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Seattle, WA 98115
http://response.restoration.noaa.gov

This Observers' Guide to Sea Ice was prepared by Dr. Orson P. Smith, University of Alaska Anchorage, School of Engineering for the National Oceanic and Atmospheric Administration. It is a product of the Cook Inlet and Prince William Sound Navigation Safety and Efficiency project. To order additional copies of this document, fax your request to 206-526-4442 or email library@hazmat.noaa.gov.

OBSERVERS' GUIDE TO SEA ICE

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Introduction

This booklet is intended for use by volunteers to report aerial, shipboard, or shoreline observations of ice conditions at sea to authorities such as the National Weather Service, National Ice Center, U.S. Coast Guard, pilots associations, port authorities, or other maritime interests. Emphasis here is on conditions of concern to mariners with regard to safe passage of ships. Scientific observers may wish to note additional details following guidance of the World Meteorological Organization.

Sea ice consists of frozen sea water. River (freshwater) ice is often indistinguishable when mixed with sea ice, especially with snow cover. Glacier ice, broken away from a tidewater glacier, is usually more irregular than river ice or frozen sea water. Tidal estuaries may also have thick, irregular pieces of sediment-laden *beach ice* or *stamukhas*, which have been grounded on tidelands, repeatedly submerged, and floated free by spring tides.

Sea ice is observed in terms of three basic parameters: *concentration*, *stage* of development, and *form*. Concentration refers to the fraction of the sea surface covered by ice, reported in tenths by international convention. Stage of development refers to age and structural characteristics of the ice that may be inferred from specific visible features and knowledge of regional conditions prior to the observation. Stage may be more directly observed from shipboard when ice breaking reveals the prevailing thickness of the ice. Stage classification does not apply to glacier ice. Form refers to the horizontal shape and dimensions of pieces of ice. The form of glacier ice is also reported in terms of *freeboard,* or maximum height above the sea surface.

Observers should report sea ice conditions with reference to the date, time, and geographical position of the observation and the particular perspective, or *field of view*. The field of view from an airplane is much different from the field of view from the bridge of a ship or from the shoreline. A reporting form for sea ice and a separate form for glacier ice are provided to aid observers in noting this essential information.

U.S. Sea Ice Reporting Agencies

National Weather Service
Alaska Region, Forecast Office
6930 Sand Lake Road
Anchorage, Alaska 99502-1845
Ice Desk: 907/266-5113
Marine Desk (24 hours): 907/266-5106
Fax: 907/266-5188
Web page: *http://www.alaska.net/~nwsar/*

National Ice Center
Federal Office Building #4, Room 2301
4251 Suitland Road
Washington, D.C. 20395
Telephone: 301/457-5303
Fax: 301/457-5305
email: liaison@natice.noaa.gov
Web page: *http://www.natice.noaa.gov*

Completing an Observation Report

1. Use a dry-erase marker to fill out either the sea ice or the glacier ice observation report form, or to make a permanent record on a copy of the form.
2. Note the date, time, and time zone of the observation, *e.g.,* "Alaska Standard," "Alaska Daylight Savings (summer) Time," or "Greenwich Mean Time" (GMT).
3. Note the latitude and longitude of the observation by reference to a chart or GPS positioning system. GPS systems also give accurate time of day.
4. Describe your position in words, as you would over the radio or telephone, noting the water body and nearby charted geographical features, *e.g.,* "central Cook Inlet, 3 nautical miles east of Middle Ground Shoal."
5. Describe your perspective in terms of altitude above the water, the compass direction toward which you are looking, and the most recognizable geographical features directly in view, *e.g.,* "10 meters (30 ft) above the water (bridge-level), looking west toward the center of Trading Bay."
6. Circle the choices of concentration that apply to the conditions you observe, noting the average and the range of concentrations in view.
7. Sea ice: Circle the stages of development you judge to be in view. Direct knowledge of recent local weather and prior nearby ice observations, as well as the appearance of the ice, may be applied to judge stage of development.
8. Use the length, or beam, of the ship or recognizable objects in view (like ships, docks, or oil platforms) to estimate the size of ice pieces observed and note the prevailing form and the range of ice forms visible.
9. Glacier ice: Note the form in terms of estimated maximum freeboard and waterline length. Also note the above-water shape.
10. Note any other observed features that might help mariners following you across the water body or that would help ice reporters match your observation with others.
11. Transmit your report as soon as possible to the National Weather Service, National Ice Center, or other marine service organization.

Sea Ice Observation Report Form

Date:	**Time:**	**Time zone:**
Latitude:	**Longitude:**	

Description of position:

Altitude of observer:

Looking toward (compass bearing):

Charted landmarks in view:

Concentration: (see pages 7-10)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Stage of Development: (see pages 11-15)	**New**				**Ni**	**YN-G**	**YN-GW**	**FL**	**FM**	**FT**	**Old**
Form: (see pages 16-22)	**New**		**Brash**		**Belts**		**Strips**		**Pancakes**		
Cakes	**Small floes**		**Medium floes**		**Big floes**		**Vast floes**		**Giant floes**		

Other description:

Glacier Ice Observation Report Form

Date:	**Time:**	**Time zone:**
Latitude:	**Longitude:**	

Description of position:

Altitude of observer:

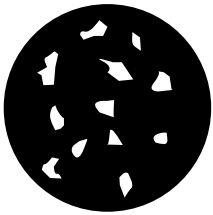
Looking toward (compass bearing):

Charted landmarks in view:

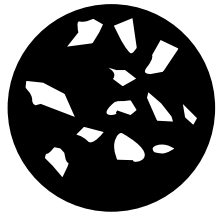
Concentration: (see page 7)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Glacier ice forms: (see pages 23-27)	**Growlers**	**Bergy bits**	**Small berg**
	Medium berg	**Large berg**	**Very large berg**
Above-water shape: (see page 23)	**Blocky**	**Tabular**	**Domed**
Pinnacled	**Drydocked**	**Wedged**	**Non-tabular**

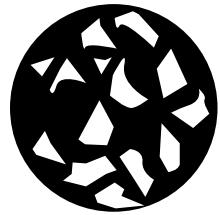
Other description:



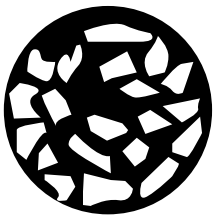
less than 1 tenth "open water"



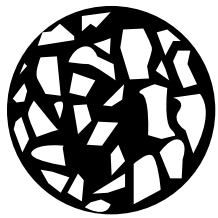
2 - 3 tenths "very open drift"



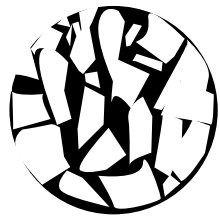
4 tenths "open drift"



5 tenths "open drift"

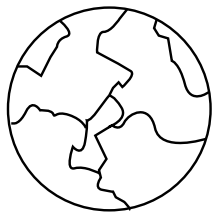


6 tenths "open drift"



7 - 8 tenths "close pack"

9 tenths "very close pack"



10 tenths "compact"

Concentration

1 - 2 tenths "very open drift"

3 - 4 tenths "open to very open drift"

5 - 6 tenths “open drift”

7 - 8 tenths “close pack”

Concentration

9 tenths "very close pack"

10 tenths "compact"

New (N):
Ice of the following initial stages of ice formation

Frazil: Separate fine needles or plates suspended in the water
Grease: A thin, soapy-looking surface layer of coagulated frazil ice
Slush: Snow mixed with water in a viscous surface layer
Shuga: An accumulation of spongy white lumps

Nilas (Ni):
A thin, elastic crust of ice, less than 10 cm (4 in) thick, easily bending on waves, often with a striped or chevron appearance.

Young (YN):
Ice 10 - 30 cm (4 - 12 in) thick of the following sub-stages

Gray (G): Young ice 10 - 15 cm (4 - 6 in) thick, less elastic than nilas, that breaks on swell and rafts (one layer over another) under pressure
Gray-white (GW): Young ice 15 - 30 cm (6 - 12 in) thick, that buckles to form ridges on its edges from pressure or collisions

First-year thin (FL):
Sea ice that, in uniform level areas without ridges or other deformations, is 30 - 70 cm (12 - 27 in) thick

First-year medium (FM):
Sea ice 70 - 120 cm (27 - 48 in) thick

First-year thick (FT):
Sea ice over 1.2 m (4 ft) thick

Old or multi-year (MY):
Sea ice 3 m (10 feet) or more thick that has survived at least one melting season, characterized by undulating, weathered ridges and a well-defined melt water drainage pattern

Stages of Development

New Ice

Frazil: Fine needles or plates suspended in the water
Grease: A soapy-looking surface layer of coagulated frazil ice

New Ice

Slush: Snow mixed with water
Shuga: An accumulation of spongy white lumps

Nilas (Ni) A thin, elastic crust of ice, less than 10 cm (4 in) thick, easily bending on waves, often with a striped or chevron appearance

Young (YN) Level ice 10 - 30 cm (4 - 12 in) thick, of the following sub-stages:

Gray (G): Young ice 10 - 15 cm (4 - 6 in) thick, less elastic than nilas, that breaks on swell and rafts under pressure

Gray-white (GW): Young ice 15 - 30 cm (6 - 12 in) thick, which buckles to form ridges on its edges from pressure or collisions

Stages of Development

First-year thin (FL) Sea ice 30 - 70 cm (12 - 27 in) thick

First-year medium (FM) Sea ice 70 - 120 cm (27 - 48 in) thick

First-year thick (FT) Sea ice over 1.2 m (4 ft) thick (Photo provided by Jerry Galt)

Old or Multi-year Sea ice 3 m (10 feet) thick that has survived at least one melting season, characterized by undulating, weathered ridges and a well-defined melt water drainage pattern

Sea Ice Forms

New: small, thin, newly formed, dinner plate-sized pieces

Brash: Broken pieces less than 2 m (6 ft) across

Pancake: Rounded floes 30 cm - 3 m (1 - 10 ft) across with ridged rims

Ice Cake: Level piece 3 - 20 m (6 - 65 ft) across

Small Floe: Level piece 20 - 100 m (65 - 328 ft) across

Medium Floe: Level, continuous piece 100 -500 m (328 - 1640 ft) across

Big Floe: Level, continuous piece 500 m - 2 km (1/3 - 1 mi) across

Vast Floe: Level, continuous piece 2 - 10 km (1 - 6 mi) across

Giant Floe: Level, continuous piece greater than 10 km (6 mi) across

Belt: A linear accumulation of sea ice from 1 km to over 100 km (0.6 - 60 mi) wide

Strip: A linear accumulation of sea ice less than 1 km (0.6 mi) wide

Beach Ice or Stamukhas: Irregular, sediment-laden blocks that are grounded on tidelands, repeatedly submerged, and floated free by spring tides

Fast Ice: Ice formed and remaining attached to shore

Useful Size-Reference Objects

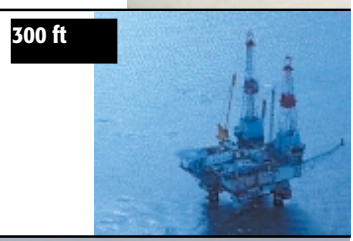
Brash: less than 2 m (6 ft) across

Growler: less than 5 m (16 ft)
Pancake: 30 cm - 3 m (1 - 10 ft)

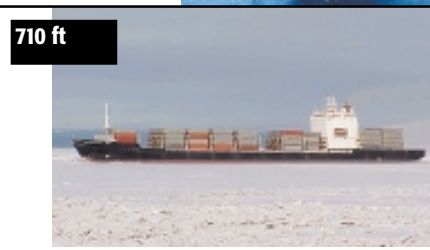
Bergy Bit: 5 - 15 m (17 - 50 ft)
Ice Cake: 3 - 20 m (6 - 65 ft) across

Small Berg: 15 - 60 m (50 - 200 ft)
Small Floe: 20 - 100 m (65 - 328 ft)

Medium Berg: 61 - 122 m (201 - 400 ft)
Large Berg: 123 - 213 m (401 - 670 ft)

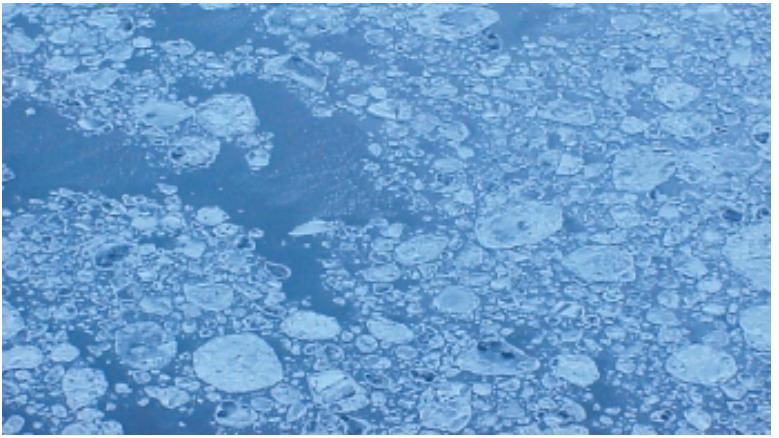


Medium Floe:
100 - 500 m (328 - 1640 ft)
Very Large Berg:
greater than 213 m (670 ft)
Big Floe:
500 m - 2 km (1/3 - 1 mi)

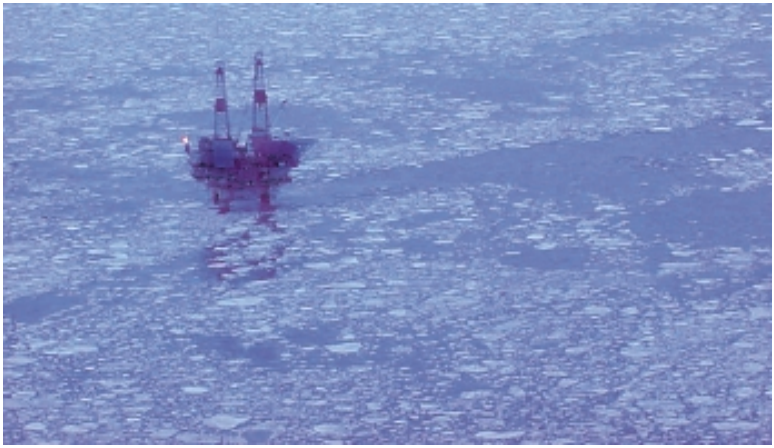


Sea Ice Forms

Brash: Broken piece less than 2 m (6 ft) across (Homer, Alaska)



Pancake Ice: Circular floes 30 cm - 3 m (1 - 6 feet) across and up to 10 cm (4 inches) thick with raised rims

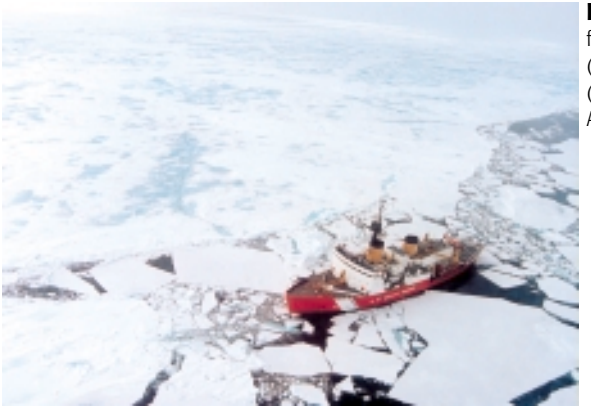


Ice Cake: Relatively level piece less than 20 m (65 ft) across (altitude 500 feet, Cook Inlet, Alaska)

Small Floe: Continuous level piece 20 - 100 m (65 - 328 ft) across (altitude 500 ft, Anchorage, Alaska)

Sea Ice Forms

Medium Floe: Continuous flat piece 100 - 500 m (328 - 1640 ft) across (altitude 800 ft, Cook Inlet, Alaska)



Big Floe: Continuous flat piece 500 m - 2 km (1/3 - 1 mi) across (altitude 500 - 600 ft, Arctic Ocean)

Belt: A linear accumulation of sea ice from 1 km to over 100 km (0.6 - 60 mi) wide

Strip: A linear accumulation of sea ice less than 1 km (0.6 mi) wide (altitude 800 ft, Cook Inlet, Alaska)

Sea Ice Forms

Beach Ice, or Stamukhas: Thick, irregular, sediment-laden *pieces*, which have been grounded on tidelands, repeatedly submerged, and floated free by spring tides (grounded beach ice, Cook Inlet, Alaska)

Fast Ice: Ice formed and remaining attached to shore (upper Cook Inlet, Alaska)

Form	Freeboard (height above water)	Length
Growler	less than 1 m (3 ft)	less than 5 m (16 ft)
Bergy Bit	1 - 5 m (3 - 16 ft)	5 - 15 m (17 - 50 ft)
Small Berg	5 - 15 m (17 - 50 ft)	15 - 60 m (50 - 200 ft)
Medium Berg	16 - 45 m (51 - 150 ft)	61 - 122 m (201 - 400 ft)
Large Berg	46 - 75 m (151 - 240 ft)	123 - 213 m (401 - 670 ft)
Very Large Berg	greater than 75 m (240 ft)	greater than 213 m (670 ft)

Blocky: generally straight-sided polygonal shape

Tabular: flat top with near-vertical sides

Domed: rounded appearance above the waterline

Non-tabular or irregular: no regular geometric shape apparent

Wedged: triangular wedge shape

Pinnacled: one or more prominent central spires

Drydocked: melted out in center to form a U-shaped slot

Black Ice: Dark, sediment-laden ice from glacier medial moraines or associated frozen glacier surface ponds of turbid runoff water

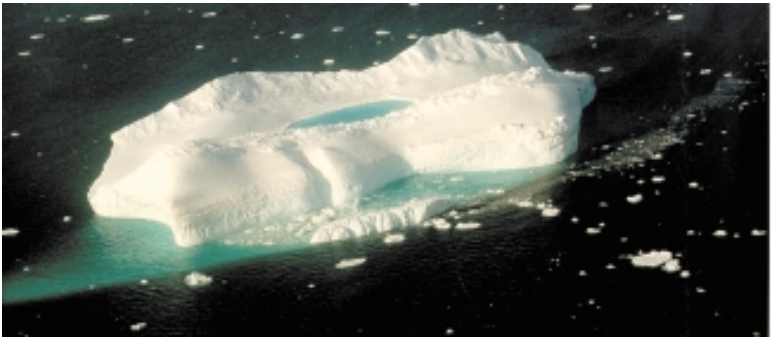
Growler: Glacier fragment less than 1 m (3 ft) freeboard and less than 5 m (16 ft) across (Prince William Sound, Alaska)

Bergy bit (irregular)

Black ice bergy bit (blocky)

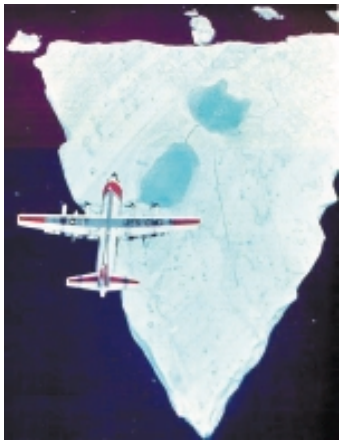
Bergy Bit: Glacier fragment 1 - 5 m (3 - 16 ft) freeboard or 5 - 15 m (16 - 50 ft) across (Prince William Sound, Alaska, photo provided by Stan Stephens)

Small Berg: Glacier fragment 5 - 15 m (16 - 50 ft) freeboard or 15 - 60 m (50 - 200 ft) across (Prince William Sound, Alaska)



Medium Berg: Glacier fragment 16 - 45 m (51 - 150 ft) freeboard or 61 - 122 m (201 - 400 ft) across (North Atlantic, photo provided by USCG International Ice Patrol)

Large Berg: Glacier fragment 46 -75 m (151 - 240 ft) freeboard or 123 - 213 m (401 - 670 ft) across (Photo provided by Jerry Galt)



Very Large Berg: Glacier fragment over 75 m (240 ft) freeboard or over 213 m (670 ft) across (Antarctica, photo provided by USCG International Ice Patrol)

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