

| THURSDAY, 4 FEBRUARY 2016 | | |
|--------------------------------|---------------------------------------|--|
| <i>Caucus</i> 13:20 - 15:20 | K.4: Harvest (Chair:) | |
| 13:20 | K.4.1: Boomer | Analyzing the Relationship between Midcontinent Mallard Harvest and Survival Probabilities (G. Scott Boomer*, Guthrie S. Zimmerman, Nathan L. Zimpfer, James D. Nichols) |
| 13:40 | K.4.2: Sedinger, B[^] | Exploring Compensation in Duck Mortality: Do Harvest Regulations Really Matter? (Benjamin S. Sedinger*, Christopher A. Nicolai, Kelley M. Stewart) |
| 14:00 | K.4.3: Vaske | Improving the Accuracy of Self-reported Waterfowl Harvest Estimates (Jerry J. Vaske*, Jay Beaman, Craig Miller) |
| 14:20 | K.4.4: Deane1[^] | Harvest and Non-harvest Mortality Relationships for Lesser Scaup Breeding in Southwestern Montana (Cody E. Deane, Jay J. Rotella, Jeffrey M. Warren, David N. Koons, Robert R. Garrott) |
| 14:40 | K.4.5: Soulliere | Trends in North American Diving Duck Hunting Community with Focus on Scaup (Gregory J. Soulliere*, Jane E. Austin, Benjamin M. Kahler) |
| 15:00 | K.4.6: | |

K.4: Harvest (Chair:)

K.4.1: Boomer

Analyzing the Relationship between Midcontinent Mallard Harvest and Survival ProbabilitiesG. Scott Boomer^{1*}, Guthrie S. Zimmerman², Nathan L. Zimpfer¹, James D. Nichols³

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The relationship between annual survival and harvest is a key source of uncertainty in the harvest management of midcontinent mallards (*Anas platyrhynchos*). Consequently, current efforts to update the midcontinent mallard Adaptive Harvest Management (AHM) model set require reliable estimates of survival and harvest probabilities. While contemporary estimates of harvest probabilities are available from operational AHM protocols, estimating historical harvest probabilities is problematic because band reporting probabilities have varied over time and space in relation to changing band inscriptions and reporting methods. Our research objective was to estimate cohort-specific survival, harvest, and band reporting probabilities with a Brownie model that integrates all preseason band recovery information for midcontinent mallards marked from 1987–2014. We used a random effects parameterization within a hierarchical, Bayesian estimation framework to model temporal variation in reporting probabilities specific to each band inscription while explicitly modeling the process correlation between harvest and survival probabilities for each cohort. Similar to previous reward band investigations, we found that reporting probabilities increased significantly over the 1990's even for birds marked with AVISE and ZIP bands. Commensurate with the liberalization of harvest regulations, harvest probabilities for each age and sex cohort increased. Adult male harvest probabilities have averaged 0.09 (SD = 0.003) since 1987. Overall, annual survival rate estimates for juvenile males and females declined as harvest probabilities increased, suggesting evidence for additive harvest mortality ($\rho = -0.67$, -0.45 , for juvenile males and females respectively). We found similar patterns for adult males ($\rho = -0.35$) but the evidence for adult females was not as strong ($\rho = -0.11$). Juvenile to adult harvest vulnerability ratios have increased for male and female midcontinent mallards, suggesting that the ratios used in AHM models should be updated. These results will provide the basis for updating population models for use in midcontinent mallard AHM.

K.4.2: Sedinger, B.^

Exploring Compensation in Duck Mortality: Do Harvest Regulations Really Matter?Benjamin S. Sedinger^{1*^}, Christopher A. Nicolai², Kelley M. Stewart¹

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Compensation in the mortality process has been proposed as a population level response to exploitation by some species. In North America we have a rich, albeit relatively short, water-fowling

tradition with hunters harvesting millions of ducks and geese every fall. Despite decades of modern harvest management and research, the response of populations to harvest is still not well understood. To explore this question in ducks, we conducted an experiment in Western Nevada from 2011-2014 where we manipulated daily bag limits for wood ducks (*Aix sponsa*) across years while maintaining a monthly capture-mark-recapture program that began in 2007. In 2011 and 2013, duck hunters were permitted 1 wood duck per day. In 2012 and 2014, duck hunters were permitted 7 wood ducks per day. First we looked at the influence harvest regulations had on direct recovery rates. We hypothesize that direct recovery rates will respond to changes in harvest regulations with more liberal restrictions resulting in higher harvest rates. Second, we analyzed capture-mark-recapture and band recovery data to explore how this wood duck population responds to annual variation in harvest pressure. We hypothesize that variation in harvest rates will result in no overall change in annual survival rates. If we observe a negative relationship between harvest rate and survival rate during the hunting season, we expect to see a positive relationship between the harvest rate during the preceding winter and survival during the following spring and summer. We analyzed these data using multistate framework in program MARK and included environmental and individual covariates to explore potential sources of variation in survival probability and harvest vulnerability. We estimated seasonal survival rates, encounter probabilities and transition probability from the non-hunting season to harvested state and from the hunting season to harvested state. This research sheds new light on our understanding of duck harvest dynamics and will help inform duck harvest management into the future.

K.4.3: Vaske

Improving the Accuracy of Self-reported Waterfowl Harvest Estimates

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Imprecision in respondent recall can cause response heaping or spikes in frequency data for particular values (e.g., 5, 10, 15). In human dimensions research, heaping can occur for variables such as days of participation (e.g., hunting, fishing), or animals / fish harvested. Distributions with heaps can bias population estimates because the means and totals can be inflated or deflated. Because bias can result in poor management decisions, determining if the bias is large enough to matter is important. This presentation introduces the logic and flow of a deheaping program that estimates bias in means and totals when people use approximate responses (i.e., prototypes). The program can make estimates even when spikes occur due to bag limits. The program is available online, and smooths heaps at multiples of 5 (numbers ending in 5 and 0) and 7 (e.g., 7, 14, 21), and produces standard deviations in estimates. The program is illustrated using 25 years of waterfowl harvest estimates from Illinois. Discussion focuses on improving the accuracy of harvest estimates for adaptive harvest management.

K.4.4: Deane^{1*}

Harvest and Non-harvest Mortality Relationships for Lesser Scaup Breeding in Southwestern Montana

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Following improved wetland and habitat conditions across the prairie-pothole region, most focal duck species surpassed long-term population goals established within the North American Waterfowl Management Plan (NAWMP) in the mid-to-late 1990s. But lesser scaup (*Aythya affinis*), which breed throughout the Boreal Forest, the prairie-potholes, and inter-montane wetlands of the West, experienced a decline in abundance beginning in the mid-1980s and their population has since remained more than 20% below the NAWMP population goal for lesser scaup. Accordingly, considerable attention has been directed towards understanding what factors may be limiting their population, including the role of harvest. Lower Lake is part of Red Rock Lakes National Wildlife Refuge in southwestern Montana and is the site of a long-term, intensive study of lesser scaup ecology and demography. Here, lesser scaup breed at densities that are among the highest observed in North America despite some of the most variable and extreme conditions experienced by the species throughout its breeding range. Preliminary Brownie model estimates (uncorrected for reporting rate) indicate that this population is harvested at rates similar to the continental population with juveniles being harvested at an annual average rate of 9.1% (95% CI = 7.7 - 10.7%) and adults at an average annual rate of 3.6% (95% CI = 2.2 - 6.1%). Since 2005, ~1,300 female and ~1,700 male lesser scaup have been banded on the study site and an additional ~1,000 females have been nasal-marked. In addition, ~1,400 resightings have been collected for nasal-marked hens at Lower Lake and ~340 dead recoveries of lesser scaup banded on the study site have been reported from Canada, the Continental U.S., and Mexico. Hierarchical, multi-state modeling techniques and the use of multiple data types, such as live resightings and dead recoveries, are useful for distinguishing sampling error from process co-variation between competing risks of mortality. Using these models and data from 2005 through the end of the 2015 hunting season, I will present (1) estimates of harvest and natural mortality rates for lesser scaup banded and nasal-marked on Lower Lake; (2) how non-harvest mortality varies in relation to harvest mortality; (3) an assessment of the degree to which harvest mortality varies in response to changes in hunting regulations. These results will be used to help inform lesser scaup harvest demography, a key structural uncertainty in current harvest models identified in the draft scaup conservation action plan.

K.4.5: Soulliere

Trends in North American Diving Duck Hunting Community with Focus on Scaup

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Scaup – lesser (*Aythya affinis*) and greater (*A. marila*) – are especially important diving duck species to North American hunters. We used waterfowl harvest and hunter-survey data to evaluate and compare distributional change in duck hunter numbers and related diving duck harvest. Numbers of duck hunters in the United States declined since the 1970s, driven primarily by declines in the Mississippi Flyway. However, the proportion of U.S. hunters harvesting ≥ 1 scaup annually increased during this 4-decade period, and the proportion of hunters harvesting a diving duck of any species increased substantially. Numbers of duck hunters in Canada declined starkly since the 1970s, whereas the proportion of Canadian hunters harvesting scaup and other diving ducks was relatively stable. The importance of diving ducks and scaup in individual hunter's harvest was relatively small compared to dabbling ducks, but diver importance varied over time and across regions in the U.S. and Canada. Although the proportion of successful hunters taking diving ducks has increased in the U.S. and remains stable in Canada, we found a downward trend for those "specializing" in diver hunting, particularly in historically important diver-hunting states and provinces of the Mississippi Flyway. We discuss implications of these changes and how they might be considered in harvest and habitat management to help sustain traditions associated with hunting scaup and other diving ducks.

K.4.6: