# LAKE HURON'S TURTLES

## *and the Coastal Wetlands They Call Home*

**The Lake Huron Centre for Coastal Conservation**

The Lake Huron Centre for Coastal Conservation is a non-government charitable organization established in 1998 with the goals of protecting and restoring Lake Huron's coastal environment, and supporting a healthy coastal ecosystem. The views expressed herein are solely those of the Lake Huron Centre for Coastal Conservation.

The Lake Huron Centre for Coastal Conservation gratefully acknowledges the contributions of Dr. Jacqueline Litzgus, Jeff Hathaway, Jory Mullen, Dr. Janice Gilbert, Devin Sturgeon, and Dr. Sue Carstairs to the development of this project.

Photos courtesy of Jory Mullen, John Jimmo, Scott Gillingwater, Patrick Moldowan, Dr. Janice Gilbert.

The following citation is recommended: Lawrie, R. E., 2017. Lake Huron's turtles and the wetlands they call home. Lake Huron Centre for Coastal Conservation.

This project was undertaken with the financial support of:

Environment and Climate Change Canada

Environnement et Changement climatique Canada

Bruce Power™

*Innovation at work*



226-421-3029 www.lakehuron.ca coastalcentre@lakehuron.ca

# Coastal Wetlands

## *Ecosystems of Wonder*

Great Lakes coastal wetlands have a direct hydrological connection to the Great Lakes and exist within 2km of the lakeshore. They are a unique wetland type found at the mouth of rivers and streams, or in open or protected bays along the shoreline. Along Lake Huron, they have developed along irregular, rocky coastlines, embayments, and shallow beaches. They often form in areas where offshore islands and shoals protect the shoreline from the high-wave energy of the lake. Along Lake Huron these wetlands can be coastal marshes, swamps, fens or bogs, with swamps and marshes being the most common. Each of these wetland types support different unique species of plants and animals, among them endangered and threatened plants, birds, reptiles, amphibians and fish that use coastal wetlands for all or part of their life cycles.

### *Types of Coastal Wetlands*

**Marsh**

90% of Great Lakes coastal wetlands are marshes. They are usually permanently flooded areas, with emergent, submerged, and floating-leaved aquatic plants, such as cattails, pondweeds, and water lilies.

**Swamp**

Swamps are common in southern Ontario, and are dominated by trees and shrubs, with limited drainage, and standing water. They tend to have neutral or slightly acidic soils.

**Bog**

Bogs are a peat-accumulating wetland type, which only receive water from rainfall or surface runoff. They have acidic soils and are low in nutrients. They often contain Sphagnum Moss.

**Fen**

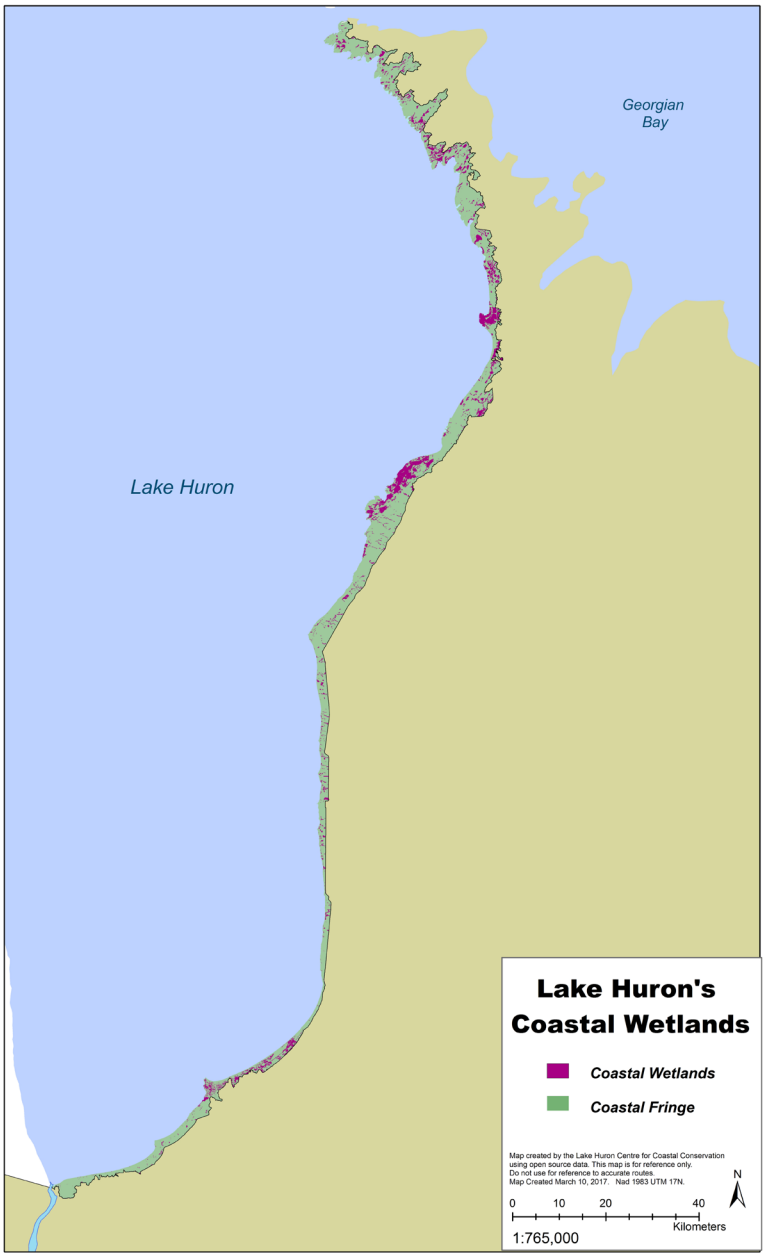
Fens are a peat-accumulating wetland type, and are fed from surface water or groundwater. They are less acidic than bogs and have a higher diversity of plant life, which can include orchids, sedges, grasses, and reeds. Over time a fen may transition into a bog.

### *What is a Wetland?*

*Wetlands are areas permanently or seasonally covered by shallow water, or where the water table is near the soil's surface, and can sustain hydrophytic vegetation .*

# Why Wetlands Matter

Coastal wetlands are critical to the well-being of the Great Lakes. Lake Huron's coastal wetlands were much more abundant than now and remain limited to a narrow corridor referred to as the Coastal Fringe (see map). Coastal wetlands provide us with a variety of benefits, called "ecosystem services". Wetlands improve water quality by filtering pollutants and excess nutrients from upstream sources, reducing the amount of algae blooms and beach closures caused by these factors. They also help to prevent flooding, by slowing the release of water during precipitation events and snow melt. They can reduce erosion, as plants collect and bind soil, and wave energy is absorbed. Wetlands have been called "natural infrastructure", because they reduce stress on built infrastructure including wastewater treatment plants and municipal water treatment systems.




Many unique species of plants and animals rely on coastal wetlands to survive. The warm, shallow, food-rich waters provide habitat for birds, fish, reptiles (such as turtles), and amphibians. Lake Huron's fishing industry depends on coastal wetlands, with at least two-thirds of Great Lakes fish using wetlands to reproduce. Recreational opportunities are abundant, including fishing, bird watching, canoeing, and kayaking.

As our climate changes, we will experience more frequent and intense storms, increased wave and wind severity, flooding, and pollution and sedimentation from increased runoff. Maintaining healthy coastal wetlands will mitigate these threats and allow us to be more resilient to change.

### *Wetland Benefits*

- Flood reduction
- Filter pollution and nutrients
- Reduce erosion
- Groundwater recharge
- Carbon storage in soil and vegetation
- Recreational opportunities
- Educational opportunities
- Habitat for wildlife

There are many ecological benefits to having a wetland on your property, and there are also many financial incentives available to keep or build wetlands on your property. The Conservation Land Tax Incentive Program (CLTIP), through the Government of Ontario, allows landowners to qualify for property tax exemptions for land that has important natural heritage features, including coastal wetlands.

There are also programs funded through your local Conservation Authority and Ducks Unlimited Canada to build or expand existing wetlands on your property to provide habitat and water quality function. These programs are often available at no cost to the landowner.

### *Know Your Land*

*Learn what type of wetland you may have on your property, and how you can best protect its health and integrity.*

# Lake Huron's Turtles Are At Risk

There are 8 species of turtles in Ontario, and most of these can be found on Lake Huron. 7 of these turtle species are considered species at risk. Species at risk are classified into 4 categories, based on the degree of risk they face, and these species are protected by federal and provincial laws. In Ontario they are protected by the Endangered Species Act, and federally they are protected by the Species at Risk Act. These Acts prohibit killing, harming, harassing, capturing, taking, possessing, transporting, buying, selling, leasing or trading an endangered or threatened species, and also make it illegal to damage or destroy their habitat.

*Most Ontario turtles are protected species. Report poaching or other illegal activity to the Ministry of Natural Resources and Forestry at 1-877-TIPSMNR (847-7667)*

**Extirpated**
A species that was found at one time in the wild in a particular geographic area (e.g. Canada, Ontario), but is no longer found in that area.

**Endangered**
A species facing imminent extinction or extirpation.

**Threatened**
A species that is likely to become endangered if conservation efforts are not undertaken.

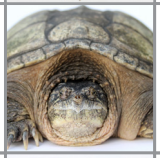
**Special Concern**
A species that may become threatened or endangered, due to identified threats and the species' biological characteristics.

# Why Turtles Matter

Turtles are an important part of Lake Huron's coastal ecosystems. They scavenge on dead fish, consume large amounts of aquatic vegetation reducing plant biomass, and create channels through vegetation that fish and amphibians use. Turtles play an important role in the transfer of nutrients from water to land, and their eggs and hatchlings are important sources of food for mammals such as raccoons, skunks, foxes, coyotes and opossums. The presence of turtles is an indicator of a healthy aquatic ecosystem which benefits humans as well.

### *Did You Know?*

Snapping Turtles evolved their "snap" as a defensive behaviour since their plastron (bottom of their shell) is smaller than most other turtles. They are not able to retreat into their shell. They feel especially vulnerable on land so they are much more likely to snap on land than in water. While a bite can be painful, their bite force is generally exaggerated.

| | Common Name | | Scientific Name | Provincial Status | Federal Status |
|---|---|---|---|---|---|
| Lake Huron Species | Spotted Turtle |  | *Clemmys guttata* | Endangered | Endangered |
| | Blanding's Turtle |  | *Emydoidea blandingii* | Threatened | Endangered |
| | Spiny Softshell Turtle |  | *Apalone spinifera* | Threatened | Endangered |
| | Northern Map Turtle |  | *Graptemys geographica* | Special Concern | Special Concern |
| | Eastern Musk Turtle |  | *Sternotherus odoratus* | Special Concern | Special Concern |
| | Snapping Turtle |  | *Chelydra serpentina* | Special Concern | Special Concern |
| | Midland Painted Turtle |  | *Chrysemys picta marginata* | Not Assessed | Not Assessed |
| | Wood Turtle |  | *Glyptemys insculpta* | Endangered | Threatened |

# Threats to Wetlands and Turtles

Over two-thirds of original wetlands in the lower Great Lakes basin have been lost, and will continue to be lost if conservation efforts are not increased. As the number of wetlands shrink, the importance of remaining wetlands becomes even greater. The amount of stress placed on these remaining wetlands also increases, escalating the likelihood of wetlands becoming over-toxified and polluted.

Due to their local importance for habitat and ecosystem function, and their global rarity, it is necessary to protect coastal wetlands, and maintain their area. Great Lakes coastal meadow marsh communities are identified as globally imperiled and are distributed along the Lake Huron coast in areas such as Oliphant, Baie du Dore, and Dorcas Bay.

The reduced number of coastal wetlands adds to the stress on turtles already created by human caused threats. These factors add to a life history for turtles which includes a low reproductive success rate. Depending on the species, turtles may take up to 24 years to reach reproductive maturity and may live well over 100 years. Turtles have low egg and juvenile survival rates, with an estimated 0.1% of hatchlings surviving to maturity in some species. It could take over 1,000 eggs for an adult turtle to replace itself, meaning it could take many decades to replace adults lost from an area.

# Threats to Wetlands and Turtles

## Invasive Species

An invasive species is a species that is not native to Ontario, and is harming or likely to harm the natural environment. Invasive species are a significant threat to the biodiversity of Lake Huron, and can have devastating effects on native species and their habitat. At least 185 non-native species have become established in the Great Lakes basin. The 2015 Ontario Invasive Species Act provides the power to make regulations to further prevent the spread of these species. Without any natural predators or controls invasive species can establish and spread very quickly, outcompeting native fish and wildlife for resources, and creating unbalanced ecosystems. Once they become established they can be extremely difficult and costly to control.

### *You Can Help!*

- Learn to identify invasive species that are a threat to Lake Huron
- Plant native species in your garden
- Never release live fish from one waterbody into another
- Clean boating equipment and hiking shoes before moving to a new area
- Never release aquarium plants into waterways

## Non-native Turtles

The introduction of non-native wildlife can have a drastic effect on turtles. One example involves the release of exotic turtles in natural environments, such as Red-eared Sliders (*Trachemys scripta elegans*), a popular pet species. Releasing these turtles can result in the transmission of diseases to native turtle populations and can create competition for basking and feeding sites. Non-native species may also prey upon native species in large numbers, or hybridize with native populations.

### *Pet Turtles Don't Belong in the Wild!*

Remember that pet turtles, like the Red-eared Slider can grow over 30cm long, and live over 30 years! If you must give up your pet, contact your local humane society or rescue.

# Threats to Wetlands and Turtles

## *Phragmites australis* (European Common Reed)

*Phragmites australis* has been named Canada's worst invasive plant and control methods should be immediately taken if it moves into a coastal wetland. This aggressive non-native invasive grass has become widespread throughout southern Ontario. *Phragmites* can grow up to 5m in height, can outcompete other plant species, and develop into a dense monoculture stand with up to 200 stems per square metre. One of the ways it can spread is through driving vehicles off-road where they can pick up seeds or root fragments and transport them to other areas. Impacts on coastal wetlands include changes to hydrology, nutrient cycling and loss of habitat. *Phragmites* alters the habitat of nesting turtles by affecting the nest temperature as it shades out ideal nesting sites. The plant can get matted as it entangles with other stems, and turtles may become trapped. Blanding's Turtles and Spotted Turtles, both Endangered species, are the most vulnerable to *Phragmites*.

Turtles rely on open, unshaded areas to nest, and an area the turtle determines to be suitable for nesting when the eggs are deposited can quickly become unsuitable due to *Phragmites*. Turtle eggs require a specific temperature and level of moisture, and *Phragmites* can change both of these in an area where it has become established. It can reduce the insulating snow cover on nests, making survival difficult for hatchlings that overwinter in their nest. The roots of the plant may even grow through the nest, destroying it.

Once established, *Phragmites* is incredibly difficult and expensive to control. It is critical that communities learn to identify invasive plants such as *Phragmites*, and immediately take action to prevent them from becoming established in coastal areas.

# Threats to Wetlands and Turtles

## Controlled Water Levels

Fluctuating water levels are essential to the health of coastal wetlands. Wetlands are ecosystems that thrive and depend on changing water levels. Lake Ontario and Lake Superior's water levels have been regulated for many decades to facilitate shipping and hydroelectric power demands. Fortunately for Lake Huron coastal wetlands, our Lake Huron water levels are not regulated. Regulation can change the water chemistry, wave action, acidity, temperature, nutrient cycling, vegetation, and fish and wildlife communities. When water levels are low and soils are exposed, buried seeds are able to germinate, increasing the diversity of plants growing. These changes to water levels creates the open water conditions commonly found in wetlands. Many plants and animals are adapted to, and depend on a highly changeable wetland environment. Fish and wildlife communities depend on coastal wetlands to survive.

## Boating & Fishing

Recreational boating is a serious threat to turtles, which can be struck and killed by powerboats. Turtles regularly come to the surface to breathe and may even bask in warmer waters by floating close to the surface. Boat propellers cause a number of injuries and deaths each year, especially to species such as the Eastern Musk Turtle which tend to bask in shallow water and are difficult to see due to their small size. Reducing speed and prohibiting powerboats in known turtle habitat is recommended to address this threat.

Since turtles often consume dead fish they can accidentally ingest fishing hooks, or they are sometimes hooked directly by anglers. Commercial fishing nets are also a significant threat, since they are usually fully submerged and captured turtles may drown.

# Threats to Wetlands and Turtles

## Illegal Collection and Trade

The harvesting of turtles can have a tremendous negative impact on a population, since turtles take so long to reach adulthood and have low reproductive success. Until recently, the hunting of Snapping Turtles was legal under certain conditions in Ontario. Hunting Snapping Turtles often led to other species, such as the Northern Map Turtle, being captured accidentally, and illegal harvesting of several other species has been documented.

Turtles are also collected illegally for the pet trade, leading to population decline, since removing even one adult turtle can have a significant impact on the population's ability to survive.

## Habitat Loss and Degradation

The loss of wetlands is a significant threat to turtles. As pockets of habitat for turtles become smaller, and barriers between them become greater, turtle populations become isolated. This fragmentation can cause populations to become more vulnerable to disease, deformities, and have reproductive issues. Their populations become less resilient to challenges and change. Fragmentation can also reduce the number of hibernation and nesting sites. Turtles often display hibernation and nest site fidelity, which means they return to the same site each year. Development may also lower groundwater tables, change the hydrology of an area, and compact the soil, making habitats unsuitable for nesting.


Shoreline development can make habitats unusable for certain stages of turtles' life cycle. For example riprap or concrete walls installed along shorelines can reduce nest site availability and act as a barrier to movement. It is critical when planning development to preserve suitable habitats that are large enough to meet the needs of local turtle populations, and consider impacts to the connectivity between suitable turtle habitats.

# Threats to Wetlands and Turtles

## Contaminants and Litter

Due to their long lifespan and their important role in the food chain, turtles can absorb or "bioaccumulate" many toxins. Studies have shown that turtles can maternally transfer contaminants such as metals to their eggs, and in some species, this can have negative impacts on their reproduction, causing deformities in embryos or causing male turtles to become feminine. Pollution may also kill food sources for turtles, such as the molluscs that Northern Map Turtles feed on.

***You Can Help!***

Organize or participate in a shoreline cleanup in your area. For more information contact the Lake Huron Centre for Coastal Conservation.

Nutrients and pathogens from nearby cottage septic systems may be entering the groundwater that flows to the lake. As cottage development increases, this concern could escalate, so septic inspection programs are highly encouraged. Lawn and garden fertilizers can also contribute to nutrient loading and should not be used in close proximity to waterbodies like Lake Huron.

Plastic pollution is an emerging issue on Lake Huron, and is a threat to the health of the Great Lakes. Turtles can be harmed by this, and other types of garbage. There is no reason to believe that plastic pollution impacts on Lake Huron are any different from other marine environments where it has been documented that turtles may ingest smaller pieces of litter, or become tangled in larger pieces, such as shopping bags or nets, causing them to drown or develop deformities.

# Threats to Wetlands and Turtles

## Roadways and Motorized Vehicles


The construction of roads and drainage ditches can alter the way water moves through an area, affecting the processes that are critical for coastal wetlands to thrive. Roads also have a significant impact on water quality through inputs of road salt, and contamination from surface runoff. Wildlife populations are less able to survive when road density increases.

The annual road mortality rate for turtles is high, particularly on roads located near wetlands. Some of our turtle species, such as the Blanding's Turtle, may travel up to 6 km in search of nesting habitat. In southern Ontario, one cannot travel more than 1.5 km without crossing a road, so turtles may have to cross several roads to reach their nesting site. Research has shown that it takes some species of turtles an average of 9 minutes to cross a road, making them particularly vulnerable to road mortality during nesting season, from May to July. Female turtles may even create their nests on the shoulders of roads, which can then be destroyed during road maintenance, such as grading.

The installation of roadway mitigation measures like eco-passages is becoming more common. An eco-passage is a fencing and culvert system that provides small animals with a safe way to cross under a road, reducing roadkill. Other solutions can include posting turtle crossing signs and seasonally reduced speed limits to help combat this issue, especially in areas where road mortality is high. It is critical that the needs of Lake Huron's species at risk be taken into consideration in road design and improvement projects.

# Threats to Wetlands and Turtles

## Off-Road Vehicles

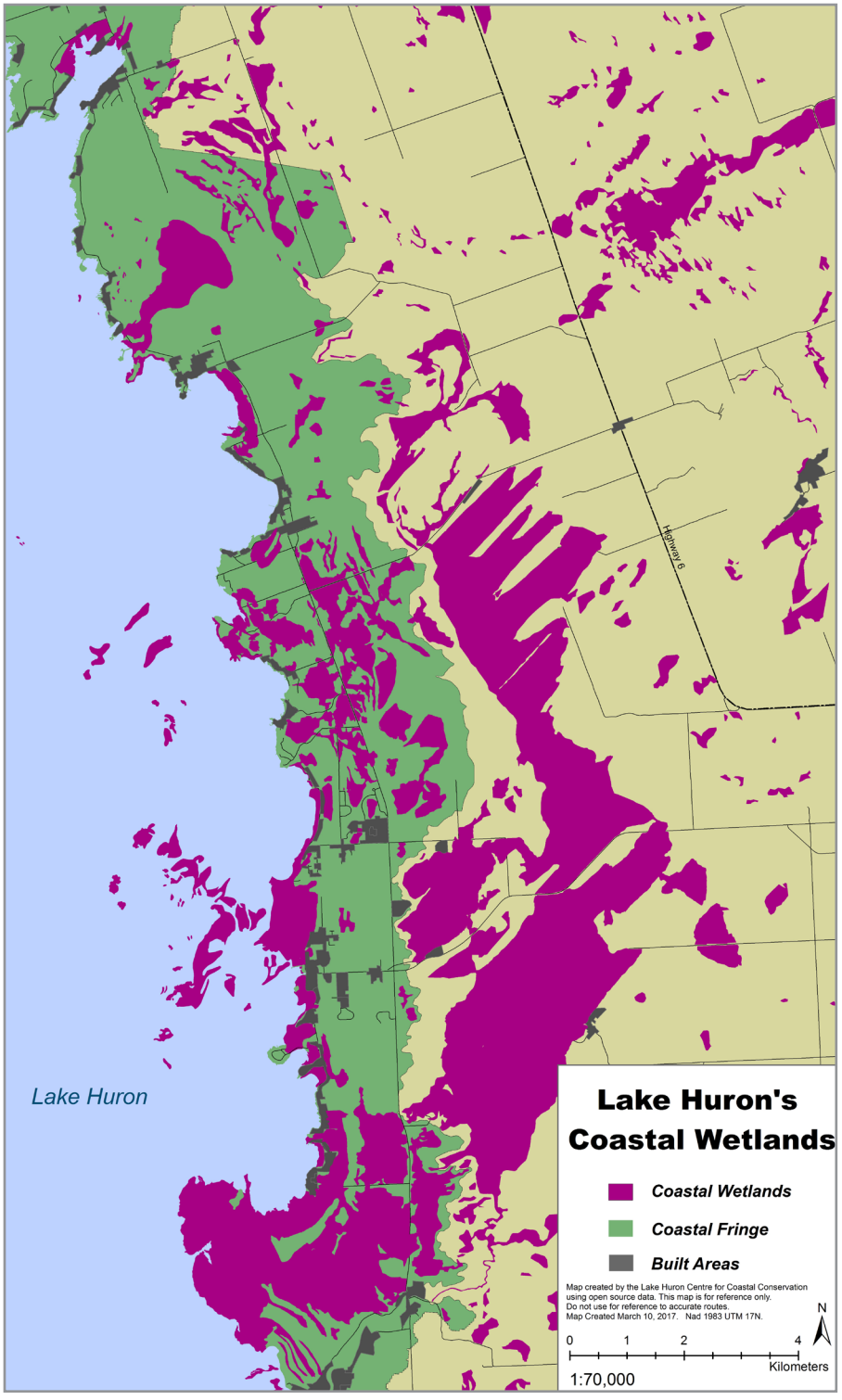
Off-road vehicles, including ATVs and dirt bikes, have a significant impact on turtles. Off-road vehicles travelling in shoreline areas can result in crushing of turtles, including adults and juveniles. In areas where trails are located near nesting sites, females are at great risk of being disturbed, hit, or killed by these vehicles. Turtle nests are also in danger of being crushed. In areas where there are no trail systems, it is recommended that a network of designated trails for off-road vehicles be developed in less sensitive areas to provide users with suitable alternatives.

Off-road vehicles damage vegetation, increase erosion, introduce invasive species to remote areas, and can change the hydrology of an area. Shorelines, including coastal wetlands, beaches and dunes, are particularly vulnerable to off-road vehicles. It is recommended that By-Laws be created and enforced that prohibit off-road vehicles from being used on shorelines. In areas where property owners must use off-road vehicles to access their cottages during low water levels, it is recommended that clearly identified designated access routes be established to minimize disturbance to the wetlands.

MOTORIZED VEHICLES DON'T BELONG IN WETLANDS!

# Highlight on Oliphant Wetlands

Oliphant is a small Lake Huron community situated within the Town of South Bruce Peninsula. The coastal meadow marshes located here, on the landward side of the Fishing Islands are unique and have many rare species, including several species at risk. The Piping Plover (Endangered), Dwarf Lake Iris (Threatened), Tuberous Indian Plantain (Special Concern), Massasauga Rattlesnake (Threatened), Monarch Butterfly (Special Concern), and several species of turtles call the Oliphant coast home.



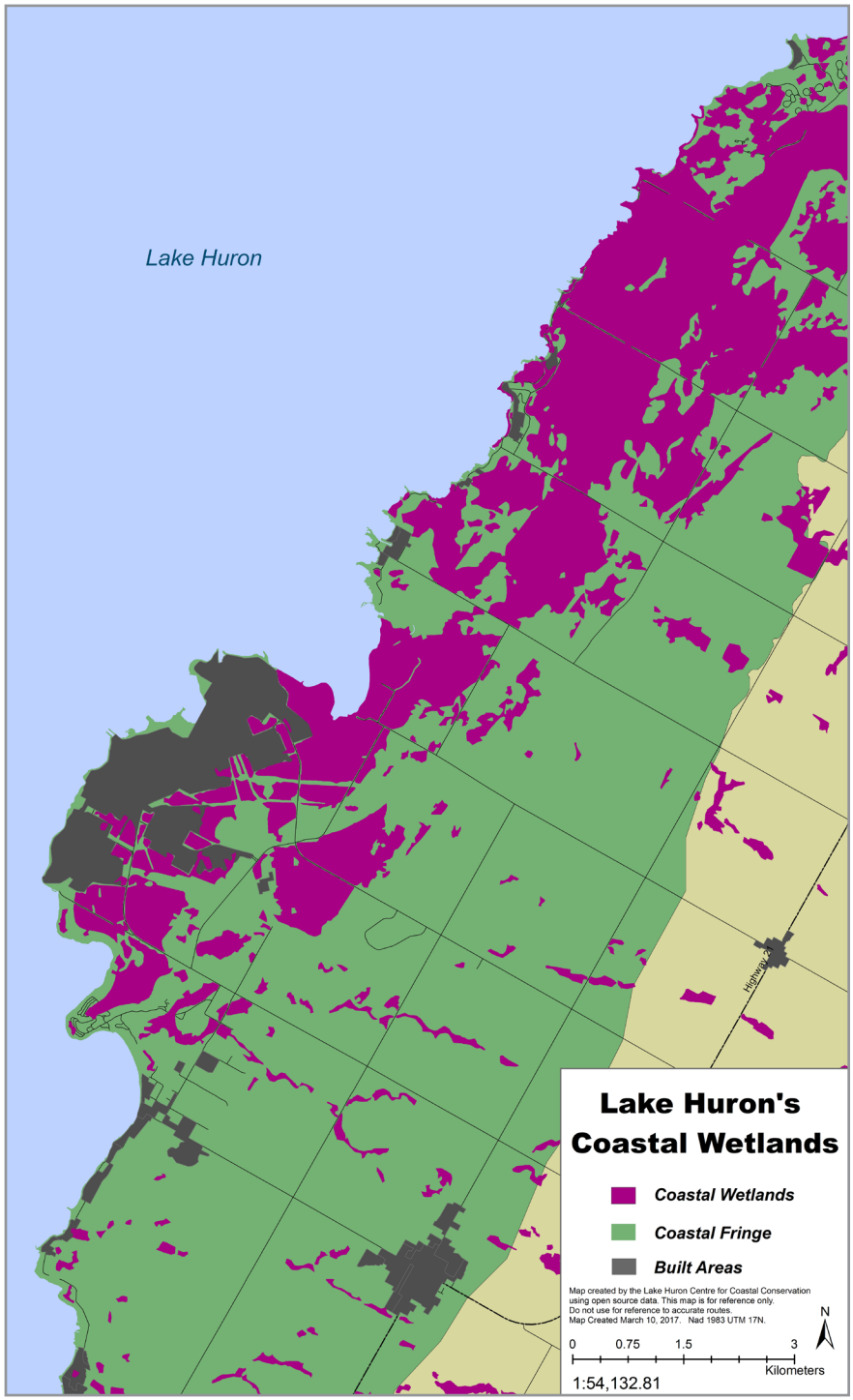

The gentle slope of the shore at Oliphant is very sensitive to lake level fluctuations. For example a 30 centimetre change in lake water levels can cause 200 to 300 metres of shoreline to flood or become exposed. During low water levels, driving of motorized vehicles in the coastal areas of Oliphant has increased, becoming one of the most destructive impacts to these globally rare ecosystems. Vehicles compact the soil, destroy vegetation, and leave ruts and ditches which channel water and change the moisture regime. The shallow nature of the seedbanks at Oliphant make them very sensitive to compaction, and wildlife nests can be destroyed by vehicles. The future sustainability of the wetlands can be affected by vehicle impacts.

The numerous vehicle trails leading from the land into the water far exceed those needed to provide access to island cottages during low water levels. Island access should follow specific marked access trails to reduce damage to the shore. In addition, vehicles often park on unsuitable areas of the shoreline, killing sensitive vegetation. Appropriate parking facilities should be established to preserve the integrity of the coastal meadow marsh and local species at risk.

Other threats to the globally rare wetlands at Oliphant include development related impacts, cottage encroachment onto the shore, and the spread of invasive plant species, such as *Phragmites australis*.

# Highlight on Baie du Dore Wetlands

The northern coast of the Municipality of Kincardine is very biologically diverse, with a high number of native plant and animal species. The coastal wetlands of Kincardine are located north of the Bruce Nuclear Generating Station to MacGregor Point Provincial Park. These wetlands are identified by the Ministry of Natural Resources and Forestry as a 'Class 2 Provincially Significant Wetland', and are home to many species at risk, including the American White Pelican (Threatened), the Eastern Ribbonsnake (Special Concern), the Bald Eagle (Special Concern), and several species of turtles. These wetlands are a birder's paradise, due to the location being a migratory flyway, and local naturalists have built a viewing platform to observe birds and other wildlife.




Major threats identified in this area are the spread of the aggressive invasive plant *Phragmites australis* (European Common Reed), and off-road vehicles. These vehicles damage vegetation, increase erosion, spread invasive vegetation, and can change the hydrology of an area. Shorelines, including coastal wetlands, beaches and dunes, are particularly vulnerable to off-road vehicles. Recreational vehicles, like ATVs and snowmobiles, should not be permitted to operate along the Municipality of Kincardine's shorelines. Community education about the sensitive nature of shore ecosystems, and the need to use ATVs only within designated areas of the municipality should be considered.

# Top Ways to Help Turtles & Their Habitat

## Top 5 Ways to Help Turtles

1. Report turtle sightings to the Ontario Reptile and Amphibian Atlas. Even if the turtle is injured or dead, this is critical information. Visit ontarionature.org/atlas.
2. Watch for reptiles and amphibians when driving between May and September. Help turtles to cross the road, in the direction they are moving, when safe to do so.
3. Remember that most Ontario turtles are protected species. It is illegal to kill, harm, harass, possess, buy, sell or trade them. Report illegal activity to the Ontario Ministry of Natural Resources and Forestry at 1-877-TIPSMNR.
4. Take care when boating to avoid collisions with turtles.
5. Encourage municipal council to install turtle crossing signs, and eco-passages under roads.

## Top 5 Way to Protect Turtle Habitat

1. Keep motorized vehicles away from beaches and coastal wetlands.
2. Participate in beach and shoreline cleanups.
3. Learn to identify and remove invasive plant species, such as *Phragmites australis*.
4. Keep natural vegetation along shorelines and participate in shoreline restoration projects.
5. Avoid releasing pet turtles into the wild.

# Be a Turtle Crossing Guard

## How to Help a Turtle Cross the Road

- Watch for reptiles and amphibians when driving between May and September.
- Always move turtles in the direction they are travelling.
- For most turtles you can pick them up by the sides of their shell. Never grab a turtle by its tail.
- Snapping Turtles can be grasped by their shell above their hind legs and moved like a wheelbarrow, or they can be carried like a tray of drinks, with your dominant hand supporting them from underneath. They can also be moved by placing them on a car mat and dragging the mat across the road.
- Note the location and report the sighting to the Ontario Reptile and Amphibian Atlas (ontarionature.org/atlas).
- Do not risk your own safety.

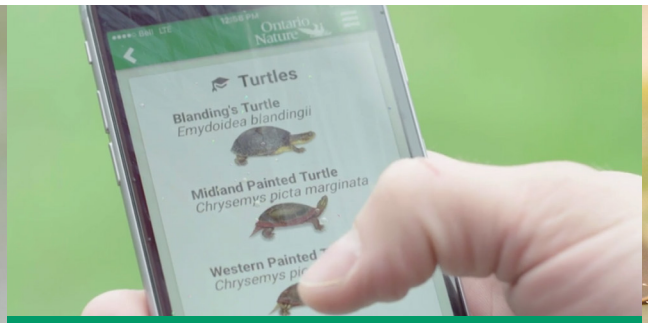
## How to Help an Injured Turtle

- Contact the Ontario Turtle Conservation Centre, home of the Kawartha Turtle Trauma Centre. They treat and release injured turtles and have a network of volunteer "Turtle Taxi" drivers.
- Place the turtle in a dry, secure container with air holes, and keep the turtle in the shade.
- Do not give the turtle any food or water.
- Try to limit handling, and wash your hands afterwards.
- Note the location where the turtle was found and report the sighting to the Ontario Reptile and Amphibian Atlas.
- Even if the turtle is dead report it to the Ontario Turtle Conservation Centre. Eggs may be recovered.

*If you find an injured turtle contact the Ontario Turtle Conservation Centre at* ***705-741-5000***

# Turtle Tracking

Reporting sightings of any species of Ontario reptiles or amphibians is very helpful to protect them for the future. The Ontario Reptile and Amphibian Atlas is a citizen-science project that tracks distributions and spatial trends of reptiles and amphibians across the province over time. You can easily report sightings through their smartphone app, email, mail, or their online form.




**Report turtle sightings to the Ontario Reptile and Amphibian Atlas!**

**Visit:**

***www.ontarionature.org/atlas***

## References


Bolton, R. M., & Brooks, R. J. (2010). Impact of the Seasonal Invasion of Phragmites australis (Common Reed) on Turtle Reproductive Success. Chelonian Conservation and Biology, 9(2):238-243.

Canadian Wildlife Service. (2002). Great Lakes Coastal Wetlands - Science and Conservation.

City of Ottawa. (2013). Blanding's Turtle Needs Assessment . Retrieved from http://www.renaud.ca/public/SAR/2013_Blandings_Assessment/2013-3smh_blandingsassessment_Chapter%203.pdf

COSEWIC. (2016). Wildlife Species Definition and Status Categories. Retrieved from http://www.cosewic.gc.ca/default.asp?lang=En&n=698DCDDB-1

Environment and Climate Change Canada. (2016). Management Plan for the Snapping Turtle (Chelydra serpentina) in Canada [Proposed]. Species at Risk Act Management Plan Series, iv + 39 p. Retrieved from Species at Risk Act Management.

Hopkins, W. A. (2017). Maternal Transfer of Mercury in Turtles. Retrieved from http://www.ecophys.fishwild.vt.edu

Lake Huron Centre for Coastal Conservation. (2010). Oliphant Coastal Stewardship Plan. Retrieved from https://www.lakehuron.ca/stewardship-plans-and-guides

Lake Huron Centre for Coastal Conservation. (2011). Kincardine Coastal Stewardship Plan. Retrieved from https://www.lakehuron.ca/stewardship-plans-and-guides

Lake Huron Centre for Coastal Conservation. (2012). Lake Huron's Coastal Wetlands, Ecosystems of Wonder. Retrieved from https://www.lakehuron.ca/coastal-wetlands

Liipere, S. (2014). Community Conservation and Stewardship Plan for the Bruce Peninsula. Bruce Peninsula Biosphere Association.

MacCulloch, R. D. (2002). ROM Field Guide to Amphibians and Reptiles of Ontario. ROM/McClelland & Stewart.

Ontario. (2015). Invasive Species Act. Retrieved from https://www.ontario.ca/laws/statute/s15022

Ontario Nature. (2016). Ontario Reptile and Amphibian Atlas Program. Retrieved from https://www.ontarionature.org/protect/species/herpetofaunal_atlas.php

Ontario Nature. (2016). Reptiles and Amphibians of Ontario. Retrieved from https://www.ontarionature.org/protect/species/reptiles_and_amphibians/index.php

Ontario Road Ecology Group, Toronto Zoo. (2010). A Guide to Road Ecology in Ontario, prepared for the Environment Canada Habitat Stewardship Program for Species at Risk. Retrieved from https://www.rom.on.ca/sites/default/files/imce/oreg_final.pdf

Ontario's Invading Species Awareness Program. (2017). Invaders. Retrieved from http://www.invadingspecies.com/invaders/

Rasmussen, M. L., & Litzgus, J. D. (2010). Habitat Selection and Movement Patterns of Spotted Turtles (Clemmys guttata): Effects of Spatial and Temporal Scales of Analyses. Copeia (1).

Storey, K. B., Storey, J. M., Brooks, S. P., Churchill, T. A., & Brooks, R. J. (1988). Hatchling turtles survive freezing during winter hibernation. Physiological Sciences (85).

the Coastal Centre

**The Lake Huron Centre for Coastal Conservation**

*Baie Du Dore, Lake Huron*