AMERICAN FISHERIES SOCIETY

ONTARIO CHAPTER

ANNUAL GENERAL MEETING

February 22 – 24, 2018
Geneva Park, Orillia, ON

"Renaturalization, Restoration, and Sustainability of Ontario Fisheries"

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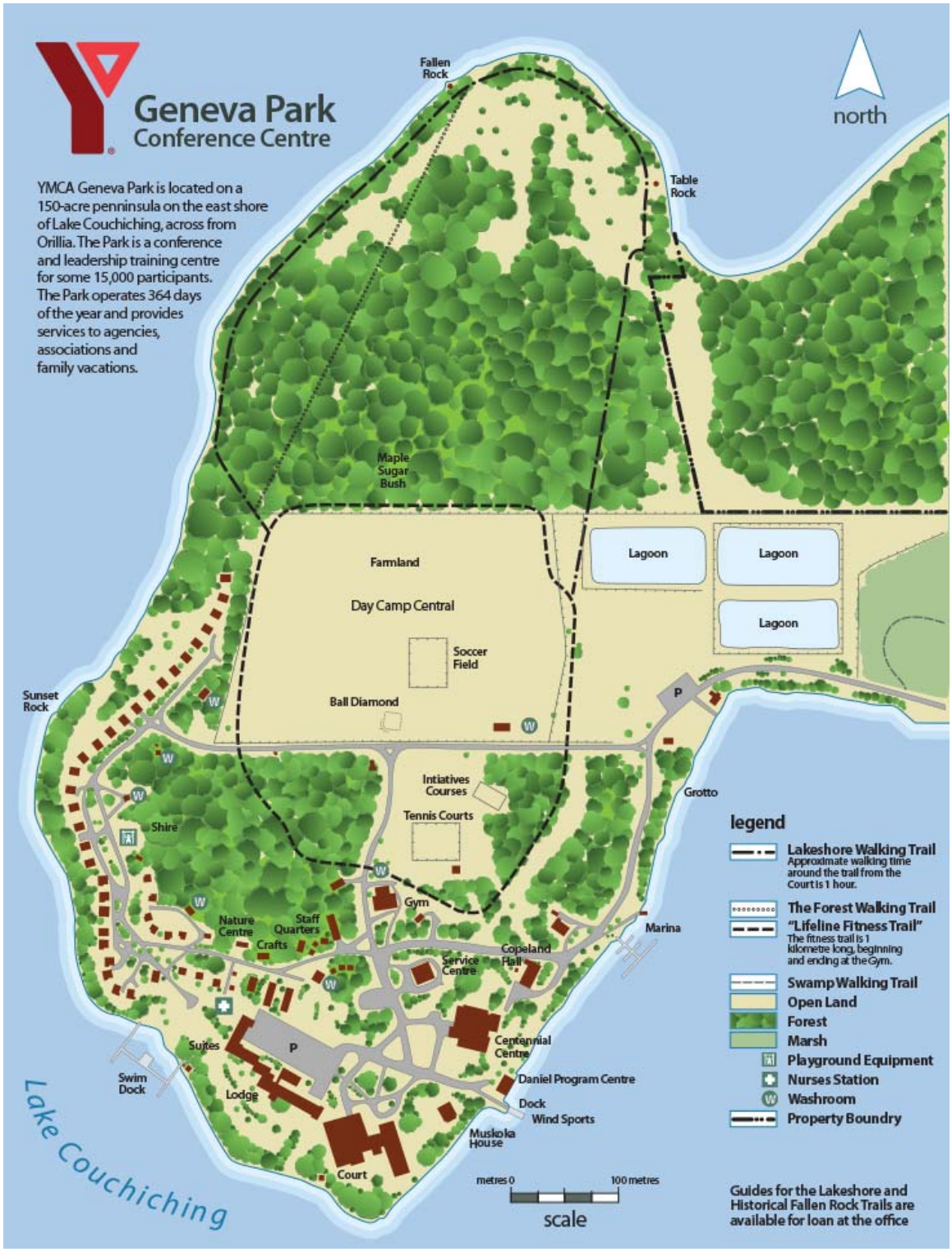
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Conference Centre
YMCA Geneva Park is located on a 150-acre penninsula on the east shore of Lake Couchiching, across from Orillia. The Park is a conference and leadership training centre for some 15,000 participants. The Park operates 364 days of the year and provides services to agencies, associations and family vacations.
north
Fallen Rock
Table Rock
Maple Sugar Bush
Farmland
Day Camp Central
Soccer Field
Ball Diamond
Lagoon
Lagoon
Lagoon
Sunset Rock
Intiatives Courses
Tennis Courts
Grotto
Shire
Gym
Nature Centre
Staff Quarters
Crafts
Service Centre
Copeland Hall
Marina
Suites
Centennial Centre
Swim Dock
Lodge
Daniel Program Centre
Dock
Wind Sports
Muskoka House
Court
Lake Couchiching
metres 0
100 metres
scale
legend
Lakeshore Walking Trail
Approximate walking time around the trail from the Court is 1 hour.
The Forest Walking Trail
"Lifeline Fitness Trail"
The fitness trail is 1 kilometre long, beginning and ending at the Gym.
Swamp Walking Trail
Open Land
Forest
Marsh
Playground Equipment
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Washroom
Property Boundry
Guides for the Lakeshore and Historical Fallen Rock Trails are available for loan at the office

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February 22 – 24, 2018
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"Renaturalization, Restoration and Sustainability of Ontario Fisheries"

Thursday February 22nd

5:30-on **Arrival, Registration (Front Desk)**

7:00-10:00 **Opening Mixer (Lodge Lounge Hospitality Suite)**

Friday February 23rd

7:30- 8:30 **BREAKFAST** ***(Geneva Court)***

08:30 **GREETING AND CONFERENCE OUTLINE (Auditorium)**

08:40 ***Keynote Talk:*** *Restoring Aquatic Biodiversity in the Anthropocene: Developing the Science of Reintroduction Biology.* **Dr. Trevor Pitcher**

Session 1

09:20 ***Talk 1:*** *Deer Creek Stream Restoration Project.* **Don Little**

09:40 ***Talk 2:*** *Gauging Aquatic System Sustainability and Health in the Face of Landuse Change.* **Jan Moryk**

10:00 **COFFEE, TRADE SHOW, POSTER SESSION (Auditorium and Lobby)**

Session 2

10:20 ***Talk 3:*** *Strategic Ecosystem Restoration Planning.* **Joel Smith**

10:40 ***Talk 4:*** *Acoustic Telemetry Research Informing Fish Habitat Restoration and Management Activities in the Toronto Harbour.* **Rick Portiss**

11:00 ***Talk 5:*** *Creating a Brook Trout Habitat Restoration Prioritization Tool for the Lake Simcoe Watershed.* **Rob Wilson**

11:20 ***Talk 6:*** *Do Fish Swim in One-Dimension or Two-Dimensions?* **Jeff Muirhead**

11:40 ***Talk 7:*** *The Connectivity Conundrum: Managing Connectivity to Enhance the Production and Diversity of Desirable Fishes.* **Rob McLaughlin**

12:00 **LUNCH (Dining Hall), TRADE SHOW (Lobby) & POSTER SESSION (Auditorium)**

Session 3

1:00 ***Talk 8:*** *Evaluating the Distribution of Eastern Sand Darter in the Ausable River, Ontario.* **Jason Barnucz**

1:20 ***Talk 9:*** *A Seine Net, a Bucket, and a Map – 2017 NANFA Meeting Recap.* **Jason Barnucz**

1:40 ***Talk 10:*** *Developing a Salmonid Spawning Survey Protocol for Streams in Ontario.* **Phil Bird**

2:00-2:40 **ANNUAL BUSINESS MEETING (Auditorium)**

2:40 **COFFEE, TRADE SHOW, POSTER SESSION (Auditorium and Lobby)**

3:00-6:30 **ICE FISHING, TRADE SHOW, POSTER SESSION**

6:30- 7:30 **DINNER (Dining Room)**

7:30-11:00 **MENTORSHIP SESSION AND SOCIAL (Geneva Court Lounge)**

Saturday February 24th

7:30-8:30 **BREAKFAST (Dining Room)**

Session 4:

8:40 ***Talk 11:*** *Does Semi-Chronic Stress Mediate Predator-Prey Interactions in Wild Fish? An Experimental Approach Using Exogenous Cortisol Implants.* **Michael Lawrence**

9:00 ***Talk 12:*** *Exploring the Spatial Ecology of Juvenile Esocids in a Large Fluvial System.* **Sarah Walton**

9:20 ***Talk 13:*** *Evaluating the Effect of Common Carp Control on Restoration of a Coastal Wetland.* **Daniel Moore**

9:40 ***Talk 14:*** *Annual and Seasonal Forage Fish Availability in the Upper and Lower Niagara River.* **Robin Gaspardy**

10:00 **COFFEE & POSTER SESSION (Auditorium and Lobby)**

Session 5:

10:20 ***Talk 15:*** *Windermere Basin: Site Rehabilitation, Wetland Construction, and Fishway Design and Monitoring.* **Megan Lloyst**

10:40 ***Talk 16:*** *Salmon River Railway Bridge Expansion.* **Sean Stuart**

11:00 ***Talk 17:*** *The Effect of Habitat Quality on Benthic Macroinvertebrate Communities and Colonization in Newly Formed Channels.* **Sarah Steele**

11:20 **PRESENTATION OF STUDENT AWARDS AND CONFERENCE WRAP (Auditorium)**

12:00 **LUNCH (Dining Room)**

1:00-3:30 ***OSAP/ROM*** **FISH IDENTIFICATION TEST (Auditorium)**

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ANNUAL GENERAL MEETING
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"Renaturalization, Restoration, and Sustainability of Ontario Fisheries"

Poster Presentation Abstracts

Dispersal patterns of black bass following early-, mid- and late-season fishing tournaments on Big Rideau Lake.

Abrams, A.E.I.[1], A.J. Zolderdo[1], and S.J. Cooke[1].

[1] *Fish Ecology and Conservation Physiology Lab, Carleton University, Ontario, Canada*

Big Rideau Lake is part of the Saint Lawrence River drainage basin, and is the largest lake on the Rideau Canal system. This lake is among the most heavily "fished" water bodies in all of eastern Ontario with bass fishing tournaments occurring from season opener to late fall.
Post-tournament release sites on Big Rideau Lake often occur at the north-eastern end of the lake, which is separated from the main basin by a long narrow channel. The objectives of this study are to determine if largemouth (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*) stay concentrated at the tournament release site, if/when these fish return to their home range, and whether there is a seasonal difference in redistribution. This knowledge may provide stakeholders with information necessary for improving management of black bass in Big Rideau Lake.

Assessments of the microbial consortia on host fish off King William Island in Nunavut

Geraint Element

The Towards a Sustainable Fishery for Nunavummiut (TSFN) Project is partnered with Nunavummiut communities to increase understanding of the fisheries resources in the lower Northwest Passage. My goal is to use genetic, demographic, physiological, and microbial analysis to inform strategies to retain genetically-diverse and healthy stocks

for the sustainable supply of high quality fish to Inuit communities. Genetic analysis will allow the identification of distinct fish populations, as well as their associated microbiomes, diversity in both being a potential indicator of disease resistance. The intestinal microbiomes (IMs) of two Arctic fish species, Arctic Char (*Salvelinus alpinus*) and Lake Whitefish (*Coregonus clupeaformis*), will be characterized by analyzing relative abundances and diversity of microbial species. Additionally, physicochemical characteristics of the water column will be analyzed, including assessments for water contaminants that may affect microbial diversity. Questions of interest include whether microbial diversity varies with genetic diversity, whether variation in microbial diversity effects parameters related to population fitness such as growth rate, and whether fish living in different environments (such as saltwater vs. freshwater) harbour different levels of potential pathogens. Accompanied by Inuit guides and fishermen, researchers sampled water and over 1200 fish from fresh and saltwater sites around King William Island, Nunavut using multi-panel, subsistence, and commercial nets. A mobile on-site lab facilitated the aseptic sampling of a suite of tissues, morphometric data, IMs, and water with subsequent DNA extraction performed. Amplification of bacterial 16S ribosomal RNA sequences, as well as fungal internal transcribed spacer regions in the 18S genes, followed by Illumina sequencing has provided sequence data that is used to construct individual microbiomes for analysis. Single Nucleotide Polymorphism (SNP) genetic data for the host fish was produced by a separate lab at Queen's University. Given that microbiota interact with the host immune system, it is important to characterize host microbiota to better understand their role in immune function and fitness of wild populations.

Assessing the habitat associations of fish species with a lacustrine life history in Nunavut and the Northwest Territories

Hancock, H[1], Kanavillil, N[1], Rennie, M[2], and Doka, S[3]
[1] Lakehead University, 500 University Avenue, Orillia, ON, L3V 0B9;
[2] Lakehead University, 955 Oliver Road, Thunder Bay, ON, P7B 5E1;
[3] Fisheries and Oceans Canada, 867 Lakeshore Road, Burlington, ON L7S 1A1

The Canadian Arctic (areas north of 60° latitude) supports unique aquatic environments governed by the local geomorphology of hundreds of rivers and thousands of lakes. Local fish communities and their associated habitats are poorly characterized compared to southern regions. Given the intense projected development activities, building a better understanding of lake ecosystems in the Canadian Arctic will be of immense help in managing these ecosystems. In this study, historic fish distribution and habitat associations of species in Nunavut and the Northwest Territories will be compared to more recent data collected from both published and unpublished literature sources. Compiled data will be analyzed using a multivariate approach. Physical and limnologic variables considered will include depth, substrate type, cover (i.e. riparian, submerged, ice, etc.), temperature and turbidity. To better evaluate the impacts of development activities on fish habitat associations, field sampling at the Whale Tail gold mine will compare two impacted sites with two fish habitat offset areas and four undisturbed lakes in the vicinity of the mine site. Habitat sampling methods will include bottom acoustics, sediment grabs, long-term logger deployments and multi-probe sonde

surveys. The aim of this research is to 1) provide an assessment of freshwater fish habitat associations in the Arctic, 2) develop and standardize habitat suitability indices and tools (e.g. Habitat Ecosystem Assessment Toolkit or HEAT) for impact and offset assessments and, 3) contribute to new protocols for the collection of fish community and habitat information in remote areas. The results will all aid in the evaluation and assessment of development impacts in Canada's North.

Keeping it level: Characterizing the time course of baseline blood physiology with sampling stressors in wild sportfish

Michael J. Lawrence, Sofia Jain-Schlaepfer, Aaron J. Zolederdo, Dirk A. Algera, Kathleen M. Gilmour, and Steven J. Cooke

Alterations in teleost blood physiology often reflects a great deal of insight into the organism's respiratory, energetic and stress status. Assessing a fish's baseline blood physiological status makes use of blood sampling via caudal venipuncture requiring handling of the animal. Over extended sampling durations, handling-induced activation of the stress axis may perturb blood metrics from a baseline state. To date, no recommended guidelines have been provided in assessing an optimal sampling duration for obtaining a representative baseline blood sample in teleost fish. This work addressed the time course of physiological changes in a number of blood metrics across six species of wild sportfish in Lake Opinicon (Chaffey's Lock, ON). Animals were caught using standardized angling techniques and held in a water filled trough. Blood samplings, via caudal venipuncture, occurred over a span of 11 minutes post-capture to investigate time-course effects of handling stressors. Blood was assessed for concentrations of whole blood glucose, lactate, hematocrit, and plasma cortisol. Breakpoint analysis was then used to determine the timing upon where these blood metrics began deviating from a baseline state. In almost all species, assessed blood metrics were found to positively correlate, linearly, with time. Breakpoint analyses indicated that values for blood lactate and hematocrit did not deviate from baseline conditions until after~3-5 minutes of handling for all species whereas blood glucose concentrations generally did not deviate significantly from baseline conditions. In all species, plasma cortisol concentrations began deviating from a baseline state between 4-8 minutes post-capture. These results indicate that the stress-response occurs in a time dependent manner resulting in a deviation of the animal's blood physiology. Additionally, we recommend that to ensure representative baseline sampling across multiple blood metrics, that sampling be limited to under 2.5 minutes in teleost fishes.

Spatial patterns of stream productivity and stable isotope ratios of C and N in Great Lakes tributaries influenced by fragmentation

Michael McKenzie and Nick Jones

Each year, thousands of important sport fish migrate out of the Laurentian Great Lakes and into the surrounding rivers to spawn. Some evidence suggests that these migrations transport large quantities of nutrients out of the lakes and donate them in the form of eggs, milt, and excrement to the stream ecosystems. Such resource subsidies have been

correlated with increases in algae production and invertebrate abundance, as well as health and recruitment in resident stream juvenile and lake fish. More research is required to fully understand how resource subsidies influence the productivity of streams, as well as how this process varies across the landscape. Furthermore, it is not clear how fragmentation affects this process, as the construction of a dam across the river can prevent sections of the watershed from receiving nutrients they have come to depend on by halting the upstream movement of the adult fish and the subsidies they provide. Comparisons of stable isotopes in the tissues of stream productivity estimates and stream characteristics to assess where and under which conditions a subsidy is most impactful. This research seeks to gain further insight into a process that may play a significant role in maintaining healthy fish populations such as Walleye and Chinook Salmon. We can use this knowledge strategically in the creation and removal of barriers that fragment the riverscape.

Effects of dual stressors on Pugnose Shiner, *Notropis anogenus*

Lindsay Potts

Hypoxia (low dissolved oxygen) and climate warming have both been identified as significant threats to freshwater fishes, which may limit fitness and performance traits. Furthermore, climate change is likely to exacerbate impacts of hypoxia on fishes, because oxygen solubility decreases with rising temperature while fish metabolism increases. The objective of this research is to examine the independent and interactive effects of hypoxia and elevated water temperatures on Pugnose Shiner (*Notropis anogenus*), and Endangered fish under the Canadian Species at Risk Act (SARA). We are rearing juvenile Pugnose Shiner live-captured from SUNY Cobleskill, NY to six ecologically relevant temperatures. We are exploring the effects of elevated water temperature on aerobically expensive behaviours (activity, aggression) and quantified aerobic performance by estimating aerobic scope (AS, the difference between the maximum and standard metabolic rate) and critical thermal maximum (CTmax) under both normoxic and hypoxic conditions (acute exposure). This research is in progress; however, we predict that fish reared under elevated water temperature may show thermal compensation, a high critical thermal maximum, and a higher aerobic scope with increased water temperature under normoxic conditions, but hypoxia exposure is expected to decrease AS ad CTmax.

Testing coloured LED strobe lights as behavioural guidance tools to enhance sea lamprey control programs

Connor H. Reid[1], Chris K. Elvidge[2], & Steven J. Cooke[3]

[1]Institute of Environmental Science, Carleton University
[2]Department of Biology, Carleton University
[3]Department of Biology and Institute of Environmental Science, Carleton University

During the last century, sea lamprey (*Petromyzon marinus*) have caused drastic population declines in many commercially- and recreationally-important fish species in

the Laurentian Great Lakes. Integrated pest management solutions that rely less on chemical lampricides and more on alternative control methods (e.g. pheromone traps, sterile-male release) have received increased focus recently as means of reducing both sea lamprey populations and collateral impacts on non-target species. The use of LED strobe lights is a new method of affecting behavioural guidance in fish and has already been applied to increasing fish usage of dam bypasses or repelling fish from hazardous areas. LED strobe lights may also be useful for capturing undesirable fish species. Here we tested in two parts whether or not several colours and strobing frequencies of LED light could be used to elicit attraction and/or avoidance responses in spawning-phase migratory adult sea lamprey in y-maze dichotomous choice behavioural assays. In the first part, we measured attraction/avoidance responses to white, green, or yellow LED light strobing at 1 or 10 Hz. Overall, strobing frequency was the most important factor in choice between lit/unlit branches of the y-maze, with green light at 1 Hz eliciting the greatest levels of attraction. However, there were significant differences in male and female responses to various combinations of colour and strobing frequency, suggesting that further study focusing on differences in light guidance and migration behaviour between males and females is necessary. In the second part, we compared success of pairing green light strobing at 1 Hz with a funnel trap to an unlit control trap treatment. The paired light-trap treatments had a small but significant increase on trapping success compared to the unlit trap for both sexes under certain environmental conditions, though the trapping success of males was significantly higher than that of females. LED strobe lights may therefore have limited beneficial applications and could be best used when paired with pheromone traps. The effectiveness of combined light and pheromone traps should be assessed in future research.

Fish community interactions with very low head hydroelectric turbine technology

Erik Tuononen

The Very Low Head (VLH) Turbine is a relatively new hydropower technology with the potential to be fish friendly. With growing interest in deploying such technology there is a need for biological assessments to understand how fish interact with these turbines. We initiated a study to assess the potential biological consequences of VLH turbines on fish with a focus on the Wasdell Falls Dam on the Severn River, in Ontario. We tagged 138 fish with acoustic telemetry transmitters to track fish movements around the turbines. Analysis of these movements will enable us to determine which species and age classes are most likely to become entrained in the turbine and their subsequent fate. We provide an overview of the project and present some preliminary findings.

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Oral Presentation Abstracts

Friday February 23, 08:40
Keynote: *Restoring Aquatic Biodiversity in the Anthropocene: Developing the Science of Reintroduction Biology.*

Trevor E. Pitcher
Great Lakes Institute for Environmental Research & Biological Sciences, University of Windsor, Windsor, Ontario, Canada, N9B 3P4, email: tpitcher@uwindsor.ca

After centuries of human-induced habitat alteration and over-harvesting, biodiversity conservation is now entering a period focused on restoration. Among restoration techniques, reintroductions are unique because they not only attempt to stem the loss of biodiversity but also attempt to increase biodiversity by releasing individuals from extirpated species back to where they historically occurred. Such methods are becoming more common as we come into the Anthropocene, our current era during which human activity has been the dominant influence on the environment and ecosystems. Reintroductions have occurred across the globe and reintroduced species span the spectrum of wildlife species, including fishes. I will provide a history of reintroduction efforts and outline empirical work on fishes that colleagues and I have been focused on in the Great Lakes. In addition to providing historical context and empirical examples, I will (i) challenge what it means to be a native species in the context of reintroduction efforts, (ii) outline how the incorporation of evolutionary principles may improve reintroduction success, and (iii) suggest ways in which we can merge theory from invasion biology and reintroduction biology to provide an integrated framework for conservation biologists.

Friday February 23, 09:20
Talk 1: *Deer Creek Stream Restoration Project.*

Don Little; Toronto and Region Conservation Authority

The Deer Creek Steam Restoration Project site is situated within the Deer Creek Golf and Country Club in the town of Ajax. The project area encompasses two branches of the Carruthers Creek watershed that flow through the golf course and converge in the south end of the property. Over the last several years the area has experienced increasing channel form changes including erosion, slumping of banks, channel widening and scouring. The overall goal of the restoration was to address the erosion hazards and improv ecological function. The TRCA Regional Watershed Monitoring Program has conducted three years of environmental monitoring at six sampling stations using Ontario Stream Assessment Protocol (OSAP) methodologies. Results from these assessments showed little to no trends within the Deer Creek study area itself; however, when compared to the Carruthers Creek Watershed findings were optimal. Species and Taxa richness values for fish and benthic macroinvertebrates were, on average, the highest in the watershed. Hilsenhoff Biotic Index (HBI) scores were, inversely, the lowest in the watershed indicating higher water quality. Furthermore, habitat results within the study area showed a large diversity in vegetation type and higher than average percentages of unembedded cover.

Friday February 23, 09:40
Talk 2: *Gauging Aquatic System Sustainability and Health in the Face of Landuse Change.*

Jan Moryk; Toronto and Region Conservation Authority

Landuse change is occurring throughout many watersheds. These changes have impacts on aquatic habitat and the biological community they support. This presentation highlights the use of various metrics/indices in order to gauge and track the health of aquatic ecosystems in the face of landuse change. The data is compared to reaches upstream and downstream of lands undergoing development in order to better understand the impacts of landuse change on the overall watershed. Water quality, fluvial geomorphology, water temperature, fish and benthic macroinvertebrate data are discussed.

Friday February 23, 10:20
Talk 3: *Strategic Ecosystem Restoration Planning*

Joel Smith; Toronto and Region Conservation Authority,

Toronto and Region Conservation (TRCA) has a long history of implementing ecological restoration programs that strengthen the health of natural systems in the Greater Toronto Area, including tree planting, wetland creation, and stream restoration. TRCA has developed an effective approach to restoration planning to assess and select appropriate sites for implementation. This Restoration Opportunities Planning (ROP) approach is routed in hydrology, based on site-specific conditions, type of opportunity

and severity of threat/impairment to natural system function. Stream ROP assessments identify specific impairments to the aquatic environment (e.g., morphologic issues, failing culverts, etc.), along with proposed treatments (e.g., bank stabilization, channel realignment, etc.). TRCA's Integrated Restoration Prioritization (IRP) framework, which consolidates watershed data and compares discrete areas based on different parameters and thresholds, further compliments ROP to prioritize restoration reaches that will provide the greatest benefits to watershed health. This framework is proving to be a valuable method for identifying successful stream restoration activities across TRCA's jurisdiction. For example, the Alfred Kuehne Stream Restoration Project in Brampton involved approximately 1 km of highly eroded and failing concrete lined watercourse within a highly urbanized setting that was restored using natural channel principals and floodplain enhancements.

Friday February 23, 10:40

Talk 4: *Acoustic Telemetry Research Informing Fish Habitat Restoration and Management Activities in the Toronto Harbour*

Rick Portiss; Toronto and Region Conservation Authority

In 2010 a multi- agency and academic research project was developed for the Toronto Harbour to evaluate the quality of fish habitat and ongoing extensive restoration efforts in the AOC. Through the combined efforts among the partners including Toronto Region Conservation Authority, Environment Canada, Department of Fisheries and Oceans, University of Toronto and Carleton University a passive acoustic telemetry array was developed to track the movement and habitat use as well as behavior in in all seasons. Approximately 450 individuals from 8 species including walleye, northern pike, largemouth bass, common carp, bowfin, yellow perch, white sucker, and brown bullhead were tagged and tracked. To date the acoustic receivers have collected more than 30 million detections giving managers and restoration practitioners insight on critical fish habitat and movements to inform future restoration initiatives.

Friday February 23, 11:00

Talk 5: *Creating a Brook Trout Habitat Restoration Prioritization Tool for the Lake Simcoe Watershed*

Rob Wilson; Lake Simcoe Region Conservation Authority

In 2013 the Lake Simcoe Region Conservation Authority created the Stewardship Priorities and Opportunities Tool (SPOT) to rank aquatic habitat restoration opportunities in the Lake Simcoe Watershed. The goal of SPOT was to prioritize a host of potential restoration projects with regard to fish habitat, phosphorus loading, sediment loading and climate change. This tool did take into account cold water habitat but didn't specifically look at brook trout habitat (*Salvelinus fontinalis*). The goal of this project was to refine SPOT to prioritize the restoration of brook trout habitat using updated data sources. The goal of the updated tool was to prioritize stream reaches where brook trout have inhabited in the past and where they are currently found.

Ultimately this tool has been created to help identify priority stream reaches so that our restoration team can focus efforts on restoring high quality brook trout habitat.

Friday February 23, 11:20
Talk 6: *Do Fish Swim in One-Dimension or Two-Dimensions?*

Jeff Muirhead; Stantec Consulting Ltd

Fish passage is a primary consideration in stream restoration – in many cases it is the driving force behind performing a stream restoration project. The conventional methods for assessing fish passage are well established and relatively consistent across the industry: results from one-dimensional (1D) hydraulic models are cross-referenced with data from the *Fish Swimming Performance Database and Analyses* (Katopodis and Gervais, 2016). While this approach may work for culverts and other plane-bed systems, 1D hydraulic modelling is unable to characterize the complex flow patterns, and therefore the fish passage, which occur through a natural riffle.

Fortunately for natural channel practitioners who design natural riffles, recent advances in technology has meant two-dimensional (2D) hydraulic modelling is more accessible than ever before. While the primary objective of 2D modelling for the majority of water resources engineers is enhanced floodplain mapping, 2D modelling allows natural channel designers to simulate the complex hydraulics which govern stream stability, aquatic habitat, and fish passage. This presentation will demonstrate the application of 2D modelling for fish passage analysis through a real-world case study with observed fish passage, highlighting the limitations of conventional approaches and establishing 2D modelling as a reasonable and viable approach for fish passage analysis.

Friday February 23, 11:40
Talk 7: *The Connectivity Conundrum: Managing Connectivity to Enhance the Production and Diversity of Desirable Fishes*

Rob McLaughlin; University of Guelph

Dam removals in the Laurentian Great Lakes are revealing tensions between the removal of dams to enhance the connectivity and production of desirable fishes and the use of dams to control the impacts aquatic invasive species have on fish production (the connectivity conundrum). Controversy surrounding dams used to control the Sea Lamprey (*Petromyzon marinus*), an invasive species in the Great Lakes, exemplify the ecological and economic importance of these tensions. I hypothesize the tensions arise from three phenomena. First, the long-term success of the Sea Lamprey control program has caused local managers and stakeholders to underestimate the need for sea lamprey control. Second, ignoring uncertainty in the success of dam removals can cause local managers and stakeholders to overestimate the benefits of restoring connectivity. Third, the mosaic management structure in the Great Lakes, combined with how benefits and costs of dam removals are distributed among management agencies, can facilitate adoption of a free rider tactic, where local managers and stakeholders pursue the fishing benefits expected from restoring connectivity, placing the added cost of invasive species

control on neighbouring jurisdictions and partner agencies. A major program researching selective fish passage has been initiated to help resolve the connectivity conundrum.

Friday February 23, 1:00
Talk 8: *Evaluating the Distribution of Eastern Sand Darter in the Ausable River, Ontario*

Jason Barnucz[1], Kari Jean[2], Robin Gaspardy[1], and D. Andrew Drake[1];
[1]Fisheries and Oceans Canada
[2]Ausable Bayfield Conservation Authority

The Eastern Sand Darter (*Ammocrypta pellucida*), a federally threatened species, exhibits a patchy geographic distribution across southern Quebec and Ontario as a result of its affinity for clean sand and gravel substrates. In Ontario, extant populations occur in the Grand River, Thames River, and Sydenham River, as well as Lake Ontario, Lake Erie, and Lake St. Clair. Eastern Sand Darter was known historically from the Ausable River in the Lake Huron drainage; however, the species has not been detected since 1928, despite repeat surveys in the watershed over the past 20 years. In 2017 Fisheries and Oceans Canada surveyed the Ausable River, in co-operation with the Ausable-Bayfield Conservation Authority, to determine if the species could be detected from poorly sampled river reaches. Targeted surveys utilized a Missouri trawl and a 'common sense' straight seine. Sampling occurred at 36 field sites (15 trawling sites, 21 seining sites) spanning deep and shallow water depositional zones. A total of 35 species were observed, representing 59% of estimated local richness. Five darter species were captured (Rainbow Darter, Greenside Darter, Logperch, Johnny Darter, Blackside Darter); however, despite potentially suitable habitat attributes at some sites, Eastern Sand Darter was not detected. Preliminary analyses indicate two primary changes within the watershed may have influenced the lack of detection: 1) Many sampled sites were dominated by coarser substrates than are typically associated with Eastern Sand Darter in southern Ontario; and, 2) Round Goby are now widespread throughout the lower watershed, suggesting that competitive interactions may be influencing population persistence. Future sampling to confirm occupancy of the species will involve targeted surveys in the upper watershed, which is believed to contain suitable substrates and is currently isolated from the competitive influence of Round Goby.

Friday February 23, 1:20
Talk 9: *A Seine Net, a Bucket, and a Map – 2017 NANFA Meeting Recap*

Jason Barnucz[1] and Scott Reid[2];
[1]Fisheries and Oceans Canada
[2]Ontario Ministry of Natural Resources and Forestry

In June of 2017 Scott Reid and Jason Barnucz travelled to the Meramec State Park near Sullivan, Missouri to participate in the North American Native Fishes Association (NANFA) Annual Meeting. This meeting is the annual meeting of many NANFA members to share, discuss and enjoy native fishes. Meramec State Park is located on the Meramec River in East-Central Missouri. The Meramec River is a large tributary to the

fabled Missouri River. This river is home to several unique species including the Meramec Saddle Darter (*Etheostoma erythrozonum*). This darter's distribution is restricted to the Meramec River drainage of Missouri. It differs from populations of its sister species, Missouri Saddle Darter (*Etheostoma tetrazonum*), from other Missouri drainages. A significant highlight of this trip was capturing and observing Gravel Chub (*Erimystax x-punctatus*). This species is common in several many rivers in Missouri but has not been observed in Canada since 1958 and is considered extirpated. This presentation will highlight, through photo and video, over 40 fish species observed from the Meramec River drainage.

Friday February 23, 1:40
Talk 10: *Developing a Salmonid Spawning Survey Protocol for Streams in Ontario*

Phil Bird; Credit Valley Conservation

Spawning surveys are routinely carried out by fisheries practitioners in Ontario. However, standard data collection methods have not been widely adopted. This talk will introduce a draft Ontario Stream Assessment Protocol module for documenting salmonid spawning-related activity. Some of the multiple purposes for inventory and monitoring of spawning activity will be discussed. As will the concepts and techniques of spawning surveys including redd identification and associated challenges. Two different proposed survey methods are outlined and related to goals of a given survey. Feedback for revision and testing from Ontario Chapter members will be strongly encouraged.

Saturday February 24, 8:40
Talk 11: *Does Semi-Chronic Stress Mediate Predator-Prey Interactions in Wild Fish? An Experimental Approach Using Exogenous Cortisol Implants*

Michael J. Lawrence, Kathleen M. Gilmour, Jean Guy J. Godin, John W. Mandelman, and Steven J. Cooke; Carleton University

In response to a stressor, teleost fish upregulate the hypothalamic-pituitary-internal (HPI) axis to produce cortisol, the animal's primary corticosteroid. While beneficial over acute durations, sustained elevations in cortisol can also be damaging to the physiological and behavioural functioning of the animal. In previous works, stressed fish have been shown to demonstrate a higher rate of predation than their non-stressed conspecifics however the mechanisms behind this have yet to be ascertained. The purpose of this work was to characterize the metabolic and behavioural consequences associated with semi-chronic cortisol elevations in a model centrarchid fish, the pumpkinseed (*Lepomis gibbosus*). Juvenile pumpkinseed were given cortisol-containing implants (25 mg/kg body weight) and were assessed for a suite of metabolic, and biochemical endpoints. Behavioural experiments characterizing anti-predator responses and risk were also ascertained. Cortisol implanted fish demonstrated higher metabolic energy expenditure that corresponded with some behavioural metrics associated with heightened risk taking. Increased metabolic demands under cortisol elevation may be involved in causing increased degrees of risk burden in this species. Together, this

provides some foundational and mechanism driven work for understanding how predator-prey interactions are influenced by stressor state.

Saturday February 24, 9:00
Talk 12: *Exploring the Spatial Ecology of Juvenile Esocids in a Large Fluvial System*

Sarah Walton; Carleton University

Exploring the spatiotemporal ecology of fish is necessary to elucidate life history strategies, delineate and conserve core habitats, and appropriately manage populations. While nursery habitat requirements for age zero esocids in the St. Lawrence River are well understood, little is known about the influence of physical habitat on residency, behaviour, and survival during initial emigration and overwintering periods. To that end, we captured age-0 Muskellunge (*Esox masquinongy*) and Northern Pike (*Esox lucius*) in known nursery bays between August and October and implanted them with the smallest, commercially-available acoustic transmitters (i.e., JSAT tags, Lotek Wireless). Detection data, recorded using passive acoustic receivers, was modeled relative to environmental covariates to examine their influence on movement, habitat use, and survival. A complementary laboratory study evaluated tag retention and associated survival, growth, and healing of surgical wounds on age-0 Muskellunge given that this is one of the first studies to track juvenile esocids. Residency patterns suggest age-0 esocids remain within their nursery bays throughout winter months, and tag retention was generally high with negligible mortality, suggesting that telemetry is an effective tool for the study of wild juvenile esocids. Overall, our study revealed that spatial environmental heterogeneity (e.g. depth, habitat structure and composition) may dictate juvenile esocid overwintering residency patterns, including high potential for interspecific overlap, and temporal environmental variation (i.e. water levels) may induce exploratory movements into deeper waters, and return to nearshore regions during overwintering periods.

Saturday February 24, 9:20
Talk 13: *Evaluating the Effect of Common Carp Control on Restoration of a Coastal Wetland*

Daniel J. Moore[1,2] and Nicholas E. Mandrak[2];
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[2]University of Toronto Scarborough

Coastal wetlands are under considerable stress from numerous anthropogenic threats, including the introduction of invasive species. Common Carp, a globally invasive species, has been well documented as an influential wetland stressor. This study documents the impact of Common Carp reintroduction on a newly restored wetland fish community and abiotic and vegetation variables. Oshawa Second Marsh, Ontario, Canada, was restored using an exclusion berm with fish grate and manual water-level drawdown to re-establish vegetation. Five years into restoration monitoring, Common Carp regained access to the wetland after the fish grate was vandalized. Fish community health was monitored over time using multimetric and multivariate approaches based on abiotic and vegetation variables. Improvements in fish community health were

observed during restoration but fish community health decreased and the community homogenized after Common Carp reintroduction. Seven of 10 abiotic and vegetation variables measured changed significantly after Common Carp reintroduction. This study highlights the impact that Common Carp has on the functional integrity of coastal wetlands and the significance of its long-term management to coastal wetland restoration.

Saturday February 24, 9:40
Talk 14: *Annual and Seasonal Forage Fish Availability in the Upper and Lower Niagara River*
Robin Gaspardy and D. Andrew Drake; Fisheries and Oceans Canada

The composition and abundance of forage fishes has fluctuated widely in the Great Lakes over the past 50 years in response to environmental and anthropogenic factors. Considerable research has focused on understanding the causes of these fluctuations (e.g., shifts in large-bodied zooplankton abundance; competition with invasive fishes) and their consequences for predatory fishes (e.g., bottom-up control of piscivore biomass). However, compared to nearshore and offshore lake ecosystems, there is a paucity of information on resident and migratory forage fishes in the connecting channels of the Great Lakes, which leads to uncertainty around prey resources to support resident and migratory piscivorous fishes. Based on a three-year seasonal boat electrofishing survey, we evaluate the degree of temporal and spatial variation in the composition and abundance of forage fishes in the Upper and Lower Niagara River, focusing on the extent to which shifts are driven by seasonal supplementation with lake-dwelling species such as Alewife and Rainbow Smelt. Results will be used to establish baseline metrics of forage fish production in response to ongoing environmental change, which will support decisions around future restoration action in both river ecosystems.

Saturday February 24, 10:20
Talk 15: *Windermere Basin: Site Rehabilitation, Wetland Construction, and Fishway Design and Monitoring*

Megan Lloyst[1], Gordon Wichert[1], John Helka[2], and Mark Bassingthwaite[3];
[1]SLR Consulting
[2]City of Hamilton
[3]Cole Engineering Corp.

Windermere Basin, Hamilton Ontario, was heavily impacted by upstream industrialization. An environmental assessment was undertaken to support the dredging of contaminated soils and the construction of a wetland to provide habitat for aquatic and terrestrial species.

In 2011, project engineers and biologists worked collaboratively to design a fishway that would facilitate multi-species passage between Redhill Creek and the newly constructed Windermere Wetland. The fishway was operated in the spring and late fall, in accordance with spawning time for resident fish. A monitoring program was developed to investigate the effectiveness of the design and construction of the fishway installed to pass fish (2015 to 2017). In an effort to understand fish movement through the fishway

into Windermere Wetland and species composition within the wetland, ecologists conducted late spring fish sampling events. Fall monitoring events were also completed to understand downstream movement out of the wetland into Redhill Creek.

As of 2017, 21 cumulative fish species have been collected from the fishway. Fathead Minnow is the numerically dominant forage fish in the wetland. When seasonality and the dominant species of capture (Fathead Minnow) are removed as variables, percent composition in the fishway was dominated by centrarchids, including Pumpkinseed and Green Sunfish. Thereafter, Rudd had the highest percent composition in the fishway and White Perch in the wetland.

Monitoring of the wetland should continue until initial fluctuation of aquatic vegetation appears to stabilize, or anticipated patterns and succession is observed, the composition of the fish community appears more balanced in terms of piscivores and forage base, and sufficient information is collected to produce a comprehensive document for wetland management.

Saturday February 24, 10:40
Talk 16: *Salmon River Railway Bridge Expansion*

Sean Stuart[1] and Luanne Patterson[2];
[1]Stantec Consulting Ltd.
[2]Canadian National Railway Company

Canadian National Railway Company (CN) conducted a large-scale rail improvement project between Toronto and Montreal from 2010 to 2012. The project involved the crossing of over 80 watercourses that included the expansion of the Salmon River Railway Bridge near Shannonville, Ontario. During pre-construction fish community and habitat assessments, the presence of two species at risk were identified near the bridge; Channel Darter (*Percina copelandi*) and Rainbow mussel (*Villosa iris*). The presence of these two species presented challenges to the design and construction of the bridge expansion including access to the bridge abutments and piers for construction along with the development of a fish habitat compensation plan for fish habitat impacted during construction.

Stantec biologists worked with railway engineers to develop a staging and access plan that allowed the construction contractors to work through winter, high flow periods and closed in-water timing windows with minimal disturbance to Channel Darter and Rainbow mussel habitat. The staging and access plan included preparing the site for large cranes required for bridge component installation and ensuring that the construction access could be removed while fish habitat was restored at the same time.

Development of the fish habitat compensation plan presented a unique challenge due to a lack of suitable habitat near the bridge and that suitable habitat could not be created near the construction site due to flow velocities at the crossing. Various habitat compensation options that covered a broad range of species and potential compensation were assessed through review of local management plans and consultation, along with

regulatory bodies and local area knowledge to select an option that benefitted at least one of the species at risk. The option that was selected involved the creation of habitat to increase productivity of fish species known to be suitable hosts for Rainbow mussel to benefit Rainbow mussel reproduction in the Salmon River. This option allowed CN to create habitat within their ROW and on land owned by landowners already involved in the project, preventing the need to negotiate offsetting strategies and access to property outside of the project area. The Department of Fisheries and Oceans Canada (DFO) approved the project and included a requirement for CN to conduct a 5-year post-construction monitoring plan. Construction was completed in 2012 and to date, the post-construction monitoring is complete.

This presentation will discuss how the compensation plan was developed, how effective construction mitigation was in reducing impacts to the species at risk and how effective the compensation measures are for the selected species. We will discuss how the mitigation measures used during construction protected sensitive fish habitat while allowing the contractor to maintain schedule along with cost savings from not stopping construction during closed in-water construction windows. It will compare traditional methods for selection of habitat compensation measures with the methods used for this project and how looking beyond typical compensation measures can be used to find alternative compensation methods when project boundaries and timelines are constrained. We will also summarize the successes of the project, including what has been learned through the post-construction monitoring program. Finally, we also intend to show how these methods could be used to maintain project timelines when applying for approvals on railway crossings of sensitive fish habitat.

Saturday February 24, 11:00
Talk 17: *The Effect of Habitat Quality on Benthic Macroinvertebrate Communities and Colonization in Newly Formed Channels*

Sarah Steele[1], Sylvia D'Amelio[1], and Don Jackson[2];
[1]Trout Unlimited Canada
[2]University of Toronto

Sustaining biodiversity has become an important consideration in current and future impacts on the environment, with restoration of cold water habitat developing as an important tool in the conservation of native aquatic biodiversity in Ontario. Biomonitoring surveys using benthic macroinvertebrate communities as indicators of ecosystem health were conducted in this study to assess the impact of restoration on community structuring in heavily altered streams. Ontario Benthic Biomonitoring Network (OBBN) protocol was used to collect benthic samples from three newly watered channels designed to improve cold water habitat: a historical reach in Marden Creek (Guelph) reclaimed to bypass a tailing pond; a segment in Marden Creek (Guelph) in the process of channelization after the removal of a dam; and a new channel segment constructed to bypass a small lake and link upstream segments of Second Creek (Terra Cotta) with natural downstream reaches. These conditions not only allowed for the assessment of restoration methods, but for a study of the successional patterns and rates of colonization events of benthic macroinvertebrates in temperate streams. Benthic

communities from five test sites within the new channels were compared to reference conditions in their respective watersheds using species diversity and community similarity indices. Results have shown seasonal variability in community similarity between reference and test conditions that may be due to differences in resource availability and habitat structure. Shifts toward less sensitive taxa within and downstream of the restoration site in summer months suggest community structure is influenced by several factors including hydrology and habitat quality.