Mule Deer Survival in the Bitterroot Valley

Progress Report - Spring 2018

In winter 2015-2016, Montana Fish, Wildlife and Parks (MFWP), in collaboration with MPG Ranch, initiated a pilot study to estimate adult female mule deer survival and to identify the sources of mortality in the northern and southern Bitterroot Valley. This report summarizes project activities and results during Spring 2017-2018.

Project Background

Mule deer populations have recently declined in parts of Montana and portions of the northwestern United States. Biologists observed similar broad, regional declines in mule deer populations in the late 1960s, the late 1970s, and again in the early and mid-1990s, yet the complex combination of factors that drive these regional mule deer population fluctuations is not well understood. Potential causes include habitat loss or degradation, intraspecific competition, predation, disease, and/or interspecific competition (i.e. with elk, white-tailed deer, and livestock). Recent intensive research efforts in Colorado and Idaho have broadly concluded that mule deer populations are limited by habitat, specifically by winter range habitat and weather that may limit the overwinter survival of fawns (Hurley et al. 2014, Monteith et al. 2014, Bergman et al. 2015). How these results translate to western Montana is unknown however, as variations in weather, vegetation communities, and predator communities may have variable effects on mule deer populations. For example, mule deer numbers have declined in the Bitterroot Valley of western Montana, but survey-based estimates of fawn recruitment do not support the hypothesis that reduced fawn survival is a driving factor. The cause of mule deer declines in the Bitterroot Valley is unknown and the purpose of this project is to evaluate adult female survival and better understand the factors that may be contributing to population declines.

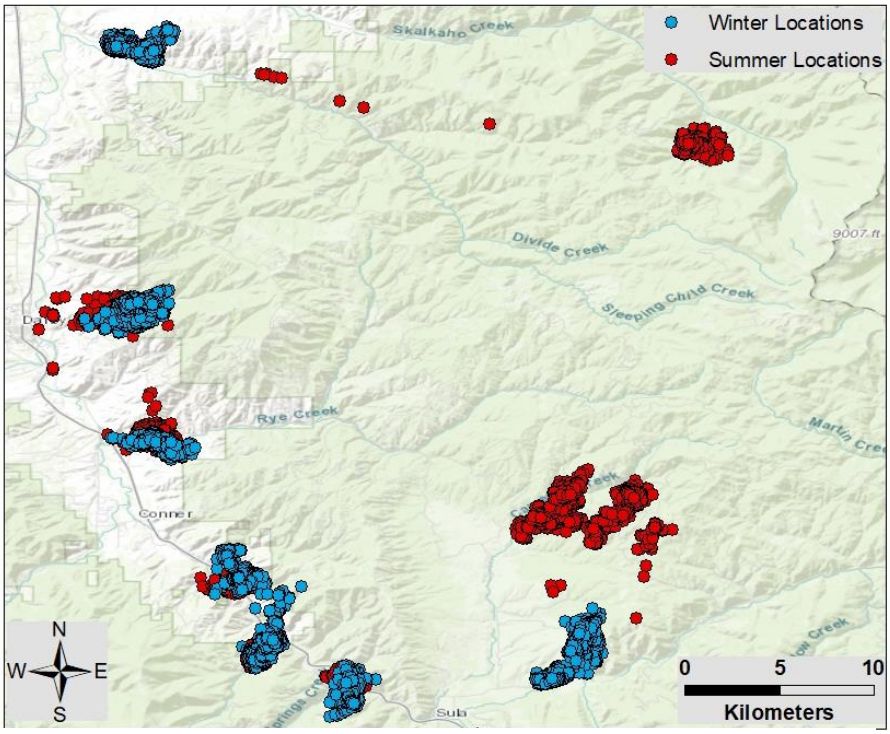

Figure 1. 2017 Summer and winter locations from adult female mule deer in the East Fork area of the Bitterroot Valley.

Mortality Cause	Northern Sapphire	East Fork
Deer-years	**52**	**51**
Coyote	2	0
Human	1	0
Lion	1	2
Natural	0	3
Unknown	3	2

Table 1. Summary of number of deer-years and mortality events of adult female mule deer in the Bitterroot Valley from December 2015 – April 2018.

Deer Capture and Survival

During winter 2015-2016 and 2016-17, we ground darted 43 adult female mule deer, including 20 mule deer on the Northern Sapphire winter range (Hunting District [HD] 204) and 23 mule deer on the East Fork winter range (HD 270). During winter 2017-18, we captured an additional 5 adult female mule deer, 3 in the Northern Sapphire and 2 in the East Fork winter range. We estimated age based on tooth wear patterns to estimate the age structure of our collared population. We instrumented each doe with a radiocollar programmed to collect a GPS location every 4 hours and send a mortality signal if the collar becomes inactive for 8-hours, and applied ear tags for future identification. When a mortality occurred, we conducted a mortality investigation and necropsy to determine cause of death. From December 2015 – April 2018, we investigated 16 mortality events: 9 in the Northern Sapphire area and 7 in the southern East Fork area (Table 1). We are currently monitoring 15 collared mule deer in the Northern Sapphire area and 16 in the East Fork area.

We used the Kaplan-Meier (KM) method to estimate survival along with log-rank tests to compare survival across study areas and years (Pollack et al. 1989). We defined the beginning of a given year as June 1 (i.e. Day 1). Adult mule deer entered the analysis on their date of capture, and were censored the last day their collar transmitted data in the case of collar failure, or at the end of a given year (i.e. May 30) if they survived (DeCesare et al. 2016). Animals that survived for multiple years then re-entered the analysis at day 1 of the following year. The overall annual KM survival estimate was 0.80 (95% CI = 0.68 – 0.87) and did not vary by year (2015: 0.83, 95% CI = 0.65 – 0.93; 2016: 0.84, 95% CI = 0.66 – 0.93; 2017: 0.82, 95% CI = 0.67 – 0.93) or area (Northern Sapphire: 0.79, 95% CI = 0.62 – 0.89; East Fork: 0.81, 95% CI = 0.62 – 0.92). In both study areas, mortalities were concentrated in winter and spring (days 202 – 304; Figure 2).

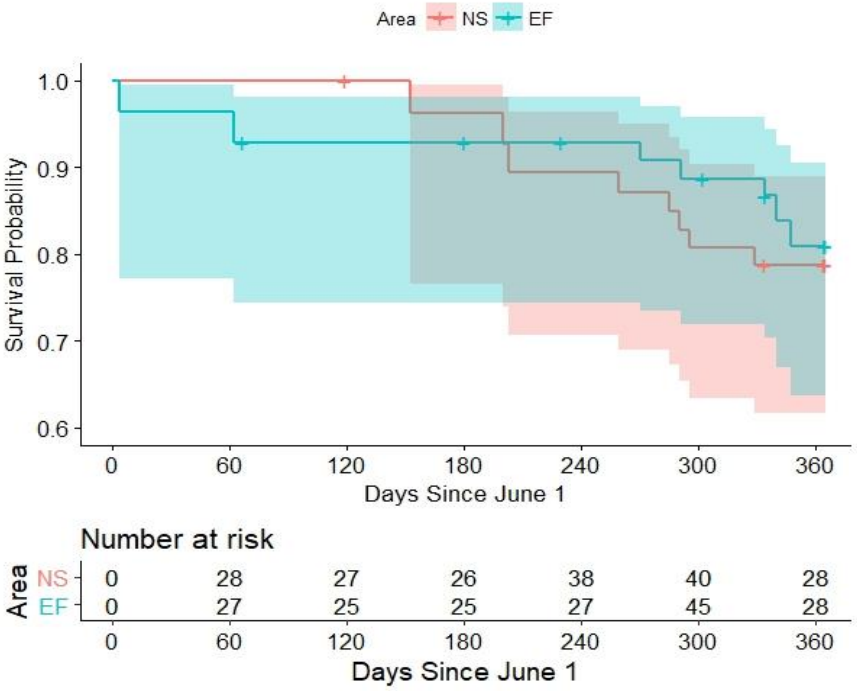

Figure 2. Kaplan-Meier survival estimates (solid line), 95% confidence intervals (shaded bands) for adult female mule deer in the Northern Sapphire (NS) and East Fork (EF) areas. Number at risk represents the number of collared individuals in each area at each time interval.

Pregnancy & Diet

Overall pregnancy rates were 95% (95% CI = 0.75 – 0.99, n=19) in the Northern Sapphire area and 91% (95% CI = 0.73 – 0.96, n=23) in the East Fork area. These rates are similar to other mule deer populations in eastern Montana, Colorado, Idaho, and Utah where

pregnancy rates range from 86 –100% (Wood et al. 1989, Andelt et al. 2004, Hurley et al. 2011, Freeman et al. 2014). We collected winter and summer fecal samples in both the Northern Sapphire and East Fork areas to assess seasonal mule deer diet. For winter diet, we collected samples from 17 mule deer captured in the Northern Sapphire area and 15 mule deer captured in the East Fork area from December 2015 – March 2016. For summer diet, we collected samples by locating and observing collared mule deer within each area to avoid mistakenly collecting pellets from sympatric white-tail deer. We collected 27 pellet samples in the Northern Sapphire area and 18 pellet samples in the East Fork from July – September 2016 (Figure 3). Fecal samples were submitted to the Washington State University Wildlife Habitat Nutrition Lab for fecal plant fragment analysis. Results indicate that mule deer diet in the Northern Sapphire included 24 plant species in the summer and 41 species in the winter. The top 3 plants consumed in the Northern Sapphire area were Antelope Bitterbrush (69%), Lupine (7%) and clover (6%) in the summer, and Antelope Bitterbrush (28%), Bluegrass (16%), and Oregon Grape (9%) in the winter. Mule deer diets in the East Fork area included 39 plant species in the summer and 35 plant species in the winter. The top 3 plant species consumed in the East Fork area were Buffalo Berry (20%), Lupine (17%), and Antelope Bitterbrush (12%) in the summer, and Oregon Grape (27%), Bluegrass (12%), and Balsamroot (8%) in the winter.

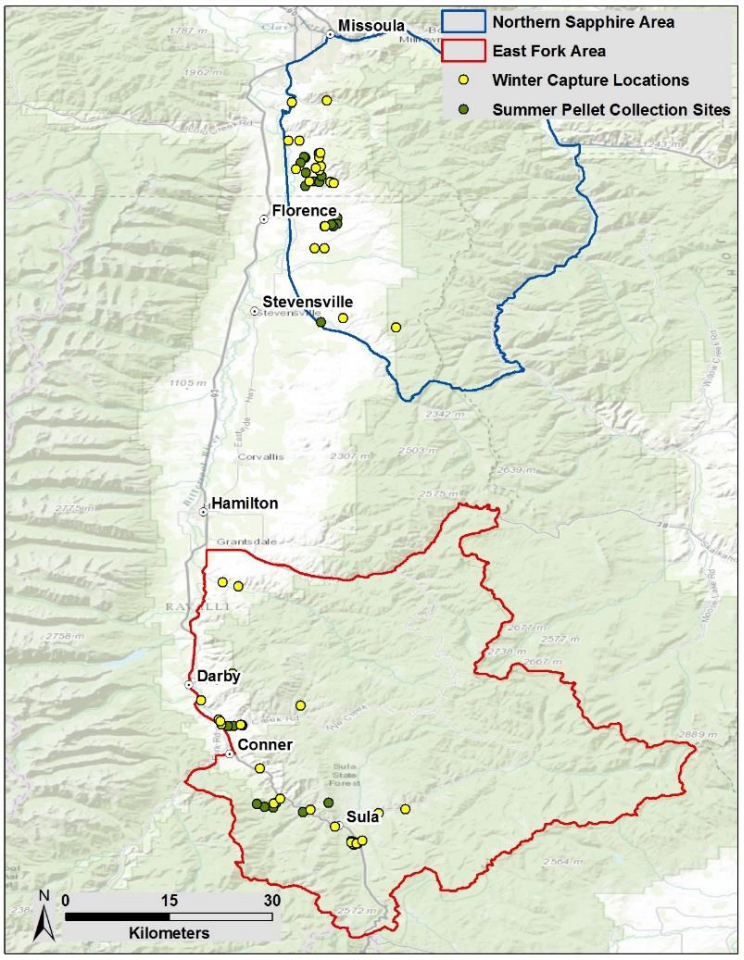

Figure 3. Fecal sample collection locations from captured mule deer and pellet sites from December 2015 – September 2016.

Acknowledgements

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Literature Cited:

Andelt, W. F., T. M. Pojar, and L. W. Johnson. 2004. Long-term trends in mule deer pregnancy and fetal rates in Colorado. The Journal of Wildlife Management 68:542–549.

Bergman, E.J., P.F. Doherty Jr, G. C. White, and A. A. Holland. 2015. Density dependence in mule deer: a review of evidence. Wildlife Biology 21: 18-29.

Cook, R. C., T. R. Stephenson, W. L. Myers, J. G. Cook, and L. A. Shipley. 2007. Validating Predictive Models of Nutritional Condition for Mule Deer. The Journal of Wildlife Management 71:1934–1943.

DeCesare, N.J., Hebblewhite, M., Lukacs, P., Hervieux, D. 2016. Evaluating common sources of censoring and truncation in telemetry-based survival data. Journal of Wildlife Management 80:138–148.

Freeman, E. D., R. T. Larsen, M. E. Peterson, C. R. Anderson, K. R. Hersey, and B. R. Mcmillan. 2014. Effects of male-biased harvest on mule deer: Implications for rates of pregnancy, synchrony, and timing of parturition. Wildlife Society Bulletin 38:806–811.

Hurley, M. A., J. W. Unsworth, P. Zager, M. Hebblewhite, E. O. Garton, D. M. Montgomery, J. R. Skalski, and C. L. Maycock. 2011. Demographic response of mule deer to experimental reduction of coyotes and mountain lions in southeastern Idaho. Wildlife Monographs 178:1-33.

Hurley, M. A., M. Hebblewhite, J.-M. Gaillard, S. Dray, K. A. Taylor, W. K. Smith, P. Zager, and C. Bonenfant. 2014. Functional analysis of Normalized Difference Vegetation Index curves reveals overwinter mule deer survival is driven by both spring and autumn phenology. Philosophical Transactions of the Royal Society of London B: Biological Sciences 369:20130196.

Monteith, K. L., V. C. Bleich, T. R. Stephenson, B. M. Pierce, M. M. Conner, J. G. Kie, and R. T. Bowyer. 2014. Life-history characteristics of mule deer: Effects of nutrition in a variable environment. Wildlife Monographs 186:1-62.

Pollock, K. H., S. R. Winterstein, C. M. Bunck, and P. D. Curtis. 1989. Survival analysis in telemetry studies: the staggered entry design. Journal of Wildlife Management 53:7–15.