

About this conference

Predation is one of the most fundamental interactions in ecology because it is a primary mechanism of energy transfer among trophic levels. People also consider predation to be fascinating because it is dramatic and invokes images of life-and death situations. But from a scientific perspective, the effects of predation on prey populations are continually debated in the literature, even within a specific study system. Is predation compensatory (i.e. animals would have died anyway, were they not eaten), is it limiting (does it reduce the number of prey), or even regulating (is it dependent on the density of prey)?

Through a keynote address, 3 days of presentations, computer modelling workshops, a poster session and a field-trip this conference will provide a cutting-edge opportunity for scientists, managers, students, guide-outfitters and hunters to share results of recent research on predator-prey dynamics in the Columbia Mountains region and elsewhere.

Conference summary will be available on the CMI website

All speakers will be submitting their abstracts to the online journal Peer J and those who choose to will submit full papers. CMI will provide a link to the Peer J conference collections page.

Conference participant list

A list of conference participants is posted near the registration desk. You are encouraged to look up contact information for people you have met at the conference. Because of CMI's privacy policy, this list will not be available for distribution after the conference.

Our thanks go out to...

Thanks to our speakers and the people who brought posters and displays. We are grateful for your willingness to share your expertise with us.

Thanks to the members of the conference organizing committee:

- Rob Serrouya, Columbia Mountains Caribou Research Project and University of Alberta
- Craig DeMars, University of Alberta
- Doug Heard, Tithonus Wildlife Research and University of Northern British Columbia
- Ian Hatter, BC Ministry of Forests, Lands and Natural Resource Operations (retired)
- Harry van Oort, CMI Director, Cooper Beauchesne
- Michelle Bacon, Golder and Associates
- Tara Szkorupa, BC Ministry of Forest, Lands and Natural Resource Operations
- Brian Glaicar, Monashee Guide Outfitting
- Gerry Kuzyk, BC Ministry of Forests, Lands and Natural Resource Operations
- Sylvia Wood, Columbia Mountains Institute

Thanks to Jennifer Greenwood, Marcy Mahr, Mandy Kellner, Kasia Kistowska, Kendal Benesh, Corey Bird, Catherine Craig and Ryan Gill for volunteering to help keep our conference running smoothly.

Thanks to our conference partners!



Conference Agenda

Tuesday April 5, 2016

- 9:00 am **Welcome** on behalf of the Columbia Mountains Institute of Applied Ecology, Sylvia Wood
Opening remarks
- 9:15 am **Introductions and overview.** Rob Serrouya, University of Alberta
- 9:40 am *COMPENSATORY MORTALITY*
Compensation and density dependence. Mark Boyce, University of Alberta
- 10:10 am **Additive and compensatory predation mortality by cougar on elk.**
David Vales, Muckelshoot Indian Tribe Wildlife Program
- 10:30 am Coffee Break and Refreshments
- 11:00 am **Can a low carrying capacity and a highly stochastic environment induce a predator pit in elk populations?**
Jon Horne, Idaho Dept. of Fish and Game
- 11:20 am **What can the inverse relationship between sex ratios and calf: cow ratios tell us about compensatory responses to hunting, in moose populations exposed to wolf predation?**
Doug Heard, Tithonus Wildlife Research and University of Northern British Columbia
- 11:40 am **Spatial-temporal variation in wolf predation dynamics in the multi-prey system of Yellowstone National Park.** Matthew Metz, University of Montana
- 12:00 pm Lunch Break
- 1:00 pm *MULTI-PREY/MULTI-PREDATOR SYSTEMS*
Predation in multi-prey/multi-predator systems.
Norman-Owen Smith, University of the Witwatersrand
- 1:30 pm **How apparent competition and predator responses led to the decline of Arctic ground squirrels in the boreal forests of the southwest Yukon.** Jeffery Werner, University of British Columbia
- 1:50 pm **Mapping the functional connectivity of predation by large carnivores in the Canadian Rocky Mountains.** Adam T. Ford, University of Guelph
- 2:10 pm *SPECIES MANAGEMENT IN PREDATOR-PREY SYSTEMS AFFECTED BY MULTI-USE LANDSCAPES*
Estimation of wolf population density using spatial capture-recapture: Refining methods for monitoring cryptic species. Gretchen H. Roffler, Alaska Department of Fish and Game
- 2:30 pm Coffee Break and Refreshments
- 2:50 pm **Behaviourally-mediated interactions of landscape pattern shape predator-prey dynamics in highly altered landscapes.** Craig DeMars, University of Alberta.
- 3:10 pm **Moose refugia from predation by wolves near mines in the Athabasca oil sands.**
Eric Neilson, University of Alberta
- 3:30 pm Panel discussion with all speakers from today. Moderated by Stan Boutin, University of Alberta
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Wednesday, April 6 2016

- 8:30 am **Welcome back** by Master of Ceremonies
- 8:40 am *EXPERIMENTAL MANIPULATION OF PREDATOR-PREY SYSTEMS*
A review of population-based management of Southern Mountain caribou in British Columbia.
Stan Boutin, University of Alberta
- 9:00 am **Avian management at Vancouver International Airport: Painting a landscape of fear with trained raptors.** Kristine Kirkby, Pacific Northwest Raptors Ltd.
- 9:20 am **Managing wolves to benefit woodland caribou populations in northeast British Columbia: What we know and what we need.** Steven F. Wilson, EcoLogic Research
- 9:40 am *CLIMATE DRIVEN CHANGES IN PREDATOR-PREY SYSTEMS*
Climate induced wolf prey selection in Yellowstone National Park, 1995-2015.
Douglas Smith, Yellowstone National Park
- 10:00 am Coffee Break
- 10:30 am **Evaluating the effects of habitat condition, climate and predator density on Shiras moose demography.** Brendan A. Oates, University of Wyoming.
- 10:50 am **Multi-scale asynchrony of white shark and US gray seal activity reveals the interaction of predators and prey engaged in food acquisition.** Jerry Moxley, Duke University
- 11:10 am **Future population trends and drivers of change for Alexander Archipelago wolves on and near Prince Of Wales Island, Alaska.** Sophie Gilbert, University of Alberta.
- 11:30 pm Lunch Break
- 1:00 pm COMPUTER WORKSHOPS FOR REGISTERED PARTICIPANTS (1:00-3:30 pm)
- 3:30 pm BEER & WINE NETWORKING/POSTER SESSION: **Karine Pigeon Poster.** **William Harrower Poster**
LINK TO SUMMARY OF ALL OTHER POSTERS
- 5:30 pm BANQUET
- 7:30 pm *Keynote Speaker-evening event open to the public*
Fear of predators as an ecosystem service.
Liana Zanette, University of Western Ontario

“Fear of Predators as an Ecosystem Service”

With Liana Zanette

Liana’s research focuses on the many dimensions of predator-induced fear, from population and ecosystem level consequences, to impacts on health and development. A “paradigm shift in ecology” is occurring concerning the preeminent role of predators in affecting everything from ecosystem dynamics to global biodiversity.

Thursday April 7, 2016

- 8:30 am **Welcome Back** by Master of Ceremonies
- 8:40 am *MANAGEMENT AND POLICY*
Silviculture approaches to restoring a predator-prey system: examples from Boreal Alberta.
Michael Cody, Cenovus Energy Inc
- 9:00 am **A Bayesian approach to understanding the functional components of a multi-predator/prey system and its response to habitat restoration.** R. Scott McNay, Wildlife Infometrics Inc.
- 9:20 am **Managing elk in a world with complex predator-prey (and social!) dynamics: A case study from the Kootenays.** Tara Szkorupa, BC Ministry of Forests, Lands and Natural Resource Operations
- 9:40 am **Determining factors affecting moose population change in British Columbia: an update.**
Shelley Marshall, BC Ministry of Forests, Lands and Natural Resource Operations
- 10:00 am Coffee break and Refreshments
- 10:20 am **Perspectives from a guide outfitter on predator-prey management in British Columbia.**
Brian Glaicar, Monashee Guide Outfitting
- 10:40 am **Predators: Who bears the costs, who bears the benefits, and how we measure it.**
Jesse Zeman. BC Wildlife Federation
- 11:00 am **The policy basis for wolf management to enable endangered species conservation in Alberta.**
Dave Hervieux, Government of Alberta
- 11:20 am Panel Discussion with all speakers. Moderated by Ian Hatter
- 12:00 pm Final Master of Ceremonies statement and Thank-you
- 12:10 pm Field Trip to the maternity pen leaves
- 12:10 pm Grab and go lunches available for field trip attendees

Professional development hours

Are you tracking your continuing education hours for your professional association? If you would like to be mailed or emailed a certificate regarding your attendance at this workshop, please use the sign-up sheet at the registration desk.

Upcoming CMI events

We are in the planning stages for these and other events. To be notified as details develop, please become a CMI Member. Or, sign up to receive event announcements at the front page of our website.

Introduction and "R" and Statistics Refresher in "R"- (April 25-28) Revelstoke BC, with Dr. Carl Schwarz, Simon Fraser University.

Fish Identification Course (May 10-11, 2016), Selkirk College, Castlegar, BC with Dr. Rick Taylor

Annual Researchers' Forum and AGM (May 13, 2016) Kaslo, BC

Identification of Native Grassland Plants course (May 24, 2016) Invermere, BC with Dr. Terry McIntosh

Predator Prey Poster Abstracts

Posters:

- Armstrong, Terry
 - Boyd, et al.
 - Dickie, Melanie
 - Dwinnell, Samantha
 - Harrower, W.
 - Marley, Jessa
 - McDaniel, Mike
 - Pigeon, Karine
 - Rancourt, K
 - Spilker, Eric
 - Stent, Patrick
-

Poster Abstracts

William L. Harrower

Trophic interactions are mediated by the availability of water in temperate grassland ecosystems

Authors:

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LAUHLAN H. FRASER, Department of Natural Resource Sciences, Thompson Rivers University, Kamloops, British Columbia, V2C 0C8

ROY TURKINGTON, Department of Botany & Biodiversity Research Centre, University of British Columbia, Vancouver, British Columbia V6T 1Z4

Abstract:

The addition or removal of predators from food webs by humans can have profound effects on the interactions between species. However, predators and primary producers are inextricably linked by the flow of energy through ecosystems. In temperate grasslands energy flow through ecosystems is often limited by water availability to plants. So, if the number and strength of interactions between species in grasslands depends on the amount of water available to plants, and we remove predators along a gradient in water availability, then we should see change in species interactions with predator removals along the gradient. After estimating trophic position and diet breadth of key predators, we excluded birds and small mammal predators from grasslands along a rainfall gradient in south central British Columbia for four years, and measured the response of plants and arthropods. Water availability significantly altered food web structure, and consequently the role of predators in structuring these ecosystems. When water was scarce, vertebrate predators impeded plant growth by feeding on spiders that would normally eat herbivorous insects. When water was more abundant, vertebrate predators facilitated plant growth by feeding on a broad range of arthropod prey. Phenomena such as climate change can determine the availability of water entering ecosystems, which then alters trophic structure. If water availability can alter food webs there are no simple generalizations for community dynamics that are independent of climate.

Krystal Rancourt

Patch selection and its influence on predator abundance and classification

Author:

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Abstract:

Predator-prey systems have been linked to influencing community dynamics but these generalizations have been discovered using a wide range of species from arthropods to mammals. Although these generalizations are useful, there are some limitations. In this study, I hope to broaden our understanding of habitat selection of a mammalian predator and how a prey and a competitor could influence their abundances and classification. In order to understand this, I will be looking at patch use of the Andean fox (*Pseudalopex culpaeus*) when the prey, the tapeti (*Sylvilagus brasiliensis*) and the competitor, the feral dog (*Canis familiaris*) presences varies in different patches. There are 4 different patches that will be selected within the Chimborazo Faunal Reserve in Ecuador within the páramo ecosystem. I will be analyzing any differences in abundances between patches using statistical analyses. Abundances should be higher in patches where predator and prey are present, without the presence of a competitor. Also, I will be evaluating if the predator adapts a specialist diet or generalist diet based on patch constituents. In patches where prey are abundant, the predator should have a specialist diet while in other patches, the predator should have a generalist diet. The significance of this study is to further our understanding of community dynamics as well as adding knowledge to the fundamentals of mammalian predator ecology.

Mike Boyd

Wildlife and human use of a utility right-of-way

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Abstract:

Right-of-ways (ROWs) create linear corridors across landscapes. Active vegetation management along ROWs can create and maintain early-seral shrub-dominated ecological communities. This shift in habitat type could result in a mixture of positive and negative impacts on wildlife. Effects of ROWs on individual prey and predator species could have consequences for predator-prey systems within the altered ecosystems. Overall changes in behaviour of prey through predation risk can have long-term behavioural impacts on population at the landscape scale. Dominant large predators may be able to have direct impacts on prey species and indirect ecosystem-wide effects.

First Nations and local groups have expressed environmental concerns centred on the impacts regional linear projects may have on important resource species. Moose (*Alces alces*) and species of conservation concern (e.g. caribou; *Rangifer tarandus*) were identified as being of particular concern. Potential effects from linear projects may include increased hunting access by humans and grey wolf (*Canis lupus*) as a result of increased access, and subsequent changes to predator–prey dynamics.

One hundred wildlife cameras were installed along an existing ROW to assess the occurrence and spatial-temporal use of humans and wildlife on a ROW in northeastern BC. Cameras were deployed in groups that spanned the entire width of the ROW providing complete coverage.

Data was analyzed for species occurrence and behavior within the ROW, the use of roads within the ROW, and the co-occurrence relationship between predators, prey and humans. This study is part of an adaptive management strategy to assess ROW effects and identify mitigation measures. This study detected all large mammal species known to occur within the Peace region, including four species at risk. Ungulate species appear to reduce their diurnal use of the ROW during the hunting season to avoid human predation. Human use, in the form of ATVs and vehicles, may be reducing Canadian lynx, grizzly bear, and grey wolf use of the ROW, while moose do not appear to be displaced by them. Our results suggest that ungulates may be using the ROW as a refugium from natural predators. Overall, this study suggests that human hunting pressures are influencing the local predator-prey system.

Karine Pigeon

Towards stable caribou populations in Alberta: Considering resource selection by wolves, grizzly bears, and caribou to prioritize restoration of legacy seismic lines.

Authors:

Doug MacNearney¹, Karine Pigeon^{1,2*}, Jerome Cranston³, Gordon Stenhouse², and Laura Finnegan¹

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Abstract :

Throughout their range, the decline of woodland caribou populations is thought to be a result of habitat degradation and fragmentation from industrial activities. Land managers are under pressure to restore habitat within caribou ranges and mitigate potential negative effects of resource extraction on caribou into the future. Considering the historical anthropogenic footprint in Alberta, restoration efforts need to be prioritized. Using a combination of LiDAR and animal GPS data, we investigated the influence of vegetation height on the selection of seismic lines, and the zone of influence of these features on grizzly bears, wolves, and caribou within four caribou ranges in west-central Alberta. Our objective was to integrate the influence of vegetation height on seismic lines, seismic line density, and the zone of influence of these seismic lines on caribou and their predators to identify areas with the highest probability of overlap among grizzly bears, wolves, and caribou to prioritize restoration of legacy seismic lines in Alberta and increase functional habitat for caribou. Based on LiDAR, the average vegetation height of 12,854 km (83%) of seismic lines was less than 1.5 m while 2,392 km (15%) of seismic lines had a vegetation height between 1.5 m and 5 m, and 341 km (2%) of seismic lines had an average vegetation height greater than 5 m. Animal responses to seismic lines varied seasonally and were dependent on regeneration stage. This research highlights predator-prey interactions on a managed landscape and how our knowledge of these mechanisms is essential to effectively prioritize restoration.

Terry Armstrong

Bison, boreal caribou and moose: apparent competition? A challenging research opportunity.

Authors :

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Abstract :

Wood bison (*Bison bison athabascae*), moose (*Alces alces*) and boreal caribou (*Rangifer tarandus caribou*) co-occur in a multi-prey, multi-predator system with wolves (*Canis lupus*) and black bears (*Ursus americanus*) within the approximately 20 000 km² range of the Mackenzie bison population, located within the sub-Arctic boreal forest of the Northwest Territories (NWT). The potential for apparent competition or other interspecific effects makes this a complicated management challenge because two prey species are listed as Threatened under SARA (boreal caribou and wood bison; bison have been recently reassessed as Special Concern by COSEWIC), but how the dynamics of each prey species is influenced by the others and their predators in this area is unknown. Where they occur, bison may have the greatest biomass of the three herbivores, but the species' distribution is very limited. Estimated moose densities in the area are among the lowest recorded in North America. In Alberta, studies found boreal caribou declined as biomass of alternate prey species increased due to apparent competition mediated by wolves; however, it is unknown if that effect occurs in this system. Local knowledge suggests that bears may be important predators of calves. There are also potential study areas within the same ecological region in the southern NWT where only two of the three herbivores co-occur (moose and caribou, bison and moose).

We welcome inquiries from potential collaborators who are interested in studying the dynamics of this system and contributing to the management of these species.

Samantha Dwinell

Risk-effects of a human-altered landscape: nutritional tradeoffs in behavior of mule deer

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Samantha P.H. Dwinell

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Abstract:

Behavioral responses to perceived risk can create tradeoffs between obtaining forage and avoiding risk of predation that may modify nutritional dynamics of ungulates; however, a landscape may not require the presence of predators to prompt risk-sensitive foraging. Human disturbance may be a novel form of perceived risk similar to predation, and affect how ungulates use available habitats. Behavioral responses to human disturbance are known to affect population performance, but the proximate mechanisms that underpin those effects are poorly understood. We hypothesized that the integrative relationship between risk-sensitive behavior and nutritional condition is the pathway by which human disturbance affects ungulate populations. To test this hypothesis, we linked behaviors and seasonal changes in nutritional condition of 148 female mule deer (*Odocoileus hemionus*) equipped with GPS collars to habitat conditions across three discrete winter ranges that vary in intensity of human disturbance from energy development. Use of available browse was most affected by proximity to energy development and annual production of browse, but use decreased with distance to development. Furthermore, deer increased movement rates near development, which in turn affected nutritional condition. Our results indicate that the potential non-lethal effects of human disturbance may operate by prompting alterations in habitat use and fine-scale behaviors which consequently affect nutritional dynamics. Such findings should aid in guiding conservation and management of ungulate populations exposed to rapid increases in human disturbance.

Melanie Dickie

Title: Effect of linear feature abundance and vegetation structure on wolf selection and movement

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Abstract:

Predation by grey wolves (*Canis lupus*) has been identified as an important cause of boreal woodland caribou (*Rangifer tarandus caribou*) mortality. Wolves have been hypothesized to use human-created linear features such as seismic lines, pipelines and roads to increase ease of movement resulting in higher kill rates. I examined how the abundance and physical properties of linear features affects wolf selection of, and movement on, these features in northeastern Alberta and northwestern Saskatchewan using 5-minute GPS (Global Positioning System) locations. The selection of linear features by individual wolves was not related to linear feature density. Linear features through uplands provided a greater increase in travelling speed relative to surrounding forest than wetlands in summer, however this was opposite in winter. Furthermore, when on linear features, wolves selected and moved faster on linear features with shorter vegetation. Once vegetation reached a height of 4.1 m in summer and 2.4 m in winter, average travelling speed was equal to that of the surrounding forest. Alternatively, linear feature roughness can be used to assess vegetation; wolf travelling speed on linear features was equal to the average speed in the forest when roughness was 1.90 and 1.82 in summer and winter, respectively. This knowledge can aid mitigation strategies by targeting specific features for reclamation and linear deactivation allowing for more effective use of conservation resources.

Jessa Marley

The impact of climate change on predator-prey systems and risk of extinction

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Abstract:

The relationship between predator and prey is fundamental to natural ecosystems. Anticipating how predator-prey systems will respond to climate change is critical for the management of species in danger of extinction. Populations suffering from extremely low numbers can struggle to reproduce, resulting in a faster population decline. This effect coupled with environmental changes could be enough to endanger a species with a currently stable population. We have developed a mathematical model that incorporates low density extinction and climate change into a predator-prey system. We used methods derived from the field of dynamical systems to analyze the system. Results show complex responses to climate changes, complicating the currently expected outcomes of species and conservation efforts. Understanding these fluctuations in population response is key for future conservation efforts under the conditions of climate change.

Eric Spilker

Assessing relative abundance and resource selection function for predicting predation risk in a multi-species predator community

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Abstract:

Understanding how large carnivores interact to distribute themselves in a heterogeneous landscape is an important first step toward quantifying how they collectively pose risk to their shared prey. Resource selection models and abundance estimates are two common approaches used as measure of predation risk, yet most studies employ only one. In this study, we assess whether camera-derived estimates of relative abundance improve a multi-species resource selection function (RSF) of predation risk on the eastern slopes of the Rocky Mountains in southwest Alberta by comparing the 2 approaches or their integration to predict location of elk kill sites. We modeled a multi-species RSF based on carnivore scats collected using detection dogs along 1057 km of transects distributed throughout 48 5x5-km grid cells and estimated relative abundance of each carnivore species within the same grid cells based on remote camera data located. Using a model selection approach, we found using both carnivore RSF and relative abundance best predicted areas where elk are likely to be killed for most but not all carnivores. Multi-species predation risk quantified from this study can be used to assess forage-predation risk trade-offs of different migratory segments of the elk population in this region.

Spilker, E.¹, K. MacAulay¹, E. Merrill¹, R. Steenweg², M. Hebblewhite², and J. Whittington³. ASSESSING RELATIVE ABUNDANCE AND RESOURCE SELECTION FUNCTION FOR PREDICTING PREDATION RISK IN A MULTI-SPECIES PREDATOR COMMUNITY. 1. Department of Biological Sciences, University of Alberta, Edmonton, AB T6G 1Z8; 2. Wildlife Biology Program, College of Forestry and Conservation, University of Montana, Missoula, MT, 59812; 3. Parks Canada P.O. Box 213 Lake Louise, Alberta T0L 1E0.

Mike McDaniel

Preliminary results of an ongoing cougar predation study in western Washington

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Abstract:

In an attempt to better understand predator-prey dynamics in western Washington the Muckleshoot Indian Tribe Wildlife Program has GPS collared 6 male and 6 female cougar (*Puma concolor*) of varying age class and tracked them for a total of 6,600 cougar days from February 2009 through December 2015. GPS clusters where cougars spent more than 10 hours in a single location were mapped and investigated to determine predation rates on large mammals. We have investigated 700 kill sites, identifying 247 blacktail deer (*Odocoileus hemionus columbianus*), 318 elk (*Cervus elaphus*) and 6 mountain goat (*Oreamnos americanus*) kills. Bobcat, beaver, and coyote made up the majority of the remaining kill sites. Total annual ungulates killed by male cougars averaged 49 (range 38-55) while females averaged 47 (range 29-72). Females with kittens had the highest annual kill rate, while sub-adult females had the lowest ungulate kill rate. At sites where ungulate prey was found we attempted to age the prey animal through investigation of tooth eruption patterns or extraction of an incisor for cementum annuli analysis. There have been 261 adult (greater than 1 year) and 314 juvenile (less than 1 year) ungulates classified at kill site clusters so far. Female cougar averaged a prey composition of 41% adult and 59% juvenile ungulates. Male cougar prey composition averaged 49% adult and 51% juvenile ungulates. When available and fresh, femurs from adult prey ungulates were collected to analyze marrow fat content to estimate prey body condition. Of the 277 femurs that were collected and analyzed 219 (79%) contained a marrow fat content above 50%, 20 femurs (7%) had a marrow fat content of 30-50%, and 38 femurs (14%) had a marrow fat content of less than 30%. With continued research this project will help the Muckleshoot Tribe predict the effects of cougar predation on the local deer and elk herds, a valuable subsistence resource for tribal members.

Patrick Stent

Kootenay Mule Deer Monitoring Project – Year 1 Progress Update

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Abstract:

Mule deer are a highly valued species in BC, and have recently declined in the Kootenay Region. In 2014, the Ministry of Forests, Lands and Natural Resource Operations initiated a 5-year project to monitor mule deer doe survival, fawn recruitment and cause of mortality in 4 populations that represent broad habitat types occupied by mule deer across the region. The long term goal of this project is to understand factors limiting population growth. Forty-one adult female mule deer were collared in the southern East Kootenay in winter 2014-15 and have been monitored for over a year. Doe survival was $0.76 \pm 13\%$ in Year 1, while fawn recruitment was 59 fawns per 100 does and population growth rate (λ) was estimated at 0.98 (approximately stable or slightly declining). Adult female survival is slightly below the North American average of 0.84. Cause of mortality included wolf predation (n=3), cougar predation (n=3), highway collision (n=3) and poaching (n=1). Differences in migratory behaviour were observed between monitored populations. Additional collars will be deployed in the West Kootenay and Northern East Kootenay areas in winter 2015-16. With additional monitoring, we will examine how predation, human-caused mortality, apparent starvation and fawn recruitment are limiting population growth. Factors contributing to doe mortality, including habitat selection and body condition, will also be investigated.
