

NEW YORK COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT



2019 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: fisher at baited camera station, juvenile cisco, Taylor Brown sampling for larval coregonines in Little Sodus Bay, NY, Santiago Garcia gathering Andean bear survey data in Ecuador.

New York Cooperative Fish and Wildlife Research Unit

2019 ANNUAL REPORT

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Cooperators:

U.S. Geological Survey

Cornell University

New York State Department of Environmental Conservation

U.S. Fish and Wildlife Service

Wildlife Management Institute

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INTRODUCTION

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

The New York Cooperative Fish and Wildlife Research Unit was established in 1961 under the leadership of Dr. Daniel Thompson. Originally established as a separate wildlife unit, the fishery unit was added in 1963 and led by Dr. Alfred Eipper. In 1984, the units were combined and led through 2008 by Dr. Milo Richmond. 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

DEBORAH ROCQUE, Deputy 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



Postdoctoral Scientists

BEN AUGUSTINE



JENNIFER BRAZEAL



JENNIFER PRICE TACK



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
Dave Garshelis, Minnesota Department of Natural Resources
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



**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)**



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



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



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



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



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

UNDERGRADUATE STUDENTS AND TECHNICIANS

VIVIAN GARCIA



BRIANNA MIMS



SABRINA MOLYNEAUX



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:
Atkinson Center, Cornell
Started:
March 2018

Ben Augustine is a postdoctoral fellow with the Cornell Atkinson Center for Sustainability 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 genetic data from hair or scat samples, remote cameras, and bioacoustic monitoring have allowed researchers to collect more abundant data than was previously possible. However, the vast majority of noninvasive applications do not always provide an unambiguous determination of individual identity. This project has developed new models to utilize partial and erroneous identities from noninvasive data to estimate parameters such as population density and growth rate. The most significant advance in 2019 was a model for genetic IDs observed with error.

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 has 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

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).



(*Vulpes vulpes*) in the southern tier of New York. She has also developed a multispecies occupancy model to estimate occupancies and species interactions at two different scales. She is using 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)
MS/PhD Student:
 Taylor Brown
Sponsors:
 EPA Great Lakes Restoration Initiative
 USGS Great Lakes Science Center
Started: June 2018

Taylor Brown is a masters student working to describe the contemporary spatial extent and quantify the environmental drivers of coregonine (*Coregonus* spp.) population distributions in collaboration with the USGS Great Lakes Science Center, NYSDEC, USFWS, and OMNRF. 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 (*C. artedii*) and lake whitefish (*C. clupeaformis*) endured through anthropogenic impacts and remain severely reduced today. A key knowledge gap for management and restoration is the spatial extent of contemporary coregonine spawning stocks and suitable habitat.



Left: Sodus Bay, a historical coregonine spawning embayment

During the 2018 Cooperative and Science Monitoring Initiative, 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. 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)
PhD Student:
 Kimberly Fitzpatrick
Sponsors:
 NYSDEC
Started:
 August 2017

Kimberly Fitzpatrick is a PhD student developing statistical tools to support fisheries management decision making. In collaboration with managers and biologists from NYSDEC, the Ontario Ministry of Natural Resources and Forestry, and USGS Great Lakes Science Center, she is modeling predator-prey population dynamics of key recreational fisheries in Lake Ontario.



Left: Kimberly collects genetic samples from Chinook Salmon with help from NYSDEC Salmon River Hatchery staff.

Recreational fisheries management in Lake Ontario requires managers to balance the abundance of sport fish, such as Chinook Salmon and Lake Trout, with the availability of prey, primarily Alewife. To characterize this predator-prey balance, we have developed a multispecies model that directly incorporates predator-prey interactions into population dynamics. This allows us to estimate values of management interest such as predation pressure on Alewife and predator growth rates. This information on the current status of the fishery can then be used by managers to inform and evaluate future management strategies for maintaining a high quality and sustainable Chinook Salmon fishery 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. The current atlas will use data collected in eBird to model changes in species occupancy with subsequent atlases. We simulated 6 occupancy block designs using eBird data collected from 2012-2016. The power to detect trends over a ten-year period for each species was determined and the top two designs were run simulating a 20-year period. We found that favoring blocks with higher inverse power-weighted occupancy scores was not significantly better than a stratified design, so we selected a final design of surveying 2 atlas blocks per quad. We also compared the distribution of habitats within the selected sampling blocks versus statewide and found our sample to be representative of habitats within New York.

Spatial risk mapping: A tool to plan and implement human-Andean bear conflict mitigation in western Ecuador



Investigators:
Angela Fuller (NYCFWRU)
Richard Stedman (Cornell)
PhD Student:
Santiago Garcia
Sponsors:
SENESCYT
Toward Sustainability Foundation
Started: Feb. 2019
Using participatory

mapping and a human values approach, we are developing a spatial intervention tool that identifies areas with high potential for Andean bear damage to crops and livestock killing. Our goal is to reduce human-bear conflicts and retaliatory killing of Andean bears through the identification of conflict hotspots that will allow communities to target areas for crop and livestock management interventions. Reducing the risk of human-bear conflicts will strengthen local food systems, promote economic activities such as ecotourism, and may increase the tolerance of local people toward Andean bears. This risk tool will serve as a model that can be used in other communities within or outside of the Andean bear corridor.



Left: Yunguilla Community workshop, June 2019. Ecuador

Last summer, we visited three communities within the Andean bear Corridor (Yunguilla, Bellavista, and El Golan). Using tablets and digital maps, 48 people identified 563 polygons representing areas of importance to local families. These polygons show 26 different types of land use categories and 16 areas are considered risk areas for livestock and farming. We are currently working on a tolerance model for Andean bears within this region.

Conservation and management of Andean bears from regional to local scales



Investigators:

Angela Fuller (NYCFWRU)
Dave Garshelis (MN DNR)

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 as a result of human-bear conflict.



Left: Robert leading a workshop.

Robert is studying 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.

Cisco spawning habitat in the Great Lakes



Investigators:

Suresh Sethi (NYCFWRU)
Brian Lantry (USGS)

Student:

Matthew Paufve

Sponsors:

EPA Great Lakes Restoration Initiative

Started:

Aug. 2016

Matt Paufve (M.S., 2019) worked with USGS, NYSDEC, and other state and provincial agencies to study the spawning habitat of cisco (*Coregonus artedii*), a native prey fish in the Great Lakes. Cisco were once a prominent component of the lake ecosystems, but populations collapsed in the mid-1900s and smaller remnant populations still persist.



Left: Cisco eggs collected from the substrate in Lake Superior

Rehabilitation of cisco populations is a management priority in the region, prompting questions about the role of spawning habitat in potential population expansion. This project wrapped up in 2019, but two journal articles based on this work will be published in 2020 and research on cisco habitat use and population rehabilitation is ongoing through other related projects.

Right: Using a sampling pump to collect eggs from potential spawning habitat in Lake Ontario



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 (Cornell)
 Martin Gilbert (Cornell)
Student:
 Shashank Poudel
Sponsors:
 Cornell Atkinson Center for Sustainability
Started: September 2019

Human-leopard conflict in Nepal results from habitat fragmentation, decline in natural prey, and increasing conflict with humans. People and leopards coexist in Nepal’s landscapes that extend from verdant sub-tropical lowland forests through patchy cultivations in the mid hills to dense urban centers in the high elevations of the Kathmandu Valley. Across this rural-urban gradient, consequences of living with leopards are site specific. The persistent issue across the mid hills and the Kathmandu Valley is human fatality while livestock loss dominates in the lowlands threatening human livelihoods and food security. These interactions are likely determined by endemic factors related to habitat composition, prey availability, livestock management and distribution, human population density and activity, and climatic variables across the landscape.

We aim to understand drivers and impacts of human-leopard interactions across the rural-urban spectrum of settlements and forests in the Himalayan foothills. A national-level policy document will be developed to enable sustainable site-specific conflict management and promote local stewardship of leopards in shared landscapes without compromising human well-being. The project will collaborate with country level institutions and partners.

Spatial optimization of invasive species management in New York



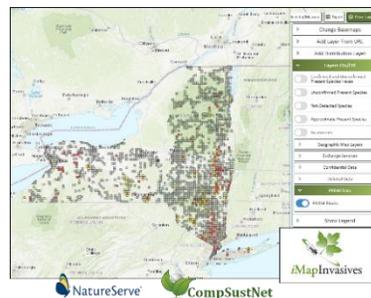
Investigators:
 Angela Fuller (NYCFWRU)
 Carrie Brown-Lima (NYISRI)
 Jennifer Dean (NYNHP)
Post doc:
 Jennifer Price Tack
Sponsors:
 NYSDEC
Started: September 2017

Jennifer Price Tack is a postdoctoral research associate working with NYSDEC and leaders from the 8 NY Partnerships for Regional Invasive Species Management (PRISMs) to better inform budget allocation decisions for reducing negative impacts of invasive species. Her work is supported by the NY Invasive Species Research Institute (NYSRI) and was funded using Environmental Protection Funds.



Left: PRISM work group.

Jennifer and her collaborators developed a tool that builds on the work of NY Heritage Program, DEC, and others to help invasive species managers optimize management actions based on species and areas statewide, with flexibility to tailor actions at the regional level. Their tool is currently being integrated into the invasive species database, iMapInvasives, so that managers can run the model, print optimization reports, and use an interactive map to explore results.



Left: Interactive map on iMapInvasives displaying optimization output for managers.

Occupancy modeling and diet analysis 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 based on the occupancy and diet analysis of Asiatic wild dogs (*Cuon alpinus*), commonly known as dholes in Nepal. Dholes are a globally endangered species. In Nepal, the ecology and distribution of dhole are largely unknown, which is a major constraint in making effective conservation decisions.



Left: camera-trapped image of a dhole in Parsa National Park, Nepal

The aim of this project is 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 the factors contributing to dhole occurrence. Species and sex identification will be carried out through genetic analysis of the scats. We will also be investigating diet profiles of dholes that can elucidate their preferred prey species (wild and domestic), factors favoring these preferences like prey density, and presence of sympatric carnivores. 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 of DNA mixture models to infer counts from fish and wildlife genetic samples

Investigators:
 Suresh A. Sethi (NYCFWRU)
 Wes Larson (NOAA)
 Dan Isermann (WICFU)
 Jose Andres (Cornell)
 David Lodge (Cornell)
 Kara Andres (Cornell)
Sponsors:
 USGS
Started: August 2016



Left: We applied DNA mixture analysis to count prey items in predatory fish stomachs.

In this project led by Suresh Sethi, we are extending 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. These methods 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, and in 2019 in collaboration with the Lodge and Andres labs at Cornell demonstrated nuclear DNA can be generated from aquatic eDNA samples—a major breakthrough in fish wildlife genetics. We published an article in *Methods in Ecology and Evolution* on this work in 2019 and will be completing the final applications analysis in 2020.

Invasive round goby ecology in Finger Lakes

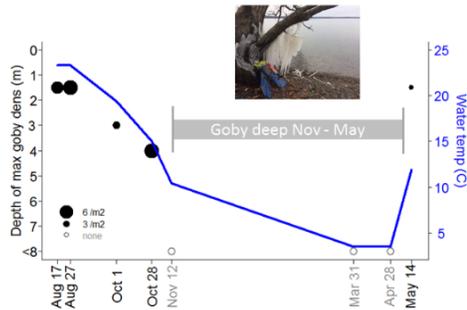
Investigators:

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

Sponsors:

NYSDEC

Started: August 2016



Above: We found round goby move between deep and shallow water seasonally. This behavior may influence their potential impact on deep versus shallow lake communities.

Information on the distribution and ecology of invasive round goby is a top priority for understanding ecosystem-level impacts from this rapidly expanding invader. Providing a mesocosm for Great Lakes systems, we analyzed a data set using benthic videography and sound recording to assess the distribution and biomass of round goby in Cayuga Lake. In 2017, we used this research as a class project for Suresh’s ‘Advanced Fisheries Methods’ graduate course. Cornell students collaborated to conduct summer and winter field sampling in Cayuga Lake. Results have indicated a clear seasonally dependent distribution of round goby between shallow and deep waters that may influence this species’ impact on invaded lake communities. This project was completed in 2019 and led to novel understanding of round goby life history in inland lakes, as communicated through a class-led publication in the journal *Freshwater Biology*. Work on this project has also spurred research to explore goby’s role in contaminant cycling.

Evaluating the potential of DNA mixture models to infer counts from fish and wildlife genetic samples

Investigators:

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

Sponsors:

Cornell Atkinson Center for Sustainability

Started: August 2016



Left: Small pelagic stocks are key fishery resources but are in need of improved monitoring.

Schooling pelagic forage fish stocks such as alewife, mackerel, and sardines provide large sources of biomass for top predator fish and for fishery harvests. Yet these populations are characterized by high population variability and patchy distributions making fishery assessments difficult. We evaluated the potential for active and passive acoustics tools for the assessment of schooling pelagic fish, using sardine as a case study. Insights from this project will be useful for a wide range of freshwater and marine schooling pelagic stocks. In 2018, we successfully deployed both active and passive acoustic sound gear to assess pelagic schooling fish stocks in the Philippines as a case study. This project was completed in 2019 where we found that schooling sardines could be assessed with active acoustics in shallow nearshore environments, and further, that schooling sardines do make sounds detectable with passive acoustic monitoring. Follow on work from this project is helping inform fisheries monitoring options for small pelagic schooling fish, and has already been used to assess harvest versus ecotourism value for sardine schools in the Visayas region of the Philippines.

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

Investigators:

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

Sponsors:

NY State Department of Environmental Conservation (NYSDEC)
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 2019, we successfully stocked and tracked a second cohort of stocked Cisco. Recruitment for a PhD student and eDNA work will commence in 2020. 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.

Contaminant impacts on game fish from invasive round goby introductions



Above: A round goby

Investigators:

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

Sponsors:

NY State Water Resources Institute
Started: January 2019

After first being recorded in N. America in the early 1990s, 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. This data is providing case study data for an upcoming graduate seminar at Cornell on Fish Bioenergetics modeling led by Suresh and Lars Rudstam. Ultimately, results will inform NY Lake managers of potential contaminant impacts from round goby invasions.

Managing for long term sustainability of seafood production from bottom tendered wild capture fisheries: evaluating tradeoffs between spatial closures versus gear modification



PhD Candidate:

T. Scott Smeltz

Investigators:

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

Started: January 2017

Sponsors:

Atkinson Center for a Sustainable Future
The Groundfish Forum
At-Sea Processors
NOAA

Scott Smeltz is a PhD candidate 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 (EFH) 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 working with the crew of the F/V Pacific Explorer to install cameras to monitor performance of the fishing gear.

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 reserve may help mitigate seafloor impacts yet are often accompanied by unintended tradeoffs.

Monitoring and Managing Black Bears: Insights from Patterns in Genetics and Population Dynamics in New York



Investigators:

Angela Fuller (NYCFWRU)
Jeremy Hurst (NYSDEC)

PhD Candidate:

Catherine Sun

Sponsors:

NYSDEC

Started: Sept. 2014

Catherine Sun worked with the NYSDEC to study the expanding black bear population in New York State’s Southern Black Bear Zone. The primary objectives are to 1) estimate density and identify spatial patterns in distribution, and 2) develop recommendations for large-scale monitoring of the species.

It is challenging to monitor wildlife populations that are distributed over large extents. Oftentimes, multiple sampling efforts are conducted to collect data at varying demographic resolutions, and at different spatial and temporal scales. A framework for integrating information and inference across datasets is necessary.

From 2014-2019, Catherine collaborated with state bear biologists and wildlife managers to collect spatially explicit data on bear detections from hair snares and camera traps. She also developed and launched a citizen science program, iSeeMammals, to involve the general public in data collection. Catherine applied the individual datasets to spatial capture-recapture and occupancy models, as well as in combination in novel integrated population models that she developed to estimate population parameters and trends over time. Results from her analyses provided insight on the spatial, temporal, and methodological considerations for collecting and combining multiple datasets for population inference. Catherine completed her PhD in August 2019.

PUBLICATIONS AND PRESENTATIONS

JOURNAL ARTICLES

- Almeida R.M., Q. Shi, J. Gomes-Selman., X. Wu, Y. Xue, H. Angarita, N. Barros, B.R. Forsberg, R. Garcia-Villacorta, S.K. Hamilton, J.M. Melack, M. Montoya, G. Perez, **S.A. Sethi**, C.P. Gomes, and A.S. Flecker. 2019. Reducing greenhouse gas emissions of Amazon hydropower with optimal dam planning. *Nature Communications* 12:4281.
- Augustine, B. C.**, J. A. Royle, S.M. Murphy, R.B. Chandler, J.J. Cox, and M.J. Kelly. 2019. Spatial capture-recapture for categorically marked populations with an application to genetic capture-recapture. *Ecosphere*, 10(4):e02627.
- Beever E., **S.A. Sethi**, I.S. Prange, D.A. DellaSalla. 2019. Introduction: Defining and Interpreting Ecological Disturbances, in *Disturbance Ecology and Biological Diversity: Scale, Context, and Nature*. E. Beever (Ed.), CRC Press, New York.
- Brown, T.A.**, M.E. Fraker, S.A. Ludsin. 2019. Space use of predatory larval dragonflies and tadpole prey in response to chemical cues of predation. *The American Midland Naturalist* 18(1):53-63.
- 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**, and 18 others. 2019. Computational Sustainability: Computing for a Better World and a Sustainable Future. *Communications of the ACM* 62(9):56-65.
- Gupta, A., B. Dilkina, **D.J. Morin**, **A.K Fuller**, J.A. Royle, **C. Sutherland**, and C. Gomes. 2019. Reserve design optimizing functional connectivity and animal density. *Conservation Biology* 33(5):1023-1034.
- Murphy, S. M., J.T. Hast, **B.C. Augustine**, D.W. Weisrock, J.D. Clark, D.M. Kocks, C. Ryan, J.L. Sajecki., and J.J. Cox. 2019. Early genetic outcomes of American black bear reintroductions in the Central Appalachians, USA. *Ursus*, 29(2):119-1335.
- Murphy, S. M., D.T. Wilckens, **B.C. Augustine**, M.A. Peyton, and G.C. Harper. 2019. Improving estimation of puma population density: clustered camera-trapping, telemetry data, and generalized spatial mark-resight models. *Scientific Reports*, 9(1):1-13.
- Paufve, M.R.**, **S.A. Sethi**, B.F. Lantry, B.C. Weidel, and L.G. Rudstam. 2019. Assessing the spawning ecology of fish in situ using a benthic pump sampler. *Fisheries Research* 214:19-24.
- Pendleton, R., C.R. Standley, A.L. Higgs, G.H. Kenney, P.J. Sullivan, **S.A. Sethi**, B. Harris. 2019. 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* 148:35-47.

Robinson, K.F., A.K. Fuller, R.C Stedman, W.F. Siemer, and D.J. Decker. 2019. Integration of social and ecological sciences for natural resource decision making: challenges and opportunities. *Environmental Management* 63:565-573.

Rose, C., J. Nielsen, J. Gauvin, T. Loher, **S.A. Sethi**, A. Seitz, M. Courtney, and P. Drobny. 2019. Pacific halibut (*Hippoglossus stenolepis*) survival 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* 76:2215-2224.

Satter, C. B., **B.C. Augustine**, B.J. Harmsen, R.J. Foster, and M.J. Kelly. 2019. Sex-specific population dynamics of ocelots in Belize using open population spatial capture-recapture. *Ecosphere*, 10(7): e02792.

Satter, C. B., **B.C. Augustine**, B.J. Harmsen, R.J. Foster, E.E. Sangehz, C. Wultsch, M. Davis, and M.J. Kelly. 2019. Long-term monitoring of ocelot densities in Belize. *Journal of Wildlife Management* 83:283-294.

Sethi, S.A., W. Larson, K. Turnquist, and D. Isermann. 2019. Estimating the number of contributors to DNA mixtures provides a novel tool for ecology. *Methods in Ecology and Evolution* 10:109-119.

Smeltz, T.S., B.P. Harris, J. Olson, and **S.A. Sethi**. 2019. A seascape scale habitat model to support management of fishing impacts on benthic ecosystems. *Canadian Journal of Fisheries and Aquatic Sciences* 76:1836-1844.

Sun, C. C., A. K. Fuller, and J. A. Royle. 2019. Incorporating citizen science data in spatially explicit integrated population models. *Ecology* 100(9):e02777.

TECHNICAL OR POPULAR ARTICLES

Beatty, W.S., P.R. Lemons, **S.A. Sethi**, J. Everett, C.J. Lewis, J.B. Olsen, J.L Garlich-Miller, G.M. Cook, and J.K. Wenburg. 2019. Estimating Pacific Walrus abundance and demographic rates from genetic mark-recapture. OCS Study, Bureau of Ocean and Energy Management, Anchorage, AK.

Murphy, S. M. and **B.C. Augustine**. 2019. Toward a cohesive framework for large-scale spatially explicit monitoring of puma populations. *Wild Felid Monitor*, 12.

Price Tack, J.L., W. Simmons, A. Bowe, and C. Brown-Lima. 2018. Warming waters: implications for invasive species in the Northeast. *Regional Invasive Species & Climate Change (RISCC) Management*. <https://ecommons.cornell.edu/handle/1813/57590>

Sethi, S.A. Joint AFS-TWS Ecosystem Transformation Synthesis Team. 2019. How to respond to changing ecosystems: resist, accept, or direct? AFS-TWS Ecosystem Transformation Synthesis Team, Final Workshop Newsletter, Seattle, WA.

PRESENTATIONS AND SEMINARS

Andres, K. et al. (**S.A. Sethi 2nd**), Novel environmental DNA methods for monitoring population genetics of an invasive species, Society for Freshwater Science, Salt Lake City, UT, May 2019.

Andres K. et al. (**S.A. Sethi 2nd**). Novel eDNA methods for monitoring the population genetics of invasive species," K Andres et al. International Association for Great Lakes Research, Brockport, NY, June 2019.

Augustine, B. C., J.A. Royle., D.W. Linden, and **A.K. Fuller**. 2019. Spatial capture-recapture with genotyping error. The Wildlife Society 26th Annual Conference, Reno, NV.

Beatty W. et al. (**S.A. Sethi 3rd**). Genetic Structure of the Pacific Walrus at Multiple Spatial Scales, Joint AFS TWS National Meeting, Reno NV, October 2019.

Brazeal, J.L. and A.K. Fuller. Carnivore occupancy and intraguild interactions across New York state. NYSDEC statewide Bureau of Wildlife Meeting, Syracuse, NY, February 2019.

Brazeal, J.L. and A.K. Fuller. Southern Zone Fisher Study. Furbearer & Small Game Mammal Management Team Meeting, Ithaca, NY, July 2019.

Brazeal, J.L. and A.K Fuller. Winter carnivore occupancy and intraguild interactions across New York state. American Fisheries Society & The Wildlife Society 2019 Joint Annual Conference, Reno, NV, October 2019.

Brown T.A. et al. (**S.A. Sethi 2nd**). Quantifying coregonine spatial ecology and early life-history dynamics in Lake Ontario. Cornell Department of Natural Resources Annual Research Symposium, Ithaca, NY, January 2019.

Brown T.A. et al. (**S.A. Sethi 2nd**). Moving to a lake-wide understanding of early life-history habitat for Lake Ontario coregonines. New York Chapter and Northeastern Division of the American Fisheries Society Annual Meeting, Poughkeepsie, NY, February 2019.

Brown T.A. et al. (**S.A. Sethi 2nd**). Lake Ontario larval coregonine assessment. NYSDEC Great Lakes Fisheries Section Meeting, Syracuse, NY, July 2019.

Fitzpatrick, K.B., et al. (**S.A. Sethi 6th**). Modeling Chinook salmon population dynamics in Lake Ontario. Cornell Department of Natural Resources Research Symposium, Ithaca, NY, January 18, 2019.

- Fitzpatrick, K.B.**, et al. (**S.A. Sethi 11th**). Modeling Chinook salmon population dynamics in Lake Ontario. New York Chapter and Northeastern Division of the American Fisheries Society Meeting, Poughkeepsie, NY, February 7, 2019.
- Fitzpatrick, K.B.** and **S.A. Sethi**. Chinook salmon and alewife: a predator-prey approach to fisheries management, Tompkins County 'In Your Own Backyard' Science Symposium, Ithaca Public Library, Ithaca, NY, April 2019. Invited presentation.
- Fitzpatrick, K.B.**, et al. (**S.A. Sethi 11th**). Predator-prey population dynamics modeling for Chinook Salmon and Alewife in Lake Ontario. International Association for Great Lakes Research Annual Conference on Great Lakes Research, Brockport, NY, June 12, 2019.
- Fitzpatrick, K.B.**, et al. (**S.A. Sethi 11th**). Predator-prey population dynamics in Lake Ontario. NYSDEC Great Lake Fisheries Section Meeting, Syracuse, NY, July 24, 2019.
- Fuller, A.K.** New methods for monitoring Andean bears using sign surveys and camera trapping for occupancy, density, and connectivity. Invited presentation, International Union for Conservation of Nature, Bear Specialist Group. Taipei, Taiwan. 6 November, 2019. (Invited)
- Fuller, A.K.**, and J.A. Royle. Coupled classification models: Moving beyond 'just' artificial intelligence. USGS Executive Leadership Team Briefing. Invited by Anne Kinsinger. March 26, 2019 (Invited)
- Fuller, A.K.**, J. Stiller, W. Siemer, **K. Perkins**. Choosing an Optimal Duck Season: Integrating Hunter Values with Duck Migration Data. American Fisheries Society & The Wildlife Society 2019 Joint Annual Conference. Reno, Nevada. (Invited) September 30, 2019.
- Heilpern, S. et al. (**S.A. Sethi 2nd**). Community consequences of indiscriminate overharvest in large tropical rivers, Ecological Society of America, Louisville, KY, August 2019. *This presentation received the best student (S Heilpern) paper award from ESA in the Aquatic section.*
- Heilpern, S. et al. (**S.A. Sethi 2nd**), Community consequences of indiscriminate overfishing in large tropical rivers, Society for Freshwater Science, Salt Lake City, UT, May 2019.
- Lynch, L. et al. (**S.A. Sethi 15th**), Guiding Principles for Managing Ecosystem Transformation. Joint AFS-TWS National Meeting, Reno NV, October 2019.
- Moriarty, M. et al. (**SA Sethi 5th**), Combining fisheries surveys to inform marine species distribution modelling. 2nd Annual Ecology and Evolution Ireland Conference, Galway, Ireland, January 2019.
- Paufve, M.R.**, **S.A. Sethi**, B.F. Lantry, M. Connerton, J.L. Jonas, D.L. Yule, E.K. Berglund, P. O'Neill, L.G. Rudstam, and B.C. Weidel. Spawning habitat and reproductive strategies of Cisco

(*Coregonus artedi*) in the Great Lakes. Cornell Department of Natural Resources Research Symposium. Ithaca, NY, January 18, 2019.

Paufve, M.R., S.A. Sethi, B.F. Lantry, M. Connerton, J.L. Jonas, D.L. Yule, E.K. Berglund, P. O'Neill, L.G. Rudstam, and B.C. Weidel. Spawning habitat and reproductive strategies of Cisco (*Coregonus artedi*) in the Great Lakes. New York Chapter of the American Fisheries Society Annual Meeting, Cooperstown, NY, February 7, 2019.

Price Tack, J.L., A.K. Fuller, C.J. Brown-Lima, J. Dean, Q. Shi, and C.P. Gomes. Approaches for Optimizing the Management of Many Invasive Species Across Space. North American Invasive Species Management Conference, Saratoga Springs, NY, October 2019.

Price Tack, J.L., A.K. Fuller, C.J. Brown-Lima, J. Dean, Q. Shi, and C.P. Gomes. Multiple Objective Spatial Optimization for Managing 254 Invasive Species Across New York State. INFORMS, Seattle, WA, October 2019. Invited presenter.

Price Tack, J.L., A.K. Fuller, C.J. Brown-Lima, J. Dean, Q. Shi, and C.P. Gomes. Multiple Objective Spatial Optimization for Managing 254 Invasive Species Across New York State. The Wildlife Society 26th Annual Conference, Reno, NV, October 2019.

Price Tack, J.L., Fuller, A.K., Brown-Lima, C.J., Dean, J., Shi, Q., and C.P. Gomes. Spatial Optimization of Invasive Species Management in New York. Cornell Department of Natural Resources Graduate Student Symposium, Ithaca, NY, January 2019.

Robinson, K., A. Fuller, M. Schiavone, D. Diefenbach, and W. Siemer. A structured decision making approach to addressing wild turkey population declines. Informs Annual Meeting, 22-23 October 2019, Seattle, Washington, USA. (Invited)

Robinson, K.F., A.K. Fuller, and M.L. Jones. Using structured decision making to incorporate ecological and social values into harvest decisions: case studies of walleye, deer, and turkey. American Fisheries Society & The Wildlife Society 2019 Joint Annual Conference. Reno, Nevada. (Invited) September 30, 2019.

Royle, J.A., **A.K. Fuller, B. Augustine**, and R. Chandler. Capture-Recapture Meets Big Data: Integrating Statistical Classification with Ecological Models of Species Abundance and Occurrence. American Fisheries Society & The Wildlife Society 2019 Joint Annual Conference. Reno, Nevada. (Invited) October 2, 2019.

Scholten G. et al. (**S.A. Sethi 2nd**), Estimating survival and movement of stocked juvenile Coregonines using small acoustic tags, International Association for Great Lakes Research, Brockport, NY, June 2019.

Sethi, S.A., J. Tobin, M. Gomez, and T. Fitzgerald. Conservation finance for fisheries. Alaska Marine Science Symposium, Anchorage, AK, January 2019.

- Sethi, S.A.** et al. Estimating the number of contributors to DNA mixtures provides a novel tool for ecology. NY Chapter American Fisheries Society, Poughkeepsie, NY, February 2019.
- Sethi, S.A.** Global fisheries perspectives: financing the sustainable future, AEM 4090-Environmental Finance and Markets, Cornell Ithaca, NY, March 2019. Invited presentation.
- Sethi, S.A.**, Fisheries research perspectives for Northeast waters, Tunison Research Labs, Cortland, NY, May 2019. Invited presentation.
- Sethi, S.A.** et al. A rapid social threshold may lead to long-term ecological transformation by invasive hippos in Colombia, Joint AFS-TWS National Meeting, Reno NV, October 2019.
- Sethi, S.A.** Fisheries research at the NY Cooperative Research Unit, NYSDEC Bureau of Fisheries Annual Meeting, Altmar NY, December 2019.
- Smeltz, T. S.** 2019. Technological solutions can mitigate global habitat costs of wild seafood production. Oral presentation at the FISH Workshop. Seattle, WA.
- Sun, C. C., A.K. Fuller,** M.P. Hare, J.E. Hurst, and J.A. Royle. 2019. Monitoring and managing for black bears: insights from patterns in genetics and population dynamics in New York. New York State Department of Environmental Conservation, Bureau of Wildlife Management Meeting. Syracuse, NY.
- Thompson, L. (**S.A. Sethi 15th**), Responding to Ecosystem Transformation: Resist, Accept, or Direct? Joint AFS-TWS National Meeting, Reno NV, October 2019.

THESES & DISSERTATIONS

- Francis, A.T.** Haudenosaunee forest stewardship. MS Thesis. May, 2019 (Advisor: Kassam/Fuller)
- Paufve, M.R.** 2019. Diversity in spawning habitat across Great Lakes Cisco populations. Masters thesis. Cornell University. Ithaca, NY. (Advisor: Sethi)
- Sun, C.** 2019. Patterns in landscape-wide spatial heterogeneity of American black bear (*Ursus americanus*) populations identified through genetic and noninvasive approaches. Dissertation. Cornell University. Ithaca, NY. (Advisor: Fuller/Hare).

COURSES TAUGHT & GUEST LECTURES

- Augustine, B.A.** and **J. Brazeal.** Co-instructor. Introduction to R 5 day course for undergraduate and graduate students. Cornell University Department of Natural Resources. August 2019.
- Fitzpatrick, K.B.** Introduction to R short course for Cornell Biological Field Station Undergraduate Interns. Summer 2019.

Fuller, A.K. Structured Decision Making in Natural Resource Management (NTRES 4940/6940), Spring 2019.

Fuller, A.K. Structured Decision Making for Natural Resource Management. Invited guest lecture in Principles and Practices of Applied Wildlife Science, Cornell University 2019.

Sethi, S.A. Guest lecture, “Global fisheries perspectives: financing the sustainable future,” AEM 4090-Environmental Finance and Markets, Cornell Spring 2019, Ithaca, NY.

ACTIVITIES

TECHNICAL ASSISTANCE AND OUTREACH

Angela Fuller

Invited briefing to Anne Kinsinger (Associate Director, Ecosystems, USGS) and the executive leadership team, on “coupled classification models: Moving beyond 'just' artificial intelligence

Scientific Advisory Committee, Andean Bear Conservation Alliance

New York State Breeding Bird Atlas Steering Committee

Chair, New York State Breeding Bird Atlas Design and Analysis Committee; developing sampling design for the third NY State Breeding Bird Atlas including power simulations

New York Mammal Atlas Sampling Design Committee and Steering Committee

Designed and oversaw implementation of New York State Department of Environmental Conservation 2019 fisher occupancy and spatial capture-recapture survey in central and western New York

Guided New York State Department of Environmental Conservation Decision making for waterfowl season setting

Advisory Board, Atkinson Center for a Sustainable Future

Department of Natural Resources Executive Committee

Taylor Brown

Otolith Extraction, Preparation, and Fisheries Science Applications Workshop. Cornell Subunit of the American Fisheries Society.

Suresh Sethi

Participated in two 1-day research consultations with NY DEC senior fisheries staff to identify research needs for Finger Lakes fisheries assessment and statewide fisheries management, SUNY-Oneonta (April, 2019) and Shackleton (October, 2019).

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

Attended a one-day workshop in Albany to discuss design considerations for a Lake Champlain Creel Survey.

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

Participated in a one-day workshop on research priorities and research capacity at Cornell University to address Harmful Algal Blooms, organized by the NY Water Resource Institute.

At the request of the NY Water Resources Institute, helped organize and develop programmatic approach to address aquatic connectivity restoration in the Hudson River (leading to collaborative work with WRI postdoc, Kristen Hychka, and NY DEC).

Attended and presented a summary of fisheries work at the NY Cooperative Research Unit at the NY DEC Bureau of Fisheries Annual Meeting, Altmar NY.

TRAINING

Jennifer Brazeal

Advanced Occupancy Modeling Course. Blacksburg, VA. 22-26 October 2018.

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 a Sustainable Future Academic Venture Funds (May 2019)

Student and Postdoc Engagement Committee, Atkinson Center for a Sustainable Future (October 2018 - Present)

Advisory Board, Atkinson Center for a Sustainable Future (June 2014 - Present)

Department of Natural Resources Executive Committee (January 2014 - Present)

Doris Duke Conservation Scholars Program (January 2014 - Present)

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

Cornell University Integrated Deer Research and Management Program Committee (April 2012 - Present)

Chair, Faculty Advisory Board, Atkinson Center for a Sustainable Future (September 2018 - September 2019)

USGS Research Grade Evaluation Panel

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

Chair, The Wildlife Society Nominating Committee (to nominate candidates for President of the society), The Wildlife Society, (October 2018 - August 2019)

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) New York Cooperative Fish and Wildlife Research Unit

NCTC Advisor 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)

Eastern United States Representative, Martes Working Group, (December 2011 - Present)

Suresh Sethi

Science Panel, North Pacific Research Board (2019-2024)

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)

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

Ben Augustine

Reviewer for Conservation Biology, Environmetrics, Nature Scientific Reports, Population Ecology, and Methods in Ecology and Evolution.

Taylor Brown

Cornell University Graduate and Professional Student Diversity Council

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

Kimberly Fitzpatrick

Cornell University Department of Natural Resources Graduate Student Assembly Treasurer (Fall 2018-Summer 2019)

Cornell University Department of Natural Resources Graduate Student Assembly President (Fall 2019-Current)

Kelly Perkins

NY Mammal Atlas Steering Committee

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

Reviewer for Ecological Informatics

Catherine Sun

Joint Diversity Initiative Report (US Fish and Wildlife Service, The Wildlife Society): 2018-2019

Publicity and Information Chair for New York Chapter of The Wildlife Society: 2018-2020

AWARDS & RECOGNITION

Trishna Rayamajhi

Best Lightening Presentation Award at DNR GSA Symposium-2019, Cornell University, Department of Natural Resources

Suresh Sethi

Ulster University Excellence Award for International Collaboration in recognition of work with Fulbright Scholar, Meadhbh Moriarty.

PRESS

Taylor Brown

Cornell University Graduate Student Spotlight. November 5, 2019.

<https://gradschool.cornell.edu/spotlights/student-spotlight-taylor-brown/>

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)