



LOOKING AT GEORGIAN BAY *through a Scientific Lens*

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Since its inception 30 years ago, Georgian Bay Forever has maintained the primary goal of using scientific studies to conserve the aquatic ecosystem of Georgian Bay. Many things have changed over the course of three decades—the scope of our projects has expanded, our staff has increased, and the range of programs has diversified—but our purpose and outlook remain the same. We believe in a fact-based understanding of the environment. Our mission is to preserve Georgian Bay through objective research, analysis, and the practical, real-world application of available information.

Whether it's promoting environmental stewardship, using state-of-the-art technology to gather the most complex data regarding Georgian Bay wetlands, or anything in between, we approach all our work with scientific methodology in mind.



Whether we are just looking out over Georgian Bay on a relaxing sunny day or are enjoying its treasures through our many water-based activities, how often do we pause to consider the science lurking beneath? Hidden below, often at levels never before seen, are the ongoing changes and challenges to the Bay's biodiversity and evolving ecology. To unlock and reveal the impact on our continuing use and enjoyment of the Bay, we must rely on many forms of scientific data-gathering, research, and analysis.

The focus of GBF's mission, of course, is to protect, enhance, and restore the aquatic ecosystem of Georgian Bay through scientific research, education, and action. Looking at the Bay through the eyes of a scientist has thus resulted in the targeted development of our various science-based programs.

These programs have ranged from student learning, both within and outside the classroom; to family and volunteer citizen scientist participatory projects; to our staff identifying, inspecting, mapping, and gathering data on the numerous changes and challenges above the surface with our drone, and in underwater sites with our Autonomous Underwater Vehicle (AUV) and Remotely Operated Vehicle (ROV).

Behind the scenes, GBF is also focused on managing the increasing amount of data gathered over time to measure and monitor changes and challenges, and on leveraging the application of technologies to enhance research and education, thereby strengthening public appreciation for the ongoing need to rely on the revelations of science. As a result of all these efforts and your support in joining us, together we can create the established foundation to protect and preserve the unique environment of Georgian Bay.



**A MESSAGE FROM
TERRY CLARK,**
Chair of
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 Georgian 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 communication, 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.

Georgian Bay Forever is steered by our esteemed board of directors, a group of dedicated individuals who are committed to ensuring the functionality and purpose of our organization. They bring their experience and expertise to all aspects of operation, with the common goal of protecting and conserving Georgian Bay.

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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
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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 Facebook page and website:

GBF.ORG

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Design and Editing by Laura Thippawong
Cover Photo by Erin Allen
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@GBayForever

The Big Picture: Surveying the Georgian Bay Wetlands with Our Drone

By Laura Thippawong

Mapping and documenting the presence of any invasive species is imperative to understanding the modality of that species and its impact on its surrounding environment. In 2024, Georgian Bay Forever's field team conducted 22 flight missions over the course of eight days with the use of our drone, covering a total of 293 hectares in the Matchedash Bay wetlands in search of invasive Phragmites hidden among the vast cattail marshes. We discovered many large sites that would not otherwise have been found due to inaccessibility by foot or boat within the marsh.

Through a holistic approach to data collection when surveying the Georgian Bay waters and landscape, Georgian Bay Forever can piece together a more comprehensive portrait of the region, gaining a deeper understanding of the ecosystem's threats and vulnerabilities. With these concerns in mind, the addition of high-quality technology for use in our day-to-day programming becomes essential. When we acquired our DJI Matrice 300 drone in 2023, we did so with the big picture in mind, both literally and figuratively. Drones enable researchers to collect substantial amounts of data from any given environment by quickly scanning vast

areas with high-resolution imagery. High-tech drones have become particularly helpful in geomatics (the field of collection and analysis of spatial or geographic information) due to their ability to collect large amounts of accurate, geo-tagged data, thereby optimizing the time spent on geo-surveying. This efficiency allows us to spend more time working on cutting invasive Phragmites stands and less time mapping them.

Our research and mapping systems will become increasingly efficient as our highly accurate data set expands over the course of the next few years. Once entire wetland areas are documented and accounted for, we can then effectively and more easily monitor those areas for the

foreseeable future with a clear understanding of invasive species spread and the correlating ecological changes.



One of our drone flight missions in 2024
Photo by Nicole Carpenter, Georgian Bay
Forever Science Projects Manager

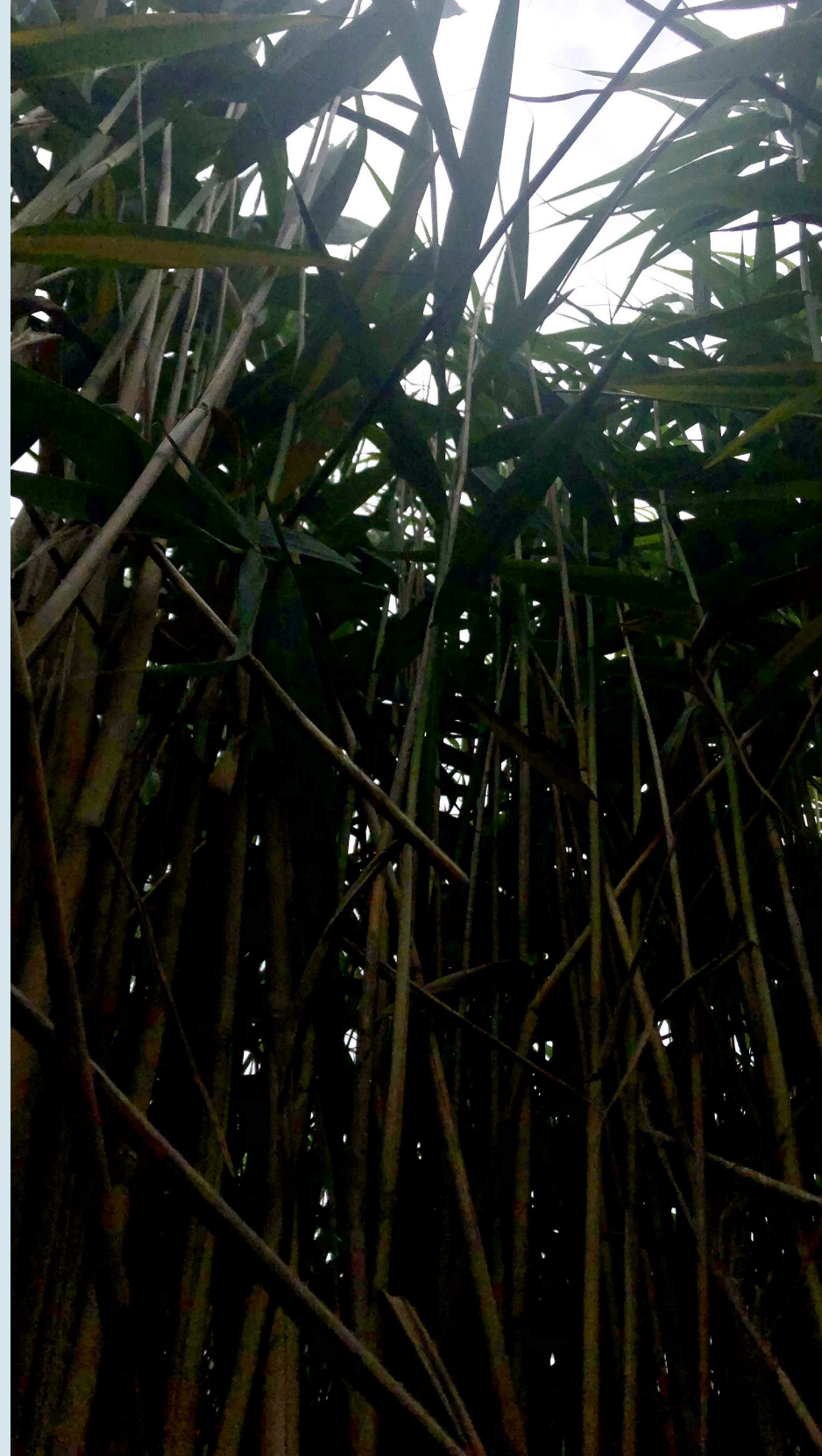
Dissecting the Science Behind Our Phragmites Management Program: Lessons in Plant Biology

By Erin Allen

Erin Allen is a graduate of Carleton University's Environmental Science program, where she focused on topics relating to ecology, biodiversity, and conservation. She is now in her second year with Georgian Bay Forever as the Conservation and Restoration Team Lead.

When our team of Phragbusters boat up to a wetland with hand and power tools in tow, people often wonder what we are up to. Most are some combination of relieved and excited to hear that we are trying to tackle the invasive perennial reed, *Phragmites australis*. Invasive *Phragmites*, also known as common reed, has become a poster child for problematic alien plants in Ontario. The plant crowds wetlands and clogs roadside ditches throughout much of the province, and continues to spread. *Phragmites* dominates the ecosystems in which it establishes, forming dense monocultures that decimate biodiversity, alter water levels, create hazards, and impact recreational and cultural land use. *Phragmites* has established itself in parts of Georgian Bay, and so many residents are glad to hear organizations like ours are controlling it. However, we get some surprised looks when we explain that our six-person team plans to cut it all by hand.

Wading along the shore and cutting down the—at times—towering stalks of *Phragmites* seems a mammoth task to many onlookers. They often wonder if what we do really works to suppress the aggressive plant. I understand the skepticism. Before becoming a GBF Phragbuster, I had never heard of selective cutting as a viable management method for *Phragmites*. Cutting *Phragmites* requires a lot of physical effort, and lacks the scientific feel of alternative approaches, like herbicide application or prescribed burning. In essence, cutting to drown invasive *Phragmites* involves shearing the reed's stalk below the water



to drown its roots at least once every year until the stand completely dies. Depending on conditions, it takes three to seven years of repeated cutting and drowning for a stand to die. Despite the technical simplicity of this method, its application relies heavily on plant biology.

When taking conservation action, a good place to start is understanding the organism's population of which you want to control. By understanding how *Phragmites* grows and spreads, we can leverage plant biology to make our cuts effective. A *Phragmites* plant has four major components: the rhizomes, stolons, stems, and seeds. We often describe rhizomes as the roots of *Phragmites*, although they perform different functions. Roots, like those on most terrestrial plants, anchor plants and transport minerals and water from the below-ground to the above-ground stems and leaves. Rhizomes are more like specialized sideways stems that store energy and grow new shoots. Rhizomes make up the bulk of a *Phragmites* plant and help it thrive by maintaining energy stores below the surface throughout harsh conditions, and dispersing *Phragmites* plants to new locations via rhizome fragments. Stolons are rapidly-growing shoots that grow along or just below the surface of waterbodies and shores. They develop buds that grow into new plants, providing *Phragmites* with another method of spread. Stems are the plant parts seen above ground and support the leaves that supply energy to the plant through photosynthesis (the conversion of the sun's light to nutrients). Lastly, seeds grow at the end of the stems in clusters, providing a final method of reproduction.

Many rhizomes will persist below the surface throughout winter when the plant is dormant, storing the energy produced the previous summer. In May, *Phragmites* enters its initial growth phase (germination) before conducting the bulk of its stem and leaf growth in June and July (primary growth), followed by seed development (flowering) in August and September. During these periods of growth and seed development, energy is transferred upwards from the rhizomes to the stems and seed heads. By fall, the plant prepares to enter its dormant phase by transferring its energy back to the rhizomes for safe winter storage.

Understanding *Phragmites'* biology informs how we manage it in two major ways. First, we know the immense storage capabilities of rhizomes mean more established stands with more rhizomes will better withstand our cutting efforts. To combat this, we focus on eliminating smaller, newer stands with less developed rhizomes. Repeated cutting quickly weakens younger stands that lack abundant rhizome energy stores to support regrowth. Prioritizing easy-to-tackle sites slows the spread of *Phragmites*. It also saves future time and resources by preventing stands from becoming hardy and costly to eliminate. Second, we know rhizomes send energy up the stalk in spring and do not return large amounts for storage until the fall. We cut stalks in July and August, when large amounts of energy are present above ground so that *Phragmites* do not get the opportunity to transfer this energy back to their rhizomes. These approaches weaken *Phragmites*, making recovery from future cuts and environmental changes more difficult, and eventually lead to the stand's demise.

BEHAVIOURAL SCIENCE: *Incentivizing Environmental Stewardship*

By Laura Thippawong



Good habits are not formed overnight. Long-term success in adopting good habits requires both means and motivation to complete an action regularly, which can be all the more tricky if the benefits are not immediate. As a non-profit organization, Georgian Bay Forever understands the need to employ tangible incentives and motivational strategies—such as the application of game theory—when approaching the task of influencing behaviour.

Intangible or conceptual rewards are insufficient on their own as a psychological tool for motivating positive habits. Let's take flossing, for example. Dentists recommend flossing your teeth at least once daily, but a 2022 survey by Narrative Research found that roughly half of Canadians do not floss daily, and one

in five do not floss at all, while National Public Radio found that twenty-seven percent of adults lie about how often they floss. We know that flossing is good for us—it prevents tooth decay and loss, and reduces inflammation, which can even reduce your chances of heart disease. It's also easy to do and only takes about a minute. It should be the easiest of habits to adopt. There are just two problems: It's unpleasant in the moment, and there are no tangible or immediate rewards.

Much like flossing, volunteering and activism-related actions can be difficult for many to factor into their day-to-day lives, so it falls to the non-profits to engage people in regularly taking positive actions in service of a specific cause. The good news is, accord-

ing to the 2019 M+R Benchmarks Study, environmental non-profits were found to be the best at engaging their supporters in advocacy through action. The bad news is that only nine percent of those supporters reported taking three or more actions a year in support of their chosen cause, with an industry average of only five percent. Unfortunately, the greater good does not often constitute behaviour-changing motivation.

To motivate most effectively requires a fundamental understanding of human behaviour. Dr. BJ Fogg, PhD, founder of the Behavior Design Lab at Stanford University, explains it this way: Behaviour equals motivation, ability, and a prompt. The equation has been used at high levels to innovate technology and create mass-marketed products, but at its simplest use, it informs a basis for common sense—the higher the motivation and lower the difficulty of the activity, the more likely the activity will become habitual. This model is exemplified by the UK-based LitterLotto app, in which participants can take photos of themselves properly disposing of garbage in public spaces, and use those photos as entries to win cash and prizes. Georgian Bay Forever launched a partnership with the organization in April (LitterLotto's first partnership in North America), and since then, has sent cash and prizes to numerous winners in the Georgian Bay area.

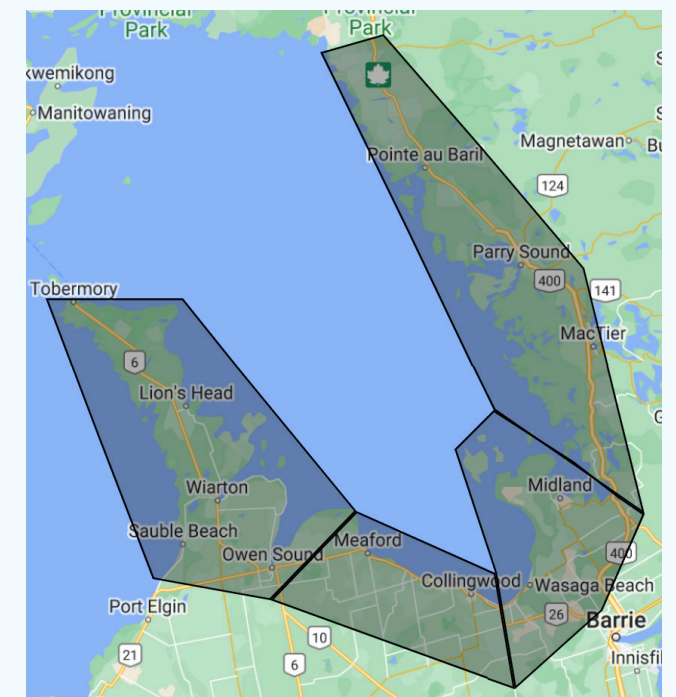
Gamification—the application of game-play elements, such as scoring points or advancing levels—is another factor at work in the LitterLotto app model, and one that has been proven successful in behaviour modification. Gamification can produce positive emotional reactions in the user by creating immediate feelings of satisfaction and accomplishment. When applied to the act of picking up trash, it creates a cognitive model of recreation out of something that was otherwise an objectionable chore. According to many participants,



LitterLotto weekly prize winner Sean Lyeo, photo courtesy of Sean Lyeo

using the app has increased their awareness of public litter, and made them excited to continuously pick it up and dispose of it. Sean Lyeo, a recent weekly-prize winner in the Georgian Bay area states: "LitterLotto has genuinely made my walks so much more fun! Now, every time I leave the house, it feels like a scavenger hunt. I've even seriously considered investing in a grabby stick to double-down on my trash-picking-up efforts." In addition to Sean Lyeo's efforts, Georgian Bay Forever recorded over 1,000 pieces of litter picked up through use of the LitterLotto app in the Georgian Bay catchment zone during the first two weeks since the launch. The results so far are impressive, but not surprising. A 2021 review in ScienceDirect of games and apps for the promotion of environmentally sustainable behavioural change concluded that gamified apps were more effective than other methods for behavioural change, with several psychological theories at play in reducing barriers to pro-environmental habits.

These concepts are intuitive and straightforward, but when applied with intention, they can be powerful tools in shaping behaviour, in this case, for the betterment of the Georgian Bay shores and the environment as a whole.



The Georgian Bay Forever LitterLotto Catchment Zone; any entries through the app logged in this zone are eligible for the weekly prize.

Learn more about LitterLotto and download the app for Android or Smartphone using this web address: www.georgianbayforever.org/litterlotto.

The Science of Georgian Bay: A Fragile Balance

By David Sweetnam



Standing at the water's edge, the casual observer might see only beauty. But to scientists, Georgian Bay is more than just a body of water—it is a dynamic system governed by intricate ecological, geological, and climatic processes. Georgian Bay, with its deep cultural and environmental significance, is a mosaic of natural forces working in concert. Georgian Bay Forever is focused on understanding and preserving this resource through multidisciplinary scientific research, public education, and action.

Georgian Bay provides many ecological services as a critical drinking-water source and a cold-water refugium essential for species' survival amidst rising global temperatures. Its biodiverse coastal wetlands enhance ecological resilience and support a complex food web. The Bay is not a static entity, but a system shaped over billions of years by geological forces, biological interactions, and recent human impacts.

Hidden beneath the surface are dramatic ecological shifts driven by climate change, invasive species, and human activity that continue to degrade the system's mislabelled "pristine" appearance.

Water temperatures in Georgian Bay are rising beyond historic norms, affecting ice formation and evaporation cycles. These shifts disrupt the spawning behaviours of fish and alter nutrient flows and wave dynamics. For instance, changes in water temperature can lead to mismatches between the hatching of fish larvae and food availability, known as a phenological mismatch (Cushing, 1990), which raises the risk of starvation and increases mortality rates (Princeton University, 2019).

Georgian Bay is home to several cold-water fish species, such as:

- Lake trout (*Namaybin*, *Salvelinus namaycush*): a key predator that thrives in deep, cool waters
- Lake whitefish (*Adikameg*, *Coregonus clupeaformis*): Historically abundant, whitefish have suffered significant population declines. This fish is featured in "All Too Clear," a feature film and three-part series funded in part by GBF and streaming on TVO.
- Brook trout (*Maazhamegosens*, *Salvelinus fontinalis*): Found in coldwater streams, these fish are highly sensitive to temperature changes and habitat degradation. GBF delivers an in-classroom hatchery program nurturing these fish.

Located in the deeper layers of lakes where temperatures remain low (maximum freshwater density occurs at about 4°C), cold-water refugia provide three essential functions: they shield organisms from rising surface temperatures, sustain oxygen-rich conditions, and create stable habitats. Human threats, such as climate change and pollution, as well as disruptive projects like the proposed Ontario Pumped Storage Facility, jeopardize these limited refugia, necessitating public education to create vital, informed conservation efforts for their protection.

Recent studies have confirmed that microplastics—originating from textiles, tires, cigarette butts, single-use plastics, and other consumer waste—pervade freshwater systems. These tiny particles bioaccumulate in aquatic organisms, impacting metabolic functions and increasing overall toxin exposure (Rochman et al., 2016). Meanwhile, larger plastic items break down over time, releasing chemicals into the water. In Parry Sound, Ontario, research has demonstrated that washing machine filters can significantly reduce microfiber emissions, underscoring the potential for widespread filtration technology to mitigate microfibre impacts on water quality (Erdle et al., 2021).

Non-native species continue to upset Georgian Bay's natural order. Zebra (*Dreissena polymorpha*) and quagga mussels (*Dreissena bugensis*), transported via ballast water from international shipping, greatly alter nutrient dynamics by filtering excessive amounts of plankton, which is vital for the aquatic food web (Nalepa & Schloesser, 2013).

Similarly, the round goby (*Neogobius melanostomus*) aggressively competes with native fish for food and habitat, contributing to declines in species such as sculpins and logperch. Yet these invasive gobies have also become a trusted food source for the native double-crested cormorant (*Phalacrocorax auritus*). Research in Hamilton Harbour, Lake Ontario, has indicated that round goby have become a predominant component of the cormorant diet (Somers et al., 2003). Further studies have shown similar trends in southern Lake Michigan, where invasive species sustain cormorant populations (Madura & Jones, 2016).

The rampant spread of invasive *Phragmites* (*Phragmites australis* subsp. *australis*) poses a significant threat to native wetland ecosystems. This towering common reed crowds out and poisons indigenous vegetation, destabilizes shorelines, and alters habitats for birds, amphibians, and fish. Its expansion drastically reduces biodiversity and interferes with natural hydrological processes. Studies have shown that the *Phragmites* invasion has notably affected amphibians

an distribution (Mazerolle et al., 2014). In response, Georgian Bay Forever has spearheaded strategic removal initiatives. These efforts include community-led mapping, monitoring, and eradication of invasive stands using environmentally sustainable methods such as underwater cutting (Georgian Bay Forever, 2023).

Science-Driven Conservation Efforts and a Call to Action

Robust water-quality monitoring and invasive-species control projects that engage citizens are forging a path toward a more informed public who demands proactive protection of Georgian Bay's resources. GBF partnerships between researchers, local communities, and policymakers ensure that restoration and rehabilitation initiatives are grounded in scientific evidence. Programs such as those led by GBF inform studies by Environment and Climate Change Canada and provide essential data that drive these reports (Environment and Climate Change Canada, 2022).

Through rigorous research, ecological modelling, and community engagement, it is possible to safeguard Georgian Bay for future generations. The combined efforts of research institutions, environmental organizations, and local stakeholders provide a roadmap for resilient management, ensuring that Georgian Bay remains a cherished natural treasure and a vital resource for generations to come.

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Measuring Georgian Bay's Coastline

By Laura Thippawong

If you Google “how many kms of shoreline does Georgian Bay have”, you’ll receive some varied answers. Several reputable websites from long-established institutions will tell you that Georgian Bay consists of 2,000 kms of shoreline. Others put the number as low as about 600, while others simply opt for the vagueness of “thousands”, and leave it at that. It might seem striking, then, that Georgian Bay Forever proclaims a whopping 8,000 or more kms of shoreline throughout the entirety of Georgian Bay.

We didn’t come to this conclusion easily. Coastline mapping is so complex it even has its own paradox: The Coastline Paradox, which states that the true measurement of a coastline is infinite as long as it remains impossible to fully measure the fractal curvature of lines comprising said coast. We knew, of course, that the coast of Georgian Bay was not infinite. We also knew, however, that it was a lot longer than 2,000 kms. To figure out its length within a reasonable margin of error, we partnered in the early 2000s with McMaster University for a project called the Coastal Wetland Inventory. The project involved precise digital mapping, from which we calculated 7,683.165 km of wetland perimeter along the eastern and northern coastline of Georgian Bay, indicating a much larger number when factoring in the yet unmeasured southern and western coastline. We used 11,109 polygons for measurement in the mapping of the 30,000 islands archipelago, creating increments small enough to deftly track around the exceedingly uneven coastline for which Georgian Bay is famous. When considering every inlet, isthmus, and rocky island, we can see that a realistic figure in representation of Georgian Bay’s shoreline is impossible without applying the most narrow units of measure.

As a scientific organization, we are sticklers for integrity of information. The difference between estimations of 2,000 km and over 8,000 km is significant, and carries with it the potential for some real-world applications. Accurate coastline measurement can help with environment and resource planning by informing as to the structure, potential hazards, and possible usage of a landscape. Knowing the make-up of a coast can help determine the existence of critical wetlands and other essential wildlife habitats. Understanding the coastal structure can also provide the foundation for protective measures, like safeguarding against human development or planning for weather-related disasters. The more you know about a coast, the better you understand the relationship between natural processes and environmental changes. Georgian Bay Forever currently uses this data to help accurately map invasive *Phragmites* stands and account for changes to the coastline as we progress in our invasive *Phragmites* eradication efforts, with the possibility of different forms of usage in the future.

Part of the scientific process is knowing that information is never stagnant—it’s dynamic, always evolving—but well-tested theories based on evidence in an ever-evolving world are the keys to understanding predictable outcomes. The true measurement of Georgian Bay’s coastline will likely never be known, but the closer we are to that truth, the more we understand the Bay, and the better we can serve to protect it.



The coastline paradox: a map of Great Britain’s coast using progressively shorter increments of measurement

DONOR PROFILE BY AMBER GORDON

The McLellands



The French Enlightenment writer and philosopher Voltaire once said, “Love is a canvas furnished by nature and embroidered by imagination.” From Dreamer’s Rock and La Cloche Mountains to the sandy beaches of Wasaga and the never-to-be-forgotten Grotto in Tobermory, Georgian Bay is a true testament to this passage.

Nature truly outdid itself when Georgian Bay was created—just ask anyone who lives and plays on its shores. Hugh and Sylvia McLelland, longtime cottagers on the Bay, can attest to this statement firsthand. In 1980, when they first sailed up the North Channel on a new adventure, marvelling at the beauty surrounding them—smelling the sweet fresh air enveloping them, enjoying the silence broken only by the call of the loon or other birds flying high in the sky—they fell in love. They began to imagine how to enjoy this special place, protecting it as best they could and sharing its wonders with family and friends.

In 1984, the McLellands purchased their island and let their imagination soar, creating their own “nature love canvas” within the Bay of Islands. Spending every summer up around Manitoulin Island provided Hugh and Sylvia with ample opportunities to make memories. Memories include picnics on Bald Rock, visiting the local waterfalls, taking extended fishing trips, and eating at the historic Island Lodge. It also allowed them to see that this body of water and its surrounding environment needed help to thrive and survive if other generations of cottagers and residents were to enjoy the water as they did.

Enter Georgian Bay Forever. Our history as a charity began 30 years ago, and it didn’t take long for Hugh to step up as one of our first donors and original board members. Boating safety, fire hazards, and environmental protection were the impetus for getting involved on day one. Still, the difficult and sometimes overwhelming amount of work and the need to keep water programs sustainable and efficient kept Hugh on the board for 15 years. If Hugh had the choice, we think he would’ve stayed on longer, but retirement was calling—it was time for some peace and relaxation without the pressures of board activities. But that hasn’t stopped Hugh and Sylvia from supporting the water work yearly, increasing their giving as they witness the escalating threats.

Their hope for Georgian Bay and the Earth in general is that more, not fewer, Canadians care enough to raise their children with values that support community and caring for the environment so that organizations like GBF can continue to work on solving issues like pollution and invasive species.

In their parting words for this profile, Hugh and Sylvia both shared that “beautiful things need protecting, and each of us should strive to leave a place as good or better than the way Mother Nature made it”.



GBF IS PLEASED TO RECOGNIZE THE MEMBERS OF THE GEORGIAN BAY FOREVER CIRCLE

Honoring our loyal supporters for their cumulative donations of \$15,000 or more up to May 31, 2025

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"The Baykeeper" indicates that Georgian Bay Forever is a member of the Waterkeeper Alliance, a global movement of on-the-water advocates who patrol and protect over 100,000 miles of rivers, streams and coastlines in North And South America, Europe, Australia, Asia and Africa.

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Georgian Bay Spirit Company, Parry Sound Marine, Beacon Marine, and Swift Canoe and Kayak

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