

Appendix A

Glossary of Ice Terms

The following text and photos are adapted from Sea Ice Nomenclature, WMO No. 259, TP 145.

AGED RIDGE: Ridge that has undergone considerable weathering. These ridges are best described as undulations.

ANCHOR ICE: Submerged ice attached or anchored to the bottom, irrespective of the nature of its formation.

BARE ICE: Ice without snow cover.

BELT: A large feature of pack ice arrangement that is longer than it is wide, from 0.5 mi to 65 mi (1–100 km) in width.

BERGY BIT: A large piece of floating glacier ice, generally showing less than 16 ft (\approx 5 m) above sea level but more than 3 ft (\approx 1 m) and normally about 120 to 360 sq yds (\approx 100–300 sq m) in area.

BESET: Situation of a vessel surrounded by ice and unable to move.

BIGHT: An extensive crescent-shaped indentation in the ice edge, formed by either wind or current.

BRASH ICE: Accumulations of floating ice made up of fragments not more than 6.5 ft (\approx 2 m) across, the wreckage of other forms of ice.

BUMMOCK: From the point of view of the submariner, a downward projection from the underside of the ice canopy; the counterpart of a hummock.

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

CLOSE PACK ICE: Pack ice in which the concentration is seven-tenths to eight-tenths, composed of floes mostly in contact.

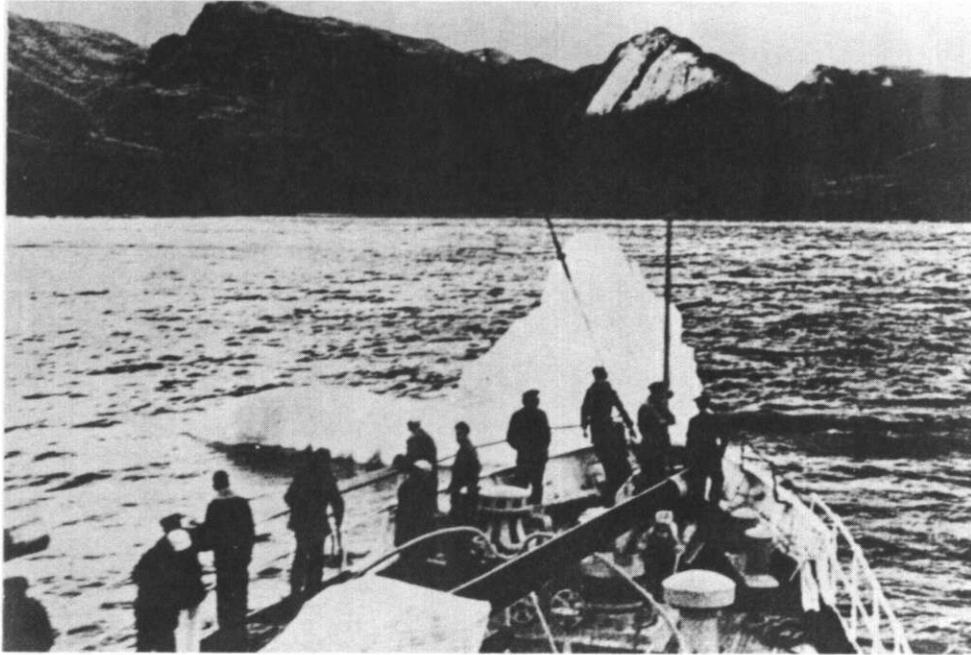


Figure A-1. Example of a Bergy Bit.

COMPACTED ICE EDGE: Close, clear-cut ice edge compacted by wind or current; usually on the windward side of an area of pack ice.

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

COMPACT PACK ICE: Pack ice in which the concentration is ten-tenths, and no water is visible.

CONCENTRATION: The ratio in tenths of the sea surface actually covered by ice to the total area of sea surface, both ice covered and ice free, at a specific location or over a defined area.

CONCENTRATION BOUNDARY: A line approximating the transition between two areas of pack ice with distinctly different concentrations.

CONSOLIDATED PACK ICE: Pack ice in which the concentration is ten-tenths and the floes are frozen together.

CONSOLIDATED RIDGE: A ridge in which the base has frozen together.

CRACK: Any fracture that has not parted.

DARK NILAS: Nilas that is under 2 in (5 cm) in thickness and is very dark in color.

DEFORMED ICE: A general term for ice that has been squeezed together and, in places, forced upwards (and downwards). Subdivisions are rafted ice, ridged ice, and hummocked ice.

DIFFICULT AREA: A general qualitative expression to indicate, in a relative manner, that the severity of ice conditions prevailing in an area is such that navigation in it is difficult.

DIFFUSE ICE EDGE: Poorly defined ice edge limiting an area of dispersed ice; usually on the leeward side of an area of pack ice.

DIVERGING: Ice fields or floes in an area are subjected to diverging or dispersive motion, thus reducing ice concentration and/or relieving stresses in the ice.

DRIED ICE: Sea ice from the surface of which meltwater has disappeared after the formation of cracks and thaw holes. During the period of drying, the surface whitens.

EASY AREA: (Opposite of DIFFICULT AREA listed above) Navigation is not difficult.

FAST ICE: Sea ice that forms and remains fast along the coast, where it is 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. Fast ice may be formed on site from sea water or by freezing of pack ice of any age to the shore, and it may extend a few yards (meters) or several hundred miles (kilometers) from the coast. Fast ice may be more than one year old and may then be prefixed with appropriate age category (old, second-year, or multiyear). If it is thicker than about 7 ft (2 m) above sea level, it is called an ice shelf.

FAST-ICE BOUNDARY: The ice boundary at any given time between fast ice and pack ice.

FAST-ICE EDGE: The demarcation at any given time between fast ice and open water.

FINGER-RAFTED ICE: Type of rafted ice in which floes thrust “fingers” alternately over and under the other.

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

FIRST-YEAR ICE: Sea ice of not more than one winter’s growth, developing from young ice; thickness 1 to 7 ft (30 cm–2 m). May be subdivided into thin first-year ice (white ice), medium first-year ice, and thick first-year ice.

FLAW: A narrow separation zone between pack ice and fast ice, where the pieces of ice are in a chaotic state; it forms when pack ice shears under the effect of a strong wind or current along the fast ice boundary.

FLAW LEAD: A passageway between pack ice and fast ice that is navigable by surface vessels.

FLAW POLYNYA: A polynya between pack ice and fast ice.

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 (ice of land origin) formed on land or in an ice shelf. The concept includes ice that is stranded or grounded.

FLOE: Any relatively flat, isolated piece of sea ice 65 ft (\approx 20 m) or more across. Floes are subdivided according to horizontal extent as follows:

GIANT: over 5.5 n mi (10 km)

VAST: 1–5.5 n mi (2–10 km)

BIG: 550–2200 yd (500–2000 m)

MEDIUM: 110–550 yd (100–500 m)

SMALL: 22–110 yd (20–100 m)

FLOEBERG: A massive piece of sea ice composed of a hummock or a group of hummocks, frozen together and separated from any ice surroundings. It may float up to 17 ft (5 m) above sea level.

FLOODED ICE: Sea ice that has been flooded by meltwater or river water and is heavily loaded by water and wet snow.

FRACTURE: Any break or rupture through very close pack ice, compact pack ice, consolidated pack ice, fast ice, or a single floe resulting from deformation processes. Fractures may contain brash ice and/or may be covered with nilas and/or round ice. Length may vary from a few yards (meters) to many miles (kilometers).

FRACTURE ZONE: An area that has a great number of fractures.

FRACTURING: Pressure process whereby ice is permanently deformed, and rupture occurs. Most commonly used to describe breaking across very close pack ice, compact pack ice, and consolidated pack ice.

FRAZIL ICE: Fine spicules, or plates of ice, suspended in water.

FRIENDLY ICE: From the point of view of the submariner, an ice canopy containing many large skylights or other features that permit a submarine to surface. There must be more than ten such features per 30 n mi (56 km) along the submarine's track.

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

GLACIER BERG: An irregularly shaped iceberg.

GLACIER ICE: Ice in, or originating from, a glacier, whether on land or floating on the sea as icebergs, bergy bits, or growlers.

GLACIER TONGUE: Projecting seaward extension of a glacier, usually afloat.

GRAY ICE: Young ice 4 to 6 in (10–15 cm) thick. Less elastic than nilas and breaks on swell. Usually rafts under pressure.

GRAY-WHITE ICE: Young ice 6 to 12 in (15–30 cm) thick. Under pressure more likely to ridge than to raft.

GREASE ICE: A later stage of freezing than frazil ice. It occurs when the crystals have coagulated to form a soupy layer on the surface. Grease ice reflects little light, giving the sea a matte appearance.



Figure A-2. Example of Gray Ice.

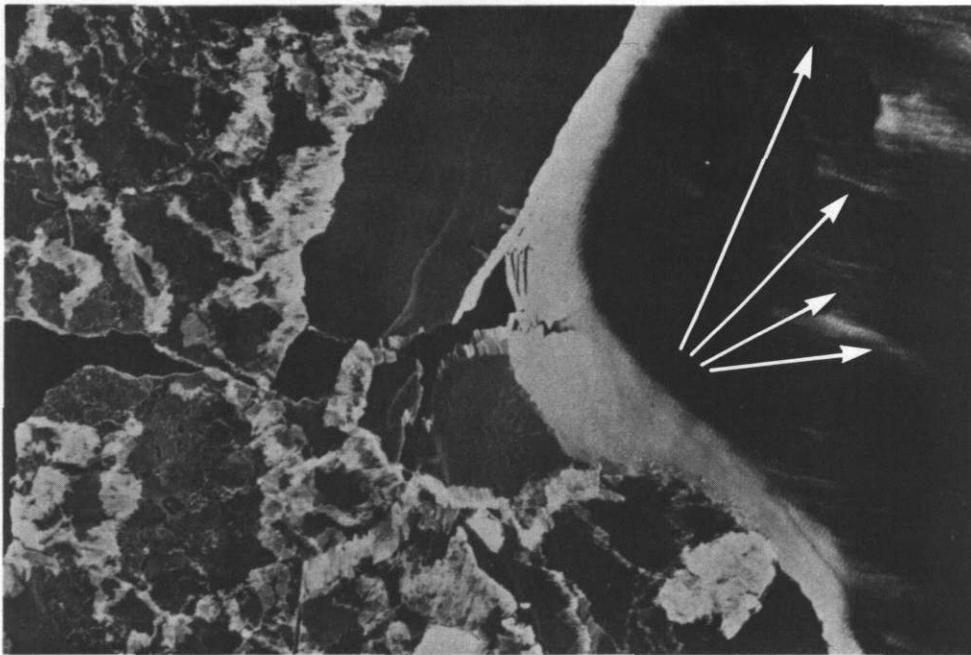


Figure A-3. Example of Grease Ice on Far Right, Nilas to the Left.

GROUNDING HUMMOCK: Hummocked grounded ice formation. Single grounded hummocks occur as well as lines (or chains) of grounded hummocks.

GROUNDING ICE: Floating ice that is aground in shoal water.

GROWLER: Smaller piece of ice than a bergy bit, often transparent but appearing green or almost black in color. Usually extends less than 3 ft (1 m) above the sea surface and normally occupies an area of about 24 sq yd (20 sq m).

HOSTILE ICE: From the point of view of the submariner, an ice canopy containing no large skylights or other features that permit a submariner to surface.

HUMMOCK: A hillock of broken ice that 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: Sea ice piled haphazardly one piece over another to form an uneven surface. When weathered, it has the appearance of smooth hillocks.

HUMMOCKING: The pressure process by which sea ice is forced into hummocks. When the floes rotate in the process it is termed screwing.

ICEBERG: A massive piece of ice of greatly varying shape, more than 16 ft (5 m) above sea level, which has broken away from a glacier, and which may be afloat or aground. Icebergs may be described as tabular, dome-shaped, sloping, pinnacled, weathered, or glacier bergs.



Figure A-4. Example of a Growler.

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

ICE BLINK: A whitish glare on low clouds above an accumulation of distant ice.

ICE BOUND: A harbor, 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.

ICE BOUNDARY: The demarcation at any given time between fast ice and pack ice or between areas of pack ice of different concentrations.

ICE BRECCIA: Ice of different stages of development frozen together.

ICE CAKE: Any relatively flat piece of sea ice less than 22 yd (20 m) across.

ICE CANOPY: Pack ice from the point of view of the submariner.

ICE COVER: The ratio of an area of ice of any concentration to the total area of sea surface within some large geographic locale; this locale may be global, hemispheric, or prescribed by a specific oceanographic entity such as Baffin Bay or the Barents Sea.

ICE EDGE: The demarcation at any given time between the open sea and sea ice of any kind, whether fast or drifting. It may be termed compacted or diffuse.

ICE FIELD: Area of pack ice consisting of floes of any size that are greater than 5.5 n mi (10 km) across.

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

ICE FREE: No sea ice present. Some ice of land origin may occur.

ICE FRONT: The vertical cliff forming the seaward face of an ice shelf or other floating glacier varying in height from 6 to 165 ft (2–50 m) or more above sea level.

ICE ISLAND: A large piece of floating ice about 16 ft (5 m) above sea level, which has broken away from an Arctic ice shelf, having a thickness of 100 to 165 ft (30–50 m) and an area of from a few thousand square yards (meters) to 200 sq mi (500 sq km) or more, and usually characterized by a regularly undulating surface that gives it a ribbed appearance from the air.

ICE JAM: An accumulation of broken river ice or sea ice caught in a narrow channel.

ICE KEEL: From the point of view of the submariner, a downward-projecting ridge on the underside of the ice canopy—the counterpart of a ridge. Ice keels may extend as much as 165 ft (50 m) below sea level.

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. Term should be preceded by minimum or maximum.

ICE MASSIF: A concentration of sea ice covering hundreds of square miles (kilometers) that is found in the same region every summer.

ICE OF LAND ORIGIN: Ice formed on land or in an ice shelf, found floating in water. The concept includes ice that is stranded or grounded.

ICE PATCH: An area of pack ice less than 6 n mi (10 km) across.

ICE PORT: An embayment in an ice front, often of a temporary nature, where ships can moor alongside and unload directly onto the ice shelf.

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. Thickness to about 1 in (5 cm). Easily broken by wind or swell, commonly breaking in rectangular pieces.

ICE SHELF: A floating ice sheet of considerable thickness showing 6 to 165 ft (2–50 m) or more above sea level, attached to the coast. Usually of great horizontal extent and with a level or gently undulating surface. Nourished 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 STREAM: Part of an island ice sheet in which the ice flows more rapidly and not necessarily in the same direction as the surrounding ice. The margins are sometimes clearly marked by a change in direction of the surface slope but may be indistinct.

ICE UNDER PRESSURE: Ice in which deformation processes are actively occurring and hence a potential impediment or danger to shipping.

ICE WALL: An ice cliff forming the seaward margin of a glacier that is not afloat. An ice wall is aground, the rock basement being at or below sea level.

LAKE ICE: Ice formed on a lake, regardless of observed location.

LARGE FRACTURE: More than 1,640 ft (500 m) wide.

LARGE ICE FIELD: An ice field over 12 n mi (20 km) across.

LEAD: Any fracture or passageway through sea ice that is navigable by surface vessels.

LEVEL ICE: Sea ice that is unaffected by deformation.

LIGHT NILAS: Nilas that is more than 2 in (5 cm) in thickness and rather lighter in color than dark nilas.

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 that may be used are mean maximum ice edge and mean minimum ice edge.

MEDIUM FIRST-YEAR ICE: First-year ice 25 to 50 in (70–120 cm) thick.

MEDIUM FRACTURE: 650 to 1,650 ft (200–500 m) wide.

MEDIUM ICE FIELD: An ice field 8 to 10 mi (15–20 km) across.

MULTIYEAR ICE: Old ice up to 10 ft (3 m) or more thick that has survived at least two summers' melt. Hummocks even smoother than in second-year ice, and the ice is almost salt free. The color, where snow free, is usually blue. The melt pattern consists of large interconnecting irregular puddles and a well developed drainage system.

NEW ICE: A general term for recently formed ice that includes frazil ice, grease ice, slush, and shuga. These types of ice are composed of ice crystals that are only weakly frozen together (if at all) and have a definite form only while they are afloat.

NEW RIDGE: Ridge newly formed with sharp peaks and slope of sides usually 40 degrees. Fragments are visible from the air at low altitude.

NILAS: A thin, elastic crust of ice bending easily on waves and swell. Nilas has a matte surface and is up to 4 in (≈ 10 cm) thick. Under pressure it thrusts into a pattern of interlocking fingers (see **FINGER-RAFTED ICE**). May be subdivided into dark nilas and light nilas.

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.

OLD ICE: Sea ice that has survived at least one summer's melt. Most topographic features on old ice are smoother than those on first-year ice. May be subdivided into second-year ice and multiyear ice.

OPEN PACK ICE: Pack ice in which the ice concentration is four-tenths to six-tenths, with many leads and polynyas, and the floes are generally not in contact with one another.



Figure A-5. Example of Multiyear Ice.

OPEN WATER: A large area of freely navigable water in which sea ice is present in concentrations less than one-tenth. When no sea ice is present, the area should be termed ice free, even though icebergs occur.

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.

PANCAKE ICE: Predominantly circular pieces of ice from 1 to 10 ft (30 cm–3 m) in diameter and up to about 4 in (\approx 10 cm) in thickness, with raised rims due to the pieces striking against one another. It may be formed 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 gray ice. Sometimes pancake ice forms at some depth, at an interface between water bodies of different physical characteristics, from where it floats to the surface; it may cover wide areas of water rapidly.

POLYNYA: Any nonlinear-shaped opening in the water but enclosed by ice. Sometimes the polynya is limited on one side by the coast and is called a shore polynya, or by fast ice and is called a flaw polynya. Some polynyi recur annually in the same position.

PUDDLE: An accumulation on ice of meltwater, mainly due to melting snow, but in the more advanced stages, also to the melting of ice. Initial stage consists of patches of melted snow.

RAFTED ICE: Type of deformed ice formed by one piece of ice overriding another.

RAFTING: Pressure processes whereby one piece of ice overrides another. Most common in new and young 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.

RECURRING POLYNYA: A polynya that recurs in the same position every year.

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.

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 in which much ridged ice with similar characteristics has formed.

RIDGING: The pressure process by which sea ice is forced into ridges.

RIVER ICE: Ice formed on a river, regardless of observed location.

ROTTEN ICE: Sea ice that has become honeycombed and is in an advanced state of disintegration.

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

SEA ICE: Any form of ice found at sea that has originated from the freezing of sea water.

SECOND-YEAR ICE: Old ice that has survived only one summer's melt. Because it is thicker and less dense than first-year ice, it stands higher out of the water. In contrast to multiyear ice, summer melting produces a regular pattern of numerous small puddles. Bare patches and puddles are usually greenish-blue.

SHEARING: An area of pack 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.

SHORE LEAD: A lead between pack ice and the shore or between pack ice and an ice front.

SHORE POLYNYA: A polynya between pack ice and the coast, or between pack ice and an ice front.

SHUGA: An accumulation of spongy white ice lumps, a few inches (centimeters) across; they are formed from grease ice or slush and sometimes from ice rising to the surface.

SKYLIGHT: From the point of view of the submariner, thin places in the ice canopy, usually less than 3 ft (1 m) thick and appearing from below as relatively light, translucent patches in dark surroundings. The undersurface of a skylight is normally flat. Skylights are called large if big enough for a submarine to attempt to surface through them, or small if not.

SLUSH: Snow that is saturated and mixed with water on land or ice surfaces, or as a viscous floating mass in water after a heavy snowfall.

SMALL ICE CAKE: An ice cake less than 7 ft (2 m) across.

SMALL ICE FIELD: An ice field 5 to 10 n mi (10–15 km) across.

SNOW-COVERED ICE: Ice covered with snow.

SNOWDRIFT: An accumulation of windblown snow deposited in the lee of obstructions or heaped by wind eddies. A crescent-shaped snowdrift, with ends pointing downwind, is known as a snow barchan.

STANDING FLOE: A separate floe standing vertically or inclined and enclosed by rather smooth ice.

STRANDED ICE: Ice that has been floating and has been deposited on the shore by retreating high water.

STRIP: Long narrow area of pack ice, about 0.5 n mi (1 km) or less in width, usually composed of small fragments detached from the main mass of ice, and run together under the influence of wind, swell, or current.

TABULAR BERG: A flat-topped iceberg. Most tabular bergs form by calving from an ice shelf and show horizontal banding.

THAW HOLES: Vertical holes in sea ice formed when surface puddles melt through to the underlying water.

THICK FIRST-YEAR ICE: First-year ice over 4 ft (120 cm) thick.

THIN FIRST-YEAR ICE (WHITE ICE): First-year ice 1 to 2 ft (30–70 cm) thick.

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.

TONGUE: A projection of the ice edge up to several miles (kilometers) in length, caused by wind or current.

VERY CLOSE PACK ICE: Pack ice in which the concentration is nine-tenths to less than ten-tenths.

VERY OPEN PACK ICE: Pack ice in which the concentration is one-tenth to three-tenths and water preponderates over the ice.

VERY WEATHERED RIDGE: Ridge with tops very rounded, slope of sides usually 20 to 30 degrees.

WATER SKY: Dark streaks on the underside of low clouds, indicating the presence of water features in the vicinity of sea ice.

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

WEATHERING: Processes of ablation and accumulation that gradually eliminate irregularities in an ice surface.

WHITE ICE: Same as thin first-year ice.



Figure A-6. Example of Thin First-Year Ice (White Ice).

YOUNG COASTAL ICE: The initial stage of fast ice formation consisting of nilas or young ice, its width varying from a few yards (meters) up to 110 to 220 yd (100–200 m) from the shoreline.

YOUNG ICE: Ice in the transition stage between nilas and first-year ice, 4 to 12 in (10–30 cm) in thickness. May be subdivided into gray ice and gray-white ice.