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SUMMER 2017

LANDSCRIPT

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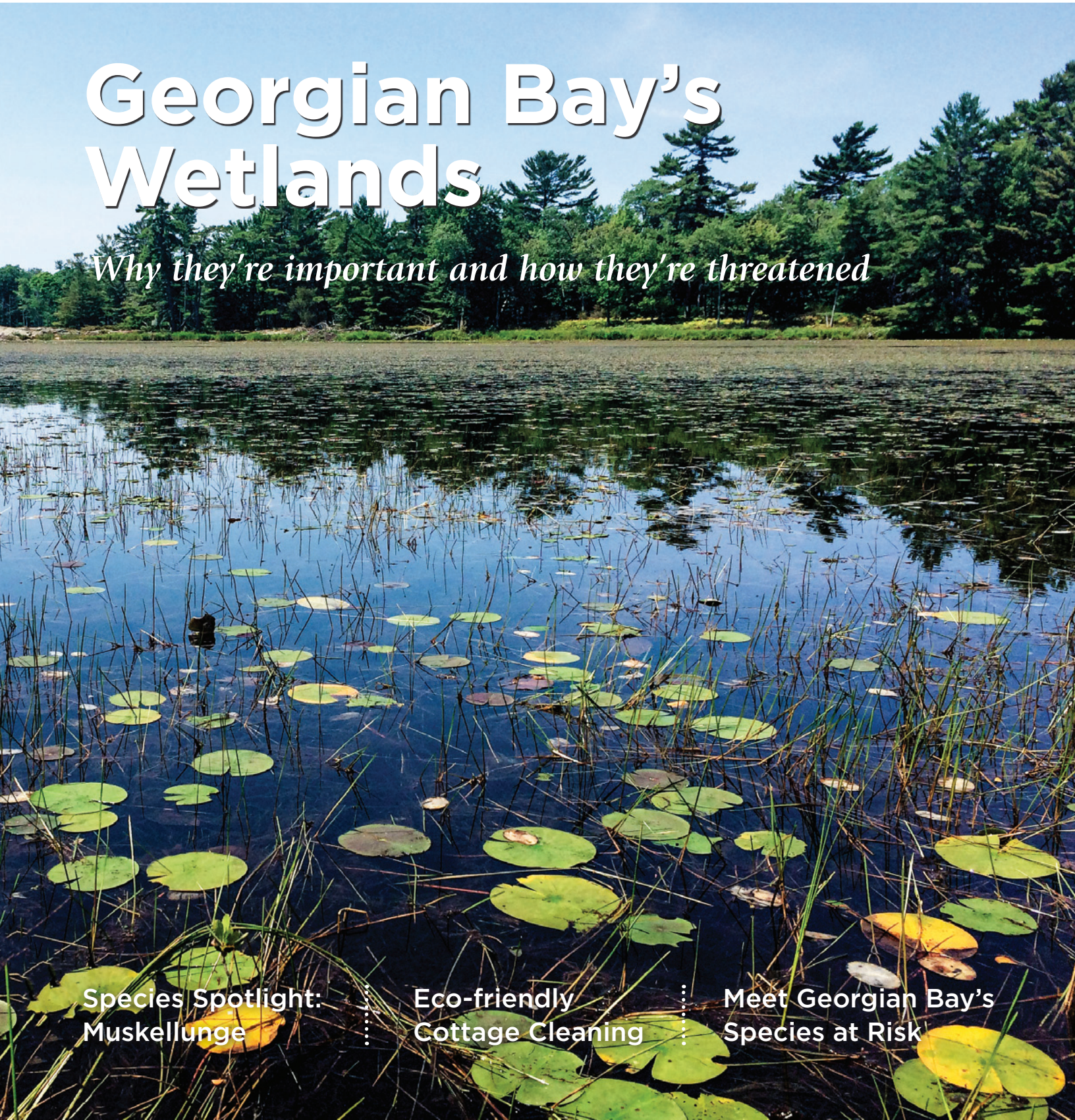

Georgian Bay's Wetlands

Why they're important and how they're threatened

Species Spotlight: Muskellunge

Eco-friendly Cottage Cleaning

Meet Georgian Bay's Species at Risk

Threats to aquatic habitat in coastal marshes of Georgian Bay:

Climate change, invasive species, and human impacts

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Port Severn Wetlands

Of the key ecosystem services provided by wetlands, one of the most important is the provision of habitat for numerous fish, birds, and wildlife species. Nowhere is this more important than in the thousands of pristine coastal marshes lining the shoreline of eastern Georgian Bay. What brings trophy-size fish such as the muskellunge and northern pike into these quiescent areas? What are they doing? How long do they stay? What else do we find there? These questions have consumed my students and me since 2003, and along the way, we have uncovered a few things about these magical places.

First, what makes wetlands such biodiversity hotspots? Wetlands occur at the interface between water and land, and therefore have both aquatic species (fish, water lilies, pondweeds) and terrestrial species (wet meadow plants, insects), as well as semi-aquatic species such as turtles and amphibians. A key component that maintains high biodiversity is the large inter-annual fluctuations in water levels that have varied by up to two meters between high and low water years over the past century. Since most wetland plants grow at an optimal water depth (for submerged or floating species) or soil wetness (for meadow/terrestrial species), as water levels go up or down, the plant communities must also shift with the shoreline accordingly. Repeated water-level cycles of five to seven years prevent any one group of plants from dominating the landscape. A healthy aquatic plant community consists of a diverse mix of submersed aquatic vegetation (pondweed and waterweed), floating species (lilies and water shield), and emergent plants (bulrush and cattails) that create a three-dimensional structure allowing small fish to hide from predators, and large fish to ambush their prey.

In 1999, when water levels dropped below the long-term mean, folks across Georgian Bay expected a correction the following year. But it did not happen the next year, nor the year after that, and when water levels remained below historic norms for 14 years, submergent and emergent plants migrated lakeward, while meadow species migrated towards the shoreline and colonized the previously submerged land. Within 10 years, the meadow and upland species like pine trees had become firmly established, and in some cases, where rock sills prevented water of Georgian Bay from flooding the wetland, aquatic habitats simply dried up. Just as suddenly, however, water levels rose above the long-term mean beginning in 2014 and have remained high over the past two years. Since 2015, we have been observing how coastal marshes recover when water levels rebound. The majority of the 40 or so wetlands we have visited thus far are still in very good health, as indicated by the Water Quality Index, which considers the relative amount of naturally occurring primary nutrients, water turbidity, and planktonic algae in water samples, and the Wetland Macrophyte Index, which considers the presence of pollution-intolerant plant species.

Blanding's Turtles, as well as many other species, call Georgian Bay's wetlands home

Despite the relatively good health of Georgian Bay wetlands, they are still faced with many current and pending threats. Human impacts, invasive species, and climate change all have the potential to disturb or disrupt the function of coastal marshes. Shoreline modifications by humans continue to be a threat; these include construction of docks, boathouses, hardened shorelines, artificial beaches and the associated removal of wetland vegetation that in turn compromises habitat quality. Certainly future development must strike a balance between recreational uses and habitat quality so as not to diminish the integrity of the natural environment that makes Georgian Bay so appealing in the first place.

Georgian Bay has also experienced several biological invasions in recent years. The round goby has spread throughout Georgian Bay over the last decade. We saw them in abundance in our nets for the first time in 2005 in Severn Sound. Its high reproductive rate, and voracious appetite (on dreissenids (zebra and quagga mussels)) has allowed it to spread rapidly in wetlands of Lakes Erie and Ontario. Their impact on wetlands of eastern Georgian Bay appears to be limited, but they are being used as a prey item by some fish species, and this may lead to avian and fish kills from dreissenid-mediated botulism poisoning that have been reported in Nottawasaga Bay. When we sampled wetlands 10 or more years earlier, most of the wetlands were free of gobies, whereas now they are present in nearly all sites although not necessarily in abundance.

Notable invasive plants include Eurasian milfoil and the common reed *(Phragmites australis ssp. australis)*. Eurasian milfoil is an aquatic species that can form large, dense patches in the water column of wetlands, and limit the foraging ability of resident fish species. *Phragmites* is a relatively recent invader that has spread throughout the province into coastal wetlands, and along highway and roadway corridors. An aggressive competitor, *Phragmites* is an emergent plant with showy seed heads that can spread by seeds or via underground stems. Its tendency to form tall dense stands makes it particularly devastating for migratory semi-aquatic species such as the Blanding's turtles. Our research in a Lake Erie wetland showed that *Phragmites* accounted for up to 170 ha (13%) of lost habitat to Blanding's turtles. Given that many wetlands in

Port Severn Wetland, protected by the Georgian Bay Land Trust

Georgian Bay are small (< 2 ha), it is frightening to imagine what the establishment of common reed could do within the Biosphere Reserve. All of these threats are compounded by the effects of a changing climate. Shifts in seasonality, timing and duration of seasons, precipitation, and water levels all have the potential to directly and indirectly affect the functioning and quality of wetland habitats. The shift away from historic, normal conditions may affect the resilience of Georgian Bay's wetlands and open the door for future invaders or facilitate the spread of those already present.

Our ongoing research on muskellunge highlights how the prized fishery has also been affected by these threats. While trophy-caliber adults continue to be captured in Georgian Bay, we have been unable to find any muskellunge young-of-the-year (YOY) at historically confirmed muskellunge nursery areas in the Severn Sound area. We surveyed wetlands in this area during 2012 and 2013, towards the end of the sustained low water period. We know that adult muskellunge return to spawn at the same sites each year and have found adult muskellunge near these sites during spawning season. Our surveys reveal that the wetland vegetation community had changed from historic conditions, with less diverse species composition and less complex structure. This a serious impediment for the survival of YOY muskellunge during their first year as they are very vulnerable to predators. They require suitable habitat structure to both hide from predators and to forage for prey. We also found an abundance of round gobies and yellow perch, both of which are documented egg predators. These changes appear to be linked to the presence of shoreline modification, and sustained low water levels that have been associated with global climate change. Further research should focus on accurate forecasts of water-level scenarios, understanding how wetland ecosystems may respond to new climate regimes, and developing adaptive strategies to manage these wetlands.