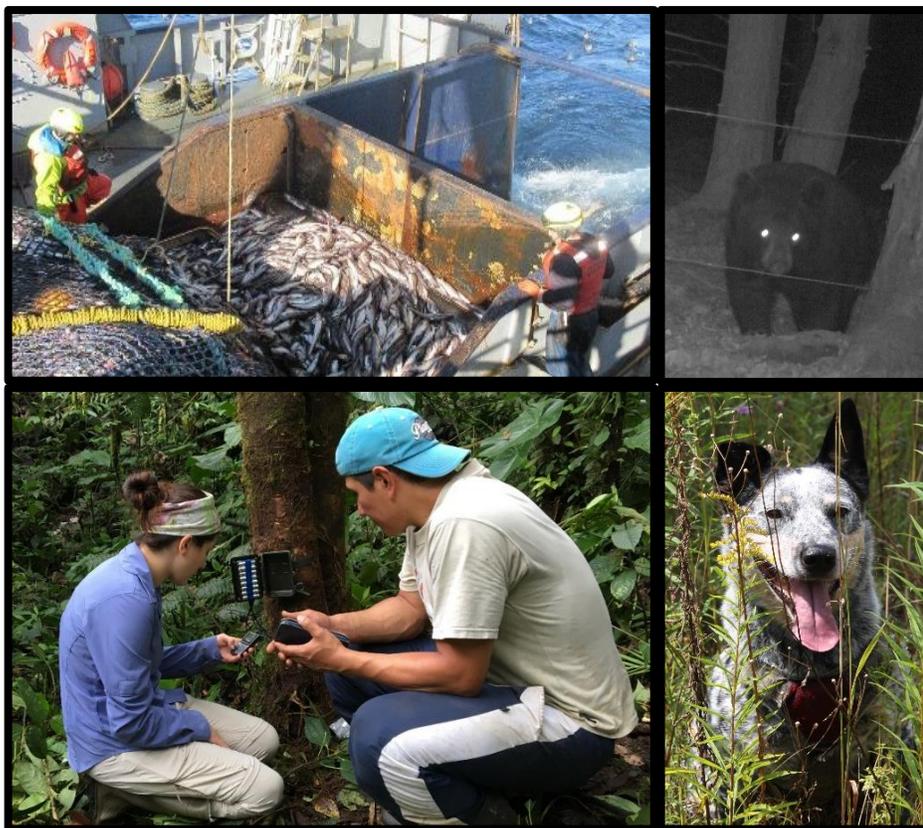


NEW YORK COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT



2017

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: Upper left: A trawl net opened to release Bering Sea pollock into the hold. Upper right: Camera-trapped black bear in New York Region 3. Lower left: Vanessa Springer training technician, Edison Tapia, on camera setup in Ecuador. Lower right: Scent dog working on Adirondack moose study.

New York Cooperative Fish and Wildlife Research Unit

2017 ANNUAL REPORT

211 Fernow Hall
Cornell University
Ithaca, NY 14853

Phone: 607-255-2839
Fax: 607-255-1895
http://www.coopunits.org/New_York/

Cooperators:

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

TABLE OF CONTENTS

INTRODUCTION	5
PROGRAM STATEMENT	6
COOPERATORS AND PERSONNEL	7
COORDINATING COMMITTEE	7
UNIT PERSONNEL	8
COLLABORATORS	9
EDUCATION	11
GRADUATE STUDENTS	11
UNDERGRADUATE STUDENTS AND DORIS DUKE SCHOLARS	13
RESEARCH	16
CURRENT PROJECTS	16
PUBLICATIONS AND PRESENTATIONS	41
JOURNAL ARTICLES.....	41
TECHNICAL OR POPULAR ARTICLES	42
PRESENTATIONS AND SEMINARS	43
THESES & DISSERTATIONS	48
COURSES TAUGHT & GUEST LECTURES	48
ACTIVITIES	49
TECHNICAL ASSISTANCE AND OUTREACH.....	49
TRAINING	50
SERVICE	50
AWARDS & RECOGNITION.....	52
PRESS.....	53
HISTORY	54

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

Cornell University

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

U.S. Fish and Wildlife Service

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



JENNIFER PRICE-TACK
POSTDOCTORAL SCIENTIST



COLLABORATORS

Tom Bell, New York State Department of Environmental Conservation
Carrie Brown-Lima, Cornell University
Lance Clarke, New York State Department of Environmental Conservation
Evan Cooch, Cornell University
Mike Connerton, New York State Department of Environmental Conservation
Jennifer Dean, New York Natural Heritage
Daniel Decker, Cornell University
Duane Diefenbach, Pennsylvania Cooperative Fish and Wildlife Research Unit
Bistra Dilkina, University of Southern California
Glen Dowell, Cornell University
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
Karim Kassam, Cornell University
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
Chris Legard, New York State Department of Environmental Conservation
Steve Lapan, New York State Department of Environmental Conservation
Wes Larson, Wisconsin Cooperative Fisheries Research Unit
James Lassoie, Cornell University
Jesse Lepak, NY Sea Grant
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
Manuel Peralvo, CONDESAN
Aaron Rice, Cornell University
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
Theodore Toombs, Environmental Defense Fund
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

KIMBERLY FITZPATRICK, Ph.D., Natural Resources, (ADVISOR: SETHI)



ABRAHAM FRANCIS, M.S., Natural Resources, (ADVISOR: FULLER)



ROBERT MÁRQUEZ, PH.D., NATURAL RESOURCES, (ADVISOR: FULLER)



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



SCOTT SMELTZ, Ph.D, Natural Resources,
(ADVISOR: SETHI)



VANESSA SPRINGER, 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 DORIS DUKE CONSERVATION SCHOLARS

SALLY COMPTON



MADDIE HOLDEN



BRIANNA MIMS



ANITA MIKLAK



SABRINA MOLYNEAUX



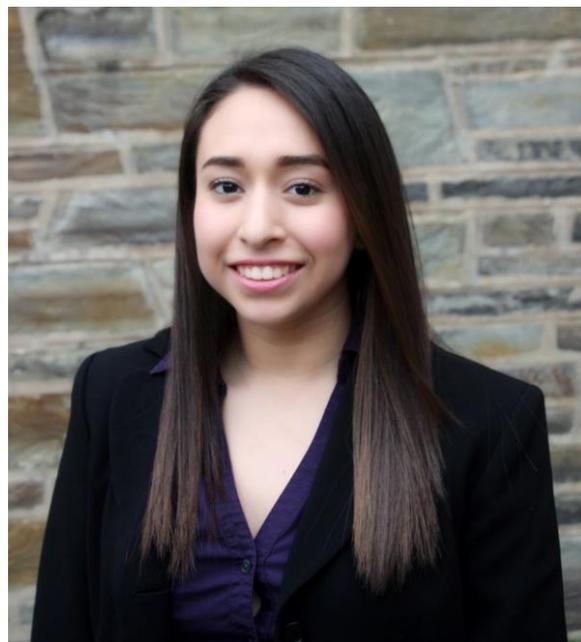
JEREMY PUSTILNIK



SARAH SCOTT-CRUZ



AMAIRANI TOVAR



Anna Ullmann



CARLOS FERNANDEZ



JAIENE 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

SPONSORS: New York State Department
of Environmental Conservation

STARTED: August 2014



**Catherine Sun,
Ph.D. Student**

Since its first description in the 1950s, the black bear population in New York has been growing. Particularly, the Southern Black Bear Range, with approximately 2,000 bears, has been expanding northwards into central New York. 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 third year of her PhD in 2017. She completed 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. In 2017, Cat began conducting simulations with the model to explore how the model can be used to improve population-level inferences and thereby inform bear management.

A third summer field season was conducted in 2017 across 5 NYSDEC Wildlife Regions on both DEC and private land. This work was conducted with substantial aid by regional biologists and technicians. Research sites consisted of both barbed wire and a trail camera. Sites were added in each Region to the design developed in 2016, resulting in a total of 241 research sites across the Southern Black Bear Range that were checked every 2 weeks. This change was based on findings from 2016 field work that showed additional sites increased the number of hair samples and spatial recaptures of individuals, which are necessary for estimating bear abundance. With the collaboration of over 20 DEC biologists, technicians, and staff, a total of 1,312 hair samples were collected in 2017 and prepared for genetic analysis by Wildlife Genetics International in Canada for genetic analysis and individual identification.

Cat completed the alpha version of the citizen science project called iSeeMammals that collects 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 is compatible with Apple and Android smartphones. Multimedia outreach efforts, including workshops, lectures, interviews, and press releases were conducted to advertise the project. The website and smartphone app was launched in early spring, and by October 2017, a total of 712 users from across New York had signed up. iSeeMammals data contributed an additional 406 independent sets of spatial locations, increasing the spatial and temporal extent of data collection. iSeeMammals will continue to collect data, which will be used in the integrated population model above to estimate population parameters.



Left: DEC biologists at a spring workshop imitate a bear to demonstrate the iSeeMammals app.



Left: Black bear hair snagged on barbed wire at a research site. DNA from the root follicles will be used to identify the bear.



Left: Research assistant, Carlos Gemora, setting up a barbed wire hair snare at a research site.

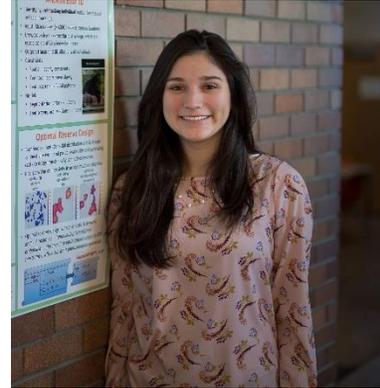
Tayra Occupancy and Carnivore Co-occurrence Dynamics in the Ecuadorian Andes

INVESTIGATORS: Angela Fuller (NYCFWRU)

Evan Cooch (Cornell)

STUDENTS: Vanessa Springer

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



**Vanessa Springer,
M.S. Student**

STARTED: August 2016

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, two large-scale camera trapping surveys were implemented across 850 km² of forest in the region northwest of Quito, Ecuador. 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.

In 2017, we completed processing the photos from our 2016 camera trap survey, which involved technicians writing species identification metatags to each image. We collected 240,604 photographs; of those, 27,125 are photos of wildlife and 6,327 are photos of Andean bears. We are in the process of fitting single and multi-species

occupancy models to data from our 2016 survey to meet project objectives. We have also established a partnership with Carla Gomes (Institute for Computational Sustainability, Cornell University) to collaborate on a machine learning method to identify individual bears from photos based on facial markings, biometrics, and spatio-temporal constraints. We hope that this method will be applicable to future research that uses camera traps to study Andean bears.

Dr. Angela Fuller (USGS) and Vanessa Springer (New York Cooperative Fish and Wildlife Research Unit, Cornell University) visited the field site in Ecuador April 25 – May 1, 2017 to meet with collaborators Santiago Molina and Manuel Peralvo (Consortium for Sustainable Development of the Andean Ecoregion), to train new field technicians, and help to set up the 2017 field survey. During this time we trained technicians new to this project on the overall goals of our research, the study method, and the use of both camera types. We also conducted field site visits with new technicians and technicians who worked on the project last year, in order to ensure consistency in the implementation of this year’s field survey.

We implemented our second camera trapping survey from April 21 – August 14, 2017 with 140 cameras (39 more cameras than our 2016 survey). The 2017 field survey resulted in 239,732 photos which are currently being processed. Approximately 90% of photos have been processed thus far and of these, we have 7,055 photos of Andean bears. Additionally, we have documented 27 other species in the study area including puma, ocelot, margay, oncilla, culpeo fox, tayra, tamandua, and kinkajou.



Photo 1. Andean bear photo from our 2017 field survey.



Photo 2. Ocelot photo from our 2017 field survey.



Photo 3. Landscape within the study area near Mindo, Ecuador.

Moose Population Assessment Using Spatial Capture-Recapture Methods

INVESTIGATORS: Angela Fuller (NYCFWRU)

J. Andrew Royle (USGS)

Jeremy Hurst (NYSDEC)

STUDENTS: Alec Wong

SPONSORS: New York State Department of
Environmental Conservation

STARTED: August 2015



Alec Wong, M.S. Student

The recolonization of moose in the Northeastern 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, we utilized scat detection dogs to detect moose feces along 70 3km transects in various habitats and management regimes. In theory, 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. This year, we collected nearly 1,000 moose scat samples between the months of June and August.

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. A simulation study shows that this method is at least as accurate and precise as ordinary SCR, but with approximately 50% of the effort. Implementation of this method in 2017 resulted in the four-fold increase in sample collections that we observed.



Above: Alec Wong and team collecting field data.



Above: Moose scat.



Above: Scat detection dog.

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

INVESTIGATORS: Suresh Sethi (NYCFWRU)
Brian Lantry (USGS Lake Ontario Biological Station)

STUDENTS: Matthew Paufve

SPONSORS: EPA Great Lakes Restoration Initiative



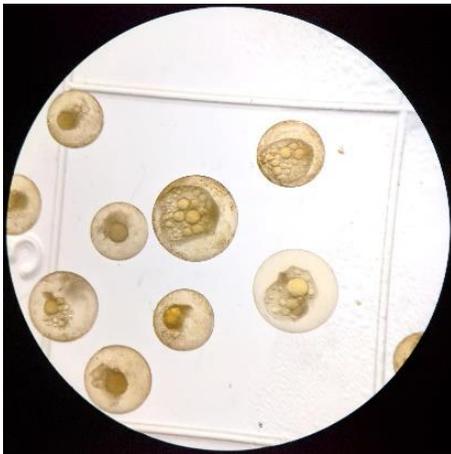
Matt Paufve, M.S. Student

STARTED: September 2016

Cisco (*Coregonus artedii*) are a native, mid-trophic coregonine that were historically abundant in the Great Lakes, serving as important prey for piscivores and supporting large commercial fisheries. In response to fishing pressure and interactions with nonnative species, among other threats, populations declined precipitously through the mid-1900s. This led to local extirpations and low abundances that persist today. Recent efforts to improve system resiliency in Lake Ontario through native fish rehabilitation have targeted remnant Cisco populations. To support these efforts, information on spawning ecology is needed to assess available habitat and to prioritize areas targeted for restoration. We studied known spawning sites to identify habitat variables associated with egg presence and viability at a high-energy reef complex in Lake Michigan, a relatively low energy area in Lake Superior, and historically important spawning areas in Lake Ontario. We utilized a diaphragm pump and egg mats to collect eggs from the lake bottom and assess the association between spawning evidence and habitat variables. In this talk, we present results from study sites in Lakes Superior, Michigan, and Ontario, and a controlled experiment testing the efficiency of benthic pump egg sampling.



Left: *Coregonine* eggs collected during egg pump sampling in Thunder Bay, Lake Superior, April 2017



Left: *Coregonine* eggs collected during spawning in Chaumont Bay, Lake Ontario, December 2017.



Left: Egg pump sampling on Thunder Bay, Lake Superior, April 2017 with Ontario Ministry of Natural Resources and Forestry and USGS collaborators.

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

INVESTIGATORS: Angela Fuller (NYCFWRU)
Karim-Aly Kassam (Cornell)
Ken Jock (SRMT- Environment Division)

STUDENTS: Abraham Francis

SPONSORS: U.S. Dept. of Agriculture- National Institute of Food and Agriculture

STARTED: August 2016



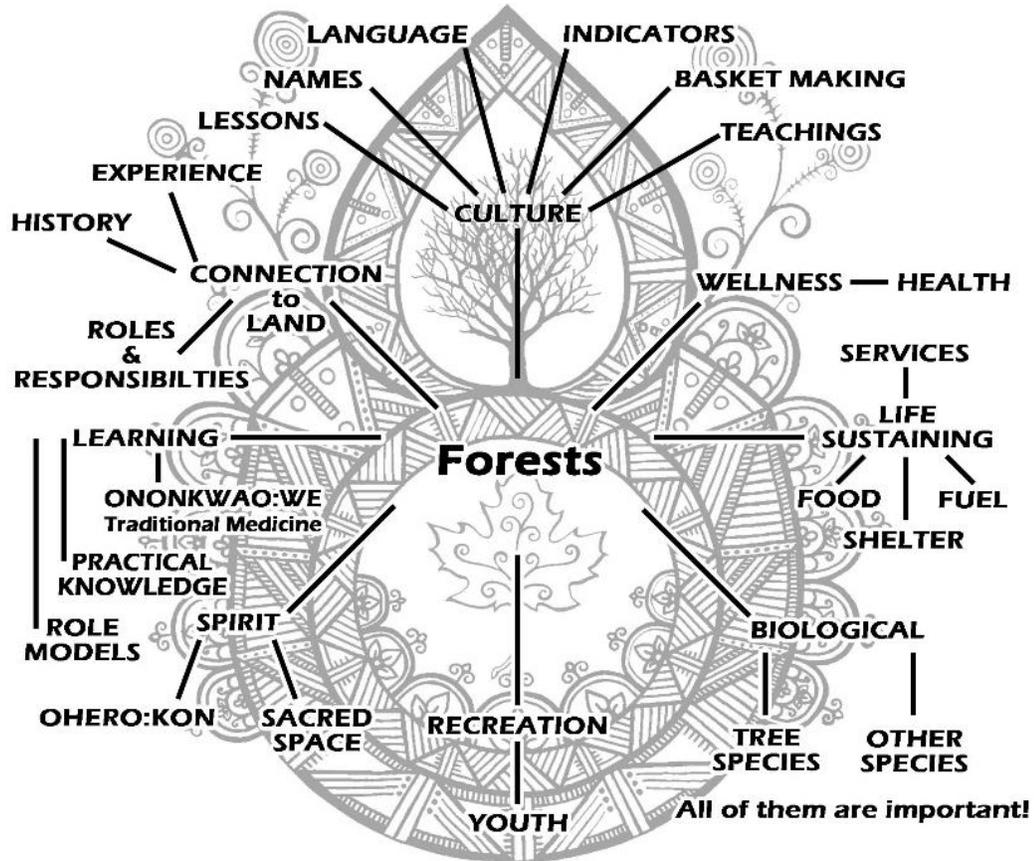
**Abraham Francis,
M.S. Student**

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) is 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. We seek to develop a biologically and culturally informed forest stewardship strategy within the context of land claim areas in partnership with SRMT and grounded in community. This research will contribute 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. The different variables that affect the lives of community member in tandem with biological information and cultural knowledge will aid in the development of the context specific forest stewardship strategy.

Rigorous sampling through community engagement occurred in the summer of 2017. The research season began with a Collaborative Gathering, which was hosted on June 3rd, 2017 at Akwesasne Housing Authority Training Center. The purpose of the gathering was to understand how Akwesasne community members view forests and articulate their values as they relate to forest stewardship. The broad conceptual map below summarizes the results of

the conversation and thoughts of the 32 people in attendance. These values were further expanded upon through 38 individual interviews that occurred during the rest of summer research season. In the Fall of 2017, time was spent transcribing interviews and developing a coding strategy for analysis of the data. This process ignited a conversation about the research methodologies used in this project, which were navigated through the Haudenosaunee teaching of the Two-Row Wampum.



Above: The culture/forest tree diagram is a piece of work that was created by Victoria Ransom. It is a visual representation display of the values that were identified in the collaborative gathering.



Above: Collaborative gathering, Akwesasne Housing Authority Training Center, June 3rd, 2017.



Above: Youth and Elder's Gathering, Thompson Island, Akwesasne, July 25th, 2017.

How Many Cooks in the Kitchen? Evaluating the Potential of DNA Mixture Models to Infer Counts from Fish and Wildlife Genetic Samples

INVESTIGATORS: Suresh Sethi (NYCFWRU)
Wes Larson (WICFRU)
Dan Isermann (WICFRU)

SPONSORS: USGS

STARTED: August 2016



We assessed whether DNA mixtures can count the number of yellow perch (*Perca flavescens*) in bass stomachs.

In many field-based genetics sampling occasions for fish and wildlife species, collection of tissue, fluid, hair, or feces samples occurs on a mix of individuals combining into a single sample specimen. In most scenarios, these DNA mixtures are either a nuisance for a given sampling design such as with genetic mark recapture studies, or the information contained in the DNA mixture is not fully utilized and is instead condensed down into presence/absence information only. In this project, we seek to extend methods developed in forensic criminology to estimate the number of individuals that contribute to a DNA mixture to identify novel applications for fish and wildlife management. If successful in development of these techniques, we envision applicability to a wide range of fish and wildlife ecology applications, including assessing fish diet compositions and taking eDNA species sampling beyond presence-absence to count-based inference, among other uses. In 2017, we implemented work to develop the DNA mixture statistical estimator, demonstrating through simulation, lab trials, and a field application to assess yellow perch predation by bass.

Lake Ontario Salmonid Management Risk Assessment: Refinement of Predator/Prey Models

INVESTIGATORS: Suresh Sethi (NYCFWRU)

STUDENTS: Kimberly Fitzpatrick

SPONSORS: New York State Department
of Environmental Conservation

STARTED: August 2017



**Kimberly Fitzpatrick,
Ph.D. Student**

Sustaining populations of salmon in Lake Ontario requires managers to balance the abundance of stocked and naturally reproducing predators with the availability of prey, primarily alewife. These management strategies may benefit from an increased understanding of predator-prey relationships and identification of key information needs. In conjunction with lake managers, we aim to improve the understanding of predator-prey population dynamics and develop pertinent support tools for Lake Ontario salmon management.

We are building upon on previous Great Lakes predator management efforts by updating existing predator-prey models for Lake Ontario and incorporating more recent data. The model will potentially combine elements of population dynamics, bioenergetics, and foraging area models to simulate predator-prey dynamics. The updated model will then be tested under different scenarios in order to design management strategies that are robust to uncertainty. These test scenarios will include situations that Lake Ontario managers have highlighted as being important (ex. alewife year-class failures, increased abundance of other predator species) or are based off of predator-prey dynamics seen in other Great Lakes population (ex. runaway naturalized predator reproduction). Finally, we will use the model to identify key data needs and cost-effective approaches to improve decision support for salmon management strategies in Lake Ontario.

Project Assessment of the Viability of Active Versus Passive Acoustic Technology for Assessment of Schooling Pelagic Fish Stocks

INVESTIGATORS: Suresh Sethi (NYCFWRU)
Aaron Rice (Cornell)
Pat Sullivan (Cornell)
Lars Rudstam (Cornell)
Rod Fujita (EDF)



High biodiversity of pelagic fish species in the Visayan Sea.

SPONSORS: Atkinson Center for a Sustainable Future

STARTED: August 2017

Schooling pelagic forage fish stocks such as alewife, mackerel and sardines provide large sources of biomass for top predator fish and for directed fishery harvests. Yet these populations are characterized by high recruitment variability, patchy distributions, and erratic phenology, making collection of stock assessment information necessary for sustainable fisheries management challenging. Acoustics technology has rapidly advanced and may provide novel tools to assess sardine biomass. In this collaboration we seek to evaluate the potential for active and passive acoustics tools for the assessment of schooling pelagic fish, using sardine as a case study. In 2017 we convened an expert workshop to design a field test protocol to assess active and passive acoustic survey gear for Pacific sardine. Sea trials will be conducted on the Visayan Sea to assess performance of acoustics-base stock assessment of sardine stocks in 2018. While targeted at sardine stocks as a case study, insights from this project comparing active versus passive acoustics fish population assessment will be useful for a wide range of freshwater and marine schooling pelagic stocks.

Invasive Round Goby Ecology in Finger Lakes

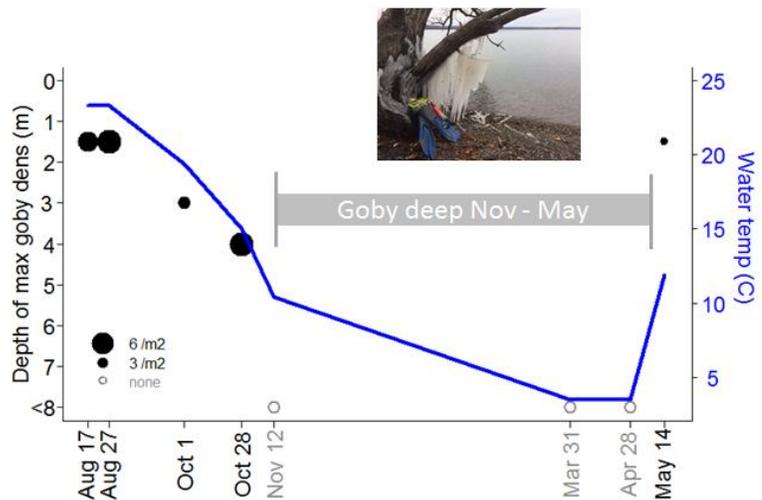
INVESTIGATORS: Suresh Sethi (NYCFWRU)
Jesse Lepak (NY Sea Grant)
Aaron Rice (Cornell)

STUDENTS: Advanced Fisheries Research Methods Course, 2017

SPONSORS: New York State Department
of Environmental Conservation

STARTED: August 2017

A relatively recent arrival to the region, round goby (*Neogobius melanostomus*) are now found throughout the Great Lakes basin. The species may negatively impact native fish species in the Great Lakes basin waters via habitat and food competition, and by predation on native fish eggs and larvae. Conversely, gobies prey on invasive *Dreissenid* mussels and themselves may be viable prey for adult native and target gamefish species. Information on the distribution and ecology of goby is a top priority for understanding ecosystem-level impacts from this rapidly expanding invader. Providing a mesocosm for Great Lakes systems, in this project we are analyzing a data set using benthic videography and sound recording to assess the distribution and biomass of round goby in heavily infested Cayuga Lake. In 2017, we used this research as a class project for Suresh's 'Advanced Fisheries



Above. Round goby are at high densities in the summer at shallow depths in Cayuga Lake but then move offshore during the winter. Data are from snorkel surveys at Long Point State Park.

Methods' graduate course. Students from the Department of Natural Resources and Ecology and Evolutionary Biology collaborated to conduct summer and winter field sampling in Cayuga Lake. Results have indicated round goby occupy a narrow summer niche in depths above ~50' but then move offshore and disperse in winter. These results are providing key information to understand the scope for trophic interactions from round goby in invaded NY waters.

Spatial Optimization of Invasive Species Management in New York

INVESTIGATORS: Angela Fuller (NYCFWRU)
Carrie Brown-Lima (NYISRI)
Jennifer Dean (NYNHP)

Postdoc: Jennifer Price Tack, Ph.D.

SPONSORS: New York State Department
of Environmental Conservation

STARTED: September 2017



**Jennifer L. Price Tack,
Postdoctoral
Researcher**

We recently started working with NYSDEC and leaders from the 8 NY Partnerships for Regional Invasive Species Management (PRISM). We are developing a tool that will help invasive species managers prioritize management actions based on species, areas, and projects statewide, with flexibility to tailor actions at the regional level. Ultimately, our approach will guide managers in determining which species should be prioritized, where those species should be managed, and the best approach to managing them. We will also include metrics of treatment feasibility into the prioritization to ensure management dollars are well spent. We will conduct a workshop to elicit objectives for invasive species management from PRISM leaders, which will be held on March 21st, 2018. This workshop will be crucial for guiding the development of the decision tool to ensure that it will reflect the needs and requirements of NYS invasive species managers.

During her first few months, Jennifer reviewed relevant literature and tools related to prioritizing and optimizing invasive species management decisions. She attended several meetings with NY invasive species managers and stakeholders, including meetings with the NYS Invasive Species Committee, Invasive Species Advisory Council, NYS Natural Heritage Program, and PRISM leaders. She has also been working with Jennifer Dean and others from NYS Natural Heritage Program to utilize iMapInvasives observations of invasive species for prioritizing spatial allocation of management funds.



Above: PRISM leaders and stakeholders participate in a structured decision-making workshop.

Managing for Long Term Sustainability of Seafood Production From Bottom Tended Wild Capture Fisheries: Evaluating Tradeoffs Between Spatial Closures Versus Gear Modification

INVESTIGATORS: Suresh Sethi (NYCFWRU)
Pat Sullivan (Cornell)
Miguel Gomez (Cornell)
Brad Harris (Alaska Pacific University)



**T. Scott Smeltz,
Ph.D. Student**

STUDENTS: T. Scott Smeltz

SPONSORS: Atkinson Center for a Sustainable Future
The Groundfish Forum
At-Sea Processors
National Marine Fisheries Service, NOAA

STARTED: January 2017

Twenty percent of global wild capture seafood production – 32 million metric tons per year – is harvested using bottom-tended fishing gear such as trawls and dredges with potential to impact seafloor ecosystems. The cumulative impact of fishing gear-seafloor interactions is variable, ranging from ephemeral disturbances in fast-recovering systems, to long-term physical changes to benthic communities. Seafloor impact management is currently a major regulatory issue affecting the long term sustainability of seafood production from bottom-tended fishing gear fisheries.

To help fisheries managers make better informed habitat-related decisions, we developed the Fishing Effects model, a quantitative tool to assess habitat impacts from fishing at seascape scales. The model produces high resolution spatiotemporal estimates of habitat disturbance using data on fishing locations, gear characteristics, and habitat distributions. We implemented the model in the North Pacific finding that less than 2% of the federally managed marine habitat in the North Pacific is disturbed from commercial fishing activities. The model was adopted by the North Pacific Fisheries Management Council for their Essential Fish Habitat (EFH) review. Protection of EFH is a provision of the Magnuson-Stevens Act – the primary law regulating fisheries management in the United States -- that requires U.S. federal fisheries managers to

consider habitat impacts when managing for sustainable fisheries. The EFH review found that habitat disturbance is not currently causing measurable negative effects on harvested fish populations in the North Pacific, however, we are continuing to work with the North Pacific Fishery Management Council to provide them with regular updates as new fishing and habitat information becomes available. Towards the end of 2017 we also began working with the New England Fishery Management Council to implement the Fishing Effects model for their upcoming EFH reviews.

With model development completed, we are now turning our efforts to using the Fishing Effects model as a framework to evaluate habitat management strategies. Our goal is to explore the tradeoffs fisheries managers must consider when changes in fleet dynamics, reduction of catch efficiency, or uncertainty about habitat distributions may hinder the effectiveness of implemented policies. We are especially seeking to understand how gear modifications may complement traditional habitat management strategies such as spatial closures.



Left: Scott and the crew of the *Pacific Explorer* attaching sensors to a pollock trawl. This was part of a three week research trip in the Bering Sea to better understand how trawl nets interact with the seafloor. This work will help us improve predictions made by the Fishing Effects model.



Left: Scott and the crew of the *Pacific Explorer* attaching contact sensors to the footrope of a pollock trawl.

Conservation and Management of Andean Bears from Regional to Local Scales: Occupancy, Density, Connectivity, and Threats.

INVESTIGATORS: Angela Fuller (NYCFWRU)
Dave Garchelis (MN Dept. of Natural Resources)
Isaac Goldstein (Wildlife Conservation Society)

STUDENTS: Robert Márquez

SPONSORS: Andean Bear Conservation Alliance
Wildlife Conservation Society

STARTED: September 2017



**Robert Márquez,
Ph.D. Student**

The Andean bear is the only extant species of bear in South America and is considered threatened across its range due to habitat loss, fragmentation, and illegal hunting. Typically, Andean bear inhabit includes natural areas with little to no human presence/activity, occurring between 200-4700 m elevation. In Colombia, non-protected areas have historically had a high level of human presence/activity. Consequently, Andean bear populations in this region are exposed to high levels of fragmentation, and to a diverse degree of human related threats, including retaliatory hunting as a result of human-bear conflict. Monitoring changes in the Andean bear population, and understanding their relationship with threats and environmental variables is necessary for informing management decisions.

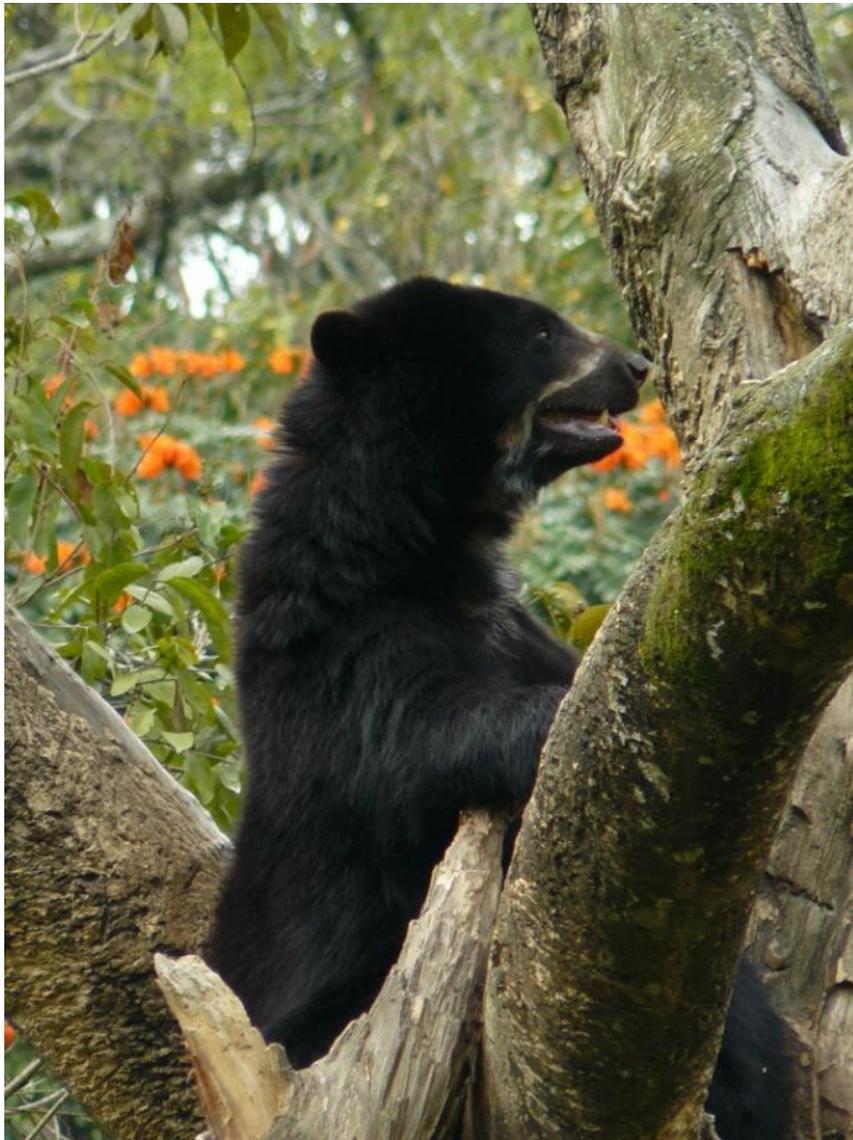
The objectives of this study are to 1) evaluate the relationship between real/perceived damage caused by Andean bears, farmers' attitudes about bears, and bear killing; 2) Evaluate landscape factors and species threats that contribute to regional occupancy of Andean bears. 3) Estimate density and connectivity of Andean bears in priority conservation areas, and evaluate the relationship between density and occupancy. In order to reach these objectives, our activities include: a) Evaluate the effect of husbandry practices and environmental variables on damage caused by Andean bears in Colombia and Peru, b) Evaluate the effect of damage caused by Andean bears and socio economic factors on the attitudes of local residents in Colombia and Peru, c) Evaluate the effect of human attitudes, norms, and context on human behavior regarding hunting in Colombia and Peru, d) Evaluate occupancy of Andean bears in Colombia, Ecuador and Peru, and e) Use spatial capture-recapture models to estimate density and movement of Andean bears in Colombia.



Above: Robert presenting at the human - Andean bear conflict workshop at the Machu Picchu History Sanctuary, Peru.



Above: Chingaza National Park – Colombia. Researchers from Cornell University, WCS and National Natural Park of Colombia.



PUBLICATIONS AND PRESENTATIONS

JOURNAL ARTICLES

- Bradley C, **S.A. Sethi**, J. Ashline, and J. Gerken. 2017. Cohort-specific variation in juvenile Coho salmon habitat use. *Ecology of Freshwater Fish* 26: 695-706.
- Crum, N.J., A.K. Fuller, C.S. Sutherland**, E.G. Cooch, and J. Hurst. 2017. Estimating Occupancy Probability of Moose in Northern New York Using Hunter Survey Data. *Journal of Wildlife Management* 81(3):521–534; 2017; DOI: 10.1002/jwmg.21207.
- Fabiano, E. L. Boast, **A.K. Fuller**, and **C. Sutherland**. 2017. The use of remote camera trapping to study cheetahs. Chapter 29 in L. Marker, L. Boast, A. Schmidt-Kuntzel, eds. *The Biology and Conservation of Cheetahs*. Academic Press.
- Kelly, P.T., B.C. Weidel, **M.R. Paufve**, B.P. O'Malley, J.M. Watkins, L.G. Rudstam, S.E. Jones. 2017. Concentration and biochemical gradients of seston in Lake Ontario, *Journal of Great Lakes Research*, 43:795-803.
- Linden, D.W., A.K. Fuller**, and J.A. Royle. 2017. Examining the occupancy-density relationship for a low density carnivore. *Journal of Applied Ecology*. doi:10.1111/1365-2664.12883.
- Molina, S., **A.K. Fuller, D.J. Morin**, and J.A. Royle. 2017. Use of spatial capture-recapture to estimate density of Andean bears in northern Ecuador. *Ursus* 28:117-126.
- Morin, D.J., A.K. Fuller**, J.A. Royle, and C. Sutherland. 2017. Model-based estimators of density and connectivity to inform conservation of spatially-structured populations. *Ecosphere* 8(1):e01623. 10.1002/ecs2.1623.
- Robinson, K. F., and A. K. Fuller**. 2017. Participatory modeling and structured decision making. Pages 83-101 in S. Gray, M. Paolisso, S. Gray, and R. Jordan (eds) *Environmental Modeling with Stakeholders: Theory, Methods, and Applications*. Springer.
- Robinson, K.F., A.K. Fuller**, M.V. Schiavone, B. Swift, D.R. Diefenbach, W.F. Siemer, and D.J. Decker. 2017. Addressing wild turkey (*Meleagris gallapavo*) population declines using structured decision making. *Journal of Wildlife Management*. DOI: 10.1002/jwmg.21220.
- Royle, J.A., **A.K. Fuller**, and **C. Sutherland**. 2017. Unifying population and landscape ecology with spatial capture-recapture. *Ecography* 40: doi: 10.1111/ecog.03170.

- Sethi S.A.**, Carey MP, Morton J, Guerron-Orejuela E, Decino R, Willette M, Boersma J, Jablonski J, Anderson C. 2017. Rapid response for invasive waterweeds at the arctic invasion front: assessment of collateral impacts from herbicide treatments. *Biological Conservation* 212: 300-309.
- Sethi S.A.**, J. Gerken, and J. Ashline. 2017. Accurate aging of juvenile salmonids using fork lengths. *Fisheries Research* 185:161-168.
- Sethi S.A.**, J. R. O’Hanley, J. Gerken, J. Ashline, and C. Bradley. 2017. High value of ecological information for river connectivity restoration. *Landscape Ecology* 32:2327-2336.
- Sun, C.C., A.K. Fuller**, M.P. Hare, and J.E. Hurst. 2017. Evaluating population expansion of black bears using spatial capture-recapture. *Journal of Wildlife Management* 81: 814–823. doi:10.1002/jwmg.21248.
- Xue, Y., X. Wu, **D. Morin**, B. Dilkina, **A. Fuller**, J. Royle and C. Gomes. 2017. Dynamic Optimization of Landscape Connectivity Embedding Spatial-Capture-Recapture Information. Association for the Advancement of Artificial Intelligence.

TECHNICAL OR POPULAR ARTICLES

- Márquez, R.**, G. Bianchi, E. Isasi-Catalá, V. Ruiz Gutiérrez, & I. Goldstein. 2017. Guía para el Monitoreo de la Ocupación de Oso Andino. Andean Bear Conservation Alliance & Wildlife Conservation. 58 pp.
- Parra-Romero, A. et al. (**R. Márquez** 2nd). 2017. Estrategia para la Conservación del Oso Andino en el Macizo de Chingaza, *in* El Oso Andino en el Macizo de Chingaza. / José F. González-Maya, Robinson Galindo-Tarazona, Marcos Manuel Urquijo Collazos, Maritza Zárate Vanegas & Angela Parra-Romero, editores — Bogotá: Empresa de Acueducto, Alcantarillado y Aseo de Bogotá D.C. / EAB-ESP, Corporación Autónoma Regional del Guavio - CORPOGUAVIO, Parques Nacionales Naturales de Colombia (Parque Nacional Natural Chingaza, Dirección Territorial Orinoquía) & Proyecto de Conservación de Aguas y Tierras – ProCAT Colombia.
- Parra-Romero, A. et al. (**R. Márquez** 4th). 2017. Los Osos Andinos del Macizo DE Chingaza, *in* El Oso Andino en el Macizo de Chingaza. / José F. González-Maya, Robinson Galindo-Tarazona, Marcos Manuel Urquijo Collazos, Maritza Zárate Vanegas & Angela Parra-Romero, editores — Bogotá: Empresa de Acueducto, Alcantarillado y Aseo de Bogotá D.C. / EAB-ESP, Corporación Autónoma Regional del Guavio - CORPOGUAVIO, Parques Nacionales Naturales de Colombia (Parque Nacional Natural Chingaza, Dirección Territorial Orinoquía) & Proyecto de Conservación de Aguas y Tierras – ProCAT Colombia, 2017.

PRESENTATIONS AND SEMINARS

- Ashline, J. et al. (**Sethi S.A.** 2nd). Where do they go and how do they get there? Juvenile coho salmon overwinter habitat selections. AK Chapter, American Fisheries Society meeting, Fairbanks, AK. March 2017.
- Acevedo, C. et al. (**R. Márquez** 21st). 2017. Conservación del oso andino a escala de paisaje. 25th Conference on bear research and management. International Bear Association, Quito.
- Cuevas, D. et al. (**R. Márquez** 7th). 2017. Claudia Acevedo, Guillermo Bianchi, Jaime Celis, Germán Forero, Padu Franco, Isaac Goldstein, Robert Márquez, Juan Troncoso, María Camila Villegas. Conservamos La Vida: Andean bear conservation at the landscape scale. 28th International Congress for Conservation Biology. Cartagena.
- Fitzpatrick, K.B., S.A. Sethi.** 2017. Predator-prey population dynamics model for Chinook salmon management. Lake Ontario Technical Committee Meeting, Clayton, NY. November, 2017.
- Francis, A.** 2017. Haudenosaunee Forest Stewardship: Bridging biological and cultural knowledge for community empowerment: Department of Natural Resources Symposium, January 19th, 2017, Ithaca, NY; St. Regis Mohawk Tribe – Environment Division, January 17th, 2017, Akwesasne, NY; St. Regis Mohawk Tribe – Tribal Meeting, July 8th, 2017.
- Francis, A.** 2017. Panel Discussion of Film Screening: Gathering Our Hearts at Standing Rock: Cornell University Event, April 25th, 2017, Ithaca, New York.
- Francis, A.** 2017. Indigenous Sustainability through Forest Stewardship: RIT Class, March 1st, 2017, Rochester, New York.
- Francis, A.** 2017. Traditional Knowledge, Community Engagement and Research: CU Class, February 22nd, 2017, Ithaca, New York.
- Fuller, A.K.** Landscape management and connectivity conservation for Andean bears. 25th International Conference on Bear Research and Management. Quito, Ecuador. 17 November, 2017.
- Fuller, A.K.** Functional connectivity conservation: linking species conservation and landscape-scale conservation decision making. University of Massachusetts Amherst, Department of Environmental Conservation Seminar Series. 13 October, 2017 (Invited).
- Fuller, A.K., D. Morin, J.A. Royle, C. Sutherland, C. Gomes, B. Dilkina, A. Gupta, Y. Xue, X. Wu.** Metrics to estimate landscape connectivity for connectivity conservation planning.

24th Annual Conference of the Wildlife Society. Albuquerque, New Mexico. 26 September, 2017 (Invited).

Fuller, A.K., K.F. Robinson, R. Stedman, W. Siemer, and D.J. Decker. Integration of social and ecological sciences for natural resource decision making: challenges and opportunities. 24th Annual Conference of the Wildlife Society. Albuquerque, New Mexico. 24 September, 2017 (Invited).

Fuller, A.K., J.A. Royle, D.J. Morin, Y. Xue, B. Dilkina, C.P. Gomes. 2017. Estimating functional connectivity for landscape management and connectivity conservation. 2017 International Congress for Conservation Biology. Cartagena, Colombia. 25 July, 2017.

Fuller, A.K. 2017. Density-weighted connectivity for landscape management and connectivity conservation. Computational Sustainability Virtual Seminar Series. 19 May, 2017 (Invited).

Fuller, A.K. Camera trap surveys to inform management decision making. Canadian Society for Ecology and Evolution annual meeting. Victoria, British Columbia. 9 May, 2017 (Invited).

Fuller, A.K. 2017. Biodiversity conservation in the Andean bear corridor. Secretary of Environment, Government of Ecuador. 26 April, 2017.

Goldstein, I. and **R. Márquez.** 2017. Core Conservation Units: an operative spatial-institutional tool for the conservation of large carnivores. 25th Conference on bear research and management. International Bear Association, Quito.

Hagan, J. et al. (**Sethi S.A.** 3rd). Assessing the accuracy of Landsat derived stream temperatures for use in juvenile salmonid habitat assessments on the Anchor River, Alaska. AK Chapter, American Fisheries Society meeting, Fairbanks, AK. March 2017.

Harris, B. et al. (**Sethi S.A.** 4th). Seascape-scale modelling of benthic habitat disturbance from commercial fishing activities. AK Chapter, American Fisheries Society meeting, Fairbanks, AK. March 2017.

Marquez, R. 2017. Andean bear conservation at the landscape scale. Tropical Biology & Conservation Lightning Symposium. Ithaca.

Marquez, R. and I. Goldstein. 2017. Decision making for the conservation of Andean bears using presence-absence data. 28th International Congress for Conservation Biology. Cartagena.

- Márquez, R.** and I. Goldstein. 2017. Diagnosis of the human-Andean bear interaction landscape. HBC workshop. 25th Conference on bear research and management. International Bear Association, Quito.
- Márquez, R.** and I. Goldstein. 2017. Interacciones negativas entre el oso y la gente. Ministerio de Ambiente de Ecuador. 25th Conference on bear research and management. International Bear Association, Quito.
- Monson, D. et al. (**Sethi S.A.** 6th). Understanding trophic relationships of sea otters and their effects on demographic attributes. Sea Otter Conservation Workshop, Seattle, WA. March 2017.
- Morton, J. et al. (**Sethi S.A.** 2nd). Secondary effects and fate of fluridone used to eradicate Elodea. Annual Invasive Species Workshop of the AK Committee for Invasives Management, Anchorage, AK. October 2017.
- Nimick, A. et al. (**Sethi S.A.** 5th). Fishing effects in 3D – it's not all about bottom contact anymore. AK Chapter, American Fisheries Society meeting, Fairbanks, AK. March 2017.
- Paufve, M.R., Sethi, S.A.,** Lantry, B.F., Jonas, J.L., O'Neill, P., Chiodo, A., Berglund, E.K., Yule, D.L., Rudstam, L.G., Weidel, B.C., Furgal, S., Karboski, C.T. 2017. Describing Spawning and Incubation Habitat for Great Lakes Cisco. New York Cooperative Fish and Wildlife Research Unit Annual Meeting. Ithaca, NY. December 5, 2017.
- Paufve, M.R., Sethi, S.A.,** Lantry, B.F., Jonas, J.L., O'Neill, P., Chiodo, A., Berglund, E.K., Yule, D.L., Rudstam, L.G., Weidel, B.C., Furgal, S., Karboski, C.T. 2017. Describing suitable spawning and incubation habitat for Great Lakes Cisco. Lake Ontario Technical Committee Meeting. Watertown, NY. November, 2017.
- Paufve, M.R., Sethi, S.A.,** Lantry, B.F., Jonas, J.L., O'Neill, P., Chiodo, A., Berglund, E.K., Yule, D.L., Rudstam, L.G., Weidel, B.C., Furgal, S., Karboski, C.T. 2017. Characterizing spawning and nursery habitat of Great Lakes Cisco (*Coregonus artedii*) and applications to areas targeted for restoration. International Coregonid Symposium. September 10, 2017.
- Paufve, M.R., Sethi, S.A.,** Lantry, B.F., Jonas, J.L., O'Neill, P., Chiodo, A., Berglund, E., Yule, D., Furgal, S., Rudstam, L.G., Weidel, B.C. 2017. Investigating habitat suitability for cisco (*Coregonus artedii*) spawning and egg incubation. International Association for Great Lakes Research Annual Meeting. Detroit, MI. May 15, 2017.
- Paufve, M.R., Sethi, S.A.,** Lantry, B.F., Rudstam, L.G., Weidel, B.C. 2017. Describing suitable spawning habitat of cisco (*Coregonus artedii*) in the Great Lakes and informing

restoration efforts in Lake Ontario. New York Chapter of the American Fisheries Society Annual Meeting. Buffalo, NY. February 3, 2017.

- Paufve, M.R., Sethi, S.A.,** Lantry, B. 2017. Cisco (*Coregonus artedi*) spawning habitat in the Great Lakes and restoration in Lake Ontario. Cornell Department of Natural Resources Research Symposium. Ithaca, NY. January 19, 2017.
- Pendleton, R. et al. (**Sethi S.A.** 6th). Seasonal distribution and habitat associations of Shortnose Sturgeon in the Hudson River estuary. NY Chapter, American Fisheries Society meeting, Buffalo, NY.
- Rose, C. et al. (**Sethi S.A.** 5th). Observing halibut survival after trawler deck-release with satellite tags. International Flatfish Symposium, St Malo, France. November 2017.
- Rose, M. et al. (**Sethi S.A.** 2nd). Observing halibut survival after trawler deck-release with satellite tags. North Pacific Fishery Management Council, Anchorage, AK. October 2017.
- Rose, C. et al. (**Sethi S.A.** 7th). Satellite tags to measure halibut survival after trawler deck release. Groundfish Forum annual captain's meeting, Seattle, WA. January 2017.
- Sethi, S.A.** et al. 2017. High value of life history information for watershed connectivity restoration. NY Chapter, American Fisheries Society meeting, Buffalo, NY.
- Sethi, S.A.** et al. 2017. Estimating denning date of wolves with daily movement and GPS location fix failure. The Wildlife Society national meeting, Albuquerque, NM.
- Sethi, S.A.** et al. 2017. Characterizing the ecological niche of invasive round goby in Cayuga Lake, Finger Lakes Research Conference, Geneva, NY (Invited).
- Smeltz, S.** 2017. EFH 5 year review. Presentation to the North Pacific Fishery Management Council. April 2017.
- Smeltz, S.** et al. (**Sethi S.A.** 4th). 2017. Seascape-scale modelling of benthic habitat disturbance from commercial fishing activities. Presentation to New York Chapter of American Fisheries Society. February 2017.
- Springer, V., and A.K. Fuller.** 2017. Spatial co-occurrence of Andean bears with puma and feral dogs in Ecuador. 25th International Conference on Bear Research & Management. Quito, Ecuador, November 2017.
- Springer, V.** 2017. Biodiversity Conservation in the Chocó-Andean Biological Corridor: linking species conservation and landscape-scale decision making. NSF Expeditions in Computing: Expanding the Horizons of Computational Sustainability, Cornell University, Ithaca, NY, October 2017.

- Springer, V. and A.K. Fuller** 2017. Large Scale Conservation: The Socio-ecological Corridor. Co-presented in Spanish with Dr. Angela Fuller at the Secretary of the Environment in Quito, Ecuador, April 2017.
- Springer, V.** 2017. Tayra occupancy and carnivore co-occurrence dynamics in Ecuador. Presented at the Department of Natural Resources Symposium, Cornell University, Ithaca, NY, January 2017.
- Sun, C.C., A.K. Fuller, M.P. Hare, and J.E. Hurst.** Phylogeography of black bears in the northeastern United States. 25th International Conference on Bear Research and Management. Quito, Ecuador. (Poster) November 2017
- Sun, C.C., M.P. Hare, A.K. Fuller, and J.E. Hurst.** Phylogeography of black bears in the northeastern United States. 24th Annual Conference of the Wildlife Society. Albuquerque, New Mexico. 26 September, 2017.
- Sun, C.C.** 2017. Black bears in New York: Research and Management. New York Conservation Council Fall Convention, Utica, NY, September 16, 2017.
- Sun, C.C.** 2017. Black Bears and Citizen Science in New York. National Active and Retired Federal Employees New York Chapter, Bath, NY, March 13, 2017.
- Sun, C.C.** 2017. Black Bears and Citizen Science in New York. 25th Annual Cornell Cooperative Extension Allegany County Rural Landowner Workshop. March 4, 2017.
- Sun, C.C. and A.K. Fuller.** 2017. Using Citizen Science in Wildlife Management. The Wildlife Society New York Chapter. Hamilton, NY, March 2, 2017.
- Sun, C.C., A.K. Fuller, J. A. Royle, and M. P. Hare.** 2017. Using Citizen Science in Wildlife Management. Department of Natural Resources, Cornell University, Graduate Student Association Symposium. January 19, 2017.
- Sztukowski L. et al. (**Sethi S.A.** 8th). Nearshore marine consumer responses to changing prey: combining quantitative and qualitative model input into a conceptual framework. AK Marine Science Symposium, Anchorage, AK. January 2017.
- Troncoso, J. et al. (**R. Márquez** 19th). 2017. Monitoreo del oso andino como herramienta de gestión de áreas protegidas. 25th Conference on bear research and management. International Bear Association, Quito.
- Wong, A.** 2017. Spatial Patterns in Density of Moose in a Heterogeneous Landscape. Cornell Department of Natural Resources Graduate Research Symposium. Ithaca, NY
- Wong, A.** 2017. Moose Population Estimation Using Spatial Capture-Recapture. New York State Department of Environmental Conservation Big Game Meeting. Albany, NY.

Wong, A., and **A.K. Fuller**. 2017. Moose density and connectivity in the Adirondacks. Adirondack Research Forum. Old Forge, NY. 1 March, 2017.

Wong, A. J.A. Royle, and **A.K. Fuller**. Novel application of adaptive sampling principles to spatial capture-recapture. 24th Annual Conference of the Wildlife Society. Albuquerque, New Mexico. 27 September, 2017.

THESES & DISSERTATIONS

Hagan, J. 2017. Assessing the accuracy of Landsat-derived stream temperature for use in juvenile salmonid habitat assessments on the Anchor River, Alaska. M.S. Thesis (Alaska Pacific University, Sethi co-advisor).

COURSES TAUGHT & GUEST LECTURES

Fuller, A.K. Decision Making for Natural Resource Management (NTRES 4940/6940), Spring 2017.

Fuller, A.K. Wildlife Ecology: How science and applied math are saving animal species. Conversation with a Scientist Seminar Series. Dryden High School. 30 May, 2017.

Fuller, A.K. The study of animal populations by capture-recapture. Cornell University student chapter of The Wildlife Society. 11 April, 2017.

Paufve, M.R. Guest lecture: Introduction to Ichthyology. Introductory Field Biology (NTRES 2100). November 7, 2017.

Perkins, K.A. Guest lecture: NY Coop Unit Data Archive. Advanced Fisheries Science (NTRES 6940). November 15, 2017.

Perkins, K.A. Guest lecture: Data Management. Advanced Fisheries Science (NTRES 6940). August 23, 2017.

Sethi, S. Advanced Fisheries Research Methods (NTRES 6940), Fall 2017.

Sethi, S. Guest lectures: 1) Multispecies fisheries harvest policies, 2) An overview of ecosystem based fisheries science: management and modeling, 3) Marine reserve fisheries management, Quantitative Ecology & Management of Fishery Resources (NTRES 4110/6110, instructor: Sullivan).

Sethi, S. Guest lecture: Global fisheries status update and trends, Introduction to Conservation Science (NTRES 2670, instructor: Rodewald).

Springer, V. Camera traps and what we can learn with them. Field Biology (NTRES 2100), Cornell University, Ithaca, NY. September 2017.

Sun, C.C. 2017. Noninvasive methods to estimating population sizes, Molecular Tools Ecology/Conservation (NTRES 4940).

ACTIVITIES

TECHNICAL ASSISTANCE AND OUTREACH

Fuller, A.K. Structured decision making process for waterfowl season setting. Includes multiple full-day meetings, conference calls, and a 1-day workshop with stakeholders held on June 17, 2017.

Fuller, A.K. Serve as a scientific advisor to the Breeding Bird Atlas steering committee, including multiple 1-day meetings.

Fuller, A.K. Participate in the moose working group with the New York State Department of Environmental Conservation, SUNY ESF, Wildlife Conservation Society, Cornell Animal Health Diagnostic Center, Biodiversity Research Institute, Adirondack Ecological Center.

Fuller, A.K. Hosted (jointly with E. Cooch) 1-week occupancy workshop and 3 day advanced occupancy workshop led by Darryl MacKenzie. March 13-22, 2017.

Sethi, S.A. Participated in a one day research consultation and technical review workshop at the NY Dept. of Environmental Conservation Rome Hatchery regarding broodstock management and fate of stocked trout.

Sethi, S.A. Participated in a 1 day workshop hosted by NYDEC (S. Hurst and W. Pearsall) at the Cornell Biological Field Station to identify goals and design considerations for Finger Lakes prey fish assessment.

Sethi, S.A. Assisting NY Dept. of Environmental Conservation Lake Ontario Unit with evaluation and testing of the Lake Ontario boater survey.

Sethi, S.A. Assisting NY Dept. of Environmental Conservation Regions 7-8 with design and evaluation of a forage fish gillnet-based survey for the Finger Lakes.

Sethi, S.A. Ongoing assistance with shortnose sturgeon research for the NY State Hudson River Estuary program.

TRAINING

Kelly Perkins

Modeling Patterns and Dynamics of Species Occurrence Course. Cornell University, Ithaca, NY, 14850. 13-17, 20-22 March 2017.

Workshops with the Cornell Statistical Consulting Unit: Bayesian Analysis, Design of Complex Surveys.

Vanessa Springer

Intergroup Dialogue Project. Cornell University, Ithaca, NY, 14850. 11-18 January 2017.

Modeling Patterns and Dynamics of Species Occurrence Course. Cornell University, Ithaca, NY, 14850. 13-17 March 2017.

Advanced Species Occurrence Modeling Course. Cornell University, Ithaca, NY, 14850. 20-22 March 2017.

Catherine Sun

Workshops with the Cornell Statistical Consulting Unit: Introduction to Meta-Analysis, Multivariate Analysis, Occupancy Modeling Workshop.

March 20-22, 2017: Modeling Patterns and Dynamics of Species Occurrence Advanced Course, Cornell University (Instructor: Darryl Mackenzie).

SERVICE

Angela Fuller

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

Faculty Advisory Board, Atkinson Center for a Sustainable Future (2014-2017)

Co-Chair, Faculty Advisory Board, Atkinson Center for a Sustainable Future (2017-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-present)

The Wildlife Society Leadership Institute Committee (2008-present)

Biometrics Working Group, TWS (2011-present)

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

Advisory Board, New York State Invasive Species Research Institute (2017-present)

Chair, Science Committee, New York Breeding Bird Atlas (2017-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)

Search committee member for NY Dept. of Environmental Conservation Lake Ontario Unit leader (2017)

Abraham Francis

Akwesasne Urban and Community Forest Management Planning Committee Member

Co-coordinator for Educational Conference: Building Blocks of Our Indigenous Foundation

Member of Mellon/Kieckhefer Proposal Evaluation Committee

Uncle and Member of Coordinating Committee for Ohero:kon

Co-Chair of Indigenous Graduate Student Association

Graduate and Professional Student Association Representative for the Department of Natural Resource Graduate Association

Matt Paufve

Department of Natural Resources Graduate Student Assembly, Secretary

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

Vanessa Springer

Grant Review Panelist, Andrew W. Mellon and Kieckhefer Adirondack Fellowship Grants (March 2017)

Graduate Mentor, Doris Duke Conservation Scholars Program, Cornell University

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

Secretary, Department of Natural Resources Graduate Student Association, Cornell University

Catherine Sun

Reviewer for The Journal of Wildlife Management, Journal of Fish and Wildlife Management and Mammalian Biology

Alec Wong

DNR Graduate Student Association Webmaster

AWARDS & RECOGNITION

Angela Fuller

Fellow, The Wildlife Society, a lifetime designation in recognition of exceptional service to the wildlife profession. September, 2017.

Abraham Francis

Francis, Abraham: Cobell Scholarship

American Indian and Graduate Center Fellowship

American Indian and Indigenous Studies Program – Summer Research Funding

Lawrence Palmer Scholarship

Vanessa Springer

Research and Conservation Grant (\$10,000), International Association for Bear Research and Management, 2017

Latin American Studies Fellow (\$500 stipend), Latin American Studies Program, Cornell University, 2017-2018

Conference Travel Grant (\$1,000), International Association for Bear Research and Management, 2017

Conference Travel Grant (\$675), Graduate School, Cornell University, 2017

Conference Travel Grant (\$500), Latin American Studies Program, Cornell University, 2017

Catherine Sun

Best Student Presentation Award, DNR GSA Annual Research Symposium

PRESS

Matt Paufve

USGS Great Lakes Science Center Highlights. May 15-19, 2017. Significant Collaborative Research or Science-Support Activities: Assessing cisco egg-rearing habitat in Thunder Bay, Lake Superior.

Catherine Sun

Cornell Daily Sun article. Available at: [Citizen Scientists Lead Wildlife Conservation Effort with New App](#). September 25, 2017.

Locally sourced science radio interview, WRFI. Aired June 25, 2017.

Fox 40 News article. Available at: <http://www.wicz.com/story/35616042/how-you-can-help-researches-with-black-bear-data>. June 7, 2017.

Radio interview, WNBF. Aired May 5, 2017.

Alec Wong

PBS short (<https://mountainlake.org/moose-poop-sniffing-dogs/>). Mountain Lake Journal. Aired August 18, 2017.

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 (fisheries)

New York Cooperative Fish and Wildlife Research Unit

2018 Update

NEW STAFF

Ben Augustine, Postdoctoral Scientist (Fuller)
Jennifer Brazeal, Postdoctoral Scientist (Fuller)
Meadhbh Moriarity Ph.D. visiting Fulbright Fellow from Ulster University (Sethi)
Jenni Poutanen, Ph.D. visiting student from University of Turku, Finland (Fuller)
Juan Carlos Jeri Vidal, Research Experience for Peruvian Undergrads (Fuller)

TEACHING AND GUEST LECTURES

Fuller

Topics in Design and Analysis of Camera Trapping Studies, Cornell University, Spring, 2018.

Guest lecture, "Structured Decision Making for Natural Resource Management." Principles and Practices of Applied Wildlife Science (NTRES 4280/6280). Cornell University. April 24, 2018.

Sethi

Controversial Conservation Topics (NTRES 6140), Cornell University, Fall 2018

Guest lecture, "As if it wasn't already hard enough: dealing with imperfect detection in ecological data," Alaska Pacific University Summer Field Course.

NEW GRADUATE STUDENTS

Taylor Brown, M.S./Ph.D. (Sethi)
Santiago Garcia, Ph.D. student (Fuller)

NEW GRADUATE STUDENT COMMITTEES

Sethi

Elizabeth Duskey, Ph.D., Cornell University
Sebastian Heilpern, Ph.D., Columbia University

NEW COMMITTEES/PROFESSIONAL SERVICES

Fuller

Associate Editor, PLoS ONE
Chair, Faculty Advisory Board, Atkinson Center for a Sustainable Future
Chair, The Wildlife Society Nominating Committee (to nominate candidates for President of the National Society), The Wildlife Society
Chair, New York State Breeding Bird Atlas Design and Analysis Committee
Advisory Board, New York State Invasive Species Research Institute
Search Committee, Senior Director of Strategic Partnerships, Atkinson Center for a Sustainable Future
Co-Chair, Sampling Design & Analysis Committee, New York Mammal Atlas

TECHNICAL ASSISTANCE, OUTREACH, AND WORKSHOPS

Fuller

Ongoing support of NYSDEC structured decision making process for waterfowl season setting.

Assist NYSDEC in designing a fisher sampling protocol to evaluate the effects of a new fisher trapping season.

Moose Scenario Planning Workshop, Minnowbrook Conference Center. June 29, 2018 - June 30, 2018.

NYS invasive species priority setting structured decision making workshop. ILR conference center, Cornell University. 21 March, 2018.

Structured Decision Making Workshop - Elk Management in Alberta. Alberta Environment and Parks. Canmore, Alberta. August 1, 2018 - August 3, 2018.

USGS Research Grade Evaluation (RGE) panel, Fall 2018

Structured Decision Making Short Course. Alberta Environment and Parks. Canmore, Alberta. July 30, 2018 - July 31, 2018.

Spatial Capture-Recapture Workshop. Alaska Department of Fish and Game and U.S. Fish and Wildlife Service. Juneau, Alaska. August 13, 2018 - August 17, 2018.

Spatial Capture-Recapture Workshop. Banff Center for the Arts, Banff, Alberta, Canada. March 12, 2018 - March 15, 2018.

Sethi

Participated in two 1-day research consultations with NY DEC senior fisheries staff to identify research needs for Finger Lakes fisheries assessment and management, Rome Hatchery, Rome NY.

Assisting in the design, implementation, and monitoring of Cisco, *C. artedi*, reintroduction into Keuka Lake. A joint collaboration with Region 8 DEC, USGS Tunison, and the NYCFWRU.

Ongoing assistance with NY Dept. of Environmental Conservation Regions 7-8 with design and evaluation of a forage fish gillnet-based survey for the Finger Lakes.

Ongoing assistance with shortnose sturgeon research for the NY State Hudson River Estuary program.

PUBLICATIONS

Published 2018

Calvert J, McGonigle C, **Sethi SA**, Harris B, Quinn R, Grabowski J. (2018) Dynamic occupancy modelling of temperate marine fish in area-based closures. *Ecology and Evolution* 8: 10192-10205.

Decker, D.J., J.F. Organ, A.B. Forstchen, M.V. Schiavone, and **A.K. Fuller**. 2018. Wildlife management is science based: myth or reality? *The Wildlife Professional* 12(4): 30-32.

Miller, J.R.B., R.T. Pitman, G.K.H. Mann, **A.K. Fuller**, and G.A. Balme. 2018. Lions and leopards coexist without spatial, temporal or demographic effects of interspecific competition. *Journal of Animal Ecology* 87: 1709-172. DOI: 10.1111/1365-2656.12883

Royle, J.A., **A.K. Fuller**, and C. Sutherland. 2018. Unifying population and landscape ecology with spatial capture-recapture. *Ecography* 41: 444-456. doi: 10.1111/ecog.03170

Shi Q, Garcia R, Flecker A, **Sethi SA**, Gomes C. 2018. Efficiently optimizing for dendritic connectivity on tree-structured networks in a multi-objective framework. *Conference on Computation and Sustainable Society* 2018.

Sethi SA, Bradley C, Harris F. 2018. Separate tagging versus capture impacts on chum salmon (*Oncorhynchus keta*) freshwater spawning migration travel time performance? *Fisheries Management and Ecology* 25: 296-303.

Sutherland, C., **A.K. Fuller**, J.A. Royle, and S. Madden. 2018. Large-scale variation in density of an aquatic ecosystem indicator species. *Scientific Reports*. DOI:10.1038/s41598-018-26847-x

Winemiller K, Fujiwara M, Cunha E, Agostinho A, Gomes LC, Flecker AS, **Sethi SA**. 2018. Designer flows for the Tonle Sap—good idea but wrong recommendation. *Science: eLetter*, March 5, 2018.

Wu X, Gomes-Selman J, Shi Q, Yexiang Xue, Garcia R, Anderson E, **Sethi SA**, Steinschneider S, Flecker A, Gomes C. 2018. Efficiently approximating the pareto frontier: hydropower dam placement in the Amazon basin. *Proceedings of the Thirty-Second AAAI Conference on Artificial Intelligence*.

IN PRESS

Pendleton R, Standley CR, Higgs AL, Kenney GH, Sullivan PJ, **Sethi SA**, Harris B. Acoustic telemetry and benthic habitat mapping informs the spatial ecology of Shortnose Sturgeon in the Hudson River, NY, USA. *Transactions of the American Fisheries Society*.

Sethi SA, Larson W, Turnquist K, Isermann D. Estimating the number of contributors to DNA mixtures provides a novel tool for ecology. *Methods in Ecology and Evolution*.

Wolf N, Harris B, Richard N, **Sethi SA**, Lomac-MacNair K, Parker L. High-frequency aerial surveys inform the seasonal distribution of Cook Inlet beluga whales. *Wildlife Society Bulletin*.

MANUSCRIPTS IN REVISION

Fabiano, E., C. Sutherland, **A.K. Fuller**, E. Eizirik, and L. Marker. Trends in cheetah (*Acinonyx jubatus*) density in north-central Namibia. *Population Ecology*.

Fuller, A.K., D.J. Decker, M. Schiavone, A. Forstchen. Ratcheting up rigor in wildlife decision making. *Wildlife Society Bulletin*.

Gomes, C., T. Dietterich, C. Barrett, J. Conrad, B. Dilkina, S. Ermon, F. Fang, A. Farnsworth, A. Fern, X Fern, D. Fink, D. Fisher, A. Flecker, D. Freund, **A. Fuller**, J. Gregoire, J. Hopcroft, S. Kelling, Z. Kolter, W. Powell, N. Sintov, J. Selker, B. Selman, D. Sheldon, D. Shmoys, M. Tambe, W. Wong, C. Wood, X. Wu, Y. Xue, A. Yadav, A. Yakubu, and M. Zeeman. Computational Sustainability: Computing for a Better World and a Sustainable Future. *Communications of the ACM (Association for Computing Machinery)*.

Gupta, A., B. Dilkina, D.J. Morin, **A.K. Fuller**, J.A. Royle, C. Sutherland, and C. Gomes. Optimizing Functional Connectivity and Density in Protected Areas using Spatial Capture-Recapture Based Conservation Objectives. *Conservation Biology*.

Robinson, K.F., **A.K. Fuller**, R.C. Stedman, W.F. Siemer, and D.J. Decker. Decision making in coupled human-natural systems: challenges and opportunities. *Environmental Management*.

MANUSCRIPTS IN REVIEW

Fitzgerald T, Higgins P, Quilligan E, **Sethi SA**, Tobin J. Catalyzing fisheries conservation investments. *Frontiers in Ecology and the Environment*.

Murphy RD, Hagan J, Harris BP, **Sethi SA**, Smeltz TS. Correcting Landsat thermal imagery to characterize water temperatures in small streams. *Remote Sensing of Environment*.

Paufve M, **Sethi SA**, Lantry BF, Weidel B, Rudstam L. Assessing the spawning ecology of fish in situ using a benthic pump sampler. *Fisheries Research*

Rice A, Fujita R, **Sethi SA**, Warren J, Ingles J, Flores J, Cusack C. Unique life history of a resident sardine school drives ecotourism on a Philippine reef. *Coral Reefs*.

Rose C, Nielsen J, Gauvin J, Loher T, **Sethi SA**, Seitz A, Courtney M, Drobny P. Pacific halibut (*Hippoglossus stenolepis*) survivals after release from trawl catches through expedited sorting: Deploying advanced tags in quantity (160) reveals patterns in survival outcomes. *Canadian Journal of Fisheries and Aquatic Sciences*.

Smeltz TS, Harris B, Olson J, **Sethi SA**. A discrete time seascape model to support management of benthic habitat impacts from fishing. *Canadian Journal of Fisheries and Aquatic Sciences*.

Sun, C.C., **A.K. Fuller**, and J.A. Royle. Incorporating citizen science data in spatially explicit integrated population models. *Ecology*.

Sun, C.C., **A.K. Fuller**, and J.E. Hurst. Citizen science data enhance spatio-temporal extent and resolution of animal population studies. *Journal of Wildlife Management*.

Wong, A., **A. K. Fuller**, and J.A. Royle. Adaptive Sampling for Spatial Capture-Recapture: An efficient sampling scheme for rare or patchily distributed species. *Ecology*.

Wong, A., **A. K. Fuller**, and J.A. Royle. Quantification of moose (*Alces alces*) population from scat counts made by detection dogs. *Ecology*

GRADUATE STUDENT THESIS/DISSERTATION

Springer, Vanessa. Occupancy and co-occurrence dynamics of carnivores in the Ecuadorian Andes. M.S. December, 2018. (advisor: Fuller)

Wong, Alec. Methodologies for abundance estimation of moose (*Alces alces*) and other rare species. M.S. December, 2018. (advisor: Fuller)

PRESENTATIONS

Almeida, R., *et al.* (**S.A. Sethi** 6th). Dams and greenhouse gases: Is hydropower a green alternative in the Amazon? Congreso AQUATROP, Quito, Ecuador, July, 2018.

Fitzpatrick, K., **Sethi, S.A.** Predator-prey population dynamics model for Lake Ontario salmon management. NY Chapter American Fisheries Society, Cooperstown, NY, February, 2018.

Flecker, A., *et al.* (**Sethi, S.A.** 4th). Damming the Amazon: evaluating tradeoffs between hydropower and ecosystem services using a computation sustainability approach, Society for Freshwater Science, Detroit, MI, May, 2018.

Fuller, A.K. Panelist: Science in an unstable world: confronting old divides and the future of natural resources. Cornell University. January 19, 2018.

Fuller, A.K. Invited seminar. Functional connectivity conservation: linking Andean bear conservation and landscape-scale decision making. University of Maine. 29 October, 2018.

Lepak, J., *et al.* (**Sethi, S.A.** 2nd). The role of invasive Round Goby in the Great Lakes basin. NY Chapter American Fisheries Society, Cooperstown, NY, February, 2018.

Paufve, M., *et al.* (**Sethi, S.A.** 2nd). Characterizing the spawning and incubation habitat of Cisco *Coregonus artedii* in the Great Lakes. NY Chapter American Fisheries Society, Cooperstown, NY, February, 2018.

Paufve, M., *et al.* (**Sethi, S.A.** 2nd). Spawning and incubation habitat of Cisco (*Coregonus artedii*) in the Great Lakes,. International Association for Great Lakes Research, Toronto, Canada, June, 2018.

- Price Tack, J.L., **A.K. Fuller**, C. Brown-Lima, J. Dean, Q. Shi, and C. Gomes. Spatial optimization of invasive species management using structured decision making. The Wildlife Society 25th Annual Conference, Cleveland, OH. 10 October, 2018.
- Rose, C., *et al.* (**Sethi, S.A.** 4th). Monitoring survival of trawler deck-released pacific halibut using satellite reporting accelerometer tags. Alaska Marine Science Symposium, Anchorage, AK, January, 2018.
- Shi, Q., *et al.* (**Sethi, S.A.** 2nd). Fisheries connectivity optimization under Amazon hydropower proliferation, Computation Sustainability Net working group on Amazon Dams annual meeting, Miami, FL, March, 2018.
- Shi, Q., *et al.* (**Sethi, S.A.** 4th). Efficiently optimizing for dendritic connectivity on tree-structured networks in a multi-objective framework, Conference on Computing & Sustainable Societies, Menlo Park, CA, June, 2018.
- Sethi, S.A.**, *et al.* Regional and local drivers combine to structure mussel growth and mortality. Alaska Marine Science Symposium, Anchorage, AK, January, 2018.
- Sethi, S.A.** Life history informed watershed connectivity restoration: win-win investments into salmon ecology, Alaska Pacific University, Anchorage, AK (Invited), February, 2018.
- Sethi, S.A.**, *et al.* Rapid response for invasive waterweeds in temperate lakes: assessment of collateral ecological impacts from herbicide treatments. NY Chapter American Fisheries Society, Cooperstown, NY, February, 2018.
- Sethi, S.A.**, *et al.* DNA mixtures for ecology. Western Division American Fisheries Society, Anchorage, AK, May, 2018.
- Sethi, S.A.**, *et al.* Rapid response for invasive waterweeds in high latitude systems: assessment of collateral impacts from herbicide treatment. Western Division American Fisheries Society, Anchorage, AK, May, 2018.
- Sethi, S.A.**, *et al.* Characterizing the ecological niche of invasive round goby in inland lakes. International Association for Great Lakes Research, Toronto, Canada, June, 2018.
- Smeltz, S., **Sethi, S.A.**, Harris, B. A seascape scale fishing impacts model to assess tradeoffs between spatial closures and gear modifications. Alaska Marine Science Symposium, Anchorage, AK, January, 2018.
- Smeltz, S., *et al.* (**Sethi, S.A.** 2nd). A seascape scale fishing impacts model to assess tradeoffs between spatial closures and gear modifications. Western Division American Fisheries Society, Anchorage, AK, May, 2018.
- Smeltz, S., *et al.* (**Sethi, S.A.** 2nd). Seascape-level fishing impacts modeling to assess tradeoffs between spatial closures and gear modifications. International Council for Exploration of the Sea FTFB Working Group, Hirtshals, Denmark, June, 2018.

- Springer, V.L., **A.K. Fuller**, and E.G. Cooch. Spatial co-occurrence of Andean bears with puma and domestic dogs in Ecuador. The Wildlife Society 25th Annual Conference, Cleveland, OH. 9 October, 2018.
- Sun, C., **A.K. Fuller**, and J. Hurst. Black bear research and management in New York with iSeeMammals, a citizen science initiative. 74th Annual Northeast Fish and Wildlife Conference, Burlington, VT. (Invited). 16 April, 2018.
- Sun, C.C., **A.K. Fuller**, and J.A. Royle. Population level inferences improve with integration of opportunistic presence-absence data and systematic capture-recapture data. The Wildlife Society xth Annual Conference, Cleveland, OH. 9 October, 2018.
- Sutherland, C., J.A. Royle, and **A.K. Fuller**. Statistical inference about landscape connectivity from animal telemetry data. The Wildlife Society 25th Annual Conference, Cleveland, OH. 10 October, 2018.
- Walsh, P., *et al.* (**Sethi, S.A.** 2nd). Estimating denning date of wolves with daily movement and GPS location fix failure, Alaska Chapter of the Wildlife Society, Anchorage, AK, March, 2018.
- Wong, A., **A.K. Fuller**, J.A. Royle. Novel application of adaptive sampling principles to spatial capture-recapture. International Statistical Ecology Conference. St Andrews, Scotland. 5 July, 2018.
- Wong, A., **A.K Fuller**, J.A. Royle, J. Hurst. Obstacles to genetic analysis of moose using fecal samples. 74th Annual Northeast Fish and Wildlife Conference, Burlington, VT. 17 April, 2018.
- Wong, A., **A. K. Fuller**, J.A. Royle. Modeling point pattern data from GSP logs of mobile detectors. The Wildlife Society 25th Annual Conference, Cleveland, OH. 9 October, 2018.