Environment Canada Environnement Canada

www.ec.gc.ca

National Marine Weather Guide

Ontario Regional Guide

Canada

Cat. No. En56-240/1-2014E-PDF
978-1-100-22311-7

Acknowledgments

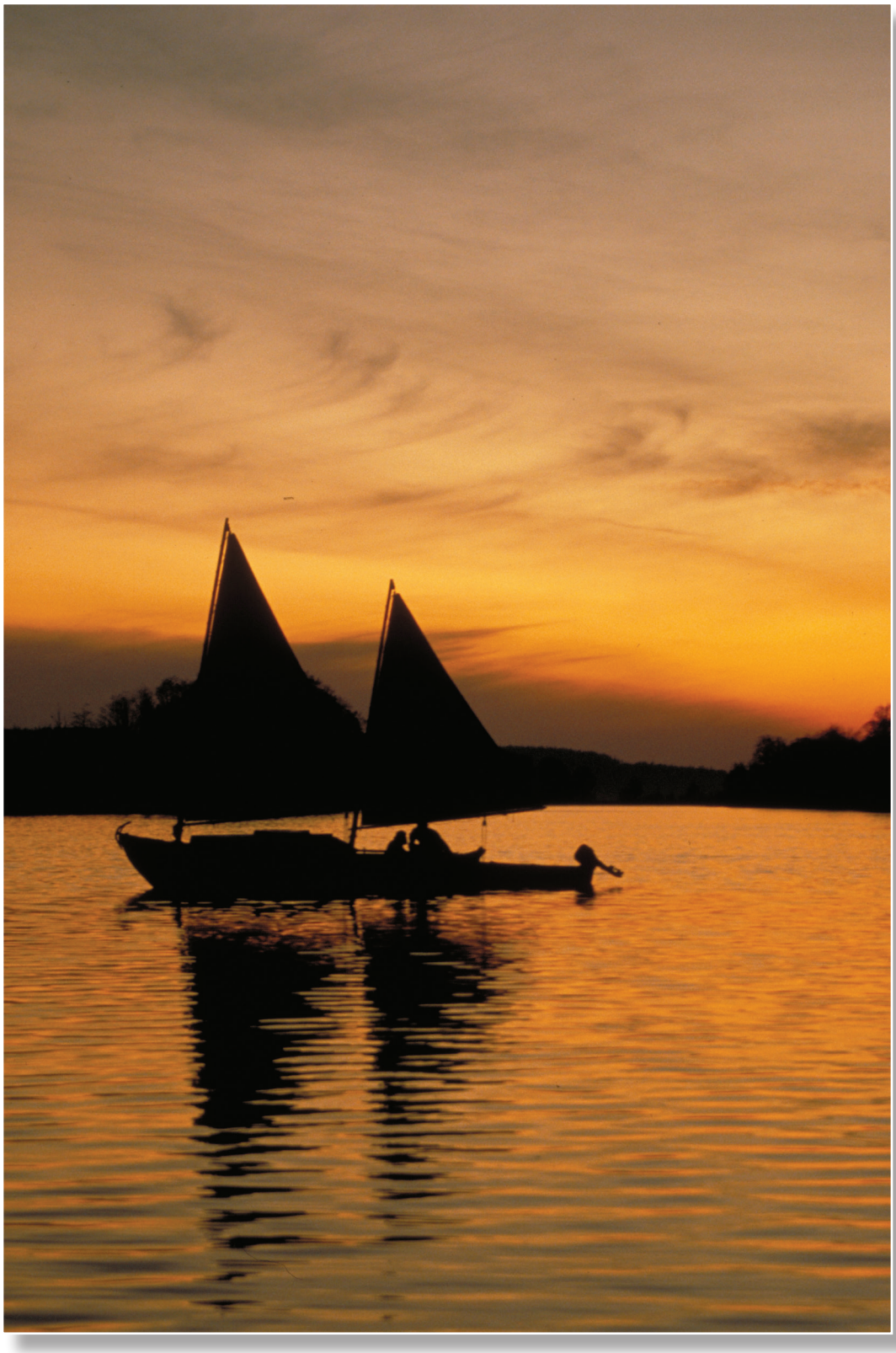
This publication was made possible by the Government of Canada's Search and Rescue New Initiatives Fund (SAR-NIF). The Fund is managed by the National SAR Secretariat on behalf of the Lead Minister for SAR and in partnership with other federal, provincial, and territorial SAR organizations.

Environment Canada provided resources and other essential support to the project. The regional guide was recreated from the Environment Canada publication *Wind Weather and Waves*, Second Edition. The following people were key to the success of this updated publication:
Serge Besner, National Project Manager and Ontario Lead
Kristina Fickes, Communications Advisor
Chelsea Kealey, National Project Assistant
Luc Lecuyer, Communication Project Coordinator
Lindsay Short, National Global Information Systems Lead

Appreciation is also extended to the authors and editors of the marine meteorology publications—from which much of the content of this publication was adapted—for sharing their knowledge and expertise:
Serge Besner, *Wind, Weather and Waves: A Guide to Marine Weather in the Great Lakes Region* (Second Edition)
Tony Chir, *Wind, Weather and Waves* (First Edition)

Special thanks go out to numerous others who helped make this publication possible, including many employees at Environment Canada and staff members and ship's captains at the Canadian Coast Guard. If not for the assistance of the following individuals, the information in this guide would have been incomplete:
Bill Burrows, Senior Meteorologist Researcher, Meteorological Service of Canada
Chris Fogarty, Program Supervisor, Canadian Hurricane Centre
Vincent Fortin, Meteorologist, Meteorological Service of Canada, Canadian Meteorological Center
David Sills, Severe Weather Meteorologist, Meteorological Service of Canada
Wade Szilagyi, Meteorologist, Meteorological Service of Canada

Table of Contents



Silhouetted sailboats at sundown.

ONTARIO REGIONAL GUIDE

1. Introduction

This chapter contains information on specific local weather effects for the Great Lakes and some of the smaller inland lakes of Ontario. The corresponding maps indicate the type and location of effects through the use of special symbols, which are defined in the following chart. It is recommended that the chart be printed for cross-referencing purposes in reading this chapter. The meteorological theory behind these effects is described in detail in the Met 101 section of this national guide.

Wave Symbols	Wind Symbols	Weather Symbols
Choppy Sea	Barrier Wind	Fog
Crossing Sea	Channelling	Freezing Spray
Large Sea	Coastal Convergence	Snow Streamer
Reflection	Cornering	Thunderstorm
Rough Water	Gap Wind	Waterspout
Shoaling	Gusty Wind	
Strong Current	Katabatic Wind	
Tidal Rip	Lee Wave	
Water Level	Wind	
	Wind Opposing Current	
	Downslope Wind	
	Diurnal Wind	
	Funnelling	

Wind, weather and wave symbols used in this guide.

1.1 Weather Lore

Long before the daily forecast or the science of meteorology, satellites, and computers existed, people were able to predict the weather to some degree, simply by watching the clouds. A combination of pattern recognition, association, environmental sensitivity, and common sense gave our ancestors all they needed to know about the weather to come. Today's portent became tomorrow's outcome, just as surely as the wind carves the wave.

> ***"Men in a ship are always looking up, and men ashore generally looking down."***
>
> **– John Masefield, The Bird of Dawning**

There have been countless words of weather wisdom written over the ages. Most are true much of the time; however, exceptions exist because each saying was based on a particular region and its prevalent cloud feature. Variations in the direction of motion, time of year, local effects, and the unpredictability of some weather situations can change the expected outcome. Such exceptions, however, reveal just as much about the weather by drawing attention to what didn't happen and why that might be so. Mariners can sharpen their skills by watching the clouds and learning what they bring—and are encouraged to test the reliability of these words of wisdom and even create their own based on the clouds they see in their particular area.

When the sun is shining, the winds are light, and the pressure is high, it might appear that not much is going on with regard to weather. It is true that most of what happens directly under a high is not particularly noteworthy, but there may be a few scratches and scrawls up there worth reading. The very earliest signs of the next low or warm front often arrive during high pressure as thin tufts and streaks of cirrus clouds. These frozen wisps are but the thinnest slivers of moisture carried far ahead of the thicker, lower cloud layers that will inevitably invade the area. The next day, the winds will freshen and the signs at hand will no longer be as subtle as those first few innocent tails of prophecy.

> ***"Hen's scarfs and mare's tails make lofty ships carry low sails."***
>
> ***"Trace in the sky the painter's brush, then winds around you soon will rush."***
>
> ***"Rain long foretold, long last; short notice, soon past."***

Large, low-pressure systems create extensive areas of cloud and rain. Strong winds aloft carry the highest parts of the cloud area far forward of the low centre and most of the rain. This cloud is constantly being added to near the low centre and expands away from it, usually to the north and east. The winds aloft "stretch" this cloud shield forward, so that a thin layer of high cloud arrives at a location up to 24 hours before the rain does. Hence, the rain can be "long foretold". While it takes a full day to thicken the cloud up, once rains begin they also persist for an extended period, as the main part of the low makes its way through. The scale of a weather system is, therefore, matched by its lead time.

On the other hand, convective showers, which are small in size and extent, give little forewarning because they are constantly forming and evaporating. These clouds also move relatively slowly. The anvil clouds from storms rarely spread more than a few hours out ahead of the rain. The convective showers of summer, then, will leave just as quickly as they arrive.

It takes a well-developed low to form the large, uniform sheets of high cloud that progress smoothly from thinner to thicker—which is what is required to form a halo in cirrocumulus. The halo, though only present once in a while, indicates a very uniform thickness of the ice crystal cloud layer. It is this homogeneous characteristic of cirrostratus that indicates that it has been stretched out over a long distance and comes out of a large cloud system.

"When the sun is in his house, it will rain soon."

Credit: Jonathan Martin DeMoor

"When clouds appear like rocks and towers, the earth's refreshed by frequent showers."

On a day when a lot of tall cumulus appear, there are bound to be numerous showers. The lively vertical motion that allows the rising towers to be taller than they are wide is a sure sign of highly unstable air. Warm updrafts, once underway, are free to rise quickly, high into the sky. When the sky is full of such clouds by early afternoon, it means that showers are ready to break out everywhere. A bit of heat is all that is needed to get things started, resulting in more frequent but smaller showers. The opposite occurs on a day with slightly unstable air, when it takes all-day sunshine to heat the air enough to make it unstable. This makes it possible for one or two bigger storms to form later in the afternoon.

Growing cumulus that rise very quickly have "crunchy" tops: bright, hard crowns that look like rocks. This "hardness" is entirely due to the newness of the condensation at the top of the tower. New air emerges continuously at the top to form numerous small cloud particles that permit this hard-edged appearance. As soon as the cloud top slows down, this detail becomes softer and duller because evaporation dilutes the cloud edge. A sky full of rocks and towers tells us that all the clouds are growing vigorously and are not likely to stop until they have spilled their bounty.

Cirrocumulus clouds cover the sky.

"A dappled sky, like a painted woman, soon changes its face."
"Mackerel sky, mackerel sky, never long wet and never long dry."

The delicate, trickling texture of cirrocumulus clouds has long been compared with the scales on a mackerel. Cirrocumulus is probably the rarest cloud type, but it is a very reliable predictor. It occurs almost exclusively with cirrus well ahead of a warm front. The way clouds thicken can vary with warm fronts, and mare's tail cirrus are not always present. If cirrocumulus patches are visible, however, the weather is sure to change soon. Because these clouds are present ahead of the warm front (and not too far north of the low or too far south along the front), they suggest that the jet stream axis is overhead and the weather will continue to alternate between wet and dry spells for a while.

Stratus clouds cover the sky.

"Red sky at night, sailors' delight; red sky in the morning, sailors take warning."

This could be the most famous rhyme ever associated with the weather. It assumes a very basic fact about the clouds in the northern mid-latitudes: that they move from west to east. If the sky turns red at sunrise, it means that a clear sky to the east is allowing full sunlight to shine underneath the layer of clouds now present in the sky. These clouds are, therefore, moving in or thickening and may soon lead to rain. The opposite holds true at sunset: the setting sun will redden the clouds if the sky is clear on the eastern horizon, indicating clear weather to come the next day.

1.2 Marine Weather Services

Weather is always changing, and local factors (e.g., topography, coastline, currents, water depth and temperature, fetch) cause local variations to general effects. To keep on top of changes in the weather, boaters and the weather service must work together.

Environment Canada operates Canada's weather service, which offers a broad range of products and services designed to help boaters make informed decisions on how the weather will affect them. The Canadian Coast Guard (CCG) also plays an important role in disseminating forecasts and warnings. Having an understanding of current weather and forecast conditions and a keen eye for local changes and peculiarities increases the safety and enjoyment of boating.

A weather buoy on Lake Ontario.

At the Ontario Storm Prediction Centre in Toronto, information is amassed, analyzed, and translated into forecasts and charts to suit varied locations and needs. Those of special interest to boaters are marine and weather warnings, offshore marine forecasts, recreational marine forecasts, and the marine observations summary—all of which are broadcast in regular cycles on Weatheradio. Environment Canada also offers direct contact with a forecaster through its user-pay marine weather line at 1-900-565-6565. Cellular phones are not reliable out on the water, so it is best to rely on Weatheradio and marine radio services once afloat..

Special bulletins, which are broadcast immediately on marine radio by the CCG, are issued when weather, wind, or water conditions could pose a threat during the 48-hour forecast period. On Environment Canada's Weatheradio, warnings are issued as part of the regular marine and recreational marine forecasts.

During the recreational boating season, (May 1 to November 30), recreational marine forecasts are also available for Lake Simcoe, Lake Nipissing, the North Channel, Lake Nipigon, and Lake of the Woods—except when these lakes are still ice-covered. These forecasts include a detailed marine forecast that is valid until midnight of day two and are issued at 05:00 11:30, and 17:00, Eastern Time. They include Strong Wind warnings for winds of 20 kt or higher.

Weather information is also available through the public media (via the Canadian Press Wire Service) and the CCG's Communication and Traffic Services Centres, which broadcast marine forecasts, current wind conditions, and weather bulletins in a continuous cycle on channels 21B and 83B. The Centres also broadcast information on aids to navigation and ice conditions.

Western Island - Credit: Jim McMullen

Before setting out, boaters may also want to check on-line sources for weather information, including websites operated by Environment Canada and the U.S. National Oceanographic and Atmospheric Administration.

For more information, contact Environment Canada's National Inquiry Response Team:
Facsimile: 506-451-6010
Teletypewriter: 819-994-0736
Internet: Email

For information concerning the U.S. National Weather Service, contact the Port Meteorological Office in Cleveland, Ohio, at 216-265-2370 or in Chicago, Illinois, at 815-834-0600, extension 269.

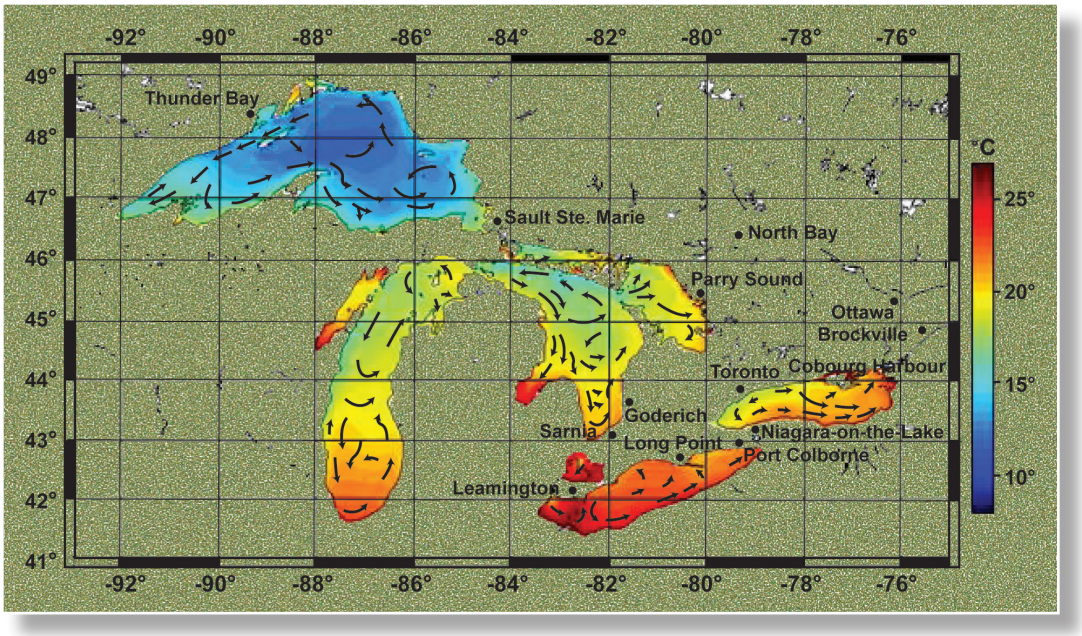
2. The Great Lakes

Local conditions are influenced by several weather factors that are true for all areas, to one degree or another. For example, cloudiness and storms are reduced if they come in over a large stretch of water. By comparison, new clouds and possible storms occur downwind over land, often along the lake-breeze front.

A persistent offshore flow causes an upwelling of colder water, increasing the likelihood of fog in the area—in particular, when it is warm and humid. The alignment of topography, long stretches of water and the day's wind flow cause certain places to have much higher winds and waves than are experienced near shore.

Currents also play a major role in local effects. Currents in the Great Lakes vary in scale, and each scale has its own local effect. It's important for mariners to know where the currents are in order to proper anticipate the "combined" local effect that the weather might create. This is true not only for large inland lakes but also for smaller inland lakes and rivers.

Forecast regions for the Canadian Great Lakes.



Average water temperatures in July between 2004 and 2009 (data made available through funding from SAR-NIF and the International Joint Commission Upper Great Lakes Study).

2.1 Lake Ontario

> ***"We must sail sometimes with the wind and sometimes against it – but we must sail, not drift, nor lie at anchor."*** **– Oliver Wendell Holmes.**
>
> ***"Where vast Ontario rolls her brineless tides…"*** **– Erasmus Darwin, 1791.**

Although Lake Ontario is the smallest of the Great Lakes, with a surface area of just under 19,000 square km, boating activity on its waters is heavier than it is on the others. There are several sizable population centres on its shores, and heavy industrialization also adds to its traffic and pollution problems.

Recreational boats of every type compete with commercial traffic from lakers and ocean-going ships, ferries, and even military vessels. The diversity and numbers of boats on the lake can cause problems, and boating collisions are a particular hazard. Care must be taken at night and in fog, smog, haze, or rain, when visibility is poor.

The most variable weather on Lake Ontario occurs in the spring and fall. In spring and early summer, alternating warm and cool air masses move through quickly, causing cloudiness and frequent thunderstorms. It is important to listen for marine and small-craft forecasts and warnings and keep an eye on the sky. It should never be assumed that a cloudless morning means clear sailing later in the day.

In summer, Lake Ontario's weather presents fewer hazards to the boater than might be encountered on Lake Erie or Lake Huron, with calm waters a frequent complaint. It is important, however, not to become nonchalant. Waves on Lake Ontario are generally only up to 1 m high but, in rare cases, can exceed 5 m. Lake Ontario has some of the deepest waters in the Great Lakes, averaging 86 m and second only to Lake Superior. Although the surface may be warm in the heat of summer, the upwelling of water from the frigid depths does occur—in particular, along the north shore from Burlington to Oshawa after two or three days of west to northwest winds.

Ketch with clear sailing.

Tropical air masses moving up from the Gulf of Mexico are a major influence on summer weather, and a temperature inversion occurs on occasion—especially around the Golden Horseshoe. The cooler air near the lake surface is trapped under a layer of warmer Gulf air above, allowing pollutants and humidity to build up and creating calm but muggy conditions.

The effects of lake breezes are noteworthy on Lake Ontario, in particular in the Greater Toronto Area, where the difference in temperatures over the warmer land and cooler water are amplified by miles of concrete buildings and highways along the lakeshore. The resulting lake breeze is enhanced by channelling (and with east northeast winds, by convergence), making winds between Mississauga and Oshawa quite brisk for sailing.

Lake Ontario does not freeze over completely, but boaters who are out as late as December—before there is any ice to dampen the effect of icing from spray—should be alert to the possibility of icing with strong winds, high waves, and even thick fog.

This section looks at local conditions in Lake Ontario in three parts: Eastern Lake Ontario and the St. Lawrence River, the Greater Toronto Area, and Western Lake Ontario.

2.1.1 Eastern Lake Ontario and the St. Lawrence River

Wind and sea conditions can be very complex at the extreme eastern end of Lake Ontario due to the lake-breeze effect, shoaling, currents, and various nearshore effects associated with the lake's many islands and straits. The most obvious wind features, however, are channelling to either the southwest or northeast and funnelling by the St. Lawrence River Valley.

Lake breezes are common for much of the summer. There can be heavy fog in spring, and thunderstorms occur on occasion during the summer. Bays in the east end may experience wave setup (i.e., a rise in water level) of up to 1 m with strong southwest winds. The inshore recreational boating route for the north shore of Lake Ontario runs from Belleville to Brighton, and boating traffic is heavy and mixed (e.g., recreational, commercial, military and international traffic) from Prince Edward Country up into the St. Lawrence River.

Brockville to Gananoque: This is a busy area, and choppy seas make the well-protected harbour at Gananoque a welcome one. With southwest or northeast winds, however, there may be steep seas east of Gananoque to the narrows due to funnelling along the St. Lawrence River (this is worse with northeast winds). The high islands produce corner effects, with gusty lee eddies. Currents can be 2-3 kt southwest of Brockville and are also strong south of the harbor at Gananoque.

Kingston Harbour and Approaches: There is heavy mixed boating in this area, including international traffic. Sailing and windsurfing are popular thanks to consistent winds of moderate strength, with a pronounced onshore wind caused by the funnelling of winds through the lower gap between Amherst and Wolfe Islands. These breezes are southerly at Kingston and southwesterly and slightly stronger in the channel between Wolfe Island and the mainland. Even moderate winds from the south to southwest build 1-2 m waves offshore due to the long fetch. Shoals, corner effects from islands, and funnelling at the lower gap can cause choppy seas at Kingston.

The sun setting behind a freighter.

Amherst Island to Prince Edward Bay: Protected anchorage at Prince Edward Bay may be a welcome relief, as shoaling can combine with high waves (caused by the long fetch) to produce heavy, breaking seas from Prince Edward Point west to Presqu'ile. These conditions, which occur with strong winds from the west through southwest (which is the direction of the prevailing winds), can make this a hazardous area. With northeast or southwest winds, wind-driven currents of 0.5 kt can cause heavy seas in the North Channel. At the west end of Long Reach, there may be heavy choppy waters because the north-to-south current interacts with waves built by funnelling southwest winds. This region is mainly ice-covered in winter, which is unusual for Lake Ontario.

Belleville to Trenton (Bay of Quinte): This area is used mainly by day sailors and windsurfers. The shallow channel of water results in the channelling of winds to the southwest or northeast, which may produce choppy waves of up to 1 m at the end of the fetch. Currents run west to east.

Brighton: This harbour is used for recreational boating but is too shallow for large vessels. Shallow waters cause shoaling and choppy seas with southeast winds.

Colborne – Ogden Point: This commercial harbour is highly exposed to southwest seas. A very strong current runs from west to east, and channelling occurs when the winds are southwest.

2.1.2 Cobourg to Metropolitan Toronto

This area gets heavy recreational use and great diversity in boat traffic. Southeasterly winds over the lake are channelled to easterly along the north shore. The resulting brisk winds make for pleasant sailing. Predominant nearshore currents are east to west but become variable just west of Toronto. Once in a while, summer inversions create calm and muggy conditions.

Cobourg: This port is difficult to enter when the winds are east through the south to west. With 1-m waves, a vessel with a 2-3-m draft can hit bottom. Shoaling occurs 1.5 km offshore, and there is silting in the port. Channelling can cause strong winds along the shoreline that may enhance the lake breeze effect. A strong current runs from west to east 2-8 km offshore.

Port Hope: This recreational harbour has a sandbar at its entrance, where there can be shoaling and rough waters. South to southeast winds create a danger of bottoming out. The wind-induced currents usually run from east to west.

Newcastle: This port is exposed to the south and experiences heavy seas with southerly winds. Shoaling 1-2 km offshore can cause choppy seas. Wind-induced currents usually run east to west.

Port Darlington: This very shallow harbour (less than 2 m deep) gets heavy wave build-up at its entrance and is limited to small recreational-vessel use. It is very exposed to the south, and there are strong offshore currents from the west.

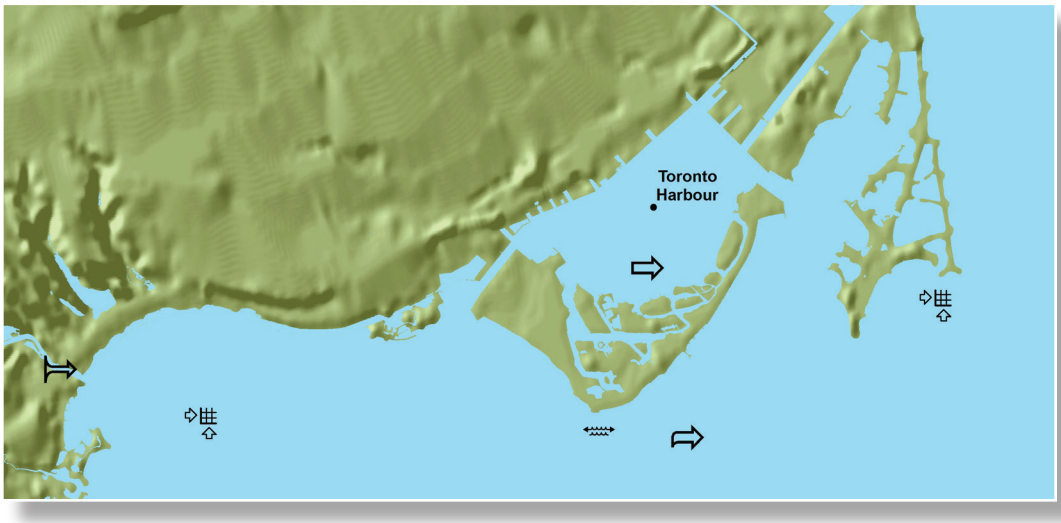
Oshawa: Traffic here is both commercial (outer-harbour) and recreational (inner-harbour). Winds from the southeast through the south to southwest make entry difficult, and the prevailing winds are southwest. Wind setup may raise water levels 30 cm, making conditions in the harbour more difficult.

Whitby: Winds from the south through the east provide a long fetch, with waves running right up the harbour and reflecting off the inner wall. There are strong currents 1.5 km offshore.

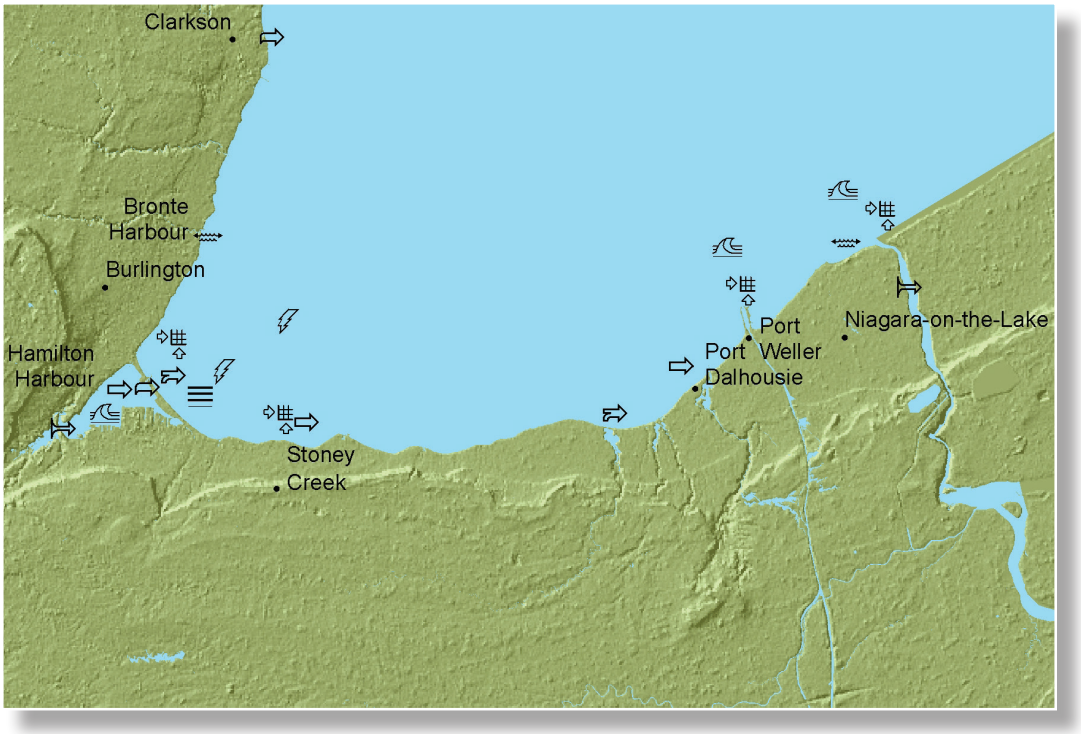
Toronto Harbour and Approaches: This harbour gets heavy recreational and mixed use. From April to December, commercial vessels use eastern and western gaps. The lake breeze is enhanced by the heat from this large urban area, with winds near Toronto Island often easterly in summer due to the lake breeze and channelling.

Approaching the harbour from the east, there can be confused seas due to shoaling 1.5 km offshore from the Eastern Gap to Frenchman's Bay, and entry may be difficult with southerlies. Waters near the Scarborough Bluffs are shielded from winds when they are northerly (due to the wind shadow). The Leslie Street Spit shelters the waters of Toronto Harbour, which has variable winds with some gustiness due to the city heat and tall buildings.

The western approach to the inner harbour can have confused seas due to the reflection of waves off the sea walls; however, inside the harbor, passage is calm. There is surprisingly strong current along the south side of Toronto Island, the direction of which varies. Humber Bay is sheltered with southeasterlies, but southwesterlies can cause waves to reflect off the sea walls. There is probably wave/current interaction at the mouths of the Humber and Rouge rivers and some funnelling of winds down the Humber Valley. Summer inversions can sometimes make conditions muggy.



Close-up of Toronto Harbour.



2.1.3 Western Lake Ontario

West winds are channelled along the south shore of Lake Ontario. The Niagara Escarpment produces local effects due to high land from Burlington to Beamsville, and thunderstorms often occur over the escarpment and move out over the water.

Clarkson: Channelling along the shore enhances the lake breeze in this area. Currents are variable but reportedly run from west to east near the shore a significant portion of the time—which is opposite to the officially recorded direction.

Bronte Harbour: This recreational harbor has a strong east-to-west current 1.5 km offshore.

Burlington Piers: There is heavy commercial and industrial traffic in this area. In the fall, westerlies funnel down Hamilton Harbour from Dundas Valley, causing breaking waves and unpredictable swirls and eddies at the breakwater near the Canada Centre for Inland Waters and the west side of the Burlington Piers. There is a 1-2 kt current in the canal. With strong easterlies, cross seas occur at the piers because the long fetch allows heavy waves that reflect off the piers and interact with the offshore current. With northeast to east-northeast winds, convergence strengthens wind and wave conditions. Watch for submerged pilings off the beach southeast of the Burlington Canal. Summer inversions can cause muggy conditions that are made even more unpleasant by the heavy industry in the area.

Hamilton Harbour: Heavy industry predominates in this harbour, with some recreational boating on the north shore. With both east and west winds, funnelling down the Dundas Valley increases wind speeds by roughly 50 percent relative to the surrounding area. Thunderstorms also tend to follow the valley to the harbour. With southwest to west winds, the harbour can be rough while the lake is calm. Lee or cliff effects from the escarpment cause locally gusty/calm patches. Strong northeast winds prevail in spring, early summer, and fall due to the combination of the lake-breeze effect and the channelling of winds into the harbour. Frequent summer inversions trap heavy pollution and haze over the area, reducing visibility to less than 10 km. With northeast winds in the spring, heavy fog can also be trapped in the harbour by a capping inversion and the effect of the escarpment.

Even small thunderstorms in a distance can change the wind direction and speed over a water body. Keep an eye out for low level clouds as an indicator.

Stoney Creek to Port Dalhousie: From Hamilton to Beamsville, cliff effects from the escarpment can cause local, gusty winds and confused seas. Currents run from west to east, sometimes causing wave-current interaction. There is shoaling at the entrance to Grimsby Beach. With northwest winds, channelling causes convergence along the south shore of the lake and increases wind speeds. Brisk onshore winds are common from Vineland to Port Dalhousie. Northeast to north winds can bring heavy seas due to the long fetch. Currents at the Port Dalhousie pier entrance are generally 1 kt but can rise to as high as 3 kt when the sluice gates are opened. Thunderstorms can cause the west pier to flood. Port Dalhousie is the only protected port between Hamilton and Niagara, but it may be difficult to enter with strong north to east winds due to heavy seas.

Port Weller: There can be heavy seas at the pier with east or west winds. With strong winds from the southwest through the northwest, there are heavy waves in the bay to the west of the piers; however, it is well-protected with light winds (up to 12 kt) from these directions. Strong, wind-driven currents interact with the flow from the canal to produce confused seas. Dumping from the locks makes berthing difficult in the reach.

Niagara-on-the-Lake: Wave-current interaction can be dangerous in this area and is made worse with shoaling in the bay. There is also some funnelling along the river. The river current flows northwest where it enters Lake Ontario but is diverted eastward by westerly winds along the south shore. Easterlies produce riptides and a clockwise gyre east of the river mouth and establish cross-lake flow, which can result in very difficult sailing. The marina provides safe shelter when there are heavy seas (locally known as "green mountains of sea"), which are especially treacherous with northerly winds.

2.2 Lake Erie

> ***"In September 1861, I was lying under Long Point when a waterspout bursted near us, and there was such a commotion in the water that my vessel walked away with her anchor."***
>
> **– Charles Gale, Marine Record**

Mariners' Tips

"The wind and waves come up so quickly on Lake Erie that you can go from dead calm one minute to ten foot waves within ten minutes."

"Erie is kind of our worst case scenario for weather – everything blows up much faster here. Ontario, being much deeper, tends to be much calmer. We'll have three to four metre waves in Lake Erie whereas in Lake Ontario they'll only be around one. For small craft that makes a big difference."

Boating on Lake Erie is not for the faint of heart. Prone to sudden and violent weather changes, including squalls, it is one of the most dangerous lakes in the Great Lakes system. Although the weather is fair and boating conditions are pleasant most of the time, thunderstorms can develop quickly, whipping up large waves.

Although it is larger in area than Lake Ontario, Erie is by far the shallowest Great Lake at an average depth of only 19 m. The gently rising land on either side of Lake Erie routinely channels winds along its east-northeast to west-southwest axis. These prevailing southwesterlies combine with sudden wind shifts to stir up steep waves and cross seas. Funnelling causes winds to be stronger in the east of the lake than they are in the west, but there are also short, steep waves in the western basin (west of Point Pelee) due to the shallowness of the waters and wave-current interaction. The prevailing year-round wind speed is 10-15 kt, but it exceeds 20 kt about 20 percent of the time in summer and over 50 percent of the time in winter.

A seagull sailing on the wind currents.

Even under normally benign weather regimes, there is usually some part of Lake Erie that produces hard-to-predict challenges for the boater. To make matters worse, safe harbour is hard to come by on the lake. With southwest winds, many ports are under the influence of onshore wave conditions and are very difficult to enter with following seas. Although the western basin is more protected, its extreme shallowness further complicates matters. With strong southeast winds, shoreline channelling produces wind-driven currents set from east to west along the north shore. This, combined with the shallow water and high waves, makes harbour entry difficult anywhere along the Canadian shoreline.

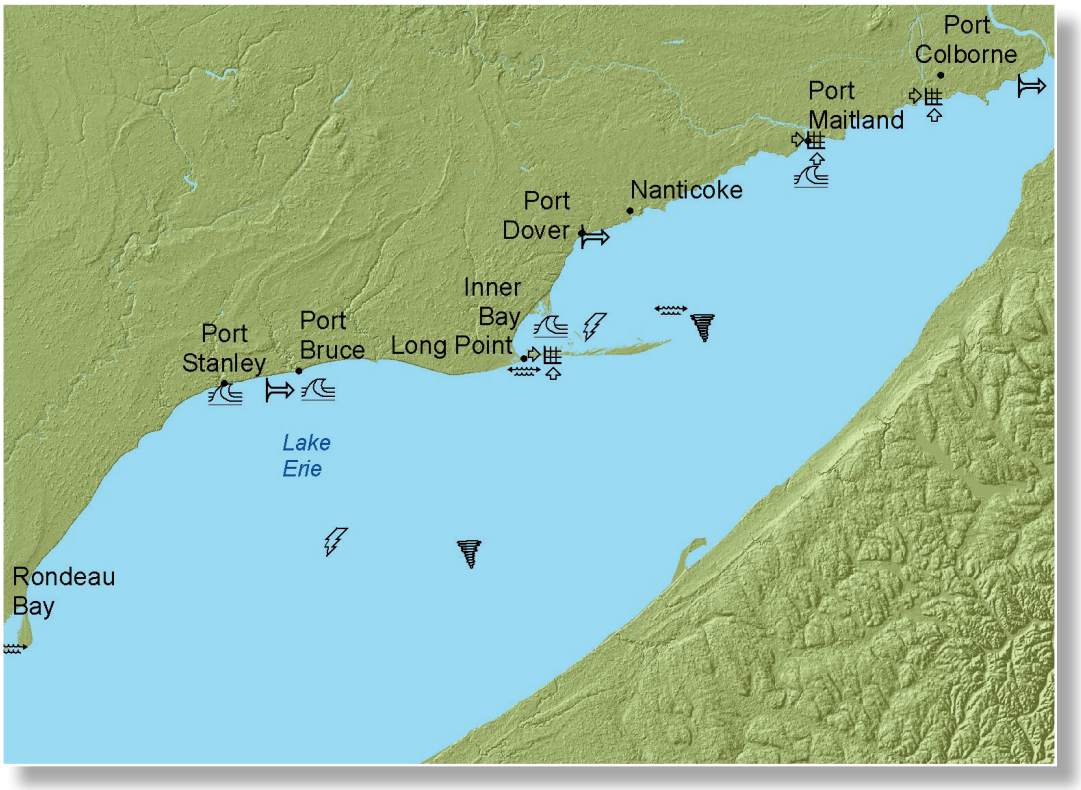
Water levels are affected by very large wind setup, followed by seiches. With southerly winds at 40 kt or more, the east end of the lake may experience a surge of over 1.5 m. Combined with 3-4-m waves, these surges cause erosion to shorelines and damage to harbour facilities. Fortunately, there are usually less than two or three such events per year, especially in recent years due to lower-than-average lake levels.

To add to the challenge of boating on Lake Erie, severe weather is also more common than it is on the other lakes, with 8-10 days of severe thunderstorms in the area each summer. Even as cooler spells move in, good weather should not be taken for granted. Waterspouts occur 4-6 days a year from late July to October, especially in the warm western basin (west of Point Pelee). Before setting out, mariners should check the forecast, watch the skies, and know where to find the nearest safe anchorage.

Lake Erie gets less fog than any of the other Great Lakes. Although it can be a problem early in the boating season—in late March and April—the lake warms up quickly, and there is little fog by June. In the late fall, freezing spray can pose a hazard in high winds and chaotic waves. On occasion, lakers must remove their icy coating at Port Colborne in order to have enough beam and draft to pass through the Welland Canal.

Traffic on Lake Erie is mixed and includes recreational boating of all types, fishing vessels (in Long Point Bay and the eastern and western sides of Point Pelee), and commercial traffic (e.g., lakers, gas-drilling rig, and other ships).

This chapter describes local conditions for Lake Erie in two parts: Eastern Lake Erie and Western Lake Erie, including Lake St. Clair.



2.2.1 Eastern Lake Erie

The prevailing southwesterlies on Lake Erie are strengthened by funnelling at the east end, causing high waves and sometimes choppy seas. Wind setup can cause dramatic rises in water level at this end of the lake—up to 2 m, in extreme cases. For the most part, summer skies are clear and weather is pleasant in eastern Lake Erie, but wind shifts and thunderstorm activity can make boating hazardous in short order.

Port Colborne: There is heavy commercial traffic in this port, including vessels going through the Welland Canal. There is good shelter behind the breakwall, but cross seas cause very rough waters outside the harbour entrance. Strong northeast winds can cause low waters followed by seiche oscillations, while strong winds from all other directions can cause high waves and difficult entry to the harbour.

Port Maitland: This port caters mainly to commercial and fishing traffic. It is difficult to enter because it is exposed to the prevailing southwest winds. There can be heavy seas with southwesterlies, and care should be taken to avoid the reef at Gull Island. A river current during spring run-off may result in wave-current interaction.

Nanticoke: This is a commercial dock where it is difficult to tie up in anything but light southeast winds. Strong currents coming around Long Point can reverse and cause eddies and wave-current interaction.

Morning radiation fog over typical Ontario lake.

Port Dover: This fishing and recreational harbour can be difficult to enter when there are southwest winds, which occur often; however, the expanded outer-harbour marina offers good protection. High ground around the river channel-harbour causes funnelling with northerly winds and morning valley winds. There are counter-clockwise currents in Long Point Bay. Thunderstorms are frequent from June to August between Port Dover and Long Point Bay.

Long Point and Inner Bay: This area is protected from the south by its peninsula. With northeast winds, channelling causes waves of up to 2 m, with a strong near shore current setting to the southwest. There is also a strong counter-clockwise current around the shallow (less than 13 m) hump in the middle of the bay that can reach 5 kt during storms. There may be cross seas near the end of the point during heavy weather. Long Point is subject to frequent thunderstorms and is a common location for waterspouts.

Port Bruce: This harbour provides poor shelter, as there is no protection from the west through the south and it is unapproachable with strong south winds. Cliffs at the creek entrance cause funnelling with northerly winds. There is a long stretch without good shelter from Long Point to Port Bruce (Port Burwell is silted).

Port Stanley: There is commercial and recreational traffic in this port. Very short, steep waves—caused by shoaling and wave-current interaction—can occur with winds from the southeast through the southwest (southeast winds are worst). Currents are from the south, but they veer to the west as they approach shore.

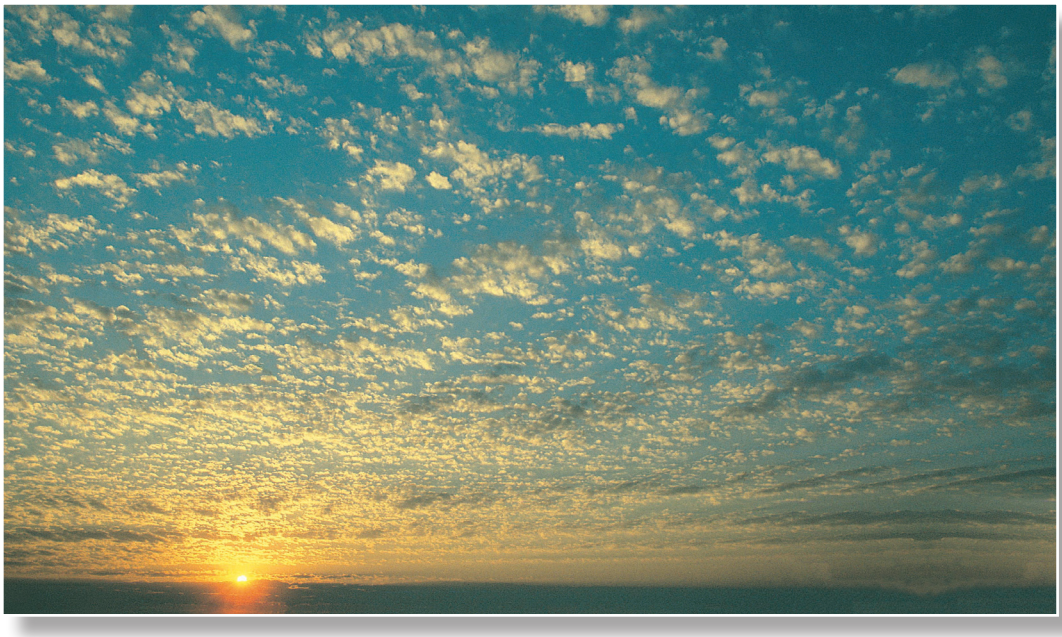
2.2.2 Western Lake Erie and Lake St. Clair

The western basin of Lake Erie (from Point Pelee to Amherstburg) is shallow and much warmer than the other lakes, with the water temperature sometimes exceeding 24°C. Its shallowness makes it prone to choppy wave conditions, as waves build up on shoals and refract around bends and points. Wave-current interaction further complicates matters. Thunderstorms and squalls are more frequent than they are elsewhere on the lake during the summer season, and waterspouts occur throughout the southwestern basin in the late summer and fall. Seiche events can be as heavy as 1-2 m. Gale-force southwesterlies can cause water levels to drop over 1.5 m, leaving some boats high and dry in extreme cases.

Rondeau (Erieau): This is a shallow harbor that is difficult to enter with southerly winds. The channel into Rondeau Bay has strong currents and fluctuations in lake level. There is a strong current at Point Aux Pins.

Wheatley: Shoaling 5 km offshore causes waves to break with easterlies. Counter-clockwise currents combine with waves generated by northeast winds, creating high and breaking waves offshore.

Pelee Island (Scudder Harbour): This is the best harbour on Lake Erie, with a sheltered entrance on the north side. Counter-clockwise currents combine with shoaling and refraction to create choppy wave conditions.



Sunrise with cumulus clouds. A good indicator of gusty winds to develop later in the morning.

Leamington and Kingsville: Leamington harbour has recreational and ferry traffic. Kingsville harbor, which has ferry and fishing traffic, is quite shallow, and grounding is possible with strong southwest winds. Entry to dock is difficult with southeast winds. South to southeast winds are strengthened due to shoreline convergence and funnelling between Point Pelee and Pelee Island. These winds produce heavy and confused seas due to shoaling and wave-current interaction.

Amherstburg: This very busy area has well-protected wharves. Strong northerly winds funnel down the river. Waves and a river current of 1-2 kt produce heavy, choppy seas with winds from the southwest through the southeast, especially near shoals. Strong southwest winds can significantly lower water levels.

Lake St. Clair: Over most of this shallow lake, traffic is recreational, but there can be heavy commercial traffic in the narrow shipping channel that runs up its centre. Smaller boats may encounter high waves from the wakes of these ships. Strong southerly winds may also build steep waves. Conditions are similar to those on western Lake Erie, where winds produce choppy waters due to shallowness, and thunderstorms and waterspouts are relatively frequent. Lake breezes are common and, in the late fall and early winter, there are snowsqualls.

2.3 Lake Huron/Georgian Bay

"We have some people who get caught in offshore breezes. You've got to be very careful. If you're a windsurfer and you get caught and the wind's blowing away from shore, your chances of getting back to shore if you get worn out are getting slimmer the further you go out there."

- Jamie Oakley, Canadian Coast Guard, Goderich.

"A grey and white cloud rose like a pillar, swelling with every stretch of altitude it cleared. Georgian Bay has its own special squalls, and this was a biggy."

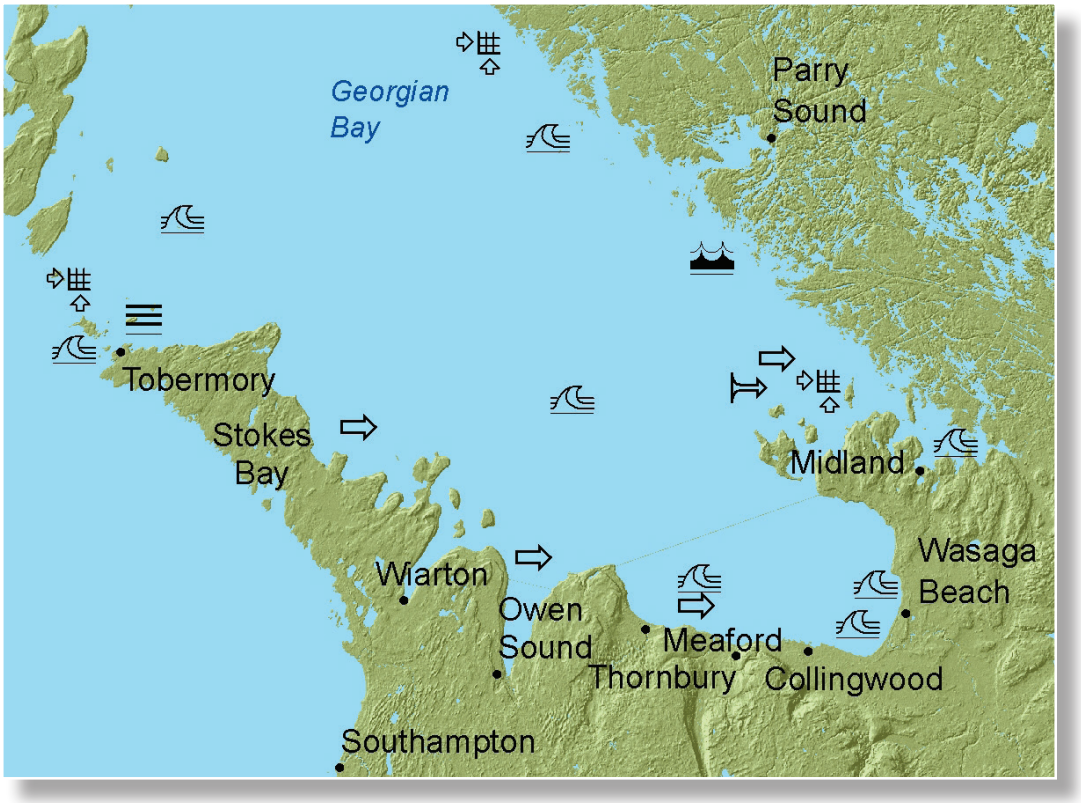
- Dave Martin, QAYAQ, Summer, 1996

Lake Huron is much larger (surface area of 59 600 km²) than lakes Ontario and Erie but not quite as deep (average 60 m) as Lake Ontario. There are many cottages along its shores and boating traffic can be heavy—in particular, in Georgian Bay.

Lake Huron offers great variety to the boater, from its vast, open reaches of cold water to the protected beauty and challenging sailing of its 30,000 Islands. Conditions are generally pleasant in summer, with precipitation occurring roughly 5 percent of the daylight hours over the lake and slightly more frequently in the North Channel. Visibility is also good, dropping below 1 km only 5 percent of the time on Georgian Bay and a little more often on northern Lake Huron.

Local effects on the lake are examined more closely under three distinct areas, the characteristics of which are sufficiently unique to require separate attention: Georgian Bay, Southern Lake Huron, and the North Channel, including Manitoulin Island.

Pointe au Baril. Credit: Jim McMullen



2.3.1 Georgian Bay

Nearshore wind effects are of particular importance in Georgian Bay because of its many islands, channels, and inlets, and its varying shoreline topography. Winds are also channelled down the bay on a broad scale, resulting in a predominant northwest wind-direction. This produces convergence along the south shore (and high ground) from Meaford to Collingwood and, as a result, seas are very heavy in this area. This may be accompanied by a rise in the water level of 0.5 m and pronounced waves in harbours along the south shore.

Marines should be alert to corner effects and funnelling as they travel through the 30,000 Islands, where many shoals and islands produce complicated wave action. Strong southwest through northwest winds produce significant wind setup (as high as 2 m at the ends of the channels) in the channels along the eastern and northeastern shores of the bay. With strong northeast winds, there can also be increases in water level and violent wave action from Cabot Head to Collingwood.

Wind speeds within the 30,000 Islands often exceed open-water speeds due to funnelling effects and channelling through the many islands. The numerous shoals can also cause waves to build steeply.

From Tobermory to Collingwood and within the Midland Channel, weather approaching from the west is not visible because of the high land that direction. Boaters must pay close attention in order to avoid being caught unaware by a thunderstorm. Waterspouts are also possible throughout Georgian Bay during the cold-air outbreaks that occur from late July through November and sometimes into early December.

Visibility problems sometimes occur due to the haze that accompanies south winds or with occasional dense fog in spring, when warm, moist air blows over the cool waters of the bay. Even when waters are calm and warm in a small bay or inlet, much colder, rougher waters may be encountered out in the open. The heavy recreational traffic in Georgian Bay and its many islands and channels make it especially important to know the waters and boating rules well.

Tobermory: This is a very busy recreational port with heavy ferry, cruising, and fishing traffic. It is also a popular area for scuba diving. The prevailing winds are northwesterly, and the outer harbour (Big Tub) is open to the northeast with a long fetch, so docking in a brisk northeast wind is difficult due to heavy seas. The inner harbour (Little Tub) is well protected. Offshore, there are cross seas due to wave-current interaction and channelling through the islands in the passage into Georgian Bay. There are extreme shoaling effects due to steep bottom-slopes from very deep to shallow waters. As well, there is some reflection of waves due to the steep drop-off at the shoreline in some places. Confused seas are further built by the refraction of waves off points and peninsulas. There is often heavy fog with west winds in the spring and summer due to the extremely cold water.

Entry to Georgian Bay: Strong westerly winds funnel through the channels between Manitoulin and Tobermory, causing seas as high as 3-5 m. The current can be as strong as 3-4 kt, moving northeastward, and with strong winds or large barometric changes, can be particularly strong in Devil's Island channel. Shoaling at the Great Barrier Shoals, east of the entrance to Georgian Bay, results in very turbulent seas, even with low wind-speeds.

Wiarton: This recreational and fishing port is well protected by a high coastline, except with northeast winds. Even then, the wave length is slightly dampened by islands at the mouth of the harbour. Cliff effects occur along the eastern side of the Bruce Peninsula, where the resulting strong, gusty winds have even blown over large sailing vessels.

Owen Sound: This is a relatively busy recreational, commercial, and fishing port. With southwesterly winds, it may be gusty at the harbour mouth due to valley winds. With east winds, which are rare, there may be significant setup (more than 0.5 m) in the inner harbour, but the marina on the northwest is well protected. Northeast winds increase through funnelling and cornering at Squaw Point, and currents run down the west side of the bay.

Meaford: This fishing and recreational port has prevailing northwest winds. When the winds are northeast, there may be heavy seas due to shoaling. The refraction of waves around the bend of the coastline increases wave heights. Currents run west to east at 0.5-1.5 kt.

Thornbury harbour: This is a fairly busy recreational harbour that is exposed to the west-northwest through the north to the east-southeast. Blue Mountain's high land causes gusty winds in the area due to valley winds and cliff effects. Channelling of northwesterly winds causes convergence near shore and increased wind speeds. Wind-generated currents as strong as 1-1.5 kt set to the east.

Collingwood: This is a recreational and fishing port. Shoaling at the Mary Ward Ledges north and west of the harbour results in heavy seas and difficult entry with the prevailing northwest winds. Convergence along the shoreline increases wind speeds, and currents of 0.5-1 kt flow from west to east.

Wasaga Beach: At this small-craft port, the gradual shallowing of the water begins about 8 km offshore and prevailing northwesterlies create a long fetch. The long, rolling waves that result are excellent for windsurfing and small sailboats. There can be strong southwest winds due to funnelling and channelling along the steep shores from Penetanguishene to Christian Island and east to the entrance to Midland Bay.

Midland: There is heavy recreational and fishing traffic as well as commercial traffic at this busy, well-protected harbour. High land, with many islands and inlets, causes a wide range of nearshore effects throughout this region. Northwesterlies funnel down the channel to the west, creating strong winds and heavy seas, but the harbour itself is

Silhouetted sailboats at sundown.

not affected. In fall, northeasterlies can make waves reflect offshore, increasing their height. Cornering and the refraction of waves around headlands create gusty winds and confused seas from Hope Island to Midland Bay Channel.

Parry Sound: This commercial and recreational harbour is protected from Georgian Bay effects. Out in the open, however, rough waters due to shoaling can take boaters by surprise.

Parry Sound to Little Current (inshore small-craft route): It is often possible to travel between Midland and Little Current sheltered from the open waves on Georgian Bay; however, in areas with steep islands and inlets, there may be gusty winds and confused seas due to funnelling and wave-current interaction. The current is onshore in eastern Georgian Bay, and winds from the south through the west to northwest produce the heaviest seas. Shoaling causes the seas to build about 2-8 km offshore. Some areas—notably from Little Current to Collins Inlet, from Point Gereaux to Bustard Island, and from Byng Inlet to Hangdog Point—are exposed to heavy seas due to the long fetch. The added effect of extensive shoaling makes the area from Byng Inlet to Hangdog point even worse.

2.3.3 Southern Lake Huron

The prevailing winds on southern Lake Huron are south to southwesterly. With winds from the southwest through the northwest, very heavy seas are generated along the entire eastern shore, which is exposed to the full fetch across the lake. Wind speeds average 15 kt in summer but have been reported as high as 50 kt in fall, with accompanying 5-6-m waves. The bottom slope near the 10-fathom line offshore causes steep and breaking waves.

With strong winds and sudden shifts in direction, there is a significant setup along this shore that can raise or lower water-levels in harbours up to 1 m. Thunderstorms can produce the same effect over limited areas. There is sometimes little warning of thunderstorm activity on Lake Huron, and waterspouts are a threat during cold-air outbreaks from August through October.

A 2-4-kt current, setting to the north, can be generated from Sarnia to Cape Hurd. This strong current can interact with waves from offshore and the confused seas at the steep bottom slope near the 10-fathom line to produce dangerous waves. Access to harbours is often difficult, with heavy and following seas.

Sarnia: This harbour has heavy commercial and recreational traffic, and the area from Sarnia to Blue Cove is known for its good windsurfing conditions. Channelling and convergence along the west shore create strong north to east winds, the characteristic northerlies causing high seas and a strong south-moving current in the river. This current is accompanied by a reverse current along the Canadian shore, which boaters and windsurfers can use to advantage. The current under the Bluewater Bridge is typically 3-4 kt.

Bayfield: Entry to this harbour is difficult unless the wind is offshore (easterly). Onshore winds produce heavy breakers due to shoaling near the 10-fathom line. Water levels in the bay can rise 0.5 m due to wind setup with northwesterly winds.

Goderich: There is mixed commercial, fishing, and recreational traffic in this harbour. It is exposed from the south to the northwest, and southwesterlies make entry difficult for small craft. Short, steep waves create difficult boating conditions. There is a strong south-to-north current offshore.

Kincardine: This recreational and fishing port is protected from the northwest by a breakwater; however, with strong northwest winds there can still be some wind setup. With westerlies, which are sometimes very strong, there can be heavy seas offshore. A strong, north-setting 2-4-kt current has been reported offshore.

Port Elgin: This small port offers good windsurfing conditions. Prevailing northwesterlies combine with the effects of shoaling and refraction to produce high waves, especially in the harbour. There is a strong south-to-north current offshore. Many thunderstorms that come across the lake arrive onshore here.

Southampton: There is mixed recreational, fishing, and commercial traffic at this port, which is difficult to enter or leave with winds from the north-northwest through the west to south. There is a strong northward current, and there can be heavy seas offshore.

Stokes Bay (the Fishing Islands): This is mainly a fishing area. The shoreline from Oliphant to Stokes Bay can be treacherous due to heavy confused seas and gusty winds. Contributing factors are strong currents set to the north, a very long fetch, cornering and shoaling around islands, and the channelling of northwest winds along the shoreline.

Sunset from the east shore of lake Huron.

2.3.4 The North Channel and Manitoulin Island

The orientation of the North Channel produces a prevailing westerly wind along its length. The winds are funnelled and increase in speed significantly in the Espanola area. East or west winds can produce large waves and wind setup, as well as strong currents through straits and passages. Rapid fluctuations in pressure during thunderstorms can also produce local jumps in water level. The east-west oriented channel extends 160 km, providing a long fetch, the impact of which is moderated at the eastern end by about 50 km of islands. Mariners should be alert to local effects from high land and narrow passages.

Fog is less extensive over the North Channel than it is on northern Lake Huron in late spring and summer. Showers and thunderstorms are more common, however, because they lose their punch over the cooler Lake Huron waters.

There are several well-protected harbours and anchorages on the north shore of Manitoulin, including Little Current and Gore Bay.

Great Duck Island and Burnt Island: There is very little recreational or commercial traffic near this sheltered anchorage between Great Duck Island and the Outer Duck Islands—as such, it is quite peaceful. Anchorage at Burnt Island is generally well protected, but seas can be heavy with southwest winds.

Western Straits: Funnelling in Mississagi Strait, Detour Passage, and False Detour Passage creates erratic doubling of wind speeds, due to high shorelines. There are strong currents in the straits.

Meldrum Bay: This harbour, with its stone dock, is well protected, except from the north to northwest. Gales from these directions can cause heavy seas, and there is a strong current from west to east.

Thessalon: This recreational and fishing port is generally well protected but exposed to easterly winds. The steep islands and shoreline create a variety of nearshore wind effects, which cause confused, choppy waves when combined with shoaling.

Little Current: This is a busy area with a strong current, especially at the bridge. Without significant wind, the current is set to east at 0-2 kt; with strong westerlies, it can reach 6-7 kt. With strong southeast winds, a light current set to west may develop. There is channelling and funnelling down the North Channel and around islands. This combines with corner effects and shoaling around islands to produce choppy seas in the east end.

South Baymouth: This is a ferry port with fairly light recreational and fishing traffic. Strong west-through-south winds cause heavy seas and currents, which can be as fast as 4-5 kt at narrows. Wind setup can raise water levels as much as 1.5 m when there are southwest winds due to the long fetch.

Starboard of Ketch under a mackerel sky.

2.4 Lake Superior

"Whitefish Bay is notorious for its rough waters. … A very high percentage of the ships that have ever sunk in Lake Superior have gone down in Whitefish Bay. It's here that the Edmund Fitzgerald was lost in a terrible storm in November 1975."

– Mary Jo Cullen, QAYAQ, Winter 1997

"To me the Great Lakes will always mean Lake Superior … There is something singularly impressive in the mere silence and vastness of our great northern solitudes."

– Alice Wellington Rollins

"Those who have never seen Superior get an inadequate even inaccurate idea by hearing it spoken of as a lake … Superior is a sea. It breeds storms and rain and fogs …It is cold, wild, masterful and dreaded."

– Reverend George Grant, 1872, Kanawa, Winter, 1995

Lake Superior is enormous. It holds 12 100 km^3 of water, reaches a maximum depth of 405 m, and covers an area of 82 100 km^2. It could hold all of the other Great Lakes plus three extra Lake Eries. It is also by far the deepest and coldest of the lakes. The air temperature over the water averages less than 15°C in summer, whereas on Lake Erie it exceeds 20°C. Because it is so large and cold, Lake Superior—more than any other Great Lake—creates its own weather regime.

Meteorologically speaking, Superior can be divided into two distinct areas: west and east. Since most of the Canadian waters are in its central and eastern portion, however, it is treated in this guide as a single area. On western Lake Superior, from south of Isle Royale to Duluth, the prevailing winds are from the northeast or southwest (due Whitefish Bay, prevailing winds are from the northwest).

Fog is a major problem on the lake, particularly in spring and summer. This is because water temperatures usually do not rise much above 10-14°C. Superior's average water temperature in May and June is 10-12° lower than it is in the lower lakes. Even in August, it only reaches 14°C, while in the southwestern basin of Lake Erie, it exceeds 24°C. As a result of these cold water temperatures, from April through July any weather regimes with dew-point temperatures above the water temperature produce extensive fog, as the relatively warm, moist spring air condenses above the cool Superior waters. June is the worst month for these fog banks, which are almost a permanent feature over the whole lake, including nearshore areas from Sault Ste. Marie to Thunder Bay. In July, fog frequency drops dramatically along the east and west shores due to a significant warming of the lake's surface temperatures.

In fall and winter, winds over the lake are often 10-15 kt stronger than they are over land. This is because the lake has reached its maximum temperature by early fall, at which time cold air is being driven down from the north. This Arctic air produces instability over the warmer water, which in turn results in very strong, cold gusty winds being drawn down to the lake surface. Strong Wind Warnings are issued from May to November when winds are 20 kt or more. Wind speeds in summer reach that strength only 10 percent of the time; in fall and winter, 40 percent of the time.

Wind setup and seiches are generally of little significance on Lake Superior, where even 40 kt winds will only raise water levels by 15 cm in most cases. The narrowing and sloping of some bays at the east end of the lake (e.g., near Sault Ste. Marie), however, can amplify the setup effect, and maximum increases in water level approaching 1 m have been reported.

In the summer, waves average less than 2 m in height, but they can get as high as 6 m on occasion. In winter, waves are higher, averaging 2-3 m and, in extreme cases, reaching 10 m. It is important to remember that seas may be higher or choppy and confused in areas where nearshore effects, currents, or thunderstorms interact with overall wave patterns.

Boat in large waves.

The Canadian shores of Lake Superior loom steeply out of its waters, setting the stage for vicious winds off the high land and a great many nearshore wind effects. Since much of the shoreline is sparsely populated, however, there is little documentation available on local experiences. The combination of coastal convergence, cornering, funneling, and channelling all contribute to diverse local effects, but only some of these are specifically identified in the descriptions of local conditions that follow.

Thunderstorms on Lake Superior are usually associated with cold fronts, but they lose some of their strength as they move from the warmer to the cooler waters of the lake. Squall lines, which typically move from west to east across the lake, are usually much weaker by the time they reach the eastern shore.

There is very little precipitation on Lake Superior during the summer, where it rains only about five percent of the time. In the winter, however, precipitation occurs about one third of the time, often combined with freezing spray.

A very real danger is presented to vessels that ply Superior late in the season, hugging the north shore for safety. In November and December, freezing spray can cause severe icing. It is no coincidence that November is also the month in which some of the worst tragedies in history have occurred on both Lake Superior and Lake Huron—in particular, early in the century, when shipping was heavy. The infamous Edmund Fitzgerald was lost "with all hands" in 1975 in one of Superior's occasionally ferocious November storms.

Sault Ste. Marie and the St. Mary's River: This area is relatively sheltered from the weather on Whitefish Bay. River traffic is heavy but carefully regulated. With strong northwest winds, there may be setup of up to 1 m northwest of the locks.

Whitefish Bay: This relatively sheltered bay has heavy commercial traffic and is a common anchorage for vessels waiting out a Superior storm. When there are strong westerly winds, there may be heavy seas.

Batchawana Bay: With strong southerlies, anchorage behind the government docks may be rough, while Harmony Bay and Havilland Bay provide protected shelter. Heavy or confused seas can occur at the west end with strong onshore winds (from south through west), due to shoaling and nearshore wind effects. The steep deepening of the lake bottom between Cape Gargantua and Whitefish Bay causes choppy seas due to shoaling when winds are westerly.

Quebec Harbour (Michipicoten Island): This is one of the best-sheltered offshore anchorages on Superior for vessels up to 100 m in length. With strong northwest winds, there is a strong easterly current in the harbour entrance. The reflection of waves with strong south winds can create heavy seas.

Michipicoten Harbour and Michipicoten River: With west or southwest winds, Michipicoten Harbour can be a "mean place" for large vessels. Winds from the south through the west channel to become southwest, and true southwesterlies are amplified by 25-40 percent due to funnelling. A strong current at the Michipicoten River entrance creates bad cross seas due to wave-current interaction and choppy seas off Lighthouse Point.

Otter Head: The very steep shoreline from Otter Head to Marathon causes convergence with southerly winds and cliff effects with northeast or southwest winds. The reflection of waves creates confused seas with strong southwest winds. With strong northeast winds, drops in water level due to seiche are reportedly sufficient to enable small craft touch bottom on occasion.

Marathon: This horseshoe-shaped harbour is surrounded by high land and provides excellent, protected shelter; however, its high walls also trap pollution. There are often valley winds, resulting in gusty, shifting winds outside the harbour when general lake winds are southerly.

Rossport and Battle Island: This is a sheltered harbour for small craft. Between Wilson Island and Salter Island and off Moffat Strait, there are cross seas. Westerlies can cause high seas south of the islands because there is a long fetch; the glass in the 14-m-high lighthouse lantern at Battle Island has been broken by such waves. Valley winds and cliff effects are likely between Schreiber and Terrace Bay.

Nipigon Bay: This is a shallow, relatively landlocked bay with five entry passages, all with steep, high walls, and several steep, small islands within it. It is a likely location for funnelling, shoaling, and wave-current interaction. There are strong currents, often running in opposition to the wind, and the west end of the bay is very gusty with high seas of up to 2 m when there are south or southwest winds, due to funnelling. East or west winds can cause steep, choppy seas due to the combination of shallow waters, steep islands, and currents.

Thunder Bay: With southwest or northeast winds, there are often steep and chaotic seas between Cape Thunder and Pie Island, due to the funneling and channelling of winds just outside the harbour. Along this stretch of Superior, the predominant northeasterlies and southwesterlies outside the bays produce strong wind changes at their mouths. The interaction of the channelled winds outside the bay with onshore lake breezes makes winds variable and difficult to forecast in the bay. Attempts to navigate between Pie Island and the mainland are dangerous with almost any wind direction. Westerly winds over the high ski-slopes produce a cliff effect, with a calm area near Pie Island and a sudden increase in wind speed further out. Southerly winds can also be bad, and the fetch in the bay is long enough to produce 2-3-m waves. A swift current of 1-1.5 kt runs down the channels into the bay, and east to east-northeast winds make the breakwater difficult to manoeuvre.

3. Smaller Lakes

Boating in Ontario is by no means confined to the Great Lakes. There are many medium and small lakes with extensive recreational activity and some commercial ventures, such as fishing and cruising. Medium-sized lakes, such as those discussed separately in this section (e.g., Simcoe, Nipissing, Nipigon and Lake of the Woods) are big enough to have their own recreational boating forecasts. Boaters on smaller lakes and rivers with no recreational boating forecast can listen to the public forecast and apply the general principles in this guide.

Sailboarders on a lake.

Wind and weather conditions on inland lakes reflect the competing influences of land and water. On small lakes, boaters are never more than a few kilometres from shore, so they feel the effects of land winds. Also, smaller, shallow lakes heat up much more quickly than the Great Lakes do, reducing the land-lake temperature contrast. Winds on small lakes, therefore, tend to be gustier in spring and summer than they are on the Great Lakes. The lake-breeze effect is also less significant on smaller lakes, such as the Muskokas and Kawarthas, than it is on larger ones.

Thunderstorms tend to be more frequent on small lakes than they are on the Great Lakes because smaller lakes do not have large enough expanses of cold water to dampen the strength of thunderstorms moving off the land. These storms may also take boaters by surprise in areas where high land and forest block the view of incoming storms. For the most part, however, wind and weather effects are governed by the same forces as they are on the Great Lakes but operate on a smaller scale. For instance, wave heights are generally less than 1 m because the fetch and lake depth on a smaller lake doesn't allow waves to build to extreme heights. These shorter waves may still be steep and choppy, especially on medium-sized shallow lakes, such as St. Clair, and in areas with heavy small-craft activity.

Boating traffic on smaller lakes is predominantly recreational. It can be very heavy in cottage areas, and the wide variety of recreational activities supported by some of these lakes demands close attention to safe boating practices.

On rivers and canal systems, the same conditions apply, but boaters should be alert to the interaction of river currents with wave conditions and the possibility of funnelling and valley effects. It should also be noted that lightning creates special problems in canal-system locks, which are lined with highly conductive materials and may experience disruptions in their power supply as the result of a lightning strike. Boaters expecting to enter locks should listen for weather watches and warnings to ensure that they are not stranded there during an active lightning storm.

3.1 Lake Simcoe

> ***"We spent a few years on Simcoe. The seas would become quite steep in a short period of time. They'd also correct quickly. There's a lot of wake-induced waves there."***

Lake Simcoe, like the Muskokas and other smaller lakes in "cottage country", is very busy with recreational boating of all types. Its proximity to Toronto makes it particularly popular, and it is also an important link in the Trent-Severn Waterway. The main body of the lake is about 30 km long and 24 km wide, with more than 230 km of shoreline. Because it is so busy, seas can be choppy, with many wake-induced waves. Thunderstorms occur relatively frequently and are sometimes severe. They can change conditions on the lake very quickly, producing dangerous winds, weather, and waves with little warning. With the prevailing west-northwest wind, the east side of the lake is exposed to heavy seas.

Barrie/Kempenfelt Bay: Kempenfelt Bay is 14 km long, with a maximum depth of 42 m and no shoals. It provides a calm, safe harbour at Barrie, at the west end of the bay, when the prevailing westerlies are blowing. Barrie is a busy recreational harbor that has sufficient water depth (1-4 m) at its Bayfield Wharf, even for larger vessels. In high

winds, there are rough seas just east of the mouth of Kempenfelt Bay; with northwest winds, cross currents and erratic wave-patterns are prevalent. The west shoreline of the lake is generally protected from the prevailing winds, but strong winds can stir up 1-m waves not far offshore. Further offshore, Long Shoal, which is well marked, causes shoaling effects.

Atherly/Lake Couchiching: The narrows into Atherly are well protected by a number of islands. There is heavy recreational boating traffic at this entry to the Trent-Severn Waterway.

Lagoon City: Popular for recreational boating, this harbour has a well-protected breakwater. Shoaling occurs in the shallow waters north of the harbour.

Beaverton: Heavy recreational boating and plentiful marina facilities are found at this harbour, which serves as a safe haven from the rough waters that occur with prevailing winds on the east shore of the lake.

Georgina Island: Georgina is the largest island on Lake Simcoe. The water is shallow south of the island, so boaters must be familiar with area to avoid hitting bottom. Marine facilities are available at Jackson's Point and along the Pefferlaw River.

Cook Bay: There are several marinas and heavy recreational boating in this shallow bay, which is generally calm, except with winds from the north-northwest. With north-northeast winds, high waves pile up in the shallows. Small boats can enter the Holland River through this bay, but only those that can negotiate under low bridges.

An October sunset.

3.2 Lake Nipissing

With a surface area of 831 km^2, Lake Nipissing is much smaller than any of the Great Lakes. Its Ojibway name means "little water", which is a reference to its size in comparison to Georgian Bay. It is also much shallower than Georgian Bay, averaging 4.5 m in depth and reaching its greatest depth (52.5 m) near the mouth of the French River. Because it is so shallow, effects from high winds can cause strong wave action. The lake's east-west orientation gives it a fetch of 80 km, long enough to produce wind setup with westerly winds. There is moderate recreational boating on the lake, much of it from fishing. In the summer, the prevailing winds are southwesterly (southwest through west-southwest); the next most-common wind direction is north. Southwest winds often follow the passage of warm front and can reach strengths of more than 15 kt and last over 12 hours. As a result, waves can reach 2 m on the east half of the lake due to the long fetch. Prolonged westerly winds also cause significant wind setup along the inhabited east shores, with seiche of up to 0.5 m over 24 hours.

Squalls and gusty winds often occur ahead of cold fronts, and thunderstorms with frequent lightning can approach quickly, with little warning. Northerly winds are common after a cold front moves through, and rapid and substantial changes in wind speed and direction stir up confused seas in the front's wake. These strong winds and heavy seas are the most common navigational hazard due to weather effects, followed by thunderstorms and heavy precipitation, which cause poor visibility.

Nearshore wind effects are less significant on Lake Nipissing than they are on Georgian Bay because the shoreline topography is generally lower and less convoluted. There is little hazard from currents or fog. The lake is too shallow to experience significant advection fog, radiation fog on calm summer mornings generally burns off by midmorning, and warm frontal fog occurs only occasionally.

North Bay: This is a busy recreational port for cruising, sailing, and fishing. Sand shoaling occurs about 500 m offshore, from North Bay to the Lavase River. Prolonged southwest winds can create waves 1-2 m in height and, if strong westerlies persist longer than 12 hours, can be greater than 2 m. Moderate to strong westerly winds combine with shoaling to create heavy seas along the entire eastern shoreline. On summer afternoons, the lake-breeze effect can build onshore winds from calm to 10-15 kt within 10 minutes. These winds persist into the late evening, stirring up waves higher than 0.5 m within 15 minutes of their onset.

Callander Bay: This is a sheltered harbour with considerable recreational and fishing activity. Boaters can be taken by surprise by approaching thunderstorms and gusty winds. Funnelling of east or west winds through the harbour entrance can increase wave heights, and strong northeast or southwest winds combine with the shoreline topography to create choppy and confused seas.

South Bay and the South Shore: There is some recreational and boating traffic in this area, despite the fact that northerly winds frequently create high seas. Crossing the lake from Deepwater Point to Cross Point can be treacherous, with full exposure to wind and wave action from all directions. Parts of South Bay provide protection, but the many islands combine with winds to produce gusty winds and confused seas.

The French River Entrance: This area is a busy one for recreational boating, including traffic from canoes and kayaks. The river mouth is protected, except from southwest or northeast winds, which can create high seas. Cold frontal thunderstorms approaching from the west or northwest may surprise boaters because of the shoreline topography. There is shoaling near the entrance as the river bottom rises from a depth of more than 50 m to meet the much shallower lake bottom.

West Bay: This area has less boating traffic and is somewhat protected from prevailing winds by its topography. Islands and shoals can create confused seas, and with easterly winds, the long fetch builds waves to 2 m, with 0.5-m rises in water level due to setup in some of the bays and channels.

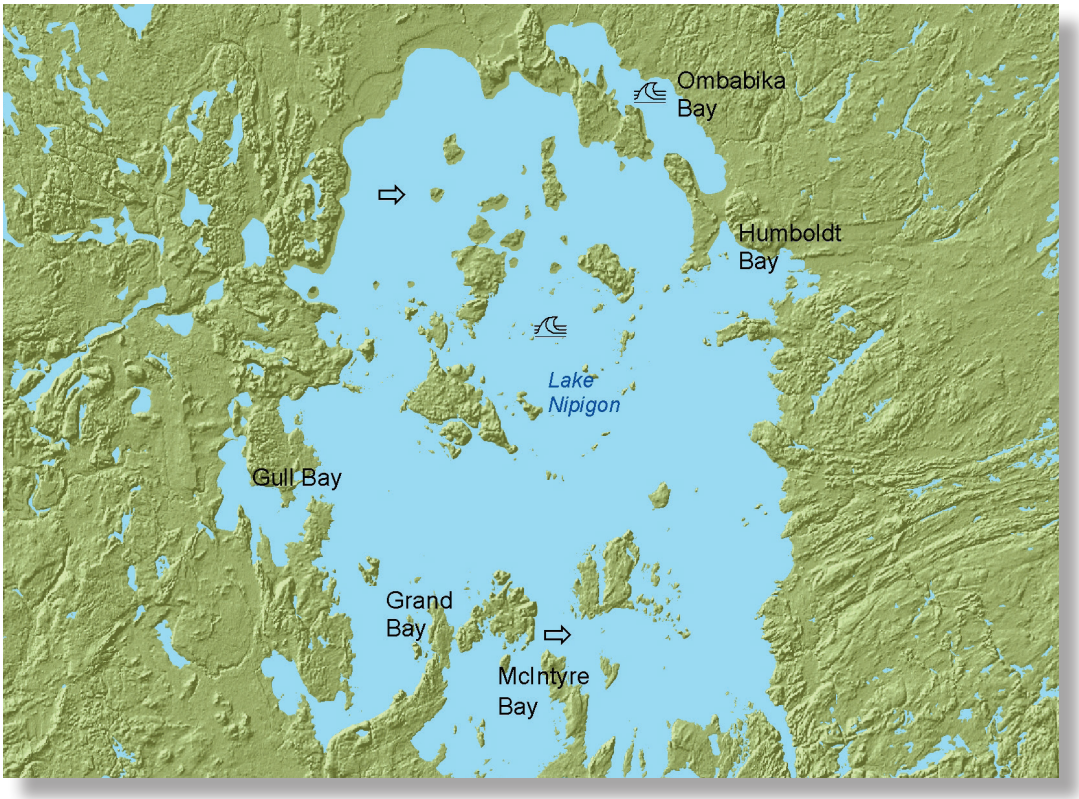
The West Arm: This area has heavy recreational and fishing traffic and offers many protected bays and channels. There is little wave action, except in a few channels where the funnelling of north or south winds produces locally confused seas.

Cache Bay and the North Shore: The north shore has considerable recreational and fishing traffic and some commercial activity, as well. Cache Bay is a protected harbor, but with winds from the south, the north shore is generally exposed. Southerly winds funnel along the Sturgeon River, and its entrance is subject to strong wave action with winds from the east to the west, through the south. The river current is less than 2 kt and poses little hazard. West of the Sturgeon River, shoreline topography, shoaling, and islands produce choppy seas but offer some shelter. East of the river, there is little protection.

The Manitou Islands: This recreational and fishing area is exposed to the prevailing winds, but the islands provide some protection from wind-driven wave action. Winds can become strong with little warning, so boaters are wise to head toward shore at the first indication of an increase. Steady winds produce long, rolling waves all around the islands due to the long fetch; with the onset of winds greater than 15 kt, from any direction, 1-2-m waves can develop within an hour.

3.3 Lake Nipigon

Lake Nipigon is larger than Lake Nipissing, at 88 km wide and 128 km long (north/south), but it is more remote and less busy. There is some commercial and recreational fishing traffic, as well as recreational boating. The paucity of marine traffic becomes a hazard in itself for boaters who need help unless they are able to establish radio communications with the commercial fishing operations.



Nipigon is, for the most part, deep, reaching an estimated 100-180 m depth at the centre. It has never been formally charted. Its shores (and the shoes of islands within it) are mainly steep and rocky, and they offer very few bays and protective harbours. The strongest winds and highest waves are most likely to occur with the passage of cold fronts over the lake, the most vigorous of which occur early and late in the boating season. Strong northerly winds whip waves up to 3 m high very quickly, and northeasterly winds are strengthened by

convergence due to channelling along the west shore. Thunderstorms are not as frequent to Lake Nipigon as on more southern lakes, but when they occur they can produce dangerous squalls and high waves in short order.

The lake's rugged islands produce a full range of nearshore wind effects, including cornering and cliff/lee effects, but they also serve to break up the long fetch, which would otherwise run 128 km with north/south winds.

Ombabika Bay: This bay on the northeast end of the lake provides some shelter, except from strong northeast/southeast winds, which can create high seas. There may be funnelling of winds through the entrance to the bay with north or south winds.

Humboldt Bay: There is little protection from westerly winds here, except behind the islands within the bay. The bay does provide shelter from other wind directions.

Orient Bay: This is a commercial fishing and recreational harbour, with a provincial park at the mouth of the bay. This narrow bay provides safe shelter from all but northwest/ southeast winds and associated waves.

South Bay to McIntyre Bay: There is some commercial fishing on South Bay. McIntyre Bay is well-sheltered. It's only access is opposite Shakespeare Island, which may produce some corner and lee effects.

Grand Bay to Gull Bay: These bays are small, but Gull Bay provides some shelter from winds and waves in the centre of the lake.

Sunset over a lake.

3.4 Lake of the Woods

There is busy recreational boating of all types on this lake, which includes both U.S. and Canadian waters and is lined with many tourist facilities and marinas. At 4350 km^2 (3149 km^2 of which is in Canada), the lake is the remnant of glacial Lake Agassiz and has many inlets and islands. It is 112 km by 102 km but boasts more than 6500 km of shoreline on the mainland and 4000 km of shoreline on its 14 632 islands. The inlets and islands, many of which are steep and rocky, make Lake of the Woods an ideal demonstration ground for nearshore wind and wave effects.

The mean water depth in Canadian waters is 7.9 m, with a maximum depth of 68.8 m in Whitefish Bay, east of Sioux Narrows. The U.S. portion of the lake is shallower and sandier, particularly at Big Traverse Bay. The water level is controlled and is allowed to fluctuate by 0.5-1.2 m.

There are frequent thunderstorms on the lake, including both frontal and isolated air-mass storms. Cold fronts that cross the area with prolonged, brisk northwest winds produce high seas and strong gusty winds. Intense lows that pass south of the lake in spring and fall can produce sustained easterly winds, which can also build large waves.

North of the Aulneau Peninsula: This is a busy recreational boating area, particularly near Kenora. Its many islands not only provide protection from wind and waves but also produce many nearshore wind effects. Winds from the northwest and east can produce

1-2-m seas. Funnelling occurs in channels and corner and cliff (lee) effects around islands.

Big Traverse Bay: This sandier, much shallower area has busy recreational traffic, and its waters get stirred up into high seas more easily than the deeper part of the lake. It is also more open (the bay is approximately 50 km by 64 km) and provides a fairly long fetch for winds from the north to northwest and from the east, which can build waves up to 3 m high. High seas create an increased risk of bottoming out in the shallow waters of the bay.