156

The impacts of grazing on Rainwater Basin wetlands

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Invasive species are a problem in many areas, but wetlands tend to be especially vulnerable to invasive species because they have higher water and soil nutrient levels than surrounding areas. In the Rainwater Basin region, reed canarygrass (*Phalaris arundinaceae*) is a common and widespread invasive species. Managers frequently use cattle grazing as a management tool to reduce the abundance of reed canarygrass and improve growing conditions for more desirable wetland plants. But, there is uncertainty about the effectiveness of using cattle grazing to achieve these management goals. A study was done to evaluate the impacts of grazing on reed canarygrass invasion in heavily invaded Rainwater Basin wetlands. Using common stocking rates and grazing timing, we first evaluated the impact of spring grazing on reed canarygrass abundance, and second, we evaluated the impact of spring grazing on basal cover, species richness, and species abundances in invaded areas to determine if grazing had beneficial impacts on the plant community. We found that grazing in these areas did not decrease reed canarygrass abundance or increase species richness during the duration of this study. However, because grazing decreased litter and increased bare soil, grazing did create conditions conducive to future improvements in native species germination and growth. We concluded that grazing, as done in this study, is not an effective way to reduce reed canarygrass, but that grazing can be used to mitigate some of the negative impacts of reed canarygrass invasion.

0157

Playa distribution and geomorphic evolution on the Kansas High Plains

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Playas and dunes ("lunettes") associated with some larger playas are important elements of the High Plains landscape. Distribution of playas and playa-lunette systems (PLSs) has been rendered as a comprehensive GIS database was created for Kansas utilizing several geospatial data sources, including aerial imagery, digital raster graphics, and SSURGO soils data. To reconstruct the evolutionary history of PLSs, several playas have been investigated throughout the High Plains. Results indicate >22,000 playas occur in Kansas, but only 174 lunettes have been identified. Playa surface area ranges from 0.03 to 188 ha, with a mean area of 1.65 ha. About 80% are smaller than 2 ha, and only about 400 playas are larger than 10 ha. Of 174 lunettes identified, 105 are single lunettes associated with a single playa, while 69 are lunette complexes. As a result of predominantly north to northwest winds during playa development, most (157) lunettes are located along the southern, southeastern, or eastern margin of playas. Lunette surface area ranges from 0.6 to ~150 h; mean surface area is 20 ha. Stratigraphic investigations of PLSs indicate they are composed of sediment spanning >40 kyrs. PLS stratigraphy represents a continuum of the uplands High Plains loess sequence, though deposits are altered by playa hydrology. Geomorphic processes alternated between fluvial- and eolian-driven as climate changed, yet playas were at least partially inundated most years. Due to the aggradational environment and sensitivity of PLSs, high-resolution records of environmental change throughout their evolution are preserved and are being extracted.

0158

The influence of playa wetlands on biodiversity of the High Plains

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The High Plains is a unique landscape linking the mesic eastern ecosystems with the arid and semi-arid western ecosystems. Originally short-grass prairie with fire, nomadic herbivores, and dynamic climate as ecological drivers, the High Plains is likely the most altered ecosystem of North America, having experienced at least 6 major landscape transformations since the late 1800s. As a transitional region, the High Plains supports a distinctive native flora and fauna that are adapted to historical ecological drivers - in particular, a dynamic, unpredictable environment. Throughout much of the High Plains, the principal element of landscape heterogeneity is in the form of isolated, depressional playa wetlands. Despite being physically isolated, ecologically all the playas comprise a critically linked system containing a vast range of habitat conditions in response to local environmental conditions. Playas of the Southern Great Plains support nearly 350 plant species, with an additional 100 species found in playas of Colorado and Nebraska. Most mammals use playa habitats with several small mammals reported only from playas. Greater than 200 avian species use playas, with majority of species completely dependent on playa habitats. Few amphibians would exist on the High Plains without the presence of playas. Recently, it was estimated that nearly 20% of historical playas are no longer evident on the landscape of the SGP. Such extensive loss, continued physical loss, and widespread degradation of remaining playas reduces the ability of the playa system to support diversity dependent upon these dynamic habitats.

0160

Buff-breasted Sandpiper (*Tryngites subruficollis*) use of agricultural fields in the Rainwater Basin, Nebraska, and implications for conservation

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The Buff-breasted Sandpiper is a trans-continental migrant shorebird of high conservation concern that migrates from central South America to the Arctic each spring and fall. Until recently, the species' migration through midcontinental North America was poorly understood. Since 1997, we have studied migratory shorebirds in the Rainwater Basin (RWB), Nebraska. Our research started as an informal inventory of migratory species that identified how migratory shorebirds, including the Buff-breasted Sandpiper, were using the region's agricultural fields during stopover. Further research showed that a large proportion of the Buff-breasted Sandpiper's world population used RWB agricultural fields during spring migration and preferred fields that had been planted with soybeans the previous year. Results from capturing and radiotagging showed that Buff-breasted Sandpiper had high fat loads when captured and suggested that an individual bird's stopover may be brief, less than a few days. Buff-breasted sandpipers spent the majority of their time foraging in agricultural field and visited wetlands to bathe, preen, and engage in social interactions. Our result show that agricultural fields serve as pivotal stopover habitat for the Buff-breasted Sandpiper and other migratory shorebird species. Whether agricultural habitats serve as a suitable replacement to native habitats and are compatible with the species' and its conservation is yet to be determined.

0161

Whooping Crane migration through the Great Plains: Conservation issues

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The Whooping Crane (*Grus americana*) is a critically endangered species with less than 300 individuals left in the wild. Whooping Cranes breed in Wood Buffalo National Park in Canada and winters along the Texas coast at Aransas national Wildlife Refuge and surrounding areas. Whooping cranes migrate south every fall and north every spring through the Great Plains. Whooping cranes use shallow wetlands as stopover roost sites while in migration. Information gathered to date via several sources has defined the migratory route and has allowed for identification of important stopover areas which will be presented. Only four migratory stopover sites have been designated as critical habitat for whooping in the entire migratory corridor. Therefore, a significant gap remains in regards to protection of migratory stopover areas for whooping cranes. The migration period is the time of the yearly cycle during which most of the whooping crane mortality occurs and is the period of most concern from a conservation standpoint. Issues of conservation concern during migration include high mortality, stopover habitat loss, lack of protection of important stopover areas, and potential future conflicts with renewable energy source infrastructure. The identification and characterization of stopover areas is of critical concern and some suggestions are made for their evaluation, categorization and prioritization for protection.

0162

Diet of spring migratory ducks: Ecological and management implications

Mike Eichholz

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The diet of North American waterfowl tends to vary between a diet high in protein during the breeding season to a diet high in carbohydrates during fall and winter. North American geese and swans, which are primarily capital breeders, switch from a fall and winter diet high in carbohydrates to a highly proteinaceous diet in late winter or early in spring migration. In contrast, little information is available regarding when dabbling and diving ducks, which are considered to be more income dependent breeder relative to geese, transition from a primarily carbohydrate to more protein based diet. In this presentation, I provide evidence gadwall, mallard, ring-neck, scaup, and blue-winged teal are beginning this transition during spring migration, prior to arrival on the breeding grounds and discuss the ecological and management implications of this transition. Preliminary results indicate the level of transition is dependent on date and latitude of collection, and varies by species depending on average date of nest initiation. These results as well as results from a simultaneous body condition study indicate, like geese, productivity of temperate nesting ducks is dependent on reserves acquired during spring migration. Results also indicate proper management of spring migratory duck habitat requires both shallow and deep water habitat that provides food high in both carbohydrates and proteins.

0164

Sedimentation and volume loss in cropland, grassland, and CRP playas

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Playas are distributed throughout the Southern Great Plains (SGP) and their physical integrity is critical to proper function and provision of ecosystem services. Loss of playa volume hinders its ability for storing precipitation runoff, thus negatively influencing hydroperiod. Playas are generally embedded in one of three land uses: native grassland, cropland, or Conservation Reserve Program (CRP), the latter designed to remove highly erodible land from cultivation. Our goal was to assess the influence of surrounding land use practices on sediment and volume characteristics of 255 playas split among the three land use types and ranging from Texas to Nebraska. Grassland playas averaged about 2-3 times larger than those in cropland or CRP watersheds, and had 2-5 times more volume. Volume loss was greatest in cropland playas, averaging 209.3±23.6%, about 2-3 times greater than that in CRP and grassland playas. Playas in the south were 4 and 7 ha larger than those in the central and north regions, which averaged 6.4±0.8 and 3.6±0.5 ha, respectively. In addition, sediment depth (27.9±1.7 cm) and sediment volume (21,429±1,346 m³) were greater in southern playas, decreasing in playas toward the north. Despite deeper sediments in southern playas, the overall larger size of playas in the south supports an average remaining volume of 22,328±5902 m³, which is over twice as much as for other playas. Southern playas were considerably larger and currently retain greater storage volume than those in the north, which supports their greater contribution to ecosystem service provisioning.

0165

Spatiotemporal scaling of continental interior wetlands: Implications for shorebird conservation

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Within the interior of North America, erratic weather patterns and heterogeneous wetland complexes cause wide spatio-temporal variation in the resources available to migrating shorebirds. Identifying the pattern-generating components of landscape-level resources and the scales at which shorebirds respond to these patterns will better facilitate conservation efforts for these species. We examined the relationships between weather and wetland habitat incidence and between wetland habitat density and shorebird occurrence over five seasons in ten focal landscapes in north-central Oklahoma. We used regression modeling and an information theoretic framework to identify weather variables associated with generating the observed spatio-temporal patterns of wetland habitats. We developed a landscape metric to estimate changes in the density of shorebird habitat over time at five spatial scales. Furthermore, we compared classification tree models to assess the spatial scale that best described the observed occurrence patterns of shorebirds. Precipitation, temperature, solar irradiation and wind speed best explained the incidence of wetland habitat, but relationships varied with time and among wetland types. Shorebird occurrence patterns were best explained by habitat density estimates at a 2km scale. This model correctly classified 85% of shorebird observations. At this scale, when habitat density was low, shorebirds occurred in 6% of surveyed habitat patches but occurrence reached 56% when habitat density was high. Our results suggest scale dependence in the habitat-use patterns of migratory shorebirds. We discuss how integrating this information into conservation efforts may lead to more accurate and efficient census and research techniques and improved conservation strategies and management practices.

0166

Vegetation and seed bank responses to sediment removal in Rainwater Basin wetlands

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Alterations of natural hydrologic regimes and sedimentation from agricultural land use have affected most depressional wetlands in the Great Plains. These changes can result in altered plant community structure through burial of seed banks. Our objectives of this study were to: (1) compare the wetland seed bank communities between land use (reference, restored and impacted by agriculture) treatments; (2) determine the available seed bank following sediment removal and; (3) determine the similarity between standing vegetation and the seed banks for each wetland land use type. The vegetation and seed banks of 15 wetlands were sampled within the Rainwater Basin region of Nebraska in 2009. There was no significant difference in species richness and the number and composition of annuals, perennials, native, or invasive species between the three land use seed bank treatments. Restored wetlands had a greater number and composition of upland plants and a lower composition of wetland plants germinate from the soil seed bank compared to reference and agricultural land use wetlands. Germination of seeds after 30 cm of soil was removed (to simulate available seed bank if the wetland was to be restored) in agricultural land use wetlands was low. Reference wetlands had the highest similarity between seed bank species and standing vegetation.

0167

Population monitoring for colonial waterbird conservation and management

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Our ability to make regional-scale inferences about population status from colonial waterbird monitoring programs in the contiguous U.S. varies by region, broadly described here as the West, Great Lakes and Midwest, Plains and Prairies, Northeast and Southeast. A review of conservation planning documents reveal that only for a few species (usually highly imperiled) is this ability considered satisfactory. In some regions this is due to a dearth of monitoring activities to produce the requisite data, in others it is incompatibility of data from existing monitoring programs within the region (e.g, differing metrics, protocols, etc). Recent thinking by the USFWS Migratory Bird Program is that maximizing the contribution of monitoring to conservation and management of migratory birds is best done by tying it to explicit decisions. Historically, these decisions are often broadly described, but in some regions, there has been an effort to more specifically state them. It is hoped that this approach will be effective in securing funding for new monitoring activities, given the trend towards outcome-oriented investments.

Moreover, definitive, well-articulated conservation decisions are the best means of identifying common stakeholder objectives, and to integrate ongoing monitoring programs, arguably a greater challenge than commencing new ones.

0168

Twenty-five years and counting - Long-term waterbird monitoring in the New York Harbor.

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NY City Audubon has conducted colonial waterbird nest surveys since 1982. Species surveyed included: Great Egret (*Ardea alba*), Snowy Egret (*Egretta thula*), Cattle Egret (*Bubulcus ibis*), Black-crowned Night-Heron (*Nycticorax nycticorax*), Yellow-crowned Night-Heron (*Nyctanassa violacea*), Little Blue Heron (*Egretta caerulea*), Tricolored Heron (*Egretta tricolor*), Green Heron (*Butorides virescens*), Glossy Ibis (*Plegadis falcinellus*), Double-crested Cormorant (*Phalacrocorax auritus*), Great Black-backed Gull (*Larus marinus*), and Herring Gull (*Larus argentatus*). By 1986, colonies occupied 4 of 17 suitable island sites; 7 in 1996; and 11 in 2010. The harbor-wide wading bird population peaked in 1993 (n=2283 pairs) and has remained at about 1,700 pairs (SE=143) through 2010. The cormorant colony dynamics follow the same pattern: increasing site use from 3 to 8 islands. The population peaked in 1995 (n=1806) and has maintained a harbor-wide population of 1201 pairs (SE=171) through 2010. Since 2006, monitoring effort has included research and surveys that describe the nutritional landscape, including assessment of adult diet, nestling provisioning, and seasonal carry-over effects. Additionally NYC Audubon and NJ Audubon Society engage citizen scientists to monitor and describe activity at foraging sites. Monitoring nesting activity provides important basic population information, but additional components addressing foraging dynamics and diet are needed in a monitoring program to fully guide management and conservation of colonial waterbirds.

0170

Assessing the impact of the Deep Water Horizon oil spill on Piping Plovers

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The Gulf of Mexico is a key wintering area for the piping plover. Hence, when the deepwater horizon oil spill occurred, there was concern that the spill might have an adverse affect on this species. Here we report the design of a project to determine what, if any, effect the oil spill had on piping plovers. During the winter of 2010, the spill portion of the study is being conducted on coastal beaches and barrier beaches from Raccoon Island, LA to Dauphin Island, AL. Reference data are being collected in Florida, Georgia and Texas. We expect all three sub populations (Atlantic Coast, Great Plains, and Great Lakes) to be represented in the sampling. Many piping plovers are marked from previous studies. We will mark additional birds to provide adequate sample sizes in the studied areas. Periodic surveys will be conducted and individually marked birds will be noted. During the breeding season of 2011, we will resight birds on the Missouri River breeding grounds and also on nearby breeding sites on other rivers and on in Alkali wetlands of the Great Plains, Nebraska through Montana. Using these data, we will estimate true and apparent survival, and immigration and emigration rates in the spill area and in control areas, and in the Missouri River area. Please email date, location, and band combinations of color-banded piping plovers to Vt.Plover@gmail.com.

0171

Assessing injury to colonial waterbirds from the Deepwater Horizon oil spill

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On April 20, 2010 over 200 million gallons of crude oil was released from a deepwater oil wellhead into the Gulf of Mexico, subsequently covering more than 180,000 km² - from central Louisiana to the Florida panhandle. As part of a natural resource damage assessment (NRDA), data quantifying the potential injury to natural resources are being collected. Colonial waterbirds are one group of organisms emphasized. Within the NRDA process, we are assessing the oiling rate and fate of representative species, including the brown pelican, black skimmer, and great egret. Because findings are litigation sensitive only the experimental design and field approaches for data collection will be presented.

0172

The effect of the Deepwater Horizon oil spill on waterbirds: Discussion and synthesis

Jonathan Cohen

SUNY-ESF, Syracuse, NY, United States

Nearly one year has passed since the Gulf Spill, and some questions are just beginning to be answered about effects on waterbirds. Some of the answers that do exist are confidential, and this has slowed the pace at which the waterbird conservation community has learned about Gulf spill-related waterbird research. The goal of the symposium has been to provide answers to the questions 1) What can waterbird scientists do to assist with damage assessment and remediation when a major spill happens, 2) what work is currently underway to assess damage to waterbirds in response to the Gulf spill and what are the preliminary findings, and 3) what are some findings from longer term studies that occurred after other major spills, that might guide efforts beyond the short term damage assessment? With this discussion forum, attendees will have another chance to get their questions and comments addressed by a panel of speakers.

0173

Bird-focused injury science, Natural Resource Damage Assessment, and the MC252 Gulf Spill

Roger Helm

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Birds are typically impacted by marine and estuarine oil spills and they have become one of the primary taxa of interest to the U.S. Fish and Wildlife Service in pursuing natural resource damage (NRD) claims. NRD is a science-based process that is conducted within a legal framework. Various federal agencies, all states, and all federally-recognized tribes can act as Natural Resource Trustees on behalf of the public to assess the magnitude of injury to natural resources following a spill and make a legal-based damage claim for restoration of the injured resources to the party(ies) responsible for the spill. Natural resources are defined broadly in the statutes and regulations guiding the NRD process, but birds often become the focal point of the injury assessment process and a major beneficiary of post-settlement restoration activities. Legally, NRD is not considered a punitive process and the responsible party(ies) are only liable to "make the public whole" for the injuries caused by their release. This presentation will explain the basics and some nuances of the NRD process, provide examples of past settlements and ongoing restoration actions, and present an overview of some of the bird assessment studies being pursued by the Department of the Interior in the wake of the MC252 Gulf oil spill.

0174

Perspective on the Deepwater Horizon Disaster: The larger conservation context in the northern Gulf of Mexico

Melanie Driscoll

National Audubon Society, Baton Rouge, LA, United States

The Deepwater Horizon explosion and resultant oil spill occurred in a working landscape amid other, smaller oil spills as well as a myriad of other threats. This working landscape is of national significance, producing over 30% of our nation's seafood as well as a significant proportion of our nationally-produced oil and natural gas. Conservation threats in this ecosystem include the fastest rate of land loss in the conterminous United States, tremendous development pressure, inappropriate energy development, and global climate change. These threats affect tremendous resources of national and global significance, including marshes which produce our seafood, beaches supporting tourism and local economies, oil, gas, and alternative energy sources, unique cultures and languages, and bird populations of global importance. I will examine conservation opportunities, both short- and long-term, and will outline strategies for conservation at scale in this dynamic, vulnerable, and productive ecosystem. I will also identify ongoing monitoring and conservation needs.

POSTER PRESENTATIONS

0013

An update on mortality of fledged Whooping Cranes in the Aransas / Wood Buffalo Population

Tom Stehn, Carey Strobel

U.S. Fish & Wildlife Service, Austwell, Texas, United States

A total of 5,335 whooping cranes (*Grus americana*) overwintered at Aransas from 1950 through spring, 2010. Winter losses (dead and disappeared) amounted to only 1.9% of the population. About 20% of total losses occurred in the wintering area where birds spend 5 to 6 months of the year. Losses of fledged whooping cranes on the summering area appear to be low with only 2 instances documented. The most significant losses seem to occur in migration and may comprise nearly 80% of the annual mortality. Migration involves only 17-20% of the birds' year, but a period when losses are high because they are exposed to new hazards as they travel through mostly unfamiliar environments. This paper updates a similar manuscript written by Lewis et al. (1992) by categorizing mortality records of the AWBP from 1987 – 2010 which includes information on 27 carcasses recovered during that time period. Of the 50 total carcasses recovered, the most losses were attributed to collisions with power lines (n=10) and shootings (n=10).

0020

Impact of harvest on survival of captive-reared Mallard released for hunting purposes

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Since the 1970s, several million juvenile Mallards *Anas platyrhynchos* have been released every year into the wild for hunting purposes in Europe. Releases take place within two months of the onset of the hunting season. Based on experimental releases of farmed Mallards on two hunting estates and one non-hunting reserve, we evaluated the impact of hunting on survival of these birds using marking-resightings dataset of individually tagged birds. Survival of released Mallards was always very low, even when these were not hunted. The estimated survival probability from release in June to the next breeding season was 6.7%, 21.3% and 5.4 % on the two hunting estates and the non-hunting reserve, respectively. These results suggest that a large part of the released Mallards shot during their first hunting season would not have survived anyway (that is, hunting mortality was almost 100% compensatory to natural mortality). It also tends to indicate that released mallards are likely to enter the breeding segment of the population only in limited numbers.

0022

The use of satellite telemetry to evaluate migration chronology and breeding, migratory, and wintering distribution of Eastern Population of Sandhill Cranes

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The Eastern Population (EP) of sandhill cranes (*Grus canadensis*) is rapidly expanding in size and geographic range. The core of the EP's breeding range spans much of Wisconsin and Michigan in the United States, and most of Ontario in Canada; however, the EP has expanded in all directions as the population has continued to grow. As a result, little is known about the geographic extent of the breeding, migratory, and wintering range of EP cranes as well as migratory chronology and use of primary staging areas. In December 2009, we began trapping EP cranes and deploying solar-powered Global Positioning System satellite transmitters to assess spatial and temporal variation in annual movements. To date, we have trapped and attached transmitters ($n = 30$) at Manitoulin Island, Ontario, Jasper-Pulaski Fish and Wildlife Area, Jasper & Pulaski Counties, Indiana, and Hiawassee Wildlife Refuge, Meigs County, Tennessee. GPS data are currently being received from CLS America Inc., Maryland, translated by software developed by NorthStar Science and Technology, Virginia, and analyzed using Environment System Research Institute (ESRI) ArcGIS software. In 2011, preliminary data show that one crane remains in Indiana, one in Kentucky, twelve in Tennessee, two in Georgia, and the remainder in Florida. These data provide the first comprehensive representation of the annual habitats that EP cranes frequent. While subsequent seasons of data collection will provide more robust estimates of range boundaries, these initial data remain particularly pertinent due to the unknown nature of the EP in general.

0025

Movements and survival of juvenile Reddish Egrets along the Gulf coast: Initial observations

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Juvenile survival is considered to be a limiting factor in Reddish Egrets (*Egretta rufescens*), a plumage-dimorphic species whose conservation efforts are limited by a lack of life history information. In addition to providing basic information about the species, differences in movements between dark- and white-plumaged Reddish Egrets could point toward additional mechanisms that play a role in the maintenance of plumage dimorphism. In this ongoing study, survival, dispersal and site fidelity of juvenile Reddish Egrets are measured using satellite telemetry. Data on 25 juveniles from the Texas coast were collected from mid-June through December 2010. Through this 6-month period, no birds have shown signs of definite mortality, though some transmitters seem to have failed. At this point in the study, 4 birds traveled to Tamaulipas, Mexico, while 1 bird reached Louisiana. All birds that have dispersed from Texas thus far have been dark-morph birds. Site fidelity has been low, indicating similarities to closely related *Egretta* species that have been considered highly nomadic. The satellite transmitters attached to the birds have a potential lifespan of 3 years, providing the opportunity for further data collection through the summer of 2013.

0027

GIS database design for analysis of Sub-Saharan African crane research

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Much of Sub-Saharan Africa is geographically complex due to significant seasonal differences in precipitation, short- and long-term climate variability, and a diverse cultural and political make-up. Avian responses to dynamic natural systems and ecologists' needs to communicate cross-culturally make it challenging for researchers to accurately map and assess crane populations. The project presented is part of an on-going study geared toward understanding the distribution of Sub-Saharan Africa's four crane species (*Balearica pavonina*, *Balearica regulorum*, *Bugeranus carunculatus*, *Anthropoides paradisea*) and where cranes are in need of protection. The objectives of this project were to 1) develop a GIS data layer that depicts Sub-Saharan African crane research, 2) to review the data layer for information about crane populations, and to 3) find spatial gaps in research. We investigated approximately 300 refereed journal articles and other published literature including technical documents from the International Crane Foundation and the African Endangered Wildlife Trust. We found it challenging to obtain other published information, and even more challenging to find spatial information in published records. Analysis of the database revealed that patterns of crane populations are closely linked to the research conducted by only a few researchers that publish most regularly. In addition, most information published involved only two of the four crane species (*Bugeranus carunculatus* and *Anthropoides paradisea*). Presented are the details of the data layer and fields constructed, results of the data analysis to date, and plans for continuation of the project.

0029

To breed or not to breed: Seabirds response to extreme climatic events

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Intermittent breeding is an important life history strategy that has rarely been quantified in the wild and for which drivers remain unclear. It may be the result of a trade-off between survival and reproduction, with individuals skipping breeding when breeding conditions are below a certain threshold. Heterogeneity in individual quality can also lead to heterogeneity in intermittent breeding. We modeled survival, recruitment and breeding probability of the red-footed booby (*Sula sula*), using a 19 year mark-recapture dataset involving more than 11,000 birds. We showed that skipping breeding was more likely in El-Nino years, and correlated with an increase in the local sea surface temperature, supporting the hypothesis that it may be partly an adaptive strategy of birds to face the trade-off between survival and reproduction owing to environmental constraints. We also showed that the age-specific probability of first breeding attempt was synchronized among different age-classes and higher in El-Nin o years. This result suggested that pre-breeders may benefit from lowered competition with experienced breeders in years of high skipping probabilities.

0031

There's no place like home: Piping Plover location experience increases fledging success

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Establishment of a self-sustaining wild population is the goal of a population recovery program and increasing reproductive productivity is an essential component of such efforts. We investigated how breeding experience and experience at a specific nesting location influenced reproductive productivity among Piping Plover pairs (*Charadrius melodus*) from the endangered Great Lakes population, as measured by the number of chicks fledged per pair during 1993-2009 ($n=408$ pairs). We conducted a Poisson analysis in program R, treating year and location as random effects and ranking models via AIC. Our best-supported model indicated female location experience had a significant, positive effect on reproductive success ($p=0.0052$). Pair location experience did not have a significant effect. Thus, these results suggest female familiarity with a site significantly increases reproductive success. Female Piping Plovers are more likely than males to change locations following reproductive failure, a strategy which may explain our results. Additionally, the interaction between male and female ages was strongly supported ($p=0.071$), suggesting the ages of mates within a pair influences reproductive productivity. Julian hatch date had a significant, negative effect on reproductive success ($p=0.00051$), indicating that pairs fledge more chicks, on average, the earlier they nest. Our results suggest that encouraging plovers to return to the same sites to breed by maintaining nest site suitability would allow them to gain more experience in a given location, which in turn could yield higher fledging success for this endangered population.

0032

Effects of the Deepwater Horizon oil spill on migratory shorebirds

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The U.S. coastline of the Gulf of Mexico is an important wintering and migratory stop-over region for several species of migratory shorebirds. The Deepwater Horizon oil spill directly impacted nine hundred and sixty-six miles of this coastline. The direct and immediate effects of oil on bird survival include toxicity and feather function. Although more difficult to quantify, evidence of indirect and long-term effects of oil on birds have been reported. These effects occur due to chronic ingestion of oil via contaminated prey and because of the inability of prey populations to recover following a spill. Given the already declining population trend of many species of shorebirds, the Deepwater Horizon incident has the potential to devastate the populations of many migratory shorebird species not only from direct mortality, but from long-term exposure to toxins, degraded habitats, and altered food chains. Our research addresses the impacts of the Deepwater Horizon oil on five species of shorebirds (Least sandpiper (*Calidris minutilla*), Western sandpiper (*Calidris mauri*), Sanderling (*Calidris alba*), Dunlin (*Calidris alpina*), and Semipalmated plover (*Charadrius semipalmatus*) that winter along the northern Gulf of Mexico. We combine measures of toxicological status of birds, their prey, and their habitats with measures of within-season and inter-annual fitness to examine the near and long-term impacts of this disaster on migratory shorebirds.

0034

Colony site species diversity as a predictor of colony persistence in Great Lakes colonial waterbirds

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The North American Great Lakes are the largest freshwater ecosystem in the world and a globally important breeding area for the colonialy-nesting Ring-billed Gull (*Larus delawarensis*), Herring Gull (*L. argentatus*), and Double-crested Cormorant (*Phalacrocorax auritus*). At least 12 other colonial waterbird species have been reported breeding in the region in the past three decades. To protect and manage nesting habitat efficiently, activities should focus on consistently-occupied colony sites. Although many ecological factors (e.g., colony size, habitat characteristics) have been shown to correlate with year-to-year colony persistence, colony site species diversity has been essentially overlooked as a potential predictor of site use. The Binational Great Lakes Colonial Waterbird Survey has identified colony sites and censused nesting species in the U.S. and Canadian Great Lakes on a decadal basis since 1976-1977. We used U.S. census data to determine colonial waterbird species diversity at sites visited in multiple years within the 1997-1999 survey period, as well as the incidence of inter-year abandonment, inter-year colonization, and inter-year persistence for each species nesting at these sites. Preliminary analyses suggest that select species, e.g., Herring Gull, may be more likely to remain at colony sites with high species diversity. Other species, e.g., Great Blue Heron (*Ardea herodias*), do not exhibit such a relationship with co-nesters. Based on these results, managing habitat to favor diverse assemblies of colonialy-nesting species could encourage regular nesting of some species at preferred sites, thus aiding in their conservation in the North American Great Lakes.

0046

Winter habitat, home range size, and activity budgets of the Saltmarsh Sparrow (*Ammodramus caudacutus*)

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Sea level rise threatens salt marshes worldwide, negatively impacting salt marsh obligates including the Saltmarsh Sparrow (*Ammodramus caudacutus*). Documentation of winter home range size and Saltmarsh Sparrow use of specific habitat types can be combined with models of shifts in vegetation caused by sea level rise to predict how rising sea levels will affect wintering sparrow populations. The goal of this study is to use radio telemetry to measure Saltmarsh Sparrow winter habitat use, home range size, and time budgets. This study will occur over two winter seasons in multiple salt marshes in South Carolina. In late winter 2011, six Saltmarsh Sparrows will be fitted with radios and tracked to gather data on time budgets, habitat use, and home range size. Sparrows will be recaptured before transmitters expire to assess transmitter effects. In winter 2011-2012, 20-50 sparrows will be located 1-2 times daily. A minimum of 20 locations per sparrow will be compared to random locations for differences in plant composition, plant height, and stem density. For home range analyses, 95% fixed-kernel home ranges and 50% core areas will be determined from all recorded sparrow locations. It will be investigated whether *Spartina alterniflora*, an important source of seeds, dominates sparrow locations. Whether home ranges are smaller than those recorded during the breeding period and if time budgets will be dominated by roosting and foraging (as reproduction will not be occurring) will also be investigated. The preliminary results from the winter 2011 field season will be presented at the meeting.

0047

Colony site identification and data maintenance for a decadal survey of Great Lakes colonial waterbirds

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The U.S. Great Lakes Colonial Waterbird Survey (GLCWS) is an important monitoring effort for colonial waterbirds undertaken decadal since 1977, and has documented approximately 846 colonial waterbird sites. Recent review of colony site coordinate data for the GLCWS indicated that many previously obtained coordinates were inaccurate, resulting from changes in technology over time, lack of site data maintenance over survey duration, and no clear definition of what constitutes “boundaries” of a colony site. Because this survey is vast in space, time, and workforce, site identification and data maintenance should be simple and consistent. Therefore we spatially evaluated GLCWS site data using Google Earth, NOAA nautical charts and Arc Map, to adjust, combine and/or remove a portion of sites that had been previously documented. More than 500 sites were adjusted in position and >40 were removed either because they no longer existed or because close proximity to other sites allowed us to combine sites. Criteria for moving sites included distance from the geographic feature a site was meant to represent; if a coordinate fell >0.25km from its intended location it was adjusted. Alternately, if a site was <0.01 km from another site and not otherwise distinguishable, sites were combined. We suggest that individuals undertaking large-scale or long-term surveys periodically review site location information, identify locational problems, and establish guidelines to standardize site identification and database maintenance. Utilizing these methods should aid researchers in increasing overall consistency and reliability of data gathered through long-term monitoring efforts.

0052

Seasonal fecal corticosterone measurements in Wisconsin Sandhill Cranes

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Corticosterone is the primary glucocorticoid hormone released by the adrenal gland in birds. Levels of corticosterone exhibit diurnal and seasonal variation, as well as fluctuate under stressful conditions. From May-November 2008 and March-May 2009, fresh fecal samples were collected biweekly at a crane roost on the Wisconsin River near Briggsville, Wisconsin. The birds were visually healthy and in either non-breeding/non-migratory or migratory condition. Fecal samples were analyzed by radio-immunoassay to measure corticosterone. The overall mean corticosterone concentration observed was 13.69 ± 0.83 (SE) ng/g. Corticosterone concentrations varied across collection dates ($F = 8.15$, $P < 0.01$) and season ($F = 11.04$, $P < 0.01$). The mean corticosterone concentration during spring migration was greater than the other 4 seasons ($P < 0.01$). The mean corticosterone concentration during summer was greater than during fall staging ($P = 0.02$). Corticosterone concentrations tended to increase during fall migration compared to the fall staging season ($P = 0.05$). Peaks in corticosterone during spring and fall migratory periods were consistent with similar elevations known from other birds, as well as coincided with colder temperatures known to influence corticosterone levels. Our study provides a preliminary understanding of seasonal baseline corticosterone levels in a well described, healthy, free-ranging crane population. We successfully used a non-invasive sampling scheme that may find applicability to conservation assessments of threatened crane populations.

0057

Effects of lake stage and marsh elevation on wading bird nesting effort at Lake Okeechobee, Florida

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Aerial surveys of wading bird nesting on Lake Okeechobee began in 1957. The lake supported about 10,000 pairs per year until regulatory changes increased water levels, producing a drop in nesting effort. Although the hypothesized cause of the drop in nesting was a reduction in area of foraging habitat, previous studies simply inferred that the relationship existing based on correlations between nesting effort and lake stage. Here we combined new soils surface elevation data with lake stages and an envelope of suitable foraging depths to model the area of foraging habitat available to wading birds each month. This estimate was then compared to monthly nest effort for the Great Egret (*Ardea alba*), Snowy Egret (*Egretta thula*), and White Ibis (*Eudocimus albus*), during 2006-2010. Nesting effort ranged from 10,176 pairs in 2006 to 20 pairs in 2008. During the extreme years the estimated maximum daily foraging habitat available to birds was 6526 ha and 839 ha, respectively. There was a moderate correlation ($r=0.48$, $p<.03$) between monthly nest effort and estimated area of foraging habitat during the peak breeding months from February to May. The relationship between lake stage and estimated foraging habitat was a quadratic function with a peak area at 3.91 m NGVD88 (approximately 14 ft msl). This depth coincides with good nesting detected during aerial surveys at moderate lake stages of 3.77-4.36 m during the dry season. Future effort will be directed at refining the habitat suitability model and incorporating other environmental factors.

0059

Status of the Florida resident flock of Whooping Cranes

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As of 15 January 2011 we are continuing to monitor the remaining 21 (12 females, 9 males) whooping cranes (*Grus americana*) in the reintroduced Florida population. Most birds currently are paired (8 pairs) facilitating continued research on their breeding challenges. Last breeding season we conducted a pilot study to determine the efficacy of using artificial eggs containing temperature loggers to measure incubation temperature in nests of whooping and Florida sandhill (*G. canadensis pratensis*) cranes. The technique will be used to compare incubation temperature and behavior between successful vs. unsuccessful nests and between sandhill and whooping cranes. A single artificial egg was placed into the nests of 5 whooping cranes and 1 sandhill crane, the first time the procedure has been done with any wild crane species. All pairs accepted and incubated the artificial eggs. The most important finding from preliminary examination of plots of incubation temperature showed that in 4 whooping crane nests there was a single large downward spike in incubation temperature that occurred on one night. Amount of time off the eggs ranged from 3.12 to 15.30 hours during which the eggs dropped up to 41 degrees below mean incubation temperature (for the period data was recorded). Unusually long lapses in incubation likely affect the hatchability of eggs. This spring we will deploy cameras capable of night-vision near nests to determine the cause of these lapses in incubation. We also will continue to deploy artificial eggs into nests to collect data on incubation temperature.

0060

Headstarting American Oystercatchers within the Cape Romain Region, SC

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Cape Romain Region (CRR) is located along the coast of South Carolina and supports over half of the breeding pairs (approximately 200 pairs) of American oystercatchers (*Haematopus palliatus*) in the state. However, research has shown that oystercatcher productivity in this area is low. To increase nest success of oystercatchers in this region, we piloted a headstarting experiment (i.e., artificial incubation of eggs with replacement just after hatching). The purpose of this study was to determine if reproductive failure due to nest loss could be reduced. We collected partial clutches randomly from nests found in two study areas within CRR and incubated the eggs in an incubator until they hatched and could be returned to their original nest. Wooden dummy eggs that were painted to resemble oystercatcher eggs were secured in the nest scrape to insure that adults continued to incubate. For the 2010 field season, a total of 26 pairs within two study areas were used for the headstarting program. Overall, 53 eggs were collected for incubation from 39 clutches. Of the headstarted nests 7 chicks fledged, yielding a productivity estimate of 0.27 chicks per pair for the two study areas. Incubator complications and the loss of dummy eggs from nests likely contributed to low productivity of headstarted nests during the 2010 field season.

0063

Diet and provisioning of Common and Caspian Tern chicks at a freshwater breeding colony

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Foraging studies may provide insight into breeding population trends for tern species. We used remote cameras and behavioral watches to study diet and chick provisioning of common terns (*Sterna hirundo*) and Caspian terns (*Hydroprogne caspia*) at a breeding colony in the Lake Ontario in 2010. Incidences of provisioning were recorded using time-lapse cameras at ten nests of common terns and five nests of Caspian terns between 04:00 and 21:00. Diet was assessed from behavioral watches undertaken throughout the chick-rearing period, primarily during the early morning. During the study, chicks of both species were fed principally on schooling pelagic fish (alewife *Alosa pseudoharengus* and emerald shiner *Notropis atherinoides*), although Caspian terns took much larger prey. Feeding rates were within the range reported at other sites. These initial data suggest similar patterns of diurnal provisioning for each species. Declines in common terns have been demonstrated throughout the Great Lakes, but at our study site nesting numbers of both species appear to have been moderately stable for the past decade and our data do not suggest food shortages at this site. However, further studies of foraging and provisioning of common terns throughout the Great Lakes are needed to investigate whether changes in the prey-base may be contributing to the observed declines.

0067

Does investigator disturbance negatively affect productivity? An experimental study in breeding Ring-billed Gulls (*Larus delawarensis*)

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Understanding responses of waterbirds to investigator disturbance is essential for minimizing any adverse effects of research while maximizing data collection to inform management decisions. It has been suggested that while some behavioral effects may be observed, disturbance is only likely to be problematic if it alters survival or productivity, and habituation may minimize negative effects by increasing tolerance. In 2008, we undertook an experimental study of the effects of disturbance on survival of ring-billed gull (*Larus delawarensis*) chicks at a large, undisturbed colony in Lake Ontario. Throughout the chick-rearing period, we banded and recaptured chicks in six, approximately 40 m² fenced plots, each containing 21-25 nests. To separate potential disturbance effects from differences in data quality, plots were grouped into three areas that differed in intensity of investigator disturbance (visits near-daily, every six days, and once every two weeks), but not all plots were monitored on every visit. Survival was analyzed in a live-dead, multistate mark-recapture model that allowed us to focus only on pre fledging survival and include dead recoveries. As plots differed in their monitoring frequency, we repeated the analyses three times using data subsampled from plots on a near daily basis, every six days and every two weeks. Data quality (recapture probability) was much higher for nests checked near-daily, but we found no evidence that this level of monitoring negatively impacted chick survival and nest productivity. Our results indicate that ring-billed gulls at this site readily habituate to daily monitoring protocols with no adverse impacts on chick survival.

0068

Hematology and serum chemistry results from experimental exposure of Sandhill Cranes to West Nile virus

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West Nile virus is a deadly virus for young cranes. In testing two different vaccines on both adult and immature juvenile sandhill cranes, we discovered that some blood parameters are altered by exposure to the virus. White blood cell counts were the most obvious, and may be used as an indicator of West Nile virus exposure in cranes. Other hematology and serum chemistry results will be reported and analyzed along with the already published information on titers encountered in experimental infections. Our work would suggest that a combination of white blood cell counts and antibody titers can be used to diagnose and assess the severity of West Nile virus infections in cranes.

0075

Seasonal movements of adult Reddish Egrets from Texas colonies

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The Reddish Egret is listed as a species of conservation concern by the U.S. Fish and Wildlife Service and as threatened by the state of Texas. While there is support for conservation of this iconic coastal bird, little is known of its life history and ecology. Our objective is to determine dispersal of nesting adult reddish egrets from known nesting colonies to possible wintering areas. Using Satellite-GPS backpack transmitters, 9 Reddish Egrets were monitored from June 2010 to January 2011. Transmitters recorded up to 6 locations per day to coincide with peak foraging times and roosting. We obtained an average of 1,302 locations for each bird. Distances traveled from capture site to wintering site ranged from 2.4-1,236 km. Preliminary findings suggest that adult Reddish Egrets make longer seasonal movements than previously thought and are capable of long distance flights of > 800 km in a day. Our findings elucidate many unknown aspects about the ecology of Reddish Egrets that will benefit future management. Specifically, identifying important migratory stopover sites and gaining a better understanding of winter distribution of individuals breeding in Texas will aid our understanding of this species ecology.

0077

Comparison of behaviors of crane chicks that were parent-reared and reared by costumed humans

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USGS Patuxent Wildlife Research Center in Laurel, Maryland, uses two primary methods to rear crane chicks. Some chicks are reared by parent or foster parent Whooping Cranes (*Grus americana*) or Sandhill Cranes (*Grus canadensis*), while other chicks are reared by humans wearing mock crane costumes and holding puppet heads. We have used both techniques to successfully rear and release Mississippi Sandhill Cranes (*G. c. pulla*) and Whooping Cranes for release in non-migratory situations. However, for the migratory releases of the Whooping Crane Eastern Partnership (WCEP) eastern migratory population, we have always costumed-reared birds and trained them to follow ultralight aircraft or other Whooping Cranes on their first southward migration. We are planning to use parent-rearing methods to supplement the eastern migratory population of Whooping Cranes in the future. In 2010, in preparation for parent-rearing Whooping Crane chicks, we gave 6 pair of captive Whooping Cranes a Sandhill Crane chick to rear. We then compared results for survival, behavior and health testing with costume-reared chicks from the same year. All 6 parent-reared chicks survived to fledge, versus only 25 of 30 costume-reared chicks. In addition, parent-reared chicks spent significantly more time hock-sitting and less time standing than did the costume-reared chicks. Parent-reared chicks also spent significantly more time foraging and being vigilant and less time preening. In the future, we hope to test the parent-rearing technique with Whooping Crane chicks that can then be released with wild adults in the fall and learn the migration route.

0080

Using ecoregions to quantify changes in breeding Sandhill Crane densities for Wisconsin

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To better understand the dynamics of breeding Sandhill Crane densities, we used Annual Midwest Crane Count (AMCC) data and US EPA Ecoregions within WI to describe potential breeding distribution changes. Crane Count is a long-term citizen science program aimed at providing an estimation of crane densities in Wisconsin through a spring census. We used both the number of pairs (representative of potential productivity) and the total number of cranes (representative of overall crane use) counted per site. Ecoregions, in addition to providing a broad intrinsic descriptor of habitats, have the advantage of providing a more accurate representation of the parts of the landscape that may be relevant to cranes. Though the overall population of Sandhill Cranes in the state is still increasing it is not changing uniformly among ecoregions. Crane densities and pair densities increased in several northwestern ecoregions of the state but densities in the southcentral ecoregions, which holds the highest concentration of cranes, did not change; one ecoregion even indicated a significant decline in the number of pairs. The feature common to the regions that show an increase in cranes is a high abundance of lakes; the only ecoregion showing a decrease in cranes is specifically mentioned as having a lower density of lakes than its surrounding regions, evidence that cranes may be adapting to marginal habitats as more characteristic habitats become fully occupied. Ecoregions appear to describe population change in Wisconsin better than political boundaries; future work will include extended areas of the Midwest covered by the AMCC.

0082

Updated Eastern Greater Sandhill Crane range maps

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The breeding, wintering, and migrating range of the Eastern Migratory Population (EMP) of Greater Sandhill Cranes (*Grus canadensis tabida*) is located within the Mississippi and Atlantic Flyaways. Historically, the majority of the Eastern Population bred across the Great Lakes Region (primarily Wisconsin and Michigan) and wintered in southern Georgia and Florida. The population is currently expanding and re-colonizing former breeding and wintering areas. We attempt to delineate the expansion of the EMP by developing an updated breeding and wintering range map for the subspecies. Christmas Bird Count (CBC) data from 2006-2010 was used to determine the current status and migratory trends of bird populations during the winter season. The North American Breeding Bird Survey (BBS) from 2000-2010 was used to describe breeding areas. Data sets were sorted by location and mapped by density. The majority of the winter distribution of EMP cranes (86%) winter in Alabama, Georgia, Florida, and Tennessee. Smaller concentrations of birds are expanding their wintering ranges east into the Carolinas and west into Mississippi and Louisiana. More and more EMP birds are also remaining later in more northerly areas of the wintering range (Michigan, Ontario, Wisconsin). BBS data confirm that the breeding range has expanded to include many northeastern and mid-west states and Maritime Canadian provinces. Accurately measuring the expansion of this subspecies population is an important step in fine-tuning future management plans.

0084

Video monitoring to identify predators on nests of Black-crowned Night-Herons at Alcatraz Island, San Francisco Bay, California

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Black-crowned Night-Herons (*Nycticorax nycticorax*) have nested on Alcatraz Island, an important breeding ground for the San Francisco Bay Area population, since at least the mid-1980s. Within the last decade, nest predation has increased nearly 150%. Before this study, the identification of nest predators was unclear because direct field observations were difficult and inspection of nest remains is ambiguous. We used remote digital video systems to monitor a subsample of nests (n = 22) during 20 May - 26 July, 2010. Our primary objective was to identify predators during the incubation and nestling stage. Common Ravens (*Corvus corax*), American Crows (*Corvus brachyrhynchos*), and Night-Herons were responsible for 6 predations during incubation and 5 during the nestling stage. Videography revealed substantial differences in nest sign following raven encounters, and sign by species were often indistinguishable. Thus, identification based on nest characteristics are not reliable. Duration of predation encounters of eggs and nestlings were 4.5 ± 0.6 and 150.9 ± 87.2 min, respectively. Night-Herons were present immediately prior to predation encounter of eggs but absent prior to nestling predation. We also evaluated variation in incubation constancy (percentage of time on the nest), recess duration, egg-turning rates, parental switching, and nestling feedings. We provide video information that contributes to our knowledge of environmental and ecological factors that relate to these life-history patterns. Information gathered from additional nest videography could improve our understanding of Night-Heron nesting ecology and allow park managers to make better-informed decisions regarding actions needed to improve nesting survival.

0086

Using geolocators to track migrations and winter quarters of North American Roseate Terns

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We attached geolocators (light-level data loggers) to Roseate Terns (*Sterna dougallii*) at a breeding site in the northeastern USA in 2007 and 2009, and retrieved seven (six with useful data) in 2008 and 2010. The birds wintered in four discrete areas on the north and east coasts of South America, from Suriname (6° N) to eastern Brazil (16-20° S). They spent the post-breeding period (July-August) around Cape Cod and departed between 28 August and 14 September. They migrated directly across the western North Atlantic to the vicinity of Puerto Rico, and thence along the north and east coasts of South America, reaching their winter quarters between 19 and 2 November, 41-62 days after leaving North America. They left their winter quarters between 5 and 23 April and returned to the breeding area in 16-26 days. We identified important staging areas around Puerto Rico (64-71° W), in Guyana/Suriname (55-59° W), Pará/Maranhao, Brazil (45-48° W), and Rio Grande do Norte, Brazil (35-38° W). During the breeding and post-breeding periods, the birds spent a mean of 20 min each day and virtually no time at night resting on the water, but during the rest of the year they often rested on the water for up to 5 h by day and up to 10 h at night. Although the geolocators weighed only 1.2-1.7 percent of the birds' body-weight, only about half the expected number of birds returned and most of these failed to obtain mates.

0088

Video surveillance of nesting Whooping Cranes

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From 1995 to 2010 we monitored 81 Whooping Crane (*Grus americana*) nests; of those, only 37 chicks hatched and 11 fledged. It often was not apparent why nests failed and it was not practical to conduct labor-intensive observations at nests; therefore we collected behavioral data using video surveillance cameras at 15 nests from 2000 to 2009. Seven of 15 nests were successful in hatching chicks, while the remaining nests failed during the incubation period. Overall 1537.5 and 1023.5 hrs. of incubation recordings were examined for successful and failed nests, respectively. No differences were detected in mean incubation bouts (time consecutively sitting on eggs) between successful and failed nests at similar stages in the incubation cycle, suggesting incubation behavior was not the sole cause of nest failure. Average time spent not incubating, however, was significantly different on 4 of 6 days. At failed nests, birds returned to the nest to incubate less frequently due to drought conditions and/or disturbances; likewise, pairs at failed nests appeared to exchange incubation duties infrequently and did not share the duties equally. Among successful nests, mean incubation bouts were 32.5min, although there was a decreasing trend throughout the incubation period. When not sitting on eggs adults spent on average 1.4 min turning the eggs and the mean time neither adult was on nest platform was 1.5 min. Video surveillance is a valuable tool for the efficient gathering of behavioral data at whooping crane nests.

0089

Copulation of non-migratory Whooping Cranes in Florida

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Information on copulatory behavior and timing before egg laying is poorly known in wild whooping cranes (*Grus americana*). We monitored 10 crane pairs for breeding behavior prior to and during the 2010 breeding season to document timing of copulations and pre- and post-copulatory behavior. We observed pairs at different times of the day and under differing weather conditions to determine if copulations were more frequent during certain daylight hours or during precipitation. Monitoring began 111 days prior to the start of incubation for the first nest of the season. Pairs were observed for 125.78 hours (mean = 75 min) during 100 observation periods; 17 observation periods occurred on days with precipitation. Three copulations were observed, two by the same pair and another by unpaired individuals. The copulations by the same pair occurred 9 and 18 days prior to incubation. The third observation was an extra-pair copulation, first ever documented for the species, which occurred between a paired female and lone male. This copulation occurred three days after the female's 20 d old chick was depredated. No copulations were observed on days with precipitation. Due to low a number of copulations, opportunistic accounts ($n = 18$) within this population also were examined and showed whooping cranes copulate up to 62 days prior to incubation and between 0610 and 1345 EST. Our data suggest copulations occur on days without precipitation between early morning and early afternoon hours. Moreover, although cranes are a long-lived, monogamous species, extra-pair copulations do occur.

0106

A video surveillance system to remotely monitor Western Snowy Plovers nests in San Francisco Bay, California

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The Western Snowy Plover (*Charadrius alexandrinus nivosus*) is listed as threatened under the Endangered Species Act due to long-term population declines. In response, managers have dedicated considerable resources to management practices, including predator removal and habitat enhancement projects in San Francisco Bay, California. The unequivocal identification of plover nest predators would allow managers to focus limited resources on appropriate predator control efforts and elucidate habitat relationships with predator types. Therefore, we examined the efficacy of using a digital video surveillance system to identify nest predators of Snowy Plovers in former salt evaporation ponds in San Francisco Bay. This system was designed to minimize disturbance to nesting plovers and limit predator bias at breeding sites with little or no cover to camouflage or protect equipment. The system included a small camera, with infrared lights, placed approximately 20 meters from nests, and a continuously-operating recording unit and power supply that can be positioned up to 300 meters from the nest. The system could be deployed in under 20 minutes, could run continuously for up to 5 days, and data could be retrieved with limited disturbance to nesting birds. We recorded six species depredating plover eggs and chicks including Red-tailed Hawk (*Buteo jamaicensis*), Common Raven (*Corvus corax*), California Gull (*Larus californicus*), Northern Harrier (*Circus cyaneus*), Ruddy Turnstone (*Arenaria interpres*), and Gray Fox (*Urocyon cinereoargenteus*). This digital video surveillance system was effective at identifying Snowy Plover nest predators and would be useful for a variety of other conservation and research applications.

0109

Wetland seed availability, seed depletion, and waterfowl use in the Rainwater Basin during spring migration

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The Rainwater Basin (RWB) is a bottleneck for millions of migratory waterfowl that stage in this area. Wetland-derived foods are believed to be a limiting resource for the millions of waterfowl that stop. Conservation organizations that manage wetlands in this area focus on maximizing seed resources, but have limited evidence of the current seed availability and waterfowl use in these wetlands. Here we estimate seed availability, seed depletion and waterfowl use for moist soil annual (MSA) and moist soil perennial (MSP) stands across 11 locations throughout the RWB. Samples were collected February - March 2010, during spring waterfowl migration. Seed availability in MSA stands was 64.10 kg/ha \pm 58.48 (mean \pm SD) and was 26.28 kg/ha \pm 28.55 in MSP stands. Seed depletion between MSA and MSP was significantly different ($F_{1,240} = 32.02$, $P = 0.0001$), where MSA stands lost more seed than MSP stands. Waterfowl-use data was collected by observing waterfowl feeding on each wetland within one hour of sunrise. Duck densities (ducks/ha) were calculated for mallard (*Anas platyrhynchos*), pintail (*Anas acuta*), and green-winged teal (*Anas crecca*), where MSA stands had significantly higher duck densities than MSP stands ($F_{1,10} = 8.67$, $P = 0.0164$). Preliminary analysis of foraging behavior and estimates of seed depletion indicate waterfowl used MSA stands more than MSP stands. Thus, it appears that wetland seed availability may be a limiting factor in the RWB. Our future studies will determine whether current available food resources in these stand types are sufficient for spring migrants.

0112

A flexible approach for growth rate analysis of waterbird chicks: Extending traditional methods within nonlinear mixed-effects models

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Over the past 40 years, parametric curve fitting has greatly improved our understanding of avian growth patterns, particularly those of semi-precocial or precocial chicks. Although rarely used in waterbird studies, nonlinear mixed-effects (NLME) models can accommodate repeated measures for individuals and be used to investigate the effects of ecological factors at all stages of growth. Coupled with parametric curve fitting, NLME methods offer great potential as a flexible way to analyze chick growth.

We explore this flexibility by employing Richards curves (flexible logistic curves) in NLME models using freely available software. By fitting these models to synthetic growth data that simulate three commonly observed growth trajectories (logistic, Gompertz, von Bertalanffy), we show that this method can be used successfully for data sets that conform to those commonly collected during waterbird studies.

Furthermore, we extend the formulation of Richards curves to accommodate negative trajectories late in development and outline a step-by-step approach to growth rate analysis that does not require a priori knowledge of the growth trajectory. We demonstrate this approach with analyses of field data on chick growth of common terns (*Sterna hirundo*) and little penguins (*Eudyptula minor*) collected over multiple breeding seasons. Our approach overcomes some of the traditional drawbacks of parametric curve fitting (assuming a priori growth trajectories and sensitivity to high interindividual variation) to provide a widely applicable method for ecological growth studies.

0114

Investigations into the factors affecting pellet production in Double-crested Cormorants, *Phalacrocorax auritus*

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Double-crested Cormorants, *Phalacrocorax auritus*, regurgitate pellets containing the undigested bones, scales and otoliths from meals. Pellets are often dissected to understand the diet of a cormorant population. Two aspects of pellet production may affect the accuracy of consumption estimates derived through pellet analysis: 1) the speed with which these pellets are produced varies and 2) the otoliths of some fish species may be more likely than to survive digestion to be regurgitated in pellets than others. Feeding trials were administered to captive birds to gain a better understanding of how different characteristics of prey morphology may affect pellet production. These included prey spinieness, prey size, otolith shape and otolith size. Birds were fed diets of pinfish, *Lagodon rhomboides*, which had been manipulated in one of three ways: spiny fins removed, selected for different sizes, stuffed with otoliths of various sizes and shapes. Small, nontoxic colored glass beads were placed in fish fed out to allow the speed of pellet production to be estimated. Preliminary results indicate that both the presence of spiny fins and a decrease in prey size were associated with an increase in the number of pellets produced. Looking at otolith survival in the pellets, both otolith shape and size were shown to influence survival.

0119

Effect of pen size on released crane subadult dispersal

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To bolster the tiny population of endangered Mississippi sandhill cranes, captive-reared cranes were released annually onto the Mississippi Sandhill Crane National Wildlife Refuge starting in 1981. Cranes were transferred from the captive site to the refuge and placed in one of two different types of pen for an acclimation period before release. We compared first year post-release dispersal between the pen types.

0121

Measuring fecal corticosterone in wild Whooping Cranes (*Grus americana*)

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Non-invasive measures of hormones in animals can be a useful tool for understanding physiological mechanisms that may lead to changes in behavior, survival and reproduction. Specifically, measures of fecal corticosterone metabolites (CORT), the primary stress hormone in birds, have been correlated with environmental changes, such as food abundance, habitat alteration, and human disturbance. In this study we provide the first measure of fecal CORT for individuals from the wild population of Whooping Cranes (*Grus americana*). Habitat alteration and urbanization on the wintering grounds are major threats to the wild population of Whooping Cranes, thus it is important to determine a possible method to assess physiological health of the population using a non-invasive technique. During winter 2009-2010, fresh fecal samples (N=32) (i.e., less than one hour old) were collected from accessible areas where whooping cranes were observed within and around Aransas National Wildlife Refuge, Texas. We used an ethanol extraction to isolate endogenous CORT from fecal samples. The enzyme-immuno-assay (EIA) was validated by showing parallel immunoactivity of endogenous CORT to that of the assay standards. Fecal CORT was measurable in wild whooping cranes where mean CORT concentration was 2.14 ng/g feces (\pm 1.96, standard deviation). Measures of fecal CORT ranged from 7.08 - 0.16 ng/g feces, although there was no significant difference between samples collected from different locations ($F_{8,23}=0.898$, $P=0.534$). Future studies will determine whether measures of fecal CORT vary with respect to foraging behavior and structure of whooping crane social groups.

0122

Differences in habitat use by Whooping Cranes, *Grus americana*, observed in natural and urban areas of Texas during winter 2009-2010

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Since 1938 the wild Whooping Crane (*Grus americana*) population has grown from 18 individuals. Although population growth occurred, available habitat for cranes has decreased, especially on wintering grounds. In response, some cranes now use urban areas in addition to natural winter habitat. Typical winter habitat in natural areas includes bay, marsh, and upland habitats; however, in urban areas these differ from those in natural areas. In urban areas, bay and marsh habitats are reduced and upland habitat includes agricultural fields or private yards where corn feeders are often present. Currently, research is needed to determine habitat use and potential negative threats for cranes frequenting urban areas compared to cranes using natural areas. Here we examine habitat use by Whooping Cranes in urban and natural areas near Aransas National Wildlife Refuge (ANWR), Texas. Behavioral observations of whooping cranes were collected in natural and urban areas during winter 2009-2010. We recorded observations in natural areas (N=112 observations) and in urban areas (N=99 observations). Family groups (two white birds and one brown juvenile), adult and/or sub-adult groups (3 or more white individuals), pairs (2 white individuals) and single animals were observed in both areas. In natural areas, we observed birds in marsh (N=91 observations), upland (N=16 observations) and bay habitats (N=5 observations), although access to the bay within ANWR was limited. In urban habitats, we observed birds in upland (N=51 observations), marsh (N=31 observations) and bay habitats (N=17 observations). Thus, preliminary analysis suggests Whooping Crane habitat use differs between urban and natural areas.

0132

Censusing colonial waterbirds in the Canadian Boreal Forest

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North America's Boreal Forest (BF) is roughly 75% the size of the contiguous U.S.; it is approximately 5,000 kms x 1,000 kms and contains 1.5 million lakes. Unfortunately, there is no current methodology which adequately censuses, or samples, this area for colonial waterbirds (CWBs). The North American Breeding Bird Survey, Breeding Bird Atlases and Marsh Monitoring Programs are all inadequate for this bird guild. Aerial Waterfowl Surveys (AWSs), which are widespread in the BF, have the potential to collect CWB data in conjunction with waterfowl data. In 2010, two types of helicopter surveys were conducted near Pickle Lake, Ontario, to develop such a method. Aerial Waterfowl Surveys for CWBs flew over all water courses in stratified random 5 x 5 km squares. Secondly, all likely looking, low-lying islands in a large lake (eastern Lake St. Joseph, 84 km long) were flown over and all flushing CWBs were noted. Islands with CWBs were re-visited by boat; nests were identified and counted. In four 5 x 5 km squares (AWSs), 3 species and 11 individual of CWBs were observed; no colonies were found; historical AWSs showed similar results. Results from the large lake were: 24 colony sites of Common Terns (726 nests), 12 colonies of Ring-billed Gulls (1672 nests) and 6 colonies of Herring Gulls (55 nests). These results suggest AWSs are not adequate for surveying CWBs in the BF. The study will continue in 2011, when various sized lakes with low-lying, shoal-type islands will be the focus.