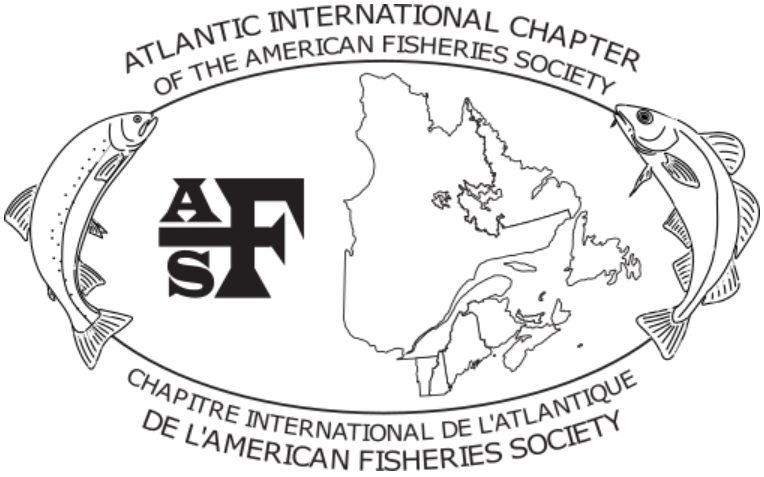
43rd Annual Meeting of the Atlantic International Chapter



43ième Congres annuel du Chapitre international de l'Atlantique

17–19 September 2017

White Point Resort, Nova Scotia

Program

Sunday 17th

16:00	Check-In Begins Main Lodge
17:00 – 19:00	Registration Lakeside Hall
	Lakeside Hall
Thelodonti Session	(Snacks and Beverages Provided)
19:00 – 19:20	1) **Faith Penny**, S. Pavey – Functional ecology and evolution of genes facilitating thermal and salinity change tolerance in Striped Bass
19:20 – 19:40	2) **Haley Viehman**, T. Boucher, A. Redden – Winter and summer differences in probability of fish encounter (spatial overlap) with tidal energy devices
19:40 – 20:00	3) **Brittany Dixon**, T. Linnansaari, R.A. Curry – Near dam, spatio-temporal distribution of migrating American eel elvers and juvenile eels in the downstream reach of the Mactaquac Generating Station
20:00 – 20:30	**Open Mic** – Informal presentations (5 min each)

Monday 18th

07:45 – 08:30	Breakfast Elliot's Dining Room (Main Lodge)
	Lakeside Hall
08:30 – 09:00	Welcome
09:00 – 09:40	Keynote Presenter – **Edmund Halfyard** The Nova Scotia Salmon Association Taking the lead: A 12-year acid rain mitigation project led by a not-for-profit
Anaspida Session	
09:40 – 10:00	4) **Hillary Dort**, T. Avery, R. Easy – Identifying changes in epidermal mucus proteins of Striped Bass (*Morone saxatilis*) as a consequence of angling stress
10:00 – 10:20	5) **John Magee** – Instream wood restoration effects on aquatic habitat and Brook Trout
10:20 – 10:40	6) **Mike Dadswell**, A. Spares, M. McLean, P. Harris, R. Rulifson – Long-term impact of a tidal turbine on three anadromous fish populations from the Annapolis River, Nova Scotia, Canada
10:40 – 11:00	Coffee Break
Conodonta Session	
11:00 – 11:20	7) **Lita O'Halloran**, G. Auton, D. Quinn, E. Carmichael, T. Avery – Using angler surveys to inform Striped Bass catch reporting
11:20 – 11:40	8) **Nathalie LeBlanc**, T. Avery, S. Andrews, G. Puncher, A. Whiteley, R.A. Curry, S. Pavey – Genomic investigation into a breeding population of Striped Bass (*Morone saxatilis*) within the Saint John River
11:40 – 12:00	9) **Michael Bailey**, B. Gahagan – Near coastal and oceanic movements of American Shad with use of surgical deployment of acoustic telemetry
12:00 – 13:00	Lunch Lakeside Hall
Cephalaspidomorphi Session	
13:10 – 13:30	10) **Alexandra Brown**, R. Easy – A phylogenetic classification of Nova Scotian squid species based on cytochrome b, cytochrome c oxidase subunit I (COI) and 18S rDNA genes
13:30 – 13:50	11) **John MacMillan**, C. Buhariwalla – Status of the sea run speckled trout fishery in River Denys, Nova Scotia

13:50 – 14:10	12) **Douglas Smithwood** – Adaptive methods for improving upstream eel passage at hydroelectric facilities on the Merrimack River of New Hampshire and Massachusetts
14:10 – 14:30	Coffee Break
Placodermi Session	
14:30 – 14:50	13) **Mark Billard**, A. Redden, J. Gibson – Age and size selectivity of the Gaspereau River Alewife fishery: Implications for the assessment of this stock
14:50 – 15:10	14) **Maja Reinhartsen**, T. Avery – Hot, Sour and Breathless: Cooperative approaches to local fisheries management in combating anthropogenic climactic changes in our oceans
15:10 – 15:30	15) **Kristopher Hunter** – Trends in aquatic habitat and fish populations in response to physical habitat restoration
15:30 – 16:30	Swim!
15:30 – 18:30	Kejimkujik Seaside Interpretive Hike (30 min travel time)
18:30 – 19:30	Dinner Elliot's Dining Room
20:00	Social – Fire Pit + Ocean Lodge
Tuesday 19th	
08:00 – 08:45	Breakfast Elliot's Dining Room
08:45 – 10:30	Business Meeting Lakeside Hall
10:30 – 10:50	Coffee Break
Acanthodii Session	
10:50 – 11:10	16) **Zhe Jackson Yang**, L. Campbell, R. Easy, T. Avery – Connecting ecological dots using diets and contaminants in Striped Bass in Minas Basin
11:10 – 11:30	17) N. Nzirorera, G. Puncher, N. LeBlanc, N. Ross, P. Smith, **Scott Pavey** – Using genome-wide association to determine the genetic basis of sex and growth rate in American Eel
11:30 – 12:30	Awards (Lunker, Soggy Boot) Raffle
12:30 – 13:30	Lunch Lakeside Hall Departure

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Program Abstracts

Keynote Presenter

Edmund A. Halfyard

The Nova Scotia Salmon Association

Eddie Halfyard is a research scientist who studies the ecology of recreational fish species and species at risk. Eddie graduated with a BSc and MSc from Acadia University, and a PhD from Dalhousie University. He has worked as a post-doctoral research fellow with the Great Lakes Institute for Environmental Research in Windsor, Ontario and has also worked for the federal and provincial governments and as a private consultant. Eddie currently works for joint initiative between the Nova Scotia Salmon Association and the province of Nova Scotia. His research interests include; acid rain mitigation, biotelemetry and invasive species. Eddie is an avid outdoorsman and lives in Sackville, Nova Scotia with his wife and three daughters.

Taking the lead: A 12-year acid rain mitigation project led by a not-for-profit

Acid rain has been greatly reduced relative to the 1980s, however along the Atlantic coast of Nova Scotia and northeastern Maine, USA, a legacy of acid rain persists; impacting soil, forest, and the aquatic ecosystem health. The Atlantic Salmon, *Salmo salar*, is a species which has been particularly negatively impacted with total abundance reduced by 88-99% along Nova Scotia's Atlantic coast. At least 2/3rds of the known populations are suspected to now be extirpated.

Beginning in 2005, the not-for-profit Nova Scotia Salmon Association initiated a demonstration acid rain mitigation project on a small coastal river 80 km northeast of Halifax. An automated lime doser continuously administers powdered limestone to the acidic river water to raise pH, reduce the concentration of toxic monomeric (labile) aluminum, and ultimately, increase the survival and abundance of Atlantic Salmon and other acid-sensitive aquatic species.

The freshwater production of juvenile Atlantic Salmon has increased by > 300% in treated areas whereas untreated areas remain at low abundance with occasional year class failure. Water chemistry is above target levels in portions of the watershed; however, a large area of important habitat remains under-treated and limits the full recovery of the population.

A major expansion of the project is underway including the installation of a second lime doser, an evaluation of helicopter-applied terrestrial liming, physical habitat restoration to compliment chemical mitigation and concerted research projects to inform development of a regional recovery strategy for acid-stressed Atlantic Salmon populations.

Presenters
(In order of presentations)

Functional ecology and evolution of genes facilitating thermal and salinity change tolerance in Striped Bass

Faith M. Penny and Scott A. Pavey

Canadian Rivers Institute, University of New Brunswick, Saint John

The Striped Bass (*Morone saxatilis*) is an economically and ecologically important migratory fish species, native to the eastern coast of North America. Across their range, Striped Bass naturally experience a wide range of temperature and salinity gradients. Even within single river systems, differences in migration patterns may exist, with some fish remaining resident in freshwater rather than returning to the ocean. While these factors are known to affect the physiology of these fish, little is known about the underlying genomic differences between populations. The overall objective of this research is to explore whether differences in genomics relate to functional changes in tolerance to salinity and temperature. Specifically, we aim to determine (1) whether resident and migratory fish have different responses to salinity exposure and (2) whether fish from cold northern populations differ in response to temperature from warmer southern populations. We plan to address these questions through a series of experiments that include rearing fish caught from these wild populations, acclimating them to various salinities or temperatures, then measuring gene expression and various metrics of salinity and temperature tolerance. We expect that migratory and resident fish will have different genomic responses to salinity, while similarly cold and warm populations will have different genomic responses to cold. The information gleaned from this research will offer important insight into the underlying functional genetic differences among populations of Striped Bass. Understanding the important genetic differences between populations are essential to guide management decisions in a changing climate.

Winter and summer differences in probability of fish encounter (spatial overlap) with tidal energy devices

Haley Viehman[1], Tyler Boucher[2], and Anna Redden[1]

[1] Acadia Centre for Estuarine Research, Acadia University
[2] Fundy Ocean Research Center for Energy

The likelihood of fish encountering an instream tidal energy device, and therefore the risk posed to fish, depends largely on the natural distribution of fish at tidal energy development sites. In temperate locations, such as the Bay of Fundy, seasonal changes in the environment and fish assemblage may alter the likelihood of fish encounters with devices. We examined two one-month hydroacoustic datasets collected in winter 2015 and summer 2016 by an upward-facing echosounder deployed at the Fundy Ocean Research Center for Energy test site in the Minas Passage. Fish density was higher and less variable in winter than in summer, likely due to the presence of migratory vs. overwintering fish. Fish vertical distribution varied with sample period, diel stage, and tidal stage. The proportion of fish at device depth was greater but more variable in summer than winter. Encounter probability, or potential for spatial overlap of fish with a tidal energy device, was < 0.002 for winter and summer vertical distributions. More information on the distribution of fish (horizontal and vertical), species present, fish sensory and locomotory abilities, and nearfield behaviours in response to instream tidal energy devices is needed to improve our understanding of likely device effects on fish.

Near dam, spatio-temporal distribution of migrating American eel elvers and juvenile eels in the downstream reach of the Mactaquac generating station

Brittany Dixon, T. Linnansaari, and R.A. Curry

University of New Brunswick, Fredericton

American eel (*Anguilla rostrata*) is a catadromous species that is native to the Saint John River (SJR), NB. Young American eels (elvers) migrate up the river during the spring of each year and distribute themselves as far to the headwaters as possible. Hydropower dams, like the Mactaquac Generating Station (MGS), block the upstream movement of elvers, resulting in barriers to migratory potential. Historically, high numbers of elvers had been observed at MGS. However, since 1980, a complete absence of elvers has been reported nearing MGS, possibly signifying the presence of a migration bottleneck downstream. Using knowledge of potential velocity barrier locations within the SJR, a variety of elver traps were deployed within 20 km downstream of MGS. During 2015, it was determined that juvenile eels do appear at certain locations of MGS and there is no apparent velocity barrier, as previously predicted. Juvenile eel behaviour was observed and areas of heightened eel activity were recorded along the banks of MGS. For 2016, our focus shifted to the area within 3 km downstream of MGS. Upon securing access to the dam's diversion sluiceway and spillway, we discovered the presence of thousands of juvenile eels coating the walls of both structures as eels showed particular preference for mild flow intensities and algae coverage. This information has led us to develop new methods of surveying techniques to quantify the eels and assess their behavior throughout 2017. By understanding elver upstream movements, we can begin designing structures to enable their upstream passage beyond the dam.

Identifying changes in epidermal mucus proteins of Striped Bass (*Morone saxatilis*) as a consequence of angling stress

Hillary Dort, Trevor Avery, and Russell Easy

Acadia University

Striped bass (*Morone saxatilis*) are native to the Atlantic coast of North America and are recognized for their ecological, economic and cultural significance. They are highly prized by recreational anglers and Aboriginal groups. Stress induced by environmental changes and anthropomorphic effects including handling and angling, can detrimentally affect striped bass populations. These effects can cause physiological and behavioral changes which are noticeable at individual, population, and ecosystem levels. This study aims to identify protein biomarkers of stress in striped bass epidermal mucus and to explore changes in these proteins as a result of angling stress. We will use proteomics to isolate, identify and characterize novel proteins and to explore their role in fish health. Our objectives include isolating proteins of interest within the epidermal mucus layer, as well as quantifying and identifying how the mucus protein profile changes in response to angling stress. These changes will be correlated along with known stress indicators including blood cortisol levels and previously identified protein markers. Blood cortisol levels will be used to determine a baseline for measuring stress levels in fish. Preliminary results using 1D SDS-PAGE show putative protein biomarkers that will be further explored using mass spectrometry and immunochemistry. We have also characterized proteolytic activity using zymography, which can provide information on the role of proteases during stress-related events. By identifying biomarkers of stress in striped bass epidermal mucus we will be able to define a novel method of measuring stress for future analyses as well as provide a greater understanding of the effects of angling stress on striped bass. This study may provide further information on the significance of the epidermal mucus layer of fish as a critical component in maintaining the health of striped bass. We anticipate by recognizing the potential pitfalls in the handling and treatment of striped bass that this study will improve current conservation practices and regulations that will help to maintain healthy populations of striped bass, while still allowing fishing by Aboriginal and recreational anglers.

Instream wood restoration effects on aquatic habitat and Brook Trout

John Magee

New Hampshire Fish and Game Department

We conducted habitat and Brook Trout population assessments in Emerson Brook in 2009, several weeks prior to adding wood in specific areas, and several years thereafter. The addition of wood led to a marked increase in the proportion of pool habitat. Overall, Brook Trout biomass and density was highest in those areas where wood was added compared to those areas where wood was not added. The Brook Trout biomass and density varied between years, and this suggests that assessments of the effects of instream wood additions should be done over several years, and not only one.

Long-term impact of a tidal turbine on three anadromous fish populations from the Annapolis River, Nova Scotia, Canada

M. J. Dadswell[1], A. D. Spares[1], M. F. McLean[1], P.J. Harris[2], and R.A. Rulifson[2]

[1] Department of Biology, Acadia University
[2] Institute for Coastal Science and Policy and Department of Biology, East Carolina University

Tidal hydroelectric power has been proposed as one potential solution for sustainable energy sources. The first tidal turbine in North America began continuous operation in the Annapolis River estuary (44º45' N; 65º 29' W) in June, 1985. The machine is a STRAFLO axial-flow, hydraulic-lift propeller turbine, a type known to cause fish mortality. Anadromous populations of American Shad *Alosa sapidissima*, Striped Bass *Morone saxatilis* and Atlantic Sturgeon *Acipenser oxyrinchus* utilize the Annapolis River for spawning and other life history phases. After power generation commenced obvious turbine mortalities of these fishes began appearing downstream of the turbine. Assessments of the American Shad adult spawning run during 1981-1982 (pre-operation) and 1989-1996 (post-operation) indicated significant post-operational changes in population characteristics. Adult age, length, weight, and % repeat spawners all declined and total instantaneous mortality (Z) increased from 0.30 to 0.55. The pre-turbine spawning runs had older fish with numerous adult cohorts whereas post-operational runs had younger fish with fewer adult cohorts. During 1972-1987 numerous studies indicated the Annapolis River had an important angling fishery for Striped Bass but detailed annual records kept by a fishing contest and an elite angler family during the period 1976-2008 demonstrated a decline in number and weight of catches after turbine generation began. Pre-turbine catch of legal fish (68.5 cm) accounted for 84.1 % of total catch, but declined to 39.6 % of total catch from 1986-1999, and to none from 2000-2008. The existence of an Atlantic Sturgeon population in the Annapolis River was unknown before turbine operation, but during 1985-2016, 20 mortalities were recovered by chance seaward of the turbine. Mechanical strike and cavitation mortalities consisted of a juvenile, mature males and gravid and spent females of ages 22 to 53 years found during June to October, the period when this anadromous species returns to its natal river to spawn. Potential development of instream tidal power in the ocean is likely to have similar long-term impacts on fisheries resources if axial-flow, hydraulic lift turbines are deployed.

Using angler surveys to uncover bias in Striped Bass catch reporting

Lita O'Halloran[1], Greg Auton2, Danielle Quinn[1,3], Emma Carmichael[1], and Trevor Avery[1,4]

[1] Acadia University, Biology Department
[2] Independent Social Statistician
[3] Memorial University of Newfoundland, Biology Department
[4] Acadia University, Mathematics and Statistics Department

Marine recreational angling is a growing sport that has considerable participation and economic impact. Anglers provide a source of information on fishing effort and catches fundamental to understanding the role of their target species in aquatic ecosystem dynamics. In addition, angler practices and perception in the fishery are important for formulating management policies. Striped Bass in the Bay of Fundy, NS is a popular anadromous species for recreational fisheries. The success of this fishery is furthered by the ease of access to fishing spots, and the lack of a saltwater fishing licence. We have been using recreational anglers as one source of fisheries reporting through an ongoing tagging program. The goal of our research is to integrate recreational angler knowledge and data into the decision-making machine. As the Striped Bass population size increases so does angler interest supposedly realized in an increase in access to information. Concomitant to an increase in angler presence, there has been an recognized increase in data gaps such as fishing effort (number of anglers, rods per angler, angling periods and locations, etc.); however, data reporting (tag recaptures and catches) is also increasing. We report on data collected thus far from recreational anglers, and on using survey/questionnaire data opportunistically collected online and in-person to fill some data gaps and help inform typical fisheries summary statistics. This information is also helpful to assess angler perspectives and their economic impact on the fishery.

Genomic investigation into a breeding population of Striped Bass (*Morone saxatilis*) within the Saint John River

Nathalie M. LeBlanc[1], Trevor S. Avery[2], Sam N. Andrews[1], Gregory N. Puncher[1], Andrew R. Whiteley[3], R. Allen Curry[1], Scott A. Pavey[1]

[1] Canadian Rivers Institute, University of New Brunswick, Saint John
[2] Acadia University
[3] University of Montana

The question of whether the Saint John River contains a viable spawning population of Striped Bass has persisted since the historical population was declared extirpated in 1968. Confirmation of successful spawning is complicated by the presence of migratory adult bass within the river, a highly dynamic tidal system with multiple potential spawning grounds and a lack of thorough survey data. This study usedStriped Bass juveniles, including young of the year juveniles, to investigate the genetic signature of juvenile Striped Bass in the Saint John River. Approximately 20 samples were taken from the Saint John River, as well as from Shubenacadie River, Hudson River, and Chesapeake Bay. A double digest RAD-seq (ddRAD) technique was used to find and sequence 4700 SNP loci within these samples, and population structure was then assessed using population differentiation statistics (F_{ST}) and genetic clustering algorithms. Three genetic clusters were identified using these methods, corresponding to Shubenacadie River, Saint John River, and the American populations. In addition, small but significant differences were found between Hudson River and Chesapeake Bay samples. These results provide support for the presence of a spawning population of Striped Bass within the Saint John River.

Near coastal and oceanic movements of American Shad with use of surgical deployment of acoustic telemetry

Michael Bailey[1] and Ben Gahagan[2]

[1] Central New England Fish and Wildlife Conservation Office, U.S. Fish and Wildlife Service
[2] Massachusetts Division of Marine Fisheries

Since 2006, the United States Fish and Wildlife Service and the Massachusetts Division of Marine Fisheries have worked cooperatively to restore American Shad on the Charles River in Boston Massachusetts, USA. In 2015 and 2016 we used surgical techniques to tag returning adults to the Charles River. The surgical tagging with acoustic biotelemetry tags has allowed us to document movement that is typically unavailable to most standard American Shad telemetry projects. We were able to utilize the Ocean Tracking Network and other collaborative efforts to capture movement in marine environments.

A phylogenetic classification of Nova Scotian squid species based on *cytochrome b*, *cytochrome c oxidase subunit I* (COI) and 18S rDNA genes

Alexandra Brown and Russell Easy

Acadia University

The Scotian shelf, located in the Northwest Atlantic, comprises approximately forty cephalopod species. These include sympatric populations of the Atlantic longfin squid (*Loligo pealeii*) and the Northern shortfin squid (*Illex illecebrosus*). The development of next generation sequencing and DNA barcoding technologies have broadened taxonomic studies which have further evolved to allow detailed species identification where morphological classification can be unreliable. This study uses molecular techniques to identify a phylogeny of squid caught off the Nova Scotian coast. Total DNA was extracted from squid tissues collected from both Bramber and Chester, Nova Scotia. End-point PCR was performed using primers targeting *cytochrome b*, *cytochrome c oxidase subunit I* (COI) and 18S rDNA genes. Following sequencing, we will have a robust data set for which we may use bioinformatics tools (e.g. Geneious and MEGA) to align and explore the phylogeny/molecular taxonomy of local squid species in comparison to other sequences available in international databases. We will use these data to construct phylogenetic trees allowing us to draw relationships between species. Refining these methods will be helpful in future studies to reduce species misidentification in the field and to develop more accurate squid stock assessments for conservation policies. Our results will provide valuable information for prospective commercial squid fisheries in Nova Scotia.

Status of the sea run speckled trout fishery in River Denys, Nova Scotia

John L. Macmillan and Colin Buhariwalla

Inland Fisheries Division, Nova Scotia Department of Fisheries and Aquaculture

The River Denys is a moderate sized watershed (215 km2) and supports a popular sport fishery for anadromous speckled trout. In 2006, the River Denys was designated a Special Trout Management Area and the opening date of the angling season was delayed to 15 May. The daily bag limit of five trout and gear type remained consistent with general regulations. In 2008 and 2010, speckled trout were angled and tagged in the estuary prior to the opening of the angling season. An angler creel survey and live trapping was used to assess movement, number in the population, and the size of the catch. Angler effort and harvest increased and in 2012 regulations were changed to include a 1 May opening and a 3-trout bag limit with only one trout longer than 35cm. In 2016 and 2017, the assessment was repeated and the number of trout harvested was below levels recorded in 2008 and 2010.

Adaptive methods for improving upstream eel passage at hydroelectric facilities on the Merrimack River of New Hampshire and Massachusetts

Doug Smithwood

Central New England Fish and Wildlife Conservation Office, US Fish and Wildlife Service

This presentation will be an overview of our upstream eel management activities on the Merrimack River. The presentation will include a survey of the myriad of technics being deployed to improve: (1) internal passage efficiency within the eel ways themselves, (2) near field attraction to the entrance of the eel ways and (3) assessing the siting for the future installation of permanent eel ways.

The Merrimack River is an extensive watercourse (188 rkm) traversing the states of Massachusetts and New Hampshire. The River was once called, "the hardest working river in the country" during the Industrial Age because of the extensive use of its waterpower. Currently there are five hydroelectric facilities on the mainstem and additional dams on all major tributaries. Many facilities have unique challenges for providing safe, timely and effective upstream eel passage.

Age and size selectivity of the Gaspereau River Alewife fishery: Implications for the assessment of this stock

Mark Billard[1]; Anna Redden[1]; Jamie Gibson[2]

[1] Acadia University, Biology Department and Acadia Centre for Estuarine Research
[2] Fisheries and Oceans Canada, Dartmouth, **Nova Scotia**

Biological reference points are indices based on the characteristics of a fish stock and its fishery. They are used to gauge whether specific management objectives are being achieved. Selectivity of a fishery can vary the impacts of a specific harvest rate depending on whether younger or older fish are being harvested. A fishery that is selective for certain age classes could have different biological reference points for the stock, and could require different management of the fishery. In this study, we examined the selectivity of a commercial alewife fishery on the Gaspereau River in Nova Scotia. Alewife (*Alosa pseudoharengus*) is a diadromous, herring-like fish species that spawn in the rivers and lakes along the eastern seaboard of North America. Alewife are fished extensively throughout their range as they return to their natal rivers to spawn. In Spring 2016, biological characteristic data were collected from alewife sampled at a commercial fisher's stand, and at a fish ladder four kilometers upriver. Data were used to reconstruct numbers at age for the total spawning run. A significant difference was found in mean fork length, weight, age, and numbers of repeat spawners between the two sampling locations, indicating that the fishery is highly selective. Selectivity was calculated for age classes, incorporated into the calculations for the biological reference points for this fishery, and compared to existing non-selective biological reference points. Biological reference points changed slightly, but not enough to change management of the Gaspereau River alewife stock.

Hot, Sour and Breathless: Cooperative approaches to local fisheries management strategies in combating anthropogenic climactic changes in our oceans

Maja Reinhartsen and Trevor Avery

Acadia University

Stakeholders in the state of our regional and local fisheries include recreational, industrial, commercial, institutional, and traditional marine resource users. The inherent and experiential knowledge of these users spans a vast and inter-connected system of disciplines that historically lack cooperative communication practices despite a universal agreement that the impact of climate change on these resources requires unification among its users. To boost the effectiveness and adherence to marine policy directives, conserve resources for future use, and better combat the environmental changes associated with climate change the knowledge holders must align on issues that inform policy. My research project aims to correlate local ecological knowledge (LEK) to environmental variables and coincidentally characterize the social perception of several key at-risk species of significance to the broader marine ecosystem: Striped Bass, American Eel and several species of skates.

The warming, increasing carbon dioxide levels and decreasing oxygen levels of our ocean waters is putting immense pressure on the survival of many species. While academic and conservation-minded groups have long been working to boost awareness in the public and private sectors there are too few projects that galvanize resource users to take meaningful action to preserve and manage biodiversity. Proper accounting and relational understanding of the social perception of these three species will allow for more deliberate and effective management of them. Because these species exemplify and embody varied levels of importance across user groups they provide a test base to help qualify and quantify the relationship of management strategies to species and user groups. Striped Bass are well known and of high position socially to recreational and academic resource users. The reputation of American Eel is more nuanced in that it maintains a long-standing historical significance to First Nations and traditional users, while its recreational and commercial use and value is highly variable across user groups. Skates represent a much less documented, socially or commercially important resource that none-the-less face similar ecological obstacles as the other species.

Through inter-disciplinary case studies, policy makers and resource users will be better equipped to conserve at-risk species by capitalizing on the inherent knowledge each group holds, but do not necessarily share. The highway 101 twinning near the Avon River causeway provides an opportunity (and an example) to qualify the informational types that local knowledge holders have as they relate to environmental variables and place them within a scientific framework. My current objective through this example is to catalogue LEK from expert resource users connected to fish residency movement patterns and correlate the information to climate variables like degree days and daylight hours. Outcomes may incite more cooperation and understanding of marine resource management practices with the goal of increasing effectiveness in their enforcement and adoption across users.

Trends in aquatic habitat and fish populations in response to physical habitat restoration

Kristopher J Hunter

St. Francis Xavier University

In response to declines in Atlantic Salmon populations governments and non-profit agencies have invested in physical habitat restoration. However, relatively few studies have rigorously looked at the effects of physical habitat restoration, especially in Atlantic Canada, nor looked extensively at what changes are occurring in the Brook and Brown Trout populations and their habitat. To address this data gap a short- (3 yr) and long-term (10 yr) examination of fish populations and river habitat before and after physical habitat restoration in 9 different tributaries in Antigonish County was developed. Annually at control (n= 2 [3 yr] ,4 [10 yr]) and restoration sites (n=2,4) the substrate composition, habitat type, hydromorphology, and fish populations were assessed. In the years prior to restoration (n=1,5) there was a trend of increasing widening, and shallowing of at all sites. Sites had highly mobile substrates with relatively high proportions of fine materials. Population and biomass estimates were stable albeit highly variable for Salmon, whereas estimates for Brown Trout seemed to increase and estimates for Brook Trout estimates seemed to decline. Early indicators from post restoration years (n=2,1) have shown an increase in the number of pools, pool depth, in substrate stability and a slight decline in the amount of fine substrates. Although they increased post restoration, fish populations have not yet shown significant increases. Habitat degradation continues post disturbance but physical habitat restoration does seem able to reverse this decline at least in the short term. Unless physical habitat is the primary limiting factor then fish population may take years to respond to restoration efforts. Other factors such as accessibility and water conditions during overwintering and spawning may play a more important factor especially for Atlantic Salmon.

Connecting ecological dots using diet and contaminants in Striped Bass in Minas Basin

Zhe Jackson Yang[1], Linda Campbell[2], Russell Easy[1], Ryan Stanley[3], and Trevor Avery[1]

[1] Acadia University
[2] Saint Mary's University
[3] Fisheries and Oceans Canada

Striped bass (*Morone saxatilis*), is a popular anadromous fish caught along the Eastern Coast of North American. We report on the initial stages of a striped bass diet and contaminants study. Striped bass carcasses from the Minas Basin region were collected from recreational anglers in the summer and fall 2017 and opportunistically from enforcement seizures. We aimed for 10 bass per month. Striped bass were sampled for otoliths, scales, stomachs, and liver and muscle tissues. Otoliths will be analyzed for age and to associate striped bass residency with water chemistry. A new approach for stomach content analysis using quantitative PCR is proposed as both a screening for prey items and to quantify their relative amounts. Stomach content analysis provides the short term (days) and stable isotope analysis of liver and muscle tissue provides a longer-term picture (weeks to months) of diets. Contaminant analysis is opportunistic given samples are available, and will provide indicators of fish health. Diet analysis coupled with known prey species pulses within Minas Basin may support the general knowledge of the residency or movement patterns of bass. Otolith stable isotope analysis may provide a longer-term perspective of fish residency, but is a complicated method. As of 1 September, 73 striped bass have been sampled; 65 for otoliths and scales, and 57 for stomach, liver, and muscle. Our goal is to provide a summary of striped bass diet and contribute to both fish health information and ecological food web linkages.

Using genome-wide association to determine the genetic basis of sex and growth rate in American Eel

Nadine Nzirorera[1], Gregory N. Puncher[1], Nathalie LeBlanc[1], Neil Ross[2], Paul Smith[2], and Scott A. Pavey[1]

[1] Canadian Rivers Institute, University of New Brunswick, Saint John
[2] NovaEel Inc.

There is a great economic opportunity to develop American eel (Anguilla rostrata) aquaculture in Atlantic Canada. All aquaculture eels must be caught in the wild as young glass eels. The Atlantic Provinces and Maine represent the last remaining fisheries for freshwater eel aquaculture as Japanese and European eel are endangered. Female eels are needed because males do not reach market size and are therefore worthless. Sexual differentiation in freshwater eels is known to be very plastic, and the dense aquaculture setting promotes maleness. Uncovering a possible genetic basis for sex and growth rate could help optimize eel rearing as it would allow for scanning of gene sequences correlated with female sex differentiation or a large size prior to aquaculture treatment, ensuring that all eels reared are marketable. To address this problem, the genomes of 107 American eels were scanned for significant genetic markers or SNPs (Single Nucleotide Polymorphisms) related to size and sex. It was found that 18 SNPs had a significant effect on the target trait of length and no SNPs were significant in their effect on sex. These results support that there is a genetic basis to size of the American eel however sex may be environmentally determined. Ongoing work will develop a screening tool to select eels that are genetically predisposed to reach larger sizes can be screened for initially during the glass or juvenile eel stage.