WINTER 2018
VOL 9, ISSUE 1

GEORGIAN BAY FOREVER

Protecting your water.

WATER LEVELS, WATER QUALITY AND ECOSYSTEMS

WATER QUALITY & CLIMATE CHANGE

Also Inside:

IMPORTANT & ONGOING PROJECTS

Preserving and protecting Georgian Bay is at the heart of what GBF does to maintain the health, safety and security of its waters for generations to come. A snapshot of our projects follows. Please consider becoming a supporter today at www.gbf.org — your generosity enables our work.

PROTECTING ECOSYSTEMS

Fighting invasive species and restoring wetlands

For more than five years, GBF has been mobilizing communities across the Bay to eliminate **Phragmites**, an invasive reed that threatens coastal wetlands. In the summer of 2017, GBF **hired five students** in partnership with communities to help tackle more severe areas with exponential results. Find information at: http://gbf.org/invasive-phragmites/

IDENTIFYING HOT SPOTS IN NEED OF PROTECTION

Ontario is unique in Great Lakes jurisdictions in allowing **net-pen aquaculture** in public water. We need to understand more about how its expansion will impact freshwater ecosystems. In 2017, GBF reviewed freshwater research on aquaculture impacts — most of which was outdated due to industry changes. GBF partnered with the University of Guelph who used bio monitoring processes to **prove** that net-pen feed was being absorbed by two native pelagic fish species (one top and one intermediate predator). Several questions regarding fish health, species transfer and its impacts need to be answered through more research.

REVOLUTIONIZING WATER QUALITY

In order to build on the work that has already begun with partners like the Georgian Bay Biosphere Reserve to standardize more than 15 water quality protocols in Eastern Georgian Bay, GBF is now seeking support for **an autonomous underwater vehicle**. This technology is the next step in **revolutionizing** water quality testing for Georgian Bay and creating high-resolution data maps of watersheds, or **Digital Elevation Models.** It also can measure a number of chemical and physical parameters, allowing critically important predictions to be made that model the impacts of climate change, water levels, development, spills, sewage outflows, septic failures, bacterial contamination and also the success of conservation measures. At the same time, Georgian Bay Forever will continue efforts to find the latest research on the impacts of, and solutions for, microplastics and combined sewage overflow pollution into Georgian Bay.

WATER LEVELS

Creating climate resilience by providing structural solutions for adaptive management in the Great Lakes

GBF retained the services of AECOM, a highly respected global engineering firm, to assess and recommend contemporary climate resilient structural options to mitigate plausible future extreme water levels of Lake Michigan-Huron and Georgian Bay. A summary of the report is available at: http://gbf.org/water-levels/creating-climateresilience/. With the report complete, our efforts will turn to highlighting its findings for the International Joint Commission and the two federal governments, in hopes that they will agree to support detailed design work on these alternatives to better understand their potential impact on existing lake level control plans, procedures and structures.

EXPECT UPDATES ON THESE PROJECTS IN THE SPRING 2018 NEWSLETTER:

- **DNA barcoding** - progress on building an aquatic database to monitor the health of ecosystem biodiversity

- **Fish habitat summary** - GBF assisted on the 32-month Eastern Georgian Bay Stewardship Council's project to survey eight tributaries within the Parry Sound District in order to prioritize remedial action for the habitats of declining fish populations

EDUCATION

GBF is dedicated to enhancing public appreciation for the environment and educating the public and governments regarding environmental protection, conservation, the safety and preservation of the water and the natural features of Georgian Bay. For recent topics and updates visit: gbf.org, join our email list and follow us on Facebook, Twitter, and Instagram.

GEORGIAN BAY FOREVER

Georgian Bay Forever is a community response to the growing need for major research and education to sustain the Georgian Bay aquatic ecosystem and the quality of life its communities and visitors enjoy.

We help monitor the Bay's well being, throughout the seasons, year after year.

We fund the research needed to protect the environmental health of Georgian Bay and the surrounding bodies of water. Using our research findings, we inform and educate the general public and governments about threats to environmental health and propose possible solutions.

Through workshops, seminars and online, we are educating the Georgian Bay community. By teaming up with reputable institutions, we enhance the credibility of our research and strengthen our ability to protect what's at stake.

Georgian Bay Forever is a registered Canadian charity (#89531 1066 RR0001). We work with the Great Lakes Basin Conservancy in the United States, as well as other stakeholder groups all around the Great Lakes.

Deeply rooted and broadly drawn, Georgian Bay Forever is steered by lifelong devotees of the Bay. We are committed advocates, educators, environmentalists, realists, idealists, and of course, residents.

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Canadian citizens may send their donations to the address above.

U.S. citizens wishing to make a donation to support our work can do so by giving to:
Great Lakes Basin Conservancy
PO Box 504, Gates Mills, OH
44040-0504, USA

This newsletter is just a snapshot of our work. For the most up-to-date information on our projects, longer versions of newsletter articles and breaking news about Georgian Bay, please become a regular visitor to our website and Facebook page.
GBF.ORG

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Follow us on

MESSAGE FROM THE CHAIR

By Anne Randell

In December, Georgian Bay Forever's Executive Director, David Sweetnam, and I attended the Great Lakes Executive Committee (GLEC) meeting in Toronto. GLEC was established by the governments of Canada and the United States as a requirement of the 2012 Great Lakes Water Quality Agreement. GLEC meetings take place twice a year, once in Canada and once in the US, and focus on planning and action related to water quality concerns throughout the Great Lakes.

Georgian Bay Forever has been granted Observer Status to attend and participate in these meetings — a great privilege for our organization in order to maintain its focus on potential water quality issues in Georgian Bay. The two-day meeting covered many topics including Areas of Concern, Chemicals of Mutual Concern, Nutrients, Discharges from Vessels and Aquatic Invasive Species, among others. The meeting was informative and helpful and we were pleased to receive commendation from IJC Commissioner, Gord Walker, for GBF's work on Phragmites and the resulting benefits to our local water quality.

The GBF Board is reviewing our Strategic Plan to ensure that our priorities and deliverables continue to be aligned with the organization's Mission, Vision and Values. The updated Strategic Plan will be finalized at our next board meeting and we look forward to sharing it with you in the spring.

I wanted to share with you that — for the first time — we spent Christmas at our Pointe au Baril cottage with our kids and grandkids. Thankfully Santa had no trouble finding us, and it was a magical experience for everyone! The ice coverage in front of the cottage was thicker than the recommended safety standard, so there was lots of skating and hockey. How special to be able to enjoy the water of Georgian Bay in such a different way than we do in the summertime!

In closing, thank you to the many donors, supporters and volunteers who make the important work of Georgian Bay Forever possible. Together we are able to protect the pristine waters of Georgian Bay that we all love so much, ensuring it will be there for future generations to enjoy throughout the year. With heartfelt gratitude to all of you!

OUR GOAL MUST BE *NBI*

By David Sweetnam, Executive Director

Happy 2018, the year of water. Actually, at GBF, every year is the year of water! Water is who we are. *Nbi* is a First Nations word for water — specifically clean water. *Nbi* is the water that constitutes us. The meaning of *Nbi* provides a more holistic perspective, instead of merely making water the molecular sum of one oxygen atom and two hydrogen atoms. *Nbi* says we are the confluence of water and ourselves.

Raw sewage flooding into our Bay, impacts of climate change increasing our water temperatures and pollutants entering our water from global sources all change the word for Georgian Bay water to *Nbish* — dirty, sick water.

Despite our impression of the pristine nature of the waters of Georgian Bay and our enjoyment of the beautiful sun-sparkled surface and delicious reflections of sunsets we adore, for most of us around Georgian Bay, *Nbish* is all we have ever seen. Centuries of overfishing, raw sewage releases, toxic waste sites and sawdust and bark dumped into bays from the lumber industry have left our ecosystems at about one percent of what they historically were. We have learned what the impacts of historic mistakes has been, but

> we are continuing to make new mistakes that we have to address immediately.

In this issue, we provide some possible actions for you to take. Our 2018 focus will be on helping our municipalities build the case for accessing funding for climate resilient water infrastructure improvements. This will directly benefit the ecosystems and citizens of the Great Lakes. And GBF will continue to:

- add to our scientific baseline inventory of all life forms who call the Bay their home,
- begin to answer the research questions found through our detailed look at the impacts of new industries like aquaculture on our ecosystems and
- investigate adaptive solutions to mitigate the long term impacts of climate change on our waters and wetlands.

GBF is also working to revolutionize the water quality testing on the Canadian side of the Great Lakes, to catch up with the tools available on the US side. GBF is working hard to get the "sh" out of *Nbish*. Our goal must be *Nbi*.

By Sara Carter

WATER QUALITY ISSUE: SEWAGE OVERFLOWS INTO GEORGIAN BAY

An example of pipes carrying run-off.

Any cottager would agree that a particularly rainy summer like we had in 2017 can put a damper on cottage activities, but it can also have a negative effect on our water quality, due to increasing sewage overflows into Georgian Bay.

WHEN DOES SEWAGE RUNOFF OCCUR?

A sewage bypass occurs when water flow exceeds the capacity of a municipality's wastewater treatment plant. Raw sewage and stormwater discharge directly into local waterways. What's most concerning to those of us who enjoy the pristine waters of Georgian Bay is that this stormwater runoff carries substantial untreated human and industrial waste, toxic materials and debris. This is the same water that we swim and play in, fish from and drink.

> Perhaps most alarmingly, no level of government is currently required to report these overflows to the public...

Political decisions and action are needed today to ensure these runoffs — which, in part, are a consequence of climate change — don't compromise the future of our waters.

WHO IS RESPONSIBLE?

Stormwater management is primarily the responsibility of municipal governments, but the Ministry of the Environment and Climate Change (MOECC) is responsible for approving sewage works under the Ontario Water Resources Act. Municipalities are asked to promptly notify the MOECC and the Medical Officer of Health of all bypasses and overflows, explains Lindsay Davidson of the MOECC. "We often encourage municipalities, who own and often operate wastewater treatment plants, to make this information available to their local community," he explains. But, currently, it is not the law.

INCREASING PUBLIC AWARENESS

Last fall, Ontario MPP (Dufferin-Caledon) Sylvia Jones put forward a private member's bill that, if adopted, would require the MOECC to report when and where sewage bypasses occur and the measured or estimated volume of discharge to the public within 24 hours. While some municipalities currently do proactively report bypasses to the public, it is not a consistent practice across the province.

Although Ms. Jones says she is still waiting on the Ministry of Environment to comply with her request for bypass data for the summer of 2017, it was reported in June of 2017 that the City of Toronto dumped 1.3 million cubic metres of partially treated sewage into Lake Ontario. "If passed," says Ms. Jones, "Bill 141 would also ensure that residents understand the importance of investing in key infrastructure like water treatment plants and pipes." "People need to know when a sewage bypass occurs so they can make more informed decisions about how and when they use public water bodies and to help inform future decisions around public infrastructure investments," says Harry Bauman, President of the Ontario Sewer and Watermain Construction Association. This need for increased awareness of necessary infrastructure is nothing new for many municipalities surrounding Georgian Bay.

MUNICIPALITIES ARE REQUESTING STUDIES AND UPGRADES

Peter Brown, Director of Public Works for the town of Parry Sound, which had numerous bypasses in the summer of 2017, confirms that although it is difficult to precisely quantify the amount of sewage that is entering the water during a bypass, it is of grave enough concern that Parry Sound's municipal government is in the process of requesting a complete inflow/infiltration study to be part of its 2018 budget. "We do our best to control high flows of water due to extreme weather events, but sometimes it is just beyond our control," he says.

In 2016, according to the MOECC, 48,565,760 litres of bypassed sewage were reported to the Owen Sound District Office (not all of this would have been discharged into Georgian Bay). The town received both federal and provincial funding to go toward a $48 million upgrade to its wastewater treatment plant. It includes a new, biological aerated filtration system that improves efficiency in processing the water and also helps consume biological contaminants such as phosphorus, ammonia

and suspended solids. According to Andy Campbell, Director of Engineering and Wastewater Services for the town of Midland, two bypasses in that area between January and August of 2017 resulted in 838,000 litres of raw sewage being dumped into Midland harbour. As a result, that municipality, like Parry Sound, also has plans to conduct a complete infiltration and inflow study and upgrade a sanitary pump station. Mr. Davidson of the MOECC agrees that new government plans are necessary to improve the current infrastructure surrounding water treatment. "Ontario's new Municipal GHG Challenge Fund will support projects such as energy-efficient upgrades to drinking water and waste water treatment plants, to achieve long-term pollution reductions," he says.

Here are some thoughts from Georgian Bay cottager, Ginny LeVan, regarding the overflow issue: "I am shocked to learn that the quality of our pristine waters of Georgian Bay is being compromised by unregulated sewer overflows. This is very disturbing. Like many cottagers we take great pride in our natural surroundings and strive to preserve its magical quality. Not only do we enjoy the undeniable beauty of our waters and inlets but regularly use them as a playground for many family recreational activities such as swimming, fishing and paddling. It is disappointing to think our governments would allow such sewage practices to carry on without any sort of regulation."

Sara Carter is a volunteer Communications Committee member for Georgian Bay Forever and a former magazine editor. Her family spends summers at Bayfield Inlet, in Georgian Bay near Parry Sound. Find connections to her blogs at ***www.gbf.org*** *by searching for Sara Carter.*

WHAT COTTAGERS CAN DO

It's best not to swim after a heavy rainfall, according to Anne Stewart, a Georgian Bay environmentalist and certified water quality expert.

- Encourage your local government to report water quality.
- Download the Swim Guide app from Lake Ontario Waterkeeper, which reports water quality at beaches all over North America.

There can be a lot of toxins and bacteria in sewage.

- Consider what kind of products you are using at the cottage, and be aware of their ingredients.
- Pesticides, pharmaceuticals, plastics, antibacterials, disinfectants and flame retardants carry serious toxins and do not belong in our water.

Have your septic tank inspected.

- Most of us do this only if there is a problem, but it should be done for all existing systems.
- Inspection should include the size of the tank, the size of the bed, measurement of solids in the tank and, if necessary, a flush test.

You can sign the petition to support Bill 141 by visiting ***www.sylviajonesmpp.ca.***

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GEORGIAN BAYKEEPER

WHY WE NEED TO CARE ABOUT MICROPLASTICS IN THE GREAT LAKES

By Lisa Erdle, PhD Student University of Toronto

Microfibers <5mm from a Lake Ontario water sample collected in 2015.

With my nitrile gloves and fish dissection kit, I am a cog in the machine investigating the impacts of plastic on the Great Lakes. Working with a team of researchers, we are helping to bring new understanding to a lake scattered with tiny pieces of plastic.

HOW MUCH PLASTIC IS OUT THERE?

The influx of plastic into the Great Lakes likely began over half a century ago, when industrial plastic production took off. Now, showing no signs of slowing down, annual plastic production has reached around 300 million metric tons after having doubled in the last 15 years. It is estimated that 60% of all plastics ever produced have either been diverted to landfills or accumulated in the environment. Many of these are microplastics, derived from plastic debris breaking down into small fragments or entering the environment as microscopic particles.

Measuring how many pieces of plastic are in the environment is not an easy task. To quantify floating plastic, I have towed fine-mesh nets aboard research vessels and boats conducting citizen science, such as the youth training tall ships of Toronto Brigantine. Quantifying the number of microplastics can be time consuming – particles are individually separated, sorted and counted.

While information on microplastics in the Great Lakes is limited compared to marine environments like the ocean gyres, a study on three of the Great Lakes (Lake Superior, Lake Huron and Lake Erie) showed the average abundance in surface water was approximately 43,000 microplastic particles per square kilometer. In 2014, surface water was sampled in Lake Erie, Lake Ontario and the rivers that feed into them. Recorded abundances of microplastics were between 90,000 and 6.7 million particles per square kilometer. These levels of microplastics are similar to and even exceed concentrations found in ocean gyres like the “Great Pacific Garbage Patch.”

The kinds of microplastics found in these studies — largely fibers, fragments and spheres

— are distinct and tell a story of the people that inhabit the Great Lakes Basin.

MICROFIBERS IN THE GREAT LAKES BASIN

Microfibers are some of the most common microplastics in the Great Lakes. Derived from synthetic textiles, e.g., polyester, acrylic, polypropylene, polyamide and polyethylene, microfibers may enter the environment in many ways. One known pathway is shedding from clothing, with studies on synthetic textiles showing that some articles can shed 100,000 microfibers in a single wash. While wastewater treatment plants (WWTPs) may capture up to 90% of microfibers entering these facilities, a recent study in the United States showed that a single WWTP can discharge up to five million microplastic particles per day, even when serving catchment areas of around 100,000 people.

And with approximately 34 million people living in the Great Lakes Basin, the total load of microfibers entering natural waterways is substantial.

WHAT ARE THE EFFECTS?

Given their ubiquity and small dimensions, the ingestion and impacts of microplastics are cause for concern. Over 220 species have been recorded as ingesting microplastics and include species ranging from microscopic, e.g., zooplankton, to megafauna, e.g., humpback whales. Microplastics also accumulate in food chains and reach humans through seafood consumption, e.g., mussels, fish and oysters.

Effects of microplastics are far-reaching. Researchers have investigated the impacts of microplastics on gene expression, individual cells, survival and reproduction. Mounting evidence shows that negative impacts can include decreased feeding and growth, endocrine disruption, decreased fertility, as well as other lethal and sub-lethal effects. While some effects are due to ingestion stress, e.g., physical blockage, many risks to ecosystems are associated with the chemicals in plastic, either added to plastic as ingredients in production or absorbed from "chemical cocktails" in the surrounding environment.

Studies have shown that chemicals transfer to fish when they consume microplastics. When these fish end up on our dinner plates, we have the potential to increase the burden of hazardous chemicals in our bodies. However, it is unclear how microfibers may uniquely contribute to these contaminant burdens, since microfibers are often associated with distinct mixtures of chemicals used to manufacture fibers and clothing.

RESEARCH IN LAKE HURON AND GEORGIAN BAY

In my PhD research, I am leading a project funded by the Department of Fisheries and Oceans (DFO), in collaboration with Ministry of the Environment and Climate Change (MOECC) and Environment Canada and Climate Change (ECCC) to better understand contamination and effects of microfibers and associated chemicals in freshwater habitats. Thus far, I have sampled fish across Lake Ontario and Lake Huron, including Georgian Bay, and will quantify microplastic ingestion and determine if microplastics are a source of emerging contaminants to these fish in a freshwater food chain. Currently there is little known about microplastics in Georgian Bay or impacts to wildlife in the Great Lakes, and my research will fill some of these gaps.

Contaminants such as flame retardants are increasingly found in the Great Lakes and are of growing concern in Canada. Some of these contaminants are commonly added to synthetic fibers and textiles during manufacturing. My PhD research specifically aims to investigate the contamination and impacts of microfibers and any associated chemical contamination of fish.The preliminary results of my research are expected in the spring, and the research is anticipated to be published in the summer or fall.

LOCAL SOLUTIONS ARE IMPORTANT

In our lab at the University of Toronto, we are testing existing and emerging solutions to reduce microfiber pollution. Initial results show that microfibers released in effluent can be reduced by 26-86% by implementing these innovations. Products currently available to capture microfibers in the wash reduce the number of microplastics that reach WWTPs and include:

- Cora Ball, produced by Rozalia Project http://coraball.com/ *
- Lint-LUVR filter, developed by Environmental Enhancements http://www.environmentalenhancements.com/ *

Legislation to ban microbeads in Canada will come into effect in July 2018. While this is an important move to reduce microplastics emissions, this ban only removes microplastics from personal care products, e.g., microbeads in toothpaste, face wash, etc. The greater challenge will be to work towards solutions that reduce microfibers, the far more prevalent microplastic in the Great Lakes.

Lisa is a PhD student in the Rochman Lab at the University of Toronto and researches the effects of microplastics on fish. In her work, Lisa aims to better understand how microfibers – one of the most common types of microplastics – impact fish through physical and chemical processes.

For more information on Lisa and the microplastics research group, visit https://rochmanlab.com/

Various microplastics extracted from Great Lakes sediment, a major sink of microplastics.

Sampling fish with Environment Canada and Climate Change in 2017

Lisa Erdle

* Georgian Bay Forever is not associated with the companies that produce these products and does not endorse or materially benefit from their sale.

WINTER TOURISM & RECREATION IN ONTARIO: IMPACTS OF CLIMATE CHANGE

By Suzanne Perdeaux and Mujtaba Ali of OCCIAR

Tucked into Lake Huron, the natural features of Georgian Bay provide residents and visitors a haven for all-season outdoor adventures. From the scenic hills of Blue Mountain to the rugged shores and crystal clear waters of Georgian Bay, outdoor recreation is often considered a "way of life" for residents and tourists, from skiing and snowboarding to swimming, hiking and fishing[i]. However, gradual and sudden changes in the regional climate due to climate change are having serious and important effects on the outdoor recreation and tourism industry in Georgian Bay. This article focuses on winter impacts and opportunities.

ONTARIO IN A CHANGING CLIMATE

Changes in Ontario's climate have been observed over the past several decades. Between 1948 and 2012, the average annual temperature in Ontario increased by 1.5°C — a rate of warming that is faster than the global average[ii]. Weather stations across Ontario have shown a trend towards increases in rainfall in all seasons, and increases in the number and/or intensity of extreme weather events such as heat waves, droughts, extreme rainfall events and ice storms have been observed province-wide[iii]. In Ontario, there is a trend towards increased snowfall in the fall in northern regions, a decline in the winter and spring in central and southern regions and an increase in the west and decrease in the east. [iv] Similar changes have been observed across the Great Lakes Basin: warmer temperatures, changing precipitation patterns, decreased ice coverage and variations to historic fluctuations of water levels. This warming trend is expected to continue throughout the 21st century. Projected air temperature changes show that some parts of Ontario will warm by as much as 7°C in the winter and 4°C in the summer by 2050. In response to this overwhelming warming trend, the annual total precipitation over Ontario is also very likely to change — with an increase by as much as 30% in the winter, a decrease of 10% in the southern portion of the province in the summer, and an increase of 10% in northern parts of the province.[v] Changes in temperature and precipitation averages will also be accompanied by changes in extremes, leading to greater climate variability and unpredictable weather patterns. This is because a warmer atmosphere holds more moisture. Storms supplied by climate change with increasing moisture are widely observed to produce heavier rain and snow and cause oscillations between flooding and drought. As a result, a changing climate will alter existing weather regimes in wide-reaching ways and lead to more "wild"or "weird" weather.

Observed and projected climate-induced changes in natural seasonality could have substantial implications for the sustainability of tourism and recreation opportunities for visitors and the communities that depend on them.

NOTES FROM GEORGIAN BAY FOREVER

- **But we've had really cold weather!** In late December and January we experienced a cold snap, which unfortunately does not mean global warming is at an end. It is necessary to understand the difference between weather and climate to evaluate risks to Georgian Bay. NOAA describes it this way: "Weather is what you might see outside on any given day, while climate is the average of that weather over a longer time period. Climate is what you expect, weather is what you get. [xviii] Climate is not represented in one year but is measured over decades and is of primary concern for GBF.

- **Climate adaptation measures.** GBF continues to work on ways to increase climate resilience through studies of infrastructure solutions and economic impacts, as well as initiatives that measure the impacts of climate change on ecosystems so protection measures can be put in place.

i Great Lakes Information Networks, 2008. Great Lakes Information Network. Accessible from: www.great-lakes.net/; **ii** Vincent, L.A., X.L. Wang, E.J. Milewska, H. Wan, F. Yang and V. Swail. 2012. A second generation of homogenized Canadian monthly surface air temperature for climate trend analysis. *Journal of Geophysical Research: Atmospheres, pp 117.;* **iii** Ontario Ministry of the Environment and Climate Change. 2014. Ontario's Adaptation Strategy & Action Plan: 2011–2014. Available from: www.ontario.ca/document/climate-ready-adaptation-strategy-and-action-plan-2011-2014-0; **iv** Lemmen, D.S., Warren, F.J., Lacroix, J., & Bush, E. (Eds.). 2008. From impacts to adaptation: Canada in a changing climate 2007. Ottawa, Ontario: Government of Canada.; **v** Canadian climate data and scenarios. Adapted from Canadian Climate Data and Scenarios. 2017. Available from: www.cccsn.ec.gc.ca;**vi** Canadian Ski Council (CSC). 2015. *Facts+Stats: Ski and snowboard industry 2014-15.* Available from: www.skicanada.org/wp-content/uploads/2016/01/2014-15-Facts-and-Stats.pdf; **vii** Avery, R. (2001, December 21). Green ski hills finally turn white. *Toronto Star*, p. A4.; **viii** Howell, K. (2002, March 21). Ski season wasn't all downhill-snowmaking saves alpine slopes, but weather hurts trails. *Toronto Star*, p. A28.; **x** Scott, D. R. Steiger, M. Rutty, M. Pons, and P. Johnson. 2017. The differential futures of ski tourism in Ontario (Canada) under climate change: the limits of snowmaking adaptation. Current Issues in Tourism.

WINTER TOURISM

As the most populous province in Canada, Ontario contains the largest proportion of active skiers and snowboarders in the country[vi]. The downhill ski areas in Ontario are located primarily along the southern shore of Georgian Bay. Due to its direct reliance on specific climate conditions, the ski industry is regarded as the tourism market most directly and immediately affected by climate change. Warmer winter temperatures are shortening the ski season in Ontario, with ski resorts unable to open during critical times (such as the holiday season between Christmas and New Year's). Mild winter temperatures and marginal snow conditions in 2001–2002 meant that four alpine snow resorts and 14 cross-country ski areas between Lake Erie and Huron were unable to open for the entire season[vii viii]. Many ski resort locations across southern Ontario were also impacted during record warm temperatures in December 2015. At Horseshoe Resort in Barrie, temperatures that month weren't cold enough to make snow and about 400 seasonal employees were placed on hold, waiting for the snow.

System-wide operational ski terrain-days in the Ontario market are projected to decline by as much as 28% by mid-century, with continually increasing dependence on machine-made snow[x]. By the 2020s, ski areas on the east shore of Georgian Bay may be reduced by as much as 19% [xi]. With diminishing ski conditions, resorts are re-opening their green season activities during the winter months and opening earlier than usual due to a trend of milder spring weather. Snowmobiling is a common recreational pursuit that contributes significantly to both the provincial and regional tourism economy. Reduced suitable snow and ice conditions make changes to the snowmobiling season length an especially useful indicator of climate change vulnerability. Studies suggest that the quality (or season length) of snowmobiling will decrease in southerly areas of the province (near Orillia and Sudbury) between 24% and 68% as early as the 2020s, and between 33% and 100% by the 2080s [xii]. The associated impacts for communities that depend on the snowmobiling industry can be significant, ranging from loss of revenue as memberships and equipment sales decline, to the social, personal and psychological impacts that can occur as communities are forced to alter their activities, or even their entire livelihoods. Ice fishing is another outdoor activity that relies on specific weather conditions. In Ontario, 11% of fishing is done through the ice. However, the area of all the Great Lakes covered in ice has declined between 1970 and 2013, with the greatest decline on Lake Superior (by 42%), followed by Lake Ontario (by 32%), Erie (by 25%), Michigan (by 21%) and Huron (by 19%)[xiii xiv]. Reduced lake-ice cover and thickness due to shorter and warmer temperatures have important implications for the safety of ice fishers and snowmobilers. Warming water temperatures can also impact the composition of fish communities, affecting both commercial and recreational fisheries. Acceleration of the current warming trend will enhance production of warm-water invasive fish like smallmouth bass and negatively affect production of cool-water and cold-water species, such as lake trout. Further, large swings in temperature can affect reproduction and immune system response in fish, making them more susceptible to disease.

ADAPTING TOURISM AND RECREATION TO CLIMATE CHANGE

Nearly all communities around the Great Lakes will need to adapt to changes in regional climate. Here climate change adaptation refers to taking proactive action to minimize the risks of climate change, taking advantage of any opportunities that climate change presents and ultimately increasing the resilience of the tourism and recreation industry to withstand changes in climate conditions and weather events. Focusing on restoring native species such as lake trout, lake sturgeon and other species is one example, and should be made a priority — since tourists who visit Georgian Bay, rent cottages and camp rely heavily on fish for recreation and as a source of food[xv].

Ski resorts are also responding to variable seasonal changes. Blue Mountain Ski Resort remained open until April last year due to unexpected spring snowfalls after a fairly mild winter. Even though the busiest time for ski resorts is around Christmas and New Year's, resorts such as Blue Mountain have adjusted their opening times to ensure that their business is not negatively impacted by seasonal variability[xvi]. The resort has diversified its business strategy and is now open year-round. There is no doubt that the effects of climate change will alter the competitiveness of tourism and recreation sectors in and around Georgian Bay, and we've only explored winter in this article. Looking ahead, it remains important for tourism operators and communities to determine how they will need to adapt to such changes in order to reduce risk and take advantage of new opportunities[xvii].

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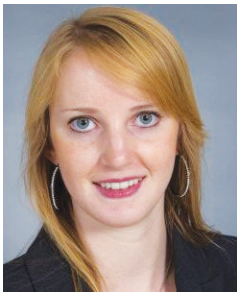
Mujtaba Ali *is a Climate Change Adaptation Intern at OCCIAR. Mujtaba holds a Bachelor of Environmental Studies in Geography and Environmental Management and a Master of Climate Change from the University of Waterloo.*



OCCIAR is a university-based resource hub that promotes, supports and advances climate change adaptation in Ontario through education, communication and stakeholder engagement. www.ClimateOntario.ca

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SYDNEY STEVENSON

Georgian Bay Forever received an extraordinary letter in the mail. It was from a young woman named Sydney Stevenson, who,because of her love for the Bay and a life-altering journey to Africa, made a gift to protect the water of Georgian Bay, now and forever. This is her story...

Many, many years ago, Sydney's grandparents, having seen and fallen in love with Georgian Bay, purchased an island in Bayfield Inlet, just outside the little community of Pointe au Baril. This island would become the most cherished gathering place for every member of the Stevenson family — the place where their best memories and stories were and still are made, from numerous family picnics, to the children learning to fish, to swimming and hunting for frogs and minnows, to the annual attempt to make it to Killarney for fish and chips! On the island, family time and connections are top priority and family fun is mandatory.
Having lived every summer of her life on the island from the time she was born and then working hard at the family's marina business in Bayfield Inlet since the time she could do chores, Sydney feels a deep and sacred connection to the water — the water that we so often take for granted and are so very lucky to have!

Then, last year, she had the opportunity to participate in a once-in-a-lifetime adventure that would profoundly change her life. Through the Me to We program, hosted through Pickering College, Sydney applied for and received one of the coveted mission positions. She was awarded the chance to travel to Africa and work side-by-side with village mamas and their children, learning about a new culture and way of life in another part of the world.

During her visit, she learned how precious clean water REALLY is. It is more precious than gold, and every drop is cherished. To the women of this little village, water is life. As she marched side by side with the women and girls of the village for many kilometres in the African heat just to get water, she realized how fortunate we, the people who live, work and play on the shores of Georgian Bay, are to have such an abundance of this most precious resource, at our fingertips — an abundance that we need to protect and ensure stays clean and healthy!

This is why Sydney chose to support the work of Georgian Bay Forever. She wanted to contribute to research that helps to monitor the water quality of the Bay and to ensure that our water and wetlands stay healthy. Sydney makes her philanthropic gifts possible by making jewellery from rock, quartz and granite chips that she and her family, including little cousins and grandparents, find on their many explorations by boat in and around the outer islands of Bayfield Inlet and up the

coast towards Killarney. Family, friends and members of the Bayfield Boat Club support her efforts by purchasing and proudly wearing her many creations. GBF and our staff are honoured and humbled by Sydney's first and generous contribution and her pledge to give more! She is a shining example of how younger generations of Georgian Bay lovers can get involved and protect the waters they've grown up on. Thank you, Sydney, for ensuring your Bay stays pristine.

THREE GREAT REASONS TO BECOME A WATER GUARDIAN AND SUPPORTER THIS YEAR!

YOU ARE WHAT YOU EAT!

Did you know that microbeads and microplastics are tiny pieces or particles of plastic found in many personal care products and synthetic clothing fabrics? These plastics are then flushed down our drains through showers and washing machines and can end up in our food chain. These kinds of microplastics were found in 29 tributaries flowing into the Great Lakes from the US. Once in our waters, they ebb and flow with the currents, infesting all of our precious water! Even though these plastics are tiny, collectively they cover a huge surface area, allowing them to absorb large quantities of toxins and other pollutants. Yikes! Then fish and other aquatic animals foraging for food can ingest those plastics into their bodies. As we catch and eat the fish, we then ingest those very same microplastics into our own bodies! Oh my! So let's all watch the products we use, cut down on our consumption of synthetic clothing — like fleece — and keep cigarette butts off the ground!

THAT'S JUST GROSS! SEWAGE OVERFLOWS DO RUN INTO YOUR BAY!

Many people have no idea that raw, untreated sewage water routinely overflows into the Bay from municipal treatment plants when they're overwhelmed by too much rain! Can you imagine finding out that the very place you and your family sail, canoe, kayak, boat and swim — and often draw your drinking water from — had over 1.3 million litres of raw sewage dumped in it over a four-year period? This happened in Midland, and let's be honest, the Township of Midland is unlikely to be alone in having outdated facilities. We're sure this is a huge problem in small Townships all around the Bay. Stormwater management infrastructure is needed! Investments in water treatment plants and processes are needed! Support public disclosure of when and where overflows happen!

THAT IS NOT PRETTY GRASS! BUST THAT PHRAG AND ELIMINATE IT FROM OUR WETLANDS!

We're on the cusp of a major invasion, and the battle to save our precious wetlands is just beginning! Our Georgian Bay coastal wetlands are home to 80% of the Great Lake's 3500 species and are considered to be among the most productive and diverse ecosystems in the world. However, invasive species like Phragmites are already having a tremendous and devastating effect on native ecosystems. Phragmites are threatening wetlands, important habitat for our native fish.

That "grass" may look pretty — it's anything but! Phragmites are a nutrient bully, hogging all the nutrients for themselves, while dispersing a harmful chemical from their roots that hampers the growth of our native plants. This species has no natural controls and can grow in almost any condition. One seed, seemingly small and insignificant, has the potential to produce 40 stems in just one season. Since there are up to 2,000 of these seeds in one Phragmites seed head, a single seed head has the potential to generate 80,000 new stems. They grow into dense monocultures and create dead zones where nothing can grow. In one square metre, it is not uncommon to see 200 or more stems growing.

Invasive Phragmites are not impossible to stop, but the longer we leave it, the more challenging and costly the cleanup will be. Please become a Phragbuster. Inspect your own properties for signs of a Phrag invasion, get some training and then get into the water and do your part for your local shoreline!

If any of these issues make you concerned about the future of Georgian Bay, please consider becoming a supporter of water protection work and make a donation.

With your help, we can ensure the pristine water of the Bay remains clean, safe and healthy for generations to come!

To donate visit:
www.gbf.org/donate
or call:
Amber at 905-880-4945, ext. 3

GBF is pleased to recognize the members of the Georgian Bay Forever Circle

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