ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 115526
Juneau, AK 99811-5526

Alaska Department of Fish and Game
Wildlife Restoration Grant

GRANT NUMBER: AKW-19

PROJECT NUMBER: P4.0

PROJECT TITLE: Assessment of factors associated with moose-vehicle collision in the Matanuska-Susitna Valley of Alaska

PERIOD OF PERFORMANCE: July 2016 – June 2019

REPORT DUE DATE: Submit to Coordinator August 24, 2018; due to FAC Sept 28, 2018

PRINCIPAL INVESTIGATOR: Jeff Stetz

COOPERATORS: Dr. Terry Messmer, Utah State University

This is the final report for a multi-year project. This template is applicable to both:

- the final closeout report of a multi-year grant; or
- the final closeout report of a multi-year *project* within the annual operating grant, summarizing all accomplishments for all objectives.

Authorities: 2 CFR 200.328
2 CFR 200.301
50 CFR 80.90

I. SUMMARY OF WORK COMPLETED ON PROJECT

OBJECTIVE 1: Identify factors that are associated with locations where moose-vehicle collisions (MVCs) occur.
ACCOMPLISHMENTS: Field data collection was successfully completed and planned analyses have been performed. Results have been submitted to a peer-reviewed journal.

OBJECTIVE 2: Identify moose movement corridors and factors associated with movement behaviors.
ACCOMPLISHMENTS: Sixty moose were captured and fitted with satellite collars, with additional animals being collared as necessary to maintain the sample size. Results have been submitted to a peer-reviewed journal.

OBJECTIVE 3: Provide information to ADFG and ADOT&PF that will allow each agency to be

ACCOMPLISHMENTS: An annual progress report with preliminary findings was prepared and submitted to both agencies.

OBJECTIVE 4: Publish a peer-reviewed research paper detailing the research and findings.
ACCOMPLISHMENTS: Two manuscript have been submitted to peer-reviewed journals at the time this report was prepared.

NARRATIVE: Approximately 60 moose were captured by ADFG biologists using aerial- and ground-based darting techniques. Immobilized moose were fitted with high fix-rate GPS radio-collars with Iridium satellite technology that periodically transmitted location data to ADFG. This new technology eliminated the need to recapture moose to obtain data.

Between the fall of 2017 and winter of 2018, twenty-one collared moose died from various causes (1 MVC, 10 Harvested, 1 starvation, and 9 Unknown). During March of 2018, seventeen additional adult moose (12 females, 5 males) were captured via ground-based and helicopter-based darting and equipped with GPS collars. All darted moose responded well to the drug cocktails used and no capture related mortalities occurred. To date, the GPS collars have successfully transmitted 1,211,187 moose location data points.

Within 72 hours (typically ≤24 hours) of being notified of an MVC, ADFG staff visited the collision site to collect data describing characteristics of the site. During the same trip, staff collected the same data at 2 randomly selected "non-collision" sites in the general vicinity (within 5 km) of the collision site.

To understand factors of MVC risk at a finer scale, we collected vegetation and road geometry data at 400 reported MVC locations across the Matanuska-Susitna Borough of Alaska between 2016 and 2018. We used these data, along with spatially extracted data, to construct generalized additive mixed models of MVC risk. Similar spatially extracted data was collected for 2,772 sites where radio-marked moose within the study area crossed roads to build a comparative model of moose road crossing risk. The final model of MVC risk included predicted snow presence, solar altitude, road sinuosity, area of the roadside obstructed by vegetation, and the angle between the road and the roadside (R^2 = 38.7%). The final model of moose crossing risk included the spatial coordinates, predicted snow presence, solar altitude, traffic volume, road density, distance to nearest building, light reflectance, land cover interspersion, and proportions of deciduous-coniferous and coniferous forest (R^2 = 49.3%). To understand the effect of each factor in these models, we manipulated each to its observed maximum or minimum and used the original model to predict MVC risk again. Winding roads, which would allow for high visibility but likely induce lower speeds, reduced MVC risk by 35.8%, and minimizing roadside vegetation reduced MVC risk by 14.6%. Extremely high light reflectance reduced moose crossing risk by 55.2%. Overall, recommended mitigation efforts include seasonal lighting or reduced speeds in areas heavily impacted by MVCs, roadside vegetation clearing, and centralization of future urban planning to areas that are already heavily urban.

Moose movement patterns were analyzed using Brownian bridge movement models. This newer method, unlike older approaches such and kernel density estimators, do not assume that locations are independent and therefore are able to provide more in-depth understanding of home ranges, migration routes, seasonal movement patterns, and habitat-use. Preliminary analyses are being conducted to identify factors associated with moose movement rates but detailed analyses will not be conducted until additional data is acquired as part of future research efforts.

II. SIGNIFICANT DEVELOPMENT REPORTS AND/OR AMENDMENTS.

No SDRs or amendments were submitted for this project.

III. PUBLICATIONS

McDonald, L. R., T. A. Messmer, and M. R. Guttery. 2018. Assessment of factors associated with moose-vehicle collisions and their relationship to moose seasonal movements in the Matanuska and Susitna valleys of Alaska. ADFG Annual Report.

McDonald, L.R. 2019. Urban Alaskan moose: an analysis of factors associated with moose-vehicle collisions. Masters Thesis. Utah State University. 93 pages.

McDonald, L.R., T.A. Messmer, and M.R. Guttery. Temporal Variation of Moose-Vehicle Collisions in Alaska. Wildlife Human Interactions. In Review.

McDonald, L.R., T.A. Messmer, and M.R. Guttery. Moose-Vehicle Collision Risk Factors in the Matanuska-Susitna Borough of Alaska. Wildlife Biology. In Review.

IV. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

Our results generally support those of previous research on collisions between motorized vehicles and large-bodied wildlife species. For example, road sinuosity has been documented as a predictor for MVCs in past studies (e.g., Finder et al. 1999, Girardet et al. 2015), as have the characteristics of roadside vegetation (Jagerbrand and Antonson 2016), and angle of the shoulder (Clevenger et al. 2015). Vehicle speed and visibility remain among the most important factors affecting MVC rates, as has been documented in Alaska (DelFrate and Spraker 1991) and elsewhere (e.g., Grilo et al. 2009). Ongoing data collection will provide enhanced opportunities to assess MVCs and refine predictive models to inform design of transportation projects and increase awareness among drivers.

Clevenger, A. P., M. Barrueto, K. E. Gunson, F. M. Caryl, and A. T. Ford. 2015. Context-dependent effects on spatial variation in deer-vehicle collisions. Ecosphere. 6:47.

Del Frate, G. G. and T. H. Spraker. 1991. Moose vehicle interactions and an associated public awareness program on the Kenai Peninsula, Alaska. Alces. 27:1-7.

Finder, R., J. L. Roseberry, and A. Woolf. 1999. Site and landscape conditions at white-tailed deer/vehicle collision locations in Illinois. Landscape and Urban Planning. 44: 77-85.

Girardet, X., G. Conruyt-Rogeon, and J. Foltete. 2015. Does regional landscape connectivity influence the location of roe deer roadkill hotspots? European Journal of Wildlife Research. 61: 731-742.

Grilo, C., J. A. Bissonette, and M. Santos-Reis. 2009. Spatial–temporal patterns in Mediterranean carnivore road casualties: Consequences for mitigation. Biological Conservation. 142:301-313.

Jagerbrand, A. K., and H. Antonson. 2016. Driving behaviour responses to a moose encounter, automatic speed camera, wildlife warning sign, and radio message determined in a factorial simulator study. Accident Analysis and Prevention. 86:229-238.

Prepared by: Jeff Stetz

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