2017 Project Update: Northeast Washington Moose Demography Project

PhD Student: James W. Goerz
Montana Cooperative Wildlife Research Unit – University of Montana

Research Committee: Dr. Mike Mitchell (MTCWRU), Dr. Richard Harris (WDFW), Dr. Joshua Millspaugh (B&C), Dr. Paul Lukacs (UMWBIO), Dr. Nicholas DeCesare (MTFWP)

Primary Field Support: Jared Oyster (WDFW), Seth Boogaard (MTCWRU)

Project Update Completed: December 27, 2017

Image 1. Adult female moose ET#56 with 2015 calf detected by remote camera.

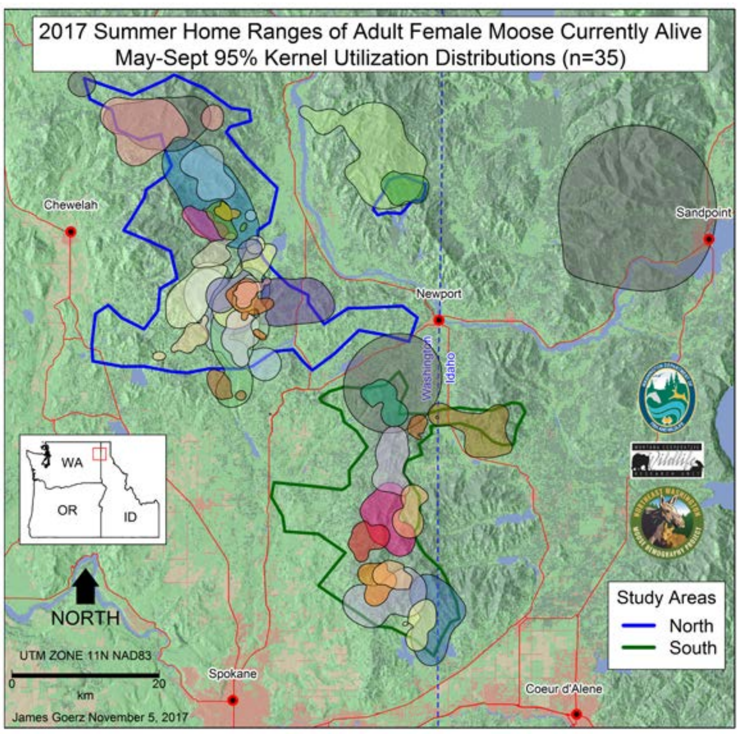
Introduction

In May 2017, the Northeast Washington Moose Demography Project entered its fourth year of fieldwork, collecting data on moose movements, population vital rates (survival and reproduction), and the factors which may be influencing them. Thus far, we have accumulated more than 1,200 ground-approaches of 67 individual radio-collared adult female moose in order to track calf production and survival. Information obtained from these field observations, as well as the location data transmitted by their radio-collars, provides the opportunity to understand population dynamics and behavior as well as the environmental characteristics driving those responses. Potential drivers of moose population dynamics and behavior that are of interest include predation risk (black bears, mountain lions, and wolves), internal and external parasites, and the composition and distribution of land-cover types (forage, thermal refuge). Field work led by the University of Montana (UM) will conclude in May 2018; WDFW will continue to monitor marked animals after this time. Final results for the UM portion are expected by May 2020.

Deleted: behavior which are of interest

Study Areas

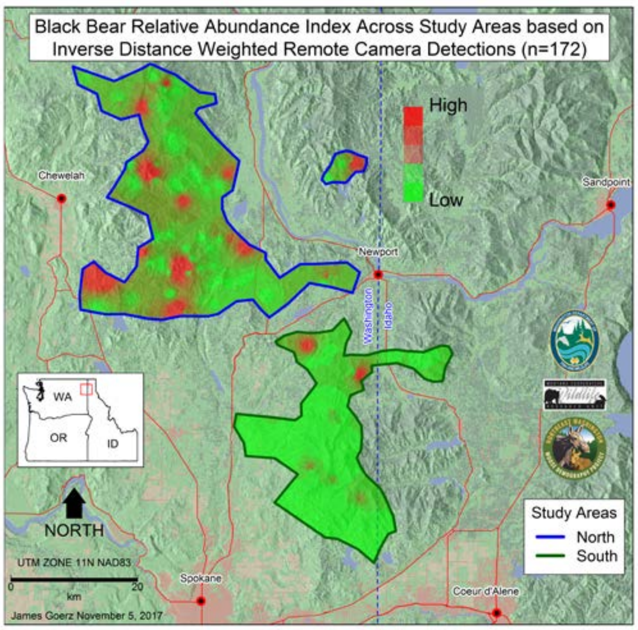
This project was designed to evaluate the consequences of variation in population stressors on moose survival and reproduction across an urban-wildland interface. With this in mind, two study areas were selected – north (blue polygon) and south (green polygon) which vary in the composition and distribution of land-cover types within and likely vary in predation risk between. Variation in land-cover type across each study area results from diverse public, private and private-industrial land-use activities, while hypothesized variation in predation risk is likely due to an inverse relationship between large carnivore population densities (north > south) and human population densities (south > north). As of December 20, 2017, 35 adult female moose are radio-collared, are alive, and are transmitting their locations daily. Summer 2017 home ranges for these moose are depicted below (Map 1).



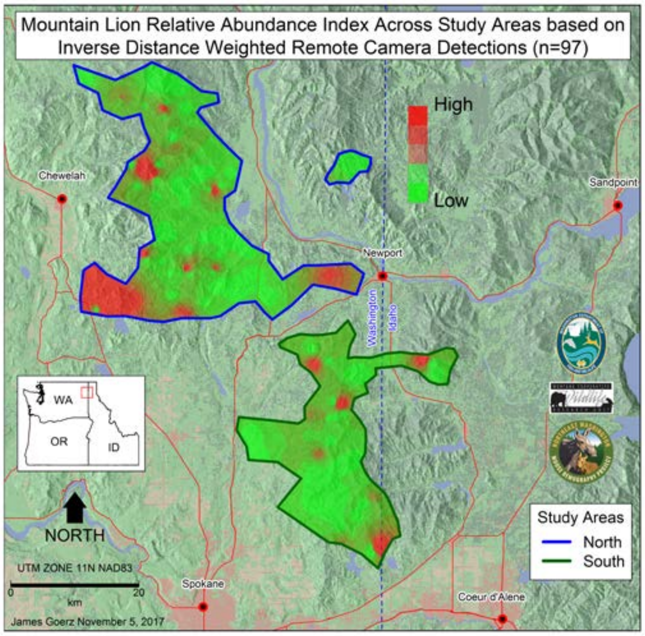
Map 1. Currently, 35 adult female moose are radio-collared, alive, and transmitting GPS locations at 23-hour intervals.

Estimating Relative Predator Abundance

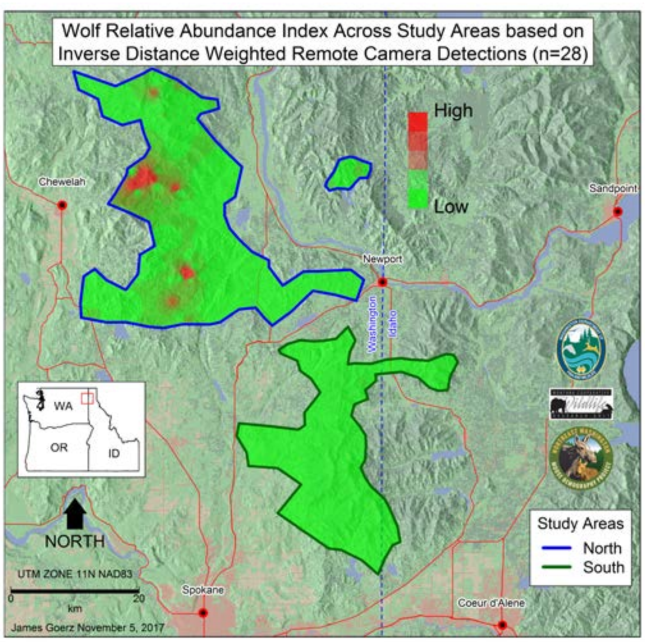
In 2017, we continued to use fixed, remote cameras throughout our two study areas to detect black bears (*Ursus americanus*), mountain lions (*Puma concolor*), and gray wolves (*Canis lupus*). These three predator species are known to consume adult and/or calf moose, therefore, estimating an index of their relative abundances within and between the study areas is critical to evaluating their potential effects on the survival of adult/calf moose. Thus far, we have placed remote cameras at 182 random locations throughout our two study areas. Each camera collects predator detections for 90 days and nights and is then rotated to a new, randomly determined location. Data are currently available from 144 cameras; preliminary results are provided below. This index of relative abundance is currently estimated as the locally-weighted number of independent detections of each predator species (number of 24-hour periods producing a detection). Exact values for free-ranging predator abundances are difficult to obtain and are not represented here. The data provided below simply represent an empirical and spatial prediction of where moose demography or behavior may be most affected by predators (Maps 2-4).



Map 2. Black bear relative abundance index across each study area (north, south) estimated from detection data obtained from 144 randomly placed remote cameras.



Map 3. Mountain lion relative abundance index across each study area (north, south) estimated from detection data obtained from 144 randomly placed remote cameras.



Map 4. Wolf relative abundance index across each study area (north, south) estimated from detection data obtained from 144 randomly placed remote cameras.

Adult Female Moose Survival

The year 2017 was marked by higher adult female moose mortality than the previous three years of research in NE Washington (Figure 1). Despite this increased mortality, the trends in cause-specificity in each study area mirrored that of all previous years (Figure 2). The causes of death for cow moose in the northern study area were diverse and largely health and predation-related (Map 4, Figure 3). Conversely, the predominant cause of death in the southern study area was legal hunter harvest (Map 4, Figure 4). Total adult survival for 2017 (0.73, Figure 1) was lower than the 4-year mean across all four years of research (0.81, Figure 2).

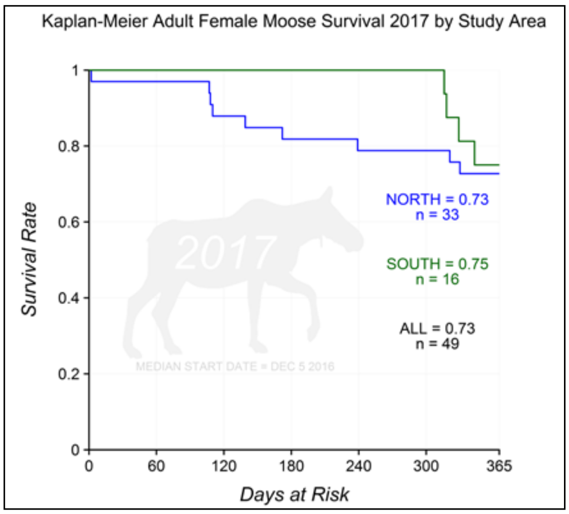


Figure 1. Adult female moose survival estimates from radio-collared individuals, 2017.

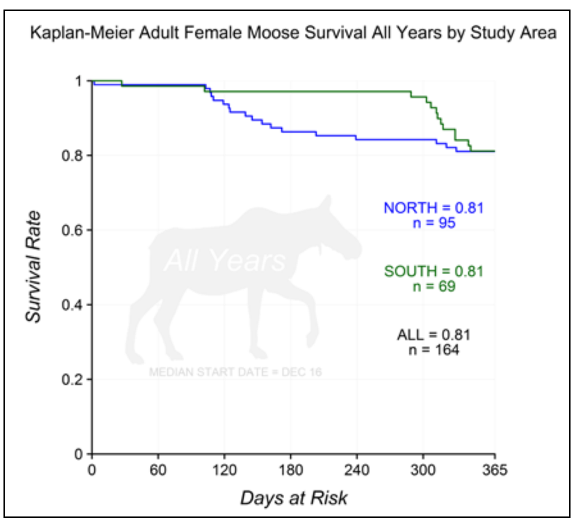
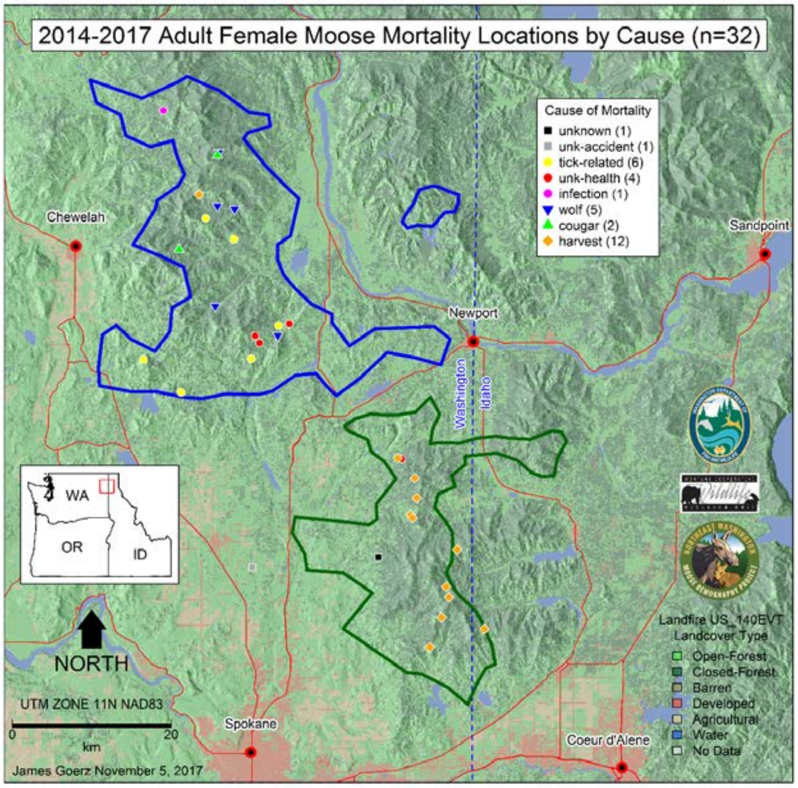
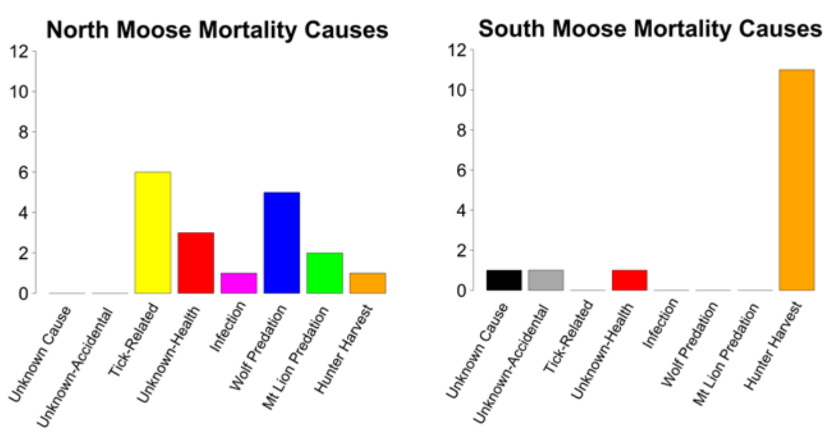


Figure 2. Adult female moose survival estimated from radio-collared individuals across all years (December 2013 - December 2017).



Map 4. Locations and sources of adult female moose mortality across all years (December 2013 – December 2017, n = 32).



Figures 3-4. Bar-plots distinguishing sources and counts of adult female moose mortality within and between study areas (north = 18, south = 14) and across all years (December 2013 – December 2017).

Calf Moose Survival

We did not put radio-collars on calf moose. Therefore, calf survival was estimated by repeated ground observations of their collared mothers; from these observations, we determined the presence or absence of a calf-at-heel. Calves are highly dependent on their mothers for their first year of life and therefore remain close to them until dispersal (typically at about 1 year of age). Through repeated ground monitoring, we have estimated calf survival for calf-years (defined as 1 June-31 May) 2014-15, 2015-16 and 2016-17. For 2017-18, we have documented calf production for each radio-collared adult female moose and are currently tracking the fates of those calves along with their collared mothers. Calf survival estimates for the current study year (2017-18) are not provided in a separate plot because calf absences (presumed mortalities) are currently being documented and interpretation of calf survival at this time could be misleading. Preliminary results from all currently available calf survival data are provided below (Figure 5).

It is important to emphasize that clear observation of un-collared calves is difficult. They are small in size early in life and mothers are typically protective of their easily concealed offspring. Thus, the estimates provided below are based on a definition of mortality that requires at least two consecutive observations of calf absence.

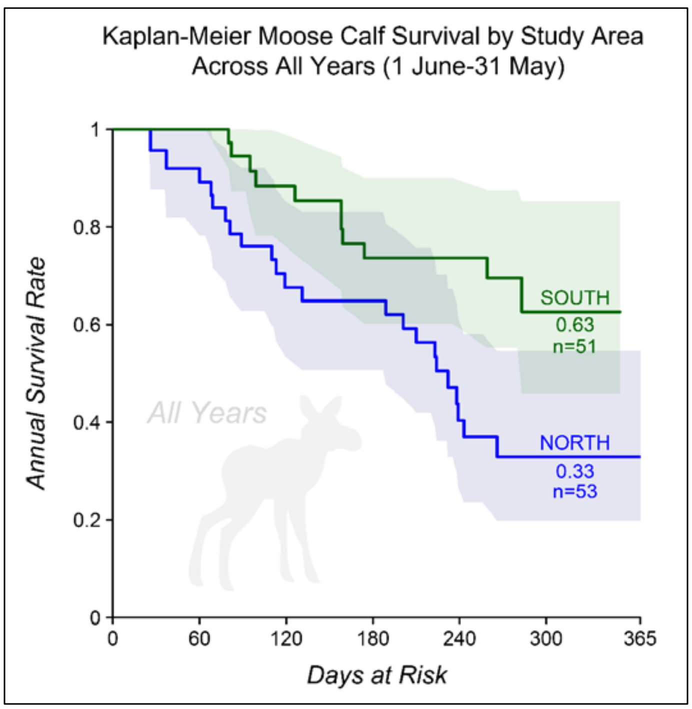


Figure 5. Calf moose survival estimates by study area and across all years
(1 June – 31 May 2014-15, 2015-16, 2016-17 and current data for 2017-18).

Pregnancy

Each winter, technicians and volunteers collect fresh fecal samples from as many radio-collared adult female moose as possible. These samples are analyzed for progesterone levels (mammalian pregnancy hormone), allowing us to estimate the probability that each moose will produce a calf the following spring. Preliminary results from 87 of these fecal samples collected across three winters (2014-15, 2015-16, and 2016-17) are provided below (Figure 6). Fecal progesterone levels are modeled using documented calf production the following year as the response variable. Study area level pregnancy rates are estimated using median fecal progesterone levels. Based on this logistic regression model, study area pregnancy rate estimates are 0.50 (North, n=49 samples) and 0.71 (South, n=38 samples). The overall pregnancy rate estimate is 0.60 across individuals, years and study areas (n=87 samples).

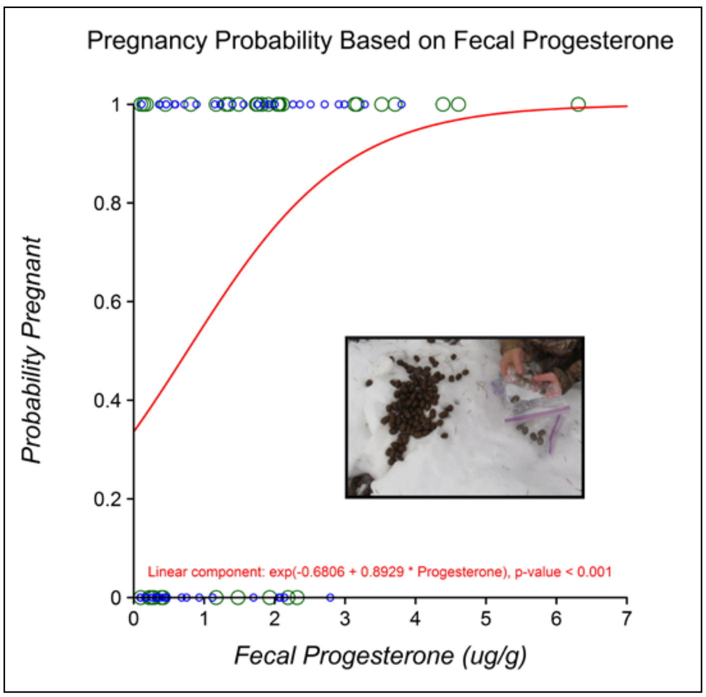


Figure 6. Pregnancy rate estimates using fecal progesterone concentrations and calf observation data from three years (2014-15, 2015-16, and 2016-17).

Calf Production

Calf production is determined via ground-monitoring (Image 2) as well as aerial surveys of moose throughout spring and summer each year. Visual observation of adult female moose and their calves is difficult and often requires multiple visits to confirm presence or absence. For this reason, some calves may be born to radio-collared female moose and die before their presence can be determined by field crews. Further data collection and analysis of body-condition and predation risk may clarify associations, if any, between calf production and predation levels or other study-area related differences. It is also important to note that these annual rates are calculated with small samples (12-26 animals) and are therefore subject to significant sampling uncertainty. Average annual calf production rates based on weighted average of the rates provided below (Figure 7) are 0.70 (south, n=71) and 0.53 (north, n=79).

Image 2. Ground observation of adult female moose ET#2 and her approximately 6-week-old calf.

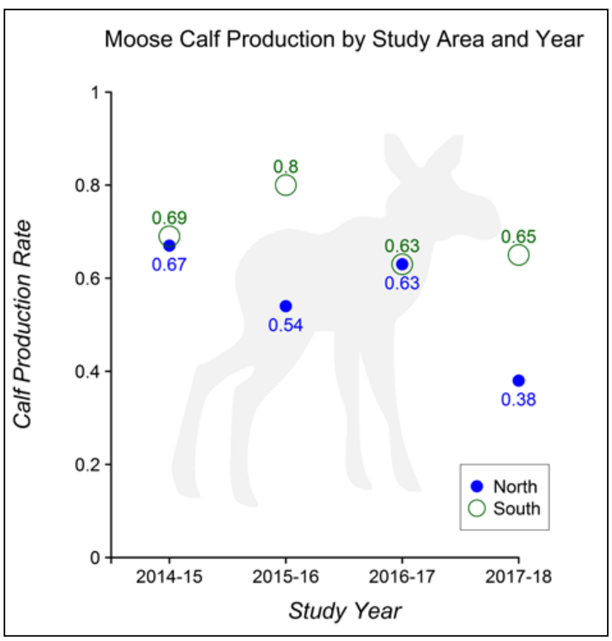


Figure 7. Calf moose production rates by study area and across all years.