

NEW YORK COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT



2020

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 photo: Clockwise starting from upper left: Angela Fuller, Ben Augustine, and research team using detection dogs to survey vineyards for invasive spotted lanternfly; Kimberly Fitzpatrick filtering lake water for Cisco eDNA in Keuka Lake; NTNC field technician tracing leopard pug-mark in Nepal; Suresh Sethi and DEC staff preparing to sample Keuka lake for Cisco eDNA.

New York Cooperative Fish and Wildlife Research Unit

2020 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

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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. Dr. Angela Fuller became the new Assistant Unit Leader-Wildlife in 2009, and assumed the Unit Leader position in 2014.

We engage in research collaborations 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

VALERIE HIPKINS, 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 FULLER, UNIT LEADER, WILDLIFE



SURESH SETHI, ASSISTANT LEADER, FISHERIES



STEVE GRODSKY, ASSISTANT LEADER, WILDLIFE



Staff

MELANIE MOSS
ADMINISTRATIVE ASSISTANT



KELLY PERKINS
RESEARCH SUPPORT SPECIALIST



Postdoctoral Scientists

BEN AUGUSTINE



JENNIFER BRAZEAL



COLLABORATORS

Tom Allgaier, New York State Department of Agriculture & Markets

Jose Andres, Cornell University

Meredith Bartron, U.S. Fish and Wildlife Service

Bill Beatty, U.S. Fish and Wildlife Service

Tom Bell, New York State Department of Environmental Conservation

Carrie Brown-Lima, Cornell University

Jessica Cancelliere, New York State Department of Environmental Conservation

Lance Clarke, New York State Department of Environmental Conservation

Lisa Cleckner, Finger Lakes Institute

Mike Connerton, New York State Department of Environmental Conservation

Chris Cusack, Environmental Defense Fund

Jennifer Dean, New York Natural Heritage

Daniel Decker, Cornell University

Andrew Deutz, The Nature Conservancy

Bistra Dilkina, University of Southern California

Glen Dowell, Cornell University

Jim Eckler, New York State Department of Environmental Conservation

Steve Ellner, Cornell University

James Farquhar, New York State Department of Environmental Conservation

Alex Flecker, Cornell University

Jacqui Frair, SUNY Environmental Science Forestry
Dave Garshelis, Minnesota Department of Natural Resources
Martin Gilbert, Cornell University
Isaac Goldstein, Wildlife Conservation Society
Carla Gomes, Cornell University
Ann Hajek, Cornell University
Brad Hammer, New York State Department of Environmental Conservation
Brad Harris, Alaska Pacific University
Mark Henderson, California Cooperative Fisheries Research Unit
Steve Heerkens, New York State Department of Environmental Conservation
Amanda Higgs, 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
Aimee Hurt, Working Dogs for Conservation
Dan Isermann, Wisconsin Cooperative Fisheries Research Unit
Randy Jackson, Cornell University
Paul Jensen, New York State Department of Environmental Conservation
Karim Kassam, Cornell University
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
Patrick Lemons, U.S. Fish and Wildlife Service
Chris Legard, New York State Department of Environmental Conservation
Jesse Lepak, NY Sea Grant
Greg Loeb, Cornell University
Abby Lynch, U.S. Geological Survey
Chris McGonigle, Ulster University
Jim McKenna, U.S. Geological Survey
Steve Morreale, Cornell University
Adrianna Muir, The Nature Conservancy

Web Pearsall, New York State Department of Environmental Conservation
Manuel Peralvo, CONDESAN
Brian Rahm, NY Water Resources Institute, Cornell University
Roxanne Razavi, SUNY-ESF
Aaron Rice, Cornell University
Wayne Richter, New York State Department of Environmental Conservation
Amanda Rodewald, Cornell University
Linda Rohleder, New York-New Jersey Trail Conference
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 Stickle, New York State Department of Environmental Conservation
Josh Stiller, New York State Department of Environmental Conservation
Patrick Sullivan, Cornell University
Laura Thompson, U.S. Geological Survey
John Tobin, Cornell University
Nina Therkildsen, Cornell University
Theodore Toombs, Environmental Defense Fund
James Watkins, Cornell University
Brian Weidel, U.S. Geological Survey Lake Ontario Biological Field Station
Steven Wolf, Cornell University

EDUCATION

GRADUATE STUDENTS



**TAYLOR BROWN, M.S. and Ph.D.,
Natural Resources, (ADVISOR: SETHI)**



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



**SANTIAGO GARCIA, Ph.D., Natural
Resources, (ADVISOR: FULLER)**



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



SHAWSHANK POUDEL, PH.D., Natural Resources, (ADVISOR: FULLER)



TRISHNA RAYAMAJHI, M.S., Natural Resources, (ADVISOR: FULLER)



SCOTT SMELTZ, PH.D., NATURAL RESOURCES, (ADVISOR: SETHI)

RESEARCH CURRENT PROJECTS

Leveraging partial identity information to advance noninvasive genetic, remote camera, and bioacoustics sampling of animal populations



Investigators:
Angela Fuller (NYCFWRU)
J. Andrew Royle (USGS Patuxent)
Post doc:
Ben C. Augustine
Sponsors:
USGS John Wesley Powell Center for Analysis and Synthesis
Started:
March 2018

Ben Augustine is a postdoctoral fellow developing new statistical models to better utilize noninvasive detection data and improve demographic parameter estimates and the conservation decisions they inform.



Left: A fisher hair snare in NY. Hairs deposited on barbs are genotyped providing individual identity information.

Noninvasive methods for monitoring wildlife species such as hair or scat sampling, remote cameras, and bioacoustic monitoring, have allowed researchers to collect more abundant data across larger spatial scales than was previously possible. However, noninvasive sampling methods do not always provide an unambiguous determination of individual or species identity. This project has developed new statistical models to utilize partial and erroneous individual and species classifications from noninvasive data to better estimate parameters such as population density and species occupancy.

Multispecies occupancy of carnivores in New York



Investigators:
Angela Fuller (NYCFWRU)
Paul Jensen (NYSDEC)
Post doc:
Jennifer Brazeal
Sponsors:
NYSDEC
Started:
September 2018

Jennifer Brazeal is a post-doctoral researcher working closely with the New York State Department of Environmental Conservation (NYSDEC) on multiple projects involving distributions and densities of carnivores in New York. Using camera-trap data from multiple NYSDEC camera surveys that took place in the winters of 2013–2018, she developed multi-species occupancy models to evaluate distributions and interspecific interactions among sympatric eastern coyote (*Canis latrans*), fisher (*Pekania pennanti*), and American marten (*Martes americana*) in the Adirondack and Tug Hill regions of New York; and coyote, fisher, and red fox (*Vulpes vulpes*) in the southern tier of New York.

Right: American marten (top-left), fisher (top-right), red fox (bottom-left), and eastern coyote (bottom-right) images from NYSDEC camera trapping surveys (2013-2018).



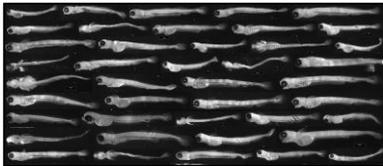
She also developed a multispecies occupancy model to estimate occupancies and species interactions at two different scales. She used this model to evaluate drivers of species spatial distributions.

Quantifying coregonine habitat use across space and time to inform assessment and restoration



Investigators:
Suresh Sethi (NYCFWRU)
Lars Rudstam (Cornell)
Brian Weidel (USGS GLSC)
MS/PhD Student:
Taylor Brown
Sponsors:
EPA Great Lakes Restoration Initiative
USGS Great Lakes Science Center
Started: June 2018

Coregonine fishes were historically the major components of native fish communities and fisheries in the Great Lakes. In Lake Ontario, only remnant populations of cisco (*Coregonus artedii*) and lake whitefish (*C. clupeaformis*) endured through anthropogenic impacts and remain severely reduced today. The spatial extent of contemporary coregonine spawning stocks and suitable habitat is a key knowledge gap for management and restoration.



Left: Coregonine larvae captured in Lake Ontario, Spring 2018

During the 2018 Cooperative and Science Monitoring Initiative and in collaboration with scientists and managers, potential spawning habitats lake-wide were surveyed to assess which habitats currently support coregonine spawning stocks and to identify environmental drivers of coregonine habitat use across life stages.

In December 2020, Taylor Brown successfully defended her master's thesis focused on describing the contemporary spatial extent and quantifying the environmental drivers of coregonine population distributions. This project contributes to a greater understanding of coregonine ecology and supports binational fisheries management in Lake Ontario.

Lake Ontario salmonid management risk assessment: refinement of predator/prey models



Investigators:
Suresh Sethi (NYCFWRU)
Steve Lapan (NYSDEC)
PhD Student:
Kimberly Fitzpatrick
Sponsors:
NYSDEC
Started:
August 2017

Kimberly is a PhD student supported by NYSDEC and collaborating with the Ontario Ministry of Natural Resources and Forestry and the USGS Great Lakes Science Center. She is working with Lake Ontario fisheries managers and researchers to develop statistical tools to support management decision making.

Right: Suresh and Kimberly assist James Watkins with a tagging a Chinook Salmon (Aug. 2019).



Fisheries management in Lake Ontario

requires managers balancing sport fish abundance, such as Chinook Salmon and Lake Trout, with the availability of Alewife. To quantify this predator-prey balance, we developed a multispecies model that links species dynamics together via predation. Subsequently, we are using this model to simulate potential future predator-prey dynamics under different management and ecological scenarios to inform strategic decision making.

Additionally, the model identified that data on the relative abundance of stocked and wild Chinook Salmon could reduce uncertainty in population estimates. To address this data need, we have begun working on a genetic technique for distinguishing between stocked and wild salmon in Lake Ontario.

3rd NY Breeding Bird Atlas design



Investigators:
Angela Fuller (NYCFWRU)
J. Andrew Royle (USGS)
Staff:
Kelly Perkins (Cornell)
Started:
April 2019

New York began its third Breeding Bird Atlas in 2020-2025 to collect data on bird distributions and status within the state. Lack of a formal survey design and documentation of atlasing effort limited inference on trends of avian distributions in New York in the previous atlases. We previously assessed occupancy designs for blocks to sample using eBird data to guide the committee in selecting a final design. Field data collection successfully commenced in 2020. The atlas block data being collected informs statewide avian distribution, but not abundance in a standardized way. We reviewed point count methodology from other recent atlases and provided recommendations for abundance sampling methods to the analysis committee; however, a decision was made to wait until there is funding to proceed with skilled technicians over volunteers. We continue to advise on the steering and methods committees and lead the analysis committee and provide feedback on data issues as they arise.



Can canines help protect New York's key agricultural crops from a new pest?

Investigators:
Angela Fuller (NYCFWRU)
Carrie Brown-Lima (Cornell)
Ann Hajak (Cornell)
Greg Loeb (Cornell)
Sponsors:
Cornell Atkinson Center for Sustainability
Started: September 2020

Spotted lanternfly (SLF), *Lycorma delicatula*, is a recently introduced invasive insect that has grown exponentially and caused severe ecological and economic impacts to agricultural production, particularly grapes, since it was first discovered in Pennsylvania in 2014. With the core infestation a mere 25 miles away from New York's borders, NYS agencies have mounted a response team with the objective to intercept SLF before it crosses into the state and to detect and eliminate any initial infestation before it grows beyond control. Human visual surveys are the most common search method employed, but can be ineffective due to the insect's cryptic nature and low density during early stages of infestation. Thus, innovative search methods are being tested to detect SLF presence including drones, environmental DNA (eDNA), and detection dogs. This work will test how detection dogs and occupancy modeling can be applied to address the complex task of early detection of SLF. The results of this study will directly inform search strategies that New York State employs and serve as a model for detecting other detrimental pests in other regions. Proof of concept studies of early detection methods inform practices that mitigate negative impacts of invasive species and protect the sustainability of agriculture and livelihoods in NYS and beyond.

Left: detection dog scouting for spotted lanternfly

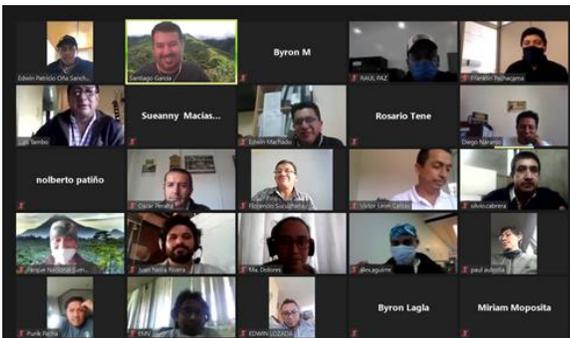
Spatial Risk Mapping: A Tool to Plan and Implement Human-Andean Bear Conflict Mitigation in Western Ecuador



Investigators:
 Angela Fuller (NYCFWRU)
 Richard Stedman (Cornell)
Student:
 Santiago Garcia, Ph.D.
Sponsors:
 SENESCYT
 Toward Sustainability Foundation
Started: Feb. 2019

We implemented an online human-wildlife conflict survey of protected areas managers, park rangers, and wildlife specialists from the protected area system in Ecuador. Using a Bayesian belief network model, we will develop a model to predict human-wildlife conflict occurrence, and evaluate which types of human-wildlife conflict are more frequent, and which species are involved. This survey was delivered to all personnel of the protected areas system of Ecuador (~700 people) in 58 protected areas. This research is carried out with the support of the Ministry of Environment of Ecuador.

Below: workshop with protected area managers and park rangers from Ecuador.



Conservation and management of Andean bears from regional to local scales: occupancy, connectivity, and threats.



Investigators:
 Angela Fuller (NYCFWRU)
 Dave Garshelis (MN DNR)
 Isaac Goldstein (ABCA)
PhD Student:
 Robert Marquez
Sponsors:
 WCS, ABCA
Started: Fall 2017

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. In Colombia, Ecuador, and Peru, non-protected areas have historically had 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 due to human-bear conflict. This research is evaluating the relationship between Andean bear presence, human-bear conflicts, human threats, and environmental variables to support effective conservation decision-making. We are investigating the relationship between real/perceived damage caused by Andean bears, farmers' attitudes toward bears, and bear poaching and landscape factors and species threats that contribute to regional Andean bear occupancy in Colombia, Ecuador, and Peru.



Left: Robert with Andean Bear Alliance

Living with Leopards: Implications of human-leopard interaction on food security and public health in the foothills of the Himalayas.



Investigators:
Angela Fuller (NYCFWRU)
Richard Stedman (DNRE, CCSS)
Martin Gilbert (Cornell-WHC)
Graduate Student:
Shashank Poudel
Sponsors: Cornell-ACS
Started: Sept. 2019

This project, funded by the Cornell-Atkinson Center for Sustainability’s academic venture fund, aims to investigate determinants and impacts of human-leopard interactions across the altitudinal gradient of human settlements and forests in Nepal. Different suits of field methods are being implemented to ascertain leopard occupancy, diet, and human dimensions of human-leopard conflict. The aim is to develop a policy document that will enable sustainable site-specific conflict management responses and promote local stewardship for the survival of leopards in human dominated landscapes.

Despite the ongoing pandemic, in October 2020 Shashank travelled to Nepal and conducted initial meetings with all project stakeholders. The necessary approval for field implementation of the project was also obtained from Government of Nepal in November. Field research activities for leopard occupancy and scat surveys are underway in six selected districts. It is expected that the ongoing data collection will be complete by May 2021 which will be followed by household surveys.

Occupancy study of Dhole (*Cuon alpinus*) in Parsa National Park, Nepal



Investigators:
Angela Fuller (NYCFWRU)
Martin Gilbert (Cornell)
Student:
Trishna Rayamajhi
Sponsors: Fulbright
Started: August 2019

Trishna Rayamajhi is a Fulbright scholar pursuing an MS degree.

Her research is focused on studying the occupancy of Asiatic wild dogs (*Cuon alpinus*), commonly known as dholes, in Nepal. Dholes, listed as an endangered species, are the top predators of the Asian tropical forest. Dholes are sympatric with tiger and leopards, yet they are the least studied species. In Nepal, the ecology and distribution of dhole are largely unknown, which is a major constraint in making effective conservation decisions.



Left: Camera-tapped image of Dhole in Parsa National Park, Nepal 2019

The project aims to understand the ecological factors (habitat characteristics, sympatric carnivores, prey species, and anthropogenic features) that contribute to the occurrence of dholes at a landscape scale. This study will provide a predicted probability of occupancy estimate and identify the factors contributing to dhole occurrence. Further, this information can be used to assess changes in dhole occupancy patterns over time. This study, as the first study of dhole ecology in lowland Nepal, will lay the foundation for establishing a long-term research program for this important species of conservation concern.

Evaluating the potential for DNA mixtures to inform fish and wildlife genetics applications

Investigators:

Suresh A. Sethi (NYCFWRU)
Jose Andres (Cornell)
Kara Andres (Cornell)
David Lodge (Cornell)

Sponsors:

USGS, U.S. Department of Defense

Started: August 2016



Left: Round goby, an invader to NY inland waters, provides a model organism for DNA mixtures.

In this project, we are extending methods developed in forensic criminology to analyze DNA mixtures. These approaches have the potential to extend eDNA sampling beyond presence-absence based inference to count-based inference that could inform the ecology and abundance of animal populations. Furthermore, this research is laying the groundwork to use eDNA samples to conduct population genetic work more broadly. Originally commencing with pilot funding from USGS, this project has continued and expanded through DoD funding awarded in 2019. In 2020, we successfully demonstrated that eDNA sampling could be used to count round gobies in a mesocosm experiment (i.e., fish in buckets). Furthermore, we demonstrated that eDNA samples showed high correlation between population-level genetic diversity inferred from conventional tissues samples. Combined, these results represent significant methodological advancements in genetics tools for fish and wildlife assessments.

Contaminant impacts on game fish from invasive round goby introductions

Investigators:

Suresh Sethi (NYCFWRU)
Lisa Cleckner (Finger Lakes Institute)
Randy Jackson (Cornell)
Jesse Lepak (NY Sea Grant)
Roxanne Razavi (SUNY-ESF)
Lars Rudstam (Cornell)

Sponsors:

NY State Water Resources Institute

Started: January 2019



Left: A round goby from Cayuga Lake, NY.

The invasive fish Round goby has expanded rapidly throughout the Great Lakes basin. Because round goby can quickly become abundant throughout invaded habitats, they may provide new energy, and thus new contaminant, pathways in invaded fish communities. In this project, we are assessing mercury levels in round goby and other prey fish in NY inland waterbodies and using bioenergetics modeling to forecast the potential impact of round goby introductions on top predator gamefish contaminant levels. In 2019, we ran Hg samples for fish collected throughout upstate NY and the lower Great Lakes. Round goby tended to have lower Hg levels than pelagic prey such as alewife, but their energy density is less such that their role in contaminant magnification will depend on how heavily predators rely on these new prey. These data were integrated into a fish bioenergetics model and used as a class project in a graduate seminar on fish bioenergetics taught by S.A. Sethi in 2020 (NTRES 6940). Initial results show that while round goby carry low Hg levels, because they are relatively energy poor, high reliance on these benthic invaders by Lake Trout could lead to bioaccumulation of contaminants.

Reintroduction of Cisco, *Coregonus artedii*, to Keuka Lake

Investigators:

Suresh Sethi (NYCFWRU)
Web Pearsall (NYSDEC)
Meredith Bartron (USFWS)
Marc Chalupnicki (USGS Tunison)
Brad Hammers (NYSDEC)
James McKenna (USGS Tunison)
Alex Koeberle (Cornell, PhD student)

Sponsors:

NY State Department of Environmental Conservation
USGS Cooperative Research Units National Program

Started: August 2018



Left: Tagged juvenile Cisco reared at NYDEC hatcheries are staged for reintroduction to Keuka Lake.

Cisco were formerly present in Keuka Lake; however, this native fish species was extirpated sometime in the late 20th century. Recently, Keuka Lake has experience both nutrient input declines and warming water temperatures that may alter prey fish populations. In an effort to promote lake resiliency, we are collaborating with the NYSDEC, USGS Tunison Labs, and USFWS Lamar Fish Center to reintroduce a self-sustaining population of Cisco to provide a resilient, oligotrophic-adapted forage species. In 2020, we successfully stocked and tracked a third cohort of stocked Cisco and conducted two eDNA sampling events. We also recruited a PhD student who will matriculate in Jan. 2021. Finally, in 2020 we submitted a manuscript on juvenile Coregonine tagging methods. Moving forward with support from NYSDEC, this project is expanding into a PhD level portfolio that will advance assessment tools for juvenile stocked fish using acoustic tags and eDNA as well as to develop foodweb models to forecast lake change implications for forage fish for NY inland waters.

Climate adaptation strategies for fishing communities

Investigators:

Suresh Sethi (NYCFWRU)
Adrianna Muir (The Nature Conservancy)
Alex Flecker (Cornell)
Carla Gomes (Cornell)
Brad Harris (Alaska Pacific University)
John Tobin (Cornell)
Franz Simon (Cornell postdoc)

Sponsors:

Cornell Atkinson Center for Sustainability
The Nature Conservancy

Started: April 2020



Left: Commercial fishing communities are facing high risk exposure to

Climate change is advancing rapidly in high latitude oceans leading to shifting marine species distributions, and impacting fish population productivity and variability. Adaptation options for fishers and fishing communities to respond to climate-driven changes in marine species dynamics, such as diversifying fishing opportunities or changing fishery supply chains, fundamentally require continued physical and legal access to fisheries. Here we seek to address a key sustainability challenge for fisheries-reliant communities: How can communities maintain access to commercial fishing resources in the face of climate-driven ocean changes? In this collaboration, we will combine marine ecology, fisheries science, and computer science to assess optimal fishing portfolios robust to climate change. Results from this work will inform fishing community adaptation strategies and inform regulators about potential obstacles to allocating fishing access in response to changing oceans.

Managing for long term sustainability of seafood production from bottom tendered wild capture fisheries



Phd Candidate:

T. Scott Smeltz

Investigators:

Suresh Sethi (NYCFWRU)

Pat Sullivan (Cornell)

Miguel Gomez (Cornell)

Brad Harris (Alaska Pacific University)

Sponsors:

Atkinson Center for a

Sustainable Future

The Groundfish Forum

At-Sea Processors

NOAA

Started: January 2017

Scott Smeltz is working to develop tools to help fisheries managers better manage seafloor impacts. The cornerstone of his work has been developing the 'Fishing Effects' model, a quantitative tool to assess habitat impacts from commercial fishing at seascape scales. The model has been adopted by federal fisheries in both the North Pacific and New England regions to meet their Essential Fish Habitat requirements under 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.



Left: Mr. Smeltz fishing in Resurrection Bay, AK for captive halibut *Ichthyophonus* research.

Over the last year, Mr. Smeltz has been expanding his work to implement the Fishing Effects model globally. He is taking an expanded perspective to evaluate how habitat management policies such as gear modifications and marine reserves may help mitigate seafloor impacts yet are often accompanied by unintended tradeoffs.

PUBLICATIONS AND PRESENTATIONS

JOURNAL ARTICLES

- Andres, K., **S.A. Sethi S.A.**, E. Duskey, J.M. Lepak, A.N. Rice, B. Estabrook, K. Fitzpatrick, E. George, B. Marcy-Quay, M. Pauve, K. Perkins, A.E. Scofield. 2020. Seasonal habitat use indicates depth may mediate the potential for invasive round goby impacts in inland lakes. *Freshwater Biology* 65:1337-1347.
- Augustine, B.C.**, M. Kery, P. Mollet, J. Olano Marin, G. Pasinelli, and C. Sutherland. 2020. Sex-specific-population dynamics and demography of capercaillie (*Tetrao urogallus L.*) in a patchy environment. *Population Ecology*, 62: 80-90.
- Augustine, B.C.**, J. A. Royle, D.W. Linden, and **A.K. Fuller**. 2020. Spatial proximity moderates genotyping uncertainty in genetic tagging studies. *Proceedings of the National Academy of Sciences*, 117: 17903-17912.
- Beatty, W.S., P.R. Lemons, **S.A. Sethi**, J. Everett, C.J. Lewis, R.J. Lynn, G.M. Cook, J.L. Garlich-Miller, J.K. Wenburg. 2020. Panmixia in a sea ice-associated marine mammal: evaluating genetic structure of the Pacific walrus (*Odobenus rosmarus divergens*) at multiple spatial scales. *Journal of Mammalogy* 101:755-765.
- Cook, G.M., D.J. Prince, S.M. O'Rourke, T.L. King, M.R. Miller, C.J. Lewis, M.S. Eackles, P.R. Lemons PR, **S.A. Sethi**, J.B. Olsen, J.K. Wenburg. 2020. A little SNP of this, a little SNP of that: the discovery of 116 single nucleotide polymorphism markers to enable the rapid identification of individual Pacific walrus (*Odobenus rosmarus divergens*). *Conservation Genetics Resources* 12:555-565.
- Fabiano, E., C. Sutherland, **A. Fuller**, E. Eizirik, and L. Marker. 2020. Trends in cheetah (*Acinonyx jubatus*) density in north-central Namibia. *Population Ecology* 62(2):233-243.
- Fitzgerald, T., P. Higgins, E. Quilligan, **S.A. Sethi**, J. Tobin. 2020. Catalyzing fisheries conservation investment. *Frontiers in Ecology and the Environment* 18:151-158
- Fuller, A.K.**, D.J. Decker, M. Schiavone, A. Forstchen. 2020. Ratcheting up rigor in wildlife decision making. *Wildlife Society Bulletin* 44(1):29-41.
- Fuller, A.K.**, and L.M. Lai. 2020. A decision analytic approach for optimal surgical treatment in early-stage breast cancer. 2020 Annual Meeting Official Proceedings, Volume XXI. *Annals of Surgical Oncology* 27:254-255.
- Jimenez, J., **B.C. Augustine**, D.W. Linden, R.B. Chandler, and J.A. Royle. 2020. Spatial capture-recapture with random thinning for unidentified encounters. *Ecology and Evolution*, <https://doi.org/10.1002/ece3.7091>.

Marcy-Quay, B., S.A. **Sethi**, N.O. Therkildsen, C.E. Kraft. 2020. Expanding the feasibility of fish and wildlife assessments with close-kin mark-recapture. *Ecosphere* 11:e03259.

Moriarty, M., S.A. Sethi, D. Pedreschi, **T.S. Smeltz**, C. McGonigle, B.P. Harris, N. Wolf, Greenstreet SPR. 2020. Combining fisheries surveys to inform marine species distribution modelling. *ICES Journal of Marine Science* 77:539-552.

Paufve, M.P., **S.A. Sethi**, L. Rudstam, B.C. Weidel, B.F. Lantry, M. Chalupnicki. 2020. Differentiation between Lake Whitefish and Cisco eggs based on diameter. *Journal of Great Lakes Research* 46:1058-1062.

TECHNICAL OR POPULAR ARTICLES

Deutz A., G.M. Heal, R. Niu, E. Swanson, T. Townshend, L. Zhu, A. Delmar, A. Meghji, **S.A. Sethi**, J. Tobin. 2020. Financing nature: closing the global biodiversity financing gap. The Paulson Institute, The Nature Conservancy, and the Cornell Atkinson Center for Sustainability, 256pp.

PRESENTATIONS AND SEMINARS

Almeida, R. et al. (**S.A. Sethi** 12th), Future Amazon hydropower under climate change, AGU Annual Meeting, virtual conference, December 2020.

Andres, K.J. et al. (**S.A. Sethi** 2nd), Is environmental DNA ready for population genetics? Estimating genetic diversity and absolute abundance of an invasive species with nuclear eDNA, Ecological Society of America Annual Meeting, virtual conference, August 2020.

Augustine, B.C., J.A. Royle, and **A.K. Fuller**. 2020. Cluster spatial capture-recapture models for autonomous recording units. The Wildlife Society 27th Annual Conference. Virtual.

Augustine, B.C., J.A. Royle, D.W. Linden, and A.K. Fuller. Spatial capture recapture with genotyping error. Virtual International Statistical Ecology Conference. June 22, 2020.

Brazeal, J.A., and **A.K. Fuller**. 2020. A multiscale, multispecies occupancy model: Investigating spatial and temporal species use and interactions. Virtual International Statistical Ecology Conference.

Brown T.A. Contemporary spatial extent and environmental drivers of larval coregonine distributions across Lake Ontario. MS Thesis Defense Public Seminar. Virtual. November 2020.

Brown, T. et al. (**S.A. Sethi** 2nd), Contemporary spatial extent and environmental drivers of larval *Coregonine* distributions across Lake Ontario, NY American Fisheries Society Annual Meeting, Lake Placid, NY, February 2020.

- Fitzpatrick, K.B.** et al. (**S.A. Sethi** 2nd), Predator-prey population dynamics modeling for Chinook salmon and alewife in Lake Ontario, NY American Fisheries Society Annual Meeting, Lake Placid, NY, February 2020.
- Fitzpatrick, K.B.** et al. (**S.A. Sethi** 11th), Balancing predator consumption and prey availability in an intensively managed fishery: a multispecies statistical catch-at-age model for Lake Ontario, American Fisheries Society annual meeting, virtual conference, September 2020.
- Fitzpatrick, K.B.**, S.R. LaPan, L.G. Rudstam, P.J. Sullivan, B.C. Weidel, **S.A. Sethi**. 2020. Predator-prey population dynamics model for Lake Ontario salmon management. Poster. Cornell Department of Natural Resources Research Symposium. Ithaca, NY. January 17, 2020.
- Flecker, A.S. et al. (**S.A. Sethi** 6th), Navigating tradeoffs between hydropower proliferation and ecosystem services across the Amazon basin using a computational sustainability approach, Ecological Society of America Annual Meeting, virtual conference, August 2020.
- Fuller, A.K.** Review of Classification Ideas in Ecology. Presentation at Powell Center Working Group Meeting. May 20, 2020. Virtual. (Invited)
- Fuller, A.K.**, D.J. Decker, M.J. Schiavone, and A.B. Fortchen. 2020. Ratcheting up Rigor in Wildlife Management Decision Making. Invited talk in special symposium, "Trending... A TWS Journal Spotlight on the Most Downloaded Papers of 2020". The Wildlife Society 27th Annual Conference. Virtual. (invited)
- Fuller, A.K.**, and L.M. Lai. 2020. A decision analytic approach for optimal surgical treatment in early-stage breast cancer. The American Society of Breast Surgeons 21st Annual Meeting.
- Fuller, A.K.** 2020. New York's Adirondack Moose Population. Moose, Disease, and Climate Workshop. Virtual. (Invited)
- Garcia, S.**, **A.K. Fuller**, and R.C. Stedman. Spatial Risk Mapping to mitigate human-Andean Bear conflict in the Western Ecuadorian Andes. New York Chapter, The Wildlife Society's 2020 Annual Meeting. Syracuse, NY.
- Marcy-Quay, B. et al. (**S.A. Sethi** 2nd) Expanding the feasibility of fish and wildlife assessments with close-kin mark-recapture, NY American Fisheries Society Annual Meeting, Lake Placid, NY, February 2020.
- Sethi, S.A.** et al., Closing the global biodiversity conservation funding gap, Invited seminar, Cornell Biological Field Station, September 2020.
- Sethi, S.A.** et al., Financing nature, Ecological Society of America Annual Meeting, virtual conference, August 2020.
- Sethi, S.A.** The changing beauty of Alaskan ecosystems, invited lecture at Kendal Retirement Center, Ithaca, NY, February 2020.

- Shi, Q. et al. (**S.A. Sethi** 9th), Efficiently approximating the Pareto frontier in multi-objective optimization problems: Insights from hydropower dam placement in the Amazon Basin,” Ecological Society of America Annual Meeting, virtual conference, August 2020.
- Smeltz, T.S.** et al. (**S.A. Sethi** 2nd), The global habitat cost of wild seafood production: solutions to overcome these tradeoffs, Alaska Marine Science Symposium, Anchorage, AK, January 2020.
- Tobin, J. et al. (**S.A. Sethi** 2nd), Financing Nature: expert discussion of mechanisms and milestones, Invited keynote presentation, Cornell Atkinson Center for Sustainability, online distributed platform, October 2020.
- Watkins, J. et al (**TA Brown** 2nd). Capacity of zooplankton prey for supporting coregonid restoration efforts. NY Chapter of the American Fisheries Society Annual Meeting. February 2020.

THESES & DISSERTATIONS

- Brown, T.** 2020. Contemporary spatial extent and environmental drivers of larval coregonine distributions across Lake Ontario. M.S. Thesis, Cornell University, Ithaca, NY (Advisors: Sethi and Rudstam).

COURSES TAUGHT & GUEST LECTURES

- Fuller, A.K.**, Decision Making for Natural Resources, Spring 2020.
- Fuller, A.K.**, Structured Decision Making for Natural Resource Management. Invited guest lecture in Principles and Practices of Applied Wildlife Science (NTRES 4280/6280). Cornell University.
- Sethi, S.A.** Bioenergetics modeling for aquatic organisms: theory and applications (NTRES 6940), Spring 2020.
- Smeltz, T.S.** Fishing impacts to the seafloor: tradeoffs and solutions. Guest lecture for Opportunities for Lifelong Education. Anchorage, AK. 21 February 2020.

ACTIVITIES

TECHNICAL ASSISTANCE AND OUTREACH

Angela Fuller

Developed and implemented a camera-trap survey design to estimate occupancy of fishers in southern New York

New York Mammal Atlas Steering Committee

Chair, New York Breeding Bird Atlas Design and Analysis Team

New York Breeding Bird Atlas Steering Committee

Guide New York State Department of Environmental Conservation in a Structured Decision Making Process Regarding Waterfowl Season Setting

Suresh Sethi

Assisted in the design, implementation, and monitoring of Cisco, *C. artedi*, reintroduction into Keuka Lake. This project includes developing novel survival assessment tools and validating eDNA tools for monitoring forage fish stocks. A joint collaboration with Region 8 DEC, USGS Tunison Aquatic Labs, USFWS NE Fisheries Center, and the NY Cooperative Research Unit.

Continued participation on the Lake Ontario Technical Committee and coordination on Lake Ontario Chinook Salmon-alewife prey fish stock assessment.

Served as an appointed member to the Council of Lakes joint U.S.-Canada Coregonine Population Viability working group. The group met three times in 2020, developed a successful grant funding application to support student contractors to synthesize Coregonine life history data in the Great Lakes, and commenced work on a white paper reviewing PVA tools for Coregonines.

At the request of the NY Water Resources Institute, co-hosted the Aquatic Connectivity working group for the Hudson River with Brian Rahm (NY WRI) to advance the NYSDEC Hudson River Action Agenda. The working group met three times in 2020, submitted a grant application, and developed an approach to identify un-inventoried dams.

Served as faculty mentor at the Cornell Initiative for Digital Agriculture 2020 Sustainability Hackathon, Ithaca, NY.

TRAINING

Santiago Garcia

Occupancy modeling course by the Center of Wildlife Studies

SERVICE

Angela Fuller

International Union for Conservation of Nature (IUCN) Species Survival Commission (October 2019-Present)

IUCN Bear Specialist Group (November 2019 - Present)

IUCN Bear Monitoring Expert Group (November 2019 - Present)

Proposal Reviewer, Atkinson Center for Sustainability

Student and Postdoc Engagement Committee, Atkinson Center for Sustainability (October 2018 - Present)

Faculty Advisory Board, Atkinson Center for Sustainability (June 2014 - Present)

Doris Duke Conservation Scholars Program (January 2014 - Present)

Faculty Fellow, Atkinson Center for Sustainability (January 2014 - Present)

Scientific Advisory Committee, Andean Bear Conservation Alliance, (October 2018 - Present)

TWS Nominating Committee, Northeast Representative, The Wildlife Society, (August 2016 - Present)

Associate Editor, PLoS ONE (September 2018 - Present)

Advisory Board, New York State Invasive Species Research Institute (April 2018 - Present)

Chair, New York State Breeding Bird Atlas Design and Analysis Committee (April 2018 - Present)

Co-Chair, Sampling Design Committee, New York Mammal Atlas (March 2018 - Present)

New York Mammal Atlas Steering Committee (January 2018 - Present)

National Conservation Training Center, Advisor and Mentor for Decision Analysis Practitioners Certification Program (2018 – Present)

Associate Director, Computational Sustainability Research Network (January 2016 - Present)

Women in Science - USGS (May 2015 - Present)

New York State Breeding Bird Atlas Technical Advisory Committee (January 2015 – Present)

Suresh Sethi

U.S. – Canada joint working group on Coregonine Population Viability Analysis (2020-present)

Science Panel, North Pacific Research Board (2019-present)

Research Working Group member, Coalition for Investment in Conservation hosted by Cornell Atkinson Center for Sustainability (2019-present)

Technical Advisory Panel for the Cornell-TNC-Paulson Institute Synthesis Team on the Conservation Finance reporting for the Convention for Biological Diversity for Conference of Parties 2020 (2020)

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

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)

Joint AFS-TWS Ecosystem Transformation Synthesis Team member (2018-2020)

Proposal reviewer, Cornell Atkinson Center for Sustainability, Postdoctoral Fellow competition (November 2020)

Proposal reviewer, United Kingdom, National Environmental Research Council (October 2020)

Ben Augustine

Reviewer for Ecological Applications, Journal of Zoology, Methods in Ecology and Evolution, Ecosphere, Population Ecology, Communications Biology, Ecological Informatics and Conservation Biology.

Taylor Brown

Cornell University DNRE Anti-Racism Book Club Facilitator

Cornell University Committee to Charter DNRE DEI Advisory Council

Cornell University Mellon/Kieckhefer Grant Proposal Evaluation Committee

Cornell University Graduate and Professional Student Diversity Council

Cornell University First Generation and Low Income Graduate Student Organization, President

Reviewer for Journal of Great Lakes Research

Kimberly Fitzpatrick

Cornell University Department of Natural Resources Graduate Student Assembly, President (2019-2020)

Lake Ontario Technical Committee (2018-Present)

Kelly Perkins

NY Breeding Bird Atlas III Steering, Analysis, and Methods Committees

AWARDS & RECOGNITION

Taylor Brown

Norman S. Baldwin Fishery Science Scholarship (\$3,000), International Association for Great Lakes Research. June 2020.

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)

Steven M. Grodsky, 2020-present (wildlife)