SCUBA ice diving procedures
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Diver qualification
The dive team consists of three divers. All divers are AAUS (American Academy of Underwater Sciences) certified and are part of the University of Alaska Dive Program, or have valid reciprocity (AAUS or NOAA dive certification from a different institution). All divers are current on their medical exam, CPR, First Aid and Oxygen provider certifications. All divers are experienced divers with ample dry suit and cold water diving experience. All divers have been approved through the UA Dive Safety Officer and are registered as part of the dive team in the UA Dive Plan.

Before a dive
All divers are in good health and feel fit to dive. All gear is in good operating order, any problematic equipment has been replaced (spares will be available). All dive gear is packed in a way that allows easy deployment to the ice and moving on the ice (e.g., sleds). Tanks are filled with compressed air; no mixed gases will be used. We will provide our own compressor to fill the tanks, and we will also provide the tanks, which all are current on the visual and hydro.
Once the ship is positioned in the ice, possible dive sites are determined. Usually, these dive sites are the ice edge in safe distance aft of the ship or a natural open hole or crack in the ice.
All divers participate in the ship’s ice briefing. In addition, the dive routine of the day is discussed, such as buddy teams, order of dives, tasks to be completed, etc. The dive team consists of three divers and a tender.
The regular dive routine is that two divers are in the water as a buddy team, one diver is at the surface ready to dive and assist the divers in the case of an emergency, and a tender tends the line to which the divers are tethered. The emergency diver cannot tend the line. Our dive team consists of 4 divers, so all dive operations are covered by the UAF dive team. No support from the Coast Guard is requested. In addition, the UAF team has two additional people on the ice during dive operations, who will be performing on-ice work (ice coring and sampling) in a safe distance to the dive team but close enough for communication.
Line signals are as follows (each signal can be given by either the divers or the tender, and are always answered from the other end):
1 pull – ok
2 pulls – give more line (usually asked by divers)
3 pulls – take line in (usually asked by divers)
Multiple rapid pulls – emergency, divers need to ascend

Diving procedures
Gear is deployed to the ice with assistance of the ship’s crew. Divers are suited in their dry suits and bring the gear to the agreed dive site. Each diver sets up their own gear. The first buddy team puts on all their gear and performs a buddy check. One of the divers is tethered to the tending line (50 m, of which only 30 m are fed out during a dive). The tending line is secured at the end onto a heavy object. The other diver is tethered to the first diver via a buddy line (4 m long). This set up ensures that divers always stay close together but have enough room to operate; having two independent buddy lines with two tenders could cause tending lines to cross, which hinders the transmission of line signals.
Divers submerge; the tender occasionally asks divers if everything is ok via line signals. Up to 30 m line are fed out. Dive depth is determined by ice structure: Level ice is mostly less than 3 m thick, while ridge structures can submerge several 10’s of meters. Maximum dive depth is usually set at 20 m, unless a greater depth has previously been agreed upon (30 m maximum) because a special ice feature has to be sampled. Divers observe conservative bottom times, although dive time is usually so short that bottom time at these dive depths is not limiting. Dive time is mostly determined by cold temperatures and varies between 15 and 30 minutes. A dive is ended before the tasks are finished if a diver experiences any discomfort (e.g., cold) or has any equipment problems.
Divers return to the entry site and enter back onto the ice. After a short break for the divers to warm up and drink some water for hydration, the second buddy team prepares for a dive. This second buddy team consists of the previous emergency diver and tender. In total, up to four dives can be performed with each dive team deploying twice. Repetitive dives are not problematic considering shallow dive depths and short dive times.
Emergency procedures

An emergency occurs if the situation on the ice becomes unsafe (ice breaks us, ship needs to move, polar bear appears, etc), or if a diver experiences problems under water. In the first situation, the tender will call divers back to the surface via the emergency line signal (multiple rapid pulls). The divers respond to the line signal to indicate that they understood the emergency, abort all sampling procedures immediately and rapidly but safely return to the entry site, where they are quickly helped onto the ice by the tender and emergency diver. An emergency also occurs if the divers fail to respond to line signals by the tender. In this case, the emergency diver quickly gets into the water and follows the tending line to the divers, where he/she will be able to assist the divers with a safe ascent and return to the entry site. In any case of emergency, the additional on-ice scientists can be called upon for assistance. For example, according to AAUS regulations, the tender does not have to be a certified diver and so another scientist can assist with the on-ice tasks in case of an emergency.

The medical emergency contact is the ship’s physician.