

IAATO Operational Procedures for Selected Vessel Operations in the Vicinity of Ice

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Ice is one of the most impressive sights in Polar Regions. It also provides a rich and important habitat for a number of species. First-hand experiences of fast ice pack ice, icebergs and tidewater glaciers is something that few visitors will ever forget and can provide a useful mechanism for explaining the driving forces of the unique natural environment of Polar Regions. Ice can also be an important element of wildlife viewing.

While impressive and beautiful, operating vessels in the vicinity of ice poses potentially serious risks and as such requires skill and alertness on the part of the operator. The following guidelines are intended to provide environmental guidance for ship's bridge officers and safety advice for small boat drivers to help enable them make good risk assessments with respect to operating in the vicinity of ice.

Every encounter with ice is different. Therefore, critical components for both ship navigation and competence as a polar small boat operator are respect for ice, constant alertness and an ability to respond within seconds.

Fast Ice – Environmental Guidelines for Ships

Fast ice is defined in the WMO Nomenclature as “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. Vertical fluctuations may be observed during changes of sea level. Fast ice may be formed in situ from sea water or by freezing of floating ice of any age to the shore, and it may extend a few meters or several hundred kilometres from the coast.”

Fast ice, particularly in near coastal and ice shelf environments, provides important habitat, including feeding grounds and nurseries for Antarctic fauna that cannot be found elsewhere on the planet. Emperor penguins, for example, rely on stable fast ice for at least eight months of the year to rear their chicks successfully but are significantly threatened by the loss of habitat through climate change in the coming decades. Weddell seals haul out on stable fast ice to rest, moult and pup. Fast ice also supports less visible species and communities, such as plankton and krill that are an essential part of the ecosystem. The duration of fast ice plays an important role in minimising disturbance by locking in icebergs, preventing movement and thereby reducing seabed scour. It also helps maintain natural stability in fjords where the breakup of fast ice can cause sea-ice algae to sink to the seafloor rather than staying in the surface as plankton. As such, it is important that we minimize any unnecessary damage to this critical habitat.

Therefore, to further support the guidance laid out in the Wildlife Watching and Emperor Penguin guidelines it is recommended vessels avoid transiting through fast ice in near coastal and ice shelf environments unless for safety and or scientific reasons. Berthing at the edge of fast ice, i.e. holding a stable safe position at the edge of the ice approximately +/- one ships length from the edge of the fast ice is not considered a transit.

Operators at all times shall have due regard to the environmental conditions and wildlife breeding grounds. Consideration can be made to proceed through fast ice over short distances in order to complete a safe, innocent passage and shall always be dynamically risk assessed. However, a transit should be avoided if operationally feasible. A Dynamic risk assessment shall include and not be limited to the safety of navigation, environmental and wildlife impacts.

Safety Considerations for Small Boat Operations:

These guidelines are primarily intended for operations with small boats using outboard engines. However, particularly around larger forms of ice (e.g Icebergs and Tide water glaciers) similar guidelines should be followed by the home vessel. Additionally, other small boat operations including, kayaks, stand up paddle boards and canoes, should also take into account the characteristics of each individual operation.



Sea Ice, Pack Ice & Brash Ice

- Pack ice can move very quickly, and can trap vessels.
- When operating amongst sea ice or icebergs, be vigilant to local sea and wind currents. Be alert to ice movement in relation to your operation and how it may affect both vessel and shore operations.
- If taking small boats along the edge of the pack ice. Keep the pack ice down wind of your operation and make sure you have a clear exit out at all times.
- Small boats can drive through brash ice at low and controlled speeds. Try to pick a route that avoids large pieces of ice that may damage the boats or get stuck under the keel limiting the boat's ability to manoeuvre.

Icebergs & Bergy Bits

- Icebergs and bergy bits are unpredictable and dangerous – even grounded bergs. Caution should be used when approaching, in proximity, or doing 'iceberg tours.'
- An iceberg should not be approached closer than two times the height of the berg above water. Even then, caution should be used.
- Remember that a drifting iceberg will have localized currents around it, which may affect your vessel's actual course.
- Do not enter an 'ice pool' and avoid driving over an ice foot. While they look very inviting, they are potentially extremely dangerous should the berg roll and either leave the boat high above the water or suck under the berg.
- Never drive through an ice tunnel or under any ice arches as it can collapse without any warning. Engine vibrations may affect the stability of the ice. Remember a cubic meter of ice weighs one metric ton and an ice fall near a boat is sufficient to cause real damage, potentially even flipping or sinking a small boat.
- Be aware that grounded icebergs will experience a gravitational change with tidal variation. This makes them more unpredictable and more likely to calve or break up.
- Leave the engine running to enable a fast exit if needed.
- Do not forget that icebergs can extend considerably further underwater than is visible from the surface. If an iceberg breaks up and rolls, ice can appear several 10's of meters (or feet) from the original site of the berg. If you see a berg start to roll drive away from it as quickly as possible.
- Be aware that a collapsing iceberg can cause a huge breaking wave and ice fragments can move remarkably quickly over a large distance. Be prepared. Anchoring close to ice is not advisable, instead maintain a watch and keep your engine running. If time allows drive away from the wave before turning the vessel to face the wave making sure the vessel and passengers onboard are prepared to ride a wave out.
- Vessels should be aware of iceberg or glacier locations when considering anchorages or starting points for operations.

Tide Water Glaciers¹

- Tide water glaciers are very unpredictable and to the naked eye calving is a random process. It is impossible to predict precisely when calving may occur, how large a block will be created, or how it will enter the water.
- Using cliff height as an estimator for the minimum safe distance is inadequate since the hinge point can lie beneath the waterline. In addition, tide water glaciers can also calve underwater, creating 'torpedos' of ice to appear unexpectedly. There is little or no warning of these events.
- Waves that are created closest to the block, in the so-called splash zone, are very large, unpredictable, and dangerous, particularly for small boats. The minimum safe distance for avoiding direct hits from ice blocks needs to be larger so that vessels are outside of the splash zone.
- Small boats cruising in the vicinity of tide water glaciers should keep at least 200 meters/600 feet from tide water glaciers to avoid both direct hits and the largest waves. For high activity glaciers this should be increased to 400 meters/1200 feet.
- Try to stay in clear water to both assure good manoeuvrability as rolling ice with waves can be extremely dangerous.
- The 200 meters/600 feet distance should be increased in narrow fjords, in shallow fjords, or locations with ice cliffs higher than 40-50 meters/120-150 feet.
- Keep the engine running and be prepared to move away quickly.
- As waves become grounded, either in shallow water, or on shore, tsunami waves are created (e.g. at Neko Harbour). Small boats should not land on shores near the edge of calving cliff faces, but further around the coastline from the glacier. Even then, implications of tsunami waves should be taken into consideration when securing boats and selecting landing sites.

¹These guidelines are based on a report by the Norsk Polar Institute on 'How close should boats come to the fronts of Svalbard's calving glaciers?'



Range Finders

- It is **strongly recommended** to use Laser Range Finders (LSRs) during small boat operations. Regularly check distances to potentially hazardous features.
- It is recommended that the LSR has a reach of minimum 1000 meters/3000 feet.
- It is recommended to use the LSR for distance assessment training for staff.
- If you do not have range finding equipment on board then request distances from the bridge (who can use their radar to measure your distance from the hazard).

Do watch...Examples of consequences of ice cliff and iceberg calving:

<http://www.youtube.com/watch?v=HbUIRELqowg>

<http://www.youtube.com/watch?v=aDJizpbNZvw>

<https://www.youtube.com/watch?v=2cTp6HVM5qM>

<https://www.youtube.com/watch?v=zt8qoggxWVg>

<https://www.youtube.com/watch?v=ANzAuqBuV4Q>

https://www.youtube.com/watch?v=LFBnmNpz_RI