

# CHAPTER I



## GENERAL TERMINOLOGY

- Floating Ice
- Stages of Development of Sea Ice
- Stages of Development of Lake Ice
- River Ice
- Ice of Land Origin
- Forms of Ice
- Arrangement of the Ice
- Ice Surface Features
- Stages of Melting
- Terms Related to Navigation



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**Photo I.1:** Fast ice forming in harbour

### I.1 Floating Ice

Any form of ice found floating in water. The principal kinds of floating ice are lake ice, river ice and sea ice which form by the freezing of water at the surface and glacier ice formed on land or in an ice shelf. This term includes ice that is stranded or grounded.

<b>Sea Ice:</b>	Any form of ice found at sea which has originated from the freezing of seawater.
<b>Lake Ice:</b>	Ice formed on a lake, regardless of observed location.
<b>River Ice:</b>	Ice formed on a river, regardless of observed location.
<b>Ice of Land Origin:</b>	Ice formed on land or in an ice shelf, found floating in water.



## 1.2 Stages of Development of Sea Ice

**1.2.1 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 while they are afloat.

**Frazil Ice:** Fine spicules or plates of ice suspended in water.

**Grease Ice:** A later stage of freezing than frazil ice where the crystals have coagulated to form a soupy layer on the surface. Grease ice reflects little light, giving the water a matte appearance.

**Slush:** Snow which is saturated and mixed with water on land or ice surfaces or as a viscous floating mass in water after a heavy snowfall.

**Shuga:** An accumulation of spongy white ice lumps having a diameter of a few centimetres across; they are formed from grease ice or slush and sometimes from anchor ice rising to the surface.

**1.2.2 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 in thickness and may be subdivided into dark nilas and light nilas.

**Dark Nilas:** Nilas up to 5 cm in thickness and which is very dark in colour.

**Light Nilas:** Nilas which is more than 5 cm in thickness and lighter in colour than dark nilas.

**Ice Rind:** A brittle, shiny crust of ice formed on a quiet surface by direct freezing or from grease ice, usually in water of low salinity. It has a thickness of about 5 cm. Easily broken by wind or swell, commonly breaking into rectangular pieces.

**1.2.3 Young Ice:** Ice in the transition stage between nilas and first-year ice, 10-30 cm in thickness. May be subdivided into grey ice and grey-white ice.

**Grey Ice:** Young ice 10-15 cm thick, less elastic than nilas and breaks on swell. It usually rafts under pressure.

**Grey-White Ice:** Young ice 15-30 cm thick. Under pressure it is more likely to ridge than to raft.



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**Photo 1.2:** Very close pack light nilas and new ice



**1.2.4 First-year Ice:** Sea ice of not more than one winter's growth, developing from young ice; 30 cm or greater. It may be subdivided into thin first-year ice – **sometimes referred to as white ice** –, medium first-year ice and thick first-year ice.



Don Isaacs (CIS)

**Photo 1.3:** Container ship tracking through a large pan of thin first-year ice

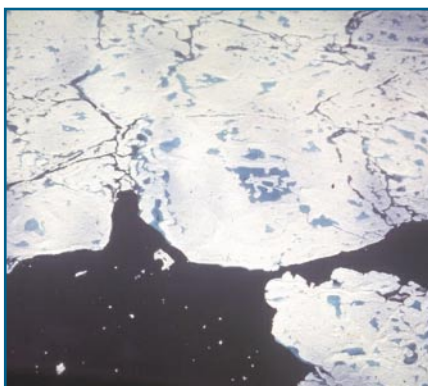
**Thin First-year Ice/White Ice - First Stage:** 30-50 cm thick.

**Thin First-year Ice/White Ice - Second Stage:** 50-70 cm thick.

**Medium First-year Ice:** 70-120 cm thick.

**Thick First-year Ice:** Greater than 120 cm thick.

**1.2.5 Old Ice:** Sea ice which has survived at least one summer's melt. Topographic features generally are smoother than first-year ice. It may be subdivided into second-year ice and multi-year ice.



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**Photo 1.4:** Large pans of old ice showing drainage pattern and puddling

**Second-year Ice:** Old ice which has survived only one summer's melt. Thicker than first-year ice, it stands higher out of the water. In contrast to multi-year ice, summer melting produces a regular pattern of numerous small puddles. Bare patches and puddles are usually greenish-blue.

**Multi-year Ice:** Old ice which has survived at least two summer's melt. Hummocks are smoother than on second-year ice and the ice is almost salt-free. Where bare, this ice is usually blue in colour. The melt pattern consists of large interconnecting, irregular puddles and a well-developed drainage system.



### 1.3 Stages of Development of Lake Ice

- New Lake Ice:** Recently formed ice less than 5 cm thick.
- Thin Lake Ice:** 5-15 cm thick.
- Medium Lake Ice:** 15-30 cm thick.
- Thick Lake Ice:** 30-70 cm thick.
- Very Thick Lake Ice:** Greater than 70 cm thick.

### 1.4 River Ice

Because of the effect of salinity on the ice formation process, ice shall be coded as follows: ice which forms in water with a salinity of more than 24.7 parts per thousand will be coded as sea ice; otherwise the lake ice code is used. In the St. Lawrence River it is Canadian practice to use sea ice terminology down river from St. Lambert lock and lake ice terminology up river from St. Lambert lock, unless otherwise noted.

### 1.5 Ice of Land Origin

#### 1.5.1 Terminology

**Firn:** Old snow which has recrystallized into a dense material. Unlike ordinary snow, particles are to some extent joined together; but, unlike ice, the air spaces in it still connect with each other.

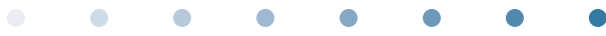
**Glacier Ice:** Ice in or originating from a glacier, whether on land or floating on the sea as icebergs, bergy bits, growlers or ice islands.

**Glacier:** A mass of snow and ice continuously moving from higher to lower ground or, if afloat, continuously spreading. The principal forms of glaciers are: inland ice sheets, ice shelves, ice streams, ice caps, ice piedmonts, cirque glaciers and various types of mountain (valley) glaciers.

**Ice Wall:** An ice cliff forming the seaward margin of a glacier which is aground. The rock basement being at or below sea level (see “ice front”, below). The term also includes the seaward face of non-active glaciers.

**Ice Stream:** Part of an inland ice sheet in which the ice flows more rapidly and not necessarily in the same direction as the surrounding ice. Margins are sometimes clearly marked by a change in direction of the surface slope but may be indistinct.

**Glacier Tongue:** Projecting seaward extension of a glacier, usually afloat. In the Antarctic, glacier tongues may extend over many tens of kilometres.



**Iceberg Tongue:** A major accumulation of icebergs projecting from the coast, held in place by grounding and joined together by fast ice.

**Ice Shelf:** A floating ice sheet of considerable thickness showing 2 m or more above sea level, attached to the coast. They usually have great horizontal extent and a level or gently undulating surface. Ice shelf growth occurs by annual snow accumulation and also by the seaward extension of land glaciers. Limited areas may be aground. The seaward edge is termed an ice front.

**Ice Front:** The vertical cliff forming the seaward face of an ice shelf or other floating glacier, varying in height from 2 to 50 m or more above sea level.

**Calving:** The breaking away of a mass of ice from an ice wall, ice front or iceberg.

**Iceberg:** A massive piece of ice of greatly varying shape, protruding 5 m 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. Sizes of icebergs are classed as small, medium, large and very large.

### 1.5.2 Shapes of Calved Ice of Land Origin

**Tabular Iceberg:** A flat-topped iceberg. Most show horizontal banding.

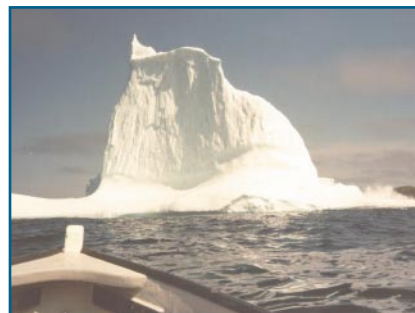
**Domed Iceberg:** An iceberg which is smooth and rounded on top.

**Pinnacled Iceberg:** An iceberg with a central spire or pyramid, with one or more spires.

**Wedged Iceberg:** An iceberg which is rather flat on top and with steep vertical sides on one end, sloping to lesser sides on the other end.

**Drydocked Iceberg:** An iceberg which is eroded such that a U-shaped slot is formed near or at water level, with twin columns or pinnacles.

**Blocky Iceberg:** A flat-topped iceberg with steep vertical sides.



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Photo 1.5: Pinnacled iceberg

### 1.5.3 Sizes of Calved Ice of Land Origin

**Growler:** Smaller than a bergy bit and extending less than 1 m above the sea surface and normally occupying an area of about 20 sq. m. A growler appears white in colour and is difficult to distinguish when surrounded by sea ice.

**Bergy Bit:** A piece of glacier ice, generally showing 1 to less than 5 m above sea level, with a length of 5 to less than 15 m. They normally have an area of 100-300 sq. m.



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**Photo 1.6:** Ice island fragment seen from the air.

**Small Iceberg:** A piece of glacier ice extending 5 to 15 m above sea level and with a length of 15 to 60 m.

**Medium Iceberg:** A piece of glacier ice extending 16 to 45 m above sea level and with a length of 61 to 120 m.

**Large Iceberg:** A piece of glacier ice extending 46 to 75 m above sea level and with a length of 121 to 200 m.

**Very Large Iceberg:** A piece of glacier ice extending more than 75 m above sea level and with a length of more than 200 m.

**Ice Island:** A large piece of floating ice protruding about 5 m above sea level, which has broken away from an Arctic ice shelf. They have a thickness of 30-50 m and an area of from a few thousand square metres to 500 sq. km or more. They are usually characterized by a regularly undulating surface giving a ribbed appearance from the air.

**Ice Island Fragment:** Piece of an ice island that has broken away from the main mass.

## 1.6 Forms of Ice

**1.6.1 Pancake Ice:** Predominantly circular pieces of ice 30 cm to 3 m in diameter, up to 10 cm in thickness, with raised rims due to the pieces striking against one another. It may form on a slight swell from grease ice, shuga or slush or as a result of the breaking of ice rind, nilas or, under severe conditions of swell or waves, of grey ice. It also sometimes forms at some depth at an interface between water bodies of different physical characteristics where it floats to the surface. It may rapidly form over wide areas of water.

**1.6.2 Ice Cake:** Any relatively flat piece of ice less than 20 m across.

**Small Ice Cake:** An ice cake less than 2 m across.

**1.6.3 Floe:** Any relatively flat piece of ice 20 m or more across. Floes are subdivided according to horizontal extent as follows:

**Small:** 20-100 m across.

**Medium:** 100-500 m across.

**Big:** 500-2,000 m across.

**Vast:** 2-10 km across.

**Giant:** Greater than 10 km across.





- I.6.4 Floeberg:** A massive piece of ice composed of a hummock or a group of hummocks, frozen together and separated from any surrounding ice. They may typically protrude up to 5 m above water level.
- I.6.5 Ice Breccia:** Ice pieces of different stages of development frozen together.
- I.6.6 Batture Floes:** Large, thick, uneven and discoloured ice floes that form on the upstream side of shoals and islets in rivers when cold weather precedes or accompanies neap tides. Composed of ice of different thicknesses formed under pressure during ebb tide, the whole mass freezing together and gradually increasing in size with each successive tide. As the range increases between the neap and spring tides, large sections of grounded ice break away and drift down river. This is a Canadian description and not part of the WMO nomenclature.
- I.6.7 Brash Ice:** Accumulation of floating ice made up of fragments not more than 2 m across, the wreckage of other forms of ice.



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**Photo I.7:** View of Québec City bridges with nilas and grey ice mixed with thin brash moving down under the bridge. Extensive fast ice (battures) has formed on both sides of the river.

**Jammed Brash Barrier:** A strip or narrow belt of new, young or brash ice usually 100-5000 m across formed at the edge of either floating or fast ice or at the shore. Heavily compacted, mostly due to wind action, may extend 2 to 20 m below the surface, but does not normally have appreciable topography. Jammed brash barriers may disperse with changing winds, but can also consolidate to form a strip of unusually thick ice in comparison to the surrounding ice.

**Agglomerated Brash:** This term is similar to Jammed Brash Barrier but is not consolidated. This is a Canadian description and not part of the WMO nomenclature.

**I.6.8. Fast Ice:** Ice which forms and remains fast along the coast. It may be attached to the shore, to an ice wall, to an ice front, between shoals or grounded icebergs.

Vertical fluctuations may be observed during changes of sea level. It may be formed “in-situ” from water or by freezing of floating ice of any age to shore and can extend a few metres or several hundred kilometres from the coast. It may be more than one year old in which case it may be prefixed with the appropriate age category (old, second-year or multi-year). If higher than 2 m above sea level, it is called an ice shelf.

**Young Coastal Ice:** The initial stage of fast ice formation consisting of nilas or young ice; its width varying from a few metres up to 100-200 m from the shoreline.



**1.6.9 Icefoot:** A narrow fringe of ice attached to the coast, unmoved by tides and remaining after the fast ice has moved away.

**1.6.10 Anchor Ice:** Submerged ice attached or anchored to the bottom, irrespective of the nature of its formation.

**1.6.11 Grounded Ice:** Floating ice which is aground in shoal water.

**Stranded Ice:** Ice which had been floating and has been deposited on the shore by retreating high water.

**Grounded Hummock:** A hummocked, grounded ice formation. There are single grounded hummocks and lines (or chains) of grounded hummocks.

## 1.7 Arrangement of the Ice

**1.7.1 Drift Ice/Pack Ice:** Term used in a wide sense to include any area of 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 pack ice is normally used. When concentrations are 6/10 or less the term drift ice is normally used.

**1.7.2 Ice Cover:** The ratio of an area of ice to the total area of water surface within some large geographic locality. This locality may be global, hemispheric or prescribed by a specific oceanographic entity such as Baffin Bay or the Barents Sea.

**1.7.3 Concentration:** The ratio expressed in tenths describing the area of the water surface covered by ice as a fraction of the whole area. Total concentration includes all stages of development that are present; partial concentration refers to the amount of a particular stage or of a particular form of ice and represents only a part of the total.

**Consolidated Ice:** Floating ice in which the concentration is 10/10 and the floes are frozen together.

**Compact Ice:** Floating ice in which the concentration is 10/10 and no water is visible.

**Very Close Pack/Drift:** Floating ice in which the concentration is 9/10 to less than 10/10.

**Close Pack/Drift:** Floating ice in which the concentration is 7/10 to 8/10, composed of floes mostly in contact with one another.

**Open Drift:** Floating ice in which the concentration is 4/10 to 6/10, with many leads and polynyas. Floes generally not in contact with one another.





**Very Open Drift:** Ice in which the concentration is 1/10 to 3/10 and water dominates over ice.

**Open Water:** A large area of freely navigable water in which ice is present in concentrations less than 1/10. No ice of land origin is present.

**Bergy Water:** An area of freely navigable water in which ice of land origin is present. Other ice types may be present, although the total concentration of all other ice is less than 1/10.

**Ice Free:** No ice present. If ice of any kind is present, this term shall not be used.

#### **1.7.4 Ice Distribution:**

**Ice Field:** Area of floating ice, consisting of any size of floes and greater than 10 km across.

**Large Ice Field:** An ice field over 20 km across.

**Medium Ice Field:** An ice field 15-20 km across.

**Small Ice Field:** An ice field 10-15 km across.

**Ice Patch:** An area of ice less than 10 km across.

**Ice Massif:** A variable accumulation of pack or very close pack, covering hundreds of square kilometres and found in the same region every summer.

**Belt:** A large feature of pack/drift ice arrangement longer than it is wide; from 1 km to more than 100 km in width.

**Tongue:** A projection of the ice edge up to several kilometres in length, caused by wind or current.

**Strip:** Long narrow area of pack/drift ice, about 1 km or less in width, usually composed of small fragments detached from the main mass of ice, which run together under the influence of wind, swell or current.

**Bight:** Extensive crescent-shaped indentation in the ice edge formed by either wind or current.

**Ice Jam:** An accumulation of broken ice caught in a narrow channel.



### 1.7.5 Openings in the Ice:

**Fracture:** Any break or rupture through very close pack ice, compact ice, consolidated ice, fast ice or a single floe resulting from deformation processes. Fractures may contain brash ice and/or be covered with nilas and/or young ice. Their lengths may vary from a few metres to many kilometres.

**Fracture Zone:** An area which has a great number of fractures. Fractures are subdivided as follows:

**Very Small Fracture:** 1 to 50 m wide.

**Small Fracture:** 50 to 200 m wide.

**Medium Fracture:** 200 to 500 m wide.

**Large Fracture:** Greater than 500 m wide.

**Crack:** Any fracture of fast ice, consolidated ice or a single floe which may have been followed by separation ranging from a few centimetres to 1 m.

**Tide Crack:** Crack at the line of junction between an immovable ice foot or ice wall and fast ice, the latter subject to rise and fall of the tide.

**Flaw:** A narrow separation zone between floating ice and fast ice, where the pieces of ice are in a chaotic state. Flaws form when ice shears under the effect of a strong wind or current along the fast ice boundary.

**Lead:** Any fracture or passageway through ice which is navigable by surface vessels.

**Shore Lead:** A lead between ice and the shore or between ice and an ice front.

**Flaw Lead:** A passageway between ice and fast ice which is navigable by surface vessels.

**Polynya:** Any non-linear shaped opening enclosed by ice. May contain brash ice and/or be covered with new ice, nilas or young ice; sub-mariners refer to these as skylights.

**Shore Polynya:** A polynya between ice and the coast or between ice and an ice front.

**Flaw Polynya:** A polynya between ice and fast ice.

**Recurring Polynya:** A polynya which recurs in the same position every year.



**1.7.6 Ice Edge:** The demarcation at any given time between open water and sea, lake or river ice whether fast or drifting.

**Compacted Ice Edge:** Clear-cut ice edge compacted by wind or current, usually on the windward side of an area of ice.

**Diffuse Ice Edge:** Poorly defined ice edge limiting an area of dispersed ice, usually on the leeward side of an area of ice.

**Ice Limit:** Climatological term referring to the extreme minimum or extreme maximum extent of the ice edge in any given month or period based on observations over a number of years. This term should be preceded by minimum or maximum.

**Mean Ice Edge:** Average position of the ice edge in any given month or period based on observations over a number of years. Other terms which may be used are mean maximum ice edge and mean minimum ice edge.

**Median Ice Edge:** The position of the ice edge where its frequency of occurrence is fifty percent.

**Fast Ice Edge:** The demarcation at any given time between fast ice and open water.

**1.7.7 Ice Boundary:** The demarcation at any given time between fast ice and floating ice or between areas of ice of different concentrations, types and/or floe sizes.

**Fast Ice Boundary:** The ice boundary at any given time between fast ice and the pack/drift ice.

**Concentration Boundary:** A line approximating the transition between two areas of floating ice with different concentrations.

**1.7.8 Iceberg Limit:** The limit at any given time between ice of land origin and the open sea or sea ice.

**Limit of all known Ice:** The limit at any given time between icebergs and/or sea-ice infested waters and ice-free waters.

**Mean Iceberg Limit:** Average position of the limit of icebergs at any given time based on observations over a number of years.

**Median Iceberg Limit:** The position where the historical or statistical frequency of occurrence of the iceberg limit is fifty percent.

**Minimum Iceberg Limit:** Minimum limit of icebergs based on observations over a period of years.

**Maximum Iceberg Limit:** Maximum limit of icebergs based on observations over a period of years.



## 1.8 Ice Surface Features

**1.8.1 Level Ice:** Ice unaffected by deformation.

**1.8.2 Deformed Ice:** A general term for ice which has been squeezed together and in places forced upwards and downwards. Subdivisions are rafted ice, ridged ice and hummocked ice.



**Photo 1.8:** Coast Guard buoy tender/icebreaker escorts small freighter through rafted new and grey ice

**Rafted Ice:** Type of deformed ice formed by one piece of ice overriding another.

**Finger Rafted Ice:** Type of rafted ice in which floes thrust "fingers" alternately over and under the other, common in nilas.

**Ridge:** A line or wall of broken ice forced up by pressure. It may be fresh or weathered. The submerged volume of broken ice under a ridge, forced downwards by pressure, is termed an ice keel.

**New Ridge:** Ridge with sharp peaks and slope of sides usually 40 degrees or more. Fragments are visible from the air at low altitude.

**Weathered Ridge:** Ridge with peaks slightly rounded and slope of sides usually 30 to 40 degrees. Individual fragments are not discernible.

**Very Weathered Ridge:** Ridge with tops very rounded. Slope of sides usually 20 to 30 degrees.

**Aged Ridge:** Ridge which has undergone considerable weathering. These ridges are best described as undulations.

**Consolidated Ridge:** A ridge in which the base has frozen together.

**Ridged Ice:** Ice piled haphazardly one piece over another in the form of ridges or walls. Usually found in first-year ice.

**Ridged Ice Zone:** An area of many ridges with similar characteristics (rubble field).

**Hummock:** A hillock of broken ice which has been forced upwards by pressure. May be fresh or weathered. The submerged volume of broken ice under the hummock, forced downwards by pressure, is termed a bummock.

**Hummocked Ice:** Ice piled haphazardly one piece over another to form an uneven surface. When weathered it has the appearance of smooth hillocks.



### 1.8.3 Other Surface Feature Definitions:

**Standing Floe:** A separate floe standing vertically or inclined and enclosed by rather smooth ice.

**Ram:** An underwater ice projection from an ice wall, ice front, iceberg or floe. Its formation is usually due to a more intensive melting and erosion of the unsubmerged part.

**Bare Ice:** Ice without snow cover.

**Snow-Covered Ice:** Ice covered with snow.

**Sastrugi:** Sharp, irregular ridges formed on a snow surface by wind erosion and deposition. On mobile floating ice the ridges are parallel to the direction of the prevailing wind at the time they were formed.

**Snowdrift:** An accumulation of wind-blown snow deposited in the lee of obstructions or heaped by wind eddies. A crescent-shaped snowdrift, with ends pointing down-wind, is called a snow barchan.

### 1.8.4 Ice Deformation Processes:

**Fracturing:** Pressure process whereby ice is permanently deformed and rupture occurs. This term is most commonly used to describe breaking across very close ice, compact ice and consolidated ice.

**Hummocking:** Pressure process by which ice is forced into hummocks. When the floes rotate in the process it is termed screwing.

**Ridging:** The pressure process by which ice is forced into ridges.

**Rafting:** Pressure process whereby one piece of ice overrides another. Most common in new and young ice.

**Finger Rafting:** Type of rafting whereby interlocking thrusts are formed, each floe thrusting “fingers” alternately over and under the other. This is commonly found in nilas.

**Weathering:** Processes of ablation and accumulation which gradually eliminate irregularities in an ice surface.



Don Isaacs (CIS)

**Photo 1.9:** Embedded floes of snow-covered old ice



### 1.8.5 Ice Motion Processes:

**Diverging:** Ice fields or floes in an area that are subjected to a diverging motion, reducing ice concentration and/or relieving stresses in the ice.

**Compacting:** Pieces of floating ice are said to be compacting when subjected to a converging motion, which increases ice concentration and/or produces stresses which may result in ice deformation.

**Shearing:** An area of floating ice is subject to shear when the ice motion varies significantly in the direction normal to the motion, subjecting the ice to rotational forces. These forces may result in phenomena similar to a flaw.

### 1.9 Stages of Melting

**Puddle:** An accumulation of water on ice, mainly due to melting snow, but in the more advanced stages also to the melting of ice.

**Thaw Holes:** Vertical holes in ice formed when surface puddles melt through to the underlying water.

**Dried Ice:** Ice surface from which water has disappeared after the formation of cracks and thaw holes. During the period of drying the surface whitens.

**Rotten Ice:** Ice which has become honey-combed and is in an advanced state of disintegration.

**Flooded Ice:** Ice which has been flooded and is heavily loaded by water or water and wet snow.

**Frozen Puddle:** A puddle which has frozen over.



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**Photo 1.10:** Vast pan of first-year ice, with extensive puddling and thaw holes





## I.10 Terms Related to Navigation

### I.10.1 Sky and Air Indications:

**Water Sky:** Dark streaks on the underside of low clouds, indicating the presence of water features in the vicinity of ice.

**Ice Blink:** A whitish glare on low clouds above an accumulation of distant ice.

**Frost Smoke:** Fog-like clouds formed by the contact of cold air with relatively warm water. These can appear over openings in the ice or leeward of the ice edge and may persist while ice is forming.

### I.10.2 Terms related to Surface shipping:

**Beset:** Situation in which a vessel is surrounded by ice and unable to move.

**Ice-Bound:** A harbour, inlet, etc., is said to be ice-bound when navigation by ships is prevented, on account of ice, except possibly with the assistance of an icebreaker.

**Nip:** Ice is said to nip when it forcibly presses against a ship. A vessel so caught, though undamaged, is said to have been nipped.

**Ice Under Pressure:** Ice in which deformation processes are actively occurring. It is a potential impediment or danger to shipping.

**Difficult Area:** A general qualitative expression to indicate that the relative severity of the ice conditions, prevailing in an area, are such that navigation in it is difficult.

**Easy Area:** A general qualitative expression to indicate that ice conditions, prevailing in an area, are such that navigation is not difficult.

**Iceport:** An embayment in ice, often of a temporary nature, where ships can moor alongside and unload directly onto the ice itself.

### I.10.3 Terms related to Submarine Navigation:

**Ice Canopy:** Ice from the point of view of the submariner.

**Friendly Ice:** An ice canopy containing many large skylights or other features which permit a submarine to surface. There must be more than ten such features per 30 nautical miles (56 km) along the submarine's track.

**Hostile Ice:** An ice canopy containing no large skylights or other features which permit a submarine to surface.



**Bummock:** A downward projection from the underside of the ice canopy; the submerged counterpart of a hummock.

**Ice Keel:** A downward-projecting ridge on the underside of the ice canopy; the submerged counterpart of a ridge. Ice keels may extend as much as 50 m below the surface.

**Skylight:** Thin places in the ice canopy, usually less than 1 m thick and appearing from below as relatively light, translucent patches in dark surroundings. The under-surface is normally flat. Skylights are termed large if big enough for a submarine to attempt to surface through them (120 m) or small if not.