# ATL 100

Canadian
# Sailing Directions

General Information, Atlantic Coast

12/2021

Fisheries and Oceans Canada    Pêches et Océans Canada

Canada

## Pictograph legend

| | | |
|---|---|---|
| Anchorage | Current | Radio calling-in point |
| Wharf | Caution | Lifesaving station |
| Marina | Light | Pilotage |

### Report discrepancies between real-world observations and descriptions in the publication

Users of this publication are requested to forward information regarding newly discovered dangers, changes in aids to navigation, the existence of new shoals or channels, or other information that would be useful for the correction of nautical charts and publications affecting Canadian waters to: chsinfo@dfo-mpo.gc.ca.


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# Record of Changes

As the CHS acquires new information, relevant changes are applied to Sailing Directions volumes in order to maintain safety of navigation. It is the responsibility of the mariner to maintain their digital Sailing Directions file by ensuring that the latest version is always downloaded. Visit charts.gc.ca to download the most recent version of this volume, with all current changes already incorporated.

The table below lists the changes that have been applied to this volume of Sailing Directions. This record of changes will be maintained for the current calendar year only

| Chapter / Paragraph | Description of Change |
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# PREFACE

The Second Edition of *Sailing Directions, ATL 100 — General Information — Atlantic Coast*, 2007, has been compiled from Canadian Government and other information sources. In general, all hydrographic terms used in this booklet are in accordance with the meanings given in the *Hydrographic Dictionary* (Special Publication No. 32), published by the International Hydrographic Bureau.

The general information of the Atlantic Coast is grouped in this booklet. It contains navigational information, a brief description of the main port facilities as well as geographic, oceanographic and atmospheric characteristics.

The detailed description of the geographical areas is given in a series of booklets. Their limits are printed on the back cover of the booklets. **The descriptive booklets should be consulted in conjunction with the *ATL 100 — General Information* booklet**.

The photographs are supplied by Fisheries and Oceans Canada.

Canadian *Sailing Directions* amplify charted details and provide important information of interest to navigation which may not be found on charts or in other marine publications. *Sailing Directions* are intended to be read in conjunction with charts quoted in the text.

## Remarks

**Buoys** are generally described in detail only where they have special navigational significance, or where the scale of the chart is too small to clearly show all the details.

**Chart references**, in italics in the text, normally refer to the largest scale Canadian chart but occasionally a smaller scale chart may be quoted where its use is more appropriate.

**Tidal information** relating to the vertical movements of the water is not given and the *Canadian Tide and Current Tables* should be consulted. However, abnormal changes in water level are mentioned.

**Names** have been taken from the official source. Where an obsolete name still appears on the chart or is of local usage, it is given in brackets following the official name.

**Wreck information** is included where drying or submerged wrecks are relatively permanent features having significance for navigation or anchoring.

## Units and terminology

**Latitudes and Longitudes** given in brackets are approximate and are intended to facilitate reference to the general area on the chart quoted.

**Bearings** and **directions** refer to True North (geographic) and are given in degrees from 000° clockwise to 359°. Bearings of conspicuous objects, lights, ranges and light sectors are given from seaward. Courses always refer to course to be "made good".

**Tidal streams** and **currents** are described by the direction toward which they flow. The **ebb** stream is caused by a falling tide and the **flood** stream is caused by a rising tide. **Winds** are described by the direction from which they blow.

**Distances**, unless otherwise stated, are expressed in nautical miles. For practical purposes, a nautical mile is considered to be the length of one minute of arc, measured along the meridian, in the latitude of the position. The international nautical mile, which has now been adopted by most maritime nations, is equal to 1,852 m (6,076 ft).

**Speeds** are expressed in knots; a knot is 1 nautical mile per hour.

**Depths**, unless otherwise stated, are referred to chart datum. As depths are liable to change, particularly those in dredged channels and alongside wharves, it is strongly recommended that these be confirmed by enquiry to the appropriate local authority.

**Elevations** and **vertical clearances** are given above Higher High Water, Large Tides; in non-tidal waters they are referred to chart datum.

**Heights** of objects, as distinct from the elevations, refer to the heights of structures above the ground.

The *List of Lights, Buoys and Fog Signals* number is shown **in brackets** following the navigational aid (light, leading lights, buoy). The expression "seasonal" indicates that the navigational aid is operational for a certain period during the year; mariners should consult the *List of Lights, Buoys and Fog Signals* to determine the period of operation. The expresion "private" means that the aid is privately maintained; it will not necessarily be mentioned in the *List of Lights* and its characteristics may change without issuance of a *Notice to Shipping*.

**Time**, unless otherwise stated, is expressed in local standard or daylight time. Details of local time kept will be found in Chapter 2 of booklet *ATL 100 — General Information*.

**Deadweight tonnage** and **mass** are expressed in metric tonnes of 1,000 kilograms. The kilogram is used for expressing relatively small masses.

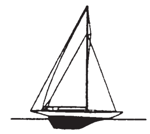
**Public wharf**, owned by a government authority, is a public port facility governed by various acts and regulations. Local authorities may charge harbour, berthing and wharfage fees for use of the facility. Contact must be made with the wharfinger before using the facility.

**Conspicuous** objects, natural or artificial, are those which stand out clearly from the background and are easily identifiable from a few miles offshore in normal visibility.

**Small craft** is the term used to designate pleasure craft and in general, small vessels with shallow draught.

**Diagrams** are large scale cartographic representations of anchorages, wharves or marinas. The horizontal chart datum used is the North American Datum 1983 (NAD 83). **Depths** are in **metres** and are reduced to the chart datum to which the diagram refers. **Elevations** are in **metres** above Higher High Water, Large Tides and in non-tidal waters, upstream of Pont Laviolette at Trois-Rivières *(46°18'N, 72°34'W)*, above chart datum.

**Pictographs** are the symbols placed at the beginning of certain paragraphs. Their main purpose is to allow quick reference to information or to emphasize details. Consult the Pictograph Legend shown on the back cover of this booklet.



## References to other publications:

### Canadian Coast Guard

- *List of Lights, Buoys and Fog Signals*
- *Radio Aids to Marine Navigation*
- *Ice Navigation in Canadian Waters*
- *Annual Edition of Notices to Mariners*
- *The Canadian Aids to Navigation System*
- *Merchant Ship Search and Rescue Manual (CANMERSAR)*
- *The International Code of Signals*

### Environment Canada

- *Gulf of St. Lawrence Marine Weather Guide*
- *Atlantic Coast Marine Weather Guide*
- *Ice Atlas, Eastern Canadian Seaboard*
- *Manice*

### Canadian Hydrographic Service

- *Catalogue of Nautical Charts and Publications*
- *Canadian Tidal Manual*
- *Atlas of Tidal Currents*
- *Tides in Canadian Waters*
- *Canadian Tide and Current Tables*

## Units

| | |
|---|---|
| **°C** | degree Celsius |
| **cm** | centimetre |
| **fm** | fathom |
| **ft** | foot |
| **h** | hour |
| **ha** | hectare |
| **HP** | horsepower |
| **kHz** | kilohertz |
| **km** | kilometre |
| **kn** | knot |
| **kPa** | kilopascal |
| **m** | metre |
| **mb** | millibar |
| **min** | minute |
| **MHz** | megahertz |
| **mm** | millimetre |
| **t** | metric tonne |
| **°** | degree (plane angle) |
| **'** | minute (plane angle) |

## Directions

| | |
|---|---|
| **N** | north |
| **NNE** | north northeast |
| **NE** | northeast |
| **ENE** | east northeast |
| **E** | east |
| **ESE** | east southeast |
| **SE** | southeast |
| **SSE** | south southeast |
| **S** | south |
| **SSW** | south southwest |
| **SW** | southwest |
| **WSW** | west southwest |
| **W** | west |
| **WNW** | west northwest |
| **NW** | northwest |
| **NNW** | north northwest |

## Various

| | |
|---|---|
| **A.P.A.** | Atlantic Pilotage Authority |
| **A.P.L.** | Laurentian Pilotage Authority |
| **CCG** | Canadian Coast Guard |
| **CHS** | Canadian Hydrographic Service |
| **ETA** | estimated time of arrival |
| **ETD** | estimated time of departure |
| **HF** | high frequency |
| **HW** | high water |
| **LW** | low water |
| **MCTS** | Marine Communications and Traffic Services |
| **M** | million, mega |
| **NAD** | North American Datum |
| **No.** | number |
| **SAR** | Search and Rescue |
| **TDW** | Total deadweight |
| **USA** | United States of America |
| **VHF** | very high frequency |
| **VTS** | Vessel Traffic Services |

CHAPTER 1

# General Navigational Information

1 **Limits of Booklet**. — This booklet of Sailing Directions covers general navigational and geographic information, natural conditions (meteorology, ice, currents...) of waters of Newfoundland and Labrador, Nova Scotia, New Brunswick, Prince Edward Island and Quebec. For detailed description of these regions, refer to the appropriate booklet which covers the particular area of interest; see the index of the booklets printed on the back cover.

## Routes and Navigational Hazards

*Chart 4001 (INT 404)*

2 **Approaches to the Canadian East Coast**. — The shortest distance for vessels crossing the North Atlantic Ocean, from Europe to the Gulf of St. Lawrence, is via the **Cabot Strait** which crosses the Grand Banks of Newfoundland. However, vessels crossing in the vicinity of these banks should avoid, as far as practicable, the fishing banks north of *43°00'N* and pass outside regions endangered by the presence of icebergs.

3 There is another access to the Gulf of St. Lawrence via the Strait of Belle Isle located between Newfoundland and Labrador. However, this strait is obstructed by ice from December to May or June.

4 Finally, during the navigation season, vessels can approach the Gulf of St. Lawrence via the Canso Strait *(45°39'N, 61°24'W)*; there is a lock open for vessels with a maximum length of 224 m (735 ft) and a draught of 8.5 m (28 ft) which could reach 9.1 m (30 ft) under certain conditions. For additional information concerning the Strait of Belle Isle and the Strait of Canso, mariners should consult the detailed booklets of these areas.

5 Shipping crossing the North Atlantic Ocean bound for the coast of Labrador will not encounter any offshore hazards in the form of shoal banks. Several named banks do lie up to 150 miles off the Labrador Coast but present no dangers as the least depth is about 61 m (200 ft). The Labrador Coast itself should be approached with **caution** as **detached dangers** lie 15 miles or more off the mainland shore (or off the larger inshore islands).

6 Off the coast of Labrador fishing vessels may be encountered, though in lesser numbers than may

be found on The Grand Banks of Newfoundland and off the east coast of Newfoundland. However, **caution** should be exercised while navigating off this coast, particularly in **fog** which is prevalent in this region.

7 The **Grand Banks of Newfoundland** cover an area which extends about 340 miles north and south between the parallels of *48°40'N* and *43°00'N*, and about 400 miles west and east between the meridians *47°30'W* and *57°30'W* on approximately the parallel of *46°30'N* where the banks attain their greatest width.

8 The **shallowest depth** and the greatest **hazard to shipping** on The Grand Banks of Newfoundland is found at **Virgin Rocks** *(46°26'N, 50°49'W)*, with a least depth of 4.2 m (14 ft). Another **shallow area** on these banks is on the **Eastern Shoals**, which lie about 13.5 miles east of Virgin Rocks, with a least depth of 14.8 m (49 ft).

9 Except for the very shallow areas mentioned above, there is sufficient water over The Grand Banks of Newfoundland for normal shipping. However, masters of very deep draught vessels should exercise **caution** in the selection of routes through this area. Throughout the year, large numbers of **fishing vessels** are encountered on the banks. Extreme **caution** should be exercised when navigating, particularly in conditions of reduced visibility.

10 The Grand Banks of Newfoundland are separated from the Nova Scotia Banks by the deep **Laurentian Channel** which runs through the Cabot Strait and enters the Gulf of St. Lawrence. The Nova Scotia Banks, for the most part, present no hazard to normal shipping.

11 Masters should exercise caution in charting their course. One of the greatest **hazards to shipping** is the shoal water in the vicinity of **Sable Island** *(43°57'N, 59°53'W)*. For other details on The Grand Banks of Newfoundland and the Nova Scotia Banks, mariners should consult the appropriate booklets as shown on the back cover.

12 **Wrecks**. — A **wreck**, over which 18 m (10 fm) of water, lies in position *45°46'N, 54°19'W*. Another with depths of 18 m (10 fm) is situated in position *44°35'N, 50°09'W*. Another **wreck**, with more than 18 m (10 fm) of water over it, has been reported in position *43°25'N, 49°37'W*.

13 There are some **explosives dumping grounds**. One is located SE of the Cabot Strait with a radius of 5 miles, centered in position *46°19'N, 58°39'W*. Another area is located south of the banks off Newfoundland, centered in position *44°43'N, 55°00'W*, with approximately 10 mile sides. Another explosive dumping area is located in the north part of Emerald Basin with a radius of 5 miles centered in position *44°12'N, 62°42'W*.

14 Finally, there are three **danger areas** with a radius of 1 mile, the first one centered in position *46°10'N, 59°26'W*, and the other located 38 miles east of St. John's (NL) centered in position *47°35'N, 51°43'W*. A third danger area with a radius of 2.2 miles is centered in position *43°30'N, 62°15'W*.

## Ship Routeing Systems

15 There are no **ship routeing systems** in use on The Grand Banks of Newfoundland and the Nova Scotia Banks. Traffic separation schemes are in effect for the Gulf of St. Lawrence and the St. Lawrence River, which include the Cabot Strait and the Strait of Belle Isle, and also for entering and leaving St. Georges Bay (NS) and the Strait of Canso, Halifax Harbour and Approaches, Placentia Bay, and the Bay of Fundy. In addition, a traffic separation scheme is in effect for passage beneath the Confederation Bridge in the Northumberland Strait.

16 **Traffic separation schemes** in St. Georges Bay and the Strait of Canso, Chedabucto Bay and the Bay of Fundy are **compulsory** for vessels of more than 20 m (65 ft) in length. Participation in traffic separation schemes which are not compulsory is highly recommended. All vessels navigating in or near a traffic separation scheme must comply with the *Collision Regulations*. For more details on ship routeing systems, consult the *Annual Edition of Notices to Mariners*.

17 The master of a vessel must comply with the *Marine Transportation Security Regulations* and submit a Pre-Arrival Information Report (PAIR) before entering Canadian waters. They must also submit a security plan to Transport Canada for approval.

18 The **Eastern Canada Traffic System ECAREG** is a mandatory **Marine Communications and Traffic Services** (MCTS) of the Canadian Coast Guard (CCG), for all vessels of 500 gross tonnage or more in the coastal and offshore waters of eastern Canada.

19 The *Eastern Canada Vessel Traffic Services Zone Regulations* pertain to the traffic system. The system is managed from traffic Centres at Dartmouth (NS) and Les Escoumins (QC). Communication within the system is conducted through any MCTS Centre free of charge. The message address is "ECAREG Canada".

20 *Eastern Canada Vessel Traffic Services Zone **Regulations*** require vessels to provide specific information concerning vessel status, position and movement, cargo, pollutants, dangerous goods and other information listed in the *Radio Aids to Marine Navigation (Atlantic…)*.

21 Vessels are also required to obtain clearance 24 hours prior to entering the Eastern Canada MCTS Zone, and 2 hours before leaving a berth within the zone. Reports are also required when a vessel crosses the seaward boundary of the

Zone (entering or leaving) and on arrival at a berth within the Zone. The outer limits of the MCTS zones and information concerning the traffic Centres are shown in the *Radio Aids to Marine Navigation (Atlantic…)*.

22 The MCTS Centres issue *Notices to Shipping* (broadcast navigational warnings) concerning conditions in Canadian and adjacent waters. An additional service is to provide inbound ships with information on changes which may have occurred between the date of issue of the most recent Canadian *Notices to Mariners* held on board and the time they come within reception range of the MCTS Centres. Vessels wishing this service should make their request to ECAREG Canada with the following information:

- vessel's name and call-sign;
- present position, destination and intended route;
- most recent monthly edition of *Notices to Mariners* on board;
- list of recent *Notices to Shipping* held on board.

23 The MCTS Centres will transmit previous *Notices* upon request when entering Canadian waters, for items which may affect conditions of navigation along the route indicated by the requesting vessel. Short summaries of previous *Notices* will be transmitted on a one time basis. Following receipt of these summaries, the vessel will be expected to obtain the latest information by monitoring *Notices to Shipping*, on regular broadcasts.

## Navigation in Ice

24 Mariners approaching the east coast of Canada during the ice season must consult the Canadian Coast Guard publication *Ice Navigation in Canadian Waters*. This publication is available for sale from: Publishing and Depository Services, Ottawa (ON) K1A 0S5; telephone: 1-800-635-7943.

25 One of the main hazards to which vessels are exposed when approaching the east coast of Canada lies in the **masses of ice** in the form of icebergs, growlers and pack ice which are carried by the Labrador Current. In the Gulf of St. Lawrence, ice formation commences in the first half of December and clears in mid-April. The danger of ice is increased by the prevalence of fog in the regions of The Grand Banks of Newfoundland and the Banks of Nova Scotia. For further information see Chapter 3 of this booklet.

26 **Recommended Shipping Routes in Ice**. — From December 1st to the end of the ice season, mariners are cautioned that when navigating in ice, Traffic Separation Schemes may not necessarily represent the best shipping routes. Recommended shipping routes may be obtained from MCTS Centres or the Eastern Canada Traffic System (ECAREG) through these MCTS Centres.

27 **Ice Detection**. — The proximity of ice may be indicated by the following signs; the observation of any one should emphasize the need for caution.

- Ice fields are frequently indicated by ice blink. This is a whitish glare on low clouds above an accumulation of distant ice which can be seen before the ice itself.
- The absence of swell or motion in a fresh breeze is a sign that there is ice on the weather side. This condition may also occur when the sea surface is freezing.
- The air temperature may fall as the ice is approached but only at a short distance if the ice is to windward. A fall in temperature also indicates a colder current which may carry ice.
- The appearance of herds of seals, far from land, may be a sign of proximity of ice.
- The ice cracking and grinding together makes a noise like breakers and can be heard for a short distance. At night or in fog it may be one of the most useful warnings.
- Sea ice in quantity can usually be detected by radar: either by distinguishing the edges on the radar display, by the absence of sea clutter, or the combination of those two effects. However, the echo pattern is affected by the shape of the ice and the relative position of the antenna. Therefore, isolated floes which may damage a vessel are not always detected by the radar.

28 **Iceberg Detection**. — Icebergs are sighted at various distances, depending on the visibility and the heights of the iceberg and the observer. On a clear day, large icebergs can be seen up to a distance of 20 miles. There is, on the other hand, a tendency to overestimate an iceberg's distance from a ship.

29 In light fog or drizzle an iceberg is visible from 1 to 3 miles. In fog, an iceberg cannot be seen at any appreciable distance ahead; it appears as a luminous white mass if the sun is shining through the fog; otherwise it appears close by as a dark shape. In a light low fog an observer can see an iceberg from aloft sooner than from the bridge. On a clear dark starlight night, a lookout will not sight an iceberg at a distance greater than 0.25 mile. With a full moon and favorable conditions, an iceberg can be sighted up to 3 miles away.

30 The presence of several growlers and of smaller pieces of detached ice indicates that an iceberg is in the vicinity and probably to windward. As growlers are often of a size to do serious damage to a ship, it is best to pass to windward of growlers or icebergs during periods of poor visibility or at night.

31 Vessels equipped with radar should be able, in favorable conditions, to pick up an iceberg, at a sufficient distance to avoid a collision. However, in certain sea conditions,

sizeable small icebergs and particularly growlers, which could potentially damage a vessel, may be missed.

32 Mariners are reminded that ice, free or floe-shaped, are more subject to the wind effect than the current effect. However, icebergs are particularly subject to the current effect.

33 **Ice on Atlantic Routes via Strait of Belle Isle, Cabot Strait and Strait of Canso**. — During the winter, trans-Atlantic shipping is re-routed southward toward the Gulf of St. Lawrence to avoid the majority of the ice. By the end of December the western portion of the Gulf is covered with ice and by mid-January the NE arm of the Gulf, the Strait of Belle Isle and its eastern approaches up to 100 miles to seaward are completely covered with ice. Consequently, the Strait of Belle Isle is closed to normal marine activity and re-opens early in June.

34 Sea ice expands seaward from the Gulf of St. Lawrence through Cabot Strait from early February into May. In the Cabot Strait, shipping is seriously affected from mid-February to mid-April.

35 Port facilities in the Strait of Canso to the SE of the Canso Causeway are generally ice-free during winter. The causeway acts as a natural barrier to prevent ice from drifting from St. Georges Bay into the Strait of Canso, while the strait is influenced by the warmer, tidal waters of the open Atlantic Ocean.

36 **Ice in the St. Lawrence River between Québec and Montréal**. — Special conditions exist in the St. Lawrence River between Québec and Montréal where broken ice brought down by the current is apt to form extensive ice jams which cause a rapid rise in the water level to dangerous heights. In order to prevent the development of this situation, icebreakers ships operate in the river throughout the winter to keep a channel open for the movement of broken ice downstream. This channel also permits the passage of vessels.

37 This channel is easily blocked if the ice is dislodged from the banks and shoals, either through natural causes or by the wash of passing vessels. This tidal icefoot may break in large sheets of ice that move across a channel and initiate the formation of a jam. At certain times when the tidal icefoot is dislodged easily, it is necessary to impose speed restrictions in certain sections.

38 When an ice jam forms, it is of utmost importance that it should be broken and the channel restored as quickly as possible to stop the rise in the river level, free any beset vessels and restore the movement of traffic. At such times it is vital that the operation of the icebreakers ships should not be hampered by the presence of other vessels in the area of the jam. It may therefore be necessary to delay sailings or curtail movement in that part of the river.

39 **Icebreaker Ship Assistance**. — The Canadian Coast Guard operates a service for the support of vessels navigating in the ice congested waters of the River and Gulf of St. Lawrence by providing up to date information on ice conditions, advice on recommended routes, icebreaker ship assistance where available and considered necessary, and the organization of convoys when conditions require it. Vessels off the east coast of Canada and in the Gulf of St. Lawrence may request ice information, ice routeing and icebreaker ship assistance through ECAREG Canada.

40 It should be noted that there are fees for icebreaking ship services provided by the Canadian Coast Guard. Information on these fees is available on the CCG website at: www.ccg-gcc.gc.ca/msf-dsm/icebreaking_e.htm.

41 When requesting icebreaker ship assistance the following information must be supplied:

- draught, forward and aft;
- displacement tonnage;
- open water speed;
- ice class (if applicable) and classification society;
- number of propellers;
- shaft horsepower;
- type of propulsion system.

42 Communications between vessels and MCTS Centres concerning ice information and ice routeing are handled free of charge.

43 **Canadian Ice Service**. — The Canadian Government conducts a comprehensive aerial ice reconnaissance program and a full ice forecast and advisory service.

44 Aerial reconnaissance patrols begin when ice forms in the St. Lawrence River and moves toward the estuary and the Gulf of St. Lawrence, and end when these areas become ice free. The aerial observations are relayed to the Canadian Ice Service where they are used to produce a composite ice chart covering the entire Gulf and Newfoundland and Labrador area.

45 Ice forecasts are issued for 2 to 5 days periods, depending on the ice concentration in the area concerned. Twice monthly, 30-day forecasts are prepared and disseminated to a variety of users.

46 Ice charts are broadcast daily and the ice forecasts and bulletins are broadcasted over the MCTS Centres. Mariners should consult the publication *Radio Aids to Marine Navigation (Atlantic…)* for further information.

47 Vessels encountering ice in the area are requested to report sightings to the Canadian Ice Service, Ottawa, through MCTS Centres. Vessels navigating independently in the Gulf of St. Lawrence when ice is present are requested to report their position and progress, as well as the ice conditions to ECAREG Canada at 1200, 1600 and 2000 UTC.

48 **International Ice Patrol**. — The International Ice Patrol is a service which observes and disseminates information on iceberg conditions in The Grand Banks of Newfoundland, and the NW Atlantic Ocean areas. The area

of main concern extends from *39°N* to *49°N* and from *42°W* to *60°W*, where most trans-atlantic vessels cross The Grand Banks of Newfoundland. Active coordination and data exchange is maintained with the Canadian Ice Service.

49 The patrol is directed from the *Ice Patrol Office* located at the *U.S. Coast Guard, Avery Point, Groton, Connecticut*. The office gathers ice and environmental data from a variety of sources, maintains ice analysis charts, forecasts ice conditions, prepares twice daily ice bulletins, and executes operational control of the Aerial Ice Reconnaissance.

50 For broadcasts details, consult the *Admiralty List of Radio Signals, Volume II*, the *Radio Aids to Marine Navigation* issued by the Canadian Coast Guard, or the annual operation order issued by the *U.S. Coast Guard* prior to the commencement of the patrol.

51 The patrol starts in late winter or early spring and stops when ice is no longer a menace to shipping routes on The Grand Banks of Newfoundland south of *48°N*. Masters of ships are asked to cooperate by reporting all ice sighted, together with ship position, course, speed, weather and sea surface temperature every six hours while in the patrol area.

## Ship Icing (Freezing Spray)

52 When strong winds occur with low temperatures, spray may freeze on contact with ship superstructures. Fog, snow or rain are also factors that may cause **ship icing**. Accumulations of 10 cm (4 in) or more can form in a few hours, which may endanger the stability of a vessel. Vessels with low freeboard are particularly prone to accumulate ice under **freezing spray** conditions.

53 Superstructure icing is most frequently encountered west of *40°W* in the vicinity of Newfoundland and up to 250 miles from the Nova Scotia coast between the months of January and March and commencing in December in the Gulf of St. Lawrence.

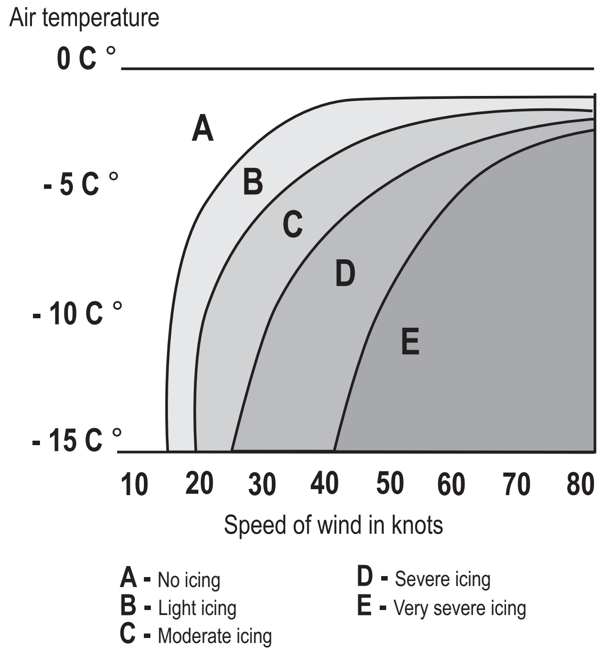
54 In the Labrador Sea, freezing spray may occur from October to May. Conditions conducive to spray icing exist more than 30 per cent of the time in January and February.

55 Freezing spray is responsible for the heaviest ice accumulations which can exceed 20 cm (8 in). Icing from supercooled fog and freezing precipitation are less frequently reported, and are generally responsible for small amounts of accreted ice in the order of 1 to 2 cm (0.4 to 0.8 in). Arctic sea smoke can accompany spray icing if air temperatures are very cold: vessel icing reports from east coast waters show that combined spray and fog icing conditions are more frequently experienced in the Labrador Sea.

56 Because icing events in the Labrador Sea are not frequently associated with westerly winds, conditions can appear deceptively sheltered near shore. The danger here is that if small coastal vessels venture out in these conditions, rapid ice accumulation can be encountered before the vessel returns to shore.

57 Moderate accumulations of up to 7.5 cm (3 in) per hour may occur with air temperatures colder than -2°C and winds greater than 20 knots. Severe accumulations may occur with air temperatures colder than -9°C with winds of 30 knots or more. In general, it is possible to obtain accumulations with air temperatures below the freezing point according to the following diagram.

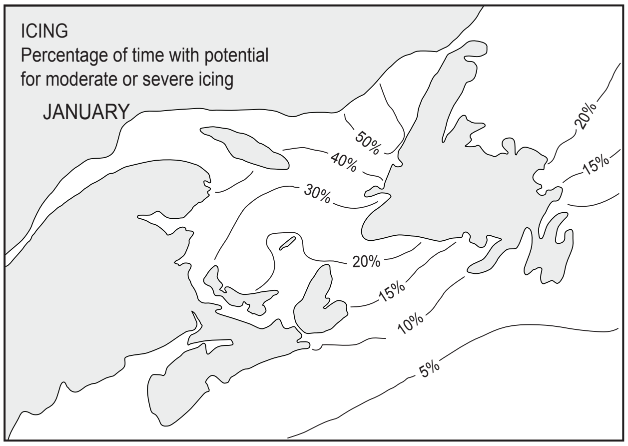
### Ship icing




Source: Environment Canada

58 Ships encountering freezing spray conditions can reduce speed to lessen spray, and a course change may help as a ship running before the wind ices less than one steering into it. It is best to seek a protected area or head for warmer water. There are *Freezing Spray Warnings* transmitted by *Environment Canada* and issued by the MCTS Centres.

59 Any fishing gear, barrels and deck gear should be placed below deck or fastened to the deck as low as possible. Cargo booms should be lowered and fastened, and deck machinery and boats covered. Gratings should be removed from scuppers and all objects which might prevent water drainage from the deck removed. A ship should be as watertight as possible and accumulated ice removed if possible. Reliable radio communication should be established with a MCTS Centre or another ship when there is ice accretion on the superstructure.




Source: Environment Canada

60 **Ice Drifted Boulders**. — The movement of the ice along the coast brings erratic blocks (boulders) onto the foreshore; it is a phenomenon called *ice drifted boulders*. Masses of ice formed along the shores may become attached to these boulders and move them with the change of tide or at an ice break-up. Therefore, these boulders may restrict certain channels. This phenomenon occurs between the high and low water marks and can be observed in areas where the foreshores are gently sloping and strewn with boulders.

## Oil and Gas Exploration

61 **Oil and gas drilling** and production platforms may be encountered in Canadian and adjacent waters. Certain platforms have a ship form but most are of tubular and lattice tower construction. Either type can be encountered underway, under tow or under power. When in position, some are fixed concrete gravity based structures elevated above the surface while others float on the surface. Some types may have anchors extending out to a considerable distance, and these anchors may or may not be marked by buoys. Some offshore production facilities have production and re-injection pipelines extending on the seabed up to 5.5 miles from the fixed installation. Some installations may also have oceanographic equipment deployed in their vicinity.

62 Exclusion zones may be charted around production platforms and their adjacent offshore loading systems. All platforms maintain a 24 hour marine radio communications watch. A safety standby vessel is normally located in close proximity to these drilling and production platforms. Additional support vessel activity may be encountered near oil drilling and production platforms. For additional information consult the chart and the *Annual Edition of Notices to Mariners*.

63 Temporary *Notices to Mariners* and *Notices to Shipping* are issued to provide information on the establishment or changes in position of these platforms. For details on the lighting and marking of drilling and extraction platforms or vessels, consult the *Annual Edition of Notices to Mariners*.

64 Seismic survey vessels may be encountered either alone or in company. These vessels may tow a sensing device in the form of a buoyant plastic cable streamed 1 to 2 miles astern. The sensing device may be on the surface or at depths of approximately 12 m (40 ft). An orange buoy, usually attached to the end of the cable, displays a quick flashing light and carries a radar reflector.

65 These vessels are unable to manoeuvre as cited in the *Collision Regulations* and should be given a wide berth. Details of these surveys are normally broadcasted by the MCTS Centres; however, survey vessels may be encountered without prior notice.

## Nautical Charts

66 **Nautical Charts**, in paper or electronic format, are designed specifically to meet the needs of marine navigation. They show depths of water, emphasize dangers to navigation, portray maritime cultural features and such topographic detail considered useful to marine navigation. Charts also show various aids to navigation, information concerning tides and currents, as well as diagrams and notes.

67 **Natural Scale** means the relationship between the size of the chart and the earth. For example, 1:15 000 means that one unit on the chart equals 15 000 units on the earth. The following are the different **types** of charts issued by the CHS and their uses; the **scales** shown are approximate:

- **Harbour Charts** are large scale, 1:5 000 – 1:15 000 and are used for navigation in harbours or intricate, hazardous, shoal-infested waters.
- **Approach Charts**, 1:15 000 – 1:50 000, are used for approaching coasts where a great deal of detail is required.
- **Coastal Charts**, 1:50 000 – 1:150 000, are used to show continuous extensive coverage with sufficient inshore detail to make landfall sightings easy.
- **General Charts**, 1:150 000 – 1:500 000, give extensive offshore coverage with sufficient inshore details to make landfall sightings easy.
- **Sailing Charts**, 1:500 000 and smaller, are used for offshore navigation beyond sight of land.
- **Small Craft Charts** describe some areas not covered by the previously mentioned charts but are specifically designed for pleasure craft operators. They are available mainly in strip format (accordion-folded).

- **Fisheries Charts**, 1:150 000 – 1:500 000, are specially designed for the fishing industry and cover vast areas of the Atlantic Coast of Canada.

68 The standard navigational charts published by the CHS are corrected to the date of printing and additionally **corrected** to the date of issue by the Chart Distribution Office in Ottawa (ON). Beyond this date, which is clearly stamped on the chart, it is the responsibility of the mariner to keep charts up to date from information published in the *Notices to Mariners*.

69 Small Craft Charts and certain other charts published by the CHS are not corrected and are not stamped with a date of issue. These charts are corrected to the date of publication only; for subsequent corrections, the *Notices to Mariners* must be consulted. A list of subsequent corrections for these charts can be obtained from: Canadian Hydrographic Service, Department of Fisheries and Oceans, Ottawa (ON) K1A 0E6, or by visiting the website *www.charts.gc.ca*.

70 Mariners are reminded that charts are not corrected from *(T)* and *(P) Notices (Temporary and Preliminary Notices to Mariners)* when purchased. Any *(T)* and *(P) Notices* affecting a chart should be noted on the chart. They are published in the Monthly Edition of *Notices to Mariners* and a summary of these notices are published quarterly during the year in the *Notices to Mariners*.

71 **Reliance on a chart**. — The value of a chart depends, to a great extent, on the accuracy and detail of the surveys on which it is based. The date of survey, or a statement of the authorities on which a chart is based, is given under the title of the chart. When a chart is compiled from several sources, the dates and areas of the surveys may be difficult to define precisely. Therefore, some of the new editions and new charts will have **source classification diagrams** to graphically illustrate the type of survey data used in the construction of the chart.

72 The chart represents general conditions at the time of survey and changes that have been reported to the Canadian Hydrographic Service up to the last edition date shown on the chart. Areas where sand or mud prevail, especially in the entrances and approaches to rivers and bays, are subject to continual change, therefore, caution should be exercised when navigating in these areas.

73 In regions where reefs and rocks abound, it is always possible that surveys have failed to find every obstruction. When navigating in such waters, customary routes and channels should be followed and waters avoided where irregular and sudden changes in depth indicate conditions associated with reefs and pinnacle rocks.

74 The appearance of the chart may show the thoroughness of the surveys on which it is based. A chart drawn from an old survey with few soundings may have had further soundings added to it later, thus masking the inadequacy of the original survey. On the other hand, the quality of a chart is not only shown from the number of soundings; on new metric charts, based on recent surveys, additional depth contours are shown with fewer soundings. Some metric charts contain information from old charts converted to metres, so it is important to assess their reliability from the source classification diagram. Many older charts show sounding in fathoms, feet or fathoms and feet. The unit for soundings is listed beneath the title of the chart.

75 For today's vessels normal draught the reliability of most charts based on early surveys has been confirmed by the continual safe passage in well frequented waters. Vessels with draughts approaching 30 m (98 ft) should exercise care within the 200 m (109 fm) contour line in less than adequately charted areas even on recognized shipping lanes. A vessel venturing into any unfrequented waters should exercise due caution.

76 Since dangers cannot be shown with the same detail on small scale charts as on those at a larger scale, **the largest scale chart of an area should always be used for navigation**.

77 **Charting**. — For the most part, the southern portion of the Canadian eastern seaboard is charted to modern standards. The main approach routes, large harbours, and frequently used waterways are charted from surveys conducted by the CHS and other associated agencies. However, in remote areas, small harbours and seldom used waterways, chart information may be based on foreign charts or surveys dated to the 19th century.

78 Most of the coastal waters of Labrador have not been surveyed to modern standards. Most of the offshore charting was done by the United States Navy and many Canadian charts are reproductions of charts produced by that agency; this is clearly stated under the title of the charts concerned.

79 Nations that maintain international chart coverage may produce charts for all or part of the Atlantic Coast. These charts are usually available from agents of the hydrographic offices of such nations. A list of **equivalent charts** is shown in the *Annual Edition of Notices to Mariners*.

80 The CHS has converted many of its navigation charts from North American Datum 1927 (NAD 27) to **North American Datum 1983** (**NAD 83**). The difference in position of the same point between NAD 27 and NAD 83 is up to 110 m (361 ft) on the Pacific Coast, 60 m (197 ft) on the Atlantic Coast and near zero at Windsor (ON).

81 *World Geodetic System 1984 (WGS 84)* is adopted as the horizontal datum for world-wide use; NAD 83 is considered equivalent to WGS 84. The advantage of the new datum is its compatibility with satellite positioning systems.

82 Horizontal positions obtained from satellite receivers (GPS) are based on WGS 84 (NAD 83). When the horizontal datum on the chart differs from the positioning equipment,

then the position must be converted before being used on the chart. New charts and new editions have notes indicating whether the chart is based on NAD 27 or NAD 83. They will also contain sufficient information to allow conversion between the two datums.

83 **Chart Datum**. — Chart datum is the low water plane to which are referred the depths of water over features permanently covered and the heights of those which are periodically covered and uncovered, heights of the tide, as well as elevations and vertical clearances in non-tidal waters.

84 By international agreement, chart datum should be a plane so low that the tide will not frequently fall below it. On most Canadian coastal charts, the level used is one determined from the Lower Low Water, Large Tide (LLWLT), which is a mean of low waters. This only occurs with the greatest spring tides, but where the range of tide is small, meteorological conditions may cause even average tides to fall below chart datum.

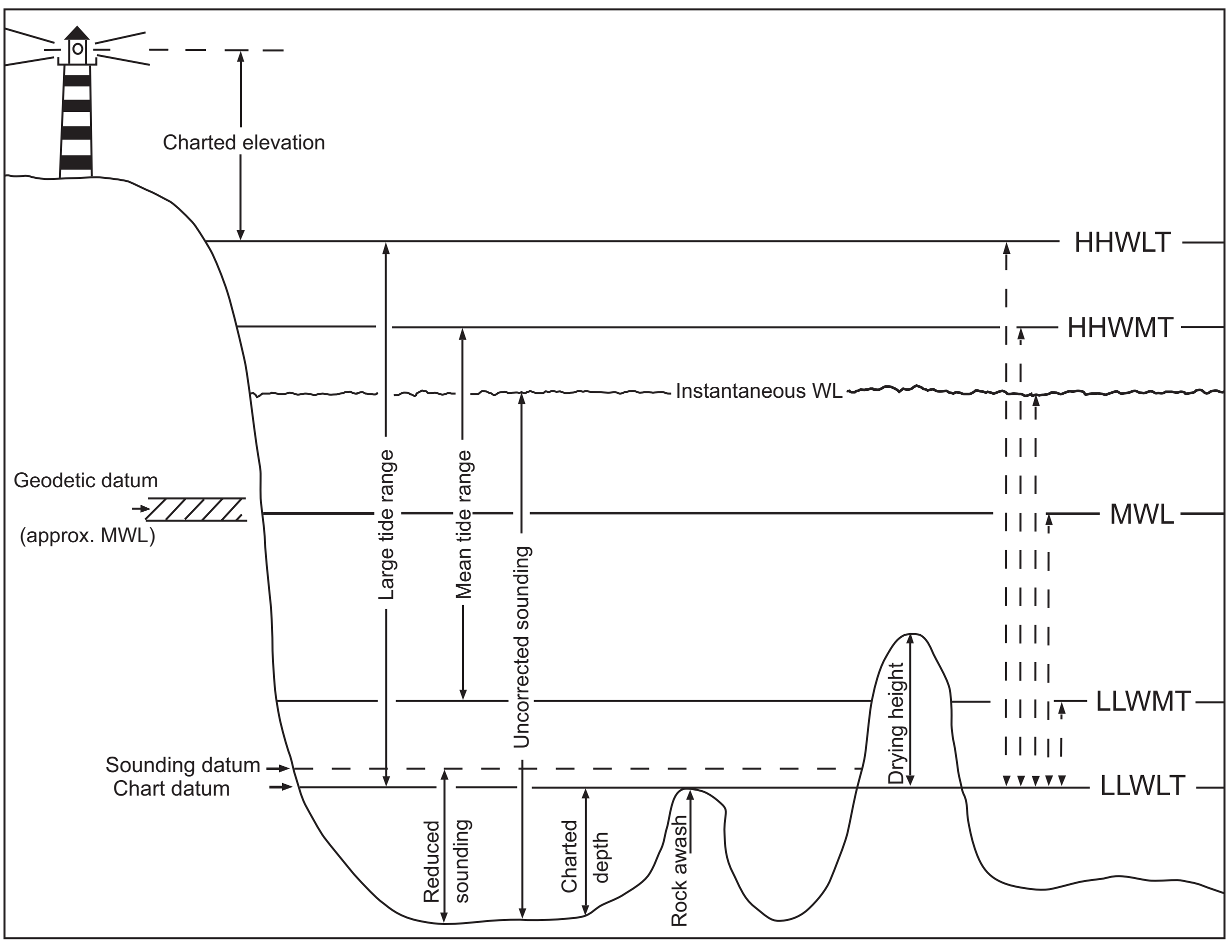
85 However, for Canadian charts not affected by the tide, chart datum is referred as a mean of lower water levels recorded for the plane water area covered at normal atmospheric conditions.

86 The following figure illustrates the *tidal surfaces* and their relation to chart datum and other physical features.

87 **Vertical Clearances**. — The vertical clearances of bridges and overheard cables are given above Higher High Water, Large Tide (HHWLT) in tidal waters. In non-tidal waters, the clearances are referred to chart datum. Therefore, in non-tidal waters, the height of the water level above chart datum must be subtracted from the charted elevation to give the overhead clearance at a particular time.

88 **Overhead Cables**. — Overhead cables are subject to frequent change as new cables are installed and existing cables are removed or modified. Therefore, the current editions of certain charts may not indicate all overhead cables that exist in an area.

## SPECIAL TIDAL SURFACES



89 To avoid the danger of **arcing** when passing under power transmission lines, mariners must allow a safe clearance where air may act as an electrical insulate. This safe clearance is dependent upon the line voltage and possible surges. Surges are unpredictable and result from short-circuits, from putting on-potential, from putting off-potential and lightning.

90 The **actual clearance** of a power transmission line depends on the temperature and **ice accumulation**. When the temperature of the cable rises, it expands and its clearance decreases; conversely, when the temperature of the cable drops, it contracts and its clearance increases. The clearance of the cable is also dependent upon the accumulation of ice on the cable. Exceptionally, under certain conditions, the decrease of clearance of the cable due to ice is less than that caused by extremely high operating temperatures.

91 The vertical clearances of power transmission lines, shown on charts within the province of Quebec, indicate the minimum elevation of cables without ice, minus the appropriate safe clearance of each line. In the *Sailing Directions*, the vertical clearances under severe icing conditions may be indicated for some cables in tables, diagrams or in the text.

92 **Submarine Cables**. — Submarine cables are subject to frequent change as new cables are installed and existing cables are removed or modified. Therefore, the current editions of certain charts may not indicate all submarine cables that exist in an area.

93 Although many overhead and submarine cables are shown on the charts, it should be noted that power and telecommunication cables may not be differentiated on certain charts.

94 **Tides and Water Levels**. — The heights or predicted tidal heights as well as water levels are referenced to chart datum. Therefore, in order to know the depth of the water at any given time, the height of the tide must be added to the depths shown on charts.

95 Mariners should consult the appropriate volume of *Canadian Tide and Current Tables* to calculate the predicted heights of tide. Predicted heights of tide are also available through the Canadian Hydrographic Service web site at *www.charts.gc.ca*.

96 CHS operates a network of digital water level gauges which allow mariners to obtain instantaneous water levels at different sites as well as the prediction for the next few days. The most recent information on water levels can be obtained by contacting *MCTS* Centres by VHF, or by calling the automated information service at 1-877-775-0790.

97 **Change of Magnetic Variation**. — When using magnetic courses or bearings, allowance must be made for the gradual change in variation from one side of the chart to the other side. The change in variation is very rapid in certain parts of the world and should always be taken into consideration.

98 On published CHS nautical charts there are compass roses which show True and Magnetic North; magnetic variation and the annual change are also shown. Isogonic lines (equal magnetic variation) are printed on certain charts.

## Nautical Publications of Canadian Hydrographic Service

99 The principal **official documents** for navigation in Canadian waters are published by the Canadian Government. In accordance with the *Charts and Nautical Publications Regulations, 1995* some of these publications are mandatory.

100 The ***Catalogues of Nautical Charts and Publications*** inform mariners of the charts and related publications available and required for safe navigation in Canadian waters. They list also the CHS dealers in Canada and foreign countries. There are four catalogues showing all the chart coverage of CHS.

101 ***Symbols, Abbreviations and Terms*** used on nautical charts are shown in the publication known as ***Chart 1***.

102 ***Sailing Directions*** are booklets that cover various regions containing general information regarding navigation, the shoreline, as well as detailed current description, general geographic information and port facilities. There is information with more detailed instructions, information with larger scale diagrams showing marine infrastructures and information on marinas.

103 The ***Canadian Tide and Current Tables*** are published annually and provide tide predictions for various ports as well as times for slack water and times and velocities of maximum and minimum currents at certain locations.

104 The ***Atlases of Tidal Currents*** are illustrated works which cover a region. There are main tidal currents (direction and rate) for different tidal cycle periods. There are three atlases which cover the main shipping lanes in Canadian waters.

## Canadian Coast Guard

105 The Canadian Coast Guard (CCG) operates a fleet of vessels and aircraft in Canadian waters from the Great Lakes to the northernmost channel of the Arctic Islands and from the Pacific to off the coast of Newfoundland and Labrador. In addition, the CCG ensures land based services.

106 Canadian Coast Guard vessels maintain and supply shore-based and floating aids to navigation in Canadian waters, without which commercial shipping could not operate.

The services, which include heavy icebreakers and icebreaking buoy tenders, buoy tenders, patrol and surveillance, and many specialized duties such as Search and Rescue, marine research and shallow-draught operations.

107 In **winter**, the CG icebreakers assist shipping in the Gulf of St. Lawrence and in east coast waters as well as providing flood control icebreaking service on the St. Lawrence River.

108 In **summer**, while the greater part of the fleet is concentrating on its task of keeping shipping channels safe for marine traffic, the icebreakers escort convoys organized by the CCG to carry the next year's supplies to civilian communities and military bases throughout the Arctic.

109 Additionally, the CCG provides icebreaker ship assistance when needed for commercial shipping using the summer sea route from the Atlantic Ocean through Hudson Bay to Churchill, Manitoba, and to the new mining developments in the Arctic.

110 The CCG also carries out duties as the marine element of the **Search and Rescue** (SAR) organization for which the Canadian Forces have the overall responsibility.

111 The principal **CCG bases** are St. John's (NL), Dartmouth (NS), Saint John (NB), Charlottetown (PE), Québec City and Sorel (QC), Prescott and Parry Sound (ON), Victoria and Prince Rupert (BC), and Hay River, on the Great Slave Lake (NT).

112 The Canadian Coast Guard also has responsibility for various marine activities on a cost-shared basis such as:

- **Marine Navigation Services**: maintenance of aids to navigation; maintenance of waterways; publishing *Notice to Mariners*.
- **Marine Emergencies**: response to shipping casualties or to marine spills.
- **Communications and Telecommunications Services**: maintenance and operation of a network of Marine Communications and Traffic Services (MCTS) Centres and radio aids; broadcast of messages, *Notices to Shipping* and Weather Warnings.

## Canadian Coast Guard Publications

113 ***List of Lights, Buoys and Fog Signals*** are four volumes providing details of names of lights as well as their characteristics, lighted buoys and fog signals used in Canadian waters.

114 The ***Annual Edition of Notices to Mariners*** provides general information of interest about navigation. There is information concerning aids to navigation, marine safety, pilotage services, search and rescue operations, marine pollution and military exercise areas.

115 The ***Monthly Edition of Notices to Mariners*** provides important up-to-date navigational information which affect nautical charts and publications. The release of new charts and new editions of existing charts as well as new publications is also announced through this publication.

116 The ***Canadian Aids to Navigation System*** is a booklet which describes the Canadian system and the aids utilized (fixed, floating, lighted, radio).

117 ***Radio Aids to Marine Navigation*** are published in two volumes; they provide information on marine forecast areas weather centres with their position, characteristics and services. They also give information on the Vessel Traffic Services Zones as well as the MCTS Centres and services.

118 The publication ***Ice Navigation in Canadian Waters*** provides information such as: ice conditions in Canadian waters, navigation in ice and ice advisory and shipping support service.

119 The above publications are available from the Canadian Coast Guard Web Site: *www.ccg-gcc.gc.ca* or *www.notmar.gc.ca* or from any Canadian Hydrographic Service Chart Dealer.

120 MCTS Centres issue ***Notices to Shipping***. It is also possible to obtain a written list by contacting the CCG offices or visit www.marinfo.gc.ca on a regular basis.

121 The above mentioned charts and publications are all affected by continual changes and amendments that take place in navigational information; mariners must keep them up to date.

## Aids to Navigation

122 This section refers to the following Canadian Coast Guard Publications: *The Canadian Aids to Navigation System*, the *Lists of Lights, Buoys and Fog Signals*, and to the *Radio Aids to Marine Navigation (Atlantic…)*.

123 **Buoyage**. — A combined lateral and cardinal system of buoyage is used in Canadian waters. For lateral buoyage, the International Association of Lighthouse Authority (IALA) Maritime Buoyage System divides the world into two regions, "A" and "B".

124 Within region B, which comprises all of North and South America, Japan, the Republic of Korea and the Phillippines, a vessel navigating in the upstream direction must keep the green buoyage system to port and the red buoyage system to starboard. The upstream direction is the direction taken by a vessel when proceeding from seaward, toward the headwaters of a river, into a harbour or with the flood tidal stream. The upstream direction is southerly along the Atlantic Coast.

125 Mariners should not rely on buoys being in their charted positions at all times. Buoys should be regarded as

aids to navigation and not as infallible navigation marks. The position of any buoy may not be as charted due to storms, collisions, or of poor holding ground. During winter, the movement of ice in an area, and the operation of icebreakers have been known to move buoys from their charted positions.

126 Large areas of Canadian waters freeze in the winter season. Therefore, many buoys are removed and some are replaced by spar buoys. To obtain more information concerning the establishment and the removal of buoys, consult the written or broadcasted *Notices to Shipping*.

127 Radar reflectors are fitted on most buoys. Light buoys, buoys using sound signals (bell or whistle) and fog signals may not give their true characteristics due to mechanical failure, icing, storm effect or calm weather.

128 In some instances where a buoy is established close to a hazard or other charted feature, the buoy symbol may be slightly offset on the chart so that the existing symbol or hazard is not overprinted. However, the position of the buoy is shown by an arrow.

129 The **lateral system of buoyage** indicates the course of a navigable waterway. There are five types of buoys in this system: port hand, starboard hand, bifurcation, fairway and isolated danger.

130 The **cardinal system of buoyage** indicates the relative position of a hazard on the compass scale with buoys of defined shape, colour or light characteristic. There are four cardinal buoys, one for each cardinal point on the compass. All cardinal buoys are surmounted with topmarks consisting of two black cones.

131 **Special buoys** are used in Canadian waters and do not have lateral or cardinal significance. These buoys may have a variety of shapes, be lighted or unlighted and may display yellow reflective material.

132 **Control buoys** indicate local restrictions such as prescribed speed limits, marine activities restrictions, etc. Details about symbols marked on buoys are given in the *Vessel Operation Restriction Regulations, Canada Shipping Act, 2001*.

133 A **hazard buoy** marks random hazards such as rocks and shoals. The buoy is coloured white and has an orange diamond on two opposite sides and two orange horizontal bands, one above and one below the diamond symbols. Information words or symbols concerning the hazard may be placed within the diamond symbol or between the orange bands. It may also display identification letter(s).

134 **Buoy Identification**. — Buoys may be identified by names, letters, or numbers and are usually preceded by a letter or several letters. Only starboard and port hand buoys are numbered; starboard hand buoys have even numbers and port hand buoys have odd numbers. Buoy numbers increase in the upstream direction and are kept in approximate sequence on both sides of the channel by omitting numbers where required. Identification is white with silver reflective material.

135 **Daybeacons** are sometime used to mark channel entrances, approaches and bridges. The hand of the daybeacon, port or starboard, is the same as for lateral buoys and will indicate the channel.

136 **Radar Beacons (RACONS)**. — Racons may be fitted to light structures, buoys or other specific locations in Canadian waters. A Racon responds to radar transmissions with a Morse Code signal that will appear to begin from its position and extend along its line of bearing from the vessel to the outer edge of the radar display.

137 Identification characteristics of Racons, shown on charts, are published in the *Radio Aids to Marine Navigation*, the *Lists of Lights, Buoys and Fog Signals* and *Sailing Directions*. Two types of Racons are used as aids to navigation: the slow sweep Racon and the frequency agile Racon; see the CCG publications concerning aids to navigation to obtain information on the characteristics.

138 The positions of Racons are shown on all Canadian charts. Should a Racon fail to give a response to a ship's radar, the master should report this immediately to the nearest MCTS Centre so the information can be broadcast to all vessels in the area.

139 **Fixed Aids to Navigation**. — There are several fixed structures positioned on the coast serving as aids to navigation. These structures are additional aids to navigation and part of the Canadian Buoyage System. The fixed aids are lighthouses, daybeacons, fog signals, sector lights and leading lights.

140 **Emergency Lights**. — These lights are installed at certain light stations. The light is of lesser intensity than the main light and is normally visible for 5 miles on a dark night with clear atmosphere. It is automatically activated by a failure of the main light and may function without issuance of a *Notice to Shipping*. The standard characteristic of an emergency light is group flash (6) 15 seconds (6 flashes, each ½ second duration, followed by a period of darkness of 7 seconds).

141 **Aids to Navigation During Winter**. — A certain number of lights and fog signals are decommissioned at the end of the navigation season, until the end of the winter. Details on seasonal changes to aids to navigation are announced in *Notices to Mariners* and *Notices to Shipping*. Additional information may be found in the *List of Lights, Buoys and Fog Signals, Atlantic Coast*.

## Positioning Systems

142 **Halifax MCTS Centre – VHF/DF Advisory Service**. — A VHF/DF Advisory Service (**radio direction**

**finding**) is only available to vessels within range of the receiver sites located at Kingsburg, Sambro, Ecum Secum and Fox Island. Information concerning position, bearing and distance may be provided for use at the discretion of the user. For further details, consult *Radio Aids to Marine Navigation (Atlantic…)*.

143 **Satellite Positioning System**. — The **Global Positioning System (GPS)** is a satellite radio navigation system established by the US Department of Defence (DOD). A set of 24 satellites orbiting around the Earth enable the users with the appropriate receivers to know their exact position, speed and time, at any time, and in any weather.

144 GPS is referenced to the World Geodetic System 1984 (WGS 84), which is considered the equivalent of the North American Datum 1983 (NAD 83). Most of the GPS receivers are equipped with a conversion function for the various Reference Systems. Transport Canada advises to always set the receiver on NAD 83 or WGS 84 in Canadian waters. Some CHS charts have a latitude/longitude grid that is still based on the old NAD 27. Corrections must be applied before a position can be plotted.

145 **Differential GPS** or **DGPS** is a method of obtaining greater accuracy in positioning than can provide a traditional GPS receiver. This method uses a network of land references, of which the positions are known with great accuracy, and for which it compares the position calculated by GPS to a known geographic position using the data sent by the satellites.

146 Corrections from GPS data are transmitted by signals to a GPS receiver equipped with demodulator (signal decoding device) and the receiver applies those corrections when calculating the position. The CCG's DGPS Reference Stations allow a positioning accuracy of 10 m or better in the Atlantic within the coverage range.

## Marine Communications

147 The radio is a very useful aid to mariners navigating off the Canadian East Coast. The Canadian Coast Guard maintains a **marine communication** network between the MCTS Centres and vessels in Canadian waters. These radio stations maintain a continuous security watch on MF 2182 kHz, 156.8 MHz (VHF Channel 16) and 156.525 MHz (VHF DSC Channel 70). Information on radiotelephone procedures for distress, urgency and safety communications are in the publication *Radio Aids to Marine Navigation (Atlantic…)*.

148 The **Global Maritime Distress and Safety System (GMDSS)** is an international system using satellite and terrestrial communication technologies and ship-board radio systems. Developed by the International Maritime Organization (IMO) and implemented at the global level since February 1999, GMDSS's aim is to save lives. The system ensures rapid alerting of shore-based rescue and communications authorities in the event of an emergency. In addition, the system alerts vessels in the immediate vicinity and provides improved means of locating shipwreck survivors.

149 The GMDSS has an impact on all radio-equipped Canadian vessels regardless of their size. Note in particular that as of April 1, 2002, vessels 8 m or more in length and operating more than 20 miles from shore must be equipped with an EPIRB, and as of February 1, 2003, towboats, vessels carrying more than 6 passengers and vessels of closed construction 8 m in length or more must be equipped with VHF DSC radio when operating outside an MCTS zone.

150 Even though 4 international sea areas – A1, A2, A3 and A4 – are defined by GMDSS, Canada has decided to implement radio services for sea area A1 (East Coast and West Coast), A3 (offshore waters of these areas) and A4 (Arctic). The MF DSC service is not available in Canada; however, the coastal radio stations monitor a radio watch on 2182 kHz. The Canadian GMDSS areas are:

- Sea Area A1 – Within range of shore-based VHF DSC coast station (40 nautical miles offshore).
- Sea Area A3 – Within the coverage of an Inmarsat geostationary satellite (approximately 70°N to 70°S) (excluding sea area A1).
- Sea Area A4 – Area outside sea areas A1 and A3 (Polar Regions).

151 **DSC Radiotelephone**. — The marine VHF or traditional MF/HF radiotelephone has been enhanced by the addition of a functionality called *Digital Selective Calling (DSC)*. This automated digital watch functionality on the distress and calling frequencies adds to the radio watch. A DSC receiver receives only calls directed to its Mobile Maritime Service Identification (MMSI) as well as calls to "*All Ships*" in its reception area. The transmission can be done by voice over another frequency, as soon as the contact is established by the DSC receiver.

152 **NAVTEX**. — A NAVTEX receiver is a unidirectional communication system, i.e. it receives, but it cannot transmit. It prints Maritime Safety Information (MSI) issued by CCG.

153 **Inmarsat Satellites**. — Inmarsat satellites network (A, B and C) allow telephone communications (Inmarsat A and B only), telex and teletex worldwide except in the Polar Regions. Inmarsat will be used for distress calls as well as for MSI and communications with coastal facilities in areas where there are no VHF, nor MF/HF DSC facilities.

154 **EPIRB**. — The **Emergency Position-Indicating Radio Beacon (EPIRB)** is a small floating and portable beacon which, when activated, transmits a distress signal. There are two classes of beacons: the free release Class 1 EPIRB

with automated activation, and the manually activated Class 2 EPIRB.

155 These classes have 4 types of EPIRB. The most common types of beacons are those which transmit on the 406 MHz frequency and which use COSPAS/SARSAT satellites, and Inmarsat EPIRB's which transmit on 1.6 GHz. The signal sent by these beacons enable the positioning of the EPIRB and the identification of the owner. **Note: It is essential to register the beacon in the National Beacon Database at 1-877-406-7671.**

156 **SART**. — The SART is a portable radar transponder that allows location of a lifeboat after a vessel has sent a distress signal. SART uses the same frequencies as the marine radar (3 cm); when it receives radar waves, the SART sends a signal which appears as a series of dots on the radar screen, indicating the position of the lifeboat. The transponder must be carried aboard the lifeboat when abandoning the vessel.

156.1 A ship-to-ship and ship-to-shore identification system, similar to aircraft identification transponders, has been developed with guidelines from the International Maritime Organization (IMO), International Telecommunication Union (ITU) and the International Electro-technical Commission (IEC). ***Automatic Identification System (AIS)*** transponders use GPS technology and can transmit ship identification, voyage information, position and present course and speed to other similarly equipped vessels and shore stations for safety and security purposes. Aids to navigation are now more equipped with AIS transponders to improve marine safety in bad weather. In Canada, *AIS* is mandatory for most vessels. *AIS*, as with other electronic aids to navigation, must be properly set up and maintained, and used with caution.

156.2 Certain Canadian vessels operating on international voyages must be equipped with ***Long-Range Identification and Tracking of Vessels (LRIT)*** equipment approved by IMO. The *LRIT* system, used world-wide in *GMDSS* Sea Area A3, transmits the ship's name, latitude and longitude, date and time in a secure radio message via *Inmarsat* geostationary satellites to intended recipients. The *Canadian Coast Guard* is responsible for receiving *LRIT* transmissions and notifying intended recipients in Canada. The main purpose of the *LRIT* system is to enhance security; however *LRIT* has been incorporated in *SOLAS* Chapter V, *Safety of Navigation*, for the purposes of safety and environmental protection.

## Search and Rescue (SAR)

157 The Canadian Forces and the Canadian Coast Guard (CCG) are responsible for coordinating all **Search and Rescue** activities in Canada, including Canadian waters and the high seas off the coasts of Canada. These SAR operations are coordinated at the Joint Rescue Coordination Centres (JRCC).

158 **Air Rescue Unit**. — The Canadian Forces maintain SAR helicopters and fixed wing aircraft that are capable of dropping inflatable liferafts, survival equipment and pumps. The helicopters are also equipped with a rescue hoist and can deploy rescue specialist personnel and equipment for evacuation purposes.

159 **Helicopter Evacuation**. — When evacuation of personnel by helicopter is planned, a suitable hoisting area should be prepared, preferably aft 15 m (50 ft) if possible. Booms, flag staff, stays, running gear, antenna wires, etc., must be cleared away. At night, light the hoisting area but shade the lights so as not to blind the pilot.

160 When the helicopter arrives, change course to place the wind 30 – 40° on the port quarter and maintain a slow speed ahead. Allow the basket, stretcher, hoisting sling or scramble net from the helicopter to touch the deck before assisting to avoid static electrical shock. Do not secure any line from a helicopter to your vessel. The helicopter pilot will give you instructions on actions to be taken.

161 **Radio Medical Advice**. — Masters of vessels can obtain medical advice via the nearest MCTS Centre which will relay the message to the nearest medical authority and transmit the reply to the vessel. It is possible to mitigate difficulties of communication that are caused by poor reception or linguistic problems by using the medical section of the International Code of Signals. This last section can be a very useful tool for masters and doctors.

162 **Request For Assistance**. — All distress, urgency and safety messages must be transmitted to the MCTS Centres on VHF Channel 16 (156.8 MHz), VHF DSC Channel 70 (156.525 MHz) or MF 2182 kHz. These messages can also be transmitted by calling the telephone numbers shown on the folded page cover of this booklet.

163 **Sail Plan**. — Small craft operators are encouraged to prepare a Sail Plan before starting on a trip and leave it

**Table 1.1 Search and Rescue Stations (SAR)**

| Province | Location |
|---|---|
| Nova Scotia | Bickerton, Clark's Harbour, Halifax, Louisbourg, Sambro and Westport. |
| Newfoundland and Labrador | Burgeo, Burin, Lark Harbour, Port aux Choix, Old Perlican and St. Anthony. |
| New Brunswick | Saint John and Shippegan. |
| Prince Edward Island | Souris and Summerside. |
| Quebec | Cap-aux-Meules, Havre-Saint-Pierre, Québec, Rivière-au-Renard and Tadoussac. |

ashore with a responsible person or any MCTS Centre. A checking in procedure, by telephone or radiotelephone, for each point specified in the Sail Plan is highly recommended and this could prevent a needless alert that might set off a comprehensive air and marine search. A Sail Plan is provided in the appendices of this booklet.

164 **AMVER**. — The Automated Mutual Assistance Vessel Rescue System (AMVER), operated by the United States Coast Guard in New York, is a maritime mutual assistance program that provides important aid to the development and coordination of Search and Rescue (SAR) efforts in the oceans of the world.

165 Merchant vessels of all nations making offshore passages of more than 24 hours are encouraged to send Sail Plans and periodic position reports to the AMVER centre. On the east coast of Canada, merchant vessels reporting to AMVER can address their message "AMVER HALIFAX" through any MCTS Centre free of charge. For further details consult *Radio Aids to Marine Navigation (Atlantic…)*.

## Cold Water Survival

166 Although air temperatures may warm during summer, Canadian waters on the Atlantic Coast are cold. Without appropriate protective clothing, even a short period of immersion in **cold water** causes hypothermia, a lowered deep-body temperature that can be fatal. Protective clothing, such as an immersion suit or Personal Flotation Device (PFD), with good thermal protection helps prevent hypothermia.

167 Skin and external tissues cool very rapidly in cold water, and in 10 to 15 minutes the temperature of the heart, brain and other internal organs begins to drop. Intense shivering occurs in an attempt to increase the body's heat production and counteract the large heat loss.

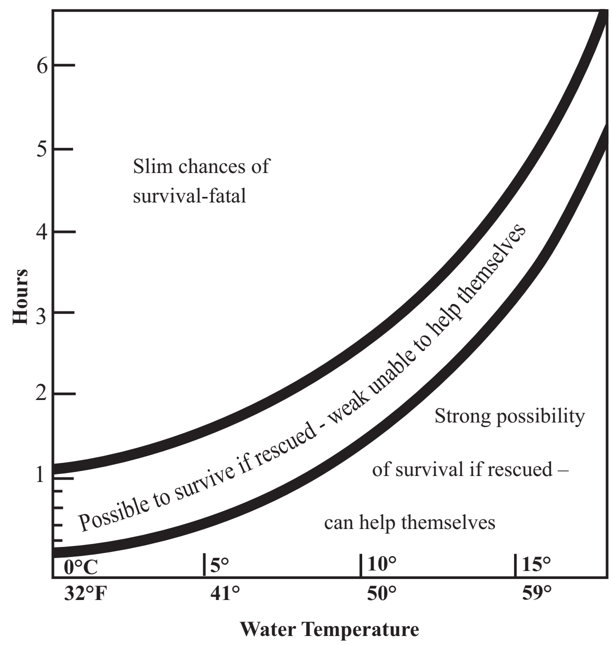
168 Once cooling of the deep-body begins, the body temperature falls steadily and unconsciousness can occur when the deep-body temperature drops from the normal 37°C to about 32°C. When the body core temperature cools to below 30°C death from cardiac arrest usually results.

169 Persons without thermal protection become too weak to help themselves after about 30 minutes in a water temperature of 5°C, and after about an hour the chances of survival are slim if rescued.

170 In almost all weather conditions, the body cools much faster in water than in air, so the less body surface submerged the better. The parts of the body with the fastest heat loss are the head and neck, the sides of the chest and the groin. To reduce body heat loss, protect these areas.

171 Two ways of reducing heat loss are:

**COLD WATER SURVIVAL**




- HELP (Heat Escape Lessening Position): arms held tight against the sides, ankles crossed, thighs close together and raised;
- Huddle: two or more persons in a huddle with chests held close together.

172 To use these methods successfully a person must be wearing a PFD. As shown by the table, survival time is greatly increased by wearing clothing that gives thermal protection, including a hood to prevent heat loss through the head.

173 Do not swim to keep warm as this causes heat to be lost to the cold water due to more blood circulation to the arms, legs and skin. If you have no PFD, remain as still as you can, moving your arms and legs just enough to keep the head out of water.

**Table 1.2 Predicted Survival Time ***

| Situation | Time (Hours) |
|---|---|
| **No flotation** | |
| Drownproofing | 1.5 |
| Treading water | 2.0 |
| **With flotation** | |
| Swimming slowly | 2.0 |
| Holding still | 2.7 |
| HELP | 4.0 |
| Huddle | 4.0 |
| Flotation jacket | 7.0 |

* In + 10°C water
Clothing worn was cotton shirt, pants and socks plus running shoes.

174 **Rewarming After Mild Hypothermia**. — If the casualty is conscious, talking clearly and sensibly and shivering vigorously, then:

- get the casualty out of the water to a dry sheltered area;
- remove wet clothing and if possible put on layers of dry clothing; cover the head and neck;
- apply hot, wet towels and water bottles to the groin, head, neck and sides of the chest;
- use electric blankets, heating pads, hot baths or showers;
- use hot drinks but **never alcohol**.

175 **Rewarming After Severe Hypothermia**. — If the casualty is getting stiff and either unconscious or showing signs of clouded consciousness, such as slurred speech, or any other apparent signs of deterioration, immediately (if possible) transport the casualty to medical assistance where aggressive rewarming can be initiated.

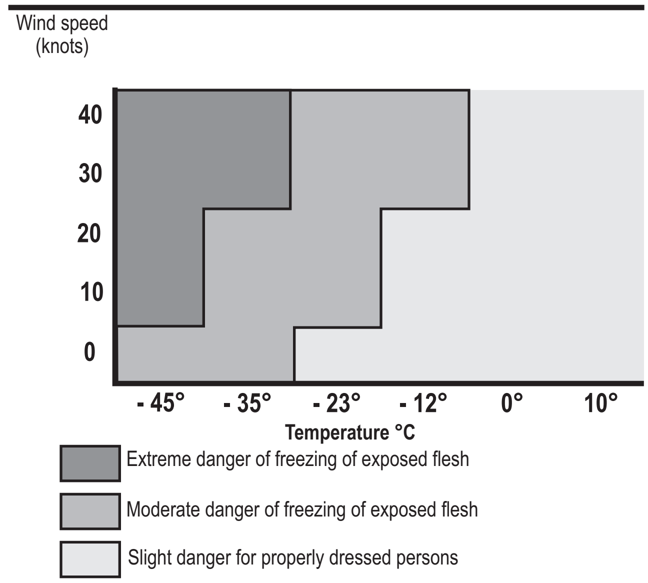
176 Once shivering has stopped, there is no use wrapping casualties in blankets if there is no source of heat as this merely keeps them cold. A way of warming must be found quickly. Some methods are:

- put the casualty in a sleeping bag or blankets with one or two warm persons, with upper clothing removed;
- use hot, wet towels and water bottles as described above;
- warm the casualty's lungs by mouth-to-mouth breathing.

177 Warm the chest, groin, head and neck but not the extremities of the body; warming the extremities can draw heat from the area of the heart, sometimes with fatal results. For this reason **do not rub the surface of the body**. Handle the casualty gently to avoid damaging the heart.

178 **Wind Effect On Persons Exposed to the Elements**. — Risk of frostbite on exposed body parts increases considerably with the wind speed and appropriate measures for protection should be taken.

**Effect of wind on exposed persons**




## Pilotage

179 For pilotage in the waters of the Atlantic Coast, two regional **pilotage authorities** are involved. The *Atlantic Pilotage Authority* (APA), with head office in Halifax, is responsible for pilotage in all Canadian waters in and around the provinces of Nova Scotia, Prince Edward Island, Newfoundland and Labrador, and New Brunswick including the waters of Chaleur Bay, south of Cap d'Espoir *(48°25'N, 64°19'W)*.

180 The *Laurentian Pilotage Authority* (LPA), with head office in Montréal, is responsible for all Canadian waters in and around the province of Quebec downstream of the lower entrance of Saint-Lambert Lock *(45°30'N, 73°31'W)*, except the waters of Chaleur Bay SW of Cap d'Espoir.

181 **Ice Pilotage Service in the Gulf of St. Lawrence**. — During periods of ice, there is pilotage service for the Gulf of St. Lawrence and the west coast of Newfoundland. This service is non-compulsory but

**Table 1.3 Compulsory Pilotage Areas**

| Province | Location |
|---|---|
| Nova Scotia | Bras d'Or Lake, Strait of Canso, Chedabucto Bay, Halifax, Pugwash, St. Peters and Sydney. |
| Newfoundland and Labrador | Botwood, Holyrood, Humber Arm, Lewisporte, Placentia Bay, St. John's and Stephenville. |
| New Brunswick | Miramichi, Ristigouche and Saint John. |
| Prince Edward Island | Charlottetown and Confederation Bridge. |
| Quebec | St. Lawrence River, from Les Escoumins going upstream to Saint-Lambert Lock, including Fjord du Saguenay.<br>St. Lawrence Seaway, upstream of Saint-Lambert Lock. |

is ensured by APA's and LPA's pilots. The ice pilot boarding stations are at Port-aux-Basques (NL), North Sydney (NS) and Les Escoumins (QC).

182 Arrangements must be made as soon as possible with APA for inbound vessels. Downbound vessels wishing to have the pilotage service must give notices 24, 12 and 6 hours before ETA at Les Escoumins. To obtain the services of a pilot, the agent of the vessel should make proper arrangements.

183 For details related to pilotage services available and procedures to be followed, mariners should consult:

- *Annual Edition of Notices to Mariners;*
- *Radio Aids to Marine Navigation (Atlantic…);*
- *Atlantic Pilotage Authority Regulations;*
- *Laurentian Pilotage Authority Regulations.*

## Regulations

184 The following extracts or summaries of **Regulations** and Acts are printed for determining general impressions only and no liability is accepted for failure to publish complete details, or for errors or omissions of text. Changes or amendments may be made subsequent to the printing of this booklet; mariners are advised to make the necessary arrangements to acquire the complete and latest regulations and acts governing subjects of interest. Copies are available for sale from: Publishing and Depository Services, Ottawa (ON) K1A 0S5; telephone: 1-800-635-7943. Most regulations are published on the Government of Canada Web Site: www.canada.gc.ca.

185 **Collision Regulations**. — Various rules for preventing collisions at sea are in place in waters under Canadian jurisdiction. These rules appear in the *Collision Regulations*.

186 **Maritime Zones and Fishing Zones**. — The ***Oceans Act*** defines four maritime zones: Territorial Sea, Contiguous Zone, Exclusive Economic Zone and Continental Shelf. In addition, Canada exercises management and control of the fisheries within a 200-mile limit.

187 **Criminal Code of Canada**. — "Every one commits an offence who operates a vessel or any water skis, surf-board, water sled or other towed object on or over any of the internal waters of Canada or the territorial sea of Canada, in a manner that is dangerous to the public, having regard to all the circumstances, including the nature and condition of those waters or sea and the use that at the time is or might reasonably be expected to be made of those waters or sea. Every one who commits an offence is guilty of an indictable offence and liable to imprisonment for a term not exceeding five years or of an offence punishable on summary conviction. And every one who commits an offence and thereby causes bodily harm to any other person is guilty of an indictable offence and liable to imprisonment for a term not exceeding ten years. And every one who commits an offence and thereby causes the death of any other person is guilty of an indictable offence and liable to imprisonment for a term not exceeding fourteen years."

188 **Shipping Casualties Reporting Regulations**. — The *Shipping Casualties Reporting Regulations*, of the *Canada Shipping Act*, require any person responsible (master, any certificated officer, member of the crew, pilot or operator) for a ship in Canadian waters, or a Canadian ship in any waters, to report without delay a shipping casualty, accident or dangerous occurrence. There are penalties for failing to report a shipping casualty.

189 The report shall be made by radio communications or other quickest means to a MCTS Centre or a Canadian harbour radio ship reporting station. Thereafter, a written report shall be completed and forwarded. For more information contact CCG offices.

190 Several laws and regulations, of which the *Fisheries Act*, the *Species at Risk Act*, the *Oceans Act*, the *Navigable Waters Protection Act*, the *Canadian Environmental Assessment Act* and the *Ballast Water Control and Management Regulations* protect the fish habitat and oversees the transfer of ballast water, dredging activities, dumping at sea, back filling and the construction or removal of infrastructures. The mariner must obtain the information on the necessary permits and on how to perform the duties.

191 **Pollution Regulations**. — ***Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals*** which are under the *Canada Shipping Act*, expressly forbids the discharge of oil, oily mixtures, noxious liquids, dry chemicals listed in Schedule 1 of the regulations, sewage and sewage sludge, organotin compounds or garbage in Canadian waters by any ship, and by Canadian ships in any waters..

192 Masters of **oil tankers** and **chemical carriers** operating in ice control zones of Eastern Canada should refer to the *Joint Industry Coast Guard Guidelines for the Control of Oil Tankers and Bulk Chemical Carriers in Ice Control Zones of Eastern Canada* for guidance in the operation of their vessels while in ice control zones. A copy of the Guidelines should be carried on board of all applicable vessels.

193 The ***Ballast Water Control and Management Regulations*** of the *Canada Shipping Act* applies to the majority of vessels inbound for Canadian waters. The Regulations are to protect Canadian waters from unintentional introduction of aquatic organisms or pathogens that can be harmful to ecosystems.

194 Any discharge, or the danger of a discharge of pollutant substance **must be reported** by the quickest means available to a pollution prevention officer. Pollution prevention

officers are located at Baie-Comeau, Gaspé, Montréal, Port-Cartier, Québec City, Rimouski and Sept-Îles (QC); at Dartmouth, Port Hawkesbury, Sydney and Yarmouth (NS); at Corner Brook, Lewisporte, Marystown and St. John's (NL); at Charlottetown (PE); at Bathurst and Saint John (NB).

195 A ship of 400 tons gross tonnage or more that carries oil as fuel or as cargo and an oil tanker of 150 tons gross tonnage or more that carries oil in Canadian waters shall keep on board an **Oil Record Book** as prescribed by the regulations.

196 **Air Pollution**. — ***Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals*** list also requirements for the construction, equipment and operation of ships to prevent pollutant substances from being discharged into the atmosphere.

197 **Disposal at Sea**. — The *Canadian Environmental Protection Act* requires that a permit be obtained before loading dredged material for the purpose of disposal at sea, as well as for the disposal or abandonment of substances at sea on ice, by incineration or disposal at sea.

198 **Permits** may be issued on receipt of the appropriate application form and the prescribed fee. For more details, mariners should contact their shipping agent. In emergencies, the requirement for a permit is waived but a report must be made in the prescribed form. An emergency is considered to be any situation where disposal is necessary to avert danger to human life at sea or to any ship.

199 Requests for application forms for the Quebec region should be addressed to the Conservation and Protection, Environment Canada, 1179 Bleury St., Montréal (QC) H3B 3H9 and for the Atlantic region it should be addressed to the Environmental Protection Branch, Environment Canada, 5th floor Queen's Square, 45 Alderney Drive, Dartmouth (NS) B2Y 2N6. In Newfoundland and Labrador requests for applications should be addressed to Environmental Protection Branch, Environment Canada, 6 Bruce Street, Mount Pearl (NL) A1N 4T3

200 **Species at Risk Act**. — The goal of the *Species at Risk Act (SARA)* is to prevent the extinction of wild species and sets the requirements defining the essential habitats and the measures to protect them. Hence, certain marine mammal populations are granted the status of endangered species or threatened species. To protect these populations, the *SARA* prohibits their hunt and also forbids any willful disturbance of these populations.

201 **Marine mammals**. — Each year many cetaceans populate the waters of the east coast of Canada. In certain areas mariners will have to proceed with **caution to avoid colliding** with cetaceans or with tour boats. All mariners must comply with the ***Marine Mammal Regulations*** of the *Fisheries Act* and with the ***Marine Activities in the Saguenay — St. Lawrence Marine Park Regulations***, and abide by the applicable rules.

202 **Protection of submarine cables**. — The following text is a summary from the *International Convention for the Protection of Submarine Cables* (ICPC).

203 It is an offence to break or damage a submarine cable that may result in an interruption or interference with communications, without prejudice to any civil action for damages. This provision does not apply to cases where those who break or damage a cable do so with the lawful object of saving their lives or their ship.

204 When a ship is engaged in repairing a cable, the other vessels shall withdraw to keep beyond a distance of at least one nautical mile from the ship in question, so as not to interfere with her operations. Fishing gear and nets shall be kept at the same distance. However, fishing vessels shall be allowed a period of twenty-four hours to comply with the regulations.

205 Vessels which see, or are able to see, the buoys showing the position of a cable when the latter is being laid, is out of order, or is broken, shall keep beyond a distance of one-quarter of a nautical mile from the said buoys. Fishing nets and gear shall be kept at the same distance.

206 Even though there may be no specific prohibition against **anchoring or trawling** in submarine cable areas, mariners should avoid doing so in these areas because of the serious interference with communications or power supplies which can result from damage to such cables.

207 Owners of vessels who can prove that they have sacrificed an anchor, a net or other fishing gear in order to avoid damaging a submarine cable, may receive compensation from the owner of the cable. In order to establish a claim to such compensation, the master of the ship must, within 24 hours after his return to port, make a report that sets forth full particulars of the occurrence and make a declaration to the Chief Officer of Customs and Excise, to the local CCG or the Fisheries Officer of the Department of Fisheries and Oceans.

208 **Danger involved in cutting to clear anchors or fishing gear**. — In the event of any vessel fouling a submarine cable, every effort should be made to clear the anchor or gear by normal methods. If these efforts fail, the anchor or gear should be slipped and abandoned without attempting to cut the cable. High voltages are carried by submarine cables as well as power transmission cables; serious risk exists of loss of life or severe burns if any attempt to cut the cable is made. No claim in respect of injury or damage sustained through such interference with a submarine cable will be entertained.

209 One of the main objectives of the *International Cable Protection Committee (ICPC)* is to make known the existence of and the location of submarine cables. The universal charting of cables has been endorsed by the International Hydrographic Organization and charts showing cable positions are available

from many Hydrographic Offices. If there is any difficulty in obtaining cable information, requests addressed to the International Cable Protection Committee, P.O. Box 150, Lymington, United Kingdom, SO41 6WA, will receive immediate attention.

210 The following texts are **extracts of regulations**:

**CHARTS AND NAUTICAL PUBLICATIONS REGULATIONS, 1995**

**Regulations requiring the presence on board ships of appropriate charts, tide tables and other nautical documents or publications and respecting their maintenance and use.**

*Interpretation*

2. In these Regulations,

"charts" means a nautical chart; *(carte)*

"ECDIS" means an electronic chart display and information system; *(SVCEI)*

"ENC" means an electronic navigational chart database that

(*a*) is standardized as to content, structure and format,

(*b*) is issued for use with an ECDIS on the authority of the Canadian Hydrographic Service or a hydrographic office authorized by the government of a country other than Canada, and

(*c*) contains all the chart information necessary for safe navigation; *(CEN)*

"nautical mile" means the international nautical mile; *(mille marin)*

"RCDS" means a raster chart display system; (*RCDS*)

"reference catalogue", in respect of an area to be navigated by a ship, means:

(*a*) for waters under Canadian jurisdiction, the *Catalogue of Nautical Charts and Related Publications*, published by the Canadian Hydrographic Service, and

(*b*) for waters outside Canadian jurisdiction, the *Catalogue of Admiralty Charts and Other Hydrographic Publications*, published by the Government of United Kingdom, or the *Catalog of Charts and Publications*, published by the Government of United States of America; *(catalogue de référence)*

"RNC" means a raster navigational chart that is a facsimile of a paper chart issued on the authority of the Canadian Hydrographic Service or a hydrographic office authorized by the government of a country other than Canada; *(RNC)*

"tons" means gross tons; *(tonneaux)*

"waters under Canadian jurisdiction" means

(*a*) Canadian waters, and

(*b*) the exclusive economic zone of Canada; *(eaux de compétence canadienne)*

*Application*

3. These Regulations apply to Canadian ships in all waters and to all ships in waters under Canadian jurisdiction.

*Exceptions*

3.1 (1) Subsection 4(1) does not apply if the owner and the master of a ship are unable to obtain the charts, documents or publications, required by these Regulations in respect of the area in which the ship is being navigated, at any place at which the ship calls.

(2) Subsections 5(1) and 6(1) and (2) do not apply if the person in charge of the navigation of a ship is unable to obtain the charts, documents or publications, required by these Regulations in respect of the area in which the ship is being navigated without endangering the ship, contravening applicable regulations or requiring the ship to make a substantial detour.

(3) Section 7 does not apply if the circumstances of the voyage are such that it is impracticable to receive *Notices to Mariners*, *Notices to Shipping* or radio navigational warnings containing information with regard to the safe navigation of the ship.

*Prohibition*

3.2 No ship of any class shall navigate in any shipping safety control zone prescribed under subsection 11(1) of the *Arctic Waters Pollution Prevention Act* unless the ship complies with these Regulations.

*Carriage of Charts, Documents and Publications*

4. (1) Subject to subsection (2), the master and owner of every ship shall have on board, in respect of each area in which the ship is to be navigated, the most recent editions of the charts, documents and publications that are required to be used under sections 5 and 6.

(2) The master and owner of a ship of less than 100 tons are not required to have on board the charts, documents and publications referred to in subsection (1) if the person in charge of navigation has sufficient knowledge of the following information, such that safe and efficient navigation in the area where the ship is to be navigated is not compromised:

(*a*) the location and character of charted:
 (i) shipping routes,
 (ii) lights, buoys and marks, and
 (iii) navigational hazards; and
(*b*) the prevailing navigational conditions, taking into account such factors as tides, currents, ice and weather patterns.

*Use of Charts*

5. (1) Subject to subsection (2), in order to plan and display a ship's route for an intended voyage and to plot and monitor positions throughout the voyage, the person in charge of the navigation of the ship shall use the most recent edition of a chart that:

(*a*) is issued officially by or on the authority of
 (i) the Canadian Hydrographic Service, when the ship is in Canadian waters, and
 (ii) the Canadian Hydrographic Service or the government or an authorized hydrographic office or other relevant government institution of a country other than Canada, when the ship is outside Canadian waters;
(*b*) applies to the immediate area in which the ship is being navigated; and
(*c*) is, for that area,
 (i) the largest scale chart according to the reference catalogue, or
 (ii) of a scale that is at least 75 per cent of the scale of the chart referred to in subparagraph (i) and is as complete, accurate, intelligible and up-to-date as that chart.

(2) The person in charge of the navigation of a ship may use the most recent edition of a chart that is the second-largest scale chart for an area according to the reference catalogue where

(*a*) the scale of the chart is at least 1:400 000 (2.16 nautical miles to the centimetre); and
(*b*) the ship is
 (i) more than five nautical miles from any charted feature or charted depth of water that represents a potential hazard to the ship, or
 (ii) within an area for which the largest scale chart, according to the reference catalogue, is primarily
  (A) a chart intended for the use of pleasure craft, or
  (B) a chart of an anchorage, a river or a harbour that the ship will not transit or enter.

(3) The chart may be in electronic form only if

(*a*) it is displayed on an ECDIS or, in the case of failure of the ECDIS, on a back-up arrangement; and
(*b*) the ECDIS
 (i) in waters for which an ENC is available, is operated using the ENC,
 (ii) in waters for which an ENC is not available, is operated using an RNC,
 (iii) when the ECDIS is operating in the RCDS mode, is used in conjunction with paper charts that meet the requirements of subsections (1) and (2), and
 (iv) is accompanied by a back-up arrangement.

*Use of Documents and Publications*

6. (1) Subject to subsection (3), the person in charge of the navigation of a ship in waters under Canadian jurisdiction shall use, in respect of each area to be navigated by the ship, the most recent edition of

(*a*) the reference catalogue;
(*b*) the annual edition of the *Notices to Mariners*, published by the Department of Fisheries and Oceans;
(*c*) the following publications, namely,
 (i) *Sailing Directions*, published by the Canadian Hydrographic Service,
 (ii) *Tide and Current Tables*, published by the Canadian Hydrographic Service,
 (iii) *Lists of Lights, Buoys and Fog Signals*, published by the Department of Fisheries and Oceans,
 (iv) where the ship is required to be fitted with radio equipment pursuant to any Act of Parliament or of a foreign jurisdiction, the *Radio Aids to Marine Navigation*, published by the Department of Fisheries and Oceans;
(*d*) the documents and publications listed in the schedule.

(2) Subject to subsection (3), the person in charge of the navigation of a Canadian ship in waters outside Canadian jurisdiction shall use, in respect of each area to be navigated by the ship, the most recent edition of

(*a*) the reference catalogue;
(*b*) the annual edition of the *Notices to Mariners*, published by the Department of Fisheries and Oceans;
(*c*) the following publications referred to in the reference catalogue, namely,

(i) *Sailing Directions*,
(ii) *Tide and Current Tables*,
(iii) *Lists of Lights, Buoys and Fog Signals*,
(iv) where the ship is required to be fitted with radio equipment pursuant to an Act of Parliament, the *Radio Aids to Marine Navigation*; and

(*d*) the documents and publications listed in the schedule.

(3) The publications referred to in paragraphs (1)(*c*) and (2)(*c*) may be replaced by similar publications issued officially by or on the authority of an authorized hydrographic office or other relevant government institution of a country other than Canada, if the information contained in them that is necessary for the safe navigation of a ship in the area in which the ship is to be navigated is as complete, accurate, intelligible and up-to-date as the information contained in the publications referred to in those paragraphs.

*Maintenance of Charts, Documents and Publications*

7. The master of a ship shall ensure that the charts, documents and publications required by these Regulations are, before being used for navigation, correct and up-to-date, based on information that is contained in the *Notices to Mariners*, *Notices to Shipping* or radio navigational warnings.

211 A list of equivalent foreign charts is issued for reference in conjunction with the *Charts and Nautical Publications Regulations, 1995*. This list is published in the *Annual Edition of Notices to Mariners* and updated in the *Monthly Editions of Notices to Mariners*.

## PUBLIC PORTS

212 The activities in **public ports** and the use of public port facilities are controlled by the *Public Ports and Public Port Facilities Regulations* and some regulations of the *Canada Marine Act*, as is navigation on and the use of the navigable waters of any natural or man-made harbour.

## QUARANTINE REPORTING REQUIREMENTS

213 The *Quarantine Act* and *Regulations* require that the Master of every vessel shall complete and furnish promptly at the first port of arrival in Canada, a Declaration of Health in the prescribed form. Quarantine Officers, Environmental Health Officers and Border Services Officers work together at Canada's international border to help prevent the introduction and spread of communicable disease.

214 Advance radio notification to a quarantine station applies only if a condition of health irregularity occurs onboard. The master of a vessel will be guided by instructions received by radio, from the quarantine officer, in reply to a notification of irregularity onboard. Section 12 of the *Quarantine Regulations* prescribes the conditions for requirements of advance notification by radio; it is quoted as follows:

12. (1) Where, in the course of a voyage of a vessel to one of the ports referred to in subsection (3),

(*a*) a member of the crew or a passenger on board the vessel has
(i) died,
(ii) had a temperature of 38°C (100°F) or greater that persisted for two days or more or was accompanied or followed by a rash, jaundice or glandular swelling, or
(iii) suffered from diarrhea severe enough to interfere with that person's work or normal activity,

(*b*) the person in charge of the vessel is, during the period
(i) of four weeks preceding the estimated time of arrival of the vessel, or
(ii) since he last submitted a declaration of health as required by section 16,

whichever is the lesser, aware of any instance of illness among the crew or passengers that he suspects is of an infectious nature and may lead to the spread of disease,

(*c*) the vessel has,
(i) within 14 days of its estimated time of arrival in Canada, been in a country that, in the opinion of a quarantine officer, is infected or suspected of being infected with smallpox, or
(ii) within 60 days of its estimated time of arrival in Canada been in a country that, in the opinion of a quarantine officer, is infected or suspected of being infected with the plague, or

(*d*) a certificate establishing that the vessel has been de-ratted or exempted from de-ratting procedures has expired or is about to expire

the person in charge of the vessel shall, by radio at least 24 hours prior to the vessel's estimated time of arrival at its port of destination and between the hours of 9 o'clock in the forenoon and 5 o'clock in the afternoon, notify the quarantine officer at the quarantine station designated in subsection (3) for that port of the occurrence and provide him with the information described in subsection (2).

(2) The information to be provided to the quarantine officer pursuant to subsection (1) is

(*a*) the name and nationality of the vessel;
(*b*) the ports called at during the voyage of the vessel;
(*c*) the nature of the cargo on board the vessel;
(*d*) the number of persons comprising the crew of the vessel;
(*e*) the number of passengers on board the vessel;

(*f*) the port of destination of the vessel and the name of the vessel's owner or, if the owner is not in Canada, the name of the vessel's agent in Canada;
(*g*) the condition of all persons on board the vessel and details of any death or illness occurring during the voyage;
(*h*) whether the body of any person is being carried on the vessel;
(*i*) the estimated time of arrival of the vessel at the port of destination;
(*j*) the number of persons on board the vessel who are not in possession of valid evidence of immunization to smallpox; and
(*k*) the date and place of issuance of any de-ratting certificate or de-ratting exemption certificate applicable to the vessel.

(3) For the purpose of subsection (1), the quarantine station for vessels bound for
(*a*) a port in the Province of Nova Scotia or a port in the Province of Prince Edward Island, is Quarantine Station, Halifax, Nova Scotia;
(*b*) a port in the Province of New Brunswick, is Quarantine Station, Saint John, New Brunswick;
(*c*) a port in the Province of Newfoundland, is Quarantine Station, St. John's, Newfoundland;
(*d*) a port in the Province of Quebec or any Canadian port via the St. Lawrence River, is Quarantine Station, Montréal, Quebec.

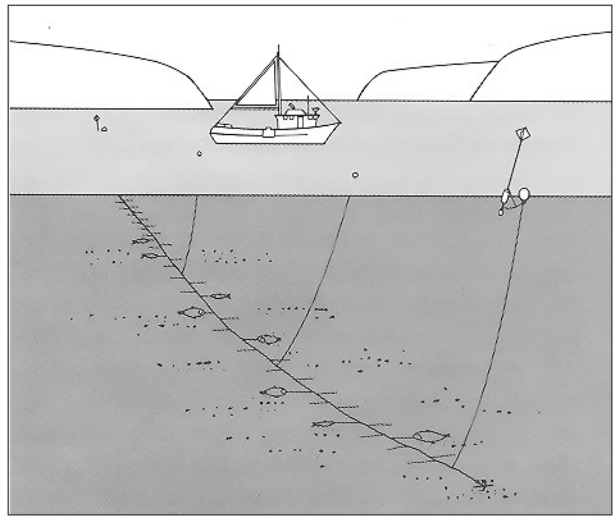
## Fishing Methods

215 The following descriptions of **fishing methods** are those most common to the Canadian East Coast waters covered by this booklet of *Sailing Directions*.

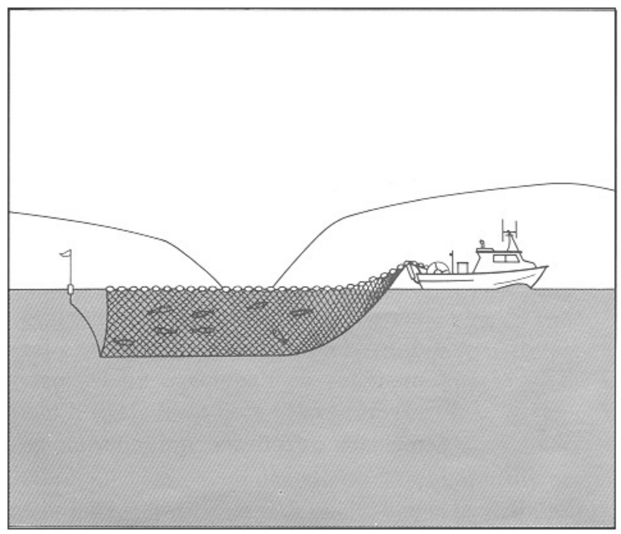
216 **Handlining and Jigging Machines**. — Handlining and jigging are two of the oldest forms of fishing and are methods used by inshore fishermen on the Atlantic Coast. Handlining utilizes a line to which a weight and baited hook is attached. Jigging activities involve the use of lure-like hooks attached to a line which is "jigged" or moved up and down in a series of short movements, manually or mechanically, in the water at a level where fish are present. The vessel is stationary but not necessarily anchored.

217 **Longlining**. — Longlining involves the use of a long line with a series of baited hooks about 1 m (3 ft) apart, set along the ocean floor. Anchors secure the longline gear, while on the surface it is marked by buoys. It is not unusual to find longlines of a few miles in length with as many as 5,000 baited hooks attached. Fishing of this nature is normally carried out in greater depths to catch groundfish. Longlines are set over the stern as the vessel steams forward, and later retrieved over the bow or the sides.

LONGLINING



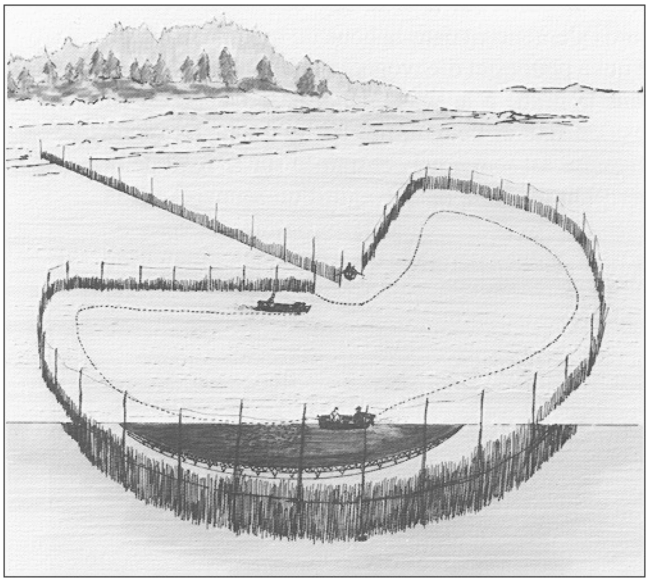
GILLNETTING



218 **Gillnetting**. — Gillnetting is used to catch many species of fish and it is the most common method of fishing in estuarine areas. Gillnets may be either anchored to the sea bottom or left to drift from the surface. Nets are positioned in varying depths depending of the behavior of the species being fished. Both ends of the net are marked with a surface buoy equipped occasionally with a radar reflector.

219 **Weir Fishing**. — The weir method of fishing is used along the shoreline where there is considerable height of the tides. This type of fishing gear is used in the Bay of Fundy and

## WEIR FISHING



its approaches, as well as on both sides of the St. Lawrence River in the province of Quebec.

220 Rigid poles are driven into the mud bottom in a heart-shaped configuration. A straight line of poles is then placed from the shoreline to the weir. This line acts as a barrier and the fish follows it into the weir. To remove the catch, fishermen use a purse seine inside the weir.

221 Weirs can be placed permanently in ice free areas and usually extend to approximate depths of 4 m (13 ft) below chart datum. Some weirs are located close to reefs and small islands, and lead nets may block off narrow passages that would otherwise be navigable at high water. Remains of old, abandoned weirs may be a hazard to small craft when anchoring close to shore on a falling tide.

222 **Traps**. — Trap fishing is somewhat similar to weir fishing and is primarily used in Newfoundland. The traps resemble open-topped box nets, measuring 11 to 22 m (36 to 72 ft) around the perimeter, with a vertical opening or "door" on one side.

223 The trap is set on the bottom, usually close to the shore, with the door facing shallow water. It is buoyed on the top and anchored on each corner to maintain its position. A long net fence extends from shallow water into the mouth of the trap. Fishermen then close the doors and bring the trap to the surface, hauling it across the vessel.

224 **Inshore and Offshore Lobster Fishing**. — Lobsters are caught by inshore fishermen using traps (or pots) set on the ocean floor, either individually or in groups on a line. The size and design of these traps differ somewhat in various localities but they are usually constructed of curved pieces of wood,

## INSHORE LOBSTER FISHING

laths, and cotton or nylon twine, and weigh approximately 40 kg. Traps are set in waters of varying depths, but usually near a rocky bottom.

225 Traps set individually are marked by a buoy with a distinctive colour and traps set in groups are marked at each end of the line. Offshore lobster traps are constructed sturdier and vessels are larger (18 to 35 m (59 to 115 ft) in length). The lobster season is open from November to May along the coast from Sambro Island westwards into the Bay of Fundy, and during spring and summer elsewhere on the east coast.

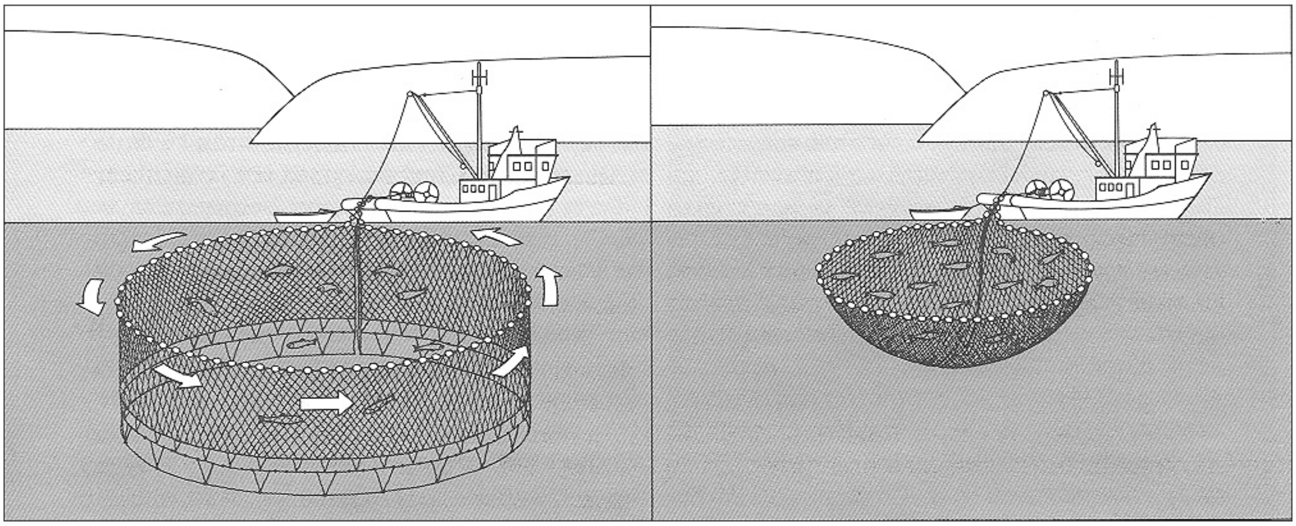
226 **Crab Traps**. — Crab traps differ considerably from those used in the lobster fishery. Crab traps are framed with iron rods and are covered with polyethylene rope webbing, and may be either cone-shaped or rectangular. Usually only one trap is placed on each line but it is possible to find a line of traps, anchored and marked by buoys at the extremities.

227 **Purse Seining**. — A seine is a wall of webbing used to encircle fish. The purse seine has floats on the top and weights on the bottom to keep it vertical in the water. A purse seine, however, has a wire rope passing through rings on the bottom of the net which enables the net to be drawn together to entrap fish.

228 Purse seines are used to capture many species of schooling fish. When a school of fish is detected, one end of the seine is taken by a small boat or "skiff". The skiff then encircles the fish with the net while the parent vessel is stationary. After receiving the end of the line from the skiff, the vessel begins to winch in the wire cable, closing the bottom of the seine and forming a bag-like net around the fish.

229 **Danish and Scottish Seining**. — Danish and Scottish seining methods are used to catch species of groundfish such as flounder and cod. Both methods use similar nets and series of ropes spread out in a pear-shaped form along the ocean floor. The action of the ropes stirs up a mud cloud and herds the fish into the path of the net. In Danish seining,

## PURSE SEINING

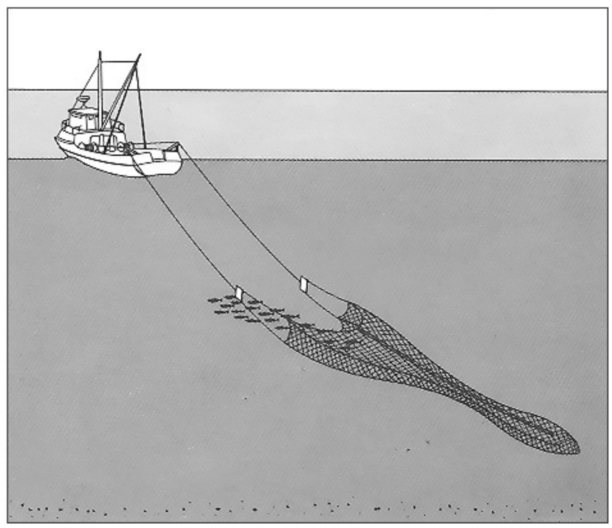


the vessel remains in a fixed position while the gear is hauled along the bottom. In Scottish seining, the net and ropes are towed along the ocean floor while they are closing.

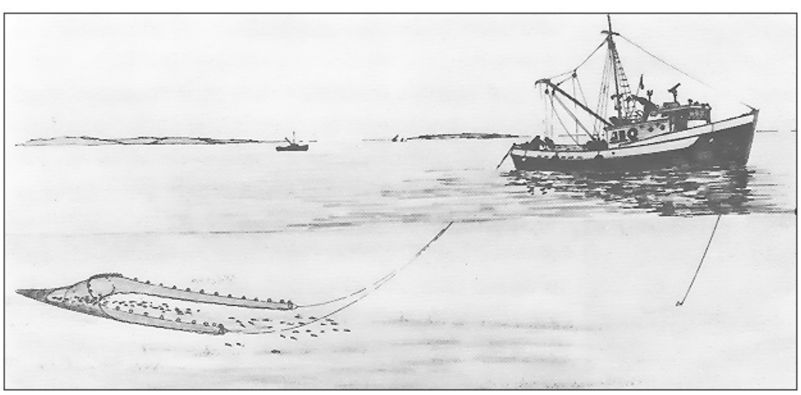
230 **Otter Trawling**. — Otter trawls are cone-shaped nets which are towed on the ocean floor to catch many species of groundfish. They take their name from the rectangular “doors” or “otterboards” that are attached to cables between the vessel and the net. These doors serve to keep the mouth of the net horizontally open while the net is making its tow. A vertical opening is maintained by weights on the bottom and floats on the top and the water pressure generated from towing. The net traps fish in the end of the bag-like section or “cod-end”, which has a mesh size that permits only the smaller fish to escape. The net rolls on the bottom with the aid of bobbins, which are similar in appearance to wheels.

231 The **side trawling operation** is performed by only a few fishermen in Eastern Canada; the gear (trawl) of the

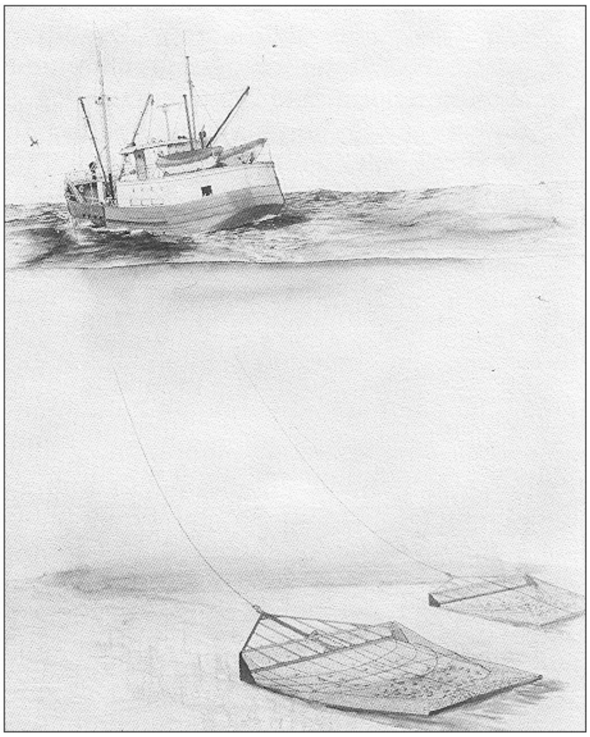
## OTTER TRAWLING



## DANISH SEINING



**SCALLOP DRAGGING**



side trawlers is towed from gallows attached on one side of the vessel. The vessel runs in circles to drop or haul in the net. **Stern trawlers**, reaching lengths up to 46 m (150 ft), are the main component of Canada's offshore fishing fleet. The trawl is hauled into the vessel over a large ramp through an opening at the stern of the ship. Stern trawlers can operate in almost any waters or weather conditions and often range as far as 300 miles off the coast, fishing at depths of up to 455 m (250 fm).

232 **Mid-Water Trawling** is used to fish species such as herring, mackerel, redfish, etc. By using fewer weights and by adjusting the vessel's speed and the length of the towing cable, the net can be towed at various depths.

233 **Scallop Dragging**. — Scallops are harvested in both offshore and inshore areas, with the offshore fishery much larger in terms of the volume of landings and the size of gear used. Offshore scallop drags consist of a metal frame having teeth to which a chain-mesh bag is attached. The drag is towed along the ocean floor raking the catch into the bag.

234 In the Bay of Fundy, Digby-type scallop draggers are approximately 20 m (66 ft) in length and they tow a gang of 7 drags, each about 75 cm (2.5 ft) wide attached to a spreader. The gear is fished from the starboard side of the vessel. Offshore scallop draggers range from 30 to 40 m (98 to 131 ft) and fish two drags, one port and one starboard each approximately 4 to 5 m (13 to 16 ft) wide.

## Aquaculture

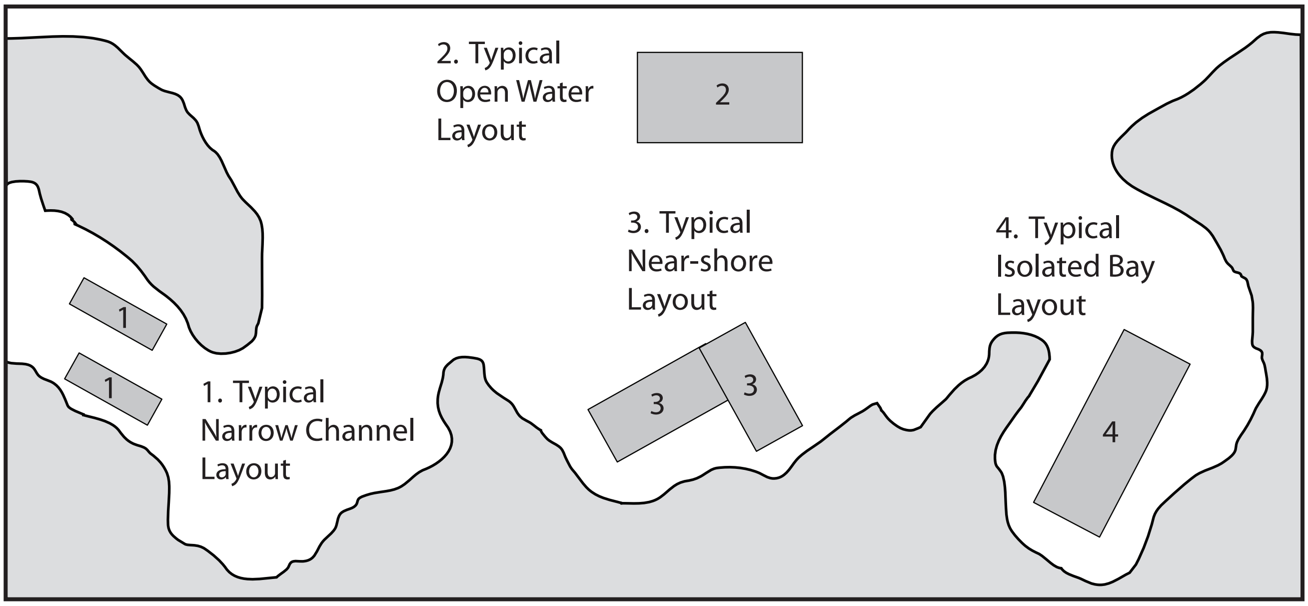
235 Mariners are encountering an increased number of **aquaculture facilities**. These facilities should be respected like any other marine wildlife fisheries with their fishing gear in operation. Licensed marine farms are **marked on the water** by yellow cautionary buoys and at times with a number of black floats located between the buoys. The shipping channels near the marine farms are marked with a lateral system of buoyage (red and green buoys). These buoys may be lighted or unlighted. Marine farms are identified with a **symbol on charts**; according to the chart scale, the perimeter may or may not be shown with the main buoys marking the maximum covered area by the aquaculture facilities.

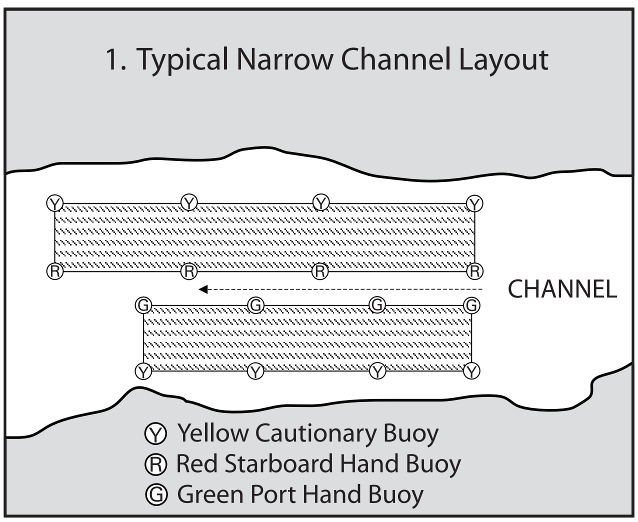
235.1 **Aquaculture** is the raising of animals and plants in salt or fresh water. Marine farming is a relatively new and rapidly expanding industry along the Atlantic coastline. Due to many changes in this industry revised positions (latitude and longitude) are not accurately known for all facilities. Only a certain number of these changes are advertised in *Notices to Mariners* and *Notices to Shipping*. Maintain a **safe distance** from marine farm facilities to avoid creating damage from excessive wash and to avoid collisions and entanglement. See diagram of **Typical Aquaculture Site Layouts** surface marine farm **facilities**.

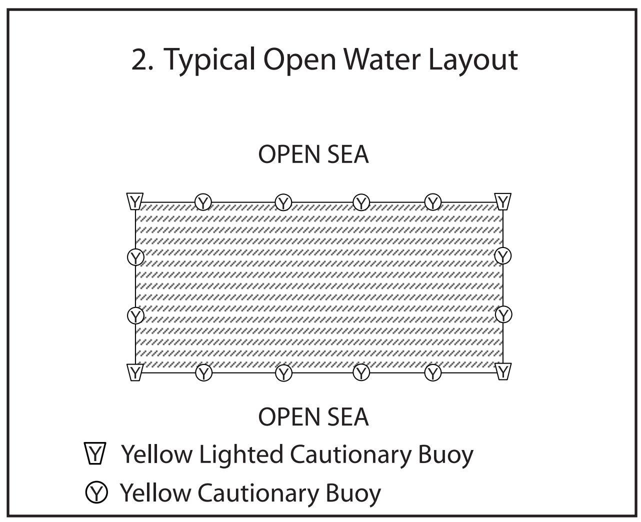
235.2 Some **fish** are raised in open water **marine farms**. A typical marine farm consists of floating walkways from which net pens are hung in the water 6 m or more deep. A large work and storage area is usually on the adjacent shore. Some farms use large barges containing work, storage and living areas. Sometime they are moored close offshore along shipping channels or are moored in bays and inlets used by commercial and recreational vessels for anchorages. In some of the shallower, less frequented bays and inlets farms may be moored in the centre of the fairway.

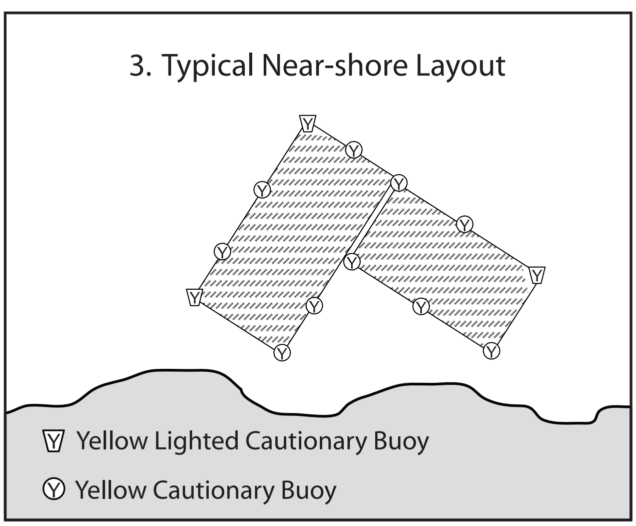
235.3 There are other types of farms established in many locations along the coast. **Shellfish** tenures use off-bottom culture for these **shoreline marine farms**. Off-bottom culture methods use floating platforms from which the shellfish are suspended. The floating platforms are a series of buoys linked by cables which are left in one position for a few years; the shellfish are then harvested. Depending on the season, these facilities are located at the surface or submerged. In

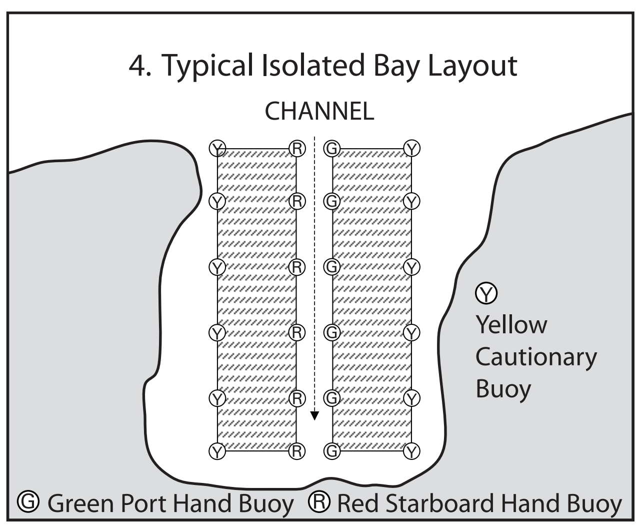
# TYPICAL AQUACULTURE SITE LAYOUTS



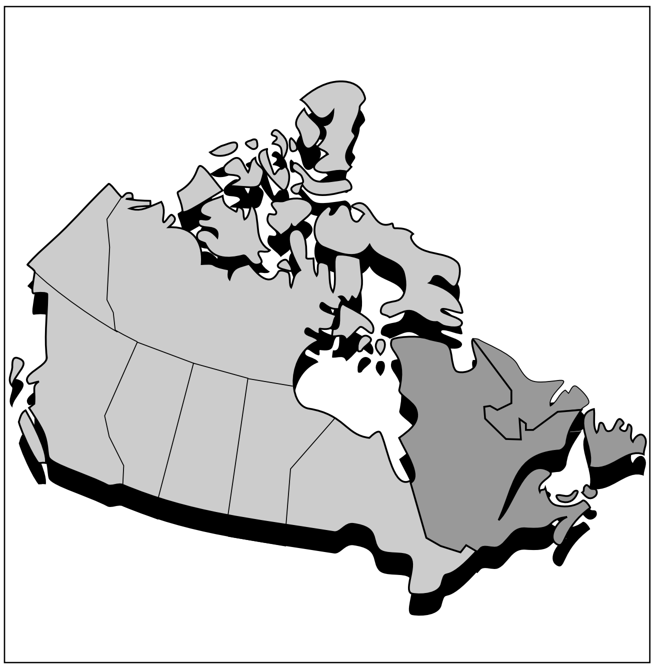
some coastal areas of Chaleur Bay, Baie de Gaspé, Îles de la Madeleine and Prince Edward Island, there are large numbers of these facilities.

235.4 **Caution. — Frequent aquaculture site changes require mariners to proceed with caution. Some areas previously occupied by marine farms may be encumbered with submerged debris from abandoned facilities. Avoid anchoring in such areas.**

## Environmentally Sensitive Marine Areas

236 Along the Canadian coast are several areas that have been designated for ecological protection. The proclamation of **sensitive areas** is under both federal and provincial authority. Areas with regulations that have significance to surface navigation, or which affect the operation of vessels, are charted or described in the appropriate Sailing Directions booklet.

# General Geographic and Port Information



## Geographical and physical features

1 **Canada** is the largest country in the Western Hemisphere and second largest in the world. It covers the northern half of the North American continent with the exception of Alaska. Its territory of almost 10 million square kilometres includes: the almost semitropical Great Lakes peninsula and SW Pacific Coast; wide fertile prairies; great areas of mountains, rocks, lakes and northern wilderness, and Arctic tundra.

2 The farthest point south is Middle Island in Lake Erie *(41°41'N)*; 4,627 km north in the Arctic is Cape Columbia on Ellesmere Island *(83°07'N)*, Canada's northernmost point. From east to west, the greatest distance is 5,187 km – from Cape Spear, Newfoundland and Labrador *(52°37'W)* to Mount St. Elias, Yukon Territory *(141°W)*.

3 Most of Canada's **population**, 32.1 million (2006), live within 325 km of the southern border where the climate is generally moderate and the resources of the land, forest, mines and water have long been developed and utilized.

4 **Politics**. — Canada is a democratic institution and a constitutional monarchy. The monarch, Queen Elizabeth II of England, is represented by the Governor General and by a Lieutenant-Governor nominated in each province. It is a Federal State, divided into ten provinces and three territories (Yukon, Northwest Territories and Nunavut), which is responsible for its constitution and all changes are legislated.

5 The central government legislates on all matters of national interest (defence, customs, immigration, transport, environment, etc.). Each province has a similar institution and administers its own natural resources; it can legislate in certain areas such as education and municipal affairs. **Ottawa**, the capital of Canada, is located on the south shore of the Ottawa River which separates the provinces of Ontario and Quebec.

6 **Official languages**. — Official languages in Canada are English and French, with federal government services available in both languages. While English is the most commonly used language, the majority of French speaking people reside in the province of Quebec, followed by New Brunswick.

7 **Legal system**. — With one exception, in all the provinces and in three territories, the legal system derives from the *common law* system of England. The exception is

**Table 2.1 National Holidays**

| Name | Date |
|---|---|
| New Year | January 1st |
| Good Friday | Friday prior to Easter |
| Easter Monday | Monday after Easter |
| Victoria Day | Monday preceding May 25th |
| Canada Day | July 1st |
| Labour Day | 1st Monday of September |
| Thanksgiving Day | 2nd Monday of October |
| Remembrance Day | November 11th |
| Christmas Day | December 25th |
| Boxing Day | December 26th |

**Table 2.2 Standard Time (Time Zones)**

| Standard time | | | | Daylight saving time | | |
|---|---|---|---|---|---|---|
| Newfoundland | (NST) | UTC | -3½ | (NDST) | UTC | -2½ |
| Atlantic | (AST) | UTC | -4 | (ADST) | UTC | -3 |
| Eastern | (EST) | UTC | -5 | (EDST) | UTC | -4 |

UTC: Universal Coordinated Time

the province of Quebec where the system has been influenced by the legal system of France. Quebec has its own Civil Code and Code of Civil Procedure. Over the years, both Canadian *common law* and Quebec civil law have developed unique characteristics.

8 In Canada, lawsuits between individuals, civil or public agencies are legislated under Civil Law. The Criminal Law concerns criminal offences and their related penalties. In civil matters the courts try to determine the rights of both parties, but for criminal cases the courts must determine the culpability or innocence of the person accused.

9 **Currency**. — The currency in Canada is the Canadian dollar with coinage in 1, 5, 10, 25 and 50 cents and 1 and 2 dollar denominations. The Bank of Canada issues notes in denominations of 5, 10, 20, 50 and 100 dollars.

10 The system of **weights and measures** in use in Canada is metric. The Canadian Imperial system was used in the past and can still be found in certain industrial sectors.

11 **Holidays**. — The following holidays (Table 2.1) are observed in Canada:

12 When New Year's Day, Canada Day, Remembrance Day, Christmas Day or Boxing Day fall on Saturday or Sunday, these holidays will generally be observed on the following Monday.

13 **Standard time and Time zone**. — The Standard Time of Newfoundland (Newfoundland Standard Time – NST) is 3.5 hours behind (UTC-3.5) Coordinated Universal Time (UTC); the Greenwich meridian is the prime meridian for UTC.

14 The Standard Time of Labrador and the provinces of Nova Scotia, New Brunswick, Prince Edward Island and Quebec *(East of Natashquan and Îles de la Madeleine)* is Atlantic Standard Time (AST) or 4 hours behind (UTC-4) UTC.

15 The remainder of the province of Quebec is Eastern Standard Time (EST), 5 hours behind (UTC-5) UTC. Table 2.2 indicates time zones for the eastern provinces of Canada.

16 **Daylight Saving Time** is observed in these provinces on a eight months' period. Daylight Saving Time is one hour in advance of Standard Time.

17 **Consulates**. — Table 2.3 lists cities in which countries are represented by a consulate.

## Provinces

18 There are five provinces in the eastern part of Canada. They are listed from east to west: Newfoundland and Labrador, Nova Scotia, Prince Edward Island, New Brunswick and Quebec. The islands of Saint-Pierre and Miquelon (France) are situated south of Newfoundland.

19 **Newfoundland and Labrador**. — This province is made up by the island of Newfoundland and Labrador on the mainland. The island is situated at the mouth of the Gulf of St. Lawrence and is separated from the coast of Labrador by the Strait of Belle Isle with a least width of 9.2 miles. To the SW, the Cabot Strait lies between the island and Cape Breton

**Table 2.3 Consulates**

| City | Countries |
|---|---|
| **Halifax (NS)** | Germany, Austria, Belgium, Denmark, United States, Finland, France, Italy, Lebanon, Norway, Netherlands, Switzerland. |
| **Montréal (QC)** | More than 50 countries represented by consulates. |
| **Québec (QC)** | Bolivia, Spain, United States, France, Indonesia, Italy, Netherlands, Peru, Sweden, Switzerland. All other consulates located in Montréal may send representatives to Québec on request. |
| **Saint John (NB)** | Denmark, Finland, France, Ireland, Malta, Norway, Netherlands, Dominican Republic, United Kingdom, Sweden. |
| **St. John's (NL)** | Germany, Denmark, Spain, France, Iceland, Italy, Japan, Malta, Mexico, Norway, Netherlands, Philippines, Portugal, Republic of Korea, United Kingdom. |

Island (NS). Labrador borders the North Atlantic Coast from the Strait of Belle Isle to Ungava Bay.

20 The island is approximately 550 km long in a north-south direction and 510 km wide. Its geomorphology ranges from mountainous in the west to rolling hills in the east. It contains innumerable fresh water lakes, ponds and rivers and is a mix of well forested terrain in some areas to barren and marshland in others. The coast is noted for its numerous fiords and bays that provide shelter to vessels. The east and NE coasts are characterized by many islands and peninsulas.

21 The Long Range Mountains on the west coast of the island reach elevations of close to 800 m (2,625 ft). From this elevation, the plateau slopes gradually SE to an elevation of approximately 213 m (700 ft) in the Avalon Peninsula.

22 The seas surrounding Newfoundland are shallow and are noted for the banks which abound with fish, and form part of Canada's continental shelf.

23 **Labrador**, which lies within the Canadian Shield, is for the most part barren near the coast but extensive forests reach west into its interior. Lakes, ponds, rivers and marshland abound. The Torngat Mountains lie in the extreme north.

24 The seaport city of **St. John's**, situated on the Avalon Peninsula on the east coast, is the provincial capital as well as the largest administrative and industrial center. The city of **Mount Pearl** lies adjacent to the west end of St. John's. The city of **Corner Brook** on the west coast, and the town of **Grand Falls-Windsor** in the middle of the island, are also major industrial centers. In 2006, the population of Newfoundland and Labrador was 533,800.

25 The economy of the province is based mostly on its natural resources such as fishing and the fish processing industry, mining, pulp and paper and oil.

26 The east coast of **Labrador** forms the bulk of the eastern coast of mainland Canada and extends from L'Anse au Clair in the Strait of Belle Isle, to Cape Chidley, its most northerly point, a distance of approximately 630 miles.

27 The entire coast of Labrador is most irregular in outline, being indented with innumerable inlets and bays and off-lying islands. The outer coast is quite barren and rocky with very little evidence of trees. However, the shores of the bays and rivers are generally well wooded and a potential source of pulpwood. The northern limit of trees near the coast lies in about latitude *58°N*.

28 The area of Labrador is 292,218 square kilometers, or almost three times the size of the island of Newfoundland. It is separated from the province of Quebec by a largely unsurveyed boundary on the south. This boundary was established in 1927, by a Judicial Committee of the Privy Council.

29 Labrador is defined on the south by the *52°N* parallel of latitude, and to the west it follows a meandering course traced by the crest of the watershed of the rivers flowing eastward into the Labrador Sea, until it reaches Cape Chidley. The hills fall steeply to the sea, often in the form of precipitous cliffs, and terminate in rugged rocky points. The land along the coast from Port Manvers to Cape Chidley is generally high, backed by the Torngat Mountains 10 to 20 miles inland. Between Nachvak Bay and Cape Chidley, these mountains approach the coast with elevations exceeding 1,524 m (5,000 ft).

30 The island of Newfoundland, together with the adjacent territory of Labrador, became the tenth province of Canada on April 1, 1949. Prior to that time it was a British colony.

31 The population of Labrador in 2006 is about 31,300, with 1,500 Inuit, 850 Amerindians, 10,150 Settlers and 18,800 "come-from-away". The Settlers are of European ancestry, many of whom married Inuit or Amerindian women. They came as fur traders, trappers, fishermen, carpenters and tinsmiths, blending their ways with those of the Amerindian and Inuit.

32 Generally, the Naskapi Indian live at Natuashish, the Montagnais Indian live at Sheshatshiu on the south side of the North West River, the Inuit and Settlers live in the communities from Hamilton Inlet north, and the Settlers live from Hamilton Inlet south. A few Settlers live in the west. The industrial west, whose largest community is Labrador City and Happy Valley-Goose Bay, have the largest "come-from-away" populations.

33 The natural resources of Labrador have as yet been relatively untapped, due in part to their inaccessibility and also to the lack of suitable ports from which to transport them to the country's markets. Recently, a road connection has been established linking the Labrador Straits to Cartwright with construction ongoing to link it with Goose Bay in the near future. Goose Bay is connected to western Labrador and Baie Comeau (QC) by road. The fishing industry has lost some of its importance due to collapse of the cod fishery stocks but fishing is still carried out by local fishermen for other species.

34 The mining industry in Labrador is chiefly centred around Labrador City and Wabush, in the interior; iron ore mined there is shipped by rail to Sept-Îles (QC) on the north shore of the St. Lawrence River, then by ship to the smelters. The mine is the largest producer of iron ore in the country. A nickel mine exists near Voisey's Bay with a port for shipping ore located at Edwards Cove in Anaktalak Bay, about 15 miles SW of Nain.

35 Hydroelectric power has been developed at Churchill Falls, on the Churchill River. It is considered that the Churchill River and its tributaries constitute one of the largest potential sources of hydro power in Canada.

36 **Saint-Pierre and Miquelon**. — These islands, together with smaller adjacent islands, form a French Territorial

Collectivity. They are located approximately 10 miles off the south coast of Newfoundland, at the entrance to Fortune Bay. The population was 7,000 in 2006. The islands are rugged masses of rocks, with a few small streams and lakes, having a thin coating of soil and scant vegetation.

37 The metric system of weights and measures is used and the currency unit is the euro. Most of the merchants trade in Canadian and American currencies, especially during the summer months.

38 The province of **Nova Scotia** is an extensive peninsula connected to the mainland by the Chignecto Isthmus, only 24 km in width. The narrow Strait of Canso separates it from Cape Breton Island. The Canso Causeway, having a navigation lock, links the mainland to Cape Breton Island. The extreme length is 613 km with a breadth of 80 to 169 km.

39 The mountainous region running from Cape Canso in the east, to Cape Sable in the SW, divides the province into two slopes – that facing the Atlantic being generally rocky, barren and windswept, while the other facing Bay of Fundy and the Gulf of St. Lawrence consisting for the most part of fertile plains and valleys, which are farmed.

40 The seaboard of the SE coast is fringed by numerous islands and is deeply indented, the inlets varying in size, from narrow creeks in which fishing boats shelter, to more important harbours such as Halifax.

41 The major urban centers are Halifax, as well as the Sydney area, situated on Cape Breton Island. **Halifax** is the capital and principal port of the province. In 2006, the population of the province was 942,782.

42 The economy of the province rests mostly with its fishing industry, agriculture, coal, gypsum and salt mining, and diverse manufacturing activities.

43 The province of **New Brunswick** has a greatest width from east to west of approximately 306 km, and from north to south of 370 km. The State of Maine (USA) bounds it on the west, the province of Quebec on the north, the Bay of Fundy and Nova Scotia on the south and the Northumberland Strait and the Gulf of St. Lawrence to the east.

**Table 2.4 Port Facilities**

| Ports | W | C | DE | Ports | W | C | DE |
|---|---|---|---|---|---|---|---|
| **Newfoundland and Labrador** | | | | **New Brunswick** | | | |
| Argentia | • | • | | Bathurst | • | • | |
| Botwood | • | • | | Campbellton | | • | |
| Burin | • | • | | Caraquet | • | • | |
| Catalina | • | | | Dalhousie | • | • | |
| Corner Brook | • | • | | Grand Manan | • | | |
| Fortune | • | • | | Saint John | • | • | D |
| Happy Valley-Goose Bay | • | • | | St. Andrews | • | • | |
| Harbour Grace | • | • | | St. Stephen | • | • | |
| Lewisporte | • | | | | | | |
| Marystown | • | • | | | | | |
| Port aux Basques | • | | | **Quebec** | | | |
| St. Anthony | • | | | Baie-Comeau | • | • | E |
| St. John’s | • | • | D | Bécancour | • | | |
| Stephenville | • | • | | Cap-aux-Meules | • | • | |
| **Nova Scotia** | | | | Chandler | • | | |
| Digby | • | • | | Gaspé | • | • | |
| Halifax | • | • | D | Gros-Cacouna | • | | E |
| Hantsport | • | | | Havre-Saint-Pierre | • | | E |
| Liverpool | • | • | | Matane | • | | |
| Louisbourg | • | | | Montréal | • | • | E |
| Lunenburg | • | • | | Pointe-au-Pic | • | | |
| Parrsboro | • | | | Port-Cartier | • | | E |
| Pictou | • | • | | Portneuf | • | | |
| Port Hawkesbury | • | • | | Québec | • | • | D |
| Shelburne | | • | | Rimouski | • | • | |
| Sydney | • | • | E | Rivière-du-Loup | • | • | |
| Yarmouth | • | • | | Saguenay | • | • | E |
| **Prince Edward Island** | | | | Sainte-Anne-des-Monts | • | | |
| Charlottetown | • | • | | Sept-Îles | • | • | E |
| Souris | • | | | Sorel | • | • | D |
| Summerside | • | • | | Trois-Rivières | • | • | E |

**W :** potable fresh water supply.
**C :** port of entry for custums purposes.
**DR :** D = deratting certificates available; E = deratting extention or exemption certificates available.

44 The topography of New Brunswick is mostly undulating. The great North-Western Plateau, with an elevation of 305 to 457 m (1,000 to 1,500 ft), is deeply dissected by river valleys from which tributaries flow to the Saint John River – crossing the entire province to the Bay of Fundy – and the Restigouche River, which flows eastward to the Chaleur Bay. The Central Highlands generally rise to an elevation of 610 m (2,000 ft).

45 The capital of the province is **Fredericton**, situated inland. **Saint John**, situated at the mouth of Saint John River in the Bay of Fundy, is the most important industrial center as well as the principal port. In 2006, the population of New Brunswick was 757,133.

46 Forestry, mining and processing of their by-products (pulp and paper, lumber, lead, zinc, etc.), fishing (mainly lobster), food processing and agriculture are the main industrial activities of the province.

47 **Prince Edward Island**. — The smallest province of Canada is approximately 193 km in length, with an average width of 32 km. The island lies in the Gulf of St. Lawrence, 16 to 32 km off the mainland, east of New Brunswick and north of Nova Scotia, and is separated from these provinces by the Northumberland Strait. The Confederation Bridge, built in 1997, crosses the strait over a length of 13 km.

48 Known as the Garden Province, the island presents a picture of gently rolling terrain, narrow green woodlots and farming fields. It has little relief but does attain an elevation of 137 m (450 ft). Its rich, red soil and red sandstone formations are distinct features. Its coastline is indented with numerous creeks and bays.

49 **Charlottetown** is the capital and the principal port. In 2006, the population of the province was 138,557.

50 Agriculture, especially potato production, and lobster fishing are the island's main industries.

51 The province of **Quebec** is the largest in size and the second largest in economic importance in Canada. It extends north and south of the Gulf and St. Lawrence River up to the Hudson Strait and Hudson Bay. It is bordered by the province of Ontario to the west, the United States and New Brunswick to the south and by Labrador to the NE.

52 The geomorphology of the province of Quebec may be divided into three regions. The Canadian Shield occupies the greater part of the area north of the St. Lawrence River. This plateau presents a rough, rugged topography strewn with lakes and varying in elevation from 300 to 900 m (1,000 to 3,000 ft) with a few higher peaks. The highlands are situated in the center of the province and many rivers flow into the St. Lawrence River from the south shore of the plateau.

53 The Appalachian Mountains range extends through the SE part of Quebec, reaching its greatest width in Eastern Townships (Estrie) and its greatest height in Péninsule de la Gaspésie where Monts Chic-Chocs have many summits over 1,070 m (3,500 ft) high. The smallest region is the St. Lawrence Lowlands, a low, flat and fertile agricultural area. It is bounded by the Canadian Shield on the NW, the Appalachians to the east and Adirondack Mountains in the United States to the south.

54 **Québec City** is the capital, but **Montréal**, the largest city in the province, is the main commercial, financial and industrial center. Both cities are important sea ports. In 2006, the population of the province was 7,598,146.

55 The province of Quebec has numerous industries including textile and clothing, food products, pulp and paper, metal processing, chemical, petroleum, lumber and

**Table 2.5 Shipyards**

| Location | Company | Facilities | Dimensions / Capacity |
|---|---|---|---|
| **Newfoundland and Labrador** | | | |
| Marystown | Kiewit Offshore Services | 1 Marine railway (for 6 ships) | 76.2 x 18.3 m (3,000 t) |
| St. John's | Newdock, St. John's Dockyard | 1 Dry dock<br>1 Marine railway | 174 x 23.3 m<br>86.5 x 20 m (4,000 t) |
| **Nova Scotia** | | | |
| Halifax | Irving Shipbuilding | 2 Floating dry docks<br>1 Dry dock | 257 x 38 m and 183 x 32 m<br>173 x 24 m |
| Pictou | Irving Shipbuilding | 1 Marine railway | 91.4 x 18.3 m (3,000 t) |
| Shelburne | Shelburne Marine | 1 Marine railway | 114.3 x 18.3 m (3,000 t) |
| **Prince Edward Island** | | | |
| Georgetown | Irving Shipbuilding | 1 Marine railway | 680 t |
| **Quebec** | | | |
| Les Méchins | Groupe maritime Verreault | 1 Dry dock<br>1 Floating dry dock | 244 x 27.4 m<br>36.6 x 12.5 m |
| Lévis | Industries Davie | 1 Dry dock (divisible in 2 sections)<br>1 Dry dock<br>1 Floating dry dock | 350.5 x 36.6 m<br>190.2 x 18.7 m<br>178 x 31 m |

the manufacturing of transportation equipment. Agriculture, fishing, mining and hydro-electric power are also important industry sectors.

56 **Îles de la Madeleine** is under Quebec jurisdiction. The main islands lie approximately 50 miles NW of Cape Breton Island in the Gulf of St. Lawrence. The main islands are joined together by a double line of sand ridges and beaches, enclosing extensive lagoons. The one exception is Île d'Entrée which is detached from the main islands. In 2006, the population of the islands was 13,042.

## Port Facilities

57 **Customs**. — A master or person in charge of a vessel, upon arriving in Canada from a foreign port, must immediately report his arrival to the nearest customs office. In case of emergency, and if Customs cannot be immediately contacted, then the nearest office of the Royal Canadian Mounted Police should be notified.

58 Customs officers also assume responsibility for immigration services and in certain ports represent Health Canada in the matter of issuance of ship sanitation certificates. For customs purposes, the following table lists the ports of entry.

59 **Ship Sanitation Control**. — Health Canada, through its Ship Sanitation Certificate Program, protects public health by ensuring that international vessels stopping in Canada are free of contamination and infection, which could introduce communicable diseases. Under *International Health Regulations*, vessels engaged in international trade are required to obtain either a Ship Sanitation Control Certificate, or a Ship Sanitation Control Exemption Certificate, every six (6) months. The Ship Sanitation Control Certificate replaces the Deratification Certificate. For more information see *www.hc-sc.gc.ca*. Vessels may obtain the certificate at various ports.

60 **Water**. — Supply of fresh water is available as listed in the following summary table. Health Canada carries out periodic checks at these sites and issues certificates attesting the quality of the water at the time of the analysis.

61 **Repairs**. — The following table lists the most important shipyards on the Atlantic Coast. It should be noted that major repairs not requiring dry docking can be carried out at most intermediate size ports. For minor repairs, numerous companies offer their services in most ports.

# Natural Conditions


## Seabed

*Chart 4001 (INT 404)*

1 **The Grand Banks of Newfoundland**. — The predominant feature of the seabed off Newfoundland is the extensive elevated submarine plateau lying to the east, SE and south of the island. The Grand Banks of Newfoundland, as defined by the 200 m (109 fm) contour line, extends about 340 miles north and south between the parallels of *48°40'N* and *43°00'N*, and about 400 miles west and east between the meridians *47°30'W* and *57°30'W*.

*Charts 4047, 8010*

2 The Grand Banks of Newfoundland are comprised of Southeast Shoal, St. Pierre, and the Green and Whale Banks. The SE extremity of the Grand Banks is called the **Tail of the Bank**.

*Charts 4049, 8011*

3 The most dangerous feature on The Grand Banks is **Virgin Rocks**, situated approximately 95 miles east of Cape Race. This rocky bank is the most significant area for fishing on The Grand Banks. There is a least depth of 4.2 m (14 ft) over a reef called **Main Ledge** *(46°26'N, 50°49'W)*, situated close to the center of Virgin Rocks.

4 **South Shoal**, situated 1.4 miles south of Main Ledge, with a least depth of 8.2 m (27 ft), is considered by fisherman to be more dangerous than Main Ledge due to the mass of uneven ground causing the sea to rise more rapidly and break more heavily.

5 Other shoals, with depths of 16.8 and 16.3 m (55 and 53 ft), lie respectively 0.6 and 2.2 miles north of Main Ledge. South Shoal and Main Ledge both break in a moderate sea and swell. Numerous other shoals are reported to break in gale force winds. Even with strong breezes the uneven ground in conjunction with the tidal streams may raise a confused sea.

6 **Eastern Shoals** lie approximately 13.5 miles east of Virgin Rocks. The least depth over them is 14.8 m (49 ft) on **Saunders Shoal** *(46°26'N, 50°30'W)*. **Emmeline Shoal**, with a least depth of 22 m (12 fm), is situated at the north end of Eastern Shoals and 2.5 miles north of Saunders Shoal. A 23 m (13 fm) patch lies 1 mile south of Saunders Shoal.

*Chart 8013*

7 **Flemish Cap** is a detached bank lying approximately 90 miles east of The Grand Banks of Newfoundland; it is separated from the Grand Banks by the relatively deep **Flemish Pass**. There is a least depth of 69 fm (126 m) over Flemish Cap.

*Chart 8010*

8 **Southeast Shoal**, with depths of 20 to 30 fm (37 to 55 m), lies near the east extremity of The Grand Banks, to the north of the Tail of the Bank. The bottom is sand, gravel and shingle.

*Charts 4015, 4045, 4047*

9 **St. Pierre Bank** is the west bank of the Grand Banks, and borders the deep Laurentian Channel to the west. The bottom is mainly sand and gravel with depths of 31 to 94 m (17 to 51 fm); a least depth of 31 m (17 fm) is found in position *46°18'N, 56°54'W*.

10 **Green Bank** is separated from St. Pierre Bank to the west by **Halibut Channel**, a gully with depths of 108 to 178 m (59 to 98 fm). The bank has a least depth of 18 m (10 fm) over a wreck in position *45°46'N, 54°19'W* and the bottom is sand, gravel, rock and shingle.

11 **Whale Bank**, east of Green Bank and separated from it by **Haddock Channel**, lies to the south of the Avalon Peninsula. The depths of this bank range from 59 to 95 m (32 to 52 fm), the bottom being sand, gravel, shingle and rock. A relatively deep basin, **Whale Deep**, lies close east of Whale Bank; it has depths of 95 to 119 m (52 to 65 fm), with a mud, sand and gravel bottom.

12 The Grand Banks of Newfoundland are separated from Ballard Bank near Cape Race by the **Avalon Channel**, approximately 20 miles wide, with depths of more than 150 m (82 fm).

*Charts 4001 (INT 404), 4021, 4025*

13 **Laurentian Channel**. — The predominant feature of the seabed in the Gulf of St. Lawrence is the deep Laurentian Channel. The channel divides the Nova Scotia Banks to the SW and The Grand Banks of Newfoundland to the NE, and then enters the Gulf of St. Lawrence by the Cabot Strait between Cape Ray *(47°37'N, 59°18'W)* and St. Paul Island *(47°12'N, 60°09'W)*.

14 Laurentian Channel continues in a NW direction from the Cabot Strait, between Anticosti Island and Péninsule de la Gaspésie, to the mouth of the St. Lawrence River. In general, this channel has an average width of 50 miles with depths of 274 to 457 m (150 to 250 fm).

15 In the Gulf of St. Lawrence, between Anticosti Island and the west coast of Newfoundland, two channels branch off from the Laurentian Channel with depths greater than 183 m (100 fm). **Esquiman Channel** extends to the NNE towards the Strait of Belle Isle and **Anticosti Channel** extends to the NW, north of Anticosti Island towards **Jacques-Cartier Strait**.

*Charts 4002, 4015*

16 **Burgeo Bank**, which lies NW of St. Pierre Bank, has a least depth of 51 m (28 fm), with a sand and gravel bottom. It is separated from St. Pierre Bank by the deep **Hermitage Channel**, approximately 20 miles wide.

*Charts 4002, 4024*

17 **Banks in the Gulf of St. Lawrence**. — The area of the Gulf of St. Lawrence, SW of the Laurentian Channel, is relatively shallow with depths of 30 to 40 fm (55 to 73 m). **Bradelle Bank**, composed of sand and rock, is situated approximately 40 miles west of Îles de la Madeleine and with a least depth of 25 fm (46 m) in position *47°22'N, 62°49'W*.

18 **Banc de l'Orphelin**, with a least depth of 29 fm (53 m), is a relatively small bank, centred in position *48°17'N, 63°11'W*. B**anc des Américains** is a small shoal area with a least depth of 38 ft (11.6 m) situated 13.5 miles SE of Cap Gaspé in position *48°36'N, 63°55'W*.

*Charts 4002, 4025*

19 **Beaugé Bank** is situated to the north of the junction of Esquiman Channel and Anticosti Channel. This bank has a least depth of 36 fm (66 m) in position *49°40'N, 60°06'W*.

*Charts 4003,4045*

20 **Banks offshore of Nova Scotia**. — The predominant feature of the seabed off the coast of Nova Scotia is the extensive continental shelf with numerous banks separated by submarine canyons and basins. The depths on the continental shelf may be very irregular and reliance should not be placed on a position assumed from soundings alone.

21 The eastern part of the Nova Scotia banks is comprised of Banquereau, Artimon Bank, Misaine Bank, Canso Bank, Middle Bank, Sable Island Bank, Emerald Bank and Sambro Bank. These banks are bounded by the deep Laurentian Channel to the NE and to the SW Emerald Basin and LaHave Basin form trenches on either side of the Sambro Bank. The eastern banks are separated from each other by depths usually less than 100 fm (183 m).

*Chart 4045*

22 **Banquereau**, adjacent to the Laurentian Channel, extends from about *44°30'N, 57°15'W* westward to the meridian of *60°W*. This bank, with depths of 29 to 89 m (16 to 49 fm), is composed of sand, gravel and shells. It can be distinguished

from contiguous banks by the numerous broken and spineless sea urchins that are found on the bottom.

23 **Eastern Shoal**, centred in position *44°38'N, 57°45'W*, is the shallowest part of Banquereau and forms a sand ridge with depths of less than 40 m (22 fm). Eastern Shoal, with a least depth of 29 m (16 fm) in position *44°41'N, 57°40'W*, is approximately 30 miles in length in a NE/SW direction and some 9 miles wide at its broadest point.

24 Banquereau is separated from Sable Island Bank by the submarine canyon **The Gully**, which is 7 miles wide at its narrowest and over 1,200 m (656 fm) deep at its southernmost extremity between Sable Island Bank and Banquereau. In 2004, *The Gully* was declared a *Marine Protected Area*.

25 **Artimon Bank**, a relatively small bank north of Eastern Shoal, borders the Laurentian Channel with a least depth of 59 m (32 fm); it is composed of sand, gravel and coral.

26 To the west of Artimon Bank and to the north of Banquereau, **Misaine Bank** lies with a least depth of 64 m (35 fm) and is generally rocky with sand, gravel and shells. Between Misaine Bank and the coast of Cape Breton Island there is a deep gully, some 25 miles wide, with depths of 82 to 300 m (45 to 164 fm).

*Charts 4003, 4013*

27 **Canso Bank,** with a least depth of 33 fm (60 m) and sand bottom, lies between Misaine Bank and Cape Canso, with its NW extremity approximately 14 miles SE from that cape. On its eastern side it is separated from Misaine Bank by a distance of approximately 17 miles. A relatively deep submarine valley, at least 6 miles wide, separates the bank extending from Cape Canso and Canso Bank.

28 **Middle Bank**, to the south of Canso Bank, lies with a least depth of 15 fm (27 m). It is composed of sand, gravel and shells and is separated from Canso Bank with depths of over 100 fm (183 m). Cape Canso lies 30 miles to the NNW of Middle Bank, and is separated by a submarine valley with a maximum depth of 144 fm (263 m). Owing to its position, the soundings on this bank can be used when approaching Halifax from the east.

29 To the south of and adjacent to Middle Bank lies **Sable Island Bank**, composed of sand, gravel, shells and rocks upon which Sable Island *(43°56'N, 59°55'W)* emerges. Middle Bank extends 26 miles to the east from Sable Island to The Gully and approximately 90 miles to the west. For more details on Sable Island and its approaches, consult the *Sailing Directions* booklet, *ATL 105 — Cape Canso to Cape Sable (including Sable Island)*.

*Charts 4003, 4012, 8007*

30 The **Western Gully** is a trench separating **Western Bank**, the west portion of Sable Island Bank, from **Emerald Bank**. The Western Gully has depths from 51 to 59 fm (93 to 108 m). Emerald Bank, composed of sand, gravel and rock, lies with a least depth of 37 fm (68 m).

31 The trench **Emerald Basin** is situated to the NW of Emerald Bank with maximum depths of 148 fm (271 m). The NW extremity of this basin is approximately 40 miles to the SE of Halifax Harbour.

32 **Sambro Bank** lies to the west of Emerald Basin with a least known depth of 49 fm (90 m) in position *43°44'N, 63°20'W*; the bank is composed of sand, gravel, shells and rock.

*Charts 4003, 4012, 8006*

33 The western part of the Nova Scotia banks, including LaHave Bank, Roseway Bank, Baccaro Bank and Browns Bank, is separated from the eastern banks by LaHave Basin.

34 **LaHave Basin** is an extensive trench with depths greater than 100 fm (183 m) and a maximum depth of 147 fm (269 m) in *43°43'N, 63°51'W*, which is near the centre of the basin.

35 **LaHave Bank** lies to the SSW of LaHave Basin with depths of 42 to 50 fm (77 to 91 m). The seabed is composed of sand, gravel, shells and rock. Its NW extremity is situated 48 miles to the SSE from the port of Liverpool.

36 **Roseway Bank** is located midway between LaHave Bank and the coast of Nova Scotia. It is a rocky bank with depths of 29 to 50 fm (53 to 91 m). Between LaHave and Roseway Banks, there is a trench with depths of 50 to 100 fm (91 to 183 m). A narrow ridge, with depths of 50 to 54 fm (91 to 99 m), connects Roseway Bank on the NW to the coast.

37 **Baccaro Bank**, situated to the south of Roseway Bank and WSW of LaHave Bank, has depths of 39 to 50 fm (71 to 91 m). The seabed is sand, gravel and rock. Its western extremity is approximately 40 miles SE of Cape Sable.

38 To the WSW of Baccaro Bank lies **Browns Bank** which is an extensive bank at the western end of the Nova Scotia banks. It includes a sandy rise with a least depth of 16 fm (29 m) in position *42°49'N, 66°13'W* but generally the depths are much greater.

39 The 100 fm (183 m) contour line of Browns Bank is separated from the 100 fm (183 m) contour line of **Georges Bank**, off the coast of Massachusetts, by the deep **Fundian Channel**, 15 to 30 miles wide. There is a maximum depth of 89 fm (163 m) between Browns Bank and the coast of Nova Scotia.

40 **German Bank** is part of the west extremity of the Gulf of Maine and lies 18 miles west of the most SW point of Nova Scotia. The seabed is sand and shells with some gravel, and a least depth of 21 fm (38 m) in position *43°16'N, 66°26'W*.

*Charts 4003, 4011*

41 **Gulf of Maine Basins**. — South of the entrance to the Bay of Fundy, Crowell Basin and Jordan Basin are northern extensions of Fundian Channel in the **Gulf of Maine**.

42 In **Crowell Basin**, there is a maximum depth of 142 fm (260 m) in position *42°58'N, 67°18'W*, with depths generally greater than 100 fm (183 m).

43 The larger **Jordan Basin** extends to the north of Crowell Basin with depths generally greater than 100 fm (183 m) and a maximum depth of 159 fm (291 m) in position *43°30'N, 67°50'W*, which is approximately 77 miles SW of Grand Manan Island. The seabed is mud, clay, sand and gravel.

44 To the NE of Jordan Basin lies **Grand Manan Banks** which consist of two relatively small rocky banks named **Southwest Bank** and **Northeast Bank**, 30 and 20 miles respectively SSW of Grand Manan Island. Southwest Bank, with a least depth of 29 fm (53 m), is in position *44°07'N, 67°07'W*. The shallowest spot of Northeast Bank is 19 fm (35 m) in position *44°16'N, 66°59'W*.

45 To the NE of the Grand Manan Banks, between Grand Manan Island and Nova Scotia, **Grand Manan Basin** is situated at the main entrance to the Bay of Fundy. The bottom of the basin is mud, clay, stones and gravel, with depths ranging from 95 to 122 fm (174 to 223 m).

## Magnetic Anomalies

46 In some areas in the Gulf and River St. Lawrence, as well as in the Saguenay River, the magnetic compass of a vessel is affected by **magnetic anomalies**. These magnetic disturbances are attributed to subsurface magnetite (magnetic iron ore), located in particular on the north shore.

47 Magnetite is abundant and has a powerful effect on the needle of a magnetic compass. Vessels situated in some locations on the north shore, in particular east of Sept-Îles, are affected. Among Îles de Mingan *(50°13'N, 63°53'W)* a variation is observed ranging from *14°45'* to *29°30'W* and is caused by this phenomenon.

48 The compass needle is also deflected in areas along the St. Lawrence River, in Portneuf-sur-Mer *(48°37'N, 69°06'W)* and Pointe de Manicouagan *(49°06'N, 68°12'W)*. It is unlikely that disturbing forces described here can extend to vessels navigating off the coast of the above-mentioned locations; however, there may be areas of magnetic anomalies in the adjacent shallow waters that cause small disturbances to vessels.

49 Between Cap Whittle *(50°11'N, 60°07'W)* and Jacques-Cartier Strait, the observed variation ranges from *23°45'W* to *32°45'W*, the maximum being in a position approximately 13 miles south of La Grande Pointe *(50°12'N, 63°27'W)*. There is a variation observed in the area off Pointe de Natashquan *(50°05'N, 61°44'W)* ranging from *23°45'W* to *28°15'W*. Magnetic attraction is reported south of the western Îles de Mingan, where the deflection of the compass needle varies from *8°15'E* to *1°45'W*.

50 A Magnetic Declination Chart (sheet No. 10 of Geophysical Atlas Series), showing isogonic lines and annual change, is published by the Geological Survey of Canada. It is available at: 601 Booth St., Ottawa (ON) K1A 0E8.

## Ice

51 **Terminology and Definitions**. — Ice nomenclature is in accordance with the internationally approved terminology *(Sea Ice Nomenclature of the World Meteorological Organization)*. *MANICE*, a complete manual of ice terminology, classification, standard ice reporting codes and ice reconnaissance practices and procedures used in Canada, is available from the Meteorological Service of Canada.

### Types of Ice

- **Sea ice**: Any form of ice found at sea which has originated from the freezing of water.
- **Ice of land origin**: Ice formed on land or in an ice shelf, found floating in water.
- **River ice**: Ice formed on a river, regardless of observed location.
- **Lake ice**: Ice formed on a lake, regardless of observed location, for example, on Lake Melville and the Great Lakes).

### Stages of Development of Sea Ice

- **New ice**: A general term for recently formed ice which includes frazil ice, grease ice, slush and shuga. These types of ice are composed of ice crystals which are only weakly frozen together (if at all) and have a definite form only when they are afloat.
- **Nilas**: A thin elastic crust of ice, easily bending on waves and swell and under pressure growing in a pattern of interlocking “fingers” (finger rafting). Nilas has a matte surface and is up to 10 cm (4 in) in thickness and is subdivided into dark nilas and light nilas.
- **Grey ice**: Young ice 10 to 15 cm (4 to 6 in) thick, less elastic than nilas and breaks on swell. It usually rafts under pressure.
- **Grey-white ice**: Young ice 15 to 30 cm (6 to 12 in) thick. Under pressure it is more likely to ridge than raft.

- **First-year ice**: Sea ice of not more than one winter's growth developing from young ice; 30 cm (12 in). It is subdivided into:
  **Thin first-year ice (white ice)**: 30 to 70 cm (12 to 28 in) thick;
  **Medium first-year ice**: 70 to 120 cm (28 to 48 in) thick; and
  **Thick first-year ice**: greater than 120 cm (4 ft) thick.

Note that in Canada the term "white ice" is commonly used in place of "thin first-year ice", especially in the Gulf of St. Lawrence.

- **Old ice**: Sea ice which has survived at least one summer's melt. Topographic features are generally smoother than on first-year ice. It may be subdivided into second-year ice and multi-year ice. Bare patches and puddles are usually greenish-blue. Melt parttern usually shows surface drainage system. In general, the rigidity and hardness of sea ice increases with age due to the gradual reduction of brine cells in the ice. The Labrador Current sometimes carries old ice to the south which can enter in the Strait of Belle Isle and penetrate the NE arm of the Gulf of St. Lawrence.

## Forms of Sea Ice

- **Drift ice/Pack ice**: Term used in a wide sense to include any area of sea ice, other than fast ice, no matter what form it takes or how it is disposed. When concentrations are high, i.e. 7/10 or more, the term "drift ice" can be replaced by the term "pack ice".
- **Fast ice**: Sea ice which forms and remains fast along the coast. It may be attached to the shore, to an ice wall or between shoals. Vertical fluctuations may be observed during changes of sea level. Fast ice may be formed "in-situ" from water or by freezing of floating ice of any age to shore. It can extend a few metres or several hundred kilometres from the coast.
- **Ice patch**: An area of floating ice less than 10 km across.

Note that the concentration of the ice is the ratio expressed in tenths describing the mean surface density of ice in a given area. Previously, the term "pack" was used for all ranges of concentration.

- **Growler**: Piece of ice smaller than a bergy bit and floating less than 1 m (3 ft) above the sea surface and normally occupying an area of about 20 m$^2$ (215 sq. ft.). Growlers are often transparent but appear green or almost black in colour.
- **Floe**: Any relatively flat piece of sea ice 20 m (60 ft) or more across. Floes are subdivided according to horizontal extent as follows:
  **Giant**: Greater than 10 km across;
  **Vast**: 2 to 10 km across;
  **Big**: 500 m to 2 km across;
  **Medium**: 100 to 500 m across;
  **Small**: 20 to 100 m across.
- **Bergy bit**: A piece of floating glacier ice, generally showing 1 m (3 ft) to less than 5 m (16 ft) above sea level. They normally have an area of 100 to 300 m$^2$ (1,100 to 3,200 sq. ft.).
- **Ice cake**: Any relatively flat piece of sea ice less than 20 m (60 ft) across.
- **Iceberg**: A massive piece of ice of greatly varying shape, protruding 5 m (16 ft) or more above sea level, which has broken away from a glacier and which may be afloat or aground. They may be described as tabular, domed, pinnacled, wedged, drydocked or blocky. Around Newfoundland, icebergs are subdivided according to size as follows:
  **Small**: 5 to 15 m (16 to 51 ft) high and 15 to 60 m (51 to198 ft) long;
  **Medium**: 16 to 45 m (52 to 149 ft) high and 61 to 120 m (199 to 395 ft) long;
  **Large**: 46 to 75 m (150 to 247 ft) high and 121 to 200 m (396 to 657 ft) long;
  **Very large**: When the dimensions for large are exceeded.
- **Brash ice**: Accumulation of floating ice made up of fragments not more than 2 m (7 ft) across, the wreckage of other forms of ice.

## Ice Surface Features

- **Lead**: Any fracture or passageway through ice which is navigable by surface vessels. If the lead lies between ice and the shore, or between ice and an ice front, it is called "**shore lead**"; if the passageway lies between ice and fast ice which is navigable by surface vessels, it is called "**flaw lead**".
- **Ridge**: A line or wall of broken ice forced up by pressure. May be fresh or weathered. The submerged volume of broken ice under a ridge, forced downward by pressure, is called **ice keel**.
- **Ice jam**: An accumulation of river ice or sea ice caught in a narrow channel.
- **Rafted ice**: Type of deformed ice formed by one piece of ice overriding another; common in new and young ice types.
- **Hummock**: A hillock of broken ice which has been forced upwards by pressure. May be fresh or weathered. The submerged volume of broken ice beneath the hummock, forced downwards by pressure is called a **bummock**.
- **Polynya**: Any non-linear shaped opening enclosed by ice. A polynya may contain brash ice or be covered

with new ice, nilas or young ice; submariners refer to these as “skylights”. If the polynia is situated between ice and the coast or between ice and an ice front, it is called “**shore polynya**”. If the polynya is situated between ice and fast ice it is called “**flaw polynya**”. When a polynya recurs in the same position every year it is called “**recurring polynya**”.

52 **General remarks**. — Most of the ice found in the Gulf of St. Lawrence and the estuary, as well as in the coastal regions of Nova Scotia, and Newfoundland and Labrador, forms within this geographical region and is categorized as sea ice. Small amounts of an older and thicker variety of sea ice brought down by the Labrador Current – sometimes referred to as “northern ice”. However, old ice is more common in the eastern part of Newfoundland and can, in some years, reach SE of Cape Race.

53 Some glacier ice in the form of bergs and growlers may also drift through the Strait of Belle Isle and penetrate into the eastern gulf. On rare occasions icebergs have been known to reach the eastern Anticosti Island or exit through Cabot Strait. Most icebergs entering the gulf tend to go aground along the Quebec shore, east of Harrington Harbour, although a few have been observed as far west as in the Bay of Islands area along the west Newfoundland coast. A considerable number of icebergs can remain grounded in the Strait of Belle Isle.

54 River ice also finds its way downstream into the gulf but it is estimated that, in general, the total amount of such ice is small compared to the amount of sea ice present.

55 **Ice on eastern coast of Newfoundland**. — Sea ice begins to form along the coast of southern Labrador in mid-December and spreads south to Newfoundland waters in early January. It gradually spreads seaward and southward to reach Notre Dame Bay and Fogo Island in late January.

56 The subsequent developments depend very much on the prevailing winds, specific to each winter. Most of the time the sea ice drifts offshore and to the SE of Cape Freels. It is not uncommon to experience loose floes along the east coast extending south of St. John’s in the spring.

57 In years when north and NE winds are prevalent, the sea ice remains close inshore and can appear in the waters off the Avalon Peninsula in January and reach Cape Race by the end of the month. From here the normal drift is southward but on some occasions a westward drift as far as the Burin Peninsula can occur. Northeast winds during the ice season can cause significant ice pressure along the Newfoundland NE and East coasts as far south as Cape Race. The bays along these coasts can experience significant ridging and rafting which will continue until the NE winds abate.

58 Sea ice which forms early in the winter in the waters of northern Newfoundland and southern Labrador grows to a maximum thickness of approximately 60 cm (2 ft) during the winter and much of it is carried southward by wind and current to the waters east and SE of Cape Bonavista. The floes which remain, in the White Bay area for instance, can reach 80 to 90 cm (2.5 to 3 ft). In addition, there is a southward drift of ice from central Labrador which replenishes the supply of ice east of Belle Isle and these floes may reach 90 to 120 cm (3 to 4 ft) in thickness.

59 Floe size in east Newfoundland waters is mainly related to the distance from the ice edge, as ocean waves break the larger floes into smaller pieces. As a result ice cakes and small floe sizes are predominant south of Cape Freels, while medium floes occur mostly at distances greater than 50 miles from the pack.

60 The ice begins to retreat in late March but changes are relatively slow at first. Between mid-April and the end of the month the southern edge has usually retreated to Cape Freels. In May, the rate of melting increases and the pack has usually retreated to southern Labrador waters by the final week of the month. This retreat releases many of the icebergs carried south by the Labrador Current and their numbers in Newfoundland waters peak at this time.

61 **Ice in the Strait of Belle Isle**. — New ice growth develops in the Strait of Belle Isle in late December while Labrador Sea ice drifts into its eastern approaches. Passage of ocean-going vessels is often feasible until mid-January. The extreme westward movement of ice into the Gulf is usually Cap Whittle *(50°11'N, 60°07'W)*.

62 By the end of January, ice completely covers the NE arm of the Gulf of St. Lawrence, the Strait of Belle Isle and the eastern approaches to 100 miles seaward, closing the strait to normal marine activity.

63 During winter, the wind and current in the eastern approaches to the strait result in a steady southward ice drift down the Labrador coast. As a result, the ice present off Belle Isle in March may have originated in the Davis Strait area in November and is thicker than would normally be expected.

64 The retreat of the pack in spring is very dependent on the wind pattern, and easy navigation through the strait can begin in early May or be delayed by ice congestion until late June. Information as to when the use of this route becomes feasible is available from the **Canadian Ice Service** in Ottawa.

65 **Ice conditions on the Labrador Coast**. — The ice formed in this area is partially of local formation and partially “imported” from Hudson Strait or from the Davis Strait – Baffin Bay area. In addition to the sea ice, numerous icebergs from West Greenland are a navigational hazard. The locally formed ice is in the new, young or first-year ice category and the same is true for Hudson Strait ice, for both areas clear completely every summer.

66 Baffin Bay on the other hand may not clear, and as a result second and multi-year ice can intrude into the Labrador

area during the late winter and spring months as it is carried south by wind and current. It is not unusual for such events to occur and when they do arise the old floes are well dispersed among the pack and they do result in unusually hard floes being encountered in these waters.

67 Freeze-up in this area develops first in the bays and inlets of the north coast late in November but this initial formation is influenced more by the distance from the sea than it is by latitude. Terrington Basin, at the head of Lake Melville, is usually ice covered by mid-November. Hopedale, even though it is farther north, does not begin to freeze until early December, and Cartwright, at the same latitude, does not become ice covered until mid-December.

68 Once initial ice formation begins in northern bays and inlets, it spreads rapidly southward along the coast and reaches the Strait of Belle Isle by the end of December. After ice has formed in coastal regions it develops and spreads seaward, drifting in response to wind and current. At the end of December, the outer ice edge normally lies from northern Newfoundland near Cape Bauld northward and gradually extends seaward to about 75 miles wide near latitude *55°N*, and to about 100 miles wide at Cape Chidley.

69 During the first half of December, Lake Melville freezes over with fast ice. A small open water area persists at Rigolet but the remainder develops a solid cover of fast ice with a deep snow cover. Ice thickness at Happy Valley-Goose Bay reaches about 50 cm (20 in) by January 1st and 85 cm (33 in) by early April.

70 The ice in this area is relatively flat but some ridges do develop due to thermal changes and in instances when fall storms disrupt the cover after growth has begun. Difficulty in breaking this ice is related more to snow cover rather than to the ice thickness. Snow cover averages 20 to 40 cm (8 to 16 in) during the winter months.

71 Fast ice, which fills the bays and inlets along the coast during the winter months, becomes more extensive between Cape Harrison and Saglek. The offshore pack also increases in thickness and coverage and in April reaches its normal maximum limits which extend from *52°N, 52°W* to *54°N, 53°W* to *57°N, 57°W* and to *60°N, 60°W*.

72 The thickness of the pack ice is not due only to local temperatures but also to the southward drift of ice from Davis Strait induced by wind and current. This ice has a thickness of up to 150 cm (59 in) compared to the 80 to 120 cm (32 to 47 in) range found in the fast ice.

73 Pack ice moves in response to wind and ocean currents. A flaw lead can often be found between the fast ice and the offshore pack when westerly winds are prevalent. At the same time, along the outer edge of the pack ice, there can be dispersed ice in the form of strips, patches and belts which could exist up to 300 miles from shore. On the other hand, east to northeast winds compact the ice near the coast resulting in coverage approaching 100%. The outer ice edge can be compressed to within 60 miles of the coastline. Ice deformation into ridges, hummocks, etc. under these conditions can be very intense.

74 In general, the long term average ice motion may be described as moving along the shoreline about 5 to 8 miles per day. Variations in wind speed may increase this motion or stop it entirely for short periods. If an average speed of 8 miles per day is maintained, multi-year ice off Devon Island at the beginning of October would arrive near the entrance to Hamilton Inlet about mid-February. This agrees with dates of older ice in the area reported by of aerial ice reconnaissance.

75 Variations in ice floe size on the Labrador coast are related to the distance of the ice from the pack edge. Sea waves and swell from the open ocean and abrasion along the coast tend to break the ice into smaller pieces. As a general rule, small floes will be found near the ice edge with larger floes located toward the interior of the pack.

76 Melting begins in southern Labrador waters in the last week of April, reaches mid Labrador in late May and Resolution Island by mid-June. Because of its inland location, melting begins in Lake Melville in early May and the ice is soon flooded with melt water. Complete melting in situ develops by the beginning of June.

77 Clearing of the pack ice on the Labrador coast is a gradual process as melting progresses northward. The pack slowly becomes narrower; it may separate into large patches and the concentration falls as new and young ice is completely melted. By early June the southern edge has cleared Belle Isle, by the end of June it is north of Hamilton Inlet and at the end of July it is in the Cape Chidley area where patches of ice may linger into the first week of August.

78 For the remainder of the season, until the fall freeze-up begins, icebergs pose a hazard to shipping.

79 **Ice on The Grand Banks of Newfoundland**. — For these purposes this area is defined as being to the south of latitude *48°N* and east of longitude *52°W*. Much of the ice encountered is the result of drift from areas further to the north and west but local ice will generally form during periods of severely cold temperatures.

80 Early in the ice season the thinner forms of ice are encountered and become thicker later. Floe sizes that are encountered range from small to large, but these usually fracture into smaller types within one to three weeks due to wind and ocean movement.

81 When considering the average conditions, from about the end of February to the first week of April, only the northwest portion of this area is influenced by sea ice. In extreme conditions the ice will extend much farther. Sea ice has invaded this area as early as the first week of January and

has persisted until the third week of May. It has been observed as far east as *43°W* and has also drifted south of *43°N*.

82 Two ice distribution patterns can be detected: the majority of sea ice drifting south of *47°N* normally remains west of *50°W* and that which drifts east of *50°W* usually remains north of *47°N*. Persistent surface winds and the relative proximity of the warm Gulf Stream account for these patterns.

83 **Ice on the south coast of Newfoundland**. — This area is usually considered as having open water on a year-round basis. However, some local formation does occur in the inner reaches of Placentia Bay, Fortune Bay and the smaller inlets to the west during cold spells. Only briefly and during the most unusual ice season has significant growth of new and young ice been reported over waters south of the Avalon and Burin Peninsulas.

84 The Gulf ice, once it has passed through Cabot Strait, moves in response to the general wind flow and if it is carried eastward to Île Saint-Pierre and Île Miquelon, the pack in the Bonavista/Cape Freels area will be similarly affected and no ice will appear in the waters off the Avalon Peninsula. In the same way if the east Newfoundland pack is driven around Cape Race and moves westward, the Gulf of St. Lawrence pack will round the corner of Cape Breton Island and be carried down the Nova Scotia coast towards Canso and Halifax.

85 Intrusions of this nature can occur in February, March and April. These occurrences are normally of short duration and can extend up to 70 miles from the coast. Any ice which appears in these waters usually can be penetrated with ease or avoided by altering course around it.

86 **Ice in Cabot Strait and SE of Cape Breton**. — In Cabot Strait ice does not usually seriously affect shipping outside the period mid-February to mid-April. About the end of January the ice drifting from the Gulf of St. Lawrence is concentrated on the Cape Breton Island side of Cabot Strait and only when persistent westerly winds are blowing does the ice reach Cape Ray *(47°37'N, 59°18'W)*.

87 Once through Cabot Strait, the ice drift continues SE past Sydney to Scatarie Island and then SW along the Nova Scotia coast.

88 When surface winds are offshore, an open water lead usually forms along the coast. In sharp contrast, onshore winds can pile the ice tight along the shore causing the formation of ridges and hummocks and exerting pressure on vessels trapped in the ice. Although severe ice conditions are not normally long lasting in this area, in the Sydney bight area very close ice under pressure has existed for 1 to 2 weeks.

89 Break-up usually begins around the middle of March with the area becoming ice free by the last week in April. In some years ice has persisted into the last week of May.

90 **Ice in the Gulf of St. Lawrence**. — The sea ice encountered in the Gulf of St. Lawrence is mainly of local origin but ice is also “imported” from the St. Lawrence Estuary. On rare occasions, when persistent NE winds develop and after the local ice in the strait has dispersed or melted, ice drifts through the Strait of Belle Isle.

91 Ice formation usually begins in the coastal shallows of New Brunswick during the third week of December then spreads toward the main body of the gulf and across Northumberland Strait. The strait becomes ice covered by the end of December. At this time, ice growth commences in the Strait of Belle Isle and then along the north shore of the gulf during the first week of January. In the meantime, ice from the St. Lawrence Estuary spreads into the northwest section of the gulf through Honguedo Strait.

92 In a normal winter, the ice thickens and spreads gradually along the south side of the estuary, eastward from the New Brunswick coast and through Northumberland Strait during the first half of January. Ice fills the SW half of the gulf from Péninsule de la Gaspésie to Cape Breton Island by the early part of February.

93 The accumulation of ice along the north shore occurs a little later. At the end of January it is normal to find only new and grey ice along the north shore from Harrington Harbour westward including Jacques-Cartier Strait while extensive amounts of grey and grey-white ice may be encountered in the NE arm of the gulf, the Strait of Belle Isle, off Îles de la Madeleine and along the west coast of Cape Breton Island.

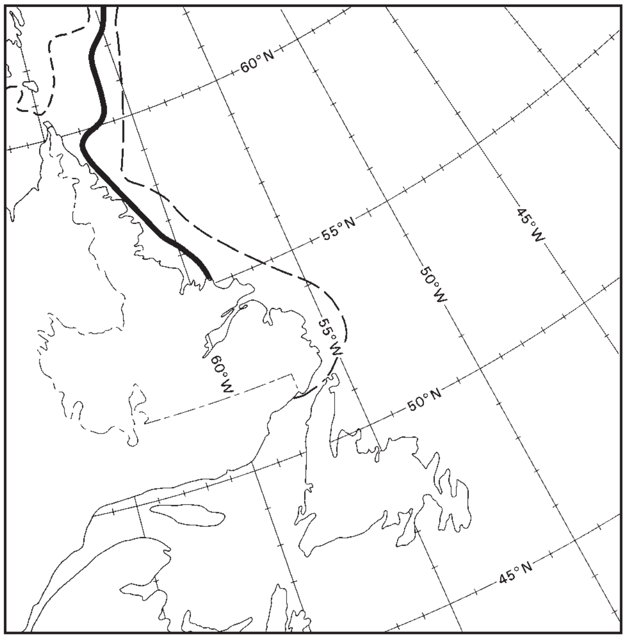
94 The portion of the gulf from central Cabot Strait to Pointe Heath to Pointe Riche, which has remained open water up to this point, is just beginning to ice over.

95 During the beginning of the season in December and January, predominant ice types along the main shipping routes are of new and grey ice. Floe size is generally less than 100 m (328 ft) across. In February, grey-white ice becomes more common and in cold winters, by March, white ice becomes the prevalent type.

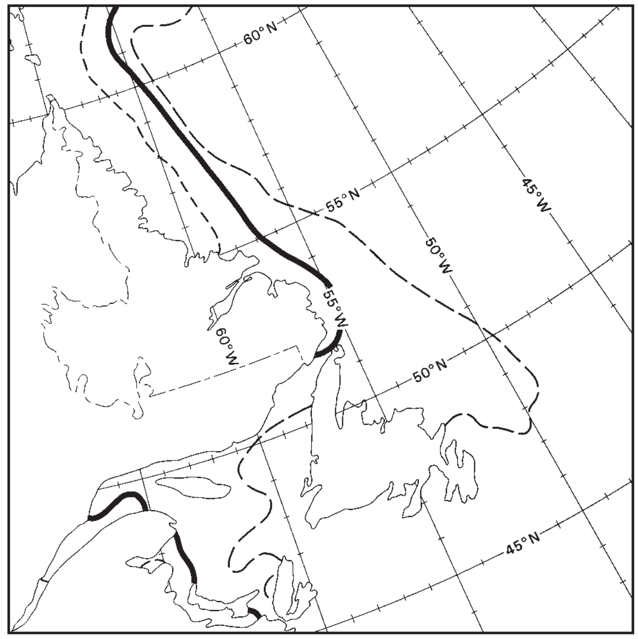
96 In the more central part of the gulf, most ice floes remain in the medium size category through the winter, but in the SW portion of the gulf, giant floes are common by mid-winter. In general, ice in the gulf is only moderately deformed into pressure ridges and hummocks, but in coastal areas where onshore pressure is common, the situation is very different.

97 The ice cover in the gulf becomes quite extensive in normal winters but even in the coldest years it is never completely covered. Tidal action, currents, and wind induced drift all combine to allow small areas of open water to remain. These openings can be used for navigation.

98 During the winter season normal shipping routes are through Cabot Strait on the Newfoundland side, through Honguedo Strait on the Anticosti Island side, and along the north side of the St. Lawrence Estuary. During prolonged




DEC/DÉC 1

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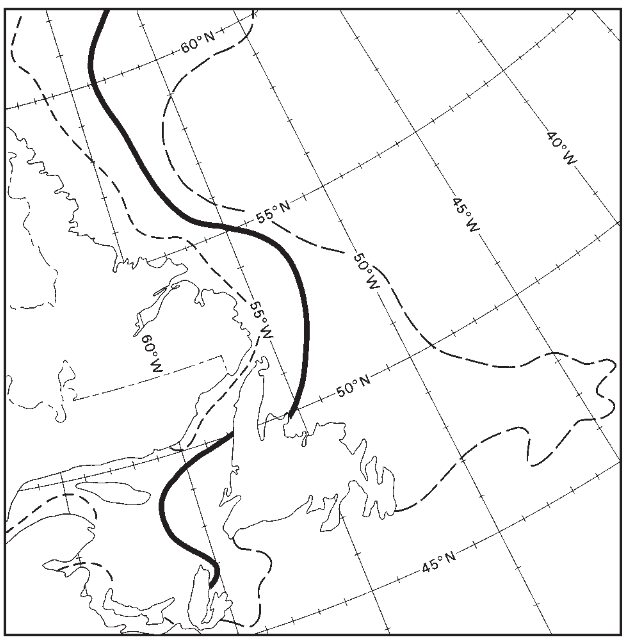


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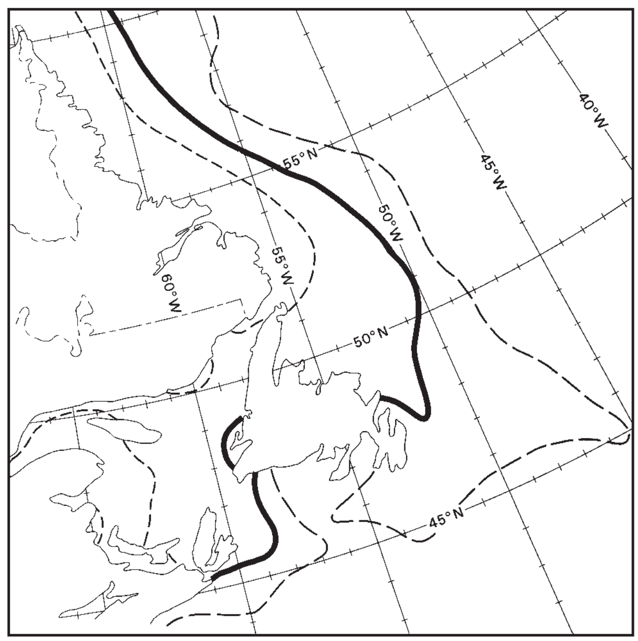



MAR/MARS 1

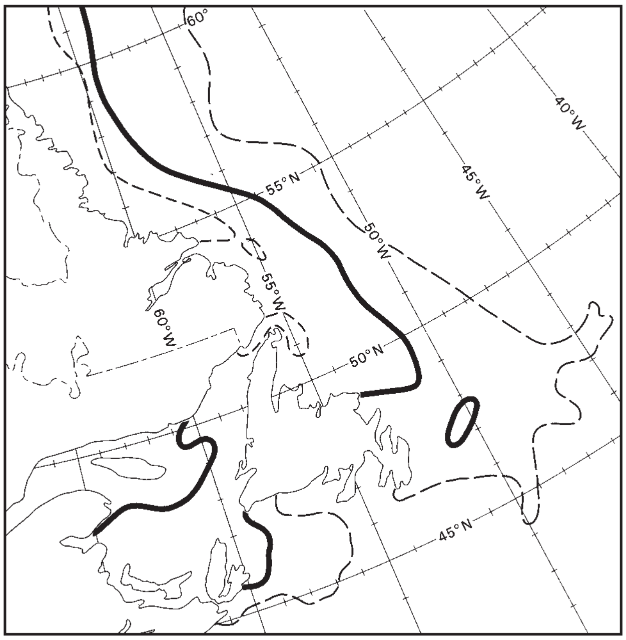
EXTENT OF SEA ICE / ÉTENDUE DES GLACES DE MER
(1964 - 1979)

MAXIMUM LIMIT — — — — — — — LIMITE EXTRÊME

AVERAGE LIMIT ——————— LIMITE MOYENNE

MINIMUM LIMIT – – – – – – – – – – LIMITE MINIMUM

NOTE - LIMITS ARE VALID FOR PARTICULAR DATES ONLY
REMARQUE - LES LIMITES NE SONT VALABLES QUE POUR LES DATES INDIQUÉES CI-DESSUS

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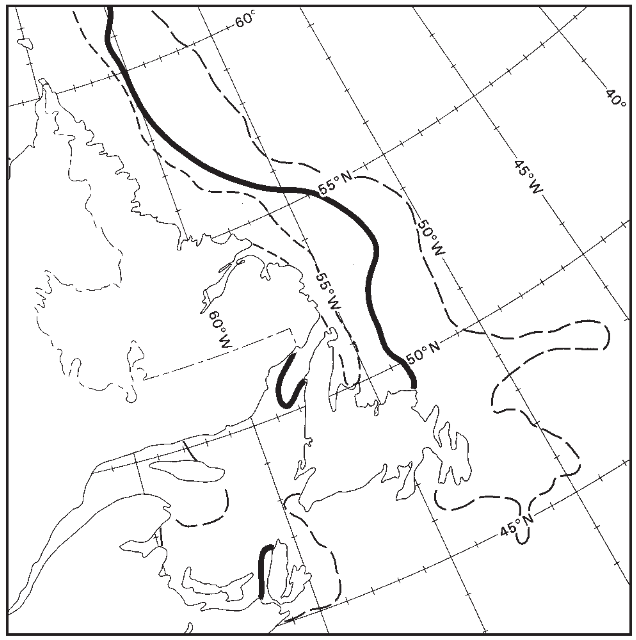
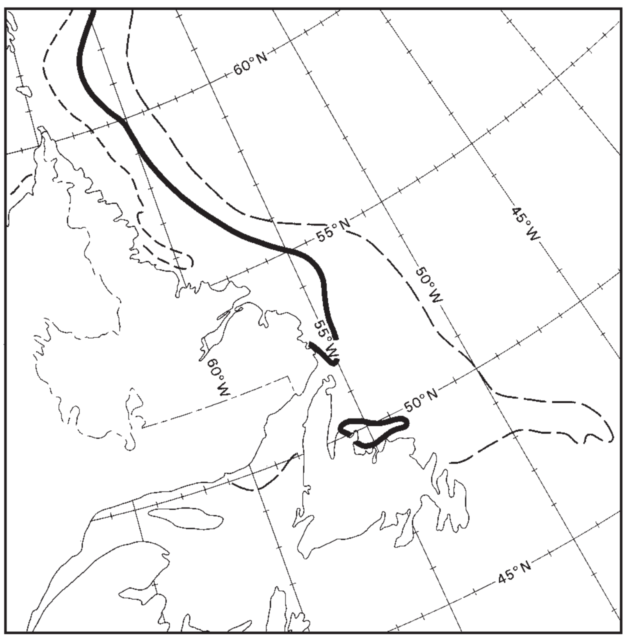
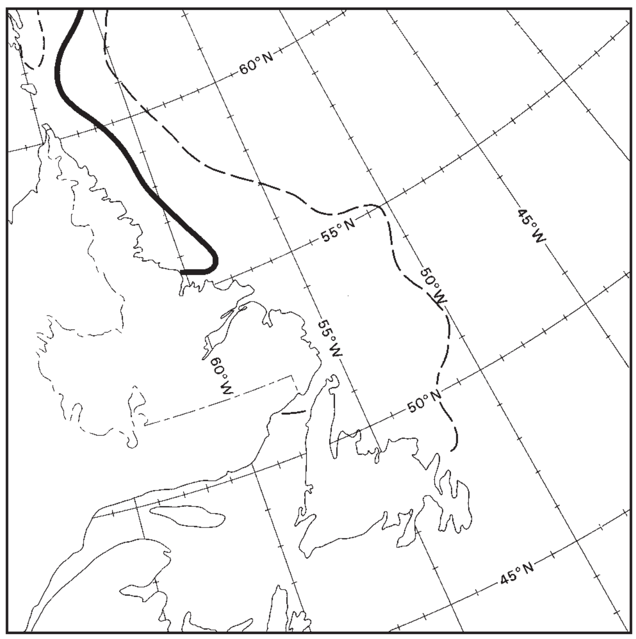



MAY/MAI 1




JUN/JUIN 1




JUL/JUIL 1

EXTENT OF SEA ICE / ÉTENDUE DES GLACES DE MER
(1964 - 1979)

MAXIMUM LIMIT — — — — — — LIMITE EXTRÊME

AVERAGE LIMIT ———————— LIMITE MOYENNE

MINIMUM LIMIT – – – – – – – – – – LIMITE MINIMUM

NOTE - LIMITS ARE VALID FOR PARTICULAR DATES ONLY
REMARQUE - LES LIMITES NE SONT VALABLES QUE POUR LES DATES INDIQUÉES CI-DESSUS

periods of unfavourable winds, ice conditions along these routes may become temporarily difficult and re-routing via Péninsule de la Gaspésie or through Jacques-Cartier Strait may be necessary.

99 A gradual eastward spread of the ice continues through February, but in most winters an area of open water will remain along the west Newfoundland coast from Cape Ray *(47°37'N, 59°18'W)* to Cape St. George to the Bay of Islands. Ice break-up usually starts by mid-March. In normal circumstances, during the early days of April, the open water area off Cape St. George spreads along the south shore of Anticosti Island to produce a route following the deep trench in the central part of the gulf.

100 Once this route opens it is nearly always maintained and the ice to the south is gradually diminished by melting or drifting into Cabot Strait and the open Atlantic. The SW portion of the gulf is usually clear by mid-May. The NE portion is somewhat slower to clear with sea ice normally persisting into the last half of the month.

101 **Note**. — Information regarding **ice in the St. Lawrence River and the estuary** is described in booklets of the various regions.

102 **Ice in the Strait of Canso**. — In the Strait of Canso, ice forms first along the shore at the causeway and then expands westward toward Cape Jack *(45°42'N, 61°34'W)*. A complete shore-fast ice cover is usually established by the end of January and generally remains undisturbed until spring break-up. The ice is generally level and smooth except along the outer edge where there is interaction with the pack ice of St. Georges Bay.

103 In this region, considerable rafting occurs and at times ice is heaped to 9 m (30 ft) above sea level with unknown amounts below the surface.

104 Since construction of the Canso causeway ice may only enter or leave the strait through the west end. The fast ice which forms during winter disappears in spring; this occurs when melting breaks up the ice sufficiently to allow it to be expelled into St. Georges Bay, usually by the action of easterly winds and spring tides. In some years, after initial signs of movement, complete clearing of the strait can occur in a matter of hours. Once the ice clears the strait, usually by late April, it does not re-enter.

105 Port facilities in the Strait of Canso, to the SE of the Canso Causeway, are generally ice-free during winter. The causeway acts as a natural barrier to prevent ice from drifting from St. Georges Bay into the Strait of Canso, while the strait is influenced by the warmer, tidal waters of the open Atlantic Ocean.

106 **Ice on the Atlantic Coast of Nova Scotia**. — The area from the Bay of Fundy to Cape Sable and NE to Halifax is ice free all year except for new and young ice which forms in bays and inlets during the cold spells of January and February. This ice soon melts when it is carried out to sea by wind and tidal stream and is never a hindrance to navigation.

107 Local tugs or Coast Guard icebreakers ships are used to open some of the harbours or to clear an access. In mild winters, harbours remain ice free.

108 The conditions are similar from Halifax to Canso with occasional intrusions of the pack ice from the Gulf of St. Lawrence. Between Halifax and Sheet Harbour, this intrusion of pack ice has occurred mainly between the third week of February and the first week of March and generally persists for only a few days. Between Sheet Harbour and Canso, being closer to the source of the ice, this intrusion of gulf ice has occurred mainly between the second week of February and the second week of May. In this area, the ice can be considerably more extensive and may persist for long periods of time.

109 The thickness of the gulf ice reaching between Sheet Harbour and Canso can attain 75 cm (30 in) and is ice cake or small floe in size. Concentrations range between 1/10 and 6/10 but may increase in the coastal areas when onshore winds develop.

110 **Ice in the Bay of Fundy**. — Strong tidal action in the Bay of Fundy prevents significant ice formation except in certain bays and inlets. For most purposes the bay is considered ice free. However, ice does form in Chignecto Bay and Minas Basin during winter. Ice may also be found in other bays and inlets of coastal New Brunswick and Nova Scotia during the colder days of January and February but it is usually well dispersed and of brief duration.

111 In cold winters, fast ice develops along the shores of Shepody Bay and covers Cumberland Basin. Because of the high tidal range, ice in the form of very discoloured “boulders” is found on the tidal flats and some may be carried seaward when offshore winds develop. The same condition is prevalent in Minas Basin and strips of this ice are often carried into Minas Channel by the ebb tidal stream.

112 **Icebergs**. — Icebergs vary widely in size and shape. The International Ice Patrol has reported icebergs having heights as great as 80 m (262 ft), the average height being 30 m (100 ft), and lengths of up to 517 m (1,696 ft) with a mass of about 204,000 t. The height to draught ratio of an iceberg depends largely on its shape.

113 Icebergs float with seven-eighths of their mass under water but this does not mean that the draught is equivalent to 7 times the height, as the shape must be taken into consideration. From actual measurements, it has been found that on the average, height to draught ratios vary from 1:3 for monolithic icebergs (or pinnacled) to 1:5 for tabular icebergs (or blocky).

114 An important consequence of the substantial draught of an iceberg is that its drift is strongly influenced by ocean currents, as well as winds. The relative importance of winds and currents on iceberg drift depends on the area and mass

exposed to winds and currents and the relative strength of each. However, icebergs are more affected by currents than winds.

115 **Precaution** should be exercised in the vicinity of icebergs. The submerged parts of an iceberg are not always clearly visible since ice ridges or rams project under water from the berg for quite a distance. In addition, it is possible to have melting of the iceberg near the water surface, but not melting at greater depths where temperatures may be lower. With surface melting, an iceberg's centre of buoyancy can change, resulting in unstable conditions and rolling of the iceberg, a situation that can occur several times a day. Therefore, it is very important for vessels to give icebergs a wide berth.

116 Most icebergs found off the eastern Canadian seaboard come from west Greenland glaciers, specifically from the area between Disko Island *(70°N)* and Melville Bay *(76°N)*. They are carried in a counterclockwise direction around Baffin Bay and move south through Davis Strait to the Labrador coast and Newfoundland waters.

117 The first icebergs are usually sighted on the eastern edge of The Grand Banks of Newfoundland in late February or early March. Greenland produces 20,000 to 40,000 icebergs each year but the number that reach the waters south of *48°N* varies considerably from year to year. Icebergs may be encountered south of Newfoundland in all months of the year but they are most numerous in April, May and June and least numerous in the months from September to January. Few icebergs reach *40°N* and these do not drift much further south.

118 In some years, the southward drift of icebergs is concentrated in the eastern portions of The Grand Banks of Newfoundland, while in other years, they remain close to Newfoundland and may round Cape Race. In general, icebergs tend to favour the offshore areas in the early part of the season and become more frequent in coastal waters at the end of the season.

119 As spring melt causes sea ice off Newfoundland to retreat northward and clear from the Strait of Belle Isle by early June, the previously entrapped icebergs remain behind impacting shipping in the area throughout the summer.

120 Icebergs in the central portion of the Gulf of St. Lawrence are very rare but they can reach this area in special circumstances. In the past 30 years, no icebergs are known to have crossed *57°W* after rounding Cape Race; the majority of icebergs entering the Gulf do so through the Strait of Belle Isle.

121 Because of a limiting depth of 55 m (30 fm), only small icebergs can enter the Strait of Belle Isle and most of these pass between Belle Isle and the Labrador coast, make a deep circuit into the strait and move eastward again between Belle Isle and Newfoundland. A few are carried westward where they may ground on the Quebec shore or be carried SW into the NE arm of the Gulf of St. Lawrence. One very small iceberg has reached Cabot Strait passing through the Strait of Belle Isle before melting.

## Tides

122 The main forces causing **tides** are the gravitational attractions of the moon and sun. Since the pull of the moon is about twice as strong as the sun, the tidal cycle is generally in tune with the lunar day of 24 hours 50 minutes. As the earth rotates, the moon's gravitational attraction causes moving tidal bulges in the world's oceans on both sides of the earth resulting in two high and two low waters every lunar day at most localities. These are known as **semi-diurnal tides**.

123 Tides with only one high and one low water each day, like in the Pacific, are called **diurnal tides**. Indeed, in many areas, particularly in those of the Atlantic coast, the tides can be interpreted from the combination of diurnal and semi-diurnal tides whose relative phases and amplitudes change with time and location.

124 The effects of the solar attraction are generally noticed as an increase or decrease of the lunar tides. When the sun, moon and earth are in line, at new or full moon, the gravitational attractions of the sun and moon combine to produce larger than normal or **spring tides**. These usually, but not always, occur one to three days after new or full moon and in the *Canadian Tide and Current Tables* are called "large tides".

125 When the sun and moon are at right angles to the earth, at first and last quarter, the gravitational attraction of the sun counteracts that of the moon and smaller than normal or **neap tides** occur. The "mean tides" used in the *Canadian Tide and Current Tables* are the average of spring and neap tides.

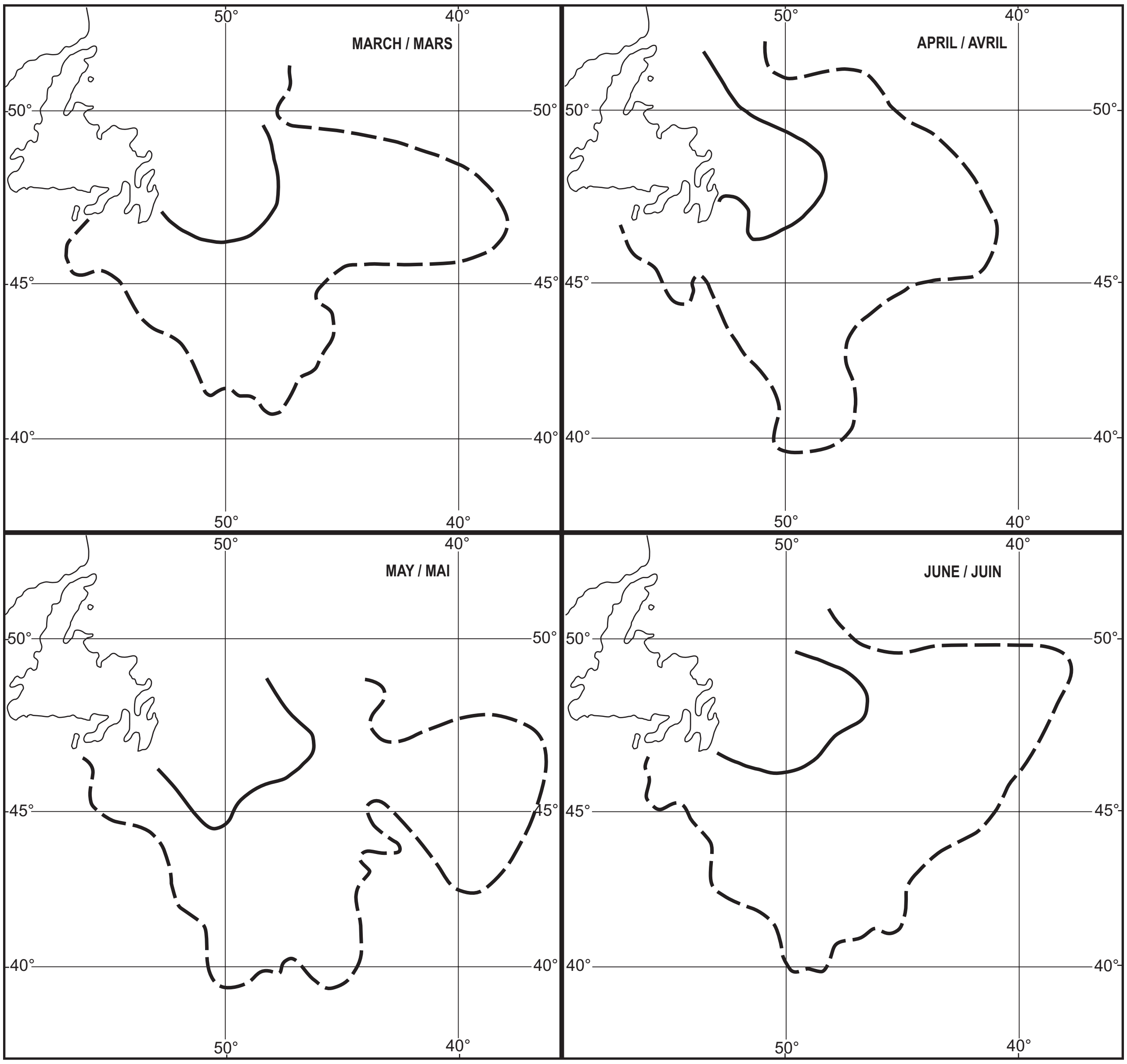
**Table 3.1 Estimated Number of Icebergs South of Latitude 48°N**

| | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average between 1945 and 1989 | 0 | 1 | 1 | 2 | 12 | 41 | 115 | 95 | 61 | 24 | 6 | 1 | **359** |
| Maximum | 3 | 11 | 7 | 54 | 165 | 185 | 953 | 559 | 266 | 335 | 93 | 32 | |
| Year | 1984 | 1984 | 1984 | 1973 | 1983 | 1972 | 1984 | 1972 | 1974 | 1984 | 1984 | 1985 | |

Compiled from information by Ice Centre, Environment Canada

**EXTREME AND MEAN LIMITS OF ICEBERGS FOR MARCH TO JUNE INCLUSIVE**

**LIMITES EXTRÊME ET MOYENNE DES ICEBERGS DES MOIS DE MARS À JUIN**




EXTREME LIMITS — — — — LIMITE EXTRÊME

MEAN LIMITS ——— LIMITE MOYENNE

126 Many other factors influence tides, such as the changing orbital declinations and radii of the earth and moon, their orbital precessions, the size and shape of the ocean basin. The effect of declination is usually only noticeable from the difference in the heights of two successive high or low waters known as “diurnal inequality” and creates **mixed tides** which are present on the Atlantic coast.

127 Changing orbital radii cause variations in tidal range over periods of months and years. When the moon is at perigee (closest point in its orbit to the earth), tidal ranges are increased and, a few times per year, when the perigee coincides with the time of spring tides, Perigean Spring Tides, tidal ranges much larger than normal will occur. All of these effects are taken into account when the predictions for the *Canadian Tide and Current Tables* are made.

128 Water levels along ocean coasts and inland water bodies are also affected by atmospheric pressure and wind. The change in water level by these effects is comparatively small to that of the tide. Because of local topography, these effects are highly variable from one location to another. In using tidal predictions, such as the *Canadian Tide and Current Tables*, it should be remembered that no allowance is made for non-tidal effects, other than for the average seasonal change in mean water level. In general, onshore winds and low barometric pressures tend to increase water levels while offshore winds and high barometric pressures tend to lower water levels.

129 “Storm surges” are significant increases in water level associated with the passage of storms. Much of the increase is the direct result of wind set up and low barometric pressure and can result in water levels one or more metres above normal in some areas. Negative surges are significant non-tidal decreases in water level associated with offshore winds and high pressure systems. They can be of considerable concern to mariners as they can create unusually shallow water if they occur close to the time of low tide.

130 Notices on storm surges are issued as required by Environment Canada and broadcasted by the MCTS Centres as a *Storm Surge Warning*.

*Chart 4001 (INT 404)*

131 **Atlantic Coast of Newfoundland and Nova Scotia**. — The Canadian east coast is subject to two tides, the semi-diurnal tide with two high and two low waters daily and the diurnal tide with one high and one low water in the same period. Along the east coast of Newfoundland, the tide is mixed but mainly semi-diurnal. High water occurs simultaneously along the coast and the tidal range is approximately 0.9 m (3 ft).

132 Along the Atlantic coast, from Cape Race to Cape Ray *(47°37'N, 59°18'W)*, across to Glace Bay *(46°12'N, 59°58'W)* and along the shores of Nova Scotia, the tide is semi-diurnal. High waters occur almost simultaneously along all coastal points between Placentia Bay (NL) to Shelburne (NS). The tidal range is not significant, the difference between high and low water seldom exceeding 1.8 m (6 ft).

133 The range of the diurnal tide is less than 0.3 m (1 ft). The contribution of the diurnal component to the resultant tide is apparent only as a comparatively insignificant inequality in the heights of successive high waters or of successive low waters.

134 **Tides on the Labrador Coast**. — The tide along the greater part of the Labrador Coast is very uniform, both in the time of high water and in the range of the tide; it is only toward the heads of inlets that any great changes occur. However, near the northern extremity of Labrador, there is a very significant and rapid increase in range as the entrance to Hudson Strait is approached.

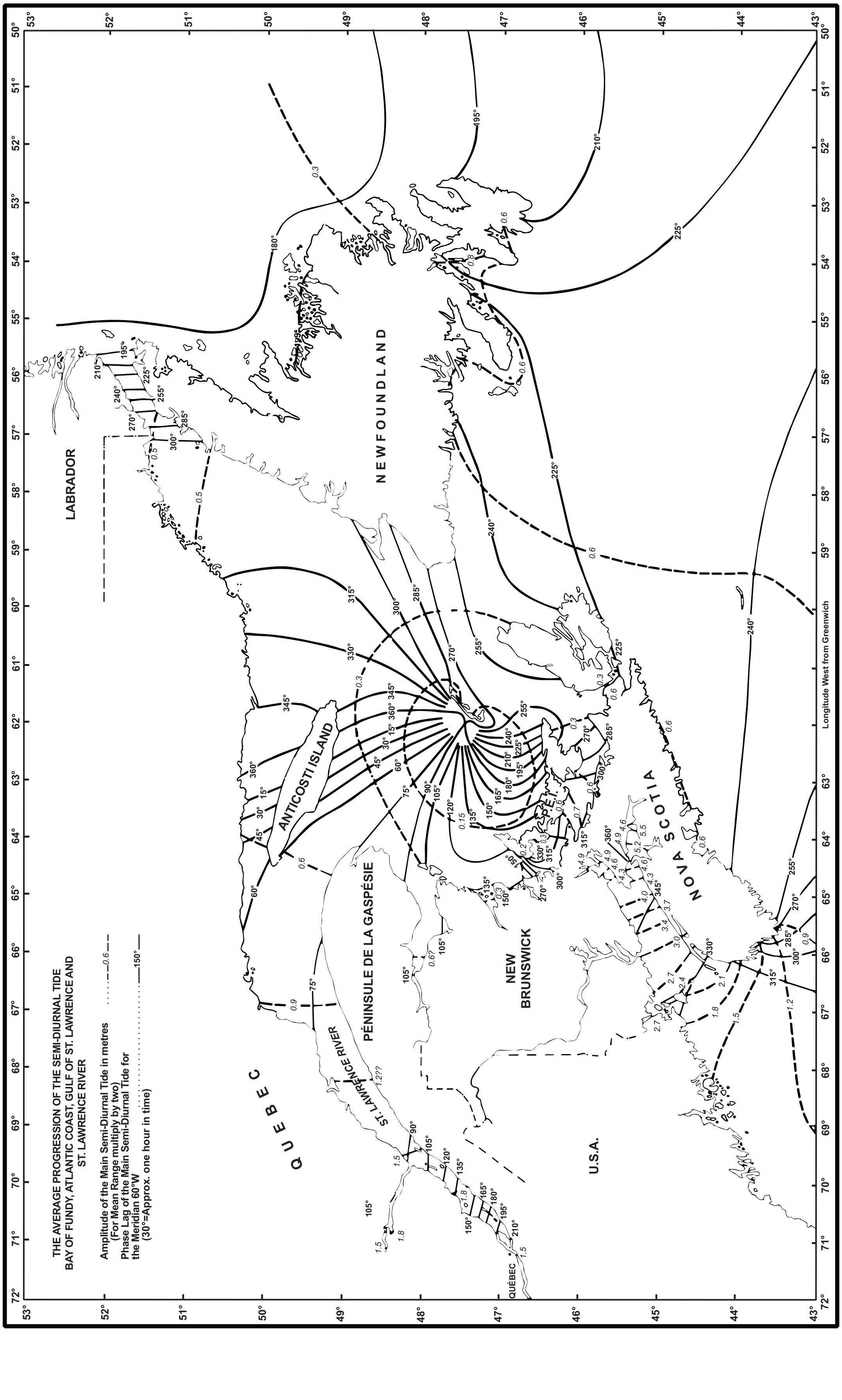
135 Near to the coast, in general, the average flood **tidal stream** runs northward and the ebb stream southward, both rarely attaining a rate of ½ knot, except around headlands.

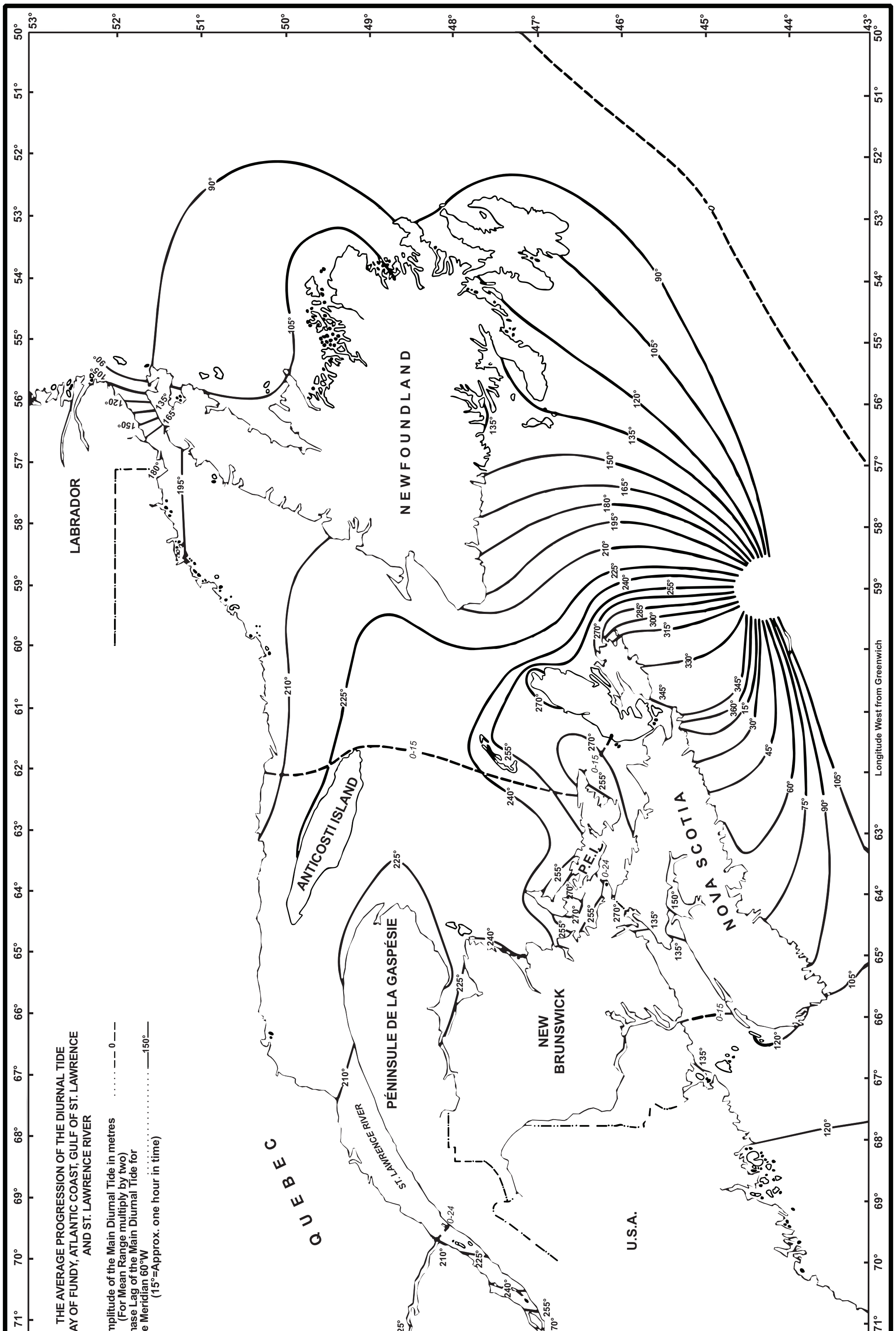
136 Because of the intricacies of the coastline, which is fringed with innumerable inlets and small islands, currents inshore remain a matter of local knowledge. Strong, **dangerous currents** up to 7 knots flow into the fiords and through the tickles in this region and around Cape Chidley.

137 The **Labrador Current**, as it leaves Davis Strait, taking with it field ice and icebergs, extends over to the Labrador Coast and moves along it at a rate of 1 to 2 knots, as reported by fishermen. Near the coast, the current produces a drift that is said to be a rate of about 6 miles per day; at about 70 miles offshore, the drift rate is reported to reach 10 to 20 miles per day.

138 **Gulf of Maine**. — When the semi-diurnal and diurnal tides are propagated from the ocean into the Gulf of Maine, they undergo considerable changes. Along the coast of Boston and Bar Harbour, high water occurs nearly four hours later than on the Atlantic coast of Nova Scotia and the tidal range is greater. The rapid changes in the high water times and in the ranges of the tide are particularly apparent around the south end of Nova Scotia.

139 **Bay of Fundy**. — The most remarkable tide, not only in Canada, but probably anywhere in the world, occurs in the Bay of Fundy where, at times, the tidal range can reach over 12.2 m (40 ft). The narrowness of this bay is one factor which increases the range of both the semi-diurnal and diurnal tides. However, the most important factors are the length and the depth of the bay which determine its natural period of oscillation. The natural period of oscillation in the Bay of Fundy closely corresponds to that of the semi-diurnal forces, and consequently the average spring range of the tide in the upper parts of Chignecto Bay and Minas Channel is approximately


THE AVERAGE PROGRESSION OF THE SEMI-DIURNAL TIDE
BAY OF FUNDY, ATLANTIC COAST, GULF OF ST. LAWRENCE AND
ST. LAWRENCE RIVER
Amplitude of the Main Semi-Diurnal Tide in metres
(For Mean Range multiply by two)
Phase Lag of the Main Semi-Diurnal Tide for
the Meridian 60°W
(30°=Approx. one hour in time)
LABRADOR
NEWFOUNDLAND
ANTICOSTI ISLAND
QUEBEC
PÉNINSULE DE LA GASPÉSIE
ST. LAWRENCE RIVER
QUÉBEC
NEW BRUNSWICK
P.E.I.
NOVA SCOTIA
U.S.A.
Longitude West from Greenwich


THE AVERAGE PROGRESSION OF THE DIURNAL TIDE
BAY OF FUNDY, ATLANTIC COAST, GULF OF ST. LAWRENCE
AND ST. LAWRENCE RIVER
Amplitude of the Main Diurnal Tide in metres
(For Mean Range multiply by two)
Phase Lag of the Main Diurnal Tide for
the Meridian 60°W
(15°=Approx. one hour in time)
LABRADOR
NEWFOUNDLAND
QUEBEC
ANTICOSTI ISLAND
PÉNINSULE DE LA GASPÉSIE
ST. LAWRENCE RIVER
QUÉBEC
NEW BRUNSWICK
P.E.I.
NOVA SCOTIA
U.S.A.
Longitude West from Greenwich

11.3 m (37 ft), as compared to about 3 m (10 ft) in the Gulf of Maine.

140 It is probable that the natural period of oscillation most closely approximates that of the lunar semi-diurnal force, for the increase in the range of the lunar semi-diurnal tide is proportionally greater than that in the range of the solar semi-diurnal tide. There is a large discrepancy between the natural period of oscillation and that of the diurnal forces. The spring range of the diurnal tide increases only from 0.4 to 0.7 m (1.5 to 2.3 ft), an increase which could be entirely explained by the decrease in cross-section of the bay.

141 **Gulf of St. Lawrence**. — The tide propagated through Cabot Strait and the Strait of Belle Isle into the Gulf of St. Lawrence is a mixed type but mainly semi-diurnal. The exception is along the coast in the SW portion of the Northumberland Strait, between Cape Tormentine *(46°07'N, 63°46'W)* and Richibucto, and near Savage Harbour *(46°26'N, 62°50'W)*, where diurnal inequalities dominate. At the southern tip of Îles de la Madeleine and near Crossman Point *(46°27'N, 64°38'W)*, the tide is entirely diurnal. The range of the tide throughout the gulf is less than 2.7 m (9 ft).

142 The semi-diurnal tide is propagated as a counter-clockwise circulation round the gulf. High water in Cabot Strait coincides with low water in the St. Lawrence Estuary. Three hours later it is high water in the NE and low water in the SW parts. This is succeeded, 3 hours later, by high water in the St. Lawrence Estuary and low water in Cabot Strait, and after a further 3 hours, by high water in the SW and low water in the NE parts.

143 The pivot, or amphidromic point of this circulation, lies near the SW coast of Îles de la Madeleine. At this point the range of the semi-diurnal tide is zero; it increases outward toward the perimeter of the gulf. Off the coast of Îles de la Madeleine, the range of the semi-diurnal tide is about 0.2 m (0.5 ft); along the north coast of Prince Edward Island it is a little over 0.3 m (1 ft); in the entrance to Honguedo Strait and in the north and east portions of the gulf, the range is 0.9 m (3 ft), or the same as in Cabot Strait.

144 A semi-diurnal tide, much smaller in volume, enters the gulf through the Strait of Belle Isle and is propagated along the north shore toward the St. Lawrence River. It is joined by part of the main circulation which is propagated through Honguedo Strait into the St. Lawrence Estuary. With the gradual decrease in the cross-section of the river, the range of the semi-diurnal tide increases progressively from 0.9 m (3 ft), to reach 2.4 m (8 ft) at Pointe-au-Père.

145 Owing to the circulation of the semi-diurnal tide, high water occurs in the west entrance to Northumberland Strait, some 3 hours before it occurs at the east entrance. The narrows off Cape Tormentine form a partial barrier between the two halves of the strait.

146 In the west half, off West Point *(46°38'N, 64°23'W)*, there is another amphidromic point where there is no semi-diurnal tide. North of this point, high water occurs simultaneously with low water in the narrows off Cape Tormentine and vice versa. High water in the east entrance to the strait occurs simultaneously in the narrows and the basin south of Hillsborough Bay, and the range of this semi-diurnal tide is approximately 1.2 m (4 ft).

147 **St. Lawrence River**. — The tide entering the Gulf of St. Lawrence is further propagated up the St. Lawrence River and its effect is easily observable as far as Lac Saint-Pierre, some 400 miles upriver from Sept-Îles. The crest of the tide takes about 1 hour to travel to the mouth of the Saguenay River, 5 hours to Québec City, and 10 hours to Lac Saint-Pierre. The range of the mean tide increases from about 2.4 m (8 ft) at Sept-Îles to about 4 m (13 ft) in Québec City, after which it diminishes to about 0.3 m (1 ft) in Lac Saint-Pierre.

148 The tidal curve in the St. Lawrence River exhibits various peculiarities due to the narrowing and slope of the river bed and to increasing friction, especially above Québec City.

149 One of these peculiarities is that the tide, as in many other river estuaries, rises faster than it falls, i.e. the time from low water to high water is much shorter than the time from high water to low. Also, the high waters maintain almost the same absolute height, while the low waters show a greater range. Above Québec City, low water level is higher at spring tide than at neap tide. This is a reversal of the normal process and is found only in tidal rivers.

150 From Québec City upward as far as the tide reaches, the seaward flow of inland waters may cause the river level to vary by as much as 2.4 m (8 ft). As a consequence of this large variation in river level, the tidal variation becomes relatively insignificant between Lac Saint-Pierre and Montréal. A slight semi-diurnal tidal effect can be observed on tidal gauges upstream from Lac Saint-Pierre. The range is very small, less than 15 cm (6 in). However, it is interesting to note that in each month there are several days when the daily mean values are below or above the monthly mean. These deviations correspond more or less to the phases of the moon.

151 The Canadian Hydrographic Service operates a network of digital water level gauges which allow mariners to obtain instantaneous water levels at different sites as well as the prediction for the next few days. The most recent information on water levels can be obtained by contacting *MCTS* Centres by VHF, or by calling the automated information service at 1-877-775-0790, or by visiting our Web Site *www.charts.gc.ca*.

152 From the St. Lawrence River, the tide is propagated into the Saguenay Fjord and River. In the deep water which extends from the river mouth to Baie des Ha! Ha! *(48°21'N,*

*70°49'W)*, high water occurs everywhere about 40 minutes later than at Pointe-au-Père. There is an increase in the range of the mean tide from about 3.7 m (12 ft) at Tadoussac *(48°08'N, 69°43'W)* to about 4.3 m (14 ft) at La Baie *(48°21'N, 70°52'W)*.

153 **Note**. — Details on local tides in the coastal regions of the eastern provinces as well as in the St. Lawrence River and the estuary are described in the *Sailing Directions* booklets that refer to the various regions.

## Currents

154 The horizontal movement of water is called flow or **current** in *Sailing Directions* booklets. It consists mainly of three components: tidal stream, ocean and river currents and wind-driven current. The tidal stream can be predicted accurately at any time provided adequate data are available.

155 However, ocean and river currents vary depending on changes in climatological and other conditions. The least predictable component is the wind-driven current, which varies according to the characteristics of the strong disturbance that generates it. To further complicate the general flow, these three components may interfere with each other depending on the topography of the coastline and the water depth.

156 The predicted currents published in *Canadian Tide and Current Tables* and on Canadian charts consist of the tidal stream plus the average river and/or ocean current only, therefore any deviation from these predictions is caused by the magnitude of the wind-driven current. In the open sea, the tidal stream is rotary and varies according to the lunar cycle — clockwise in the northern hemisphere and counter-clockwise in the southern hemisphere, due to the Coriolis force.

157 As the tidal stream approaches the coastline, the flow towards or away from the coast gradually diminishes, and only the flow along the shore remains, setting one direction with a rising, and opposite direction with a falling tide. These stages, which are called **flood** and **ebb**, are used to describe flow in *Sailing Directions* booklets.

158 When the tidal stream changes from flood to ebb or vice versa, it reaches a state of rest called **slack water**. During this time, the horizontal movement of water is dominated by non-tidal currents. The turn of the tidal stream seldom coincides with the time of high and low water. Off the coast, the tidal stream may turn 2 to 3 hours after the occurrences of high or low water on shore.

*Chart 4001 (INT 404)*

159 **Labrador Current**. — The ocean current having the greatest effect on the waters adjacent to the island of Newfoundland is the predominant cold Labrador Current. This current is comprised of components of the Baffin Land Current and the West Greenland Current.

160 A small part of the frigid component of the Labrador Current (Baffin Land Current) and a few icebergs enter the Strait of Belle Isle on the Labrador side. The extent of Arctic intrusion into the Gulf of St. Lawrence is largely controlled by tidal streams, winds and barometric pressures. The major portion of the Labrador Current continues south along the east coast of Newfoundland and completely covers the whole of the Tail of the Bank during the summer months.

161 A large branch of the current follows the east edge of the banks, this being the current which carries ice the farthest south. Another branch rounds Cape Race and sets in a SW direction. The bulk of the water on the banks also sets in this direction so that the Labrador Current fills the region between the south coast of Newfoundland, the SE coast of Nova Scotia and the north edge of the Gulf Stream.

162 North of Cape Spear *(47°31'N, 52°37'W)*, the flood tidal stream is NE going, and slows down the Labrador Current which is usually SW going; the SW going ebb tidal stream accelerates the current.

163 **Strait of Belle Isle**. — The flow encountered through the Strait of Belle Isle is a resultant of the tidal streams setting to and from, and of currents whose directions and rates are largely determined by weather conditions.

164 Under average conditions, the currents in the west entrance to the Strait of Belle Isle, near the Labrador coast, set into the Gulf of St. Lawrence at a rate of approximately 0.6 knot. Over the rest of the strait, the current normally sets out of the gulf with a mid-channel rate of approximately 0.7 knot.

165 The west going stream reaches its maximum rate about 2 hours 35 minutes before high water at Harrington Harbour *(50°30'N, 59°29'W)* and the east going at about the same time before the low water. These currents vary considerably with the north/south barometric pressure gradient. When the pressure north of the strait is very much lower than that to the south, the out-going current extends over the whole strait; when the pressure south of the strait is as low as, or lower than that to the north, the in-coming current prevails.

166 Therefore, under certain meteorological and astronomical conditions, the resultant mid-channel flow may reach a maximum out-going rate of 3 knots with little or no flow towards the gulf. Under different conditions, the resultant flow may reach a maximum in-coming rate of 1 knot with little or no out-going flow. With any combination where the flow is strong in one direction, it is described as the dominant flow.

167 There is a tendency for the dominant flow to vary seasonally. The dominant out-going flow occurs more frequently in the summer months, and the in-coming flow dominates during May, June and from September onwards.

**Table 3.2 Current predictions in the Strait of Belle Isle — 51°25'N, 56°48'W**

| Interval to count from HW at Harrington Harbour | Direction | Spring tide (knots) | Neap tide (knots) |
|---|---|---|---|
| 6 h before | 045° | 1.1 | 0.4 |
| 5 h before | 045° | 0.3 | 0.0 |
| 4 h before | 225° | 0.4 | 0.4 |
| 3 h before | 225° | 0.7 | 0.5 |
| 2 h before | 225° | 0.6 | 0.5 |
| 1 h before | 225° | 0.2 | 0.3 |
| High water | 045° | 0.5 | 0.1 |
| 1 h after | 045° | 1.3 | 0.5 |
| 2 h after | 045° | 2.0 | 0.9 |
| 3 h after | 045° | 2.4 | 1.1 |
| 4 h after | 045° | 2.5 | 1.1 |
| 5 h after | 045° | 2.1 | 0.9 |
| 6 h after | 045° | 1.4 | 0.5 |

168 The presence of icebergs is not necessarily an indication of the direction of the dominant flow. The west going flow may be confined to a narrow band along the Labrador coast while the rest of the strait has an east going flow. Alternatively, the whole of the upper depths of the strait may be dominated by an easterly flow so that icebergs, previously transported into the strait by a west going flow are moving back towards the ocean.

169 **SE Coast of Newfoundland**. — For approximately 30 to 40 miles off the coast, between Cape Spear and Cape Race, the Labrador Current sets very consistently SW with an observed rate slightly greater than 1 knot. The current occupies the trench that is situated between The Grand Banks and the SE coast of Newfoundland. It is not unusual for this current to be so disturbed as to set across its ordinary direction, or even to be reversed on the surface. When such a disturbance occurs, it is usually for a short time immediately before a gale.

170 On this coast, close inshore, the flood tidal stream is SW going, and the ebb tidal stream, NE going. The resultant flow of the Labrador Current and the tidal stream is usually to the SW, with an increased rate during the flood tidal stream and a decreased rate during the ebb stream. When the flow sets strongly SW along the coast between Cape St. Francis and Cape Race, a strong eddy sets to the north for approximately 1 mile SW of Cape Spear.

171 The drift of icebergs has shown great variations and occasional reversals of flow. Sometimes icebergs are carried through the trench (between Cape Race and The Grand Banks) at rapid rates, at other times they remain nearly stationary; finally, for short periods prior to a decisive change of wind, the flow has been known to reverse and the icebergs move back to the north.

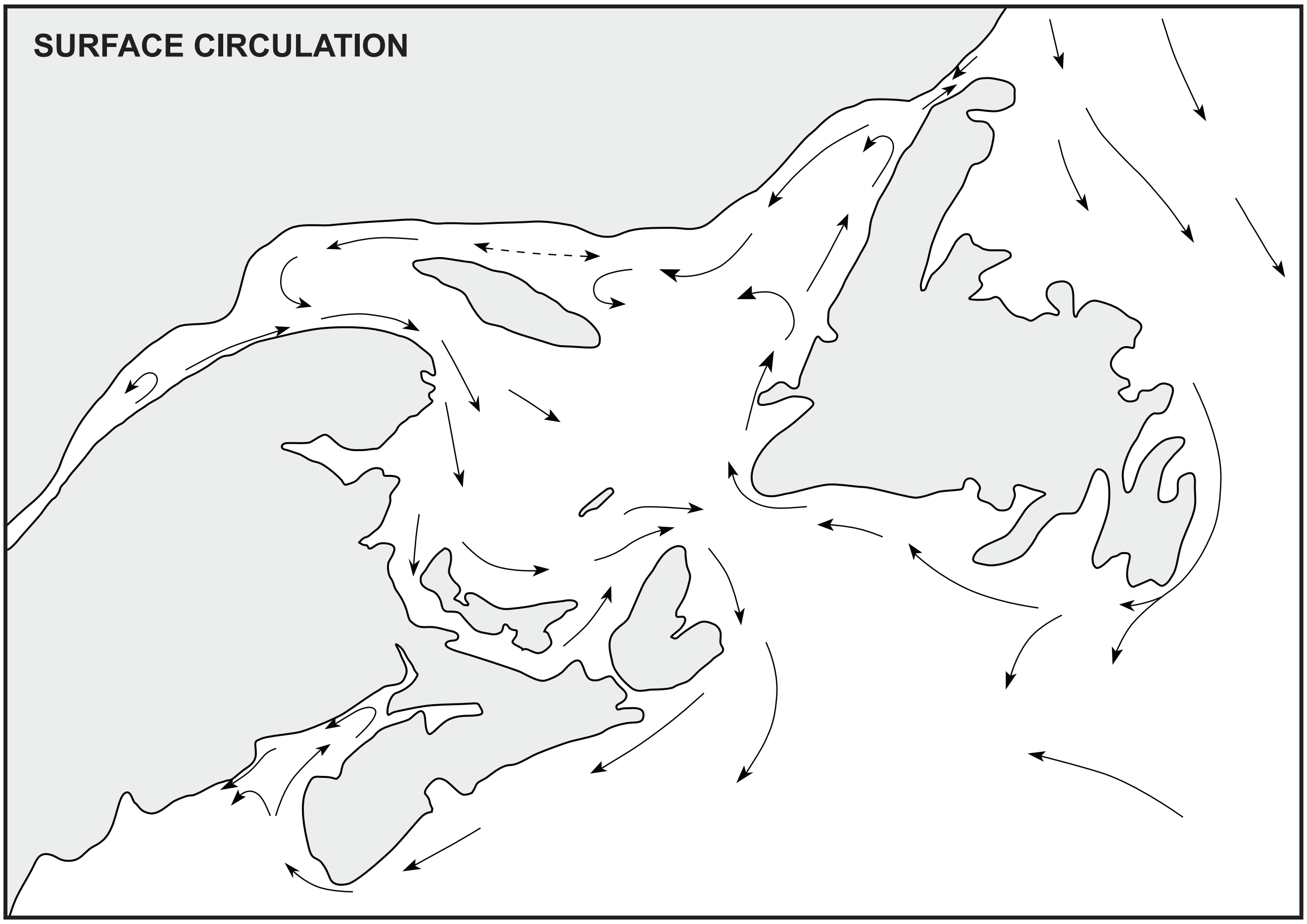
172 Over the banks south of Newfoundland during south or SW breezes, there is a strong set to the north, which is stronger still during and after NE winds. A northerly set of 1.2 knots has frequently been experienced over the banks at a distance of as much as 50 miles from the coast. A southerly current has at times been encountered on the banks, but it is the exception.

173 **Gulf Stream**. — The Gulf Stream, after passing along the coast of the United States of America, is deflected eastward between the parallels *35°N* and *40°N*, in an approximate direction of 067°, passing south of the Tail of the Bank during the winter months. It extends over the south end of the bank during the summer season with usually a variable rate at times greater than 1 knot in an approximate direction of 067°.

174 From a combination of causes such as prevailing, or recently prevailing winds, and the preponderance of polar or tropical waters, the Gulf Stream is characterized as having an oscillatory motion, so that it is impossible to determine any definite limits of this current.

175 **South Coast of Newfoundland**. — West of Cape Race, the general flow is in a westerly direction at a rate of less than 1 knot. In the offing, the flow is very much influenced by the wind and it is often variable in rate and direction. Near the coast, the flow is influenced by tidal streams, and generally, it runs in on the east side of the great bays along the south coast and out on the west side.

176 **Cabot Strait**. — In the Cabot Strait, there is a strong outflow from the Gulf of St. Lawrence around Cape North, Cape Breton Island. This outflow usually extends




over a large portion of the strait with rates ranging from 0 to 1.2 knots; rates greater than 0.5 knot are confined to the area between Cape North and St. Paul Island. Off Cape Ray *(47°37'N, 59°18'W)*, there is an inward flow into the Gulf of St. Lawrence which may attain a rate up to 2 knots close to the cape.

177 **Gulf of St. Lawrence**. — Throughout the Gulf of St. Lawrence, the horizontal water movements are the results of progressive movements of the waters, on which are imposed the tidal influences, effects of the winds and varying atmospheric pressures. Current directions may turn with more or less regularity with the rise and fall of the tide, but they may be slowed down, reversed or accelerated in their prevailing directions when different factors are in unison.

178 The rate in most of the open areas of the gulf seldom exceeds 1 knot; the direction therefore is variable being easily influenced by changes in meteorological conditions, and on this account it is necessary to exercise caution in navigation. In a broad sense, a general counterclockwise circulation of the currents exists in the gulf area.

179 **Northumberland Strait**. — In the west entrance to the Northumberland Strait, there is a weak SE set into the strait, part of which eddies out again near the shore of Prince Edward Island. This weak SE set persists throughout the central part of the strait and is directed towards St. Georges Bay (NS). In the east entrance, there is an inset on the west side, part of which eddies northwards farther inshore, but which is mainly directed also towards St. Georges Bay. There is a fairly strong NE outset along the shore of Cape Breton Island.

180 **Gaspé Current**. — The best known current in the Gulf of St. Lawrence is the seaward-flowing current which hugs the shore of Péninsule de la Gaspésie; hence, its name “Gaspé Current”. It originates in the fresh water discharged from the St. Lawrence River; as this light water flows over the denser water of the estuary, a mixing process is established. This process vastly increases the volume of water flowing seaward; this is compensated for by an inward flow in the water below and beyond the boundaries of the Gaspé Current.

181 The outrun of the Gaspé Current turns southward round Cap Gaspé and finds its way eastward between Îles de la Madeleine and Prince Edward Island. West of a line drawn from Pointe du Sud-Ouest, Anticosti Island, to about 12 miles east of St. Paul Island, there is usually a current setting SSE at a rate of 0.5 to 1 knot; but occasionally it is reversed, when its rate is only about 0.5 knot, or it may set NE or SW as a cross-current at a rate of 0.5 to 1 knot.

182 **Note**. — Details concerning local currents in coastal regions of the Maritime Provinces as well as in the St. Lawrence River and the estuary are described in the *Sailing Directions* booklets.

183 The hourly surface currents forecasts for the Estuary (downstream of Trois-Rivières, QC) and the Gulf of St. Lawrence are available on the *St. Lawrence Global Observatory* Web site at www.ogsl.ca (click on the *Ocean Forecasts* tab). You can obtain hourly details of the direction and speed of surface currents forecasted for the next 48 hours.

## Meteorological Information

184 **Climate and Weather Conditions**. — The Atlantic Provinces and the Gulf of St. Lawrence together constitute a region through which many cyclonic disturbances pass in the course of the year. During the summer months, the prevailing storm tracks are usually displaced farther north and persistent strong winds become less frequent over the gulf.

185 From autumn through the spring (including winter) many of the cyclonic disturbances of tropical or continental origins pass through the gulf and the east coast or close enough that their effects will be felt. The Atlantic Provinces have a humid continental climate type even with the influence of the sea along the shore.

185.1 The ***SmartAtlantic Alliance*** is an initiative of the Fisheries and Marine Institute of Memorial University of Newfoundland's Centre for Applied Ocean Technology (CTec) and the Halifax Marine Research Institute (HMRI). It is an observation system that collects and disseminates real time oceanographic and meteorological information via the internet for use by the marine community.

185.2 Information is available for sites at Holyrood, St. John's, Placentia Bay, Port aux Basques, Bay of Islands and Bay of Exploits, Newfoundland and Labrador, Saint John, New Brunswick and Halifax, Nova Scotia. In addition to site specific observations, Placentia Bay, Saint John and Halifax Harbour also provide marine forecasting.

185.3 With the exception of seasonal buoys in the Bay of Islands and Bay of Exploits, the remainder will be year-round installations, except when excessive pack ice may interfere. Please contact SmartBay@smartbay.ca for more information.

185.4 The ***Halifax Marine Research Institute (HMRI)***, under the guidance of the Canadian Marine Pilots' Association (Atlantic Region), is leading the operation of a meteorological/oceanographic buoy off Herring Cove at the mouth of Halifax Harbour in Nova Scotia. Please contact david.klassen@hmri.ca for more information.

185.5 *SmartAtlantic Alliance* buoy data, weather forecasts and value added information products are freely available at ***www.SmartAtlantic.ca***.

186 The climate of **Newfoundland** is temperate, but less equable than that of Vancouver Island lying at the same latitude. The influence of the sea is modified by the cold water of the Labrador Current, which flows along the east and west coasts. The ice-laden waters chill the atmosphere above them and also set up a barrier against the warm air masses from the south. Spring is late and the summers are cool. Winters are rather cold and are most severe on the west coast and northern peninsula which are affected by their proximity to the continental land mass.

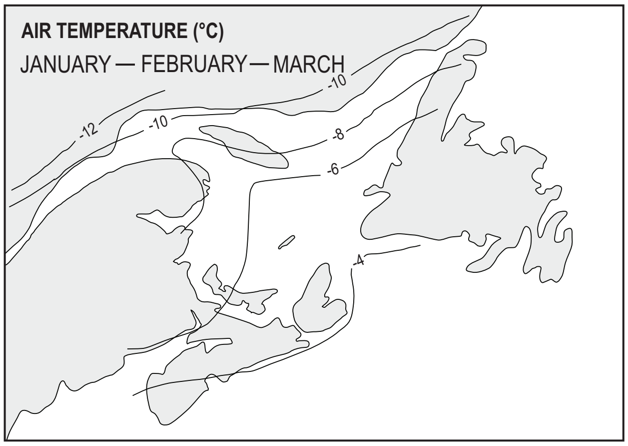
187 Temperature is very closely related to wind direction, with southerly winds bringing the warmest temperatures in winter. NW winds are very cold and their onset brings a sharp fall in temperature so that a variation of 20°C may occur in a single day.

188 In summer, the westerly winds are warm and the coolest winds are from the NE, the latter being unpleasantly cool and raw. Spring is cold because of the great quantities of ice brought south into the Strait of Belle Isle by the Labrador Current; the average temperature does not rise above freezing until the end of April.

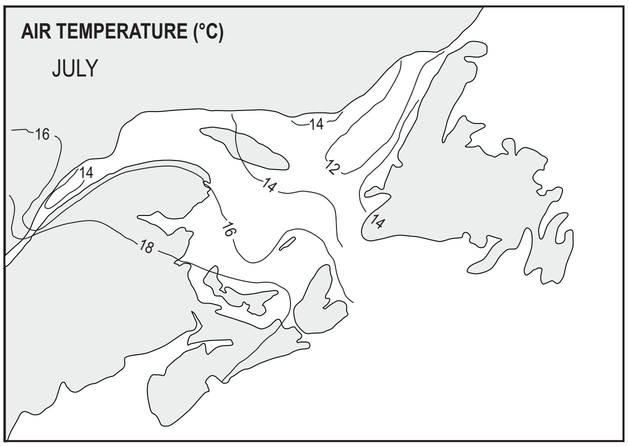
189 Summer is comparatively warm in southern Newfoundland but cool in the approaches to the Strait of Belle Isle and on the Labrador coast, where frosts are liable to occur in any month of the year. In Newfoundland, autumn is often a pleasant season, and a warm period between September 15 and November 15 frequently occurs.

190 In the cold season, the region is one of considerable storminess, since it lies within the core of the belt traversed by intense extratropical depressions. In summer, the eastern area, particularly in the region of The Grand Banks of Newfoundland, is subject to prolonged periods of heavy fog.

191 Winter depressions may enter the Newfoundland-Labrador region by way of the St. Lawrence valley, or they may leave the continent much farther south, proceeding in a NE direction and affecting Newfoundland waters before passing north toward the Atlantic Ocean. The storms which arrive from the south are likely to be more severe than those from the west and may be accompanied by hurricane force winds. The NW winds at the rear of these disturbances are often very cold. In winter storms, precipitation may be in the



Source: Environment Canada



Source: Environment Canada

form of rain, freezing rain, hail or snow, falling during steady winds or squalls.

192 **Labrador**. — The residents along the rugged and deeply-indented coast of Labrador are well aware that the weather presents a variety of patterns, so very dependent on offshore and onshore winds, and often subject to the full force of intense cyclonic systems. The broad aspects of the climate are readily apparent, but topography plays a critical role in the variations of local climate. The frequencies of fog and gales show wide variations between the coastal islands and the extremities of the deep inlets.

193 Marys Harbour, Cartwright, Hopedale, Makkovik and Nain now regularly report weather, however, the period of record is short for Marys Harbour, Nain and Makkovik. Records from years past are on hand for other locations. The weather reports from Happy Valley-Goose Bay are the only ones available for the vicinity of Hamilton Inlet. It is understood that conditions in the open sea are often more extreme than those indicated by the coastal weather stations.

194 The **Strait of Belle Isle**, although much smaller in size, has features in common with Hudson Strait. Both have islands near their eastern extremities situated within cold currents of Arctic water. These cold currents have a pronounced effect on the summer water temperatures in the eastern entrances to the straits. Both are located on the mean tracks of low pressure areas. Both, by virtue of the neighbouring topography, are effective channels for surface winds. Cold water deflected from the Labrador Current along the north coast keeps summer temperatures low, especially when the winds are onshore.

195 Belle Isle, located within the Labrador Current, indicates daily summer mean temperatures over the cool open waters of the strait – June 5°C, July 9.3°C, August 10.1°C, and September 6.8°C. Coastal stations can expect to have higher temperatures, and a few miles inland, away from the cooling influence of the strait, temperatures will be considerably higher. Along the strait, minimum temperatures drop below freezing by the last week in October and maximum values drop below freezing about a month later. Once the strait freezes over, temperatures seldom rise above freezing.

196 Frequently lying in the path of deep storms, the Strait of Belle Isle receives heavy winter precipitation. Battle Harbour averages 396 cm (156 in) of snowfall annually, more than double the annual average at Resolution Island *(61°36'N, 64°38'W)*. Snowfalls seldom start before the end of October, which is about 2 months after they start at Resolution Island, whereas that island has an annual average of 155 cm (61 in). Battle Harbour averages 76 cm (30 in) in the month of March alone, and has had one month (March 1949) as high as 278 cm (109.5 in). Along the strait, rainfall is possible in any month of the year. Small amounts fall in the winter months, rising to an average of about 75 mm (3 in) monthly, June through October, decreasing thereafter as a larger percentage of the total precipitation is in the form of snow.

197 **Cape St. Charles to Hopedale**. — Proceeding northward, Battle Harbour is the first location from which regular weather observations were taken over an extended period. In 1983, the observation site was moved to Marys Harbour, but a number of years of historical data are available for Battle Harbour. Although hills lay SW of Marys Harbour, between Niger Sound and St. Lewis Sound, they did not appear to have more than a minor influence on surface wind.

198 The Marys Harbour station appears to have been well located to record the frequency of weather events along the coast. There are no weather reporting stations in the generally northward trending and deeply indented coastline to Domino Run, a straight line distance of more than 60 miles. Along the lengthy inlets (St. Lewis Sound, Alexis Bay and White Bear Arm), the climate shows considerable variation as the distance from the coastal waters increases.

199 Between **Domino Run** and **Hamilton Inlet**, about 80 miles NW, the Labrador coast is much indented. Coastal elevations are between 152 and 183 m (500 and 600 ft) as far as Sandwich Bay, but between there and Hamilton Inlet they increase to 305 m (1,000 ft) with 488 m (1,600 ft) elevations farther inland. Along this portion of the coast, the station at Cartwright represents the coastal weather. It is well exposed, especially for wind directions from the NW quadrant. The Cartwright reports are a compromise between the foggier and windier climate of the outer islands, and the somewhat more protected inner reaches of Sandwich Bay.

200 Weather records at Cape Harrison suggest that the frequency of strong winds approximates the frequency on the outer coast, since a large proportion of these are out of the north, especially through the winter season. It is probable that the cape and outer islands have a higher frequency of fog than recorded since the easterly fog-bearing winds are less likely to carry fog all the way into Tuchialic Bay. Hamilton Inlet, about 200 miles northward of the Strait of Belle Isle, is the largest indentation on the Labrador coast.

201 North of Groswater Bay, starting at the cluster of islands centered near *54°30'N, 57°10'W*, the coastline trends WNW to Hopedale at *55°27'N, 60°14'W*, a straight line of 120 miles. Hopedale has a fairly open exposure but is more than 10 miles from the outer islands. From previous records in January, the mean daily temperature of -10.3°C at Battle Harbour drops to -15.9°C at Hopedale, a difference of almost 6°C in 3 degrees of latitude. Early in May, the mean daily temperature at Battle Harbour rises above freezing; Hopedale follows this trend about 1 week later.

202 The influence of the cold waters offshore is evident in summer when the warmest mean daily temperature of the period for both Battle Harbour and Hopedale is realized in the month of August. A westerly flow across Labrador can produce exceedingly warm temperatures on the coast: Extremes – Hopedale 33.3°C, Cape Harrison 36.7°C, Cartwright 36.1°C, and Battle Harbour 28.9°C. In the fall, a mean daily temperature of 0°C is normally reached at Hopedale by late October and at Battle Harbour by mid-November.

203 High winter temperatures in warm spells are suppressed by the cooling of the ice and cold waters offshore: January maxima – Hopedale 5.6°C and Battle Harbour 5.5°C. This coastline is frequently on the north side of intense winter storms and thus subject to heavy snowfall. Battle Harbour has an annual average of 396 cm (156 in), Cartwright 440 cm (173 in), Cape Harrison 371 cm (146 in), and Hopedale 417 cm (164 in).

204 Snowfall is infrequent in October near the southern end, but at Hopedale, snowfall begins about the end of September. At Battle Harbour, snowfall is likely to be over in May although some falls may occur as late as early June. At Hopedale, light snowfalls are possible throughout June and the very early part of July. Rainfall along the coast may occur in any month. Most of the rain falls in the months of May through end of October at Hopedale and April through the end of November at Battle Harbour.

205 From **Hopedale** to **Cape Chidley**, a distance of nearly 400 miles, there is only one reporting station, Nain, providing observations on a regular basis. The Nain station has been in operation only since 1984; consequently, the period of record is so short that it is of limited use in describing the conditions along this stretch of coast. There have been climatological observations taken in the past at Saglek, Ramah, Okak, Nain, Zoar and Hebron; as well, there are short period data sets for Killinek. These observations are helpful for defining the seasonal trends of temperature and precipitation.

206 There have been only sparse observations of wind and visibility along this deeply indented and mountainous coast. The width of the coastal area, if measured from the farthest outlying island within the Labrador Current to the western limits of the fiords and bays, varies from about 50 miles in the south to about 20 miles in the north. Weather variations are large.

207 Wind directions are affected by the rugged topography while fog banks move in and out under the influence of the general airflow and the solar heating of the cliffs and slopes. The definition of the intricate patterns of the local climates must await the establishment of weather stations and the thorough analysis of marine observations. It is along this coast that the climatologist has the greatest need for additional weather reports from ships to portray more clearly the hazardous meteorological conditions which can affect marine navigation.

208 Throughout the winter months the Icelandic low, supported by frequent deep storms moving into the Labrador Sea, sustains strong winds on the coast.

209 Although winter snowfall is light, falls from the occasional storm may be heavy on leeward slopes. Temperatures average -18°C while extreme January minima are about -37°C. By early June, daily temperatures are above freezing along the coast. Some moderate snowfalls can be expected in April and May, and a few light snowfalls in June. Except at higher elevations, snowfall is unlikely through July and August.

210 Days with fog average about eight in July and August. The frequency of fog during a particular year is dependent on the air circulation. If several lows in succession cross the coast near the latitude of Hopedale, the persistent onshore wind keeps fog and low temperatures on the coast for days. A predominance of lows in Hudson Strait gives a westerly flow of subsiding air to the lee of the Torngat Mountains, a flow that brings sunny skies and temperatures of about 20°C to the coast.

211 Extreme high temperatures in July and August are in the low 30’s near Hopedale and in the low 20’s near Cape

Chidley. Although gales in July and August are not common, channelling may set off strong winds in fiords even when the pressure gradient is weak. In early September, some snowfalls can be expected around Cape Chidley. The mean daily temperature drops to freezing in early October in the north and reaches Hopedale about mid-October.

212 Fog becomes less frequent during September and is unusual after October. Snow is the usual restriction to visibility by late September. Visibility often drops to near zero in heavy snow squalls in the strong NW winds that sweep along the coast behind the deep fall storms. With a steadily developing and strengthening NW circulation, coastal snowfalls diminish after December. Temperatures trend downward to reach their lowest values in January and February.

213 **Nova Scotia** and **New Brunswick** are subjected to both the continental air masses which arrive from the west, and the maritime influence of the Atlantic Ocean. These provinces thus experience rather wide fluctuations in temperatures on a day to day and season to season basis. Fog is frequent in the Bay of Fundy and along the SE coast of Nova Scotia, particularly in the spring and summer. These results in the interior regions being generally warmer than the coast in summer, while in winter the temperatures are somewhat milder near the coast than farther inland. Daily temperature ranges of 20°C or more occur on a number of occasions each year. The greater extremes are more likely during the winter months.

214 Spring is apt to be chilly with very changeable weather but the transition to summer may be quite rapid. While snowfalls of small amount and brief duration are not unknown in October, the first significant amounts usually arrive between mid-November and mid-December. By this time, the severity of winter is beginning to establish itself with frost continuing from near Christmas to April. The harbours of the Atlantic coast of mainland Nova Scotia are not frozen during the winter like those on the northern shore of the province.

215 Nova Scotia and New Brunswick are subject to marked extremes of weather owing to their position in the region where there is a convergence of the depressions which cross the continent or move up the Atlantic coast of the United States of America. Since the general direction of movement is from west to east, an observer situated south of the track of the centre of the depression experiences winds veering through south toward NW, at times with a cold front or squall line, whereas north of the centre, east winds backing through the north are experienced.

216 The passage of a depression greatly changes the regimes of prevailing winds in summer and winter. When a depression moves down the St. Lawrence valley and passes out to sea over the Strait of Belle Isle, the winds will veer from an easterly to a southerly direction. These winds are accompanied by milder weather generally with snow or rain in winter and rain or fog in summer. The passage of such a depression in winter is frequently accompanied by gales, beginning first from the NE or east and shifting through south to SW as the depression passes east along the lower St. Lawrence River and the gulf.

217 Another type of depression leaves the United States of America's coast, usually between Cape Cod and Cape Hatteras, its centre passing either south of Nova Scotia or directly across the Maritime Provinces. These depressions are accompanied by strong to gale force winds, mainly from a NE to NW direction. In central New Brunswick, the north winter winds are very cold and after the passage of the depression, the NW winds are often accompanied by temperatures near or below -18°C.

218 In such cases, the cold air from the NW becomes squally when passing over the relatively warmer sea surface. Rain showers and snow flurries are frequently associated with the squally winds. On some occasions the centre of the depression passes over the Maritime Provinces; in these situations, the winds to the east of the storm track, on the Nova Scotian coast (and sometimes in the Bay of Fundy) shift through north to NW. Marked temperature variations may be experienced over a relatively short time in such occurrences.

219 The **Gulf of St. Lawrence** has a humid continental climate type with cold winters, warm summers, and in general abundant precipitation throughout the year.

220 Although the Gulf of St. Lawrence is a relatively small area, it is not unusual to run into various atmospheric phenomena simultaneously within the region. During a winter storm, it is quite possible for the NW part to be experiencing heavy snowfalls with temperatures well below the freezing point while the SE part is affected by mild temperatures, fog banks, intermittent drizzle, and perhaps some breaks in the cloud permitting intervals of sunshine.

221 In the more settled weather of summer, the days generally hold sunny skies with light winds, good visibility and pleasant temperatures. As well, there may be some days with rain or drizzle which tend to produce mist or fog. Thunderstorms are relatively rare, being more frequent during July and August. These are often accompanied by squally weather of short duration.

222 With the approach of autumn, there is an increase in the frequency of depressions. When disturbances approach from the south to SW, they produce slowly strengthening easterly winds. Drizzle, and then rain, may follow. If the centre of the disturbance passes to the west of the observer, he or she will find the moist cool easterly winds will shift to the south or SW often with a partial clearing of the skies.

223 In time, this will be followed by a further shift to a westerly or NW wind with the arrival of a cold front which frequently, though not always, will bring showers. If however, the centre of the disturbance passes by to the east of the

observer, the moist easterly winds will back gradually to the north or even NW and any precipitation will gradually come to an end as drier air arrives.

224 The same general pattern applies to winter disturbances but the gradual lowering of temperatures with the advance of the season results in snow rather than rain to the north and NW of the centre of the disturbance. In the warm sector (usually found to the SE of the centre), southerly to SW winds will still occur, but the much milder temperatures associated with these winds may produce rain and mist.

225 Colder air arriving from the NW, once the system has gone by, becomes very unstable over open waters of the gulf in early winter. In such circumstances, snow squalls are produced which may be so frequent and vigorous as to appear like a continuous snowstorm. These strong NW winds of early winter can persist for many hours or even days, producing spray which tends to freeze on contact with vessel superstructure.

226 The spring months are truly transitional, in that a week or two of wintry weather may be followed by relatively mild weather which, in turn, will give way to yet another cold (and often stormy) period. Gradually, however, a decrease in stormy conditions will be noted as the temperatures move toward values above the freezing point. More and more frequently winds from a southerly to SW direction will be noted, bringing milder air which is rapidly cooled over the still cold waters of the gulf.

227 Weather on the **St. Lawrence River** is subject to the same general pattern as that on the Gulf of St. Lawrence. Both areas lie on the path of many weather disturbances, particularly in the winter when the greater intensity of the air circulation generally results in more intense storms and stronger winds. On the other hand, the sheltering effect of the deep St. Lawrence River valley and the narrower extent of the water surface modify the general conditions.

228 Thunderstorms are common in late June, July and August, particularly along the upper half of the river. These are sometimes accompanied by violent squally conditions and an advancing thunderstorm should be treated with respect. This adverse weather is not usually preceded by falling pressure although violent pressure fluctuations may occur during a thunderstorm. Spring and autumn thunderstorms do occur but are unlikely to include squally conditions as the ceiling is some distance above the surface.

229 In autumn, winter and spring, precipitation occurs mainly in periods of easterly or NE winds, the latter more commonly in the upper parts of the river. A wind shift to these directions accompanied with a falling barometer and increasing cloudiness may indicate impending rain or snow. On the other hand, westerly winds, especially in winter, accompanied with rising pressure, indicate clearing weather, which is sometimes punctuated by snow flurries and almost always followed with colder weather.

230 **Winds**. — The region of **Newfoundland** lies in the SW quadrant of the Icelandic low pressure area and to the north of the Atlantic high pressure belt. Hence the most prevalent winds are from westerly directions; wind shifts occur during the passage of depressions and storms. To the east of Newfoundland, the most common direction is south, followed in frequency by north and SE.

231 In winter, since the average pressure decreases from SW to NE, the pressure gradient causes winds to blow between west and NW. The southern part of Newfoundland is often on the south side of depressions and experiences winds veering from east or SE to SW and thence from west to NW. The winds may increase in strength as they veer.

232 Moderate to heavy rain and snow usually occur with SE winds in advance of the depression. Snow sometimes falls along the cold front, especially on the west coast. The northern part of Newfoundland and the Strait of Belle Isle are more often in the cold air of depressions, with snow and winds from NE backing through north to NW and followed generally with a clearing.

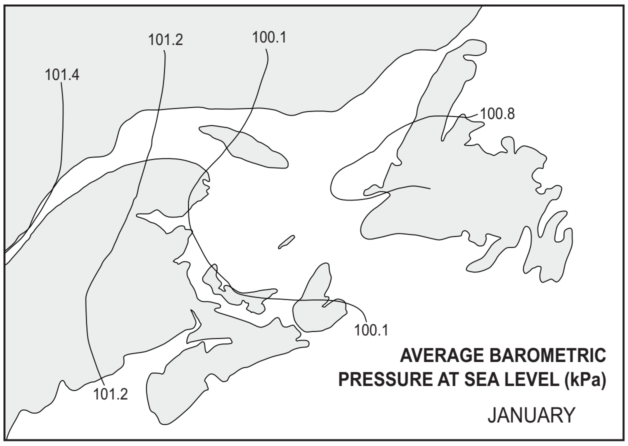
233 In spring, when the average pressure gradient is weaker, winds become somewhat more variable. In the early part of the season, as depressions tend to take more northerly routes than in winter, NE winds become more frequent. Sea breezes may develop towards the end of the season on some parts on the coast.

234 In the summer, as Newfoundland is on the NW margin of the Azores high, there is, on the average, a pressure gradient for SW winds. Local sea breezes develop on the coasts. Disturbances are not so numerous or intense as in winter, as they tend to travel on more northerly tracks. They may occasionally give rise to gale force winds, mainly from a westerly direction.

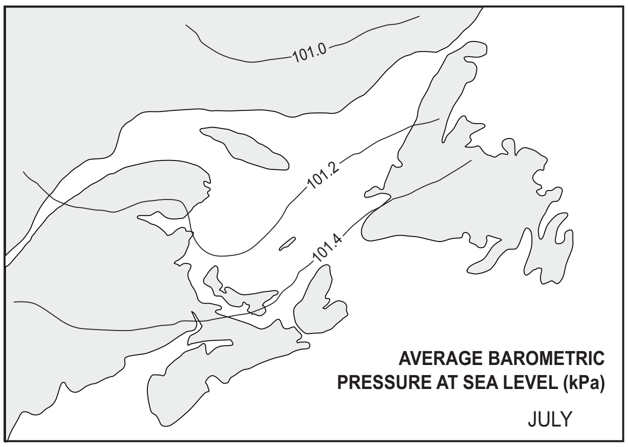
235 Near the coast, the wind is affected by the topography. At the entrances to many of the harbours, the wind may be variable in direction. With offshore winds, squalls are likely to blow down from the high ground.

236 The westerly winds are, on average, stronger than those from the easterly quadrants. In The Grand Banks of Newfoundland area, the westerly winds during the winter months have an average speed of 18 to 22 knots, the west to NW winds being the strongest. The easterly winds average 15 to 19 knots, with NE and SE being the strongest. In July, the westerly winds have an average speed of 10 to 13 knots, and the easterlies, of 9 to 11 knots. Similar speeds prevail south of Newfoundland, between *55°W* and *60°W* longitude, but the winter means are slightly higher.

237 **Labrador**. — In the **Strait of Belle Isle**, January wind directions predominate out of the NW quadrant, although the effect that the strait has on channelling wind is evident




Source: Environment Canada




Source: Environment Canada

in the high frequency of NE winds at Blanc-Sablon. By July, winds show a strong tendency to blow parallel to the coastline, being 34 per cent of the time from the SW at Blanc-Sablon, and 37 per cent from the south at Battle Harbour. Direction frequencies at Belle Isle are less influenced by terrain, hence, they are more representative of the general airflow in all seasons.

238 In January, hurricane force winds have been reported at Belle Isle (NE, SE and west) and at Battle Harbour (north). At Blanc-Sablon, winds as high as force 10 were from the north and NE. As in other areas, July is likely to be the month with fewest strong winds. Blanc-Sablon averages winds above force 6 for only 6 hours in July, Battle Harbour 3 hours, and Belle Isle, a notoriously windy location and more representative of conditions at sea, nearly 45 hours. Winds of force 10 have occasionally occurred in July at Belle Isle from SE, west and NW. From July onward, the probability of gale force winds increases, reaching a maximum number of days with gales in December.

239 A predominant westerly flow of Arctic air exists across Labrador and the Labrador Sea in winter. Ocean Station Vessel *Bravo* (formerly stationed 270 miles east of Hopedale), Cape Harrison, Battle Harbour, and Cartwright have roughly 60 per cent of their winds from the SW, west and NW. There is a greater variability of summer winds under the influence of the lesser pressure gradients and the diurnal variation of winds through land and sea breezes. Representative of the summer circulation of this area is (the former) Ocean Station Vessel *Bravo* which had 49 per cent of its winds south, SE, and east, whereas, only 19 per cent are from these directions in January. The frequency of gales is dependent on the season and the exposure.

240 In the quieter months of May through August, the average is 2 to 3 days of gales. A windy summer month might have up to 7 days; a short distance inland from the coastal islands, represented by the frequencies of Cape Harrison and Cartwright, days with gales are unlikely to exceed 4. After September, the probability of strong winds increases month after month. The windy season, with a minimum of days with gales in a month, occurs from October through April.

241 Winds higher than force 9 have been recorded frequently at the coastal stations in winter and unconfirmed observations in exposed areas indicate that winds exceeding 100 knots are certainly not unknown to this coast; however, these reports are not adequate to assess how often such strong winds occur. In July and August, winds have been observed as high as force 9 at Hopedale (NW, north) and Cape Harrison (NW); force 8 at both Cartwright (west) and Battle Harbour (SW).

242 Surface wind directions at Happy Valley-Goose Bay in winter are dominated by the prevailing westerly flow across Labrador although influenced somewhat by the Churchill River basin. In July, winds are usually light and show no pronounced directional preference. With the sheltering effect of extensive vegetation, Happy Valley-Goose Bay records show very few days with strong winds.

243 Over the fetch of Lake Melville, the winds are stronger, especially where channelled through the Mealy Mountains. Heavy squalls have been reported in Etagaulet Bay during easterly storms. Throughout the shipping season, June to November, the highest wind noted at Happy Valley-Goose Bay was in 1993, and it was from the west at 44 knots. Directions of the strongest winds are west, SW and NE, generally parallel to the length of Lake Melville.

244 North of Hopedale, wind directions are affected by the rugged topography while fog banks move in and out under the influence of the general airflow and solar heating of the cliffs and slopes.

245 Throughout the winter months, the Icelandic low, supported by frequent deep storms moving into the Labrador Sea, sustains strong winds on the coast. Gale force winds are

common, averaging about 20 days in January. When the wind on the coast is strong, the winds within the bays and inlets are variable, sometimes accelerated by the slope and channelling of the topography to speeds over 100 knots, at other times reduced to near calm. Although gales in July and August are not common, channelling may set off strong winds in fiords even when the pressure gradient is weak.

246 In winter, the average low barometric pressure near Iceland, in combination with a usual high pressure over the Canadian Arctic, causes the prevailing winds over the provinces of **Nova Scotia** and **New Brunswick** to be west to NW. In summer, a large high pressure area develops over the Atlantic, which influences the winds over the Maritime Provinces to favour a SW direction. Deviations from these directions may be caused by local influences.

247 Winds from the SE to SW bring fog; from west to north, dry clear weather. Winds from NE to SE are frequently accompanied by rain in summer and by rain or snow in winter.

248 Gale force winds occur at sea from 10 to 15 per cent of the time during the winter months but the frequency drops to near zero in the summer. Winds of close to 70 knots have been recorded at both Eastport (U.S.A.) and Sable Island. Average wind speeds of close to 20 knots occur in the winter months but in July and August the average is closer to 10 knots. Winds of over 20 knots are relatively frequent except in the period from late May to early September when winds of this strength are reported less than 10 per cent of the time.

249 Calm winds or light breezes are rare but have been reported from about 10 to 15 per cent of the time from May to September and are most common during July and August.

250 During the summer months, winds from the SW quadrant are most prevalent over the open waters of the **Gulf of St. Lawrence**, away from the coastal effects, while in winter the most frequent directions are from the NW quadrant. Nearer to the coasts, and particularly in straits or estuaries, these generalities no longer hold.

251 In the Strait of Belle Isle, SW winds predominate through much of the year, but favour northerly in February and March. In Honguedo Strait, the winds favour NW in winter and SE in summer. The high ground on either side of the Strait of Canso constrains most winds there to blow parallel to the strait with little regard to the direction found in the approaches at either end.

252 During the summer season, occasional squally weather may be encountered, which produce suddenly increasing winds with, at times, abrupt changes in direction. These are not always accompanied by showers or thunderstorms; in some instances, such squally conditions have been observed with relatively little cloud present.

253 This type of phenomenon is more likely to take place through the afternoon and evening hours, particularly in relatively confined waters such as Northumberland Strait. Comparatively weak cold fronts advancing from the NW may cross the gulf in summer months with associated squally conditions of this nature. Since such weak cold fronts and squall lines are sometimes difficult to locate on meteorological charts, it is not always possible to obtain advance warning of them in the regular marine forecasts. Squalls of this nature may be a hazard to small craft for brief periods.

254 In the **St. Lawrence River**, below Québec City and west to Anticosti Island, easterly to NE winds predominate during spring. Such winds will also accompany the passage of low pressure areas south of the river in all seasons. During summer, SW winds will be fairly frequent and will often bring warm moist air producing extensive fog. In autumn, NW winds become more common as cold air flows off from the north. Late in the fall, these NW winds may be accompanied by snow squalls.

255 Winds along the Saguenay River take their direction almost entirely from the relative difference in pressure between the upper portion of the river in Lac Saint-Jean and the mouth of the river. Winds will blow from high to low pressure and have been known to be frequently opposite to that prevailing along the St. Lawrence River itself.

256 Above Québec City, where the river and valley are narrower than lower down the river, NE winds develop during the cool seasons whenever a low pressure area is moving in the vicinity of the Great Lakes and southern Ontario while the pressure is high in the lower St. Lawrence area. Such winds will also be present while lows are passing south of the St. Lawrence Valley.

257 In the wake of low pressure areas in this portion of the river, downriver winds predominate varying over the sector SW to WNW. In summer, winds rarely blow up the river on the upper part of the river while SW winds are common. North to NW winds are rare but occur in winter associated with an intense low pressure area moving along the Atlantic coast of the United States of America from New Jersey to southern Maine.

258 **Note**. — Diagrams with wind roses indicating the frequency, direction and mean wind velocity for the sectors of the Atlantic coast are shown in the appendices.

259 **Gales**. — In general, the frequency of gale force winds (Beaufort force 8) in **Newfoundland** decreases from mid-ocean toward the west, between latitudes *45°N* and *55°N*. Westward from the vicinity of *45°W* and including The Grand Banks of Newfoundland, the mean annual percentage occurrence of gales is 5 or 6, with the highest percentages, 10 to 16, in winter and the lowest, 1 per cent in the late spring and summer months. In the area *50°N* and *55°N* latitude, west of *45°W*, 14% of the annual observations show gales of 35 knots or greater.

260 Off the Labrador Coast and the extreme northern coast of Newfoundland, west of *55°W*, observations are too

few for consideration, except from June to November. During the summer months, 1 to 2% occurrence of gales is indicated in these areas rising to 8 to 10% by late fall. In the southerly portion of the area, hurricane force winds are recorded from nearly all westerly directions from October to March. Such high speeds rarely occur from an easterly direction. From June to August, gales in excess of Beaufort force 9 or 10 are few.

261 During the hurricane season, tropical storms from low latitudes sometimes move into the Newfoundland area and bring gales or storm force winds. During a fifty-year period, 17% of recorded hurricanes passed close to or over the Nova Scotia and Newfoundland region.

262 In **Nova Scotia** and **New Brunswick**, gales seldom occur in summer. However, with the onset of the hurricane season in summer, storms of tropical origin occasionally pass over these regions. With the onset of autumn, storms of both tropical and non-tropical origin become more frequent and during the winter months numerous intense disturbances either pass through the area or near enough to cause gale force winds. Barometer indications should be closely watched, especially when winds begin to freshen from the easterly quadrant.

263 A high barometer, steady or beginning to fall, indicates that a SE to SW wind accompanied by precipitation and fog may not be far distant. A bank of cloud rising on the west horizon makes the indication more certain.

264 When the barometer ceases to fall, a wind speed reduction is sometimes observed and a wind shift may be expected often to more than 90°. This is then followed by a rising barometer and some improvement in weather although the winds may increase and remain strong for some time. In the winter months, strong north to NW winds bring falling temperatures and caution should be exercised regarding the icing of ship superstructures.

265 Winds of gale strength in the **Gulf of St. Lawrence** may occur at any time of the year, but are relatively rare during June, July and August. During the summer months, the prevailing storm tracks are usually displaced farther north, and persistent strong winds become less frequent.

266 However, from autumn through the winter and spring, many of the cyclonic disturbances pass through the gulf or close enough that their effects will be felt. Many of these are either in a process of intensification or have already reached maturity; these will produce gale to storm force winds which may persist for many hours. In some cases, the storm will decelerate or even stall in the vicinity, and at such times gale force winds have been known to persist for several days with little change in either strength or direction.

267 During autumn, the frequency of gales increases to between 5 and 10% of the time. From December until April, the frequency on average is between 12 and 20% in the northern and eastern gulf and over the ocean approaches. A slightly lower frequency is observed in the SW gulf during the winter months, averaging closer to 10% of the time.

268 Storm force winds (Beaufort force 10) are very rare from May until October, but will average about 2 to 5% of the time from late November until early April. Winds of close to 80 knots have been recorded in Îles de la Madeleine in mid-winter.

269 Some of the vast disturbances of the winter months have a zone of relatively light winds near the centre. With the passage of such a centre through the gulf area, it can happen that a lull in the winds may follow many hours of gales, even though the barometer is low and, perhaps, still falling. Such a lull will usually be of short duration – a few hours – following which the winds will increase and shift to the NW.

270 The general remarks on gales over the Gulf of St. Lawrence apply in a general sense to the **St. Lawrence River** as well, but because of the sheltering effect of the high ground along the river and because storms are at an earlier stage of development than they are when they reach the Gulf of St. Lawrence, maximum wind speeds are not quite as great.

271 Marine forecasts covering all these regions are issued at regular intervals by the MCTS Centres; details on times and frequencies are to be found in the *Radio Aids to Marine Navigation (Atlantic…)*. Special warnings are issued when required and may be transmitted at any time: • *Strong wind warning*; • *Gale Warning*; • *Storm Warning*; • *Hurricane Force Wind Warning*; • *Hurricane or Tropical Storm Warning*. Weather forecasts are also available on demand, for certain marine areas, via the Weatheradio Canada provided by Environment Canada.

272 **Fog and Visibility**. — The major causes of poor visibility are fog and snow. A light snow fall will reduce visibility to less than 0.5 mile and in heavy snow it may be only a few metres. The Grand Banks of Newfoundland and their adjacent coasts and waters are one of the largest and most persistently foggy areas of the world. The fog often covers a vast area; it may be more or less unbroken and it may be dense.

273 Most fog is of the sea fog type, due to the cooling of relatively warm and moist air by the cold water of the Labrador Current; winds of Beaufort force 3 to 4 are the most likely to produce fog but the latter becomes rare with winds force exceeding 5. Warm, moist winds are most common during the summer; for this reason and because of the seasonal lag in the increase of temperature of the sea surface, sea fog is most common during the months of May, June and July.

274 At sea, sudden showers of snow often accompanied with a squall are frequent in winter. They are known as “snow squalls” or “flurries” and occur mainly with winds from north through west. Thunderstorms are not frequent and occur mainly in summer, but can occur any month of the year, especially over southern waters.

275 Near the land, there are appreciably fewer occurrences of fog, particularly along the east coast of Newfoundland. Whenever fog is over the open sea in this area and the wind is offshore, there will be a gap between the shore and the fog. The more rugged the land, the more marked will be the improvement of visibility. During the late spring, there is a further improvement in the visibility close to leeward of land during the late forenoon and afternoon, when the land is at its warmest.

276 **Labrador**. — The Strait of Belle Isle has a high frequency of fog in May through August as moist air is cooled below its dew point by ice-chilled waters. The predominance of winds with a southerly component keeps the north coast foggier than the south, a feature aided by the tendency for surface water temperatures to be colder along the north side. Fog occurrences are reported on over half the days in July.

277 By late August, the probability of fog decreases and shows a steady decline thereafter. Because of its downwind location, the frequency of fog days at Battle Harbour is representative of the eastern edge of the strait. Warmer water temperatures in August result in a lower frequency of fog days at the SW end of the strait.

278 The frequency of fog along the south Labrador coast in a particular year is related to the frequency of onshore winds across the Labrador Current. Diurnal temperature range is an important factor as the fog tends to move inland at night and retreat seaward during the day. Battle Harbour records indicate its highest average frequency of 17 fog days in July, as the prevailing southerly wind carries sea fog northward from the Strait of Belle Isle. Probably the area north to Domino Run experiences similar frequencies. Hopedale, Cape Harrison and Cartwright all average about 5 fog days a month in the period May through August. There are indications that this average is low with respect to the average number of foggy days in the adjacent coastal waters.

279 An example of a prolonged extensive fog occurred in August 1964 when a strong high pressure area dominated Greenland and the surrounding maritime areas. As a result, easterlies prevailed in the steep pressure gradient over northern shipping lanes and storm tracks were located farther south. One such cyclone originated off Newfoundland on the 12th and remained stationary on the 12th, 13th and 14th of August near *51°N, 41°W*. Four stations along the Labrador coast, Belle Isle to Hopedale, reported 11 consecutive days with fog.

280 Lower air temperatures, stronger winds and fewer onshore winds lead to an appreciable reduction in coastal fog in September. The averages indicate that little fog occurs after September but the maxima show that, provided sufficient warm moist winds traverse the Labrador Current, there may be up to 10 or more days with fog. Towards the latter part of the shipping season the more likely restriction to the visibility is snow.

281 Fog days are unusual at Happy Valley-Goose Bay, never having exceeded 5 in any one month.

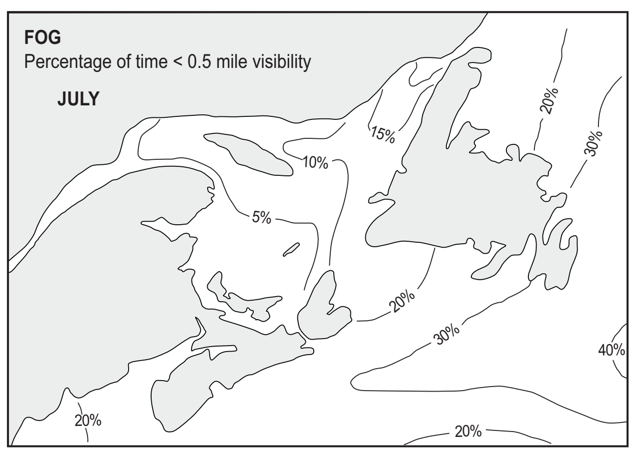
282 From Hopedale to Cape Chidley, days with fog average approximately 8 in July and August. The frequency during a particular year is dependent on the air circulation. If several lows in succession cross the coast near the latitude of Hopedale, the persistent onshore wind keeps fog and low temperatures on the coast for days.

283 A predominance of lows in Hudson Strait gives a westerly flow of subsiding air to the lee of the Torngat Mountains, a flow that brings sunny skies and temperatures of about 20°C to the coast. Fog becomes less frequent during September and is unusual after October. Snow is the usual restriction to visibility by late September.

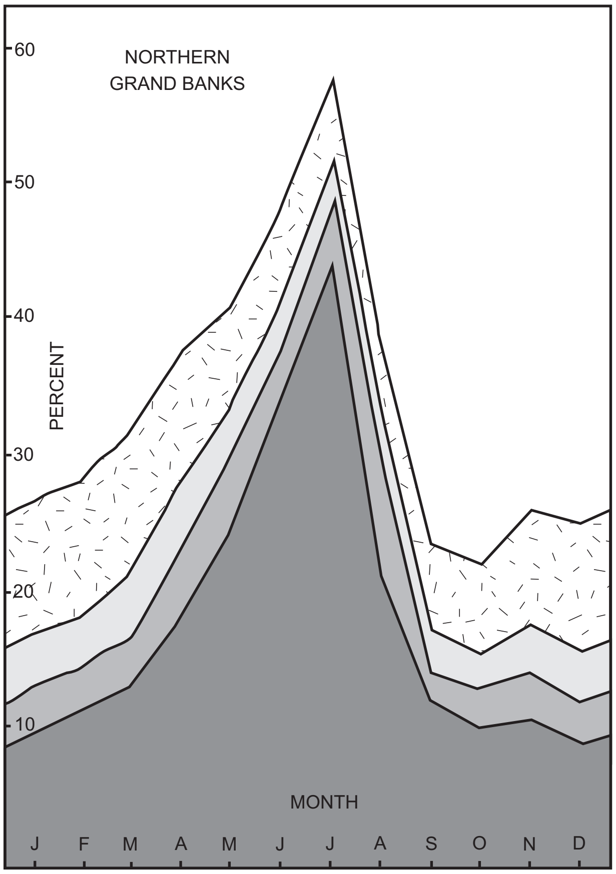
284 Off **Nova Scotia**, fog and low visibility occur at sea 2 to 4 days a month in winter, but in late spring fog can be frequent and often persistent. From May to August, some 10 to 14 days a month are foggy, while in April and September the average range is 5 to 10 days. This is usually sea fog associated with southerly winds blowing over the cold waters which lie between the coast and the Gulf Stream. Low visibility is unlikely to improve until the winds veer to west or NW, unless the vessel is proceeding toward warmer waters.

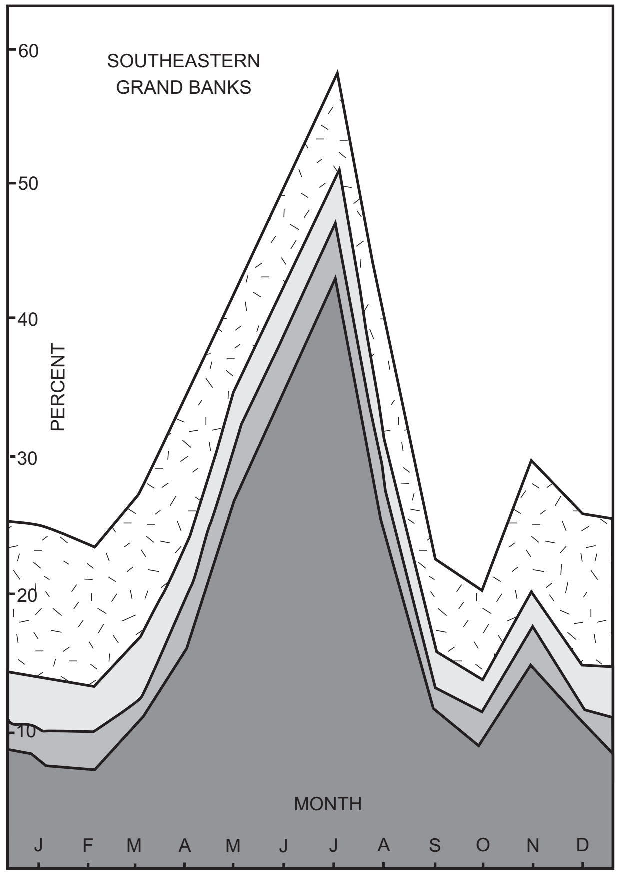
285 Locally along the coast visibility will be found to be much better to leeward of the land especially where the land is not very low lying. That is why a frequent, fog-free area is found along the NW shore of Nova Scotia in the Bay of Fundy NE of Digby *(44°38'N, 65°46'W)*, and why there is so often comparatively little fog north or NE of Grand Manan Island when there is fog elsewhere.

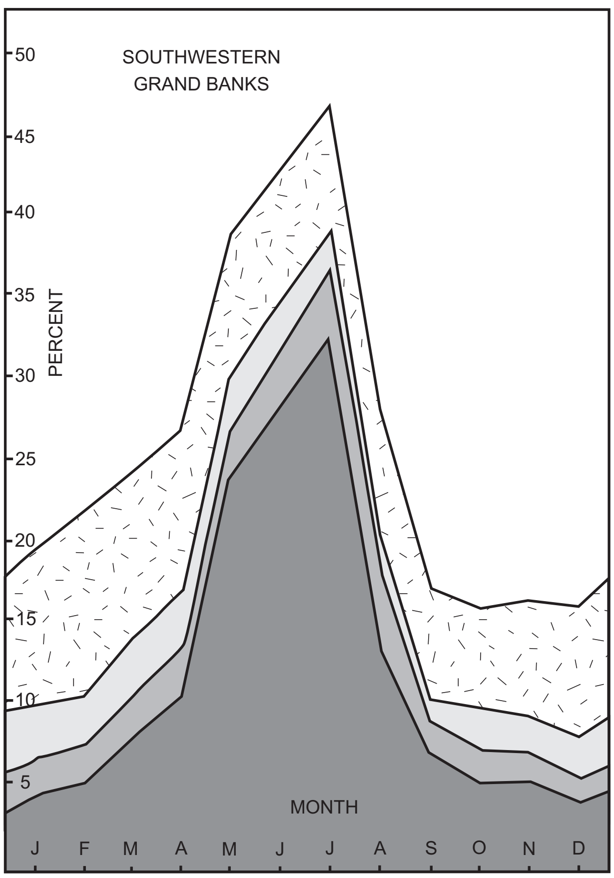
286 **Radiation fog** forms over land during the early morning, generally under clear skies and light wind conditions. It may drift over the water when light breezes develop from land during the night. It is primarily a problem in harbours and estuaries. Radiation fog rarely spreads far out to sea and often lifts off the water surface to form low stratus clouds.



Source: Environment Canada



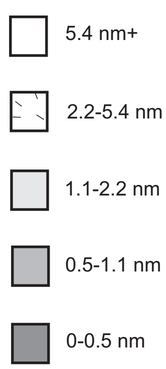




GRAND BANKS OF NEWFOUNDLAND

RECORD OF VISIBILITY
1855 - 1981

VISIBILITY




INTERPRETATION

Average visibilities for the SW part of The Grand Banks of Newfoundland during the month of July, between 1855 - 1981:

| | |
|---|---|
| 0-0.5 nm | 32% of the time |
| 0.5-1.1 nm | 4% of the time |
| 1.1-2.2 nm | 2% of the time |
| 2.2-5.4 nm | 8% of the time |
| 5.4 nm+ | 53% of the time |

Source: Atmospheric Environment Service, Environment Canada

After sunrise, the fog burns off over the land then clears more slowly over the water.

287 Off Nova Scotia, the visibility is also reduced with snowfalls that occur approximately 10 days per month from December to March.

288 In the **Gulf of St. Lawrence**, fog is most prevalent from mid-spring to early summer. As summer approaches, water temperatures move toward warmer values, reaching their peak in late August or early September. As this happens, the frequency of fog diminishes.

289 Of a different nature, **sea smoke** is sometimes produced in winter if very cold air passes over relatively warmer open water when winds are light. At such times, evaporation from the water is cooled into fog droplets in the first few metres above the water surface restricting visibility. Such conditions are seldom persistent, as any increase in the wind strength will set up air currents which dissipate the mist.

290 Visibility is reduced to 1 mile or less by fog, mist or precipitation 5 to 10% of the time through the year. In the east part of the Gulf, including Cabot Strait and the Strait of Belle Isle, visibility of 1 mile or less averages from about 5% of the time in autumn to between 10 and 15% of the time from February to late July.

291 Average conditions in the SE gulf show that visibility is reduced to 1 mile or less about 10% of the time in March and April, but only about 3 to 5% of the time in most other months. In the NW gulf, including the estuary, poor visibility occurs over 10% of the time in February, March and April, and again in July, while in other months, the frequency averages 6 to 7% of the time.

292 Fog is frequent in the summer months in the lower part of the **St. Lawrence River** because of the relative coolness of the water surface. The effect is intensified and the fog thicker and more persistent in flows of warm moist air from the SW. This type of fog may persist even with moderate winds. Above Québec City, fog is more likely to occur in the autumn as patches along the river in the early morning and in light or calm winds.

293 **Note**. — Tables that contain summarized meteorological observations recorded at land stations of the Atlantic coast are found in the *Sailing Directions* booklets of the various regions.

## Sail Plan

Adapted from Transport Canada Publication TP 511E.

Fill out a sail plan for every boating trip you take and file it with a responsible person. Upon arrival at your destination, be sure to close (or deactivate) the sail plan. Forgetting to do so can result in an unwarranted search for you.

# Sail Plan

### Owner Information

Name: ____________________

Address: ____________________

Telephone Number: ____________ Emergency Contact Number: ____________

### Boat Information

Boat Name: ____________ Licence or Registration Number: ____________

Sail: ________ Power: ________ Length: ________ Type: ________

Colour Hull: ________ Deck: ________ Cabin: ________

Engine Type: ____________ Distinguishing Features: ____________

### Communications

Radio Channels Monitored: HF: ☐ VHF: ☐ MF: ☐

MMSI (Maritime Mobile Service Identity) Number: ____________

Satellite or Cellular Telephone Number: ____________

### Safety Equipment on Board

Lifejackets and PFD's *(include number)*: ____________

Liferafts (include type and colour): ________ Dinghy or Small Boat *(include colour)*: ____________

Flares (include number and type): ____________

Other Safety Equipment: ____________

### Trip Details — Update These Details Every Trip

Date of Departure: ____________ Time of Departure: ____________

Leaving From: ____________ Heading To: ____________

Proposed Route: ____________ Estimated Date and Time of Arrival: ____________

Stopover Points (include date and time): ____________

____________ Number of People on Board: ____________

**Search and Rescue Telephone Number:** ____________

The responsible person should contact the nearest Joint Rescue Coordination Centre (JRCC) or Maritime Rescue Sub-Centre (MRSC) if the vessel becomes overdue.

Act smart and call early in case of emergency. The sooner you call, the sooner help will arrive.

**JRCC Victoria (British Columbia and Yukon)** 1-800-567-5111
+1-250-413-8933 (Satellite, Local or out of area)
# 727 (Cellular)
+1-250-413-8932 (fax)
jrccvictoria@sarnet.dnd.ca (Email)

**JRCC Trenton (Great Lakes and Arctic)** 1-800-267-7270
+1-613-965-3870 (Satellite, Local or Out of Area)
+1-613-965-7279 (fax)
jrcctrenton@sarnet.dnd.ca (Email)

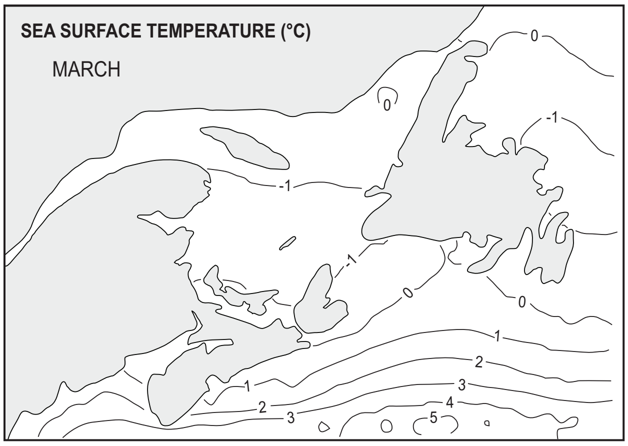
**MRSC Québec (Quebec Region)** 1-800-463-4393
+1-418-648-3599 (Satellite, Local or out of area)
+1-418-648-3614 (fax)
mrscqbc@dfo-mpo.gc.ca (Email)

**JRCC Halifax (Maritimes Region)** 1-800-565-1582
+1-902-427-8200 (Satellite, Local or out of area)
+1-902-427-2114 (fax)
jrcchalifax@sarnet.dnd.ca (Email)

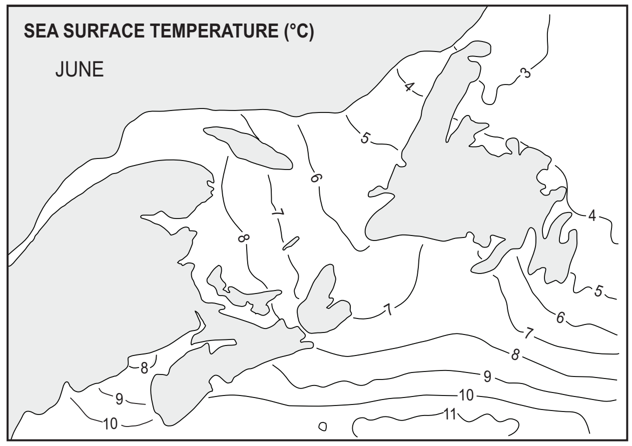
**MRSC St. John's (Newfoundland and Labrador Region)** 1-800-563-2444
+1-709-772-5151 (Satellite, Local or out of area)
+1-709-772-2224 (fax)
mrscsj@sarnet.dnd.ca (Email)

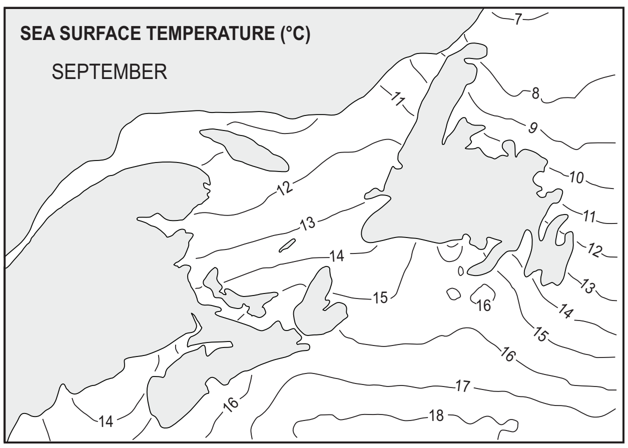
## MCTS Sail Plan Service

Marine Communications and Traffic Services Centres provide a sail plan processing and alerting service. Mariners are encouraged to file Sail Plans with a responsible person. In circumstances where this is not possible, Sail Plans may be filed with any MCTS Centre by telephone or marine radio only. Should a vessel on a Sail Plan fail to arrive at its destination as expected, procedures will be initiated which may escalate to a full search and rescue effort. Participation in this program is voluntary. *See Canadian Radio Aids to Marine Navigation.*

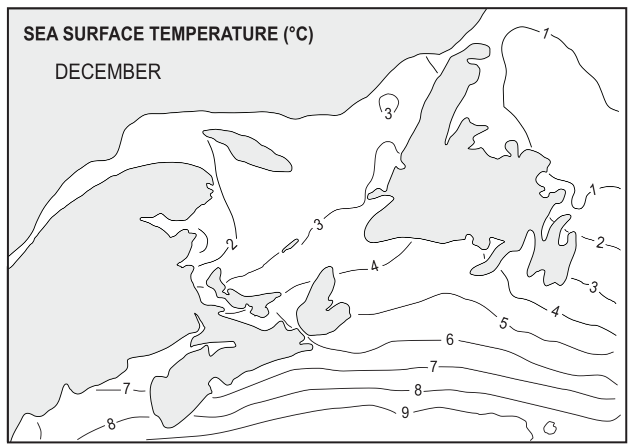



Source: Marine Environment Data Services




Source: Marine Environment Data Services

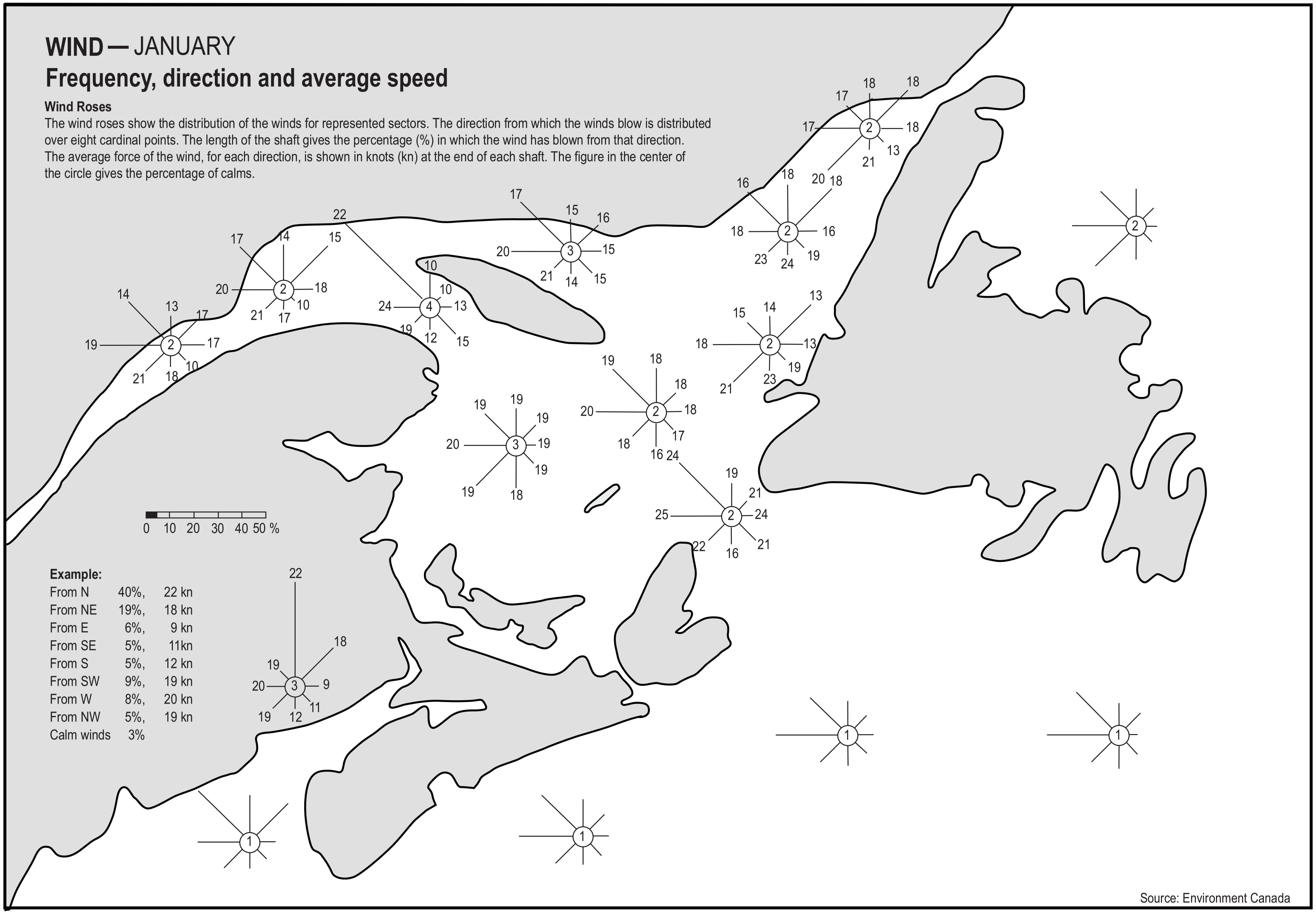


## WIND — JANUARY

### Frequency, direction and average speed

**Wind Roses**

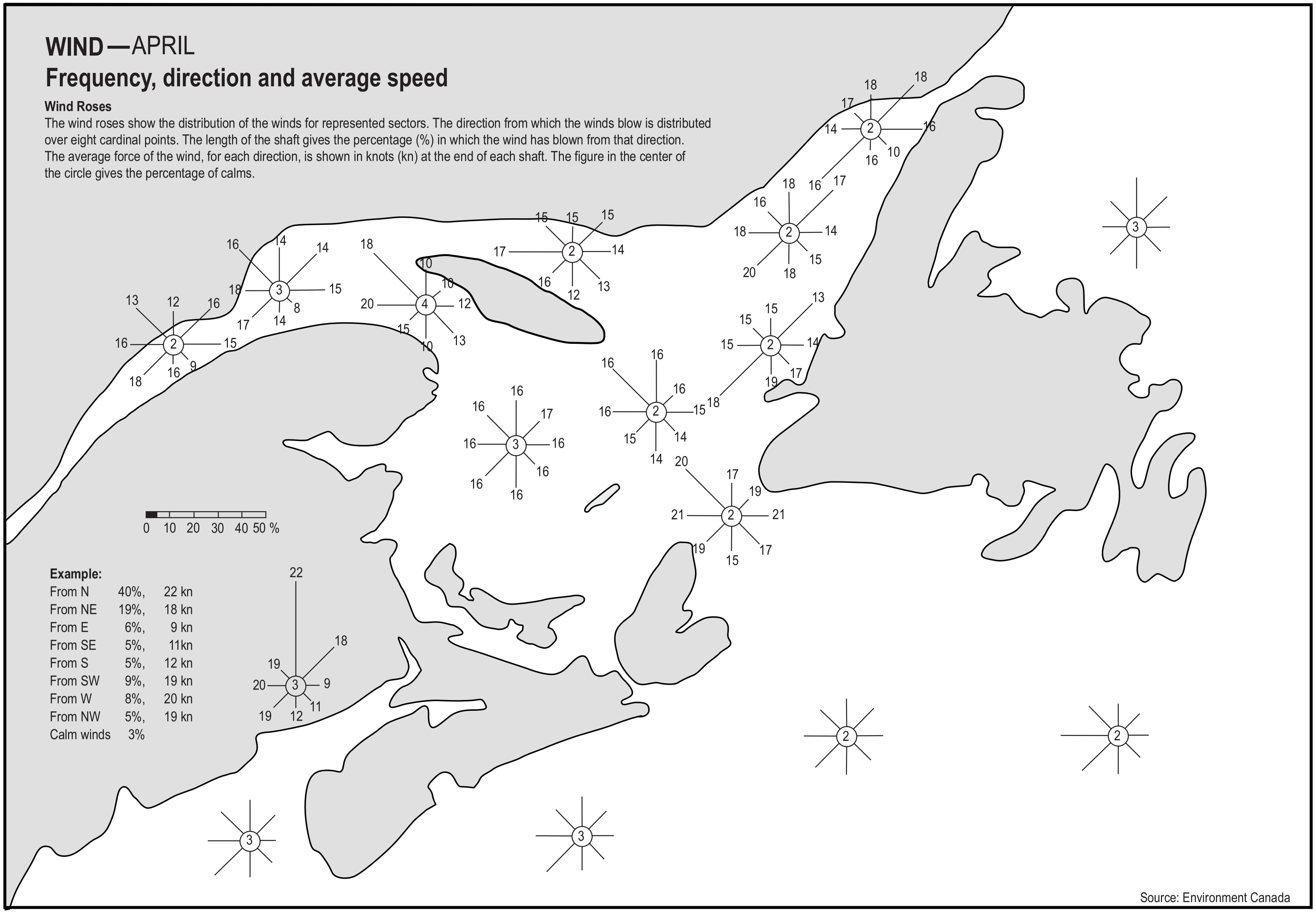
The wind roses show the distribution of the winds for represented sectors. The direction from which the winds blow is distributed over eight cardinal points. The length of the shaft gives the percentage (%) in which the wind has blown from that direction. The average force of the wind, for each direction, is shown in knots (kn) at the end of each shaft. The figure in the center of the circle gives the percentage of calms.




**Example:**

| | | |
|---|---|---|
| From N | 40%, | 22 kn |
| From NE | 19%, | 18 kn |
| From E | 6%, | 9 kn |
| From SE | 5%, | 11kn |
| From S | 5%, | 12 kn |
| From SW | 9%, | 19 kn |
| From W | 8%, | 20 kn |
| From NW | 5%, | 19 kn |
| Calm winds | 3% | |

Source: Environment Canada




## WIND — APRIL

## Frequency, direction and average speed

**Wind Roses**

The wind roses show the distribution of the winds for represented sectors. The direction from which the winds blow is distributed over eight cardinal points. The length of the shaft gives the percentage (%) in which the wind has blown from that direction. The average force of the wind, for each direction, is shown in knots (kn) at the end of each shaft. The figure in the center of the circle gives the percentage of calms.

**Example:**

| | | |
|---|---|---|
| From N | 40%, | 22 kn |
| From NE | 19%, | 18 kn |
| From E | 6%, | 9 kn |
| From SE | 5%, | 11kn |
| From S | 5%, | 12 kn |
| From SW | 9%, | 19 kn |
| From W | 8%, | 20 kn |
| From NW | 5%, | 19 kn |
| Calm winds | 3% | |

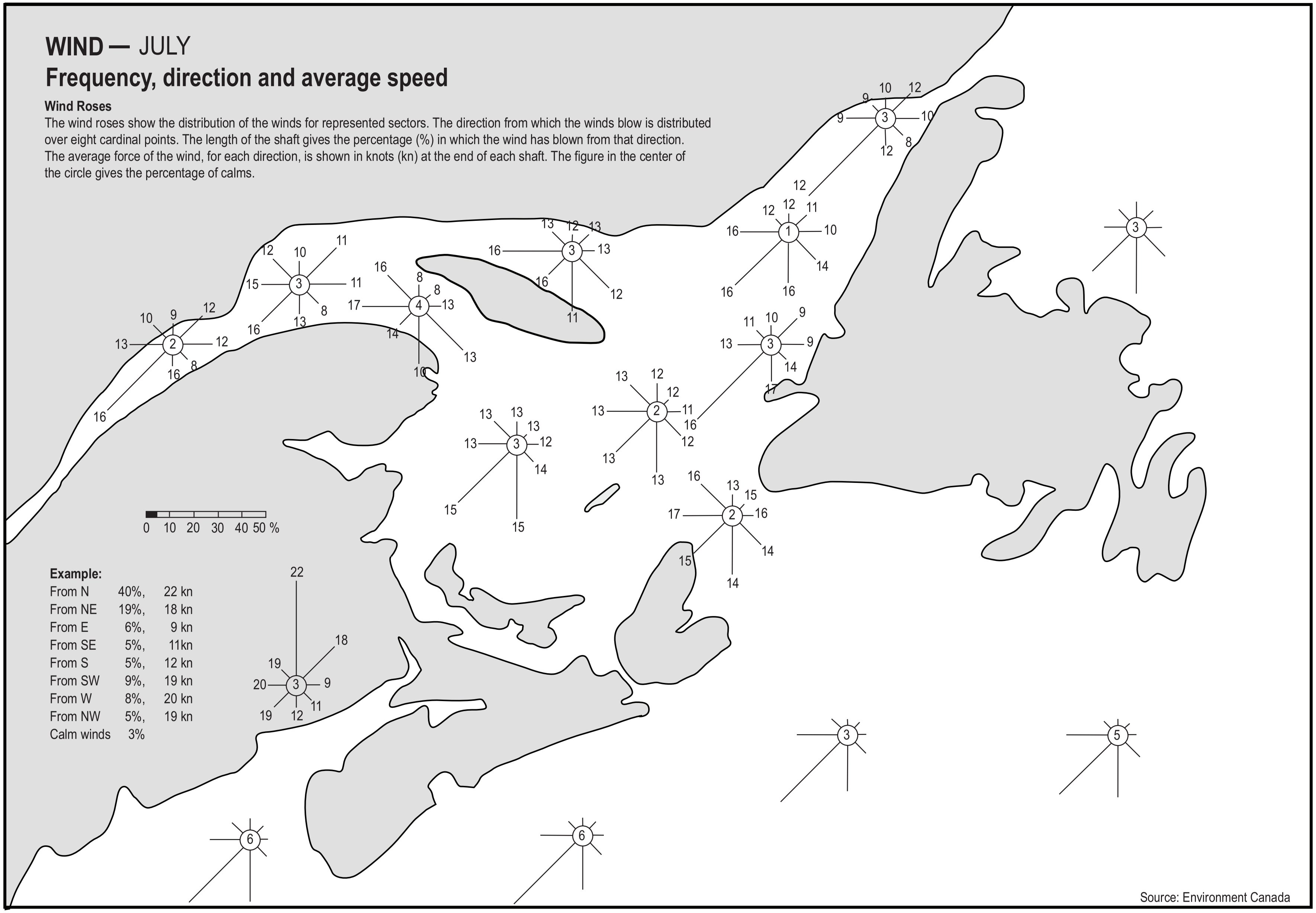
Source: Environment Canada

## WIND — JULY

### Frequency, direction and average speed

**Wind Roses**

The wind roses show the distribution of the winds for represented sectors. The direction from which the winds blow is distributed over eight cardinal points. The length of the shaft gives the percentage (%) in which the wind has blown from that direction. The average force of the wind, for each direction, is shown in knots (kn) at the end of each shaft. The figure in the center of the circle gives the percentage of calms.




**Example:**

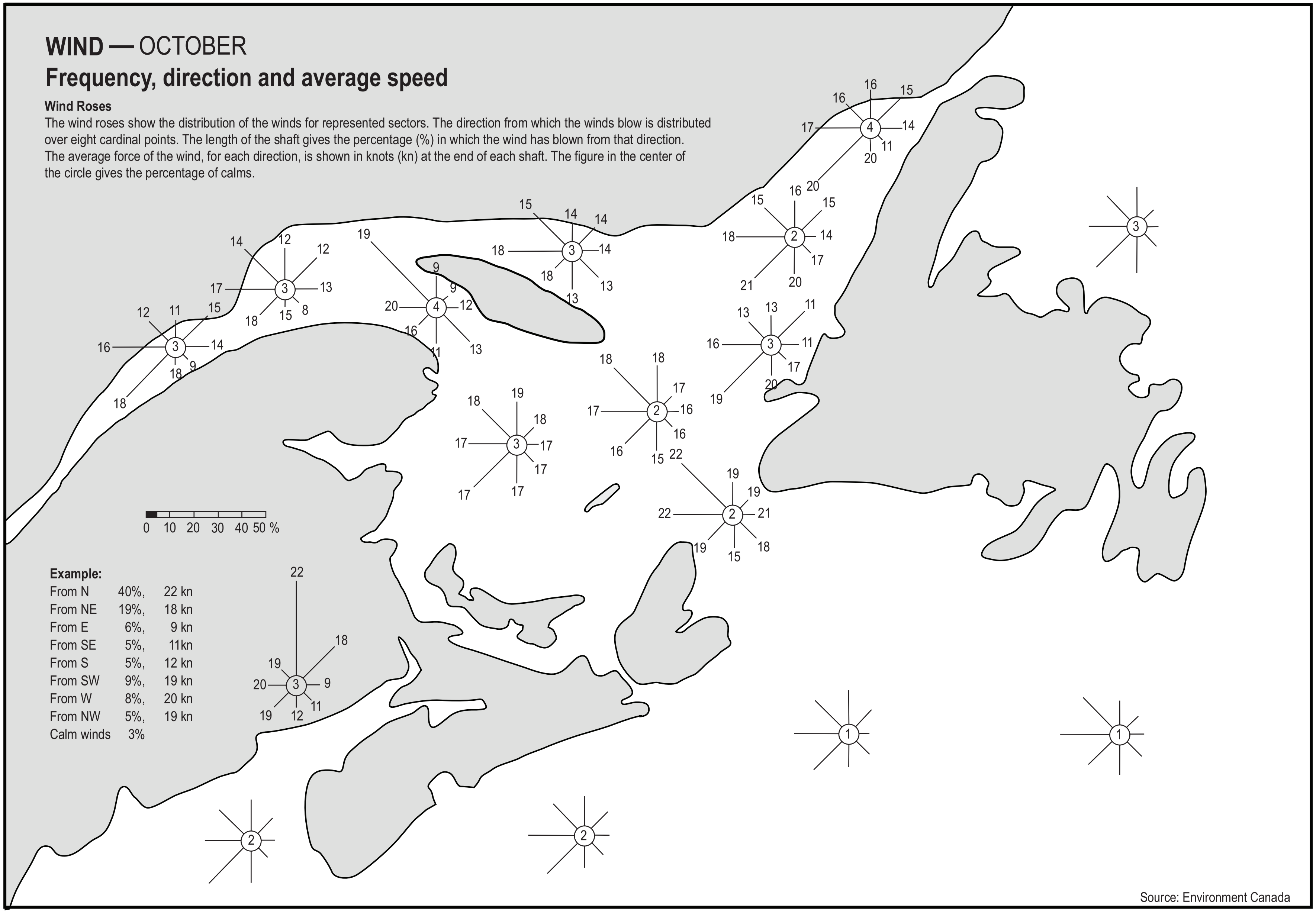
| | | |
|---|---|---|
| From N | 40%, | 22 kn |
| From NE | 19%, | 18 kn |
| From E | 6%, | 9 kn |
| From SE | 5%, | 11kn |
| From S | 5%, | 12 kn |
| From SW | 9%, | 19 kn |
| From W | 8%, | 20 kn |
| From NW | 5%, | 19 kn |
| Calm winds | 3% | |

Source: Environment Canada

## WIND — OCTOBER
## Frequency, direction and average speed

**Wind Roses**

The wind roses show the distribution of the winds for represented sectors. The direction from which the winds blow is distributed over eight cardinal points. The length of the shaft gives the percentage (%) in which the wind has blown from that direction. The average force of the wind, for each direction, is shown in knots (kn) at the end of each shaft. The figure in the center of the circle gives the percentage of calms.




**Example:**

| | | |
|---|---|---|
| From N | 40%, | 22 kn |
| From NE | 19%, | 18 kn |
| From E | 6%, | 9 kn |
| From SE | 5%, | 11kn |
| From S | 5%, | 12 kn |
| From SW | 9%, | 19 kn |
| From W | 8%, | 20 kn |
| From NW | 5%, | 19 kn |
| Calm winds | 3% | |

Source: Environment Canada

Pêches et Océans Canada
Région du Québec
Gestion des pêches
Conservation et Protection

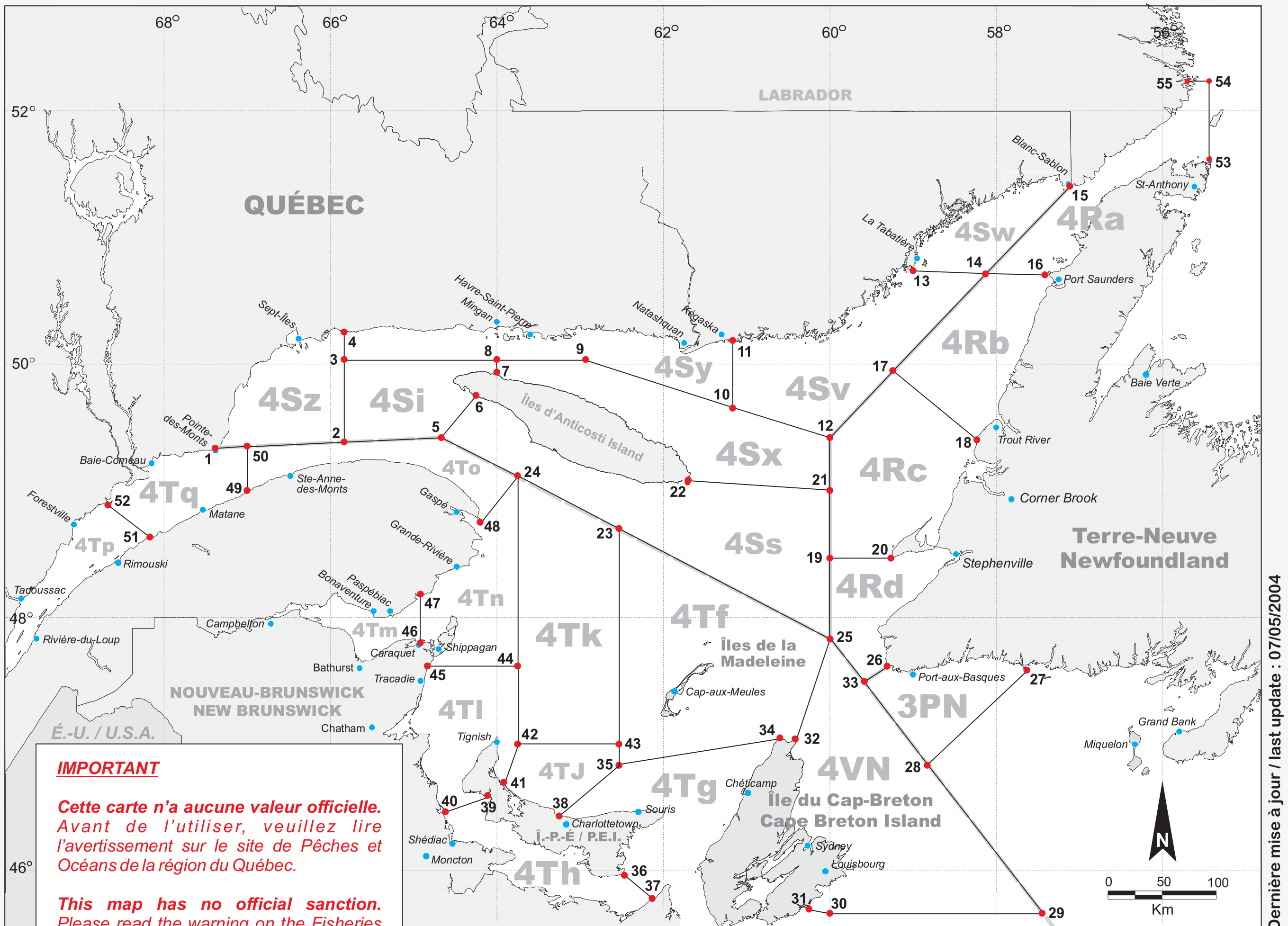
Fisheries and Oceans Canada
Quebec Region
Fisheries Management
Conservation and Protection

SECTEUR / SECTOR

# Régions du Québec et du Golfe / Quebec and Gulf Regions

DIVISIONS et SECTEURS / DIVISIONS and SECTORS :

## OPANO / NAFO




**IMPORTANT**

***Cette carte n'a aucune valeur officielle.*** *Avant de l'utiliser, veuillez lire l'avertissement sur le site de Pêches et Océans de la région du Québec.*

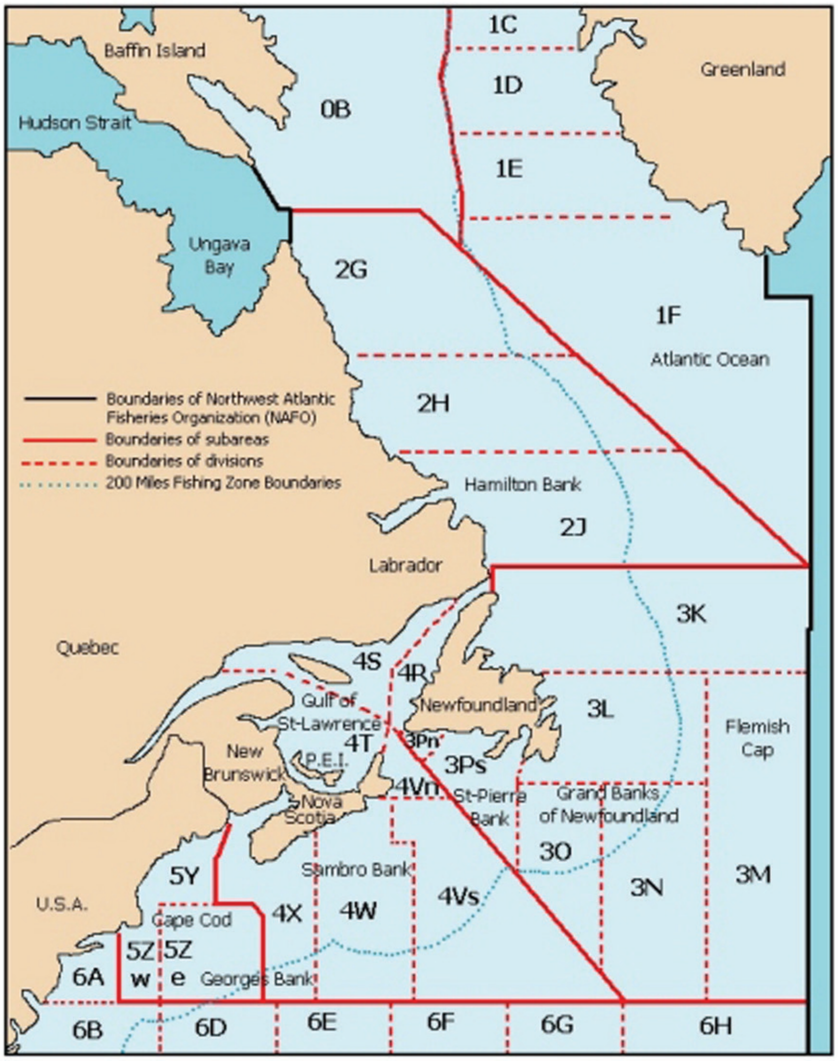
***This map has no official sanction.*** *Please read the warning on the Fisheries and Oceans Web site of the Quebec Region before using it.*

**d**: degré / degree **m**: minute **s**: seconde

| Points | LATITUDE NORD / NORTH d m s | LONGITUDE OUEST / WEST d m s |
|---|---|---|
| 01 | 49 20 00 | 67 23 00 |
| 02 | 49 23 00 | 65 50 00 |
| 03 | 50 02 00 | 65 50 00 |
| 04 | 50 15 00 | 65 50 00 |
| 05 | 49 25 00 | 64 40 00 |
| 06 | 49 45 00 | 64 15 00 |
| 07 | 49 56 00 | 64 00 00 |
| 08 | 50 02 00 | 64 00 00 |
| 09 | 50 02 00 | 62 56 00 |
| 10 | 49 39 00 | 61 10 00 |
| 11 | 50 11 00 | 61 10 00 |
| 12 | 49 25 00 | 60 00 00 |
| 13 | 50 44 00 | 59 00 00 |
| 14 | 50 43 00 | 58 09 00 |
| 15 | 51 24 00 | 57 07 00 |
| 16 | 50 42 00 | 57 25 00 |
| 17 | 49 57 00 | 59 15 00 |
| 18 | 49 24 00 | 58 14 00 |
| 19 | 48 28 00 | 60 00 00 |
| 20 | 48 28 00 | 59 16 00 |
| 21 | 49 00 00 | 60 00 00 |
| 22 | 49 05 00 | 61 42 00 |
| 23 | 48 42 00 | 62 32 00 |
| 24 | 49 07 00 | 63 45 00 |
| 25 | 47 50 00 | 60 00 00 |
| 26 | 47 37 00 | 59 19 00 |
| 27 | 47 35 00 | 57 38 00 |
| 28 | 46 50 00 | 58 50 00 |
| 29 | 45 40 00 | 57 27 00 |
| 30 | 45 40 00 | 60 00 00 |
| 31 | 45 42 00 | 60 15 00 |
| 32 | 47 02 15 | 60 24 55 |
| 33 | 47 30 00 | 59 35 00 |
| 34 | 47 03 00 | 60 36 00 |
| 35 | 46 50 00 | 62 32 00 |
| 36 | 45 58 00 | 62 28 00 |
| 37 | 45 47 00 | 62 08 00 |
| 38 | 46 26 00 | 63 15 00 |
| 39 | 46 35 00 | 64 06 00 |
| 40 | 46 28 00 | 64 37 00 |
| 41 | 46 42 00 | 63 55 00 |
| 42 | 47 00 00 | 63 45 00 |
| 43 | 47 00 00 | 62 32 00 |
| 44 | 47 37 00 | 63 45 00 |
| 45 | 47 37 00 | 64 50 00 |
| 46 | 47 48 00 | 64 55 00 |
| 47 | 48 11 00 | 64 55 00 |

| POINTS | d m s | d m s |
|---|---|---|
| 48 | 48 45 00 | 64 12 00 |
| 49 | 49 00 00 | 67 00 00 |
| 50 | 49 21 00 | 67 00 00 |
| 51 | 48 38 00 | 68 10 00 |
| 52 | 48 53 00 | 68 40 00 |
| 53 | 51 38 00 | 55 26 00 |
| 54 | 52 15 00 | 55 25 00 |
| 55 | 52 15 00 | 55 41 00 |

Fishing Zone Boundaries



# Gulf of St. Lawrence
# Protection of the North Atlantic Right Whales

Due to the changing migratory habits of North Atlantic right whales and their increasing presence in the Gulf of St. Lawrence, the *Government of Canada* has implemented seasonal speed restrictions in certain defined areas. These restrictions consist of a combination of a static zone and dynamic areas of speed reduction.

These measures will be in effect on a seasonal basis and subject to change. Refer to the complete Notice in Notices to Mariners, Section 1, for exact periods of implementation of these measures. After the lifting of the mandatory speed limits, vessels are encouraged to voluntarily reduce their speed over the ground so as not to exceed 10.0 knots when the presence of North Atlantic right whales is confirmed and in so far as maritime conditions permit the safe operation of their vessel at this speed.

**Static Protected Area**

Within this **static zone** a ground speed restriction will be imposed for vessels 20 m or longer to a maximum of 10 knots when travelling in the western Gulf of St. Lawrence. The speed restriction zone may be changed as the whales migrate through the area. See the complete Notice in Notices to Mariners, Section 1, for the coordinates of the static zone.

**Temporary speed restriction in shipping lanes**

Within these **dynamic areas**, vessels may operate at a safe operating speed for as long as the *Government of Canada* has not confirmed the presence of whales in these areas. When right whales are spotted in one of these dynamic areas, vessels of 20 m or more in length will receive a Notice to Shipping (NOTSHIP) and will have to reduce their ground speed to 10.0 knots or less as they navigate the sector in question. Refer to the complete Notice in Notices to Mariners, Section 1 for dynamic zones coordinates.

Speed restrictions in dynamic areas will be in effect for a period of 15 days from the date of application. This period can be extended if the presence of whales continues. The implementation of the zones and speed reduction areas will be announced through the NOTSHP broadcasts.

**NOTSHIP Broadcasts**

The *Canadian Coast Guard (CCG)* continues to promulgate valid NOTSHIPs through radio broadcasts on various terrestrial systems and also online at http://www.ccg-gcc.gc.ca/navigating-hub. Mariners must ensure that they have the correct and up-to-date information on the protection of North Atlantic right whales in all Notices to Mariners (NOTMAR) and NOTSHIPs.

**Aids to navigation**

In addition, CCG is testing the use of virtual AIS aids to navigation (AIS AtoN), NOTMAR 819(T)/2016 refers, which will notify automatically a mariner of a dynamic sector that is subject to a speed reduction. Each dynamic sector will be delimited by four virtual AIS AtoN which will be displayed on ship's navigation equipment such as: ECDIS, ECS, RADAR, Minimum Keyboard Display, Electronic Nautical Charts. The virtual ~~aids~~ AIS AtoN will be broadcasted only when speed reduction is in effect in one or more sector. The mariner is required to select the virtual AIS AtoN symbol to view a message such as: SectA1 Spd Lim 10 kt. This message refers to a speed reduction in effect for a specific sector. As this system continues to be in the testing phase, it is not the primary means of communicating with the mariner.

**Conformity and application of the law**

Failure to comply with mandatory speed restrictions could lead to enforcement action and subject to fines ranging from CAN$6,000 to CAN$25,000. If vessels appear to have violated the speed restriction, *Transport Canada Marine Safety* Inspectors will review all information provided through AIS and seek information from the master.

Exemptions to the speed restrictions will not be granted in advance; however, factors such as navigation to ensure vessel safety, weather conditions, and responding to emergencies, will be reviewed and considered.

**To report whales in distress**

Mariners are requested to report all observations of entangled, dead, or injured whales to the nearest *CCG Marine Communication and Traffic Services* Centre; or as follows:

For the southern Gulf of St. Lawrence region:
Marine Animal Response Society at 1-866-567-6277
For Newfoundland and Labrador:
Whale Release and Strandings at 1-888-895-3003
For the Quebec sector:
Marine Mammal Emergencies at 1-877-722-5346

Sightings of live, free-swimming whales should be reported by phone to 1-902-440-8611 or 1-844-800-8568 or by email: XMARWHALESIGHTINGS@DFO.

C = Chapter/P = Paragraph

C = Chapter/P = Paragraph

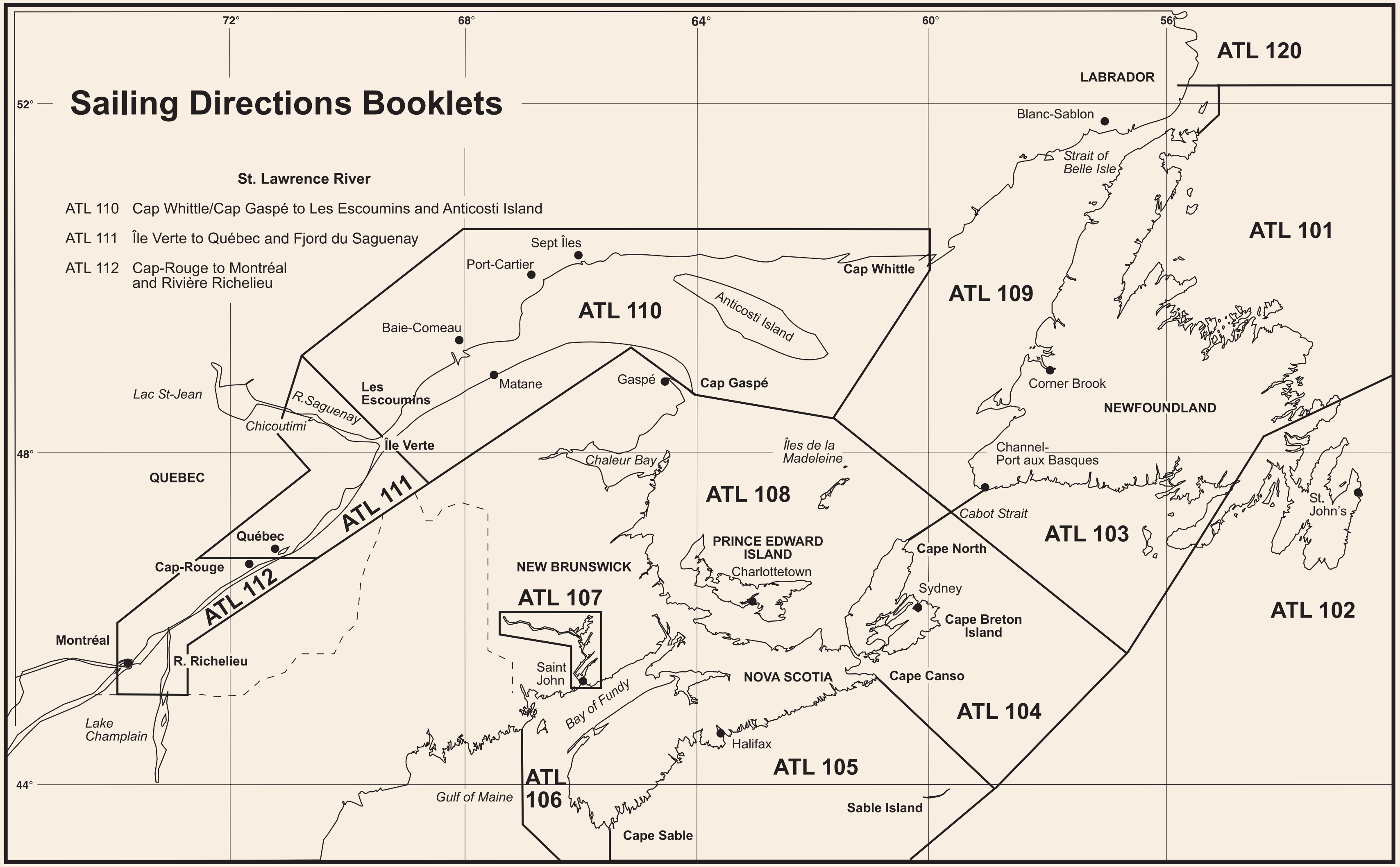
# Sailing Directions Booklets

## St. Lawrence River

ATL 110 Cap Whittle/Cap Gaspé to Les Escoumins and Anticosti Island

ATL 111 Île Verte to Québec and Fjord du Saguenay

ATL 112 Cap-Rouge to Montréal and Rivière Richelieu




## Newfoundland and Labrador

ATL 101 Northeast and East Coasts

ATL 102 East and South Coasts

ATL 103 Southwest Coast

ATL 120 Camp Islands to Hamilton Inlet (including Lake Melville)

## Nova Scotia (Atlantic Coast) and Bay of Fundy

ATL 104 Cape North to Cape Canso (including Bras d'Or Lake)

ATL 105 Cape Canso to Cape Sable (including Sable Island)

ATL 106 Gulf of Maine and Bay of Fundy

ATL 107 Saint John River

## Gulf of St. Lawrence

ATL 108 Gulf of St. Lawrence (Southwest Portion)

ATL 109 Gulf of St. Lawrence (Northeast Portion)

ATL 100 General Information, Atlantic Coast