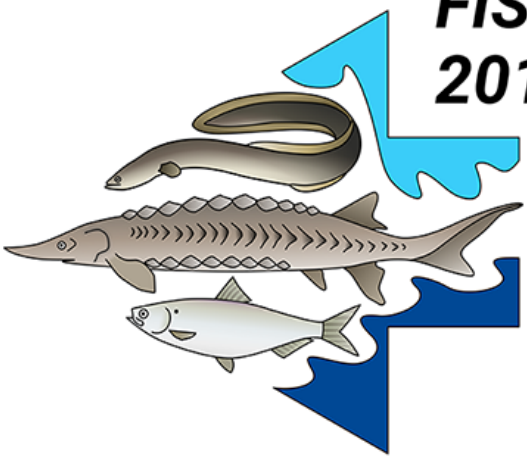
# ABSTRACTS

# 53RD ANNUAL MEETING OF THE NEW YORK CHAPTER AMERICAN FISHERIES SOCIETY



**FISH ON THE MOVE**
**2019 ANNUAL MEETING**
NEW YORK CHAPTER and
NORTHEASTERN DIVISION of the
AMERICAN FISHERIES SOCIETY

**February 6 – 8, 2019**
**Poughkeepsie Grand Hotel**
**40 Civic Center Plaza**
**Poughkeepsie, NY**

# PLENARY PRESENTATIONS

**The Hudson River Eel Project: Fish Conservation through Community Engagement (and vice versa)**

Chris Bowser

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What do you get when you combine a half-million eels with thousands of trained volunteers? A wonderful example of conservation in action. Since 2008 the Hudson River Eel Project has trained citizen scientists—from high school students to retirees—to monitor migrating glass eels with fyke nets set in tidal tributary mouths. A dozen sites span over 120 miles of estuary from New York City to the Albany area. This has given us a decade-long snapshot of glass eel migration along an estuarine gradient, and has built an energized constituency of eel enthusiasts, some of whom have gone on to pursue further environmental and education careers.

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# PLENARY PRESENTATIONS

**Fish on the Move – One Manager's Perspective**

John Maniscalco

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Climate change and its impacts on the ocean and fish stocks is a reality that managers are struggling to deal with. Most interstate fishery management participants accept that many fish distributions are shifting in response to a changing climate, the difficulty is what to do about it. Every interstate body along the east coast has a committee dedicated to ecosystem and climate impacts to marine fisheries. Many assessments are beginning to incorporate environmental variables and climate impacts into their models and survey indices. Some assessments even require climate impacts be considered in the assessment Terms of Reference. When it comes to implementation, management has been slow to adopt and change. Drawing from recent assessment and management of black sea bass, the impacts of climate change on a stock and the dependent fisheries will be explored.

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# PLENARY PRESENTATIONS

### Vulnerabilities and adaptation of Northeast fishing communities in the context of fish on the move

Katherine E. Mills[1], Michael Alexander[2], Andrew Allyn[1], Lisa L. Colburn[3], Steve Eayrs[1], Bradley Franklin[1], Troy Hartley[4], Mary Hudson[1], Brian Kennedy[1], Sabrina Kerin[1], Jonathan Labaree[1], Andrew Pershing[1], James Scott[2] and Jenny Sun[5]

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Ocean waters on the Northeast U.S. continental shelf have warmed rapidly in recent years, and climate models project this warming to continue. Associated changes in species distributions and productivity are already affecting fishing communities, as they face declines in traditionally-fished species and the appearance of emerging species in their fishing areas. The local impacts of these changes depend on the nature and rate of ecosystem change, patterns of dependence on marine resources, and adaptation capacity and choices. We use climate projections to drive species models as a basis for conducting port-scale assessments of social-ecological vulnerabilities to climate-related species changes. Results of this assessment provide insights into relative vulnerability of 75 fishing communities from Maine to Virginia and help identify key risks in specific ports. For four focus communities, we integrate projected species changes into economic models of the fishing sector and regional economy to quantify their impacts. We also consider a suite of adaptation scenarios to assess the extent to which different adaptation approaches would buffer the impact of species changes and create new opportunities for fisheries in the community. Results indicate a high degree of variability in the impacts of shifting species to specific communities, but in most cases, considerable benefits can be realized from adaptation. Adaptation choices will substantially shape outcomes, but a variety of factors facilitate or constrain implementation of specific adaptation strategies. Community planning, policy choices, and financial resources that support adaptation will be important for ensuring the resilience of fishing communities in the context of climate change.

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# PLENARY PRESENTATIONS

**The future is now: Climate change and North Atlantic fisheries**

Janet Nye

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We often talk about climate change as something that will happen in the future, but in fact, the climate has already changed and marine ecosystems have responded in a variety of ways. Waters off the Northeast US coast have warmed faster than 99% of the global ocean and have experienced two ocean heatwaves in just the past six years. In response, fish have moved to cooler waters and some populations have declined in abundance. While there are numerous negative impacts to fisheries such as cod and yellowtail flounder, other fisheries like summer flounder and black sea bass have responded favorably to warming. With responsive and more flexible fisheries management, coastal communities can adapt to climate change.

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# PLENARY PRESENTATIONS

**Migration Ecology of Marine Fishes: Contingents for Contingencies**

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The digital age has ushered in countless discoveries on the previously hidden lives of marine fishes. What have we learned? Have organizing principles emerged from this deluge of discovery? Can we harness new found diversity to improve stewardship of coastal fisheries? Through partial migration, fish populations build contingents for contingencies, a property that can build resilience and stability in marine fisheries against future novel ecosystem states. In this talk I highlight examples of contingents for contingencies including (1) assessing coastal striped bass fishery fleets according to partial migration; (2) differential exploitation on Hudson River striped bass spawning runs; (3) unit stock boundaries for Atlantic mackerel contingents; and (4) hurricane evacuations by black sea bass.

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# ORAL PRESENTATIONS

## Shadeau research project: from applied to academic research for the recovery of Allis shad and Twaite Shad

Acolas, M-L ; Bardonnet, A ; Bauman, L ; Bareille, G ; Blaya, M ; Boschet, C ; Daverat, F ; Geffard,O ; Kerouaz, F ; Lambert, P ; Lassalle, G ; Lepais, O ; Nachon, D ; Paumier, A ; Poulet, C ; Pecheyran, C ; Rambonilaza, M ; Rochard, E ; Tabouret, H ; Taillebois, L ; Tentelier, C.

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Allis shad Alosa alosa and its sister species Alosa fallax were once very abundant species along their respective distribution range. Allis shad populations abundance decreased drastically with occurrence of extirpations for the southernmost populations. The French South Western shads populations which used to be the most abundant within their distribution range, collapsed. Despite the implemented fish ban during ten years, the populations have not recovered yet. The SHADEAU project was constructed in close collaboration with stakeholders and managers of shad species within the South West Region of France (Nouvelle Aquitaine Region) in order to acquire knowledge on the causes of the collapse and the non-recovery of the populations. It is funded by the Nouvelle Aquitaine Region, the Adour Garonne Water Agency and the different research institutions. As a trade-off between the need for local knowledge and the need for generic results at the species scale, the different tasks of the project were built in order to investigate the effects of anthropogenic pressures along the different life stages and hence along the different habitats occupied by shads during their life cycle, using ecology and economy as disciplines, as well as art & science. The project involves five PhD, two post doctorates, six masters within three different research laboratories. The project is planned from 2017 to 2021.

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# ORAL PRESENTATIONS

**Hudson River American shad: A brief status update**

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American shad are intertwined with the long, rich history of the Hudson Valley. Spring spawning runs were a source of sustenance, commerce, and recreation from pre-colonial days through the end of the last decade. Unfortunately, centuries of habitat loss, pollution, and excessive harvest led to a precipitous decline of the American shad stock in the Hudson River, culminating in a complete closure of the fishery in 2010. Stock collapse is well illustrated through historical commercial landings; however, the NYSDEC spawning stock and young-of-year relative abundance estimates provide the most conclusive evidence for collapse. The continuation of these fishery independent monitoring efforts is instrumental in evaluating stock recovery progress. Unfortunately, the time series for each respective survey represents a small fraction of the stock history and recovery targets from these surveys may not reflect historic population characteristics. Additional Hudson River specific reference/recovery metrics will be explored in the upcoming 2019 Atlantic States Marine Fisheries Commission stock assessment of American shad.

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# ORAL PRESENTATIONS

**Variability in growth of alewife in six coastal rivers**

*David Andrews

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As a critical link between freshwater and marine ecosystems, and for their role as forage to larger commercially important fish species, alewife (*Alosa pseudoharengus*) are vital to the health of coastal ecosystems. Understanding dynamics of populations in recovery allows us to better manage for increased recruitment and biomass from recovering stocks. In New England, there has been a moratorium on harvest of alewife since 2006, and managers are taking steps to improve habitat connectivity and ensure passage both into and out of spawning habitat. The results have been a recovery in some spawning runs to pre-2006 levels with most runs experiencing more moderate returns and some seeming reluctant to rebound. Observed differences in overall size of fish within spawning runs suggests that there is some factor allowing for exceptional growth compared to other rivers. Using back-calculation of adult fish lengths and the growth function proposed by Galluci and Quinn (1979) within a Bayesian hierarchical framework we assessed variation in growth in 6 coastal spawning runs to determine at what point in life these differences in size arise. This information will allow managers to better understand why some spawning runs have shown more impressive signs of recovery than others since the moratorium on harvest in 2006.

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# ORAL PRESENTATIONS

## Oocyte development of Age 2 alewife in Lake Ontario

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Since their introduction in Lake Ontario, Alewife (*Alosa pseudoharengus*) have dominated the forage fish community, making them the primary food source for the lake's salmonines. Therefore, population dynamics of Alewife directly impact the success of these economically valuable predatory fish. Recently observed variability in Alewife year class strength has identified a need to understand the reproductive potential of young alewife. Previous research has focused on the role of climate, but little is known about how age or size influence Alewife reproductive potential. The objective of this study was to document oocyte development in age 2 Alewife (106-145 mm) using gonadosomatic index (GSI) analysis and histomorphometic changes (distribution of oocyte size and relative proportion of the various oocyte stages). Alewife were collected from Lake Ontario between October 2017 and October 2018 when accessible using bottom trawls and boat electroshocking. Changes in GSI of age 2 Alewife were similar to those observed in age 4 alewife (166+ mm). GSI remained low until June (<3.5%), then peaked in July prior to a sharp drop in August. In July, GSI of age 2 Alewife averaged 7.3 ± 2.3% and were similar to those observed for age 4 Alewife (7.2 ± 2.7%). In addition, ovaries collected in July contained oocytes at different stages of maturity (previtellogenic, endogenous and exogenous vitellogenesis and final maturation). These data confirm that Alewife are multiple-spawner fish and that age 2 Alewife have the potential to contribute to the spawning stock.

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# ORAL PRESENTATIONS

**The importance of winter foraging by thermally-dissimilar fish species**

*Benjamin D. Block, J. Ellen Marsden and Jason D. Stockwell

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How to manage energetic demands in the winter is a conundrum for temperate and high-latitude fishes, but each species may respond differently to such demands. Our research will test if cool- and warm-water fish species differ in winter foraging strategies and the degree to which winter foraging influences their growth and survival. Diets of yellow perch (cool-water species), pumpkinseed (warm-water), and bluegill (warm-water) will be compared within winters and among seasons. The importance of winter foraging for the annual energy budget of fishes will be evaluated by measuring seasonal changes in total lipid content. Individual growth rates will be estimated using bioenergetics models to determine if winter diets contribute significantly to annual growth. Models will also provide an opportunity to test how individual growth across thermally-dissimilar fish species may respond to predicted climate changes, such as increases in mean water temperature. Results may be particularly relevant to fish communities in mid-latitude lakes that exhibit annual variations in ice cover and winter conditions and thus could provide novel insights into the relative importance of winter foraging to fish population dynamics.

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# ORAL PRESENTATIONS

**The global rise of crustaceans: shelling out more for seafood?**

Robert Boenish

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Amidst broad-scale overfishing and climate change, global decapod crustacean (lobsters, crabs, and shrimp) fisheries are growing faster than any other major group. It is therefore likely that direct and indirect enhancements not dissimilar to domestication have a facultative role in the global rise of crustaceans. Due to intrinsic reproductive and trophic generalist qualities, and the methods by which they are prosecuted in fisheries, a future of crustaceans will introduce ecological, economic, and social implications. While increased productivity due to overfishing of lower productivity high trophic level species has been suggested, little attention has been given to the direct and indirect socio-biological costs of a shift towards crustaceans. We analyzed six decades of global catch and nutrition data, and present two case studies to show that increasing crustacean dependence will generate more employment and profit, but come at the cost of increased carbon emissions, decreased food production, socio-ecological resilience, and biodiversity, of which most costs will be realized by developing countries. Further, we suggest direct and indirect fishery enhancements have a facultative role in the global rise of crustaceans.

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# ORAL PRESENTATIONS

**Moving to a lake-wide understanding of early life-history habitat for Lake Ontario Coregonines**

*Taylor Brown[1], Suresh Sethi[1], Lars Rudstam[2], Brian Weidel[3], Michael Connerton[4], Jeremy Holden[5], Marc Chalupnicki[6], Thomas Evans[2], Dimitry Gorski[7], Curt Karboski[7] and Nicholas Sard[8]

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Coregonines (*Coregonus* spp.) in the Laurentian Great Lakes were historically the major component of native fish communities and commercial fisheries. In Lake Ontario, only remnant populations of cisco (*C. artedi*) and lake whitefish (*C. clupeaformis*) endured through the impacts of habitat degradation, overexploitation, and invasive species. Key information needs for the successful rehabilitation of coregonine populations include elucidating why certain spawning populations have successfully persisted and what factors are limiting the resurgence of historic subpopulations. To describe larval coregonine spatial distributions and identify characteristics of suitable early life-history habitat lake-wide, approximately 1,100 ichthyoplankton samples were collected among contemporary and historic nursery habitats across Lake Ontario during April and May 2018. In this presentation, we present preliminary results exploring trends in spatial distributions and associated habitat factors of presence and relative abundance. The results of this research will further our understanding of coregonine early life-history habitat needs and lake-wide population dynamics to support future management actions.

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# ORAL PRESENTATIONS

**Grass carp Ctenopharyngodon idella growth before and after Hydrilla verticillata control**

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Grass carp *Ctenopharyngodon idella* are a long-lived, large-growing species of herbivorous fish. Because of their voracious feeding behavior, grass carp have been stocked across the United States for aquatic plant management, commonly hydrilla *verticillata*. Triploid grass carp were long believed to have a maximum age of approximately 11 years based on historical, large stocking efforts through which aquatic plants were eliminated. But recent studies in systems where preferred foods were not eliminated due to over-stocking have found that the maximum age far exceeds previous estimates. Grass carp stocking in Lake Gaston, VA & NC, has occurred from 1995 through 2016. Hydrilla coverage peaked at just more than 1,300 ha in 2003 and has since been reduced to about 100 ha through a combination of grass carp stocking and herbicide applications. The objective of this study was to relate growth and maximum size of grass carp to changes in hydrilla biomass during the course of a multi-decade, integrated-plant management project. A Bayesian hierarchical approach was used to estimate parameters of the von Bertalanffy growth model. These estimations have found a drastic reduction (600 mm) in maximum size ($L_\infty$) over time, and this change in $L_\infty$ was linked to the hydrilla surface coverage on the reservoir. Through the inclusion of hydrilla area as a continuous variable in Bayesian models, the growth of grass carps was linked directly to availability of a preferred food source. These relationships will be useful in informing management decisions in the future.

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# ORAL PRESENTATIONS

**The reintroduction of the American eel to the NY portion of the Upper Susquehanna**

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Dams across the Susquehanna River from Maryland to New York currently prevent American eels from returning to this watershed, where they were once a significant part of river, stream, and lake fauna. Eels have been poorly studied in the Susquehanna. Our study will gather data on eel dispersal and migration, their effects on their native ecosystem, and changes associated with their extirpation and subsequent reintroduction. With the loss of American eels, some impacts to our local ecosystems are apparent. These include the loss of the sole effective host of our historically most numerous riverine pearly mussel – The Eastern Elliptio – and the irruption of the invasive rusty crayfish (*Orconectes rusticus*). Rusty crayfish densities have apparent negative consequences to at least one pearly mussel species of greatest conservation need (SGCN), the yellow lamp mussel (*Lampsilis cariosa*). We are initiating a full evaluation of the American eel and ecosystem impacts following their reintroduction to the Susquehanna Watershed.

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# ORAL PRESENTATIONS

**Seasonal condition and VHSV prevalence in the invasive round goby in the Upper St. Lawrence River**

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Invasive species are an environmental disturbance that can have cascading effects on non-native systems, potentially affecting disease dynamics, food web relationships, and ecosystem services. The invasive round goby (*Neogobius melanostomus*) has had dramatic consequences for ecosystem function in the Great Lakes- St. Lawrence River system since their introduction in the 1990s. They dominate abundance and serve as a highly competent reservoir and vector for viral hemorrhagic septicemia virus (VHSV). Round gobies present many life history traits typical of invasive organisms, including changeability in body condition to maximize reproductive output and attainment of large body size relative to their native range. They have proven to be very susceptible to disease in the Great Lakes and St. Lawrence River, likely due to their high density and lack of immune competence from previous exposure or host-pathogen co-evolution. This project aims to investigate the relationship between epidemiologic host-environmental factors and disease dynamics, relating seasonal physiological characteristics of round gobies and temperature to VHSV prevalence and viral load. We collected round gobies from the Thousand Islands region of the St. Lawrence River using a suite of methods during spring, summer, and fall of 2018. We examined individuals for sex, age, hepatosomatic index, gonadosomatic index, and clinical disease symptoms, and assessed a subsample for the prevalence and viral titers of VHSV in pooled organ and brain tissues by RT-qPCR. We found substantial physiological variability in round gobies based on their seasonal organosomatic indices. VHSV was detected at high prevalence in brain tissues and differences were observed between sexes and seasons. By investigating the larger population-level factors that may lead to high VHSV prevalence in round gobies, we should better understand their role in VHSV maintenance and transmission to native sport fish and suggest the most effective goby demographics for future testing to gain local prevalence estimates.

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# ORAL PRESENTATIONS

**Dam removals and the return of East Coast shads and other native species**

Candice Constantine, Nick Nelson and Michael Burke, PE

*Inter-Fluve*

In their native ranges along the eastern seaboard, shad, herring, and American eel are key members of both marine and riverine ecosystems where they help support healthy populations of larger fish, birds, and mammals. Shad stock has historically been on the decline most likely as a result of loss and degradation of spawning habitat due to dams and other human activities, fishing and bycatch, and predation. Both species of river herring (alewife and blueback herring) are included on NOAA's Species of Concern list. In the past decade, Inter-Fluve has designed and participated in the permitting and construction phases of dam removal projects on rivers from Maine to Maryland focused on restoring fish passage among other goals. Our process of post-removal channel design considers the full range of native aquatic species and their particular passage requirements. In this talk, we present dam removal case studies, including fish passage design and the range of approaches to permitting dam removal. We present exciting evidence of the return of native fish runs, including shad, herring, and eel, soon after construction. Many of the sites were historical mill dams on rivers that had not seen migratory fish runs for nearly 200 years. Finally, we discuss how aspects of the permitting process can help to expedite dam removal projects for the benefit of ecosystems and to get the most out of available funding.

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# ORAL PRESENTATIONS

**Foraging ecology of round goby: Impacts on native and non-native prey choices**

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The Round Goby, *Neogobius melanostomus,* an invasive species now in the Finger Lakes (New York, USA), has been known to forage primarily on dreissenid mussels, but their preference and impact on other lake invertebrates is not well known. Tank feeding studies were conducted to assess consumption and diet choice of native and non-native benthic and pelagic prey, including the invasive *Hemimysis anomala*. When given choices between benthic and pelagic prey, we hypothesized that Round Goby would prefer some invertebrates over others depending on availability and energy required to capture and consume the prey. Round Goby preferred some snail families *(Physidae and Bithyniidae)* over others and *Hemimysis* were consumed at a low rate, however there was a season-dependent foraging pattern. Pelagic prey, including both native amphipods and non-native *Hemimysis*, were selected more frequently than benthic prey such as dreissenid mussels. While the energetic costs of a benthic, sessile prey might be lower than a motile prey option, gobies chose the pelagic, motile prey. Dispersal of this invasive fish will likely change the abundance of invertebrates in the lower trophic levels of the Finger Lakes.

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# ORAL PRESENTATIONS

**River herring abundance and parameters influencing migration patterns in Black Creek, a small tributary of the Hudson River**

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Beginning in 2013, we deployed an in-stream fish counter to assess river herring spawning dynamics in Black Creek, a small tributary of the Hudson River with a known river herring spawning run. The primary objective was to determine if a fish counting device was an appropriate method to collect absolute abundance data for river herring in small tributaries of the Hudson River. Our secondary objectives were to a) document the seasonality of river herring migrations into tributaries and b) identify parameters that may influence migratory patterns. To date, the spawning run in Black Creek has been comprised exclusively of alewives and with annual run counts ranging from 205,885 (2013) to 655,827 (2014) with a mean ± SE of 376,001 ± 76,093. Bimodal spawning patterns were observed in each year and analysis of environmental parameters using generalized additive regression models indicate immigration into Black Creek is influenced by a combination of moon luminosity, ordinal day, turbidity, pH and the difference in water temperatures between the main-stem Hudson River and Black Creek. Future analysis will investigate other potential parameters influencing migrations such as stream discharge, time of day and water level. Our study demonstrates that an in-stream application of a fish counter is an appropriate method to quantify river herring abundance and combined with environmental data can identify parameters influencing spawning dynamics. A better understanding of river herring spawning dynamics will provide fisheries managers and environmental regulators the necessary information to develop fisheries management plans as well as mitigate potential threats during spawning events.

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# ORAL PRESENTATIONS

**Can size spectrum modeling be used to inform ecosystem management of the Great Lakes?**

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Understanding the productivity of Great Lakes and their capacity to support fishes is an important goal of managers. However, the Great Lakes are too large and resources too limited to sample all species-specific components of the food web. Therefore, managers rely on a combination of sampling, often limited to a single species or functional group, and predictive modeling to predict responses in Great Lakes food webs. These models tend to focus on few species or, when more inclusive, reliant on extensive parameterization. There is a need to develop a holistic food web model which relies on few parameters. Theory and empirical analysis have shown that aquatic systems can be resolved as a function of organismal body size and their density; larger individuals prey upon smaller individuals but exhibit slower life histories. As a result, complex food webs can be represented using relatively simple models (i.e., size spectrum modeling; SSM) to elucidate energy flows. Size and density data are routinely collected for a broad range of organisms throughout the Great Lakes, opening the possibility of using SSM across the Great Lakes with no additional cost for data collection. To date SSM has not been widely applied in the Great Lakes, and even when used only a single lake and a relatively modest number of years (one or two) were examined. The present work will investigate whether SSM is suitable for broad use in the Great Lakes by comparing data from all lakes through multiple years.

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# ORAL PRESENTATIONS

**Can fish have too much fat? Lower thiamine concentrations in salmonines associated with the consumption of fatty alewife *Alosa pseudoharengus***

*Matthew Futia[1], Michael Connerton[2], Brian Weidel[3] and Jacques Rinchard[4]

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Various salmonine populations in the Great Lakes region have limited natural recruitment, potentially due to Thiamine Deficiency Complex (TDC) – a deficiency of the essential vitamin, B1 (thiamine). TDC has been associated with the consumption of alewife *Alosa pseudoharengus* in both natural and hatchery settings. Alewife have elevated activities of thiaminase, an enzyme that degrades thiamine, but this has not been proven to cause the deficiency. Alewife are also rich in lipids compared to other common prey, which results in a higher fat content for fish that consume them. As a result, these predators may have a greater vulnerability to lipid peroxidation – particularly when the concentrations of polyunsaturated fatty acids (PUFAs) increase – which can result in the use of thiamine as an antioxidant. In the Baltic Sea, high fat content of prey has been associated with the prevalence of thiamine deficiency in Atlantic salmon *Salmo salar*, but this hypothesis for thiamine deficiency has not been confirmed either. Thus, the specific reason(s) why alewife cause TDC remains unknown. In the present study, we analyzed the diet of salmonine species from Lake Ontario using fatty acid signature analysis and investigated correlations between predator fat content and thiamine concentrations. We found that alewife are a major component in all salmonine diets; however, correlations between predator muscle lipid content (%) and thiamine concentrations were limited. When comparing thiamine concentrations with the proportions of different types of fatty acids (i.e. degrees of saturation), significant negative correlations were present when compared to PUFAs, although these correlations were inconsistent among species. Therefore, while high fat content of prey and elevated concentrations of PUFAs in salmonines may cause thiamine concentrations to decline, it is unlikely that these factors alone would induce TDC in Lake Ontario salmonines.

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# ORAL PRESENTATIONS

## Improving acoustic telemetry in alosines: American shad in the Charles River and beyond

Ben Gahagan[1] and Michael Bailey[2]

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Since 2006, Massachusetts Division of Marine Fisheries and the United States Fish and Wildlife Service have worked cooperatively to restore American shad to the Charles River in Boston, MA USA. To better understand potential restoration issues, we conducted an acoustic telemetry study. Previous American shad telemetry studies have used gastric tagging methods and often relied on reporting simple descriptive statistics as telemetry data has many complications. Here, we used a surgical tagging methodology and incorporated dynamic Brownian Bridge Movement Models (dBBMM), developed in terrestrial and avian ecology studies, to see if our understanding of shad restoration could be improved. Adult shad were collected using a boat electrofisher and surgically tagged with acoustic transmitters during the springs of 2015 (n=46) and 2016 (n=52). We observed limited mortality and fallback as a result of tagging. No tagged fish were detected above the Watertown Dam (rkm 17), the first fishway on the river, during the year they were tagged. However, 6 of 10 fish tagged in 2016 that entered the river in 2017 did successfully ascend the fishway. Tagged shad displayed diel movement patterns in both years while attempting to ascend this fishway for 2 to 46 days (mean = 16.9). In both years, downstream transit was rapid, followed by much slower movement rates and multiple mortalities at the downstream New Boston Dam and Locks (Kruskal-Wallis $\chi^2$ = 77.14, $p < 0.001$). Results from the dBBMM analysis corroborated other methods (Kruskal-Wallis $\chi^2$ on Brownian Motion Variance = 71.56, $p < 0.001$) while alleviating many of the statistical concerns with telemetry data. Surgical implantations allowed for shad to be detected in the marine environment between spawning events and within the river a year removed from tagging. This tagging method provided a window into a largely unknown portion of the shad's life history and allowed us to observe in-river movements that were presumably free of handling and tagging effects. As technologies and analytical methods continue to advance alosine and diadromous biologists and researchers should use these tools to uncover new information and re-examine previous theories.

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# ORAL PRESENTATIONS

**Genetic diversity, stock structure, and hybridization of cisco in Lake Ontario**

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Cisco *Coregonus artedi* were once an ecologically and commercially important species in the Great Lakes before their collapse in the early 1900s. Today, Lake Ontario contains only two established spawning populations in Chaumont Bay and the Bay of Quinte. In the last decade, research and restoration efforts have increased with much of the work focused on the Chaumont Bay spawning population. In addition to concerns about spawning habitat and quality, the Chaumont Bay population faces two potential genetic threats; a loss of genetic diversity following severe population reduction and hybridization and introgression with lake whitefish *C. clupeaformis*. To address these concerns, we analyzed genetic diversity at eight microsatellite sites in cisco samples from several spawning and non-spawning aggregations around Lake Ontario. In addition, we developed a panel of three species diagnostic nuclear markers to measure the rate of hybridization in the Chaumont Bay population.

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# ORAL PRESENTATIONS

**Efficacy of Environmental DNA and traditional sampling methods to monitor the expansion of round goby in the Mohawk River-Barge Canal System**

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The Round Goby (*Neogobius melanostomus*) is an invasive benthic fish indigenous to the Ponto-Caspian region of Eurasia which recently colonized all five Great Lakes and is presently invading eastward into the Mohawk River Basin through the New York State (Barge) Canal System. During 2016-2018, the U.S. Geological Survey, New York State Department of Environmental Conservation, and the U.S. Fish and Wildlife Service conducted a collaborative study to (a) document the distribution, relative abundance, and rate of expansion of Round Goby through the Mohawk River-Barge Canal system and (b) compare the efficacy of environmental DNA (eDNA) and traditional fish sampling methods for monitoring the distribution of this species. The presence of Round Goby was assessed using water samples (eDNA) and standard benthic trawls, bag seines, and minnow traps twice annually at 12 sites between Rome and Albany, NY during June and August in 2016, 2017, and 2018. Preliminary results indicate Round Goby were captured or detected at 3 of 12 sites and have invaded waters at least as far east as Utica, NY. Environmental DNA appears to be the most sensitive method for detecting populations at low abundances. The slow expansion towards the Hudson River drainage is surprising considering the rapid colonization that recently occurred west of the study area.

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# ORAL PRESENTATIONS

**Co-infections in Oneida Lake smallmouths and Sodus Bay sunfish**

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NYSDEC Region 6 fishery biologists reported dead pumpkinseed (*Lepomis gibbosus*) and bluegill sunfish (*Lepomis macrochirus*) floating and laying on bottom in Sodus Bay during May 2018. Specimens collected for necropsy showed no significant external lesions. Examination of fixed tissues revealed necrosis, congestion, and bacteremia in many organs. Kidney cultures identified at Cornell's Animal Health Diagnostic Center Bacteriology Section showed the isolates were *Pseudomonas mandelii*, a pathogen recently identified killing the same fish species in New Jersey. Fathead minnow cells inoculated with tissue homogenates from sunfish showed cytopathic effects after 3 days incubation. Viral hemorrhagic septicemia virus (VHSV) was confirmed with RT-qPCR and the brain and pooled organs from all five pumpkinseeds also tested positive. The diagnosis for this die-off was complicated by the co-infection with both *P. mandelii* and VHSV. The severe bacteremia observed in histology slides suggests *P. mandelii* was the primary pathogen in this case. Both pathogens were observed in other fish kills documented in New York this past spring, though not as co-infections. An outbreak of VHSV in late March 2018 involving thousands of dying gizzard shad (*Dorosoma cepedianum*) occurred in Irondequoit Bay. And then sunfish mortalities occurred in May 2018 in both Conesus Lake and the Seneca River where *P. mandelii* was cultured.

This past fall Oneida Lake fishery biologists and anglers reported unusual lethargic behavior and chronic lesions in the smallmouth bass (*Micropterus dolomieu*) population. Twelve specimens were submitted with significant skin and eye lesions, and necrotic areas on the distal tips of the gills. Bacterial cultures of the kidney showed 3 of 12 fish systemically infected with *Edwardsiella tarda*. The gill lesions were likely caused by *Flavobacterium columnare*. Cells inoculated with pooled organs showed cytopathic effects. Quantitative PCR assays for largemouth bass virus (LMBV) were positive for 7 of 12 pooled organs and the cell culture supernatant tested. The consistent pattern of uveitis and lesions on the heads of these SMB is not surprising given that controlled studies with this species showed similar lesions when challenged with LMBV. The severe infestation of helminth parasites, particularly nematodes in the spleens, was certainly a stressor in the population.

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# ORAL PRESENTATIONS

**Incorporating anticipated climate change effects in growth models for American shad populations throughout the Atlantic Coast**

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American Shad *Alosa sapidissima* are anadromous fish with populations that range along the entire U.S. Atlantic coast. Being highly sensitive to environmental factors, populations have been on a noticeable decline throughout their historic range. It is believed that the three primary drivers of their population and range include hydropower dams, overfishing, and global climate change. To date, we have found that predictions about population abundance of American Shad are particularly sensitive to information about fish growth, in addition to potential climate effects. To investigate this further, growth models were developed to characterize effects of climate change on historical growth of American Shad using temperature as a continuous predictor of growth parameters. We investigated these trends across a number of populations, to result in regional and river-specific relationships that should aid in assessing changes in these stocks. The development of these models will help to better understand what the future of climate change may bring for this species, and will lead to more robust management decisions through the incorporation of this information in decision support models.

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# ORAL PRESENTATIONS

**Development of native fish and aquatic macrophyte assemblages in excavated coastal wetlands of the Upper St. Lawrence River**

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A series of potholes and channels were excavated in four coastal wetlands in the upper St. Lawrence River between 2010 and 2014. These excavations were designed to expand available hemimarsh area in cattail-dominated wetlands, provide corridors for fish movement, and increase area for spawning and nursery habitat. The development of native submersed aquatic vegetation as well as the colonization of native fishes to these wetland complexes was studied between 2016 and 2018. For Northern Pike (*Esox lucius*), the excavations were especially beneficial to reproduction, providing additional area for year-0 fish to forage and grow. Annual productivity and species composition of these enhanced wetlands was assessed as fish emigrated from the excavations to nearshore nursery areas in the adjacent bays. Restoration of coastal wetlands requires a multifaceted approach where creation of quality habitat may encourage fish to use excavations; however, a lack of sufficient habitat quality may discourage recruitment. Promoting the development of a healthy aquatic community within a restored wetland requires consideration of not only project goals, but a firm understanding of existing fish and macrophyte assemblages, as well as potential issues that may arise after the construction is completed.

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# ORAL PRESENTATIONS

**The first 2 years of the Lower Grasse River Freshwater Mussel Relocation Project**

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The lower 7.2 miles of the Grasse River in Massena, NY (downstream of the old power canal to its confluence with the St. Lawrence River) is a US EPA Superfund Site due to historic PCB contamination from Arconic Inc. (formerly Alcoa) industrial facilities. Extensive sediment dredging and capping is planned to occur in the 7.2 mi stretch over the next 4 years. Recent surveys of the project reach found a diverse and abundant unionid mussel community, documenting 10 species and estimating over 1 million individual mussels. Four recorded species were NYS designated Species of Greatest Conservation Need (SGCN) – *Lampsilis cardium, Ligumia nasuta*, *Utterbackia imbecillis*, and *Potamilus alatus*, the latter of which was abundant. As a result of the remedy, we expect the mussel community to be largely reduced with slow to no recovery. Hence, NYSDEC has implemented a project to assist post-remedy mussel community recovery. Over 2 seasons (2017-2018), mussels were collected from remedial areas and either placed in in-river cages or released in non-remedial areas. Caged mussels will be re-distributed throughout the lower river to act as 'founder colonies.' The project has seen early success with > 97 % survival after 1 year for mussels caged in 2017. A total of 17,013 mussels were collected and relocated (3,070 caged and 13,944 re-released). Three of the 4 SGCN were among collected mussels as well as one new species not recently recorded within the site (*Alasmidonta undulata*). Next steps are to continue monitoring annual survival in cages and determine how soon following remediation to release mussels.

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# ORAL PRESENTATIONS

**Differential migration in blueback herring as evidenced from otolith chemical signatures**

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Previous studies of the blueback herring (*Alosa aestivalis*) population in the Mohawk River have indicated a variety of life history patterns, which expand upon the textbook definition of anadromy. While all recruits to the spawning stock eventually migrate out to sea before returning to spawn, some will overwinter somewhere in the river system, some will migrate back up into lower salinity for a second season as sub-adults, and others may become freshwater residents. This study aims to use trends in otolith microchemistry to determine the importance of the Mohawk River to the declining blueback herring population as part of the Hudson River system.

Collections of spawning adults were tested for the presence of biogeochemical markers in their otoliths via laser ablation inductively coupled mass spectrometry (LA-ICPMS) as well as multicollector LA-ICPMS and stable isotope analysis. Results indicate that Mohawk River blueback herring displayed differences in size at first egress to the ocean, as evidenced from $^{87:86}$Sr signatures in the otolith. Early and late migrators may experience different environmental conditions at both the freshwater and oceanic ends of their pathway. This differential migration may indicate response to changes of climate and habitat quality in a relatively narrow migration window. Indeed, a wide variety of migration strategies may indicate resilience, a good sign in this struggling population.

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# ORAL PRESENTATIONS

**Year-class production of black bass before and after opening of a spring catch and release season in New York: Case studies from three lakes**

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Impacts of angling for black bass (Micropterus spp.) during the nesting stage have received much recent attention, with particular focus on individual nest and genetic implications. However, few empirical studies of population-level impacts have been conducted. New York State historically protected nesting bass with a closed season. In 1994, a special spring bass season was opened in the New York waters of Lake Erie, and in 2007, a spring catch and release season was opened in most of New York's remaining waters. Long-term monitoring programs were in place on two inland lakes and New York's portion of Lake Erie prior to the regulation changes, facilitating assessment of impacts on year class production of liberalized regulations. In Canadarago Lake (surface area 787 ha), fall electrofishing surveys sampled both young-of-year largemouth (M. Salmoides) and smallmouth bass (M. dolomieu). Mean catch per hour of largemouth bass during the six years prior to the spring season was 15.6, compared to 27.8/hr over the six post-change years ($p = 0.63$). For smallmouth bass in Canadargo Lake, pre-change catch rates averaged 1.2/hr, with a rate of 0.6/hr after the change ($p=0.32$). In Oneida Lake (surface area 20,700 ha), a trawl survey provided an index of young-of-year smallmouth bass. Average catch-per-haul during the eight years prior to the regulation change was 0.4, compared to 1.1/haul during the following eight years ($p=0.04$). A gill net survey of age-2 smallmouth bass in Lake Erie produced a year class index of 3.0/net over 15 years prior to opening of a spring bass fishery and a catch of 6.0/net over the following 17 years ($p=0.04$). In most cases, year class production increased following the opening of spring angling for bass, although no results were statistically significant. Our results suggest that population level impacts on bass recruitment do not result from spring fishing in large lake systems.

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# ORAL PRESENTATIONS

**Chemical and biological recovery of Adirondack Mountain region lakes from acid deposition: a conservation success story**

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Sources and impacts of acid deposition on Adirondack Mountain region lakes and fisheries were studied from the 1950s through the 1980s. Acid deposition research informed enactment of landmark federal environmental legislation, the Clean Air Act Amendments (CAAA) in 1990, to reduce sulfur dioxide and nitrogen oxide emissions. Honnedaga Lake represents ongoing chemical and biological recovery of lakes in response to CAAA 1990. Large decreases in surface water sulfate and nitrate have produced increases in Honnedaga Lake pH and decreases in inorganic aluminum (< 2 μmoles/liter) toxic to brook trout. In response, brook trout abundance has increased as measured by boat electrofishing and trapnet catch rates and redd counts. For four decades, eight acidified lakes were limed to neutralize the effects of acid deposition. Based on acid deposition recovery in other lakes, lime additions were halted in the lakes in winter 2014. The summer surface pH in all eight lakes has remained near 6.0 and inorganic aluminum has remained below levels toxic to brook trout. Several other unlimed and formerly acidified lakes have naturally chemically recovered from acid deposition and now support stocked recreational brook trout fisheries.

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# ORAL PRESENTATIONS

**Modifying age-based selectivity to rebuild overfished stocks and increase resilience**

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Rebuilding truncated age structures is an important goal in fisheries management as the reproductive contributions of older fish are predicted to reduce fluctuations in recruitment and increase stock resilience. Harvesting of older fish can be reduced by modifying fishery selectivity curves from asymptotic to dome-shaped. We model harvest slot limits (HSLs) for Tautog (*Tautoga onitis*) in Long Island Sound, a stock which is overfished and experiencing overfishing. Traditionally, the fishery was managed by temporal closures, bag limits, and minimum legal size (40 cm). Tautog are a candidate species for HSLs because they are a long-lived, slow-growing species with low release mortality (2.5%). Because angler behavioral response to regulatory changes is unknown, two responses were evaluated: full compliance and 50% noncompliance. We evaluated changes in population demographics relative to status quo (SQ), for three candidate HSLs: 38–44, 41–51 and 43–55 cm. Using a long-term projection model, stock recovery and equilibrium periods were analyzed. The population crashed with the 38–44 cm HSL noncompliant scenario. But with the other two HSLs, the abundance of older fish rapidly increased to 8–30 times SQ levels within the first 10 years and SSB was restored regardless of angler behavior. After stocks reached equilibrium, HSLs maintained two to three-fold more older fish than SQ management. Thus, the age-structure can be rebuilt while maintaining harvest levels. These results indicate that dome-shaped selectivity curves are likely to rebuild truncated age structures in other long-lived. slow growing species and should be considered in management approaches.

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# ORAL PRESENTATIONS

**Evaluation of fish assemblage response to the remediation of an urban lake**

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Once the site of chemical and municipal sewage dumping, Onondaga Lake in Syracuse, New York was designated a national superfund site in 1994. It has been the target of restoration efforts to reduce toxic chemical concentrations and enhance shoreline habitat for over two decades. One of the major restoration goals is rehabilitation of the fish assemblage, particularly in the more-polluted southern basin. To monitor the progress of this restoration effort, trap and gillnet samples were collected from 2008 to 2018 in May through October at index sites throughout Onondaga Lake (11 trapnet; 12 gillnet). Additionally, we gathered data on environmental parameters that may influence fish communities, including wave index, water temperature, and pH. We calculated community indices, expected species richness and Shannon diversity, and in conjunction with multivariate ordination, assessed changes in structure of the nearshore and pelagic aspects of the Onondaga Lake fish assemblage with respect to lake restoration and possible driving environmental factors. Preliminary results indicate that rarefied species richness and diversity of pelagic fish increased in this timeframe ($p = 0.008$ and $p = 0.032$, respectively). These indices both declined for the nearshore fish assemblage data (both $p < 0.001$). The results suggest that larger pelagic fish have been responding positively to remediation, while the inshore fish may be temporarily impacted by the disturbance.

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# ORAL PRESENTATIONS

**Shedding light on an understudied environmental factor: how does light impact cisco (Coregonus artedi) eggs and larvae?**

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Climate change is expected to increase winter temperatures and reduce ice and snow cover on northern lakes. Such changes could impact the development, hatch time, and survival for fish species that incubate over winter, such as cisco (*Coregonus artedi*). Warmer winter temperatures are expected to result in earlier hatch dates but impacts of an increased light environment through reduced ice/snow cover remain unclear. We conducted a pilot experiment to test if changes in the light environment could influence cisco egg and larval development. Fertilized eggs were exposed to three light treatments: continuous light, regular photoperiod, and continuous dark. Development rates, hatch dates, yolk sac size and survival rates were measured in eggs and larvae from all three treatments. To assess how light impacts cisco at the molecular level, the transcriptomes of eggs and larvae from the extreme light treatments (continuous light, continuous dark) were sequenced. A transcriptome allows us to understand which genes are being expressed in each treatment. The genes that are differentially expressed between the light and dark treatments can shed light on any differences in the demographic metrics that were measured (i.e. yolk sac size). Larvae hatched from the continuous light treatment had a higher mortality rate than the continuous dark and regular photoperiod treatments. The continuous light offspring also had smaller yolk sacs than those reared in the continuous dark and regular photoperiod treatments. The transcriptome results appear to complement the demographic observations. Cisco eggs and larvae from the light treatment expressed metabolism related genes at a higher level than the dark or regular photoperiod treatments, which could explain the reduced yolk sac size. The transcriptome data coupled with survival and yolk sac data provide a cursory glance at the potential threat that increased light resulting from decreased ice cover pose for cisco.

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# ORAL PRESENTATIONS

## Diadromous fishes and ecosystem services: A transnational approach for a first valuation

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Diadromous fishes are migratory and cross-border resources: they move between fresh and marine waters and their populations share individuals between river basins, crossing administrative boundaries (*e.g.* states, countries). Diadromous fishes are threatened by various human activities and climate change. A generalized decline has been noticed for many species with, in some cases, a climate-induced shift in the species ranges. The situation is obviously changing, causing new socio-economic and ecological interactions among territories to appear. Consequently, a transnational approach is required in Europe and elsewhere to account for and facilitate these spatial changes in fish populations through better-adapted management plans, and ease the adaptation of territories in the face of climate change. As a consequence, DiadES, a recently-funded European project, will bring together ecologists, economists and key stakeholders from the five European member states bordering the Atlantic Ocean, i.e. France, Portugal, Spain, U.K. and Ireland, to start a joint valuation of ecosystem services associated to diadromous fishes and their potential evolution under climate change. DiadES adopts the innovative approach to convert fish abundances into monetary units, thus circumventing the difficulty to orientate public decision on diadromous fish management with only observed numbers of fish or stock estimates from models. DiadES is a multi-species initiative but its methodologies will be presented through the Allis shad (*Alosa alosa*) case study.

Among the ecosystem services provided by diadromous fishes, the transfer of matter, nutrients and energy operated by these fishes between the continental and marine domains is directly connected to food-web functioning and thus to ecosystem state (Limburg and Waldman, 2009). Even being a widely recognized process, few quantitative estimates of this fish-based nutrient flows exist. The application of the mechanistic species distribution model (GR3D) could help in estimating such transfer at large spatial scale and under past, present and future climatic conditions. Allis shad (*Alosa alosa*), and its American counterpart, the American shad (*Alosa sapidissima*), could benefit of such model-based estimates, with arising conclusions on fish and ecosystem management being strengthened by this comparative approach.

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# ORAL PRESENTATIONS

**Monitoring Long Island alewife populations: Evaluating the efficacy of a new fishway at Beaver Lake in Mill Neck, NY**

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Spawning runs of alewives in Long Island rivers have been greatly reduced if not eliminated by dam construction. There are multiple projects completed or underway restoring access to upstream habitats through fishway installation. This study monitored the efficacy of a steeppass fishway installed in 2018 at Beaver Lake spillway (Mill Neck, NY). Because there have only been sporadic observations of alewives observed below the spillway during spawning season, alewives were translocated from Peconic River (Riverhead, NY), PIT-tagged, and released above and below the spillway in an effort to develop a spawning run. Passage of PIT-tagged alewives was monitored for two spawning seasons prior to fishway installation (2015-2016) and one season after installation (2018) using antennas placed at the top of the spillway (2015-2017) and the fishway entrance (2018). For the 2018 season, a camera was submerged in the fishway exit pool to observe passage of tagged and untagged fish. To test for site fidelity, PIT-tagged alewives were also translocated from Peconic River to two other north and south shore sites on Long Island during the 2017 and 2018 spawning seasons. An antenna was placed at the donor site to test if there were any alewives returning to Peconic River. Only 2 of 256 tagged alewives released downstream of the spillway at Beaver Lake in 2015 and 2016 were detected by the spillway antenna. None of 143 alewives released in front of the fishway entrance in 2018 were detected by either antenna. While some fish were observed by video passing upstream through the fishway, most were probably carp, and none were identified as alewives. The Peconic River antenna detected the return of tagged alewives translocated to all north and south shore sites during previous seasons and even within the same season (2017 detections: 12 of 118 for 2016 releases; 2018 detections 6 of 199 for 2017 releases, 4 of 395 for 2018 releases). The lack of successful passage into Beaver Lake during the first season of fishway operation might be due to fallback, large tidal amplitudes downstream of the spillway, and drive to return back to spawning habitat in Peconic River.

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# ORAL PRESENTATIONS

**Whither Shad? What has happened to America's "Founding Fish"?**

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The American shad was arguably the most important inland food fish in North America up through the early 20th century. It was commercially fished by George Washington; it was the subject of the first article in the Transactions of the American Fish Culturalists Association (to become the American Fisheries Society). Such an important fish is hardly remembered today except in remnant, regional fisheries. New York's shad fisheries were closed in 2010, but stocks have not yet recovered. Rather, the absence of shad festivals and other observances of the annual return of spawning fish to the Hudson River has exacerbated the loss of shad from collective consciousness. This presentation introduces the shad(s) symposium with an overview of past and present status of shad.

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# ORAL PRESENTATIONS

**River restoration project mediates secondary contact between anadromous and landlocked alewife**

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Fish passage projects are altering habitat connectivity for many anadromous fish species, increasing the chance that previously isolated populations will come into contact. A recent fish passage project at Rogers Lake in Old Lyme, Connecticut has brought anadromous and landlocked alewife (*Alosa pseudoharengus*) into secondary contact. The ecological and evolutionary outcomes of secondary contact between alewife life histories may be complex due to their divergent ecology, morphology, and migratory ability. Using a combination of field surveys and mesocosm experiments, we quantified two possible outcomes of secondary contact: the potential for hybridization and competition between alewife life histories for zooplankton. Hybridization potential was examined using otolith-derived spawning probabilities from five alewife populations (2013-2015). We detected low (less than 15%), but variable levels of overlap in spawning time between alewife life histories, with anadromous alewife spawning earlier and over a shorter duration than landlocked alewife. Following secondary contact, we genetically analyzed samples of juveniles each year and detected the production of anadromous alewives starting in 2016 and hybrids in 2017 and 2018. We also conducted two field mesocosm experiments to determine the outcome of competition for zooplankton between alewife life histories. The results indicated that anadromous alewife grew faster than landlocked alewife when zooplankton were abundant, but landlocked alewife may have had a competitive advantage when zooplankton were scarce. The interplay between hybridization and competition with landlocked alewife after secondary contact may have significant ecological and evolutionary implications for the successful management of anadromous alewife populations.

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# ORAL PRESENTATIONS

### A comparison of three boat electrofishing effort metrics

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While catch per unit effort is the most widely used metric for expressing and comparing boat electrofishing catch data, "effort" has been inconsistently defined. Boat electrofishing guidelines refer to both time- and distance-based metrics with little consensus about the appropriateness of one over the other. To address this, we evaluated the correspondence of three effort metrics – time, shoreline length, and a GPS-based areal measure – using data over a three-year period from 288 sampling occasions when all three metrics were recorded simultaneously. We fit three candidate models to each potential pair of CPUE metrics: a simple linear model, a linear model with separate slopes for four littoral habitat classifications, and an asymptotic model. The best-fit model (identified using $AIC_c$) was asymptotic when the time-based CPUE metric was compared to either space-based metric, and the linear model accounting for habitat was the best-fit model for the comparison between both spatial methods. These results indicate that using a time-based measure of effort resulted in underestimates of CPUE at typical fish densities found in the study lakes; this type of inverse relationship between abundance and catchability has been referred to as “gear saturation”. By comparison, spatial measures of effort were robust to changes in fish density. The habitat-based variation in the linear relationship between the two spatial metrics suggests that while a CPUE measure based on shoreline distance is adequate for assessing trends in abundance within a lake or river, it may not be suitable for comparing relative abundance between waters or areas with contrasting habitat conditions. We recommend the use of an area-based effort metric due to its robustness to gear saturation, comparability between waters and habitats, and potential for incorporating other variables that influence CPUE.

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# ORAL PRESENTATIONS

**Using lake trout movement patterns to understand reproductive failure in Lake Erie**

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Native Lake Trout stocks were extirpated from Lake Erie approximately 50 years ago and restoration efforts have been ongoing since the early 1980s. Extensive Lake Trout stocking and Sea Lamprey control efforts have succeeded in establishing an adult Lake Trout population in Lake Erie, but natural reproduction has yet to be documented. In order to better understand Lake Trout spawning location, habitat, and timing, we used acoustic telemetry and Lake Erie's extensive network of acoustic receivers supplemented with additional perimeter receivers to detect Lake Trout movements at spawning time. Preliminary results indicate a strong preference for Lake Trout spawning in nearshore areas on the southern shore and have led to a better understanding of the potential mechanisms behind the reproduction failure.

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# ORAL PRESENTATIONS

**Lobsters in Southern New England and Climate Change**

Kim McKown

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American lobster (*Homarus americanus*) is a cold adapted species. The center of their distribution is the Gulf of Maine and the Canadian Maritime. Southern New England (SNE) lobster declined after a peak in the mid to late 1990's, this is particularly true for lobsters in Long Island Sound which are at the southern end of their inshore range. The 2014 Atlantic States Marine Fisheries Commissions (ASMFC) American Lobster Assessment model fit the SNE data better with increased natural mortality after 1998. Temperature data for Long Island Sound and other areas in SNE found increased temperature anomalies since the late 1990's – early 2000's. Research in Long Island Sound conducted by the Long Island Sound Lobster Research Initiative (2001 - 2004) after a major die off in 1999 determined that the die off was probably due to multiple causes and that high water temperature was a major factor. Additional research by Wahle et al. (2009) and Hoenig et al. (2017) determined that shell disease has increased during this same time period in some areas of SNE, and that this increase is correlated with increased water temperature. Output from the SNE Assessment model also indicates that recruitment has declined with 2013 having the lowest recruitment. Research conducted by Wahle et al. (2015) and Pugh and Glenn (personal communication) in SNE indicate changes to lobster nursery areas which may affect recruitment. Lobster distribution has shifted over time, with lobsters in general moving to deeper cooler habitats. If water temperature continues to increase in inshore waters, the SNE lobster population may continue to be impacted.

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# ORAL PRESENTATIONS

**The American eel: Citizen science ambassador at all life stages**

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As eel populations decline worldwide, there is a need for basic information on all life stages to best inform management and restoration. In the Hudson Valley, over 800 citizen scientists participate annually in research of all continental eel life stages. In the spring, glass eel numbers are monitored at 13 tributaries to the Hudson from New York City to Troy. In the summer, elvers and yellow eels are surveyed via backpack electrofishing above and below barriers to their migration. At 4 of these dams, eel ladders are installed and volunteers count, measure, and pass eels upstream. At one study stream, a long-term project investigates eel growth, movement, and maturity with an annual mark-recapture PIT tagging effort. At that same study site, we check a fyke net during the fall migration season to observe mature silver eels on their way to the Sargasso Sea to spawn. Students and community members are an integral part of the longevity and reach of these research projects. This cadre of citizen scientists provides a unique opportunity to study various eel life stages at multiple sites within one watershed.

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# ORAL PRESENTATIONS

**A survey of salmonid infection with the copepod *Salmincola californiensis* in Lake Ontario**

*Brian Mullin

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*Salmincola californiensis* (Subclass Copepoda: Family Lernaeopodidae) parasitizes the gills of salmonids of genus *Oncorhynchus*. Three species of salmon native to the Pacific, Rainbow trout, Coho salmon, and Chinook salmon have been reported as hosts for *S. californiensis* in the Pacific Northwest since 1852. These three salmon species were introduced to the Great Lakes region intermittently since the late 1800's. The introduction of these salmon species to the Great Lakes region was followed, at some point in time, by the introduction of their parasitic copepods. Given various anecdotal accounts of *S. californiensis* in Lake Ontario, we chose to conduct a survey to formally document this invasive species. Our survey took place in 2018 during the spring and fall spawning run at the Salmon River Fish Hatchery in Altmar, New York. Our survey results indicate the prevalence of *S. californiensis* to be 69% with a mean intensity of 2.71 for the 61 Rainbow trout examined and 39% with a mean intensity of 1.56 for the 223 Chinook salmon examined. *S. californiensis* was not found on the 100 Coho salmon sampled. This work constitutes the first formal documentation of *S. californiensis*in Lake Ontario. Follow-up studies of potential relationships of infection with fish age, sex and length are being explored.

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# ORAL PRESENTATIONS

**Historical and future changes in spawning phenologies of American Shad and Striped Bass in the Hudson River Estuary**

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Predicted increases in temperatures over the next century have raised many concerns about changes in life history traits and geological distributions of anadromous fishes. Anadromous fishes are particularly vulnerable to human activities due to the diverse array of habitats needed to complete their life cycle and the proximity of essential habitats to large human population centers. To understand the potential changes in spawning phenology of American Shad and Striped Bass in the Hudson River Estuary, a model was developed to project the onset, cessation and duration of the spawning season through the 21st century, using projected water temperatures. Water temperatures for the Hudson River estuary were determined using recent models accepted by the International Panel of Climate Change. Model results indicate that by the 2090s, the spawning season of both species will initiate, on average, approximately 15 days earlier in the year, with spawning duration reduced by four days compared to the average spawning season in the 2010s.

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# ORAL PRESENTATIONS

**Spawning habitat and reproductive strategies of Cisco in the Great Lakes**

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Cisco (*Coregonus artedi*) are mid-trophic level fish native to the Great Lakes. They were historically abundant, an important component of native food webs, and supported some of the largest fisheries in the Great Lakes. In response to fishing pressure and other factors, Cisco populations declined precipitously through the mid-1900s. This led to local extirpations and low abundances that persist today. Recent efforts to improve ecosystem resiliency in Lake Ontario through native fish rehabilitation have targeted remnant Cisco populations. Cisco spawn in late fall and their eggs overwinter on the substrate until hatching in spring, thus the quality of available spawning habitat may play a role in reproductive success. Information about habitat requirements for spawning is needed to assess available habitat and to prioritize research and management actions. To address this, we studied established spawning populations at bays in Lakes Ontario, Michigan, and Superior to identify habitat variables associated with spawning site selection and egg survival. Over two winters, egg pump and mat sampling and habitat characterization were conducted across gradients of depth and substrate, revealing differences in spawning habitat use between populations and informing our understanding of Cisco reproductive strategies in the Great Lakes.

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# ORAL PRESENTATIONS

**Tracking the recovery: Atlantic Sturgeon in the Hudson River**

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Atlantic Sturgeon once supported an important fishery along the Atlantic coast. Within the Hudson River, commercial landings peaked in the 1890's with harvest continuing until the compounding effects of overfishing and habitat loss caused a severe population reduction and the ultimate closure of the fishery in 1996. Developing a fishery independent survey thus became a high priority to assess the effects of the fishery moratorium and to monitor progress towards population recovery. Beginning in 1995, the New York State Department of Environmental Conservation in conjunction with Cornell University and USFWS, developed and refined a protocol to identify the location, time of year, and sampling methodology to effectively monitor the juvenile Atlantic Sturgeon population. After 15 years of continuous annual monitoring, the relative abundance of juvenile sturgeon has increased over time. Modelling indicates sturgeon catches are influenced by salinity, water temperature and depth, and tidal stage, yet predicted catches closely track arithmetic means indicating robust sampling methodology. Data from this sampling program represent one of the longest, standardized annual efforts to monitor Atlantic Sturgeon abundance along the coast and provide interstate managers information to assess the status of species recovery in the NY Bight Distinct Population Segment.

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# ORAL PRESENTATIONS

**Fish parasites as indicators of host biology: insights from a fish parasite survey in New York**

Florian Reyda

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This presentation provides a set of examples illustrating the utility of parasites as tools to examine host biology. Examples are from a long-term fish parasite survey in various water bodies in Otsego County in central east New York that took place 2008–2018. In total, 1,637 individual fish representing 44 species were examined for intestinal helminths. The majority of parasites that were collected have been identified to species at this time. Parasites encountered in the digestive system of fishes included a diversity of flukes, tapeworms, nematodes and acanthocephalans. Representatives of these groups were also encountered in other body organs of the fish. Infections with parasite species that have well-documented life cycles allow insight into host ecology. This presentation emphasizes such examples for Walleye, Largemouth bass, Chain pickerel, and Golden shiners. Otsego Lake Walleye lack host-specific parasites that are present in adjacent water bodies, reflecting their recent reintroduction to that water body via stocking. The parasites that were encountered in Chain pickerel, including a difficult-to-identify species of trematode, reflect the piscivorous diet of the host. The parasites that were present, or absent, in Largemouth bass among the different water bodies examined provide information about the differences in mollusc and other invertebrate populations among the water bodies. The presence of the Asian fish tapeworm in Golden shiners and other cyprinids in Otsego County water bodies raises the possibility of bait bucket introductions of cyprinid species in different areas, followed by the subsequent spread of that generalist tapeworm species. Each of these examples attest to the utility of parasites as tools in the study of ecosystems as well as the importance of ongoing survey work in a changing water body.

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# ORAL PRESENTATIONS

**Differing movement patterns of walleye spawning stocks in Lake Erie**

Jason Robinson

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Walleye in the Great Lakes are known to move long distances through multiple management jurisdictions. The western, central, and eastern basins of Lake Erie support important sport and commercial Walleye fisheries driven by multiple individual walleye stocks. Understanding when and where these walleye stocks mix relative to commercial and recreational fishery activity is important to inform annual harvest decisions. We used an acoustic telemetry approach to describe key differences in movement patterns among several discrete Lake Erie Walleye spawning stocks. Major repeatable differences in the movement behavior of individual walleye stocks was observed. This work has demonstrated that some stocks have major impacts on lakewide fisheries, some are important on the basinwide scale, and others have only local importance.

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# ORAL PRESENTATIONS

**Contrasted patterns of divergence and gene flow among five fish species in a Mongolian rift lake following glaciation**

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Lakes and rivers in the Baikal ecoregion of central Asia provide particularly interesting models to assess the emergence and maintenance of species diversity, as they display strong contrasts in the composition of their aquatic vertebrate communities. We used RAD-seq to study the recent evolutionary history of five fish species from Lake Hovsgol in Mongolia. This ancient lake was probably recolonized from its outlet following the Last Glacial Maximum, and harbors only 10 native fish species. We detected substantial genetic differentiation between the lake and the putative ancestral refuge river in 5 species but we also found that these species have experienced different population dynamics. Some appear to have colonized the lake after the Last Glacial Maximum, while others harbor levels of genetic differentiation consistent with the presence of refugia in the lake that could have persisted during glacial maxima or suggestive of colonization from a distinct source. We further demonstrated that fish species have experienced different levels of gene flow following colonization of the lake, suggesting that ecology and habitat use have had a substantial impact on the differentiation of lake populations.

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# ORAL PRESENTATIONS

## Environmental DNA metabarcoding sampling methods are effective at detecting low abundance species in complex aquatic communities

Nicholas Sard

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The detection of low abundance species, including aquatic invasive species (AIS), is critical for making informed management decisions. Environmental DNA (eDNA) methods have become a powerful tool for detecting AIS; however, many of these assays offer limited utility for community-level analyses due to their use of species-specific 'barcodes'. Metabarcoding methods provide information on entire communities based on sequencing of all taxon-specific barcodes within an eDNA sample. To quantify species present at low abundance, we compared measures of fish community diversity and site occupancy based on eDNA metabarcoding methods to estimates based on traditional fisheries sampling methods. In 2016, eight lakes in Michigan were chosen using a stratified random sampling design. Each lake was sampled using multiple traditional gear types including boat electrofishing, seines, large-mesh fyke nets, small-mesh fyke nets, trap nets, and gill nets. One to two weeks following traditional gear sampling, 50 ± 8 one liter water samples were collected from the same lakes. Extracted eDNAs from each water sample were used to amplify regions of the 12S and 16S rDNA loci using fish-specific primers. Samples were sequenced on two MiSeq lanes, one per locus. Fish species present within each lake were identified by comparing the eDNA sequence data to a database of sequences from Michigan fish species. We found most species collected using traditional gears (mean ± sd: 95% ± 4%) were detected using eDNA assays. In addition, our eDNA approach detected other species not observed using traditional gears across the eight lakes (12S: 3 ± 2 species; 16S: 5 ± 2 species). Accordingly, our eDNA assays confirmed AIS presence in known infestations and detected AIS in some lakes where traditional gears were unsuccessful at detecting the same species. Measures of species richness between the two eDNA loci were correlated (0.73 ± 0.11, $p < 0.001$); however, we did observe some evidence of amplification bias. Results indicate it is essential to use multiple loci when applying eDNA metabarcoding methods to fish community surveys. Given the efficacy of our assay, we suggest managers consider implementing the approach in early detection efforts in conjunction with traditional gear sampling.

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# ORAL PRESENTATIONS

**"Ecological Trap" consequences of fish restoration: a case history of American shad in the Connecticut River**

Tom Savoy

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The Connecticut River American shad stock has persisted despite loss of 50% of their habitat, periods of over exploitation, highly degraded water quality and elevated predation levels. Whether they will survive restoration efforts is unknown. Effective fish passage in the Connecticut River dates to 1976. To date, passing 50% of the annual run above Holyoke has resulted in no significant increase in population size. The stock is now composed of smaller younger virgin fish, with a large decrease in numbers of repeat spawners and fewer year classes (3 age groups versus 5-7 historically). Platooning of many year classes into a spawning run and spreading single year classes over multiple years were techniques to account for environmental variability of Northern stocks. Stock changes in the annual runs caused by "Restoration efforts" have created a destabilized stock. Given year class strength of shad in the Connecticut River is linked to environmental effects in June, adverse abiotic impacts can cause year class failure, which is also more likely with the truncated age structure. A poor year class will reduce population size and consecutive weak year classes could cause stock collapse. Current "Restoration" efforts are actually re-distribution efforts with serious "ecological trap" consequences.

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# ORAL PRESENTATIONS

**Estimating the number of contributors to DNA mixtures provides a novel tool for ecology**

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Mixtures of DNA from multiple contributors present a novel opportunity to count specimens to inform fisheries and aquatic ecology. In this talk, we introduce a likelihood-based framework to estimate the number of contributors to a DNA mixture for ecological applications. We assessed the performance of DNA mixture estimation through a combination of simulations, laboratory testing, and a field trial to estimate fish predation rates from stomach content analysis. Simulations indicated reasonably sized genetic marker panels could estimate the number of contributors to mixtures comprised of up to 10 individuals, with potential to resolve larger mixtures. Mixture estimates demonstrated robustness to common genotyping errors associated with fish and wildlife genetics applications. Laboratory trials demonstrated genotypes from amalgamations of yellow perch (*Perca flavescens*) DNA could be generated with a 14-loci microsatellite panel and led to successful estimation for up to 5-contributor mixtures. Stomach content analysis with DNA mixtures indicated a 5-fold increase in predation rates of yellow perch by largemouth bass (*Micropterus salmoides*) relative to conventional visual assessment of diet contents which can miss partially digested prey items. DNA mixtures have potential to expand applications of count-based ecological analyses. Technical challenges in generating genotypes from DNA mixtures may initially limit their use, however, advances in next generation genotyping platforms are anticipated to surmount these obstacles. Chiefly, we envision opportunity for DNA mixtures to advance eDNA analysis beyond presence/absence based inference to local enumeration of specimens.

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## ORAL PRESENTATIONS

### Aquatic organism passage benefits resulting from culvert replacement projects at Fort Drum

Scott Siegfried

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In the past few years, extremely wet weather resulted in the washout of roads and extensive failure of over 4 dozen culverts on Fort Drum, a US Army Training Installation in Northern New York State, reducing access to military ranges. Most of these culverts were prone to failure through a combination of old age, disrepair, and improper hydraulic sizing and placement. From 2014 through 2018, Fort Drum replaced 55 culverts using in-house resources. As required by the New York State DEC and the US Army Corps of Engineers, the replaced culverts restored aquatic organism passage (AOP) on several streams where it had been reduced or prevented for years.

In 2018, Fort Drum assessed and scored the potential for upstream and downstream passage through 109 culverts utilizing the North Atlantic Aquatic Connectivity Collaborative (NAACC) AOP protocol. When possible, culverts were scored prior to and after their replacement. Preliminary results indicate that post-culvert replacement, Fort Drum restored over 10 miles of bidirectional AOP on trout streams.

NAACC scores assess AOP through a culvert considering conditions immediately upstream and downstream from the culvert. However, it was noted during the 2018 work that culvert replacements alter hydrologic, hydraulic, geomorphic, physicochemical, and biological parameters a further longitudinal distance from the crossings. If these are measured they could provide evidence of greater ecological benefits. Fort Drum hopes to investigate these through robust, research-level studies in the near future.

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# ORAL PRESENTATIONS

**Reconnecting waters for eels and river herring: Towards resilience building approaches for dam removal action in the Hudson River watershed**

*Kayla M Smith, Andrea Feldpausch-Parker, Karin Limburg

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The Hudson River watershed (HRW) contains at least 797 registered dams on its tributaries that disrupt connectivity for endemic diadromous fishes to access critical nursery and spawning habitat. Derelict or hazardous dams are often targeted for removal to aid river connectivity efforts, however communities interested in dam removal must consider multiple social and biophysical challenges before making a decision.

Using a social-ecological approach can help prioritize management actions that benefit people and biodiversity, where social concerns and conservation goals are linked. In this study, we use a series of engagement strategies in the fields of environmental communication and systems thinking to determine how stakeholders in HRW perceive dam removal, and what drives receptivity to removal given other priorities, interests and managing institutions. We apply social function system theory to a content analysis of focus group discussions identifying ecological, cultural and regulatory considerations for DR projects.

From our analyses, we found that DR discourse was multi-faceted and dominated by risk and uncertainties. Participants identified competing restoration priorities among key actors and institutional complications, leading to failed dam removal efforts or project stagnation. Survey data indicated a disparity in prior knowledge and overall importance of diadromous fishes among participants between communities. Further, dam removal discourse identified a general lack of discussion regarding potential benefits of restored eel or herring populations to this social-ecological system, a feature that compromises resilience.

As sustainable environmental policy actions such as dam removal gain momentum, how ecosystem services of diadromous fishes transform in response to future restoration activity is important to evaluate when establishing discourse. While this research highlights the utility of multiple engagement modes to foster a greater understanding and communication of dam removal complexities, continued work will provide opportunities to engage and strengthen key stakeholder networks and alleviate conflict or inaction.

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# ORAL PRESENTATIONS

**Moving toward a unified approach to informing American shad dam passage performance standards**

Dan Stich and Erin Gilligan

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Recovery planning for diadromous fishes is complicated by variable life histories, gaps in biological information, and competing human demands on natural resources. Management plans are in place and being implemented for most stock complexes of American Shad *Alosa sappidisima*, but dams, indirect fishing mortality, and climate change continue to present significant impediments to recovery in most systems. Fishery managers in regulated hydropower systems are tasked with difficult decisions about fish passage, specifically how many fish must pass upstream and downstream through dams over what time period to achieve management goals for the species, while minimizing impacts on human use? The dearth of hi-quality information in many of these stocks further complicates decision making, and it can be challenging for hydro managers to negotiate dam passage performance standards with substantial evidence such that agency prescriptions are not deemed arbitrary and capricious. This need has led to the development of life history-based simulation models for a number of large, regulated rivers in the northeast US. This talk will focus on the application of these tools for understanding 1) scope for recovery, 2) empirical research needs and management priorities, and 3) trade-offs in fish passage based on competing management objectives during dam relicensing. The ability to quantify contemporary reference points, model sensitivities, and trade-offs promotes transparency and provides support for decisions when used in concert with other information available to managers.

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# ORAL PRESENTATIONS

**Whole genome sequencing provides new insights into adaptive divergence in Atlantic cod**

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With recent advances in DNA sequencing methods, it has now become possible to compare patterns of variation across entire genomes in large population samples of virtually any organism. Our recent work on Atlantic cod illustrates how this unprecedented resolution can reveal previously undetected divergence between populations, with potentially large management implications. We used low-coverage whole genome sequencing of over 300 individuals from 20 sampling locations in U.S. and adjacent Canadian waters, including all the major current and historical spawning aggregations in the Gulf of Maine in addition to spawning aggregations from Georges Bank, southern New England, the eastern Scotian Shelf and St. Pierre Bank. We analyzed variation across ~11 million single nucleotide polymorphisms spread throughout the Atlantic cod genome and compared patterns of neutral and adaptive genetic differentiation. We found large differences in haplotype frequencies of previously described chromosomal inversions but also discovered novel outlier peaks outside the inversions, some of which showed highly significant allele frequency differences among sampling locations. Overall, our results reveal greater biocomplexity than is recognized under the current management regime. These findings should inform the ongoing revision of stock definitions in Atlantic cod in order to preserve the adaptive genetic diversity and evolutionary potential of the species.

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# ORAL PRESENTATIONS

**When your diadromous reputation precedes you: Convincing striped bass anglers & unintended consequences of a Hudson River slot limit**

Audrey Van Genechten

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The New York State Department of Health (NYS DOH) has been issuing fish consumption advisories since the 1970s. Starting in 2009, the Hudson River Fish Advisory Outreach Program was formed to educate Hudson anglers about the fish advisories for the 200-mile Superfund site. Data from over 1000 convenience sample surveys taken at community events along the river show striped bass continues to emerge as the most talked about and most eaten fish.

Many anglers view striped bass as ocean fish and therefore uncontaminated with PCBs. The program has created innovative outreach materials to help anglers understand NYS DOH's "don't eat" striped bass advisory between Troy and Catskill, NY. Using graphs of the data that show immense variability and high levels of PCBs in striped bass caught in Troy, staff help anglers understand that if they are fishing for a meal they should consider fishing south of Catskill.

While exploratory, we will also share data on location-based fish contaminant levels and how regulatory slot limits may have had an unintended consequence on consumption of legal size striped bass near Troy.

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# ORAL PRESENTATIONS

**Pop-off satellite archival tags on Chinook Salmon in Lake Ontario**

James Watkins[1], Christopher Perle[2], Jesse Lepak[3] and Lars Rudstam[1]

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Pop-off Satellite Archival Tags (PSATs) collect environmental and behavioral data for individual fish over pre-programmed durations, and upon release, float to the surface, transmitting their position and data to a satellite. Chinook Salmon in Lake Ontario are an ideal platform for this technology due to their extensive spatial and depth ranges, return to tributaries for spawning, and large size. Following up on our 2017 study, ten additional adult Chinook salmon were tagged in the summer of 2018 with the assistance of charter boat captains in Oswego. Within months, fish travelled to spawning habitat in the Oswego River, Niagara River, Hamlin Beach, and Cobourg. The tags measured depth, temperature, light, and acceleration at up to a second resolution. As seen in 2017, salmon had a clear temperature preference (12-14 C) that corresponds to the base of the thermocline and a depth of 15-30 m in the open lake. Fish again responded rapidly to changes in thermal structure, including coastal upwelling events, to maintain that preferred temperature. In the late afternoon to night, fish made several forays into the epilimnion, presumably to track alewife prey. Fish often dived to great depths (> 100 m) during daytime. Fish changed their behavior as they staged prior to entering tributaries for spawning. A key product of this study is to update Chinook bioenergetics models based on a single temperature preference with the daily average temperatures experienced by our fish towards updating alewife consumption estimates important for managers to determine sustainable stocking levels.

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# ORAL PRESENTATIONS

**Growth and recruitment of lake trout juveniles in Lake Champlain**

*Pascal Wilkins and Ellen Marsden

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Lake trout were extirpated from Lake Champlain by 1900 and have been stocked annually since 1973, but no wild recruitment was seen until 2015. Lake trout stocked in fall as fingerlings (age-0) are the size of age-1 wild fish and have high recruitment, so age-0 growth and overwinter survival are likely key parameters for wild lake trout recruitment. We hypothesized that for lake trout, a coldwater species, feeding may not stop in winter and overwinter growth could be a period of continued growth. To evaluate year class abundance, size, and condition of yearling and older year classes, we sampled juvenile lake trout throughout the ice-free season in Lake Champlain. The sampling data also provided estimates of seasonal changes in size and condition. We sampled juvenile lake trout by bottom trawling in the central section of the main lake every 2-3 weeks from April to November, 2015-2018. Southern and northern sections of the main lake were also sampled two to three times during the field season. Stocked lake trout were identified by presence of an age-specific fin clip. Length-frequency data of wild recruits identified four size classes, equivalent to ages-0 through age-3, that were fully recruited to the sampling gear. Relative abundance (catch-per-unit-effort) of wild lake trout increased annually from 1.5 to 5.1 individuals per 10-minutes of trawling and proportion of wild juveniles increased annually from 27 to 65%. Abundance and proportion of wild lake trout older than age-3 also increased during the sampling period, providing evidence of survival past age-3. Wild juvenile lake trout abundance and proportion was higher in the central section than in the southern and northern sections of the lake. Abundance and proportion of wild juveniles increased considerably in the southern section during this time period as well. Wild lake trout in each year class grew in length over winter while overwinter condition did not change in 4 of the 6 cohorts, indicating that juveniles were actively foraging over the winter. Our results indicate that juvenile wild lake trout abundance is increasing in Lake Champlain, and suggest that overwinter foraging may be a key to recruitment.

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# ORAL PRESENTATIONS

**Dam removal: When less is more**

Laura Wildman

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Dam removals come in all shapes and sizes, with a myriad of different issues that impact the final design, sediment management, and channel restoration approaches selected. Some projects require a more “engineered” design when critical infrastructure is at risk; however, many dam removal projects can be designed with a “less is more” approach, letting the river do the work, and setting the river back on a trajectory to restore itself. We will discuss multiple successful dam removal projects that we purposefully designed to avoid “heavy handed” approaches. For these projects, an upfront understanding of the channel’s equilibrium slope, history of sediment deposition, and understanding of potential risks and impacts were critical to the final design choices made. Habitat building blocks were added as needed, however grade controls, hard armoring, extensive plantings, and active channel reestablishment were avoided. The upstream channels were allowed to remain dynamic and re-establish themselves. Examples of completed projects such as the Tannery Dam removal in New Hampshire and the Pleasant Grove mitigation site in New Jersey will be described, as well as other dam removal projects in the Hudson Valley and throughout the greater northeastern US. While a “less is more” approach is not always attainable, we will discuss the benefits of this approach, such as ease of constructability, and how to look for the right opportunities to apply this approach.

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# POSTER PRESENTATIONS

**Annual trends in young of the year abundance for two Hudson River catfish**

Douglas Bishop

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White catfish (*Ameiurus catus*) is a native Ictalurid species of the Hudson River estuary that appear to be declining as introduced channel catfish (*Ictalurus punctatus*) become more abundant. Similar shifts have been documented in other estuarine rivers and while speculated in the literature, little work has been done to investigate the impacts of channel catfish invasions on white catfish populations. I examine 29-years of utility-sponsored shoal trawl survey data to evaluate trends in young-of-year relative abundance over time and compare annual changes along a latitudinal gradient for each species. Analyses of annual catch per unit effort are used to compare the effects of time on different regions and elucidate any spatial patterns of abundance that may exist within the estuary. The purpose of this project is to develop a better understanding of the population dynamics for each species and serve as a starting point for future analysis on the potential effects of the channel catfish introduction on native Hudson River fish populations. This work underscores the importance of long term fisheries monitoring on understanding how populations respond to non-native species invasions.

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# POSTER PRESENTATIONS

**Environmental drivers of broad-scale adult Atlantic sturgeon behavior in the Hudson River**

Matthew Breece[1], Amanda Higgs[2] and Dewayne Fox[1]

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The Hudson River supports the largest spawning population of Atlantic Sturgeon in the U.S.. Historic insults and planned activities near the river pose significant threats to spawning Atlantic Sturgeon and their offspring. To improve resource management we have examined how adult Atlantic Sturgeon habitat use varies with environmental conditions. Our efforts were largely based on the merger of environmental and telemetry data from a system-wide passive acoustic network from 2010-2016. The study area encompassed the tidal Hudson River from the Federal Dam at Troy, NY to the mouth of the Hudson River Estuary. Maintained in this reach were 63 acoustic receiver stations recording 123 telemetered Atlantic Sturgeon, 20 of which were female, 56 male, and 47 were of undetermined sex. Using the package V-Track we partitioned these raw detections into 3115 residences and 13,822 movements. Environmental data (water temperature, conductivity, and turbidity) were taken from three Hudson River Environmental Observing System stations, Piermont (RKM 39), Norrie Point (RKM 135), and Schodack Island, NY (RKM 215). Additionally, day-of-year, distance from the salt front, location (RKM), and lunar phase were matched to behaviors. Stations were also matched to dominant sediment type within 1km using the Hudson River Estuary Sediment Type Map from the NYSDEC. A Generalized Additive Mixed Model (GAMM) of residence/movement behaviors revealed that day-of-year influenced the models the most with 26% importance, followed by turbidity (23%), conductivity (20%), and RKM (19%) with temperature, lunar phase, and sediment type all having a variable importance of less than 5%. Atlantic Sturgeon appear to be more resident from June-August while exhibiting more of a movement behavior in the spring and fall. Atlantic Sturgeon also seem to be more transient in the lower Hudson River (< RKM 100) compared to the upper portions of the river. In addition to behavior type, a GAMM of residency duration found day-of-year to have the overwhelming influence on the model (>80%) with peak durations occurring from July-September. Given this information managers can concentrate on certain areas, stretches, and times of year in the Hudson River that are likely vital to the survival and recovery of this endangered species.

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# POSTER PRESENTATIONS

**Late-spawning suckers of the eastern and western Adirondacks**

Doug Carlson

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Fish names get shuffled around by ichthyologists every 10 years but rarely do new species get described, at least in NYS. Two varieties of late-spawning suckers of the Adirondacks have been lumped into a category that is currently one species, Summer Sucker (*Catostomus utawana*), as re-described in 2009. That is likely to change but it is unclear when, to what and by whom. It is important to get these things right because special things can disappear if we don't care for them. One version of getting it right might be that there is insufficient evidence of species integrity, but there are still important genetic specialization warranting protection. Perhaps it could be likened to that of wild brook trout strains. Offering a twist of complexity, is that the two morphs look-alike or are cryptic. Field studies in the last four summers advanced our understanding of spawning lateness and of workable locations. Late-spawning suckers spawn into the summer or after mid-June. The western basins including this fish called Summer Sucker are Squaw Lake, Little Moose Lake (headwaters) and Cowhorn Pond while members of the other taxa (*Catostomus* sp. cf. *utawana*) are in eastern basins including Elk Lake, Barnum Brook, Joe Indian Inlet and Santanoni Brook. The poster calls for more engagement in field observation and in technical lab work, and volunteers are welcomed.

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# POSTER PRESENTATIONS

**Walleye and tiger muskellunge stocking in Jamesville Reservoir and its fish community**

*Ryan A. Cooper, Olivia F. Vosburg, Michaela R. Willett, Thad E. Yorks

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Jamesville Reservoir (Onondaga County, NY) is a 91-ha impoundment built in the 1870s to supply water to the Erie Canal. It is a warm-water fishery stocked with 6,600 walleye pond fingerlings every other year and 1,700 tiger muskellunge each year. With the objectives of experience with some basic fisheries biology techniques, characterizing the overall fishery, and a tentative assessment of recent stocking efforts, our class sampled the fish community with trap-nets at two sites at opposite ends of the lake over nine consecutive nights in October 2018. We collected length and weight data from nearly 400 fish. Average catch per trap-night for the two nets, 11.3 and 30.7 fish/trap-night, was relatively low compared to most other area lakes. Black crappie was the most numerous species (30% of catch) followed by white perch (18%) and common carp (17%). Yellow bullhead, white sucker, walleye, and largemouth bass each accounted for 6-8% of the catch, while six more species each accounted for ≤3% of the catch (bluegill, pumpkinseed, chain pickerel, yellow perch, brown bullhead, and golden shiner). One gill-net was deployed for a single night as a demonstration of method; in addition to 58 white perch and one black crappie, captured were 35 walleye which is a very high number relative to data from other area lakes. Of the species for which we collected data from at least ten fish, mean relative weights (Wr) ranged from 88 to 104 for black crappie, carp, largemouth bass, pumpkinseed, walleye, and yellow bullhead. However, mean Wr was only 79 for white perch and 67 for white sucker potentially indicating an overabundance or relatively high level of interspecies competition. Proportional Size Distribution was 95 and 90 for largemouth bass and walleye, respectively, possibly reflecting low levels of exploitation; however, no trophy-sized fish of any species was observed. Overall, the abundance and size distribution of walleye compared to the absence of tiger muskie in our data may indicate that the walleye stocking program has been considerably more successful than the stocking of tiger muskie.

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# POSTER PRESENTATIONS

**Western Long Island striped bass seine survey**

Caitlin Craig

*New York State Department of Environmental Conservation, Division of Marine Resources, East Setauket, NY*

The New York State Department of Environmental Conservation has conducted the Western Long Island Survey annually since 1985. This project samples sub-adult striped bass in the bays of Western Long Island. The objectives of this survey include determining catch per unit effort (CPUE) for juvenile striped bass and other important fisheries resources; tagging and releasing sub-adult striped bass to determine migration and survival; and obtaining striped bass biological information. This survey is a requirement under Atlantic States Marine Fisheries Commission (ASMFC) Fishery Management Plans.

Little Neck Bay, Manhasset Bay, and Jamaica Bays are sampled bi-weekly, and Oyster Bay and Hempstead Harbor are sampled once a month from May through October. A 200 foot x 10 foot x 1/4 inch square mesh beach seine, with a 25 foot x 12 foot x 3/16 inch square mesh bunt area, is set by boat and hauled to shore by hand. Striped bass and other important recreational and commercial species lengths are measured. All species captured are identified and counted. Information obtained is reported to the ASMFC in NY State annual compliance reports.

Indices of relative abundance are developed for Young-of-the-Year (YOY) and Yearling (1 year old) striped bass. Scale samples are aged, and Length-at-Age keys are developed. Yearling and older striped bass are tagged to examine migration and mortality of sub-adult fish. Indices and tagging survival information are incorporated into striped bass stock assessments. Our survey is unique along the east coast, as it is directed toward yearling striped bass.

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# POSTER PRESENTATIONS

**Long Island juvenile American eel survey**

Caitlin Craig and Zachary Schuller

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Since 2000, the New York State Department of Environmental Conservation has conducted an annual survey to investigate glass eel abundance and recruitment. This survey is a requirement under the Atlantic States Marine Fisheries Commission (ASMFC) American Eel Fishery Management Plan (FMP). Glass eels are collected using a fyke net that is deployed in the tidal portion of the Carmans River on Long Island. This river flows south for 17.7 kilometers through the Wertheim National Wildlife Refuge into Bellport Bay. The survey site is ideally suited to catch eels migrating upstream because it is located at a constriction in the river which the eels must pass through to reach freshwater habitat.

The survey begins at the end of February, as glass eels make their migration from the sea to fresh water, and runs until the end of April. The net is monitored daily and sampling times are tide dependent. Eels and other species caught in the net are counted. A subset of up to 60 eels are brought back to the lab for analysis. Once in the lab, eels are sedated and weights and lengths are taken. Additionally, pigmentation stage for the glass eels is determined. Once examined, eels are released alive upstream of the dam in Southaven Park. Data from this survey is used in ASMFC stock assessments to determine annual recruitment and Young-of-the-Year trends in abundance.

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# POSTER PRESENTATIONS

**Status and seasonal habitat use by Lake Sturgeon in the Seneca River, New York.**

Dawn Dittman and Marc Chalupnicki

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We have assessed the survival and migration patterns of Lake Sturgeon (*Acipenser fulvescens*) released into Lake Ontario tributaries as part of the New York Lake Sturgeon recovery program. The Seneca River section of the Oswego River system was colonized by Lake Sturgeon originally released into Cayuga Lake (3,752, 1995-2004). We have tagged 242 adults in the section of the Seneca River between the Cayuga Lake Outlet and the dam at Baldwinsville between 2005 and 2018. Mature males were present in the Seneca River by 2006. In May 2013, the first female with mature eggs was confirmed at the Cayuga outlet. In fall of 2014, a spawning bed was constructed downstream of the dam at the Cayuga Lake outlet. Ripe males and females have been captured there 2015-2018, with some of the individual males present every year. Results of an ongoing mark-recapture study show that the Lake Sturgeon are using habitat in the spawning bed area in the spring and in Cross Lake in the fall. Cross Lake is a fish rich lake in the Seneca River system. One example of this is, of Lake Sturgeon tagged in Cross Lake in October 2009, 4 of 5 sturgeon caught were recaptured in May/June 2010 at the Cayuga outlet and 5 of 6 tagged lake sturgeon recaptured in Cross Lake in October 2010 had been tagged at the Cayuga Lake outlet in Spring 2010. We document this migration pattern thru 2018. Measurements of Lake Sturgeon status and seasonal habitat use in this river helps provide some critically needed long term milestones for the assessment of Lake Sturgeon reintroduction as a restoration management action.

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# POSTER PRESENTATIONS

**Assessing adult muskellunge movements in Buffalo Harbor, Lake Erie, and the Niagara River**

Christopher Driscoll, Justin Brewer, Michael Todd, Robert Roth Jr. and James Zanett

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Eastern Lake Erie, including the upper Niagara River and Buffalo Harbor, support one of the few self-sustaining muskellunge (*Esox masquinongy*) populations in New York State. Historically, this area has supported an excellent muskellunge fishery, yet angler catch rates and mean catch rates of young-of-the-year (YOY) in fall electrofishing surveys have declined considerably since the early 1990's. Furthermore, these declines in catch rates were the most substantial in the Buffalo Harbor. Over the past few decades several ecosystem changes have occurred, which have likely contributed to reductions of muskellunge, and other native fish populations, in the upper Niagara River and Buffalo Harbor. Unfortunately, the effects of these changes are not easily quantified. Recent studies have highlighted the need for habitat restoration in these areas, especially in the Buffalo Harbor, where habitat for nearshore fishes appears to be particularly poor. Since little is known about the spatial ecology and residency patterns of muskellunge in eastern Lake Erie, the New York State Department of Environmental Conservation (NYSDEC) and the Niagara Musky Association (NMA) have partnered to conduct an acoustic telemetry study. The key objectives of this study aim to identify important habitat use areas during spawning periods and to describe coarse-scale temporal and spatial movement patterns throughout the year. Since 2016, 13 muskellunge have been captured in the Buffalo Harbor, implanted with acoustic transmitters, and then released near their capture site. Acoustic receivers were deployed near suspected spawning habitat and travel corridors in the Buffalo Harbor. Over the next 5 years, as part of the Great Lakes Acoustic Telemetry Observation System (GLATOS), the Buffalo Harbor receivers and nearby receiver arrays will be used to monitor tagged muskellunge movements. Results from this study will be used to inform muskellunge management and habitat restoration projects within the Buffalo Harbor and surrounding areas.

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# POSTER PRESENTATIONS

**Modeling diadromous movement of Hudson River spawning Atlantic sturgeon**

*Elizabeth Duskey[1], Amanda Higgs[2] and Patrick Sullivan[1]

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The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) of the New York Bight distinct population segment are currently listed as endangered by National Oceanic and Atmospheric Administration (NOAA). In order to promote the recovery of the species, it is a priority to protect the habitat during the spawning migration. If we were able to predict the location of the sturgeon at any given time throughout the migration, it might be possible to reduce the alteration of habitat when and where it is most critical for reproduction and survival. Given that the fish are highly mobile, if we wish to predict the location of the fish, we must choose a model to account for their movement. Here, we present the results of a hierarchical Bayesian model of diadromous fish migration built from a multi-year acoustic tagging study of Atlantic sturgeon in the Hudson River. We represent movement as a hidden Markov process, with separate pieces modeling largely upriver, and downriver migration. We include habitat preference on a finer scale. We present predictions of location as probability of occurrence during a given time period, and suggest that some threshold of occurrence probability may be a potential guideline for management and permitting.

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# POSTER PRESENTATIONS

**Modeling Chinook salmon population dynamics in Lake Ontario**

*Kimberly B. Fitzpatrick[1], Travis O. Brenden[2], Steven R. LaPan[3], Lars G. Rudstam[1], Patrick J. Sullivan[1], Brian C. Weidel[4] and Suresh A. Sethi[1]

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Chinook Salmon are the hallmark Lake Ontario fishery, providing cultural and economic benefits to thousands of New York anglers and surrounding communities. While this recreational fishery has been historically stable, recent population declines in the dominant prey fish, Alewife, and potential increases in naturalized Chinook Salmon production have raised concerns over future sustainability. To maintain this fishery, lake managers must balance stocked and naturally reproducing predators with prey availability. To help support future management strategies, we have developed a statistical catch-at-age model to better understand Chinook Salmon population dynamics in Lake Ontario. This model builds upon previous Great Lakes predator management efforts and relies on new and updated datasets to address questions concerning Chinook Salmon mortality, spawning behavior, and naturalized production. Our results suggest Chinook Salmon abundance has increased over the last two decades due to changes in stocking practices and potential increases in natural production. This model is part of a suite of decision support tools under development in collaboration with lake managers to support future management decision making. Future research will involve incorporating an Alewife population dynamics model to improve our understanding of joint predator-prey population dynamics in Lake Ontario.

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# POSTER PRESENTATIONS

**Range expansion of the Western Tubenose Goby in the Upper St. Lawrence River**

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The Western Tubenose Goby, *Proterorhinus semilunaris*, native to the Ponto-Caspian region of eastern Europe, first appeared in the Great Lakes basin in the early 1990s, alongside the Round Goby, *Neogobius melanostomus*. Both species were introduced via ballast water from the Black Sea; however, the spread of the Tubenose Goby has been much slower than that of the Round Goby. There were no records of Tubenose Goby in Lake Ontario or the St. Lawrence River until a single report outside of Kingston, Ontario, in 2011. Beginning in 2016, Tubenose Gobies have appeared in annual ichthyological surveys of nearshore areas of coastal wetlands and bays of the upper St. Lawrence River and appear to be continuing their spread downstream. The presence of this species indicates an expanding invasion front into the St. Lawrence Seaway: a secondary invasion potentially facilitated by domestic ballast water transport and discharge, as well as passive downstream drift of larval fish.

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# POSTER PRESENTATIONS

**Cazenovia Lake's fish community and short-term results of three years of walleye stocking**

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Cazenovia Lake (Madison County, NY) is a 479-ha controlled lake with a warm-water fishery typical of central New York lakes. Our class and previous classes sampled the fish community by trap-netting in five of the last seven years with the broad objectives of quantifying species composition and fish condition. Though the lake had not been legally stocked with walleye since 1989, our daily observations in 2012, 2013, and 2015 frequently included one or more walleye, indicating illegal stocking or some level of reproduction in the previous two decades. In 2015, 2017, and 2018, the lake was stocked with ~22,000 Walleye fry (~35 mm TL), and similar stockings are planned for 2019 and 2020. Since 2015, our objectives have also included an assessment of this walleye stocking program. In 2018, we collected length and weight data from nearly 300 fish captured in trap-nets at two sites (mid-lake, east and west shoreline) over five consecutive trap-nights. Average catch per trap-night, 17.2 and 38.2 fish/trap-night, was comparable to previous years. The two most abundant species were bluegill and pumpkinseed (55% and 11% of catch). Black crappie, chain pickerel, and yellow bullhead each accounted for 6-8% of the catch with six more species accounting for ≤4% of the catch (white sucker, yellow perch, rock bass, largemouth bass, smallmouth bass, and brown bullhead). Unlike previous years, no walleye were captured. Mean relative weights ranged from 89 to 106 for the five species with at least 20 fish observed (bluegill, pumpkinseed, black crappie, chain pickerel, yellow bullhead) indicating a fish community in good condition overall. Proportional Size Distribution was 88 for both bluegill and pumpkinseed without any Memorable or Trophy-size fish observed, possibly reflecting low harvest rates for smaller fish and/or high harvest rates for larger fish. Though larger walleye continue to be occasionally caught by anglers, our sampling efforts and those of others (NYSDEC's electrofishing surveys) have not resulted in the observation of any walleye likely to be the result of recent stocking.

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# POSTER PRESENTATIONS

**Experimental grading of Washington steelhead**

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Achieving uniform growth of steelhead (*Oncorhynchus mykiss*) has traditionally been problematic at the Salmon River Fish Hatchery. Steelhead fingerlings were graded in 2018, in an effort to reduce the extreme size variation that typically resulted in large sampling errors. A minnow grader was used when steelhead averaged 670 fish /lb. Through trial and error, and some consultation with Vermont's Ed Weed Fish Culture Station, a consistent method was established and the steelhead were graded into one of two categories: large or small. The fish were graded and inventoried back into the same tanks with like-size fish together with densities adjusted based on size. Small fish were kept in slightly lower densities in the hopes that the smaller fish would catch up to the larger fish. Grading the steelhead allowed for much more consistent sampling, higher inventory confidence, better feed estimate confidence and the smaller fish quickly caught up to the large fish over a few weeks. Providing suitable water quality conditions exist, when necessary, grading of the steelhead raised at Salmon River Fish Hatchery will most certainly continue in the future.

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# POSTER PRESENTATIONS

**Lake Sturgeon and round goby prey consumption and availability in the northern end of Cayuga Lake and the Cayuga/Seneca Canal**

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Lake Sturgeon and Round Goby diet composition were looked at in the Northern end of Cayuga Lake and start of the Cayuga/Seneca Canal using the gastric lavage (sturgeon) and dissection (goby) methods. Measurements were taken from all Round Goby and Lake Sturgeon. Benthic composition and invertebrate availability were also collected using a ponar. Fish material (likely round goby) was found in the highest number of Sturgeon sampled. Dreissenid mussels were found exclusively in the round goby stomachs. There was a nearly even composition between zebra and quagga mussels found between the ones that could be distinguished. This study needs to be conducted at different times of the year to truly grasp what the diet composition of these two species is. We especially recommend this study to be done in the Spring when round goby is known to prey on fish eggs. Our findings have implications that juvenile Lake Sturgeon may not be in direct competition for prey with Round Goby when they are stocked in the fall. In addition, Lake Sturgeon may be eating the round goby at a much smaller size than previously anticipated, however, much more research still needs to be conducted.

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# POSTER PRESENTATIONS

**Understanding angler response to barotrauma in Lake Erie Yellow Perch**

Jesse M. Lepak

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Yellow Perch are one of the primary fish species targeted by commercial and recreational anglers in the New York portion of Lake Erie. Unfortunately, Yellow Perch caught in this area tend to be from depths where they suffer the effects of barotrauma when brought to the surface. These fish sustain tissue damage from the change in pressure and subsequent expansion of their gas bladders. When released, these fish often float, and either experience mortality directly or from predation by birds or other predators. There is concern about the message and ethics of practicing catch-and-release angling that results in mortality and what some might argue is wanton waste of game. A workshop was held to determine stakeholder and expert perceptions (efficacy, feasibility, costs) of different means to mitigate the effects of barotrauma (switching target species/depths/locations, harvest, and treatment prior to release) on the fish, fishery reputation and angler satisfaction. Harvest was determined to be a unanimously desirable option while there was uncertainty about treating Yellow Perch with barotrauma. Thus, harvest of fish suffering from barotrauma may represent an acceptable option to combat the impacts of barotrauma on the fish and fishery, while there is some disparity about the perceived efficacy and benefits to individual fish treated for barotrauma prior to release. This situation provides an educational opportunity to encourage more sustainable and ethical behaviors with proper messaging.

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# POSTER PRESENTATIONS

**29 years on, your PhD shad otoliths may still surprise you**

Karin Limburg

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I raised juvenile American shad (*Alosa sapidissima*) for bioenergetics experiments during my Ph.D. studies. These were reared at three different temperatures and three ration levels. At the end of the experiment, I extracted their otoliths, mounted and polished them, and used them primarily for an age validation study. A second use during my Ph.D. was to investigate whether otolith Sr/Ca was affected by a change in diet. Recently however, I had reason to re-analyze these to test hypotheses about physiologically sensitive trace elements. In the process, I discovered that not only was Sr/Ca affected by a switch from feeding on freshwater zooplankton to a marine fish-based diet, but so was Ba/Ca, even more strongly. Thus, hanging onto research materials like otoliths, which do not degrade under most storage conditions, can enable you to ask questions in the future that never occurred to you at the time.

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# POSTER PRESENTATIONS

**Distribution and abundance of larval yellow perch in Lake St. Clair and adjoining waters**

*Clara Lloyd[1], Celia Evans[1], Robin DeBruyne[2], Andrew Briggs[3], Jan-Michael Hessenauer[3], Todd Wills[3] and Edward Roseman[4]

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Spatial and temporal dynamics of fish larvae play an important role in determining year-class strength. These dynamics are affected by variation in habitat quality and food resources that influence larval growth, development, and survival rates. Ichthyoplankton surveys conducted during the past decade in the Detroit River revealed a high abundance of larval yellow perch originating from Lake St Clair and drifting through the river to Lake Erie. Genetic and microchemistry analyses showed that these fish make a substantial contribution to the yellow perch stock in western Lake Erie. Our study examines the spatial and temporal distributions of larval yellow perch in Lake St. Clair in order to identify important spawning and nursery areas and other ecological factors influencing their early life history. We employed a lake-wide daytime sampling program using paired bongo nets to sample pelagic larvae beginning in early spring before yellow perch had hatched and continued through mid-summer when larvae were absent from samples. Based on preliminary sample analysis, yellow perch first appeared in samples on 08 May 2018, quickly increased in abundance, and were no longer vulnerable to our sampling gear by the fourth week in July. Densities were highest at sample sites along the Canadian shore and near the Clinton River outlet. Spatial overlap and abundance of larvae will be compared with older age-0 and juvenile yellow perch bottom trawl survey data to explore relationships between life stages. Results from this study will reveal important locations for yellow perch spawning and nursery areas in Lake St. Clair and provide insight to ecological interactions that influence year-class formation.

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# POSTER PRESENTATIONS

**What eels teach us about people: Evaluating a citizen science project**

Aidan Mabey[1], Sarah Mount[2] and Chris Bowser[3]

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The Hudson River Eel Project aims to strengthen the connection between Hudson Valley residents and the river's ecosystem through engagement in citizen science. Thirteen nets are placed from New York City to Troy where volunteers check them daily each spring for juvenile glass eels. Eels are an ideal study species for a citizen science project because they are hearty, easy to handle, and are found in a diversity of habitats. This citizen science eel monitoring project is in its 11th year and engages about 700 community volunteers annually. We recruit participants using a variety of methods including school assemblies, in-class programs, and public presentations. Self-reflective post-program evaluations ask participants to rank their knowledge and interest in their local stream environment. We see an increase in both metrics from a majority of participants. Through these evaluations we can also determine volunteer retention rate and gather important feedback from participants of the project. One high school student responded on an evaluation, "I enjoyed the ability to experience what actual conservation studies are like and the feeling of joy I got from participating in a volunteer study.

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# POSTER PRESENTATIONS

**Parasitic crustacean survey of Oneida Lake**

Christopher Marshall[1], Patrick Hudson[2], Jim Watkins[1], Lars Rudstam[1], Tom Brooking[1], and Randy Jackson[1]

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The 2018 warm water fishery survey of Oneida Lake was supplemented with a survey of the parasitic crustacean community associated with fish. Parasitic crustaceans are well established in natural systems and provide a unique linkage between invertebrate zooplankton and the animals they parasitize. In 2015, Bauer and Whipps conducted a bass parasite survey of Oneida Lake and located two species of parasitic crustaceans. Since that publication, there has been no systematic survey of these animals on any fish species found in the lake and therefore warrants further investigation. The primary goal of this study was to locate as many different genera and species of parasitic crustaceans as possible and develop preliminary insights into common hosts for each taxon in order to develop a working understanding of the prevalence, intensity, fecundity, and host associations of these animals. Preserved specimens also provided genetic sequencing materials for the benefit of a public genetic barcode database. At present, this study has recovered seven different species of parasitic crustaceans from eleven different species of fish, collected and preserved over 700 total parasites, and produced 16 accepted genetic barcodes, all from Oneida Lake. We did not find any of the invasive parasitic crustaceans (*Argulus japonicus*, *Neoergasilus japonicus*, *Lernaea cyprinacea*) that are known to parasitize fish in nearby freshwater systems (Nepszy 1988, Mills et al. 1993, Hudson and Bowen 2002). Researching this group of animals adds to our understanding of the biology of economically important fish species in Oneida Lake. There have been several instances when parasitic crustaceans have caused noticeable harm to their fish hosts and affected their survivability and fecundity, diminishing the overall value of the fishery. Parasitic crustaceans are also known to be potential vectors for other pathogens which can devastate fish populations. Ecology and life history studies involving fish predation upon crustacean zooplankton in freshwater systems are well documented, but there is a clear need to expand our knowledge of the symbiotic relationship parasitic crustaceans share with their hosts.

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# POSTER PRESENTATIONS

**Zooplankton community shifts in Lake Ronkonkoma**

*Monica Matt

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Zooplankton are essential components to the food web of aquatic ecosystems. Not only do zooplankton serve as a food resource for juvenile and adult fish, but they graze on phytoplankton and can filter large quantities of water. The composition of the zooplankton community and relative size of the individuals of certain species can affect both water quality and fish growth. Lake Ronkonkoma, located in Suffolk County, NY, has experienced multiple harmful algal blooms (HABs) and has high densities of phytoplankton in the water column. Over a period of seven months, the shifts in community composition and mean size of selected groups (orders Cladocera and Rotifera and subclass Copepoda) were examined with potential connections made to current water quality and trophic interactions. Overall, rotifers were the most abundant group; various rotifer species have been observed to indicate eutrophic conditions.

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# POSTER PRESENTATIONS

## Nesting of diamondback terrapins (Malaclemys terrapin) at three locations in coastal New Jersey

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### Background/Question/Methods

Barnegat Bay Estuary in New Jersey is a diverse ecosystem that is home to many species including the northern diamondback terrapin (*Malaclemys terrapin*). The increase in human activity along the New Jersey Shore, especially during the summer months (coinciding with the nesting season), may have a negative impact on terrapin nesting behavior. This study examines previously undocumented *M. terrapin* populations on Long Beach Island (LBI) and compares this population to populations on North Sedge Island (NSI) and the Edwin B Forsythe National Wildlife Refuge (EBFNWR). Field sites were patrolled to encounter and identify all nesting females. We examined female morphometrics along with information on proximity of sightings and nests to water access, roads, and human structures.

### Results/Conclusions

Morphometric measures on nesting females, as well as details on each clutch were recorded. For nesting females at NSI, mean straight-carapace length was 196.0 mm (±1.4 SE) and mean clutch size of 12.6 eggs (±0.5 SE). Females at LBI had a mean straight-carapace length of 197.2 mm (±2.0 SE) and a mean clutch size of 12.9 eggs (±0.3 SE). Females located at FR had a mean straight-carapace length of 149.5 mm (± 0.92 SE) and a mean clutch size of 11.5 eggs (± 0.9 SE). On the northern end of LBI out of 173 sightings all but two females were all encountered or nested less than 190.5 m from water access. On NSI out of 99 sightings 75 were encountered or nested less than 22.9 m from water access. On EBFNWR all 945 sightings were less than 82.3 m from water access. Our results show that there were higher nest densities in areas where land was more accessible to females. Simple precautions like limiting boat traffic near nesting areas can be undertaken to improve long-term viability of New Jersey *M. terrapin* populations.

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# POSTER PRESENTATIONS

**A remote video camera system to observe behavior, abundance, and predator-prey interactions of deepwater organisms**

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The application of remote video technologies can provide alternative views of *in situ* behavior and distribution of aquatic organisms that might be missed with traditional net-based techniques. We describe a remote benthic video camera system designed to quantify epibenthic density of the macroinvertebrate *Mysis diluviana*. We deployed the camera multiple times during the day and night at deep (> 60 m) sites in lakes Champlain and Ontario to quantify *Mysis* density near the lake bottom. Density estimates from the video were on average 43 times higher than concurrent estimates from benthic sled tows, suggesting sleds may be inefficient at sampling mysids. Deployment caused initial scattering of individuals, resulting in low densities immediately after deployment that slowly increased. Sculpins were observed to lunge at *Mysis*, providing opportunity to gather quantitative data on demersal predators that could be used to construct 2-D foraging models. On some occasions, *Mysis* densities on video fluctuated greatly over several hours, suggestive of organisms that have a patchy distribution on the lake bottom. The camera system provided novel insights on behavior and distribution of *Mysis* on benthic habitats, demonstrating potential for use as a tool to study partial diel vertical migration and predator–prey interactions in deepwater habitats.

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# POSTER PRESENTATIONS

**Assessing the environmental control on fish life cycle: case of temperature, discharge and photoperiod control on shad reproduction**

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Diadromous fish are facing multiple anthropogenic pressures resulting in a global decline of these migratory species. In Europe, the allis shad (*Alosa alosa* L.), is no exception and has dramatically declined since 2000. Despite this well documented decline, the potential disruptive force of global warming has not been fully considered. In view of this, we used ecological niche modeling approach to define the occupied niche during the reproduction. Giving this definition, we explored how the environmental control of reproduction for the shad population in the Gironde watershed, which used to be the most abundant population in Europe, can provide clues to the sensitivity of this species. The present study analyzed a set of instream and climatic environmental factors, likely to be perceived by anadromous fish, and a data-set of daily reproductive activity monitored on spawning grounds. The results suggested that the most influential environmental factors are variation in day-length, the temperature and the discharge. Since temperature and discharge will be disrupted by global warming, phenology of reproduction of this species may be affected in the future, , as observed for the American shad.

Keywords: Diadromous fish; global warming; sensitivity; reproduction; niche

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# POSTER PRESENTATIONS

**Mercury bioaccumulation and diet overlap of two invasive goby species in the St. Lawrence River**

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Invasive fishes can affect native fish populations by shifting predator-prey dynamics and influencing contaminant transfer. Understanding the impacts of new invaders is important for long-term management of aquatic systems This proposed project will compare bioaccumulation and biomagnification of mercury in Round Goby (*Neogobius melanostomus*) and Tubenose Goby (*Proterorhinus semilunaris*) in the St. Lawrence River. Objectives are to compare the bioaccumulation of mercury between the two invasive goby species, and to estimate the importance of zebra mussel (*Dreissena polymorpha*) consumption for fish mercury uptake. I will collect gobies and measure mercury concentrations in whole fish, as well as important prey species. This data will be used to estimate the average mercury concentrations in each species and compare bioaccumulation factors between species. In addition diet will be compared from stomach contents and stable carbon and nitrogen isotopes samples to estimate the importance of benthic invertebrates, specifically zebra mussels, for each species. I hypothesize that there will be a significant difference in the bioaccumulation of mercury between the two goby species, and that zebra mussel consumption will largely account for this difference. If the hypotheses are supported, there are two main implications for the St. Lawrence River ecosystem and its management. First, identifying differences in mercury between the goby species will help determine the susceptibility of higher trophic organisms via diet preferences. Second, by examining the amount of diet overlap between the two gobies, we can determine what prey item(s) are the source of mercury concentration differences.

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# POSTER PRESENTATIONS

**Characterization of spawning rainbow smelt in relation to water temperature on Otsego Lake, NY**

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On Otsego Lake, rainbow smelt (*Osmerus mordax*) play a crucial role in the lakes planktivorous fish fauna. Populations of smelt plummeted after the introduction of alewife (*Alosa pseudoharangus*) into the lake, but since the alewife have been extirpated from the lake, the rainbow smelt populations are starting to rebound at a slow rate. The primary goal of this study was to interpret the characterization of spawning rainbow smelt and their direct correlation to the water temperature, as well as to see the water temperature that they prefer to spawn in. Between 5 April 2018 and 26 April 2018, between the times of 08:15pm and 12:15pm, 1,167 rainbow smelt were captured via backpack electrofishing the small creek. The study has shown that the direct correlation between water temperature and spawning characteristics has not been proven, but the temperature most smelt prefer to spawn in is greater than 5°C.

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# POSTER PRESENTATIONS

**Fluctuations in drought levels that effected banded sunfish populations in the Peconic River Drainage**

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Banded sunfish are found in the northeastern part of the United States, ranging from norther Massachusetts to southern Maryland. In New York, they are considered a threatened species and only found in the small ponds and bogs of the pine barren region of Long Island. The smallest member of the sunfish family, this species only grows to approximately 70mm in total length and are easily distinguished from other sunfish by their rounded tail. Habitat characteristics consist of bog and mud bottom substrates with bladderwort, smart weed, white water lilies, and sweet pepperbush growing in and around the ponds. They can withstand some of the harshest water quality parameters including high water temperatures, a low pH, and low dissolved oxygen. The main goal of this study was to see the presence and absence of these sunfish within the pine barrens as well as the Peconic river drainage. Banded sunfish have been found in great numbers in most of the ponds since 1994, but have been on the decline ever since. Most of these ponds are known to dry up in the summertime and we want to see if the droughts have a significant impact on banded sunfish presence. Of the 27 ponds sampled in 2018, only 8 of the ponds contained banded sunfish living in them. Banded sunfish were caught through most of the Peconic River Drainage prior to 2018 back dated to 2008. What possibly could have been the main cause of their disappearance is the water level fluctuation within the system. The water table is the highest it's been since July of 2014. Since 2014 to the present day, the water table in the Peconic River drainage has dropped down to the lowest level it has ever been. This water level drop caused many of the amphibians, primarily the endangered tiger salamander, to inhabit many of these areas and also provide them a place to breed. Once tiger salamanders or any amphibians made their way into this system, according to NYSDEC records, banded sunfish were never found again.

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# POSTER PRESENTATIONS

**Joint fisheries investigation plan for the Delaware Tailwaters, 2018-2020**

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The Delaware tailwaters (West Branch, East Branch, and Delaware River) is considered one of the best wild trout fisheries in New York State. The information on the biological and angler use characteristics of the wild brown and rainbow trout fishery of the Delaware tailwaters available to New York State Department of Environmental Conservation (NYSDEC) and Pennsylvania Fish and Boat Commission (PAFBC) biologists is outdated. It predates significant changes in the fishery, including current flow management and fishing pressure and patterns. The existing information is inadequate to support a scientific evaluation of whether declines in the quality of the fishery have occurred and whether changes in management objectives and strategies are warranted in response to current patterns of angler use and trout population dynamics. A new trout management plan addressing both the current trout populations supported by enhanced flows since 2010 and current angling pressure and pattern is needed. While a robust information base is essential to all phases of the management process, it is particularly critical to the development of an effective management plan in which actions can be evaluated relative to explicitly stated goals and objectives. The development of this information base is the subject matter of this investigation plan. Research objectives include characterizing the current trout population and current angling pressure and patterns of recreational use. Single pass daytime electrofishing (July-October) for young-of-year will occur at five sites on the West Branch, two sites on the main stem and 10 tributary sites). Two pass nighttime electrofishing for adults will occur at four sites on the West Branch. A creel census from April-October 15, 2018 and 2019 will be conducted on all three rivers. Based on the results of the studies completed under this investigation plan, NYSDEC and PAFBC will develop a new trout management plan as the next step in the adaptive management of the recreational trout fishery of the Delaware tailwaters.

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# POSTER PRESENTATIONS

**Lake-wide comparison of Chinook salmon condition after pen-rearing in Lake Ontario**

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Chinook salmon is the top predator in Lake Ontario supporting a multi-million dollar sport fishery. Each year, New York State Department of Environmental Conservation and the Ontario Ministry of Natural Resources and Forestry stock millions of Chinook into Lake Ontario at dozens of sites around the lake to maintain the fishery. The Chinook are reared in net pens to increase imprinting and survival. The objectives of this study were to compare growth, condition, and lipid content of Chinook after pen-rearing around Lake Ontario. Pen-rearing was conducted by volunteers at 6 sites in Canadian waters and 9 sites in US waters in April and May 2018 and pen-rearing duration varied among sites (11-38 days). The highest specific growth rates were for Chinook reared in Canadian waters. However, lipid content increased significantly between the initial sampling (prior to stocking) and the final sampling at six US sites and only one Canadian site. In addition, growth of Chinook was limited during the two first weeks after stocking in the pens in both Canadian and US waters. These results suggest the duration of the rearing and potential differences in diet composition (Ewas vs. BioOregon) affect weight gain and lipid content.

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# POSTER PRESENTATIONS

**Comparison of prey fish fatty acid signatures among the Finger Lakes**

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The Finger Lakes are home to a mixture of native (yellow perch) and non-native (alewife and round goby) prey species that compose the majority of the forage base for predators such as lake trout. However, the availability of these prey species varies in each Finger Lake: alewife can be found in all the lakes except in Skaneateles Lake, round goby is only currently present in Cayuga Lake, and yellow perch is present in all the lakes. The objectives of my research were to (1) characterize fatty acid signatures (FAS) of yellow perch, round goby, and alewife collected from the Finger Lakes, and (2) to compare alewife FAS among lakes. Alewife, yellow perch, and round goby were collected from Keuka, Seneca, Canandaigua, Cayuga, and Skaneateles lakes using seine and gill nets during the summer of 2017 and 2018. Lipids were extracted from whole body fish and fatty acids were then transmethylated and separated using a gas chromatograph/mass spectrometer. Our results indicate that FAS differed significantly among the three different species (ANOSIM, Overall $R = 0.726$, $P < 0.001$). The major fatty acids responsible for differences among species were 16:1n-7, 18:1n-9, 20:5n-3, and 22:6n-3. In addition, alewife FAS differed significantly among the lakes they are present in (PERMANOVA, pseudo $F = 8.87$, $P < 0.001$). The major fatty acids responsible for differences in alewife FAS among lakes were 18:1n-9, 22:6n-3, 16:0, and 18:4n-3. These data will be used for comparisons with lake trout FAS to determine lake trout diet based on the principle “you are what you eat”.

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# POSTER PRESENTATIONS

**Against the current: stream-run behavior in Cisco (*Coregonus artedi*)**

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Cisco (*Coregonus artedi*) morphometry, merisitics and life history are notoriously variable, both among and within populations, however habitat preference in inland lakes is predictable and typically restricted to cold-water, pelagic areas. Nonetheless, during a sampling trip at Follensby Pond, New York State, we observed stream-run behavior where adult-sized cisco swam over an outlet sill from a narrow, shallow stream into the lake. We used a dip net to opportunistically capture 11 individuals (3 female, 8 male). Stream captured cisco were considerably larger at a given age than individuals captured in the lake, had significantly larger asymptotic length (lake, $L_\infty$=280 ± 5mm; stream, $L_\infty$=333 ± 17mm), and were present only as mature individuals between the age of 3 and 5. This alternative life-history strategy suggests two possible scenarios. Firstly, Follensby Pond is hydrologically connected to other inland lakes via the Raquette River, making it possible that individuals are migrating from elsewhere along the Raquette River system to spawn in Follensby Pond, or secondly, individuals from Follensby Pond exhibit complex and diverse life history strategies wherein distinct morphotypes exist in sympatry, with the larger of the two morphotypes entering the outlet stream at some point only to return to the lake to spawn. While stream-run Cisco have been seen in large river systems (e.g. Saint Mary's River between Lake Superior and Lake Huron) and estuarine environments (e.g. Northern Quebec tributaries of James and Hudson Bay), this perplexing behavior has very rarely been documented in inland lakes.

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# POSTER PRESENTATIONS

**Effectiveness of thiamine immersion and feeding trails on juvenile lake sturgeon growth and success**

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Lake Sturgeon (*Acipenser fulvescens*) are a long lived and late maturing fish that were once abundant throughout the Great Lakes watershed, but saw rapid population declines in the late 20$^{th}$ century because of overharvest, habitat degradation and migration impediment. Stocking programs in NYS have been underway for 26 years through collaborations with NYSDEC, USFWS and USGS with the goal of reestablishing self-sustaining populations. Throughout this restoration program, we have seen low hatchery survivorship of Lake Sturgeon and this study aims to identify methods to mitigate current challenges. Lake Sturgeon raised at the DEC Oneida Fish Hatchery in 2018 were subjected to five different feeding trials and thiamine immersions either as eggs or fry to determine best methods for raising juvenile Lake Sturgeon in a hatchery environment to minimize fry loss and optimize growth. We tested for significant differences in lengths and weights between treatment tanks for age-0 Lake Sturgeon to examine if these parameters were dependent on thiamine levels and food type. A one-way ANOVA was performed for each week to determine if lengths and weights between treatments were significantly different from each other and then, if significant, a Tukey test was preformed to see which were similar. General trends show significant differences between treatments for length and weight for each week following week one, and average daily fry loss was shown to have significant differences between treatment tanks over the course of the study. Results show average daily fry loss to be lowest in fish that were subject to thiamine immersion as fry and fed a mix of artemia, otohime and bloodworms. Loss was highest in fish that were not treated with thiamine as eggs or fry and fed a diet of otohime. The information gained in this study will provide an improved understanding of Lake Sturgeon culture and could suggest improved methods for raising Lake Sturgeon in a hatchery setting in the future.

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# POSTER PRESENTATIONS

**Analyzing the change in glass eel count and weight throughout the glass eel season**

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*Anguilla rostrata (*American eel) have faced a drastic decline over the past 40 years. Through a citizen science study over a decade, we have observed that daily eel catches and weights vary throughout the migration season. However, not much research has been done to look at the overall pattern of these changes and their relation to water temperature and stream water depth. A fyke net was placed at the mouth of Furnace Brook, a tributary in the lower Hudson River estuary, and monitored daily February through May during the eels' upstream migration season. Glass eels were counted and water/air temperature and weather were also recorded. A HOBO Logger was installed above the head of tide to measure absolute barometric pressure, and water depth (a proxy for stream flow). The HOBO data revealed a negative correlation between water depth and date ($R=.64$, $p<.0001$); showing greater flow earlier in the season. We found a negative correlation between sampling date and eel weight ($R= -.62$, $p<0.05$); eel weight declined throughout the migration season. Additionally, our results reveal a change in the timing of the glass eel arrival season with a shift towards earlier arrivals in more recent years. Our findings provide insight on the American eel migration patterns in a tributary of the Hudson River, a critical habitat for this culturally, economically, and ecologically important fish species.

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# POSTER PRESENTATIONS

**A synthesis of management regulations and attitudes towards bowfins, and conservation implications of a developing caviar fishery**

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Historically, bowfins have been viewed by fishery managers and anglers as 'rough fish' that were not economically or ecologically important. These fishes play an ecosystem role similar to other larger aquatic predators, however, by regulating their prey populations. Recently, it also has been discovered that Bowfins can provide a valuable source of caviar as a viable alternative to now heavily-regulated paddlefish and protected sturgeons. Commercial Bowfin caviar harvests began in Louisiana and are beginning to gain traction in other Gulf Coast states. Considering this developing threat of caviar harvesting, along with invasive competitors (i.e., Northern Snakehead) and habitat losses, it is important to summarize status of Bowfin management regulations across their range. That information, in turn, can provide useful guidance to jurisdictions that are presently unregulated or have minimal regulations. Bowfins naturally range across 30 US states and two Canadian provinces, inhabiting a variety of lowland habitats east of the Rockies. To determine regulation status for Bowfins across their native range, recently published state/provincial freshwater fishing regulations were reviewed. For some states, fishery managers were interviewed to refine our understanding of published regulations. States were separated into those: 1) with Bowfins mentioned as being variously regulated, and 2) with Bowfins listed as unregulated (or not even mentioned in regulations). Of the 30 states and 2 Canadian provinces, only 13 states and one province presently have regulations for Bowfins, and most of those do not consider possible caviar harvests. Jurisdictions with Bowfin regulations mostly considered them "game fish with restriction" or "nongame fish with restriction". Given these findings, we strongly recommend a broader consideration of regulations that might prevent population collapses should a caviar fishery develop in a particular area. Existing but localized regulations potentially suitable for broader applications include: 1) a closed season up to and including spawning, depending on geographic region, could be established to protect Bowfin at their most vulnerable stage; 2) a catch-and-release sport fishery or creel limits could protect Bowfin populations from overharvesting; and 3) proactive caviar harvest rules written specifically for Bowfins could also be added to state/provincial commercial fishing regulations.

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# POSTER PRESENTATIONS

**Utilizing pass thru and pass over radio frequency identification HDX single antenna systems to evaluate the passability of a culvert pre and post baffle installation**

Steven Swenson

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The New York State Department of Environmental Conservation Region 4 Habitat unit is currently partnered with Trout Unlimited and conducting a study of the passability of a perched culvert within the Beaver Kill drainage in Delaware County. There are two objectives to this project, to assess the passability of the concrete box culvert pre and post baffle installation and to assess two different types of radio frequency identification units (RFID). To determine culvert passability, 72 trout were surgically tagged with 12mm passive integrated transponders, returned to the downstream culvert pool and will be detected using three RFID units. Two RFID units are pass over units that were fabricated in house at a cost of $540.00. The third unit is a pass thru single antenna unit which was purchased from Oregon RFID at a cost of $1855.00. This two-year study has thus far assessed one year of culvert passability pre-baffle installation. Seven routor-moulded flexible plastic baffles have been purchased from ATS Environmental and will be installed in the spring of 2019. These baffles are affordable, and installation is simple. If effective in improving passability, grant money will be sought to install the ATS baffles on a broader-scale.

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# POSTER PRESENTATIONS

**Scaling riverine ecological restoration services from dam removals**

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The National Oceanic and Atmospheric Administration (NOAA), along with co-trustees including the U.S. Fish and Wildlife Service (USFWS), states and tribes, is responsible for undertaking natural resource damages assessments (NRDAs) through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) and Oil Pollution Act (OPA), and to secure compensatory restoration from responsible parties for natural resource injuries resulting from oil spills and other contaminant releases. Trustee agencies conduct NRDAs including quantifying habitat and/or species injuries resulting from contamination and contamination cleanup, applying Habitat Equivalency Analysis (HEA) and/or Resource Equivalency Analysis (REA) methods and scaling metrics. Through its Damage Assessment, Remediation and Restoration Program (DARRP), NOAA seeks to advance restoration scaling of dam removals. Related to this task, NOAA has been engaged in more than 320 fish passage projects in its Northeast Region (NER: Maine through Virginia), including 130+ dam removals. Nearly all the dam removals have been proactive projects, removing run-of-the-river dams to restore diadromous fish populations. NOAA and its consultants are developing a conceptual model to scale restoration by addressing riverine ecological services derived from restored fish habitats and diadromous and potamodromous fish populations resulting from targeted dam removals in the NER and Great Lakes Region (GLR). Model development includes review of existing published and gray literature on changes in fish populations and their habitats including forage species populations resulting from dams and other barrier removals. Fishery expert input is also a key component to identify fish surveys, other datasets and data gaps for selecting key scaling metrics for the model. Model templates will be completed by a team of collaborating fishery and resource scaling experts for use by trustees to assess alternatives for NRDA river injury restoration, and for other foreseeable uses in watershed restoration and prioritization.

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# POSTER PRESENTATIONS

**Reaching and educating Hudson River fish consumers about PCB contamination in fish**

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The Hudson River has one of the largest federal Superfund sites in the United States stretching 200-miles from Hudson Falls to New York City. Due to PCB contamination, the New York State Department of Health has fish consumption advisories for this extensive Superfund site. Women under 50 and children under 15 should not eat any fish from the project area, and for men and older women the advice varies by section:

- The Upper Hudson, which is the most contaminated, has the strictest regulations that prevents anyone from keeping the fish,
- the Mid Hudson has a slightly more relaxed advisory for men and older women but no one should eat the most desirable fish – the striped bass, and
- the Lower Hudson has the least restrictive advisory for men and older women but has the most diverse populations who speak many languages.

Reaching these vastly different populations with advice along 400 miles of shoreline is the project's mission. Since 2009, staff at the Hudson River Fish Advisory Outreach project have developed many tools to help convey the advisory and promote behavior change in anglers and their families.

Through the process of doing over 1300 convenience surveys and many, many conversations with anglers, striped bass continues to be the top fish consumed. Many anglers do not realize that between Troy and Catskill there is a "don't eat" advisory for striped bass. The program continues to do in-depth outreach to anglers including handing out a "striper packet" with PCB data and summary information to help clear up misconceptions that Hudson River striped bass are "ocean fish". This is provided in a format that is shareable and promotes conversations between anglers.

The poster will describe some of these outreach techniques used and strategies NYS DOH utilizes to communicate the advice to the incredibly diverse populations who fish the Hudson River.

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# POSTER PRESENTATIONS

**Long-term surveys inform Lake Ontario coregonine dynamics**

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Lake Ontario fish community objectives seek to conserve and or restore Coregonines, including Cisco, Lake Whitefish and Bloater. Collaborative long-term survey data provide insight into the dynamics of these native fishes. Multiple surveys suggest Cisco increased in the 1980s, declined in the late-1990s, and increased slightly in the mid-2010s. These dynamics suggest Cisco experience variable year-class strength. In addition, catches were highest catches in eastern Lake Ontario possibly because that region's rock or embayment habitats serve as spawning habitat. At a regional scale, Lake Ontario Cisco catches were positively correlated to Lake Superior suggesting climate may drive populations at a regional scale. Lake Whitefish catches have generally been low over the past 45 years, except during the late 1980s and 1990s. Lake Whitefish catches were also variable, and highest in the east, near Oswego NY and near the Niagara River. Bloater historically inhabited the deeper offshore habitats but were possibly extirpated. Since Bloater restoration began in 2012, five individuals have been captured in US waters. Three of those Bloater likely traveled 71 and 126 miles from their stocking location in October to their April capture locations. While not targeted at these species, long-term surveys provide unique lake-wide information for Lake Ontario coregonine management.

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# POSTER PRESENTATIONS

**Potential effects of culvert water velocity on upstream movements of brook trout**

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Upstream movements of brook trout in headwater streams can be restricted by the presence of perched culverts. Sloped culvert extensions have been proposed to increase the likelihood of passage; however, high water velocities funneled through the culvert may also limit the movement of brook trout. We measured discharges of House, Heathen and Panther Creeks and developed a rating curve with a local USGS stream gauge. This allowed us to assess the number of days in a given year a 25cm brook trout, swimming at either burst or prolonged rates, would be unable to make upstream movements for both the velocity of the natural stream and the velocity of the stream traveling through a three foot wide culvert. Compared to the natural stream velocity, the addition of a culvert to the House Creek site would have increased the number of impassible days by 27 for burst swimming and 40 for prolonged swimming. Compared to the natural stream velocity, the addition of a culvert to the Heathen Creek site would have increased the number of impassible days by 4 for burst swimming and 8 for prolonged swimming. Compared to the natural stream velocity, the addition of a culvert to the Panther Creek site would have increased the number of impassible days by 44 for burst swimming and 64 for prolonged swimming. The velocities of the natural stream have limited impact on brook trout upstream movement. When adding a culvert extension it is important to consider how frequently passage will be limited by high flow events, especially during the spawning season when we anticipate the levels of movement to be the greatest.

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# POSTER PRESENTATIONS

**One fish, two fish, red fish, blue fish: Nearshore ocean trawl survey**

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The nearshore ocean trawl survey is a ten-year survey that started in the fall of 2017. The survey collects abundance and biological data from adult and subadult finfish and macro invertebrates to better understand their distribution, relative abundances and life history. The survey samples the Atlantic Ocean from Breezy Point to Block Island Sound during the winter, spring, summer and fall. The survey samples New York's inshore waters to supplement data from other surveys. During the first year of sampling, important commercial and recreational species were present throughout the west to east gradient along the south shore of Long Island. By sampling the entirety of New York's three-mile boundary during all seasons, we will be able to establish a baseline for managers to monitor local fisheries.

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