

# Alphabetical list of abstracts for presentations in the 1st Herons of the World Symposium in New Bern, North Carolina, USA, in 2016

Bolded names are the presenters

———— Oral Presentation ————

## **Patterns of annual habitat utilization, spatial distribution, and migration by Great Egrets (*Ardea alba*)**

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State-of-the-art satellite GPS transmitters (48-g Bird Solar; e-obs) are providing unprecedented details regarding movements and habitat utilization for birds heavier than 1 kg. We present current information on habitat utilization and the spatial distributions of 13 Great Egrets (*Ardea alba*) captured in various locations from 2013 to 2015. Nearly 560,000 GPS points were used to quantify the size of areas used by birds during 3694 observation-days by using LoCoH program in the R platform. The habitat size required for breeding (n = 10 birds), particularly when young require most food, is larger than that used for the post-breeding period (n = 7) and during winter (n = 5). All major migrations occurred at night, and we present details for post-breeding (n = 9) and Spring (n = 5) migration segments. Two young-of-the-year, non-breeding birds displayed both conservative and exploratory use of habitat.

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## **Estimating the breeding population of Great Blue Herons in Maine: what's not on our colony list?**

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The Great Blue Heron (*Ardea herodias*) is listed in Maine as a Species of Special Concern due to a decline in nesting pairs and colonies along the coast since the mid-1980s. In order to determine whether the decline is limited to the coast, occurring statewide, or due to movement from the coast to inland sites, an aerial survey was conducted in 2015 to obtain an estimate for the statewide breeding population. Aerial surveys had been conducted previously, but this time a stratified dual-frame design accounting for imperfect detection of colonies was used. The strata were based on habitat and known colony densities. The area frame consisted of 10 km x 10 km plots; a sample of which was searched independently by front and rear observers for both new and known colonies. The list frame consisted of plots that contained known colonies and was only searched for known colonies. Detection of active nests within colonies and colonies themselves were accounted for in the estimation. The estimates of total nests and active nests were obtained from the number of colonies multiplied by the average colony size. The estimate of total colonies for

the state is 336 (range = 261-455 colonies) and the estimate of active nests is 1,800 (range = 1,631-2,159 nests). Observer detection ranged from 31 to 95 percent. The list coverage, or the percentage of colonies included in the list frame, was 67 percent but varied widely among strata. By repeating these methods at future intervals (e.g., every 5 years), we plan to obtain population trends for each strata as well as the entire state of Maine.

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## **Conservation status of herons in Paraguay: future scenarios in face of accelerated habitat degradation**

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Paraguay's five major ecoregions hold a total of 14 heron species. Currently, no species is considered threatened at a national or international level; in fact on the contrary, most species are common to abundant. Exceptions include the Boat-billed Heron, which is scarce and locally distributed, but probably overlooked due to its nocturnal habits; and the three species of bittern (Pinnated, Least and Stripe-backed). Knowledge of the vocalizations of the two *Ixobrychus* bitterns has revealed them to be more widespread and abundant than previously thought, though they are still infrequently recorded and primarily found in wetlands within the Paraguay River valley. A recent increase in Pinnated Bittern records is likely related to the expansion of rice fields, and the relative ease of observing the species in such habitat. Capped Heron is the one species with a restricted distribution, limited to the Pantanal and associated wetlands in the north of the country. Little Blue Heron is a scarce vagrant to the country, though records appear to be increasing. Cattle Egret was already widespread in Paraguay by 1977, when first recorded by ornithologists. There is increasing evidence for seasonal movements by both that species and Striated Heron. While most herons remain common and widespread throughout the country, the increasing loss of wetland habitats, and their degradation through runoff and sedimentation (driven by massive deforestation and conversion to industrial agriculture) is of concern. Although the rapid and ongoing expansion of rice agriculture in Paraguay provides important foraging habitat for at least 8 heron species, their populations depend on the survival of natural wetland and woodland habitats in surrounding areas for roosting and breeding.

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## **Development of a survey protocol for monitoring Reddish Egrets in Florida**

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The Reddish Egret (*Egretta rufescens*) is North America's rarest heron and roughly 10% of its global population resides in Florida. The rarity of the species, its localized breeding distribution and a potential negative population trend have prompted the need to monitor this species. However, standard aerial surveys performed from fixed-wing aircraft often implemented for colonial nesting wading birds are ineffectual for this dark-plumaged and sub-canopy nesting species, leading some researchers to use either direct counts or flight-line surveys. During the 2015 breeding season we compared the efficacy of flight-line surveys and direct counts using data collected by multiple observers during repeated visits to colonies located in three of Florida's core breeding areas (Tampa Bay, Florida Bay, and the lower Florida Keys). Our objectives were to 1) determine the appropriate duration of flight-line surveys, 2) estimate

variation between multiple flight-line surveys performed at the same sites, and 3) estimate the correlation between flight-line surveys and direct counts. Average variation between counts was high for a 1-hr flight line survey (60%), but more acceptable for 2-hr (20%) or 3-hr (16%) surveys. Flight-line surveys often produced abundance estimates that were biased high when compared to direct counts, likely because nest exchanges occurred >1 time per survey, violating a primary assumption of the method, or because breeding sites contained interior ponds used for foraging by adult birds breeding elsewhere. Nevertheless, some breeding sites were not amenable to direct counts and others are in areas where such access is prohibited. Ultimately, variation in habitat, site access, and breeding synchrony will necessitate the use of multiple approaches when conducting a statewide survey.

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## Range-wide Survey of Inland Wading Bird Nest Colonies in North Carolina

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Although fairly common in North Carolina, accurate estimates of Great Blue Heron (*Ardea herodias*) and Great Egret (*A. alba*) abundance are poor. Since the 1970s, wading bird colony surveys have been conducted only for certain regions. From April to mid-May, 2008-2012, we completed a stratified aerial survey of all major waterways within the state breeding range. Goals were to design a repeatable survey accounting for detection probability using a double-observer method. We also wished to evaluate landscape characteristics associated with persistent and abandoned heronries to improve conservation recommendations. A total of 490 active heronries were detected ([192] Piedmont, [298] Coastal Plain), 80% of which had not been recorded previously. Heronry size was not correlated with detection probability and detection probability did not differ between observers (0.9, 95% credible interval [CI] [0.8-1.0]). Along our flight route, the Bayes estimate of total heronry abundance incorporating detection probability was 548 heronries (95% CI [535-561]). We estimated 533 heronries that included GBHE (95% CI: [520-546]) and 38 heronries with GREG (95% CI: [37-39]). Nest abundance estimates were 8,306 GBHE nests (95% CI [7,963-8,660]) and 4,963 GREG nests (95% CI [4,963-5,406]). Other species had low counts and/or detectability and so are not reported.

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## Hydrologic fluctuations influence daily survival rates of small herons and Great Egrets in a subtropical littoral wetland

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Subtropical freshwater wetlands in South Florida USA, support large populations of wading birds that are thought to be food-limited. The production of many wading bird prey species is controlled by hydrological variation, which is increasingly regulated by human activities through water management regimes. Thus, we expected that water management regimes on Lake Okeechobee, Florida USA would also influence wading bird reproduction. We use a model selection approach to investigate the influence of hydrological parameters on the daily nest survival rates (DSR) of wading birds. We pooled Tricolored Heron (*Egretta tricolor*) and Snowy Egret (*Egretta thula*) nests since they are indistinguishable during the incubation period. Because lake stage and water level recession rates, in particular, can be adjusted by water managers, we focused on the influence of those parameters on the DSR of Great

Egrets (*Ardea alba*; n=298) and small herons (n=1,524). Nest survival for all species was highest when lake stage was below 4.0 m and above 3.6 m. Lake stage was the only important parameter that influenced DSR of Great Egrets, but this model was only marginally better than the null model. Water level recession rate, lake stage, and their interaction were important parameters for predicting DSR of small herons, regardless of nesting stage. These species were more sensitive to lake stage and water level recession rate than were Great Egrets. Our results suggest that water management strategies could be designed to benefit species sensitive to hydrologic constraints such as small herons without hindering the reproductive success of less sensitive species.

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### **Current Status, ecological characteristics and conservation of Family Ardeidae in natural and disturbed forests of urban area, Korea**

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Of 72 egret species recorded in the world, 18 species were observed in Korea. According to the nationwide census conducted by the National Institute of Environmental Research between 2011 and 2012, 35,512 breeding pairs at the 148 sites were recorded in Korea. We found 142 breeding pairs of 5 species at 3 sites in Daejeon in 2016. 10 individuals (5 gray herons, 4 great egret and 1 intermediate egret) were tagged with GPS-Mobile based Telemetry (WT 300; 35 x 63 x 14 mm, >27 g, Korea) and released. Some of them (5 gray herons, 2 great egret) were successfully tracked by now. Their home-range sizes were about 20-25 km<sup>2</sup> (100% Minimum Convex Polygon Method, 95% Kernel Density Estimation) in breeding season. They moved down to the southern part of China and Vietnam on October 2015. As a result of analyzing potential habitats using 12 variables selected by Maxent model, 106.68 km<sup>2</sup> (19.7%) were extracted in Daejeon, Korea. Among them, we selected Wolpyung Park as compensatory habitat, and placed 20 decoys with nests and a recorder stored breeding song on the top of trees to induce egret breeding on January 2016, but failed. More effective long-term plan should be needed to solve the conflict between residents and breeding egrets.

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### **Dry rice paddies cause a decline of the breeding herons and egrets in Italy**

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After a period of strong increase since 1980, and a peak around 2000, the breeding herons and egrets in Northwestern Italy entered a phase of decline. The population fluctuations were affected by several climatic factors, but the main cause for the increase was reduced human-induced mortality. The recent decline, however, occurred following the expanding practice of rice cultivation on dry paddies that during 2015 reached 80% of the rice surface in some areas. The dry paddies are not flooded for more than a few days, and become unsuitable for the herons and egrets, except for the Cattle Egret, the only one of the seven species that is adapted to forage on dry lands and that is

still increasing in our study area. In the paddies that remain flooded, prey availability for herons has changed dramatically due to arrival of alien species and to the decreased water level compared to the traditional practices. In the other European areas of rice cultivation, in Spain, France, and Greece, cultivation without submersion has not been adopted yet, but in Italy the new practices are undermining the value of rice cultivation for waterbirds. The monitoring of the 200 heronries in our study area, now in its 45th year, is continued thanks to a group of 100+ volunteer collaborators.

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## **Representing hydrologic variability in heron models: key processes for wetland ecosystem management**

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The response of herons and other wading birds to hydrologic variability has been studied for over 50 years in the Florida Everglades (USA) and globally. Collectively, these studies illustrate a variety of mechanisms through which hydrologic variability affects nesting and foraging, and how this variability can be represented in ecological models that have application to wetland restoration and management. In wetlands with a pronounced seasonal water cycle, herons and other wading birds often initiate nesting when water levels are dropping and aquatic animals are concentrated into shallow water. The success of nesting is dependent on the rate of receding water being at an optimal level, with rates above and below the optimum causing lower nest survival. When water levels stop receding and rise suddenly due to rain or inflows, birds will abandon their nests. This pattern contrasts with that of floodplain wetlands where wading birds often initiate nesting when water levels are rising and prey are dispersing rather than being concentrated. Juvenile aquatic animals disperse out of river channels to the floodplain where they experience a rapid growth rate leading to an increase in prey biomass for birds. The parameters hydroperiod and minimum water level affect the production of prey populations, establishing the upper limit to subsequent foraging conditions, with the actual value being lowered by the degree to which deep water levels restrict access to prey by birds. The range in water level fluctuations defines the spatial extent of habitat that becomes suitable for foraging. In floodplain systems this variable is often the primary determinant of numbers of nests.

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## **Characterization of Ardeid assemblages on the southern coast of Cuba**

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Cuba has 12 species of herons distributed throughout the national territory, with exception of American Bittern, all breeding in Cuba and has migrant populations from North America. The group is well represented in natural and anthropic wetlands, however little has been published about their status and distribution. In this work we evaluated the ardeidos assembly in nine Cuban natural wetlands distributed along the southern coast of Cuba from May 2011 to March 2013, and one ricefield between 1992 and 1995. Of the 12 species represented in the archipelago, nine were present in 100% of observations in nine of the wetlands studied. Here were included all representatives of genus *Egretta* in Cuba. The highest values of abundance were recorded in Los Palacios (1,188 individuals); Delta del Cauto (958 individuals) and Canales Hanábana (924 individuals). In more than 50% of the sites Snowy Egret, Little Blue Heron, Tricolored Heron and Great Egret were identified as the most abundant species. In Punta Caribe and Tunas de Zaza, the highest values of abundance were recorded in the period of Permanent Residence (May-June), while in Los Palacios y Monte Cabaniguán was during the fall migration (October-November). In the remaining sites these higher abundance values were reported during the spring migration (February-March). Meanwhile, in the ricefield 12 species of herons were identified. Of these, the most abundant were Cattle Egret, Snowy Egret, Little Blue Heron and Great Egret. In general, the results support the importance of natural and anthropic wetlands in Cuba for ardeidos.

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### **Clinal variations in dark morph proportion of Reddish Egret (*Egretta rufescens*) in Cuba**

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The Reddish Egret presents a polymorphic plumage that is independent of age and sex. According to information from the ratio of dark morph in some areas of its range, the species appears to exhibit a cline variation, with dark individuals predominating in the most western populations (e.g., Baja California, ~100% dark morph), while the eastern populations contain a small proportion of these (e.g., Great Inagua, ~12% dark morph). An analysis of the proportion of dark individuals over 20 Cuban wetlands revealed a consistent pattern of geographic variation with apparent cline described in the global distribution of the species. In turn, the proportion of dark individuals was higher in the N coast than in the S, but in both cases the probability of observing a dark individual decreased with distance from the western end of Cuba (cline west-east, coast N: 92-50%, S coast: 80-9%). A case study in three wetlands of the south coast distributed throughout Cuba confirm the results found for this coast. The study included systematically sampled in these wetlands for two years.

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### **A decade of Reddish Egret research: looking back and moving forward**

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In 2006, the US Fish and Wildlife Service published a species status report for the Reddish Egret (*Egretta*

*rufescens*), the first status review of the species in 15 years. From that report, it was evident that knowledge gaps on the ecology and limiting factors of the species remained. Since 2006, we have conducted research in Texas and various parts of the species' range on 1) movement ecology, 2) nesting and foraging ecology, 3) juvenile and adult survival and 4) genetic differentiation and gene flow. Juvenile Reddish Egrets exhibit nomadic behavior during post-fledging dispersal before showing little movement during first winter and subsequent breeding season, whereas roughly 60% of adult Reddish Egrets nesting in Texas exhibit migratory behavior overwintering in Mexico and as far south as El Salvador. While annual survival of adult birds is high, survival of juvenile Reddish Egrets is low (~25%) and potentially as low as 10% during first 3-6 months post hatch. Low juvenile survival is in contrast to high nesting survival (~80-90%) from incubation through 4-5 weeks post hatch. Within Texas, we found little genetic differentiation (mtDNA and microsatellites) geographically or between color morphs. Across the range, we found significant differentiation along a longitudinal gradient with genetically isolated population centers in Baja California, Chiapas and Bahamas. Populations in Louisiana, Texas, eastern Mexico and Florida appear to be transitional between the extremes of Baja and Bahamas. Our research fills many information gaps for this little studied species, provides important implications for future research, and informs resource managers for more directed and impactful conservation for the Reddish Egret.

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### **HeronryMAP: Africa — mapping the distribution and status of ardeid (and other waterbird) breeding colonies in Africa**

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Colonial breeding waterbirds are spread across seven bird families — Laridae, Phalacrocoracidae, Ardeidae, Phoenicopteridae, Threskiornithidae, Pelecanidae and Ciconiidae. Due to their conspicuous behavior and often socio-economic and ecological impacts, most taxa have been well studied. In Africa, information on the status and distribution of breeding colonies in the Ardeidae is severely lacking which provides a gap in the knowledge of how important these sites are in terms of location and productivity. HeronryMAP: Africa is a citizen science initiative that aims to address this gap through the systematic collection of long-term data on inter alia where ardeid breeding sites occur, their species composition, nest abundance and site tenureship. Preliminary results are presented from 2013, and challenges identified and discussed regarding data mobilization and sustainability. Future objectives such as the assessment of priority sites, and identification of conservation action for colonies under threat are discussed and the impact of climate and landscape changes are briefly highlighted.

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### **Rice fields support the largest known breeding population of the endangered Australasian Bittern**

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The Australasian Bittern (*Botaurus poiciloptilus*) is a poorly known, globally endangered species with a total population of just 1,000-2,499 mature individuals. The Riverina region of New South Wales is recognised as a stronghold. It supports around 95% of Australia's rice production, which constitutes approximately 100,000 hectares in years of 100% water allocation. Despite this, little was known about the Australasian Bittern population found in these rice fields. From 2012-2016, standardised surveys of rice crops on randomly selected farms in two of the three

main rice-growing areas were used to estimate the population size and determine the extent of breeding. Occupancy at the 23-30 hectare sites ranged 0.23-0.29, depending on the year and region. Most observations were of one or two birds, but up to four were recorded during a single survey. Habitat occupancy modelling, accounting for the unsurveyed third region and substantial detectability issues, suggests that in most years these rice fields attract approximately 500-1,000 mature individuals. This represents around 43% of the estimated global population. Nests found at the randomly selected farms indicate widespread breeding and observations of fledged young confirm that some nests succeed before harvest. The results highlight the overlooked conservation role of agricultural wetlands in Australia and the potential for dual-purpose water use. Bitterns showed a strong preference for more traditional rice growing methods of aerial sowing with early inundation, as opposed to direct-drill sowing with delayed inundation. However, driven by water savings, an increasing number of rice growers are altering their sowing methods and water management. Development of bittern friendly rice growing incentives will be discussed.

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### **Impacts of a road construction on water bird populations and first regional rehabilitation actions at Asunción Bay Ecological Reserve (Paraguay)**

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The Asunción Bay, is a relatively small bay (c.600 ha in total) located along the northern outskirts of Asunción, the capital of Paraguay. Although a relatively small area, more than 290 species of birds have been recorded in the bay, including 89 waterbird. Families represented by most species include Scolopacidae (18 species), Anatidae (15 species), Rallidae (13 species) and Ardeidae (11 species). 34 of the recorded waterbirds are migratory species, including 21 Nearctic migrants and 13 Austral migrants. Due to its importance for migrants in particular, the bay has been designated as an IBA and WHSRN site, and in 2005 was declared as an Ecological Reserve. The recent development of a coastal road has presented important opportunities for the urban population of Asunción to reconnect with its natural heritage, but unfortunately dredging to create the embankment for this road in 2010 destroyed about 70% of the habitat in the bay. The disappearance of muddy beaches on the bay caused drastic reductions of the total number of Nearctic shorebirds that regularly visited the Bay, but also caused changes in abundance and diversity of resident waterbird populations. The Municipality of Asunción and the Ministry of Public Works have been working together with Guyra Paraguay on the implementation of a series of habitat recuperation and management measure to improve remnants habitats for both waterbirds in general and shorebirds in particular.

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### **Intraspecific and Intersexual Variation in Three Species of Wading Birds**

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Intraspecific and intersexual morphological variation is common in many groups of birds, but few data regarding such differences exist for Ardeids. Since 2008, we have trapped long-legged wading birds in Kansas and along the East Coast for telemetry studies. Captured individuals are weighed and several measurements taken before they are released. Beginning in 2013, a blood sample was collected from each bird, which was used to determine its sex.



Measurements of 103 birds of three species were used to examine relationships among mass, culmen length, and tarsus length, and to determine whether males of each species differ from females in these values. Great Blue Herons (1,702-2,859 g), Great Egrets (1,769-1,300 g), and Snowy Egrets (349-539 g) all showed high variation both in body weights and morphometric measurements. For all three species, weight was correlated significantly both with culmen and tarsus lengths, which were themselves strongly associated. For Great Egrets and Snowy Egrets, males were significantly heavier than females and also had longer culmen and tarsus lengths (all  $P < 0.003$ ). Sample size for Great Blue Herons was not large enough to compare male and female birds. We discuss the possible implications of intraspecific variation and sexual differences in Ardeids.

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## **Foraging Microhabitat Selection by Long-legged Wading Birds at an Artificial Weir**

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To better understand how wading birds select among different foraging microhabitats that show spatial heterogeneity, we divided a 100-m-long concrete weir located at the terminus of the Little Arkansas River in Wichita into 10 patches based on water depth. We observed four species of wading birds during 60 1-h periods from 12 June-28 July 2015 to document microhabitat use and feeding behavior. The independent variables collected before each session were time of day, date, water level, water clarity, and flow velocity. We documented capture efficiency, prey length (relative to bill length), and aggressive interactions for Black-crowned Night-Herons ( $n = 396$ ), Great Egrets ( $n = 54$ ), Snowy Egrets ( $n = 36$ ), and Great Blue Herons ( $n = 30$ ). Time of day and water level were the only significant predictors of weir attendance. A total 348 fish were captured, of which 108 were  $\geq 3/4$  bill length or greater. Wading bird species differed in capture efficiency, mean prey lengths, and the primary patch use. Great Blue Herons and Black-crowned Night-Herons captured mainly large fish (gizzard shad, catfish, and freshwater drum); Great Egrets captured both large and small fish, and Snowy Egrets captured mainly small fish (minnows). Overall aggression rate was correlated with the number of large fish captured but not with total fish, whereas the per capita aggression rate was correlated with the number of birds at the weir. Electro-fishing showed a non-uniform distribution of fish among the 10 patches. The pattern of fish spatial distribution was reflected in prey-capture patterns, where mean fish length differed significantly by patch and ranged from 2.8 cm to 11.9 cm.

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## **Recent trends of the nesting location of Grey Herons in Hokkaido, northern Japan**

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The nesting location of Grey Herons (*Ardea cinerea*) in Hokkaido (83,450 km<sup>2</sup>), northern Japan was documented from 1960 to 2016. During the study period, 152 colonies were confirmed to exist, though some of them have been already abandoned. All herons were observed to nest at trees in the inland area until the early 1990s. After the mid-1990s, however, 10 colonies were confirmed in unusual locations: an islet, flooded trees and buoys in reservoirs, and offshore rocks. These type of locations could be considered to be selected to defend their eggs and chicks against terrestrial predators by being surrounded with water area. In fact, in Hokkaido, Brown Bears (*Ursus arctos*) and Common Raccoons (*Procyon lotor*) were observed to eat chicks in conventional colonies in 1994 and 2012, respectively. Moreover, some colonies were recently established in isolated groves in towns and others

adjacent to houses despite the presence of vast woodlands around. It would be another strategy to prevent bears and raccoons from approaching the colony. The number of colonies had increased, at least until 1999, and raccoons, which are alien species, have rapidly expanded their range until now. These situations would increase the encounters between herons and predators, and therefore, herons may be forced to nest in unusual locations.

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### **The effects of colony structure and nest position on the reproductive success of small herons**

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When food is not limiting, competition for high quality nesting sites can limit the density of breeding birds. Quality nesting sites must provide structural support for nests as well as to offer effective protection against predators and unfavorable weather. Anthropogenic influences can alter the structure and composition of vegetation available for nest sites, thereby providing birds with novel habitat. During the 2015 breeding season, we examined the effects of colony structure and nest position on the reproductive success of Tricolored Herons (*Egretta tricolor*) and Snowy Egrets (*Egretta thula*) nesting at Lake Okeechobee, Florida USA, to determine if colonies in anthropogenic habitat (spoil islands) had lower reproductive rates than colonies in natural habitat (willow, *Salix* sp.; islands). Daily survival rate (DSR) of nests did not differ significantly between the two colony types. The best model predicting DSR included nest height, distance to canopy, and type of substrate species (invasive or noninvasive). Apparent survival was higher for nests placed farther from the canopy edge, higher from the ground, and in noninvasive substrate. Results indicate that spoil islands are capable of providing nesting habitat comparable to natural islands in some years. However, factors that led to a lower DSR, (e.g., invasive plants and short vegetation), also tended to be more prevalent on spoil islands, so over a longer time we would expect to see differences in DSR emerge.

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### **Diversity of waterbirds in Periyakulam Lake, Tiruchirappalli District, Tamil Nadu, Southern India**

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The bird community of Periyakulam wetlands in Tiruchirappalli District, Tamil Nadu, Southern India was studied during January 2011 to December 2012. The methodology followed was mainly observations using binoculars, and the site was done by direct count. A total of 35 species belonging to 7 orders and 18 families, including 14 resident species, 16 resident-migrant species, and 5 migrant species. Thirty species of Least Concern and 5 Near Threatened species were recorded in the area during the period. Little egret, Little Cormorant, Purple Moorhen, Purple Heron, Little Grebe, Spot billed duck, Black crowned Night Heron, Indian Pond Heron, Common coot, River tern, White breasted Kingfisher, and Whiskered Tern were the most abundant resident and migrant species found in the Periyakulam wetlands.

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### **Foraging strategy and prey-handling time in White-bellied heron *Ardea insignis* in Namdapha Tiger**

## Reserve, Arunachal Pradesh, India

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The White-bellied heron (*Ardea insignis*) is Critically Endangered and no detailed studies have been carried out prior to ours across the species' range. Studies on the foraging behavior and prey handling time of the heron were undertaken from November 2013 to March 2016 in Namdapha. Focal animal sampling was used to record the foraging behaviour of herons. The major fish species of the reserve were used for length (cm) and wet weight (g) estimates. The White-bellied heron is a visual forager and adapts to forage amidst fast-flowing freshwater rivers in India, especially within Namdapha. Number of foraging attempts and number of fish caught while 'facing water current' (FWC) and 'against water current' (AWC) was studied during different months in three seasons. Though the mean number of foraging attempts during FWC (Mean $\pm$ SD; 0.80 $\pm$ 1.04) and AWC (0.85 $\pm$ 1.05) did not vary significantly ( $t=-0.63$ ; d.f. 558; n.s.) during three seasons, the number of fish caught did (FWC: 0.34 $\pm$ 0.60) (AWC: 0.26 $\pm$ 0.51;  $t=-2.13$ ; d.f. 558;  $p<0.03$ ). The fish eaten ranged in length from 3-60 cm (mean $\pm$ SD) (12.9 $\pm$ 6.8;  $n=335$ ) in Namdapha. Fishes of 7 cm were more (11.1%) in the diet of WBH followed by 25 (9%) and 26 cm (9%). As the size of the fish increased in the diet of WBH corresponding prey-handling time also increased.

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## Status assessment and population trends of the Madagascar Pond Heron, *Ardeola idea* (Hartlaub, 1860)

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The Madagascar Pond Heron, *Ardeola idea*, is a migratory species breeds exclusively in Madagascar and related islands such as Europa, Aldabra, Mayotte and Comoros. Changes in the population of this species were investigated over the last 20 years through literature reviews, field monitoring and surveys undertaken from 1993 to 2016. Data from 108 localities including the seven known breeding sites were collected and analyzed for the species population assessment. The species occurs to all types of wetlands including lakes, ponds, marshes, rivers, mangroves and also rice field. During the non-breeding season, May-October, birds migrate to eastern and central Africa but some population, with 911 records, remain in Madagascar spent austral winter. Data shows that the current population is evaluated at 2,200 breeding birds remaining into its entire breeding areas. The populations are rapidly declining particularly at its main breeding sites. The main threats are the habitat destruction, collect of eggs and fledgling birds, predation and disturbance at its breeding sites.

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## Current status of the Madagascar Heron, *Ardea humbloti* (Milne-Edwards and Grandidier, 1885) in Madagascar

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The Madagascar Heron, *Ardea humbloti*, is endemic to Madagascar and Comoros. The species breeds in Madagascar, with recent records in Mayotte. Distribution and status of the species was investigated over the last 23 years through literature reviews and surveys undertaken from 1993 to 2016 in Madagascar. During this period, 374 records from 108 localities were collected and analyzed. Bird occurs to all type of wetlands habitat with higher concentration recorded to site along the coastal area in western Madagascar; Mangoky Ihotry wetland complex (+100 individuals), Tsiribihina River & delta (+20 individual), Manambolomaty Lakes complex (+300 individual), Baly Bay wetlands (+100 individual), and Mahavavy Kinkony wetland complex (+40 individual). The current population was evaluated at 1,470 individual breeding birds remaining into its entire distribution areas. The population is in declining. The main threats are habitat destruction, disturbance and persecution at its breeding site. Action plan for conservation are needed to preserve this species.

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## Morphological trade-offs and recursive plumage patterns as indicators of integrated evolutionary dynamics in the Ardeidae

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The ultimate form an organism attains is based, in large part, on the rate and timing of developmental trajectories and on compensatory relationships between anatomical structures. For example, there is often an inverse correlation between the size of an organism's head and the length of its legs. To determine whether a compensatory relationship exists between relative head size and leg length in Ardeidae, I measured skull dimensions (length, width, and height of cranium, and total length including bill) and skeletal limb dimensions (femur, tibiotarsus, and tarsometatarsus) of the 12 North American species as well as 10 other taxa, including the morphologically divergent *Cochlearius*. In addition, plumage pattern was tabulated across Ardeidae to assess whether an association exists between various patterns and specific morphological traits. My comparisons show that, in general, there is a negative association between proportionate head size and leg length. *Ardea* species exhibit the smallest relative head size while *Cochlearius*, *Nycticorax*, and *Nyctanassa* have the relatively largest heads. Similarly, *Butorides* and *Ixobrychus* have disproportionately large heads compared to leg length, but since their intracranial proportions are average for the family, the relatively large size of the head results from disproportionately short legs. I propose that the long legs of *Ardea* derive from hypermorphosis while the short legs of *Butorides* and *Ixobrychus* are pedomorphic features, which, in compensation, permit the feet to evolve a specialized prehensile function for grasping branches and reeds. Regarding plumage pattern, there are identifiable trends; for example, smaller species and those that forage in enclosed habitats tend toward cryptic patterns. Additionally, specific plumage patterns are not restricted to closely related taxa but recur in diverse genera across Ardeidae.

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## Prey Consumed by Wading Birds in Mangrove Swamps of Colombia Caribbean Coast

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Understanding the diet of wading birds can act as an instrument to study relations of key ecosystems, such as mangroves. Although the diet of various species has been studied due to their tendency to regurgitate upon capture, for many species their food requirements are still unknown. In 2015, from May until December, we studied the diet composition of wading birds in the best-conserved area of mangrove swamps of Northwestern Caribbean coast of Colombia. This study encompasses both non-breeding season for Little Blue Heron, Tricolored Heron and Snowy Egret and breeding season for Agami Heron, Cocoi Heron, Boat Billed Heron and Bare Throated Tiger Heron. For all species, except Little Blue Heron, fish was the most common prey, with guppies as the most common item followed by gambusia; even with in reduced samples for some egret species. Samples from Agami Heron and Bare-Throated Tiger Heron were too difficult to obtaining for both adults and nestlings, proving them still the most poorly known diet of wading birds in the area and in general in the Neotropic. Based on this information, we assembled a trophic network to better understand the role of wading birds in mangrove areas, and how this can be affected or not due to human intervention. We found out two families of fish, Engraulidae and Poecilidae are the most vulnerable resource of the trophic network, which are used as bait by artisanal fishermen and are also preys eaten by wading birds.

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## **Hérons in Colombia; status, knowledge gaps and conservation**

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Colombia is host of 24 species of herons including both migrant and breeding populations. This significant diversity is due to the geographical position that includes a large number of biomes and wetlands complex in the country, such as Orinoco floodplains, Amazon forests, and Pacific and Caribbean coasts. However, few studies have focused on herons in this country and information about genera *Syrigma*, *Tigrisoma*, *Agamia*, *Cochlearius*, *Ixobrychus*, *Botaurus* and *Zebrius* is scarce. The vast majority of this species inhabits on mangrove forest, swampy forest and natural grasslands that are being profoundly transformed by legal and illegal mining, urbanization, agriculture development, and infrastructure. We made an analysis of risks for herons in Colombia, crossing species distribution and national scale threats. As a result of this analysis we propose two heron species to be included in the Colombian Red List: Zig-zag heron and Agami heron.

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## **A hop, skip and a jump: The use of long-term banding data to understand movement and survivorship of the Reddish Egret in Texas and Mexico**

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Understanding a species' dispersal and movement behavior is critical when developing a conservation strategy at local and global scales. Without knowledge of the species' life history in regards to movement patterns, it can be

difficult to create an appropriate management plan across and within its range, especially if the species in question travels great distances. The Reddish Egret (*Egretta rufescens*, REEG) is a medium-sized heron that displays plumage-dimorphism (dark and white). Its range is along the coast of the Gulf of Mexico, Pacific coast of Mexico, as well as portions of Central American and the Caribbean islands. The primary objective of this research was to estimate survivorship of juvenile REEG through long-term color banding, as well as analyze the movement ecology of individually marked birds across Texas and Mexico. During the breeding seasons between 2006-2016, we color banded REEGs in Texas/Tamaulipas (n=628), Yucatan (n=105), Chiapas (256), and Baja California Sur (n=220). Using multi-state models, we analyzed the movement between color morphs (dark and white), sexes (when known), and the four target breeding regions mentioned above. Variation in movement measurements and juvenile dispersal behaviors was seen among individual birds and within different regions. Our results also suggest that juvenile REEG suffer from high mortality rates, which leads us to believe that this life stage is possibly a limiting factor on the growth of the population across its range. Therefore, our research targets the importance of long-term color banding, yielding to considerable insight on survivorship and movement of a species. As more band-resight data is gathered, our ongoing research of REEG will hopefully contribute to the conservation of one of North America's rarest herons.

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## Response of Avian Communities to Water Management in the Floodplain Grasslands of the Mekong Delta

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Critically important to waterbirds, wetlands in the world's deltas are disappearing at an alarming rate. In locations such as the Vietnamese Mekong Delta, the loss of natural wetlands is almost complete, necessitating research into the restoration and conservation of the remaining remnants. At Tram Chim National Park (TCNP), a restored floodplain grassland in the Mekong Delta, managers use water control structures to conduct season long draw-downs, mimicking the flood pattern of the Mekong River. Few publications have studied avian communities in Southeast Asian floodplain grasslands or evaluated the success of season long draw-downs in maintaining these communities. At TCNP, changes in water management coincided with two surveys of bird and plant communities, one during a period of dry-season water draw-downs (1986-1995) and another following a period where high water levels were maintained year-round (1996-2005). In the spring of 2016, we repeated these surveys to assess the status of TCNP's floodplain grassland communities following the resumption of draw-downs in 2006. Using results from the previous surveys as a reference, we assessed species turnover and used taxonomic and functional diversity indices to compare the avian and vegetative communities present during different water management regimes. In 2016, we recorded 33 plant species and 2,241 individuals of 46 bird species. We found that grassland plant communities remained stable across all three surveys. In contrast, avian species diversity was lowest when high water levels were maintained year-round. Grassland specialists (e.g., *Megalurus* sp. and *Anthus* sp.) were most abundant in draw-down years, while *Ardea* sp. and *Phalacrocorax* sp. were more abundant with high water. As currently implemented, dry-season draw-downs are an effective management technique to maintain floodplain grassland communities at TCNP.

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## Distribution and Temporal Trends of Western Reef Heron (*Egretta gularis*) Populations along the Arabian Gulf Coast, United Arab Emirates

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The Arabian Gulf of the United Arab Emirates contains highly productive mangrove and seagrass habitats that are essential breeding and non-breeding areas for vast numbers of waterbirds. Unfortunately, both mangroves and seagrasses are declining in this area due to anthropogenic disturbances such as pollution, development, and commercial and recreational activities. Due to their dependence on these coastal habitats, waterbirds such as the western reef heron (*Egretta gularis*) can act as important bioindicators of ecosystem health. The estimated global population size of *E. gularis* roughly 10,000 to 100,000 individuals. While populations are considered stable, many important breeding and overwintering areas of the western reef heron remain unprotected. We performed line transect counts at fifteen sites along the Arabian Gulf Coast of the U.A.E. monthly from 2006-2015. Using a mixed effects model, we found that counts varied by both month and year independently, suggesting no interaction between the two fixed factors. Our model analysis also suggested a decline in annual abundance by approximately three birds per year, but lacked statistical significance. We found significant inverse relationships between year and count at the Al Aryam and Abu Al Abyad sites, suggesting annual abundance may be decreasing in these areas. Further research and monitoring of the U.A.E. western reef heron population is recommended due to habitat loss and potential declines of the species.

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### **From Argos to conservation: reporting 4 years of action for the Agami Heron**

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The Agami Heron is ranked 13th among the world's conservation priority heron species, and 2nd for the Americas. In French Guiana, which holds the world's largest Agami Heron colony (representing over 95% of the known population), knowledge was lacking until recently to be able to evaluate the threats on the species and develop an effective conservation plan both for French Guiana and throughout its distribution in South and Central America. To achieve this objective, GEPOG (Group for the Study and Protection of Birds in French Guiana) used the results of two years of Argos tracking of 8 individuals and built up a working group under Heron Conservation (Agami Heron Working Group -AHWG), including several experts and natural protected area managers across South America and beyond. To be effective to serve conservational purposes, research results need to be set in perspective with local and regional environmental, economic, social and political conditions, before being declined in concrete and adapted actions.

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### **Abundance and distribution patterns of two heron species in multiple agricultural landscapes of south Asia**

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Multi-cropped agricultural landscapes in South Asia have recently been discovered to host surprisingly high bird diversity despite a very long history of cultivation and high human density. Nuanced understanding of how herons interact with the seasonal crops and persisting wetlands is absent. Comparisons across landscapes with different levels of cultivation and human densities are also absent. We systematically collected information on seasonal abundance and distribution of two heron species, the Grey Heron *Ardea cinerea* and the Purple Heron *Ardea purpurea*, simultaneously in five agricultural landscapes in lowland Nepal and north-central India during 2014-2016. This project is part of a long-term monitoring framework developed to track the status of large waterbirds in south Asia. We also generated detailed wetland maps for each landscape to determine if abundance and distribution of the two heron species was influenced by wetland extent and position. Both heron species showed: (1) significant spatial and temporal variations in both abundance and distribution in all five landscapes, and (2) considerable complexity in their associations with wetlands varying between landscapes and seasons. Agricultural landscapes showed considerable variations in their utility as heron habitat, with strong evidence of cropping patterns, agricultural intensity, and human population density influencing observed patterns. This is the first assessment carried out simultaneously in multiple landscapes and covering all three seasons for herons in agricultural landscapes. We will discuss the conservation implications of the findings, and future research needs.

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### **Making a case for long-term monitoring of large waterbirds in agricultural landscapes: preliminary findings from south Asia**

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Scientific attention to large waterbird ecology outside of the United States and Europe, unfortunately, continues to be low. Understanding of large waterbird needs is therefore biased, with literature frequently suggesting that intensively-cultivated agricultural landscapes have poor utility as large waterbird habitat. Assumptions regarding the impact of areas with high human densities and long agricultural histories on waterbird populations drive global status assessments despite lack of empirical evidence. In south Asia, agriculture is the dominant land use with some areas experiencing cultivation for several centuries. In other areas, government policies are driving increases in cultivation with concomitant alterations in land use, particularly wetland persistence. These landscapes remain largely unexplored for biodiversity, with meagre to no information existing on large waterbirds in these areas. In 2012, as part of Program SarusScale, we instituted a systematic, spatially-explicit, landscape-scale, long-term monitoring program focusing on large waterbirds (cranes, storks, ibis, spoonbills and herons) in seven areas in lowland Nepal and north-central India. These areas were chosen to represent variations in cropping history, agricultural intensity, crop species, human population density, rainfall patterns, and wetland persistence. The effort has yielded: (1) new populations of species of global conservation concern (Sarus Crane, Lesser Adjutant, Asian Woolly-neck); (2) novel information on heronry ecology; (3) evidence for landscape-scale effects of croplands on large waterbird distribution; and (4) a high value of agricultural landscapes as habitat for several large waterbird species. We posit therefore that assumptions regarding status of large waterbird species using land use alone require to be revisited. Evidence-based understanding of the utility of different habitats and land uses to large waterbirds is critical to obtain realistic large waterbird status assessments.

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### **Collective Colony Formation Algorithm**



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Colonies of breeding herons and egrets should be located so as to maximize individual resource intake. Food spectra of these species are relatively strict, and their colony sites are restricted to wood and wetlands, so it is relatively easy to specify their habitat requirements. But simple calculation of availability of food and nesting habitats often fails to explain why colonies were formed at specific locations. We tackled this problem by a different analysis of heronry locations, using long-term data for large study areas in Italy and Japan. First we incorporated not only favorable resource sites, such as nesting and foraging sites, but also unfavorable sites, such as urban and bare ground, for evaluating probability of colony formation. Second we incorporated site fidelity, or tendency to reuse the same places as colonial sites. The second aspect was inspired by the fact that nearly two thirds of colonies formed in the past 30 years in our study area in Japan, and in the past 43 years in Italy, were located exactly at the same or at nearby sites. We applied the random forest analysis to create the collective brain, or colony locating algorithms. Their collective brains show that they used specific scale and land use combinations for colony formation, avoiding urban or bare fields at the 10 km scale, but favoring ever green forest at the 4 km scale. Importance of site fidelity constantly increased after 1995 in Italy, and after 2005 in Japan. We discuss the change in colony formation algorithms according to the change of member species in colonies.

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### **Potential Impacts in heron populations due to scenarios of climate change in South America: focus in Paraguay and bordering countries**

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Climate change affects ecosystems, habitats and species with increasing velocity and continuity. Climate change is expected to cause shifts in the geographic distribution of species worldwide as species track their optimal habitat which will likely shift as a result of rearrangement of climate zones. Water and wetlands are very linked to heron populations and severe extreme conditions such as drought and flooding may affect these populations in light of the different future scenarios related to shifts in temperature and rainfall. We here analyze the historical information on climate for Paraguay and the distributional ranges for the 14 Ardeidae species occurring in the Paraguayan territory and their contribution to the 57 country's Important Bird and Biodiversity Areas (IBAs). Though most of the Paraguayan heron species may not be severely affected by the different climate change scenarios, this contribution highlight some of the threats and identify strategies for creating conditions towards more resilient heron populations which will serve to decision makers for improving their response and support for natural resource management.

———— Poster Presentation ————

### **Importance of Costa Rican Conservation Areas and IBAS for Ardeidae conservation and management**

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Costa Rica has 350 documented wetlands (350,000 ha) in the National Wetland Inventory; all them administrated by Conservation Areas (Environmental Ministry). However the diversity of more of them is poorly known (except Ramsar Sites). Ardeidae species live and move along the country. I used 55,000 electronic records from the National Museum and Global biodiversity information facility (GBIF) to create Conservation Areas and IBAS ardeidae species lists and prioritize them by species diversity, vulnerability and future needs. I applied ecological niche modelling for Costa Rica threatened or sensible species: Agami Heron, Least Bittern, Pinnated Bittern and Rufescent Tiger-Heron.

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**Great Egret roosting dynamics along the North Carolina coast**

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To understand more about the habits, habitat preferences, species composition, abundance trends and overall importance of Great Egret (*Ardea alba*) roosting sites, we monitored eight roosts along the North Carolina Coast from 2015–2016. These roost locations, in Carteret County and at Lake Mattamuskeet National Wildlife Refuge, were obtained through reported observations of tagged egrets from concerned citizens and from a separate radio-telemetry project. Only two of the eight roosting sites have been used consistently by Great Egrets throughout the year; these roosts are on suburban, privately-owned land and are at risk of development or other manipulation. Three roosts are used on a short-term basis ( $\leq 3$  consecutive months), two sites have been deemed inactive, and we lost access to another. Roost size ranged from 0–259 Great Egrets. High counts of other colonial waterbirds at these roosts include 6 Snowy Egrets (*Egretta thula*), 46 Cattle Egrets (*Bubulcus ibis*), 20 Black-crowned Night Herons (*Nycticorax nycticorax*), 15 Little Blue Herons (*Egretta caerulea*), 7 Green Herons (*Butorides virescens*), 7 Great Blue Herons (*Ardea herodias*), 1 Tri-colored Heron (*Egretta tricolor*), 383 White Ibis (*Eudocimus albus*), 18 Glossy Ibis (*Plegadis falcinellus*) and 1097 Double-crested Cormorants (*Phalacrocorax auritus*). Our data collection is ongoing and will supplement other roost monitoring projects in North America.

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**The correlation between prey item distribution and Reddish Egret (*Egretta rufescens*) foraging behavior**

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The Reddish Egret is a coastal wading bird with an IUCN conservation status of near threatened, and is listed as threatened in Texas where much of its breeding population occurs. We utilized a Texas Parks and Wildlife Department coastal fisheries database to examine spatial and temporal factors driving prey community structure in

the Laguna Madre of Texas. We divided the Laguna Madre into three regional zones: Upper Laguna, Landcut, and Lower Laguna. The fisheries data was collected from 1976-2014 and consisted of multiple seine hauls each month. Environmental data including salinity, turbidity, and temperature were also collected corresponding to each seine haul collection event. We limited the fisheries data to only include those species either known to be prey of Reddish Egrets or were members of the same genus as known prey species. The dataset was also broken into breeding, post-breeding, and migration-wintering seasons based on Reddish Egret life history. We used multivariate analysis to determine what biotic and abiotic factors influenced prey species distribution. This multivariate analyses showed prey varied by both season and region within the Texas Laguna Madre. Future analysis will examine the relationship of prey distribution to known Reddish Egret colony site location and nest initiation date.

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## **Population Viability of the Reddish Egret (*Egretta rufescens*) in Texas: An Analysis of Management Actions and Implications**

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

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## **Status and Conservation of White-eared Night Heron in Vietnam**

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For the last ten years, several works have been done for the little known and endangered White-eared Night Heron *Gorsachius magnificus* in Northern Vietnam. From direct field surveys and interview the local hunters, we confirmed the records of this species at three different sites in two provinces in Northern Vietnam including (Cho Don and Ba Be districts of Bac Kan province), Trung Khanh district of Cao Bang province. We have also confirmed the occurrence of 8 breeding pairs and estimated the population size in Northern Vietnam is under 100 individuals.

The main threats to the species have been identified including habitat loss and hunting. Several conservation works have been done such as setting up the nest protecting group at Xuan Lac and Ba Be sites and the species action plan have been made. Particularly, this species was included in the 160 Degree of Vietnam Government in 2013 which is used as the mainreference for Vietnam penal code and Biodiversity Law.

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## Changes in populations of colonial herons and egrets in Japan

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Rice is the most important crop in Japan, and large areas of rice paddies support large populations of colonial herons and egrets. Japanese people have traditionally worshiped herons and egrets as gods protecting crops from pest bugs and locusts. But population sizes of herons and egrets are thought to be declining after World War II due to the decline of areas of rice fields. Here we report colony dynamics around Ibaraki Prefecture, eastern Japan. First, 10-year population dynamics from 2002 to 2011 were addressed by censuses based on a combination of aerial photography and ground surveys. Population changes differed among the six constituent species: Great Egret (*Ardea alba*) and Black-crowned Night Heron (*Nycticorax nycticorax*) remained relatively constant, while Grey Heron (*A. cinerea*) and Intermediate Egret (*Egretta intermedia*) increased, but Little Egret (*E. garzetta*) and Cattle Egret (*Bubulcus ibis*) decreased. The marked increase of the Grey Herons contributed to the increasing temporal variation in colony size and in species composition ratio. Second, whether the addition of Grey Herons has affected colony persistence was examined. After the increase of Grey Herons in 2005, colonies with Grey Herons had a greater propensity to persist. Grey Herons began to take the initiative in establishing colonies, and other species began to follow them in colony site selection. The expansion of Grey Herons into mixed-species colonies has promoted the persistence of colonies, and local populations of colonial herons and egrets seemed to gain the benefit of colony sustainability.

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## Distribution and abundance of egret and night-heron species in Pennsylvania, past and present

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Of the egret and night-heron species inhabiting Pennsylvania before the turn of the 20th century, only the Black-crowned Night-Heron was reported reasonably often as a breeding species. Yellow-crowned Night-Herons and Great Egrets were recognized only as stragglers and post breeding wanderers. At the turn of the 20th century, a few nests were reported in southeastern Pennsylvania, also the focus of Black-crowned Night-Heron nesting at the time. Nests of all three species increased in number through the mid 20th century, likely a response to recovery from plume hunting and subsequent range expansion. At this time major colony location switched to the lower Susquehanna Valley and environs from the southeast, perhaps due to increasing development in this most populated corner of Pennsylvania. In the mid 20th century, the three species were joined by relatively short-lived colonies of Snowy and Cattle Egrets, also nesting in the lower Susquehanna Valley. Beginning in the early 1970s, colony locations and numbers were documented routinely and, with the advent of two state-wide atlas efforts spanning 25 years and

eBird, a continuous and accurate record of population status has been available since then. Interestingly, throughout this entire period, few individuals and almost no nesting have occurred in the western half of the state. The number of colonies and current population levels of all three species warrant endangered status within the state.

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## Mitochondrial and Nuclear Phylogenies of the Herons

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Systematic relationships of the herons (Aves: Ardeidae) are of strong interest to ornithologists. Here we present phylogenies derived from both mitochondrial (cytochrome b) DNA and next-generation sequencing of nuclear DNA, encompassing most of the world's heron species. Phylogenies from both genomic regions were largely concordant with similar structures confirming the monophyly of five main heron groups: (1) *Cochlearius* (*Tigrionis*, *Tigrisoma*); (2) *Agamia*; (3) *Zebrilus* (*Ixobrychus*, *Botaurus*); (4) *Syrigma*, *Pilherodias*, (*Egretta*), (5) (*Butorides*, *Ardeola*) (*Ardea*, *Casmerodius*, *Mesophoyx*, *Bubulcus*). The night-herons *Nycticorax*, *Nyctanassa*, and *Gorsachius* appear to be polyphyletic.

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## Effects of hydroelectric generation on foraging in Great Blue Herons (*Ardea herodias*)

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Tailwater streams below hydroelectric dams are subject to drastic changes in water depth and velocity over short periods of time. The effects of altered flow regimes on macroinvertebrates and fish have received significant study, but the effects on other wildlife have received virtually no attention at all. I examined the effects of altered flow regimes on foraging success and bird abundance of great blue herons (*Ardea herodias*) at the Lake Wylie Dam near Rockhill, South Carolina, USA. Heron foraging was observed from the dam structure to a distance of 850 m downstream of the dam. During periods of no generation foraging rates were highest at shallow areas 500-850 m below the dam and lowest near the dam. During generation foraging rates were highest immediately downstream of the dam near the outflow of the generators and foraging in the shallows downstream was very low. Censuses conducted every thirty minutes during foraging observations show that significantly more herons were present near the dam during generation than in periods of no generation. Conversely, in the shallow areas 500-850 m below the dam, more herons were present during periods of no generation than during generation, though the differences at this location were not significant. Great blue herons generally forage solitarily but hydroelectric dams concentrate foraging great blue herons into much greater densities than they are found elsewhere. This may impact breeding colony size and the distance travelled between foraging and nesting sites, particularly during the breeding season when adults are feeding young.

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## **Survival and movements of Black-crowned Night-Herons in Lake Erie, Ohio**

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Located 9 miles due north of the Ohio mainland, West Sister Island is home to 40% of the nesting herons and egrets in the U.S. Great Lakes. One such species of heron, Black-crowned Night-Heron, has experienced a decline in breeding pairs from 3,000 in 1977 to 387 pairs in 1999 and is currently listed as threatened in Ohio (Hothem et al. 2000). Understanding factors influencing movements of individuals across spatial and temporal scales is critical to the preservation of populations threatened by environmental change. Using this information, in accordance with survivorship estimates, is important in understanding population dynamics and the conservation needs of species. To estimate post-fledging survival and examine dispersal patterns, Black-crowned Night-Herons (n=15 fledglings) were marked with coded nanotags in Lake Erie, Ohio, in 2015. Adult night-herons (n=5) were captured at local marinas near public-use fish-cleaning stations using a baited woosh net technique. In combination with active hand tracking, automated telemetry towers were used to passively monitor movement activity of marked birds. During the 2016 nesting season, we will use the same techniques to deploy coded nanotags (n=60) and ARGOS satellite transmitters (n=15 adults). I will present preliminary results on fledging rates, survival, recruitment, and movements of juvenile and adult Black-crowned Night-Herons. Incorporating knowledge of night-heron movement and population demographics may help guide future management decisions to maintain a viable population.

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## **ARGOS tracking to understand the ecology and behavior of Agami Herons**

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The Agami Heron is ranked 13th among the world's conservation priority heron species, and 2nd for the Americas. Until recently, nothing was known about the feeding grounds of this species during the breeding season, or about areas used during the nonbreeding season. In French Guiana, which holds the world's largest Agami Heron colony (representing over 95% of the known population), the location and characterization of these habitats as well as the identification of the geographic location and routes travelled by breeding and non-breeding individuals has been crucial to evaluate the threats on the species and develop an effective conservation action plan both in French Guiana and throughout its distribution in South and Central America. To achieve this objective, GEPOG (Group for the Study and Protection of Birds in French Guiana) tracked 8 Agami Herons in 2012 and 2013 via the European LIFE+ Cap DOM program. Data from 4 individuals show that this species migrates north and south along the coast (Brazil, Suriname and Venezuela) and is able to cover up to 1,300 km within two months, including several stop-overs. Sizes and habitats of the breeding season home ranges are determined.

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## **Seasonal variation of Reddish Egret movement along the Gulf of Mexico**

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Understanding seasonal variation in waterbird movement is essential for conservation management of key habitats used during breeding, post-breeding and wintering seasons. Reddish egrets (*Egretta rufescens*) are a near threatened waterbird species with the breeding population primarily occurring along the Texas coast. There has been limited knowledge on their movement especially changes in movement from juvenile dispersal to breeding adult. In this study, we estimate seasonal variation in home range size and site fidelity of reddish egrets. Data was analyzed from five years of satellite telemetry data collected during 2010-2015 from 25 individuals along the Texas Coast in the Laguna Madre. Our results show individual home range sizes were the largest during the 2010 breeding season 3,825 km<sup>2</sup> (n=20) and decreased to 145 km<sup>2</sup> (n=19) in the 2010 winter season. Home range size varied between age and season with an overall decrease during the study. During 2013-2015, home range size significantly decreased to <3 km<sup>2</sup> suggesting further evidence for weak long distance migration in this species. Of the remaining tagged birds from 2013-2015, there was no evidence of site fidelity to the natal colony. All of these birds settled in the southern tip of Texas and the Laguna Madre y Delta del Río with the largest dispersal of 165 km. Our study is the first study to track individual Reddish Egret movement from juvenile age class to breeding age class.

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### **Habitat characteristics and seasonal numbers of Great Egrets at 70 roost sites in the area of Southern Ontario, Canada**

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Roosting sites of Great Egrets (*Ardea alba*) away from breeding colonies are little known and studied. Our objective was to identify roosting sites, their size and habitat, annual usage and rarity, and to answer the question of whether roost sites should be Important Bird Areas (IBAs). We searched for and monitored roosting sites annually, 2008-15; 70 confirmed roosting sites were located in southern Ontario and adjacent U.S. states; 18 other sites were suspected of being roosts. All roosts were located in wetlands where microhabitat included: adjacent to water in trees on mainland (40%) or islands (11%), shallow water or mudflats (25%), trees in water (11%), bushes in water (7%) and herbaceous vegetation in water (6%). The most common size categories were 6-15 birds (30%) and 16-40 birds (24%) but individual roosts ranged in size from 1 to 816 birds. Most roosts consisted of a single site in a wetland, however, at 38% of the wetlands, egrets roosted sequentially at 2 or more sites within the wetland, i.e. they moved to a 2nd site within the wetland, often within the same season. They often moved from trees to mudflats as water levels receded. Roosts usually became active during mid-June to early August, had peak numbers in late August-early September and declined in numbers during late September-late October. Not all roosts are worthy of IBA designation.

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### **Long Term monitoring of egrets and herons in Hong Kong (1989–present)**

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Systematic, territorial-wide monitoring of egrets and herons has been conducted in Hong Kong since 1989. Through the population change, this monitoring could reveal how egrets and herons make use of fragmented wetlands and adapt dynamic change in urbanized landscapes. In recent years, the annual population of five species (Great (*Ardea alba*), Little (*Egretta garzetta*) and Cattle Egrets (*Bubulcus coromandus*), Black-crowned Night Heron (*Nycticorax nycticorax*) and Chinese Pond Heron (*Ardeola bacchus*)) fluctuated around 1,000-1,400 nests, with Little Egret and Chinese Pond Heron were the dominant species. The Great Egret exhibited a long term increasing trend (from zero in 1989 to 283 nests in 2015), while Cattle Egret showed a long term decline in the number of nests (from 118 nests in 1989 to 54 nests in 2015). Although pond type wetlands, and farmlands in Hong Kong were degraded in terms of fragmentation and shrinking in area during the period, both the total number of nests and the number of colonies in 2015 are higher than 1989. This may imply that nesting birds tend to split into more small colonies, and these colonies could be situated in close proximity to feeding habitats. This may help reducing energetic costs. Also, their feeding habitat use pattern may shift to coastal wetlands in order to compensate for the loss of pond type wetlands and farmlands. Pollution control in coastal areas, and better management of protected wetlands (for instance the Mai Po Nature Reserve and Hong Kong Wetland Park) may also provide prime feeding habitats although the wetland area was shrinking.