Poster Session II

THURSDAY, 4 FEBRUARY 2016

19:00 - 22:00 *Annapolis Ballroom*

R.1	**Conservation Planning**	
R.1.1:	**Fields**	**The Prairie Pothole Joint Venture Implementation Plan: A Road Map for Integrated Bird Conservation in the Northern Prairies of the United States** (Sean Fields*, Casey Stemler, Neal Niemuth)
R.1.2:	**Kaminski, M.**	**Making a Wetlands Splash for Waterfowl during Texas Drought** (Matthew R. Kaminski*, M. Todd Merendino)
R.1.3:	**Slattery**	**Conserving Canada's Boreal Duck Populations Using Systematic Conservation Planning** (Lindsay McBlane, Julienne L. Morissette, Stuart M. Slattery*, Kevin Smith)
R.2	**Foraging Ecology**	
R.2.1:	**Bachman**	**Assessment of Important Food Plants for Dabbling Ducks During the Nonbreeding Season at Modoc National Wildlife Refuge, California** (Cameron T. King, Holly L. Ferrara, Dominic C. Bachman*)
R.2.2:	**Blenk^**	**Digestive Organ Morphology as an Indicator of Dietary Ecology in the Hawaiian Duck** (Robert H. Blenk, Bruce Dugger)
R.2.3:	**Colmorgen^**	**Building a Predictive Model of Submerged Aquatic Vegetation for Atlantic Brant using Remote Sensing and In-situ Sampling** (Chase Colmorgen*, Christopher K. Williams)
R.2.4:	**Fara^**	**Migration Patterns, Habitat Use, Food Habits, and Harvest Characteristics of Long-tailed Ducks Wintering on Lake Michigan** (Luke Fara*, Kevin Kenow, Michael Eichholz, Steven Houdek)
R.2.5:	**Holland**	**Dietary Analysis of Plastics in Digestive Tracts of Freshwater Birds** (Erika R. Holland*, Mark L. Mallory, Dave Shutler)
R.2.6:	**Huck**	**Diet of Female Northern Pintails Wintering along the Texas Coast** (Nathaniel R. Huck*, Matthew J. Garrick, Bart M. Ballard, Kevin Kraai, Matt R. Kaminski)
R.2.7:	**O'Connor^**	**The Foraging Habits and Resultant Functional Response of American Black Ducks** (Jessica L. O'Connor*, Alicia M. Wells-Berlin, Patrick C. Kangas, Jennifer Murrow)
R.2.8:	**Varner**	**An Assessment of Landscape Carrying Capacity for Waterfowl in Nebraska's Rainwater Basin** (Ele Nugent, Andy Bishop, Roger Grosse, Ted LaGrange, Dana Varner*, Mark Vrtiska)
R.3	**Harvest**	
R.3.1:	**Austin**	**Multi-Scaled Analyses of Lesser and Greater Scaup Harvest in North America** (Gregory J. Soulliere, Jane E. Austin*, Benjamin M. Kahler)

	R.3.2: Bonczeck	**Harvest Distribution of Mallards Marked on the Yukon-Kuskokwim Delta, Alaska** (Elizabeth S. Bonczek*, Callie B. Moore, Kyle A. Spragens)
	R.3.3: Brady	**Direct Recovery Rates of Egg Salvaged and Wild Mallards in California, 1986-2014** (Caroline M. Brady*, Mark P. Herzog)
	R.3.4: Miller, C.	**Using Waterfowl Harvest Data to Investigate Efficacy of Non-toxic Shot Regulations** (Craig A. Miller*, Brent D. Williams)
	R.3.5: Olsen, D.	**Banding Cinnamon Teal throughout the Intermountain West to Improve Information for Management** (Dave Olson*)
	R.3.6: Amundson1	**The Effect of Harvest Regulations on Hunter Effort, Harvest Rates, and Annual Survival of Mallards and Grey Ducks in New Zealand** (Matthew B. McDougall, Courtney L. Amundson*)
R.4	**Migration**	
	R.4.1: Amundson2	**Population Change Varies by Trophic Level and Migration Strategy for Arctic-breeding Waterfowl** (Courtney. L. Amundson, Paul L. Flint, Robert Stehn, Robert Platte, Heather Wilson, Julian Fischer)
	R.4.2: Knox^	**Waterfowl Migration Chronology and Food Production at Great Swamp National Wildlife Refuge** (Sean R. Knox*, Dorothy M. Fecske, Frank K. Ammer)
	R.4.3: Lavretsky	**Exploring Fall Migration Patterns of Northern Pintail Using Band-Recovery Data** (Philip Lavretsky*)
	R.4.4: Pearse, A.	**Distribution of Spring Migrating Waterfowl along the North and South Platte Rivers in Western Nebraska** (Aaron Pearse*, Dana Varner, Rob Spangler, John Denton, Jonas Davis, Kirk Schroeder, Mark P. Vrtiska, Emily Munter, Heather Johnson)
	R.4.5: Simms	**A Test of the Migration-Modulation Hypothesis in a Non-Passerine Neotropical Migrant, the Blue-Winged Tea,l *Anas discors*** (C. Morgan Wilson, Christopher G. Sims*, Stephan J. Schoech, Sarah K. Peltier, Zac L. Robinson)
	R.4.6: Vrtiska2	**Factors Influencing Body Mass of Spring-migrating Female Northern Pintails** (Mark P. Vrtiska*, Matt Haugen, Rich Walters)
	R.4.7: Wells-Berlin	**Migration, Phenology, and Philopatry of Long-tailed Ducks Wintering on the Atlantic Coast** (Alicia M. Wells-Berlin*, Matthew C. Perry, Jonathan Fiely)
R.5	**Physiology**	
	R.5.1: Amundson3	**Infection Dynamics of Helminths in Arctic and Sub-arctic Breeding Geese** (Courtney L. Amundson*, Autumn Smith-Herron, Nicole Traub, Paul. L. Flint)
	R.5.2: Amundson4	**Mallard Duckling Survival and Brood Habitat Selection in Southland, New Zealand** (Erin J. Garrick, Courtney L. Amundson*, Philip Seddon)

R.6.3 Ballard, D.^	**Survey of Gizzard Helminths in Female Northern Pintails** (Derek C. Ballard*, Matthew J. Garrick, Bart M. Ballard, Alan M. Fedynich)
R.6.4 Dorak^	**Micro-site Climatic Conditions Associated with Urban Thermal Refugia used by Canada Geese During Winter** (Brett E. Dorak*, Heath M. Hagy, Mike P. Ward)
R.5.5 Drahota	**Spatial and Temporal Differences in Anatid Body Condition and Forage Preference During Sspring Migration in the Rainwater Basin, Nebraska** (Jeff L. Drahota*, Dustin Casady, Mery Casady, Ryan Walters)
R.5.6: Elmberg	**Farmed European Mallards are Genetically Different and Cause Introgression in the Wild Population Following Releases** (Johan Elmberg*, Pär Söderquist, Gunnar Gunnarsson, Carl-Gustaf Thulin, Jocelyn Champagnon, Matthieu Guillemain, Jakub Kreisinger, Herbert H. T. Prins, Richard P. M. A. Crooijmans , Robert H. S. Kraus)
R.5.7: Guillemain1	**Biases in Duck Body Mass Measurements at Banding** (Matthieu Guillemain*, François Cavallo, Grégoire Massez, Thierry George, Jean-Pierre Baudet, Pierre Gonzalez, Valérie Ducasse, Emmanuel Caillot, Benoît Lecaplain, Luc Tison, Natacha Piffeteau, Jean-Pierre Artel, Jocelyn Champagnon)
R.5.8: Guillemain2	**Is Swabbing for Avian Influenza a Safe Technique for Ducks?** (Matthieu Guillemain*, Jocelyn Champagnon, Marie-Lucile Gourlay-Larour, François Cavallo1 Anne-Laure Brochet, Jean Hars, Grégoire Massez, Thierry George, Pierre-Yves Perroi, Véronique Jestin, Alain Caizergues)
R.5.9: Hinton^	**Exploring the Development of Personality in Captive-reared and Released Waterfowl** (Mitchell G. Hinton, John Eadie, Andrea K. Townsend)
R.5.10: Huck	**Lead Ingestion by Female Northern Pintails Along the Texas Coast** (Nathaniel R. Huck*, Bart M. Ballard, Alan M. Fedynich, Kevin Kraai, Mauro E. Castro)
R.5.11: Latty	**Diseases as Potential Limiting Factors in Common Eider Nesting in the Beaufort Sea, Alaska** (Christopher J. Latty*, Tuula Hollmen, Claire Montgomerie, Katrina Counihan)
R.5.12: Marty^	**Index of Spent Shot in Louisiana and Texas Gulf Coast Prairie Ricelands** (Joseph R. Marty*, J. Brian Davis, Richard M. Kaminski, Michael G. Brasher, Erin Brinkman)
R.5.13: McGrew	**Captive Raised Duckling Growth Models for Sea Ducks and Dabbling Ducks** (Kathleen A. McGrew*, Sarah Fitzgerald, Alicia M. Wells-Berlin)
R.5.14: McPherson^	**Estimating Behavioral Multipliers to Resting Metabolic Rate in American Black Duck and Lesser Scaup** (Jacob McPherson*, Christopher Williams, Alicia Berlin, John Coluccy)

R.5.15:	**Olsen, G.**	**Hematology and Chemistry of Wild Scoters and Long-tailed Ducks** (Glenn H. Olsen*, Alicia M. Wells-Berlin, Sara E. Crowell, Kathleen A. McGrew)
R.5.16:	**Skalos**	**Validated Indices to Predict Body Condition of Pacific Greater White-fronted Geese** (Daniel A. Skalos*, John M. Eadie, Daniel Yparraguirre, Melanie L. Weaver, Shaun L. Oldenburger, Craig R. Ely, Joseph P. Fleskes)
R.5.17:	**Spragens**	**Avian Influenza and Foraging Waterfowl in Spring; an Ecologically-based Study Design** (Kyle A Spragens*, Mason Hill, Erica Spackman)
R.6	**Population Dynamics**	
R.6.1:	**Deane^**	**Potential Nasal-marker Effects On Lesser Scaup Vital Rates** (Cody E. Deane, Jay J. Rotella, Jeffrey M. Warren, David N. Koons, Robert R. Garrot)
R.6.2:	**Nicolai, C.**	**Using Pre-season Duck Banding Data to Estimate Population Size and Variation in Body Condition Across Different Wetland Management Regimes in Terminal Wetlands in Nevada** (Chris A. Nicolai*, Russell J. Woolstenhulme)
R.6.3:	**Raquel^**	**Patterns of Duck Community Composition in the Prairie Pothole Region and Southern Boreal Forest** (Amelia J. Raquel*, Robert G. Clark)
R.6.4:	**Ross, M.**	**Ecological Factors Affecting Midcontinent Light Goose Recruitment** (Megan V. Ross*, Ray T. Alisauskas, Dana K. Kellett)
R.7	**Winter Ecology**	
R.7.1:	**Slown^**	**Winter Ecology of Temperate-Breeding and Interior Canada Geese in the Greater Chicago Metropolitan Area** (Kendra E. Slown*, Michael W. Eichholz, Brett E. Dorak, Heath M. Hagey)
R.7.2:	**Iemola^**	**A New Hypothesis for Explaining Differences in Winter Distributions of Male and Female Ducks in North America** (Elyse Iemola, Michael L. Schummer, Michael Valentino)
R.7.3:	**Towery^**	**Monitoring the Effects of Hurricane Sandy Salt Marsh Restoration on Forsythe National Wildlife Refuge for American Black Duck Carrying Capacity** (Brenna Towery^*, Christopher Williams)

R.1: Conservation Planning

R.1.1: Fields

The Prairie Pothole Joint Venture Implementation Plan: A Road Map for Integrated Bird Conservation in the Northern Prairies of the United States

Sean Fields[1]*, Casey Stemler[2], Neal Niemuth[3]

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The Prairie Pothole Joint Venture (PPJV) is a partnership of federal, state and non-governmental organizations focused on bird conservation in the Prairie Pothole Region (PPR) of the United States. The PPJV was established in 1987, through the North American Waterfowl Management Plan, as one of the first bird habitat joint ventures in the US. Known as the primary breeding area for continental waterfowl populations, the PPR is also important for a suite of other wetland and grassland dependent birds. The PPJV works to sustain abundant populations of waterfowl, shorebirds, waterbirds, and landbirds through the long-term protection, restoration, and management of wetland and grassland habitats throughout the US PPR.

Three decades of science-based breeding bird conservation has placed the PPJV on the forefront of integrated bird management. Intensive, long-term monitoring programs have informed conservation strategies and provided the data necessary to develop spatially explicit models to guide management actions. Strategic spatial prioritization provides the foundation for leveraging the benefits of waterfowl conservation to non-waterfowl priority species of concern and enables partners to maximize desired biological outcomes from limited funding. The PPJV Implementation Plan is currently being updated and provides an opportunity for partners to embrace changes in science and technology, public policy, and human dimensions to create a vision for strategic conservation in the US PPR. Extensive wetland and grassland loss, coupled with ongoing changes in agricultural technology and practices, energy development, and climate, provide substantial challenges for conservation in the northern prairies. By continuing to strengthen the adaptive, science-based approach to conservation, PPJV partners are prepared to resolve uncertainties regarding the effects of stressors on the bird populations and habitats, and guide future conservation efforts. The Implementation Plan update is a status report on key resources and trends in the US PPR for the North American bird conservation community.

R.1.2: Kaminski, M.

Making a Wetlands Splash for Waterfowl during Texas Drought

Matthew R. Kaminski[1]*, M. Todd Merendino[1]

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Historically and currently, the Texas Mid Coast (TMC) and Cheneir Plain (CP) provide critical habitat for North American waterfowl using the Central Flyway. This vast grassland-wetland landscape of TMC mirrored the Prairie Pothole Region in the Dakotas, and the CP mimicked the Everglades in Florida. These dynamic systems evolved with a history of drought. With over a century of anthropogenic alterations to this region, droughts are increasingly becoming an exacerbating challenge for wetland conservationists. Scientists and conservationists generally agree that droughts are unpredictable in intensity and duration. Despite this uncertainty, Ducks Unlimited (DU) and multiple state, federal, and private partners continue to deliver waterfowl habitat through the Texas Prairie Wetlands Project (TPWP) and a shallow water flooding program. Traditionally, TPWP focused on infrastructure improvements (e.g., levees, water management structures). However, with drought since 2011, drilling irrigation wells and installing pipelines have been DU's main deliverable to help irrigate rice and flood harvested croplands and moist-soil wetlands. Although ground water is a finite resource, it is a stop-gap resource to maintain wetlands during dry cycles. In 2010 and 2014-2015, DU received grants from the National Fish and Wildlife Foundation that funded a shallow water flooding program in the TMC and CP. Over 8,000 ha were enrolled in the program each year, and participating landowners and waterfowl greatly benefitted. Success of the 2014-2015 program hinged on landowners who had irrigation wells, because ground water generally was the only resource available during the continuing drought. Additionally, this water source was particularly important for TMC landowners enrolled in the late spring water program, as water then is typically a limiting factor for late migrating waterfowl and shorebirds. Our poster will illustrate that continued programmatic expansion, policy, research, and financial support will be needed to provide wetlands for waterfowl and other waterbirds in these regions in the face of drought and declining aquifer and reservoir water resources.

R.1.3: Slattery

Conserving Canada's Boreal Duck Populations Using Systematic Conservation Planning

Lindsay McBlane[1], Julienne L. Morissette[1], Stuart M. Slattery[2]*, Kevin Smith[1]

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Conservation organizations combine multiple sources of information to develop planning models that not only reflect ecological and socio-economic considerations across geographic regions but also assist with identifying cost-efficient, strategic conservation plans. Ducks Unlimited Canada is developing an approach for comprehensive, systematic spatial planning in the Canadian boreal forest. A preliminary analysis focussed on relative waterfowl abundance by cavity, overwater, and ground nesting guilds. Using modelled duck density distributions and Marxan, a decision support tool, we identified regions with 25%, 50%, and 75% of the modelled duck populations. While ducks are generally distributed at low densities across the forest, there appears to be sufficient aggregation to support spatially-explicit planning for waterfowl conservation. This approach will form the basis for further spatial planning, integrating additional considerations such as locations of presumed limiting factors (i.e. threats to waterfowl habitat), habitat intactness, species diversity, and conservation opportunities. Given important differences in density distributions nationally, we plan to use a national scale analysis to support and enhance this effort with regional considerations specific to provincial jurisdictions to evaluate and set local conservation goals. This project will help us identify the most important, most threatened duck habitat in conjunction with existing and emerging opportunities for conservation.

R.2: Foraging Ecology

R.2.1: Bachman

Assessment of Important Food Plants for Dabbling Ducks During the Nonbreeding Season at Modoc National Wildlife Refuge, California

Cameron T. King[1], Holly L. Ferrara[1], Dominic C. Bachman[1]*

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The Modoc national wildlife refuge is an important migratory stopover for many species of waterfowl during fall. The Modoc NWR is one of the most important areas for dabbling ducks in the Modoc plateau region, which is an important part of the Southern Oregon and Northeastern California wetland complex. This research was conducted to gain insight on potentially important food items for dabbling ducks at Modoc NWR. Eighty-nine hunter harvested gizzards were gathered during the 2013 and 2014 hunting seasons from five species of dabbling ducks. The total number of seeds and tubers for each plant species was recorded for each species of duck. We collected a reference sample of all available waterfowl seed plants during fall 2012 to assist in identifying seeds and tubers. Of the 12,588 seeds sorted for this project the most common foods found in all duck species were Polygonium seeds, Eleocharis seeds and Stuckenia seeds. Food matter found in gizzards was analyzed for each duck species over time early fall, late fall and winter periods. Dwarf spikerush (Eleocharis parvula) was of special interest as over 70% of green wing teal contained some Eleocharis seeds and over 40% of Mallards had some Eleocharis seeds. Pintails had almost no Eleocharis seeds but over 50% of them had eaten Eleocharis tubers. Due to time and financial considerations this project was focused on seeds and tubers that could be obtained from gizzards collected from hunter shot waterfowl and no invertebrate or esophageal contents were analyzed. However, this baseline research will be a good first step to assist the Modoc NWR in determining proper wetland management techniques to provide optimal forage for priority waterfowl species.

R.2.2: Blenk^

Digestive Organ Morphology as an Indicator of Dietary Ecology in the Hawaiian Duck

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Numerous studies suggest that internal digestive morphology may be an accurate reflection the dietary ecology of waterfowl. It has been well-documented that factors such as diet composition, reproductive status, and seasonal food availability can strongly influence digestive morphology. Island endemic species represent an understudied group in this respect. While a single allometric model for waterfowl may hold true between continental guilds, sedentary island species may exhibit unique morphological adaptations. The Hawaiian Duck (*Anas wyvilliana*) is one such island endemic. I examined the dietary ecology of the Hawaiian Duck by comparing the morphology of digestive organs (gleaned from botulism-killed specimens) to existing data for well-studied continental species. Analyses of the length and mass of digestive organs (including proventriculus, gizzard, intestines and ceca) suggested that digestive organ robustness scales directly with total body mass in Hawaiian Ducks. However, the correlation was weak indicating that additional factors affect digestive organ plasticity as in continental species. Our conclusions are limited because we could not assign individual Hawaiian Ducks to a specific reproductive status and the decaying condition of some specimens reduced the quality of morphological information. Interspecific comparisons indicate that the digestive morphology of the Hawaiian duck is most similar to that of congeneric Mallards (*Anas platyrhynchos*) and to omnivorous species of dabbling ducks in general. However, some differences in organ measurements suggest possible adaptations of island endemics. When scaled to body mass, Hawaiian Ducks exhibited a significantly longer small intestine (SI) and significantly more massive ceca than Mallards ($p<.01$). In the case of SI length, Hawaiian duck measurements did not differ significantly from those of Gadwall (*Anas strepera*), a species know for high rates of herbivory. This similarity may suggest a lower quality, higher fiber diet than that of Mallards.

R.2.3: Colmorgen^

Building a Predictive Model of Submerged Aquatic Vegetation for Atlantic brant using Remote Sensing and in-situ sampling

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With a constantly changing environment, the ability to retain and protect submerged aquatic vegetation (SAV) is becoming more and more important as they provide critical ecosystem functions. In this study they include, eelgrass (*Zostera marina*), widgeon grass (*Ruppia maritima*), and macro algae (*Ulva* sp., *Entermorpha* sp.) have many benefits to organisms, specifically, the migratory bird Atlantic brant (*Branta bernicula hrota*) which is a specialist on these food sources. For example, after a stark decrease in eelgrass in the early 1930s due to a wasting disease from the slime mold *Labyrintha zosterae*, the population of Atlantic brant also decreased due to lack of food availability. With eelgrass never fully recovering, the brant switched to macroalgae as an alternative food source within a few years. Today, brant populations are still fluctuating raising questions as to whether current food abundance is a factor in their population changes. Thus, building a predictive model of SAV abundance will aid in predicting the potential carrying capacity of wintering brant within the Atlantic flyway. Our goal is to use high-resolution imagery, digital elevation models, bathymetric LIDAR, and ground validation to measure water depth and water quality to assess these covariates as predictors of SAV presence/absence and, thus, allow the building of a predictive model across the Atlantic flyway. In addition to presence/absence data, field samples will include SAV collection to measure abundance and potential energy availability to brant. Each SAV sample will have biomass identified to species, cleaned, dried, and weighed to determine energy density availability. With this information, an estimate of carrying capacity can be developed for brant using an equation for Goose Use Days. A preliminary field season consisted of SAV sample collection from January – April 2015 in the intertidal areas of northern New Jersey, spanning the range of protected areas of Forsythe National Wildlife Refuge. Of the 95 samples, 35 had SAV present. For the 2015 – 2016 season, additional covariates will consist of sampling water quality to assess nutrient load in water, bottom types present to better understand sediment movement and potential turbidity issues, as well as potential quadcopter photography to measure extent of seagrass beds during sampling.

R.2.4: Fara^

Migration Patterns, Habitat Use, Food Habits, and Harvest Characteristics of Long-tailed Ducks Wintering on Lake Michigan

Luke Fara[1,2]*, Kevin Kenow[1], Michael Eichholz[2], Steven Houdek[1]

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Recent aerial surveys indicate that Lake Michigan supports a sizeable wintering population of long-tailed ducks (*Clangula hyemalis*). Over 18,000 long-tailed ducks (LTDUs) were tallied along 2,400 km of transects during a December 2013 survey. Long-tailed ducks rank high in priority with the Sea Duck Joint Venture and have been a focal species in a large-scale sea duck telemetry project to address information needs concerning population delineation, migration, and ecology of sea ducks wintering in the Atlantic and Great Lakes regions. While a large effort has been placed on radiomarking LTDUs during 2007-2013 on the Atlantic coast and Lake Ontario, the effort has not yet included the Lake Michigan population. We will be conducting a study to estimate spatial patterns of migration, breeding ground affiliations, and site fidelity of long-tailed ducks wintering on Lake Michigan by implanting adult females with satellite transmitters. Additional components of the study are expected to include evaluations of food habits, harvest characteristics, and relations to avian botulism and wind energy concerns that are associated with Lake Michigan.

R.2.5: Holland

Dietary Analysis of Plastics in Digestive Tracts of Freshwater Birds

Erika R. Holland[1]*, Mark L. Mallory[1], Dave Shutler[1]

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Plastics in marine environments are a global environmental issue. However, little research has focused on the ramifications of plastic debris on freshwater organisms. In comparison to marine waters, freshwater bodies have comparable surface and sedimentary plastic concentrations, and recent studies have found traces of plastic contaminants in the digestive tracts of freshwater migratory waterfowl. Plastic ingestion is problematic as it can lead to chronic health and reproductive issues, as well as eventual death through starvation. Plastic debris also act as contaminant vectors for heavy metals and persistent organic pollutants, which could be metabolized into tissues, leading to potential biomagnification. Using a dissection based dietary analyses method I am assessing levels of plastics, specifically microplastics and microbeads, being consumed by freshwater bird species collected from across Canada, determining the most commonly consumed plastics, as well as identifying potential contamination sources. I predict that freshwater and marine birds experience similar rates of anthropogenic debris exposure, and thus exhibit similar high rates of plastic ingestion. More specifically, I predict that freshwater dabbling birds will exhibit higher rates of plastic debris ingestion because they experience greater microplastic exposure, due to their high exposure to sedimentary layers with their foraging style. This work will establish a baseline on the incidence of plastic debris ingestion in freshwater birds in North America against which other studies, or future investigations, can be compared, and will allow researchers to assess spatio-temporal patterns in this emerging environmental issue.

R.2.6: Huck

Diet of Female Northern Pintails Wintering along the Texas Coast

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Historically one of the most populous ducks in North America, northern pintails (*Anas acuta*) are currently >45% below current population goals. The Texas Coast is an important region for wintering pintails with up to 78% of the central flyway population wintering there each year. Pintails use both fresh and saltwater habitats along the Texas Coast, but habitats important to pintails have substantially declined over the last few decades due to changes in land use. Our goal was to estimate diet composition and energy content of foods consumed by pintails wintering along the Texas Coast. We collected 228 female pintails from fresh and saltwater habitats during the winters of 2012-13 and 2013-14. Sixty-eight percent (154) of our sample contained food in their upper digestive tract, 42 from freshwater habitats and 112 from saltwater habitats. Foods were sorted and dried to constant mass. Macronutrient and energy content of individual foods were derived from the literature. A total of 104 taxa were identified in the diets including 57 plant taxa and 47 animal taxa. The most common foods consumed in freshwater habitats included paspalum, smartweed, and pondweeds, and in saltwater habitats included shoalgrass rhizomes, Bittium gastropods, and Gammarus amphipods. True metabolizable energy of diets from coastal habitats was lower than from freshwater habitats throughout winter and are lower than those found in other areas of North America where pintail diets have been estimated. This study provides managers with the information necessary to inform bioenergetic models that estimate carrying capacities of habitats important to waterfowl and to better manage habitats along the Texas Coast.

R.2.7: O'Connor^

The Foraging Habits and Resultant Functional Response of American Black Ducks

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American black ducks, *Anas rubripes*, are an indicator species for the health of the Chesapeake Bay, and their habitats are under pressure as a result of increasing anthropogenic changes in addition to ongoing climate changes. This study is part of a larger effort by partners to build a comprehensive bioenergetics model for black ducks wintering in the Chesapeake Bay. We are creating functional response curves for each of five known prey species, including widgeon grass, horned pondweed, softstem bulrush seeds, Eastern mosquitofish, and saltmarsh snails. We test each prey item at four different densities, ranging from levels lower than those typically found in nature to levels much higher than normal. During trials, captive raised ducks forage in a water or mud substrate containing one prey species for an hour. We record both the total time the ducks spend foraging and the total amount of prey they consume in order to calculate the ducks' functional response in intake at varying densities. Based on previous similar research on different waterfowl species, we hypothesize finding a type II functional response curve for each prey species, meaning the intake rate will initially increase with increasing density, but eventually level off at some critical density. This research will be used to determine optimal foraging habitats for black ducks in the bay, and thus assist in identifying areas where conservation efforts should be targeted in order to help increase black duck populations and benefit the health of the Chesapeake Bay.

R.2.8: Varner

An Assessment of Landscape Carrying Capacity for Waterfowl in Nebraska's Rainwater Basin

Ele Nugent[1], Andy Bishop[1], Roger Grosse[1], Ted LaGrange[2], Dana Varner[1]*, Mark Vrtiska[2]

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The Rainwater Basin (RWB) wetland complex in Nebraska provides critical spring-staging habitat for millions of waterfowl. However, 90% of the original RWB wetlands have been lost. This project was conducted to estimate the accessible forage resources on wetlands enrolled in the Wetlands Reserve Program (WRP) and other conservation programs, on publicly-owned lands, and across the entire RWB landscape. A map of the vegetation communities of all historic RWB wetlands in 2012 was created from aerial imagery and vegetation survey data. Energetic resources accessible to waterfowl were estimated using a kilocalorie per acre rate for each habitat type based on the vegetation map communities. Energetic availability for waterfowl was calculated as the total potential forage production, assuming all wetland areas were ponded, as well as the actual, accessible energetic resources based on annual ponding data. Total potential forage resources available in 2012 for waterfowl, including all ponded and non-ponded areas, was 6.1 billion kcal, enough to meet the 4.4 billion kcal needed to sustain target waterfowl populations. Estimated mean kilocalorie accessibility based only on ponded wetland areas, however, was only 1.3 billion kcal, 3.1 billion kcal short of the target accessible forage for waterfowl. Comparison of the 2012 vegetation map to a map of vegetation in 2004 indicated that the area of early successional habitat increased 560 ha in the entire RWB between 2004 and 2012, and 441 ha on WRP wetlands. Between 2004 and 2012, the total vegetative potential kilocalorie production for waterfowl increased by 228.8 million kcal, while the average ponded accessible forage for waterfowl increased by 131.9 million kcal. Active management actions in the RWB appeared to increase the accessible kilocalories for waterfowl.

R.3: Harvest

R.3.1: Austin

Multi-Scaled Analyses Of Lesser And Greater Scaup Harvest In North America

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The combined populations of lesser scaup (*Aythya affinis*) and greater scaup (*A. marila*) are widely distributed and abundant, comprising 10–20% of North American breeding duck populations surveyed annually. However, declines in scaup populations have challenged waterfowl managers to develop improved harvest strategies while at the same time addressing falling waterfowl hunter numbers. We analyzed harvest data and examined trends in harvest of lesser and greater scaup in the United States and Canada, at national, flyway, state/province, and U.S. county levels. Our analyses indicated annual harvests of both scaup species in the U.S. and Canada were highest during the late 1960s to early 1980s, a period of high scaup and hunter abundance. The Mississippi Flyway dominated U.S. lesser scaup harvest whereas the Atlantic Flyway accounted for the highest proportion of greater scaup harvest; similar harvest distribution patterns were observed in coastal and interior regions of Canada. Relative dominance of the Mississippi Flyway for lesser scaup harvest has depreciated substantially in recent decades, with reduced harvest in states of the Great Lakes region accounting for this change. County-level harvest data for high harvest (1975–1984) and low harvest (2000–2008) periods revealed specific areas important to scaup hunters in the U.S. plus changes in harvest distribution during these periods. States in the upper Midwest and Gulf Coast regions have been most important to lesser scaup harvest whereas coastal areas bordering the Great Lakes and northern Pacific and Atlantic regions of the U.S. were most important for greater scaup hunting. We discuss implications of these changes and how they might be considered in scaup harvest and habitat management.

R.3.2: Bonczeck

Harvest Distribution of Mallards Marked on the Yukon-Kuskokwim Delta, Alaska

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Mallards (*Anas platyrynchos*) are one of the most heavily hunted ducks in North America. Because these birds arrive from various breeding areas and tend to mix on the wintering grounds, complications often arise in setting hunting regulations. During the span of 1990-2014, a total of 1466 mallards have been banded in the course of annual preseason duck banding at Kgun Lake, Yukon Delta National Wildlife Refuge, Alaska. As of 2015, a total of 112 hunter-harvested recoveries of Yukon Delta-marked mallards have been reported across three North American Flyways: Pacific, Central, and Mississippi, with the overwhelming majority (97%) of these recoveries occurring in the Pacific Flyway. Although California dominates the Pacific Flyway's total mallard harvest, Washington and Oregon are responsible for the bulk of the flyway's Yukon Delta-marked mallard harvest at 44.6 and 20.5 percent, respectively. Yukon Delta-marked mallards are primarily harvested in a region of the northern Puget Sound coastline spanning between Vancouver, British Columbia, Canada and Mount Vernon, Washington, USA. Using hunter reported band recoveries, we describe the harvest distribution of Yukon Delta-marked mallards in terms of ecologically-relevant regions, such as watersheds and coastal estuaries, and compare it with that of other birds originating in Alaska.

R.3.3: Brady

Direct Recovery Rates of Egg Salvaged and Wild Mallards in California, 1986-2014

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A large percentage of the world's rice, wheat, hay, and other grain crops are farmed in the Sacramento and San Joaquin Valleys. Once a mosaic of wetlands and upland nesting habitat, it is now a landscape dominated by agriculture. By nature of some of these crops, such as vetch, wheat, and alfalfa - they create dense nesting cover appealing to local breeding waterfowl. California Waterfowl's Egg Salvage Program has been facilitating the salvage of duck nests that would be destroyed by normal agricultural practices (i.e. harvest of wheat) since 1986. Eggs are salvaged and incubated. Birds remain at the salvage facility until they reach 5 weeks of age; they are then banded and released. Since 1986, CWA has banded and released over 83,000 egg salvaged mallards (*Anas platyrhynchos*). Comparatively, CWA has also captured and banded wild mallards since 1986; of the local and hatch-year cohorts 75,555 have been banded. Band analysis of salvaged and wild mallards shows that direct recovery rates of wild birds tend to be greater than that of salvaged birds. This suggests that survival of salvaged mallards from time released to their first hunting season may be lower than that of wild mallards. Further analysis will include distribution of harvest of direct recoveries for both salvage and wild ducklings.

R.3.4: Miller, C.

Using Waterfowl Harvest Data to Investigate Efficacy of Non-toxic Shot Regulations

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The Illinois Waterfowl Hunter Harvest Survey has been collecting waterfowl harvest and crippling data from hunters since 1981. Lead shot was banned for waterfowl hunting in Illinois beginning with the 1994 waterfowl season. We employed time series analysis to investigate efficacy of non-toxic ("steel shot") regulations on waterfowl crippling rates for ducks and geese among Illinois hunters across the 33 years of waterfowl harvest data. Crippling trends prior to 1994 (R^2 = -0.356) suggest the same trend in decline as that from 1994 to the present (R^2 = -0.353); however, number of crippled ducks was greater prior to the lead shot ban. Crippled ducks per 100 ducks bagged showed a steady trend prior to the ban (R^2 = 0.001) and declined after the ban was in place (R^2 = -0.617) with number of crippled ducks greater prior to 1994. Standardizing crippled ducks per hunter per day produced differing trends: Cripples were greater and trend line for decrease lower (R^2 = -0.153) prior to the ban, and trend for crippled ducks (R^2 = -0.540) declined following the ban. Trends for geese showed crippled geese per year increasing (R^2 = 0.478) prior to the ban, and declining afterwards (R^2 = -0.178). Trends for crippled geese per 100 bagged were similar to ducks: R^2 = 0.0003 prior to the ban and R^2 = 0.-535 after it was in place. The trend for crippled geese per hunter per day was increasing prior to the ban (R^2 = 0.142) and declined afterwards (R^2 = 0.331). Discussion will focus of the effectiveness of the lead shot ban on waterfowl crippling in Illinois and use of harvest data to denote trends in regulatory effects.

R.3.5: Olsen, D.

Banding Cinnamon Teal throughout the Intermountain West to Improve Information for Management

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Based on spring breeding-ground surveys, numbers of blue-winged (*Anas discors*) and green-winged (A. crecca) teal have increased to record levels in recent years. In response to requests for more hunting opportunities on teal, the U.S. Fish and Wildlife Service in 2009 requested an assessment of the harvest potential of the three North American teal species, including the cinnamon teal (*A. cyanoptera*). The assessment included five areas of interest, two of which were a derivation and distribution of harvest for each species and a description of the population dynamics of each species (Teal Harvest Potential Working Group 2013). The Working Group's preliminary analysis of banding data indicated that there was a lack of cinnamon teal demographic information and the assessment of the harvest potential was limited to blue-winged and green-winged teal only. This project is working on reducing information gaps on cinnamon teal. The objectives of this study are to: (1) develop a distribution and derivation of harvest for cinnamon teal, and (2) provide more precise survival and recovery estimates by reducing the current coefficient of variation (48% [Teal Harvest Potential Working Group 2013]) on calculated survival and recovery estimates by 50%. Using program BAND2 and an estimated band-recovery rate of 0.02, sample sizes were calculated to meet objective 2. A pre-season banding program targeting cinnamon teal was initiated in 2012 to collect data that would fulfill the objectives. Banding stations were set up in five locations within the breeding range of cinnamon teal (i.e., in Colorado, Utah, Idaho, California and Oregon). To date, cooperators have banded 4,213 cinnamon teal (2012 – 2014), of which 51% and 49% were males and females, respectively. From those banded birds, 113 recoveries have been reported, of which 52% were males and 48% were females. Forty six percent of all recoveries occurred in California while 16 % were in Mexico and Central America. This project will continue through 2018 when final analysis on both objectives will be completed.

R.3.6: Amundson1

The Effect of Harvest Regulations on Hunter Effort, Harvest Rates, and Annual Survival of Mallards and Grey Ducks in New Zealand.

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We investigated how mallard and grey duck hunter behavior, environmental covariates, and mallard and grey duck population size affected per capita harvest, hunter effort (i.e., hours hunted), and hunter participation (i.e., license sales) between 1997–2012 in the Eastern Fish and Game Region of New Zealand. Additionally, we examined how total annual hunter effort and harvest affected annual survival and harvest rates. Per capita harvest increased with hunter effort and bag limits while per capita hunter effort decreased over time, but effort and participation increased with mallard population size. Harvest rates were greater for juveniles and oscillated over the study period on an approximately 15-year cycle. Harvest rates were not associated with hunter effort, total harvest, or environmental covariates. The relationship between harvest regulations and harvest rates were inconsistent. The 44 day seasons had greater juvenile harvest rates than the 31, 57 and, 72 day seasons. Similarly the 7 bag limit (BL) years had higher juvenile harvest rates than the 10 BL years. Hunter effort affected annual survival rates, especially for females. However, hunter effort may be a surrogate for population size; fewer hunters hunted less in years with relatively few birds. Thus, survival rate may have been density dependent. Our results suggest bag limits are more effective at managing harvest than season length; reducing bag limits to 4–5 birds per day could decrease harvest by as much as 50%. Furthermore, better enforcement of season regulations may improve harvest management as 58% of active hunters reported they shot mallard and grey duck after the close of the short season (31-days) which accounted for 13% of total harvest. Our findings have implications for the length and timing of the hunting season in New Zealand and may provide insight into hunter behavior relative to harvest regulations in North America.

R.4: Migration

R.4.1: Amundson2

Population Change Varies by Trophic Level and Migration Strategy for Arctic-breeding Waterfowl

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For arctic-breeding waterfowl, changes in climate are occurring rapidly with unknown consequences to population dynamics. Further, climate change is predicted to influence waterfowl populations differently depending on species and guild-specific life history strategies. Here we evaluated US Fish and Wildlife Service aerial survey data for 20 species of waterfowl breeding on the Arctic Coastal Plain, Alaska (ACP) from 1992–2014 using Bayesian hierarchical Poisson state-space models to examine patterns in population change among species exhibiting similar diet and migration pathways, and explore spatially explicit population change. We grouped species into 4 guilds: herbivores (4 species of geese), freshwater aquatic herbivore (tundra swan), invertivores (9 species including eiders, scoters, scaup, and long-tailed ducks), and freshwater omnivores (5 species of dabbling ducks). We further partitioned these based on non-breeding migration patterns as: coastal migrants (Pacific flyway; 8 species) or those using overland routes primarily through the Midcontinent (12 species). Preliminary results suggest herbivores are increasing rapidly and shifting distributions toward the coast where concurrent studies have documented abundant high quality forage. Invertivores and freshwater omnivores are exhibiting mixed trends among species and high levels of variability. Populations of a freshwater aquatic herbivore (tundra swans) and piscivorous (common mergansers) waterfowl are growing rapidly. In general, ACP breeding populations of species utilizing terrestrial habitats in the midcontinent and eastern Canada and U.S. appear to be increasing at a greater rate than those that utilize the Pacific flyway and rely more on marine habitats during migration and winter. Our results suggest that climate change may be affecting waterfowl populations through changes in bottom-up processes on the breeding grounds and possibly during other times in the annual cycle emphasizing the importance of cross-seasonal effects. Ongoing US Geological Survey research is seeking to identify causal mechanisms behind observed change.

R.4.2: Knox^

Waterfowl Migration Chronology and Food Production at Great Swamp National Wildlife Refuge

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Waterfowl rely on a long line of stopover sites during migration between their wintering and breeding grounds. Along with naturally occurring wetlands, managed wetlands serve as valuable locations where waterfowl can rest and feed. To effectively manage wetlands for certain waterfowl species, knowledge of area-specific migration trends, wetland food production, and water depth distribution is key. This study will document the waterfowl migration chronology and associated food production of five managed freshwater wetlands located within Great Swamp National Wildlife Refuge, Morris County, New Jersey. To determine migration chronology, weekly ground surveys will be conducted in the spring and fall of 2015 and 2016 using protocols based on the Integrated Waterbird Management and Monitoring Program for the North Atlantic Region. To quantify waterfowl food production, spring and fall sampling will be conducted immediately prior to the arrival of migrating waterfowl, with 20 sampling sites allocated within each wetland. Spring sampling will consist of aquatic invertebrates and belowground seeds, while fall sampling will add in aboveground seeds, tubers, and submerged aquatic vegetation present at each sampling site. Food production will be measured in terms of biomass (kg/ha), and will be divided into categories of total sampled biomass and biomass of preferred waterfowl food species. Additionally, bathymetric mapping will be conducted in each wetland and at associated water control structures to gather information on the relationship between water depth, food production, and waterfowl abundance. Preliminary results from spring migration surveys show that 13 species were detected over the course of spring migration; of these, Wood Ducks (*Aix sponsa*), Ring-necked Ducks (*Aythya collaris*), Canada Geese (*Branta canadensis*), Mallards (*Anas platyrhynchos*), Green-winged Teal (Anas crecca), and American Black Ducks (*Anas rubripes*) were the most common species, with highest numbers of each documented between late March and early April. Diversity calculations (H' = 1.958, Ds = 0.834) demonstrated moderate species diversity within the Refuge, although proportionally higher numbers of the 6 most common species resulted in a lower evenness score overall (E = 0.764). Preliminary results from vegetation composition surveys indicate that a small number of emergent (cattail [*Typha* spp.], spatterdock [*Nuphar advena*], arrowhead [*Sagittaria* spp.], and giant bur-reed [*Sparganium eurycarpum*]) and submergent (watermilfoil [*Myriophyllum* spp.], elodea [*Elodea canadensis*]) wetland plant species have become relatively dominant within the wetlands. Additional results will focus on the data gathered by 2015 fall migration surveys, summer vegetation surveys, and spring/fall biomass sampling. Once completed, data will serve as a baseline reference for the Refuge, and will assist Refuge staff in managing wetlands to support the greatest diversity of migrating waterfowl.

R.4.3: Lavretsky

Exploring Fall Migration Patterns of Northern Pintail Using Band-Recovery Data

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Waterfowl annually traverse wide geographic areas as they migrate between spring rearing and wintering grounds. Knowledge of migratory patterns, including changes over time, is necessary for the successful management of migrating species. Northern pintail (*Anas acuta*) have been a species of management concern since the 1950s when populations began to significantly decline. To understand the migratory tendencies of pintail, I reconstructed fall (September-February) migration patterns by overlaying monthly kernel density estimates based on a century of direct band-recoveries on maps. Data was partitioned by three banding locations following current pintail management units: Alaska, Northwestern Territories (NWT), and the prairie pothole/parkland (PP) region. Additionally, the proportions of bands annually recovered in different major wintering regions were estimated for each population. Results were consistent between hatch-year and after hatch-year individuals. In general, recovery distributions support that pintail arrive on wintering grounds early, with high density of recoveries in October and November in California's Central Valley and the West Gulf Coast (WGC), respectively. On average, 62% (range = 25%-100%) of Alaska bands were consistently recovered across time in the Pacific flyway, and specifically in California's Central Valley, as compared to an average of 8% in the WGC. Conversely, distributions for NWT and PP birds split between those ultimately recovered in the WGC or California's Central Valley. Interestingly, only NWT and PP birds had distributions extending into Mexico. Furthermore, annual recovery proportions of NWT and PP bands oscillated, with either equal recoveries in both wintering regions (1940-1970 and 2000-2007), greater in the Pacific Flyway (1970-1990), or greater in the WGC (1990-2007). Higher recoveries recorded in the Pacific Flyway were positively correlated with spring pintail abundance estimates. In general, these results shed light into migratory tendencies of pintail that support NWT and PP region as a single management unit and separate from the Alaskan population.

R.4.4: Pearse

Distribution of Spring Migrating Waterfowl along the North and South Platte Rivers in Western Nebraska

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Riverine systems worldwide function as critical stopover sites for migratory waterbirds, providing key resources for migration and lipids prior to arrival at breeding grounds. The North and South Platte River Valleys in Nebraska has been recognized as an important wintering area for waterfowl, yet few efforts have been made to quantify abundance and distribution during spring migration. Information is lacking to implement and prioritize conservation actions in this region, namely migration chronology, spatial distribution of species, and habitat attributes that drive distribution. During springs 2014 and 2015, we conducted 8 waterfowl surveys in an area extending from the confluence of the North and South Platte Rivers west to the Nebraska state line. A pilot and observer collected data on waterfowl abundance and distribution within river channels and associated wet meadow and wetland complexes. Flights were conducted at approximately 100 m above ground in a fixed-wing aircraft. We summarized observations of ducks (species combined) and Canada geese (Branta canadensis) to understand temporal and spatial dynamics. We determined presence, areas of core use, and density along the river channel, highlighting locations consistently and intensely used by migrating waterfowl. Coupled with habitat and landscape covariates, our results will provide information to government and non-government entities working to implement conservation strategies for the benefit of waterfowl and other priority species.

R.4.5: Simms

A Test of the Migration-Modulation Hypothesis in a Non-Passerine Neotropical Migrant, the Blue-Winged Teal *Anas discors*

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Blue-winged Teal (*Anas discors*) initiate southward migration from breeding grounds in late summer, making trans-Gulf flights to overwinter in South America. As such, this species displays a fall migratory pattern unique among North American waterfowl and similar to that of Neotropical passerines. Corticosterone, the major avian hormone of stress and energy regulation, has been shown to influence migratory physiology in passerines. The Migration-Modulation Hypothesis (MMH), a pattern of corticosterone secretion characterized by elevated baseline and a reduced adrenocortical response to a standardized stressor, has been documented in several passerine species during migration. However, little is known about the adrenocortical response in migratory waterfowl. Therefore, we sampled Blue-winged Teal during fall (n = 8) and spring migrations (n = 10), and compared their adrenocortical profiles to those of breeding teal (n = 20). Baseline corticosterone was low and did not differ among groups; however, migrating teal showed a significantly reduced adrenocortical response. While the low baseline corticosterone data do not support the MMH, the reduced adrenocortical response during migration does, and suggests the existence of a mechanism similar to that of Neotropical migratory passerines, which is hypothesized to protect flight muscle from the catabolic effects of elevated corticosterone.

R.4.6: Vrtiska2

Factors Influencing Body Mass of Spring-Migrating Female Northern Pintails

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The Rainwater Basin (RWB) area of Nebraska is an important spring staging area for Northern Pintails (*Anas acuta*, hereinafter pintails). Understanding factors which may influence accumulation of nutrient reserves and recruitment is important for conservation and management planning. We collected female pintails in the springs of 2000 and 2001 to examine possible differences in body mass between age classes (adult vs. juvenile), pairing status (courting, paired, or single), area (east or west RWB) and years. Adult female pintails had greater body mass than juvenile females. Courting and paired females had greater body masses than single females. Females collected in the western portion of the RWB, where light goose conservation order activities were limited, and those collected in 2001, a year with better habitat conditions, had greater body masses. Management actions that reduced disturbance and improve habitat conditions for female pintails during spring migration should benefit pintails by increasing body condition and subsequently recruitment.

R.4.7: Wells-Berlin

Migration, Phenology, and Philopatry of Long-tailed Ducks Wintering on the Atlantic Coast

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Long-tailed ducks were captured (n=101) via night-lighting and tagged with PTT inter-abdominal transmitters at Nantucket, MA, Cape Cod, MA and Chesapeake Bay, MD/VA during the winter between 2007 and 2012. Telemetry indicates long-tailed ducks exhibit strong site fidelity to wintering areas in which they were captured; birds captured at one location tended to return to the same areas after completing their migration. In addition there is evidence of two distinct routes chosen by ducks migrating from their respective wintering and breeding areas. Ducks tracked from the Cape Cod/Nantucket capture site departed early to mid-April, passed through the Northumberland Straite, and either stopped over in the St. Lawrence Estuary or Chaleur Bay before departing to breeding/molting areas. Birds released in Chesapeake Bay migrated straight to Lake Erie before continuing to presumed breeding sites. Preliminary analysis suggests wintering sites are not a good predictor of final breeding destination as birds from either capture location had overlapping breeding grounds ranging from northwestern Quebec to Nunavut. This information will be useful for the management of the species – especially at key bottleneck areas along their migratory route - and refinement of surveys on breeding and wintering grounds.

R.5: Physiology

R.5.1: Amundson3

Infection Dynamics of Helminths in Arctic and Sub-arctic Breeding Geese

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Parasitic infections are often positively associated with host relative population density. Pacific black brant populations on the sub-arctic Yukon-Kuskokwim Delta, Alaska (YKD) are declining and likely near carrying capacity. However, black brant and greater white-fronted goose populations in Arctic Alaska (arctic) are increasing rapidly. We hypothesized that arctic-breeding geese might have reduced parasite burdens because of lower relative densities of birds and potential limited opportunity for parasites to complete complex annual life cycles. Thus, reduced parasite infections may be one advantage to birds breeding at high latitudes. In 2014, we collected juvenile and adult black brant from a subarctic site (YKD, n = 43), and black brant (n = 41) and greater white-fronted geese (n = 58) at an arctic site, to examine: a) prevalence and intensity of parasite infections between hosts and locations, b) the relationship between parasite infection and adult mass or juvenile size, and c) whether helminths are transmitted locally at high latitudes. We found that 100% of adult and juvenile geese were infected with an average 101 helminths (range: 2-659). Helminth communities were most often comprised of 3 species (range: 1-7). Helminth species composition and species richness were similar between sites and hosts. However, arctic-breeding geese had greater overall infection intensities than sub-arctic breeding geese. In the arctic, juveniles of both species had higher overall prevalence than adults. Infection intensity did not vary by sex or adult mass. At the arctic site, overall helminth intensity was greater in juvenile black brant with greater wing length (an index of age and structural size). Our results demonstrate that helminths readily complete their life cycle and infect waterfowl at high latitudes, which may have fitness consequences for hosts. These data do not support our original hypotheses, and suggest that parasite burdens are not always related to host population density.

R.5.2: Amundson4

Mallard Duckling Survival and Brood Habitat Selection in Southland, New Zealand

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New Zealand pasture management has shifted in recent years from sheep and deer farming that typically results in short-grass pasture during the waterfowl breeding period to stocking dairy cattle resulting in largely long-grass pastures during this time period. This shift has led to some concern over potential impacts of habitat change to the mallard (Anas platyrhynchos) population, specifically during the brood-rearing season, in Southland, New Zealand. In 2014, we investigated environmental factors and female characteristics affecting mallard duckling survival including: pasture type (long or short grass), percent dense nesting cover within a buffer of the broods used-route, presence of ephemeral water, distance to the nearest permanent water source, distance to the nearest anthropogenic structure, brood size, egg volume, female age, date of hatch, precipitation, log-linear duckling age, and average distance moved from the nest site. We monitored 438 ducklings from 50 radio-marked brooding females to 30 days post hatch. We modeled ragged telemetry data using the nest survival module in Program MARK and evaluated model fit using Akaike's Information Criterion adjusted for small sample size and over dispersion (QAICc). Duckling survival was not affected by pasture type, but increased with log-linear duckling age (β = 0.05, 85% CI = 0.02 – 0.08), the presence of ephemeral water (β = 0.58, 85% CI = 0.15 – 1.01) and with greater distance from the nearest anthropogenic structure (β = 0.28, 85% CI = 0.02 – 0.54). Survival was lower for second-year (SY) females than after-second-year (ASY) females (β = -0.52, 85% CI = -0.90 – -0.13), in areas with more dense nesting cover (β = -0.37, 85% CI = -0.60 – -0.15), and when ducklings moved, on average, greater distances (β = -0.33, 85% CI = -0.56 – -0.10). Cumulative 30-day survival ranged from 0.11 (85% CI = 0.07 – 0.15) for SY females without ephemeral water present to 0.46 (85% CI = 0.41 – 0.51) for ASY females with ephemeral water present. Compositional analyses demonstrated broods selected for dense nesting cover disproportionately to what was available at both the landscape (30 km2) and within habitat corridors used by broods. Our results suggest duckling survival is generally low in Southland relative to estimates using similar methods from North America and that dense nesting cover is important for brood-rearing females, but translated into lower duckling survival. Dense nesting cover could support greater predator abundance, or females could be selecting habitat to maximize another aspect of their life history (e.g., adult female survival, nest success) with tradeoffs to duckling survival.

R.5.3: Ballard, D.^

Survey of Gizzard Helminths in Female Northern Pintails

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Northern pintails breed from the southern Artic to the Prairie Pothole region of southern Canada and the northern Great Plains of the United States. Major wintering areas for northern pintails include the Central Valley of California and the Gulf coast of Texas and Louisiana. The northern pintail is currently 45% below population objectives and has been declining since the 1950's. Although many studies have been conducted to better understand the ecology of the northern pintail, there is little knowledge about the influence of parasites. Parasite infections can lead to damage to the gizzard lining and lead to gizzard dysfunction, weakness, and possible poor growth rates of juveniles. Our objectives are to identify and determine the frequency and intensity of helminths that occur underneath the gizzard lining in female northern pintails while evaluating the influence of host age on parasite populations. One hundred female northern pintails, representing 51 adults and 49 juveniles, were collected along the Texas coast between October 15, 2014 and March 15, 2015. Each specimen was aged by wing and other feather characteristics, and necropsied as part of a larger study. During necropsy, the gizzard was cut open, contents removed, gizzard lining removed, and examined for parasites. Twenty-six (26%) birds were infected with one or more helminth species. Twenty-one percent were infected with 1 or more species of nematodes and five percent were infected with the cestode *Gastrotaenia cygni*. Of the 51 adults examined, eight (15.7%) were infected with nematodes while five (9.8%) had the gizzard cestode *G. cygni*. Of the juveniles examined, 8 (16.3%) and 9 (18.4%) had nematodes and *G. cygni*, respectively. Findings are discussed in relation to other studies of gizzard helminths in waterfowl.

R.5.4: Dorak^

Micro-site Climatic Conditions Associated with Urban Thermal Refugia used by Canada Geese during Winter

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In the past several decades temperate-breeding Canada geese (*Branta canadensis*) have increased throughout the midwestern United States and appear to concentrate in more urban environments opposed to migrating to southern latitudes during winter to aid in thermoregulation. We investigated Canada geese wintering in the Greater Chicago Metropolitan Area (GCMA) and identified winter roost sites to measure micro-site thermal benefits of selected thermal refugia. Our objectives were to determine thermal regulatory benefits of selected habitats during winter; identify the temperature gradient when geese transition from one roost site to another; and determine how thermal refugia can be manipulated so thermoregulatory benefits are no longer available and birds are forced to move into new locations. Use sites were determined by attaching solar-powered global positioning system (GPS) CTT 1040a transmitters (Cellular Tracking Technologies, Somerset, PA) to waterfowl neck collars on nine Canada geese and monitoring movements. Of the nine geese tracked, seven were deemed temperate-breeding and two deemed subarctic-breeding based on morphological measurements. At unique sites, we deployed iButton temperature loggers (Maxim Integrated, San Jose, CA) in January and February 2015 to determine differences in ambient temperature and these data were compared to local weather station data. Even after birds shifted from one site to another, iButtons were left deployed at each site for the remainder of the field season to identify at what temperatures sites were used. Four main roost locations where identified including two rooftops, a waste water treatment plant and a park along Lake Michigan. Areas that were previously used had temperatures in close proximity to data gathered from a local weather station, but the waste water treatment plant and rooftops had temperatures exceeding local temperatures by 21.6°C and 9.6°C at certain points throughout the day, respectively. Canada geese showed a preference for black color rooftops when compared to white and gray colored rooftops of adjacent buildings. Each black rooftop had as many as 350 individuals occupying them at one time. Of the geese using the rooftops as many as one third of the birds had been neck-collared during the year from areas all throughout the GCMA. Geese also had a tendency to congregate on the northeast corners and around heat vents of each building. During the winter of 2015–2016 we will deploy temperature recorders along with anemometers to record micro-site specific data for use in an operative temperature model. Identifying thermal benefits will help understand why current sites are selected by wintering geese and how local businesses and wildlife managers can manage these areas to decrease conflicts with humans."

R.5.5: Drahota

Spatial and Temporal Differences in Anatid Body Condition and Forage Quality During Spring Migration in the Rainwater Basin, Nebraska

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Many North American ducks rely on the feeding and resting habitats of the Rainwater Basin (RWB) in south-central Nebraska each spring. This area is believed to be a bottle neck for refueling and fat deposition. Yet, very few studies have evaluated available habitat quantity and quality, the bird response to these conditions, and the body condition of ducks using these habitats during spring stopover. Therefore, we evaluated spatial and temporal habitat variables and the agent-based response by collecting and determining ingesta and body condition of 6 different granivorous duck species that were actively feeding in wetlands (n = 471) and are locally abundant during spring migration. Habitat quantity was determined for all public wetlands (n=97) by using low-level aerial surveys (~ 450 m AGL) flown within 3 days of peak migration and by evaluating high-angle photography collected by the Rainwater Basin Joint Venture to evaluate available habitat (ponding >0.4 ha of water) within a 10-km area of each study wetland. For the publically managed areas were ducks were sampled, the median number ponding water in 2012 was 12 (mean = 16.7 ± 2.0) wetlands with a mean total ponded area of 120.9 ± 14.4 ha, and the median in 2013 was 6 (mean = 6.6 ± 0.8) wetlands with a mean total ponded area of 41.8 ± 3.9 ha. We determined wetland habitat quality by calculating peak weekly duck-density (mean = 1151.4 ± 190.5 ducks/ha) for each wetland (n = 64) and by measuring the initial energy available for a subsample of wetlands prior to waterfowl arrival. Ingested items were identified, counted (seeds), and weighed to determine percent (%) aggregate of ingested items. A total of 64 ingested seed genera and 3 phyla including 6 classes of invertebrates were identified. We used published forage quality for many seeds consumed, but we also determined protein, fat, ash, and metabolizable energy for frequently consumed items when they were not available in the literature. Body condition was evaluated temporally by sampling early (n = 232) and late (n = 239) arrivals, and spatially by evaluating available habitat (>0.4 ha) within a 10-km area for two dry years (2012-13). Across all ducks sampled, only wigeon indicated a significant difference in % fat where late arriving birds were significantly fatter ($F_{1,12}$ = 9.81, P = 0.009), yet all ducks sampled indicated a decline in % fat (r = -19.3%, P = 0.0001) over time. Furthermore, linear regressed hens (n = 216) indicated a decline in % fat (r = -23.7%, P = 0.0004), but an increase in % protein (r = 21.5%, P = 0.0013) during the 69 day spring sampling period. Species-specific evaluations determined that early arriving adult hen pintails had higher % fat than late sampled birds ($F_{1,73}$ = 6.253, P = 0.015). No significant differences in body condition (% fat or % protein) were found in ducks using complexes with low (XX□=4.8, median = 4 ponded wetlands) or high (mean = 17.8, median = 14 ponded wetlands) wetland densities or in the total ponded area provided (low mean =27.7 ±4.4 ha ; high mean = 108.2 ±13.6 haa) within 10-km. Early arriving ducks also did not indicate any significant differences in body condition for the number of wetlands or the area of wetland habitat available in the 10-km area. However, early arriving hens (n = 108) had significantly higher % fat in complexes with low numbers of wetlands available (Z = 2.11, P = 0.035) while % protein indicated an inverse relationship (Z = -1.88, P = 0.059). Finally, duck-densities were not correlated to surrounding wetland density or the total ponded habitat within a 10-km area. These results indicate that early arriving ducks are generally in better condition than later

arriving ducks. In dry years, wetland complexes (10-km radius) are not used disproportionately, and they are not correlated to use by ducks in better body condition. Spatial distribution is correlated to habitat quality; therefore all wetlands that have high amounts of energy and pond water (such as temporary wetlands) will support fat deposition. Rather than limit conservation delivery by focusing on existing complexes, future programs should focus on increasing the number of reliable wetland habitats (spring ponding) across all areas of the RWB, especially where expected gains in annual total ponded area will increase significantly.

R.5.6: Elmberg

Farmed European Mallards are Genetically Different and Cause Introgression in the Wild Population Following Releases

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The practice of restocking already viable populations to increase harvest potential has since long been common in forestry, fisheries and wildlife management. The potential risks of restocking native species have long been overshadowed by the related issue of invasive alien species. However, during the last decade releases of native species with potentially non-native genome have received more attention. A suitable model to study genetic effects of large-scale releases of native species is the Mallard *Anas platyrhynchos*, being the most widespread duck in the world, largely migratory, and an important quarry species. More than 3 million unfledged hatchlings are released each year around Europe to increase local harvest. The aims of this study were to determine if wild and released farmed Mallards differ genetically, if there are signs of previous or ongoing introgression between wild and farmed birds, and if the genetic structure of the wild Mallard population has changed since large-scale releases started in Europe in the 1970s. Using 360 Single Nucleotide Polymorphisms (SNPs) we found that the genetic structure differed among historical wild, present-day wild, and farmed Mallards in Europe. We also found signs of introgression in the wild Mallard population, that is, individuals with a genetic background of farmed stock are part of the present free-living population. Although only a small proportion of the released Mallards appears to survive to merge with the free-living breeding population, their numbers are still so large that the genetic impact may have significance for the wild population in terms of individual survival and longterm fitness.

R.5.7: Guillemain1

Biases in Duck Body Mass Measurements at Banding

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Body mass of ducks often decreases between banding and subsequent recapture. This may be indicative of stress caused by handling, but an alternative hypothesis comes from the general use of bait in/around traps, which could bias such measurements. Initial body mass and body mass loss between first and subsequent captures were compared between trapping sites where Common Teal (*Anas crecca*) were attracted with bait or with live decoys. When bait was used Teal had a greater body mass at banding but were lighter at recapture. When using live decoys initial body mass was lower, but remained constant at the next capture event. This suggests that the commonly observed pattern of body mass decrease between capture and recapture is not simply reflecting stress caused by handling. Rather, we hypothesize this is an artifact linked with duck hyperphagia when first encountering an unexpected abundant source of food. Upon recaptures birds would ingest less of this now predictable grain, instead favoring predator escape ability through lighter body mass. Banding itself may not be such a source of stress than Teal loose body mass. However, another implication of our results is that most available duck body mass data, usually obtained from ringing at baited traps, may be artificially inflated.

R.5.8: Guillemain2

Is Swabbing for Avian Influenza a Safe Technique for Ducks?

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Hundreds of thousands of wild birds have been sampled worldwide over the last decade for the purpose of avian influenza viruses surveillance given they are a natural reservoir of these viruses for poultry and a wide range of mammals including human beings. Fecal shedding resulting in water contamination is considered among the most common mean of AIV transmission, hence most samples have consisted in cloacal swabs, although blood sampling (and pharyngeal swabs) have also been used to a lesser extent. To date, the consequences of such sampling for the behavior and subsequent survival of waterfowl have not been evaluated. Combining metal band recaptures and recoveries, plus observations of nasal-saddled individuals, we compared the fate of control, swabbed, and swabbed and bled individuals in Common Teal (*A. crecca*), Mallard (*A. platyrhynchos*), Common Pochard (*Aythya ferina*) and Tufted Duck (*A. fuligula*) in France. The only apparent effect of swabbing was a lower re-encounter rate in Teal, while survival rates did not differ: these birds likely left or avoided resighting sites after swabbing. No other significant effect was recorded in the other cases, suggesting that cloacal swabbing is a suitable and safe method to monitor AIV prevalence in ducks.

R.5.9: Hinton^

Exploring the Development of Personality in Captive-reared and Released Waterfowl

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The decline of eastern U.S. populations of wild Mallards in the 1980's led to increasing interest in the release of captive-reared birds to supplement wild populations, a practice that has been used to enhance hunting opportunity since the 1930's. Although concerns have been raised, these programs are still employed today and the release of captive animals is now more heavily regulated. In California, egg salvage programs collect eggs of Mallards and Wood Ducks from abandoned nests (nests which the hen has abandoned due to agricultural activities or some other disturbance) with the intent of future release. Salvaged eggs are hatched in captivity, and ducklings are reared with protection from predators to be released back into their native wild populations. Federal and state regulations require that birds are released only during the non-hunting season and are not baited or used as decoys. Egg salvage is intended to provide greater potential harvest opportunity while supplementing and maintaining populations. Though ducklings receive social stimuli from conspecifics of the same age, they are unable to interact with adult ducks (i.e. hens) and their early-life experiences are limited to an artificial environment with food provided ad libitum. Interestingly, little is known about how the captive rearing environment might influence behavioral development and impact the overall success (survival and reproductive success) of captive-reared and released ducklings. Recent work suggests that personality might be an important factor influencing the survival of captive-reared and released animals. Animal personality can be defined as individual variation in behavior that is consistent across time and/or context. This variation has been shown to be important in ecological and evolutionary processes and appears to be driven by both genetic and experiential processes. Some of the commonly measured and generally important animal personality characteristics include boldness (risk-sensitivity; i.e. the response to predation risk), activity, exploration, sociability, aggression, and neophobia. These parameters are typically measured using tailored, repeated assays conducted on solitary individuals. In the current study, we document and describe individual behavioral variation and its consistency throughout the ontogeny of captive-reared Wood Ducks. Prior to this study, personality has not been formally examined in this species and only a small handful of studies exist for any waterfowl species. Using a variety of behavioral assays in both an individual and social context, we tracked ecologically relevant metrics of boldness (risk-sensitivity), activity, and exploration throughout the first 8 weeks of age for 47 Wood Ducks. We report our findings here.

R.5.10: Huck

Lead Ingestion by Female Northern Pintails Along the Texas Coast

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Lead poisoning has historically been a major health factor impacting North American waterfowl populations. Lead shot was banned for use in waterfowl hunting in the United States in 1991 and throughout Canada in 1997. While many studies have documented declines in lead consumption since the banning of lead shot, it has been suggested that lead may continue to persist in the environment for decades. Along the Texas Coast post-ban studies have documented mottled ducks (Anas fulvigula) having lead consumption rates as high as or higher than pre-ban rates of other species of ducks. Our goal was to estimate lead and non-toxic shot ingestion rates in female northern pintails (Anas acuta) wintering along the Texas Coast. We collected 227 female pintails during the winters of 2012-13 and 2013-14. Shot was removed from gizzard contents and later identified. In total 39 (17%) of 227 gizzards contained shot; 7 (3%) females contained lead, 20 (9%) contained non-steel/non-lead shot, and 24 (11%) contained steel. Some females had ingested multiple shot types. Shot ingestion rates in pintails were similar to those documented prior to the lead shot ban; however, lead ingestion rates have declined to ~30% of pre-ban ingestion rates (10%), suggesting lead is becoming less available over time. Lead may be persisting in the environment or it may be that it continues to be deposited through other means such as fishing tackle or upland bird hunting. While lead consumption by northern pintails has decreased, continued monitoring is important to assure consumption rates remain low.

R.5.11: Latty

Diseases as Potential Limiting Factors in Common Eider Nesting in the Beaufort Sea, Alaska

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The Pacific common eider (*Somateria mollissima v-nigrum*; COEI) population declined by 50–90% between 1957 to 1992, and has since stabilized at these reduced numbers. COEI is a USFWS Bird of Management Concern, Tier 1 Priority Species, and pilot Flagship Surrogate Species for the barrier islands and associated lagoons off the Arctic Coastal Plain of Alaska. COEI breeding on barrier islands in the Beaufort and Chukchi Seas are at risk due to small population size, isolation, and rapid environmental change at their arctic nesting areas. These factors may place the population vulnerable to disease, and disease may be limiting their ability to recover. Infectious and parasitic diseases have been documented to cause both mortality and reduced productivity in multiple eider populations across the circumpolar region. In previous studies, evidence of disease exposure has been detected in COEI in the Beaufort Sea and a novel adenovirus was reported as a cause of mortality in other sea ducks in the same region. However, the ecology and role of disease as a limiting factor in COEI in the arctic Alaska has not been systematically studied. We collected 35 blood samples and 47 cloacal swabs from nesting COEI hens across 120 miles of barrier islands in the Eastern Beaufort Sea in 2015. Our objectives were to screen serum samples and cloacal swabs for evidence of exposure to avian pathogens. Our results are compared to previous data collected 15 years ago in the same region, and will be followed by a 2-year intensive study to evaluate if diseases affect nesting success of Beaufort Sea COEI.

R.5.12: Marty^

Index of Spent Shot in Louisiana and Texas Gulf Coast Prairie Ricelands

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An estimated 2-3% of North American waterfowl die annually from lead poisoning despite the long-term ban on lead shotgun shells for waterfowl hunting. Lead also is deposited in waterfowl habitats when hunters use lead shot to pursue other game birds. The Chenier Plain (CP) of Louisiana and Texas and the Texas Mid Coast (TMC) are popular hunting areas that winter millions of waterfowl and other birds annually. Production and idled ricelands in the CP and TMC provide high energy foods for waterfowl, such as waste rice, natural seeds, tubers, and aquatic invertebrates. Consequently, waterfowl may ingest residual lead or non-toxic shot while foraging. We conducted a study to estimate density of lead and non-toxic shot in ricelands in the CP and TMC. We randomly collected and x-rayed 1,000 soil cores (10-cm diameter and depth) from production and idled ricelands in the CP and TMC (n = 760 and n = 240, respectively) in November 2013. We washed soil cores through a series of graduated sieves (4.75 mm – 300 µm) to recover shot pellets. We imaged the remaining soil biomass using a 600 mA generator x-ray system and computed radiography imaging plates. The samples were imaged at 60 kVp and 2.4 mAs with a focal film distance of 16 cm. Using the x-ray images, we detected one lead shot pellet from a production rice field in the CP of Louisiana and zero non-toxic pellets. Density of lead shot was 1273 pellets/ha (95% CI: 0-3,820). We believe that x-ray images were effective in detecting lead and non-toxic shot, because we imaged 20 soil cores containing known numbers of lead and non-toxic shot with 100% detection before imaging the 1,000 core samples. We speculate that regular soil tillage incorporates spent shot into the soil, likely rendering it unavailable to foraging waterfowl. Given that spent shot likely exhibits a clumped spatial distribution, our line-transect sampling may have been an imperfect design for estimating shot availability. Nevertheless, our results indicate that lead shot is not a widespread concern for waterfowl foraging in Gulf Coast ricelands."

R.5.13: McGrew

Captive Raised Duckling Growth Models for Sea Ducks and Dabbling Ducks

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The establishment of Patuxent Wildlife Research Center's breeding captive colony has enabled us to collect duckling growth data on multiple species of seaducks and dabbling ducks, including surf scoters (*Melanitta perspicillata*), white-winged scoters (*Melanitta fusca*), long-tailed ducks (*Clangula hyemalis*), lesser scaup (*Aythya affinis*), and American black ducks (*Anas rubripes*). Daily weights and biweekly tarsus and culmen measurements were obtained on ducklings from day of hatch up to 100 days of maturity for two years, with the objective of developing models that predicted each respective species' growth trend. Analyses of the data to determine key parameters of the Gompertz growth model, including growth rate constants, total growth, and the growth asymptote for multiple species, are being completed at present. These baseline data could be used as model growth curves of ontogenetic development and peak growth for individuals encountered in the field, allowing field biologists to use these measurements to potentially estimate age.

R.5.14: McPherson^

Estimating Behavioral Multipliers to Resting Metabolic Rate in American Black Duck and Lesser Scaup

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American black duck (*Anas rubripes*) and lesser scaup (*Aythya affinis*) populations have experienced continual declines over past decades. Research suggests that declines in these species may be the result of a complex set of factors including resource availability on migrating and wintering landscapes. Specifically, the widespread loss and degradation of historic coastal and inland wetlands has caused concern over the capacity of existing landscapes to support non-breeding waterfowl. In an attempt to quantify the ability of a landscape to support migrating and wintering waterfowl populations, many studies have begun using bioenergetics modeling to calculate energetic carrying capacity by estimating energetic demand and energetic supply. Estimates for many parameters required to calculate energetic demand (i.e. resting metabolic rates and percentages of time free-living ducks spend in various behavioral states) have been explored but sound estimates of behavioral multipliers to resting metabolic rate (RMR) are still needed. American black duck and lesser scaup were chosen as focal species due to their current population status and their representation of both the diving and dabbling duck guilds, which could allow for reasonable extrapolation to additional species. This study uses open-flow respirometry techniques to estimate RMR and to isolate behavior specific factorial increases to RMR in captive American black ducks and lesser scaup. Respirometry trials are being performed between September, 2015 and March, 2016 at Patuxent Wildlife Research Refuge, Laurel, MD. Results of this study will provide more accurate estimates of daily energetic expenditure for individuals of these species and will ultimately contribute to refined landscape carrying capacity estimates for waterfowl during the non-breeding period.

R.5.15: Olsen, G.

Hematology and Chemistry of Wild Scoters and Long-tailed Ducks

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Starting in 2006 as part of Sea Duck Joint Venture and Bureau of Ocean and Energy Management Projects we have collected blood from healthy surf scoters (*Melanitta perspicillata*), black scoters (*Melanitta americana*), white-winged scoters (*Melanitta fusca*), and long-tailed ducks (*Clangula hyemalis*) being banded and receiving satellite transmitter implants. We will report the clinical blood results including white blood cell counts, red blood cell counts, hematocrits, differentials, serum chemistry results, between sexes, age class, and species. Red and white blood cell counts were done using a bright-line hemocytometer and staining with an eosinophil solution and Nate-Herrick's solution. Differentials were performed using Diff-quick solution. Serum chemistry results were obtained from a Hemagen chemistry analyzer or commercial laboratory. These results can provide a standard for field biologists to determine the health of wild scoters and long-tailed ducks, and can be useful in disease epizootics.

R.5.16: Skalos

Validated Indices to Predict Body Condition of Pacific Greater White-fronted geese

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Accurate measures of avian body condition for use in energetic models are important to inform conservation planning. Body condition is a function of the lipids, protein, and mineral reserves maintained by an individual, which ultimately influence survival and fitness. Estimates of these reserves can be obtained using direct or indirect methods and different metrics may apply depending on the life history stage. For migratory birds, numerous methods are available to measure body condition and each sampling strategy has strengths and weaknesses. The chosen methodology ultimately depends on the level of resolution necessary to answer the research questions. Here we demonstrate the precision and utility of species-specific water ratio formulas and several body condition indices validated against measured lipid values in Pacific greater white-fronted geese (*Anser albifrons frontalis*). We divided our data into two datasets; one to build and one to test models (we did not do this for the development of the water ratio constant because there was no need to evaluate competing models). For structural indices we ranked models using model selection procedures. The most precise estimates came from the water ratio procedure (R^2 = 0.9914). Next best models included validated models for abdominal fat to predict total body fat (adjusted R^2 = 0.81 males, 0.93 females). Performance of validated models that were developed to provide nonlethal indices varied. Structural indices performed better (adjusted R^2 = 0.59 males, 0.64 females) than scaled mass indices (adjusted R^2 = 0.45 males, 0.54 females). Our findings confirm the results of other studies reporting that direct analysis of collected specimen tissues provide the most precise estimates of body condition; however, validated models using body mass and length measurements provide useful non-lethal methods for obtaining reasonable estimates of body condition.

R.5.17: Spragens

Avian Influenza and Foraging Waterfowl in Spring; an Ecologically-based Study Design

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Waterfowl foraging ecology dictates segregation of certain species across available habitat types. An opportunity existed to collect a supplemental piece of information related to Avian Influenza status during concurrently planned collections of scaup (*Aythya affinis* and *A. marilia*), ruddy duck (*Oxyura jamaicensis*) and northern pintail (*Anas acuta*) in spring 2015. Collection of these three species were conducted within three different managed habitat types spanning from bay to inland estuary. Thus, the samples were not only a reflection of species-specific viral prevalence, but perhaps represented a unique insight into habitat influence on transmission potential. A total of 53 collected AIV samples were processed, these included 8 scaup, 15 ruddy duck and 30 northern pintail. Nine samples (1 scaup, 1 ruddy duck, 7 northern pintail) tested positive for type A flu by rRT-PCR, a 16.9% pooled prevalence rate, including 1 northern pintail confirmed positive for the intercontinental H5 clade 2.3.4.4 by sequencing partial HA. In relation to the pond habitats, no positive samples were detected in Deep Muted-tidal Ponds (n=11), two type A positives were detected in Shallow Muted-tidal Ponds (n=12; 1 scaup, 1 ruddy duck), and seven type A positives were detected in Shallow Freshwater Ponds (n=30), including the 1 confirmed H5 clade 2.3.4.4 positive. Species co-occurrence, densities and their interactions with various habitat types on the landscape, combined with the differentiation between foraging and resting habitats (e.g. pond bottom versus levee or island) may provide ecologically relevant insights into the process of disease transmission. In this study, only ruddy duck was actually detected in all three habitat types, but no one species was observed actively foraging in all three habitats. If certain habitats facilitate viral transmission or circulation, then means to lessen potential transmission by altering that habitat-state may be available to habitat managers.

R.6: Population Dynamics

R.6.1: Deane^

Potential Nasal-marker Effects on Lesser Scaup Vital Rates

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Nasal-markers have long been used by waterfowl researchers to individually identify a wide array of duck species, including lesser scaup (*Aythya affinis*), ruddy ducks (*Oxyura jamaicensis*) mallards (*Anas platyrhynchos*), and spectacled eiders (*Somateria fischeri*). Decreased foraging efficiency, increased time spent on maintenance activities, and icing during severe winter weather are concerns regarding the use of nasal-markers. While researchers have conducted numerous investigations into the impact of neck-collars and various types of radio transmitters on waterfowl vital rates, most nasal-marker effect research has only focused on time activity budgets and the only analysis investigating changes to vital rates is limited to mallards for one breeding season. These analyses have offered important insight into nasal-marker costs but a comprehensive examination of nasal-marker effects on duck vital rates is warranted. This claim is reinforced by recent research showing strong reductions in important vital rates resulting from commonly used marking techniques for greater sage-grouse (*Centrocercus urophasianus*), king penguins (*Aptenodytes patagonicus*), and emperor geese (*Chen canagica*). Red Rock Lakes National Wildlife Refuge in southwestern Montana is the site of a long-term, intensive study of lesser scaup ecology and demography. Mark-recapture data collected on the study site since 2010 is being used to investigate potential nasal-marker effects on a suite of lesser scaup vital rates. Preliminary Brownie model results based on 863 lesser scaup females released only with metal bands and 770 females released with nasal-markers between 2010 and 2014 suggest that survival rates may be lower (β = -0.735, 95% CI = -1.578, 0.108) and recovery rates higher for nasal-marked females compared to banded-only females (β = 0.53, 95% CI = 0.016, 1.043). For the same time period, recaptures of lesser scaup females will be used to compare estimated recruitment age for 484 nasal-marked and 832 unmarked individuals released as juveniles. For 111 lesser scaup nests monitored in 2014, nest initiation date was estimated to be 4.06 days later for 17 marked hens compared to unmarked females (95% CI 0.09, 8.20 days), but clutch size did not differ (β = -0.141, 95% CI = -0.69, 0.56 eggs). For these same nests, daily nest survival rate will be estimated for marked and unmarked hens and these nesting analyses will be expanded to include 116 lesser scaup nests monitored in 2015. Vital rates for nasal-marked and unmarked females will be compared and implications of any differences will be discussed with respect to using data from nasal-marked birds to investigate lesser scaup population dynamics.

R.6.2: Nicolai, C.

Using Pre-season Duck Banding Data to Estimate Population Size and Variation in Body Condition Across Different Wetland Management Regimes in Terminal Wetlands in Nevada

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The terminal wetland complexes found in the intermountain west are unique as they provide nearly perfect independent experimental units due to their discontinuous nature. We collected banding, recapture, recovery, and morphometric data for several species of waterfowl in the Lahontan Valley of Nevada during pre-season banding operations from 2009 through 2015. The capture-recapture-recovery data was used to estimate species, sex, and age specific estimates of abundance. We compare these abundance estimates across three wetland complexes. We also compare to aerial survey estimates which are not able to account for age and sex and also are biased due to detection probability. Examination of age/sex ratios from a CRR approach allows for assessment of the importance of these terminal wetlands for molting or production purposes. We use a multi-state approach to substantiate that individuals have specific movement patterns among these wetland units during the annual pre-season banding effort. We compare total head and weigh measurements to show differences in body condition of individuals across wetland units and relate these differences to wetland management regimes. In summary, we present a multi-faceted approach to traditional pre-season duck banding program which maximizes the use of these long term data sets. This data will be useful to managers of intermountain west wetland units as optimal.

R.6.3: Raquel^

Patterns of Duck Community Composition in the Prairie Pothole Region and Southern Boreal Forest

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Spatio-temporal shifts in dabbling duck community composition are evident from long-term surveys of mid-continent North American duck breeding populations, but it is unclear whether these changes result from redistributions of breeding pairs, differences in regional recruitment, or other mechanisms such as habitat change. We correlated annual abundance estimates for five common dabbling duck species within the U.S. and Canadian Prairie Pothole Regions (PPR) and the southern boreal forest during 1974-2014. Using residuals derived from a Gompertz density-dependent model, we evaluated whether changes in duck abundance occurred asynchronously between the three regions over this time series. Finally, we used general linear models to estimate population abundances considering effects of density-dependence, regional pond counts, and region. Counter to predictions of the redistribution hypothesis, no negative correlations were detected between abundances of breeding ducks in all three regions in four of five species. However, blue-winged teal population estimates were positively correlated between the Canadian and U.S. PPR, but negatively correlated between the U.S. PPR and southern boreal--perhaps indicative of redistribution. There was no evidence of temporal asynchrony in estimates of population size in any species. Synchrony was detected in northern pintail estimates for the U.S. and Canadian PPR. The best supported models for mallard, pintail, gadwall, and blue-winged teal included a pond*region interaction which suggests species-specific responses to pond condition are distinct between the two regions. This further negates the redistribution hypothesis in that species populations are highly correlated with regional pond counts, as expected, and therefore do not appear to be redistributing uncoupled to this known population driver. Overall, we found no support for the hypothesis that changes in community composition of these species resulted from redistributions of ducks over time. How climatic and land use conditions have affected duck communities warrants further investigation.

R.6.4: Ross

Ecological Factors Affecting Midcontinent Light Goose Recruitment

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Adult survival probability in Ross's geese (*Chen rossii*) and midcontinent lesser snow geese (*Chen caerulescens caerulescens*) has remained high (>0.80) despite reduction efforts implemented in 1999 with a spring conservation order designed to increase harvest of light geese. Population growth rate of lesser snow geese may be attenuating, and with no concurrent decline in adult survival probability, the attenuation must be an outcome of reduced recruitment. A decline in the age ratios (immatures/adults) of Ross's and lesser snow geese has been observed in August at central arctic brood-rearing areas during banding, as well as on prairie staging areas later in the fall. Recruitment is an outcome of various transition probabilities leading to adulthood, any of which could be influenced by ecological proximal factors (e.g. nutrient reserves, spring phenology) or regulating mechanisms (i.e. density dependence) potentially with direct or indirect effects on annual productivity. My study aims to estimate the relative contribution of factors that influence the per capita production of fledged goslings in populations of Ross's geese and midcontinent lesser snow geese. The study area includes brood-rearing areas near the Karrak Lake goose colony (67° 14' N, 100° 15' W) located within the Queen Maud Gulf Migratory Bird Sanctuary, Nunavut, Canada. Long-term data for nest initiation date, clutch size, nest success collected (1991-2015) at the colony using nest plot surveys and banding drives, pre-nesting body composition of females arriving to nest at Karrak Lake, climate indices and local weather will be employed to model retrospectively the response in August age-ratios – a metric of per capita recruitment until fledging. This research will provide insight about current population trajectories and the relative contributions of recruitment vs. survival in governing annual variation in abundance of both Ross's and midcontinent snow geese.

R.7: Winter Ecology

R.7.2: Slown^

Winter Ecology of Temperate-Breeding and Interior Canada Geese in the Greater Chicago Metropolitan Area

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The Mississippi Valley subpopulation of interior Canada geese (*Branta canadensis interior*) has remained stable in abundance over the past several decades, but appears to have changed its wintering range, wintering further north than historically. Concurrently, temperate-breeding Canada goose populations (*Branta canadensis maxima*) have increased in abundance across much of the Midwest. During winter these populations' ranges overlap, creating abundances of geese adequate to create human wildlife conflicts in areas such as the Greater Chicago Metropolitan Area (GCMA). Little-to-no hunting, reduced predator risk, open water throughout winter, and presumably ample food sources likely attract geese to the region in the late fall, winter, and early spring. The total GMCA goose population increases dramatically from the breeding to the migration and overwintering periods. This offers opportunities for wildlife recreation, but may create challenges and conflicts that range from inconvenient to extremely dangerous, such as aircraft strikes. At present, it is uncertain if this increase is due to an influx of temperate-breeding Canada geese from outside the region, an influx of interior Canada geese, or a combination of the two. While temperate-breeding geese are considered overabundant by most administrative authorities, interior geese offer important recreational activity to areas north of the GCMA, and there is a strong political desire to maintain their population levels. Therefore, research is needed to determine if the two populations are temporally or spatially segregated adequately to allow for reduction or management of the temperate-breeding population without negatively effecting the migrant population. Additionally, correlations between behavioral characteristics (behavioral syndrome) and natal dispersal (a presumed evolutionary precursor to migration) have been documented for numerous organisms. Understanding how behaviors differ between closely related migrant and sedentary organisms should provide additional insight into the evolution of migration. We will investigate wintering ecology of Canada geese in the GCMA by comparing the behavior and distribution between the two populations. Analysis of DNA will be used to characterize the proportion of interior and temperate-breeding Canada geese in areas of management interest. Daily movements, feeding areas and food types used, characteristics of desirable and undesirable roosts and the influences of weather and other factors on behavior will be inferred from re-sighting of neck collars and time budget data. Goose capture will begin in the GCMA in late fall when the abundance of the goose population begins to increase in the GCMA and continue through early spring, when interior geese begin to depart. A sample will be removed for DNA analysis and geese will be fitted with a neck collar and a USFWS metal leg band. We will visit multiple locations used by geese and re-sight neck-collared individuals daily. We will record habitat information and conduct behavioral observations of marked geese. Because genetic composition of the marked sample will be known, we will use this data to test for spatial and temporal differences between populations of Canada geese wintering in the GCMA and test the prediction migrant geese are more aggressive and are less sedentary during winter.

*Speaker; ^Student

R.7.3: Iemola^

A New Hypothesis for Explaining Differences in Winter Distributions of Male and Female Ducks in North America

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The traditional view for birds is that the largest or 'best' males, or those individuals that are more dominant, winter at greater latitudes and do not have to endure the cost of migration. However, it seems counter-intuitive for larger, dominant males to maintain winter residency at higher latitudes if their potential mates winter at southern latitudes, at least for species of ducks that begin to pair in October or November. In early pairing ducks, dominant males pair earlier and must follow their females south during autumn, while late pairing ducks need not follow females. There is evidence that spring migrating teal in Spain switch mates at stopover sites. Such evidence suggests there may be fitness consequences depending on the choice to winter south with a mate/potential mate or to sustain at northern latitudes to court and pair with females on their way to breeding grounds in spring. We hypothesized that differences in winter distributions between female and male ducks occurs, not solely because females winter farther south or dominant males winter farther north, but because unpaired males, for species that pair late, remain at northern latitudes where they can encounter and court females returning north in late-winter and spring. We predicted that latitudinal differences in ratios of M:F among latitudes would be greatest for late pairing species. We used data from the USFWS Part Collection Survey from the Mississippi and Atlantic Flyways, December – January 1995 – 2014, to investigate if differences in sex ratios of harvested ducks, by latitude and timing of pairing, were consistent with our hypothesis. We designated M:F ratios as our dependent variable, and latitude (South ≤ 35◦, Central 35.1◦-39.9◦, North ≥ 40◦; categorical), mean timing of pairing by species (continuous), and their interaction as independent variables. Covariates included month (December or January) and body mass and sex ratios of males and females from published literature. We included year as a repeated measure. The interaction of timing of pairing and latitude performed substantially better (wi = 1.0) than models without this interaction, and models without the full suite of potential covariates. Predicted values produced models relatively consistent with our prediction; that differences in M:F ratios among latitudes would be greatest for late pair species (Fig 1.). In future modeling efforts, we will investigate inclusion of differential vulnerability among species and annual differences in weather severity.