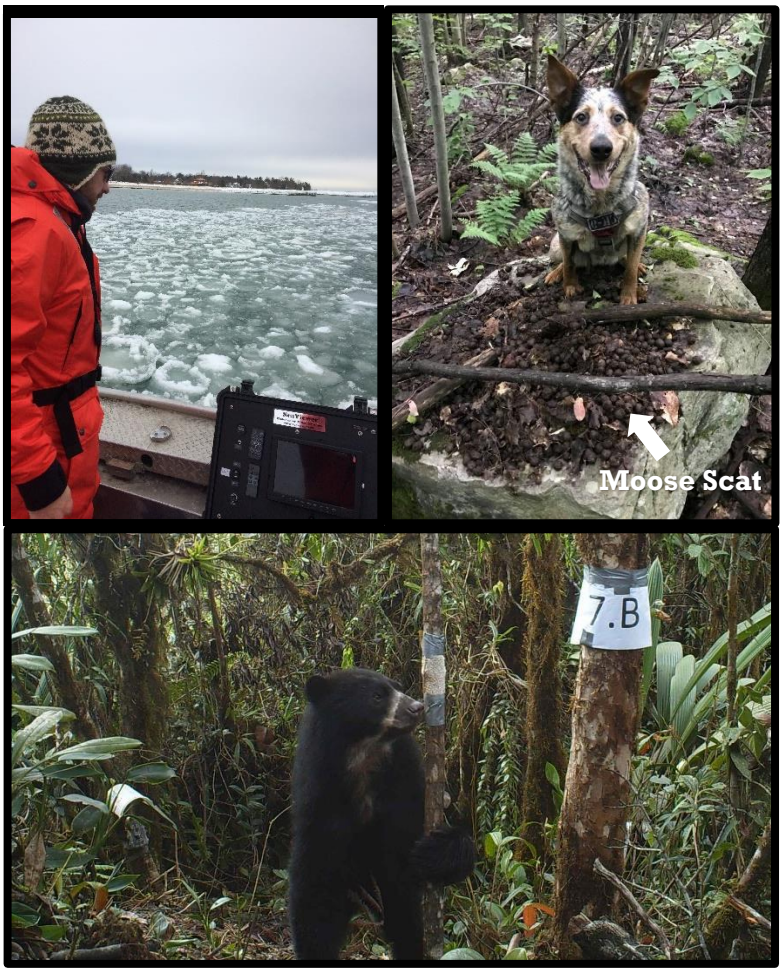
NEW YORK COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT



2016

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, Matt Paufve at Grand Traverse Bay, Lake Michigan; scat detection dog with moose scat in Adirondacks, NY; Andean bear visiting a scent post in Ecuador.

New York Cooperative Fish and Wildlife Research Unit

2016 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

ANTHONY WILKINSON, Director, Division of Fish, Wildlife, and Marine Resources, 625 Broadway, Albany, NY 12233

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PATRICK SULLIVAN, Chair, Department of Natural Resources, Fernow Hall, Cornell University, Ithaca, NY 14853

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

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KEN ELOWE, Assistant Regional Director, Science Applications, 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

Scientists

ANGELA K. FULLER, UNIT LEADER, WILDLIFE

SURESH SETHI, ASSISTANT LEADER, FISHERIES

Staff

MELANIE MOSS
ADMINISTRATIVE ASSISTANT

KELLY PERKINS
RESEARCH SUPPORT SPECIALIST

DANA MORIN
POSTDOCTORAL SCIENTIST

COLLABORATORS

Tom Bell, New York State Department of Environmental Conservation
Lance Clarke, New York State Department of Environmental Conservation
Daniel Decker, Cornell University
Duane Diefenbach, Pennsylvania Cooperative Fish and Wildlife Research Unit
Jim Eckler, New York State Department of Environmental Conservation
James Farquhar, New York State Department of Environmental Conservation
Alex Flecker, Cornell University
Jacqui Frair, SUNY Environmental Science Forestry
Isaac Goldstein, Wildlife Conservation Society
Carla Gomes, Cornell University
Miguel Gomez, Cornell University
Matthew Hare, Cornell University
Brad Harris, Alaska Pacific University
Fred Henson, New York State Department of Environmental Conservation
Steve Heerkens, New York State Department of Environmental Conservation
Amanda Higgs, 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
Steve Hurst, New York State Department of Environmental Conservation
Dan Isermann, Wisconsin Cooperative Fisheries Research Unit
Randy Jackson, Cornell University
Kathryn Jahn, U.S. Fish and Wildlife Service
Paul Jensen, New York State Department of Environmental Conservation
Steve Joule, New York State Department of Environmental Conservation
Arthur Kirsch, New York State Department of Environmental Conservation
Clifford Kraft, Cornell University
Heidi Kretser, Wildlife Conservation Society
Brian Lantry, U.S. Geological Survey Lake Ontario Biological Field Station
Steve Lapan, New York State Department of Environmental Conservation
Wes Larson, Wisconsin Cooperative Fisheries Research Unit
James Lassoie, Cornell University
Sean Madden, New York State Department of Environmental Conservation
Jennifer Miller, Panthera, Cornell University and University of Cape Town
Steve Morreale, Cornell University

Web Pearsall, New York State Department of Environmental Conservation
Rich Pendleton, New York State Department of Environmental Conservation
Amanda Rodewald, Cornell University
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
Krysten Schuler, Cornell University
Michael Schwartz, USDA Forest Service
William Siemer, Cornell University
Richard Stedman, Cornell University
Jim Stickles, New York State Department of Environmental Conservation
Josh Stiller, New York State Department of Environmental Conservation
Patrick Sullivan, Cornell University
Mike Wasilco, New York State Department of Environmental Conservation
Brian Weidel, U.S. Geological Survey Lake Ontario Biological Field Station
Steven Wolf, Cornell University

EDUCATION

GRADUATE STUDENTS

VANESSA SPRINGER, M.S., Natural Resources, (ADVISOR: FULLER)

CATHERINE SUN, Ph.D., Natural Resources, (ADVISOR: FULLER)

ALEC WONG, M.S., Natural Resources, (ADVISOR: FULLER)

ABRAHAM FRANCIS, M.S., NATURAL RESOURCES (ADVISOR: KASSAM/FULLER)

MATTHEW PAUFVE, M.S., NATURAL RESOURCES,
(ADVISOR: SETHI)

UNDERGRADUATE STUDENTS

Undergraduate Students

BRIANNA MIMS

JEREMY PUSTILNIK

SALLY COMPTON

ANITA MIKLAK

Doris Duke Conservation Scholars

CARLOS FERNANDEZ

JAILENE HILDAGO

RESEARCH
CURRENT PROJECTS

Integrated Population Modeling of Black Bears in New York

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

STUDENTS: Catherine Sun, Ph.D.

SPONSORS: New York State Department of Environmental Conservation

STARTED: August 2014

Catherine Sun, Ph.D. Student

The Southern Black Bear Range in NY has an estimated 2,000 bears, with the population growing since the 1990s. Cat's PhD seeks to develop non-harvest based spatial estimates of population size, density, and demographic rates of black bears in the Southern Black Bear Range, as harvest-based indices may not track true changes in the population. This work builds on her Masters research in which she estimated bear density and distribution in a study area of the Southern Black Bear Range using noninvasive, genetic spatial capture recapture. This work will inform bear management and help to understand and anticipate the spatial patterns of black bear range expansion in New York.

Cat completed the second year of her PhD in 2016. She continued developing the framework for an integrated population model that uses 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 noninvasive spatial capture recapture, camera trapping, radiotelemetry, citizen science, and harvest and hunter surveys.

A second summer field season was conducted in 2016 across 5 NYSDEC Wildlife Regions at 194 sites on both DEC and private land. This work was conducted with

substantial aid by regional biologists and technicians. Two changes were made to the sampling design in 2016. First, sites in Regions 3, 4, and 8 used only trail cameras. Second, 14 sites were added in Regions 7 and 9, and both trail cameras and barbed wire hair snares were used at these and 33 other sites. The additional sites allow us to evaluate if decreasing the spacing between sites would increase the number spatial recaptures of individuals, which are necessary for estimating bear abundance. A total of 63 hair samples were collected in 2016 and sent to Wildlife Genetics International in Canada for genetic analysis and individual identification. These changes were implemented because the sampling design in 2015 yielded no spatial recaptures of 52 individual bears.

Cat continued to develop the citizen science project for collecting presence-absence data from hikes and trail cameras submitted by the public. A local web and app development company was hired to continue development after two local high school students developed the prototype. The app, named iSeeMammals, is compatible with Apple and Android smartphones. Versions of the app were available for testing by the fall of 2016.

In March, Cat passed her qualifying A-exams and transitioned from a PhD student to PhD Candidate.

Cat mentored two undergraduate students in their second and final year of their Doris Duke Conservation Scholars Program. Victoria Williams and Erica Forstater graduated in May 2016. Victoria deferred acceptance to veterinary school and Erica began a graduate degree at Bowling Green State University.

Left: Camera-trapped black bear

Tayra Occupancy and Carnivore Co-occurrence Dynamics in the Ecuadorian Andes

Investigators: Angela Fuller (NYCFWRU)

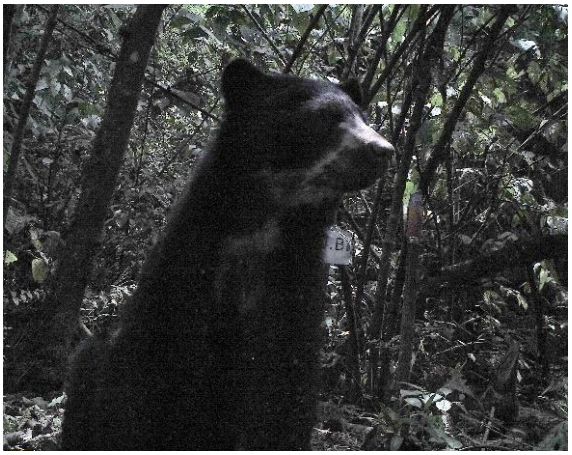
Students: Vanessa Springer, M.S.

Sponsors: U.S. Geological Survey
National Science Foundation (NSF)
International Association for Bear Research and Management (IBA)

Started: August 2016

Vanessa Springer, M.S. Student

The Chocó-Andean region of Ecuador lies at the convergence of two of the world's top 25 biodiversity hotspots and is home to more endemic species than any other hotspot on Earth. Unfortunately, half of this region has been deforested and the expansion of agriculture, development, and recently granted mining concessions threatens remaining forest. As part of an overarching project to design a socio-ecological corridor between two ecological reserves using the Andean bear (*Tremarctos ornatus*) as an umbrella species, a large-scale camera trapping survey was implemented across 850 km² of forest in the region northwest of Quito, Ecuador. The first survey season, August-November 2016, resulted in over 100,000 photos of at least 18 mammal species. As a subset of the corridor design project, this specific study has two aims: 1) To evaluate how land use and land cover influence occupancy of tayra (*Eira barbara*), a generalist species throughout Latin America, and 2) to describe the spatial co-occurrence patterns between the Andean bear and other native and nonnative fauna including puma (*Puma concolor*) and domestic/feral dogs (*Canis familiaris*). This study will increase the understanding of how wildlife species are using the landscape and will contribute to conservation planning efforts in this region.



Left: Andean bear.

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

STARTED: August 2015

Alec Wong, M.S. Student

The recolonization of moose in the Northeast U.S. 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).

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 DNA in 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. From these models we can also infer which of the hypothesized effects have the strongest relationship with moose distribution and density.

Due to the low encounter frequency of moose in the park using our methods in 2016, we have begun to test an adaptive method of sampling under the SCR analytical framework. In brief, our method allows us to apply SCR sampling at only sites that are likely to provide samples during the season, and avoid sites without evidence of moose at the site.

Above: Alec Wong collecting field data.

Above: Moose scat.

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)
	James Lassoie (Cornell)
Staff:	Dana Morin (NYCFWRU)
SPONSORS:	Atkinson Center for a Sustainable Future
STARTED:	September 2014

Dana Morin, Postdoctoral Scientist

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 Andean bear. Concurrently, rural communities are facing the loss of critical ecosystem services. The Andean Bear is endangered in South America and is considered an important umbrella species for biodiversity in the Andes. Primary threats to Andean bears include habitat loss, human-wildlife conflict, and threats from mining. Landscape-scale planning and design is critical to balance conflicting objectives while promoting conservation.

Our research takes a unique approach to landscape management by directly estimating landscape resistance to movement of Andean bears, which we will integrate with local community and socioecological and economic values for landscape-scale corridor planning. We provided novel quantitative methods for estimating animal density, space use, and landscape connectivity, with applications to management problems of importance to wildlife conservation globally. We designed and implemented a large-scale camera trapping survey to monitor wildlife species across Ecuador (101 trail cameras at 70 sites). Our work provided the first ever estimate of Andean bear density for Ecuador, we developed new computational methods to estimate landscape connectivity, and we developed a dynamic spatial optimization method to evaluate the

selection of landscape parcels for corridor design, given multiple objectives. Our computational solution to sustainable landscape design will identify a connected network of critical landscape "hotspots" that will provide ecological, social, and economic values for Andean bears and other species of conservation concern.

Once all phases of the work are complete, we will implement the spatial optimization approach that integrates ecological, social, and economic objectives with the goal of identifying the optimal selection of areas on the landscape to conserve. This work provides a proof of concept and approach that enables scaling up worldwide, and will be relevant to governments, land managers, and conservation groups who seek to conserve some of the most biodiverse places in the world. With funding from the Atkinson Center, we implemented phase one of the work, focusing on estimating Andean bear density and connectivity and developing new methods for corridor design. Phase two of the work will focus on monitoring biodiversity and characterizing social values.

This work has involved collaboration between Cornell University, the U.S. Geological Survey, Ecuadorian government (Secretary of Environment – Ecuador), the Wildlife Conservation Society, the University of San Francisco, Quito, University of Andina, Consortium for Sustainable Development of the Andean Ecoregion (CONDESAN), Cambugan Foundation, Yungilla, Santa Lucia Ecuadorian Cloud Forest Reserve, Pululahua Geobotanical Reserve, and Mindo Cloudforest Foundation.

Above: Field training workshop for local technicians camera trapping Andean bears.

Sustainable Forest Communities: Integrated Land Stewardship Strategy for Native American Land Claims

INVESTIGATORS:	Karim-Aly Kassam (Cornell)
	Angela Fuller (NYCFWRU)
	Ken Jock (SRMT-Environment Division)
STUDENTS:	Abraham Francis, M.S.
SPONSORS:	McIntire-Stennis
STARTED:	August 2016

Abraham Francis, M.S. Student

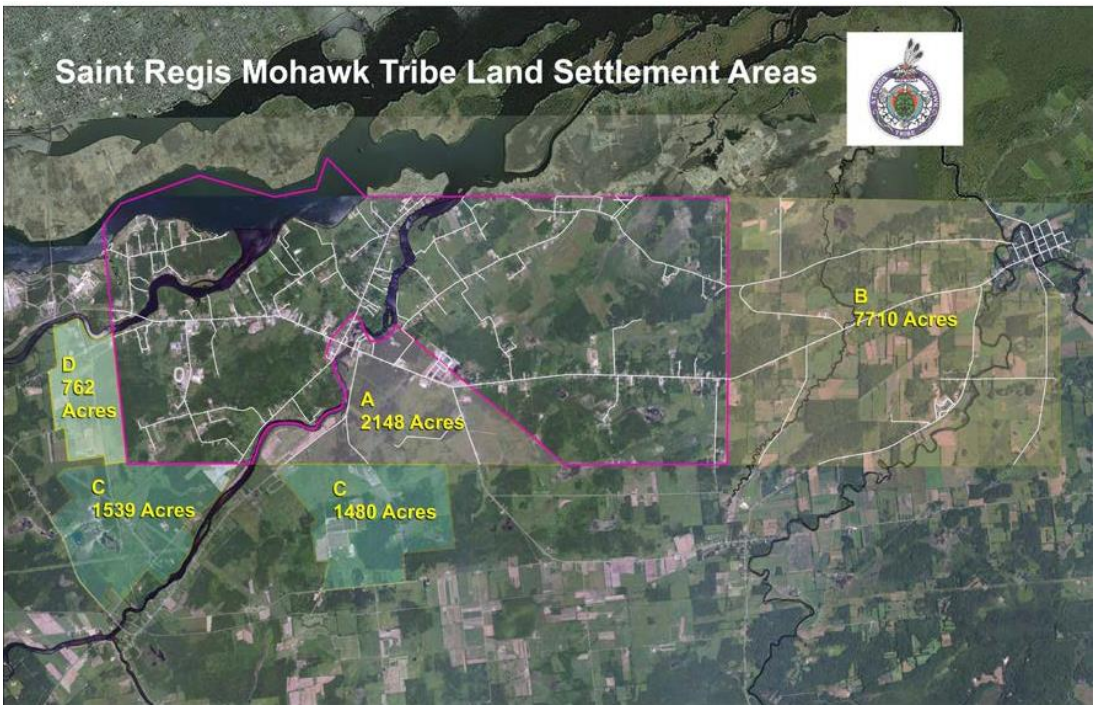
The Saint Regis Mohawk Tribe (SRMT), governing body in the southern portion of Akwesasne, is in the process of purchasing lands to be placed into trust, up to 13,000 acres from willing sellers. The Bureau of Indian Affairs (BIA) will be responsible for overseeing this land, along with the other 56.2 million acres of lands in trust for various Indigenous Communities and Individuals. Within this framework, SRMT is a category 2 tribe, which requires an approved Forest Management Plan or only very limited and restricted management can occur. My master's research project will develop a biologically and culturally informed forest stewardship strategy within the context of land claim areas in partnership with SRMT. It contributes to an important cultural responsibility of SRMT to the land and community, and aids them in asserting their rights over their lands.

Akwesasne, sovereign Mohawk community, holds a unique geographic location along the US and Canadian border. It is culturally, environmentally and politically diverse. It has a land base of approximately 14,648 acres of land on the American side, which will be expanded in the land claims process, and 7,400 acres of land on the Canadian side. The forested lands are dominated by quaking aspen (Populus tremuloides), basswood (Tilia americanan), sugar maple (Acer saccharum), red maple (Acer rubrum), silver maple (Acer saccharinum) and bottomland hardwoods.

Mohawk cultural history is shared with the Haudenosaunee Confederacy which is composed of six nations – Seneca, Cayuga, Onondaga, Oneida, Mohawk and Tuscarora. Mohawk cultural traditions and narratives provide insight into conceptualizing Akwesasronon identity and values which are engrained in the Ohén:ton Karihwatéhkwen, the Creation Story, Origin of the Four Sacred Ceremonies, History of

the Clans and Origin of the Great Law. Additionally, the tribal governments of Akwesasne worked with Akwesasronon to develop the Akwesasne Comprehensive Community Development Plan for the southern portion and Akwesasne Comprehensive Community Plan for the northern portion. These together articulate the values held by the community, along with their context specificity, which will be refined through community engagement.

Rigorous sampling through community engagement will occur in the summer of 2017 and provide critical information for the development of biologically and culturally informed forest stewardship strategy for Akwesasne. The data collected from this summer research approach will be used for analysis in Fall 2017. There will be multiple layers of data to be analyzed spatially across the landscape, such as values, cultural activities, history and biological information. The more finely articulated values of the community supplemented with the spatial analysis will inform forest strategy options for forested lands in Akwesasne.



Development of Descriptive Indices for the Spawning and Nursery Habitat for Great Lakes Cisco (*Coregonus artedi*) and Their Application to Areas Targeted for Restoration

INVESTIGATORS:	Suresh Sethi (NYCFWRU)
	Brian Lantry (USGS Lake Ontario Biological Station)
STUDENTS:	Matt Paufve, M.S.
SPONSORS:	EPA Great Lakes Restoration Initiative
STARTED:	September 2016

Matt Paufve, M.S. Student

Cisco (*Coregonus artedi*) are shallow-water, native coregonines that were historically abundant in the Great Lakes, important prey for native piscivores, and the target of large commercial fisheries. In response to fishing pressure and interactions with nonnative species, populations began to decline in the late 1800s and losses continued through the mid-1900s. This resulted in Cisco currently being scarce or extirpated in some Great Lakes systems. Restoration projects have recently been initiated with the goals of increasing abundance and encouraging the use of historical spawning locations in the Great Lakes.

Information on Cisco spawning ecology is needed for prioritizing target areas for stocking juvenile Cisco and monitoring naturally reproducing populations. Towards that end, we are studying documented spawning sites for established, healthy populations in Lake Michigan and Lake Superior to identify habitat variables associated with egg presence and viability. Post-spawning, which occurs in early December, a diaphragm pump is used to collect eggs from the lake bottom and habitat attributes are measured using underwater video cameras and other sensors. High quality Cisco spawning habitat will be characterized by estimating the relationship between habitat attributes and spawning evidence using an occupancy modeling framework.

Field testing of the sampling equipment began in October, 2016, contributing to the development of a sampling protocol and refinement of gear designs. The first field sampling occurred in December, 2016, at Grand Traverse Bay in Lake Michigan. Working with collaborators from the Michigan Department of Natural Resources, the

Little Traverse Bay Band of Odawa Indians, and The Nature Conservancy, we completed the first run of sampling and successfully collected coregonine eggs.

Above: Field testing the egg sampling pump.

Above: Underwater view, through a camera cage, of the egg sampling pump intake being lowered to collect a sample.

Above: Collaborators from the Michigan Department of Natural Resources Charlevoix Fisheries Research Station look out over the icy water in Grand Traverse Bay, Lake Michigan.

PUBLICATIONS AND PRESENTATIONS

JOURNAL ARTICLES

Carey M., **S.A. Sethi**, S. Larsen, and C. Rich. 2016. A primer on potential impacts, management priorities, and future directions for Elodea spp. in high latitude systems: learning from the Alaskan experience. Hydrobiologia 777:1-19.

Dayer, A.A., R.C. Stedman, S.B. Allred, K.V. Rosenberg, and **A.K. Fuller**. 2016. Understanding landowner intentions to create early successional forest habitat in the northeastern United States. Wildlife Society Bulletin 40:59-68.

Eaton, M.J., **A.K. Fuller**, F.A. Johnson, M.P. Hare, and R.C. Stedman. 2016. Application of Decision Science to Resilience Management in Jamaica Bay. Chapter 9 in W. Solecki, J. R. Waldman, and E. W. Sanderson, editors. Prospects for Resilience. Island Press.

Fuller, A.K., D.W. Linden, and J.A. Royle. 2016. Management decision making for fisher populations informed by occupancy modeling. Journal of Wildlife Management 80:794-802.

Fuller, A.K., C. Sutherland, J. A. Royle, and M. P. Hare. 2016. Estimating population density and space usage of American mink using spatial capture-recapture. Ecological Applications 26:1125-1135.

Kaiser M.J., et al. (**S.A. Sethi** 53rd). 2016. Prioritization of knowledge needs to achieve best practices for bottom-trawling in relation to seabed habitats. Fish and Fisheries 17:637-663.

Micheli F., K.W. Heiman, C.V. Kappel, R.L. Martone, **S.A. Sethi,** G.C. Osio, S. Fraschetti, A.O. Shelton, and J.M. Tanner. 2016. Combined impacts of natural and human disturbances on rocky shore communities. Ocean and Coastal Management 126:42-50.

Nadeau, C.P. and **A.K. Fuller**. 2016. Combining landscape variables and species traits can improve the utility of climate change vulnerability assessments. Biological Conservation 202:30-38.

Robinson, K.F., **A.K. Fuller**, J.E. Hurst, B.L. Swift, A. Kirsch, J. Farquhar, D.J. Decker, and W.F. Siemer. 2016. Structured decision making as a framework for large-scale wildlife harvest management decisions. Ecosphere 7(12):e01613. 10.1002/ecs2.1613.

Royle, J.A., **A.K. Fuller**, and C. Sutherland. 2016. Spatial capture-recapture models allowing Markovian transience or dispersal. Population Ecology 58:53-62.

Sethi S.A. and C. Bradley. 2016. Statistical arrival models to estimate missed passage counts at fish weirs. Canadian Journal of Fisheries and Aquatic Sciences 73:1251-1260.

Sethi S.A., D. Linden, J. Wenburg, C. Lewis, P. Lemons, **A.K. Fuller,** M. Hare. 2016. Accurate recapture identification for genetic mark–recapture studies with error-tolerant likelihood-based match calling and sample clustering. Royal Society Open Science 3:160457.

Walsh P., S.A. **Sethi**, B. Lake, B. Mangipane, R. Nielson, S. Lowe. 2016. Estimating denning date of wolves with daily movement and GPS location fix failure. Wildlife Society Bulletin 40:663-668.

PRESENTATIONS AND SEMINARS

Esler, D. et al. (**S.A. Sethi** 7th). 2016. Barrow's Goldeneye demographic responses to changing mussel conditions on wintering areas: a conceptual model exercises, Alaska Bird Conference, Cordova, AK. December 2016.

Fuller, A. Computational Sustainability Research Network: Connecting the Cooperative Research Units. Cooperative Research Units All-Hands Meeting. Santa Fe, New Mexico. 9 March, 2016.

Fuller, A. Landscape design for conservation and management of animal populations using computational sustainability solutions. Invited plenary address to the CompSust 2016 Conference. Ithaca, NY. 6 July, 2016.

Fuller, A., D. Morin, and J. Royle. Density-weighted connectivity for corridor design. 24th International Conference on Bear Research & Management. Anchorage, Alaska. 16 June, 2016.

Gupta, A., B. Dilkina, D. Morin, **A. Fuller**, J. Royle, C. Sutherland, and C. Gomes. Using model-based estimators of connectivity for landscape corridor design. CompSust 2016. Ithaca, NY. 6 July, 2016.

Linden, D., **A. Fuller**, and J. Royle. Incorporating uncertain identity in spatial capture-recapture modeling. CompSust16. Ithaca, NY. 7 July, 2016.

Linden, D., **A. Fuller**, and J. Royle, and M. Hare. Examining the occupancy-density relationship for a low density carnivore. The Wildlife Society 23rd Annual Conference, Raleigh, NC. October 17, 2016.

Morin, D., **A. Fuller**, J. Royle, C. Sutherland, A. Gupta, B. Dilkina, and C. Gomes. Modeling animal home range and landscape connectivity from spatial capture-recapture data. CompSust16. Ithaca, NY. 7 July, 2016.

Morin, D., A.K. Fuller, J.A. Royle, C. Sutherland. 2016. Landscape design applications of spatial capture-recapture models. Cornell Department of Natural Resources.

Molina, S., **A.K. Fuller**, J.A. Royle, and D.J. Morin. Population Ecology of the Andean Bear (*Tremarctos ornatus*) in the Northwest of the Metropolitan District of Quito, Ecuador. 24th International Conference on Bear Research & Management. Anchorage, Alaska. 14 June, 2016.

Paufve, M. R. 2016. Cisco (*Coregonus artedi*) spawning habitat: Informing restoration in Lake Ontario. New York Cooperative Fish and Wildlife Research Unit Annual Meeting. December 8, 2016.

Sethi, S.A., et al. 2016. Implementing change in the North Pacific bottom trawl groundfish fishery: sweep modifications success. ICES Fish Tech. and Fish Behavior Working Group Annual Meeting, Merida, Yucatan, Mexico. April 2016.

Sethi, S.A. et al. 2016. Taking salmon ecology through to optimal management decisions: fish passage restoration in Alaska. Invited talk, Cornell Biological Field Station Seminar Series, Oswego, NY. July 2016.

Sethi, S.A. et al. 2016. For the fish and by the fish: integrating life history into optimal aquatic barrier mitigation decisions. Computation Sustainability Conference, Ithaca, NY. July 2016.

Sethi, S.A. et al. 2016. Informed management: optimal fish passage restoration decisions for Pacific Salmon in Alaska. Invited talk, Ecology and Evolutionary Biology, Cornell University, NY. September 2016.

Sethi, S.A., J. Gerken, J. Ashline. 2016. Estimation of juvenile salmonid age and growth from routinely collected fork length data. Invited talk, AFS NY Student Chapter, Cornell University, NY. October, 2016.

Sethi, S.A., T.S. Smeltz, B. Harris. 2016. Oceanscape models inform policy options to manage seafloor impact from commercial fishing. Computation Sustainability Conference, Ithaca, NY. July 2016.

Springer, V. 2016. Tayra occupancy and carnivore co-occurrence dynamics in Ecuador. Presented at the New York Cooperative Fish and Wildlife Research Unit Coordinating Committee Meeting, Cornell University, Ithaca, NY. December 8, 2016.

Sun, C. 2016. Integrated population model for black bears to inform harvest management. New York Cooperative Fish and Wildlife Research Unit Coordinating Committee Meeting, Ithaca NY. December 8, 2016.

Wong, A., and A. Fuller. Assessing parasitic threats to moose in the Adirondacks of New York. New York Chapter of The Wildlife Society Annual Meeting. Albany, NY. 12 April, 2016.

Wong, A., A. Fuller, J.A. Royle. 2016. Spatial Patterns in Density of Moose in a Heterogeneous Landscape Using Non-Invasive Genetic Sampling to Inform Management. Cornell Graduate Student Association Annual Research Symposium, January 25, 2016.

Wong, A., A. Fuller, J.A. Royle. 2016. Challenges of Sickness & Stress for Moose: Assessing thermal stress and parasitic threats to moose in the Adirondacks of New York. The Wildlife Society New York Chapter Meeting, April 12, 2016.

THESES & DISSERTATIONS

Crum, N.J. 2016. Spatial Ecology and Recolonization Dynamics of Moose in New York and Northeastern North America. M.S. Thesis.

COURSES TAUGHT & GUEST LECTURES

Fuller, A. 2016. Landscape Genetics (NTRES 6940), Cornell University, Ithaca, New York: Spring 2016.

Fuller, A. and J.A. Royle. 5-day Spatial Capture-Recapture Workshop, University of Turku, Finland. August 29-September 2, 2016.

Sethi, S. 2016. Controversial Conservation Topics (NTRES 6940), Cornell University, Ithaca NY. Fall 2016.

Sethi, S.A. 2016. Global fisheries status update: ecological, economic, and social dimensions. Invited lecture, Introduction to Conservation Science (NTRES 2670), Cornell University, NY. November 2016.

ACTIVITIES

TECHNICAL ASSISTANCE AND OUTREACH

Fuller, A. Andean Bear Camera Trapping Workshop, Yunguilla, Ecuador; Taught by NY Coop Unit, Cornell University, Wildlife Conservation Society, CONDESAN. July 19-23, 2016.

Sun, C. Black bears in New York State - Natural history and citizen science. New York Master Naturalist Program, Arnot Research Forest, September 2016.

Sun, C. Black Bears in New York. Cub Scouts Troop 55. October 10, 2016.

Sun. C. Training workshops for black bear field work. NYSDEC Wildlife Regions 3,4,7,8,9 May 17 and 25, 2016.

TRAINING

Sun, C. Integrated Population Modeling Workshop, USGS Patuxent, August 1-5 2016

Sun, C. Data Visualization using ggplot2 in R. November 1, 2016. Cornell Statistical Consulting Unit

SERVICE

Angela Fuller

Associate Director, CompSustNet (Computational Sustainability Network), NSF, Cornell University (January 2016-present)

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

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

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

Cornell Department of Natural Resources Executive Committee (2014 – present)

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

Nominations Committee, The Wildlife Society (2016)

The Wildlife Society Leadership Institute Committee (2008-present)

Biometrics Working Group, TWS (2011-present)

College and University Education Working Group, TWS (2008-present)

Suresh Sethi

Faculty Fellow, Atkinson Center for a Sustainable Future (2016-2021)

Lake Ontario Technical Committee (2016-present)

International Council for Exploration of the Sea: Fish Technology and Fish Behavior Working Group (2016-present)

Associate Editor, Journal of Fish and Wildlife Management (2013-present)

Matt Paufve

Department of Natural Resources Graduate Student Assembly, Secretary

Cornell Student Subunit of the American Fisheries Society, Vice-President

Vanessa Springer

Graduate Mentor, Doris Duke Conservation Scholars Program, Cornell University

Co-Founder, Tropical Biology & Conservation Graduate Student Association, Cornell University

Catherine Sun

Graduate Mentor, Doris Duke Conservation Scholars Program, Cornell University

Department of Natural Resources Graduate Student Association, President

AWARDS & RECOGNITION

Scientific Excellence Award to the New York Cooperative Fish and Wildlife Research Unit, 2016.

Above: Drs. Sethi and Fuller receiving the Scientific Excellence Award for the New York Cooperative Fish and Wildlife Research Unit.

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)
Suresh A. Sethi, 2016-present