ERVO Cruise leader course Polar operations

Purpose/Goal

To give new and experienced cruise leaders and cruise personnel necessary knowledge about:

- Preparations for cruises in ice covered waters
- Execution of cruises in ice covered waters

Course topics

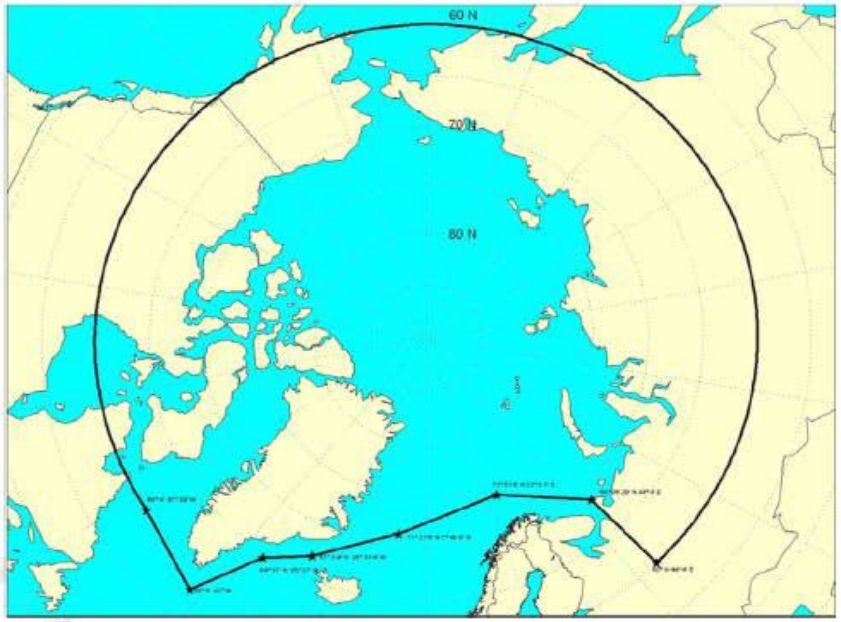
- What is the difference between cruises in open and ice covered waters?
- The IMO Polar Code and Polar Water Operation Manual (PWOM)
- Survival gear and equipment (personal and group equipment)
- Planning cruises in ice covered waters
- Staying and working on the ice
- Working in extreme low temperatures (on deck/on ice/on land)
- Polar bears
- Trawling in ice-covered waters
- Towing of scientific equipment and instruments
- Launch and recovery through moonpool
- Launch and recovery over the side in ice-covered water
- Diving in ice-covered water
- Use of workboats ice-covered water
- Helicopter operations
- Environmental protection management in Arctic

What separates cruises in ice covered waters from cruises in open water?

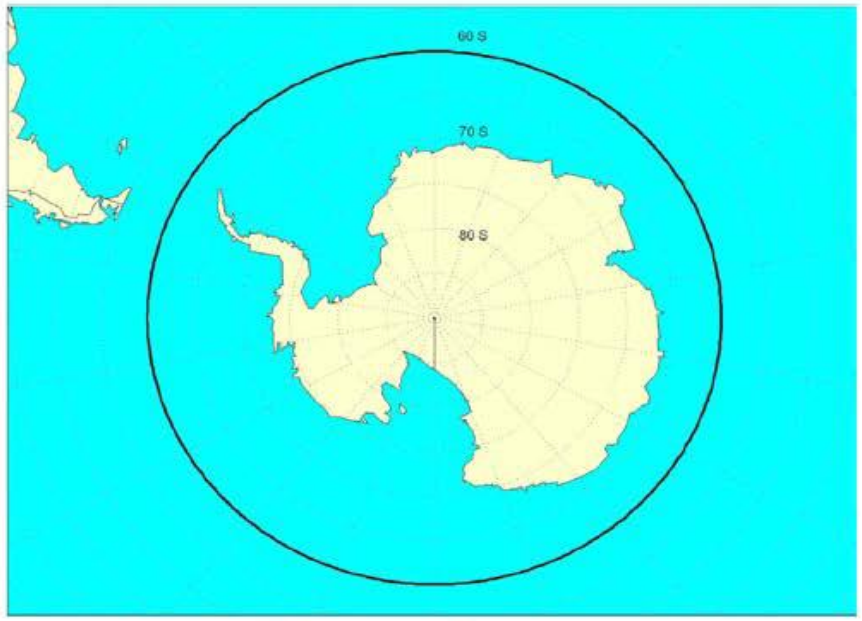
- Ice conditions decide to a large extent the vessel's possibilities to navigate and manoeuvre in the ice, deploy, operate and recover equipment, and work on or under the ice.
- The vessel will always look for the «cheapest route» through the ice, looking for openings in the ice and/or thinnest possible ice to save fuel and avoid unnecessary noise, vibrations and motions in the vessel.
- Some times the vessel must follow pre-defined tracks during hydrographic mapping, seismic operations etc.
- Usually drop keels will to be deployed in ice covered waters, but rather use the antennas mounted in the arctic tanks.
- Trawling with use of the «ice-gallows».
- Limited possibilities to tow equipment and deploy over the side due to danger of breaking/damaging the cables due to passing ice floes.
- Extreme low air temperature could damage equipment that «freezes to death», e.g. water sampling rosette on its way on board after sampling in the water column.
- Use of moonpool for deploying some types of equipment/instruments.
- Work on the ice.

IMO Polar Code

Maximum extent of Arctic and Antarctic waters



Arctic waters



Antarctic waters

WHAT DOES THE POLAR CODE MEAN FOR SHIP SAFETY?

EQUIPMENT

WINDOWS ON BRIDGE
Means to clear melted ice, freezing rain, snow, mist, spray and condensation

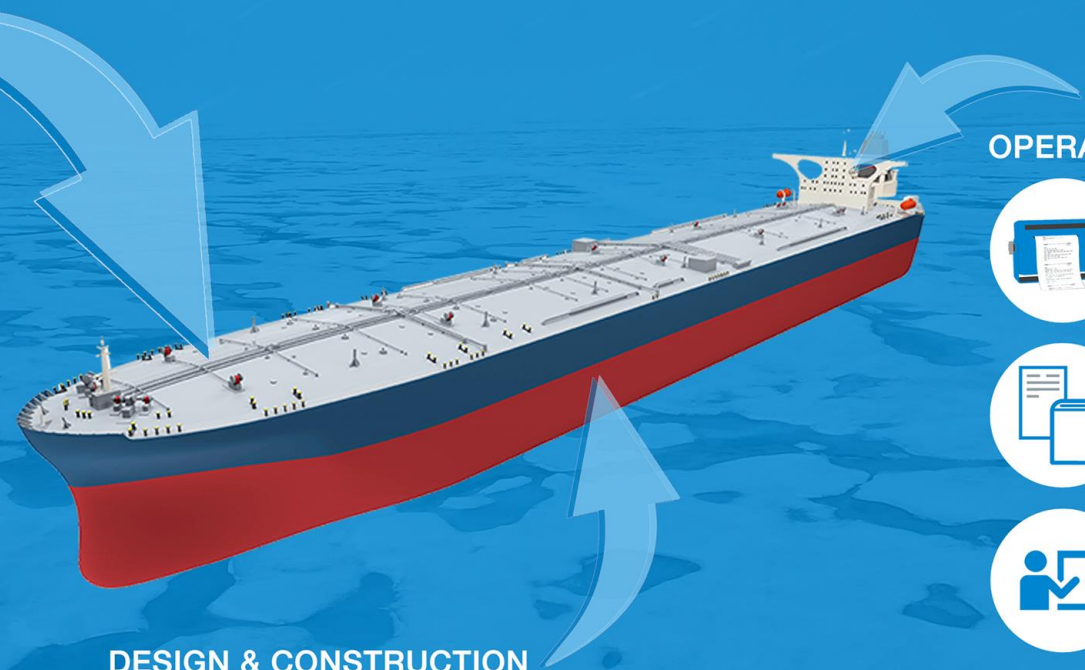
LIFEBOATS
All lifeboats to be partially or totally enclosed type

CLOTHING I
Adequate thermal protection for all persons on board

CLOTHING II
On passenger ships, an immersion suit or a thermal protective aid for each person on board

ICE REMOVAL
Special equipment for ice removal: such as electrical and pneumatic devices, special tools such as axes or wooden clubs

FIRE SAFETY
Extinguishing equipment operable in cold temperatures; protect from ice; suitable for persons wearing bulky and cumbersome cold weather gear



DESIGN & CONSTRUCTION

SHIP CATEGORIES
Three categories of ship which may operate in Polar Waters, based on:
A) medium first-year ice
B) thin first-year ice
C) open waters/ice conditions less severe than A and B

INTACT STABILITY
Sufficient stability in intact condition when subject to ice accretion and the stability calculations must take into account the icing allowance

MATERIALS
Ships intended to operate in low air temperature must be constructed with materials suitable for operation at the ships polar service temperature

STRUCTURE
In ice strengthened ships, the structure of the ship must be able to resist both global and local structural loads

OPERATIONS & MANNING

NAVIGATION
Receive information about ice conditions

CERTIFICATE & MANUAL
Required to have on board a Polar Ship Certificate and the ship's Polar Water Operational Manual

TRAINING
Masters, chief mates and officers in charge of a navigational watch must have completed appropriate basic training (for open-water operations), and advanced training for other waters, including ice

BACKGROUND INFO

- THE INTERNATIONAL CODE FOR SHIPS OPERATING IN POLAR WATERS WAS ADOPTED NOVEMBER 2014 BY THE IMO MARITIME SAFETY COMMITTEE
- IT APPLIES TO SHIPS OPERATING IN ARCTIC AND ANTARCTIC WATERS
- THE AIM IS TO PROVIDE FOR SAFE SHIP OPERATION AND THE PROTECTION OF THE POLAR ENVIRONMENT BY ADDRESSING RISKS PRESENT IN POLAR WATERS AND NOT ADEQUATELY MITIGATED BY OTHER INSTRUMENTS

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HOW THE **POLAR** CODE PROTECTS THE ENVIRONMENT

OIL

DISCHARGES
Discharge into the sea of oil or oily mixtures from any ship is prohibited

STRUCTURE
Double hull and double bottom required for all oil tankers, including those less than 5,000dwt (A/B ships constructed on or after 1 January 2017)

HEAVY FUEL OIL
Heavy fuel oil is banned in the Antarctic (under MARPOL). Ships are encouraged not to use or carry heavy fuel oil in the Arctic

LUBRICANTS
Consider using non-toxic biodegradable lubricants or water-based systems in lubricated components outside the underwater hull with direct seawater interfaces

SEWAGE

DISCHARGES I
No discharge of sewage in polar waters allowed (except under specific circumstances)

TREATMENT PLANTS
Discharge is permitted if ship has an approved sewage treatment plant, and discharges treated sewage as far as practicable from the nearest land, any fast ice, ice shelf, or areas of specified ice concentration

DISCHARGES II
- Sewage not comminuted or disinfected can be discharged at a distance of more than 12nm from any ice shelf or fast ice
- Comminuted and disinfected sewage can be discharged more than 3nm from any ice shelf or fast ice

INVASIVE SPECIES

INVASIVE AQUATIC SPECIES
Measures to be taken to minimize the risk of invasive aquatic species through ships' ballast water and biofouling

GARBAGE

PLASTICS
All disposal of plastics prohibited (under MARPOL)

FOOD WASTES I
Discharge of food wastes onto the ice is prohibited

FOOD WASTES II
Food wastes which have been comminuted or ground (no greater than 25mm) can be discharged only when ship is not less than 12nm from the nearest land, nearest ice shelf, or nearest fast ice

ANIMAL CARCASSES
Discharge of animal carcasses is prohibited

CARGO RESIDUES
Cargo residues, cleaning agents or additives in hold washing water may only be discharged if: they are not harmful to the marine environment; both departure and destination ports are within Arctic waters; and there are no adequate reception facilities at those ports. The same requirements apply to Antarctic area under MARPOL

CHEMICALS

DISCHARGES
Discharge of noxious liquid substances (NLS) or mixtures containing NLS is prohibited in polar waters

BACKGROUND INFO

- THE INTERNATIONAL CODE FOR SHIPS OPERATING IN POLAR WATERS WILL ENTER INTO FORCE ON 1 JANUARY 2017
- IT APPLIES TO SHIPS OPERATING IN ARCTIC AND ANTARCTIC WATERS: ADDITIONAL TO EXISTING MARPOL REQUIREMENTS
- IT PROVIDES FOR SAFE SHIP OPERATION AND PROTECTS THE ENVIRONMENT BY ADDRESSING THE UNIQUE RISKS PRESENT IN POLAR WATERS BUT NOT COVERED BY OTHER INSTRUMENTS

DEFINITIONS

SHIP CATEGORIES
Three categories of ship designed to operate in polar waters in:
A) at least medium first-year ice
B) at least thin first-year ice
C) open waters/ice conditions less severe than A and B

FAST ICE: Sea ice which 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

ICE SHELF: A floating ice sheet of considerable thickness showing 2 to 50m or more above sea-level, attached to the coast

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Polar Code for vessels manned and operated by IMR

Polar Ship Certificate

- The Polar Code would require ships intending to operating in the defined waters of the Antarctic and Arctic to apply for a Polar Ship Certificate, which would classify the vessel as:
  - Category A - ships designed for operation in polar waters at least in medium first-year ice (70-120cm thickness), which may include old ice inclusions (thickness 3m or more) (PC1 – PC5);
  - Category B - a ship not included in category A, designed for operation in polar waters in at least thin first-year ice (30- 200cm) , which may include old ice inclusions (PC6 – PC7);
  - Category C - a ship designed to operate in open water (less than 10% sea ice) or in ice conditions less severe than those included in Categories A and B.
- The issuance of a certificate would require an assessment, taking into account the anticipated range of operating conditions and hazards the ship may encounter in the polar waters. The assessment would include information on identified operational limitations, and plans or procedures or additional safety equipment necessary to mitigate incidents with potential safety or environmental consequences.
- Ships would need to carry a Polar Water Operational Manual, to provide the Owner, Operator, Master and crew with sufficient information regarding the ship's operational capabilities and limitations in order to support their decision-making process.

Training of cruise leaders and cruise personnel must include information about the contents of the Polar Water Operational Manual (PWOM) and in particular safety aspects regarding polar operations and work on the ice.

Potential hazards

- **Ice**, since it can affect the hull structure, vessel stability, machinery installations, navigation, outdoors working environment and maintenance and safety tasks, and result in malfunctioning of safety equipment and safety systems.
- **Ice accumulation** on the hull, deck equipment, masts etc above the waterline, potentially reducing the vessel's stability and functionality of exposed equipment.
- **Low temperatures**, since it affects the working environment and human performance, maintenance and safety tasks, material properties and equipment efficiency, survival time and performance of safety equipment and systems.
- **Long periods with darkness or daylight,** which can effect navigation and human performance.
- **Atmospheric disturbances** which can disturb communications and navigation systems.
- **High latitude,** which degrades performance of some navigation systems, VSAT coverage and quality of sea ice coverage pictures.

Potential hazards cont'd.

- **Remoteness** and lack of precise and complete sets of hydrographic data and information, reduced access to navigation aids and sea marks and beacons with increased potential for groundings in remote areas with limited availability of search and rescue (SAR) assets, extended response time due to remoteness, limited communication efficiency and capacity, with large potential for negative impact on the rescue process.
- Potential **lack of experience** with operations in polar waters among the crew, with increased potential for human errors.
- Possible **lack of adequate emergency equipment**, limiting the efficiency of damage reduction/limiting efforts.
- **Rapidly changing and adverse weather conditions**, potentially making an incident worse and escalating.
- **The environment** with regards to vulnerability from toxic materials and other negative impacts on the environment and it's need for extended recovery time in polar regions.

Polar service temperature

- Polar Service Temperature (**PST**) means a temperature specified for a ship which is intended to operate in low air temperatures, and it shall be set at least 10°C below the lowest MDLT for the planned area of operations and the planned operational season in polar waters.
- Mean daily lowest temperature (**MDLT**) means the average value of the daily lowest temperature for each day a year over a period of at least 10 years. A data set accepted by the national maritime authorities can be applied if 10 consecutive years of data is not available.
- DAT (-X°) - Design temperature for hull and external structures.

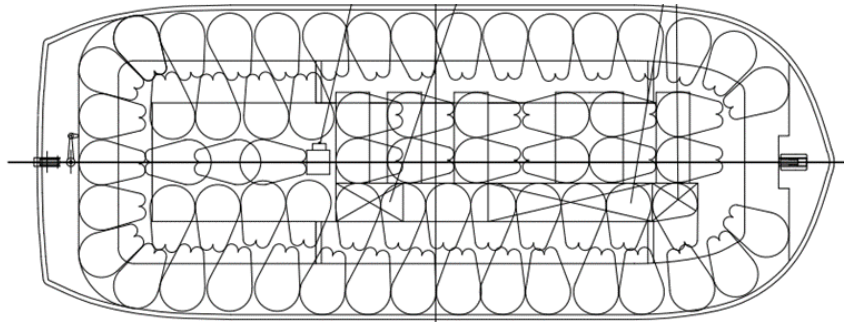
- For example, “Kronprins Haakon” has PST = DAT = -35°C.

- Normal operations shall stop at temperatures below PST/DAT.

Polar rescue equipment

- The Polar Code require rescue equipment supporting survival after the ship is abandoned, regardless of it is on water, on ice or on land, for the maximum expected time until rescue (min. 5 days).
- These resources shall provide:
    1. A habitable environment.
    2. Protection against low temperatures, wind and sun.
    3. Room enough for people equipped with thermal protection suitable for the current environment and conditions.
    4. Means to stay alive.
    5. Safe entrance- and exit points.
    6. Means to communicate with SAR assets.

Modification of lifeboats



- Capacity reduced from 68 to 55 persons
  - Room and buoyancy for extra gear
  - Room to move around
- Heating:
  - Engine heater
  - Lube oil heater
  - Electric cabin heater
  - “Webasto” diesel generated heater
- Extra batteries for light, heating and communications
- Double battery chargers
- Food and water for 5 days
- «Toilet»
- Extra comms. equipment
  - Iridium 9575 Extreme w/GPS
  - EPIRB
  - VHF

(Kronprins Haakon example)

Personal survival kit

- Each person gets a water tight bag with personal survival gear in addition to survival suit.
  - Water tight bag
  - Sleeping bag
  - Sleeping pad
  - “Jerven” canvas
  - Caps and gloves
  - Snow glasses
  - Isolated under clothes
  - Headlight w/extra battery
  - 2 Energy bars

Jerven canvas

Group survival kit

- Each group kit consists of three Pelicase containers with equipment and food supplies for 10 persons for 5 days.
- Container #1
  - 3 tents, “Hilleberg”
  - 18 snow plugs
  - 2 snow shovels
  - 1 MSR primus
  - 1 set matches
  - 2 ltrs. paraffin
  - 1 signal gun w/12 cartridges
  - 1 first aid kit
  - 5 rolls toilet paper
  - 10 sets eating utensils

Group survival kit

- Container #2 and 3
- Each container contains:
  - 25 field rations
  - 2 ltrs. paraffin
  - 5 rolls of toilet paper

  - Endurance can be extended by adding extra Pelicase # 2 and 3 containers

Group survival kit

Communication equipment

- 4 Pelicases with
  - 1 McMurdo Fastfind EPIRB
  - 1 Iridium Extreme w/2 extra batteries
  - 1 portable VHF w/2 extra batteries

Weapons

- 4 rifles (cal. 30.06) w/1 box ammunition
- Extra for winter operations in remote areas
  - “Venorgamme” (1 pr. 10 persons)
  - Paraffin oven w/100 ltr. paraffin
  - Extra snow shovels

Venorgamme

Abandon ship in polar waters

If the vessel is surrounded by compact ice

- Everyone brings their personal survival equipment (grab bag)
- Life boats and rafts to be deployed on the ice
- Group survival kits to be deployed on the ice
- Communication equipment to be deployed on the ice

If the vessel is surrounded by dense ice floes

- Everyone brings their personal survival equipment (grab bag)
- Lifeboat is equipped for 5 days
- Bring communication equipment
- Rafts must be supplied w/extra food/water
- Consider bringing along group survival kits

Polar Waters Operations Manual (PWOM)

- The purpose is to give the operating company, the Master and crew sufficient information about the vessel's operational capabilities and limitations to support their decision making process.
- Scientific operations are not covered by the PWOM.

(RV Operator) Quality Handbook

Link to RV operator QA handbook(s)

PWOM contents for (Vessel name)

- Introduction to «Vessel name»
- Operator guidance for safe operations
- Icebreaker capabilities for «Vessel name»
- Manoeuvring in ice covered waters
- Special equipment for ice operations
- Navigation in areas where ice can be expected
- Operations in low temperatures – Ship systems
- Operations in low temperatures – Personnel
- Communications on high latitudes
- Navigation on high latitudes
- Cruises of long endurance
- Route planning in polar areas
- Annex 1 – Cruise and route planning checklist
- Manning under operations in ice covered waters
- Environmental limitations and restrictions in the Arctic
- Information about ice conditions
- Metrological information
- Verification of hydrographical, metrological and navigation information
- Procedure for trawling in ice covered waters
- Operation of scientific equipment in ice covered waters
- Annex 1 – Icing on the vessel
- Winterization plan for «Vessel name»
- Operation of the sea water cooling system
- Annex 1 – Sea water system operating procedures
- Procedure for use of deck equipment in low temperatures
- Check list for machinery systems operations in low temperatures
- Equipment for removal of snow and ice
- Safety procedures regarding polar bears
- Work on sea ice
- Emergency procedures- damage control in ice covered waters
- Firefighting in ice covered waters
- Abandon ship in polar areas
- Polar emergency equipment
- Search And Rescue (SAR) in polar areas
- Reporting procedures COMNAP and SAFREP
- Polar Code certificate – List of equipment
- Risk assessment – Operations in polar waters
- Risk assessment – Personnel in polar waters
- Risk assessment – Navigation in polar waters
- Sea Ice Nomenclature
- Polar Code part 1
- Polar Code Part 2

Particulars with regards to cruise planning in polar areas

Cruise planning for ice covered waters with «Vessel name»

- Risk analysis and and SJA – Safe Job Analysis
- Equipment needs – redundancy, single point of failure
- Course and station network
- Cruise personnel requirements and skills
- Equipment and instruments use in extreme cold and ice covered waters
- Logistics for long endurance cruises far away from the nearest logistics supply point.
- Use of helicopter(s).
- Working on the ice.
- Diving.
- Etc.

Course- and station-net

- It is more difficult to plan a course- and station net for operations in ice-covered waters due to the ice drift and to what extent it is possible and/or beneficial to use large quantities of fuel to brake ice to follow a predefined track or keep a particular position.
- Fuel is an operational restriction regarding the duration of the cruise and is in addition a very expensive consumable. Fuel consumption must therefore be carefully planned and try to save as much fuel as possible as long as possible during the cruise!
- It is of paramount importance to study thoroughly the expected ice conditions for the planned area of operations, taking in to account that moving from point A to point B will not necessarily be along a straight line due to ice conditions (always look for the easiest and cheapest route through the ice), and make a time budget for scientific activities that takes in to account the possibility that the distance between two stations can be 2-3 times the length of the straight line between them.
- In heavy ice, the vessel will not be breaking ice 24/7 because the Master must ensure that off-duty personnel gets the necessary rest (avoid noise/vibrations/heavy motions). Resting periods where the vessel stays put must therefore be expected.
- It is important to develop a plan B (and also a plan C can be useful) in case the ice conditions becomes too demanding and changing very rapidly.

Amendments to (Vessel operator) general cruise leader instructions (1)

Responsibilities

- All operations on board the vessel and on the ice in the immediate vicinity of the vessel which involves the vessel's crew and equipment, such as winches and cranes, is the Master's responsibility with regards to safety for personnel and equipment.
- The Cruise leader is responsible for the safety of personnel working on land or in autonomous teams on the ice far away from the vessel.
- The Master can order all personnel being off the vessel and working on land or on ice to return to the vessel immediately if changes in weather and/or ice conditions can make it difficult to return to the vessel at a later stage, or if the vessel must be ready to leave the area on short notice due to developments in weather/ice conditions.

Amendments to (Vessel operator) general cruise leader instructions (2)

Health certificate

- In addition to the general requirement to have a valid health certificate from a certified sea farers doctor, for cruises in particularly remote and inaccessible areas such as the Antarctica and for «freezing in» of the vessel, all personnel shall have had a dental check no more than 6 months before the start of the cruise.

Training before cruise

- Safety training course for work on sea ice
- Firearms training for polar bear guards

Amendments to (Vessel operator) general cruise leader instructions (3)

General training

All personnel must be given instructions/training in the following:

Work on board the vessel

- Need for proper clothing in low temperatures (covering exposed skin etc)
- Dangers when working on deck (slippery decks due to icing and/or falling ice from upper structures)
- Use of protective gear
- Limitations when working in LOW, VERY LOW and EXTREMELY LOW temperatures
- Knowledge about signs of frostbite and hypothermia
- Location and use of personal and group survival kits

Amendments to (Vessel operator) general cruise leader instructions (4)

Training for work on land and ice

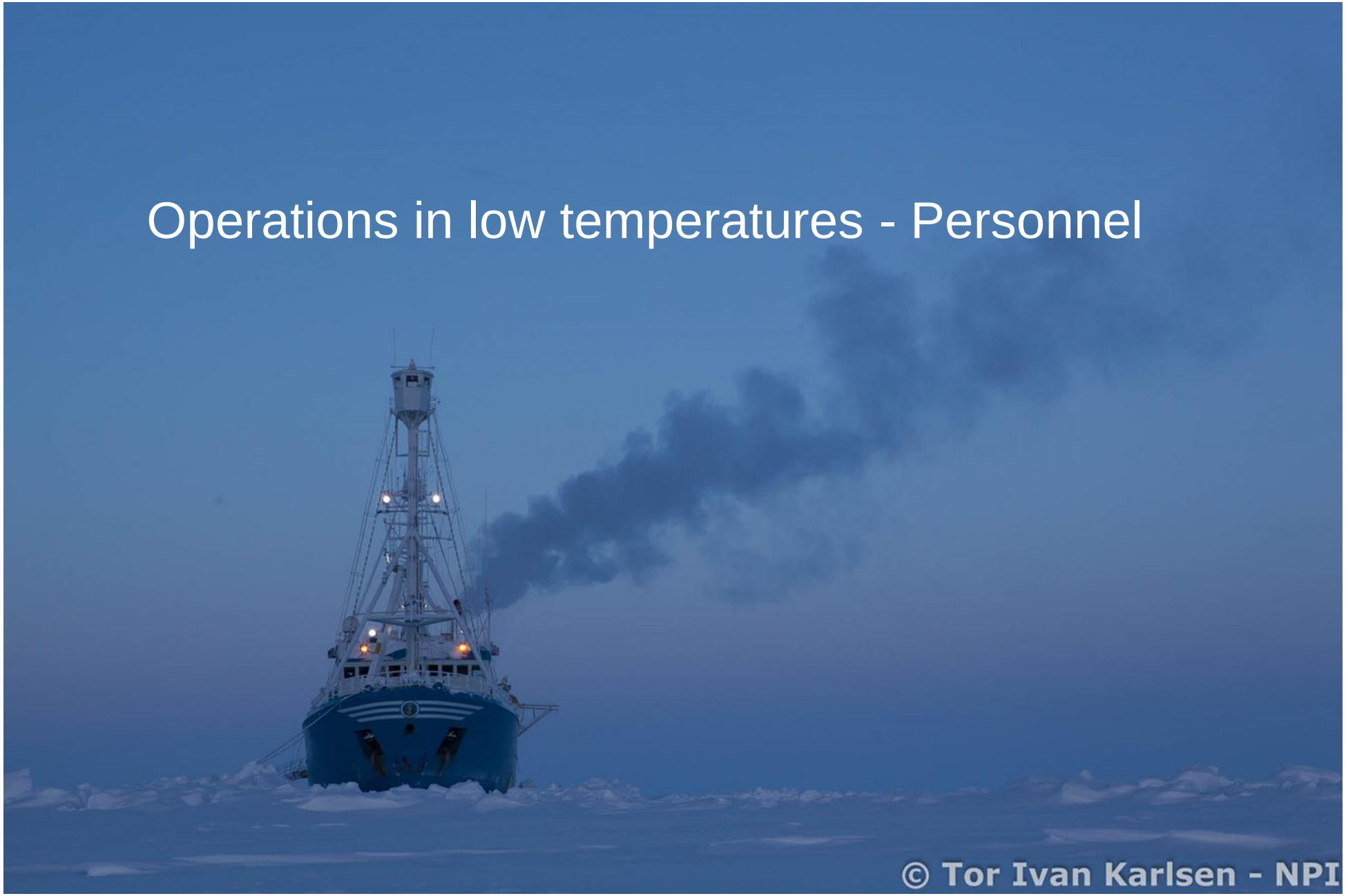
All personnel must be given instructions/training in the following:

Work on sea ice and on land

Cruise leader must ensure that all personnel working on the ice and on land is familiar with and follows the procedures from the Polar Water Operations Manual (PWOM):

- 1.2.2 – Operations in low temperatures - personnel
- 3.1.3 – Polar bear safety
- 3.1.4 – Work on sea ice

Operations in low temperatures - Personnel



Operations in low temperatures - Personnel

- It is the Master's and Cruise leader's responsibility to continuously monitor the weather conditions and decide if special precautions to counter the effects of cold air and wind is necessary to be activated and implemented.
- All personnel working on deck or on the ice shall be properly informed about the current and expected working conditions, and what measures that may be necessary to be taken.

Beaufort		Air temp.	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
		m/s	Wind chill index										
2	Light breeze	1,5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53
		3,0	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57
3	Gentle breeze	4,5	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60
		6,0	1	-5	-12	-18	-24	-31	-37	-43	-49	-56	-62
4	Moderate breeze	7,5	1	-6	-12	-19	-25	-32	-38	-45	-51	-57	-64
		9,0	0	-7	-13	-20	-26	-33	-39	-46	-52	-59	-65
5	Fresh breeze	10,5	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66
6	Strong breeze	12,0	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68
		13,5	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69
7	Moderate gale, Near gale	15,0	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-70
		16,5	-2	-9	-15	-22	-29	-36	-43	-50	-57	-63	-70
8	Gale	18,0	-2	-9	-16	-23	-30	-37	-43	-50	-57	-64	-71
		19,5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72
		21,0	-2	-9	-16	-23	-30	-37	-44	-51	-59	-66	-73
9	Strong gale	22,5	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73

	Possibilities for frosbite on exposed skin
	Possibilities for frosbite on exposed skin within 10 minutes
	Possibilities for frosbite on exposed skin within 2 minutes

Working on sea ice

Working on sea ice (1)

General requirements

- All personnel working on the ice must as a minimum have attended «Safety training course for work on sea ice» (1/2 day)
- Each team working on the ice must have a dedicated polar bear guard. The polar bear guard must have attended «Firearms training for polar bear guards» course, arranged by NPI and/or UNIS.
- Each team and team leader shall bring communications equipment iaw PWOM Procedure «Working on the ice» Chapter 12 «Communications».
- Each team shall report to the Officer Of the Watch (OOW) on the vessel's bridge when they leave the vessel and when they return. The OOW shall keep continuous record of who are on the ice at any time.

(IMR example)

Working on sea ice (2)

Judgement of ice conditions

- When arriving at ice station, the ice thickness shall be checked using a drill or ice thickness measuring instrument
- The ice's behaviour and development shall be monitored continuously, in particular in spring time and in the ice edge zone
- For ice stations involving several teams over an extended period of time, one should make several transects with EM-31 to get the best possible overview of the ice thickness distribution in the area
- Particular attention must be given to cracks and ridges to identify potentially weak parts of the icefloe
- Ice ridges and snowdrifts must be evaluated with regards to limitations in lines of sight and dead zones for the polar bear guard(s)
- Personnel making the first evaluation of the ice thickness must wear survival suits.
- A rule of thumb for minimum safe ice thickness is:
  - On foot: >10 cm
  - With snowmobile or other heavy equipment: > 30 cm

Working on sea ice (3)

Safety equipment

- Personnel entering ice of unknown thickness wear survival suit – e.g personnel securing the vessel in the ice and personnel checking ice thickness.
- As soon as the ice thickness is evaluated and regarded as safe, the survival suits can be replaced with lighter floating suits («Regattadrakt» or other floating devices).
- Personnel in smaller boats and rubber dinghies shall use survival suits at all times.
- All personnel on the ice shall be equipped with rescue belt with ice spikes, throwing rope and portable AIS if required.

Working on sea ice (4)

Scientific equipment

- Have a minimum of equipment on the ice at any one time. All equipment that is not necessary to keep on the ice must be packed and transported back on board the vessel as soon as possible, and equipment not currently in use shall be packed and ready for rapid evacuation.
- Unnecessary equipment shall be removed form the ice at the end of the working day at equipment left behind over night on the ice shall be protected against the weather.
- All equipment placed far away from the vessel (logging equipment etc.) shall to the extent possible be secured such that it can be kept floating if the ice brakes up and such that it is possible to locate at a later stage. This can be done using floating devices and AIS transponder.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Working on sea ice (5)

Safety equipment

- First aid kit.
- Aluminium ladders to cross cracks in the ice.
- Buoys/floating devices to secure equipment.
- Necessary gear and equipment if a return to the vessel is impossible.

Communications

- Each autonomous team on the ice shall be equipped with communications equipment (VHF radio, Iridium sat phone if far away) for communication with the vessel and other teams on the ice.
- The vessel and all teams on the ice shall have continuous communications watch as long as there are personnel on the ice.
- Portable AIS for all personnel outside field of view from the vessel.
- Two PLBs in each team operating outside the vessel's field of view.


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Working on sea ice (6)

Return to vessel

- If the situation requires it (weather conditions, ice conditions, polar bears visiting etc) the Master and/or the Cruise leader will call on all personnel on the ice to return to the vessel.
  We have to alarm levels for such situations:

RED alarm

- RED alarm signal will be given as the morse code letter “R” (one short, one long, one short) with the vessel’s fog horn. Simultaneously an alarm and evacuation message will be given on VHF maritime radio channel 6. If RED alarm is initiated, the teams on the ice shall return to the vessel in the quickest possible manner and leave all equipment behind without spending time on collecting and/or securing it.

YELLOW alarm

- YELLOW alarm will be given on VHF maritime radio channel 6. This alarm will be given when the situation is uncertain with regards to weather conditions and ice conditions to be expected. If YELLOW alarm is given, them the teams have the opportunity to collect and secure their equipment before returning to the vessel. The teams are then expected to be back on board the vessel within 30 minutes.

Muster station

- Muster stations is the vessel’s auditorium. Nobody leaves until other orders are given. The Cruise leader shall make sure that all personnel are accounted for and to arrange a debrief of the incident with all involved personnel present. (IMR Example)

Polar bear safety

Polar bear safety procedures (1)

General requirements

- Each team working on the ice shall have at least one dedicated polar bear guard who's main task is to continuously survey the surroundings to detect polar bears closing in.
- The Firearms training course for polar bear guards given by (Institution(s)) is mandatory for any person assigned to act as dedicated Polar bear guard.

Safety regulations

- Fire arms shall be emptied for ammunition when on board the vessel, in work boats or helicopters.
- When entering on to the ice the weapon shall be in semi-loaded position (ammunition in the cartridge magazine, but not in the cartridge chamber). The weapon shall not be loaded (cartridge in the chamber) before the intention is to open fire.
- When returning to the vessel/work boat/helicopter, empty the fire arm chamber and remove the magazine before pulling the trigger in a safe direction with at least 4 km free line of sight before entering the vessel/work boat/helicopter.

Polar bear safety procedures (2)

Safety regulations cont'd

- Fire arms shall always be locked up in the vessel's weapon locker.
  Under extreme low temperatures a dedicated weapon locker on deck should be available in order to keep the weapons functional. If a very cold weapon is taken inside the superstructure to be placed in the indoor weapon locker, there is a risk of condensation taking place inside the weapon which can potentially turn into ice the next time the weapon is taken out on deck again and the weapon may not function properly.
- Ammunition and pyrotechnical material shall also be stored in the weapon lockers when not in use.
- Signal guns have no trigger safety mechanism. They shall therefore only be loaded when the intention is to open fire. When taken on board they shall be stored in «open» position such that it is easy to check if the are loaded or not.

Weapon and pyrotechnical equipment

- The Polar bear guards shall be equipped with a hunting rifle calibre .308W or 30-06 (7,62 mm).
- In addition to the rifle, the Polar bear guard shall be equipped with a signal gun or signal pen with thunder flash or similar devices in order to scare off the polar bears.

Polar bear safety procedures (3)

When polar bears are detected:

- If one or more approaching polar bears are detected, the vessel and other teams on the ice shall be alerted immediately.
- As a general rule, all teams shall head back to the vessel and stay there until the situation is stabilized and under control.
- If the polar bear(s) approaches a team they shall attempt to scare the bear(s) away using pyrotechnical equipment (signal gun, signal pen, thunder flash etc) or firing warnings hot(s) with the hunting rifle.
- If the bear(s) do not disappear and instead comes closer it is allowed to kill the bear(s) in self defence if the situation requires. In such cases, the Governor of Svalbard to be informed without unnecessary delay. The incident will then be investigated.

Polar bear safety procedures (4)

Vessel regulations

- When the vessel is stationary or secured in the ice, a continuous polar bear watch shall be kept i order to detect polar bears approaching the vessel. The Polar bear lookout must have good visibility of the surroundings and towards the gangway(s).
- IR-camera og CCTV-cameras shall be used to ensure the best possible overview of the surroundings and give early warning.
- Search lights shall be used in darkness to light up the area near the vessel as much as possible.
- Gangways should be hoisted up in the air after working hours to limit access from the ice to deck when not in use.
- If the vessel is frozen in or stationary for an extended period of time it is important to remove snowdrifts building up close to the vessel and potentially could give polar bears easier access to the vessel deck.

Icebreaking

- Progress
- Consumption

Long duration cruises (Kronprins Haakon example)

Fuel Max 1290 tons (1500 m^3)
- Consumption 1 engine (11 knots) 15 tons/day – 86 days
- Four engines 10MW = 50 tons/day – 26 days
- Contractual endurance 65 days

In polar waters you can never have too much fuel – unless you're on fire!

Food waste
- Food waste can only be sent over board when the vessel is as far away as possible from areas with 1/10 or higher ice coverage and never closer to land or solid ice than 12 nm. Food waste shall be grinded such that it can pass a mesh with max 25mm openings and shall not be mixed with other types of waste. To meet these requirements the vessel has 5,8 m^3 tank capacity for food waste.

Fresh water
- The vessel has storage capacity for 579 m^3 of freshwater.
- It has two freshwater production systems, each producing 15 m^3/day. In addition an osmosis-system can produce another 15 m^3/day.
- Freshwater production is not seen as a limiting factor for long duration cruises, but it can be problematic to produce fresh water when in ice covered waters.

Long duration cruises

Black water and grey water

- When the vessel is stationary in the ice for an extended period of time, it can be necessary to stop releasing black water and grey water to avoid contaminating samples taken close to the vessel. This could also apply to filtered water.

In addition the Polar Code has the following requirements:

- Grinded and disinfected sewage can only be released if the vessel is more than 3 nm from the ice-shelf (Antarctica) or solid ice, and to the extent possible avoid areas where the ice coverage exceeds 1/10.
  Un-grinded and non-disinfected sewage only to be released at a distance of more than 12 nm.
- To meet these requirements, the vessel has the following tank capacity:
  - Maximum capacity with all tanks in use: 41 days
  - Storage capacity filtered water: 24 days
  - Storage capacity sewage (sludge): 36 days

Towing of equipment and sensors

- Icefloes and blocks of ice can destroy the towed body, cut the cable and/or pull of the towed body.
- If equipped with propeller pods, use them to remove icefloes and ice blocks during launch and recovery.
- Pointing the pods outwards to create a wider ice free channel behind the vessel.

Handling of equipment over the side

- Equipment and cables are exposed to drifting icefloes and ice blocks along the side of the hull, and that the «channel» between the hull and the ice is rapidly closing during the period the equipment is in the water.
- During recovery of equipment the «flight» from the water and into the hangar can be a challenge if the air temperature is extremely low. This can result in icing of the equipment and in worst case destruction.
- The vessel's side thrusters and/or azimuth-propellers can be used to keep the side of the hull as ice free as possible.

Moonpool

- «Vessel name» is equipped with a AxBm moonpool with a «guiding system» (cursor) for launch and recovery of ROV, CTD etc.
- It is a hatch at the bottom of the moonpool shaft to block ice from entering when not in use.
- The shaft is equipped with steam nozzles for melting of ice/slush.
- To tow equipment through the moonpool when breaking ice is not recommended since icefloes and ice blocks can slide under the hull and hit the cable coming out of the moonpool.

Drop keels and Arctic tanks

- Deploying the drop keels in ice covered waters in not planned. Instead so called «Arctic tanks» are installed in the hull, containing the following antennas:
  - EK 80 all frequencies
  - ADCP 38kHz og 150kHz
  - EM302 multibeam echo sounder
  - EA600 single beam echo sounder
  - SBP300 sub-bottom profiler
  - Topas 40 sub-bottom profiler

Not available:
Simrad SH 90 sonar
Simrad SU 90 sonar
Simrad MS 70 multibeam sonar
Simrad ME 70 multibeam echosounder
EM710 multibeam echosounder
HiPAP

(Kronprins Haakon example)

Trawling in ice-covered waters

- Minimum ice in the direction for trawling in order to maintain as close to normal progress as possible.
- Lower the trawl below the depth of the ice as quick as possible to avoid collecting ice blocks in the trawl.
- Always keep the ice trawl gallows locked in inner position in ice-covered waters.
- Heave the trawl in as open water as possible.
- Use minimum speed when recovering the trawl.
- Time and distance will be limited when trawling in the ice. The deck crew must therefore be well trained and drilled in rapid launch and recovery of the trawl.

Diving

- During diving operations, the decompression chamber shall be embarked and together with qualified operator
- New and more stringent requirements for professional diving are implemented.
- Internal procedures for scientific diving are updated.

Use of work boats

Use of the vessel's work boats or embarked work boats shall only take place when the Master allows it, and the following safety rules are implemented:

- Communications with (Vessel name)
- AIS
- Safety equipment and survival gear
- Firearms
- Cruise plan

Note If you plan with extensive use of the work boats (RV Operator) must hire an extra able seaman or two!

Helicopter operations

Note: If you plan on bringing organic helicopter(s) on a cruise, (RV operator) must hire an extra able seaman to cover helicopter deck operations

Helicopter operations

- Before starting helicopter operations OOW on the bridge shall announce this over the intercom and smoking and hot work stops.
- It is forbidden for passengers to stay on the helicopter deck during landing and take off.
- During landing and take off passengers shall wait in the hangar or helicopter office.
- Personnel/passengers on their way to the helicopter shall use the safe zones around the helicopter and follow the instructions from the HLO. There are posters showing safe passageways around different helicopter types at all exits to the helicopter deck and in the helicopter office.
- Passengers entering/leaving the helicopter shall be equipped with required safety gear (survival suit etc.)

Drone flights

- Remember to get a permit for drone operations before cruise start!
- Form to be filled in and shown to the Captain when approved can be found in (QA manual …) and is named: "……."

Check also: URL to aviation authorities web pages about drone flying in controlled airspace

Logistics Longyearbyen (1)

- «Vessel name» will often use Longyearbyen (LBY) as start and/or end port for cruises in the Arctic. The infrastructure in LBY, such as piers, cranes, trucks, storage facilities etc is very limited and there is not daily arrival of cargo vessels from the main land.
- In addition, Svalbard is a «Tax free sone» and therefore all goods coming from LBY to mainland Norway must og trough customs clearance.
- The vessel have some cargo storage capability, but not enough to act as a «warehouse» for equipment, samples etc long before or after a cruise.
- Experience so far is that many cruises bring huge amounts of equipment etc on board for a cruise. It is therefore of paramount importance that the vessel crew is informed about what and how much you plan to bring on board.
- It is equally important that the number of cruise participants listed in the approved cruise plan is correct!

Logistics Longyearbyen (2)

- If equipment, samples etc is to be carried to/from Tromsø by cargo ship it must be packed in containers that can be temporary stored on land in LBY before loading on board «Vessel name» or on board a cargo vessel going to Tromsø.
- If you bring containers to be loaded on board «Vessel name», be aware that they may have to be of reduced height!
- If you need freezer or cooler containers, make sure you plan it in time if you want to take them on board, be used on land or used on board a cargo vessel, to make sure you have the necessary power source available at all times.

Logistics Longyearbyen (3)

- A procedure has been developed for transportation to/from LBY. See «RV operator QA manual documents…….»:

Contact information «Vessel name»

Email addresses VSAT

- khkaptein@hi.no
- khchief@hi.no
- khmaskin@hi.no
- khstuert@hi.no
- khdekk@hi.no
- kheto@hi.no
- khaakon@hi.no
- khforsker@hi.no
- khinstrument@hi.no

Email addresses Iridium

- khaakon@khaakon.uuplus.net
- khkaptein@khaakon.uuplus.net
- khmaskin@khaakon.uuplus.net
- khtoktsleder@khaakon.uuplus.net
- khfelles@khaakon.uuplus.net
- khinstrument@khaakon.uuplus.net

Phone
VSAT: +4755906480
Iridium: +8816 777 52265

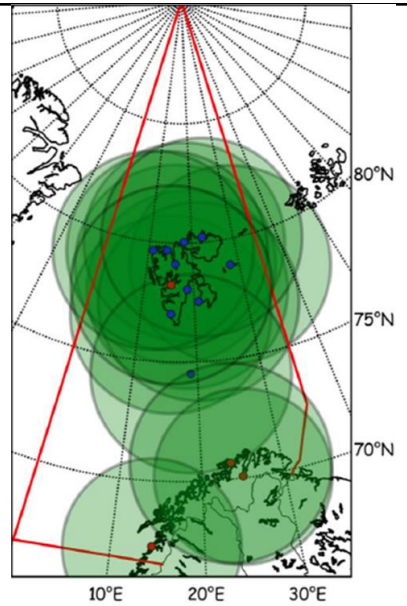
(Kronprins Haakon example)

Search And Rescue (SAR) in the Arctic

- SAR-responsibilities are shared between the Arctic nations
- HRS N-Norway in Bodø is responsible for the Norwegian sector

SAR resources in Norwegian Arctic sector

Asset	Place	Readiness	Range	Sensors	De-ice
2 x Sea King, 330 Squadron	Lakselv, Bodø	15 min.	220nm with 2 passsengeres, 50nm with 20	FLIR, radar NVG	No
2 x AS332L1 Super Puma, Lufttransport	Longyearbyen	No. 1 – 1 hour, No. 2 – 2 hours guaranteed. Typical 15-20 min. day, 25-35min night	250nm from nearest fuel depot	FLIR, radar, NVG, AIS, DF homer	Yes
2 x S-92 SAR, Bristow Helicopters	Hammerfest	No. 1 – 1 hour, No. 2 – 2 hours guaranteed. Typical 20-30 min.	250nm	FLIR, radar, NVG, AIS, DF homer	Yes



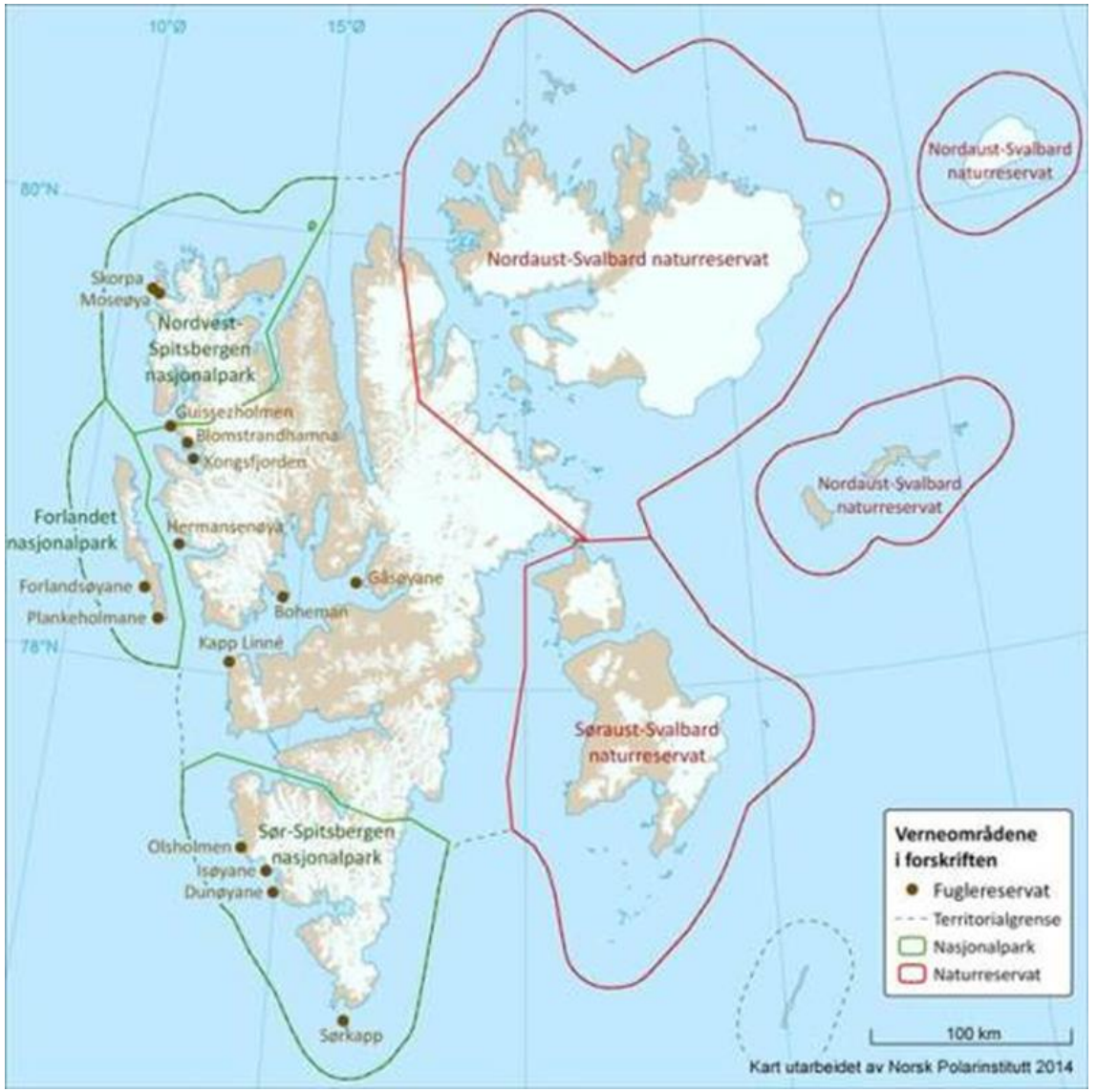
SAR in Antarctica

- SAR-responsibilities are shared between the «surrounding» nations
- No dedicated SAR resources, using what's available.
- Research vessels are often the main resource in Norwegian sector (Queen Maud's Land)
- More commercial traffic along the Antarctic peninsula

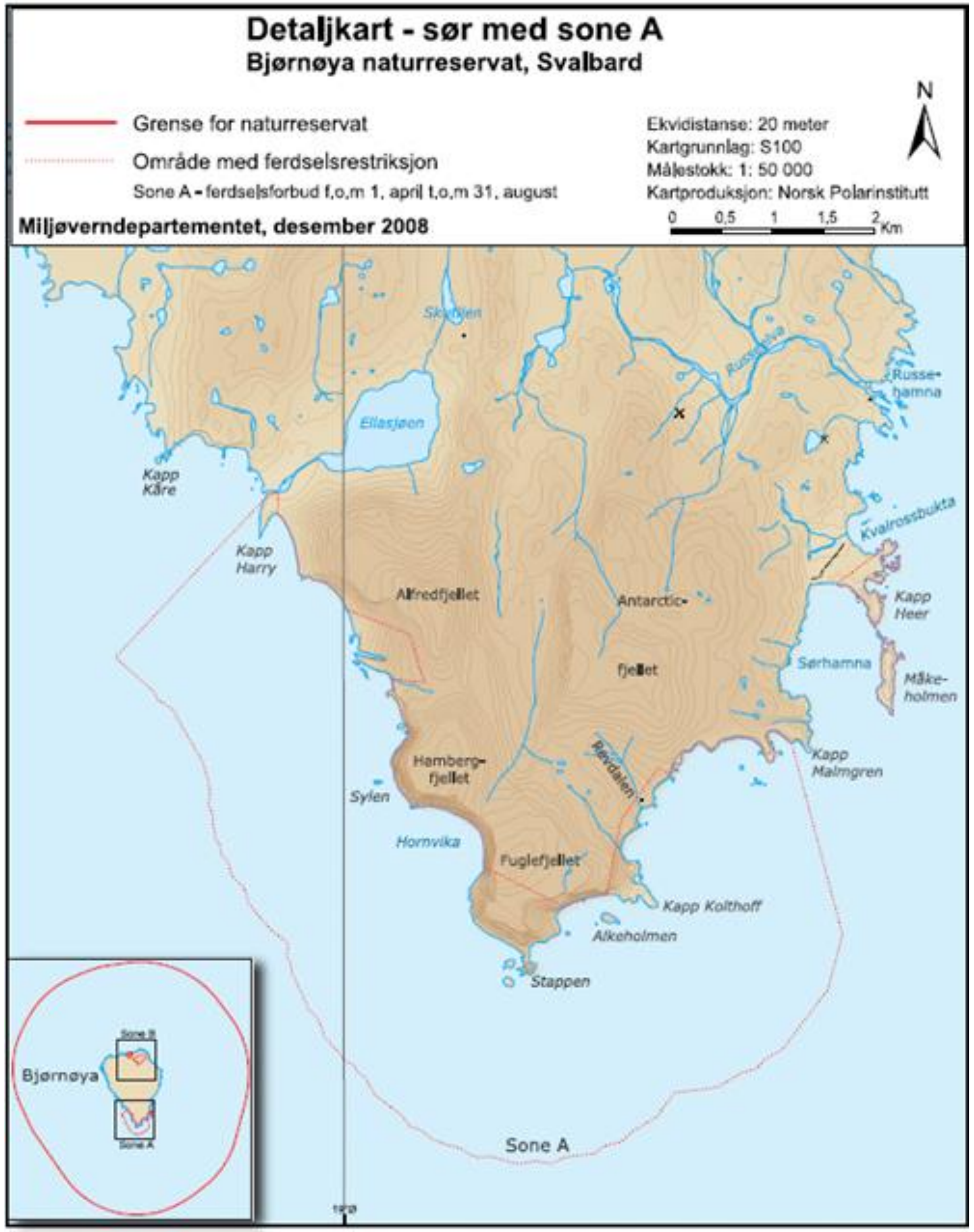
Environmental protection regulations Svalbard

National parks/nature reserves

- Landing with helicopter is prohibited
- No fly zone below 300m/1 nm off shore
- No diving
- No bottom trawl or bottom scraper in less than 100m water depth
- No landing near cultural heritage sites
- No sampling
- Application to Governor of Svalbard if planning scientific activities




Sone A – Referanseområde for forskning
Nordaustlandet
Hinlopen-
stretet
Erik Eriksenstretet
Kong Karls Land
Spitsbergen
Olgastretet
Barentsøya
Storfjorden
Edgeøya
50 km
Kart utarbeidet av Norsk Polarinstitutt 2014


Detaljkart - sør med sone A
Bjørnøya naturreservat, Svalbard
N
Grense for naturreservat
Område med ferdselsrestriksjon
Sone A - ferdselsforbud f.o.m 1. april t.o.m 31. august
Miljøverndepartementet, desember 2008
Ekvidistanse: 20 meter
Kartgrunnlag: S100
Målestokk: 1: 50 000
Kartproduksjon: Norsk Polarinstitutt
0 0,5 1 1,5 2 Km
Ellasjøen
Russelva
Russe-
hamna
Kapp
Kåre
Kapp
Harry
Kvalrossbukta
Alfredfjellet
Antarctic-
fjellet
Kapp
Heer
Sørhamna
Måke-
holmen
Kapp
Malmgren
Hamberg-
fjellet
Revdalen
Sylen
Hornvika
Fuglefjellet
Kapp Kolthoff
Alkeholmen
Stappen
Sone A
Bjørnøya
Sone B
Sone A


Ferdselsforbud ved automatisk fredede kulturminner
Ytre Norskøya
Likneset
Ebeltofthamna
Lægerneset


Ferdselsforbud ved automatisk fredede kulturminner
Haudegen
Habenichtbukta
Zieglerøya, Delitschøya og Spekkholmen
Halvmåneøya


Ytre Norskøya, Nordvest-Spitsbergen nasjonalpark
Klovningen
Ytre Norskøya
Cook-sundet
Norskøy-sundet
Norskøyane
Indre Norskøya
Svenske-gattet
Vasa-halvøya
N
1 km
Ekvidistanse 50 m


Likneset, Nordvest-Spitsbergen nasjonalpark
Fuglepynten
Fuglepynt-fjellet
Nordgattet
Likneset
Rohssberget
Kennedy-bukta
N
1 km
Ekvidistanse 50 m


Haudegen, Nordaust-Svalbard naturreservat
Gangarodden
Rijp-fjorden
Grynet
Beistfaret
Wordie-bukta
Haudegen
Wordie-odden
N
1 km
Ekvidistanse 50 m


Habenichtbukta, Søraust-Svalbard naturreservat
Fleinholmane
Hassenstein-bukta
Grunnline-sletta
Stor-fjorden
Årdalstangen
Habenichtbukta
Svarttangen
Kraussbukta
N
1 km
Ekvidistanse 50 m

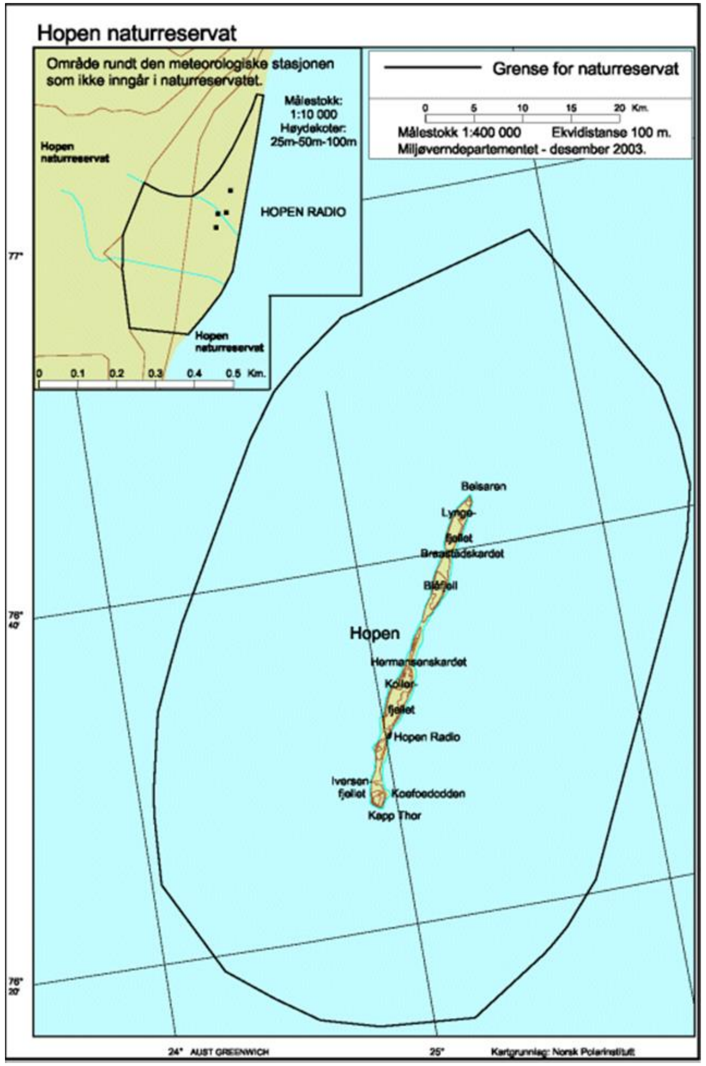

Ebeltofthamna, Nordvest-Spitsbergen nasjonalpark
Tromsdalen
Bouréeneset
Ebeltoft-hamna
Ebeltoftodden
Krossfjorden
Enjalbal-stranda
N
1 km
Ekvidistanse 50 m
Kart utarbeidet av Norsk Polarinstitutt 2014

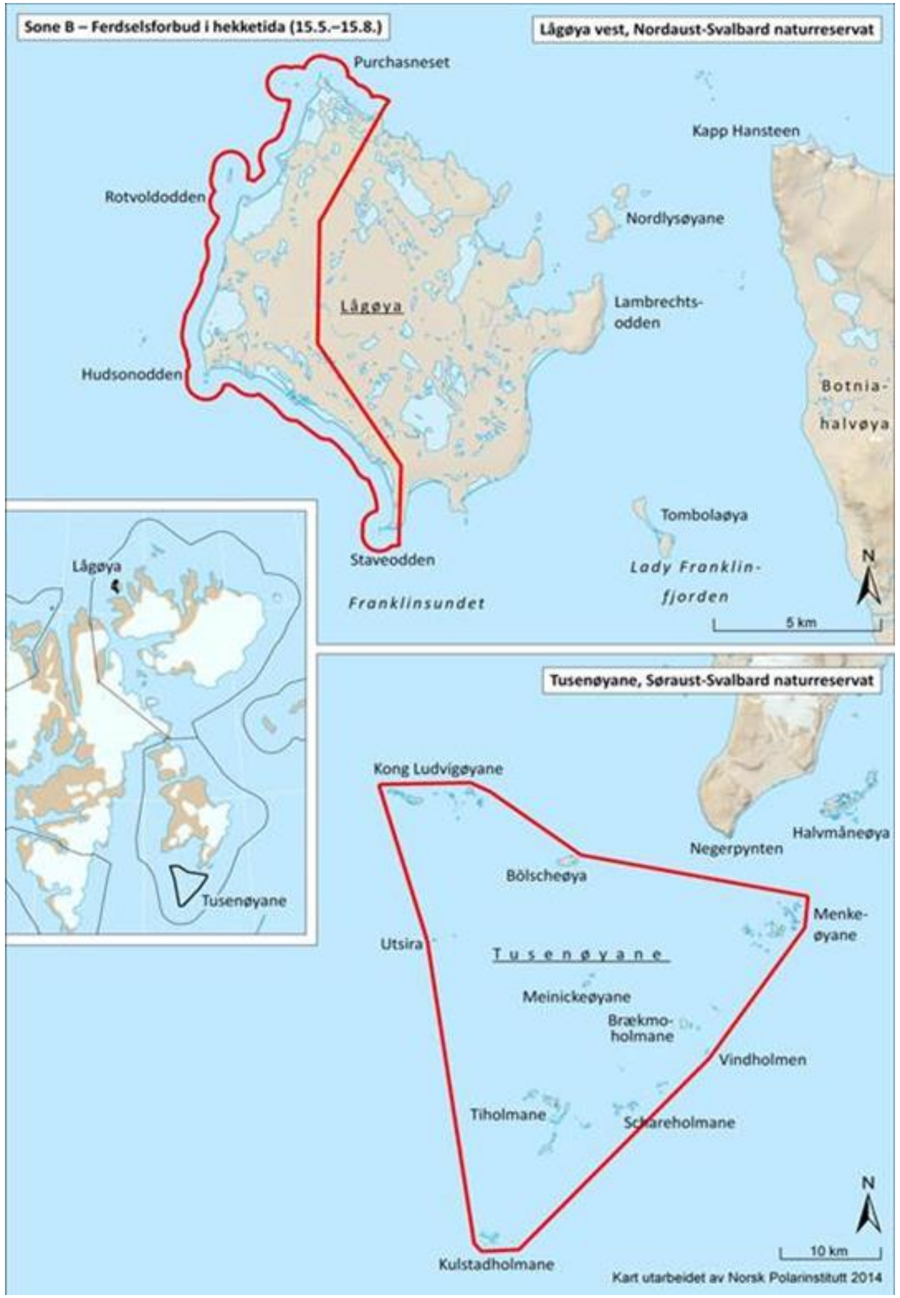

Lægerneset, Sør-Spitsbergen nasjonalpark
Reinodden
Recherche-fjorden
Reinsletta
Lægerneset
Martin-fjella
N
1 km
Ekvidistanse 50 m

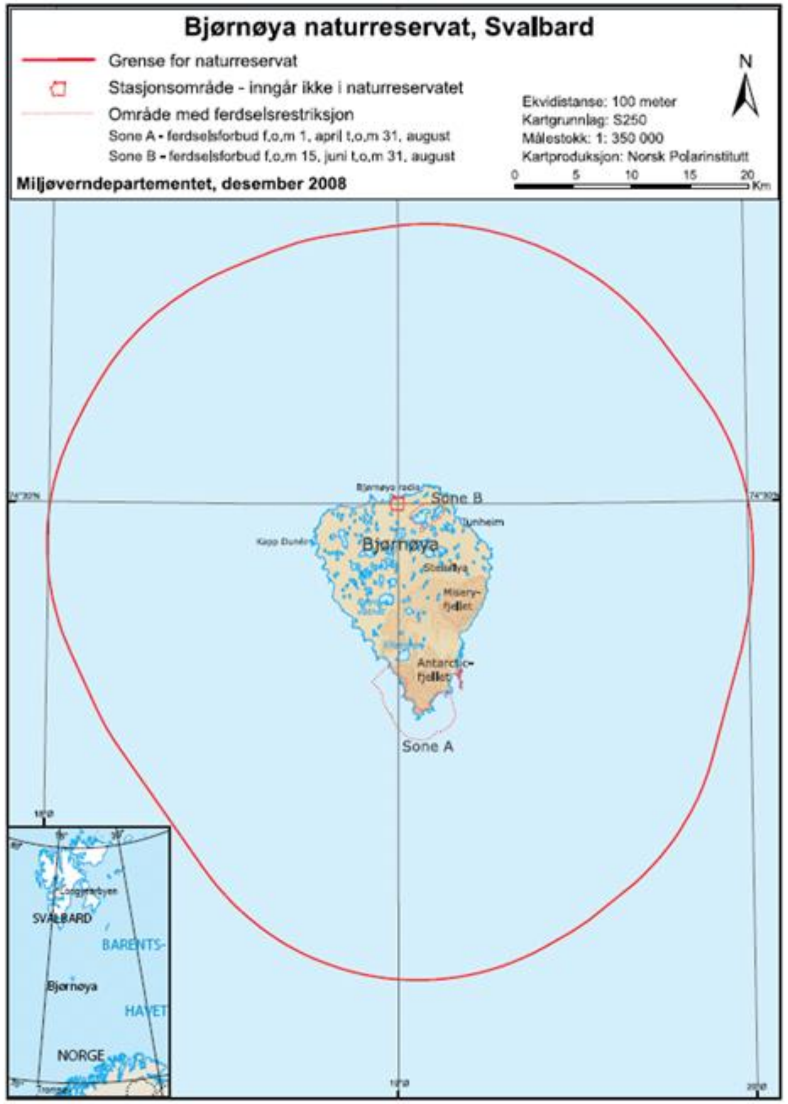

Zieglerøya, Delitschøya og Spekkholmen, Søraust-Svalbard naturreservat
Tjuv-fjorden
Andrée-tangen
Zieglerøya
Delitschøya
Spekkholmen
N
2 km
Ekvidistanse 50 m


Halvmåneøya, Søraust-Svalbard naturreservat
Edgeøya
Halvmåne-sundet
Diana-hamna
Halvmåneøya
Tennholmane
N
2 km
Ekvidistanse 50 m
Kart utarbeidet av Norsk Polarinstitutt 2014


Område med forbud mot utslipp av kloakk og gråvann fra skip eller andre fartøy
Kapp Platen
Kapp Wrede
Platen-halvøya
Nordenskiöld-bukta
Kapp Lovén
Duve-fjorden
Rijpfjorden
Prins Oscars Land
Gustav V Land
Rijpfjorden
N
5 km
art utarbeidet av Norsk Polarinstitutt 2014


Hopen naturreservat
Område rundt den meteorologiske stasjonen som ikke inngår i naturreservatet.
Målestokk: 1:10 000
Høydekoter: 25m-50m-100m
Hopen naturreservat
HOPEN RADIO
Grense for naturreservat
Målestokk 1:400 000
Ekvidistanse 100 m.
Miljøverndepartementet - desember 2003.
Hopen
Hopen Radio
Kapp Thor
Koefoedodden
Kartgrunnlag: Norsk Polarinstitutt


Sone B – Ferdselsforbud i hekketida (15.5.–15.8.)
Lågøya vest, Nordaust-Svalbard naturreservat
Purchasneset
Kapp Hansteen
Rotvoldodden
Nordlysøyane
Lågøya
Lambrechts-odden
Hudsonodden
Botnia-halvøya
Tombolaøya
Staveodden
Lady Franklin-fjorden
Franklinsundet
5 km
Lågøya
Tusenøyane
Tusenøyane, Søraust-Svalbard naturreservat
Kong Ludvigøyane
Halvmåneøya
Negerpynten
Bölscheøya
Menke-øyane
Utsira
Tusenøyane
Meinickeøyane
Brækmo-holmane
Vindholmen
Tiholmane
Schareholmane
Kulstadholmane
10 km
Kart utarbeidet av Norsk Polarinstitutt 2014


Bjørnøya naturreservat, Svalbard
Grense for naturreservat
Stasjonsområde - inngår ikke i naturreservatet
Område med ferdselsrestriksjon
Sone A - ferdselsforbud f.o.m 1. april t.o.m 31. august
Sone B - ferdselsforbud f.o.m 15. juni t.o.m 31. august
Ekvidistanse: 100 meter
Kartgrunnlag: S250
Målestokk: 1: 350 000
Kartproduksjon: Norsk Polarinstitutt
Miljøverndepartementet, desember 2008
Sone B
Bjørnøya
Sone A
SVALBARD
BARENTS-
HAVET
Bjørnøya
NORGE

Environmental protection regulations Svalbard

Bird reservations

- All traffic, incl. Boats and planes are forbidden 15. May – 31. August.
- Seafloor down to 100m depth is protected.
- No sampling allowed.

Environmental protection regulations Svalbard

Cultural hertitage sites

- Any trace of human activities before 1946.
- All gravesites and remains of gravsites
- Protective zone 100m in all directions were camping is prohibited.
- Full overview on http://svalbardkartet.npolar.no

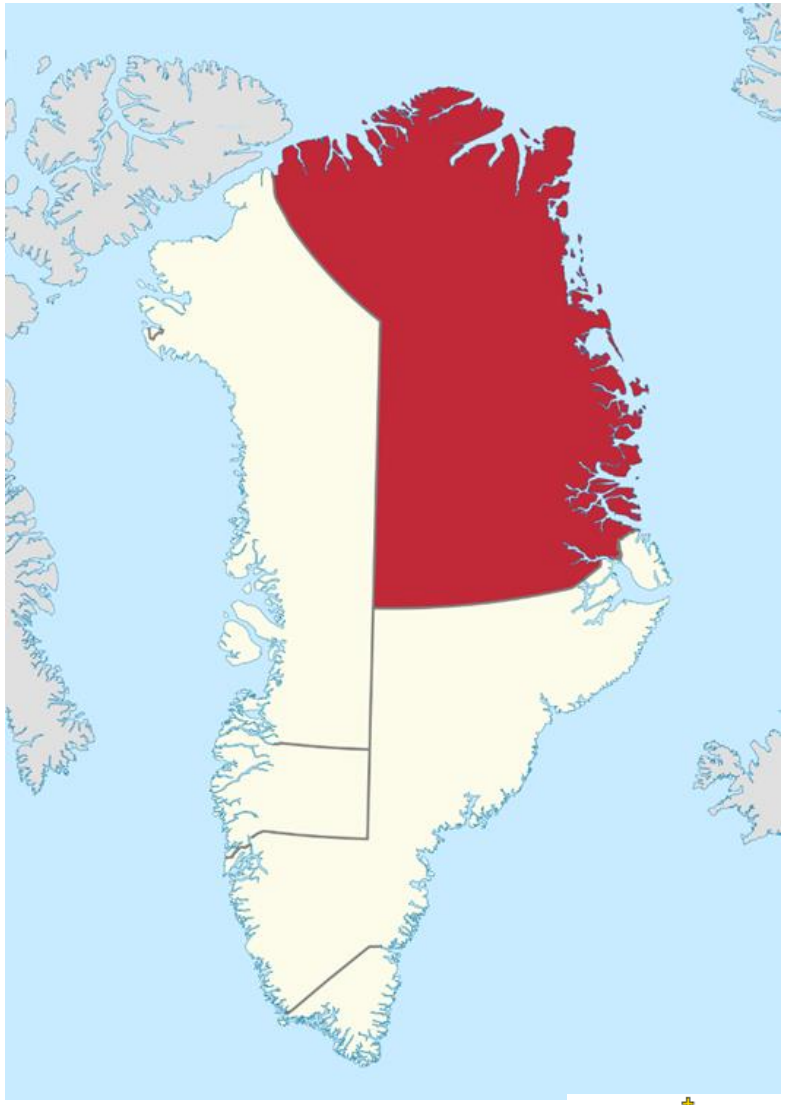
Glaciers

- Recommended minimum distance from glacier fronts that could be breaking off is 200m
- At glacier fronts of more than 40m height and in narrow fjords the distance should be increased.

Environmental protection regulations

Greenland

- Traffic inside territorial borders in Northeast-Greenland national park require permit.
- A number of forms must be filled in: http://en.mipi.nanoq.gl/sitecore/content/Websites/uk,-d,nanoq/Emner/International_relations/expeditions.aspx
- Notification of proposed research cruise.
- Diplomatic clearance via Danish Arctic Command vfk-ktp-a-mar@mil.dk




Questions?