FRIDAY, 5 FEBRUARY 2016		
Senate **13:20 - 15:20**	**O.3: Winter Ecology** (Chair:)	
13:20	**O.3.1: Collins**	**Impacts of Wind Energy on Wintering Redheads** (Daniel P. Collins*, Cory J. Lange, Bart M. Ballard)
13:40	**O.3.2: Lancaster1^**	**Linking Habitat Use and Survival to Identify Suitable Winter Habitats for Female Mallards in Mississippi** (Joseph D. Lancaster*, J. Brian Davis, Richard M. Kaminski, Edward J. Penny, Alan D. Afton)
14:00	**O.3.3: Williams**	**Bioenergetics, Behavior, and Sea Level Rise: Current Status and Future Implications for Wintering Dabbling Ducks in Delaware** (Mark C. Lovolsi, Christopher K. Williams*, John M. Coluccy, Matthew T. DiBona)
14:20	**O.3.4: Askren^**	**Habitat Selection of Midcontinent Greater White-fronted Geese During the Wintering Period** (Ryan J. Askren*, Douglas C. Osborne)
14:40	**O.3.5: Kennedy^**	**Wintering Redhead Duck Effects on Northern Gulf of Mexico Seagrasses** (Maddie Kennedy*, Kenneth L. Heck Jr., John Valentine, Thomas Michot)
15:00	**O.3.6: Raquel^**	**Species-specific Timing of Breeding in Response to Winter Climate and Spring Pond Conditions** (Amelia J. Raquel*, Robert G. Clark, James H. Devries, David W. Howerter)

O.3: Winter Ecology (Chair:)

O.3.1: Collins

Impacts of Wind Energy on Wintering Redheads

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Up to 80% of North America's redhead (*Aythya americana*) population winters along the lower Texas Coast. Throughout winter, these birds make daily movements between foraging areas in the Laguna Madre and inland freshwater ponds used for drinking. Recently, a large wind farm was constructed within a section of the Laguna Madre heavily used by redheads. We ranked each coastal pond based on their water permanence, isolation, and proximity to foraging area in order to investigated impacts from the wind farm on the distribution of redheads and availability of ponds. We conducted weekly aerial surveys during 3 winters prior to construction of the wind farm and during 2 winters following its completion. We documented each pond used and the number of redheads on each pond during each survey. We also extracted surface water from LandSat imagery for the entire lower Texas Coast for the 3 driest, 3 most medial, and 3 wettest winters (based on Palmer Drought Severity Index) over the last 30 years. Our prioritization scheme showed that North Padre Island and the mainland in and around the wind farm were the highest ranked areas prior to wind farm construction. Redhead abundance within the wind farm declined by 78% following construction, but increased by 226% throughout the lower Texas Coast following construction. Our surface water modeling found that coastal pond availability declined within the wind farm, particularly during dry years when < 2% of ponds were available post-construction that were available pre-construction under similar conditions of wetness. Thus, it appears that the wind farm has altered local hydrology and reduced coastal pond availability within the wind farm. Our results identify areas along the lower Texas Coast where development, such as wind farms, should be avoided due to their importance to a large proportion of North America's redheads during winter.

O.3.2: Lancaster1^

Linking Habitat Use and Survival to Identify Suitable Winter Habitats for Female Mallards in Mississippi

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The Mississippi Alluvial Valley (MAV) is continentally important for migrating and wintering waterfowl

in North America, especially mallards (*Anas platyrhynchos*). Amid extensive hardwood bottomland loss, flooded croplands, moist-soil, and forested wetlands are critical contemporary habitats in the MAV. Research has revealed that greatest abundances of wintering mallards in the MAV occur on landscapes comprised of 50% flooded croplands, 20% moist-soil, 20% forested, and 10% permanent wetlands. However, information is lacking to link daily habitat use and survival to characterize habitat complexes that promote winter survival (i.e., "suitable habitats"). We quantified use of flooded croplands (AG), moist-soil (MS), forested (FO), and permanent wetlands (PW) by female mallards radio-marked in the Yazoo Basin of Mississippi, December-March 2010-2012 and 2013-2015. Using compositional analysis, we divided proportional use of MS, FO, and PW by proportional use of AG and used natural log ratios of these as response variables in a split-plot multivariate analysis of variance (MANOVA). We tested ($\alpha = 0.05$) influences of individual female, north or south Basin, hunting or post-hunting periods, and a period by region interaction. We are also using a multistate mark-recapture with dead recovery model in program MARK to estimate daily survival relative to diurnal habitat use, north or south Basin, hunting or post periods, and a body-condition index. We will rank models using an information theoretic approach and use daily survival rates from the most parsimonious model to assess habitat-complex composition among three levels of winter survival rates (upper 25%, middle 50%, and lower 25%). We will incorporate proportional use of habitats by radio-marked females as the dependent variables in a MANOVA, then use individuals' level of winter survival as the independent variable to test the null hypothesis that habitat-complex composition does not differ among females with high, middle, or low winter survival. We located 241 radio-marked females on 7,441 occasions, including 2,048, 3,477, 349, and 1,567 locations in MS, FO, PW, and AG, respectively. Habitat use varied among females, north or south Basin, hunted and post-hunted periods, and the period by region interaction ($Ps \leq 0.002$). Permanent wetlands were used 70-80% less ($Ps < 0.001$) than AG among all period by region combinations. Moist-soil wetlands were used 108% and 29% more ($Ps \leq 0.024$) than AG during hunting season in north and south Basins, respectively. Post-hunting season, MS wetlands were used 38% less ($P < 0.001$) but 51% more ($P = 0.014$) than AG in north and south Basins, respectively. Forested wetlands were used 88-154% more ($P < 0.001$) than AG among all period by region combinations, except post-hunting season in the north Basin, where use of these habitats did not differ ($P = 0.42$). Comparable to findings from Louisiana and Arkansas, forested wetlands were significant to female mallards wintering in the Yazoo Basin. However, moist-soil wetlands were also important to female mallards in the Yazoo Basin, despite being seldom used in Louisiana and Arkansas. Our continued analyses will enhance understanding of mallard ecology and identify habitat complexes that promote their survival in the MAV.

O.3.3: Williams

Bioenergetics, Behavior, and Sea Level Rise: Current Status and Future Implications for Wintering Dabbling Ducks in Delaware

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Coastal wetlands in Delaware provide dabbling ducks with critical habitat and food resources over the wintering period. Bioenergetics modeling suggests that the landscape's ability to support dabbler populations is contingent upon energy supply meeting demand. However, little is known of the

relative value of unmanaged saltmarshes compared with managed impoundments. Thus, our objective was to compare energetic carrying capacity (duck use-days; DUD), population abundance, and behavior of 7 dabbler species (*Anas rubripes, A. platyrhynchos, A. acuta, A. clypeata, A. crecca, A. americana, A. strepera)* between these habitats. We estimated energy supply along the Delaware Bayshore within a 10-mi buffer of the coast via soil core (n = 1,346), nekton (n = 426), and saltmarsh snail (n = 87) samples in impoundments and 5 saltmarsh habitats, October–March, 2011–2013. We multiplied food biomass by true metabolizable energy (TME) values to determine energy available to dabblers. We found that for most dabblers, freshwater impoundments (range: 183,344–562,089 kcal/ha) contained greater energy densities than saltmarsh habitats (range: 39,477–361,429 kcal/ha). To estimate energy demand, we constructed time-energy budgets based on 10-min instantaneous scan samples between November–March, 2011–2013 over the 24-hr period. We estimated daily energy expenditure (DEE) between 111.84–349.79 kcal/bird/day. Thus, we estimated between 8.73 x 106 – 7.06 x 107 available DUD, depending on species, suggesting that dabblers are not currently at carrying capacity in Delaware. Additionally, we quantified the proportion of time spent in various behaviors between habitats. Dabblers tended to feed more and fly less on impoundments than saltmarshes. Our results suggest that impoundments are valuable habitat for wintering dabblers, providing more food energy and serving as refugia for feeding and sleeping compared with neighboring salt marshes. With the threat of sea level rise looming, we recommend that managers consider maintaining impoundments for future dabbler populations.

O.3.4: Askren^

Habitat Selection of Midcontinent Greater White-fronted Geese During the Wintering Period

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The midcontinent population of greater white-fronted geese (*Anser albifrons frontalis*) has gained considerable attention in recent years from an evident increase in population abundance and perceived shift in winter distribution from the Central to the Mississippi Flyway. This shift is likely due to changing land use practices and availability of water on the non-breeding range. To better understand potential implications of shifting distributions of wintering white-fronts, we must first understand factors influencing habitat selection on the wintering range. To date, little has been quantified on habitat selection of white-fronts wintering in the Mississippi Alluvial Valley, thus warranting further investigation. The objective of this research was to determine local and landscape factors influencing selection of foraging habitat by white-fronts during winter. During July 2014, 10 white-fronts were marked with solar-powered PTT transmitters in the Queen Maud Gulf, Nunavut, Canada and 4 were marked with GSM transmitter on the North Slope in Alaska. Of the 9 surviving PTT-marked white-fronts, 7 wintered in the Mississippi Alluvial Valley of Arkansas and Louisiana and 2 in Texas. Selection ratios (Wi) for habitat availability were calculated for Texas and the Mississippi Alluvial Valley separately using 95% Kernel Density Estimate of all transmitter locations. Composition of both habitat use and availability were calculated for each crop type from National Agricultural Statistics Service GIS data. Notable differences in habitat selection were detected among white-fronts wintering in Texas and those in the Mississippi Alluvial Valley. White-fronts wintering in Texas selected for herbaceous wetlands (26% of foraging locations; Wi = 10.5), pasture (21% of foraging locations; Wi = 2.4), and winter wheat (7% of foraging locations; Wi = 7.2). Whereas white-fronts wintering in the Mississippi Alluvial Valley selected for rice (54% foraging locations; Wi = 5.0) and soybeans (25% foraging locations; Wi =1.5). Regional differences in selection reflect varying strategies for energetic acquisition within the species that have

consequences for managers concerned with local and landscape energetics. We suggest that shifting distributions of midcontinent white-fronts into the MAV are increasingly selecting for flooded agriculture, particularly rice, which will impact local resource availability through increased competition for energetics among waterfowl species.

O.3.5: Kennedy^

Wintering Redhead Duck Effects on Northern Gulf of Mexico Seagrasses

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While it has been well established that waterfowl grazing can control the distribution and abundance of seagrasses in other regions, less is known about their effects in the northern Gulf of Mexico. This is likely because herbivorous waterfowl are only present during winter when less fieldwork has typically been done. We are evaluating the effects of winter waterfowl (specifically redhead duck (*Athya americana*) feeding on mixed shoalgrass (*Halodule wrightii*) and widgeon grass (*Ruppia maritima*) beds. Considered the dominant winter seagrass grazers in temperate zones, previous studies have found redheads to selectively consume the belowground roots and rhizomes of shoalgrass. Given that the major carbohydrate reserves are stored in its rhizomes, heavy redhead grazing might result in significant impacts on the regrowth and/or of shoalgrass and widgeongrass in the following growing season.

To determine the impacts of redhead grazing on shoalgrass, we are carrying out exclusion caging experiments at three locations along the Alabama coastline. At each location, cages were deployed to exclude waterfowl from grazing, and samples of seagrass biomass were taken from both grazing exclusion and uncaged control locations five times throughout the year: at time zero (before waterfowl presence), one month post bird arrival, following northward bird migration in the spring, during peak summer reproduction, and, finally, in early fall at peak seagrass biomass. Once in the lab, seagrass samples are separated by species and above and below-ground tissues. Time-lapse photography was used to provide estimates of the abundance and feeding activities of the birds and upper digestive system contents are being examined to determine the type and amount of seagrass consumed. Results to date show that redheads actively and regularly feed in all experimental areas for extended periods of time, with as many as 100% of the individuals feeding at any given time. Consequently, a large majority of collected redheads contained seagrass in their digestive tracts. Additionally, there was significantly more shoalgrass root and rhizome biomass in ungrazed areas after redhead departure, indicating that grazing produced a negative impact on rhizomal reserves. In ungrazed areas widgeon grass began flowering earlier, consistent with the loss of rhizomal reserves available to support flowering. Additionally, in grazed areas widgeon grass became more abundant than in caged areas. Thus, it appears that redhead herbivory has affected the relative abundances of both species of seagrass as well as the flowering of widgeon grass. We hypothesize that in the second year of study we will likely see additional evidence of a species shift and/or reduction in shoot density and biomass in grazed locations.

O.3.6: Raquel^

Species-specific Timing of Breeding in Response to Winter Climate and Spring Pond Conditions

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Climate change is expected to alter temperature and precipitation regimes across North America, and the ability of duck species to respond to these changes could have serious implications for population dynamics. Presumably, flexible species that can adjust timing of spring migration or lay date are better able to respond to advances in spring phenology. However, flexibility in such seasonal adjustments may be related to species-specific life history traits. Changes in climate are also anticipated to affect conditions on overwintering areas which may have carry-over effects during the subsequent breeding season. Favorable wintering conditions may advance migration and nesting dates, and therefore affect recruitment. We tested for species-specific responses to both winter and spring pond conditions to determine how these conditions influenced timing of breeding in eight duck species representing distinct life-histories. We used records (n = 22,238) for ducks nesting on 164 sites, 1993-2011. Using linear mixed effects models, controlling random effects of site-year, we first tested for species-specific differences in clutch initiation date, and characterized the relative timing of nesting for green-winged teal (*Anas carolinensis*), blue-winged teal (*A. discors*), northern shoveler (*A. clypeata*), American wigeon (*A. americana*), gadwall (*A. strepera*), northern pintail (*A. acuta*), mallard (*A. platyrhynchos*), and lesser scaup (*Aythya affinis*). Then, we related timing of breeding to climate indices such as the El Nino Southern Oscillation (ENSO) and the North Atlantic Oscillation (NAO) for the preceding wintering period (Dec-Feb) and to standardized annual May pond counts. General linear mixed effects models incorporating combinations of the above indices and a random site-year term were used to explore species-specific responses to variation in clutch initiation dates. The best-supported model included a species effect, as expected, along with a negative effect of previous winter ENSO, indicating that in general ducks nested earlier following warmer and wetter winters in the southern U.S. and Mexico. No main effect of current spring pond conditions was detected. There was evidence of an interaction between winter ENSO and nesting dates of American wigeon, blue- and green-winged teals, and shoveler. We explored the interaction between winter ENSO and spring ponds; in general, in years with low pond numbers, clutch initiation dates advanced more rapidly following wetter winter conditions. This suggests that there are species-specific responses in timing of nesting in relation to both antecedent winter and current climate indices which may arise from species-specific life history traits. This also suggests that carry-over effects from the wintering grounds may allow some species to respond more flexibly to anticipated changes in climate. To determine species-specific responses to climate change, we will also consider both winter carry-over effects and local spring climate conditions simultaneously to provide deeper insights into spatio-temporal variation in prairie duck community composition.