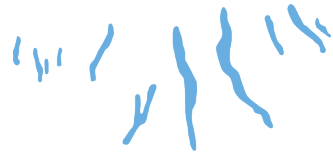


# FLI Freshwater Initiatives and Programs



Dr. Lisa B. Cleckner  
Director

FINGER LAKES  
INSTITUTE



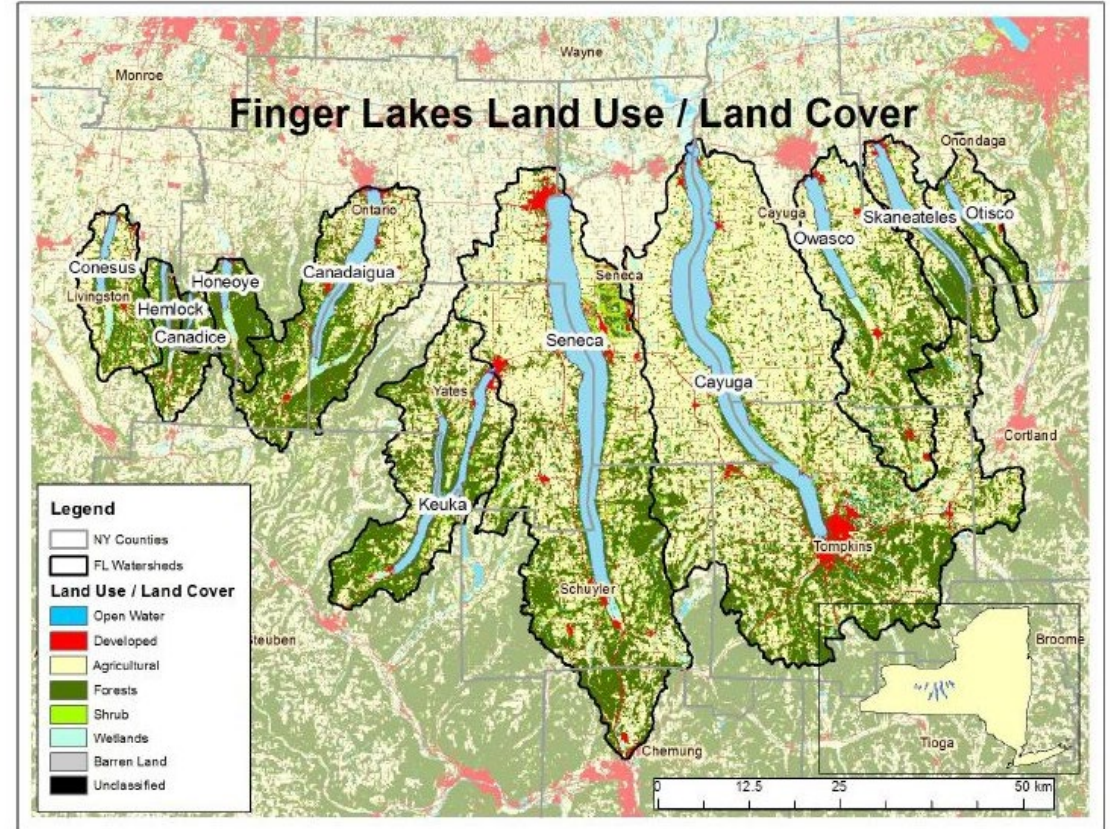
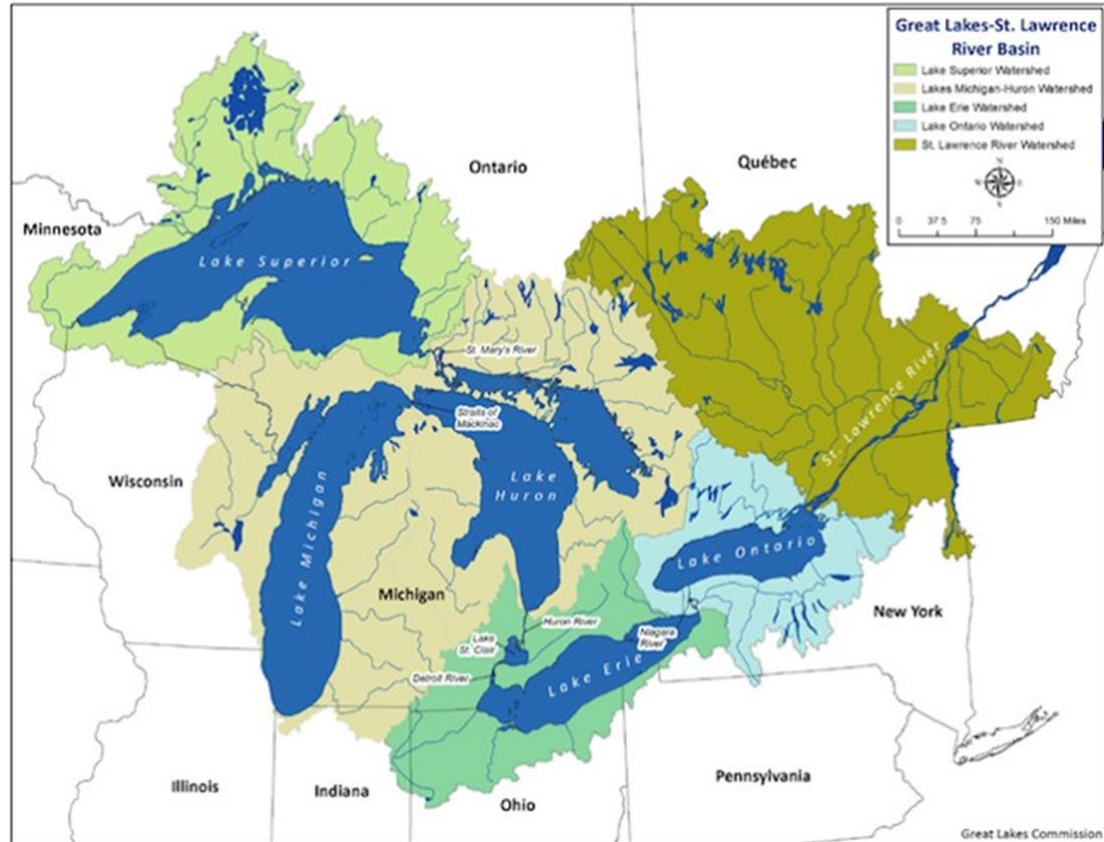
Chautauqua Lake Water Quality  
Conference  
06/17/2023



HOBART AND WILLIAM SMITH COLLEGES



# The Finger Lakes



# Finger Lakes - a natural laboratory

A LIMNOLOGICAL STUDY OF THE FINGER LAKES  
OF NEW YORK : : By Edward A. Birge and Chancey Juday

From BULLETIN OF THE BUREAU OF FISHERIES, Volume XXXII, 1912

Document No. 791 : : : : : Issued October 27, 1914

It is probable that there is no group of lakes in the world which offers to the limnologist such opportunities for working out the problems of his science.

Lake	Mean, Max Depth (m)	Volume (km <sup>3</sup> )	Surface area (km <sup>2</sup> )	H <sub>2</sub> O- shed area (km <sup>2</sup> )	H <sub>2</sub> O-shed /Surface Ratio	Retention Time (years)
Honeoye	5, 9	0.03	7	95	13.57	1-1.5
Canandaigua	39, 84	1.64	42	477	11.36	8.5-10
Seneca	89, 198	15.54	175	1181	6.74	12-23
Cayuga	55, 133	9.38	172	1145	6.66	8.5-10
Owasco	29, 54	0.78	27	470	17.41	1.5-3

# Finger Lakes Institute at HWS - Vision

The FLI strives to protect and promote the water resources and natural capital of the Finger Lakes region. We connect HWS academic activities to regional, state and federal research and community needs. The FLI provides (i) relevant, **actionable scientific analysis** for the region; (ii) research and professional **development opportunities** for students, faculty, and staff; and (iii) a place for **community education** about existing and emerging water quality issues.



HOBART AND WILLIAM SMITH COLLEGES



# Finger Lakes Institute at HWS - Mission

Translate knowledge and research about the Finger Lakes environment into collaborative action





# Finger Lakes Institute at HWS

Research



Education



Outreach

2020 Finger Lakes Research Conference

Threats to the Finger Lakes

Schedule

8:30 a.m.	Registration and poster set-up
9 a.m.	Opening Remarks
Session 1	
9:15 a.m.	A program to understand and mitigate nutrient supply and harmful algal blooms in Skaneateles Lake Charles Driscoll, Ph.D., Professor, Department of Civil and Environmental Engineering, Syracuse University
9:45 a.m.	Panel: Citizen Science HAB Programs in Seneca and Canandaigua Lakes Frank D'Onofrio, Bill Roops, Sally Napolitano, Lynn Klotz HABs Program Managers for Seneca and Canandaigua Lakes
10:30 a.m.	Break
Session 2	
11-11:30 a.m.	Gobies and invasive mussels in New York lakes - predicting future ecosystem effects Lars Rudstam, Ph.D., Professor, Department of Natural Resources, Cornell University, and Director, Cornell Biological Field Station
11:30 a.m.	Changes to wetland structure and function following plant community restoration at Braddock Bay Wildlife Management Area, NY Rachel Schultz, Ph.D., Associate Professor of Wetland Science, Department of Environmental Science and Ecology, SUNY Brockport
12 p.m.	Lunch

1 p.m.

**KEYNOTE ADDRESS:**  
"Integrating Science and Technology for Enduring Lake Protection"

Dr. Rick Relyea, the David M. Darrin '40 Senior Endowed Chair, Director of the Darrin Fresh Water Institute, and the Director of the Jefferson Project at Rensselaer Polytechnic Institute

Dr. Relyea completed his Ph.D. at the University of Michigan in 1999 and spent the next 15 years as a professor at the University of Pittsburgh, where he served as the Director of the Pennsylvania Lake of Ecology. In 2014, he moved his research group to Rensselaer to become the Director of the Darrin Fresh Water Institute and the Director of The Jefferson Project.

The Jefferson Project — a collaboration between Rensselaer Polytechnic Institute, IBM Research, and The FNU for Lake George — is an unprecedented approach to studying fresh water, with a goal of understanding the impacts of human activities and how to best mitigate those impacts. The Jefferson Project has created the "Toucan Lake in the World" at Lake George and drives to bring its technologies to other lakes around the world while serving as the global model for sustained ecosystem understanding and protection.

Dr. Relyea has published more than 170 peer-reviewed publications and 10 textbooks in the fields of ecology and environmental science.

Education: Ph.D., Univ. of Michigan; M.S., Texas Tech Univ.; B.S., SUNY ESF  
Prior Areas: Ecology, Limnology, Disease ecology, Ecosystems, Evolution, Animal behavior

Session 3

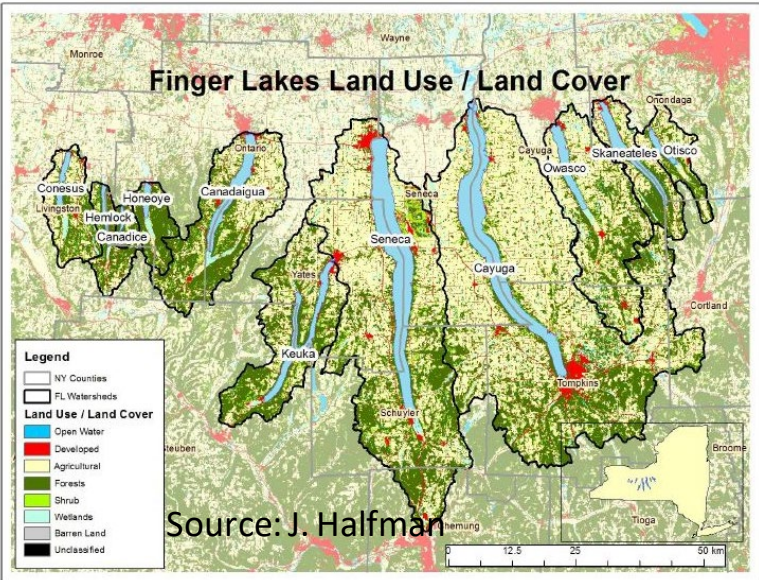
2 p.m.

Managing New York State's Water Resources  
Brian G. Rahn, Ph.D., Director, New York State Water Resources Institute, Department of Biological & Environmental Engineering, Faculty Fellow, Adkins Center for a Sustainable Future

2:30-4 p.m.

Poster Session and Reception

Watershed Stewardship





# Finger Lakes Economic Impacts

- **Water** is the basis of the Finger Lakes economy

- Tourism

- \$3B/yr
    - 58,242 jobs

Source: Tourism Economics 2018 Report

- Agriculture

- ~\$1B/yr

- Ecosystem services

- Non-monetized

- FLX is a global brand



Finger Lakes named  
America's best wine region

[Browse Current Contests](#)

This is second win in a row for New York wine region

While California undoubtedly produces excellent wine, it's got stiff competition these days. The United States is as of 2019 home to 244 American Viticultural Areas, or AVAs – grape-growing regions designated by the Alcohol and Tobacco Tax and Trade Bureau. We asked a panel of wine industry experts to pick their favorite American AVAs and wine regions, and our readers voted for their favorites from the pool of 20 nominees.



<https://ecology.fnl.gov/ecosystem-services/>



# Threats to Finger Lakes – FLI Focal Areas

- Nutrients/land use
  - Drive energy flow of system, feed harmful algal blooms
- Invasive species
  - Alter habitats, change cycling of nutrients
- Contaminants
  - Increase or decrease pending sources, microbial transformations, nearshore vs. offshore
- Watershed management practices, climate change



ENERGY > WASTE-TO-ENERGY

Circular enerG Seeks to Build  
WTE Facility in Seneca County,  
N.Y.



Photo: Bill Hecht



# FLI Project Areas

<i><b>Focal Area</b></i>	<i><b>Research</b></i>	<i><b>Education</b></i>	<i><b>Demonstration/ Community Work</b></i>	<i><b>Funders</b></i>	<i><b>Partners</b></i>
<i>Harmful Algal Blooms (HABs), Nutrients, and Water Quality</i>	Investigating HABs and toxin production in nearshore areas of Honeoye, Seneca, Owasco, Canandaigua, Cayuga Lakes; Use of drones/remote sensing to detect and monitor HABs	New grant to develop curricular materials for K-12 students and teachers; hosted 2021 symposium with 205 attendees; Youth Climate Summits	Screen shoreline samples collected by volunteers on Seneca, Canandaigua, and Keuka Lakes; nearshore dock monitoring projects on Canandaigua, Cayuga, Seneca Lakes	Great Lakes Research Consortium, Emerson Foundation, Ontario County, Seneca Lake Pure Waters, Tripp Foundation, Canandaigua Lake Watershed Association and Council, Corning, Inc., Keuka Lake Assn, Wyckoff Foundation, NYS Water Resources Institute, NOAA, NY Sea Grant	SUNY College of Environmental Science and Forestry, Wright State U, Cornell U., NYS Dept. of Environmental Conservation (NYSDEC), Lake Associations, Wild Center, Corning, Inc., SUNY Fredonia, SUNY Binghamton, SUNY Oneonta, watershed associations, local school districts
<i>Invasive Species</i>	Exploring species richness of macrophytes in invasion areas compared to uninvaded habitats; multi-year datasets on macrophyte communities in lakes	Watercraft stewards, giant hogweed, water chestnut, Hydrilla, citizen science, stream monitoring; virtual web series	Control projects for terrestrial/aquatic species, training/prof development workshops, citizen science programs, water chestnut pulls, early detection/reporting	NYSDEC, US Fish and Wildlife Service, US EPA, US Dept. of Agriculture, US Forest Service, Cornell U., county soil and water districts, watershed associations	17 counties of FLPRISM, NYSDEC, NYSFOLA, Montezuma, Cumming Nature Center, Finger Lakes Trail Conf., NYS Parks, Cornell, Finger Lakes National Forest, Seneca Park Zoo, FL Regional Watershed Alliance, ...
<i>Mercury</i>	Contaminant levels in Finger Lakes food webs and fish; exploring applications/connections to other contaminants such as PFAS	Stream monitoring, four HWS honors students, summer research plus modules in HWS classes	Synthesis findings used to brief officials in Attorney General Office in NYC and Washington, DC; other information used by NYSDOH for fish consumption advisories	NYS Energy Research and Development Authority, Cornell, SUNY ESF, SUNY Purchase, Seneca Lake Pure Waters, <a href="#">CoE</a> Healthy Water Solutions, Clarkson U	Biodiversity Research Institute, USGS, Syracuse U, SUNY ESF, Adirondack Lake Survey Corp, Cornell, NY Sea Grant, NYSDEC, SUNY Brockport, Contract work for academic institutions
<i>Watershed Management and Governance</i>	Water resource management and water quality protection by inter-governmental organizations; Mitigation techniques; NYSDOH Certified Laboratory	Municipal official workshops, briefings, white papers	Leading and facilitating meetings, providing fiscal administration for organization, assisting with grant applications, 9 Element Plan project, project implementation	NYSDEC, municipal pledges, private \$\$, Yates County, NYS Department of State, NYS Pollution Prevention Institute, NY Wine and Grape Producers, Cayuga IO, Park Foundation, NY Sea Grant	Ontario, Yates, Steuben, Schuyler, Chemung, Seneca, Tompkins, Cayuga, Cortland Tioga counties plus over 70 Seneca, Keuka, Cayuga Lake municipalities plus watershed associations, NYSDEC, NYSDOS

# Acknowledgments – FLI Staff



Nadia Harvieux



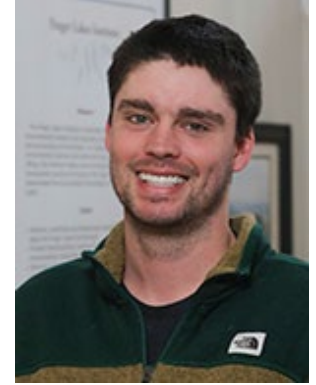
Trevor Massey



Sam  
Beck-Andersen



Ian Smith



Evan Helming



Josh Neff



Matt Gallo



Erin Norris



Amy Slentz



Ben Kelley

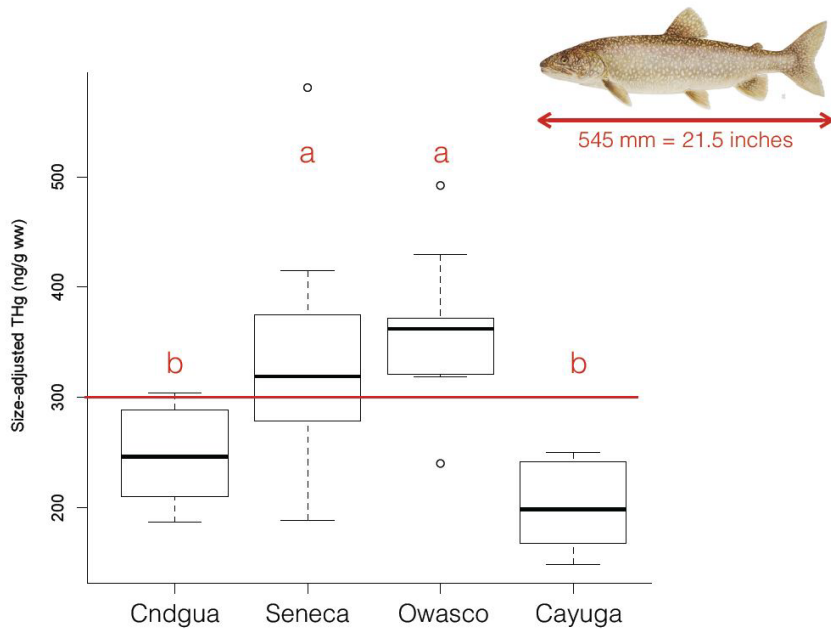


Lisa Cleckner



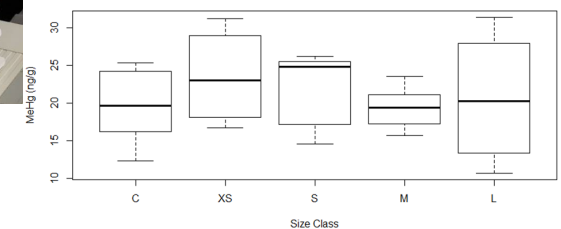
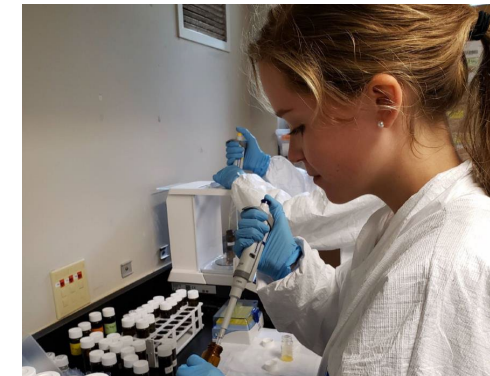
# Mercury in fish in the FLX

- Multiple summer research students
- HWS class modules, lectures
- Honors students



## Mercury, PCBs: New health advice for eating fish from 5 Upstate waterways

Updated Mar 21, 2019; Posted Mar 20, 2019



# Example Hg Publications



Ecotoxicology and Environmental Safety  
Volume 172, 15 May 2019, Pages 265–272



## Mercury bioaccumulation in stream food webs of the Finger Lakes in central New York State, USA

N. Roxanna Razavi<sup>a</sup> , Susan F. Cushman<sup>a b c</sup>, John D. Halfman<sup>a c d</sup>, Trevor Massey<sup>a</sup>, Robert Beutner<sup>e</sup>, Lisa B. Cleckner<sup>a c</sup>

Show more ▾

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<https://doi.org/10.1016/j.ecoenv.2019.01.060>  Get rights and content ▸

Published: 09 December 2019

## Mercury concentrations in fish and invertebrates of the Finger Lakes in central New York, USA

N. Roxanna Razavi<sup>a</sup> , John D. Halfman, Susan F. Cushman, Trevor Massey, Robert Beutner, John Foust, Bruce Gilman & Lisa B. Cleckner

*Ecotoxicology* 29, 1673–1685 (2020) | [Cite this article](#)

523 Accesses | 6 Citations | 1 Altmetric | [Metrics](#)

New York State Mercury Connections is a summary of the major findings of a series of research studies undertaken by Biodiversity Research Institute in cooperation with the New York State Energy Research and Development Authority.

**Biodiversity Research Institute**

Biodiversity Research Institute (BRI), headquartered in Portland, Maine, is a nonprofit ecological research group whose mission is to assess emerging threats to wildlife and ecosystems through collaborative research, and to use scientific findings to advance environmental awareness and inform decision makers. For information about BRI's Center for Mercury Studies, visit: [www.brioon.org/mercurycenter](http://www.brioon.org/mercurycenter)

**New York State Energy Research and Development Authority**

The New York State Energy Research and Development Authority (NYSDERA), a public benefit corporation, offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSDERA professionals work to protect the environment and create clean energy jobs. NYSDERA has been developing partnerships to advance innovative energy solutions in New York State since 1975. To learn more about NYSDERA's programs, visit [nysdera.ny.gov](http://nysdera.ny.gov) or follow on Twitter, Facebook, YouTube, or Instagram.

Synthesis of Environmental Mercury Loads in New York State — NYSDERA Agreement #12842 with additional support from Songbirds and Loons for Mercury Bioaccumulation Assessments— NYSDERA Agreement #3438

**Syracuse University**

Syracuse University, a private research university located in Syracuse, New York, was incorporated in 1870 and grew rapidly, establishing programs in architecture and fine arts that were among the nation's earliest. By 1934, the University's academic divisions had grown to comprise 13 schools and colleges, which persist to the present day.

**Suggested Citation**

Evers, D.C., Adams, E., Burton, M., Gulka, J., Sauer, A., and Driscoll, C.T. 2019. New York State Mercury Connections: the Extent and Effects of Mercury Pollution in the State. Biodiversity Research Institute, Portland, Maine. BRI Science Communications Series 2019-12-2, 41 pages.


**Workshop Participants**

Biodiversity Research Institute—Evan Adams, Mark Burton, Chris DeSorbo, David Evers, Julie Gulka, Cikiana Lema, Amy Sauer  
NYSDERA—Diane Bertok  
Adirondack Center for Loon Conservation—Victoria Burton, Nina Schuch  
Finger Lakes Institute at Hobart and William Smith Colleges—Lisa Cleckner  
Harvard University—Marie Perkins  
New York State Department of Conservation—Wayne Richter  
State University of New York College of Environmental Science and Forestry—Huiting Mao, Roxanna Razavi, Yang Yang  
Stony Brook University—Nick Fisher  
Syracuse University—Charles Driscoll, Geoffrey Millard  
U.S. Geological Survey—Douglas Burns, Karen Riva Murray

Home > *Ecotoxicology* > Article

Published: 21 May 2020

## Mercury in fish from streams and rivers in New York State: Spatial patterns, temporal changes, and environmental drivers

Karen Riva-Murray<sup>a</sup> , Wayne Richter, N. Roxanna Razavi, Douglas A. Burns, Lisa B. Cleckner, Mark Burton, Scott D. George & Douglas Freehafer

*Ecotoxicology* 29, 1686–1708 (2020) | [Cite this article](#)

480 Accesses | 8 Citations | 1 Altmetric | [Metrics](#)


**Environmental Science & Technology**


pubs.acs.org/est

Article

## Emergent Freshwater Insects Serve as Subsidies of Methylmercury and Beneficial Fatty Acids for Riparian Predators Across an Agricultural Gradient

Cornelia W. Twining,\* N. Roxanna Razavi, J. Thomas Brenna, Sarah A. Dzielski, Sara T. Gonzalez, Peter Lawrence, Lisa B. Cleckner, and Alexander S. Flecker

 Cite This: *Environ. Sci. Technol.* 2021, 55, 5868–5877


 Read Online

 Springer Link

Home > *Archives of Environmental Contamination and Toxicology* > Article

Published: 01 April 2021

## Mercury Concentrations in Big Brown Bats (*Eptesicus fuscus*) of the Finger Lakes Region, New York

Abby M. Webster<sup>a</sup> , Lisa B. Cleckner & N. Roxanna Razavi

*Archives of Environmental Contamination and Toxicology* 81, 1–14 (2021) | [Cite this article](#)


399 Accesses | 2 Citations | 1 Altmetric | [Metrics](#)



Journal of Great Lakes Research  
Volume 48, Issue 1, February 2022, Pages 252–259



## Elevated methylmercury concentration and trophic position of the non-native bloody red shrimp (*Hemimysis anomala*) increase biomagnification risk in nearshore food webs

Meghan E. Brown<sup>a</sup> , Kayleigh L. Buffington<sup>a</sup>, Lisa B. Cleckner<sup>b</sup>, N. Roxanna Razavi<sup>b c</sup>

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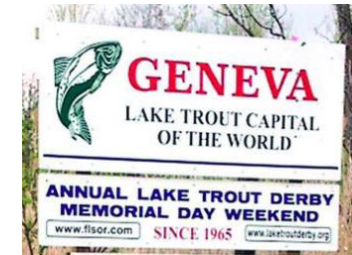
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<https://doi.org/10.1016/j.jglr.2021.11.010>  Get rights and content ▸



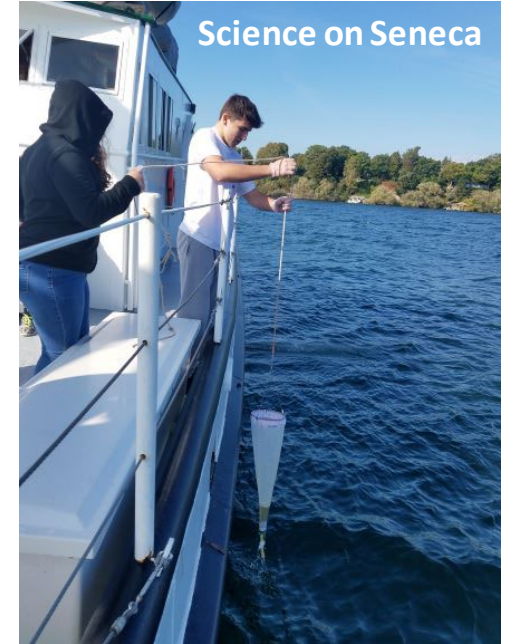
# Current Hg research

- Collaborative research among HWS (Cushman), SUNY ESF, NYSDEC, Seneca Lake Pure Waters, others
- 2022: Lake Trout derby
  - Data - species, length/weight (condition)
  - Stomachs for diet analysis (Cushman, students)
  - Tissue (muscle, skin on) for foodweb (stable isotopes), contaminant (Hg, PFOS/PFAS) analysis
- 2023: Fish community assessment in Seneca
  - Leverage NYSDEC Region 8 planned work in Seneca
  - Parallel work in Cayuga (Region 7) offers an opportunity for comparison



# FLI Education Programs: K-12 Core Program

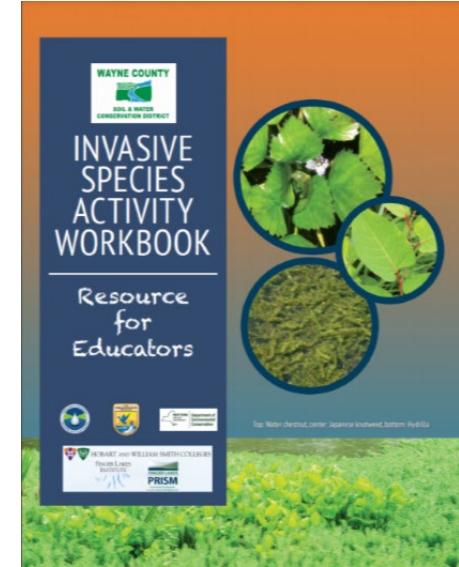
- Science on Seneca
- Stream monitoring
- Finger Lakes Youth Climate Summit
- Youth for Water & Climate Action
- Outdoor Finger Lakes environmental education and classroom enrichment
- Community Science pilot programs





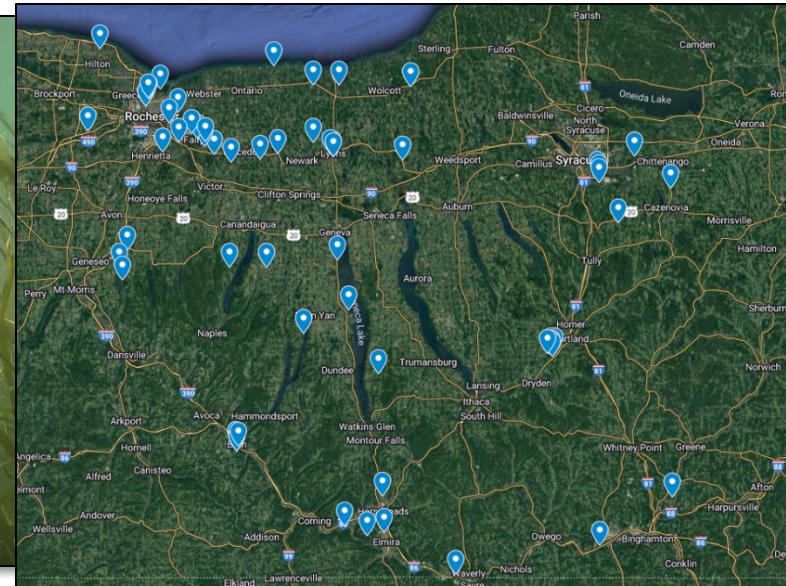
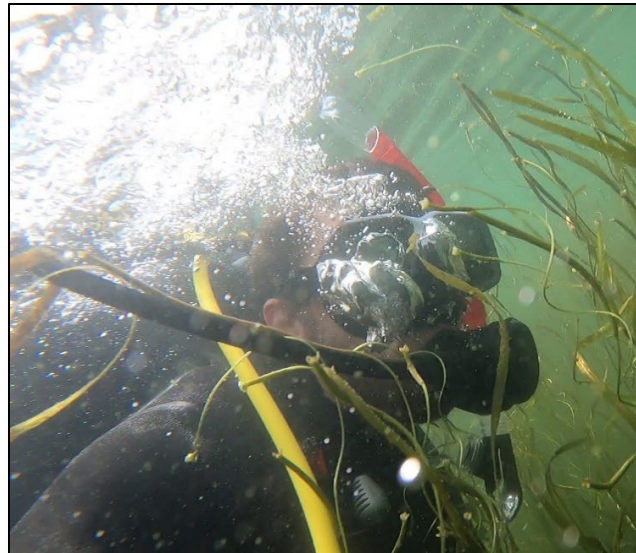
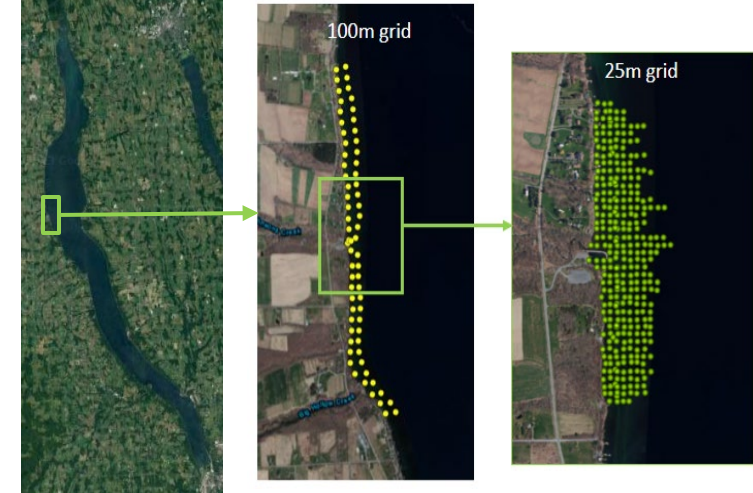
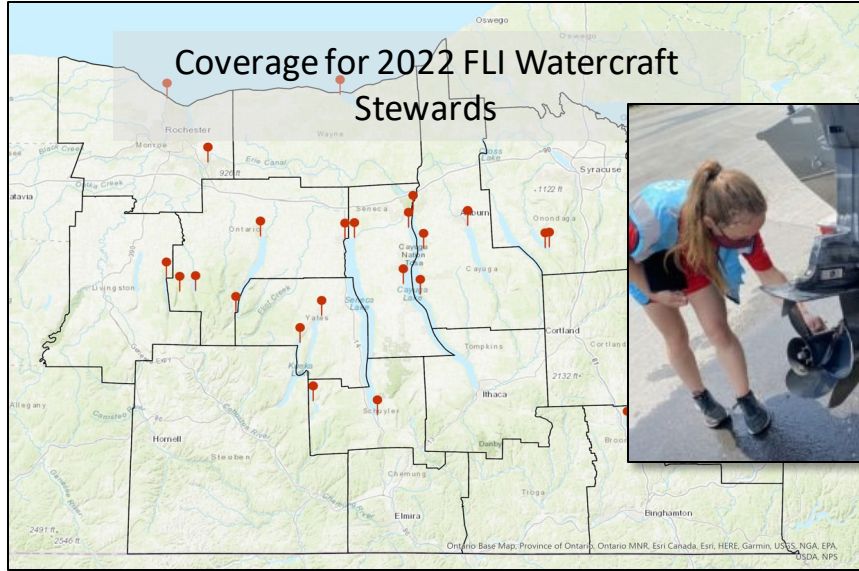
# Education – professional development

- For Educators
  - Educator retreats, workshops
  - Educational resources
- For HWS students
  - Intern positions at FLI
  - Environmental education training



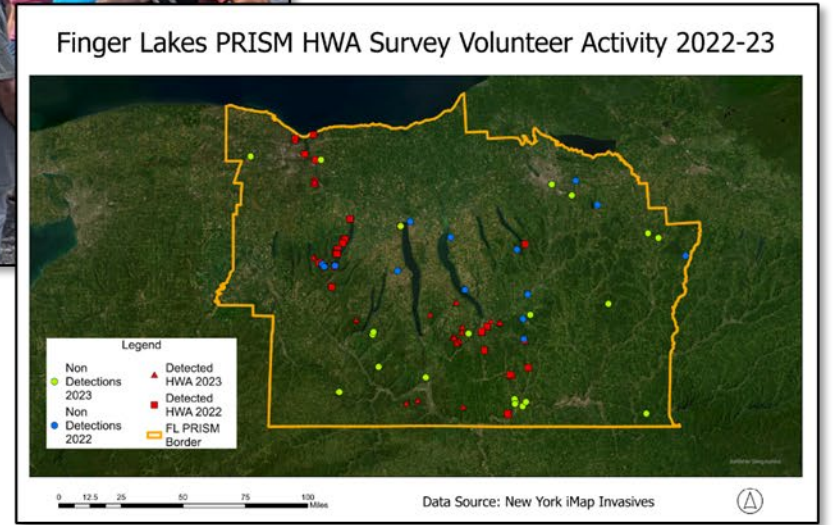


# Invasive Species – 1 of 8 NYS PRISMs





# Invasive species outreach and education





# Collaboration with Prof. Christine Chin

Artist and professor Christine Chin will join us on **April 20<sup>th</sup>** to explore the intersection of art and conservation. To combat the increasingly fuzzy distinction between truth and fiction in the media, Christine Chin's recent work seeks to create a more direct relationship between the art work and the data and sources of climate research. This talk will discuss the processes and thought behind various bodies of work: Stuffed Storms, Dust Storm Animations, and Invasive Species Cyanotypes—including directions being explored as a result of work with summer research students and the Finger Lakes Institute. ([christinechinphotography.com](http://christinechinphotography.com))



Sydney Van Winkle and  
Christine Chin in front of  
the exposing print of  
Invasive Species  
Cyanotype: *Heracleum  
mantegazzianum*

**Speaker:** Christine Chin—Artist and Professor at Hobart and William Smith Colleges

**Title:** *Concerning Climate: Art About Climate*

**Date:** April 20, 2023

**Time:** 12:00 PM to 1:00 PM

**ZOOM REGISTRATION REQUIRED**

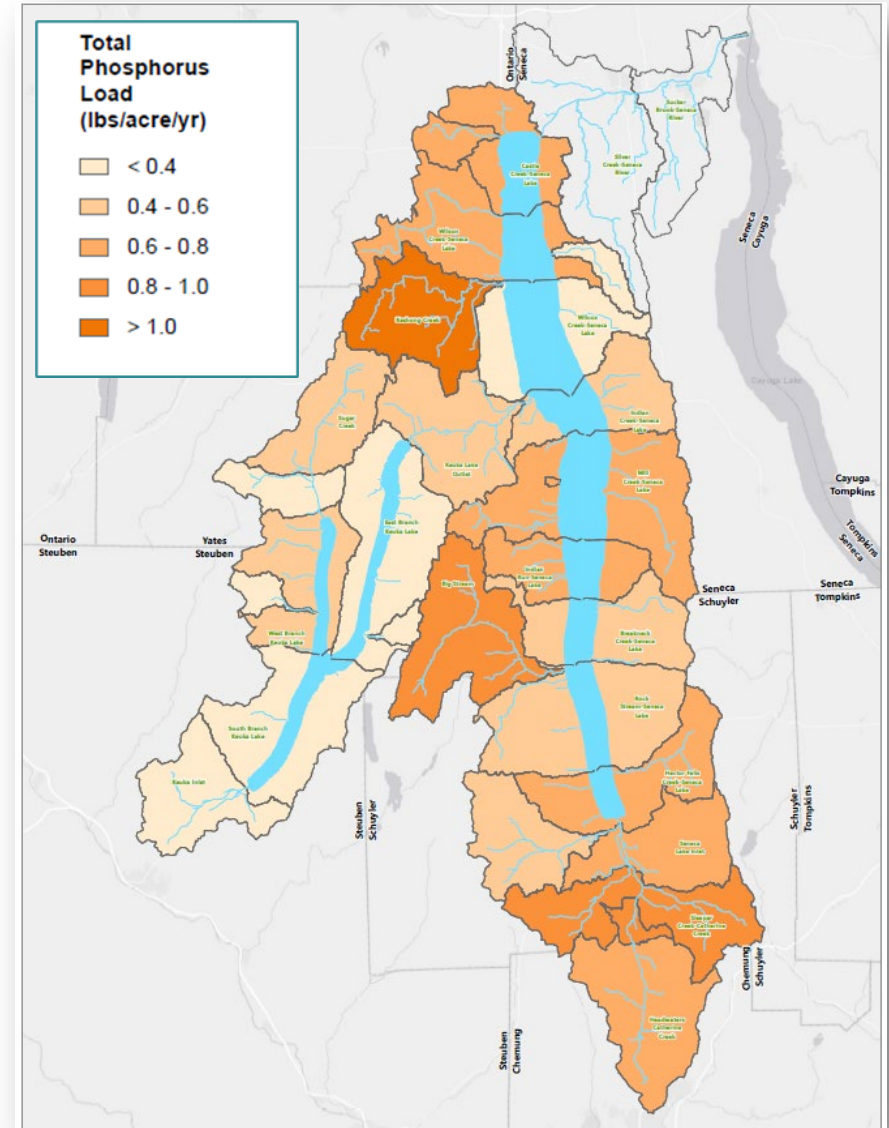
Christine Chin Studio:  
Invasive Species Cyanotypes  
Making a print of the  
Giant Hogweed (*Heracleum mantegazzianum*)  
July 26, 2022





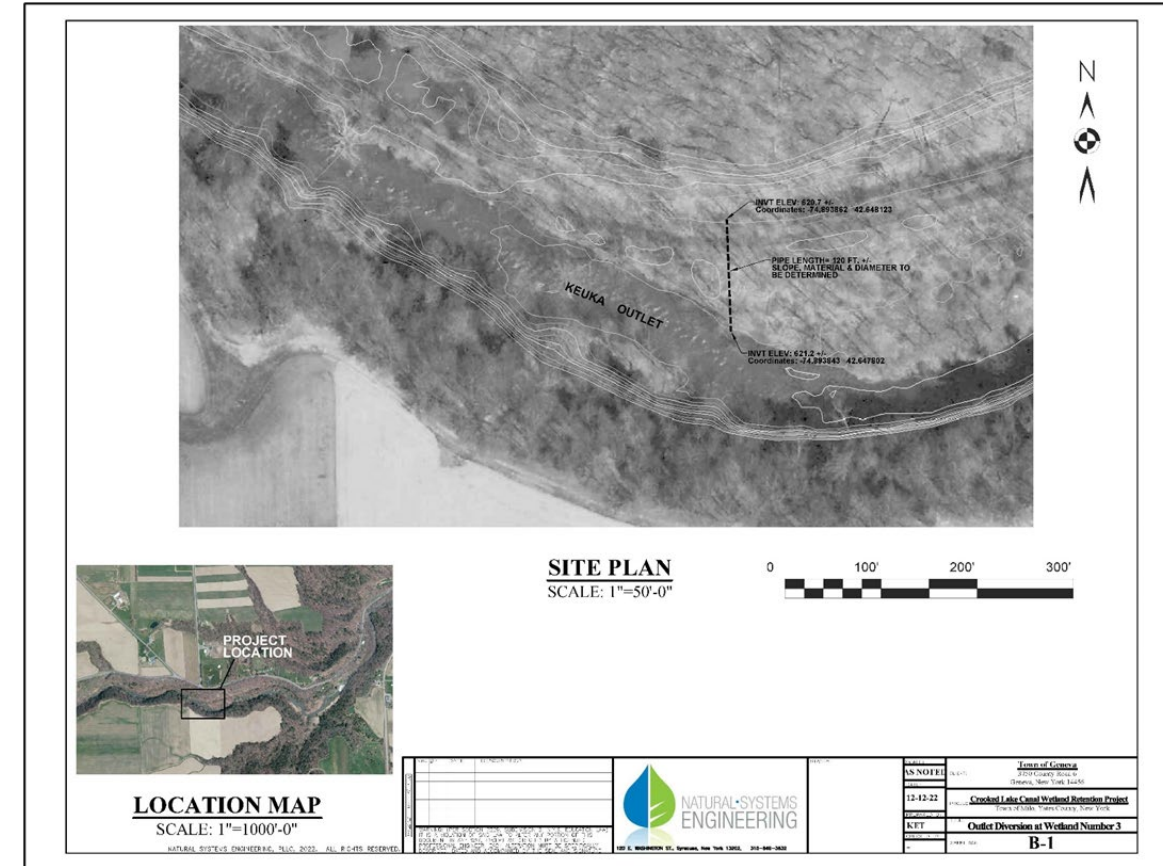
# Seneca Lake Watershed IO

- Collaborative intermunicipal organization focusing on natural resource management
- FLI provides staff and resource support to execute projects
- Nine Element Plan completed in 2022 to support accelerated execution
- \$750K in active project with an additional \$350K pending



# SWIO active project examples

- Keuka Outlet Wetland Creation
  - Repurposing abandoned portions of the defunct Crooked Canal to reduce flooding and sequester nutrients and sediment along the Keuka Outlet
- Road Drainage Assessment
  - Developing a methodology to assess and prioritize 2,000+ miles of road drainage ditches and culverts for best management implementation work
- Odessa Green Infrastructure
  - Planning and engineering work to integrate green infrastructure into the Village of Odessa stormwater system and parklands





# Baker Lab – NYS Certified Lab

- NYS Department of Health certified in October '21, renewed in April '22, '23
  - Procedures
  - Databases
  - Logs for dedicated equipment, supplies
  - Safety and ethics training, records
  - Semi-annual demonstration of capability tests
  - Audits
- TP, SRP, NO<sub>x</sub>, NH<sub>4</sub>, Microcystin to start...



Finger Lakes Institute Quality Manual, v4  
Effective date 02/17/2020



FINGER LAKES INSTITUTE QUALITY MANUAL

Lead Director JBC Date 12/22/2020

Finger Lakes Institute  
HOBART AND WILLIAM SMITH COLLEGES  
601 South Main Street, Geneva, NY 14456

# Baker Lab – FLI Capabilities

- Data management, QA/QC automation
  - R, report generation
- Work with clients
  - Chain of custody forms
  - Quality Assurance Project Plans
  - Timely reporting
- Revenue generating



## Finger Lakes Institute Lachat Report

Analyte - NOX

Analysis Date: 11/03/2020

Sample Results (all results expressed as mg/L)

formattable(NOXsam)			
Sample.ID	Peak.Concentration	Detection.Date	
200917_KE-A1_NOX	0.01040	11/3/2020	
200917_KE-A1_NOX	0.01010	11/3/2020	
200917_KE-A1_NOX	0.01010	11/3/2020	

## Certified Reference Material Percent Recovery


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Test <- formatter("span",
  style = x ~ style(display = "block", font.weight = "bold", color = "black", "border-radius" = "4px", "padding-right" = "4px", "background-color" = ifelse(x < 80, "tomato", ifelse(x > 120, "red", "palegreen"))),
  x ~ percent(x/100))
formattable(NOXCRMs, align=c("l", "r", "r", "r"), list('PctRecCRM' = Test))
```

Sample.ID	Peak.Concentration	CRM	PctRecCRM
0.22 CRM	0.233	0.22	105.91%
0.22 CRM	0.225	0.22	102.27%
1 CRM	1.020	1.00	102.00%
1 CRM	1.000	1.00	100.00%



# NYSDOH Certificates

NEW YORK STATE DEPARTMENT OF HEALTH  
WADSWORTH CENTER



Expires 12:01 AM April 01, 2024  
Issued April 01, 2023

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE  
*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

DR. LISA B. CLECKNER  
FINGER LAKES INSTITUTE  
601 SOUTH MAIN STREET  
GENEVA, NY 14456


NY Lab Id No: 12144

*is hereby APPROVED as an Environmental Laboratory in conformance with the  
National Environmental Laboratory Accreditation Conference Standards (2016) for the category  
ENVIRONMENTAL ANALYSES NON POTABLE WATER*

*All approved analytes are listed below:*


Nutrient

Ammonia (as N)	EPA 350.1, Rev. 2.0 (1993)
Nitrate (as N)	EPA 353.2, Rev. 2.0 (1993)
Orthophosphate (as P)	EPA 365.1, Rev. 2.0 (1993)
Phosphorus, Total	EPA 365.1, Rev. 2.0 (1993)




Serial No.: 67429

Property of the New York State Department of Health. Certificates are valid only at the address shown and must be conspicuously posted by the laboratory. Continued accreditation depends on the laboratory's successful ongoing participation in the Program. Consumers may verify a laboratory's accreditation status online at <https://apps.health.ny.gov/pubdoh/applinks/wc/elappublicweb/>, by phone (518) 485-5570 or by email to [elap@health.ny.gov](mailto:elap@health.ny.gov).



Page 1 of 1

NEW YORK STATE DEPARTMENT OF HEALTH  
WADSWORTH CENTER



Expires 12:01 AM April 01, 2024  
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DR. LISA B. CLECKNER  
FINGER LAKES INSTITUTE  
601 SOUTH MAIN STREET  
GENEVA, NY 14456


NY Lab Id No: 12144

*is hereby APPROVED as an Environmental Laboratory for the category  
ENVIRONMENTAL ANALYSES NON POTABLE WATER*

*All approved subcategories and/or analytes are listed below:*

Bacteriology

Total Microcystins	EPA Method 546
--------------------	----------------



Serial No.: 67430

Property of the New York State Department of Health. Certificates are valid only at the address shown and must be conspicuously posted by the laboratory. Continued accreditation depends on the laboratory's successful ongoing participation in the Program. Consumers may verify a laboratory's accreditation status online at <https://apps.health.ny.gov/pubdoh/applinks/wc/elappublicweb/>, by phone (518) 485-5570 or by email to [elap@health.ny.gov](mailto:elap@health.ny.gov).

Page 1 of 1

# Our Funding Sources



New York State  
Water Resources Institute  
Cornell University

CORNING



SIEMENS

Cayuga County Government  
In the Finger Lakes Region Of



FOLLOWPA  
FINGER LAKES - LAKE ONTARIO WATERSHED PROTECTION ALLIANCE



CANANDAIGUA LAKE  
WATERSHED ASSOCIATION

USDA NRCS  
U.S. Department of Agriculture  
Natural Resources Conservation Service



Department of  
Environmental  
Conservation

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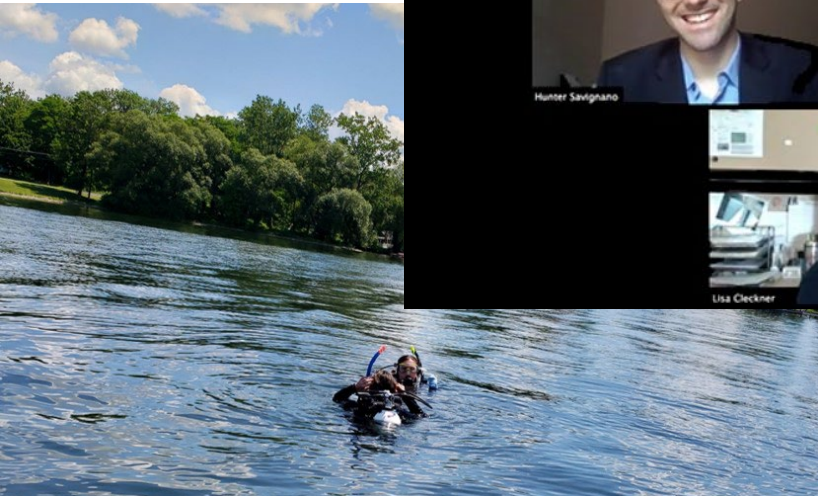
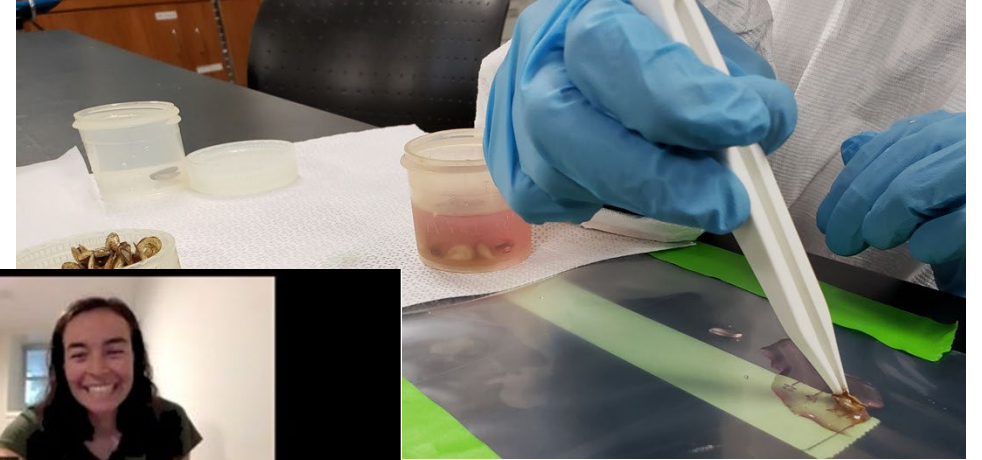
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# Conclusions

- Water resources and natural capital are economic heart of the Finger Lakes region
- Many pressing issues including HABs, invasive species, nutrients
  - Citizens, watershed associations, municipalities play key roles
- Watershed stewardship needs many partners including landowners, citizens/volunteer scientists, municipal leaders and agencies, academics, people who drink water and \$\$
- FLI helps to protect and promote these natural assets by connecting activities at HWS to regional, state, and federal needs
- Baker Lab is key asset for FLX region

# Acknowledgments – Students and Partners



FLISTEWARD.COM

**Of Cheeseburgers and Protecting Finger Lakes Waters: A Superhero's Reflections Midway Through Watercraft Stewardship**

By: Nick Aiezza, Watercraft Steward Long Point State Park. Aurora, New York. And the breeze...



# Acknowledgments – HWS Faculty



John Halfman



Susan Cushman



Meghan Brown



Beth Kinne



Kristen Brubaker



Tara Curtin



Brad Cosentino



Darrin Magee



Leslie Hebb



Ileana Dumitriu



Dave Finkelstein



Tom Drennen



Christine Chin

# HABs – lots of interests, projects, collaborations

## Comprehensive monitoring of HABs via molecular tools and weekly sampling in two Finger Lakes, NY



Lisa B. Cleckner<sup>1</sup>, Trevor Massey<sup>1</sup>, Evan Helming<sup>1</sup>, Nan Wang<sup>2</sup>, Ruth Richardson<sup>2</sup>

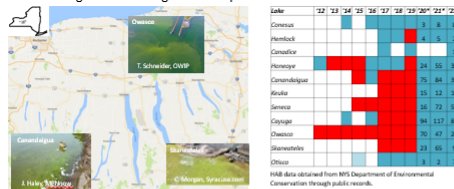
<sup>1</sup>Finger Lakes Institute, Hobart and William Smith Colleges, Geneva, NY

<sup>2</sup>Civil and Environmental Engineering, Cornell University, Ithaca, NY



### Background

The Finger Lakes, located in New York State, are 11 glacially formed lakes with a wide variation of trophic status, watershed size, land use, and lake depth (Figure 1). Harmful algal blooms (HABs) have been reported across the 11 Finger Lakes over the past decade, with all lakes having confirmed HAB events in the same year in 2017. Detectable microcystins in public drinking water supplies on Owego Lake in 2016 and on Canandaigua Lake in 2018 focused greater attention on addressing HABs including the development of NYS Action Plans.



**Figure 1.** Location of the Finger Lakes and the documented HAB events over the past decade. There have been notable HAB events over the past few years including those in oligotrophic lakes such as Canandaigua and Seneca. Bloom events are differentiated by high blue-green chlorophyll concentrations (cyan color) and the presence of high concentrations of microcystins (red). From 2020 forward, the number of confirmed blooms is listed.



**Figure 2.** Flow chart of NYS definition of HABs based on screening using a bbe FluoroProbe and subsequent toxin analysis. Results of analysis are shared with the public through an ArcGIS website that is updated by NYS. The map on the right shows the HAB status in the Finger Lakes in September 2019. Yellow symbols indicate active blooms while grey symbols show archived blooms (> 2 weeks old). Circled lakes are part of this study. Source: NYHABs, NYSDEC.

The Finger Lakes Institute analyzes HABs for several watershed associations and intermunicipal groups and as part of research projects. The bbe FluoroProbe is used in the lab for to measure Chla by phytoplankton including green algae, diatoms, cyanobacteria, and cryptophytes (red channel can also indicate presence of cyanobacteria with phycocyanin). Confirmations of cyanobacteria are made using light microscopy and total microcystins are analyzed using EPA Method 546 using an Abraxis Automated ELISA system.



### Objectives

In order to better understand the formation and dissipation of HAB events, we performed weekly (Tues) sampling of nearshore waters from Canandaigua and Cayuga Lakes (Table 1) in 2020, regardless of whether HABs were present or not.

- Weekly composite (0.5m) water samples were collected at the surface and bottom from 4 nearshore locations (depth ~1.5 - 3m) of each lake
- Samples were analyzed for FP Chla, total microcystin
- HAB samples were collected opportunistically through community science HAB programs on both lakes throughout HABs season (August – October)
- Microbial community 16S analysis was performed on select subsamples at Cornell to help characterize the microbial community in water and HAB samples



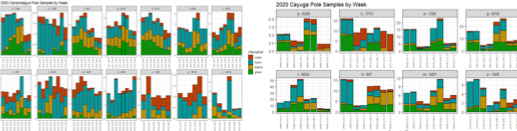
**Table 1.** Average water quality and watershed characteristics of Canandaigua and Cayuga Lakes.

Lake	Mean, max depth (m)	Volume (km <sup>3</sup> )	Surface area (km <sup>2</sup> )	Watershed area (km <sup>2</sup> )	Watershed: Surface Ratio	Mean summer Total P (µg/L) <sup>a</sup>	Mean summer water Chl a (µg/L) <sup>b</sup>
Canandaigua (CN)	30, 64	1.64	42	477	11.4	6	2.3
Cayuga (CY)	55, 133	9.38	172	1145	6.65	13	4.3

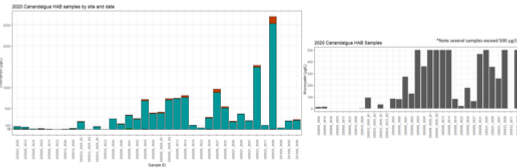
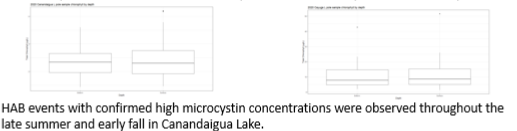
<sup>a</sup>NYDEC, 2018 Finger Lakes Water Quality Report - Summary of Historic Finger Lakes Data and the 2017-2018 Citizen Statewide Lake Assessment Program.

### Results

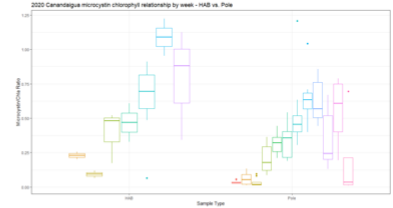
On average, nearshore Canandaigua Lake composite water Chla concentrations (µg/L) were lower than Cayuga Lake nearshore composite water Chla (note y-axis change).



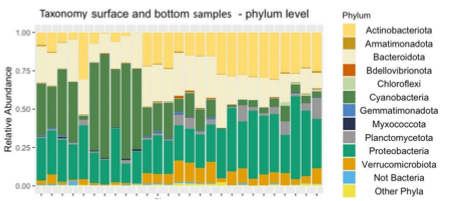
Over the sampling period, Chla concentrations were not different between surface and bottom depths from both lakes. This is likely due to the relatively shallow water depth.



Composite water samples from Canandaigua Lake mirrored microcystin:Chla ratios of HABs over the sampling season with highest concentrations seen in September. Cayuga Lake composite sample toxin quotas were highest in July and lower and consistent throughout August and September (data not shown).



16S Community analysis of HABs and composite samples continues. At this time, we have preliminary data from a subset of composite samples and HABs in 2020. The three most common phyla of bacteria found across both Canandaigua and Cayuga Lakes other than Cyanobacteria are Actinobacteriota, Bacteroidota, and Proteobacteria.

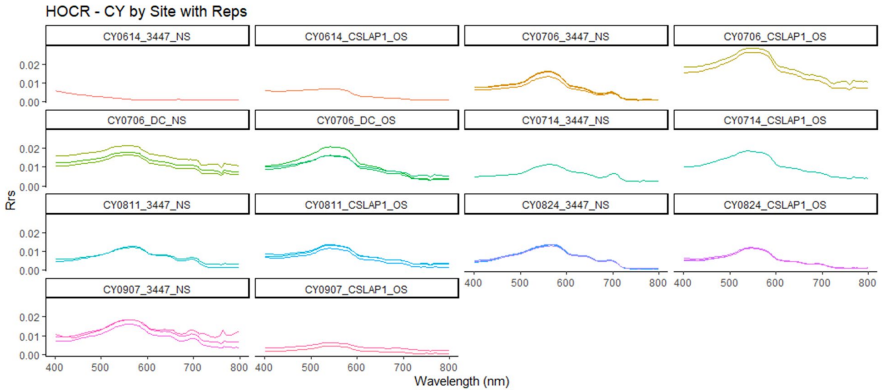


### Summary and Future Work

- Community scientists play a key role in enabling HABs research in the Finger Lakes and have contributed much to our understanding of spatial and temporal changes of HABs for different Finger Lakes.
- Canandaigua Cyanobacteria communities have higher toxin quotas compared to other Finger Lakes.
- Canandaigua Lake has had consistent HABs since 2017 despite its low nutrient concentrations.
- More analysis of 16S communities from HABs and composite water collected in 2022 is underway to help understand short-term changes in HAB biomes.

### Acknowledgments

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# Thank you

