Ice Diving 101

With my roots firmly planted in the Upper Midwest, a midwinter trip to the tropics for a dive vacation only mildly satiated my appetite for the underwater world. For me, it wasn't reasonable to simply pack up my dive gear and wait for warmer weather in order to dive at home. The one thing that helps me through Wisconsin's five months of winter is ice diving. I guess that the divers up here are all some distant cousin to Paul Bunyan, typically having handy a hearty pair of long johns and a chainsaw. So, come late November or so, the motto of the northern diver changes to "Have chainsaw - will dive."

Ice diving welcomes you to a never-ending dive season, opening up opportunities to access favorite dive sites year-round. Sites that during the summer months are plagued with heavy boat traffic or poor visibility are now readily accessible. Objects lost through the ice such as ice shanties, snowmobiles, or vehicles can be recovered - a potential money maker for the savvy diver.

I've learned that as long as you play by the basic rules, diving under ice can be one of the safest of diving activities. If a problem occurs, after only a few swift tugs on the line tethering you to your access hole, your tender will send you flying, pulled for the light of the hole, and yank you out onto the ice sheet like a hooked fish. As only three or four divers dive at a time, standby divers are always available to tend to your needs.

Ice diving is nothing short of a small scale expedition. Preparation is key, and by far the most time consuming aspect. Nothing is worse than towing all your gear out onto the ice sheet only to find that a basic item was forgotten. It is a walk of shame having to leave your buddies to brave the chill on the ice while you walk back to the truck; or worse, have to drive back to the dive shop.

Besides the normal list of dive gear, my list of specialty items for ice diving looks like this:

Chainsaw • Gasoline/Oil • Axe • Ice Auger • Ice Chipper
Crampon • Sand • Block and Tackle • Ropes
Rope Minders • Carabiners • Ice Screws • Shovel
Chest Harness • Portable Ice Shanty • Propane Heater (with full propane tank) • Extra Mittens/Hats
Extra Dry Clothes/Fleece • Hot Water in a Thermos
Extra Regulator • Extra Tanks
Full Face Mask (if it is really cold) • Dawn Dish Soap
Portable Chairs • Chemical Hand Warmers
Tarps • Dry Suit • Extra Thick Dry Suit Undergarment
Dry Gloves • Glove Liners • Small Snowblower (if there is a lot of snow)

Before you pack up and head out on the ice, there are several advance preparations that must be attended to.

Not every piece of dive gear is suitable to handle the extreme temperatures of ice diving straight out of the box. Some regulator manufacturers suggest a simple adjustment of intermediate pressure to better tolerate the cold. Others suggest the addition of an environmental kit to the first stage. These kits, however, may use silicone to prevent freezing, and render your regulator incompatible for Nitrox use.

Make sure that the blades of your ice auger, axe, and chipper are sharpened. Check that there is propane in the heater tank. The chainsaw is one of the more important items and should also be carefully checked – the bar oil, spark plug – and make sure it starts and runs easily. A recon to check the ice thickness should be made ahead of time to make sure the chainsaw blade is long enough to cut all the way through the ice. Last winter the ice was 28 inches thick. With only an 18-inch blade on my chainsaw, I hired a friend, a tree trimmer by trade, to tackle the job of cutting the hole.

It is best to dive in locations you are familiar with to ensure adequate depth and suitable bottom composition. Dive sites with strong currents should be avoided, as this will make it difficult to impossible to return to the exit hole. When you arrive at the site, first drill a test hole with the ice auger to check the ice thickness and quality. Make sure you lower a weight on a measured reel through the test hole to check the depth of water. Some bodies of water are lowered during the winter to prevent ice damage to shorelines. This will ensure that the dive site is deep enough to avoid stirring up the bottom with fins while entering the water.

Ice six to eight inches thick will support the weight of people standing on it, while ice greater than twelve inches thick will support the weight of vehicles. Be aware that the cumulative weight of dive gear, vehicles, and people concentrated around the hole can cause the ice to sink or crack. Exhaled bubbles from open circuit divers under the ice will cause deterioration and further weaken the ice. Ice near shore or around breakwaters, piers, and pilings is generally weaker. Water currents caused by springs or rivers will thin the ice and cause thickness to vary. Changing temperatures also weaken ice and may cause cracks. It is best to watch the weather forecast, and choose a day following consistently cold temperatures. Late season ice that has experienced many freeze/thaw episodes may become rotten and honeycombed. This is the most dangerous ice as whole chunks will rot away or break off. Two years ago on a late March ice dive in unseasonably warm weather, we noticed the ice all around us seemed to instantly turn blue. Luck apparently was on our side because as the last equipment was removed from the ice, a booming crack developed leading out to open water, and within thirty minutes the ice that we had been standing on cleaved off! By the next day no ice was visible on the lake.

Once the site has been selected, it is time to cut the hole. The lucky diver selected to cut the hole should dress in a dry suit and safety harness. He should be tethered to warrant against accidentally falling in. Scribe the outline of the hole with an axe or chipper before you begin to cut. Some divers elect to tether the chainsaw as well, but problems may arise with entangling the tether. If the chainsaw blade does end up too short, then blocks will have to be cut and chipped away before the second and final cut can be made to access the water.

An ice diving hole is not circular. The best shape is actually an equilateral triangle with edges approximately eight to ten feet long. The triangular shape facilitates divers exiting the water. A diver can move into a narrow corner and, with hands on either edge, kick up onto the sheet. If the diver cannot get out by himself, he can back into the corner and a tender can pull him out by his tank valve/manifold while he pushes up with his hands. The hole needs to be large enough to accommodate three or four divers. Extra care should be taken in cutting the corners of the hole – over-cuts may result in the safety lines becoming stuck in the grooves.

The ice from the hole should be cut into small blocks and removed by prying out with the ice chipper or pulled out with a combination of ice screws and block and tackle. The ice blocks can then be used as part of a windbreak, and stored for later replacement into the hole. Although it is tempting to simply push the blocks under the ice, there are several reasons this is not a good idea: 1) Blocks under the surface may freeze to the ice, and it will not be possible to be replace them into the hole. 2) Divers can bang their heads on the blocks. 3) Ice blocks can work their way loose, and end up back in the hole during a dive. 4) Safety lines can become jammed amongst the blocks, making signals impossible to interpret.

A cool trick that I learned is to put a drop of Dawn dishwashing detergent into the water of the freshly cut hole. This will dissipate any oil from the chainsaw, keeping it away from dry suit seals and other petroleum-vulnerable gear. Once the hole is cut, the next step is to clear snow from the immediate area. A 20-foot radius around the hole should be shoveled clear to allow for better light penetration and to prevent wet dive gear from freezing to the snow. It may seem obvious, but don't set anything you want to keep dry in the snow or directly on the ice – it will melt underneath. Tarps are great for keeping items off of the ice. Sand should be scattered around the hole to increase traction, and crampons can be worn, if you have them. The ice tends to sink around the edges of the hole and water will get on its surface, making it very slippery. Along with shoveling in the immediate vicinity of the hole, a large circle 100 feet around the hole should be shoveled clear, with several radial spokes in toward the center, making a "wheel" pattern. This pattern will help a lost diver find the hole, if separated from the tether, and will provide greater light under the sheet. Depending on the thickness of the snow, another circle can be shoveled closer to the hole to allow for additional lighting.

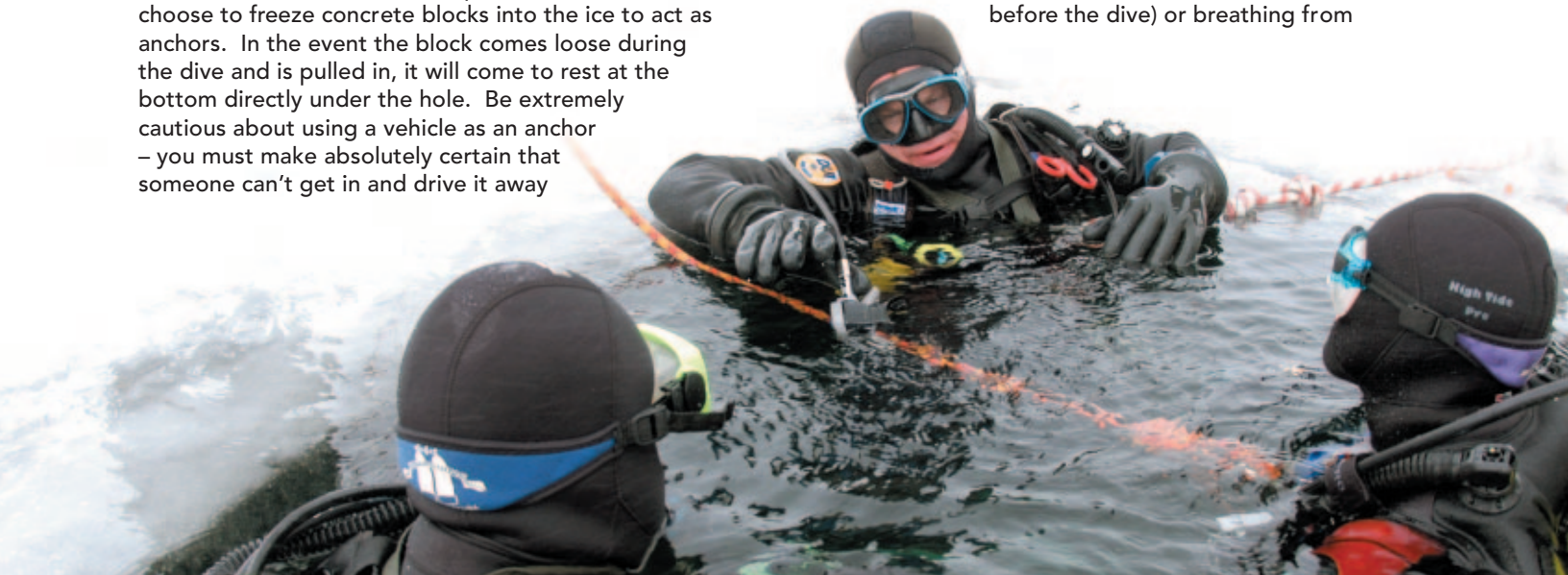
I have seen some interesting and elaborate ice shanties created for diving. Some allow divers to actually sit inside, suit up, and access the hole from inside the warming shelter. Inexpensive pop-up ice shanties can be purchased from a local sporting goods store, and provide adequate shelter from the wind and cold while changing clothing. If propane heaters are run inside the shelter, be sure to consider exhaust ventilation. No shelter material, extra clothing, hats, or mittens should come in contact with the heat source.

Primary tether lines should be 100 feet in length and a minimum of _ inch in diameter. Thicker line is easier to manage while wearing heavy gloves. The safety/standby diver should be tethered on a 200-foot line. Brightly colored line is more visible through the ice sheet, and makes it easier to track the progress of the divers. Ideally, the line should be stored in a large-mouthed line bag, a milk crate, or on a garden-hose reel. The end of the line should be secured to the catchment, and the entire device should be anchored to the ice with ice screws, or tied to a fixed object on shore to avoid pulling it in. Some divers choose to freeze concrete blocks into the ice to act as anchors. In the event the block comes loose during the dive and is pulled in, it will come to rest at the bottom directly under the hole. Be extremely cautious about using a vehicle as an anchor – you must make absolutely certain that someone can't get in and drive it away while divers are in the water. For whatever line storage device you choose, the tender must be able to easily see how much line is remaining, and must have a quick and tangle-free way to stow the line. One buddy team operates off of the same line. A knot with a locking carabiner is tied approximately 10 feet from the end for the lead/signal diver. Another station for the buddy should be tied with a locking carabiner onto the end of the line.

Decompression typically isn't the limiting factor for ice dives, but rather the ability to withstand the cold water temperatures. Dry suits are suggested for prolonged exposures, with the addition of dry gloves and extra warm undergarments. If chemical heaters are added, caution must be taken to avoid direct contact with the skin. Be aware that many chemical heaters are oxygen-fueled, and increased partial pressures of oxygen may cause hyperactivity of the heater. If you are inflating your dry suit with Nitrox from your primary tank (as opposed to a dry suit inflation system utilizing argon or air), burns may result, even through layered clothing. A safer option for suit heating is commercially available suit heaters, like those available from Patco, Inc., or Golem Gear which operate off battery packs wired into variable sized heating pads running through a bulkhead connector. If wetsuits are worn, warm water can be poured into the suit and gloves to help maintain body temperature during the dive. Warm water should be added immediately prior to entering the water, and care should be taken not to burn the diver. The warm water should be kept handy and can also provide a quick fix for frozen inflators and free-flowing regulators.

Commercially available chest harnesses can be used, or one can be fashioned out of a long piece of webbing tied into a loop, crossed in the back, figure-eighted through the arms and connected in the front with a locking carabiner knotted to the safety line. Many divers choose to add an additional weight belt buckle to their belt to avoid accidentally dropping weights during the dive. Redundant air sources such as pony bottles, H (or Y) valves, or double tanks are often used during ice dives.

Because outside temperatures can be colder than the temperature of the water itself, divers who are not submerged should avoid using a power inflator for wing inflation (oral inflation only should be used before the dive) or breathing from



regulators until fully submerged. If a free flow occurs, turn off the tank immediately and pour warm water over the first stage, into the second stage, and onto frozen inflators. Once these items are thawed and significantly warmed, then the tank can be turned back on. When the team enters the water, they should remain near the hole for a minute or two for a period of acclimation to ensure the proper function of regulators and to get used to being under the ice sheet. The dive team should follow the rule of thirds for gas management – use no more than two thirds of their total gas during the dive, allowing an adequate reserve for emergencies.

The divers enter the water as a team on one rope. When swimming, the divers should stay in the same position relative to one another. Divers on individual ropes may lead to entanglement, if lines are crossed underwater, when divers do not stay in the same relative position. The signal (or lead) diver is clipped into the line at the first station 10 feet from the end of the line, and the buddy is clipped to the carabiner at the end. If visibility is limited, the buddy may take up slack in the line between the divers and hold it coiled in his hand during the dive. The signal diver's responsibility is to relay messages to and from the tenders, and then to his buddy. Common signals that are used are: One tug = let line out. Two tugs = ok. Three (or more) tugs = take line up / recall divers back to hole. Any set of signals can be used as long as they are agreed upon prior to the dive. Single line tugs tend to be difficult to interpret and easily confused with line drag on the ice edge, therefore signals should be strong and distinct. The receiver should always repeat signals that are given. It is important for the tender to keep the line relatively taut and maintain constant line awareness with the signal diver. Communication every few minutes will prevent line from becoming fouled on underwater obstructions. If there is no response to a signal given by the tender, it should be assumed that the dive team has separated from the line, and the safety diver/team (standing by) should be dispatched. Tenders should not pull all the line in if the divers become separated from the line, as it can be used by the safety divers to help locate the team.

If a diver (or dive team) becomes separated from the line, he should ascend to the ice sheet and look for the shoveled wheel pattern. While ascending, the diver should keep a hand above his head to prevent crashing into the ice. He should look only briefly for the wheel pattern and then wait under the ice sheet to conserve gas, looking for the safety diver or safety diver's line. Only if it is obvious should the lost diver progress toward the hole. The safety diver will follow the dive team's line out and sweep around at the extent of the snow pattern keeping just under the ice sheet at the surface. Only if necessary should the safety diver search the bottom. The search should continue until the safety diver has used two thirds of his gas, or the divers are found.

The tender's responsibility is not only to respond to signals from the dive team, but also to pay out and repack line. At the beginning of the dive, the tender should ensure that the divers are securely tethered. Gentle tension should be maintained on the line at all times to avoid slack and to feel any communication, but the tension should not limit the divers' ability to move freely underwater. The line should be maintained free of ice, and prevented from freezing onto the ice surface by immediately repacking the line into the holding device. The hole will also need to be maintained by the tenders, and kept free of floating ice.

I find that the most interesting place to explore during an ice dive is directly beneath the ice sheet. Ice ridges, abandoned fishing holes, cracks and freeze-overs all provide interesting areas to look. By far the most fascinating time to ice dive is on freshly frozen "black ice." It is like diving under glass, and can provide fantastic photographic opportunities.

Many divers play ice diving games. Upside down underwater golf uses ping-pong balls instead of golf balls - divers flip upside down, stand on the ice sheet and putt into augured out holes. Upside down underwater water skiing has divers swim out the distance of the line, invert, stand on the ice sheet and tug the line three times. The tender and friends then take off running with the line towing the diver water ski-style back toward the hole at a rapid rate!

When the fun and games are done, it is time to close up the hole. Replace the ice blocks into the hole, and fill in the cracks with snow. Mark the hole with branches, poles, or a snow fence – anything to make others aware of the open water. If you are leaving poles or a snow fence on the ice, it is important to return within a few days to recover them. Review the list of items that you brought out on the ice so that nothing is forgotten or misplaced in the snow.

It is important to check with local authorities before ice diving. Some municipalities have laws regarding vehicles on the ice, and flotation required for passage over the ice. Additionally, there may be regulations regarding cutting and repairing the ice. Be aware of warnings issued, and consider the weight-bearing ability of the ice.

I hope that these few tricks that I have learned along the way will make ice diving safe and fun for everyone involved. Understand that there are as many different techniques for ice diving as there are ice diving instructors. This article was written to provide divers with new ideas and thoughts to improve your own ice dives, and is in no way intended to replace proper training.

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