

**POST-BREEDING DISTRIBUTION OF DOUBLE-CRESTED CORMORANTS FROM THE COLUMBIA RIVER ESTUARY: SATELLITE TELEMTRY CONTRIBUTES INFORMATION TO A CURRENT PACIFIC COAST STATUS ASSESSMENT (Oral)**

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The largest Double-crested Cormorant (*Phalacrocorax auritus*) breeding colony on the Pacific Coast (13,770 breeding pairs in 2007) is located on East Sand Island (ESI) at the mouth of the Columbia River. Cormorant numbers in the interior Columbia Basin, though smaller, are also growing. While these trends apparently reflect a general post-DDT era recovery of the Pacific Coast subspecies, *P. a. albociliatus*, numbers have not increased across the entire range of the subspecies and population size is still an order of magnitude less than the nominate subspecies *P. a. auritus*. Columbia Basin fisheries managers have raised concern over the impact of cormorant predation on survival of juvenile salmonids (*Oncorhynchus* spp.). Any management of Double-crested Cormorants in the Columbia Basin to reduce salmonid losses should be supported by an updated status assessment of the entire Pacific Coast subspecies. Little is known, however, about the inter-colony movement and winter roost sites of these populations. We initiated a satellite tracking study during the 2008 breeding season at ESI to examine the post-breeding dispersal of cormorants from this colony and understand connections between the ESI colony and others in the region. Roosting locations from the first months of tracking demonstrate that birds from ESI do sometimes visit other cormorant colonies in inner-coastal Washington and British Columbia when they leave the Columbia River estuary.

**IMPACT OF BALD EAGLE *HALIAEETUS LEUCOCEPHALUS* RECOVERY ON SEABIRD COLONIES IN THE NORTHEASTERN UNITED STATES (Oral)**

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Bald eagles suffered dramatic declines in population and distribution within the “Lower 48” during much of the 20th Century, a period coincidental with the recovery and expansion of large gulls and other seabirds. Since the early 1970’s Bald eagles in Maine have increased from 29 pairs to 477 in the Summer of 2008. In many cases eagles occupy nesting sites on or near islands also used by seabirds, and predation and general disturbance by eagles on other species is increasingly common. Eagles raid gull colonies throughout the season and appear to use some colony sites as “training grounds” for eagle fledglings during the latter portion of the breeding season. Beyond the immediate impact of direct eagle predation, disturbance of nesting birds increases egg predation by American crows and Ravens (*Corvus brachyrhncus* and *C. corax*). One consequence of this increase in eagle activity appears to be the abandonment or significant reduction in size of colonies of Herring and Great Black-backed gulls (*Larus argentatus* and *L. marinus*) and Double-crested cormorants (*Phalacrocorax auritus*) in eastern Maine. While all three species have been regarded as “nuisance species” in some quarters, the long-term implications of colony collapse are unclear, and it is possible that the loss of gull colonies could have a negative effect on breeding populations of Common eider (*Somateria mollissima*) as well as having eventual impact on the eagles themselves. This paper will present results from one island complex as a case study with implications for broader conservation practice.

## **PIECING TOGETHER THE ANNUAL CYCLE PUZZLE FOR NORTH AMERICAN WHIMBRELS AND HUDSONIAN GODWITS (Oral)**

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Hudsonian Godwits and Whimbrels have been identified as species of high conservation concern in Canada and the United States, and biologists have developed, or are developing, conservation plans for these two species. Hudsonian Godwits and Whimbrels breed in sub-arctic regions and are widely distributed in their breeding areas. Whimbrels are widely dispersed along the hemisphere's coastlines during the non-breeding season, whereas godwits aggregate in a few estuarine areas in austral South America. Over the last few years, we have been working in breeding and wintering areas to better understand the annual cycle of these long-distant shorebird migrants. Aerial survey methods are being developed on Canadian breeding grounds, and reproductive success is being investigated at sites in Canada and Alaska. In non-breeding areas, we are identifying important aggregation sites and estimating population sizes. Well known for supporting large numbers of Hudsonian Godwits, Chiloé Island, Chile, also supports a high proportion of Whimbrels wintering along North America's Pacific Coast. A Whimbrel satellite-tagged in Alaska helped to discover an important winter roost in the mangroves of Sanguiana National Natural Park, Colombia. Individually-flagged Whimbrels and Hudsonian Godwits have established direct links between passage populations in the US and those wintering on Chiloé Island. Future plans will help us understand the link between breeding and wintering populations and identify migration pathways.

## **BUGS, BIRDS AND BLOOD: COMPARING FIELD METHODS OF BLOOD SAMPLING FOR BASELINE CORTICOSTERONE ANALYSIS (Oral)**

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Stress hormones are regularly used to assess the health, condition or disturbance levels of waterbirds. Blood collection for stress hormone analysis typically involves trapping birds and collecting blood samples within three minutes to obtain a baseline hormone measurement ("conventional protocol"). However, in some situations, trap shyness, sensitivity to investigator disturbance, or logistical difficulties (e.g., small blood vessels) can make it difficult to obtain samples for accurate baseline analysis. As such, alternative sampling techniques may be preferable. We collected blood samples from incubating common terns *Sterna hirundo* via both the conventional protocol and a newly developed, minimally invasive technique that utilizes blood sucking bugs (Heteroptera, Triatominae) contained in dummy eggs ("bug method"). We found no significant differences in the mean or variance of baseline corticosterone levels between samples collected via the conventional method and those collected via the bug method suggesting that the latter is a viable alternative for hormone sampling. In addition, the bug method has several advantages in that it does not require trapping or handling of the birds, minimizes disturbance, permits multiple measurements within relatively short time periods and requires little training.

## **LONG-TERM ADAPTIVE MONITORING OF BIRD HABITATS FOR SALT POND RESTORATION IN SAN FRANCISCO BAY, CA (Poster)**

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In 2003, the U.S. Fish and Wildlife Service and the California Department of Fish and Game acquired over 10,700 ha of commercial salt ponds in San Francisco Bay for the purpose of restoring tidal wetlands. However, San Francisco Bay estuary has been recognized as a site of hemispheric importance for migratory birds, and salt ponds support large numbers of migratory and wintering shorebirds and waterfowl. One goal of the South Bay Salt Pond Restoration Project (SBSRP) is to maintain the waterbird habitat value of the area at pre-restoration levels, but information is needed to ensure that habitat requirements of large numbers of waterbirds can be met with reduced salt pond acreage. USGS has conducted monthly bird monitoring at salt ponds in the Alviso, Eden Landing, and Ravenswood systems since 2002. Additionally, we have collected environmental data including water depth, salinity, DO, pH, and temperature. In addition to documenting baseline conditions, this monitoring has provided a dataset for relating environmental variables to bird use and determining which characteristics of salt ponds are most valuable to different avian foraging guilds. This long term salt pond monitoring data, in conjunction with avian mudflat surveys, is important for SBSRP planning processes as well as adaptive management of the ponds.

## **GENETIC DIVERSITY AND POPULATION STRUCTURE OF REDDISH EGRETS IN TEXAS (Oral)**

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The Reddish Egret (*Egretta rufescens*) is the rarest species of heron in North America. Primarily residents of coastal lagoons in the Gulf of Mexico, Reddish Egrets were nearly extirpated from the United States during the early 1900s because of plume hunting. Today, there are thought to be about 2,000 pairs in the United States, with 75% of the breeding population located along the Texas Coast, where they are designated as threatened. Little is known about the basic ecology and population structure of Reddish Egrets, making it difficult to effectively manage this species. Furthermore, the effects of the near extirpation on genetic variation of Reddish Egrets are unknown. We sequenced a 223-basepair region of the mitochondrial DNA (mtDNA) control region in 149 Reddish Egret samples from 16 breeding colonies along the Texas Coast. Despite experiencing a severe reduction in population size, Reddish Egrets retained a high amount of haplotype diversity (0.705) and a moderate amount of nucleotide diversity (0.005). A mismatch distribution among haplotypes is consistent with historical population size changes. We found no evidence of genetic structuring among colonies or regions. Reddish Egrets along the Texas Coast form a single panmictic population. We estimated a historical population size that is 10-15 times larger than the current breeding population in the United States. The results of this study, the first conservation genetic study of Reddish Egrets, should serve as a valuable foundation for management and additional research for this little-known species.

## **SURVIVAL AND MOVEMENT OF JUVENILE REDDISH EGRETS (Poster)**

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Limited information exists concerning survival and movements of post-fledging waterbirds. Estimates of survival and movement patterns can be beneficial in developing management plans, particularly for threatened or endangered species. Reddish Egrets are the rarest species of heron in North America and are designated as threatened by the State of Texas. There is a lack of information on the immature stage of this species making managing for Reddish Egrets difficult. Therefore, our objectives were to 1) assess post-fledging survival of Reddish Egrets and 2) record timing of juvenile dispersal and movement patterns. During June 2006 we attached radio transmitters to 30, 5-6 week old Reddish Egrets, from six colonies in the Laguna Madre of Texas. We conducted weekly surveys of the Texas Laguna Madre from 20 June 2006 to 1 November 2006. We also included portions of the Texas Coast north of the Laguna Madre to Matagorda Bay on one survey in September 2006. Post-fledging (Jun - Nov) survival rate was 0.738 (SE 0.134) and appears to be consistent with other species of wading birds. The majority of radio-marked individuals dispersed from colonies at 12-15 weeks old. In September, a large proportion of juveniles dispersed to the 9-mile hole south of the mouth of Baffin Bay and remained there into November when transmitter life diminished. One of our radio-marked Reddish Egrets dispersed to Columbia, South America where it was observed foraging for 4 days, and was recovered after dying from starvation.

## **WATERBIRD PLANNING AND CONSERVATION IN THE SONORAN JOINT VENTURE: NORTHWESTERN MEXICO AND SOUTHWESTERN UNITED STATES (Oral)**

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The Sonoran Joint Venture includes the southern part of Arizona and California, and the Mexican states of Sonora, Sinaloa, Baja California and Baja California Sur. Wetlands are both inland and coastal; with over 3,000 miles of coastline and some very important inland freshwater sites such as the Salton Sea and the Colorado River. Habitats for waterbird include desert oases, mangroves, salt marsh, and estuaries. This presentation will focus on our planning process, recommendations, projects completed, and future waterbird conservation needs. For the SJV's planning process and resulting Bird Conservation Plan waterbirds were not considered as a separate group but were analyzed with landbirds, waterfowl, and shorebirds using a similar process to the Partners in Flight Species Assessment Process. If that analysis did not include a priority species from Waterbirds for the Americas it was added. Congruity was high between the two methodologies (90%). Because of the high degree of endemism in our area, several waterbird subspecies are also address in the SJV Plan, such as six subspecies of Clapper Rail. Programs for Binational bird conservation used in the SJV area, specific projects, partnerships, and training will be showcased.

## **NEST HABITAT OVERLAP BETWEEN LARGE GULLS (LARUS SPP.) AND BLACK GUILLEMOTS (CEPPHUS GRYLLE) (Poster)**

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Herring and Great Black-backed Gulls (*Larus argentatus* and *L. marinus*) have been identified as significant predators and/or competitors with other seabirds in coastal New England. Great Duck Island, ME, USA (44° 09' N. Lat. 68° 15' W. Long.) is the largest nesting colony of Guillemots in New England. The island also supports over 1000 pairs of nesting gulls. Gull nesting areas have been mapped into a GIS database in previous seasons. During the summer of 2008 we located Guillemot nest sites using a combination of techniques, including flushing groups of guillemots by walking along the rocky berm and searching for individual nests beneath slabs and boulders. Guillemots nested in crevices between large boulders along the island's southern and western shore and in hollows in cliffs on the eastern side of the island. We recorded habitat parameters including maximum crevice width and depth. These measurements were contrasted with randomly selected crevices in areas containing guillemots and also in areas lacking guillemots. 79% (N= 116) of located guillemot nests were in habitat also occupied by gulls. Measurement of crevices in areas lacking gulls suggests that this pattern may be due to a preference for living in close proximity to gull sub-colonies, rather than to a lack of available habitat. Although we observed dead guillemots at some Black-backed Gull nest sites, we found that a high proportion of guillemot nests in gull free areas were predated. We hypothesize that gulls may provide a degree of protection from nest predators such as Common Crows (*Corvus brachyrhynchos*) and Ravens (*C. corax*).

## **MARSH BIRDS IN OKLAHOMA: A REVIEW OF DISTRIBUTIONS AND RECORDS OF SECRETIVE MARSH BIRDS IN OKLAHOMA (Oral)**

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Marsh birds are secretive in nature and are difficult to survey. For this reason very little is understood about basic elements of their natural history such as distribution. This one, but very important fact is evident in Oklahoma. Many current accounts of species such as the American Bittern, Virginia Rail, etc, don't recognize Oklahoma as a place of breeding, even though there are current breeding records for the state. For this reason between 2007 and 2008 marsh bird monitoring began in Oklahoma. During these seasons numerous new breeding records and important distributional evidence was gathered. Some of these records extend current know breeding ranges as far as 200 miles. This presentation is designed to provide a current overview of the American Bittern, Least Bittern, Virginia, King, and Black Rails, as well as the Common Moorhen and Purple Gallinules in Oklahoma. By compiling recent historical accounts as well as published and unpublished data from multiple sources this presentation will provide researchers with a complete overview of these species in Oklahoma, something for which there has never been on the state level. Following this update a short outline for the monitoring of marsh birds in Oklahoma will also be discussed.

## **IMPACTS OF IRRIGATED AGRICULTURE AND TRADE-OFF FOR WATERBIRDS CONSERVATION AT A RAMSAR SITE IN SRI LANKA (Oral)**

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The ecological character of a system of coastal brackish lagoons, one of the three most important Ramsar sites in Sri Lanka, has been affected by the implementation of a large agricultural scheme developed upstream of the wetlands system. The lagoons natural hydrological cycle has been disrupted by irrigation drainage flows and the water quality altered by nutrient-rich run-off from agriculture. This has affected waterbird community composition and abundance. Among different waterbird guilds, shorebirds were the most sensitive to changes in water level fluctuations and concentration of suspended sediments. The relationship between irrigated agriculture and its effect on wetland ecosystems has often been portrayed as a direct trade-off between the human need for food versus conservation. We also investigated the role of artificial wetlands (irrigation reservoirs, rice-paddies, and saltpans) near the Ramsar site, in supporting waterbirds communities as substitutes of natural wetlands. Waterbird abundance and in particular migratory shorebirds, were lower in artificial compared to natural wetlands. Water level fluctuations and water quality parameters were the major drivers of the observed differences. This study recommends on how to restore better conditions that support higher waterbirds diversity and habitat quality in the degraded lagoon of the Ramsar site, and on potential ways to manage (ie: controlling water levels) the other artificial wetlands. Maintaining a variety of wetland types across the landscape is particular important in the case of mobile species such as waterbirds using a matrix of different wetland types during their life cycles.

## **COASTAL WATERBIRDS, HURRICANE WILMA AND THE SUBSEQUENT THREE NESTING SEASONS (Oral)**

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On 10/24/05 at 05:00, Wilma a class three hurricane hit seven miles south of Marco Island Florida. Of the five colonies I have been monitoring, three were severely damaged and two brushed, by the storm. Coastal waterbird mortality recorded in the area was less than 1% of those present in the vicinity at the time. Coastal waterbirds have been monitored for 35 years, along the coast from Naples to Chokoloskee Bay, Southwest Florida (96 km). Having long term data has provided the opportunity to evaluate the affects of this hurricane on coastal waterbirds. A big problem with trying to determine the impact of a single environmental event on bird populations is separating it from other factors that are going on at the same time. After Wilma, 2006 colony nesting of Brown Pelicans, Double-crested Cormorants and Great Egrets increased, whereas Snowy and Cattle Egrets plus Little Blue and Tricolored Herons declined, this was caused by hurricane substrate damage. In both 2007-08 all these species had varying numbers of nests and success; whether this was due to Wilma or a severe drought or both is impossible to tell. Sundown censusing at the large Marco colony did not show any discernable differences that could be attributed to the storm (or the drought). The most striking information to come out of the disruption caused by hurricane Wilma is that although there was considerable damage to three of the colony/roosts monitored; the birds continue to use them in good numbers. This shows how important these sites are.

## **USING RADIOTELEMETRY TO ASSESS BLACK-CROWNED NIGHT-HERON FORAGING HABITAT USE IN NEW YORK CITY (Oral)**

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Black-crowned Night-Heron (BCNH) adults were captured and marked with radiotransmitters in the New York City area to examine patterns of urban foraging site use. From 2004-2006, seven BCNHs were captured with a remote-controlled drop net at foraging sites in close proximity to breeding colonies, and were tracked by car and boat from June to October. Two BCNHs returned to nest sites (Hoffman Island and Canarsie Pol), and routinely foraged at the capture locations; five BCNHs did not return to nest sites following capture. All BCNHs foraged and roosted within 0 – 16 km of the initial capture site. Observed foraging patterns included (1) long-term use of a single site for both foraging and roosting; (2) short-term, short distance movements to new foraging habitats followed by a return to a core area; and (3) longer distance movements to new foraging/roosting locations. Following major storm systems in mid-October, radiomarked BCNHs were not relocated, suggesting dispersal beyond the study area. Signal interference was a principal confounder in tracking BCNHs at these urban sites.

## **BEHAVIORAL RESPONSES IN HERRING GULLS *LARUS ARGENTATUS* TO LOBSTER FISHING IN THE EASTERN GULF OF MAINE (Poster)**

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Lobster fishing is an iconic element of communities in Downeast Maine. Lobster traps are typically baited with herring *Clupea harengus*, which is discarded when traps are pulled. Some lobstermen toss bait immediately out of traps, others bucket the bait for later disposal. Prior studies show a significant portion of food fed to young gulls consists of lobster bait discards. During the summer of 2008, I observed gulls responding to lobster boats fishing in the vicinity of Great Duck Island, an off-shore island in the western Gulf of Maine. Over the course of 6 weeks I was able to observe gull behavior around 30 boats, with repeat observations of vessels concentrating their activity in the immediate vicinity of the island. I also analyzed 20 samples of food boli regurgitated by young gulls during banding procedures. Flock sizes around boats were recorded for fishing vessel behaviors that included rapid transit, slow, stop, turn, hauling trap, trap up, toss lobster and bait over. Gull numbers in the vicinity of lobster boats increased in apparent response to visual cues from gulls already over boats and also to lobster boat activity. Peak numbers of gulls (Max = 57) were observed over boats that were actively tossing bait. Some gulls persisted in following boats that were not throwing bait, although flock size never exceeded 12. Eight out of 20 sample food boli contained lobster bait. Bait was found in samples collected in both clear and extremely foggy days, suggesting that gulls may also use aural cues to locate fishing vessels.

## **FORAGING BEHAVIOR AND ENERGETICS OF GREAT EGRETS AND SNOWY EGRETS AT INTERIOR RIVERS AND WEIRS (Oral)**

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We measured foraging behavior and its energetic costs for Great Egrets (*Ardea alba*) and Snowy Egrets (*Egretta thula*) at two weirs and in two rivers in Wichita, Kansas, in May and June 2000 and 2005. We observed 99 randomly selected birds (38 Great Egrets, 61 Snowy Egrets) for 1513 min, and compared the following variables between species and microhabitats: strike rate, prey capture rate, capture efficiency, prey size, and social interactions. A subset of those birds was observed for 504 min and used to estimate ambulation velocities and foraging energetics. We tested the hypothesis that egrets adapt components of their foraging behavior to local conditions. If correct, then the feeding patterns for both species should differ between microhabitats. Both species had higher strike rates and prey capture rates in rivers but caught larger fish at weirs. Prey sampling showed that the fish at weirs were larger than those in rivers. Snowy Egrets had higher capture efficiency at weirs, but Great Egrets did not differ between microhabitats. Snowy Egrets had higher rates of conspecific aggression at weirs than in rivers; little aggression was documented for Great Egrets. For both species, the percentage of time spent standing was twice as high at weirs as in rivers. Both species also used low-cost foraging strategies at weirs that yielded larger fish, so net energetic gains at weirs were higher than in rivers. Weirs appear to be more important to Snowy Egrets than to Great Egrets.

## **NEST-SITE SELECTION AND RESPONSE TO HABITAT MANIPULATION BY ROSEATE TERNS ON SEAVEY ISLAND, NEW HAMPSHIRE (Oral)**

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In the cold water portion of the Gulf of Maine, little research has been conducted on Roseate Tern (*Sterna dougallii*) nesting habitat, and the optimal conditions that the species requires are poorly known. On Seavey Island, New Hampshire, increasingly dense vegetation has caused parts of the island to become unusable by nesting Roseate Terns. To provide additional nesting habitat and possibly increase Roseate Tern productivity, habitat manipulation was implemented in 2006. Eighteen plots measuring 2m x 2m were established in areas where Roseate Terns historically nested but where increased vegetation density has apparently displaced the species in recent years. The treatment methods included (1) weed-whacking and hand-pulling vegetation around the rocks within each plot, and (2) the application of an herbicide to clear up to 50% of the plot. In the study plots, the two treatment methods and the control were randomly assigned to a total of 18 plots. At each nest established within the plots, vegetation characteristics were measured during or immediately after nest initiation, within 5 days of chick hatching and at the end of the season within 5-7 days of fledging. Habitat variables were also measured at Roseate Tern nests located outside the study plots. In the fall of 2006, New Hampshire Fish & Game Department developed a comprehensive prescribed burn plan to manage the vegetation on Seavey Island. Similar vegetation characteristics were measured in 2007, and were compared to those measured in 2006. The average height of the closest vegetation around Roseate Tern nests was 0.40 m in 2006 and nests were found in more densely vegetated areas than in 2007. In all of the study plots there was a notable shift from grass to herbaceous species; the herbicide plots showed the greatest change.



## **PIPING PLOVER CHICK SURVIVAL ON NATURAL AND ENGINEERED SANDBARS: THE EFFECTS OF A LARGE-SCALE EXPERIMENT (Oral)**

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Habitat creation may be a good way to conserve threatened and endangered waterbirds if the managed species are habitat limited. Evaluation of habitat creation efforts should include measurement of the impact of the management on the demography of the population of interest. We studied the survival of piping plover chicks on the Gavins Point Reach of the Missouri River, on natural and engineered sandbars, during the 2005 – 2007 breeding seasons. Chicks were captured and banded with unique color combinations soon after hatch. We recaptured chicks every other day until fledge (25 days). Band resighting continued throughout the breeding season. We used random effects models to explore correlates to survival and to compare the performance of engineered and natural habitats. Initially, chick survival on engineered habitats was comparable to natural habitats, but survival declined over the three years of study. In 2007, all but one of the engineered habitats had lower chick survival than natural habitats. The decrease in survival for the other engineered sandbars appeared to result from increasing predation by avian predators. In the third year of the study, engineered sandbars appeared to be sinks, meaning that the plovers nesting on them did not produce enough young sustain the local population. Additional years of study will be required to determine if this low survival will continue on these sandbars. If low chick survival does continue, and birds on engineered sandbars might have had higher reproductive output elsewhere, engineered sandbars might actually impede piping plover recovery in the long term.

## **VARIATION IN GROWTH RATES OF PIPING PLOVER CHICKS ON THE MISSOURI RIVER (Oral)**

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Avian growth rates may be positively correlated with survival, but growth rate can be affected by individual, territory, or habitat quality. We studied the variation of growth rates at several hierarchical levels to determine where the greatest amount of variation was present in the growth of piping plover (*Charadrius melodus*) chicks on natural and engineered sandbars on the Missouri River. We captured, banded, and measured the mass (0.1 g), wing-chord (1mm), and culmen (1mm) of newly hatched piping plover chicks using sandbar habitat from 2005 – 2007. We continued to recapture and measure chicks until they were fledged or dead. We also evaluated the effect of habitat type (natural vs. engineered sandbars), timing of hatch, and availability of foraging habitat (ha of moist habitat). We used a multi-level random effects model with sandbar, nest, and individual as levels of random variation. We modeled these effects for each of the morphometric measurements. Variation was greatest at the sandbar level, intermediate at the nest level, and least at the individual level. Birds that hatched earlier in the season and that had more foraging habitat available to them grew more quickly than others. Our results indicate that habitat recovery programs should not only focus on creating the appropriate amount of nesting habitat, but also on the amount of foraging habitat that is available and that this type of management should be directed at the sandbar level to take advantage of the greatest amount of variation in growth.

## **WILD WHOOPING CRANES: CURRENT AND EMERGING CONSERVATION ISSUES (Plenary)**

**Felipe Chavez-Ramirez**, Platte River Whooping Crane Maintenance Trust

The wild Aransas-Wood Buffalo population of Whooping Cranes (*Grus americana*) has increased from a low of 16 individuals in 1941 to a current 266 individuals. While significant proportional increases have occurred since 1941, the current net size of this population makes it one of the rarest and most critically endangered birds in the wild. While the majority of the distribution range in wintering and breeding grounds are in protected areas, several emerging issues have the potential to negatively impact growth of this population. Current and future conservation problems in the wintering grounds include habitat loss due to developments and potential decreases in food resources related to freshwater inflows impacted by potential municipal uses. Causes and location of high undocumented spring and fall migration mortality is unknown and needs to be investigated. In the breeding grounds there is a paucity of data on diet, food availability, chick rearing behavior, and specific factors and processes that influence reproductive success. Current and potential problems arising in different areas will be presented as well as research initiatives to address some of them. Additionally, I will present new and current information on state of the wild population including new demographic models and longevity records based on banded individuals. In addition to Aransas-Wood Buffalo birds, reintroduced Whooping Cranes are present in the wild as a result of reintroduction efforts. Despite significant public awareness of these reintroduction efforts, none have become self sustaining as required under the recovery plan and are therefore not considered successful. Some significant problems with reintroductions include high mortality of reintroduced birds, lack of productivity of surviving individuals, and low population viability. Other specific problems encountered with the reintroduced populations are presented and include, negative imprinting, nest desertions, and low chick survival. Updates on current reintroductions and plans for new ones will be presented.

## **ABUNDANCE, PRODUCTIVITY AND CONSERVATION OF SANDBAR-NESTING RIVER BIRDS IN NORTHEASTERN CAMBODIA (Oral)**

**Andrea H. Claassen\***, Conservation Biology Graduate Program, University of Minnesota, St. Paul, MN USA.

In Northeastern Cambodia the contiguous stretches of the Mekong River and its three major tributaries, the Sesan, Sekong and Srepok Rivers, have immense regional importance for riverine birds. Black-bellied Terns, River Terns, River Lapwings, Great Thick-knees, Small Pratincoles, and Little Ringed Plovers all nest on river sandbars, which makes them particularly vulnerable to alteration of river habitat, predation and disturbance. Surveys to estimate abundance and distribution, and nest searching and monitoring to estimate productivity and identify causes of nest failure were conducted on the Sesan and Sekong Rivers in 2003. A follow-up survey was conducted on the Sesan River in 2008. This study supports other studies documenting that sandbar-nesting river birds in Cambodia have declined significantly in recent years. Major threats to sandbar nesting birds on the Sesan River include inundation of nests and chicks, reduction in breeding and foraging habitat, and reduction in food resources caused by the Yali Falls hydropower dam, predation of nests and chicks by animals, egg harvest by local people, and incidental disturbance from people and domestic animals. During this study, hydropower-related inundation and predation caused an equal number of nest failures, however predation levels may have been augmented by the decreased area of sandbar habitat during water releases from the Yali Falls dam. Egg harvest by local people was the next highest cause of nest failure. One nest was trampled by domestic water buffalo. Future river bird conservation efforts should focus on preventing further large-scale hydropower development in the region, implementing mitigation measures for current hydropower operations such as the use of environmental flows, and working with local communities to protect nesting sites.

## **RED KNOT STOPOVER IN VIRGINIA, DELAWARE, AND NEW JERSEY: NUMBERS, PHENOLOGY, AND INTERCHANGE (Oral)**

**Jonathan Cohen**, jocohen1@vt.edu, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA.

Weekly counts of western Atlantic red knots (*Calidris canutus rufa*) at their Delaware Bay migration stopover site have suggested a major decline since the 1980s, which has been attributed to diminishing horseshoe crab eggs, the knots' primary prey during stopover. Most red knot management has focused on human disturbance and horseshoe crab eggs in the Delaware Bay; little is known about the importance of other stopover sites. We estimated red knot spring passage population size in the New Jersey Coast/Delaware Bay region (NJDE) (2004 and 2006) and Virginia (VA, 2006 and 2007) by correcting weekly aerial counts for mean daily residence probability between counts. We used daily telemetry relocations in mark-resight models to estimate mean daily residence probability. Average daily residence probability was ~1.0 in mid-May, 0.96-0.97 in the week of 22 May, and 0.64-0.77 after May 28 in NJDE in 2004 and 2006 and in VA in 2006. Average daily residency was ~0.88 in VA in 2007 from 22 May to 5 Jun. No birds moved from VA to NJDE in 2006 and only 2 birds (5.5%) moved in 2007. Stopover population sizes ( $\pm$ SD) adjusted for residency in NJDE were 17,108  $\pm$  1,322 in 2004 and 19,555  $\pm$  831 in 2006 and in VA were 7,224  $\pm$  389 in 2006 and 8,332  $\pm$  718 in 2007, significantly greater than peak aerial counts. Years with similar peak counts had different residence probabilities; hence adjustments for turnover should be used in the future to assess annual population changes. Our results are consistent with early literature suggesting Virginia was of historic importance in the spring red knot stopover, which once occurred over a much greater geographic range than at present.

## **DOUBLE-CRESTED CORMORANT DIVING BEHAVIOR AND FORAGING EFFORT AT THREE NEW YORK COLONIES (Oral)**

**Jeremy T. H. Coleman**, U.S. Fish and Wildlife Service, Jeremy\_Coleman@fws.gov; **Milo E. Richmond**, New York Cooperative Fish and Wildlife Research Unit, mer6@cornell.edu; **Lars G. Rudstam**, Cornell Biological Field Station, Cornell University, lgr1@cornell.edu; **Harold Mills**, Nova Speech, harold.mills@gmail.com.

In 2002 we initiated a 2-year study of double-crested cormorant foraging behavior to compare foraging effort at 3 colonies in New York. We deployed electronic time-depth recorders (TDRs) on adult cormorants from Oneida Lake, Lake Ontario, and Lake Champlain to record the time, duration, and depth profiles of foraging dives over several days. A total of 491 full days of activity were recovered for 22 individuals, during which the TDRs recorded 88,000 dives. Duration of individual deployment ranged from 3 to 55 days, and repeated measures ANOVA revealed no significant difference between lakes in the daily number of dives performed by individual, or the total time spent underwater each day. Maximum dive depths varied by individual and by lake. The maximum depth recovered was 25.8 m, recorded at Lake Ontario. No difference in dive depth or total daily dive time was detected by sex or body size. Maximum dive depths exhibited a deepening trend through the season on both Lake Ontario and Lake Champlain. Mean individual dive durations ranged from 17–34 sec ( $\bar{x}$  = 22  $\pm$  10 sec [1 SD]). Mean values by lake for the total amount of time cormorants spent diving (underwater) ranged from 62–70 min, ( $\bar{x}$  = 66  $\pm$  37 min [1 SD]). Timing of diving activity was most similar between Oneida Lake and Lake Champlain, with a bimodal activity pattern focusing on late morning and late afternoon. The results from the three systems reveal a great degree of flexibility in foraging strategy and diving behavior, likely associated with prey distribution and availability.

## **LITTLE DUCK OR GREAT DUCK? EIDER DUCK! (Poster)**

**Clodagh Collins\***, College of the Atlantic, 105 Eden Street, Bar Harbor, Maine 04609, (ccollins@coa.edu).

More than 215 islands along the Maine coast serve as nesting grounds for eiders, and recent estimates suggest that up to 29,000 eiders nest in Maine. The Eider duck (*Somateria mollissima*) prefers to breed/nest on small, offshore uninhabited islands that are free of predators and human disturbance. Both Little Duck and Great Duck in eastern coastal Maine offer, to some degree, a combination of both. This paper is based on a 6 weeks observation study on Great Duck Island from June 10th to July 19th, 2008. Daily observations were made on numerous eider crèches occurring throughout the island. Duckling numbers were recorded also, and peak estimates reached 240 ducklings. The poster itself consists of an account of two offshore islands along the Maine coast on which the Eider Duck (*Somateria mollissima*) breeds and nests. This is a story narrated through the eyes of a young eider duckling. It follows its first steps from the nest down to the shoreline, and continues through the next few weeks as it learns to feed and stay close to its mother, siblings and other accompanying ducklings. Throughout the story features of the islands' habitats unfold, demonstrating why these islands are preferred breeding and nesting habitats by the eider. The intent of the story is to provide solid natural history information to children and young adults in a format that will combine technical data and artistic interpretation.

## **PERFLUORINATED COMPOUNDS IN GREAT BLUE HERON EGGS COLLECTED ON THE MISSISSIPPI RIVER NEAR ST. PAUL, MINNESOTA (Oral)**

**Custer, C.M.** and **Custer, T.W.**, U.S. Geological Survey, La Crosse, WI, ccuster@usgs.gov;  
**Kannan, K., Tao, L., and Saxena, A.**, New York State Dept of Health, Albany, NY and **Trowbridge, A.**, U.S. Fish and Wildlife Service, Bloomington, MN.

One of two manufacturing plants worldwide for perfluorochemical compounds (PFCs) was located on the Mississippi River near St. Paul, Minnesota. PFCs have been widely used in commercial products as water and stain repellents, for nonstick cookware, and as surfactants, polymers, and wetting agents. Laboratory studies have indicated that this class of chemicals can be toxic to birds and mammals. Great blue heron (*Ardea Herodias*) eggs were collected in 1993 from a colony (Pig's Eye) on the Mississippi River near this manufacturing plant and one colony upstream and another downstream from Pig's Eye. Based on a multivariate analysis, the pattern of nine PFC concentrations differed significantly between Pig's Eye and the upstream ( $P = 0.002$ ) and downstream ( $P = 0.02$ ) colonies; but not between the upstream and downstream colonies ( $P = 0.25$ ). Mean concentrations of perfluorooctanesulfonate (PFOS), a major contributor to total PFC concentrations, were significantly higher at the Pig's Eye colony (geometric mean = 976 ng/g wet wt.) than at upstream or (64 ng/g wet wt.) and downstream colonies (136 ng/g wet wt.). PFOS concentrations from Pig's Eye were among the highest ever reported in bird eggs (maximum = 1,794 ng/g wet wt.). Most PFOS concentrations in heron eggs were near or above a threshold associated with reduced hatching success in chickens (100 ng/g wet wt., *Gallus domesticus*) and which caused liver necrosis in 7-day-old chickens (1000 ng/g wet wt.). Further study is warranted to determine whether these high levels are persisting and causing adverse effects.

## **PERFLUORINATED COMPOUNDS AND POLYBROMINATED DIPHENYL ETHERS IN GREAT BLUE HERON EGGS FROM INDIANA DUNES NATIONAL LAKESHORE, INDIANA (Oral)**

**Thomas Custer**, U.S. Geological Survey, La Crosse, Wisconsin. [tcuster@usgs.gov](mailto:tcuster@usgs.gov), **Kuruthachalam Kannan**, **Lin Tao**, and **Abhinav R. Saxena** State University of New York, Albany, New York, [kkannan@wadsworth.org](mailto:kkannan@wadsworth.org), **Bill Route**, National Park Service, Ashland, Wisconsin. [Bill.Route/GLKN/NPS@NPS@NPSX](mailto:Bill.Route/GLKN/NPS@NPS@NPSX)

In 1993, great blue heron (*Ardea herodias*) eggs were collected from Indiana Dunes National Lakeshore, IN, and analyzed for organochlorine pesticides (OCs), polychlorinated biphenyls (PCBs), mercury, and selenium. In 2007, archived samples from these eggs were analyzed for perfluorinated compounds (PFCs) and polybrominated diphenyl ethers (PBDEs) and reanalyzed for OCs and PCBs. Concentrations of 10 OCs and PCBs did not significantly differ after 14 years of storage. Perfluorinated compounds were detected in all eggs. Most concentrations of perfluorooctanesulfonate (PFOS), the major contributor to total PFC concentrations, were near or above a threshold associated with reduced hatching success in white leghorn chickens. However, it is not known whether great blue heron embryos are as sensitive as chickens or whether effects of PFOS injected into chicken eggs are comparable to biologically incorporated PFOS. Polybrominated diphenyl ethers were detected in all eggs. The ranking of PBDE congener concentrations was PBDE-47 > -99 > -100 > -153 > -154 > -28 > -183. This pattern is consistent with the contributions from Penta PBDE formulation. Total PBDE concentrations in great blue heron eggs from IN Dunes were more than five times greater than total PBDE concentrations in great blue heron eggs collected from the southwest coast of British Columbia in 1993. The higher PBDE concentrations in IN Dunes probably reflect local contamination from the highly urbanized and industrialized inputs into Lake Michigan. Polybrominated diphenyl ether concentrations were within levels associated with altered reproductive behavior in other avian species.

## **SITE OCCUPANCY AND HABITAT USE OF THREE MARSH BIRD SPECIES IN THE ILLINOIS AND UPPER MISSISSIPPI RIVER VALLEYS (Oral)**

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Many marsh bird populations in the Midwest have declined dramatically as a result of wetland habitat loss. Proper management of wetland refuges is critical to the conservation of these species. In this study we used repeated surveys with call-broadcast to detect 3 species of secretive marsh birds in the Illinois and Upper Mississippi River Valleys in 2006 and 2007. We estimated detection probabilities ( $p$ ) for each species and incorporated  $p$  into our estimates of site occupancy rates ( $\psi$ ). We related  $\psi$  for each species to habitat covariates measured  $\leq 50$  m of each survey point. King Rail (*Rallus elegans*) site occupancy was negatively related to percent woody cover in both years and positively related to interspersions in 2007. Least Bittern (*Ixobrychus exilis*) site occupancy was positively related to percent tall (>1 m) emergent cover in both years and to interspersions in 2007. Pied-billed Grebe (*Podilymbus podiceps*) site occupancy was negatively related to percent woody cover in both years and positively related to percent open water in 2006. These results can be used as guidelines by refuge managers for marsh bird habitat management.

## **CALIFORNIA GULLS IN SAN FRANCISCO BAY: LANDFILL USE, IMPACTS ON BREEDING WATERBIRDS, AND IMPLICATIONS FOR THE SOUTH BAY SALT POND RESTORATION PROJECT (Oral)**

**Jill Bluso Demers**, San Francisco Bay Bird Observatory (jdemers@sfbbo.org), **Josh Ackerman** and **Collin Eagles-Smith**, US Geological Survey, Davis Field Station (jackerman@usgs.gov and ceagles-smith@usgs.gov), **John Takekawa** and **Nicole Athearn**, US Geological Survey, San Francisco Bay Estuary Field Station (john\_takekawa@usgs.gov and nathearn@usgs.gov), **Cheryl Strong**, US Fish and Wildlife Service (cheryl\_strong@fws.gov).

Breeding populations of California Gulls (*Larus californicus*) have increased by 37 fold over the past two decades in San Francisco Bay, from less than 1,000 breeding birds in 1982 to over 37,000 in 2007. Their exponential increase in the San Francisco Bay may be closely related to their use of landfills and other anthropogenic sources of food, and this increase may have negative effects on other ground-nesting waterbirds through harassment, encroachment on nesting sites, and predation on eggs and chicks. Furthermore, the South Bay Salt Pond Restoration Project is initiating plans to restore 16,000 acres of salt ponds into tidal marsh or other habitats, and may cause a portion of the 37,000 breeding gulls to move to new nesting sites, displacing other breeding waterbirds and potentially increasing predation rates. In response, we conducted surveys to determine the extent of landfill use by California Gulls, radio-marked California Gulls to examine their current distribution and movements in the bay, and documented predation rates by gulls on eggs and chicks of other locally nesting waterbirds. Our results indicate that California Gulls heavily use local landfills and intensively use habitats that support other breeding waterbirds. Additionally, gulls are predators of shorebirds eggs and the major predator of American Avocet (*Recurvirostra americana*) chicks. The expanding gull population will may negatively impact other breeding waterbirds and threaten the success of the South Bay Salt Pond Restoration.

## **HABITAT SELECTION BY FORSTER'S TERNS IN SAN FRANCISCO BAY: THE IMPORTANCE OF SALT PONDS (Poster)**

**Jill Bluso Demers**, San Francisco Bay Bird Observatory (jdemers@sfbbo.org), **Josh Ackerman**, US Geological Survey, Davis Field Station (jackerman@usgs.gov), **John Takekawa**, US Geological Survey, San Francisco Bay Estuary Field Station (john\_takekawa@usgs.gov).

The San Francisco Bay is currently undergoing large-scale habitat restoration and several thousand hectares of artificial salt evaporation ponds are being converted to tidal marsh. To identify potential impacts of this habitat restoration on breeding waterbirds, we examined the space requirements and habitat selection of Forster's Terns (*Sterna forsteri*) at four spatial scales. We radio-marked 53 Forster's Terns and tracked them during the pre-breeding and breeding season in 2005 and 2006. At each spatial scale, we calculated habitat selection ratios and simultaneous Bonferroni confidence intervals by season and year. Forster's Terns had large home ranges ( $129 \pm 24.0$  km<sup>2</sup>) and overwhelmingly selected salt pond habitats at most spatial scales, including selecting salt ponds for foraging and roosting habitats. Forster's Terns strongly selected low salinity salt ponds (0.5 – 30 g l<sup>-1</sup>) and generally avoided higher salinity salt ponds (>31 g l<sup>-1</sup>). Forster's Terns typically used tidal marsh and managed marsh habitats in proportion to their availability, avoided upland and tidal flat habitats, and strongly avoided bay habitats. Our data indicate that salt ponds provide important habitat for Forster's Terns in San Francisco Bay, and suggest that regional restoration efforts to convert salt ponds to tidal marsh may reduce the availability of preferred habitat.

## **A SPATIAL ANALYSIS OF CO-EXISTING RESIDENT AND MIGRANT SHOREBIRDS: AMERICAN AVOCETS IN SAN FRANCISCO BAY (Oral)**

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San Francisco Bay is well known as a migration and wintering area of international importance for shorebirds. However, in the past century a breeding population of American Avocets (*Recurvirostra americana*) has become established in the estuary. These breeders overlap during parts of the year with a migrant population of avocets, presenting a unique opportunity to compare the spatial ecology of coexisting migrant and resident shorebirds. We captured and radio-marked pre-breeding migrant and resident avocets at two capture sites (salt pond and tidal flat) to examine their space use, habitat selection, and morphometrics. Migrants had larger linear movements and traveled farther than residents captured at the salt pond. Conversely, migrants had smaller home ranges and remained closer to their capture site than residents captured on the tidal flat. We detected significant differences in habitat selection between birds captured from the two habitats, but minimal differences between migrants and residents within those capture sites. Generally, avocets selected habitats that were similar to their capture locations regardless of their migratory status. Migrant wing lengths averaged 4 mm longer than residents. We suggest that site differences in habitat selection indicate they have adaptable pre-breeding strategies, while differences in space use between migrants and residents reflect their dissimilar phenology.

## **FORAGING HABITATS, MOVEMENTS, AND BEHAVIORAL INTERACTIONS OF A MIXED SPECIES HERONRY IN PENNSYLVANIA (Oral)**

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The Wade Island heronry, located in the Susquehanna River at Harrisburg, is home to Pennsylvania's largest populations of Black-crown Night Herons (*Nycticorax nycticorax*), Great Egrets (*Ardea alba*) and only breeding population of Double-crested Cormorants (*Phalacrocorax auritus*). Since the arrival of double-crested cormorants, and their resulting exponential population expansion, the interactions between the three species have been a principle concern. To that end we observed the nesting behaviors (maintenance, provisioning, incubation behaviors and chick fates) of thirteen Night-Heron nests. Night-Herons occupy the lowest nests in this vertically stratified colony and were therefore expected to receive the most stress from overhead nesting activities. The mean number of chicks per nest was 3.23, while the mean number of chicks fledged was 2.77 per nest equating to 85.6% of chicks surviving to fledging suggesting limited negative interactions. Observations and telemetry also indicated that Night-Herons were benefiting from the cormorants presence by scavenging fish dropped by nestlings. Habitat use of great egrets and Night-Herons was investigated on both local and landscape scales. Locally, these observations were conducted using direct observation of foraging individuals, while the landscape scale was investigated by recording colony departure and return vectors and relating them to known foraging locations identified by aerial survey and tracking radio tagged Night-Herons. The results indicate the expected temporal segregation of foraging habitats, and identified a spatial separation of foraging habitats within the focal area, with great egrets heavily utilizing the shores of islands and emergent grass shoals, while Night-Herons preferentially utilized the river banks.

## **WATERBIRD PLANNING AND WATERBIRD CONSERVATION ACTION IN BOREAL AND ARCTIC CANADA (Oral)**

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Arctic and Boreal landscapes are characterized by their vast size, harsh climate and general lack of human presence. In a global context, these areas are largely untouched and the areas where there is human activity on the landscape, impacts rarely register high on conservation action priority lists. Given the logistical challenges of working here and relatively low need for information on waterbirds to direct conservation action, much basic biological information is still to be determined in these regions. Recent economic factors combined with a climate that is on a steep warming trend, have introduced the need to rethink our concept of the Boreal and Arctic as wild and untouchable. With this comes the recognition that information on waterbirds, as well as other biota, will soon be needed to ensure conservation in the context of increased industrial activity from forestry, mining and transportation sectors among others. An approach under development will put the onus on industries to participate in the gathering of information and will require them to put conservation measures in place as a condition for gaining the necessary permits for their activities.

## **FOOD WEB INTERACTIONS AMONG DOUBLE-CRESTED CORMORANTS AND TOP PREDATOR FISH SPECIES (Oral)**

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Increasing numbers of double-crested cormorants (*Phalacrocorax auritus*) in North America have raised concerns regarding consumption and competitive displacement of top predator fish; however, we currently have a relatively poor understanding of how cormorants integrate into aquatic food webs. Stable isotope ratio analyses have become common tools to study food web dynamics because they can verify and provide new understandings about diet in addition to conventional methods. Using a combination of carbon and nitrogen stable isotopes and stomach content analyses, we investigated the diet and food web position of breeding double-crested cormorants in three lakes spanning the major habitat transition from the northern Great Plains into the southern boreal forest region of Saskatchewan, Canada. These lakes also support two economically important top predator fish species, northern pike (*Esox lucius*) and walleye (*Sander vitreus vitreus*). Stomach content analyses on all three lakes indicated that cormorants consumed predominantly abundant small forage fish species, while rarely taking walleye or pike. Stable isotopes analyses support the findings from stomach contents, and identify cormorants as versatile piscivores with a varying food web position relative to top predator fish on each lake investigated. In some cases stable isotopes signatures were similar among cormorants and adult walleye, suggesting that there is overlap in their diets and thus the possibility of competition for prey. The circumstances that lead to this potential niche overlap among cormorants and top predator fish, and the importance of competition to fisheries management remain uncertain and require further study.



## **BAYESIAN BELIEF NETWORK MODEL OF KING RAIL OCCUPANCY OF MARSH HABITATS (Oral)**

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We are testing the suitability of Bayesian Belief Networks to enhance the predictive resolution of species distribution models for use in adaptive management. Bayesian Belief Networks are a class of models commonly employed in situations where risk-prone, value-laden decisions must be made with incomplete data and therefore are well suited to the complexities and uncertainties inherent to population and habitat management. In our models, initial beliefs constructed from literature review and expert opinion, are then tested and updated with each season's field data. Our first pilot project modeled and surveyed King Rail (*Rallus elegans*) in coastal plain marsh habitats of North Carolina and southeast Virginia. Data from the first year of validation surveys indicate that experts accurately identified the environmental gradients that would best predict the probability of King Rail occurrence at a given site and time. In order of importance, King Rail occupied sites with lower salinity, larger patch size, and greater interspersion of open water. They were never observed in interior habitat (> 250 m from mapped open water). Of particular importance to distribution modeling efforts, however, the model using landscape data alone (e.g. fresh, brackish, and saline marsh landcover classes), rather than site and time specific measurements (e.g. salinity in ppt at time of each repeat survey), do not effectively describe the observed occurrence patterns. We will highlight methods used to distinguish different sources of error and uncertainty (e.g. inaccurate maps, incomplete knowledge, or false expert assumptions) to help managers and researchers better allocate limited resources to gradually shift from expert-based to data-based decision support.

## **THE SOUTH BAY SALT POND RESTORATION PROJECT (Poster)**

**Ron Duke**, rduke@harveyecology.com, **John Bourgeois**, jbourgeois@harveyecology.com, **Steve Rottenborn**, srottenborn@harveyecology.com, **Scott Demers**, sdemers@harveyecology.com; H. T. Harvey & Associates, **Cheryl Strong**: cheryl\_strong@fws.gov; U.S. Fish and Wildlife Service, **Steven Ritchie**: sritchie@scc.ca.gov; California Coastal Commission.

Prior to European settlement, much of the land fringing the San Francisco Bay consisted of tidal marsh and other wetlands habitats. Approximately 90% of these wetlands have been lost to diking, draining, and filling, with most of the wetlands in the South San Francisco Bay (South Bay) converted to commercial salt production ponds. Recently, state and federal agencies have purchased several salt pond complexes for habitat restoration. The South Bay Salt Pond Restoration Project (SBSP Project) encompasses 15,100 acres and is the largest wetland restoration project on the West Coast of the United States. The goals of the SBSP Project include the restoration and enhancement of wetlands in South Bay, flood management, water quality protection, and public access. Salt ponds currently provide nesting, foraging, and roosting habitat for several waterbird species. As a result, conversion of this habitat to tidal marsh represents an ecological tradeoff between pond-associated waterbirds and estuarine fish, marsh species, and estuarine productivity. Due to uncertainties regarding the effect of tidal restoration on waterbird populations, "bookend" alternatives representing the range of restoration outcomes were identified. The Managed Pond Emphasis would provide approximately 7,500 acres of tidal habitat and 7,500 acres of managed pond habitat. The Tidal Emphasis, when fully implemented, would provide approximately 13,400 acres of tidal habitat and 1,600 acres of managed ponds. The SBSP Project will be guided by Adaptive Management, where research and monitoring at each stage will guide future management decisions and ultimately determine the configuration of the SBSP Project.

## **ADAPTIVE MANAGEMENT AND THE SOUTH BAY SALT POND RESTORATION PROJECT (Poster)**

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The State of California and the Federal government are proceeding with the restoration of 15,100 acres of former salt ponds in South San Francisco Bay. Acquisition of South Bay salt ponds provides an opportunity for landscape-level wetlands restoration, improving the physical, chemical, and biological health of the San Francisco Bay. The South Bay Salt Pond Restoration Project will restore tidal marshes and tidal channels, increasing habitat for the endangered California clapper rail and salt marsh harvest mouse, as well as habitat for fish, harbor seals, and other aquatic life while enhancing estuarine productivity. Managed ponds will be enhanced to maximize foraging and roosting habitat for migratory shorebirds and waterfowl traveling on the Pacific Flyway. Restoration at this scale has generated a number of uncertainties, including: 1) Will a decrease in high-salinity ponds and overall pond area reduce migratory shorebird use of South San Francisco Bay? 2) To what extent can waterbird use of managed ponds be enhanced by reconfiguration and targeted management of ponds? 3) Will the habitat value and carrying capacity of South Bay for nesting and foraging migratory and resident birds be maintained or improved relative to current conditions? The project's Science Team, Project Management Team, and Consultant Team have worked collaboratively on an Adaptive Management process to address these uncertainties. The first step of that process is integrated in the project design, via the incorporation of experiments built into Phase 1 of the restoration, which is slated to commence in 2008.

## **SNOWY PLOVER NESTING SUCCESS AND NEST DENSITY AT GREAT SALT LAKE, UT (Oral)**

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The Snowy Plover (*Charadrius alexandrinus*) is a small (40 g) shorebird that inhabits the sparsely vegetated sand beaches, lagoons, river channels, and dry salt flats of North America. Throughout much of its range, Snowy Plover numbers have been declining over the past two decades. In fact, the Pacific Coast population has been designated as "Threatened" under the Endangered Species Act. Interior populations also have experienced declines and have been given "Priority Status" by many bird conservation organizations. Nesting success estimates at some interior sites are low due to predation and flooding events; potentially limiting the ability for populations to rebound. In addition, critical habitat loss has occurred more frequently with increasing human activity and urban expansion. The expansive mudflats and playas of the Great Salt Lake (GSL) shoreline provide ideal breeding habitat for the Snowy Plover. Great Salt Lake is recognized both nationally and globally for its importance to breeding and migratory birds. We conducted a productivity study and nest density survey at GSL to provide information essential for the successful conservation and management of this species. During the 2008 breeding season, we monitored the fates of nests at three study sites within the GSL ecosystem. Overall apparent nesting success rate was high, with 65 of 109 nests (60%) successful. Mayfield nest survival was 46.1% for the three survey sites. We determined nest densities at each site by calculating two separate values; the number of nests found per searching hour and the number of total nests per km<sup>2</sup>. We hope these new data will assist in the future success of this shorebird.

## **CONSIDERATIONS FOR CAPTURE TECHNIQUES OF WATERBIRDS AT NESTING AND FORAGING SITES (Oral)**

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Waterbird research increasingly involves capturing birds to measure attributes of individuals and for attachment of telemetry devices. We describe and evaluate techniques used for the capture of waterbirds at both their nests and sites away from nesting sites (e.g., foraging sites) as key first-steps to any telemetry study. Techniques include both passive and active approaches that can be applied in a variety of habitats and for a variety of waterbird species. Consideration for the choice of trapping techniques include cost, potential capture rate based on previous studies, capture safety for target and non target species, and ease of operation for researchers. For example, we tagged pre-fledged Great Egrets, *Ardea alba*, when we were not easily able to catch adults for a radio telemetry study in the New York Harbor. We may have lost some of the tagged birds to fledging mortality, but we were able to predictably capture birds in the breeding colony. Based on the results of this review of waterbird trapping techniques, we suggest researchers need to consider the time frame available for capture of their target species, the site where trapping will be conducted, and the behavior of the target and species when selecting a trapping technique and developing a trapping protocol.

## **EVIDENCE AND IMPLICATIONS OF BIOFILM GRAZING IN SHOREBIRDS (Oral)**

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Calidrid shorebirds extract invertebrate prey from intertidal sediments by either pecking or probing. Although a broad spectrum of prey types and sizes has been reported, observations of feeding behaviour, stomach contents and field experiments have long suggested the presence of unknown food type(s). Examination of bill and tongue morphology of Western Sandpipers and Dunlin (*Calidris alpina*) presented a functional case for unfiltered grazing on surficial biofilm. Subsequently, multiple lines of evidence from stable isotopes, stomach contents, energy budgets and video images of foraging confirmed that biofilm on the intertidal mudflats of the Fraser River estuary, British Columbia, is a significant food source for migrating western sandpipers (*Calidris mauri*). Estimates are that biofilm contributes 45-59% of dietary intake and an average of 50% of daily energy requirements. Further analyses of the natural diets of shorebirds collected from mixed flocks in the estuary reveal that the relative contribution of biofilm is similar for Western Sandpipers and Dunlin as well as sex-related differences in their diets. Given the ubiquitous nature of biofilm and the morphological requirements not appearing particularly specialized, we anticipate that other shorebird species graze biofilm in a variety of aquatic situations. Because of its inconspicuousness and uncertain ecological values, biofilm is usually overlooked in environmental and shorebird habitat assessments. We advocate that protecting areas which are frequented by shorebirds and favourable to biofilm production is a priority. Physical and biological processes maintaining biofilm are poorly understood; research into this area could greatly benefit shorebird conservation.

## **WESTERN GREBES IN ALBERTA: AN EVALUATION OF HABITAT ALTERATION AND SPECIES ABUNDANCE (Oral)**

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The Western Grebe (*Aechmophorus occidentalis*, WEGR) is a colonial waterbird that breeds on several lakes throughout Alberta. Alberta's Endangered Species Conservation Committee has listed the WEGR as a Species of Special Concern, which is partly due to the species' sensitivity to habitat alteration and disturbance. Increased human development coupled with recent population declines on many lakes that support WEGR has prompted research to better understand the ecology of this species and to develop strategies to ensure its persistence in the province. Using historical surveys and current field data from lakes both with and without breeding populations, we evaluated how WEGR abundance is affected by environmental variables such as type and amount of shoreline and emergent vegetation, water-quality indices, level of recreational use, and prey availability. We compared historical changes in these factors to annual fluctuations in WEGR abundance while incorporating variation in detectability to determine if population declines may be local (i.e. moving from lake to lake) or regional (actual extirpation from the area). As WEGR distribution is influenced by water depth and presence of emergent vegetation, we hypothesized that lakes with increased recreational activity will exhibit greater rates of habitat alteration, causing WEGR abundance to decline. This could lead to abandonment of what were once suitable nesting grounds and eliminate possibilities for colony reestablishment elsewhere. Identifying these factors can allow for a more concentrated effort in preserving those lake characteristics required to support WEGR populations.

## **CHESAPEAKE BAY WATERBIRDS: A GOOD NEWS-BAD NEWS SCENARIO (Oral)**

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Waterbird populations have undergone substantial changes in the Chesapeake Bay region of Maryland and Virginia since the mid 1970s. In spite of pessimism in reaching nitrogen-reduction goals in EPA's Chesapeake Bay Restoration Program and dramatic decreases in key resources such as oysters, sea grasses, and blue crabs, a number of waterbird species are increasing their ranges and/or populations in the Bay region. Bald Eagles and Ospreys have exploded since the 1970s, expanding up major tributaries of the Bay. Brown Pelicans and Double-crested Cormorants have expanded northward into the Bay over the past 20 years. These increases partially reflect release from suppression by organochlorine pesticides and perhaps changes in forage fishes. However, certain ground-nesting seabirds including Common, Royal and Gull-billed Terns and Black Skimmers have declined dramatically. The isolated islands upon which these species, and others such as American Black Ducks, nest have either disappeared or eroded dramatically due to sea-level rise. Other threats are mammalian predators and "New Age" chemicals such as flame retardants. Island restoration efforts (e.g. dredged material islands) have increased throughout the Bay, providing some level of optimism.

## **PIPING PLOVER NEST-SITE SELECTION AND NEST SURVIVAL ON NATURAL AND ENGINEERED SANDBAR HABITAT IN THE MISSOURI RIVER (Oral)**

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Habitat management should be accompanied by documentation of the behavioral and demographic effect on the target species. We studied the nest-site selection and nest survival of piping plover (*Charadrius melodus*) nests on natural and engineered sandbars in the Missouri River from 2005 – 2007. We monitored piping plover nests, revisiting nests every 2 – 3 days to determine fate. We examined the effect on nest survival of habitat type (natural vs. engineered habitat), nest age, date, and the use of exclosures using a random effects logistic exposure model. Piping plovers nesting on the Missouri River selected nest sites that were largely unvegetated dry sand, and other habitat types were rarely used for nesting. Our results also show that piping plovers selected for engineered habitat and against natural habitats. Nest survival increased with increasing date, possibly as a result of least tern (*Sterna antillarum*) nesting, and there was no significant difference in nest survival between natural and engineered habitats. Our results indicate that engineered habitat is a viable substitute for natural habitat in terms of bird use and nesting success. The long-term effects of engineered habitat and the effect of this habitat on overall productivity and recruitment, however, need to be evaluated in more detail before a final decision on the worth of engineered habitat is made.

## **SATELLITE TAGGING DOUBLE-CRESTED CORMORANTS AT EAST SAND ISLAND, OREGON: AN EVALUATION OF TAGGING TECHNIQUES AND DEVELOPMENT OF A NOVEL LOW-DISTURBANCE TECHNIQUE FOR CAPTURING INDIVIDUAL NESTERS (Oral)**

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To identify the best satellite tagging options for future studies of post-breeding season dispersal of Double-crested Cormorants (*Phalacrocorax auritus albociliatus*) nesting at East Sand Island, Oregon, four satellite transmitter types, 33-gram abdominal implants (n = 6), 46-gram abdominal implants (n = 7), and 60-gram tags with harness attachments powered by battery (n = 7) and solar and battery (n = 7), were deployed during June and July, 2008. Tracking data from 100% and 86% of abdominally implanted and harness equipped individuals, respectively, were collected to 30-days post-release. Tracking data from months 2-11 will provide insight into which tag configurations will best allow for data collection at the desired spatial and temporal resolution. Total holding time considerations when procedure times are multiple hours, such as with surgical implantation of tracking devices, can preclude researchers from capturing multiple individuals in one capture event. Colony dynamics, however, can result in difficulty capturing single individuals, particularly when multiple individuals are needed for a study. We used social attraction techniques (i.e., nesting habitat and decoys) to lure cormorants to nest alongside above-ground tunnels. Researchers successfully captured individual nesters, at night, by reaching through openings in these tunnels. Minimal disturbance to the colony or neighboring nesters resulted from using this unique method to capture these colonial ground-nesting cormorants.

## **THE ECOLOGICAL IMPLICATIONS OF MARSH MANAGEMENT TO WETLAND BIRDS (Poster)**

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Texas coastal freshwater wetlands have declined in number and quality due to human encroachment, saltwater intrusion, and changes in land use, prompting many managers to use levees and water control structures to create or enhance wetland areas. There is little data to support the value of these management techniques in providing suitable habitat for waterbirds compared to adjacent natural areas. We compared waterbird richness and abundance, vegetation composition, and aquatic invertebrate biomass between 4 managed and 4 adjacent, unmanaged sites along the central Texas coast. Our sampling periods were scheduled to coincide with fall migration (Sep 15-Oct 30), winter (Jan 1-Feb 15) and spring migration (Apr 15-May 30) during 2007-08. Ecological value of managed and unmanaged areas will be evaluated based on information gathered from our sampling of the vegetation, invertebrate, and avian communities.

## **MAKING THE CONNECTION BETWEEN SHOREBIRDS AND OFF-ROAD VEHICLES (Oral)**

**Katherina Forgues\***, Trent University. (Oral)

Rapid declines in shorebirds populations have sparked a flurry of research aimed at improving conservation efforts. However, there are still large gaps in knowledge concerning the causes of shorebird declines. One factor that has been consistently highlighted as a key cause of decline is human disturbance. Recreational activities in particular, pose a large threat to shorebirds. Yet, the growing popularity of recreational activities continues to augment shorebird disturbance. A thorough understanding of the relationship between recreational activities and shorebird decline is necessary if effective conservation efforts are to be achieved. This project aims to improve understanding of human disturbance and its effect on shorebirds by examining the relationship between off-road vehicles and migrating shorebirds. The purpose of the study is to determine if there is a correlation between off-road vehicle use and shorebird abundance. Field work is being conducted on a barrier island in Maryland that is managed by the U.S. National Parks Service, with results scheduled to be published in a thesis report in April 2009. The findings from this study will help inform current efforts to conserve shorebirds and the coastal ecosystems they depend on. The study will also yield information on the ecology of coastal ecosystems, specifically concerning the quality of shorebird feeding habitat in areas experiencing high levels of tourism activity. This information, combined with data collected on off-road vehicles, will be incorporated into future park management plans in order to minimize disturbance to migrating shorebirds.

## **SELECTION OF LAKE HABITATS BY WATERBIRDS IN THE BOREAL TRANSITION ZONE OF NORTHEASTERN ALBERTA (Oral)**

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We examined habitat characteristics associated with presence or absence of sixteen waterbird species on 113 lakes during 2001-2006. We found that piscivorous species such as pelicans, loons, and mergansers were found on fish-bearing lakes, while birds that typically nest in emergent vegetation (e.g., coots, grebes) strongly preferred waterbodies with moderate to high levels of emergent macrophytes. The presence of a riparian buffer was important for loons and several species of waterbird that nest on the backshore. Moderate to deep lake depth and high water clarity also were important for some species and likely associated with hunting habits and/or fish availability. Breeding occurrence models were developed for a few conspicuous species that could be sampled using aerial surveys. Surprisingly, changes in water levels were not important predictors for most species, and associations between waterbirds and high levels of recreational activity were unexpected. Common Loon (*Gavia immer* (Brunnich, 1764)) and Great Blue Heron (*Ardea herodias* L., 1758) were most sensitive to anthropogenic activities, with fewer of these species detected on lakes with more disturbed shorelines.

## **VARIABILITY IN THE TIMING OF ANNUAL CYCLE EVENTS IN THREE LONG-DISTANCE MIGRANT SANDPIPER SPECIES (Oral)**

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In a variable environment, the ability to make condition-dependent decisions is advantageous. Birds may consider their condition-dependent status when making decisions about the timing of events in their annual cycle, such as migration and moult. The timing of annual cycle events is especially critical for long-distance migrants who are often subject to extreme interannual and seasonal variation in their environments. Decisions about migration and moult can subsequently influence other aspects of stopover ecology. We investigated migration and moult strategies and stopover duration in southward migrant Least, Semipalmated, and Western sandpipers at a mid-continent stopover site. Flight feather moult was very common in adult Least and initiated early, was common but initiated later in Westerns, was rare in Semipalmateds, and was absent in all juveniles. Poor flight feather condition increased the likelihood of moult in Least, but not in Westerns or Semipalmateds. Adult Least and Western sandpipers stayed four to eight times as long as adult Semipalmated sandpipers. Juvenile Westerns stayed twice as long as juvenile and adult Semipalmateds and juvenile Least. These data suggest that moult and migration strategies are highly variable both within and between species and that individuals have different considerations when making decisions about the timing of annual cycle events and migration stopover ecology. This variability in critical annual cycle events should be an important consideration when formulating conservation management plans that are species- or population-specific.

## THE IMPORTANCE OF LAGUNA MADRE AND SOUTH PADRE ISLAND TO WINTERING GREAT PLAINS PIPING PLOVERS (Oral)

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The distribution of birds during the non-breeding season can have a significant effect on the conservation of threatened and endangered species. Despite its potential importance, often little is known about the distribution of individuals outside of the breeding season. We examined the wintering distribution of banded piping plovers (*Charadrius melodus*) on South Padre Island and other Texas barrier islands as well as other sites in the US and Mexico. We banded more than 1500 adult and juvenile piping plovers from 2005 – 2007 on the Gavins Point Reach of the Missouri River. Winter sightings were reported by private individuals, and employees of state and federal agencies. More than 50% of birds sighted were on barrier islands in Texas, and most of these were on or near South Padre Island and Laguna Madre. Our results suggest that Laguna Madre, South Padre Island, and nearby areas are important areas for conservation focus for the threatened Great Plains piping plover.

## CAPTIVE PROPAGATION AND RELEASE OF LIGHT-FOOTED CLAPPER RAILS *RALLUS LONGIROSTRIS LEVIPES* (Oral)

**Charles G. Gailband**, Chula Vista Nature Center, [Charles@cvnc.us](mailto:Charles@cvnc.us).

The Light-footed clapper rail *Rallus longirostris levipes* is one of the most endangered coastal birds in southern California. This subspecies' range is from Santa Barbara, California to northern Baja California, Mexico. There are approximately 23 distinct subpopulations in the United States (US). The US population declined to fewer than 200 breeding pairs in the 1980s, primarily due to destruction, degradation, and fragmentation of coastal wetlands. Habitat fragmentation has resulted in the remaining subpopulations being cut off from each other. This fragmentation combined with the Light-footed clapper rails reluctance to traverse distances has led to a genetic bottlenecking within the subpopulations. Dr. Richard Zembal championed the plight of the Light-footed clapper rail and formed a coalition dedicated to the study and propagation of this species. U.S. Fish & Wildlife Service, Chula Vista Nature Center, SeaWorld California, and the San Diego Wild Animal Park have partnered to develop a captive-propagation program. The program has successfully bred wild-captured rails and hand-reared birds for release into the wild. Since 2001, more than 200 rails have been produced in captivity and released into nine distinct areas identified as rail habitat with depressed populations. Radio telemetry was used to monitor the movements of some captive reared rails in 2005, 2006, and 2007 at four release sites. Telemetry studies have shown that the techniques used to rear the captive-hatched clapper rails result in birds that can survive in the wild after release. The captive-breeding and release efforts in conjunction with wetland management and public awareness have resulted in a historic population high since 1980s.



## **SHOREBIRD VULNERABILITY TO CLIMATE CHANGE - DISRUPTION OF LONG-DISTANCE MIGRATION SYSTEMS (Oral)**

**Hector Galbraith**, Manomet Center for Conservation Sciences, hg2@hughes.net.

Because of rapid population declines, their high latitude breeding areas, their energetically demanding migration strategies, their dependence on wind patterns for migration, their reliance on coastal stopover sites that are threatened by sea level rise, and their dependence on ecological synchronicities, shorebirds are likely to be highly vulnerable to climate change. This presentation reviews these likely vulnerabilities, focusing on how climate change may disrupt and invalidate the long-distance migration systems and synchronicities on which many shorebird life history strategies are based. It also proposes monitoring and research studies that need to be supported if we are to arrest current population declines and anticipate the disruptive impacts of climate change.

## **ECOLOGY AND CONSERVATION OF COLONIAL NESTING WATERBIRDS AT INDIA'S LARGEST HERONRY IN A MANGROVE ECOSYSTEM, EASTERN INDIA (Oral)**

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Bhitarkanika mangroves harbours one of the largest mixed-species heronries in India with more than 30,000 birds of 11 species breeding annually in a small mangrove patch of c.5 ha area. Field work was conducted from March 2004 to January 2007. We examined patterns of spatial segregation, breeding biology, resource partitioning and perceived threats for the heronry. It was observed that Asian openbill, Large egret, Intermediate egret, little cormorant, and little egret were associated more frequently than they would be expected at random. There was a significant avoidance trend between Grey and Purple herons, and between Darter and Asian openbill. Interestingly, Black-headed ibis was observed to nest away from most of the species within the heronry forming sub-colonies on its own. There was a significant radial zonation of species in the heronry with Asian openbill storks preferring the central portion of the heronry ( $P < 0.05$ ) whereas Darter and Grey heron nests were observed more towards the periphery of the heronry ( $P < 0.05$ ). Reproductive success was less than 50% for most species, barring purple heron and darters which recorded higher success ( $57.74 \pm 10.58$  and  $50 \pm 8.94$ ). A total of 674 aquaculture farms (793.45 acres) were located along the peripheral region of the National Park alone. This illegal conversion of coastal wetlands will result in loss of foraging grounds for Asian openbills. The dependence of these species on restricted nesting sites makes the sites critical to conservation. Resource partitioning in terms of food habits and perceived threats to the heronry in terms of land use pattern changes around the Protected Area are discussed.

## **DEVELOPMENT OF SPATIALLY EXPLICIT DECISION SUPPORT TOOLS FOR SECRETIVE MARSH BIRDS (Oral)**

**Diane A. Granfors**, U.S. Fish and Wildlife Service, HAPET, [diane\\_granfors@fws.gov](mailto:diane_granfors@fws.gov).

Efforts to design and implement standardized surveys for secretive marsh birds have made great progress in recent years. When applied across broad geographic areas, such surveys can be used to develop spatially explicit decision support tools for marsh birds. I conducted surveys for marsh birds in prairie wetlands of northwestern Minnesota across a 12 county area from 2003-2006. The results were used to examine relationships between American Bittern, Sora, Virginia Rail, and Pied-billed Grebe and local and landscape habitat characteristics. Detections for all species were associated with both landscape and local habitat factors, but models containing multiple spatial scales explained more variation than single scale models. Application of landscape relationships to spatially explicit data enabled mapping of priority areas for marsh birds. Such maps can be used to model the influence of predicted future land use scenarios on marsh bird distributions, including potential impacts of climate change. Although these models were conducted in a relatively short time frame and in a small area of the prairie pothole region, such interim models can be used to help design more efficient surveys. Models will become more refined as regional surveys become standardized and surveys are conducted across a wider geographic range.

## **ACCURACY OF SURVIVAL ESTIMATES IN SASKATCHEWAN PIPING PLOVERS: IMPLICATIONS FOR POPULATION VIABILITY ANALYSES (Oral)**

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Most shorebirds are characterized by low annual productivity and high adult survival. Their population viability analyses are sensitive to slight differences in adult (and often juvenile) survival rates. Therefore, it is very important to accurately determine such rates. Even analyses such as Program Mark can underestimate survival, as birds permanently leaving the study area will be considered dead, unless all potential areas are searched. This rarely is possible. Additional use of winter sightings may improve estimates. Almost 800 adult Piping Plovers and over 500 chicks were uniquely colour banded in Saskatchewan from 2002-2006. Resightings of marked birds concentrated on banding locations. However, many other areas of Saskatchewan were searched on an irregular basis from 2002-2008, and sightings were obtained from Alberta and the Great Plains of the U.S., as well as wintering grounds in the southeastern U.S. At a major banding site, Lake Diefenbaker, preliminary results from Program Mark suggest local survival rates of 0.69 (SE 0.02) using only resightings from Diefenbaker itself, and 0.76 (SE 0.02) using all breeding ground resightings. A proportion of adults seen again only in winter suggests survival rates are about 9% underestimated. This is even more significant for survival rates of Saskatchewan juveniles from fledging to the following summer, since a much larger proportion of all uniquely marked fledged young were seen only in winter. A preliminary first year local survival rate, based only on breeding ground resightings, was 0.49 (SE 0.06). If this rate is underestimated by 29%, true juvenile survival may be closer to 63%. Such corrections could make a huge difference in estimating population viability or annual productivity necessary to maintain populations.

## **IN OVER THEIR HEADS: SEA LEVEL RISE AND COASTAL STORMS EFFECTS ON WADING BIRDS (Oral)**

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While environmental change is a fact of life, the rapidity of recent changes in the climate may result in great ecological change globally. This warming of the earth's surface and melting of land-based glaciers and polar ice caps all result in sea level rise (SLR). In North America, SLR is most dramatic along the northern Gulf of Mexico coastline; current reports suggest that SLR will result in a loss of coastal habitat unable to migrate inland as well as erosion and ensuing loss of barrier islands. Long-legged wading birds forage predominantly in shallow water habitat (< 30 cm); many wading bird species show niche partitioning related to water depth. While these highly-mobile animals have demonstrated considerable movement in relation to available foraging habitat, nesting birds are limited in distance they can travel from the nest to forage by time constraints and energetic costs/benefits. Nesting and foraging habitats during the breeding season are usually in close proximity to one another; most adult birds generally foraging within 10km of the colony, especially during the nesting/incubation period. The effects of SLR will have direct effects on the nesting colony (i.e. erosion) as well as result in shallow water habitat becoming deeper and therefore inaccessible to wading birds. While these shallow water habitats should theoretically migrate inland, it is a real possibility that these habitats may be impeded in their migration due to impermeable, man-made surfaces (i.e. seawalls) and/or the spatial juxtaposition of foraging habitats to nesting colonies will be altered. Additionally, the predicted increase in intensity and frequency of hurricanes may have significant effects on colonies and adjacent foraging habitat.

## **STATUS UPDATE OF THE REDDISH EGRET BASED ON RANGEWIDE SURVEYS CONDUCTED DURING 2007-2008 (Oral)**

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The Reddish Egret, the least numerous North American Ardeid, is a globally restricted species occurring along disjunct and generally small colonies along the Gulf of Mexico, the Caribbean, Bahamas, Pacific coastline of Mexico, and Belize. Its population is estimated at 6,000-10,000 adults, though those data are old and incomplete. In 2007 and 2008, ground surveys of Reddish Egrets were conducted in Texas, the Florida Keys, Mexico (Tamaulipas), and in the Bahamas. In the Florida Keys, we visited all historically known colonies and found < 50 breeding pairs (b.p.) during 2 surveys; this is down from estimate of < 200 b.p. from previous surveys. In Texas, the number of breeding pairs has remained relatively constant at approximately 900-1000 b.p. over last 10 years. In the Bahamas (Great Inagua, New Providence, and Grand Bahama), we estimate < 75 b.p. of Reddish Egrets with the majority of these individuals occurring on Great Inagua. This estimate appears to be down from estimate of 100 b.p. from surveys conducted in mid 1980s. We estimated 150 b.p. of Reddish Egret in Tamaulipas, providing a survey baseline for future breeding surveys. Overall, estimates of Reddish Egret populations are either down (i.e. Florida and Bahamas) or relatively stable (i.e. Texas) for the regions we have surveyed. These surveys, coupled with existing surveys from Pacific coast of Mexico and future surveys in Florida and Bahamas, will provide a clearer understanding of status and distribution of global population of Reddish Egrets; information essential for conservation of species.

## **WHOOPING CRANE FORAGING ECOLOGY: GAINS, COSTS, AND PROFITABILITY OF FORAGING DURING WINTER (Poster)**

**Danielle Greer\***, Texas A&M University.

Determination of foods most benefiting to survival and reproductive success of the endangered whooping crane (*Grus americana*) is needed to guide recovery efforts, including selection of future reintroduction sites. Often, food habits studies deem foods as important for a species when some measure of use or contribution to diet (e.g., percent aggregate volume) is substantial or when foods consistently appear in the diet. Selectivity studies compare percent use versus availability of foods in attempts to identify preference versus avoidance of foods but usually fail to recognize potential differences between abundance and availability, exhibit subjectivity in deciding what foods to include in analysis, and fail to investigate multiple currencies guiding selection of foods (e.g., numeric, energy, protein). Controlled experiments are also used to examine preference. However, all such studies typically do not account for the risks or effort associated with foraging for foods. In this study, our overall goal was to quantify the gains, costs, and profitability of foraging for foods by adult whooping cranes during winter at Aransas National Wildlife Refuge (ANWR), Texas. Specifically, we (1) documented temporal and spatial variability in food consumption (foraging gains), represented by dry mass composition of foods in the crane diet and numeric, dry mass, energy, lipid, and protein intake rates, (2) qualitatively described the foraging tactics and risks associated with foods observed in the diet and quantified the effort (foraging costs; e.g., steps, probes, food manipulations) required to search for and handle foods, and (3) quantified profitability of foraging for foods and ranked foods in importance using indices of numeric, dry mass, energy, lipid and protein profitability (i.e., intake rate to foraging effort ratios).

## **MITOCHONDRIAL DNA AND PHENOTYPIC VARIATION AMONG POPULATIONS OF MAGNIFICENT FRIGATEBIRDS AND BROWN BOOBIES (Oral)**

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Despite their wide roaming behavior and high dispersal potential, genetic and banding studies have revealed strong philopatry in many seabirds. Numerous species of tropical seabirds are currently declining, and we lack basic knowledge on population connectivity and levels of genetic variation. We studied mtDNA variation and phenotypic characteristics in brown boobies (*Sula leucogaster*) and magnificent frigatebirds (*Fregata magnificens*) from the Caribbean and Pacific Ocean. Brown boobies typically forage relatively close to their breeding colonies, while the frigatebirds can be observed far away from their colonies even amidst the breeding season. Our results illustrate how life history traits can influence population genetic structure as well as phenotypic variation among breeding colonies of tropical seabirds.

## **SATELLITE (PTT) and GPS TRACKING OF SEASONAL MOVEMENTS BY ALASKA SEABIRDS (Oral)**

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Since 1994, Argos-based transmitters or GPS trackers have been deployed on more than 130 individuals of 8 species of seabirds in Alaska. A primary focus has been the wintering areas of birds from geographically dispersed colonies, but recent work has also examined foraging strategies of some species within and between breeding seasons. Results include the discovery of colony-specific migration and wintering behavior of Northern Fulmars. Birds from the northern Bering Sea (Hall Island) visit waters of the western Bering Sea and Sea of Okhotsk post-breeding, whereas Pribilof Island fulmars mostly stay within a few hundred kilometers of the breeding ground throughout the year. Aleutian fulmars (Chagulak Island) favor deep waters of the central Bering Sea and passes between Aleutian islands both during and after breeding. Birds from the Semidi Islands (Gulf of Alaska) migrate south to waters of the California Current off Washington, Oregon, and California. Telemetry data permit a first estimate of population-level impacts of fulmar bycatch in Bering Sea longline fisheries. On Middleton Island (Gulf of Alaska), satellite tracking has revealed the wintering areas of Glaucous-winged Gulls (lower BC and Washington) and Pelagic Cormorants (SE Alaska and BC coasts), whereas GPS trackers (coupled with time-depth recorders) have revealed summer foraging by cormorants that is highly localized and consistent from year to year. GPS trackers on Black-legged Kittiwakes have revealed a marked transition from deep ocean foraging in spring to exclusive use of neritic waters of the continental shelf during breeding. Coelomic implants and several methods of external attachment have been used in our studies. Successful methods vary with species, and device attachment remains problematic for some.

## **USING MOLECULAR GENETICS TECHNIQUES FOR POPULATION STRUCTURE AND LIFE HISTORY OF REDDISH EGRETS (Poster)**

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One significant aspect of biodiversity, which represents the focus of conservation genetics, is genetic variation. The World Conservation Union (IUCN) has suggested the conservation of genetic diversity as one of three components of biodiversity. In this study we use microsatellites to accomplish five goals: to assess population differentiation among Reddish Egret (*Egretta rufescens*) populations in Texas and Mexico, identify extent of gene flow and immigration among populations, determine if there was any historical occurrence of bottlenecks in Texas, assess genetic differentiation between color morphs, and clarify subspecies status of *E. r. dickeyi*. In addition we use microsatellites to answer questions about previously unknown life history traits such as sex ratios and the occurrence of mixed-paternity nests. For this analysis, we collected blood samples from 36 complete nests on the Texas coast. We will present our preliminary and ongoing results on Reddish Egret conservation genetic. In the future, we will also include samples from Bahamas and Florida.

## **THE RELATIONSHIP OF FORAGING HABITAT AVAILABILITY AND NEST SITE SELECTION FOR THE REDDISH EGRET IN THE FLORIDA KEYS (Oral)**

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The Reddish Egret (*Egretta rufescens*) is a species that is greatly dependent on shallow, barren, mud flats ideal for its active foraging behavior. It is unknown why some seemingly identical islands are chosen for nesting over others. The goal of this study is to determine if there is a difference in amount of foraging habitat between mangrove keys in the Florida Keys that do and do not have Reddish Egrets nesting on them within a 15 km, 12.5 km, 10 km, 7.5 km, 5 km, 4 km, 3 km, 2 km and 1 km radius using ArcGIS. Islands with nesting Reddish Egrets had a greater amount of foraging habitat within a 2 km radius ( $p = .047$ ) while at all other radii there was no difference between islands with and without nesting Reddish Egrets. When comparing the Upper and Lower Florida Keys, significant differences occur at all radii from 12.5 km to 2 km in the lower keys while there were no significant differences in foraging habitat between islands with and without nesting Reddish Egrets in the upper keys. Distance is not likely to be the only factor that influences the choice of nesting location otherwise all islands near ideal foraging habitat would be occupied. Many other factors should be examined in addition to the availability of foraging habitat in order to accurately be able to identify and potentially predict ideal nesting habitat necessary for protection.

## **NATAL ORIGINS OF HARVESTED LESSER SCAUP: MAKING CONNECTIONS USING STABLE ISOTOPE ANALYSIS (Oral)**

**Keith Hobson**, Environment Canada, Keith.Hobson@ec.gc.ca.

Determining recruitment rates of young into breeding populations of birds represents a fundamentally important component of our understanding of avian demography and population dynamics, and is crucial knowledge required for sound management of harvested species. For migratory birds, recruitment of hatch-year birds into the population moving from breeding to wintering grounds can vary regionally, but it is generally unknown which portions of the breeding range are more productive than others, particularly for populations breeding in remote areas where reliable observational demographic assessments are limited. Here we assigned geographic origins to hatch-year lesser scaup (*Aythya affinis*) harvested by hunters in the United States during 1999-2000 ( $n = 325$ ) and 2000 ( $n = 482$ ), and 2001 ( $n = 58$ ) from North American flyways by examining the stable-hydrogen isotope ( $\delta D$ ) abundance in feathers grown on natal sites. To account for assignment errors, geographic assignments were made using Monte Carlo integration to propagate errors based on within-site variance described from known source samples, and incorporated prior probabilities based on band return data. We compared the geographic distribution of the geographic assignments with the geographic distribution of lesser scaup pair counts from the May Waterfowl Breeding Population and Habitat Survey. For Eastern populations, the northern boreal forest produced fewer and the central and southern boreal and the Prairie-Parkland region produced more young than expected by indices of populations of breeding adults. Birds from the Pacific drainage showed a similar pattern but interpretation was complicated due to some confounding attributes of  $\delta D$  basemaps for that region. Overall, our findings suggest that either the northern boreal was less productive for scaup recruitment, or that a disproportionate number of young birds was being harvested from more southern populations.

## **A COMPARISON OF POSSIBLE SURVEY METHODS FOR REDDISH EGRETS IN THE FLORIDA KEYS (Oral)**

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There is not yet a good estimate of reddish egret distribution and abundance in the Florida Keys, an expansive geographic area with many possible nesting sites. In 2008, we compared results of boat and nest searches (ARCI/USFWS team) with helicopter surveys (Audubon team) by establishing a pre-delineated search area, and assuming uniform coverage among survey efforts. To compare the ground-based and helicopter nest searches, we selected six islands, of which at least two (unknown to the helicopter observer) would be searched from the ground. Comparison of boat and helicopter counts (individual egrets) – The helicopter survey detected one reddish egret in the search area where none was observed by the boat survey. The boat survey found 12 egrets where none was observed from the helicopter. Comparison of ground and helicopter nest searching - The helicopter search found no nests on the six targeted islands, whereas eight nests were found on three islands searched from the ground. We lack sufficient data and experience at this time to conclude that the boat surveys (for detecting individual birds) and ground-based nest searches represent the most advisable methods for monitoring Reddish Egret populations. However, both methods apparently surpassed substantially the effectiveness of the helicopter survey. Further work is needed to develop statistically adequate yet efficient survey methods for the Reddish Egret. Relevant information on the species' behavior and ecology may be needed also before a robust monitoring protocol can be selected.

## **REPRODUCTIVE ECOLOGY, COLONY SITE AND POLYMORPHISM IN REDDISH EGRETS EGRETTA RUFESCENS (Oral)**

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The reddish egret is a rare heron species that exists in a distinct dark and white morph. As part of my thesis research, I have been studying the behavior and reproductive ecology of this species. During my study, I collected data on the distribution of white and dark morph nests within two colonies in the Laguna Madre, Texas. Reddish egrets assortatively mate, with mixed-morph pairs only rarely occurring. Since reddish egrets appear to recognize individuals of the opposing morphs, I wanted to assess if the two morphs distribute themselves spatially in relation to each other. I used GIS to plot nests, create random nests, and measure nearest distances between nests. Initial analysis shows clumping of white birds within patches utilized by reddish egrets of both morphs. We also opportunistically collected regurgitant from nestlings of both color morphs. As studies before have shown, sheepshead minnow (*Cyprinodon variegatus*) content was high. While difference between regurgitant of the two morphs existed, colony site seemed to be an overriding factor in determination of regurgitant content. Subtle difference between the morphs and assortative mating could affect the proportion of the two morphs over the species range and local population structure.

## **BIAS AND ERROR IN RESIGHTING COLOR AND METAL BAND COMBINATIONS ON STAGING FLOCKS OF ROSEATE TERNS (Poster)**

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Resighting of color-marked individuals is a technique commonly used in mark-recapture studies to estimate population demographics and movement patterns where actual recapture is not always feasible. Although observer experience level and observed flock size have been shown to influence error rates in color-band resighting (e.g., Milligan et al. 2003), both inter- and intra-observer bias as sources of error are often overlooked in mark-recapture studies. During the 2007 field season, a major resighting initiative began on the staging grounds of the Atlantic Coast population of the Roseate Tern (*Sterna dougallii*). Over 60% of the breeding adult population at three sites in Buzzards Bay, MA is currently banded with a combination of 6 bands (each bird receives 4 color bands and 2 different types of metal bands). Fifteen different colored bands have been used, in addition to a USGS Bird Banding Laboratory (BBL) metal band and a field-readable metal band (with alpha-numeric combinations of 4 characters). Due to the errors observed in the field during this pilot year, we undertook a study to investigate primary factors that may influence error and bias in color-band recording: observer experience level, scope type, and color-band types. Typical field conditions were mimicked using model birds with randomly generated band combinations, and observers were given a limited amount of time to record observations on two model birds in each trial. In a pilot study, accuracy in recording band combinations ranged from 43-90%; error rate was especially high between similar colors such as dark green and black. Implications of results will be discussed in the context of interpreting data on individually-marked birds in staging flocks.

## **THE ATLANTIC MARINE BIRD CONSERVATION COOPERATIVE (Poster)**

**Scott Johnston**, U.S. Fish and Wildlife Service, Scott\_Johnston@fws.gov.

Comprehensive planning by the Mid Atlantic/New England/Maritimes waterbird working group indicates that not nearly enough is known about the Atlantic seabirds plying near- and offshore waters, and their vulnerability to a number of ongoing and emerging threats. Data on the pelagic distribution and abundance of seabirds are critical for understanding their basic ecology and role in marine ecosystems, monitoring population trends, assessing actual or potential impacts from oil spills, fishery by-catch, offshore development (shipping, wind generation, gas and mineral exploration), identifying critical marine habitats, and educating the public about marine conservation issues. An organizing entity -- the Atlantic Marine Bird Conservation Cooperative -- has emerged committed to using best information to prioritize research and management needs and to engage resource agencies and partners in and outside its membership to develop budget initiatives or outreach products to address these needs.



## **WHOOPING CRANE FOOD AVAILABILITY IN DIFFERENT MARSH TYPES (Poster)**

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Louisiana historically supported both resident and wintering populations of Whooping Cranes (*Grus americana*). Migratory and resident Whooping Cranes favored different habitats. Migratory cranes wintered on the tallgrass prairies, brackish marshes, and salt marshes of the Chenier Plain, whereas a resident flock nested in the isolated freshwater marsh north of White Lake in Vermilion Parish. The current suitability of the White Lake marshes to support Whooping Cranes is unknown and necessitates an understanding of marsh characteristics and life history needs of Whooping Cranes. Whooping Crane chicks are flightless for several months and must be able to access ponds by walking. Similarly, Whooping Cranes undergo molt from April to June and are flightless during this period. Thus, food must be available in walking distance and across suitable terrain. An improved understanding of temporal and spatial food availability is needed to assess the suitability of these marshes for a potential Whooping Crane reintroduction. The goal of this study is to determine how aquatic invertebrate and nekton community structure and biomass are affected by season and microhabitat. Thus, we will investigate seasonal variation in aquatic invertebrate and nekton community assemblage structure in the field. We will also experimentally determine threshold levels of salinity and dissolved oxygen for aquatic invertebrate and nekton survival. A clear understanding of food availability in different marsh types will aid an evaluation of habitat suitability for the potential reintroduction of Whooping Cranes.

## **ACTIVE MANAGEMENT OF LIGHT-FOOTED CLAPPER RAIL IN MISSION BAY, SAN DIEGO, CALIFORNIA (Oral)**

**Isabelle Kay**, University of California Natural Reserve System.

Habitat enhancement and predator protection have been provided for the endangered light-footed clapper rail (LFCR, *Rallus longirostris levipes*) as part of an active management program within the 40 acre Mission Bay Marsh Reserve since 1988. The wetland is surrounded on three sides by dense residential development, developed parkland, commercial recreational development, and open water. Since monitoring began in 1980, the number of breeding pairs has ranged from 24 (in 1984) to four (in 1989; Zembal, 1992.) While the site has in the past supported the highest population density in southern California, this population is clearly in a precarious situation due to pressures on the site; the predicted effects of global warming on sea-level rise, and invasive species, among other factors, will exacerbate the situation. To counter the flooding of nests resulting from declines in the stature and density of cordgrass (*Spartina foliosa*) nesting habitat, platforms were introduced in 1988 and continue to be maintained by staff, volunteers and the public sector. Predator management was initiated in 1993 and continues during breeding seasons to protect nests and adults in the high marsh. In 2004 and 2005 14 pairs of LFCR were detected (Zembal, et al. 2007). Thousands of invasive non-native mangroves have been removed from the marsh since 1980. Five nesting platforms were added in 2007 and a new nest cover design was introduced in Spring 2008. Public outreach and engagement have been successful in accomplishing many of these projects. Continued public support is necessary to secure the population of LFCR through continued volunteerism, and support for the implementation of tentative plans to expand the marsh habitat and reduce urban runoff effects through contiguous wetland restoration.

## **FORAGING SEGREGATION OF ARCTIC, COMMON, AND ROSEATE TERNS IN THE GULF OF MAINE (Poster)**

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National Audubon Society's Seabird Restoration Program (SRP) has restored tern colonies to 7 islands in the Gulf of Maine. Common Terns are well established on all SRP islands, whereas Arctic and Roseate terns only have colonies on a few islands. Previous dietary studies performed by SRP indicate a high overlap between all three species. Diets for all three species of terns contain a high percentage of fish, however Arctic Terns do include more invertebrates in their diet than Common and Roseate terns. Dietary information collected by SRP is based on observations of adults provisioning chicks at the nest. Tern chick diets are estimated from 12 hour nest observations per week. To obtain a greater understanding of tern diets on SRP islands, stable isotope delta values of carbon (C13) and nitrogen (N15) were obtained from Common and Arctic tern down and fledgling feathers, and from Roseate Tern fledgling feathers. Delta values obtained from both feathers were compared to delta signatures from prey dropped by parents in the colony for the 2005 through 2007 breeding seasons. Stable isotope data did support SRP observational dietary studies. Terns consuming higher amounts of fish had higher N15 delta values. However C13 and N15 delta values indicate that foraging segregation only occurred between islands. Terns occupying the same islands usually had very similar isotopic signatures.

## **MIGRATORY MOVEMENTS AND SUMMER RANGES OF AMERICAN WHITE PELICANS CAPTURED IN THE SOUTHEASTERN UNITED STATES (Oral)**

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Little information exists on the regional and continental 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. Transmitter equipped pelicans (N=50) had a migratory corridor extending from the front range of the Rocky Mountains eastward through the Mississippi River Valley. Migrating pelicans tended to follow river systems and/or hop from water body to water body. Summer ranges (95% kernel) and core use areas (50% kernel) of a subset of pelicans migrating to the Northern Great Plains and the Upper Midwest averaged 288,000 km<sup>2</sup> and 52,000 km<sup>2</sup> (respectively). Information from this study is being used to develop conservation and management strategies for the American White Pelican.

## **A SYNTHESIS OF BREEDING AND WINTERING KING RAIL RESEARCH IN LOUISIANA (Oral)**

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King Rails are listed as threatened or endangered by 13 states and Canada. The USFWS has identified King Rail as a Bird of Management Concern, a Game Bird Below Desired Conditions, and as a Focal Species. Louisiana supports both a resident and wintering population and the species is considered a game species. We have initiated several studies in Louisiana to evaluate: 1) the status and habitat factors affecting breeding King Rails; 2) conservation priorities in southwestern Louisiana; 3) the proportion of resident to migrant King Rails wintering in Louisiana; and 4) techniques to distinguish between King and Clapper Rails. Our results indicate that in southwestern Louisiana ditches surrounding rice fields positively influence King Rail nest densities whereas trees around the perimeter of the field are a negative influence. Relative nest densities and nest success are high in southwestern Louisiana but nothing is known about brood survival. Habitat suitability models indicate, however, that habitat quality is not uniform over the region; King Rail distribution and habitat needs in other parts of the state are poorly understood. During winter, few migrant King Rails were identified by stable isotope analysis. Some progress has been made in distinguishing between King and Clapper Rails, but additional research is needed.

## **A SYNTHESIS OF RESEARCH ON MIGRATORY KING RAILS IN THE MISSISSIPPI FLYWAY (Oral)**

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In the Mississippi Flyway, there are both resident and migratory King Rails. While the resident King Rail population that occurs along the Gulf Coast is relatively stable, the migratory King Rail population elsewhere has experienced severe declines over the last 40 years. As a result of research advice from the King Rail Focal Species workshop, we initiated a series of studies to better understand: 1) the status and habitat factors affecting breeding King Rails in the Mississippi River Valley and Great Lakes Region, and 2) where migratory King Rails winter. Using occupancy survey methods, we found that King Rails were rare and hard to detect across all areas surveyed. Similar to the King Rail results from Louisiana, we found that woody vegetation in the surrounding area was negatively related to occupancy whereas the interspersed water to wetland vegetation was positively related to occupancy by King Rails. To investigate wintering locations, we first explored methods of attaching satellite radio transmitters. We captured 17 King/Clapper Rails at Rockefeller Wildlife Refuge, Louisiana and attached mock satellite units using either a thigh harness (n=9) or a Dwyer harness (n=8) in November 2007 and followed the birds for a month. Based on movements and evidence of wear on recaptured birds (n=7), we believe the thigh harness is a better method for attaching satellite transmitters. We are planning to deploy 8 satellite transmitters on King Rails during late summer 2008.

## **PATTERNS OF INTERTIDAL HABITAT USE BY BIRDS IN AN OREGON COASTAL ESTUARY (Oral)**

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To explore approaches for habitat based ecosystem services, birds in Yaquina Estuary, Oregon were censused in five intertidal habitats at five tide levels. The overall most important habitats (MIHs) in terms of total number of birds were mudflat (colonized by mudshrimp *Upogebia pugettensis*), and *Zostera marina* eelgrass beds. *Upogebia*/mudflat supported large numbers of foraging gulls, crows and shorebirds when exposed, and diving ducks when flooded. *Zostera marina* beds were important for foraging gulls, crows, dabbling ducks and coot when exposed, and for diving ducks, herons and egrets when flooded. Eelgrass was consumed by ducks, coot and geese. The third ranked MIH, sandflat (colonized by ghost shrimp *Neotrypaea californiensis*), was utilized by ducks and gulls for resting and by shorebirds for foraging. Emergent low marsh was used for shelter and foraging by ducks and coots in winter, as a rest area for herons and shorebirds, by swallows and sparrows for foraging, and by Canada geese for nesting, while marsh tidal channels were used by shorebirds, herons and egrets for foraging. The nonindigenous dwarf eelgrass, *Zostera japonica* was consumed by ducks, coot and geese, while gulls, crows and shorebirds crossed *Z. japonica* habitat as they foraged for invertebrates. In terms of number of birds per hectare, the MIH was *Zostera marina*, primarily due to usage by large flocks of ducks, coot and brant grazing on the eelgrass in winter. The second ranked MIH was *Upogebia*/mudflat, due to the presence of diving ducks when the habitat was flooded in winter, as well as use by shorebirds during migration and the large numbers of foraging gulls and crows.

## **USING INTRINSIC MARKERS TO DEVELOP MANAGEMENT TOOLS FOR MIGRATORY SHOREBIRDS (Oral)**

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Management of migratory populations requires knowledge of the connectivity between breeding, migration, and non-breeding areas. Using Western Sandpiper as a model species, we will develop novel methods for determining movement patterns of individual migratory birds between areas, using intrinsic biological, physical, and biochemical markers. We will collect feather and blood samples, and test the potential of (1) stable isotope ratios from feathers, (2) trace element profiles in feathers, (3) AFLP and other genetic markers, and (4) morphometrics, separately and in combination, to determine probable connectivity among sites. We will use genetic information to describe population structure on the breeding grounds, and stable isotope and trace element analyses to create a base map of wintering sites. We will develop statistical methodology for determining the probabilities that individual birds moved from one area to another, taking regional population estimates into account. Preliminary results from stable hydrogen isotope analysis of feathers indicate a latitudinal gradient in wintering ground hydrogen isotope signatures, and trace element analysis of feathers appears to provide a more local site-level basis for assignment to wintering sites (Norris et al. 2007, Canadian Journal of Zoology). We will determine which approaches will be most useful for determining patterns of migratory connectivity in species of shorebirds of more immediate conservation concern.

## **FEMALES OF WHISKERED TERN *CHLIDONIAS HYBRIDA* SWINDLE FOOD FROM ALIEN MALES (Oral)**

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In many bird species males provide their mates with food prior to egg-laying. The quality of courtship feeding affects clutch quality and reflects male ability for parental investment. Females can get additional food by trading copulations for gifts with a strange male. However they risk: fertilization by male with poor genes, transfer of parasites, reduction in partner's care or partner's punishment. So females should trade copulation for food only with high quality males (good genes hypothesis) which bring more energy-rich prey than their own mates. In this study, I investigated frequency of extra-pair courtship feeding (ECF) and extra-pair copulation (EPC) in Whiskered Tern under different conditions of food abundance in carp ponds. I found that males tried to trade food for copulation with females that were not their mate. Attempts of ECF represented 11% (N=320) of all male feeding visits (N=2902, N=82 pairs). In only two cases (1% of visits) did females allow cloacal contact. Twenty-five percent of females swindled food from strange males. They had begged for copulation. Alien males with food had jumped on their backs and females immediately grabbed the food and chased the males away. Females which swindled food did not allow for cloacal contact. Success in grabbing gifts was significantly smaller when females didn't encourage males to mount them than when they begged for copulation. Females obtained an average of 0,19 prey items per hour from alien males. Females which were well-fed by their mates as well as females which had poor quality males tried to obtain additional food from strange males. Alien males couldn't rape females, so females didn't risk copulating with unfavorable males during swindling food. These data suggest that females of monogamous species can effectively obtain additional food from strange males without cuckoldry their own partners.

## **THREE TECHNIQUES FOR CAPTURING PISCIVOROUS BIRDS (Oral)**

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We describe three techniques for capturing American White Pelicans (*Pelecanus erythrorhynchos*), Double-crested Cormorants (*Phalacrocorax auritus*) Great Blue Herons (*Ardea herodias*), Great Egrets (*Ardea alba*), Black-crowned Night Herons (*Nycticorax nycticorax*) and other piscivorous birds in breeding, loafing and aquatic habitats. The first technique involves using #3 padded-jaw soft-catch leghold traps modified by replacing both factory coil springs with weaker #1.5 coil springs to reduce the closing force of the jaws, replacing the factory chain with a length of aircraft cable, and attaching an elastic shock-cord to minimize injury caused by lunging. The second technique involves using a rocket net system fired from a modified aluminum box for weight, portability, and use in wet areas or shallow water. The third technique involves capture of cormorants which roost in cypress and water tupelo inundated oxbow lakes, making their capture for research purposes difficult. This capture technique involves using a flat bottom boat for use in shallow water equipped with flood lights. Birds are flushed from their roost trees to the water at night, shined with flood lights to allow for close approach, and captured with the use of landing nets. From 1997-2008 over 250 American White Pelicans, 300 Double-crested Cormorants, 75 Great Blue Herons, 15 Black-crowned Night Herons, and 50 Great Egrets were captured using these three techniques for multiple research studies. We describe situations for the optimum use of each technique. All methods are safe, humane, and cost, labor, and time efficient.

## **SOCIAL FACILITATION AND PREDATION RISK AS FACTORS IN NEW COLONY FORMATION BY SEABIRDS ON LOUISIANA BARRIER ISLANDS (Oral)**

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Colonial nesting seabirds face a variety of threats, including habitat loss and degradation, human disturbance, and predation. Louisiana is host to many thousands of breeding seabirds; however, the state has restored several barrier islands that appear to be suitable nesting habitat but are not used by the birds. Absence of social facilitation and predation risk are hypothesized as explanations for the lack of nesting colonies on these islands. We conducted an experiment to test these hypotheses for restored barrier islands in Terrebonne Bay, Louisiana. Royal Tern and Black Skimmer decoys (n= 32 per site) were set up on eight sites on one large (12 km long) unoccupied island, with each site including an experimental (decoy) and a control plot. Half of the sites were fenced (1.2m high, 5x10cm wire mesh, 90m circumference) to exclude terrestrial predators. We quantified the reaction of birds to the plots during two-hour blocks of behavioral observations, and examined plots for predator sign at each visit. Decoys attracted birds to examine plots, but neither skimmers nor Royal Terns nested on any of our treatment or control plots. However, Least Terns did nest inside fenced plots and had high (75%) nest success, compared to failure for all nests in unfenced areas. Scent station surveys showed that the fences did exclude terrestrial predators. We also compared colony presence/absence to predator presence/absence on the various islands. Islands with large breeding colonies lacked mammalian predators, while those without such colonies hosted raccoons, rats, and coyotes. We conclude that abundant predators on large barrier islands make them unsuitable for nesting seabirds.

## **HABITAT USE AND HOME RANGE OF AMERICAN BITTERNS (BOTAURUS LENTIGINOSUS) AND MONITORING OF INCONSPICUOUS MARSH BIRDS IN NORTHWEST MINNESOTA (Oral)**

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Information on habitat use of the American Bittern (*Botaurus lentiginosus*) and a statistically valid survey design for monitoring changes in populations of inconspicuous marsh birds, which include American and Least Bitterns (*Ixobrychus exilis*), Pied-billed Grebes (*Podilymbus podiceps*), Soras (*Porzana carolina*), and Virginia Rails (*Rallus limicola*) is needed to inform conservation and management actions. My research, from 1999 – 2002, examined breeding habitat use and home range of American Bitterns. Also, I used pilot survey data to guide design options to meet objectives for monitoring marsh bird occupancy rates in association with habitat changes. Nest sites of American Bitterns in wetlands (n = 47) and grasslands (n = 33) were positively associated with percent dead vegetation cover and density and negatively associated with vegetation height. Foraging sites of American Bitterns were negatively associated with distance to small water openings and vegetation height. Daily survival rate was 0.96 (95% CI 0.930 – 0.979) and nest survival rate of American Bitterns was 0.35 (95% CI = 0.15 – 0.58). The average core home range size (50%) was 18.08 ha ( $\pm$  6.38) and the 95% home range was 109.28 ha ( $\pm$  38.47) using the fixed-kernel estimator. Results from occupancy analyses of pilot data and evaluation of a set of a priori candidate models provide the needed guidance for reliable marsh bird monitoring programs.

## **CHARACTERISTICS AND ENERGETICS OF GREAT EGRET AND SNOWY EGRET FORAGING FLIGHTS (Oral)**

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We studied the flight patterns of Great Egrets (*Ardea alba*) and Snowy Egrets (*Egretta thula*) arriving at and departing two mixed-species colonies in Wichita, KS, in May-June 2007. For 137 short-distance flights (about 200 m) at one colony, we recorded flight duration, measured flight distance, and counted wing beats. For 90 longer flights (about 1200 m) at a second colony, we recorded flight duration. From these data we calculated wing beat frequencies and flight velocities, then used vector addition to determine air speeds and examine the effects of wind velocity and wind direction on flight patterns. We used published algorithms and data from two of our previous flight line studies to estimate daily flight costs. Flight patterns by Great Egrets and Snowy Egrets showed some similarities, such as mean air speed, but revealed more differences. This included lower wing beat frequencies by Great Egrets and a much stronger effect of headwinds on Snowy Egret flight velocities. Energetic requirements for flight also differed between species, which we ascribe to differences in wing-loading and mass. We then estimated the cost of an average flight, and compared daily flight costs to overall daily energy budgets. Flight comprises 13% of the total energy budget for Great Egrets and 14% for Snowy Egrets. Based on previous foraging studies, we estimate that a Great Egret can meet its daily energy requirements for flight after 41 min of foraging, whereas a Snowy Egret must forage for 84 min to capture enough prey to meet the demands for flight.

## **THE POTENTIAL EFFECT OF GLOBAL WARMING ON STREAM-DEPENDENT BIRDS (Oral)**

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The influence of global warming will likely be wide ranging on small, first through third order streams because they compose approximately 75% of a typical watershed. They already suffer from a relative lack of protective measures which currently focus primarily on large rivers and the downstream portions of watersheds. Potential warming effects on stream-dependent birds derive from greater unpredictability of water levels due to the timing and severity of drought and flood conditions and the influence of both water level and water temperature on prey composition, emergence patterns (macroinvertebrates), distribution and abundance. Flooding destroys stream-side nests and drought reduces prey abundance. Streams of this size have limited heat absorption capacity, thus their temperatures track the ambient temperature closely leaving little flexibility for prey items sensitive to increasing temperatures. Changes in insect emergence patterns and chronology will influence food availability which is especially critical during the breeding season. Very little research has been conducted on the overall effect these changes might have on stream-dependent bird populations. However, studies on the general ecology and behavior of North American and European stream-dependent species, including the Louisiana Waterthrush, American and White-throated Dippers and Grey Wagtail, provide insight into the likely response such species will have to global warming and its effects on streams.

## STATUS OF SOUTHEAST UNITED STATES WATERBIRD PLANNING (Oral)

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The Southeast United States planning region includes all or part of 21 states, 10 BCRs, and 4 joint ventures. Waterbird resources in the region are vast and diverse. In the western portion of the region are the extensive salt marshes and beaches along the northern Gulf of Mexico which support long legged wading birds, marsh birds, and beach nesting waterbirds. The eastern border of the planning region encompasses the extensive salt marsh, barrier island, and estuary system of the Carolinas and Georgia. In the south is the massive freshwater ecosystem of the Everglades, historically important for long legged wading birds. Several major river floodplain systems, including the Mississippi, bisect the region providing nesting and foraging habitats for waterbirds as well as important migration corridors. Major threats for waterbird conservation in the southeast include habitat loss, disturbance, and implications of climate change. Three overarching conservation recommendations resulted from waterbird planning efforts. They include 1) recovery of declining and vulnerable high priority species, 2) maintenance of healthy populations of other species, and 3) restoration and protection of critical habitats. This presentation will summarize progress toward implementing these general recommendations as well as more specific conservation actions in the Southeast United States planning region since completion of the regional waterbird conservation plan in 2006.

## PREY UTILIZATION BY WADING BIRDS AND NURSERY POTENTIAL IN A TROPICAL MANGROVE SWAMP (Oral)

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Wading birds are a diverse assemblage of waterbirds that exploit the fish communities of tropical mangrove swamps. Information on factors affecting their foraging ecology is scant in such systems and needed to better understand predator-prey relationships and assess nursery potential. We asked whether foraging site selection of Tricolored Heron (*Egretta tricolor*), Snowy Egret (*E. thula*), Little Blue Heron (*E. caerulea*) and Great Egret (*Ardea alba*) was influenced by prey density. We also assessed the functional relationship between capture rates and prey density, and the relative importance of group size as a factor influencing captures rates. Waders foraged where prey densities were highest (131 prey per m<sup>2</sup> used vs. 17 unused sites). Capture rates increased as prey density increased following a Type II functional response, but competing functional response models also underscored the importance of predator interference in molding capture rates. Maximum capture rates for waders foraging in groups (4-70 individuals) were 8.3 prey/5 min. For individual species it was 7.5 for Great Egrets, 8.3 for Tricolored Herons, and 9.8 for Snowy Egrets. This work affirmed the importance of prey density in molding foraging site selection and capture rate, but also of how this process is influenced by the presence of other predators. We also document how habitat modifications and reported capture rates could compromise nursery potential in a tropical mangrove swamp.



## **MONITORING IDAHO'S WATERBIRD SPECIES OF GREATEST CONSERVATION NEED: ROLE OF THE IDAHO BIRD INVENTORY AND SURVEY (Oral)**

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Idaho's Comprehensive Wildlife Conservation Strategy (CWCS) was officially accepted by the U.S. Fish and Wildlife Service in February 2006. A major component of CWCS implementation is monitoring of Species of Greatest Conservation Need (SGCN) and their associated habitats. There are over 200 species that have been identified as SGCN, 25 of which are aquatic birds. The Idaho Bird Inventory and Survey (IBIS) program, which seeks to monitor all birds throughout the state in a coordinated manner, provides a unique opportunity to efficiently monitor these high priority birds. The initial focus of IBIS has been determining distribution and abundance of aquatic birds at Idaho's wetland Important Bird Areas and Idaho Department of Fish and Game Wildlife Management Areas. From 2004 through 2007, we conducted aquatic bird monitoring at 30 wetland sites throughout the state. Monitoring efforts included general aquatic bird counts, marsh bird playback surveys, and colonial waterbird counts. During general aquatic bird counts and marsh bird playback surveys at 26 sites, 24 of the 25 aquatic bird SGCN were detected. At least 2 SGCN were detected at each site. Thirty-five percent of sites had 2-7 SGCN detected, 38% had 8-15 SGCN, and 27% had 16-22 SGCN. Colonial waterbird counts at all known island and white-faced ibis colonies yielded Idaho breeding population estimates for 5 SGCN (California Gull, American White Pelican, Caspian Tern, White-faced Ibis, Franklin's Gull), and site-level estimates for 3 additional SGCN (Cattle Egret, Snowy Egret, Black-crowned Night-Heron). From these initial results, the IBIS program shows great potential for serving as an important implementation tool for Idaho's Comprehensive Wildlife Conservation Strategy.

## **INVESTIGATING THE DEMOGRAPHICS OF A SHOREBIRD NEAR THE NORTHERN LIMIT OF ITS RANGE (Oral)**

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The American Oystercatcher (*Haematopus palliatus*) has experienced a dramatic range expansion along the Atlantic Coast, reaching Massachusetts 40 years ago. The Massachusetts population continues to grow with the largest concentrations occurring on the islands associated with Cape Cod. At the same time, recent evidence shows this species is declining in its core areas and has recently been named as a species of concern by the US Shorebird Plan. Understanding the pattern and extent of spatial variation in demography and population growth rate ( $\lambda$ ) is critical to understanding the structure and dynamics of the Atlantic Coast population. From 2005-2008, we examined the demographics of a population near the northern limit of the breeding range in Nantucket County, Massachusetts. Productivity, 0.46 (SE 0.037) young fledged per breeding pair, was greater than all other populations studied along the Atlantic Coast so far. We estimated local annual survival of 103 uniquely marked adult oystercatchers using a Cormack-Jolly-Seber capture-recapture (resight) model. The model for time-dependence survival and constant recapture probability reported the lowest AIC value. The recapture probability was close to 1 (0.96, SE 0.025). The annual local survival estimates ranged from 0.79 to 0.96, with an overall average of 0.93 (SE 0.028). These demographic estimates were applied to a stage-structured population model, and simulations were run to consider the effect of low and high fecundity rates on the local population trajectory. Model results indicate that the recent population growth in Massachusetts, as well as the decline in the core areas of the Southern US, may be explained by differences in local production.

## **MODELING MARSH BIRD HABITAT SUITABILITY IN THE LOWER 48 STATES: THE FIRST STEP IN EVALUATING THE EFFECTS OF CLIMATE CHANGE ON MARSH BIRDS (Oral)**

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Emergent wetlands are one of the most imperiled ecosystems in North America and therefore marsh birds are equally imperiled. Global climate change and associated sea-level rise pose new and unpredictable consequences to wetlands throughout North America. To ensure the long-term persistence of marsh birds in the United States and manage unpredictable threats to marsh birds in a changing environment, we must identify wetlands that provide optimal marsh bird habitat. We developed a habitat suitability model for marsh birds in the lower 48 states using point-count data collected during the development of the National Marsh Bird Monitoring Protocols and wetland classification data from the National Wetland Inventory. We correlated the amount and types of wetlands surrounding each of 3,990 marsh bird survey points with an index of marsh bird abundance at each point. Using the results of the correlation we ranked the value of wetlands throughout the lower 48 states to each species of marsh bird. We also ranked wetlands by their value to all marsh bird species. The results of this project provide managers with the necessary information to prioritize wetland management for the conservation of marsh birds throughout the United States. Moreover, our model is the essential first step in modeling the effects of climate change on marsh birds in North America.

## **DEVELOPMENT OF A COASTAL COLONIAL WATERBIRD CENSUS OF TAMAULIPAS, MEXICO (Oral)**

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The Laguna Madre is a unique and extensive hypersaline lagoon that extends from Corpus Christi, Texas south to La Pesca, Tamaulipas, Mexico. This binational body of water provides nesting, feeding, and roosting habitat for a diverse group of waterbird species. While the birds and their needs are consistent throughout their range, the management challenges and conservation actions vary greatly between the two countries. For over thirty-five years, a collaborative effort between agencies, researchers and volunteers has surveyed coastal colonial waterbird populations throughout Texas.

While the characteristic avifauna of the Laguna Madre de Tamaulipas has been documented previously, there has not been a systematic effort to census colonial waterbirds. In May 2008, Pronatura Noreste, in collaboration with Audubon Texas, completed the most comprehensive colonial waterbird survey of the Laguna Madre in Tamaulipas to date, using aerial assessment followed by site visits by boat, identifying over forty active colonies. Large and diverse heronries were encountered on natural islands, and ground-nesting bird colonies have colonized relatively recent dredge material deposits. Greater binational collaboration and capacity-building are needed in order to better understand and effectively address issues causing declines in populations of colonial waterbirds that know no border. We will present the format and results of the first comprehensive Tamaulipas Colonial Waterbird Survey (with notes on the only known population of American White Pelicans breeding in a marine environment), and discuss commonalities and differences in management challenges on both sides of the border.

## **IMPLEMENTATION OF THE NORTHERN PRAIRIE & PARKLAND WATERBIRD CONSERVATION PLAN (Oral)**

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The Prairie Pothole Region harbors large proportions of the population of many waterbird species, including American White Pelican, Eared Grebe, Horned Grebe, Sora, Black Tern, Forster's Tern, California Gull, and Franklin's Gull. In addition, several other species that breed in the region are species of special concern, including Yellow Rail, Least Bittern, Clark's Grebe, and Least Tern. The Northern Prairie & Parkland Waterbird Conservation Plan identified loss and degradation of wetland habitats and surrounding uplands as highest priority conservation issues affecting waterbirds in the region. The plan identified strategic conservation of habitats and acquisition of reliable information on waterbird populations and their habitat requirements as priority actions. Despite limited funding, considerable progress has been made in pursuing these goals in both Canada and the U.S., particularly acquiring information on population status and habitat requirements of waterbirds. In Canada, specific efforts have focused on Whooping Crane, Least Bittern, Yellow Rail, Franklin's gull, Western Grebe, and Horned Grebe. Efforts in the U.S. have focused on developing spatial models for strategic conservation of waterbird habitat and development of surveys for secretive marshbirds. Little conservation in the region is funded by waterbird interests or specifically targets waterbird habitat, but waterbirds continue to benefit from extensive waterfowl conservation efforts.

## **DEVELOPING AND USING SPATIAL MODELS TO GUIDE CONSERVATION OF WATERBIRDS IN THE U.S. PRAIRIE POTHOLE REGION (Oral)**

**Neal D. Niemuth** (Neal\_Niemuth@fws.gov) and **Brian Wangler** (Brian\_Wangler@fws.gov), Habitat and Population Evaluation Team, U.S. Fish and Wildlife Service, 3425 Miriam Avenue, Bismarck, ND 58501 USA.

We present a philosophy and process of conservation planning used in the Prairie Pothole Joint Venture that ensures that spatial models are biologically sound and truly useful for strategic conservation of waterbird habitat. Because diversity metrics are poor response variables in models used for conservation planning, we developed species-specific models that can stand alone or be integrated with results of other models. This allows precise targeting of locations and treatments to address different needs (e.g., preservation, restoration, enhancement, or mitigation of wildlife habitat) for any focal species, combination of species, or program while maintaining biological integrity of information used in conservation planning tools. We developed models by using National Wetlands Inventory data and accurate landcover data as predictor variables for species presence/absence or count data. Because water conditions in the Prairie Pothole Region are highly variable in space and time, we adjusted National Wetlands Inventory data using wetness data from annual surveys of ~40,000 wetlands. Our models indicate that numbers and distributions of waterbirds in the Prairie Pothole Region are strongly influenced by landscape composition and configuration, as well as annual water conditions. Spatial models also indicate that some waterbird species have benefited substantially from waterfowl conservation efforts in the Prairie Pothole Region.

## **REPRODUCTIVE PERFORMANCE OF LITTLE PENGUINS IN RELATION TO YEAR, AGE, PAIR-BOND DURATION, BREEDING DATE AND INDIVIDUAL QUALITY (Oral)**

**Ian C. T. Nisbet**, I.C.T. Nisbet & Company, icnisbet@verizon.net, and **Peter Dann**, Phillip Island Nature Park, pdann@penguins.org.

We measured breeding performance of Little Penguins at Phillip Island, Victoria, Australia, during a 21-year period. All birds considered in this paper (N = 307) were of known age (2-22 yr) and sex, and most were of known pair-bond status (1-8 mates per bird; pair-bond durations 1-13 yr). Breeding dates and breeding performance varied markedly from year to year; measures of annual performance were not associated with early breeding. Measures of individual breeding performance (clutch-size, chick masses and productivity) were related to early laying, parental age, and duration of pair-bond. Dependence of breeding performance on parental age was curvilinear, leveling off at about 8 yr of age. Productivity declined significantly among birds older than 8 yr. Breeding performance increased with duration of pair-bond at least through year 5. Early breeding was significantly correlated with age and duration of pair-bond. After controlling for other factors, breeding performance varied significantly among birds, but autocorrelations were low and limited to intervals of one year. Parental quality (defined for birds studied in six or more years as the individual bird term in a GLM for productivity controlling for other factors) was not correlated with lifespan or other demographic parameters, but high-quality birds were less prone to change mates and burrows than low-quality birds. This study is unique in measuring simultaneous effects of laying date, age and pair-bond duration on breeding performance, while controlling for year and individual quality.

## **HOW CLIMATE CHANGE MIGHT IMPACT ARCTIC-BREEDING SHOREBIRDS: EVIDENCE FROM SHORT AND LONG-TERM STUDIES (Plenary)**

**Erica Nol**, Trent University

Climate change has increased the global temperature by about 0.8°C, with disproportionate warming occurring in Polar Regions. Many North American shorebirds breed on the interface between the treed and treeless habitats in the arctic and sub-arctic, where their distribution is squeezed between forests to the south and arctic water bodies to the north. Using four approaches, I discuss how my students and I have studied the problem of potentially shrinking or disappearing habitat due to climate warming. Examining long-term records at single locations, we can document demographic responses of shorebirds to weather variation and then extrapolate population dynamics and risk of extinction under different climate scenarios. Shorter-term habitat models can indicate the range of conditions species can tolerate currently, and those conditions that result in the highest local fitness. We can then project what future habitat changes might do to the distribution of the most productive habitats. Geographic information systems and older aerial photos of particular locations can help to assess the degree to which habitat and shorebird distributions have already changed, especially if we are fortunate enough to have historical data on bird distributions. Finally, we can use surveys conducted at broad geographic and temporal scales to identify changes in breeding ranges at the interface of the distributions of temperate and arctic and sub-arctic breeding species. From identifying patterns, we can go into the field and make testable hypotheses about mechanisms of species interactions that might underlie these changes. I use these approaches in four case studies and discuss their potential and limitations for focusing our conservation needs for arctic and sub-arctic breeding shorebirds.

## **DEVELOPMENT OF A RELATIONAL DATABASE AND PREDICTIVE MODELING OF SEABIRD OCCURRENCE FOR THE WESTERN ATLANTIC OCEAN BETWEEN MAINE AND FLORIDA (Oral)**

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Wind-generated electricity in the marine environment promises to be an important source of renewable energy in the future, but is controversial because negative interactions between birds and wind turbines have been documented. To assist regulatory agencies such as the US Fish and Wildlife Service and Mineral Management Service in evaluating the potential for adverse effects of wind facilities and other offshore activities on seabirds and advance the goals of the Northwestern Atlantic's Birds at Sea Conservation Cooperative, we developed a database of bird occurrence datasets by compiling electronic and physical seabird records dating back to the early 1900's. Survey data were collected using many different techniques and recorded in different formats; thus, we standardized this information to provide more consistent and interpretable data. To date, we have identified 58 datasets containing seabird observations and accumulated >400,000 seabird observations for this period and significantly expanded historic seabird observations previously available, especially from the southeast. However, notable gaps in surveys occurred between the 1990's and early 2000's over much of the region. Recent surveys have focused on small areas proposed for wind energy development, but renewed interest in large-scale surveys has expanded historical survey coverage. Future work will focus on linking these data with biophysical information to model seabird distribution between Maine and Florida using a hierarchical approach for select seabird species. Seabird prediction maps will also be generated for individual species to identify potential areas of high activity and possible conflict between offshore activities and seabird populations.

## **TEMPORAL PATTERNS OF RACCOON PREDATION ON BREEDING BLACK-CROWNED NIGHT HERONS AND DOUBLE-CRESTED CORMORANTS AT A COLONY IN LAKE ONTARIO (Poster)**

**Alison Olausen\***, Department of Psychology, St. Cloud State University [olal0701@stcloudstate.edu](mailto:olal0701@stcloudstate.edu), **Kerresha Khan**, [kkhan@yorku.ca](mailto:kkhan@yorku.ca), **Gail S. Fraser**, [gsfraser@yorku.ca](mailto:gsfraser@yorku.ca), Faculty of Environmental Studies, York University.

Predators can have a significant impact on colonial waterbird reproductive success and their subsequent persistence at a site. We studied the activity patterns of raccoons in a mixed species colony of tree nesting Black-crowned Night-Herons *Nycticorax nycticorax* and Double-crested Cormorants *Phalacrocorax auritus* on a peninsula in Toronto, Canada, 2007 and 2008. We compared relative tree visitations by raccoons *Procyon lotor* by placing foil on trunks of nesting trees (2007: n = 20 heron trees; n = 10 cormorant trees; 2008: n = 20 heron trees; n = 15 cormorant trees). Claw marks, the index of activity, were clearly visible in the foil. In 2007, all the raccoon activity was limited to Black-crowned Night-Heron nesting trees. In 2008, the pattern of tree visitations was more variable (total number of foiled trees with claw marks from May 5 to Aug 7: heron = 35, mixed species = 22, cormorants = 17). In 2008, raccoon activity on heron trees peaked three times: mid-May, end of June and the end of July, while activity on the cormorant trees increased in mid-July and peaked at the beginning of August. For all trees monitored there appeared to be a lull in raccoon activity in mid-June. This colony of Black-crowned Night-Herons is one of the larger colonies in Ontario and provides a partial basis of the Important Bird Areas designation for this site. We recommend installation of predator guards to reduce predation on nesting night herons.

## **SIMPLE AND INEXPENSIVE DEVICES TO MEASURE HEART RATE OF INCUBATING BIRDS (Poster)**

**Rafael Ordonez\*** (reo114@psu.edu), **Stephen Oswald** (sao10@psu.edu), **David Copeland** (coped@sas.upenn.edu), and **Jennifer M. Arnold** (jma25@psu.edu), Division of Science, Penn State University, Berks Campus, Reading, PA.

Understanding physiological responses of birds to external stimuli is critical for improving our knowledge of the impacts of stress resulting from events such as predation, environmental change and human disturbance. Simple modifications to MP3 players, using a wire extended to a microphone enclosed within a dummy egg, allowed us to record heart rate for three species of colonial waterbirds (common terns *Sterna hirundo*, Caspian terns *Sterna caspia* and ring-billed gulls *Larus delawarensis*). Over 350 separate recordings were made in the field at Gull Island, Ontario, Canada, in 2008. We also recorded heart rate using a wireless bluetooth headset enclosed in a dummy egg and examined the effect of the wire associated with the MP3 devices on bird behavior. When a single egg from a clutch was removed and replaced with an egg monitoring heart rate, birds appeared to incubate normally and no differences were observed in the behavior of birds incubating wired versus wireless devices. Both devices recorded similar heart rates. The differences in heart rate between species were greater than that between individuals of the same species. Here, we demonstrate each of these devices and present potential applications.

## **HEAT STRESS IN WATERBIRDS: TRADE-OFFS WITH FORAGING AND NEST ATTENDANCE (Oral)**

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Migratory waterbirds adapted for successful breeding in temperate and arctic areas may experience problems of heat dissipation as a result of rapid climate change. Here, we examine impacts of heat stress on bathing, foraging and nest attendance of great skuas *Catharacta skua* in the north Atlantic during three breeding seasons of marked variation in prey availability. We report that diurnal variation in bathing activity matched heat-stress conditions and more birds bathed on days of higher heat stress, suggesting that bathing plays a role in thermoregulation. Great skua chicks are normally guarded by female parents and fed by males but, under conditions of low food availability both birds temporarily deserted territories during periods of high heat stress, leaving chicks exposed to cannibalism by conspecifics. Such direct effects imply that forecast rates of species' responses to climate change may be currently underestimated. We also report on a remote camera study of heat stress in Caspian terns *Sterna caspia* in the Great Lakes. We compare the responses of birds at this temperate, breeding colony with that of great skuas in the subarctic to explore how widespread adverse, direct impacts of climate change are likely to be.

## **STATUS AND BREEDING DISTRIBUTION OF THE REDDISH EGRET IN WESTERN MEXICO (Oral)**

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The Reddish Egret is the rarest heron in North America. Very little is known about their numbers in Mexico, especially on the west coast. In 2008 we surveyed the coasts of Chiapas, Sinaloa, Sonora, Baja California Sur, and Baja California in order to estimate the size and distribution of Reddish Egret colonies. There are at least 39 nesting sites, including eighteen nesting sites in Baja California Sur, eight in Sinaloa, six in Baja California, five in Sonora, and only two in Chiapas. However, the largest colony (258 pairs) and the only one with dark and white morphs was found in Chiapas (Laguna Mar Muerto). The second largest colony (248 pairs) was found in Baja California Sur. On the Pacific coast of Mexico, the breeding range goes along both coast of the Baja California peninsula (north to Islas Todos Santos on Pacific side and north to Isla Montague in the Gulf of California), along the coast of Sonora, Sinaloa, Nayarit, Colima, Oaxaca, and Chiapas (south to Laguna La Joya). The total breeding population was estimated between 954 and 1,260 pairs, based on the number of pairs that we actually counted and on the mean colony size (35 pairs). This breeding population estimate is three or four times higher than Mexican population numbers previously reported on Mexico's Pacific coast (300 pairs). Nineteen (49%) Reddish Egret colonies are on sites inside a protected area, but none of the Chiapas and Sinaloa colonies are protected. Postbreeding dispersal studies are badly needed.

## **WATERBIRD CONSERVATION IN NORTHWEST MEXICO (Oral)**

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Northwest Mexico region includes seven states, hundreds of islands in the Economic Exclusive Zone, 10 BCRs, and two joint ventures. This region provides critical nesting, foraging and roosting habitat for a wide variety of waterbirds, including 44 species of high and moderate concern in the NAWCP. In addition, several other subspecies are of special concern or endemic to Mexico. A Mexican Waterbird Conservation Plan is nonexistent yet, however waterbird conservation in this region has progressed through habitat protection. Most of the conservation work in the region has been a result of extensive waterfowl conservation efforts funded by NAWCA Mexico Program, including land and water acquisitions, establishment of conservation easements, dedication of federal land for habitat conservation, and wetland restoration. Designing and then protecting habitats efficiently, more than restoring or protecting single species, is essential to maintain waterbird diversity in Mexico. We are expanding the capacity to other regions in Mexico through the National Bird Program of Pronatura. Current projects are documenting the population status of Reddish Egrets in western Mexico, and identification of important colonial waterbird areas in Mexico. We need to generate information on waterbird abundance and distribution, habitat requirements, habitat threats, and conservation opportunities in order to support well-informed decisions by politicians and managers at priority sites. Conservation planning will provide the opportunity to agree on priorities for action, assign responsibilities for these actions, agree on how to monitor and evaluate the success of the work. This presentation will show Pronatura's projects that benefit waterbird habitats and make general recommendations to waterbird conservation planning in Mexico.

## **REACTIONS OF COMMON TERN CHICKS TO FEATHER SAMPLE REMOVAL (Poster)**

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Feather samples taken from live birds have a variety of uses. Feathers can provide DNA for genetic studies and molecular sexing, and they can also provide material for stable isotope studies of feeding ecology and for measuring levels of contaminants. While removing a pinch of breast feathers from each of 104 Common Tern (*Sterna hirundo*) chicks, we recorded the behavior of the chick. Seventy-four of these chicks showed no visible reaction to sampling and only 14 ran after sampling. Other reactions included changing position, calling, and biting. Chicks were most likely to run if they had not been previously banded, and thus were banded at the same time that feathers were removed (5 of 12 ran). Chicks that ran after feather sampling frequently ran again when reencountered, while other chicks very rarely did so. We find no evidence that removal of feather samples increases chick mortality, confirming that this technique is relatively noninvasive.

## **WATERBIRD CONSERVATION PLANNING AND IMPLEMENTATION IN THE MID-ATLANTIC/NEW ENGLAND/MARITIMES REGION OF THE US AND CANADA (Oral)**

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A partnership of organizations and individuals working to facilitate waterbird conservation in the Mid-Atlantic/New England/Maritimes (MANEM) region of the US and Canada has developed a regional waterbird conservation plan to be implemented during 2006-2010. Over 200 partners comprising the MANEM Waterbird Working Group have compiled and interpreted technical information on the region's waterbird populations and habitats, assessed conservation status of these natural resources, developed strategies to ensure the persistence of sustainable waterbird populations in the region, and identified near-term priorities. MANEM partners include wildlife managers, scientists, policy makers, educators and funders. The MANEM region consists of Bird Conservation Regions 14 (Atlantic Northern Forest) and 30 (New England/Mid-Atlantic Coast), and Pelagic Bird Conservation Regions 78 (Northeast US Continental Shelf) and 79 (Scotian Shelf). Seventy-four waterbird species utilize habitats in MANEM for breeding, migrating and wintering. Avian families include Gaviidae (loons), Podicipedidae (grebes), Procellariidae (shearwaters), Hydrobatidae (storm-petrels), Sulidae (boobies), Pelecanidae (pelicans), Phalacrocoracidae (cormorants), Ardeidae (herons), Threskiornithidae (ibises), Rallidae (rails), Laridae (gulls, terns), Stercoraridae (skuas, jaegers) and Alcidae (alcids). Partners in four subregions of MANEM selected 43 Focal Species for immediate conservation action.

Summarized information on waterbirds and their habitats provide a regional perspective for local conservation action. In addition, the plan consists of technical appendices on 1) waterbird populations including occurrence, status, and conservation needs, 2) waterbird habitats and locations within the region that are critical to waterbird sustainability, 3) MANEM partners and regional expertise for waterbird conservation, and 4) conservation project descriptions that present current and proposed research, management, habitat acquisition, and education activities.



## **CONSERVATION OF SHOREBIRDS THAT DISPERSE DURING MIGRATION (Oral)**

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Shorebird conservation efforts prioritize protection of spectacular aggregations of shorebirds by saving relatively few migration stopover sites. However, not all shorebird species aggregate during migration; some spread out across the landscape or along coastlines. These 'dispersed' species have not received equal conservation attention, despite showing population declines. Explicit conservation planning is needed for dispersed shorebirds -- especially coastal specialists, due to widespread habitat loss and sea-level rise. We analyzed 30 years of data from the International Shorebird Surveys during 1977-2007, and identified sites of importance to Sanderling, a dispersed coastal specialist (in fall). 'Important sites' host proportionally more individuals during migration, are important over multiple years, and (whenever possible) are used by multiple coastal shorebirds. We suggest that deficiencies in shorebird conservation planning for dispersed species reflect two problems common to the field of conservation biology: 1) conservation targets often remain static when a single approach appears to work well, creating "forgotten" species that neither fit - nor benefit from - the generic approach; and 2) protecting dispersed species – of any taxonomic group - is logistically daunting, so clear steps and a detailed road map are essential. We present results needed to develop a conservation plan for Sanderling (i.e., identifying sites of importance). In addition, we use this example to highlight challenges -- and offer concrete solutions – to improve conservation planning for dispersed species.

## **THE PURPLE SWAMPHEN (*PORPHYRIO PORPHYRIO*) IN SOUTH FLORIDA: AN INVASIVE EXOTIC (Poster)**

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A small, localized population of Purple Swamphens was first discovered in south Florida in 1997 that had probably descended from zoo or avicultural escapees. Swamphens have since increased in numbers and dispersed to wetlands and agricultural areas of Broward and Palm Beach Counties including Lake Okeechobee and various managed wetlands. Swamphens are large and aggressive and may compete for food and habitat with native wading birds and ducks. They may also prey on eggs and nestlings of other birds. Purple Swamphens are known to use waters that are sheltered, fresh or brackish, slow-flowing or stagnant, overgrown or surrounded by dense vegetation. Although one individual was seen near rice fields in 2007, no nests were found in agricultural areas until the 2008 field season. In 2008 in about 32 hectares of planted rice more than 12 individuals were observed and two probable nests were located. One nest with eggs measured 33 cm outside diameter and 19 cm for the bowl. It was situated in rice that was 69 cm tall over water that was about 20 cm deep. The nest itself was 32 cm above water and contained 7 eggs that had been destroyed by an avian predator. The other nest was similar in shape and position but had no eggs.

## **BURROW DISTRIBUTION AND HABITAT PARAMETERS IN LEACH'S STORM PETREL (*OCEANODROMA LEUCORHOA*) (Oral)**

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Population estimation for Leach's Storm Petrel (*Oceanodroma leucorhoa*) is subject to a broad array of potential biases. Petrels nest in inconspicuous burrows and only return to nesting areas after dark. Great Duck Island (lat. 44° 8' N, long. 68° 10' W) is listed as the largest Leach's Storm Petrel breeding colony in the eastern United States. Prior population estimates for Great Duck Island have assumed an even distribution of petrel burrows within the island's spruce forest. This study, however, identified distinct nesting areas with a strong west to east bias in burrow distribution. Habitat parameters such as soil density, soil moisture content, canopy cover, vegetation type and density, distance from shore, and distance from forest edge, were measured in order to develop a model reflective of population distribution and abundance. Of those parameters, canopy cover differed significantly between actual burrow sites and randomly selected sites. In addition, the concentration of burrows on the eastern half of the island positions the majority of nests on the lee side in relation to the prevailing westerly winds. Both factors are consistent with the hypothesis that petrels are selecting nest sites which provide maximum protection from weather conditions. While a limited number of petrels nested in open meadows, the greatest densities were recorded within the forest, where the differential distribution of burrows suggests that canopy alone may not provide a useful proxy for the identification of preferred petrel habitat.

## **CONSERVATION PLANNING FOR THE RICE REGION OF SOUTHWESTERN LOUISIANA (Oral)**

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The Southwest Louisiana rice region is critical for millions of wintering, migratory, and breeding waterbirds. Wetland birds of concern include King Rails, Little Blue Herons, shorebirds, wintering ducks, Mottled Ducks, and Sandhill Cranes. Land use conversions and invasive species threaten wetland birds and rice habitat in the region. Yet, priority areas for wetland birds have not been identified. Our objective was to develop habitat suitability models for wetland birds of conservation concern to assist with broad-scale conservation planning in the region. We used Geographic Information Systems (GIS), expert opinion, and commonly available GIS data to build habitat suitability models with the goal of identifying priority areas in the region. For a case study, we examine the King Rail (*Rallus elegans*) and the habitat suitability index we derived from GIS data layers of ditches/streams, rice density, and canopy cover. Each variable was ranked and multiplied to obtain a habitat suitability index. We tested the model in 2007-2008 with call-back surveys in rice fields. A logistic regression found that the model worked well at predicting King Rail distribution. Our final step in the modeling process was to bring together all of our species/guild models into a single habitat priority map which can be incorporated in conservation planning. In this regard, we used a Principal Components Analysis (PCA) to reduce seven suitability models into a single map. We found wetland bird models were well correlated due to the similar geographic attributes of winter precipitation, streams/ditches, and distance to marsh. This regional landscape approach can be used to support land use decisions and conservation programs in the region.

## **ERADICATION OF *RATTUS RATTUS* AND *RATTUS NORVEGICUS* ON OFFSHORE CAYS IN THE U.S. VIRGIN ISLANDS (Oral)**

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The U.S. Virgin Islands include the three main islands of St. Thomas, St. John, and St. Croix and numerous small offshore islands or “cays”. The cays comprise about 3% of the territory’s total area and provide sanctuary for a variety of wildlife species and are especially important for nesting seabirds and endangered reptiles. In 2003, the Virgin Islands Government Division of Fish and Wildlife in partnership with the U.S. Fish and Wildlife Service and U.S. Department of Agriculture-Wildlife Services began a program to remove non-native rats, the Black Rat (*Rattus rattus*) and Norway Rat (*Rattus norvegicus*), from cays under federal or local government control. The program also has involved the removal of goats from one cay. Eradication methods include hand deployment of rodenticide bait (0.005% diaphacinone), and live- and snap-trapping of rats on the smaller cays where eradication is feasible. Post-eradication trapping revealed the program has been successful on all but Congo Cay. Rat genetic samples from Congo and 3 other cays in close proximity have been collected to see if re-invasion is occurring from adjacent islands.

## **THE ROLE OF CHANGING AQUATIC ECOSYSTEMS ON AVIAN PREDATORS: DO FORSTER’S TERNS RESPOND TO THE AQUATIC ENVIRONMENT AS WELL AS TO CHANGES IN PREY ABUNDANCE? (Oral)**

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Aquatic ecosystems within Delta Marsh, Manitoba are highly variable throughout the summer months. Temperatures reach above 29°C and dissolved oxygen (DO) levels fall below 1 mg/L (anoxic). This variability, along with changes in turbidity can affect not only piscine species composition within the marsh, but also the interactions between piscivorous birds and their piscine prey. The activity of both Forster’s terns and their prey was monitored in Delta Marsh from May to August of 2006 (data was collected sporadically), 2007 and 2008. YSI data sondes recorded temperature, dissolved oxygen and turbidity for the duration of the study. Preliminary results from 2006 indicated that terns were possibly responding to changes in prey behaviour as a result of changing DO levels – when conditions were hypoxic, there were significantly more terns present. In 2007 however, the same pattern was not present. While it was expected that there would be more terns present when DO was lowest, temperature highest and/or turbidity lowest as well as when prey were most abundant, there was no relationship between either variable and tern abundance. However there were significantly less terns present in 2006 than 2007. Further analysis of the data indicated there were also significantly fewer prey fishes present in 2007 than 2006, suggesting a larger scale interaction between predator and prey. Data from 2008 will be analyzed to determine if the predator – prey interaction between terns and minnows are strictly on a large scale, or if smaller scale changes in the aquatic environment also plays a role.

## **BREEDING ECOLOGY OF WILSON'S PLOVERS (*CHARADRIUS WILSONIA*) AT MARINE CORPS BASE CAMP LEJEUNE, NORTH CAROLINA.**

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Novel disturbances like the Marine Corps Base Camp Lejeune's (MCBCL) amphibious training activities can have impacts on the beach habitat used by many shorebirds, including erosion, sand compaction, disturbance, and potential direct mortality to migratory and breeding shorebirds. However, military lands may have reduced levels of recreational disturbance compared to other areas and thus provide refuge to avian species. We studied the abundance, distribution, foraging ecology, and breeding biology of Wilson's Plovers (*Charadrius wilsonia*) from March to August 2008 at this military base. The study area is the 12 km Onslow Beach, which includes three zones that differ greatly in their level of human disturbance and military training. We located and studied 20 nests of Wilson's Plovers during this season and color-banded 20 adults and 18 chicks. Three of these nests were depredated, two by rodents and one by a raccoon. We observed  $1.17 \pm 0.31$  chicks hatched per pair and 0.78 fledglings per pair during this first of two planned field seasons at this site. Adults and chicks foraged primarily on fiddler crabs (*Uca pugnax*, *Uca minax*, and *Uca pugilator*) located on mudflats along the backside of the island, and some broods were observed to travel >1.8 km from their nest site to the fiddler crab mudflat where they subsequently foraged until fledging. Our preliminary results indicate that accessibility of these fiddler crab foraging areas to Wilson's Plover chicks may be an important factor limiting this population at Onslow Beach. Nesting and foraging Wilson's Plovers disproportionately used areas of Onslow Beach that were closed to recreational vehicles and therefore experienced low levels of human disturbance. Results of this study will be used by biologists and managers at MCBCL to develop efficient and effective management strategies for Wilson's Plovers, a Species of High Concern in the U.S. Shorebird Conservation Plan.

## **BREEDING WATERBIRD USE AND HATCHING SUCCESS OF THREE COLONIAL SEABIRDS ON LOUISIANA'S BARRIER ISLANDS (Oral)**

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Louisiana's barrier islands provide critical breeding habitat for several species of colonial waterbirds that are of conservation concern. However, this habitat is subject to erosion from wave energy, storms, and reduced accretion from the human-altered Mississippi River system. In response to these effects, there has been considerable restoration efforts focused on barrier islands, but there has been little evaluation of their use by avian species. Since 1994, Louisiana's Isle Dernieres Barrier Island Refuge has been augmented via breakwater structures and dredge fill material. To determine the breeding waterbird use of the refuge we conducted boat/ground surveys during May and June 2008, to determine breeding species and estimate population sizes. We observed 20 species and approximately 45,000 pairs breeding on the barrier island refuge. We also monitored the nest success of three species of conservation concern, Sandwich Tern (*Thalasseus sandvicensis*), Royal Tern (*Thalasseus maxima*), and Black Skimmer (*Rynchops niger*). We monitored 7 colonies of Sandwich Tern (N=320 nests) and Royal Tern (N=538 nests) and 8 colonies of Black Skimmer (N=265 nests) to assess their hatching success. Hatching success was variable among islands, but overall hatching success was 82.5% for Sandwich Terns, 86.2% for Royal Terns, and 58.1% for Black Skimmers. Future work will include modeling hatching success based on a suite of habitat characteristics that have been measured and comparing habitat characteristics at the colony site-level among active colony sites and restored but inactive sites.

## **FEMALE SURVIVAL AND NESTING PROPENSITY OF MOTTLED DUCKS ON THE UPPER TEXAS GULF COAST (Oral)**

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The Mottled Duck (*Anas fulvigula*), a non-migratory resident of gulf coastal marshes, has undergone a severe population decline in Texas since the mid-1990s according to limited survey data. Annual Mottled Duck survival has been estimated from banding data since 1997, but differential seasonal survival is poorly understood. From 2006-2008, we captured, radio-transmitted, and tracked 39 adult female Mottled Ducks throughout the breeding season (February 1-June 30) to estimate their survival and monitor their breeding ecology. Survival during the 19-week breeding season did not differ between the first two years and was  $S=0.81$ , similar to survival estimates from banding data. The female survival rate in the third year was lower than in the first two years, despite excellent habitat conditions. The decrease in the female survival rate was likely linked to increased nesting effort in 2008. Nesting propensity was 21.7% in 2006 and 2007, but was 62.5% in 2008. We believe that continued excellent marsh conditions encouraged juvenile females to remain in the study area throughout 2007 and breed there in 2008, leading to relatively greater nesting propensity. An increase in predation risk due to nesting and brood-rearing activities likely led to a reduced breeding-season survival rate for females in 2008. A decline in female survival rates in years with excellent habitat conditions may mitigate expected increases in recruitment due to greater nesting propensity.

## **WESTERN SNOWY PLOVER USE OF MANAGED SALT PONDS IN THE SOUTH SAN FRANCISCO BAY (Oral)**

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The western snowy plover (*Charadrius alexandrinus nivosus*) is a threatened species that nests on dry former salt evaporation ponds in the San Francisco Bay. The number of snowy plovers in the Bay area has decreased over the past 30 years. The majority of plover habitat in the Bay is within the South Bay Salt Pond Restoration Project area. As the restoration project restores salt ponds to tidal action and opens areas to the public, the amount of available habitat for plovers will decrease. In 2006, the California Department of Fish and Game started managing water levels in ponds to provide high quality nesting and foraging habitat with the goal of maintaining the same number of plovers in a smaller habitat area footprint. Managed and seasonal control ponds were monitored for plover use, nest abundance, and nest success in 2006 and 2007. The mean nests per hectare on managed ponds was higher ( $0.122 + 0.044$  SE,  $n=7$ ) than on control ponds ( $0.082 + 0.026$  SE,  $n=13$ ). In wet years, the managed ponds provide crucial early breeding season nesting habitat. In 2006, there were significantly higher numbers of plovers roosting on managed ponds, and in 2007 there were significantly higher numbers of plovers foraging on managed ponds. We recommend that the South Bay Salt Pond Restoration Project continue to manage ponds for plovers to reduce the impact of the habitat reduction.

## **HYDROLOGIC CONDITIONS AND PREDATOR-PREY INTERACTIONS INFLUENCE CLAPPER RAIL POPULATIONS IN TWO NORTHERN GULF OF MEXICO ESTUARINE SYSTEMS (Oral)**

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Within the Northern Gulf of Mexico, hydrologic conditions can act in concert with sea-level fluctuations and anthropogenic development altering existent tidal marsh ecosystems and resulting in loss of emergent marsh habitat. These productive tidal systems are used by a diverse array of marsh bird species; many already facing population declines or compromised habitat availability. However, for the majority of these species, such as the Clapper Rail (*Rallus longirostris*), ecological information remains limited thus adding complexity to predictions relating the impact of habitat loss and alteration to population stability. During 2005 to 2008 we employed standardized marsh bird surveys, GIS, radio-telemetry and ecological tracers in the form of stable isotopes to explore the trophic, spatial and reproductive ecology of Clapper Rails from several distinct locations in Mississippi. Evidence suggests that the diet and reproductive success of Clapper Rails can vary annually and at relatively small spatial scales while occupancy and abundance may be more strongly driven by trophic feedbacks and hydrologic variation found at broader temporal and spatial scales. Applying this information we will discuss possible relationships between habitat use, Clapper Rail population demographics and the potential impact of sea level rise. Synthesis of this information will not only further our understanding of the ecology of tidal communities but also find application in their effective management with a changing environment.

## **SUCCESS AND TEMPERATURE FLUCTUATIONS OF SNOWY PLOVER NESTS IN THE SOUTHERN HIGH PLAINS OF TEXAS (Oral)**

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Snowy Plovers (*Charadrius alexandrinus*) have experienced population declines throughout their range. Decreased nest success has been recognized as a primary cause for the decline of the Western Snowy Plover. Although populations west of the Rocky Mountains have been extensively studied, few studies have focused on interior populations. We estimated nest success of Western Snowy Plovers on 3 saline lakes on the Southern High Plains of Texas during 2008 and determined causes of nest failures, factors influencing nest success, and temperature fluctuations of nests during incubation. We monitored 85 nests and estimated a 27% apparent nesting success (Mayfield estimate = 23%) with leading causes of failure being predation (55%) and weather (27%). Nest success was most influenced by lake, distance to nearest object, and substrate type. Nest temperatures during incubation were found to fluctuate throughout a 24hr period (nest range: 18.7-46.1°C; control range: 17.2-55.1°C), with nests having lower temperatures (mean = 30.9°C) during day and higher temperatures (mean = 26.8°C) during night than controls (day mean = 32.3°C; night mean = 24.3°C). Additionally, nests located on sand substrate (mean = 31.3°C) had higher temperatures during day than nests located on pebble/rock substrate (mean = 30.6°C). Nest success was lower than previous studies in this region. Although nest success is variable from year to year, our results suggest that if nesting Snowy Plovers continue to experience increased predation rates, unpredictable weather events, decreased hydrological integrity, and habitat alterations, populations may decline throughout this region.

## **A LONG-TERM POPULATION STUDY OF THE UPLAND SANDPIPER: SEASONAL DEMOGRAPHY OF A MIGRATORY SHOREBIRD (Oral)**

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Investigations of the seasonal demography of migratory birds are rare but essential for addressing major questions in ecology. For example, a better understanding of the seasonal demography of shorebirds is necessary to determine the role of life-history tradeoffs in the evolution of migratory behavior, to identify the limiting factors and regulatory mechanisms that determine the population dynamics, and to plan effective conservation at critical stages of the annual cycle. I will present demographic data on fecundity, age at maturity and survivorship from an 8-year population study of Upland Sandpipers at a tallgrass prairie site in northeast Kansas. In this migratory shorebird, fecundity rates are low because clutch size is 4 eggs and nesting success is low (10-30%) in managed grasslands. Returns of philopatric young indicate that sandpipers start breeding as yearlings. Survival of radio-marked birds is high during stationary breeding period (0.90 for 4 mo) and annual rates of apparent survival for color-banded birds are moderate (0.80). Life-stage simulation analysis indicated that survival during migration and nonbreeding periods would have the greatest effect on population growth rates. Major knowledge gaps in our understanding of the annual cycle of Upland Sandpipers remain but models of seasonal demography have suggested useful avenues for future research.

## **ABUNDANCE AND HABITAT USE OF THREE NONBREEDING SHOREBIRD SPECIES IN THE ESTERO DE URÍAS, SINALOA, MEXICO (Oral)**

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We studied the abundance and habitat use of nonbreeding Whimbrels *Numenius phaeopus*, Long-billed Curlews *N. americanus*, and Marbled Godwits *Limosa fedoa* in the Estero de Urias, Sinaloa, Mexico. Shorebird surveys were carried out from September 2007 to April 2008 in two tide levels (<300 and 300–800mm) during ebbing and rising tides. All three species had their highest numbers during the southward migration and decreased as the nonbreeding season progressed. Marbled Godwits was the most abundant species, and Whimbrels and Curlews presented similar numbers. Overall shorebirds tended to be more abundant during falling tides and in the tide level of 300–800mm. All three species used the study area mainly as a foraging site, with the highest proportions of foraging individuals in the <300mm tide level during southward migration and wintering season. We confirmed that all three species used the estuary throughout the nonbreeding season, and changes in their numbers and habitat use are related to the season and tidal cycle. These findings imply that maintaining the overall value of the estuaries for foraging shorebirds requires extensive mudflats with areas available for different species at different tidal stages.

## **REDISTRIBUTION OF BREEDING DOUBLE-CRESTED CORMORANTS IN RESPONSE TO DISTURBANCE (Oral)**

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The Georgian Bay Double-crested Cormorant population is viewed as problematic by some members of the public and population reduction through lethal means has been sought. However, if a metapopulation of cormorants exists throughout the Great Lakes lethal management of individual Georgian Bay colonies may not be successful. We sought to determine if disturbance would reveal a response by cormorants indicative of a metapopulation, including redistributing throughout the Great Lakes. Over the course of two breeding seasons, cormorants were observed at both individual and colony levels for their response to disturbance. We captured 28 individuals on colonies selected to be disturbed and implanted them with PTTs. These colonies were then disturbed on three occasions with pyrotechnics to produce a similar acoustic effect as that associated with lethal management. Ten of these 28 birds responded to disturbance by making large-scale movements to different localities throughout the Great Lakes. The willingness of disturbed nesting birds to move appeared to depend however, on egg stage. Colony-level responses were observed from aerial photographs taken before and after disturbance to assess the determinants of change in abundance of nesting birds on colonies. This change in abundance of birds was best predicted by a model including whether or not the colony had been disturbed and gull abundance on the colony. Close proximity to disturbed colonies did not necessarily result in a gain of birds on undisturbed colonies, which had highly variable trajectories. Both individual- and colony-level responses suggest that local management of the Georgian Bay cormorant population may be ineffective due to metapopulation dynamics.

## **FREQUENCY OF OCCURRENCE AND SITE SELECTION OF CLAPPER AND KING RAILS IN COASTAL SOUTH CAROLINA (Oral)**

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If marsh birds are to remain abundant, some coastal marshes managed for wintering waterfowl must be available to multiple species year-round because much unmanaged tidal marsh has been lost to development or degraded by pollutants. We investigated the frequency of occurrence and site selection of Clapper (*Rallus longirostris*) and King Rails (*R. elegans*) in managed and tidal marshes to evaluate use of these wetlands under current conditions. We used call-playback protocol to estimate frequency of occurrence of rails during summer 2005, and winter and summer 2006 within the ACE Basin, South Carolina. We related occurrences to habitat features during winter and summer 2006. We assessed site selection by analyzing radio-locations of 2 Clapper Rails and 1 King Rail from March to August 2006. Rails occurred more frequently in tidal marshes during summer and winter. Tidal marshes were characterized by a dense cover of tall (100–200 cm) marsh grasses (*Spartina spp.*). This preliminary telemetry study found that all Clapper Rail radio-locations were in tidal marshes, but locations of the King Rail were in managed impoundments. Tidal marshes provided resources for Clapper Rails, while managed impoundments may provide resources for King Rails. On 3 June 2008, 24 Clapper Rails were captured using a new technique, and each was radio-tagged. Locations and survival were recorded every 2 days through summer 2008. All locations were in tidal, brackish marsh with movement from interior to edge of marsh from high to low tide, respectively. This study continues through 2010.



## **SECRETIVE MARSHBIRD SURVEY FOR THE UNITED STATES; PILOT STUDY FIRST YEAR RESULTS (Oral)**

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Secretive marshbirds (rails, bitterns, gallinules, American Coot, and Limpkin) are poorly monitored by existing bird monitoring programs. A pilot study was initiated in Wisconsin in 2008 to test a proposed sampling design and the feasibility of a monitoring program for marshbirds in the U.S. Program objectives are to provide information for decisions regarding harvest regulations, endangered or sensitive species status, and habitat management. A generalized random tessellation stratified (GRTS) approach was used to select: (1) primary sampling units (PSUs; 40 km<sup>2</sup> hexagons) from a hexagonal grid covering the state; and (2) survey points within wetlands in selected PSUs. Fifty-eight PSUs were surveyed in 2008. On average 6.3 points were surveyed in each PSU. All target species known to occur in Wisconsin were detected during the survey. There was a clear tradeoff between maximizing sampling effort and strict randomization of survey point locations. Random allocation of individual points versus use of survey routes will be explored further before the planned expansion of the survey to 3 additional states in 2009.

## **THE STATUS OF BREEDING SEABIRDS AND WATERBIRDS ON THE ERITREAN RED SEA ISLANDS (Oral)**

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We assess the current status of breeding seabirds and waterbirds on the still mostly unpopulated Eritrean islands, many of which had never previously been visited by ornithologists. In 2001–07 we surveyed 325 islands (93% of the total), of which 210 were found to harbour 21 breeding species of seabirds and waterbirds. We counted c.150,000 breeding pairs and estimate the total number at c.175,000 pairs. The following species or subspecies were found to have internationally important breeding populations, as the Eritrean islands support more than 1% of the regional population: Crab Plover *Dromas ardeola* (>8,000 pairs), White-eyed Gull *Larus leucophthalmus* (5,900 pairs), Lesser Crested Tern *Sterna bengalensis par* ( 63,000 pairs), Swift Tern *S. bergii velox* ( 2,200 pairs), Bridled Tern *S. anaethetus fuligula* (30,000–35,000 pairs), White-cheeked Tern *S. repressa* (27,000–30,000 pairs), Brown Noddy Anous stolidus plumbeigularis (11,000 pairs), Brown Booby *Sula leucogaster plotus* (10,000 pairs) and Eurasian Spoonbill *Platalea leucorodia archeri* (c.300 pairs). Socotra Cormorant *Phalacrocorax nigrogularis*, previously reported in the Red Sea only as a rare vagrant, was observed in large numbers and is suspected to breed in the southern islands. Currently, the main threats to breeding seabirds are egg collection by local and foreign sea cucumber fishermen and the occasional introduction of cats. We confirm that the Eritrean islands deserve the status of Important Bird Area and we identify 50 islands in need of special protection.

## **STATUS OF WATERBIRD CONSERVATION IN THE INTERMOUNTAIN REGION (Oral)**

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The Intermountain West Region is comprised of four Bird Conservation Regions (BCRs) and encompasses portions of 11 western states and two Canadian Provinces. The region includes the extensive Great Basin, Columbia Basin, Colorado Plateau, and Wyoming Basin physiographic regions and their associated mountain ranges. Characterized by this diverse basin and range topography, the region provides a variety of habitats for waterbirds, including high mountain lakes, rivers and streams, fresh and brackish wetlands and large terminal hyper-saline lakes. This region is used by 41 waterbird species (33 breeding and 8 migrants/vagrants) throughout the year, 21 of which have been identified as priority focal species in the Intermountain West Waterbird Conservation Plan. The IWWCP, completed in 2006, identifies population and habitat objectives for these species, monitoring and research recommendations, and conservation strategies for management, monitoring, and outreach. Implementation of some recommended conservation actions is underway; this includes the development of an atlas of all known and historical colony locations, and planning for a region-wide survey of some island-, tree-, and marsh-nesting species in the region.

## **DIFFERENTIAL EFFECTS OF FLOODING ON TWO SYMPATRIC MARSH-NESTING TERNS (Oral)**

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Flooding and rapid or unpredictable changes in water levels have been implicated as important causes of nest loss in marsh-nesting terns. Since 1999, Black Terns (*Chlidonias niger*) and Forster's Terns (*Sterna forsteri*) nesting at various colony sites in southeastern Wisconsin have experienced two years of extreme flooding, the first in 2004 and the second in 2008. High water in these two years delayed nesting by Black Terns, but not by Forster's Terns. Although nest losses by these two species initially were substantial in both years, overall productivity, as indexed by hatching success, were among the highest recorded over the ten-year period. This anomalous finding can be attributed primarily to re-nesting by the two species following the loss of first nests. High water levels prevalent throughout the season created unique foraging opportunities for these two terns and prevented predators from gaining access to the nesting colonies. Forster's Tern nests were more resistant to the effects of flooding in most years because they were built on sturdier substrates; however, extreme flooding events resulted in catastrophic nest losses. Conversely, the floating nests constructed by Black Tern were more resilient, better able to withstand drastic and rapid changes in water levels. Black Terns also responded more quickly than Forster's Terns to nest loss by rebuilding destroyed nests and producing replacement clutches in only a few days.

## **FLUCTUATING MISSOURI RIVER WATER LEVELS: POTENTIAL LINKAGES BETWEEN HABITAT QUALITY, NEST SURVIVAL AND ADULT DISTRIBUTION OF PIPING PLOVERS (Poster)**

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Lake Sakakawea and the Garrison Reach of the Upper Missouri River are important nesting areas for piping plovers (*Charadrius melodus*) in North Dakota. These major units of breeding habitat can differ substantially in quantity and quality of plover nesting habitat depending on annual variation in water levels. Survival of plover nests varies within breeding seasons, and the pattern of variation differs among years and major units of habitat. Poor survival of nests initiated early in the breeding season may lead to extensive renesting and peak chick abundance occurring later in the breeding season than would have occurred had more early nests survived. Many studies have demonstrated a negative relationship between phenology (e.g., nest initiation or hatching date) and productivity (e.g., nest or fledging success), which is potentially due to declining abundance or quality of food resources for brood rearing with advancing date. Thus, factors contributing to failure of early nests may have several additional consequences, including secondary local peaks of nest initiation, landscape-scale redistribution of adults into other suitable breeding habitat, or changes in productivity related to phenology. Variation in abundance and quality of nesting and foraging habitats may alter the magnitude of these responses, particularly where adjacent units of habitat are available for renesting. We use adult count and nest survival data from Lake Sakakawea and the Garrison Reach to illustrate these potential linkages between habitat and productivity.

## **PREDATOR ABUNDANCE AND INCUBATION BEHAVIOUR EXPLAIN INTERANNUAL AND INTERSPECIFIC PATTERNS OF NEST SUCCESS FOR ARCTIC BREEDING SHOREBIRDS (Oral)**

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We studied breeding shorebirds at two sites in the eastern Canadian arctic and related the interannual patterns in nest survival to factors such as weather and predator abundance. Interspecific variation in nest survival was also large, and we tested the hypothesis that risk of predation is lower for biparental incubators than for those that incubate alone and leave the nest unattended during frequent recesses. From 2000-2007, we monitored 899 nests of 12 species, and used program MARK to assess patterns in daily nest survival. Most of the interspecific variation was explained by grouping species by incubation strategy, with uniparental species showing consistently lower nest survival. Over 8 years of study at East Bay, the average survival of nests from lay to hatch was 10% for uniparental species as compared to 42% for biparental species. Strong temporal patterns suggest that nest survival is highest early and late in the breeding season and depressed mid-season. Among years, variation in the encounter rate of predators was an extremely strong predictor of nest survival. Models received little support if they contained effects of weather or abundance of lemmings, which are assumed to be a primary prey for tundra predators. Changes in fox abundance explained variation in nest survival of biparental species whereas changes in abundance of jaegers explained variation in nest survival of uniparental species. Our results demonstrate that increases in predator abundance indeed account for interannual variation in shorebird nest survival, but that the relationship may be influenced by the behaviour of both the predators and the shorebirds.

## **SHARING WATER IN A DRY LAND: EXAMINING OVERLAP IN LAKE USE BY FISH-EATING BIRDS AND HUMANS ON THE NORTHERN GREAT PLAINS (Oral)**

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Large, fish-bearing lakes are uncommon on the northern Great Plains, and thus are crucial habitat for piscivorous waterbirds. Increasing human population size and economic prosperity in western Canada are intensifying recreational use of lakes in this region, potentially causing habitat use overlap with waterbirds. To address this issue, we used point counts to examine the distribution of double-crested cormorants (*Phalacrocorax auritus*), American white pelicans (*Pelecanus erythrorhynchos*), western grebes (*Aechmophorus occidentalis*), and recreational boats on two popular lakes in southern Saskatchewan during 2005-2007. We found cormorants and pelicans at significantly lower densities in areas with the highest human use on both lakes. In contrast, western grebes either did not vary in density or were present at the highest densities in areas with high human use. Our data suggest that cormorants and pelicans may avoid boats and areas of shoreline development, or select aquatic habitats that are substantially different from those used by boaters. In contrast, western grebes either do not avoid boats, or they select habitats with some common characteristics to those used by recreational boaters. We conclude that extensive habitat use overlap is not the cause of recent increases in the frequency of complaints from Saskatchewan anglers regarding fish consumption by cormorants and pelicans. The conservation implications of our findings for western grebes are uncertain; we suggest further studies as lake use by humans continues to increase.

## **IMPACTS OF CLIMATE CHANGE ON WETLANDS AND AQUATIC BIRDS IN THE CARIBBEAN.**

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Possible effects of climate change in the Caribbean include warmer oceans, more intense storms and hurricanes, sea level rise and increased summer drought. These effects will impact many ecosystems and habitats used by birds. Warming sea temperatures will threaten coral reefs and marine food webs, ultimately impacting many coastal and wide-ranging pelagic species that feed on fish. Increasing frequency and intensity of storms and hurricanes will have direct and indirect effects on aquatic bird populations including increased mortality and damage to habitats (e.g., loss of mangroves, saltwater intrusion into fresh and brackish marshes, beach erosion). Sea level rise will also lead to loss of habitat for aquatic birds, including coastal nesting and feeding sites and flooding of low-lying islands and cays used by colonially breeding seabirds. Research has shown that Caribbean waterbirds are dependent on a network of local wetlands in their annual cycle. Increased summer drought will likely cause wetlands of all types to dry up, leading to a scarcity of habitat for waterbirds. All of the stresses from climate change will be overlaid on top of serious existing stresses on the environment, including out of control development, pollution, freshwater depletion, and invasive species. Bird and habitat monitoring, inclusion of climate change scenarios in conservation planning, and greater public and decision-maker awareness are all needed to help plan for and mitigate some of these effects. The most important action, however, is to redouble efforts to protect and restore coral reefs, mangroves, and wetlands of all types. These habitats provide invaluable ecological services and will help mitigate against the worst impacts of climate change in the Caribbean.

## **WEATHER AND WEST NILE VIRUS IMPACT ON AMERICAN WHITE PELICAN PRODUCTIVITY (Oral)**

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American White Pelicans (*Pelecanus erythrorhynchos*) nest colonially at few sites, making the species vulnerable to disease, disturbance, predation, and weather events. Nearly half of the population breeds at four colonies in the northern plains; thus, sustained productivity at these colonies is crucial. Beginning in 2002, unusually high mortality of pelican chicks was noted at the four northern plains colonies. During 2004-2008, we monitored three of these four colonies to assess mortality of chicks. Weather events and West Nile virus (WNV) were documented as major causes of mortality. Weather-related mortality might be a more important factor now than in the past because pelicans are arriving at breeding sites almost 2 weeks earlier than 40 years ago; earlier arrivals may be linked to warmer spring temperatures in recent decades. Severe weather in late May and early June has caused significant losses of chicks at all four colonies. Had pelicans initiated nests later, the magnitude of these losses may have been less because fewer chicks would have been in the vulnerable transition stage from being brooded by adults to creching with other chicks. Later in the season, WNV caused high rates of chick mortality. Before WNV arrived in the region, chick mortality after mid-July was  $\leq 4\%$  but has been as high as 44% since WNV arrived. Mortalities caused by WNV are likely additive to other causes because the disease killed older chicks that were no longer vulnerable to other common causes of mortality and typically would have fledged. Persistent low productivity at white pelican colonies in the northern plains likely is reducing the adult breeding population in the region.

## **NEST-ACTIVITY PATTERNS AND FOOD-PROVISIONING RATES BY GREAT EGRETS (ARDEA ALBA) (Oral)**

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Great Egrets nesting in an island-based, mixed-species colony in Wichita, KS, were studied in May and June 2008. Observations included 70 h of continuous sampling and 2472 instantaneous observations on 12 random study nests. We also recorded 75 food-provisioning intervals during a separate 62 h of observation. The results from the focal and scan samples were in close agreement and showed that the attending parent engaged in low-cost activities such as sitting (35% of the time), standing (26%), and preening (18%). Maintenance activities (nest repair, egg-turning) accounted for 5% of daily activity, whereas food-transfer to chicks comprised 1% of the daily activity budget. Food-provisioning trips ranged from 6-480 min with a mean of 186 min. For both nest activities performed by the attending parent and food-provisioning trips, we found significant differences for nests with eggs compared with those with chicks. Adults with eggs spent more time sitting and maintaining the nest but less time standing or away from the nest. The mean food-provisioning interval for nests with eggs was 80 min longer than the interval for nests with chicks. Neither the size nor the number of chicks was a factor in the duration of food-provisioning intervals; however, there were significant effects of time of day and wind velocity on food-provisioning intervals. Our previous work examined the energetic costs of foraging activity and foraging flights. Here, we examine the energetic costs of the activities performed by the attending parent as well as those involved in food-provisioning. We relate these costs to a Great Egret's overall time-and-energy budget.

## **MORPHOMETRIC DISCRIMINATION OF SEXES IN LEAST TERNS (Oral)**

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Limited sexual dimorphism exhibited by Least Terns (*Sternula antillarum*) often presents challenges to researchers trying to distinguish sexes. Previously, sex determination of Least Terns has occurred through behavioral observation of marked birds during courtship and copulation, or through necropsy of deceased individuals. Morphometric characteristics have been successfully used to discriminate sex of other Larid species, including terns. In 2007 and 2008, we obtained morphometric measurements and feather or blood samples from 135 live adult Least Terns, and used genetic analysis to determine sex (n=33 males and 102 females). Using 2007 data (n=18 males and 45 females), we conducted a stepwise discriminant analysis to select the morphological measurements that best discriminated between males and females. Males had a significantly larger mean head+bill length, mean bill length, and mean head length than females ( $t_{63} \leq -2.5$ ,  $P < 0.015$ ), but weight did not differ significantly between males and females in 2007 ( $t_{63} = 1.4$ ,  $P = 0.16$ ). The best discriminant function included head+bill length and weight, which correctly classified females and males 78% and 74% of the time, respectively. Results of the cross validation of this 2007 model using additional 2008 data (n=76) and subsequent model refinement will be presented. Our results suggest that morphometric characteristics may provide an alternative approach to separate sexes of least terns over a discrete size range, potentially limiting the need for genetic testing to individuals with inconclusive results.

## **TRACKING SMALL WATERBIRDS: INSIGHTS FROM USE OF RADIO TRANSMITTERS AND REMOTE STATIONARY DATALOGGERS WITH LEAST TERNS (Oral)**

**Jennifer Stucker, Mark Sherfy**, USGS - Northern Prairie Wildlife Research Center.

Federally endangered Interior Least Terns (*Sternula antillarum*) nest on emergent sandbars in riverine systems. In 2006, we initiated research to identify and quantify use of emergent sandbar habitats by least terns on the upper Missouri River, including time allocation to incubation and parental care, and departure from sandbars. Because transmitter attachment has proven problematic with this species, we developed and tested new techniques for use with adult least terns. We found that apparent nest success did not differ between nests at which one adult was radiomarked and nests at which neither adult was radiomarked, suggesting that nest attendance and incubation patterns were not altered appreciably by presence of transmitters. We deployed transmitters on adult least terns on the Gavins Point Reach ( $n_{2006} = 44$ ,  $n_{2007} = 72$ ,  $n_{2008} = 77$ ) and used a network of remote telemetry dataloggers at fixed colony and river locations to quantify movements of radiomarked terns. These data allow us to quantify several elements of tern movements and behavior that have not been measured previously, including duration of colony attendance, frequency of departures, and distance moved from colonies. This knowledge will aid in understanding the importance of sandbar proximity to other habitat features. Because our dataloggers scan continuously for radio-marked terns, our data provides insights into 24-hour movement and behavior patterns of birds throughout the river reach. We illustrate potential insights from telemetry data collected at several sandbar colony sites included in the study.

## **GENE FLOW AMONG COMMON TERN POPULATIONS IN THE ATLANTIC OCEAN (Poster)**

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Bermudian Common Terns (*Sterna hirundo*) exhibit distinctive ecological features, including solitary nesting and unusual migratory habits as well as morphological distinctions when compared to continental populations. Historically, this population has remained small and is isolated by 1,000-2,000 km from other populations. The population bottle-neck caused by hurricane “Fabian” in 2003, stimulated interest in the potential for recovery and initiated a genetic study of gene flow among colonies in the Atlantic. We predicted that the Bermudian population is genetically isolated from its nearest neighbor populations in New England and the Azores. Microsatellite analysis at six loci indicates significant barriers to gene flow resulting in differentiation between all three colonies ( $P < 0.001$ ). Bermuda and Azores show the greatest structure ( $F_{ST} = 0.44$ ), followed by Bermuda and New England ( $F_{ST} = 0.25$ ) and New England and Azores ( $F_{ST} = 0.15$ ). The number of migrants per generation ( $N_m$ ) based on these  $F_{ST}$  values is 0.46. This level of dispersal seems significant enough to maintain genetic diversity and avoid severe inbreeding effects in the Bermudian population ( $F_{IS} = 0.47$ ), however, it is not enough to facilitate recovery of population size in Bermuda. In light of the fact that the effective population size in Bermuda is eight, this lack of immigration potential presents a serious conservation dilemma.

## **GROUND-NESTING DOUBLE-CRESTED CORMORANTS AT A COLONY IN LAKE ONTARIO: DOES EGG OILING CHANGE NEST ATTENDANCE BEHAVIOUR? (Oral)**

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Egg oiling is a common management tool used on cormorant colonies. But despite the frequency of use of egg oiling by managers, there is a paucity of information available on whether egg oiling negatively influences adult nest attendance behaviours. In this study, our main objective was to compare the behaviour of ground nesting cormorants in three groups: treatment (handled and sprayed with Daedol 50 NF,  $n=30$ ); sham (handled and sprayed with water,  $n=30$ ); and control (nest contents not handled,  $n=30$ ) using focal (15 min) and instantaneous scan observations from a blind. We also measured how long the treatment birds would attend the nest before abandoning. We found no difference in rates of abandonment of the nest site within two weeks among the three groups (treatment and sham were administered at night). We found no difference in the frequency of incubation among the three groups in the first two weeks; after two weeks, incubation in the treatment group started to decline. Overall, the treatment group did not attend their nest site (mean  $\pm$  SD  $39.6 \pm 13.1$  days) as long as the sham ( $55.7 \pm 10.1$  days) or control ( $57.79 \pm 7.7$  days). Our results suggest that egg oiling cormorant nests did not cause immediate changes in their nesting behaviour. We will discuss egg oiling for population control and egg oiling to disperse cormorants in the context of our results.

## **ESTIMATING SITE FIDELITY USING LOCAL DISPERSAL DATA (Oral)**

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In mark-recapture studies on finite-area study sites, apparent (“local”) survival is a product of both true survivorship and site fidelity. In order to more accurately calculate the latter, we must have estimates of the former. Site fidelity is often higher for individuals that reunite with their previous mates than for those who do not. Hence estimates of mate fidelity based on mark-recapture data, are likely to be overestimated. Here, we develop a method for calculating site fidelity taking finite study site boundaries into account, based on a dispersal kernel estimated from local dispersal data. Improved estimates of site fidelity are then used to revise estimates of mate-fidelity and apparent survival and can substantially reduce biases in apparent survivorship between groups, particularly sexes, attributable to the local dispersal component. We apply this method to published data for two species of shorebird at the same site and show the resulting change in relative survivorship estimates for males and females for both species, due to higher local dispersal rates of females. This approach does not estimate long-distance dispersal, which remains confounded with true survivorship in revised estimates of  $\phi$ . Nonetheless, the method does produce a less biased and closer estimate of true annual survival and mate fidelity.

## **LONG-TERM TRENDS OF THE ROSEATE SPOONBILL POPULATION IN TEXAS (Oral)**

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Recent trends in Christmas Bird Count and Breeding Bird Survey data for Roseate Spoonbills (*Ajaja ajaja*) in Texas suggest an increasing population. We analyzed the most comprehensive and accurate dataset of the Texas Roseate Spoonbill breeding population over a 35-year period. Over 380 waterbird colonies along the entire Texas Coast were surveyed during a 2-week period in late May - early June each year from 1973 - 2007. Results indicate a slightly decreasing trend ( $P = 0.068$ ,  $r^2 = 0.098$ ,  $n = 35$ ) in the breeding population across the survey period. The upper Texas Gulf Coast consistently supported the highest abundance of breeding pairs ( $f \sim 900$ ,  $SE = 66$ ,  $n = 35$ ) and exhibited a decreasing trend ( $P = 0.002$ ,  $r^2 = 0.248$ ,  $n = 35$ ). The central coast also supported relatively large numbers of breeding pairs ( $f \sim 878$ ,  $SE = 73$ ,  $n = 35$ ) that were stable throughout the survey period ( $P = 0.360$ ,  $r^2 = 0.026$ ,  $n = 35$ ). The lower coast had the lowest yearly breeding population ( $f \sim 308$ ,  $SE = 36$ ,  $n = 35$ ) and exhibited a slightly increasing trend across the survey period ( $P = 0.071$ ,  $r^2 = 0.095$ ,  $n = 35$ ). The upper Texas coast represents an important area of conservation for the Texas population of Roseate Spoonbills. Loss and degradation of estuarine and palustrine wetlands from development and subsidence are most pronounced along the upper coast and likely have influenced the availability of breeding and foraging habitat.



## **SIT AND WAIT: LIVING ON PREDICTABILITY (Oral)**

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Fishing discards are an important diet component for many seabirds. Several studies have shown that seabirds follow boats for food, considering this resource to be predictable, as food will be eventually available during the fishing process. However, the fact that seabirds select the predictable situation amongst the different alternatives has not been studied in the same extent. In this work we have studied the relationship between the presence of fishing boats and the presence of yellow-legged gulls, *Larus michahellis*, in the western Mediterranean Sea. This is the most dominant competitor species in the area and they can choose the foraging situation due to their foraging preferences and their knowledge of the environment, but not because of interspecific competition. Models were based on spatial and temporal variables collected during four aerial surveys, which were conducted off the Ebro delta between December and March 2005. Our results show that the distribution of the species is mainly explained by the time of the day and the density of trawlers. Yellow-legged gulls optimize their foraging time approaching trawlers when they return to the harbour in the afternoons, coinciding with the highest discarding activity. On the other hand, when feeding opportunities in trawlers are less predictable (during the morning) the species has been less abundant offshore. Our models suggest that the gulls do not simply follow trawlers for food but they approach trawlers offshore at the time of the day when they can get the better feeding situation, resting during the rest of the day.

## **REDUCTION IN THE BREEDING RANGE OF NEWELL'S SHEARWATERS PUFFINUS NEWELLI ON KAUAI, HAWAII: EVIDENCE AND INSIGHTS FROM FIELD SURVEYS AND GIS MODELLING (Poster)**

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The Newell's shearwater, or A`o (*Puffinus newelli*), is endemic to the Hawaiian Islands, is listed as State and Federally in the U.S.A., and as endangered on the IUCN Red List. From 1993-2001 a population decline of 60% was reported, based on a concurrent decrease in ornithological radar targets recorded, and numbers of fledglings collected as victims of artificial light attraction and collision with human-made structures. Whereas these surveys provide crucial information about overall trends and one key threat to these birds, there is a paucity of current information describing colony health (e.g. reproduction and demography) and threats (e.g. alien species and habitat degradation). Here we present evidence of what appears to be a breeding range contraction for Newell's shearwater, including auditory and habitat surveys at three colonies found to be inactive in 2006-2007 that were previously active from 1980-1994. We also present preliminary results from GIS habitat modeling analyses comparing these inactive breeding areas to seven currently active areas for the parameters of slope, elevation, and percent native vegetation. Inactive colonies were significantly lower in elevation and composed of significantly less native vegetation, suggesting that in addition to light attraction and predation by non-native animals, breeding habitat modification by non-native plants may play a role in the decline of this species.

## **ABUNDANCE AND DISTRIBUTION OF FORAGING COLONIAL WATERBIRDS IN THE NY/NJ HARBOR (Poster)**

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In June 2008 we initiated a collaborative effort of New Jersey Audubon Society and New York City Audubon to advance the conservation of colonially breeding waterbirds in the NY/NJ Harbor and to instill in local citizens an appreciation for these birds and their habitats. Specific objectives of this project were to 1) mobilize and coordinate citizen scientists to conduct observations of colonial waterbirds; and 2) to determine the abundance and distribution of long-legged colonial waterbirds at various sites and habitats and identify areas used as foraging grounds in wetlands of northern New Jersey. A total of over 50 citizen scientists were recruited to conduct surveys at approximately 40 potential foraging sites in the NY/NJ Harbor including the Meadowlands District, Raritan Bay and Arthur Kill. These volunteers were trained in survey methodology and heron and egret identification. They conducted two surveys per month, recording total number of waterbirds of each species at several locations within their site, as well as habitat, tide and behavioral information. Preliminary results show that Great Egrets and Snowy Egrets are the two most abundant species observed away from the colony at New Jersey sites. Birds use different habitats when foraging and when roosting. There are also differences among sites in foraging success and in their overall use at different times in the tide cycle.

## **HABITAT CHARACTERISTICS ASSOCIATED WITH BREEDING SECRETIVE MARSH BIRDS IN THE MISSISSIPPI ALLUVIAL VALLEY OF LOUISIANA (Oral)**

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Populations of many secretive marsh bird species have declined over the past 30 years, primarily as a function of wetland loss. Louisiana is an important breeding region for many of these species, but has lost 46% of its wetlands in the past 200 years. We need to understand what wetland attributes attract secretive marsh birds to facilitate protection and restoration of waterbird habitat. In the summers of 2007 and 2008 we surveyed 114 wetland sites in the Mississippi Alluvial Valley of Louisiana for six species of secretive marsh birds. We did not encounter enough individuals of three species (*Botaurus lentiginosus*, *Fulica americana*, and *Rallus elegans*) to allow data analysis. For the other three species (*Gallinula chloropus*, *Porphyryula martinica*, and *Ixobrychus exilis*) we modeled the probability of wetland sites being occupied as a function of vegetation characteristics at those sites, while accounting for imperfect detection probabilities. Presence of each breeding species was positively correlated with cattail cover, while presence of *Gallinula chloropus* and *Porphyryula martinica* was positively correlated with cover by some floating plants.

## **TIMESCALES OF RESPONSE BY PELAGIC SEABIRDS TO GLOBAL CLIMATE CHANGE (Oral)**

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Global climate fluctuates on several timescales. I have characterized some of these scales as “cycles”, “trends” and “regime shifts”, in order of increasingly large period, and asked how these environmental changes have impacted populations of pelagic birds. There are many examples of seabird response to cyclic variation in climate, especially ENSO. Indications so far are that, by virtue of their longevity and consequent ability to breed in many years, seabirds recover quickly from declines related to these short-term cycles. Some longer term (decadal or more) declines and increases in seabird populations have occurred that are correlated with longer-term changes in oceanic climate. There are clear examples of regime shifts in marine ecosystems of the North Pacific, North Atlantic and Antarctic Oceans, but these shifts have apparently not caused changes to the dominance structure of seabird communities.

## **GULF COAST JOINT VENTURE CONSERVATION PLANNING FOR REDDISH EGRET (Oral)**

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The Gulf Coast Joint Venture (GCJV) region was one of six priority habitat areas identified in the 1986 North American Waterfowl Management Plan. The GCJV region encompasses coastal marsh, grasslands, and forested habitat stretching from the Texas-Mexico border to Mobile Bay, Alabama. In 2004, the GCJV partnership elected to begin derivation of population and habitat objectives for priority landbird, shorebird, and non-waterfowl waterbird species. The Reddish Egret (*Egretta rufescens*) is among the priority waterbird species identified for habitat planning, implementation, and evaluation by the GCJV partnership. The Waterbird Working Group of the GCJV Monitoring, Evaluation, and Research Team established a population objective of 2100 breeding pairs of Reddish Egrets in the GCJV region, and identified the most important factors limiting the species population as: 1) availability of suitable nesting sites; and, 2) availability of suitable foraging habitat. This presentation describes an attempt to link regional population targets to their habitat needs through explicit model-based derivations based on factors assumed to currently limit population growth. We believe that protection, maintenance, restoration, and creation of optimal colony sites are critical in maintaining current population levels, and in achieving GCJV regional population objectives.

## **INTEGRATED WATERBIRD USE OF MOIST SOIL UNITS (Poster)**

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The Mississippi Alluvial Valley (MAV) provides important stopover habitat for waterbirds during fall migration, however, unmanaged habitat is usually limited. Moist soil units in the MAV can potentially provide more predictable habitat resources for shorebirds, wading birds, marsh birds, and waterfowl during fall migration. In this study, we evaluate waterbird species presence, abundance, and density on moist soil units on six wildlife management areas (WMAs) in the MAV of Louisiana to determine habitat use in relation to management activities and habitat conditions. We conducted 15 weekly surveys of 22 moist soil units from 16 July to 25 October 2007. We visually identified all waterbirds present at survey points on each moist soil unit. In addition, we recorded distance, behavior, habitat, and water depth for all birds observed, and completed 13 vegetation surveys during the season at each survey point. We recorded habitat coverage within 150m of each point. We observed 21,135 waterbirds of 47 species, including 7,894 shorebirds of 18 species. Waterbird abundance peaked from 12-18 August 2007, and again from 21-27 October when waterfowl were present. Shorebirds were most abundant during 12-18 August 2007, and density was highest during 5-11 August 2007. Most moist soil units consistently provided wading bird, marsh bird, and waterfowl habitat, but only sporadically provided shorebird habitat. The amount of herbaceous vegetation and water depth were factors limiting shorebird use of moist soil units.

## **WHIMBREL TRACKED WITH SATELLITE TRANSMITTER ON MIGRATORY FLIGHT ACROSS NORTH AMERICA (Poster)**

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The two breeding populations of Whimbrel (*Numenius phaeopus*) described in the western hemisphere have been thought to have separate migratory routes confined to the Pacific and Atlantic Coasts. Virginia represents a terminal staging area for Whimbrel along the Atlantic Coast and it has been assumed that all of the Whimbrel staging here were from the Hudson Bay breeding population. We fitted an adult Whimbrel with a satellite transmitter on 20 May 2008. The Whimbrel left Virginia on 23 May and arrived on breeding grounds on the north slope of Alaska on 7 June after staging for 5 days on the Mackenzie River in Canada. After 35 days, the bird left the north slope, staged along the Kuskokwim River and then flew nonstop to Willapa Bay, Washington on 10 August. Evidence of a transcontinental migration route brings portions of the two Whimbrel populations into contact during spring migration and suggests that a portion of the western population may undergo an elliptical migration route and overlap with the eastern population along the south Atlantic Coast of North America. These findings also suggest that Virginia may be an important staging area for a portion of the western breeding population. Since peak surveys from our study area have been used, in part, to estimate the size of the Hudson Bay population, these findings suggest that the use of peak surveys from this or other sites along the Atlantic Coast may overestimate the size of that population.

## **BIRD RICHNESS AND ABUNDANCE ANALYSIS OF NORTH AMERICAN BREEDING BIRD SURVEYS (NABBS) AND CHRISTMAS BIRD COUNTS (CBC) HISTORICAL DATA AT CENTRAL PLATTE RIVER NEBRASKA (Oral)**

**Enrique Weir**, River Whooping Crane Maintenance Trust.

The Central Platte River Ecosystem is vastly complex. The physical, chemical and wildlife elements of the river and surrounded wetlands are complicated because an intricate relations between the river flows, precipitations, ground water charge and discharge, evaporation and evapotranspiration. The river runs west to east, the Central Flyway a main corridor for migratory birds; and the wetlands associated to river flow-groundwater equilibrium provide valuable habitat for these. We analyzed the NABBS and CBC historically data from South Central Nebraska (average NABBS from 1967 to 2007 at Kearney, Sumner, and Kennesaw; and average CBC from 1986 to 2007 at Grand Island, Beaver Valley, Calamus Loup, and Branched Oak-Seward) to study how climate variables (precipitation, river flow, temperature average, average maximum and average minimum), and river management variables (river flow, groundwater dynamics) could affect the abundance and richness of aquatic birds in the Central Platte River, Nebraska. Regression analysis shows that river flow, and precipitation were main drivers variables that determined changes in bird richness and abundance during the NABBS as well as CBC surveys. Temperature average maximums were also a driver of abundance in NABBS, and could be related with tolerance-limits of aquatic birds. We discussed the role of river and wet meadows management at Central Platte River in the richness and abundance tendencies.

## **BIRD RICHNESS AND ABUNDANCE IN THE OLIVITOS WILDLIFE REFUGE AND FISHING RESERVE, ZULIA STATE, WEST VENEZUELA (Oral)**

**Enrique Weir**, Platte River Whooping Crane Maintenance Trust.

We studied monthly bird species composition, richness and abundance, from January 1999 to December 2000, in Los Olivito's Ramsar and Wildlife Refuge and Fisheries Reserve, Zulia State, western Venezuela. We observed birds in open and closed habitat associated with mangrove forest by establishing five fluvial transects in five habitat areas: 1. two in the estuary area: Ancon-Punta de Java and Cañonera, 2. three in creeks inside of mangrove forest (New Creek, Old Creek and Oribor Creek, and 3. Swamp back to mangrove forest. Birds were registered monthly for periods of two days in each area (habitat type); every day observation were done running at constant speed through a 2 Km. fluvial transects (using a boat with a 40Hp engine) for two hours in the morning (8:00 h to 10:00 h) and afternoon (16:00 h – 18:00 h). We observed significant differences in richness and abundance related with open and closed habitats, seasonality and tides. Swamp and Los Olivito's Mangroves have a current richness of 78 bird species (from 33 families). However 95 percent of bird assemblage's abundance was represented in only five species: *Phalacrocorax brasilianus* 61%, *Phoenicopterus ruber* 22%, *Egretta thula* 5,0%, *Pelecanus occidentalis* 3,7% , and *Sterna maxima* 3,2%. The dominant species has changed in the last 20 years. *Pelecanus occidentalis* (Brown Pelican) was the dominant species in 1981 and 1981, while *Phalacrocorax brasilianus* (Olivaceous Cormorant) is currently the dominant species (since 1995) in the mangrove and estuary ecosystems and *Phoenicopterus ruber* (Flamingo) in the hypersaline swamp (since 1990). The increment of Cormorant and Flamingo populations as well as the species diversity could be related to the current protection status of wildlife refuge and fisheries reserve of Los Olivito's Ecosystem.

## **EFFECTS OF CHANGES IN GARBAGE MANAGEMENT ON GLAUCOUS GULL DIET AT BARROW, ALASKA (Poster)**

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Glaucous Gulls are major predators in northern Alaska and may be affecting threatened or declining species of birds. Gulls are believed to benefit from anthropogenic foods, but it is not known to what extent this may affect their diet, populations, or impacts on other species. We describe Glaucous Gull diet before and after a change in garbage management in Barrow, Alaska. Prior to August 2007, garbage was deposited at a landfill and covered with earth; afterwards, refuse was incinerated before the ashes were disposed of in a new landfill. While hundreds of gulls had sometimes been recorded at the old landfill, we observed no more than 70 gulls at a time at the new landfill in summer 2008. Gulls continued to feed at dumpsters at the old landfill, where garbage was staged before incineration. The reduced access to garbage was reflected in the diet of gulls loafing in and around Barrow. Garbage was present in 40% of the regurgitated pellets we collected in those areas in 2007; it was present in significantly fewer pellets in 2008 but still made up a substantial portion of the gulls' diet. This indicates that while the change in garbage management had some effect, it was not sufficient to eliminate the potential benefit to gulls. That benefit may enhance gull survival, and the resulting gull population growth could detrimentally affect the gulls' natural prey species. This potential effect will be an important consideration as oil and gas exploration and development continue in northern Alaska.

## **SATELLITE TRACKING OF BREEDING GREAT BLACK-BACKED GULLS (LARUS MARINUS) FROM EASTERN LAKE ONTARIO (Oral)**

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In the last decade, the number of Great Black-Backed Gulls (*Larus marinus*, henceforth GBBG) nesting in eastern Lake Ontario increased to over 30 pairs and prompted us to look at their seasonal movements. In 2002, two adult GBBGs were captured near their nests on Pigeon Island, 20 km SW of Kingston, Ontario, and fitted with back-pack mounted satellite transmitters. General migration patterns, breeding season and over-wintering locations and ranges as well as nocturnal movements were evaluated. The birds' general pattern of movement was to remain near the breeding colony from April until August and then travel south to Rochester, NY, where they stayed until late December. They then traveled to Niagara Falls, NY/ON for up to two weeks before continuing southwest to the Cleveland, OH, area to spend the remainder of the winter. Birds began heading back to the breeding colony in early March to arrive there for April. Both birds occupied similar, overlapping ranges during the winter of 2002/2003. In the winter of 2003/2004, the one remaining transmittered bird spent most of its time in Sandusky, OH, rather than Cleveland. During the breeding season, it was found that Pigeon Island GBBGs consistently flew 40-45 km northwest from Pigeon Island to the Bay of Quinte on what is assumed to be foraging trips. Interestingly, they were also making these trips at night, which is a new insight into the ecology of these birds.

## **WHAT HAS ALL THIS PLANNING DONE FOR WATERBIRDS? A REVIEW OF THE WATERBIRD CONSERVATION FOR THE AMERICAS INITIATIVE (Oral)**

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The North American Colonial Waterbird Conservation Plan was unveiled at the 24th Annual Meeting of the Waterbird Society, held in October, 2000 in Manomet, Massachusetts, USA. This meeting marked the decision of the Society to drop the term “Colonial” from its name, and the Plan soon followed suite, expanding its scope to all aquatic birds not considered waterfowl or shorebirds. The Plan was created to provide a vision and framework for the conservation of waterbirds and serve as the basis of an ongoing initiative, Waterbird Conservation for the Americas. In addition to increased awareness and commitment to waterbird conservation at the North American scale, the initiative has resulted in a series of regional plans for assemblages of Bird Conservation Regions (BCRs). Each regional waterbird conservation plan reflects a process of communication and collaboration between partners within the region, who have compiled and interpreted technical information on regional populations and habitats, assessed conservation status, developed conservation strategies and developed priorities. These plans provide support and perspective for local conservation actions, and serve as a tool in assessing the progress towards designing and delivering projects that address conservation needs. Each region has evidence that planning has successfully positioned waterbirds for increased conservation activity; yet all include recommendations for activities that are not possible given the current level of investment.

## **FEEDING ECOLOGY OF LONG-TAILED DUCKS CLANGULA HYEMALIS WINTERING ON THE NANTUCKET SHOALS (Poster)**

**Timothy White\***, **Richard Veit** and **Matthew Perry**, City University of New York, tim.p.white@gmail.com.

A substantial proportion, perhaps 30%, of the North American breeding population of Long-tailed Ducks (*Clangula hyemalis*) winter in the vicinity of Nantucket Island, Massachusetts. These birds spend the night on Nantucket Sound and commute during daylight hours to the Nantucket Shoals, which extend about 65 km offshore from the southeastern corner of Nantucket. Strip transects done from a single engine plane in 1997 and 1998 indicated that Long-tailed Ducks foraged over the shallower (≈ 20 m depth) portions of the Nantucket Shoals, up to 70 km offshore. Diet analyses of the ten birds collected in February 1998 and five in December 2006 showed that they were feeding principally on *Gammarus annulatus*, a pelagic amphipod, that often forms large aggregations, and is consumed by several species of fishes and marine mammals. Our findings emphasize the importance of conservation of the Nantucket Shoals and the prevention of oil spills or other potentially harmful accidents.

## **STATUS OF WATERBIRD CONSERVATION IN THE UPPER MISSISSIPPI VALLEY / GREAT LAKES REGION (Oral)**

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The Upper Mississippi Valley / Great Lakes (UMVGL) Region is comprised of five Bird Conservation Regions (BCRs) and provides a wide variety of waterbird nesting, roosting and foraging habitats: marshes, ponds, creeks, streams, sloughs, lake shorelines, islands (especially in the Great Lakes), shoals, river floodplains (especially along the Mississippi, Illinois, Missouri, and Ohio Rivers), and reservoirs. This region is used by 46 regularly-occurring waterbird species throughout the year, including 11 species that are of highest or high conservation, and 7 more of stewardship or management concern. Waterbird conservation planning for this region is based on a vision of maintaining and restoring waterbird distribution, abundance and habitats throughout the area, with the ultimate result of robust, self-sustaining waterbird populations throughout their historic or naturally expanding ranges. Implementation of some recommended conservation actions is underway; notably, a fourth Great Lakes-wide colonial waterbird survey with exploration of enhancements to improve detection of trend while at the same time making the survey less labor-intensive; steps towards development of a standardized marshbird monitoring program; identification and prioritization of habitat and sites for conservation by relevant bird habitat Joint Ventures; and emphasis on concerted species-specific strategies where needed, especially King Rail, Common Tern, Whooping Crane, and Double-crested Cormorant. The region's complexity (it includes all or parts of 19 states and 3 provinces) and the controversial aspects of managing abundant piscivorous waterbirds are notable challenges to cooperative conservation.

## **DIET COMPOSITION AND CHANGES IN BODY COMPONENTS OF AMERICAN COOTS WINTERING IN SOUTHWESTERN ARKANSAS (Poster)**

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We investigated diet composition, patterns of digestive tract morphology, and determined nutrient reserve dynamics of American Coots (*Fulica americana*) during the non-breeding period. Coot foraging habits reflected general, opportunistic patterns. Diets were principally comprised of plant matter, but coots increasingly consumed animal matter as winter progressed. Dietary transitions included granivory in fall, aquatic herbivory in winter and omnivory in spring. Body composition and digestive tract morphology differed between sexes and ages within sexes. Mass and length of digestive tract components differed between sexes and age related variation was more pronounced in males. Similar dietary intake and composition during fall and winter elicited similar trends in body composition and adjustments in digestive tract morphology. Differences in diet observed during spring likely involved more complex factors such as behavior, migration, and social differences.



## INDEX (LISTED BY PAGE NUMBER)

Abraham, K.	56	Coleman, J.T.H.	11
Abrahams, M.V.	51	Collazo, J.A.	17, 40
Ackerman, J.	14, 15	Collins, C.	12
Adkins, J.Y.	1, 21	Conway, C.J.	42
Amador-Silva, E.S.	47	Conway, W.C.	54
Anderson, C.	5	Copeland, D.	46
Anderson, J.G.T.	1	Costanzo, G.	20
Andres, B.A.	2	Custer, C.M.	12
Anteau, M.J.	59	Custer, T.W.	12, 13
Arnold, J.M.	2, 46	Dann, P.	44
Athearn, N.D.	3, 14, 15	Darrah, A.J.	13, 35
Baldassarre, G.A.	22	De Marchi, G.	57
Ball, D.	18	Demers, J.B.	14
Ballard, B.M.	3,4,22,64,72	Demers, S.	15, 17, 18
Bartos, A.J.	61	Detwiler, D.L. IV	15
Bates, E.M.	3, 4	DeYoung, R.W.	3
Bauch, C.	2	Donaldson, G.	16
Beardmore, C.J.	4	Doucette, J.L.	16
Bearhop, S.	46	Drew, C.A.	17
Beaudette, A.	5	Duerr, A.E.	68
Beck, E.	5	Duke, R.	17, 18
Becker, P.H.	2	Duncan, C.	49
Bellio, M.	6	Eagles-Smith, C.	14
Below, T.H.	6	Edwards, C.	18
Bernick, A.J.	7	Elbin, S.B.	19, 66
Beyersbergen, G.W.	43	Elner, R.	19
Bolenbaugh, J.R.	35	Enriquez-Medina, F.	42
Bourgeois, J.	17	Erickson, M.E.	20
Bowen, Y.	7	Erwin, R.M.	20
Bowman, J.	56	Farley, G.	18
Boyce, M.S.	23	Felio, J.H.	9, 21, 24
Braasch, A.	2	Fellows, S.	58
Brinker, D.F.	20	Ferrer, X.	65
Brzorad, J.N.	8, 39, 61	Fernández, G.	36, 55
Budd, M.J.	35	Fischer, K.N.	1, 21
Buhl, D.	62	Fitzsimmons, O.N.	22, 72
Burbidge, S.	8	Fleischer, R.C.	28
Catlin, D.H.	9, 21, 24	Forbes, M.R.	59
Cavitt, J.	18	Forgues, K.	22
Chavez-Ramirez, F.	10	Found, C.	23
Chesser, R.T.	28	Franks, S.E.	23, 36
Chiozzi, G.	57	Fraser, G.S.	45, 63
Claassen, A.H.	10	Fraser, J.D.	9, 21, 24, 52
Cohen, J.B.	9, 11, 21, 24	Frazier, M.R.	36

Fredrickson, L.H.	38	Khan, K.	45
Furness, R.W.	46	Kimmons, J.	34
Gailband, C.	24	King, D.T.	21, 34, 37
Gailbraith, H.	25	King, S.L.	33,35,50,66,67
Garthe, S.	29	Kingsford, R.	6
Gebrezgabhier, Y.	57	Kjoss, V.A.	60
Gilbert, A.T.	45	Kotzerka, J.	29
Gilchrist, H.G.	59	Kratter, A.	49
Gilliam, J.F.	40	Krementz, D.G.	13, 35
Gopi, G.V.	25	Kyser, T.K.	36
Granfors, D.A.	26	Lamberson, J.	36
Gratto-Trevor, C.	26	Lank, D.B.	23, 36
Green, M.C.	27,29, 30, 31	Larsen, R.S.	21
Greer, D.	28	Ledwoń, M.	37
Hagos, T.	57	Lee, H.L.	36
Haile, Z.	57	Lemmons, S.	37
Hailer, F.	28	Leumas, C.	38, 52
Hall, S.	34	Levin, I.I.	28
Hamer, K.C.	46	Lor, S.	38
Hanna, A.	64	Lund, D.	19
Harrington, B.	49	Lyons, D.E.	1, 21
Harris, R.	32	Maccarone, A.D.	8, 39, 61
Hatch, S.	29	Mahoney, P.J.	31
Haukos, D.A.	53, 54	Master, T.L.	15, 39
Herring, G.	19	Mathot, K.D.	19
Hewitt, D.G.	72	McGregor, S.P.	56
Hill, A.	29, 30	Mellink, E.	47
Hinojosa-Huerta, O.	47	Melvin, S.L.	40
Hobson, K.	30	Mercer, D.	1
Hodgson, A.B.	31	Merendino, T.M.	22
Holderby, Z.	31	Meyer, K.D.	31
Holmes, N.D.	65	Mikoda, P.	70
Hoover, L.	61	Mills, H.	11
Huntley, B.	46	Mills, W.E.	56
Igl, L.D.	61	Miranda-Castro, L.	40
Irwin, D.	36	Mojica, E.K.	68
Jedrey, E.	32	Moskal, S.M.	3
Jimenez, I.C.	65	Moulton, C.E.	41
Johnson, J.A.	2	Murphy, S.P.	41
Johnson, W.P.	54	Mylecraine, K.	66
Johnston, S.	32, 45, 48	Nadeau, C.P.	42
Johnston, V.	2	Nelson, W.G.	36
Johnston-Gonzalez, R.	2	Neves, V.	63
Kang, S.R.	33	Newhouse, M.	65
Kannan, K.	12, 13	Newstead, D.	42
Karpanty, S.M.	52	Niemuth, N.D.	43
Kay, I.	33	Nisbet, I.C.T.	44, 63

Nol, E.	44	Sauma-Castillo, L.	55
Norris, D.R.	36	Saxena, A.R.	12, 13
O'Connell, A.F.	45	Scherr, H.	56
Olausen, A.	45	Schreiber, E.A.	28
O'Neill, S.E.	48	Schwarz, B.	36
Ordonez, R.	46	Schweitzer, S.H.	56
Ortiz, J.S.	49	Seamans, M.	57
Oswald, S.A.	2, 46	Seleba, G.	57
Palacios, E.	47	Semere, D.	57
Palestis, B.G.	48	Seto, N.W.H.	58
Palme, R.	2	Senner, A.	2
Pandav, B.	25	Seymour, M.	68
Parker, P.G.	28	Shaffer, T.L.	59
Parsons, K.C.	48	Shealer, D.A.	58
Paxton, B.J.	68	Sherfy, M.H.	59, 62
Payne, L.X.	49	Shinn, J.M.	3
Pearlstine, E.V.	49	Smith, F.M.	68
Pekarik, C.	70	Smith, L.M.	3
Pérez, R.G.G.	42	Smith, P.A.	59
Perkins, M.	35	Somers, C.M.	16, 60
Perry, A.	50	Sorenson, L.	60
Perry, M.	71	Sovada, M.A.	61
Pickens, B.A.	35, 50	Stone, H.M.	39, 61
Pierce, A.R.	38, 52	Strickland, B.K.	34
Pierce, J.	51	Strong, C.	14, 17
Pierluissi, S.	35	Stucker, J.H.	62
Pietz, P.J.	61	Suzuki, Y.	1
Pink, M.	51	Szczys, P.	63
Powell, A.N.	70	Takekawa, J.Y.	3, 14, 15
Ray, K.L.	52	Tao, L.	12, 13
Raynor, E.J.	38, 52	Taylor, B.	63
Reinalda, L.H.	1, 21	Taylor, C.	36, 64
Richmond, M.E.	11	Thompson, J.F.	72
Rigby, E.A.	53	Tjelmeland, A.D.	64
Ritchie, S.	17, 18	Torrell, A.C.	65
Robinson, C.	53	Trowbridge, A.	12
Roby, D.D.	1, 21	Troy, J.R.	65
Rohwer, F.	38, 52	Truitt, B.R.	68
Romano, W.B.	15	Tsipoura, N.	66
Rottenborn, S.	17, 18	Valente, J.	35, 66
Route, B.	13	Veit, R.R.	41, 67, 71
Rudstam, L.G.	11	Vermillion, W.G.	50, 67
Rush, S.A.	54	Vidal, R.M.	47
Ruskin, K.	66	Vieites, D.R.	65
Saalfeld, S.T.	54	Villani, R.	68
Sallabanks, R.	41	Voigt, C.C.	2
Sandercock, B.K.	55	Wanler, B.	43

Warnock, N.	15	Wiggers, E.P.	56
Watts, B.D.	20, 68	Wilke, A.L.	68
Webb, S.M.	23	Wilmers, T.J.	31
Weir, E.	69	Wiltermuth, M.T.	59
Weiser, E.L.	70	Wingate, D.	63
Weseloh, D.V.C.	70(2)	Wires, L.R.	72
Wheeler, J.A.	71	Yee, C.G.	72
White, T.	71		