NEW YORK COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT

2015

Annual Report

The New York Cooperative Fish and Wildlife Research Unit works closely with our cooperators to conduct research that guides management of fish and wildlife resources in New York State and beyond.

Front cover photos: Clockwise starting in upper left, black bear cubs visiting a camera trap/hair snare research site (image credit: Cat Sun); fisher visiting a camera trap/hair snare research site (image credit: NYSDEC); moose (National Park Service).

New York Cooperative Fish and Wildlife Research Unit

2015 ANNUAL REPORT

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Cooperators:

U.S. Geological Survey
Cornell University
New York State Department of Environmental Conservation
U.S. Fish and Wildlife Service
Wildlife Management Institute

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INTRODUCTION

The Cooperative Research Units (CRU) program was established in 1935 as a cooperative partnership between the Federal and State biological resource agencies and Land Grant universities to conduct research on managing wildlife populations and habitats, train wildlife managers, and disseminate information to management agencies. Seventy-five years later, the mission of the program remains unchanged. Now with 40 Units in 38 states, the CRU program employs over 100 scientists that conduct research on natural resource issues of importance to State and Federal agencies and other organizations, teach graduate-level courses at their host universities, and conduct workshops and short courses for their cooperators and other partners.

The New York Cooperative Fish and Wildlife Research Unit was established in 1961 under the leadership of Dr. Daniel Thompson. Originally established as a separate wildlife unit, the fishery unit was added in 1963 and led by Dr. Alfred Eipper. In 1984, the units were combined and led through 2008 by Dr. Milo Richmond. Most recently, Dr. Angela Fuller became the new Assistant Unit Leader-Wildlife in 2009, and assumed the Unit Leader position in 2014

We look forward to embarking on new research directions in cooperation with our partners at Cornell University, the New York State Department of Environmental Conservation, U. S. Geological Survey, U.S. Fish and Wildlife Service, Wildlife Management Institute, and other organizations.

This annual report provides an overview of the research, teaching, and technical assistance activities of the New York Cooperative Fish and Wildlife Research Unit.

The Scientists and Staff of the
New York Cooperative Fish and Wildlife Research Unit

PROGRAM STATEMENT

The New York Cooperative Fish and Wildlife Research Unit, one of 40 in a national Cooperative Research Units program, was established for the purpose of enhancing the management of this nation's natural resources. The mission of the program is to conduct research on natural resource questions, contribute to graduate education by engaging graduate students in research projects and teaching graduate-level courses, provide technical assistance and consultation on natural resource issues, and provide continuing education for natural resource professionals. The Unit is a partnership among the U.S. Geological Survey, the New York State Department of Environmental Conservation, Cornell University, the U.S. Fish and Wildlife Service, and the Wildlife Management Institute. The mission of the Unit is to conduct and facilitate applied and basic research in fish and wildlife management among state and federal natural resource agencies, non-governmental organizations, and university faculty and staff on topics of mutual concern. The three Unit research scientists are aided by a highly motivated group of graduate students and research affiliates who conduct scientific research and understand the need for application and dissemination of research results. Particular attention is given to the natural resource problems and issues of the Northeastern states, with New York as the focal point, but we also work on national and international conservation issues. Our research focuses on how spatial and temporal variation in environmental and habitat characteristics influence habitat selection, movements, and population ecology of fish and wildlife. When appropriate, we promote the principles and use of structured decision making to guide management and research, and apply methods of adaptive management as a framework to reduce the pervasive uncertainties that complicate natural resource management and policy decisions.

Approved: September 18, 2012

COOPERATORS AND PERSONNEL

COORDINATING COMMITTEE

U.S. Geological Survey

MIKE TOME, Eastern Supervisor, Cooperative Research Units, Leetown Science Center, 11649 Leetown Road, Kearneysville, WV 25430

New York State Department of Environmental Conservation

PATTY RIEXINGER, Director, Division of Fish, Wildlife, and Marine Resources, 625 Broadway, Albany, NY 12233

Cornell University

DANIEL DECKER, Chair, Department of Natural Resources, Fernow Hall, Cornell University, Ithaca, NY 14853

MAX PFEFFER, Senior Associate Dean, College of Agriculture and Life Sciences, Roberts Hall, Cornell University, Ithaca, NY 14853

U.S. Fish and Wildlife Service

RICHARD BENNETT, Regional Scientist, U.S. Fish and Wildlife Service, Northeast Regional Office, 300 Westgate Center Dr., Hadley, MA 01035

DAVID STILWELL, Field Supervisor, U.S. Fish and Wildlife Service, New York Field Office, 3817 Luker Rd., Cortland, NY 13045

Wildlife Management Institute

SCOT WILLIAMSON, Northeast Regional Representative and Vice-President, Wildlife Management Institute, 69 Clinton Avenue, St. Johnsbury, VT 05819

UNIT PERSONNEL

Scientist

ANGELA K. FULLER, Unit Leader Wildlife, USGS, and Courtesy Associate Professor, Department of Natural Resources

Staff

MELANIE MOSS, Administrative Assistant

Postdoctoral Research Associates

KELLY ROBINSON

DAN LINDEN

DANA MORIN

CHRIS SUTHERLAND

COLLABORATORS

Tom Bell, New York State Department of Environmental Conservation
Gordon Batcheller, New York State Department of Environmental Conservation
Lance Clarke, York State Department of Environmental Conservation
Paul Curtis, Cornell University
Daniel Decker, Cornell University
Duane Diefenbach, Pennsylvania Cooperative Fish and Wildlife Research Unit
James Farquhar, York State Department of Environmental Conservation
Jacqui Frair, SUNY Environmental Science Forestry
Michale Glennon, Wildlife Conservation Society
Carla Gomes, Cornell University
Matthew Hare, Cornell University
Fred Hensen, New York State Department of Environmental Conservation
Lisa Holst, New York State Department of Environmental Conservation
Phil Hulbert, New York State Department of Environmental Conservation
Jeremy Hurst, New York State Department of Environmental Conservation
Kathryn Jahn, U.S. Fish and Wildlife Service
Paul Jensen, New York State Department of Environmental Conservation
Steve Joule, York State Department of Environmental Conservation
James Kelly, New York State Department of Environmental Conservation
Arthur Kirsch, York State Department of Environmental Conservation
Clifford Kraft, Cornell University
Heidi Kretser, Wildlife Conservation Society
James Lassoie, Cornell University
Jeff Loukmas, New York State Department of Environmental Conservation
Sean Madden, New York State Department of Environmental Conservation
Jennifer Miller, Panthera, Cornell University and University of Cape Town
John Ozard, New York State Department of Environmental Conservation
Gregory Poe, Cornell University
Joe Racette, New York State Department of Environmental Conservation
Daniel Rosenblatt, New York State Department of Environmental Conservation
J. Andrew Royle, Patuxent Wildlife Research Center
Lars Rudstam, Cornell University
Mike Schiavone, New York State Department of Environmental Conservation
Michael Schwartz, USDA Forest Service
William Siemer, Cornell University
Richard Stedman, Cornell University
Pat Sullivan, Cornell University
Bryan Swift, New York State Department of Environmental Conservation

EDUCATION

GRADUATE STUDENTS

NATHAN CRUM, M.S., Natural Resources,
(Advisor: Fuller)

CATHERINE SUN, Ph.D., Natural Resources,
(Advisor: Fuller)

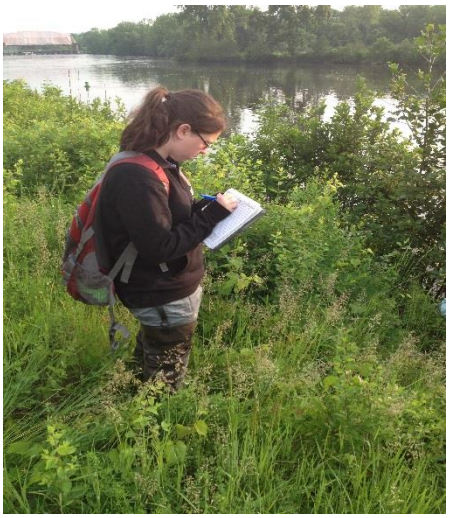
ALEC WONG, M.S., Natural Resources,
(Advisor: Fuller)

UNDERGRADUATE STUDENTS AND HIGH SCHOOL STUDENTS

Undergraduate Students (Doris Duke Conservation Scholars)

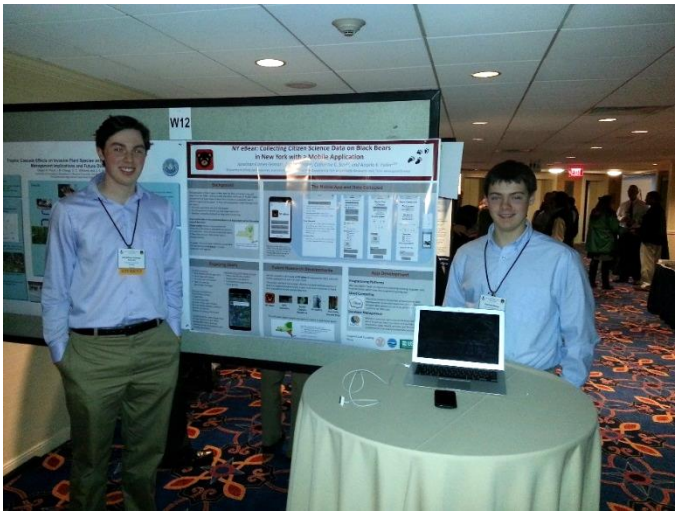
Victoria Williams

Erica Forstater



High School Students

Jonathan Gomes-Selman (left) and Patrick Finlay (right)



RESEARCH

CURRENT PROJECTS

Integrated Population Modeling of Black Bears in New York

INVESTIGATORS: Angela Fuller (NYCFWRU)
Matthew Hare (Cornell)
Gordon Batcheller (NYSDEC)
Jeremy Hurst (NYSDEC)

STUDENTS: Catherine Sun, Ph.D.

SPONSORS: New York State Department of Environmental Conservation

STARTED: August 2010

CATHERINE SUN, Ph.D. STUDENT

The Southern Black Bear Range in New York has an estimated 2,000 black bears with the intensity and frequency of human-bear interactions increasing as bears expand northwards into areas with anthropogenic and agricultural land cover. For example, the number of bears harvested in the last two decades has increased by approximately 500%. However, population indices derived from harvest may not track true changes in the population, motivating the need to develop non-harvest based estimates of population size, density, and their spatial patterns. Cat's PhD seeks to study the spatial patterns of population size and density of bears across ~50,000 km^2 of upstate New York, building on her Master's research where she estimated bear distribution in a study area of the Southern Black Bear Range. A primary objective is to better understand and anticipate the spatial patterns of the continued range expansion of an important wildlife and game species, with the ultimate goal of informing management.

Cat completed the first year of her PhD in 2015. She began developing the framework for an integrated population model, which makes use of different datasets collected from the same population to more precisely and accurately estimate population parameters of ecological interest, including population size, distribution, and rates such as population growth, survival, and recruitment. The integrated population model will ultimately accommodate data collected from harvest and hunter surveys, noninvasive spatial capture-recapture, camera trapping, radiotelemetry, and citizen science.

Another objective is to evaluate the ability of the abovementioned sampling methods for collecting data at large spatial extents for population monitoring. A first summer field season was conducted in

2015 across 5 NYSDEC Wildlife Regions at 180 sites on DEC land with hair snares and trail cameras, with the aid of regional NYSDEC biologists and technicians. Bears were detected on cameras in every region, and 144 hair samples were sent to Wildlife Genetics International in Canada for genetic analysis and individual identification. Cat also completed, with the assistance of the two local high school students, Jonathan Gomes Selman and PJ Finlay, a prototype of a citizen science smartphone app for collecting observations of bear sign from hikes and trail cameras.

Cat mentored two undergraduate students in their second year of their Doris Duke Conservation Scholars Program. Victoria Williams completed a second summer internship with the Florida Fish and Wildlife Conservation Commission in Gainesville, FL, on wildlife veterinary science including Florida panther health investigations and chronic wasting disease in deer. Erica Forstater completed a second summer internship with the US Fish and Wildlife Service in Cortland, NY, on research and database development for endangered species. Victoria and Erica also attended the Ecological Society of America conference in August to identify post-graduation career opportunities.

Camera-trapped Black Bear

Estimating the Distribution of Moose across New York State Using Hunter Survey Returns

Investigators:	Angela Fuller (NYCFWRU)
	Jeremy Hurst (NYSDEC)
Students:	Nathan Crum, M.S.
Sponsors:	New York State Department of Environmental Conservation
Started:	August 2013

NATHAN CRUM, M.S. STUDENT

After moose re-colonized New York in 1980, their population was projected to exceed 1,000 individuals by 2010. However, population indices of moose abundance in New York suggested that the population had only reached 500 – 800 individuals by 2010. Additionally, there are growing concerns that moose populations are declining across the southern extent of their range, adjacent to New York, due to high parasite incidence and a warming climate. Yet, little is known regarding the distribution and dynamics of the moose population in New York. Producing rigorous estimates of the distribution and abundance of species, such as moose, that occur at low densities can be difficult, and that difficulty is compounded when producing estimates over a large spatial scale. To overcome these difficulties, we used big game hunter surveys to collect large amounts of information regarding where hunters do and do not observe moose across New York from 2012 – 2014. We analyzed this information within an occupancy modeling framework that produced estimates of the spatial patterns of moose occurrence across the state at a fine scale while providing information regarding what land cover, climatic, and biological factors correlate with moose occurrence.

Moose were most likely to occur within the Adirondack Park in New York, specifically the northeastern and south-central regions of the park. Moose were most likely to occur in large areas composed primarily of coniferous forest with low white-tailed deer prevalence. Additionally, hunters were more likely to see moose at the beginning of the hunting season while moose are in rut and most active. We also found that future survey efforts can improve the power to detect changes in moose occupancy by prioritizing eliciting responses from hunters in as many sample sites as possible rather than increasing the number of responses per sample site. Additionally, surveying hunters that hunt early in the hunting season (i.e., bow hunters) will provide more information regarding where moose occur than surveying hunters who hunt late in the hunting season, since detection probability is highest early in the hunting season. These results also provide a spatial reference for future work to estimate the abundance and density of moose in New York. Additionally, this method may prove to be a rigorous and cost effective method for the New York State Department of Environmental Conservation to monitor the moose population.

Moose Population Assessment Using Spatial Capture-Recapture Methods

INVESTIGATORS: Angela Fuller (NYCFWRU)

Jeremy Hurst (NYSDEC)

STUDENTS: Alec Wong, M.S.

SPONSORS: New York State Department of Environmental Conservation

ALEC WONG, M.S. STUDENT

STARTED: August 2015

The recolonization of moose in the Northeastern United States has seen generally steady growth in most states following extirpation from their range in the 1860s due to unregulated hunting and forest loss. Moose expanded back into their former range from populations in Maine in 1950, and eventually returned to New York in the 1980s. Current population estimates suggest that the New York population has not seen the same rate of increase as the rest of the Northeast states, with estimates of moose abundance ranging from 500-1000 individuals (for comparison, neighboring Vermont contains an estimated 3000-4000 moose).

Moose populations in several areas of the United States and Canada have experienced marked declines in recent history, and it is suspected that several factors contribute to these declines including thermal stress from climate change, parasitism, habitat loss, and competition with white-tailed deer. Observations of moose in New York have indicated that moose may suffer parasitism by the lethal brain worm (*Parelaphostrongylus tenuis*) and the sub-lethal liver fluke (*Fascioloides magna*), but they have not yet exhibited the severe infestations of winter tick (*Dermacentor albipictus*) that are seen in other parts of the moose's range. Moose are also threatened by thermal stress, as temperatures in New York easily exceed the upper limit of moose temperature preference (approximately 14°C).

This study aims to provide an estimate of moose abundance in New York State through spatial capture-recapture and noninvasive genetics. Within the Adirondack Park, scat detection dogs are being utilized to detect moose feces along 70-3km transects in various habitats and management regimes. The identity of each individual moose can be determined from epithelial cells on the surface of the feces. The spatial capture-recapture method can subsequently provide estimates of local density. The models will include covariates on moose density including deer density, habitat type, forage availability, canopy cover, human activity, and topography, which are expected to help predict moose density where they occur. From these models we can also infer which of the hypothesized effects have the strongest relationship with moose distribution and density.

Spatial Capture-Recapture Models for Carnivores

INVESTIGATORS: Angela Fuller (NYCFWRU)

J. Andrew Royle (USGS, Patuxent Wildlife Research Center)

Sean Madden (NYSDEC)

Kathryn Jahn (USFWS)

STAFF: Christopher Sutherland, Postdoctoral Research Associate

SPONSORS: U.S. Fish and Wildlife Service

New York State Department of Environmental Conservation

STARTED: June 2011

CHRIS SUTHERLAND, POSTDOCTORAL SCIENTIST

It is difficult to estimate abundance and density of carnivores due to their elusive nature, often low densities at landscape-scales, and the expense of methods that rely on capturing individuals. In this project we are specifically interested in estimating and comparing density of a riparian carnivore in two river systems. To do this we combine three extremely useful approaches to wildlife monitoring that overcome this difficulty associated with difficult to capture species: 1) The use of both hair snares to collect hair samples and the use of trained and highly skilled scat detection dogs to locate otherwise very difficult to find DNA yielding scat, 2) The identification of individuals based on DNA extracted from samples collected non-invasively (scat and hair), and 3) The analysis of spatial encounters of unique individuals with spatially explicit capture-recapture models.

We conducted three field seasons for scat collection across two > 600 km^2 river systems in New York State. Building on 2012 pilot study data collection and analysis of the data using spatial capture-recapture methods, we updated our field protocols and identified an efficient and optimal sampling design that was conducted in 2013 and subsequently repeated in 2014. During 2015 the project was in its post-field sampling phase to focus on analysis of meso-carnivore densities compared between two major river systems. In addition to comparing population density, the design and scale of this study permit investigations of home range geometries (size and shape) and landscape connectivity of an important community regulator and habitat specialist.

A Structured Decision Making Approach to Harvest Management of White-tailed Deer Bucks and Wild Turkeys in New York

INVESTIGATORS: Angela Fuller (NYCFWRU)

Jeremy Hurst (NYSDEC, deer)

Bryan Swift (NYSDEC, deer)

Michael Schiavone (NYSDEC, turkey)

STAFF: Kelly F. Robinson
Postdoctoral Research Associate

SPONSORS: U. S. Geological Survey

New York State Department of Environmental Conservation

STARTED: March 2012 (deer), September 2013 (turkey)

KELLY ROBINSON, POSTDOCTORAL RESEARCH ASSOCIATE

We engaged the New York State Department of Environmental Conservation (DEC) in two structured decision making (SDM) projects to guide the decision process for harvest management of white-tailed deer bucks and wild turkeys throughout the state. Structured decision making is a defensible, transparent, objective way to make complex decisions by breaking decisions into component parts.

In the case of white-tailed deer, the 2012 Deer Management Plan for DEC stated that the agency should "encourage various strategies to reduce harvest of young bucks in accordance with hunter desires." We worked with members of the DEC and social scientists in the Department of Natural Resources at Cornell to evaluate a series of alternative buck harvest management actions that could meet a set of stakeholder objectives. In 2015, we completed this project. We found that the optimal alternative was to maintain Status Quo. In addition, this decision-aiding framework allowed DEC to see that implementing a strategy of encouraging voluntary restraint from harvesting yearling (<1.5-year-old) bucks would not have any negative consequences to hunters. The report for this project was submitted to DEC and the results of the project have been implemented within the agency.

For the wild turkey problem, we partnered with DEC staff to use SDM to inform decisions about how best to regulate fall wild turkey harvest. Setting fall wild turkey harvest regulations entails taking into account both biological and social concerns, including turkey population dynamics and the satisfaction of multiple stakeholder groups. These multiple concerns require decision-makers to integrate different sources of information, including results from a turkey population model, expert opinion of turkey

biologists, and a statewide fall turkey hunter survey. In 2015, we completed this SDM project. We found that throughout the state, the optimal regulation was to have a two-week hunting season that allowed for the harvest of one turkey per hunter. DEC has used the results of our SDM project to set new fall hunting seasons for wild turkey throughout New York. The report for this project was submitted to DEC.

Assessment of Furbearer Populations in New York

INVESTIGATORS:	Angela Fuller (NYCFWRU)
	Michael Schiavone (NYSDEC)
	Paul Jensen (NYSDEC)
STAFF:	Daniel Linden, Postdoctoral Research Associate
SPONSORS:	New York State Department of Environmental Conservation
STARTED:	April 2014

DAN LINDEN, POSTDOCTORAL RESEARCH ASSOCIATE

Population-level and area-specific management decision making for fishers in New York is the responsibility of the New York State Department of Environmental Conservation, which is mandated to ensure the conservation and sustainable use of fisher populations as a public trust resource (New York Environmental Conservation Law Section 11-0303). Large populations may offer opportunities for sustainable use and enjoyment of fishers by the public, but population-level information is required to help inform harvest decision making, especially for a species known to occur naturally at low densities, that has relatively low reproductive capacity, and is susceptible to overharvest, as happened historically. Harvest data are often used by wildlife managers when setting harvest regulations, however, when such data are not available because an area had not previously supported a harvest season, alternative approaches are required to help inform management decision making.

We implemented a camera trapping and hair snare study during the winters of 2013–2015 across a 70,096 km^2 region of western New York to compare fisher density and distribution in areas that were currently open to fisher harvest and those that had been closed to harvest for ~65 years. We fit occupancy models to the detection-nondetection data collected by remote cameras, and spatial capture-recapture models to the genotyped hair samples. We compared the inferences from each collection of data, particularly with regards to management decision making.

We found that seasonal patterns in fisher detection probability varied across the years, likely due to differences in winter weather. Fisher occurrence probability was positively related to coniferous/mixed-forest proportion and negatively related to road density. Spatial patterns in density as predicted by spatial capture-recapture models were similar to those for occupancy. Both modeling approaches suggested that several wildlife management units historically closed to fisher trapping were potentially able to support a harvest, based on landscape characteristics. Importantly, our results indicate that detection-nondetection data can serve as a useful approximation to density under certain conditions, some of which can be controlled by survey design. This information will be useful for wildlife managers looking to design large-scale monitoring programs for low density carnivores.

Landscape Conservation in the Chocó-Andean Biological Corridor: Integrating Local Communities and Wildlife for a Sustainable Future

INVESTIGATORS: Angela Fuller (NYCFWRU)

J. Andrew Royle (USGS, Patuxent Wildlife Research Center)

Carla Gomes (Cornell)

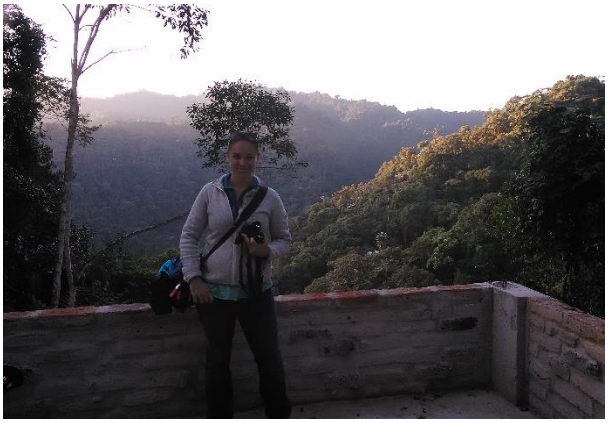
Gregory Poe (Cornell)

Richard Stedman (Cornell)

Amanda Rodewald (Cornell)

James Lassoie (Cornell)

STAFF: Dana Morin (NYCFWRU)



DANA MORIN,
POSTDOCTORAL RESEARCH ASSOCIATE

SPONSORS: Atkinson Center for a Sustainable Future

STARTED: September 2014

Ecuador's Chocó-Andean Biological Corridor comprises two of the world's biodiversity hotspots, but much of the region has been deforested by unsustainable land uses. Continued deforestation and planned major infrastructure projects threaten landscape connectivity and population viability of critical species such as the endangered Andean bear. Concurrently, rural communities are facing the loss of critical ecosystem services. We will develop a landscape-scale conservation program focused on this region that integrates 1) landscape connectivity for Andean bears and other species of conservation concern, 2) sustainable livelihoods, and 3) optimal corridor design to connect new and existing reserves. Novel methods developed in this project have direct relevance for open space planning and landscape conservation in New York and other areas of the United States. The research team traveled to Ecuador in January 2015. In addition, the team hired a postdoctoral research scientist in May 2015, who traveled to Ecuador in August 2015 to meet with local collaborators and gather existing GIS and Andean bear camera trap data from a previous pilot study. The primary focus of 2015 was development of short and long-term objectives for the project, building support and relationships with existing and potential regional collaborators, refining study design options for a large-scale camera trap study to be implemented in 2016, and applying for additional funding.

PUBLICATIONS AND PRESENTATIONS

JOURNAL ARTICLES

Curren, L.J., **D.W. Linden**, V.K. Heinen, M.C. McGuire, and K.E. Holekamp. 2015. The functions of male-male aggression in a role-reversed mammal. Animal Behaviour 100:208-216.

Dayer, A. A., R. C. Stedman, S. B. Allred, K. V. Rosenberg, and **A. K. Fuller**. 2015. Understanding landowner intentions to create early successional forest habitat in the northeastern United States. Wildlife Society Bulletin 40:59-68.

Eakin, C.J., H. Campa III, **D.W. Linden**, G.J. Roloff, D.B. Rowe, and J. Westphal. 2015. Avian response to green roofs in urban landscapes in the Midwestern U.S. Wildlife Society Bulletin 39:574-582.

Kane, M.D., **D.J. Morin**, M.J. Kelly. 2015. Estimating density of a critically endangered west African lion (*Panthera leo*) population, using camera traps and a spatial mark-resight model in the Niokolo Koba National Park in Senegal. Biodiversity and Conservation 24:3527-3541.

Larson, R.N., **D.J. Morin**, I.A. Wierzbowska, K.R. Crooks. 2015. Food Habits of coyotes, gray foxes, and bobcats in a coastal southern California landscape. Western North American Naturalist 75: 339-347.

Linden, **D.W.**, and G.J. Roloff. 2015. Improving inferences from short-term ecological studies with Bayesian hierarchical modeling: white-headed woodpeckers in managed forests. Ecology and Evolution 5:3378-3388.

Nadeau, **C.P.**, and **A. K. Fuller**. 2015. Accounting for multiple climate components when estimating climate change exposure and velocity. Methods in Ecology and Evolution 6:697-705.

Nadeau, **C. P.**, **A. K. Fuller**, and D. L. Rosenblatt. 2015. Climate-smart management of biodiversity. Ecosphere 6(6):91. http://dx.doi.org/10.1890/ES15-00069.1

Royle, J. A., **C. Sutherland**, **A. K. Fuller**, and **C. C. Sun**. 2015. Likelihood analysis of spatial capture-recapture models for stratified or class structured populations. Ecosphere 6(2):22. http://dx.doi.org/10.1890/ES14-00148.1

Sutherland, **C.**, **A. K. Fuller**, and J.A. Royle. 2015. Modeling non-Euclidean movement and landscape connectivity in highly structured ecological networks. Methods in Ecology and Evolution 6:169-177.

Suwanrat, A., D. Ngoprasert, **C. Sutherland**, P. Suwanwaree, and T. Savini. 2015. Estimating density of secretive terrestrial birds (Siamese Fireback) in pristine and degraded forest using camera traps and distance sampling. Global Ecology and Conservation 3:3149-3160.

TECHNICAL REPORTS

Huning, B., B.J. Mattsson, C. Sloop, G. Block, J. Cummings, W. Murray, **K.F. Robinson**. 2015. Developing a spatially-explicit climate adaptation framework for estuarine ecosystems of the San Francisco Bay: Climate Adaptation for Decision Support (CADS Phase 1). Final Report to the California Landscape Conservation Cooperative, Interim Report to the US Fish and Wildlife Service National Wildlife Refuge System Inventory and Monitoring Initiative. San Francisco Bay Joint Venture, San Francisco, CA.

Linden, D.W., and S.T. McKinney. 2015. Evaluation of the Maine Department of Inland Fisheries and Wildlife black bear management program: Integrated population modeling of intensive monitoring data. Final Report, University of Maine. 96pp. DOI:10.13140/RG.2.1.4479.1921

Robinson, K.F., A.K. Fuller. 2015. A structured decision making approach to white-tailed deer buck harvest management in New York State. Report to the New York State Department of Environmental Conservation, Albany NY. 207 pp.

Robinson, K.F., A.K. Fuller. 2015. A structured decision making approach to mitigating wild turkey population decline in New York State. Report to the New York State Department of Environmental Conservation, Albany, NY. 27 pp.

Royle, J.A. and **A.K. Fuller**. 2015. Spatial capture-recapture models to estimate abundance and density of animal populations.

Sutherland, C., A.K. Fuller, and J.A. Royle. 2015. Investigation of Mink Abundance Relative to Polychlorinated Biphenyl (PCB) Contamination within the Hudson River Drainage. Interim report 2012 – 2013. April 22, 2015.

Sutherland, C., A.K. Fuller, and J.A. Royle. 2015. Investigation of Mink Abundance Relative to Polychlorinated Biphenyl (PCB) Contamination within the Hudson River Drainage. Summary of Findings. 1 September, 2015. 108 pp.

PRESENTATIONS AND SEMINARS

Crum, N. J. 2015. Estimating the occurrence of moose in New York using hunter observations. Department of Natural Resources Graduate Student Association Symposium, Ithaca, NY. January, 2015.

Crum, N. J. 2015. Spatial Ecology and Recolonization Dynamics of Moose in Northeastern North America. Department Seminar, Cornell University, Department of Natural Resources, Ithaca, NY. July 2015.

Crum, N. J., A.K. Fuller, C. Sutherland, and J. Hurst. 2015. Estimating the occurrence of moose in New York using hunter observations. Northeast Association of Fish and Wildlife Agencies Conference, Newport, RI. April 21, 2015.

Crum, N. J., A.K. Fuller, C. Sutherland, H. Kretser, M. Glennon, M. Schwartz, and K. Pilgrim. 2015. Population Structure and Recolonization Dynamics of Moose in Northeastern North America. The Wildlife Society Conference, Winnipeg, MB. October 19, 2015.

Fuller, A.K. 2015. Estimating the distribution of fishers in an expanding population in New York using noninvasive methods. American Wildlife Conservation Foundation. DeWitt, New York. June 18, 2015.

Fuller, A.K. 2015. Landscape-scale conservation in the Ecuadorian Andes: The Socio-Ecological Corridor. Department of Natural Resources Seminar Series. Cornell University, Ithaca, New York. March 10, 2015.

Fuller, A.K. 2015. Landscape-Scale conservation in the Ecuadorian Andes: The Socio-Ecological Corridor. Fisheries and Wildlife Seminar Series, Paul Smith's College. March 6, 2015.

Fuller, A.K. 2015. Occupancy modeling of fishers informs management decision making related to harvest opportunities. Presented to Furbearer and Small Game Management Team Meeting. July 16, 2015.

Gomes-Selman, J. P. Finlay, C. Sun, and A. Fuller. 2015. NY eBear: Collecting Citizen Science Data on Black Bears in New York with a Mobile Application (Poster). Northeast Association of Fish and Wildlife Agencies, April 20, 2015.

Higdon, S.D., **D.J. Morin**, J. Holub, D.M. Montague, L.P. Waits, M.J. Kelly. 2015. Diet competition among Virginia's three dominant predators (Poster). Annual Meeting of the Virginia Chapter of The Wildlife Society, Natural Bridge, Virginia.

Higdon, S.D., **D.J. Morin**, M.J. Kelly, L.P. Waits. 2015. Bias in Carnivore Diet Analysis As a Result of Misclassification of Predator Scats Based on Field Identification. 22nd Annual Conference of The Wildlife Society, Winnipeg, Manitoba.

Holub, J., **D.J. Morin**, S.D. Higdon, D.M. Montague, L.P. Waits, M.J. Kelly. 2015. Uncertainty in traditional diet analysis for carnivores: a case study with bobcats, coyotes, and bears in western Virginia (Poster). Annual Meeting of the Virginia Chapter of The Wildlife Society, Natural Bridge, Virginia.

Linden, D.W., A.K. Fuller, and J.A. Royle. 2015. Incorporating uncertain identity in spatial capture-recapture: application to fisher in New York. The Wildlife Society 22nd Annual Meeting, Winnipeg, Manitoba, Canada. October 21, 2015.

Linden, D.W., and C. Sutherland. 2015. Spatial capture-recapture. Invited seminar, USGS Northern Prairie Wildlife Research Center, Jamestown, ND. 23 October, 2015.

Morin, D.J., A.K. Fuller, J.A. Royle, **C. Sutherland**. 2015. Corridor design applications of spatial capture-recapture models. 22nd Annual Conference of The Wildlife Society, Winnipeg, Manitoba. Invited presentation in symposia. October 21, 2015.

Olson, S.J., D.J. Harrison, J.H. Vashon, and **A.K. Fuller**. 2015. Food habits of Canada lynx at the southeastern limit of their range: Always the specialist? Poster at 22nd Annual Conference of The Wildlife Society. Winnipeg, Manitoba, Canada. October 19, 2015.

Rodriguez, R., P. Curtis, E. Craig, and **C. Sun**. 2015. The population dynamics of Common Terns (*Sterna hirundo*) at Oneida Lake, NY (Poster). Ecological Society of America. August 13, 2015.

Sun, C., A. Fuller, J. Royle, and J. Hurst. 2015. Multi-scale integrated modeling framework of animal population dynamics incorporating spatial capture-recapture and occupancy data collected from citizen science and traditional sampling. Ecological Society of America, August 13, 2015.

Sun, C., A. Fuller, J. Royle, J. Hurst. 2015. Novel approaches to big problems: Integrating citizen science to monitor and estimate black bear populations in New York. Northeast Association of Fish and Wildlife Agencies, April 20, 2015.

Sun. C. 2015. Novel approaches for a big problem: How to monitor and estimate the range of black bear populations across New York? DNR GSA Annual Graduate Research Symposium, January 16, 2015.

Sun, C. 2015. How to monitor and estimate the range of black bear populations across New York? Presented to NY Fish and Wildlife Management Board, March 26, 2015.

Sun, C. 2015. Black Bears in New York State - Natural History and Citizen Science. Presented to NY Master Naturalist Program, July 19 and September 19, 2015.

Sutherland, C. A.K. Fuller, and J.A. Royle. 2015. Estimating abundance when landscape structure determines patterns of both space-use and density. 22nd Annual Conference of The Wildlife Society. Winnipeg, Manitoba, Canada. October 21, 2015.

Sutherland, C., A.K. Fuller, and J.A. Royle. 2015. Estimating American mink, *Neovision vison*, density in complex river networks using spatial capture-recapture. 71st Annual Northeast Fish and Wildlife Conference. April 21, 2015.

COURSES TAUGHT & GUEST LECTURES

Fuller, A.K. Structured Decision Making in Natural Resource Management (NTRES 4940/6940). Cornell University, Ithaca, NY. Spring semester, 2015.

Fuller, A.K. 2015. Decision analysis for natural resources. Guest lecture in NTRES4280/6280, Cornell University.

Sun, C. "Noninvasive Genetics" – guest lecture in NTRES 2830 "DNA, genes, and genetic diversity". Cornell University, Ithaca, NY. March 25, 2015.

Sutherland, C. 2015. Ecological models in R and BUGS. Cornell University Graduate level. An interactive computer based seminar course based on the upcoming Royle and Kéry 'Hierarchical Modeling' book.

ACTIVITIES

TECHNICAL ASSISTANCE AND OUTREACH

Fuller, A. 2015. New York State Invasive Species Decision Making Workshop. Provided possible decision analysis approaches to managing invasive species in New York. Cornell University, Ithaca, NY. 3 November, 2015.

Linden, D.W. 2015. Assisted Marc Kéry (Swiss Ornithological Institute) with workshop on Hierarchical Analysis of Species Abundance and Distribution. Yale University. April 9–12, 2015.

Sun, C. 2015. Training workshops for NYSDEC bear field work May 15th and 26th.

Sutherland, C. 2015. Unmarked National Park Service workshop. 4-day workshop taught with Andy Royle. Patuxent Wildlife Research Center.

TRAINING

Sun, C. Participated in Cornell GETSET 2015: Engaging Students in Quantitative Courses (April); Active Learning Strategies (September).

Sun, C. Participated in Cornell Statistical Consulting Unit: Introduction to Multilevel Modeling (July), Introduction of Logistic Regression Analysis (September), Introduction to Count Data (October), Multiple Comparisons (October).

Wong, A. Participated in Applied Hierarchical Modeling in Ecology, Patuxent Wildlife Research Center, Fall 2015

SERVICE

Angela Fuller:

Women in Science (WISDom) Advisory Group to Director of USGS (Suzette Kimball), May 2015-present

Ad Hoc Postdoctoral Associate and Visiting Scholar Integration Committee, Department of Natural Resources, Cornell, September 2014 – 2015

Search Committee for Jay Hyman Professor of Wildlife Medicine, College of Veterinary Medicine, Cornell University, September 2015-present

Cornell Department of Natural Resources Executive Committee, January 2014 - present

Faculty Advisory Board, Atkinson Center for a Sustainable Future, 2014-present

Faculty Fellow, Atkinson Center for a Sustainable Future, 2014-present

Biodiversity Conservation Advisory Committee, New York State Department of Environmental Conservation (2011-present)

State Wildlife Action Plan Advisory Committee, New York State Department of Environmental Conservation, 2013-2015

Operations Committee, Northeast Section of The Wildlife Society (October 2015-present)

The Wildlife Society Leadership Institute Committee, December 2008 - present

College and University Education Working Group, The Wildlife Society, November 2008 - present

Biometrics Working Group, The Wildlife Society, November 2011 - present

Spatial Ecology and Telemetry Working Group, The Wildlife Society, November 2010 – present

Catherine Sun

Graduate representative on Search Committee NYCFWRU's Fisheries assistant unit leader.

Graduate mentor for Doris Duke Conservation Scholars Program.

Department of Natural Resources Graduate Student Association, President.

AWARDS & RECOGNITION

Sun, C. Sigma Xi best student presentation award at Department of Natural Resources Graduate Research Symposium, January 2015.

Sun, C. The Northeast Section of the Wildlife Society's Best Student Presentation Award, Annual Northeast Fish And Wildlife (NEAFWA) conference 2015.

Sun, C. Kieckhefer Adirondack fellowship, March 2015.

Wong, A. Kieckhefer Adirondack Research Grant, 2015.

HISTORY

New York Cooperative Wildlife Research Unit (established 1961)

Unit Leaders

Daniel Q. Thompson, 1961-75
Milo E. Richmond, 1975-77 (acting), 1977-1984

Assistant Unit Leaders

Milo E. Richmond, 1968-1975
Richard A. Malecki, 1978-84

New York Cooperative Fishery Research Unit (established 1963)

Unit Leaders

Alfred W. Eipper, 1963-75
John G. Nickum, 1975-76 (acting), 1977-80
Steven P. Gloss, 1980-84

Assistant Unit Leaders

Henry A. Regier, 1964-66
Clarence A. Carlson, Jr., 1966-72
John G. Nickum, 1973-75
Steven P. Gloss, 1978-80

New York Cooperative Fish and Wildlife Research Unit (combined 1984)

Unit Leaders

Milo E. Richmond, 1984-2008 (wildlife)
William L. Fisher, 2008-2013 (fisheries)
Angela K. Fuller, 2014 to present (wildlife)

Assistant Unit Leaders

Steven P. Gloss, 1984-87 (fisheries)
Richard A. Malecki, 1984-2008 (wildlife)
Mark B. Bain, 1991-2003 (fisheries)
Angela K. Fuller, 2009-2014 (wildlife)
Mitchell J. Eaton, 2011-2013 (ecology)