LAKE SUPERIOR CANADIAN NEARSHORE Assessment

2020 HIGHLIGHTS REPORT

Canada

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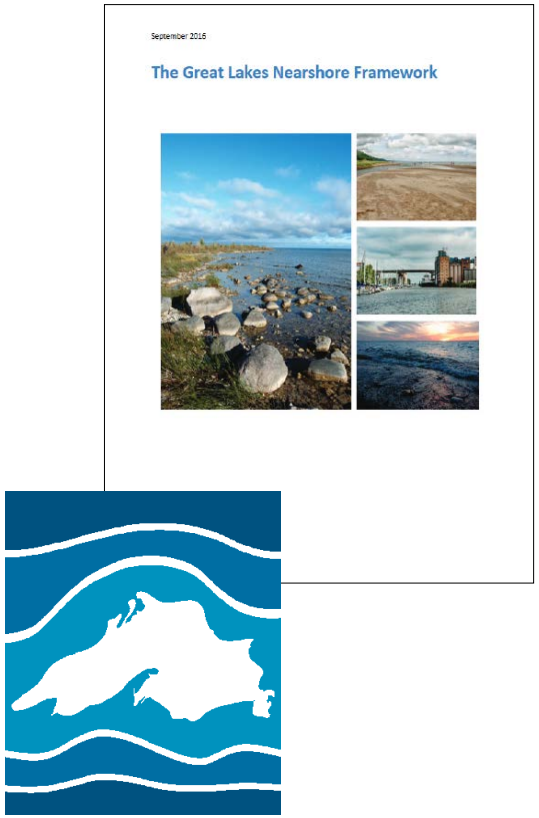


This document supports Canadian commitments in the 2012 Great Lakes Water Quality Agreement.

The Great Lakes Water Quality Agreement, 2012. Environment and Climate Change Canada and the United States Environmental Protection Agency, 2012.
https://binational.net/wp-content/uploads/2014/05/1094_Canada-USA-GLWQA-_e.pdf

The Great Lakes Nearshore Framework, Environment and Climate Change Canada and the United States Environmental Protection Agency, 2016.
https://binational.net/wp-content/uploads/2016/09/Nearshore-Framework-EN.pdf

Report prepared by: Janette Anderson, Julia Hatcher, Jody McKenna and Jocelyn Sherwood, Environment and Climate Change Canada. Many thanks go to the individuals and agencies who provided data, advice and reviews of this first nearshore assessment of Lake Superior. This assessment would not be possible without the contributions from: Mary Thorburn, Satyendra Bhavsar, and Ashleigh Boucher (the Ontario Ministry of Environment, Conservation and Parks); Dr. Lee Grapentine (ECCC); Dave Gondar (the Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry); Richard Stumpf (National Oceanic and Atmospheric Administration); Peter Zuzek and Kevin Grootendorst (Zuzek Inc.) and ECCC program staff. Supporting Documents and Data Sources are listed at the end of this document.

OVERALL ASSESSMENT OF THE STATE OF NEARSHORE WATERS Resources

Lake Superior Canadian Nearshore Assessment, 2020 Results.
Cat. No.: En164-71/4-2020E-PDF ; ISBN: 978-0-660-39158-8

Canadian Great Lakes Nearshore Assessment, Detailed Methodology.
Cat. No.: En164-71/1-2021E-PDF; ISBN: 978-0-660-39154-0

Assessment data available from Government of Canada
Open Data: https://open.Canada.ca/en/open-data

The Great Lakes Nearshore Framework

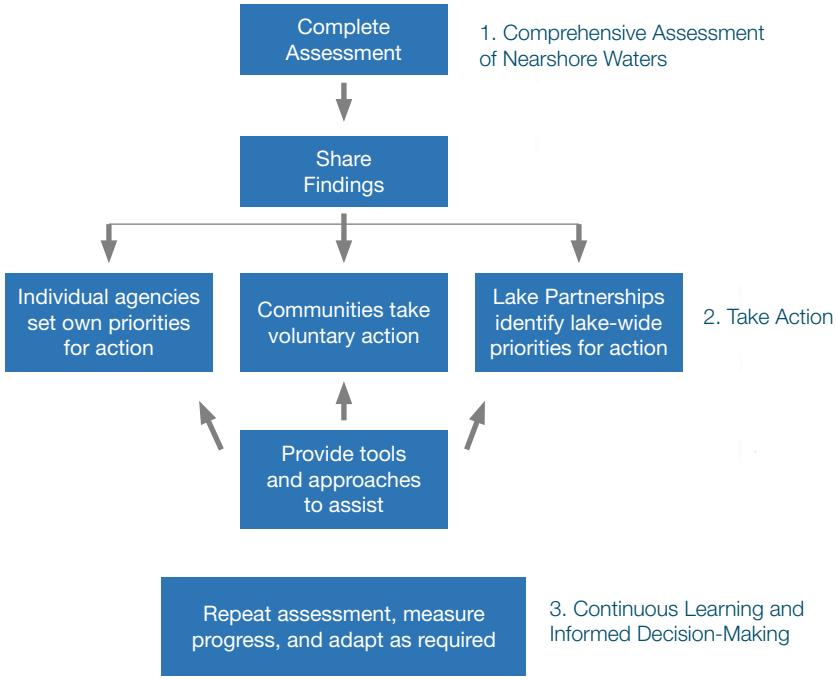
The Nearshore Waters

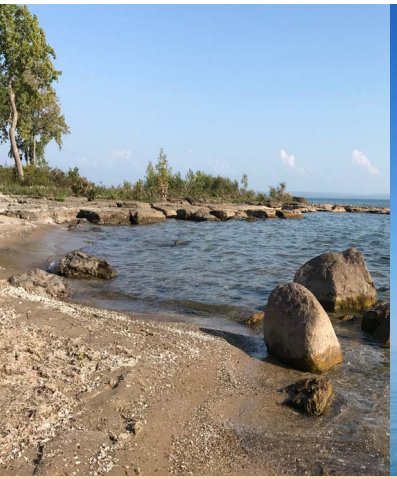
The waters of the Great Lakes, together with their 16,000 kilometres of coastline, connecting river systems and watersheds are globally significant ecosystems. Nearshore areas are a key priority for restoration and protection because they are the source of drinking water for most communities within the basin, are the areas of the lakes where most human recreation (*e.g.*, swimming, boating, fishing, wildlife viewing) occurs, and are the critical ecological link between watersheds and the open waters of the Great Lakes.

About the Framework

As envisioned by the updated Great Lakes Water Quality Agreement (GLWQA) of 2012, Canada is implementing a "Nearshore Framework" to provide a cumulative effects assessment of nearshore waters; share the information from the assessment; identify areas that would benefit from protection, restoration or prevention activities; and identify causes of impairment and threats. Data used in the assessment came from existing monitoring programs, from a range of partners, and varied in type, format and resolution. Key considerations in the selection of data were the spatial and temporal resolution, availability of the data, and amount of processing required. Using a weight of evidence approach, disparate data that traditionally has been evaluated separately was integrated into the first cumulative assessment of the Lake Superior Canadian Nearshore. Through the sharing of these assessment results and with added detailed local information from communities and organizations, users can set their own priorities and take action. This document describes the findings of the Lake Superior assessment.

Nearshore Framework Components





Long Term Outcomes:

- Improved water quality and ecosystem health at both the local and lake-wide scale;
- Improved and more resilient structure and function of nearshore ecosystems;
- Reduced cumulative impacts of human activities in nearshore areas;
- Decrease in unsustainable uses of nearshore waters;
- Increased provision of ecosystem services from Great Lakes waters; and
- Increased public and partner awareness of the value, stewardship of, and investment in the Great Lakes.

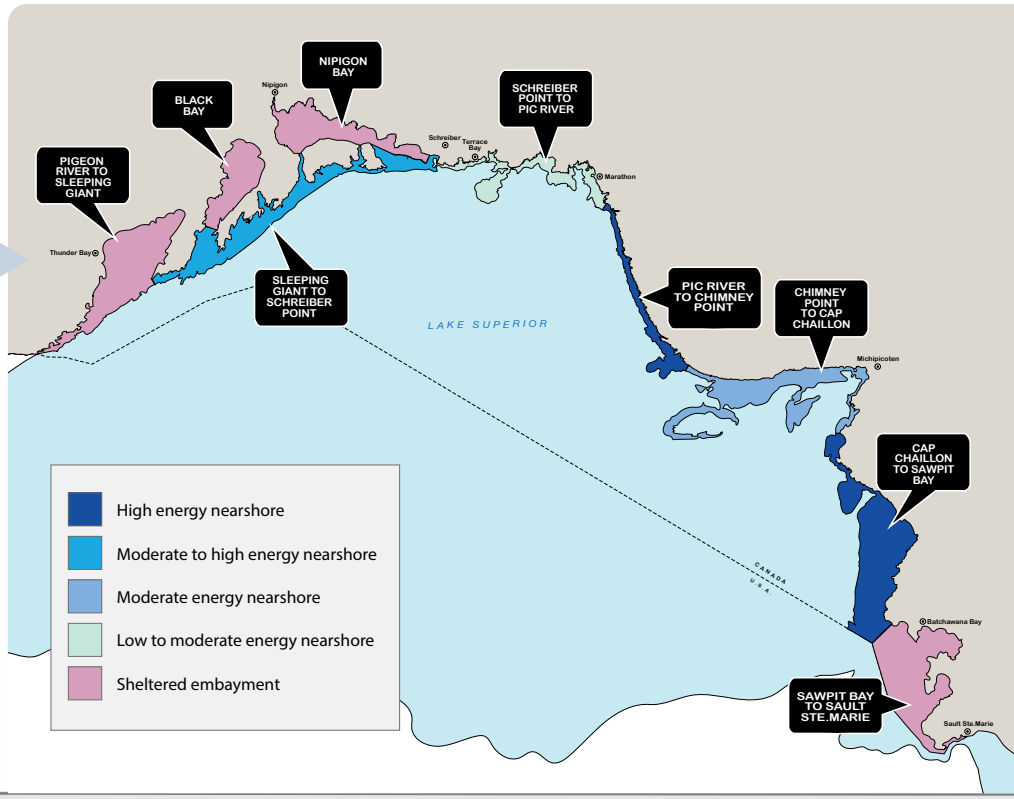
Canadian Assessment Methodology

1

The nearshore was delineated into distinct Regional Units using physical characteristics such as bathymetry (up to 100 m depth), bottom substrate type, wave energy and littoral cells. The units were then classified based on their overall ecological type. These Regional Units provide an ecologically relevant scale for the assessment.

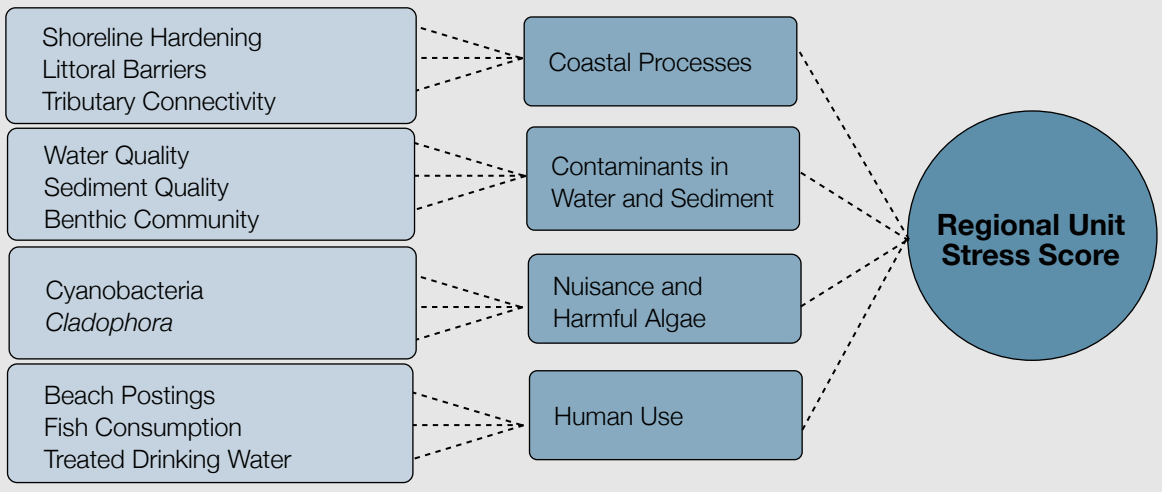
2

The assessment consists of 11 individual measures grouped into four categories that were developed with consideration of the GLWQA General Objectives. Each measure was evaluated to be of low, moderate or high stress based on documented ecological thresholds or best professional judgement, and then grouped into an overall cumulative assessment for each Regional Unit. A special status was assigned to Regional Units where there is concern to human and ecosystem health due to Cyanobacteria.

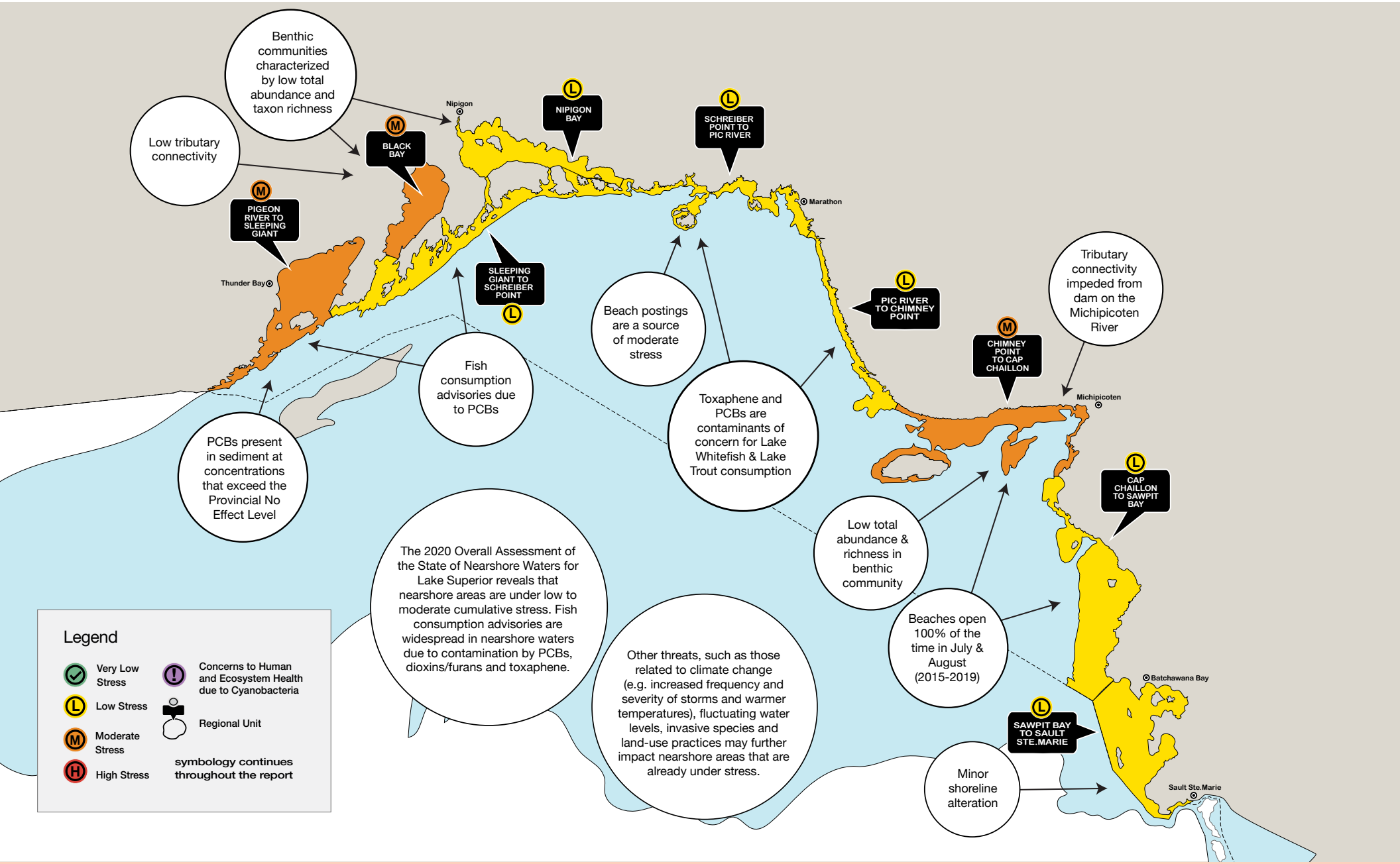


General Objectives state the waters of the Great Lakes should...

- Support healthy & productive habitats to sustain native species; Be free from negative impacts on chemical, physical or biological integrity
- Be free from pollutants harmful to humans, wildlife, aquatic organisms
- Be free from nutrients in amounts that promote excessive algae & cyanobacteria growth, interfere with ecosystem health or human uses
- Be a source of safe, high quality drinking water, allow for consumption of fish/wildlife, swimming and other recreational uses



Nearshore Assessment Lake Superior 2020



Description of Assessment Measures & Thresholds

Nuisance & Harmful Algae

Cyanobacteria	*Cladophora*
Cyanobacteria, a blue-green algae, occurs naturally in freshwater, however an overgrowth of cyanobacteria can result in a harmful algae bloom that can release toxins dangerous to human and ecosystem health. Cyanobacteria is assessed by calculating the extent of a bloom in a Regional Unit in 7-day satellite composites (June – Oct., 2019). An additional flag is assigned to Regional Units where cyanobacteria is a source of high stress, as it is considered a serious concern. Thresholds for severity are based on World Health Organization guidelines; thresholds for extent are based on binational and domestic nutrient management efforts.	*Cladophora* is a native filamentous green algae that typically grows on hard substrate in shallow waters. It can become a nuisance when it detaches from the bottom and washes onto shore where it can foul beaches and water intakes. No data was available to assess the extent of *Cladophora* in Lake Superior.
L No cyanobacteria bloom detected in any 7-day composites	? No Data
H Cyanobacteria bloom detected in one or more 7-day composites	

L Low Stress

M Moderate Stress

H High Stress

Contaminants in Water & Sediment

Water Quality	Sediment Quality	Benthic Community
Contaminants in water can have acute and chronic impacts on aquatic organisms that depend on water for some part of their life cycle. Water quality is assessed by determining the number of sampling events for which contaminant levels exceeded Provincial or Federal water quality guidelines at Provincial and Federal long-term monitoring stations for the most recent sample years (2011, 2016 & 2019).Thresholds are based on best professional judgement.	Contaminants in bottom sediment have the potential to be released into the water column and enter the food chain, which can lead to toxic and reproductive effects in species, as well as bioaccumulation in aquatic life. Sediment quality is assessed using the severity of median contaminant levels in sediment for four categories (metals, organochlorine pesticides, PAHs and PCBs) at Provincial long-term monitoring stations (2011). Thresholds are based on best professional judgement using Provincial & Federal Guidelines.	The general health of an ecosystem may be reflected in the benthic invertebrate community, as composition can vary from habitat conditions and human stressors. Contaminants in benthic communities can bioaccumulate or biomagnify in the food chain and become a source of contamination to other aquatic life and to humans. The benthic community is assessed through statistical analysis of 2011 Provincial monitoring sites using total benthos, taxon richness and evenness. Thresholds were set by a statistical analysis.
L 0 exceedances	L • PCBs < No Effect Level • Organochlorine pesticides & PAHs < Lowest Effect Levels • Metals < Probable or Severe Effect Levels	L Benthic community condition is functional
M 1 - 2 exceedances	M • PCBs > No Effect Level OR • Organochlorine pesticides & PAHs > Lowest Effect Levels OR • Metals > Probable Effect Levels but < Severe Effect Levels	M Benthic community condition degraded but functional
H >2 exceedances	H Any contaminant > Severe Effect Level	H Benthic community condition degraded and not functional

Description of Assessment Measures & Thresholds (cont.)

Coastal Processes

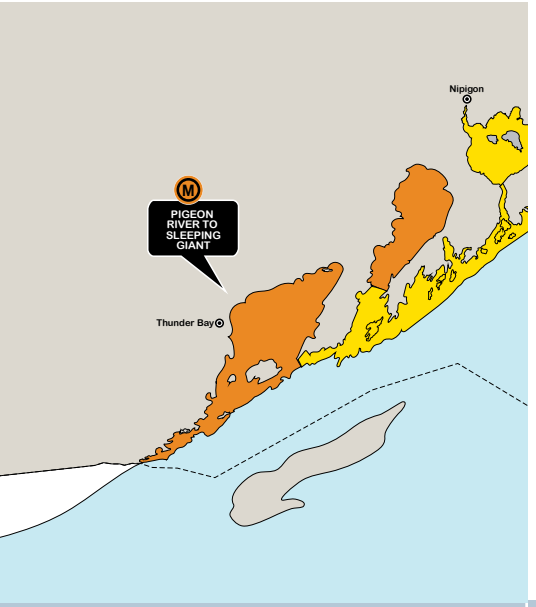
Shoreline Hardening	Littoral Barriers	Tributary Connectivity
Across the Great Lakes, much of the nearshore, waters edge or back of beach has been altered with engineered structures or artificial material. Hardened shorelines reduce coastal resiliency by altering sediment dynamics, accelerating erosion, increasing water turbidity & eliminating local vegetation. Shoreline hardening is assessed by determining the percent of the total length of shoreline in a Regional Unit that is hardened. Thresholds are based on best professional judgement.	The supply, transport and deposition of sediment are natural processes that form and maintain coastal features like wetlands and beaches. Artificial shore perpendicular structures (littoral barriers) can disrupt natural movements of sediment and affect the integrity of ecosystems. Littoral barriers is assessed by counting the number of littoral barriers (>100 m in length) in a Regional Unit. Thresholds are based on best professional judgement.	Connectivity between watersheds and the nearshore supports healthy habitats and promotes natural physical processes. Barriers to connectivity can restrict access of fishes to spawning/nursery habitats and alter nutrient flows and coastal processes. Tributary connectivity is assessed by calculating the percent of the total length of tributaries flowing into a Regional Unit that are connected to the nearshore. Thresholds are based on the State of the Great Lakes Aquatic Habitat Connectivity sub-indicator for Aquatic Habitat Connectivity.
L <25% of the shoreline has been hardened	L 0 littoral barriers	L >75% of the total length of tributaries are connected to the Regional Unit
M 25-50% of the shoreline has been hardened	M 1 littoral barrier	M 25 to 75% of the total length of tributaries are connected to the Regional Unit
H >50% of the shoreline has been hardened	H >1 littoral barriers	H < 25% of the total length of tributaries are connected to the Regional Unit

Human Use

Beach Postings	Fish Consumption	Treated Drinking Water
Across Lake Superior, public beaches are popular recreation spots and use should not be restricted by environmental quality concerns. Poor water quality at beaches due to bacterial contamination can have negative effects on human health and limit recreational use. Beach postings are assessed by calculating the average percent of time that beaches within a Regional Unit were posted as unsafe for swimming during July and August of 2015 -2019. Thresholds based on best professional judgement.	In Lake Superior, fish such as Yellow Perch, Lake Whitefish and Lake Trout provide a diverse and accessible source of food. Depending on the size and location, harmful substances such as PCBs, Mercury, and Toxaphene can result in consumption advisories in fish species. Fish consumption is assessed by calculating the average number of meals per month recommended for Yellow Perch (class size: 20-30 cm), Lake Whitefish (class size: 40-60 cm) and Lake Trout (class size: 40-70 cm) within a Regional Unit. Thresholds based on best professional judgement through consultation with MECP.	The Great Lakes are a source of drinking water for millions of Canadians and should not have an adverse impact on human health. Water intended for human consumption should not contain disease-causing organisms (e.g. E.coli) or other hazardous concentrations of toxic chemicals or radioactive substances. Treated drinking water is assessed by determining whether adverse water quality incidents were reported at any water treatment plants between 2015 and 2019. Thresholds based on Ontario Drinking Water Quality Standards.
L Beaches posted for 5% or less of the time	L ≥ 8 meals per month	L No adverse water quality incidents
M Beaches posted 5 to 20% of the time	M 1-7 meals per month	H Adverse water quality incident reported
H Beaches posted more than 20% of the time	H <1 meal per month	

Pigeon River to Sleeping Giant

Ecological Unit Type:
Sheltered Embayment
Area (ha): 95,000



M Moderate Stress

Pigeon River to Sleeping Giant is under moderate stress from the cumulative impact of contaminants in sediment, benthic community quality, fish consumption advisories and beach postings. With an average of one meal per month, fish consumption advisories are restrictive due to contamination from PCBs, Mercury, and Toxaphene. Four monitored beaches were posted an average of 6% of the swimming season: Chippewa Main (17%) Chippewa Sandy (3%) Wild Goose (2%) and O'Connor Point (3%). PCBs were found in sediment at the Welcome Island Provincial monitoring station above the No Effect Level which may impact the food chain. An ongoing sediment management project at the Thunder Bay Area of Concern (in the North Harbour) is addressing deposits of Mercury, and wood fibre waste. Although low stress, at 10%, the Regional Unit has the highest amount of shoreline hardening.

Thunder Bay:

- Large sheltered embayment within Regional Unit – largest city in Canadian Lake Superior watershed
- Kaministiquia River mouth provides diverse habitat that is important for some life history stages of Lake Sturgeon
- Large stretch of rugged rock and cliffs along the coast to the west. Cobble beaches and some coastal wetlands
- Spawning habitat for Cisco

L Coastal Processes

L SHORELINE HARDENING
10% Hardened

NA LITTORAL BARRIERS
Not applicable: littoral drift is not a significant process in this Regional Unit

L TRIBUTARY CONNECTIVITY
91% of the total length of tributaries are hydrologically connected to Lake Superior

M Contaminants in Water and Sediment

L WATER QUALITY
No contaminants found in excess of guidelines

M SEDIMENT QUALITY
Evidence of contamination due to PCBs

M BENTHIC COMMUNITY
Low total abundance, richness and evenness

L Nuisance and Harmful Algae

L CYANOBACTERIA
No blooms in 2019

NA *CLADOPHORA*
Not applicable: conditions not conducive to *Cladophora* growth

M Human Use

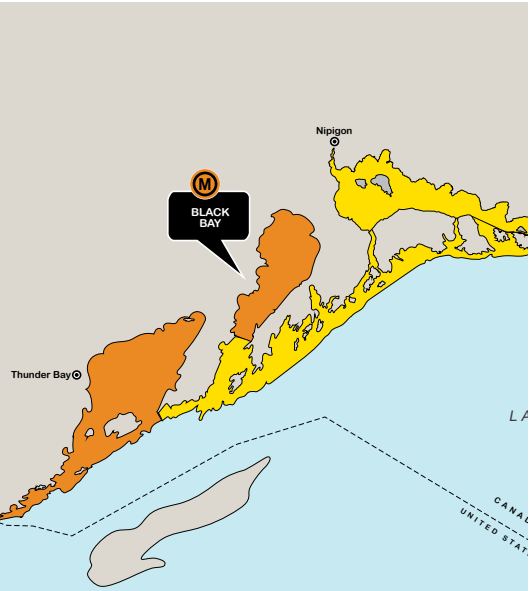
M BEACH POSTINGS
Monitored beaches were posted 6% of the time in July & August

M FISH CONSUMPTION
1 meal/month

L TREATED DRINKING WATER
No adverse water quality incidents

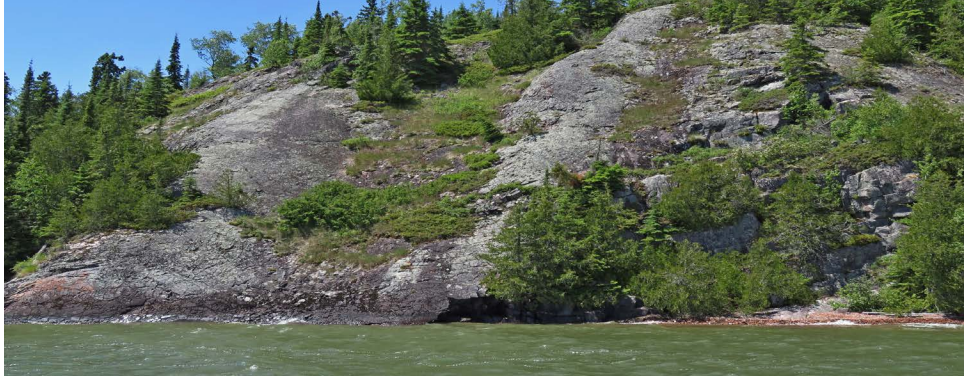
Black Bay

Ecological Unit Type:
Sheltered Embayment
Area (ha): 47,000



M Moderate Stress

Black Bay is under moderate stress from the cumulative impact of low tributary connectivity and poor benthic community quality. Dams on the Black Sturgeon River and Wolf River disconnect 82% of the total length of tributaries from the Bay, making it the only Regional Unit under high stress for tributary connectivity. Benthic community quality is high stress due to low total abundance, taxon richness and evenness. There are no publicly monitored beaches or drinking water facilities in the Bay so the Human Use measure has insufficient data to score. With an average of 7 meals per month, fish consumption is a source of moderate stress but amongst the least restrictive of all Regional Units. Advisories are due to contaminants including PCBs, dioxins/furans and mercury.



- Home to large spawning grounds of Cisco
- Important habitat area for Lake Whitefish
- Camp 43 dam on Black Sturgeon River: cut off spawning habitat for large population of Walleye
- Shallow waters: good for migrating ducks
- Lake Superior National Marine Conservation Area: within a portion of Regional Unit
- Granite Point Conservation Area: Habitat for Species at Risk: American White Pelican, Caspian Tern, Peregrine Falcon and Bald Eagles – site of rare orchids and arctic species

M Coastal Processes

L SHORELINE HARDENING
< 1% Hardened

NA LITTORAL BARRIERS
Not applicable: littoral drift is not a significant process in this Regional Unit

H TRIBUTARY CONNECTIVITY
18% of the total length of tributaries are hydrologically connected to Lake Superior

M Contaminants in Water and Sediment

L WATER QUALITY
No contaminants found in excess of guidelines

L SEDIMENT QUALITY
Metals detected but not at levels of concern

H BENTHIC COMMUNITY
Low total abundance, richness and evenness

L Nuisance and Harmful Algae

L CYANOBACTERIA
No blooms in 2019

NA *CLADOPHORA*
Not applicable: conditions not conducive to *Cladophora* growth

? Human Use

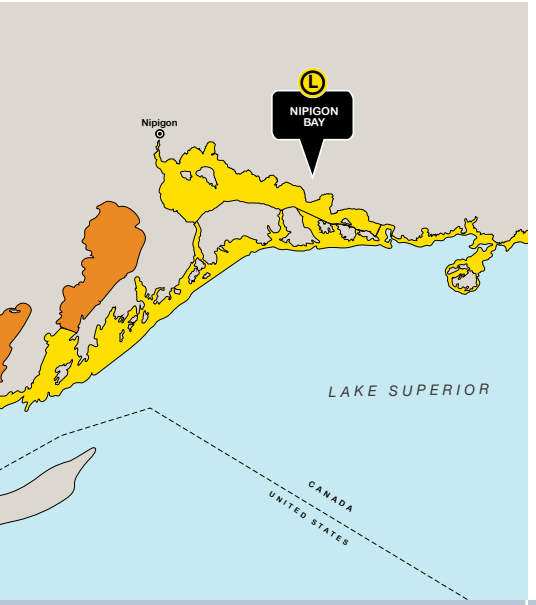
NA BEACH POSTINGS
Not applicable: no monitored beaches within the Regional Unit

M FISH CONSUMPTION
7 meals/month

NA TREATED DRINKING WATER
Not applicable: no drinking water plant

Nipigon Bay

Ecological Unit Type:
Sheltered Embayment
Area (ha): 61,500



Low Stress

Nipigon Bay is under low cumulative stress with some impact from benthic community quality and fish consumption advisories. Benthic community quality is characterized by low total abundance and taxon richness. Advisories to fish consumption are due to PCBs, dioxins/furans and mercury. There are approximately 25,000 km of tributaries draining into Nipigon Bay, including the largest tributary on Lake Superior – the Nipigon River – although much of these are naturally disconnected from the Bay by waterfalls. Roughly 88% of the length of tributaries downstream of a waterfall remain connected to the Bay. The one beach (Rainbow Falls Provincial Park - Rossport Beach) had no postings during the swimming season in the years from 2015 to 2019. The Nipigon Bay Area of Concern is moving towards delisting as all actions have been completed.

- Nipigon River: largest tributary on the Canadian side of Lake Superior
- Important coastal wetlands, waterfowl nesting & staging areas
- Largest remaining population of Brook Trout in Lake Superior
- Rocky shores & cliffs, some sand beaches & coastal wetlands
- Lake Superior National Marine Conservation Area: in a portion of the Regional Unit
- Most of 212 islands are undeveloped, intact wilderness

Coastal Processes

SHORELINE HARDENING (L)
4% Hardened

LITTORAL BARRIERS (NA)
Not applicable: littoral drift is not a significant process in this Regional Unit

TRIBUTARY CONNECTIVITY (L)
88% of the total length of tributaries are hydrologically connected to Lake Superior

Contaminants in Water and Sediment

WATER QUALITY (L)
No contaminants found in excess of guidelines

SEDIMENT QUALITY (L)
Metals detected but not at levels of concern

BENTHIC COMMUNITY (H)
Low total abundance and richness; moderate evenness

Nuisance and Harmful Algae

CYANOBACTERIA (L)
No blooms in 2019

CLADOPHORA (NA)
Not applicable: conditions not conducive to *Cladophora* growth

Human Use

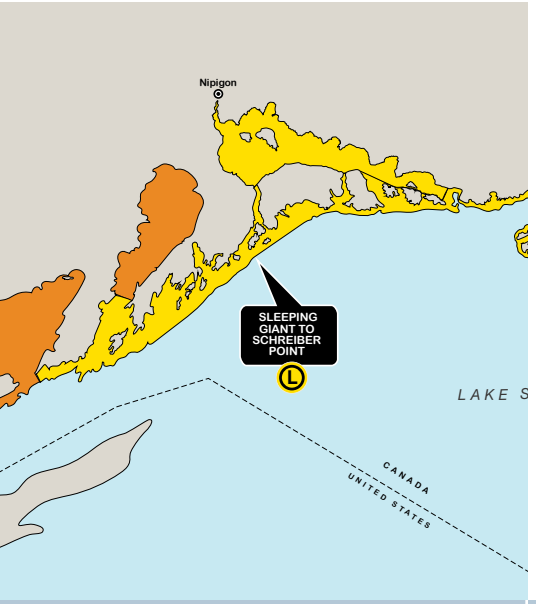
BEACH POSTINGS (L)
Monitored beaches were posted 0% of the time in July & August

FISH CONSUMPTION (M)
5 meals/month

TREATED DRINKING WATER (L)
No adverse water quality incidents

Sleeping Giant to Schreiber Point

Ecological Unit Type:
Moderate to High Energy
Area (ha): 85,200



L Low Stress

Sleeping Giant to Schreiber Point is under low cumulative stress but impacted by benthic community quality and fish consumption advisories. The Human Use category has insufficient data to score since there are no publicly monitored beaches and no drinking water facilities. Advisories on fish consumption average 1 meal per month due to dioxins/furans and PCBs, which is among the most restrictive of all Regional Units. Although there is no recent MECP sediment quality monitoring data available for this assessment and water quality meets all guidelines, the Contaminants in Water & Sediment category indicate moderate stress due to average benthic community quality compared to other areas of the Lake Superior nearshore. The Sleeping Giant is a flat-topped ridge with dramatic steep cliffs on top of the Sibley Peninsula, which separates Thunder Bay in the west and Black Bay in the east.

- Lake Superior National Marine Conservation Area soon to be recognized as one of the largest protected areas of freshwater in the world
- Superior Shoals: underwater "mountain" – depths of less than 10M can drop to hundreds of metres
- Important habitat sites for Lake Trout
- Sleeping Giant Provincial Park: contains over 200 bird species; rare orchids; arctic alpine species
- Sleeping Giant – series of mesas formed by the erosion of thick, basaltic sills on Sibley Peninsula; Ojibway legend identifies the giant as Nanabijou

L Coastal Processes

L SHORELINE HARDENING
< 1% Hardened

NA LITTORAL BARRIERS
Not applicable: littoral drift is not a significant process in this Regional Unit

L TRIBUTARY CONNECTIVITY
95% of the total length of tributaries are hydrologically connected to Lake Superior

M Contaminants in Water and Sediment

L WATER QUALITY
No contaminants found in excess of guidelines

? SEDIMENT QUALITY
Data Gap: no recent sampling events with in the Regional Unit

M BENTHIC COMMUNITY
High total abundance and richness

L Nuisance and Harmful Algae

L CYANOBACTERIA
No blooms in 2019

? *CLADOPHORA*
No Data

? Human Use

NA BEACH POSTINGS
Not applicable: no monitored beaches within the Regional Unit

M FISH CONSUMPTION
1 meal/month

NA TREATED DRINKING WATER
Not applicable: no drinking water plant

Schreiber Point to the Pic River

Ecological Unit Type:
Low to Moderate Energy
Area (ha): 38,200

L Low Stress

Overall, Schreiber Point to the Pic River is under low stress but is impacted from benthic community quality, fish consumption advisories and beach postings. There are no dams impeding tributary connectivity and although there are a number of communities along the coast, less than 1% of the shoreline has been hardened. Contaminants in water or sediment were not found to be at levels of concern, but the benthic community quality is characterized by average abundance, richness and evenness. Fish consumption advisories are due to PCBs and toxaphene. The beach at Neys Provincial Park was posted as unsafe for swimming 32% of the time while Terrace Bay Dockside, Pump House and Carden Cove beaches were never posted. The Peninsula Harbour Area of Concern and the Jackfish Bay Area of Concern in Recovery are both located within this Regional Unit. Remediation of contaminated sediment in Peninsula Harbour has been completed and monitoring of recovery is underway.

- Craigs Pit Provincial Native Reserve: important bird migratory area – significant bluffs and kettle holes
- Shoreline: primarily rock shores & cliffs. Few sandy beaches and coastal wetlands
- Important habitat area for Lake Trout and Lake Whitefish
- Lake Superior National Marine Conservation Area: partially in Regional Unit
- Slate Islands Provincial Park: Home to herd of woodland caribou. Complete lack of light pollution, Thought to have been formed from a meteorite impact almost 1 billion years ago
- Islands: largely natural condition of many islands provide excellent bird habitat

L Coastal Processes

L SHORELINE HARDENING
<1% Hardened

NA LITTORAL BARRIERS
Not applicable: littoral drift is not a significant process in this Regional Unit

L TRIBUTARY CONNECTIVITY
100% of the total length of tributaries are hydrologically connected to Lake Superior

L Contaminants in Water and Sediment

L WATER QUALITY
No contaminants found in excess of guidelines

L SEDIMENT QUALITY
Metals detected but not at levels of concern

M BENTHIC COMMUNITY
Moderate in total abundance, richness and evenness

L Nuisance and Harmful Algae

L CYANOBACTERIA
No blooms in 2019

? *CLADOPHORA*
No Data

M Human Use

M BEACH POSTINGS
Monitored beaches were posted 8% of the time in July & August

M FISH CONSUMPTION
7 meals/month

L TREATED DRINKING WATER
No adverse water quality incidents

Pic River to Chimney Point

Ecological Unit Type:
High Energy
Area (ha): 30,000

Low Stress

Pic River to Chimney Point is under low cumulative stress but is impacted from low tributary connectivity and fish consumption advisories. The Regional Unit is characterized by very high wave energy and the largest stretch of undeveloped coastline on the Canadian Great Lakes and runs along Pukaskwa National Park. There are approximately 16,000 km of tributaries that drain into the Regional Unit but of the tributaries downstream of a waterfall, 32% are disconnected due to a dam on the Black River. The Human Use category has insufficient data to score since there are no publicly monitored beaches and no drinking water facilities. Advisories on fish consumption average 5 meals per month due to PCBs, toxaphene and PCBs.

- Highest average annual wave energy in Lake Superior (3rd highest in Canadian Great Lakes)
- Pukaskwa National Park: 187,800 hectares: woodland caribou, eagle nesting. Extensive wetlands; pink-and-slate granite shores
- Great Blue Heron: sightings decreasing
- At least 3 known nesting sites for Peregrine Falcons within the park
- Dam on Black River impedes tributary connectivity
- Pic River Site - National Historic Site of Canada ("set on sandy lowlands, the site is bounded by the lake to the west, a rocky highland to the north and the Pic River to the south and east")

Coastal Processes

SHORELINE HARDENING
<1% Hardened

LITTORAL BARRIERS
Not applicable: littoral drift is not a significant process in this Regional Unit

TRIBUTARY CONNECTIVITY
68% of the total length of tributaries are hydrologically connected to Lake Superior

Contaminants in Water and Sediment

WATER QUALITY
No contaminants found in excess of guidelines

SEDIMENT QUALITY
Data Gap: no recent sampling events with in the Regional Unit

BENTHIC COMMUNITY
High total abundance and richness

Nuisance and Harmful Algae

CYANOBACTERIA
No blooms in 2019

CLADOPHORA
No Data

Human Use

BEACH POSTINGS
Not applicable: no monitored beaches within the Regional Unit

FISH CONSUMPTION
5 meals/month

TREATED DRINKING WATER
Not applicable: no drinking water plant

Chimney Point to Cap Chaillon

Ecological Unit Type:
Moderate Energy
Area (ha): 89,800

(M) Moderate Stress

Chimney Point to Cap Chaillon is under moderate cumulative stress due to low tributary connectivity, poor benthic community quality and fish consumption advisories. There are four hydroelectric generating stations that impede tributary connectivity on the Michipicoten River. Fish consumption advisories are due to PCBs and toxaphene and the average of four meals per month is the second most restrictive of all Regional Units. Benthic community quality is characterized by low total abundance however this may be a case of natural impoverishment due to the depth of the survey station. Each of the three monitored beaches (Old Woman Bay, Government Dock Beach and Sandy Beach) were open for 100% of the swimming season.

- Michipicoten Island: First Nations named “Missipacouatong” meaning “Land of the Big Bluffs”
- Michipicoten Bay: important habitat for Lake Sturgeon. Michipicoten River mouth: fall salmon spawning, bald eagles
- Coast: natural rocky shores and cliffs
- Numerous rivers that provide habitat for warm and cold-water fish species
- Nearshore: important habitat for Lake Trout and Lake Whitefish

3 Parks:

- Michipicoten Island Provincial Park: spawning beds for Lake Trout; rare species: Pygmy Whitefish
- Nimoosh Provincial Park: Unique forests & arctic alpine associated species
- Lake Superior Provincial Park: one of the largest parks in Ontario, 155,647 hectares

(M) Coastal Processes

(L) SHORELINE HARDENING
<1% Hardened

(NA) LITTORAL BARRIERS
Not applicable: littoral drift is not a significant process in this Regional Unit

(M) TRIBUTARY CONNECTIVITY
26% of the total length of tributaries are hydrologically connected to Lake Superior

(M) Contaminants in Water and Sediment

(L) WATER QUALITY
No contaminants found in excess of guidelines

(?) SEDIMENT QUALITY
Data Gap: no recent sampling events with in the Regional Unit

(H) BENTHIC COMMUNITY
Low total abundance and richness

(L) Nuisance and Harmful Algae

(L) CYANOBACTERIA
No blooms in 2019

(?) *CLADOPHORA*
No Data

(M) Human Use

(L) BEACH POSTINGS
Monitored beaches were posted 0% of the time in July & August

(M) FISH CONSUMPTION
4 meals/month

(NA) TREATED DRINKING WATER
Not applicable: no drinking water plant

Cap Chaillon to Sawpit Bay

Ecological Unit Type:
High Energy
Area (ha): 122,400

L Low Stress

Cap Chaillon to Sawpit Bay is under low cumulative stress and with the exception of fish consumption, all measures were assessed as being low stress. With an average of six meals per month, fish consumption advisories are due to dioxins/furans, mercury, PCBs and toxaphene. Of the tributaries that are downstream of a waterfall, 100% are connected to the nearshore. Benthic community quality is determined to have high total abundance, taxon richness and evenness. The two monitored beaches (Agawa Bay and Katherine Cove) were not posted at all during the swimming season. Lake Superior Provincial Park runs along the Regional Unit and is characterized by a high wave energy rocky coastline interspersed by sandy beaches.

- Lake Superior Provincial Park: one of the largest parks in Ontario, 155,647 hectares
- Rocky shores, cliffs. Very few sand beaches or coastal wetlands
- Important habitat for Lake Trout and Lake Whitefish
- Agawa Bay features unusual bedrock features and a high abundance of insects
- Agawa Rock Pictographs - culturally significant, sacred site

L Coastal Processes

L SHORELINE HARDENING
<1% Hardened

NA LITTORAL BARRIERS
Not applicable: littoral drift is not a significant process in this Regional Unit

L TRIBUTARY CONNECTIVITY
100% of the total length of tributaries are hydrologically connected to Lake Superior

L Contaminants in Water and Sediment

L WATER QUALITY
No contaminants found in excess of guidelines

? SEDIMENT QUALITY
Data Gap: no recent ambient data within the Regional Unit

L BENTHIC COMMUNITY
High total abundance, richness and evenness

L Nuisance and Harmful Algae

L CYANOBACTERIA
No blooms in 2019

? *CLADOPHORA*
No Data

M Human Use

L BEACH POSTINGS
Monitored beaches were posted 0% of the time in July & August

M FISH CONSUMPTION
6 meals/month

NA TREATED DRINKING WATER
Not applicable: no drinking water plant

Sawpit Bay to Sault Ste. Marie

Ecological Unit Type:
Sheltered Embayment
Area (ha): 103,800

Low Stress

Sawpit Bay to Sault Ste. Marie is under low cumulative stress and is the only Regional Unit to score low in all four categories. The only measure that is a source of moderate stress is fish consumption. An average of five meals a month are advised due to mercury, dioxins/furans, toxaphene, and PCBs. There are six monitored beaches in the Regional Unit – the most of any – that were posted an average of 3.5% of the swimming season (Mark's Bay South and Pointe des Chenes: 9%; Harmony Beach: 3%; Havilland Beach, Batchawana Provincial Park and Pancake Bay Provincial Park: 0%). Although only 6%, shoreline hardening is the second most extensive of all Regional Units, with much of the alteration at Sault Ste. Marie. There are two distinct bays in the Regional Unit – Batchawana and Goulais – both characterized by mud and sand.

- Important area for Lake Sturgeon migration and spawning
- Shore Ridges Conservation Areas: provincially significant wetland: 25% fen; 74% swamp; 1% marsh
- Some of the largest sand beaches on Canadian side of Lake Superior
- Goulais Bay: spawning habitat for Lake Trout, Lake Whitefish, Yellow Perch & Muskellunge
- Large area of gravelly shoals where Lake Superior empties into the St. Marys River

Coastal Processes

SHORELINE HARDENING
6% Hardened

LITTORAL BARRIERS
Not applicable: littoral drift is not a significant process in this Regional Unit

TRIBUTARY CONNECTIVITY
80% of the total length of tributaries are hydrologically connected to Lake Superior

Contaminants in Water and Sediment

WATER QUALITY
No contaminants found in excess of guidelines

SEDIMENT QUALITY
Data Gap: no recent ambient data within the Regional Unit

BENTHIC COMMUNITY
Low total abundance; high richness and evenness

Nuisance and Harmful Algae

CYANOBACTERIA
No blooms in 2019

CLADOPHORA
Not applicable: conditions not conducive to *Cladophora* growth

Human Use

BEACH POSTINGS
Monitored beaches were posted 3.5% of the time in July & August

FISH CONSUMPTION
5 meals/month

TREATED DRINKING WATER
No adverse water quality incidents

Threats to Lake Superior Nearshore Waters

Fish Consumption Advisories

Fish from the Great Lakes provide a diverse and accessible source of food, a high quality source of protein and healthy unsaturated fats. However, they can be a source of contaminants. The province of Ontario provides consumption guidance based on a combination of fish size, species, location and contaminant burden. Generally, for the Great Lakes waters, the province recommends consuming smaller, leaner fish, such as Yellow Perch or Walleye, as contaminants accumulate as a fish ages and grows, and primary contaminants such as PCBs are stored in the fat. However, mercury can accumulate at higher amounts in fish like Walleye and Yellow Perch that eat other fish.

Across Lake Superior's nearshore, fish consumption advisories were found to be a source of moderate stress. This is due largely to levels of PCBs, Mercury, Dioxins, Furans, and Toxaphene and in the edible portions Lake Trout, Lake Whitefish and Yellow Perch, the species most targeted in the nearshore for consumption. Historically, PCBs were primarily used as coolants and lubricants in electrical equipment or as plasticizers in adhesives and sealants. They have been banned in Canada and the United States for decades. Pulp and paper production, manufacturing or incineration activities released Dioxins and Mercury. Natural sources of Mercury can also contribute to surface waters. Toxaphene has been found in Lake Superior from long-range transport of this insecticide, which was heavily used in the 1970's and early 1980's primarily to control pests on cotton and other crops in the southern United States. However, because of their ability to persist in the environment and bioaccumulate, some contaminants continue to be of a concern and can result in consumption advisories in fish and represent a risk to human health.

Risks and benefits should be considered when deciding to consume Great Lakes fish; provincial consumption advisory guidelines should be consulted when choosing fish for consumption.

Areas of Concern

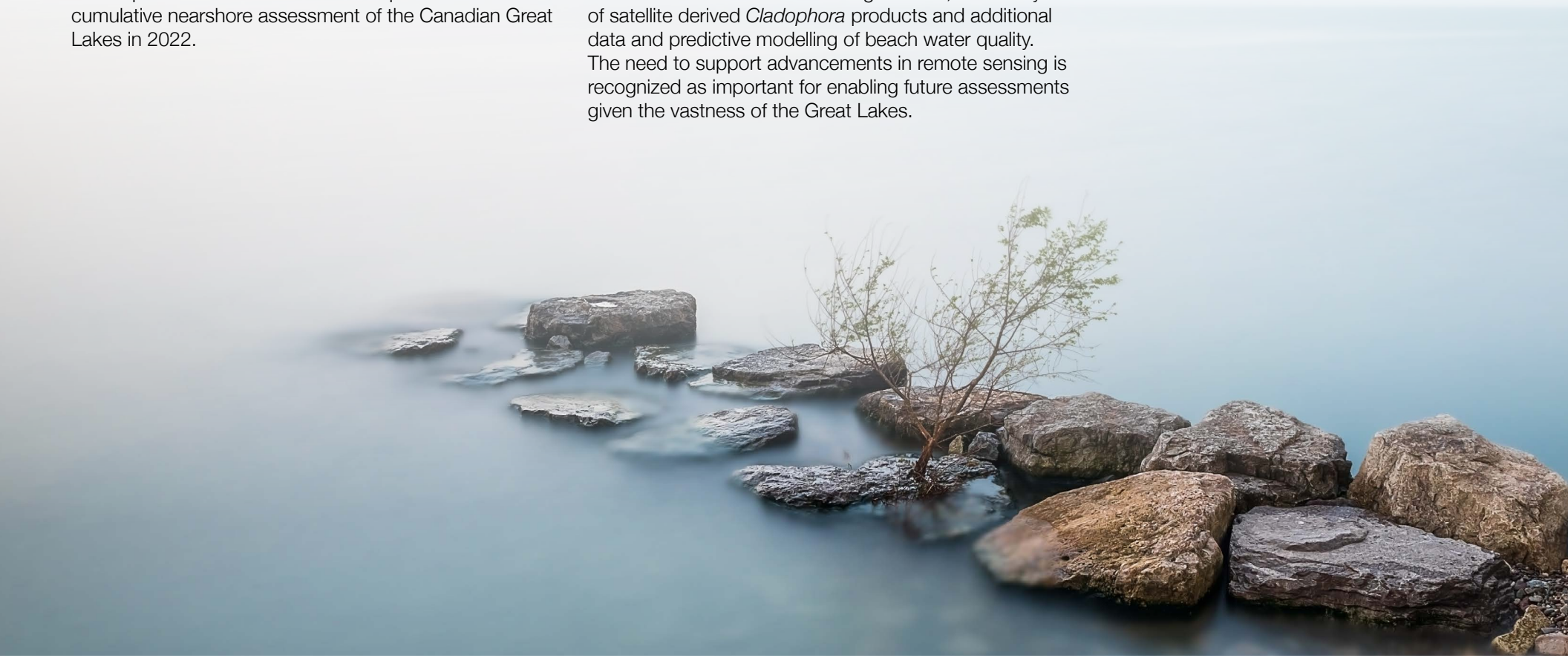
Areas of Concern are locations within the Great Lakes identified as having experienced high levels of environmental harm. Under the 1987 Great Lakes Water Quality Agreement between Canada and the United States, 43 such areas were identified, 12 of which were Canadian and 5 of which were shared binationally. Since 1987, the Government of Canada has supported local action to clean up Areas of Concern. Canadian Areas of Concern on Lake Superior are: Thunder Bay, Nipigon Bay, Jackfish Bay and Peninsula Harbour. The St. Marys River is a binational Area of Concern shared by Canada and the United States. All clean-up actions in Jackfish Bay have been completed, allowing this site to be designated as an Area of Concern in Recovery. This means that all actions are complete and the area now needs more time for the environment to recover naturally.

Nearshore Framework Next Steps

The Nearshore Framework Assessment Cycle

The results of this assessment have been included in the 2020 Lake Superior Lakewide Action and Management Plan (LAMP).The assessment will be repeated on a regular cycle to monitor change over time. A number of data gaps have been identified and will be considered within the lakewide management process when Cooperative Science and Monitoring priorities are identified. Progress continues for the remaining Canadian Great Lake nearshore assessments as respective LAMPs are developed. Assessments of Erie, Ontario, Huron and Superior will be combined and reported as the first cumulative nearshore assessment of the Canadian Great Lakes in 2022.

This report reflects the best efforts using readily accessible data. Methods and the decisions made for this assessment have been documented and revisions or improvements based on advances in science and expert judgment are part of the Framework's iterative learning process. This first assessment of Lake Superior has brought to light several limitations that may be improved upon in future including: regular updates of databases used to evaluate barriers to tributary connectivity; increased sampling effort at existing long-term water, sediment and benthos monitoring stations, availability of satellite derived *Cladophora* products and additional data and predictive modelling of beach water quality. The need to support advancements in remote sensing is recognized as important for enabling future assessments given the vastness of the Great Lakes.



Taking Action Case Study: Protecting High Ecological Value in Lake Superior

Protecting High Ecological Value in Lake Superior

The Lake Superior National Marine Conservation Area encompasses remarkable features including: amazing biodiversity with over 50 fish species and rare arctic-alpine plants; dramatic terraced landscapes, shoals and some of the world's oldest known rocks. In Canada, national marine conservation areas are established "for the purpose of protecting and conserving representative marine areas for the benefit, education and enjoyment of the people of Canada and the world," and they "shall be managed and used in a sustainable manner… without compromising the structure and function of the ecosystems…" (Canada National Marine Conservation Areas Act, 2002). These conservation areas are an integral part of Canada's Federal Marine Protected Areas Strategy (2005), which serves to guide the efforts of federal agencies in establishing marine protected areas, and meeting Canada's international commitments.

In 2015, the passing of Bill C-61 confirmed the legal description of lands and lake bed that will be transferred from the province of Ontario to Parks Canada to create Lake Superior National Marine Conservation Area (NMCA). Once established, Lake Superior NMCA will comprise an area over 10,000 km^2, and will be one of the largest freshwater protected areas in the world. Although formal establishment and land transfer is not yet complete, an Interim Management Plan (2016) has been developed. Following direction in this plan, and to meet the stated mandate of protection and ecologically sustainable use, staff at Lake Superior NMCA are developing and implementing an adaptive resource management approach, including aspects of inventory, scientific research, and long-term monitoring.

Data Sources

MEASURE	DATA SOURCE(S)	YEARS ASSESSED
Shoreline Hardening	Zuzek, Inc. Shoreline Hardening and Littoral Sediment Budgets. Shoreline Hardening Methodology and Guidance Document. ESRI World Imagery.	2016-2020 (Imagery)
Littoral Barriers		
Tributary Connectivity	Ontario Ministry of Natural Resources and Forestry. Ontario Integrated Hydro Network.	Last updated 2019
	Great Lakes Connectivity - FishWerks GIS platform.	Accessed 2020
Water Quality	Ontario Ministry of Environment, Conservation and Parks. Great Lakes Nearshore – Water Chemistry.	2011
	Environment and Climate Change Canada – Great Lakes Water Quality Monitoring and Surveillance Data.	2016, 2019
Sediment Quality	Ontario Ministry of Environment, Conservation and Parks. Great Lakes Nearshore – Sediment Chemistry.	2011
Benthic Community	Ontario Ministry of Environment, Conservation and Parks. Great Lakes Index Stations Network.	2011
Cyanobacteria	National Oceanic & Atmospheric Association. Harmful Algal Bloom Monitoring. 7-day satellite composite images, with Cyanobacteria Index algorithm.	June to October 2019
Beach Postings	Swim Drink Fish Canada. SWIMGuide.	July & August 2018
Treated Drinking Water	Ontario Ministry of Environment, Conservation and Parks. Drinking Water Treatment Plant Monitoring data.	2015-2019
Fish Consumption	Ontario Ministry of Environment, Conservation and Parks. Guide to Eating Ontario Fish Advisory Database.	2015, 2017 & 2020

OVERALL ASSESSMENT OF THE STATE OF NEARSHORE WATERS Resources

Lake Superior Canadian Nearshore Assessment, 2020 Results.
Cat. No.: En164-71/4-2020E-PDF; ISBN: 978-0-660-39158-8

Canadian Great Lakes Nearshore Assessment, Detailed Methodology.
Cat. No.: En164-71/1-2021E-PDF; ISBN: 978-0-660-39154-0

Assessment data available from Government of Canada
Open Data: https://open.Canada.ca/en/open-data