AMERICAN FISHERIES SOCIETY

ONTARIO CHAPTER

ANNUAL GENERAL MEETING

February 20 – 22, 2020
Geneva Park, Orillia, ON

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Court
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metres 0
100 metres
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legend
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Approximate walking time around the trail from the Court is 1 hour.
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AMERICAN FISHERIES SOCIETY
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February 20 – 22, 2020
Geneva Park, Orillia, ON

"What's the cost of doing nothing?"

Thursday February 20th

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

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

Friday February 21st

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

08:30 **GREETING AND CONFERENCE OUTLINE (Auditorium)**
Dan Moore, AFS-OC President

Session 1

08:40 ***Keynote: How much does it cost? The socio-economic impact of algal blooms on Lake Erie.*** **Dr. Brad Bass**

09:20 ***Talk 1:*** *Reproductive Ecology of Spotted Gar (Lepisosteus oculatus) in Canada*
D. Andrew R. Drake

09:40 ***Talk 2:*** *Prospects for enhancing selective fish passage by manipulating water flow through a fishway: an experimental field test*
Aliana Hellmuth

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

Session 2

10:20 ***Talk 3:*** *Does environmental uncertainty influence how juvenile Brook Charr respond to novel situations?*
Melissa Goodwin

10:40 ***Talk 4:*** *A network approach for quantifying lake influence on stream reaches*
Meghan L. Allerton

11:00 ***Talk 5:*** *Evaluating the effectiveness of fish habitat restoration in the Toronto and Region waterfront*
Kaylin M. Barnes

11:20 ***Talk 6:*** *Seasonal variation in critical thermal maxima of Eastern Sand Darter (Ammocrypta pellucida)*
Britney L. Firth

11:40 ***Talk 7:*** *Seasonal Variation in the Critical Thermal Maxima and Thermal Safety Margin of Redside Dace (Clinostomus elongatus) at its Northern Range*
Alexandra Leclair

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

Session 3

1:00 ***Talk 8:*** *Exploring establishment potential of Bighead Carp (Hypophthalmichthys nobilis) in the Canadian Great Lakes under climate change*
Erik Dean

1:20 ***Talk 9:*** *Spawning and Over-Wintering movements of Lake Sturgeon in the Garden and St. Marys Rivers*
Lexi Sumner

1:40 ***Talk 10:*** *Alternative reproductive tactics: An overlooked source of behavioural variation in the invasive Round Goby (Neogobius melanostomus)*
Caitlyn Synyshyn

2:00 ***Talk 11:*** *Greater potential for some aquatic invaders under climate change: A case study of the Laurentian Great Lakes*
Justin A.G. Hubbard

2:20 **COFFEE, TRADE SHOW, POSTER SESSION (Auditorium and Lobby)**

Session 4

2:40 ***Talk 12:*** *Using coastal wetland monitoring data to determine the effectiveness of restoration Actions*
Dan Moore

3:00 ***Talk 13:*** *Effects of wastewater and temperature on fathead minnow behavior*
Markelle Morphet

3:20 ***Talk 14:*** *Drivers of primary production in freshwater lakes globally and their implications on water quality*
Arnab Shuvo

3:40 ***Talk 15:*** *Spatial ecology of invasive Round Goby in the Rideau Canal Waterway: Understanding fish behaviour at the invasion front.*
Jordanna N. Bergman

4:00 **COFFEE, TRADE SHOW, POSTER SESSION (Auditorium and Lobby)**

4:20 **ANNUAL BUSINESS MEETING (Auditorium)**

5:00 **TRADE SHOW, POSTER SESSION (Auditorium and Lobby)**

6:00 **DINNER (Dining Room)**

7:30-11:00 **MENTORING, STUDENT RAFFLE, SOCIAL (Geneva Court Lounge)**

Saturday February 22nd

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

Session 5:

8:30 ***Talk 16:*** *Pop it or Drop it: Do carbonated beverages reduce bleeding from gill injuries in angled Northern Pike (Esox lucius)?*
Alexandria Trahan

8:50 ***Talk 17:*** *Results and Lessons Learned from Two Years of Common Carp Removals at Island Lake Conservation Area*
Jon Clayton

9:10 ***Talk 18:*** *Plankton communities in Lake Ontario coastal wetlands are structured by water quality conditions along an urban land-use gradient*
Eric Anderson

9:30 ***Talk 19:*** *Predicting open-water thermal regimes of temperate North American lakes*
Daniel P. Gillis

9:50 **COFFEE & POSTER SESSION (Auditorium and Lobby)**

Session 6:

10:10 ***Talk 20:*** *The Status of Pugnose Minnow (Opsopoeodus emiliae, SARA:THR) in Canada*
Robin C. Gaspardy

10:30 ***Talk 21:*** *Dispersal patterns of black bass following early-, mid- and late-season fishing tournaments on Big Rideau Lake.*
A.E.I. Abrams

10:50 ***Talk 22:*** *Ecological Consequences of Shoreline Armouring on Fish and Benthos in an Eastern Ontario Lake*
Auston Chhor

11:10 Talk 23: *Detecting Brook Trout (Salvelinus fontinalis) Seasonal Occupation in Haliburton County, ON using Environmental DNA*
Karl Weise

11:30 **PRESENTATION OF STUDENT AWARDS & CONFERENCE WRAP (Auditorium)**

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

1:00-2:00 **WORKSHOP: Beginner's guide to freshwater telemetry**

Oral Presentation Abstracts

Friday February 21, 08:40
Keynote: *How much does it cost? The socio-economic impact of algal blooms on Lake Erie?*

Dr Brad Bass
Environment and Climate Change Canada

The recurrence of hazardous cyanobacteria, often referred to as hazardous algal blooms, and the nuisance algae *Cladophora* on Lake Erie has raised concerns about the impacts across a number of areas and a across a number of sectors. How do these impacts affect the welfare of Canadians living in the Lake Erie Basin? An economic assessment was used to assess the impact of these blooms on the welfare of the residents within 100 km of the Lake in the Canadian Province of Ontario. The analysis began with the damage that algal blooms can cause to the ecological goods and services provided by the Lake. All of the ecological goods and services that contribute to human well-being and not just those that are observable in the market were considered in this study. The reductions in ecological goods and services for each scenario were used to assess changes in the economic value to the Canadian sectors in the basin economy including recreation, fishing, tourism, property values as well as non-monetary values. The impacts of the blooms are presented for two 30-year scenarios from a baseline condition: a business-as-usual (no actions to reduce nutrient loadings into Lake Erie) and a policy intervention scenario (that assumed actions are taken to reduce nutrient loadings leading to reductions of blooms). This presentation will include some of the concepts of welfare economics, the decisions that were made during the study as well as the results of the analysis.

Friday February 21, 09:20
Talk 1: *Reproductive Ecology of Spotted Gar (Lepisosteus oculatus) in Canada*

D. Andrew R. Drake
Great Lakes Laboratory for Fisheries and Aquatic Sciences, Fisheries and Oceans Canada

Spotted Gar (*Lepisosteus oculatus*), a species listed as Endangered under Canada's *Species at Risk Act*, has unique spawning requirements, including submerged aquatic macrorphytes for egg laying and early life stage development. However, the environmental factors associated with spawn site selection and the timing of reproduction are poorly understood, limiting the ability to predict spatial and temporal variation in hatch and resulting year-class strength. To quantify the thermal and physical factors associated with spawning, adult Spotted Gar were tracked using radiotelemetry over a 6 week period in Rondeau Bay, Lake Erie. The onset of spawning was predicted via a cumulative growing degree day (CGDD) model, where a 90% probability of spawn initiation occurred at 291 CGGD10 and 85 CGDD15. Cumulative degree days of base 10 provided slightly better predictive performance than base 15, but both models had high overall classification rates (96.3% and 94.9%, respectively).

Physical factors associated with site selection estimated via boosted regression trees indicated that the proximity of the spawning site from the shoreline, the ratio of *Potamageton* spp. to site volume, dominant substrate, and water depth were important variables. Future research will evaluate the influence of these factors on young-of-year survival and growth, thereby providing a mechanistic link between environmental factors and mortality of early life stages.

Friday February 21, 09:40
Talk* 2 (S)*: *Prospects for enhancing selective fish passage by manipulating water flow through a fishway: an experimental field test*

Aliana Hellmuth[1], Gale Bravener[2], Thomas Pratt[3], McLean Smith[1], Robert McLaughlin[1]
[1] University of Guelph Department of Integrative Biology
[2] Fisheries and Oceans Canada Sea Lamprey Control Centre
[3] Fisheries and Oceans Canada Great Lakes Laboratory for Fisheries and Aquatic Sciences

Barrier removal can improve desirable fish populations by restoring habitat connectivity, but this action can pose a risk to these populations by allowing invasive species to disperse and proliferate. Selective fish passage can mitigate these consequences by trapping and sorting desirable fish from invasive fish so that invasive fish are removed, and desirable fish are passed upstream. The current trap-and-sort process is costly and time consuming, but it can be improved by having desirable fish sort themselves from invasive fishes. We tested if the passive sorting of desirable fishes from sea lamprey (*Petromyzon marinus*) could be improved by increasing water flow through the fishway. Field experiments comparing high and low water flow treatments in a 2-chambered fishway were performed on Big Carp River during the sea lamprey spawning migration. Contrary to expectation, the degree of passive sorting was not improved by manipulating water flow within the fishway. For both desirable fishes and sea lamprey, the degree of passive sorting between the downstream and upstream chambers did not differ between nights of increased and decreased flow. However, the number of desirable fish entering the fishway was higher on nights of low flow than nights of high flow, whereas the number of sea lamprey entering the fishway was lower on nights of low flow than on nights of high flow. Our findings suggest that manipulation of flow should be evaluated as a method of separating desirable fish from sea lamprey prior to entrance into the fishway as opposed to within the fishway.

Friday February 21, 10:20
Talk* 3(S)*: *Does environmental uncertainty influence how juvenile brook charr respond to novel situations?*

Melissa Goodwin
University of Guelph

Captive rearing and stocking can be important conservation tools for the recovery of populations that are declining in nature. However, the success of these tools can be

limited if stocked individuals do not survive and contribute to population growth. For fishes, being reared in conventional hatchery conditions can impair the cognitive abilities of individuals and their ability to adapt to novel situations, potentially reducing the probability of survival upon release into the wild. It has been hypothesized that rearing fish under more complex and variable conditions will encourage brain development, improve behavioural performance in novel situations, and increase stocking success. We tested the first two parts of this hypothesis by rearing brook charr (*Salvelinus fontinalis*) under conditions differing in habitat complexity (no structure, structure) and variability in the location of habitat structure and the timing of feeding (stable, variable). Fish from 8 families were reared under each of the rearing treatments for 3 months and then tested for risk taking in a novel environment and time to attack a novel prey item. Our initial findings suggest that the behavioural performance of fish reared in environments containing structure exceeded those of fish reared in barren environments. This suggests implementation of structural habitat in hatchery settings will increase performance and survival of hatchery fish upon reintroduction to the wild.

Friday February 21, 10:40
***Talk 4* (S):** *A network approach for quantifying lake influence on stream reaches*

Meghan Allerton, Nicholas E. Jones, Bastian J. Schmidt, Stephanie J. Melles
Trent University

Lakes are abundant across the Canadian Shield region of North America and have important impacts on the ecology of connected rivers and streams. However, the influence of multiple upstream lakes on stream habitat conditions is poorly understood. We propose a network approach to quantify lake influence on two key physical components of stream habitat: flow and water temperature. Metrics of lake influence on stream flow and temperature were developed using stream and lake spatial data of catchments in Ontario and are broadly applicable to other lake-rich regions. Their use as explanatory variables in modelling applications will advance our understanding of lake influence on key ecological features of streams and improve our ability to design and implement effective management programs for aquatic ecosystems in many parts of the world.

Friday February 21, 11:00
Talk 5: *Evaluating the effectiveness of fish habitat restoration in the Toronto and Region waterfront*

Kaylin M. Barnes, Lyndsay A. Cartwright, Rick Portiss, Jonathan D. Midwood, Christine M. Boston, Monica Granados, Thomas Sciscione
Toronto and Region Conservation Authority

The Toronto Waterfront Aquatic Habitat Restoration Strategy (TWAHRS) was published in 2003 and made recommendations for restoration actions to address the widespread negative impacts of urbanization to aquatic habitats. To take stock of restoration actions guided by TWAHRS, we examined related restoration projects in the Toronto region implemented since 2003. In this paper, we assessed the effectiveness of TWAHRS by 1)

accounting for waterfront development or conservation projects that incorporated TWAHRS recommendations, while exploring the strategy's broader adoption by various waterfront developers and 2) analyzing the response of localized fish communities to projects that used TWAHRS-recommended restoration techniques. Restoration projects were enumerated, and a geodatabase was developed to document the change in aerial extent and shoreline length. We also used a long-term electrofishing dataset to examine changes in local fish communities. We found that from 2003 to 2020, the strategy served as a resource to direct the aquatic habitat restoration of 42 waterfront projects by multiple organizations. Coastal wetland and embayment restoration initiatives were successful in creating suitable habitat for warm water species and for shifting the community from that of pelagic, transient species to a resident, vegetation-loving community. Freshwater estuary restoration projects were few but compared to an unrestored reference site, post-restoration conditions had higher species richness. Post-restoration communities at both estuary and open coast sites had more lithophilic species, targeted through substrate choice. Compared to unrestored reference sites, post-restoration communities appear to be contributing to a balanced piscivore community. Overall, these results demonstrate the widespread use of restoration techniques along the waterfront as outlined in the strategy, increases in fish habitat and shoreline length and a change in fish communities.

Friday February 21, 11:20
***Talk 6* (S):** *Seasonal variation in critical thermal maxima of eastern sand darter (Ammocrypta pellucida)*

Britney L. Firth[1], Andrew Drake[2], and Michael Power[1]
[1] Department of Biology, University of Waterloo
[2] Great Lakes Laboratory for Fisheries and Aquatic Sciences, Fisheries and Oceans Canada

Anthropogenic stressors are predicted to increase water temperature which is expected to impact species as risk. Species at risk are vulnerable to changing water temperatures as they often have unique physiological tolerances compared to species within their family and genus. In this study we assess the critical thermal maximum (CTmax) of Eastern Sand Darter (ESD; *Ammocrypta pellucida*), a small benthic fish listed as Threatened under the *Species at Risk Act*. In this study, field based trials were conducted across seasons from June-November to obtain a range of acclimation temperatures (10-25°C) for ESD. CTmax was assessed using critical thermal maximum experiments with temperature increased using standardized methods of 0.3°C per minute until thermal stress endpoints of agitation and loss of equilibrium occurred. CTmax and agitation temperature significantly increased with an increase in acclimation temperature. There was not a significant change in the resistance and the tolerance zone for ESD. The temperature gap between CTmax and the environmental temperature significantly decreases as environmental temperatures warm; therefore, ESD is living closer to their thermal limits in the summer and there are higher chances an environmental disturbance could surpass these temperatures. CTmax is used to find the upper thermal limits and this can be used to predict species survival in the future. This knowledge allows us to improve species

management by directly informing abiotic habitat suitability, thereby contributing to the definition of critical habitat for ESD.

Friday February 21, 11:40

Talk 7* (S)*: *Seasonal Variation in the Critical Thermal Maxima and Thermal Safety Margin of Redside Dace (Clinostomus elongatus) at its Northern Range*

Alexandra Leclair
University of Toronto

Understanding seasonal changes in the thermal performance of fishes is necessary to identify optimal thermal habitat, which can provide insight into how species distributions may shift under climate change. Using an experimental thermal chamber in the field, I investigated the effect of short- and long-term acclimation, and body size on the critical thermal maximum (CT_{max}) and thermal safety margin (TSM) of wild-caught Redside Dace (n = 169) in Two Tree River, Ontario. Streamside CT_{max} trials were used to identify the maximum temperature at which Redside Dace maintain equilibrium, providing a powerful tool for understanding how thermal stress affects individual performance. CT_{max} and TSM of Redside Dace were sensitive to changes in temperature, regardless of season, suggesting that temperature pulses caused by climate change can impose negative fitness consequences year-round. The results provide insight into the thermal performance of Redside Dace that, to date, has been difficult to assess due to the species' rarity and lack of suitable streamside protocols.

Friday February 21, 1:00

Talk 8* (S)*: *Exploring establishment potential of Bighead Carp (Hypophthalmichthys nobilis) in the Canadian Great Lakes under climate change*

Erik Dean
University of Toronto

Bighead Carp are a fast-growing, voracious, and highly invasive species of fish that occur throughout the Mississippi River in the United States. Today, they have the potential to expand northwards and enter the Canadian Great Lakes, where they may encounter environmental conditions that can affect their growth and maturation. Populations of Bighead Carp in colder climates have been shown to grow slower, and mature later in life; however, under the projected warming from climate change, faster growth, and earlier maturation may become possible in the Great Lakes. This study presents a stage-based matrix population model that considers varying ages of maturity, growth, and associated survival and fecundity parameters that change with temperature. Population growth simulations show that early maturation results in faster population establishment; however, anticipated climate change may not be sufficient to induce early maturation in the near future. Alternatively, model outputs show that the most influential factor upon the rate of establishment for Bighead Carp is the fecundity of the founding individuals

Friday February 21, 1:20
Talk 9: *Spawning and Over-Wintering movements of Lake Sturgeon in the Garden and St. Marys Rivers*

Lexi Sumner, Anishinabek/Ontario Fisheries Resource Centre

Over the past 4 years, the Anishinabek/Ontario Fisheries Resource Centre (A/OFRC), in partnership with Garden River First Nation, have been monitoring the spawning and over-wintering movements of lake sturgeon in the Garden and St. Marys River. Fifty-nine sturgeon captured at the mouth of the Garden River were implanted with acoustic telemetry tags. The movements of these fish are recorded by acoustic telemetry receivers in the Garden River, the north channel of the St. Marys River, and in Lake George. Preliminary results suggest that sturgeon that spawn in the Garden River remain within the St. Marys River system year-round. By monitoring the movements of this endangered species, we can observe how their behaviour may be impacted by human activities and altered waterways.

Friday February 21, 1:40
Talk 10 **(S)*:*** *Alternative reproductive tactics: An overlooked source of behavioural variation in the invasive round goby (Neogobius melanostomus)*

Caitlyn Synyshyn and Dr. Sigal Balshine
Aquatic Behavioral Ecology Lab Department of Psychology, Neuroscience & Behaviour McMaster University

Variation in life history strategies, such as alternative reproductive tactics (ARTs), can have profound impacts on the dynamics of a population. Considering such variation can be especially important for management strategies, such as how to best conserve at-risk populations or how to prevent the spread of an invasive species. The round goby is a prolific invasive species where males have ARTs, however few studies to date have considered the impact this life history variation may have on their population dynamics. In this study, we begin to address this knowledge gap by analyzing behavioural differences between sneaker and guarder male round goby. Specifically, we asked if the two male tactics had differing levels of activity, boldness, exploration, sociality, aggression, and dispersal tendency. Understanding the behavioural tendencies of guarder and sneaker males, especially as it relates to dispersal tendency, may provide valuable information about the types of individuals likely to spread into new ranges. Armed with this information, management techniques will be able to better target individuals with higher dispersal tendencies and better predict the likelihood and speed at which round goby populations will spread.

Friday February 21, 2:00
Talk 11* (S)*: *Greater potential for some aquatic invaders under climate change: A case study of the Laurentian Great Lakes*

Justin A.G. Hubbard[1,2], D. Andrew R. Drake[3], Nicholas E. Mandrak[1,2]
[1] University of Toronto Department of Ecology and Evolutionary Biology
[2] University of Toronto Scarborough Department Biological Sciences
[3] Fisheries and Oceans Canada Great Lakes Laboratory for Fisheries and Aquatic Sciences

Climate change and invasive species are expected to have impacts to aquatic ecosystems globally, yet interactions between these stressors are poorly understood. Existing software, CLIMATCH, uses the CLIMATE algorithm to measure the climatic similarity of the native range of an invasive species to areas of potential invasion using current climate data. In this study, we predict future climate similarity between global aquatic watersheds under different climate-change scenarios using the CLIMATE algorithm in an R environment. We use data from the WorldClim database, downscaled general circulation model data for the years 2050 and 2070 for all Resource Concentration Pathways generated from the International Panel on Climate Change Coupled Model Intercomparison Project 5 models. We used the PCA scores calculated from the eight temperature and eight precipitation variables as the inputs for our modelling. We ran a pairwise analysis of climate similarity between all global watersheds. We provide a case study of our model's predictions using predictions for the Laurentian Great Lakes which is predicted to increase in climate similarity with eastern Australia, parts of eastern South America, western Europe and south eastern United States. This means that potential invaders in those areas will have a greater chance of survival in the Great Lakes. Our global model predicts that many individual watersheds will have large increases in their average climate similarity globally. These data and analyses can be used to increase the robustness of aquatic invasive species risk assessments and other management actions.

Friday February 21, 02:40
Talk 12: *Using coastal wetland monitoring data to determine the effectiveness of restoration actions.*

Dan Moore and Heather Pankhurst
Central Lake Ontario Conservation Authority

A critical component of the restoration process involves setting goals and objectives that reflect a desired change in a measurable indicator. However, many restoration projects fail to accomplish this for a variety of reasons, such as the complexity of the task, the lack of a planning framework, insufficient background data, and/or funding limitations. In the absence of SMART goals and objectives, evaluating restoration success is difficult and when attempted, often misrepresents the results. This presentation will discuss how Central Lake Ontario Conservation Authority uses data from two long-term coastal wetland monitoring programs to set goals and objectives and evaluate project success.

Using Oshawa Second Marsh as an example, we will discuss the design of the long-term monitoring programs, how that informs developing meaningful goals and objectives, and how we can use these to determine the success or failure of restoration actions.

Friday February 21, 3:00
Talk 13* (S)*: *Effects of wastewater and temperature on fathead minnow behaviour*

Markelle Morphet
McMaster University

Municipal wastewater treatment plant effluent is the largest source (by volume) of aquatic pollution in Canada. Treatment plants are not capable of fully eliminating all contaminants, such as pharmaceuticals and personal care products and as a result, effluent can pose a serious threat to aquatic organisms living near treatment plants. Exposure to wastewater effluent has been demonstrated to affect fish at multiple levels of biological organization, from cellular-level effects to population- and community-wide responses. However, the vast majority of the research conducted to date has been conducted in warm weather. Few have considered how contaminants from treated wastewater affect fish in winter-like conditions. In this study, we examined fathead minnow (*Pimephales promelas*) behaviour following exposure to varying concentrations of wastewater effluent in either summer vs. winter temperatures. Fish were exposed for 21 days to 0%, 25%, and 50% wastewater effluent at two temperatures (4˚C and 20˚C) to simulate winter- and summer-like conditions. We assessed various behavioural endpoints including boldness, activity, sociality, foraging and anti-predator response. Our study is among the first to explore how two major stressors (temperature and contaminants) interact and our results will further our understanding of how wastewater affects fitness-linked behaviours in ecologically-relevant contexts.

Friday February 21, 3:20
Talk 14* (S)*: *Drivers of primary production in freshwater lakes globally and their implications on water quality*

Arnab Shuvo, Alessandro Filazzola, Octavia Mahdiyan, Carolyn Ewins, Luke Moslenko, Roberto Quinlan, Derek Gray, Catherine O'Reilly, & Sapna Sharma, York University

Declining water quality has become a major issue of concern because of the large alterations it has made in water usage and availability, ecosystem health and global biodiversity. Freshwater ecosystems are amongst the most degraded waterbodies and are worsening in water quality faster than ever before. Our objective was to quantify the relative importance of climate, nutrient inputs, and lake morphology as drivers of primary production in freshwater lakes globally. We used chlorophyll as a proxy of primary production because it is readily found in lakes and almost all models of primary production use chlorophyll as their index. Thus, we synthesized a global database on lake water chemistry with a focus on chlorophyll for freshwater lakes around the globe. A systematic review was conducted which examined over 3300 published manuscripts and online repositories such as KnB, Dryad, and Pangaea that

measured lake chlorophyll. Nutrient and morphological data were also collected from published literature, while climate data was collected from The Climate Research Unit (CRU) and The National Oceanic and Atmospheric administration (NOAA). Our database contained 2561 lakes in 7 countries after performing quality control and assurance. We found that globally, total phosphorus (TP) was the most influential driver of primary production in the spring and summer, while spring solar radiation (SRAD) and summer temperature were the most influential climactic drivers. Mean depth was the most influential morphometric driver, but the variation explained was quite low compared to TP and climate. Although there are increased efforts and regulations in place for land use and farming, nutrient inputs continue to be the leading cause of primary production in lakes. However, the influence of climactic variables synergistically (temperature, precipitation, cloud cover and solar radiation) are nearly equal to that of total phosphorus suggesting nutrient management efforts are not enough to mitigate water quality degradation. Action against climate change must be taken as well. We highlight the degradation of water quality to loss of high-quality fish habitat. Such loss of habitat negatively impacts the size, fecundity, and overall reduced viability owing to increased competition for resources (food) and predation.

Friday February 21, 3:40
Talk 15* (S)*: *Spatial ecology of invasive Round Goby in the Rideau Canal Waterway: Understanding fish behaviour at the invasion front.*

Jordanna N. Bergman
Department of Biology, Carleton University

The round goby (*Neogobius melanostomus*), native to the Black and Caspian seas, is one of the most globally widespread invasive fish, with introduced populations in the Laurentian Great Lakes, the Baltic Sea, and several European rivers. Invasive round goby are detrimental to native ecosystems because of their propensity to (1) predate on the eggs and young of nesting fish, (2) outcompete and displace native species, and (3) serve as a vector in botulism spread and outbreaks. In fall 2018, round goby were first discovered in the Rideau Canal near Smiths Falls, Ontario; as such, and due to low population densities, we believe we are at the front of an invasion. I acoustically tagged (JSAT L-AMT-1.416 & L-AMT-1.421) 45 round goby and recorded morphological characteristics and sex to evaluate size- and sex-specific movements. Using fish movement data, we will assess interactions with anthropogenic barriers (lock and dam infrastructure), characterize spatial ecology, and examine dispersal potential. Subsequently, we will evaluate management options to control further invasion of round goby to other inland waterbodies. As invasive species pose one of the greatest threats to the biotic integrity of freshwater ecosystems, with potentially adverse socio-economic effects on human welfare, it is critical we act in a timely manner to implement management strategies.

Saturday February 22, 08:30
***Talk 16*(S):** *Pop it or Drop it: Do carbonated beverages reduce bleeding from gill injuries in angled Northern Pike (Esox lucius)?*

Alexandria Trahan
Fish Ecology and Conservation Physiology Laboratory, Department of Biology, Carleton University

Whether because of conservation ethic or to comply with regulations, the premise of catch-and-release angling is that most fish survive fisheries interactions. Therefore, it is common for anglers and management agencies to share strategies that are believed to yield high levels of post-release survival. Recent media coverage has sensationalized the use of carbonated beverages to treat bleeding fish, a strategy that is purported to stop bleeding. To date, no scientific studies have tested the validity of this strategy. We captured northern pike across two distinct periods (11-18 ^{o}C and 24-27 ^{o}C) and experimentally injured their gills in a standardized manner to assess the effects of carbonated beverages on (1) the bleeding time of injured fish, (2) the bleeding intensity of injured fish, and (3) the overall blood loss using gill colour as a proxy, relative to controls (no injury and injury without treatment). Three different carbonated beverages were assessed at cooler temperatures (i.e., carbonated lake water, Mountain Dew, and Coca Cola) whereas at the warmer temperature only Mountain Dew was used but it was kept at ambient temperature or on ice to assess the potential influence of beverage temperature.

Saturday February 22, 08:50
Talk 17: *Results and Lessons Learned from Two Years of Common Carp Removals at Island Lake Conservation Area*

Jon Clayton
Credit Valley Conservation Authority

Following the confirmation of Common Carp (*Cyprinus carpio*) in Island Lake in 2015, and concern over potential impacts to aquatic vegetation, recreational angling and water clarity, an assessment of four control options was completed. Boat electrofishing was chosen as the preferred option and a three year trial removal plan was developed. Sampling occurred in late May and early June when carp were spawning and concentrated. Two years of removals have occurred, with 41 carp removed in 2018 and 146 removed in 2019. Once removed, carp were euthanized and buried on-site. Spawning surveys were also completed elsewhere in the reservoir each year to better understand preferred carp spawning locations and help in estimating carp numbers in the reservoir. To date, boat electrofishing has been a cost and time effective method of capturing carp, however, the locations where the carp were caught differed between the 2 years of sampling. A third year of removals is planned for 2020, after which a decision on continuing the removals will be made.

Saturday February 22, 09:10
Talk 18 (S): *Plankton communities in Lake Ontario coastal wetlands are structured by water quality conditions along an urban land-use gradient*

Eric Anderson
Ontario Tech University

Wetlands are vital ecosystems, not only for their role as wildlife habitat, but also their ecosystem services. Human land-use, such as agriculture and urbanization, can negatively impact water quality in the Great Lakes basin. Coastal wetlands are particularly vulnerable because they are typically located at the confluence of tributaries and the nearshore zone. Our study assessed the impact of land-use type and intensity on water quality and the lower aquatic food web (phytoplankton, zooplankton, macrophytes) across a gradient of urban land-use in coastal wetlands on the north-shore of Lake Ontario. Four coastal wetlands (Frenchman's Bay, Lynde Marsh, McLaughlin Bay, and Bowmanville Marsh) were sampled along a transect from inflow to outflow May-September 2018-2019. We found positive relationships between total phosphorus and phytoplankton abundance, measured as chlorophyll a (R^2=0.401, $p<0.001$), as well as a positive relationship between chloride and chlorophyll a (R^2=0.209, $p<0.001$). We also saw chloride has a positive relationship with cyanobacterial biomass (R^2=0.29, $p<0.001$). We found a negative relationship between chloride ($r=-0.33$, $p<0.001$) and total phosphorus ($r=-0.38$, $p<0.001$) with phytoplankton richness, indicating that these nutrient rich, saline environments are more susceptible to algal blooms and decreased community fitness. Overall, results from this study provide important information about the biological condition of coastal wetlands in Lake Ontario, and how continued land-use development and intensification may further impact planktonic community composition and structure.

Saturday February 22, 09:30
Talk 19* (S)*: *Predicting open-water thermal regimes of temperate North American lakes*

Daniel P. Gillis[1]*, Brian J. Shuter[1,2], and Charles K. Minns[1,3]
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* **Presenter**

Temperature profoundly affects the physical, chemical, and biological attributes of lakes, and is influenced by several abiotic factors. Lake temperature modelling permits regional estimates of seasonal fish thermal habitat availability; however, this requires models that are accurate across large spatial scales. To address this, we fit a semi-mechanistic seasonal temperature-profile model (STM) to 369 morphometrically diverse North American lakes (2847 lake-years) with temperature data spanning 46 years (1971-2016). We found that a fixed depth thermocline sub-model adequately described the temperature profile datasets (median pseudo R^2: 0.95, median RMSE: 1.13 ^{o}C). We used

linear mixed-effects modelling to create STM parameter sub-models by relating lake and climate variables to STM output. We tested the efficacy of the sub-models by predicting the thermal dynamics of 776 Ontario lakes. The sub-models accurately predicted lake temperatures (median lake-year specific RMSE: 2.28 °C) and the presence/absence of stratification (91.9%). These findings strengthen our understanding of the factors that influence lake temperatures and could be used to identify lake types and regions that may be especially susceptible to climate change.

Saturday February 22, 10:10
Talk 20: *The Status of Pugnose Minnow (Opsopoeodus emiliae, SARA:THR) in Canada*

Robin C. Gaspardy, Karl A. Lamothe, and D. Andrew R. Drake, Fisheries and Oceans Canada

Pugnose Minnow *Opsopoeodus emiliae*, one of the rarest fishes in Canada, is listed as Threatened under Canada's Species at Risk Act. DFO's Great Lakes Laboratory for Fisheries and Aquatic Sciences has been conducting targeted field sampling to detect Pugnose Minnow within their historic range in Canada for the past two decades, as well as research to understand threats and limiting factors. Prior to 2013, Pugnose Minnow was difficult to detect, despite numerous targeted sampling efforts. However, between 2013 and 2017, Pugnose Minnow was captured incidentally by DFO's Asian Carps Surveillance Program in the Canard River, a tributary of the Detroit River. These detections led to an intensive, targeted sampling effort by the Species at Risk research program in the Canard River in 2018, which utilized pelagic trawling and depletion seining. The 2018 sampling resulted in the capture of 294 Pugnose Minnow, which was the largest single collection of the species in Canadian history. Occupancy modelling of field data indicated that Pugnose Minnow preferentially relate to the most turbid waters in the Canard River, which is inconsistent with previous descriptions of preferred habitat. Furthermore, models indicated that clearer waters may be occupied, but only when certain aquatic vegetation is present. The ecological implications of these findings may be explained by several potential hypotheses involving predator avoidance or variation in preferred habitat for range-edge populations. There remains an ongoing need to continue assessing the distribution of Pugnose Minnow across their Canadian range, including extensive surveys conducted by DFO in 2019 and planned for 2020.

Saturday February 22, 10:30
Talk 21 **(S)*:*** *Dispersal patterns of black bass following early-, mid- and late-season fishing tournaments on Big Rideau Lake.*

A.E.I. Abrams, A.J. Zolderdo, E.J.I. Lédée, P.E. Holder and S.J. Cooke
Carleton University

Big Rideau Lake is the largest lake on the Rideau Canal system and is among the most heavily "fished" water bodies in eastern Ontario. Bass fishing tournaments occur regularly from season opener (June) to late fall (October). Tournaments tend to displace fish from their capture-site and release within close proximity to the weigh-in site. 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 were 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. Results indicate that there is a brief accumulation of fish at the tournament release site, and all fish do eventually return to their home range. Because tournaments target the largest most fecund individuals of the population, it is important for stakeholders to be equipped with the science necessary to make informed decisions regarding the fishery. Using this lake as a representative system, the findings of this research will ultimately provide broader implications for black bass tournament management.

Saturday February 22, 10:50
Talk 22* (S)*: Ecological Consequences of Shoreline Armouring on Fish and Benthos in an Eastern Ontario Lake.

Auston Chhor
Fish Ecology and Conservation Physiology Lab, Carleton University

Shoreline erosion is a pressing issue for landowners, however common mitigation methods can drastically alter littoral habitat. Our study compared habitat and nekton diversity between shorelines altered with riprap, retaining walls, and unaltered shores. While species richness did not vary between shoreline types, fish and benthos community structure varied among sites and habitat was significantly diminished at altered shoreline types. Abundance of submergent macrophytes, emergent macrophytes, and coarse woody debris was significantly lower at altered shorelines compared to natural shorelines. Abundance of largemouth bass was significantly higher at natural shorelines compared to altered shorelines. Abundance of scuds, isopods, Cladocera, and mayflies was highest at riprap shorelines and lowest at natural shorelines. These results suggest that usage of riprap and retaining walls for erosion mitigation significantly alters littoral habitat and may be causing shifts in nekton communities. Our study highlights the growing need for a shift to alternative erosion mitigation methods that better preserve existing littoral habitat.

Talk 23* (S)*: *Detecting Brook Trout (Salvelinus fontinalis) Seasonal Occupation in Haliburton County, ON using Environmental DNA*

Karl Weise
Trent University

Brook trout (*Salvelinus fontinalis*) are declining across Ontario, prompting concern for their future. Currently, little is known about their non-summer habitat and movement within streams. Winter occupation in particular is poorly understood and to properly manage brook trout more needs to be understood about their occupancy year-round. Here I combined backpack electrofishing and Environmental DNA (eDNA) sampling to quantify seasonal occupation in two river systems across their tributaries and main channel. Backpack electrofishing was used to validate eDNA sampling in the Canadian Shield environment and eDNA samples were collected each season to determine occupancy. Results show that eDNA was more sensitive than single pass backpack

electrofishing at detecting brook trout in the sample sites and brook trout occupation varied seasonally. Furthermore, seasonal occupation differed between the two study rivers and was possibly influenced by fish community or habitat drivers. Quantifying the seasonal occupation of brook trout is needed for setting critical habitat and conserving the species in the future, management strategies within the province should address seasonal occupancy changes and connectivity within river systems.

Poster Presentation Abstracts

Evaluating post-release behaviour in recreationally angled fish following air exposure
Auston Chhor **(S)**
Fish Ecology and Conservation Physiology Lab, Carleton University

Air exposure is a physiologically stressful event that occurs during most catch-and-release events. Observing short-term behaviour after release can be useful for predicting future mortality. We observed post-release behaviour in three species: Smallmouth Bass, Walleye, and Northern Pike following 0, 15, 30, 60, and 180 seconds of air exposure. We attached tri-axial accelerometers to the fish using velcro harnesses to monitor behaviour immediately after an angling event for 10 minutes. Fieldwork took place at three locations: Big Rideau Lake for Smallmouth Bass, Mississippi Lake for Walleye, and Opinicon Lake for Northern Pike. We used an unsupervised clustering algorithm to classify three distinct behavioural patterns from accelerometer data: steady swimming, resting, and burst swimming. Accelerometer data was also used to calculate Overall Dynamic Body Action (ODBA), a measure of total activity during the trial. Across all three species, time spent steady swimming and time spent resting did not vary among air exposure treatments. In Northern Pike, ODBA was lowest when air exposure was minimal, and peaked after 30 seconds of air exposure. Our experiment provides a novel approach for the monitoring of fish behaviour with minimal impact on fish health or swimming performance.

Evaluating the effectiveness of spawning habitat offsets for Lake Sturgeon (S)
Kosziwka, K.[1] , Smokorowski, K.[2], Pratt, T.[2], and Cooke, S.J.[1]
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[2] *Great Lakes Laboratory for Fisheries and Aquatic Science, Fisheries and Oceans Canada, Sault Ste Marie, Ontario, Canada*

Lake Sturgeon are endemic to North America, and in Canada are located within the St. Lawrence and Hudson Bay drainage basins. Since the late 1800s, there have been a variety of anthropogenic factors resulted in overexploitation and population declines. A primary factor affecting lake sturgeon recovery is the installation of hydroelectric generating stations. Hydroelectric dams remove ideal spawning habitat for lake sturgeon, as they are installed in areas with the most hydraulic potential, which are often historic spawning locations for lake sturgeon. They can also limit access to historical upstream spawning areas. As such, regulators and hydropower utilities attempt to offset these losses through the installation of artificial spawning habitats

downstream of hydropower facilities. However, the evidence base regarding the effectiveness of this offsetting measure is limited. As such, we embarked on a study to determine 1) the efficacy of artificial spawning habitats created specifically for spawning lake sturgeon, and 2) if physical parameters such as water velocity, depth, and substrate size can be used as a proxy for biological metrics such as egg deposition and larval drift. This study is ongoing with a focus on several large rivers in eastern and central Ontario. Record high spring water levels greatly influenced outcomes from year 1 of the study, requiring assessment of different rivers and spawning shoals than originally planned. Lake sturgeon eggs and/or larvae were collected at most locations, and lessons learned from year 1 will be used to strengthen the study design in year 2. Further knowledge about the spawning requirements for lake sturgeon will help future recruitment of this species of conservation concern. This study will inform evidence-based selection of offsetting measures and provide insight on standardized monitoring designs for spawning habitat studies.

Consumption of terrestrial food resources by a small-bodied stream fish: Silver Shiner in an urban drainage (S)

Jacob Burbank[1,2], D. Andrew R. Drake[2] and Michael Power[1]
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Aquatic communities can exhibit strong functional dependencies on allochthonous inputs for both primary and secondary production. Terrestrial inputs provide valuable food resources for a variety of fishes; however, relatively little is known about the importance of terrestrial food for small-bodied fishes, particularly within urban drainages. We determined the relative contribution of terrestrial food to the diet of Silver Shiner (*Notropis photogenis*), a small-bodied freshwater fish listed as threatened under Canada's *Species at Risk Act*. Furthermore, we quantified seasonal and spatial analysis variation the in consumption of terrestrial food over a gradient of urbanization. Stomach content and preliminary stable isotope analyses indicated seasonally and spatially variable consumption of terrestrial food, comprising up to ~50 % of average stomach content. Terrestrial resources were more common in the Fall relative to Summer based on stomach contents, while isotopes indicated seasonal variation in trophic niche width. Preliminary results highlight the importance of terrestrial food consumption, which to-date has not been described for this species in Canada. Gaining a better understanding of: 1) the relationship between the extent of riparian vegetation and availability of terrestrial food; and, 2) the ecological benefit of consuming terrestrial food resources, will provide further insight into recovery measures for this species.

Environmental DNA Survey in Lake Ontario to Assess Presence of Round Whitefish During Known Spawning Periods

Fei Luo, Rob Eakins, Joe Tetreault, Paul Patrick, Elizabeth Haack, and Jason Dietrich
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Environmental DNA (eDNA) analysis is an emerging and non-intrusive tool to detect species in the environment. It is supplemental, or in some cases, may be an alternative to traditional methods for surveying biota. Industrial applications of eDNA approaches have primarily been in rivers, streams and small ponds, whereas studies in large water bodies such as the Great Lakes are scarce. In the current study, a winter field program was developed to survey eDNA from Round Whitefish in tandem with gillnetting in Lake Ontario. The objective was to evaluate the potential for eDNA analysis to be used as a tool for detecting Round Whitefish during spawning. In this study, size-selective gillnets were deployed in December to capture Round Whitefish in a known spawning location in Lake Ontario. Different volumes of water were collected along the nets before, during, and after fish capture, followed by on-site DNA extraction. Primers were developed to detect Round Whitefish DNA using quantitative polymerase chain reaction (qPCR) in a highly sensitive and specific manner. Metabarcoding was also investigated for assessing fish community composition. Results from qPCR and gillnetting were consistent, as both approaches demonstrated the presence of Round Whitefish in the spawning area, with no detections at the control site. Round Whitefish DNA was more frequently detected at sampling locations in close proximity to the nets. The most promising approach for detecting Round Whitefish DNA is collecting larger volumes of water along a transect within a spawning location. Metabarcoding of Lake Ontario water samples yielded results indicating a relatively small number of fish species including Round Whitefish, White Sucker, Rainbow Trout, while only Round Whitefish, White Sucker and American Eel were captured by nets. Limitations associated with metabarcoding were noted, including not being able to distinguish between closely related species (genetically), and not being able to detect American Eel that were caught in the nets. Overall, this study successfully demonstrates the potential for using eDNA to assess fish presence in the Great Lakes during winter spawning and the potential to provide additional information on fish community composition. It is the first study to use eDNA to demonstrate Round Whitefish presence in the Great Lakes and that transect sampling to collect large volumes of filtered water greatly improves eDNA detection sensitivity.

Notes: