

# **Montana Cooperative Wildlife Research Unit**

## **Report of Activities for the Coordinating Committee Meeting April 12, 2017**

### **Cooperating Agencies**

U. S. Geological Survey, Biological Resources Division  
Montana Fish, Wildlife and Parks  
The University of Montana  
Wildlife Management Institute  
U. S. Fish and Wildlife Service

**Project and fiscal information included in this report:  
01 April 2016 through 31 March 2017**

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## **Coordinating Committee Members**

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### **Wildlife Management Institute**

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### **The University of Montana**

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Office of Research and Creative Scholarship  
Main Hall 116  
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Chad Bishop, Program Director  
Wildlife Biology Program  
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### **Unit Staff**

Mike Mitchell, Unit Leader  
Thomas E. Martin, Assistant Unit Leader  
Tina Anderson, Accounting Manager

## **Graduate Students Advised by Unit Faculty**

### **Mike Mitchell**

Kristin Barker  
Sarah Bassing, MSc Candidate  
Shannon Forshee, MSc Candidate  
James Goerz, MSc Candidate  
Allison Keever, PhD Candidate  
James Goerz, MSc Candidate  
Sarah Sells, PhD Candidate  
Jeff Stetz, PhD Candidate \*

### **Tom Martin**

William Blake, MSc Candidate  
Andrew Boyce, PhD Candidate  
Karolina Fierro-Calderon, PhD Candidate  
Adam Mitchell, PhD Candidate  
James Mouton, PhD Candidate  
Juan Carlos Oteyza, PhD Candidate \*  
Riccardo Ton, PhD Candidate \*

## **Unit Faculty on Graduate Students' Committees**

### **Mike Mitchell**

Jennifer Feltner, PhD Candidate  
Karolina Fierro, PhD Candidate  
Charlie Henderson, PhD Candidate  
William Janousek, PhD Candidate  
Anna Moeller, MSc Candidate  
Juan Oteyza, PhD Candidate  
Keith Slauson, PhD Candidate  
Robin Steenweg, PhD Candidate  
Tshering Tempa, PhD Candidate  
Tshewang Wangchuk, PhD Candidate  
Sara Williams, PhD Candidate

### **Tom Martin**

Katie Baer, PhD Candidate  
Sara Berk, PhD Candidate  
Hannah Beyl, MSc Candidate  
Ryan Hegstad, PhD Candidate  
Joseph Smith, PhD Candidate

\* Graduated

## **Research Associates**

Connor Armstad  
Maggie Riordan

Jesse DeVoe  
James Nowak

Alan Harrington

## **Research Assistants**

Amy Bardo  
Nicole Biladeau  
Loni Blackman  
Haley Boyle  
Heather Brower  
Samantha Bundick  
Stephen Caird  
Andrea Centola  
Edward Conrad  
Dana Dale  
Genevieve Day  
Jacob Decker  
Emily Donahue  
Jacquelyn Evans  
Aubrey Gardner

Nicholas Gondek  
Summer Graham  
Julian Grudens  
Colton Harner  
Alan Harrington  
Jenny Harris  
Karl Heide  
Sarah Jordan  
Ryan Keiner  
Molly McDevitt  
Raina Milnes  
Ashley Minnich  
Philip Newberry  
Vivian Nguyen

Kristen Oliver  
Emily Pierce  
Amanda Reininger  
Alex Rischette  
Liam Rossier  
Katherine Ruffenach  
Kayla Ruth  
Tucker Seitz  
Ryan Steiner  
Christopher Stephens  
Sarah Straughan  
Keegan Tranquillo  
Viviana Vidal Astudillo  
Derek White

## **Student Workers**

Audrey Aamot  
Violet Arnold  
Laura Beniek  
Gabriella Berman  
Marko Capoferri  
Colton Crismore  
Cayla Daily  
Jeremy Deal  
Rosie Ferguson  
Shalynn Fernau

Ellie Gluhosky  
Kadie Heinle  
Jazzlyn Johnson  
Tyler Johnson  
Susan Keizer  
Keith Moore  
Nathan Parker  
Angie Pastuszek  
Christine Peterson  
Katalina Dakeshia

Kaitlyn Reintsma  
Branna Riding  
Rebecca Romero  
Skylar Sargent  
Sueanne Stewart  
Alexis Tate  
Arianna Tourtellot  
Shelby Weigand  
Holly Womack

## **DIRECTION STATEMENT**

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The Montana Cooperative Wildlife Research Unit performs research designed to address the needs of cooperators, bridging the gap between applied and basic wildlife science. Our studies provide new insights useful to management and conservation, based on understanding the ecological mechanisms that underlie habitat requirements and demography of individual and coexisting wildlife species. Research emphases within the Unit include ecology and management of carnivores, applied landscape ecology, management of large game, interactions between forest management and wildlife, environmental influences (predators, habitat, ungulates) on demography and diversity of birds, habitat requirements and community ecology of birds, and comparative demography and life history strategies of birds in differing environmental and geographical contexts. Other research topics are addressed as needed, in keeping with the Cooperative Research Program's mission to best meet the needs of the Cooperators by remaining flexible and open to new areas of inquiry. When Cooperator's needs occur outside Unit expertise, the assistance of appropriate University faculty will be recruited.

Unit staff will advance the training and education of graduate students at the University of Montana by teaching up to one graduate-level course per year in wildlife science, chairing graduate committees of Unit students, and serving on graduate committees of non-Unit students. Technical support and training will be provided to Cooperators and other agencies as the need exists.

## OPERATING BUDGET 2016

### Unit and Administrative Operating Funds

USGS – Cooperative Research Units – Administrative Funds	\$	0
University of Montana - Full-time Admin. Associate - Salary/Benefits		42,517
SPABA – FY14 IDC returned to Unit in FY17		<u>74,262</u>
<b>Subtotal</b>		<b>\$ 116,779</b>

### FY 2016 – Research Projects Funding

Montana Fish, Wildlife and Parks Operating Funds		<b>\$ 20,000</b>
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### T. Martin – PI

#### New Funding:

National Geographic Society	\$	19,920
NSF – Effects of El Nino Drought on Tropical Songbirds		198,410
NSF – Graduate Research Fellowship		44,000
NSF – Dissertation Improvement Grant		18,705
USGS – Climate and Habitat Change		53,000
UM Research Administration – Graduate Support		<u>46,000</u>
<b>Subtotal</b>		<b>\$ 380,035</b>

#### Continued Funding:

NSF – Graduate Research Fellowship		88,000
USGS – Climate and Habitat Change		465,433
Colciencias Fullbright Scholarship		16,000
NSF - A New Theory of Clutch Size Evolution		536,534
NSF – Historical Influence/Biodiversity in Tropical Asia		<u>1,326,660</u>
<b>Subtotal</b>		<b>\$2,432,627</b>

### M. Mitchell – PI or Co-PI

#### New Funding:

MTFWP – Montana Wolf Hunt - Residents Analysis	\$	7,100
MTFWP - Sage Grouse Research		101,184
MTFWP – Migratory Songbird Grazing		136,827
MTFWP – Statewide Mule Deer Study		34,619
MTFWP – Sapphire Elk Project – Technician		21,804
IDFG – Cougar Study		15,485
IDFG – Sandhill Cranes		65,000
IDFG – Mule Deer Population Dynamics and Modeling		220,719
USDI – Linking Exposure to Sub-Lethal Stressors		129,997
NSF Fellowship		<u>46,000</u>
<b>Subtotal</b>		<b>\$ 778,735</b>

#### Continued Funding:

MTFWP – Elk Distribution Sapphire Mountains	\$	29,304
MTFWP – Mountain Goat Historical Data Monitoring		10,000
MTFWP – Mountain Lion Support		16,000
MTFWP - Montana Wolf Monitoring		244,123
IDFG - Linking Resource Selection to Population - Mule Deer		88,826
IDFG - Evaluating Occupancy Estimation – Mule Deer		109,444
NSF Fellowship		134,000
WDFG - Moose Demography		<u>88,000</u>
<b>Subtotal</b>		<b>\$ 719,697</b>

**Total Budget \$4,447,873**



## Completed Projects - 1 January 2016 - 31 December 2016

End Date	Principal Investigator	Funding Agency	Title
October 2016	Mike Mitchell / Mark Hurley	Idaho Dept of Fish and Game	Linking resource selection to population dynamics of mule deer
November 2016	Mike Mitchell / Jeff Stetz	USFS/ USGS	Spatial and temporal scales of population performance in grizzly and black bears in the Northern Continental divide ecosystem

## MTCWRU – Federal and State Vehicles

<u>Description</u>	<u>Tag number</u>	<u>Odometer as of 3/31/2017</u>
1999 Ford Truck, Extended Cab Pickup 4 x 2	FED 252524	112,300
2006 Ford F250 Crew Cab Pickup, 4 x 4	FED 430965	101,410
2010 Ford Expedition 4 x 4	FED 433441	60,668
2011 Ford F250 Crew Cab Pickup, 4 x 4	FED 433440	37,425
2011 Ford F250 Crew Cab Pickup, 4 x 4	FED 433610	41,432
2012 Dodge 1500 Crew Cab 4 x 4	FED 433621	52,902
1997 Chevy Suburban, 3/4 ton, 2wd	UM 7787	152,479
1998 Ford Taurus 4 Door Sedan	UM 7623	154,892
2005 Ford Explorer 4 x 4	UM 3787	143,222

# BIRDS

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photo by William Blake



photo by Tom Martin

# ***Habitat preference and reproductive success of Lewis's Woodpeckers in western Montana***

**Student:** William Blake  
**Degree:** MSc Candidate  
**Advisor:** Thomas Martin  
**Project Duration:** 2015 – 2017  
**UM Affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit  
**Funding Source:**

- MPG Ranch



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## **Objectives**

Habitat selection is a major influence on populations. Determining how environmental factors influence habitat selection is central for management of wild populations, particularly for species of concern. Therefore, understanding which, and how, environmental factors interact to influence habitat selection, and how habitat selection may play a role in population dynamics is quintessential to conservation of species.

Lewis's Woodpecker is thought to be declining in most of its range and is a level II Species of Concern in Montana and considered of management concern at the national level. During the breeding season, populations are typically found in patches of riparian and burned forests. Based on prior research, 10-15 year old burns are thought to be particularly good for Lewis's Woodpecker reproductive success. One prior study reported low reproductive success in riparian habitat, possibly indicating an ecological trap. The generality of these patterns requires testing in other key areas of the species' range. Moreover, prior studies have failed to define a strong relationship between habitat preference and reproductive success. I therefore propose to examine how Lewis's Woodpecker habitat preference compares with its reproductive success, in burned and riparian forests, the two habitats it most commonly uses. I am investigating factors generally known to influence the reproductive success of cavity nesting species: nest site availability, food availability and habitat patchiness and proximity to edge. Understanding habitat influences on reproductive success is critical for habitat management of such species of management concern.

## **Progress and Status**

I conducted a pilot season in the summer of 2015 and monitored 63 nests. I expanded my comparative study to 8 field sites across the Bitterroot Valley for 2016 and 2017 and will bolster my comparisons in reproductive success between sites with abundance estimates, insect availability, parental feeding rates and habitat characteristics. I am analyzing my first set of results after the 2016 breeding season and will communicate my findings through three presentations including a presentation for the local chapter of the Audubon Society (December 2016), and presentations at two annual conferences: the Montana TWS conference (February 2017), and during the MPG Conference (March 2017).

# ***The fight for space: Exploring the role of competition and physiological tolerance in limiting elevational distributions and structuring communities in tropical birds***

**Student:** Andrew Boyce

**Degree:** PhD Candidate

**Advisor:** Thomas Martin

**UM Affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife  
Research Unit

**Project Duration:** 2011 - 2016

**Funding Sources:**

- National Science Foundation
- The University of Montana
- Montana Cooperative Wildlife Research Unit
- American Ornithologists Union



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## **Objectives**

I am conducting an observational and experimental study to investigate the importance of competition and physiology in limiting species distributions. Groups of closely related species with abutting, non-overlapping elevational ranges are key components of biodiversity and endemism in the tropics and have been documented across taxa (Cadena et al. 2011). However, the mechanisms underlying this pattern are poorly understood. I will perform playback to determine the degree to which pairs of species compete and possibly limit each other's ranges. I am also measuring physiological tolerance to temperature among closely related species that exist at different elevations to determine if adaptation to a particular range of temperatures could limit the elevations at which a given species could persist. Additionally, I will be examining phylogenetic community structure across elevationally stratified bird communities. Phylogenetic community structure, or the degree to which species in a community are related to one another, is thought to reflect the relative importance of interspecific competition and environmental filtering in a given community (Losos 1996, Webb 2000, Graham 2009). Understanding factors influencing coexistence is critical for conservation of biodiversity.

## **Progress and Status**

I am currently a PhD student in Tom Martin's lab at the University of Montana. I am interested in exploring how physiology and competition act to constrain species ranges, shape communities and shape species life-history strategies. My current study system is the avian community at Kinabalu Park in Sabah, Malaysia. Kinabalu provides an opportunity to work on an amazing avian assemblage across an extensive elevational gradient from 500m to 4,100m. This has introduced a strong elevational component to my research and I am excited to continue exploring interesting ecological and physiological questions in this system and others.

I finished my final field season in Borneo and I am writing my dissertation to defend in fall 2017.

# ***Understanding variation in habitat use among Orange-Crowned Warblers (*Oreothlypis Celata*) in Central Arizona, USA***

**Student:** Karolina Fierro  
**Degree:** PhD Candidate  
**Advisor:** Thomas Martin  
**UM affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit  
**Project duration:** 2012 – 2017



## **Funding sources:**

- Montana Cooperative Wildlife Research Unit and the University of Montana
- Scholarship “Francisco Jose de Caldas” COLCIENCIAS and FULBRIGHT Colombia
- PEO International Peace Scholarship

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## **Objectives**

Classic habitat selection theory predicts that individuals will choose habitats that confer higher fitness. Yet, we see cases where individuals use habitats associated with low reproductive success, even if highly suitable habitat is available. Using a 20-year dataset of Orange-crowned warblers (*Oreothlypis celata*) in Arizona, I will examine first what factors determine territory suitability. Furthermore, I propose two hypotheses that might explain variation in territory use. My hypotheses state that low-quality individuals may not always experience low reproductive success, as the Ideal Despotism Distribution affirms, but instead might increase their fitness, and therefore the territory suitability, via two strategies. These low-quality individuals may use territories with 1) higher variation in the survival probability of multiple nest sites, which will increase the cumulative survival probability of the territory, and 2) higher variation in the survival probability of eggs, nestlings and fledglings, which may increase territory suitability. Understanding habitat factors influencing reproductive success is critical for appropriate management prescriptions.

## **Progress and Status**

I started my pilot field season in the Coconino National Forest, central Arizona, on May 2012. During three months, I collected preliminary data about the distribution of territories, interspecific interactions, and foraging strategies of four ground-nesting bird species.

My research proposal was approved by my doctoral committee in December 2013. Since then, I have collected data on survival of eggs, nestlings, and fledglings in territories occupied by high- and low-quality individuals.

I have also carried out my building interruption experiment in order to determine the cumulative probability of survival for multiple nest sites within the territories occupied by high- and low-quality individuals.

In 2015, I started a new experiment to test whether an increase in the temperature experienced by the nestlings on the nest increases their growth rate and modifies parental behavior

I completed my fieldwork in summer 2016 and I am currently writing my dissertation for defense in May 2016.

# ***Climate change and elk browsing on bird demography and trophic interactions in a high elevation riparian ecosystem***

**Obligated Funds: \$1,001,967**

**Principal Investigator:** Thomas E. Martin

**Project Duration:** 1985-2017

**UM Affiliation:** Montana Cooperative Wildlife Research Unit

**Funding Sources:**

- U.S. Geological Survey – Research Work Order 102
- National Science Foundation



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## **Objectives**

Measure and examine: 1) annual variation in avian nest success and predation, adult survival, fledgling survival, population size, habitat selection, parental care behaviors, and physiological metrics, and 2) changing vegetation density and species composition in a high-elevation riparian ecosystem in north-central Arizona relative to climate variation and elk browsing.

## **Progress and Status**

Climate has had large consequences for 32 bird species by affecting trophic levels below (plants) and above (predators) them from study of their populations over the past 29 years. Winter snowfall has declined strongly across this time, as typical throughout western North America, and has increased over-winter densities of elk in the study area. This decline in snowfall and increase in overwinter elk led to the loss of deciduous aspen and other trees that represent preferred bird habitat, and causing a decline in bird abundance. In addition, summer precipitation has declined over the 29 years of study and drier summers have yielded greater predation on offspring. Three large (10 ha) exclosures were established in fall 2004 to test the effects of elk and winter snow on plant, bird and small mammal communities. Results showed a large effect on aspen recruitment and ground cover, and a slower but increasing effect on maple and locust recruitment; plant abundance and diversity increased after fence establishment. In addition, several bird species increased in abundance compared with adjacent controls. Some small mammal species (deer mice, wood rats) also increased and others (chipmunks) decreased on fenced areas compared with controls.

Current work includes studies of fledgling survival, a critical influence on demography that is poorly studied across species. I am measuring fledgling flight mobility to examine the consequences for parental energy expenditure per offspring, measured using doubly-labeled water, and fledgling mortality rates, using radio transmitters. Management depends on understanding which species and life stages are most sensitive to environmental perturbations for population maintenance.

I am also examining the potential consequences of rain for adult and offspring energy expenditure. Climate change studies have focused on temperature effects because they are easier to model. However, rainfall is also changing strongly, not only over the long-term, but also in the short-term over El Niño cycles. Lab studies have demonstrated that wetting increases thermal conductance and energy expenditure of adult and juvenile endotherms, and rain may constrain foraging (energy acquisition). Any such energy constraints may be particularly significant when parents are trying to meet the needs of growing offspring, such that rain may play a critical role in demography of endotherms during reproduction. I am using doubly-labeled water to examine energy expenditure of parents and offspring on rainy versus dry days and with respect to variation in habitat (overhead cover).

The results will have important implications for elk and ecosystem management in this vulnerable habitat type. This project also has a strong training component, training up to 20 students each year in a diversity of field techniques and conduct of hypothesis-testing science.

# ***Historical and contemporary influences on elevational distributions and biodiversity tested in tropical Asia***

**Obligated funding: \$1,325,620**

**Principal Investigator:** Thomas E. Martin  
**Project Duration:** 2013-2020  
**UM Affiliation:** Montana Cooperative Wildlife Research Unit  
**Funding Source:**

- National Science Foundation



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## **Objectives**

This project parallels work being conducted in the Arizona project with respect to environmental influences on demography (clutch size, nest predation, development rates, parental care, adult survival rates) of bird species in montane Malaysian Borneo (Kinabalu Park) to compare tropical versus U.S. birds studied at similar elevations. Tropical birds are often longer-lived and slower developing than north temperate birds in the U.S. and extend the range of variation in demographic strategies which provides critical new insight into environmental influences on demography. We are also measuring metabolic sensitivity of adults and offspring to temperature variation, possible role of competition in constraining elevational ranges, measuring dispersal through both capture/recapture and gene flow, and measuring genetic differentiation across elevations. Examine the relative importance of nest predation, food limitation, and adult mortality on variation in demography and life history strategies. Ultimately, this work provides critical information on environmental determinants of demography and how it varies among tropical compared with north temperate species.

## **Progress and Status**

We work in tropical Borneo because it retains large blocks of pristine forest at mid-elevation from 1450 to 1950 m elevation. In the past seven seasons, 4,895 nests were found and monitored, nestling metabolism and nestling growth measured, parental care videotaped, and egg temperatures quantified. In addition, a total of 13,630 capture/recapture/resight events were accrued to aid in estimating adult survival. Adult survival and nest predation interact to strongly influence reproductive strategies and demography not only in Borneo but also in North America. This integration of adult and offspring survival data across suites of species have never been available previously and has yielded critical new insight into environmental influences on demography. In addition, data collected on both adult and nestling metabolism shows that species vary strongly in their sensitivities to temperature, but we have not yet examined whether this can explain elevational distributions as more data are still needed. The importance of temperature suggests that global warming may be particularly important to long-term reproductive success of tropical birds. Work is focusing on a novel issue, the potential demographic costs of rainfall, an issue of concern for management in both temperate and tropical regions. Moreover, using diverse field techniques, we can show that adult survival estimates for tropical birds have been flawed and under-estimated due to a reliance on standard effort netting alone

This work continues to include an important training component for young US and Malaysian scientists. The perception that reproduction cannot be studied in the field is corrected by training young scientists in the conduct of this field work. In addition, the most motivated are invited to the lab in Montana where they are taught to write their first publications on the life history of some species that is previously undescribed.



## ***Are long lives of south temperate songbirds explained by reduced energy expenditure of parents compared with north temperate species?***

**Obligated funding: \$19,920**

**Principal Investigator:** Thomas E. Martin  
**Project Duration:** 2016  
**UM Affiliation:** Montana Cooperative Wildlife Research Unit  
**Funding Sources:**

- National Geographic Society
- University of Montana



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### **Objectives**

This one-season project paralleled work being conducted in the Arizona and Borneo projects on the environmental determinants of adult survival and longevity. Studies conducted 15 years ago provided background information on adult survival probability, and current existence of birds banded 15 years ago provide an indicator of much greater longevity than north temperate species. Adult survival and longevity are often the most important influence on demography in songbirds, such that understanding determinants of variation in adult survival can provide critical insight into sensitivity of species to environmental perturbations, and therefore critical for species management. As in Arizona and Borneo, we used doubly-labeled water to measure energy expenditure of parents across species of this bird community to compare with measures of their adult survival and longevity. This project will support work of two graduate students to also include work on metabolic variation in adults relative to adult survival, and the effects of rain on energy expenditure of offspring to extend the work being conducted in the Arizona project. Work was completed 2016.

## ***Effects of rainfall on nestling bird energetics***

**Student:** Adam E. Mitchell  
**Degree:** PhD Candidate  
**Advisor:** Thomas Martin  
**Project Duration:** 2014 – 2019  
**UM Affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit  
**Funding Sources:**

- Montana Cooperative Wildlife Research Unit
- National Science Foundation (NSF)



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### **Objectives**

Organisms living at higher elevations typically have slower life histories, but the causes of this shift are not fully understood. Ambient climatic conditions (e.g. temperature, rainfall, humidity, etc.) can be very different between elevations (often harsher at higher elevations), and can also have significant effects on the growth, development, and survival of organisms. This is particularly true in birds, but few studies directly test the effects of harsh, high elevation climate on avian life histories. I am testing a hypothesis that the harsh weather at high elevations constrain avian life histories.

Rainfall can be a harsh weather condition, even in tropical mid-elevation rainforests, where birds may be particularly adapted to heavy rain. This selection pressure may explain the increased prevalence of enclosed nests in these habitats, despite literature favoring protection from predation as the primary driver of enclosed nests. My research explores the effects of rainfall on the energetics of nestling birds in the tropical mountain forests of Borneo. The effects of rainfall variation on nestling energetics are almost entirely unknown, despite predictions of shifting rainfall patterns due to climate change. This limits our understanding of nest success, which can affect demographic rates, as well as ecosystem stability. Furthermore, many tropical montane birds are vulnerable due to habitat loss, and these effects are likely to be exacerbated as mountains warm, allowing lower-elevation species to displace those in the highlands. Wildlife watching provides strong economies with high conservation value in many developing tropical communities, but this is threatened as species decline and ecosystems degrade. Through my research, I hope to improve our understanding of the basic processes that influence wildlife, helping us predict changes and protect our fragile resources.

### **Progress and status**

I recently defended my PhD research proposal and am currently collecting field data in Malaysian Borneo. My research addresses theoretical gaps in avian reproductive strategies, life history evolution, physiological effects of harsh weather events, and the evolution of different nest types.

I am working at a montane field site at two different elevations on Mt. Kinabalu, on the tropical island of Borneo (appx. 1500 meters and 3200 meters). I am using a manipulation experiment to test the effects of harsh weather on avian development at high elevations. I am doing this by ameliorating the harsh climate by adding supplemental heat and placing rain covers over bird nests. If harsh weather at high elevations does constrain avian life histories, I expect to see heated/covered nestlings grow faster with reduced energetic costs. I also expect to see the benefit of ameliorated nests realized by the parents by reduced brooding rates (i.e. nestling warming) and increased feeding rates.

I will measure the energetics of nestlings at the lower elevation site to correlate with ambient weather conditions, as well as add experimental rain (using a make-shift portable shower) on nests during dry periods to directly test the energetic and behavioral effects of rainfall on nestling and adult birds. This experiment will allow me to infer the costs of increased rainfall on avian energetics and life histories.

## ***Plastic reproductive strategies in response to nest predation risk***

**Student:** James C. Mouton  
**Degree:** PhD Candidate  
**Advisor:** Thomas Martin  
**Project Duration:** 2013 – 2017  
**UM Affiliation:** Division of Biological Sciences  
Montana Cooperative Wildlife Research Unit

**Funding Sources:**

- National Science Foundation
- MT Institute on Ecosystems
- Drollinger-Dial Foundation
- Montana Cooperative Wildlife Research Unit
- The University of Montana



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### **Objectives**

Life history theory predicts that organisms will allocate limited time and energy between current and future reproduction to maximize lifetime fitness. Age specific mortality can affect this allocation such that increased risk of offspring predation is expected to reduce reproductive value of current broods and decrease reproductive effort. Studies examining mortality patterns and evolved levels of reproductive effort across taxa support theory. Organisms may also plastically adjust overall reproductive effort and the expression of different life history traits (e.g. clutch size, food provisioning behaviors, growth and developmental rates) in response to variation in offspring mortality risk. Such plasticity can have important consequences for the rate of evolution and the persistence of populations in ecological time. However, we know little about plastic responses of life histories to changes in current brood reproductive value caused by offspring predation risk.

My research will examine how reduced brood value caused by nest predation risk affects reproductive effort expended by parents and growth and development in offspring in four songbird species. I will test the effect of nest predation risk on parental effort by manipulating the perceived level of risk and measuring parental energy expenditure. I will examine how nest predation risk affects offspring growth and development through the amount of food received by each nestling or prioritized development of traits required for nestlings to leave the nest and escape nest predation risk (i.e. endothermy and locomotor traits). Additionally, I will be examining how predation risk influences offspring begging and how parents respond to it by using playback experiments at nests across species. Understanding the plastic responses of organisms to important sources of selection, such as offspring predation, is vital for a full understanding of life history evolution and can help explain ecological differences between populations.

### **Progress and Status**

I have manipulated the perceived level of predation risk at bird nests by playing recorded vocalizations from nest predators (i.e. Red Squirrels) and a songbird species that does not pose any threat to the study species. I have measured the daily energy expenditure of parents using doubly labeled water to examine the effect of nest predation risk on parental effort. I will also examine parental food provisioning strategies, nestling growth, and the development of heterothermy. I began fieldwork in summer 2014 will continue work at least through the summer of 2017. Most fieldwork will take place in the in high-elevation forested snowmelt drainages in the Coconino National Forest, AZ, USA. Last year I expanded my project to include species from another field site in Kinabalu Park, Sabah, Malaysia. I have defended my proposal for this work and advanced to candidacy in Fall 2016.

# *The influence of nest predation on parental and offspring strategies*

**Student:** Juan C. Oteyza  
**Degree:** PhD Candidate  
**Advisor:** Thomas Martin  
**Project Duration:** 2011 – 2016  
**UM Affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit  
**Funding Sources:**

- National Science Foundation
- Montana Cooperative Wildlife Research Unit
- The University of Montana



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## **Dissertation Abstract**

Age-specific mortality is a dominant driver in the evolution of life history strategies and reproductive effort. Species with low adult mortality probability, such as those commonly found in the tropics, are expected to prioritize themselves over their offspring that is manifested in their relatively low parental effort. Indeed, if we take tropical bird as an example, we can observe that parents do not devote effort to their young to the best of their ability. I found that one species decreased effort in food provisioning when the brood decreased in size, and I showed experimentally that provisioning was not limited by adult quality or food availability. Instead, this species with low mortality, may be reducing effort to enhance chances of future reproduction. Thus, mortality selection during the adult stage can influence parental effort. But selection on adult mortality can also interact with offspring mortality risk to affect reproductive success.

When offspring predation risk increases, parents may reduce parental effort in order to decrease the probability of actual predation. Yet, these reduction in parental effort can have negative consequences for reproductive success. Theory suggests that the degree of these reductions and their associated demographic costs will be greater for species with low adult mortality, such as those in the tropics. I performed an experiment increasing perceived offspring predation risk and found evidence for an alternative. When perceived offspring predation risk increased, some tropical species maintained parental effort and incurred less of a demographic cost than temperate species. Parental effort of tropical species may already be at a minimum and further reductions may not be favored by selection.

When changes in predation risk are directed towards adults instead of offspring, species with low adult mortality (i.e. long lives) are expected favor their own survival over that of their offspring. I tested this idea experimentally across diverse species and latitudes using direct measures of adult mortality probability. I found that species with lower adult mortality were more risk averse, favoring self-preservation more than temperate species. The influence of adult mortality was observed both within and across latitudes. This experimental result confirms and observational pattern, where adult mortality is positively correlated with parental effort across latitudes.

Lastly, mortality selection can also influence the evolution of offspring strategies. Young of many species produce loud calls to solicit food from their parents, but these calls can be costly as they can inadvertently attract predators. I found that young from nests of species under high nest predation produced calls that have characteristics that makes them harder to locate by predators. Together, the work presented here furthers our understanding of the influence of mortality during different life stages on parental care behaviors and offspring strategies, at both proximate and ultimate levels.

# ***Test of the causes of evolved differences and plasticity in growth and development rates of passerines offspring across three continents***

**Student:** Riccardo Ton  
**Degree:** PhD Candidate  
**Advisor:** Thomas Martin  
**Project Duration:** 2011 – 2016  
**UM Affiliation:** Division of Biological Sciences –OBE  
Montana Cooperative Wildlife  
Research Unit  
**Funding Sources:**

- National Science Foundation
- The University of Montana



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## **Dissertation Abstract**

Rates of embryonic and post-natal growth vary extensively among species and geographic space. This variation is well represented in songbird offspring from different latitudes and can strongly influence organismal quality and fitness. However, environmental and evolutionary causes and consequences of variation in embryonic and post-natal growth remain unclear. Here we experimentally show that, within the constraints imposed by physiological trade-offs, warmer incubation temperatures shortened embryonic period length among nine species of songbirds from two latitudes. Yet, the magnitude of the response varied and species-specific reaction norms of embryonic reduction in response to our treatment positively correlated with the natural temperature experienced during incubation. Furthermore, we found little evidence for potential metabolic costs imposed on offspring by faster development, but we detected benefits for size at hatching instead. These results question the generality of theories considering avian development to be strictly dictated by intrinsic trade-offs and suggest that shorter embryonic periods caused by warmer temperature may not be as detrimental as traditionally thought. Costs of shorter development due to warmer embryonic temperature may appear later in life as stunted post-natal growth via influences on offspring metabolism and parental feeding and brooding effort. Our treatment increased metabolic rate without producing appreciable changes in parental care yielding slower post-natal growth rates in two species, faster growth in one and no effects for the majority of the species studied. These results suggest that shorter embryonic periods are not generally associated to costs paid during the post-natal stages but also question the role of metabolism for growth. We tested for the association between metabolism and growth using a comparative approach. We discovered that metabolic rate and body mass of nestlings predicted variation in post-natal growth rates among 59 species of songbirds at three latitudes. These results beg the question of what are the possible evolutionary bases of metabolic variation. We found that nest depredation may be a selective force favoring increased metabolic rate to achieve faster growth independently from the constraints of adult mortality. This study advances our understanding of ecological and physiological causes and consequences underlying variation in embryonic time and post-natal growth.

**MAMMALS**

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photo by Sarah Sells



photo by Sarah Bassing

## ***Causes and consequences of partial migration in elk***

Student: **Kristin Barker**  
Degree: MSc Candidate  
Advisors: Mike Mitchell  
Project Duration: 2015-2017  
UM Affiliation: Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit  
Funding Source: Montana Fish, Wildlife & Parks

Obligated Funding: \$67,390



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### **Objectives**

I am broadly interested in using science and technology to help inform wildlife management. Prior to moving to the University of Montana, I studied movements and habitat selection of red fox at Western State Colorado University, where I received my bachelor's degree in biology. I also hold a BA in English from the University of Georgia. Since receiving my biology undergraduate degree in 2012, I have worked in the field on studies of carnivores, mesopredators, ungulates, birds, amphibians, insects, trees, and understory plants for federal agencies, state agencies, university researchers, and private consulting companies. My varied work experience has strongly impressed upon me the importance of rigorous scientific research (in addition to social and economic considerations) in helping wildlife managers identify and achieve management goals. My current work, in collaboration with Montana Fish, Wildlife, and Parks, focuses on an elk population that provides important recreational and hunting opportunities to residents and visitors of the Bitterroot Valley south of Missoula.

### **Progress and Status**

Generally, my project seeks to understand causes and consequences of partial migration in elk. The first chapter of my thesis examined the nutritional consequences of differing migratory behaviors in an elk population in the North Sapphire Mountains. I found that migratory elk have access to lower forage quality than their non-migratory counterparts during summer. The amount of nutrition migrants have access to may result in delayed reproduction, but migrants may be able to compensate for areas of apparently lower nutritional quality. My second chapter seeks to test several hypotheses of how partial migration is maintained in elk populations. This project will provide stakeholders and managers with information about current elk behaviors and distributions, the factors influencing elk behaviors, and the effects of individual behaviors on population health.

# ***Effects of Harvest on Wolf Populations: Impacts for Monitoring and Managing Abundance***

**Student:** Sarah B. Bassing  
**Degree:** MSc Candidate  
**Advisors:** Mike Mitchell  
**Project Duration:** 2014-2017  
**UM Affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit



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## **Objectives**

I began working for the MTCWRU in 2010 as a field technician and led crews while surveying for wolves in southwestern Alberta for 3 years. Based on survey and harvest data, wolf mortality appears to be particularly high in this region. Managers and local communities alike are keenly interested in the wolf population but high turnover in the population makes long-term monitoring difficult and there is currently no wolf monitoring program in place. My objective was to apply patch occupancy models as a monitoring framework for wolves in this region to better understand the effects of harvest on population dynamics of wolves, including the distribution and turnover of packs.

In addition, there is growing interest in how recent changes in wolf management, i.e., from federally protected under the Endangered Species Act to delisted with annual hunting and trapping seasons, affect wolves in the U.S. Northern Rocky Mountains. Recent research from the MTCWRU (Ausband et al. 2015) demonstrated that recruitment of wolf pups in central Idaho has declined since the initiation of harvest. My objectives were to test whether dispersal (immigration) into harvested regions compensates for harvest mortality and aids in population persistence when pup recruitment is reduced.

## **Progress and Status**

My research focuses on studying the effects of harvest on wolf pack distribution and dispersal across landscapes dominated by human-land use in the Rocky Mountains. I used patch occupancy models, populated with wolf pack detection data from 3 years of field surveys, to estimate pack distribution and turnover in southwestern Alberta in collaboration with Alberta Environment and Parks. I incorporated habitat, human land use, and harvest data to assess the relationship between pack occupancy, distribution, turnover, and harvest in this population. I also used genetic cluster analyses and estimated relatedness among wolves sampled with noninvasive genetic methods to quantify the proportion of immigrants associated with packs in response to harvest in southwest Alberta and central Idaho in collaboration with both Alberta Environment and Parks and Idaho Department of Fish & Game. I recently completed my occupancy models and genetic analyses and am writing my thesis. I will defend in May.



# ***Evaluating spatiotemporal patterns of parturition and juvenile recruitment in Sierra Nevada Bighorn Sheep***

**Student:** Shannon Forshee  
**Degree:** MSc Candidate  
**Advisors:** Mike Mitchell  
**Project Duration:** 2015- 2018  
**UM Affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit  
**Funding Sources:** National Science Foundation Graduate Fellowship  
California Dept. of Fish and Wildlife



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## **Objectives**

My interests range broadly from genetics to applied conservation management of endangered species. I have been fortunate to work on wide variety of projects and with species across the world; ranging from stingrays to large African carnivores and now alpine ungulates. In 2014, I began working for the California Dept. of Fish and Wildlife (CDFW) on the Sierra Nevada Bighorn Sheep Recovery Program. CDFW has made great progress towards the recovery of Sierra Nevada bighorn, yet variable trends in juvenile recruitment could jeopardize conservation efforts. Evaluating the causes and consequences of juvenile, specifically neonatal, mortality is important for maintaining positive population growth. In addition to understanding mortality factors, we are also interested in learning how maternal behavior decisions influence mortality risk. Neonatal lambs are dependent on their mothers for several months, as such, her selection of habitat during this critical period can potentially explain the level and type of mortality risk that neonates face. Understanding juvenile recruitment and maternal habitat selection are essential management tools for CDFW's SNBS Recovery Project.

## **Progress and Status**

To track juvenile recruitment and maternal habitat selection, we are using high-fix rate GPS collars and vaginal implant transmitters (VITs) to track the movement of maternal ewes and determine when lambs are born. When we detect a birth, we collar the neonate to track survival and measure other intrinsic factors influencing mortality (birth weight, sex). Preliminary and anecdotal information suggests that predation and low genetic diversity may be driving juvenile mortality rates. We are in our second season of the project and will continue to collect data through spring of 2018. To increase my sample size, I have developed a method for detecting birth using GPS movements from females without VITs. With this information, I will develop a resource selection function for lambing season that can be incorporated into CDFW's translocation protocols and location selection criteria. I will also be evaluating the factors that most strongly influence a neonates risk of mortality.

# ***Effects of summer foraging strategy on reproduction and survival of moose in northeast Washington***

**Obligated Funds: \$72,000**

**Student:** James Goerz  
**Degree:** MSc Candidate (transitioning to PhD)  
**Advisor:** Mike Mitchell  
**Project Duration:** 2014 - 2020  
**UM Affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit



## **Funding Sources:**

- Washington Department of Fish and Wildlife
- UM College of Forestry and Conservation
- National Science Foundation Graduate Research Fellowship

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## **Objectives**

We are currently monitoring 48 GPS/VHF radio-collared adult female moose within two study areas of Northeast Washington to estimate pregnancy, calf production, and adult/calf survival. To explain variation in these vital rates, we are studying the spatial and temporal foraging patterns employed by moose to meet the competing needs of energy acquisition and predator avoidance during critical but thermally-stressful summer months. Data obtained over four years of continuous fieldwork may reveal behavioral plasticity in moose that increases their probability of persistence despite rapidly increasing temperatures and expanding large carnivore populations.

## **Progress and Status**

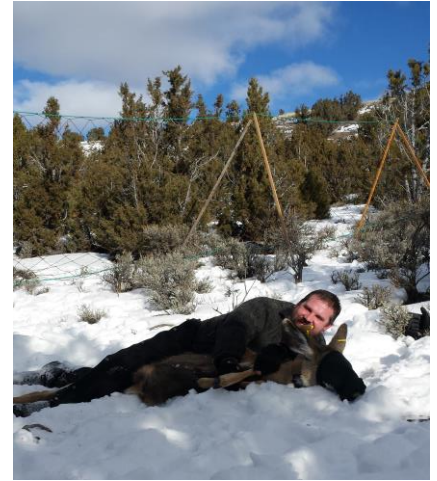
In North America, moose (*Alces alces*) populations are experiencing widespread declines due in large part to the cascading effects of warming climate. These large, cold-weather adapted herbivores may have difficulty meeting the energetic demands of survival and reproduction amidst increasingly high seasonal temperatures. Late spring through early fall is a critical energy acquisition period for adult female moose when they must give birth, lactate, protect offspring, restore fat reserves, and breed again before the approaching winter. This physiological stress is compounded by the expanding presence of large carnivores across much of the Northwestern U.S. Paradoxically, moose in Northeast Washington are reportedly stable to increasing, raising interest in the possible behavioral mechanism responsible for their success.

## ***Optimizing the use of wildlife monitoring resources***

**Obligated Funds: \$51,400**

**Student:** Charles R. Henderson, Jr.  
**Degree:** PhD Candidate  
**Advisor:** Mike Mitchell/Paul Lukacs  
**Project Duration:** 2014 – 2018  
**UM Affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit  
**Funding Source:**

- Idaho Department of Fish and Game



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### **Objectives**

The main goal of this project is to provide the Idaho Department of Fish and Game (IDFG) with information and tools to more efficiently monitor wildlife populations. The study system being used to quantify monitoring effectiveness and develop tools to optimize the use of monitoring resources is IDFG's statewide monitoring program for mule deer. This project is split into 5 lines of research. The first line of research is a cost-effectiveness analysis of the current methods used by IDFG to monitor mule deer abundance. The next research line is the development of a method for weighting different types of data included in the current IDFG population model. The development of a weighting method will facilitate the appropriate use of different data types and suggest how to prioritize the collection of data. The third line of investigation will focus on improving survival estimates from data gathered using radio collars. Specifically, this research will address differences in data generation between GPS and VHF radio tracking devices and the impact of these differences on missing data points. The fourth line of research will focus on the efficiency of monitoring conditional mule deer habitat to inform the frequency of winter aerial surveys. Monitoring conditional habitats via less expensive and less risky methods, i.e. camera traps or driving transects, has the potential to reduce the frequency of winter aerial surveys thereby reducing cost and the risk to personnel. The overarching goal of this project will be to develop a tool for managers that simultaneously optimizes over cost and abundance estimate precision using information generated by the previous lines of research. The expected result of the optimization process is to produce a set of potential monitoring strategies that are tailored to specific budgets and management requirements. This optimization process is also expected to be flexible enough for application to other game and non-game species management scenarios.

### **Progress and Status**

Data for this analysis is being provided by IDFG and is the product of their mule deer monitoring from the past 20 years. To date the cost effectiveness analysis of different monitoring methods and the development of a data weighting scheme are nearing completion. Research on optimization will be beginning in mid-May 2017. I will be presenting the results of the data weighting research at the 2017 Western States and Provinces Deer and Elk Workshop in May.

# ***Adaptive harvest management and estimation of recruitment for wolves in Montana***

**Student:** Allison Keever  
**Degree:** PhD Candidate  
**Advisor:** Mike Mitchell  
**Project Duration:** 2015 – 2020  
**UM Affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit  
**Funding Sources:**

- Montana Fish, Wildlife, and Parks



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## **Objectives**

Produce approach to estimate recruitment that is more tractable, cost effective, and biologically credible than the breeding pair metric. This will increase understanding of mechanisms driving recruitment, identify the best analytical approach to estimating recruitment, and thus further refine monitoring of factors relevant to recruitment.

Develop framework for adaptive harvest management to help guide harvest decisions while learning about the effects of harvest on wolves via management and monitoring. This will not only be a useful tool for managers to guide harvest decisions for wolves, but also provide a means to learn about basic biological processes and improve decision making over time.

Conduct sensitivity analyses and propose an efficient monitoring regime. I will use sensitivity analyses to understand the characteristics influencing estimates produced by our models. I will then identify factors that require monitoring to produce robust population estimates and reduce uncertainty associated with making harvest decisions.

## **Progress and Status**

The wolf (*Canis lupus*) population in the United States northern Rocky Mountains (NRM) increased rapidly due to natural recolonization in the 1980s and reintroductions in 1995. Wolves were delisted from the endangered species list in 2011, and responsibility for management fell to individual states (Idaho and Montana). Harvest is an important tool for managing wolf populations. Harvest regulations are set to reach a desired population size or objective. To be successful in this endeavor requires that the current population size is known and the effects of harvest on the population can be accurately predicted. Both of these requirements, however, can be difficult to achieve. To predict the effects of harvest on the wolf population we need to understand key factors influencing population dynamics, or changes in the population over time. One of the most important aspects to population dynamics is recruitment, or the number of young that survive to a point at which they contribute to the population. Currently, recruitment is gauged by a proxy, the breeding pair metric (a male and female wolf with at least 2 surviving pups by December 31), via direct counts. The breeding pair metric, however, is an ineffective measure of recruitment, as it gives little insight into population growth rate or the level of harvest that could be sustained. Harvest decisions for wolves are further hindered by poor understanding of the effects of harvest on the wolf population. Given uncertainty in wolf population dynamics and the effects of harvest on those dynamics, it is difficult to make informed harvest decisions. An adaptive harvest management (AHM) model for wolves could help guide harvest decisions in an adaptive framework, which would allow the formal assessment of harvest regimes in meeting objectives and determination of underlying biological processes.

# ***Carnivore territoriality and sociality: Optimal behavior for gray wolves in the Northern Rocky Mountains***

**Student:** Sarah Sells  
**Degree:** PhD Candidate  
**Advisor:** Mike Mitchell  
**Project Duration:** 2015 – 2020  
**UM Affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit  
**Funding Sources:**

- Montana Fish, Wildlife, and Parks
- Montana Cooperative Wildlife Research Unit



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## **Objectives**

Abundance estimates are a key component of monitoring gray wolves (*Canis lupus*) in Montana and Idaho. In Montana, abundance is estimated using 3 parameters. Area occupied is estimated with a Patch Occupancy Model (POM) based on hunter observations and field surveys. Average territory size is assumed to be 600 km<sup>2</sup> with minimal overlap, and annual average pack size is estimated from field surveys. Total abundance is then calculated as area occupied ÷  $\bar{x}$  territory size ×  $\bar{x}$  pack size.

Although estimates of area occupied from POM are reliable, development of accurate methods to estimate territory size, territory overlap, and pack size is critical for accurate estimates of abundance. Assumptions of fixed territory size and minimal overlap are simplistic; in reality, territories vary spatiotemporally, and this variability is likely even greater under harvest. Meanwhile, estimating pack size requires packs to be located and accurately counted each year, which is increasingly difficult due to the number of packs and declining funding for monitoring. Furthermore, our understanding of territories and pack sizes are based on abundant data collected prior to delisting and implementation of harvest in 2009. Data collected post-delisting and concurrent with harvest are comparatively sparse; meanwhile, those data that do exist show behaviors of wolves have changed. Abundance estimates may therefore become increasingly inaccurate.

My objectives are to develop territory and group size models based on hypothesized behavioral mechanisms of wolves. The models will yield biologically based, spatially explicit predictions for territory size, location, and overlap and group size at any spatiotemporal scale, in absence of abundant empirical data. Alongside POM, the models will help accurately estimate abundance of wolves in the northern US Rocky Mountains. Results of this work will negate need for intensive monitoring efforts and aid in decision-making for wolf management.

## **Progress & Status**

Much of year 2 was devoted to defending my proposal, studying for and passing my comprehensive exams, doing fieldwork, communicating with wolf specialists, and managing collar orders and data. As of February 2017, MFWP field staff has successfully captured and collared 55 wolves in approximately 42 packs. These collars have yielded >20,000 locations of wolves. Additional capture efforts will continue through 2017. I will compare model predictions with these empirical data to identify territory and group size models with most support.

# ***Spatial and temporal scales of population performance in grizzly and black bears in the Northern Continental Divide Ecosystem, Montana***

**Obligated Funds: \$56,230**

**Student:** Jeff Stetz  
**Degree:** PhD Candidate  
**Advisor:** Mike Mitchell  
**Project Duration:** 2009-2016  
**UM Affiliation:** Wildlife Biology Program  
Montana Cooperative Wildlife Research Unit

**Funding Sources:**

- U.S. Forest Service
- U.S. Geological Survey



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## **Dissertation Abstract**

Understanding how environmental factors interact to determine the abundance and distribution of animals is a primary goal of ecology and fundamental to the conservation of wildlife populations. Studies to determine these relationships, however, often assume static environmental conditions, and rarely consider effects of competition with ecologically similar species. In many parts of their shared ranges in western North America, grizzly bears (*Ursus arctos*) and American black bears (*U. americanus*) have nearly complete dietary overlap, relying heavily on seasonally abundant fruits and forbs. Further, they share similar life history traits, including a period of hyperphagia preceding potentially lengthy hibernation. We therefore tested the hypothesis that density patterns of both bear species would reflect seasonal variation in available resources, predicting that areas of higher primary productivity support higher densities of both species. We also hypothesized that effects of interspecific competition would influence their respective density patterns. Specifically, we predicted that grizzly bear density would be locally reduced due to the ability of black bears to more efficiently exploit patchy resources typical of areas lacking concentrated resources like spawning salmon. To test our hypotheses, we used detection events of 248 grizzly and 468 black bears from two independent noninvasive genetic sampling methods in spatially-explicit capture-recapture (SECR) models. Advances in SECR methods allow modeling variation in density as a function of factors that vary in space and time, as well as variation in sampling effort and detection methods. Our results suggest that both male and female grizzly bear density is reduced in areas of high black bear density during spring and summer seasons, although intraspecific densities were also important, particularly during the breeding season. Black bears had lower densities in areas of high grizzly bear density in spring; however, density of black bears in early and late summer was best explained by primary productivity for both sexes. Our results support the hypothesis that smaller-bodied, more abundant black bears may suppress the density of socially dominant grizzly bears through exploitation competition. We also recommend that seasonal variation in resource availability should be considered in efforts to relate environmental conditions to animal density.

## AWARDS AND RECOGNITIONS

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### **Barker, Kristin**

- University of Montana Research and Creative Scholarship Fund travel grant
- Spatial Ecology & Telemetry Working Group of the Wildlife Society graduate student travel award
- Programs of National Distinction Fund travel grant, University of Montana

### **Bassing, Sarah**

- Wildlife Biology Program PoND Fund Conference Travel Grant, University of Montana
- University of Montana Research and Creative Scholarship Fund travel grant

### **Boyce, Andrew**

- Cooper Ornithological Society Board of Directors Award for Best Student Presentation, North American Ornithological Congress, 2016, Washington D.C.

### **Fierro-Calderon, Karolina**

- 2016. "Latin American Caribbean Travel Award" to participate in the 6<sup>th</sup> North American Ornithological Conference. Administered by the American Ornithologists' Union.
- 2016. "PoND Travel Funding" to participate in the 6<sup>th</sup> North American Ornithological Conference. Granted by the Wildlife Biology Program, University of Montana

### **Forshee, Shannon** – NSF Graduate Research Fellowship

### **Goerz, James** – NSF Graduate Research Fellowship

### **Mitchell, Adam**

- American Ornithologist Union (AOU) travel grant (\$265) for travel to Washington, DC for 2016 NAOC conference
- Wildlife Biology Program PoND travel award (\$400) for travel to Washington, DC for 2016 NAOC conference

### **Mouton, James**

- Drollinger-Dial Foundation Travel Grant 2017 (\$990), Ecological Society of America Conference (taking place Aug 2017)
- NSF Doctoral Dissertation Improvement Grant (\$13,000), For radio transmitters needed to measure survival rates of fledglings exposed to increase nest predation risk
- MT Institute on Ecosystems Graduate Enhancement Award (\$5,000), To employ a field technician and purchase supplies needed for measuring the concentration of yolk hormones
- UMT Research and Creative Scholarship (\$450), For airfare to visit the University of Arizona to conduct laboratory work analyzing yolk hormones
- Drollinger-Dial Foundation Travel Grant 2016 (\$1200), For airfare to Malaysia to conduct fieldwork.
- Drollinger-Dial Foundation Travel Grant 2015 (\$1000), Society for Integrative and Comparative Biology Meeting 2016 in Portland,OR (taking place Jan. 2016)
- Drollinger-Dial Foundation Travel Grant 2014 (\$849), For travel to conduct laboratory work at the Duckworth lab (University of Arizona) and the Wolf lab (University of New Mexico)
- American Ornithologist Union Research Grant (\$1000) For laboratory supplies needed to analyze the concentration of yolk hormones in the Duckworth lab (University of Arizona)
- NSF Graduate Research Fellowship

**Oteyza, Juan**

- American Ornithologists Union, Student travel award (\$701), to attend N. American Ornithol. Conference (NAOC), Washington D.C. 2016.
- Cooper Ornithological Society, Student travel award (\$256 - honorary) to attend N. American Ornithol. Conference (NAOC), Washington D.C. 2016.
- Wildlife Biology Program, University of Montana, travel support (\$400) to attend N. American Ornithol. Conference (NAOC), Washington D.C. 2016.

**Sells, Sarah**

- Research and Creative Scholarship Fund Travel Grant, University of Montana, March 2017
- Wildlife Diseases Working Group Travel Grant, The Wildlife Society, October 2016
- PoND Fund Conference Travel Grant, University of Montana, October 2016
- Research and Creative Scholarship Fund Travel Grant, University of Montana, October 2016
- George and Mildred Cirica Graduate Student Support Fund, University of Montana, April 2016
- Bertha Morton Fellowship, University of Montana, April 2016



## PRESENTATIONS AND POSTERS

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**Barker, Kristin.** February 2017. Nutritional consequences of migratory behavior by elk in the North Sapphire Range. MPG Ranch Annual Conference, Missoula, MT

**Barker, Kristin.** March 2017. Nutritional consequences of varying elk migratory behaviors. Montana Chapter of The Wildlife Society Annual Meeting, Helena, MT

**Barker, Kristin.** February 2017. Comparing methods of assessing migratory behavior. The Wildlife Society Annual Conference, Raleigh, NC

**A.J. Boyce, B.O. Wolf and T.E. Martin.** Live fast and die young? – Does resting metabolic rate explain variation in adult mortality probability within and across latitudes? Oral presentation to the North American Ornithological Conference. August 2016. Washington D.C.

**A.J. Boyce, B.O. Wolf and T.E. Martin.** Resting metabolic rate explains variation in adult mortality probability within but not across latitudes in Passerine birds. Oral presentation to the Society for Integrative and Comparative Biology annual meeting. January 2016. Portland, OR.

**Bassing, Sarah, D.E. Ausband, M.S. Mitchell, M.K. Schwartz, L.P. Waits.** March 2017. Immigration as a compensatory mechanism to offset harvest mortality in wolf populations. The Wildlife Society Montana State Chapter Conference, Helena, MT.

**Bassing, Sarah, D.E. Ausband, M.S. Mitchell, M.K. Schwartz, L.P. Waits.** March 2017. Immigration as a compensatory mechanism to offset harvest mortality in wolf populations. The Wildlife Society Idaho State Chapter Conference, Boise, ID.

**Bassing, Sarah, D.E. Ausband, M.S. Mitchell, M.K. Schwartz, L.P. Waits.** October 2016. Immigration as a compensatory mechanism to offset harvest mortality in wolf populations. The Wildlife Society Annual Conference, Raleigh, NC.

**Bassing, Sarah.** September 2016. Wolves on the move. Waterton Wildlife Weekend invited speaker, Waterton Lakes National Park, AB Canada.

**Bassing, Sarah.** July 2016. Gray wolves in southwestern Alberta. Summer Interpretive Program invited speaker, Beauvais Lake, AB Canada.

**Blake, William.** March 2016. Habitat selection and reproductive success of Lewis's Woodpeckers, MPG Annual Conference, Missoula, MT

**Blake, William.** December 2016. Montana Audubon Annual Festival, Missoula, MT – Bird guiding at McClay Flats

**Blake, William.** MPG 2016 Annual Conference, Missoula, MT – Presentation: “Lewis's Woodpecker reproductive success and life history traits in burned and riparian forests in the Bitterroot Valley

**Fierro-Calderon, Karolina.** “Does the cumulative probability of nest survival explain territory use in a ground nesting songbird?” 6<sup>th</sup> North American Ornithological Conference. Washington DC. August 2016.

**Martin, T.E.** 2016. Causes and considerations of variation in growth strategies among temperate and tropical songbirds. Keynote presentation, Nestling growth symposium, North American Ornithological Conference, Washington, D.C.

**Mitchell, A.E. and Martin, T.E.** 2016. The Harsh Weather Hypothesis: A proximate mechanism for slow post-natal development of high elevation birds. NAOC 2016, Washington, DC.

**Oteyza, J.C., J.C. Mouton, T.E. Martin.** 2016. Adult survival probability explains parental risk-taking behavior in tropical and temperate songbirds. VI North American Ornithological Congress, Washington D.C. (oral presentation).

**Mouton, J.C., and T.E. Martin.** "Why do responses to nest predation risk differ across species?" North American Ornithological Congress, 18 August 2016, Washington, D.C.

Kaiser, S.A., **T.E. Martin, J.C. Oteyza, C. Armstad,** R.C. Fleischer. 2016. Unexpected kin relationships in a group-living Old World tropical babbler. VI North American Ornithological Congress, Washington D.C.

**Sells, S., M. Mitchell,** A. Luis, & K. Podruzney. March 2017. Carnivore territoriality: simulating economic selection of territories. Annual Meeting, Montana Chapter of The Wildlife Society, Helena, MT

**Sells, S., M. Mitchell,** J. Gude, & N. Anderson. October 2016. Application of structured decision making to wildlife management in Montana. National Meeting, The Wildlife Society, Raleigh, NC

## SCIENTIFIC PAPERS AND REPORTS

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- Ausband, D.E., **M.S. Mitchell**, **S.B. Bassing**, M. Nordhagen, D. Smith, and D. Stahler. 2016. Dog days of summer: influences on decision of wolves to move pups. *Journal of Mammalogy* 97:1282-1287.
- Boyce, A. J., and T. E. Martin.** 2016. Contrasting latitudinal patterns of life-history divergence in two genera of new world thrushes (*Turdinae*). *Journal of Avian Biology* 48: 1-10.
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