POSTER GALLERY

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(1) Prebreeding migration strategies of mallards wintering in the Mississippi Alluvial Valley

Nick Masto - *PhD student, Tennessee Technological University*; Email: nmmasto42@tntech.edu

Spring migration is a crucial time for waterfowl, yet stopover ecology and migration strategies are the least studied aspect in the otherwise well-studied Anatidae. Specifically, variation in time-minimizing and energy-maximizing migration strategies likely exist on a spectrum within and among wintering duck populations, but fitness and habitat management consequences relative to varying migration strategies has not been studied. In this poster presentation, we 1) describe spring migration chronology of mallards wintering across three states in the Mississippi Alluvial Valley, and 2) examine behavioral and spatial migratory patterns in the context of time-minimizing and energy-maximizing migration strategies. In winter-spring 2019-2020, we deployed animal-borne GPS/GSM transmitters on male and female mallards captured in Tennessee (n = 25 females and n = 58 males), Arkansas (n = 18), and Louisiana (n = 43; n = 143 total). We calculated spring migration departure and arrival to breeding grounds, and total migratory duration. We also estimated migration metrics which will index a gradient of time-minimization and energy-maximization strategies including migration speed and distance, number and duration of stopovers, and maximum step-length. As expected, mallards wintering in Louisiana, initiated migration ~12 d earlier than birds wintering in Arkansas and Tennessee. However, birds from Tennessee arrived to the breeding grounds 12 days later than the other two cohorts, despite being closest to the breeding grounds. In addition, Tennessee mallards migrated more slowly and with more frequent stopovers. Finally, mallards migrating from Arkansas stayed at stopovers only 12 d (SE = 1.7 d), ~5 days less than birds from Louisiana and Tennessee (16.7 d [SE = 1.9 d] and 17.3 d [SE = 1.0 d], respectively). We conclude that early arrival to the breeding grounds may be a stronger selective pressure for mallards west of the Mississippi River. Likewise, energy-maximizing and partial migration strategies may be a profitable strategy for some individuals from Tennessee. Based on preliminary data, it seems that stopovers, migration corridors, and overall strategies differ among geographically distinct wintering mallard populations. Future analyses will include Dynamic Brownian Bridge Movement Models to identify migration corridors, important stopovers, and areas of conservation concern for spring-migrating waterfowl. Estimating migration chronology and critical stopover regions may allow conservation planning organizations to fine-tune spring habitat management.

(2) Depletion Rates of Flooded, Unharvested Corn in Western Tennessee

Track: Wildlife

Cory J. Highway - *Graduate Research Assistant , Tennessee Technological University;* Email: chighway42@students.tntech.edu

Abstract : Management of wintering areas for non-breeding waterfowl necessitates provision of forage to meet the energetic demands associated with recovering from autumn migration, maintaining body condition during winter, and preparing for spring migration. Wetland managers are often tasked with providing energy-rich foods and making them available for waterfowl during the winter. Some waterfowl species such as the mallard (Anas platyrhynchos), readily forage on available agricultural seeds to meet their energy requirements. Thus, calorie-dense agricultural seeds readily consumed by waterfowl such as corn (Zea mays), grain sorghum (Sorghum bicolor), millet (Echinochloa spp.), and soybeans (Glycine max), are often planted by wetland managers to supplement waterfowl diets and meet energetic demands of wintering waterfowl. In western Tennessee, flooding unharvested corn is a popular management tool used by hunters and wildlife managers to attract and provide energy for waterfowl. However, the degree of utilization and depletion of flooded, unharvested corn by waterfowl during winter is relatively unknown. We measured corn depletion by repeatedly surveying 30 flooded, unharvested corn fields at two-week intervals throughout the winter (October-February), to estimate and determine the factors influencing depletion of flooded, unharvested corn. We will develop a model for depletion of flooded, unharvested corn to help estimate carrying capacity for waterfowl and better understand the movements of mallards in relation to food resources in the region. Likewise, our estimates of factors influencing depletion rate of flooded, unharvested corn will allow wetland managers to plan spatial and temporal distribution of this resource to ensure availability across the wintering period.

Author(s): Cory J Highway, Tennessee Technological University; Abigail G Blake-Bradshaw, Tennessee Technological University; Nicholas M Masto, Tennessee Technological University; Jamie C Feddersen, Tennessee Wildlife Resources Agency; Heath M Hagy, U.S. Fish and Wildlife Service; Daniel L Combs, Tennessee Technological University; Bradley S Cohen, Tennessee Technological University.

Tags (Key Words): waterfowl habitat Tennessee

(3) **Effects of Prescribed Burning on White-tailed Deer Habitat in the Southeastern United States: An Analysis of the Literature**
Track: Wildlife

Miranda L. Hopper - *Student, University of Georgia*; Email: mlh52798@uga.edu

Abstract : In the southeastern United States, prescribed burning replicates the effects of naturally occurring fires historically common in the region. Prescribed fire is a cost-effective tool widely used by managers to benefit timber and wildlife objectives including restoration and maintenance of critical habitats for wildlife. However, species-specific guidelines are needed to inform managers how prescribed burns should be conducted to best meet objectives. We reviewed available literature concerning prescribed fire and habitat management for white-tailed deer (Odocoileus virginianus) in the southeastern United States. We found >80 scientific works in the primary literature since 1955. Studies documented effects of fire on deer behavior and nutrition, plant community response, forage availability, and fire seasonality and interval. The literature supported that white-tailed deer increased use of burned areas to access improved forage ≥1 month after burning when nutritious browse became available. Deer maintained unburned portions of their home ranges likely to access cover. Available forage on burned sites had consistently higher nutritional value versus unburned sites, but forage quality declined 4 to 5 years after burning. In general, a 3- to 5-year fire-return interval is recommended to allow for woody understory development to benefit deer. Shorter intervals may eliminate soft mast production and limit adequate cover, specifically during fawning season. Longer fire-return intervals caused declines in forage quality. Growing season fires promoted a grass-dominated understory, while dormant-season fires increased herbaceous and woody flora. Since plant recovery occurs more rapidly following early growing season fires, requirements for forage and cover should be considered when planning prescribed burns. Best practices for managing deer habitat with prescribed burning include combining fire with other silvicultural treatments, such as thinning and herbicides, and varying fire-return intervals, seasons, and severity to create mosaics of habitat that ensure quality forage and cover availability across years.

Author(s): Miranda L. Hopper, The University of Georgia; Gino J. D'Angelo, The University of Georgia

Tags (Key Words): white-tailed deer, prescribed fire

(4) **Evaluating the Impacts of Wild Pigs on Ecosystem Health and Water Quality in Palustrine Wetlands in the Gulf Coastal Plain Region of Alabama**
Track: Wildlife

Elizabeth A. Bradley - *Graduate Research Assistant, Auburn University School of Forestry and Wildlife Sciences*; Email: eab0128@auburn.edu

Abstract : With over 2.3 million acres of wetlands and 132,000 miles of rivers and streams, Alabama's abundance of riparian and wetland systems provides ideal habitat for wild pigs, Sus scrofa. One of the most biodiverse states in the US, Alabama's watersheds are critically important ecosystems that provide incalculable benefits to the state's inhabitants human and wildlife alike. As ecosystem engineers, wild pigs significantly alter wetland and riparian ecosystems through disruption of abiotic and biotic conditions. The negative impacts of wild pigs on wetland vegetation and water quality have been shown to increase the risk of transmission of disease-causing pathogens. Wild pigs are well-documented transmitters of disease; 87% of swine pathogens identified by the World Organization for Animal Health have been shown to cause clinical disease in livestock, poultry, wildlife, and humans. Many of these pathogens are waterborne and have significant implications for Alabama's $3.8 billion livestock and poultry industry. However, there is limited research assessing the impacts of wild pigs on Alabama's wetland ecosystems, water quality, and potential pathogen transmission. As part of the Alabama Feral Swine Eradication and Control Pilot Program and in coordination with the USDA-NRCS and USDA-APHIS, this project aims to evaluate the impacts of wild pigs on ecosystem health and water quality in Palustrine wetlands in the Gulf Coastal Plain region of Alabama. The project will assess standard metrics of water quality, wetland vegetation composition and health, and pathogen indicators of public health concern in selected watersheds in the Gulf Coast and Wiregrass regions of the state prior to and post wild pig removal effort.

Author(s): Elizabeth A. Bradley, Auburn University School of Forestry and Wildlife Sciences; Graeme Lockaby, Auburn University School of Forestry and Wildlife Sciences;

Tags (Key Words): Wild Pigs, Water Quality

(5) **How Do Wetland Birds Respond to Habitat Variables Associated with Wetland Restoration? An Evaluation of Wetland Reserve Program Easements in Western Kentucky and Tennessee**
Track: Wildlife

David P. Hicks - *Student, University of Missouri*; Email: dphzn6@mail.missouri.edu

Abstract : The Wetland Reserve Program (WRP) conducts wetland restorations on private lands and seeks to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. Restoration activities on WRP sites often focus on improving wildlife habitat that supports hunted species such as migratory waterfowl but it is uncertain how restoration methods affect non-game waterbird communities (Charadriiformes, Gruiformes, Ciconiiformes, and Podicipediformes). Our objective was to assess how waterfowl and non-game waterbird richness and abundance are related to the water depth, vegetative cover, and vegetation species composition on WRP easements in western Tennessee and Kentucky. We sampled avian communities and habitat variables in four distinct habitat types; remnant forests, tree plantings, natural woody regeneration, and constructed shallow water areas (SWA), on 37 study sites to assess seasonal responses of avifauna to habitat variables. Data from the first two sampling rounds (collected in October 2019 and February 2020) indicate that mean waterfowl richness on sites was 1.36 (±1.45) and mean waterbird richness was 0.26 (±.059). Mean abundances of waterfowl and waterbirds were 10.44 (±16.07) and 0.40 (±0.93) respectively. Water depth was positively associated with waterfowl species richness ($F = 9.109$, $R2 = .114$, $P = .004$), but not with abundance ($F = 1.977$, $R2 = .02$, $P = .17$). Waterbird abundance was positively associated with percent submersed plant cover ($F = 4.44$, $R2 = .08$, $P = .04$) while waterbird richness was not significantly associated with any measured variable. Data collection is ongoing and planned through spring 2021. Evaluation of wetland bird responses to habitat variables on WRP easements may serve to inform future wetland restoration activities.

Author(s): David Hicks, School of Natural Resources, University of Missouri; Jon Podoliak, School of Natural Resources, University of Missouri; Lisa Webb, U.S. Geological Survey, Missouri Cooperative Fish and Wildlife Research Unit, School of Natural Resources, University of Missouri.

Tags (Key Words): Wetland Restoration, Wildlife

(6) **Mallard Response to a Gradient of Experimental Disturbance on Waterfowl Refuges During Winter**

Track: Wildlife

Abigail G. Blake-Bradshaw M.Sc. - *Graduate Student, Tennessee Technological University*; Email: agblakebra42@students.tntech.edu

Abstract : Winter is an energetically and physically stressful time for animals and may be especially demanding for hunted species such as waterfowl. Waterfowl refuges are important management tools which provide forage and sanctuary for waterfowl during winter. Refuges are essential because anthropogenic disturbance from recreational activities may displace waterfowl from preferred foraging areas, reduce daily foraging time, and modify diurnal behavior. Waterfowl increase refuge use during hunting periods likely due to limited disturbance and provision of food resources. However, increased refuge use may result in pressure from the public and other stakeholders to offer access to refuges for hunting or other activities (e.g., birding, photography). Despite seasonal closures of refuges to the public, empirical evidence quantifying waterfowl responses to a gradient of disturbance regimes and subsequent implications on individual fitness is lacking and may have greater population-level consequences than is currently understood. To determine the impact of disturbance on waterfowl movements, space use, and site fidelity, we will assess mallard (Anas platyrhynchos) responses to a gradient of experimentally induced disturbance on state and federal refuges in western Tennessee. During winter 2019–2020, we captured 127 mallards on refuges and fitted them with GPS/GSM solar rechargeable transmitters. We simulated distinct disturbance treatments which represent activities that potentially occur on waterfowl refuges including 1) waterfowl surveys from a vehicle, 2) bird watching while walking, and 3) hunting in planted corn or wooded areas. We will assess mallard behaviors before and after experiencing disturbance. Specifically, we will examine shifts in mallard resource selection and determine whether changes in selection are associated with survival. This research will provide insight into direct and indirect effects of disturbance on wintering waterfowl and further inform acceptable levels of disturbance for state and federal refuges to better meet the needs of waterfowl and people.

Author(s): A. G. Blake-Bradshaw, Tennessee Technological University; N. M. Masto, Tennessee Technological University; C. J. Highway, Tennessee Technological University; D. L. Combs, Tennessee Technological University; J. C. Feddersen, Tennessee Wildlife Resource Agency; H. M. Hagy. U.S. Fish & Wildlife Service; B. S. Cohen, Tennessee Technological University.

Tags (Key Words): waterfowl, winter, disturbance

(7) **Modeling Approaches Refine Areas of Importance for Imperiled Biodiversity in Southeastern States**

Track: Wildlife

Healy Hamilton - *Chief Scientist, NatureServe;* Email: healy_hamilton@natureserve.org

Abstract : Using modern computational approach to determine imperiled species distributions, a new national analysis that identifies areas of conservation significance re-confirms the importance on the southeastern United States as a biodiversity hotspot. NatureServe's Map of Biodiversity Importance used habitat suitability models to map and analyze habitat for 2,216 species in the contiguous United States, including critically imperiled, imperiled, and ESA-listed vertebrates, freshwater invertebrates (mussels and crayfishes), pollinators (bumbles, butterflies, and skippers), and vascular plants. Using these models, and information on range size and degree of protection derived therefrom, we identified areas of unprotected biodiversity importance. Overall, 42% of these areas of high importance are located in SEAFWA states, including 97% of areas identified as most important for freshwater invertebrates and 68% of areas identified as most important for vertebrates. Further analysis of the inputs revealed patterns that can guide conservation strategies. Our analysis of diverse taxonomic groups (i.e. vertebrates, invertebrates, and plants) resulted in markedly different spatial patterns for areas of high importance than those identified with data only for vertebrates, suggesting that conservation strategies guided primarily by vertebrates may be inadequate to protect the region's extraordinary biodiversity. Nationally, a majority of imperiled species (52%) are primarily found on privately owned and managed land, but this is particularly true in the Southeast (76%) – a finding that emphasizes the importance of private land conservation partnerships in the region.

Author(s): Regan Smyth, NatureServe; Healy Hamilton, NatureServe; Peter Cutter, NatureServe; Bruce Young, NatureServe

Tags (Key Words): T & E species, conservation priorities, distribution modeling

(8) **Reconnecting the Rivers of Puerto Rico: Cambalache Dam Removal at Río Grande De Arecibo**
Track: Fisheries

Alexandra M. Galindo MS - *Fish Biologist, U.S. Fish and Wildlife Service;* Email: alexandra_galindo@fws.gov

Abstract : The Island's freshwaters are inhabited by 9 native fish species and due to the presence of physical barriers such as dams built for agricultural or potable water these species are not present in all potential riverine habitats. In 2013, Cooney and Kwak identified a total of 335 fish barriers, including 29 high dams, 208 low dams and 98 road crossings that hinder fish migration to 75% of Puerto Rico upstream riverine habitat. Therefore, the reestablishment and/or enhancement of river connectivity for the conservation of the migratory native freshwater species through the removal of dams or the installation of fish passages has been identified as a conservation priority in the U.S. Fish and Wildlife Service (USFWS) Habitat Restoration Programs' Strategic Plans (Fish and Aquatic Conservation (FAC), Partners for Fish and Wildlife (PFW) and Coastal programs) and the Puerto Rico State Wildlife Action Plan. In order to avoid the degradation of these ecosystems and address the aquatic issues in Puerto Rico, the USFWS in collaboration with the Puerto Rico Department of Natural and Environmental Resources (PRDNER) and several partners is implementing the Stream Connectivity Restoration Initiative in Puerto Rico to restore and enhance aquatic habitats for the conservation of native freshwater fauna. After an evaluation conducted in 2016 to prioritize areas in Puerto Rico for aquatic restoration, the first project in Puerto Rico aiming to restore aquatic connectivity via the removal of a physical barrier (Cambalache dam) at Río Grande de Arecibo watershed was developed and successfully implemented in 2019.

Author(s): Alexandra M. Galindo, U.S. Fish and Wildlife Service; Iván Llerandi-Román, U.S. Fish and Wildlife Service

Tags (Key Words): stream, restoration, connectivity

(9) **Regional Examination of the Contribution of Nest Boxes to Wood Duck Recruitment in the Southeast and Mid-Atlantic United States**
Track: Wildlife

Beau A. Bauer MS, CWB - *Staff Biologist, Nemours Wildlife Foundation*; Email: bbauer@nemourswildlife.org

Abstract : Since the 1920s, nest box programs, harvest regulations, and sustainable forestry practices have led to the conservation success and recovery of wood duck (Aix sponsa) populations in Eastern United States. During a waterfowl workshop convened at Nemours Wildlife Foundation, Yemassee, SC in February 2018, biologists representing state agencies, U.S. Fish and Wildlife Service, universities, and non-government organizations throughout the southeastern and mid-Atlantic United States indicated a need for contemporary information to manage wood ducks and evaluate the effectiveness of nest box programs. Studies suggest that population growth for box-nesting populations is driven by female recruitment, wherein these data were lacking to assess the contribution of nest boxes to this vital rate throughout this region. We initiated a collaborative effort in January 2020 to investigate the contribution of nest boxes to wood duck recruitment at a regional scale and sampled nest boxes (n = 1,318) in study sites in Delaware, Maryland, North Carolina, South Carolina, Georgia, Florida, Mississippi, and Louisiana. Across study sites, mid-season data (1 May 2020) indicated 72.5% box use with 1,057 unique nesting attempts. Cumulative nest fates included 148 successful, 128 abandoned, and 144 depredated nests. We observed inter- and intraspecific nest parasitism (> 12 eggs) for 556 nests. We captured 533 adult females across three species (wood duck [92%], hooded merganser [8%, Lophodytes cucullatus], and black-bellied whistling duck [
Author(s): Beau Bauer, Nemours Wildlife Foundation; Paul Schmidt, Nemours Wildlife Foundation; Ernie Wiggers, Nemours Wildlife Foundation; Brian Davis, Mississippi State University; Gary Hepp, Auburn University; Richard Kaminski, Clemson University, James C. Kennedy Waterfowl and Wetlands Conservation Center; Kevin Ringelman, Louisiana State University; Christopher Williams, University of Delaware; Dylan Bakner, Louisiana State University; Taylor Gibson, Mississippi State University; Tori Mezebish, University of Delaware; Emily Miller, Clemson University; Jacob Shurba, Clemson University; Nathaniel Simmons, Maryland Dept. of Natural Resources; Greg Balkcom, Georgia Dept. of Natural Resources; Andrew Fanning, Florida Fish and Wildlife Commission; Justyn Foth, Delaware Dept. of Natural Resources and Environmental Control; Heath Hagy, U.S. Fish & Wildlife Service; Josh Homyack, Maryland Dept. of Natural Resources; Molly Kneece, South Carolina Dept. of Natural Resources; Larry Reynolds, Louisiana Dept. of Wildlife and Fisheries

Tags (Key Words): waterfowl, recruitment, collaboration

(10) **Using Stand Structure and Composition to Qualify Habitat for Strategic Forest Management Planning**

Track: Wildlife

Casey E. Phillips CWB®, RF 1744 - *Recovery and Sustainment Program Forester, NC Wilidlife Resources Commission*; Email: casey.phillips@ncwildlife.org

Abstract : Several conservation groups have developed indices of habitat quality for a guild of wildlife species associated with the longleaf pine ecosystem. We built on this approach to create a broader range of indices for a range of species across a large region in North Carolina. Our objective was to specify ranges of quality (i.e., Best, Good, Poor) for forest conditions (e.g., basal area, fire return interval) as habitat for focal wildlife species (e.g., ruffed grouse [Bonasa umbellus]) or guilds (e.g., shrubland associated species) to guide management on forests managed by the NC Wildlife Resources Commission. We identified 20 focal species across 17 forest management regimes, based on communication with agency staff and management goals. When possible, we grouped focal species into guilds with similar habitat requirements. Qualitative levels for each condition metric were determined based on published research. Six focal species did not fit well into a guild – Carolina northern flying squirrel (Glaucomys sabrinus), Appalachian cottontail (Sylvilagus obscurus), ruffed grouse, yellow-bellied sapsucker (Sphyrapicus varius), brown-headed nuthatch (Sitta pussila), and American woodcock (Scolopax minor). We grouped Bachman's sparrow (Peucaea astivalis), red-cockaded woodpecker (Picoides borealis), northern pine snake (Pituophis melanoleucus), Carolina gopher frog (Rana capito capito), and northern fox squirrel (Scirurus niger) into the longleaf pine (Pinus palustris) associates guild. We grouped black bear (Ursus americanus), white-tailed deer (Odocoileus virginianus), timber rattlesnake (Crotalus horridus), eastern wild turkey (Meleagris gallopavo silvestris), and red-headed woodpecker (Melanerpes erythrocephalus) into the open forest associates guild. The shrubland guild included northern bobwhite (Colinus virginianus), prairie warbler (Dendroica discolor), indigo bunting (Passerina cyanea), and eastern cottontail rabbit (Sylvilagus floridanus). We will describe challenges experienced in the qualification process, present values for ranges in forest conditions for three guilds and discuss opportunities for the application of these results to management decisions.

Author(s): Casey E. Phillips, NC Wildlife Resources Commission; Christopher Moorman, NC State University; Joseph Roise, NC State University, Chris Jordan, NC Wildlife Resources Commission

Tags (Key Words): Forest Management Planning