



Extension FactSheet

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Ice Safety

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Winter recreational sports are popular activities with many Ohioans. As temperatures drop below freezing (32°F/0°C) people want to get on the ice for the exciting sport of ice fishing. Ice fishing, sledding, snowmobile riding, ice skating, downhill skiing, and cross-country skiing are just some of the most popular winter sports. With these activities come some safety precautions, especially when ice over water is involved. Ice can be very dangerous, and people can be injured or killed if ice and its conditions are not respected and understood.

Many things other than temperature can affect ice conditions on ponds, lakes, and rivers. The strength and thickness of the ice should be known before any activities take place upon it. The condition, strength, and stability of ice can change dramatically from day to day and hour to hour depending on temperature, precipitation, wind, and the amount of sunshine. Most accidents occur when people don't understand ice formation or how to read ice conditions. Other reasons are due to a person's careless attitude, overconfidence, and lack of appreciation of the risks involved when on ice.

There are no hard and fast rules to assure your safety on ice, but you can learn what to look for and what to do in case of an accident to protect yourself further. Focusing on four key items should be part of planning any winter outdoor activity, especially those conducted on ice. Item one is your physical condition—are you able to sustain the conditions and physical demands on your body under the weather's conditions, and would you be able to save yourself if you fell through the ice? Item two—are you properly dressed for the conditions? Loose and layered clothing including proper head and hand gear is a must. The three main areas of heat loss are through the head, the armpits, and the groin area. Keeping these areas warm is more important than the other extremities. The third item is the equipment you should take with you. A personal flotation device (PFD) and ice claws are the

most important pieces of equipment you should have (see the "Safety Equipment" section). The final item is comprised of procedures to follow when on the ice, meaning how and what to do whenever you go out on the ice (see the "Tips to Remember for Safety on Ice" section).

Reading Ice

Ice does not develop uniformly or evenly. Ice thickness can range from 12 inches (30 cm) thick to 1 inch (2.5 cm) thick within a 10 foot (3 m) area. Ice is actually a very complex formation, and no ice is completely safe. New ice is usually stronger than old ice. As ice ages, the bond between the crystals decays making it more dangerous and weaker even if melting has not occurred. Ice thickness can be affected by many factors other than temperature. Factors like wind, wave action, natural springs, snow, obstacles protruding through the ice (like docks, limbs, logs, etc.) all can weaken ice. Wind and wind speeds influence ice formation. Light winds speed up the formation making for weaker ice, and strong winds force water from beneath the ice and can decay the edges of the ice. Large fluctuations in weather and the surrounding climate conditions can also create weak spots in ice. Temperature, precipitation (snow, sleet, rain), ice age, water depth, and water quality are all factors that can affect ice strength and thickness. Conduct an ice inspection as you proceed across any body of ice. Inspect the ice structure and thickness by augering or drilling a hole through and chipping at the ice every 10 feet (3 m) to inspect the thickness and color. When chipping at the ice and it comes off in chunks, it is an indication of high density and a strong bond between the ice molecules. When chipping at the ice and it comes off in flakes or thin layers, it is an indication of low density and porous ice due to its deteriorating condition. This inspection needs to be completed every time you go out on the ice to assure you know the ice condition at that specific time of day.

Ice Formation

An old saying used by ice fishermen was “Thick and blue, tried and true; thin and crispy, way too risky.” Just because the temperature drops below freezing does not mean it’s time to hit the ice. There are many different types of ice formations.

First Ice or Old Ice

Typically the first ice to form is often called “frazil ice” or old ice, which is loosely formed crystals that clump together at the surface as the water temperature dips past 32°F (0°C). Frazil ice is soft and will not hold weight, as its structure is porous giving it a very low density and making it very weak. This ice is often formed very quickly and would seem to be the strongest; however, it’s not, as it is some of the weakest ice and should be avoided.

Gray or Black Ice

Rotting ice is the honeycombed ice that is in the advanced stage of disintegration and can appear gray to black in color due to being saturated with water. Gray or black ice should be avoided altogether as it is not safe to bear any weight load. Slush is a danger sign. It indicates that ice is no longer freezing from the bottom and indicates weak or deteriorated ice. Stay off slushy ice until it has been frozen for 24 hours straight.

Snow Ice

Snow ice is formed when water-soaked layers of snow are thawed and then frozen to form an ice layer. It has a very low density and is also very porous due to air pockets formed while freezing, which makes it weak. It

can have a white to opaque striped colored appearance due to the layers of thin frozen snowmelts. Its porous state makes it structurally weak, and when it is chipped at and comes off in flakes, it should be avoided. Snow can insulate ice and keep it strong. It can also insulate it to keep it from freezing. The plane between the top of the ice and the bottom of the snow can create a melting area that will lead to the ice losing its strength and density. When ice is covered by snow, great precautions need to be taken to determine ice thickness before starting any activity. Snow can also hide cracked, weak, and open water areas.

Clear Ice

Clear ice is the ice to look for during your inspections. It is formed during extended periods of below freezing temperatures. It can have a blue tint and sometimes has a greenish tint due to the color of the water. Clear blue ice is by far the strongest and safest type of ice because it is very dense, not very porous, and the crystals forming it have a tight bond giving it its high density, strength, and structural stability. When chipping clear ice it will come off in chunks of solid ice. Clear ice is the strongest, but its location within a water body has an effect on its thickness. The weakest or worst ice will be next to shores and in the middle of a lake or pond. Caution must be used when in these areas.

River Ice

River ice is another issue altogether. Only cross river ice or be on it as a last resort. If you have to cross river ice look for an area where the water is still or in shallow pools as this is where the strongest ice will be found.

Table 1. Reading ice—how was it formed and what you need to know.

Ice Type	Color	Formed From	Good Issues	Dangerous Issues	Safety Rating
First Ice or Old Ice	Oily to Opaque	Water temperature reaches 32°F (0°C) and freezes crystals into clumps	None, very unsafe and unstable	Can form a solid sheet but has no strength and is very unsafe—STAY OFF	Very poor
Gray or Black Ice	Light Gray to Dark Black	Melting ice, occurs even if air temperature is below 32°F (0°C)	None, very weak structure, unsafe and unstable	Not safe, its weak density can’t hold a load—STAY OFF	Very poor
Snow Ice	White to Opaque	Water-saturated snow freezes on top of ice forming another thin ice layer	If density is high and covers large base of blue ice can be used	Most times it’s weak due to being porous from air pockets	Poor to fair
Clear Ice	Blue to Clear	Freezing water formed over a long period of below freezing temperatures	High density, very strong, safest ice to be on if thick enough (see Table 2)	Stay off if less than 4 inches (10 cm) thick	Best

Never cross areas where the river makes a bend or in areas of elevation drop where ripples are and areas where rocks or other obstructions are within the river. The moving water of rivers makes for ever-changing ice conditions. The ice may look thick and solid from the riverbank but it could actually be paper-thin due to being undercut by moving water. On average, river ice is 15 percent weaker than pond ice of the same thickness. Great caution must be utilized when crossing on river ice. One way to check river ice thickness is to throw a heavy rock or log onto the ice and see if the ice holds the weight or if it breaks through. Even if it holds, still utilize extreme caution crossing river ice. ***Crossing river ice should be a last resort as its strength and stability is never a sure thing.***

Ice Thickness and Safe Activities

How thick is thick enough? General guidelines to determine what activities can safely take place on ice and a rough rule of thumb on ice thickness and safe activities are given in Table 2. For any load you intend to leave on the ice for longer than two hours you need to multiply the load weight by 2 due to the fact that contact between the load and ice can cause ice melting and failure.

Always spread out the weight load over a large area. When ice fishing keep at least 10 to 20 feet (3 to 6 m) between people and even greater distances from autos to spread the weight out over the ice. The heavier the weight load, the greater the distance needs to be. It is critical to check ice thickness described in the previous sections.

Air Temperature and Cracks in Ice

If the air temperature goes above freezing 32°F (0°C) for 6 hours over a 24-hour period, ice can quickly lose strength and stability and become unsafe. To counter this, you should multiply the weight of the load you are taking on the ice by 1.3 to find the inches of ice needed for your activity or wait for the next hard freeze of more than 24

hours to go back on the ice. Always check local conditions at the fishing or skating pond, as its ice can be much different than the ice conditions at your home. Cracks are a normal part of ice formation. You may hear the cracks rumbling under your feet and this is normal. There are two types of cracks: wet cracks and dry cracks. Dry cracks are nothing to be concerned about. They are a result of the ice expanding on the upper layers due to increasing buildup of ice from the bottom, and this is actually a sign that the ice is getting stronger. Wet cracks are a danger sign because they indicate that the crack went clear through to the water level and caution should be taken. If wet cracks are present, load weights must be multiplied by 2.5 to find the new maximum weight load and the ice thickness needed to handle the activity.

Examples

A 200 lb ice fisherman finds 5 inches (13 cm) of clear ice, but the temperature has been above freezing for the past 8 hours. He must multiply his weight (200 lbs/91 kg) and equipment (20 lbs/9 kg) by 1.3 to find the new weight load maximum and ice thickness required to hold the weight load.

$$220 \text{ lbs (100 kg)} \times 1.3 = 286 \text{ lbs (130 kg)}$$

This means that he or she needs ice that is at least 6 inches (15 cm) or thicker.

A group of fishermen pull a multi-person ice shanty with a 4-wheeler onto 8 inches (20 cm) of ice with an estimated weight of people, equipment, shanty, and ATV of 2,100 lbs (953 kg) and wet cracks are present. A new weight load maximum and ice thickness needs to be found by multiplying the estimated load by 2.5.

$$2,100 \text{ lbs (953 kg)} \times 2.5 = 5,250 \text{ lbs (2,381 kg)}$$

This means that they need ice that is at least 12 inches (30 cm) or thicker.

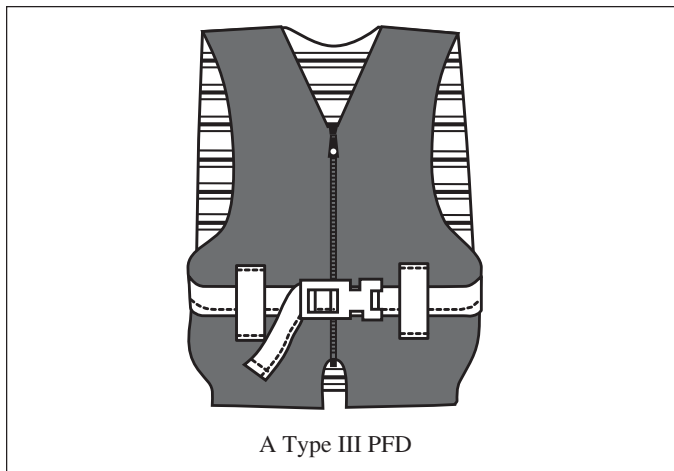
Table 2. General guidelines for ice thickness and safe activities.

Thickness of Clear Ice*		Activity	Maximum Weight
Inches	Centimeters		
0–3	0–8	No Activities	None
4–5	10–13	Skating, Fishing	250 lbs / 113 kg
6–7	15–18	Snowmobile or ATV	1,100 lbs / 499 kg
8–11	20–28	Light Truck or Car	3,527 lbs/ 1,600 kg
12–14	30–36	Medium Truck	7,937 lbs / 3,600 kg

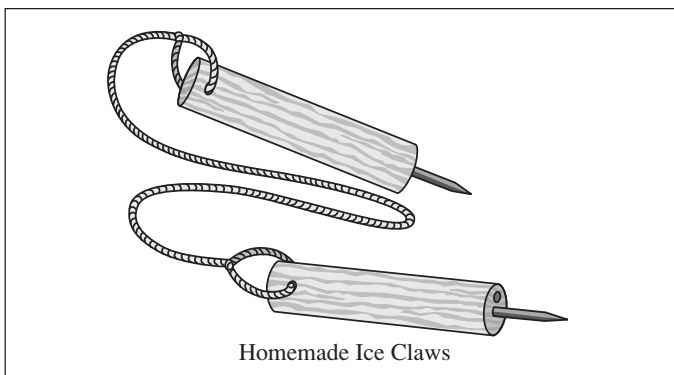
**Indicates inches or centimeters of new, clear or blue ice, not old or deteriorating ice. If you are unsure of the condition of the ice, stay off.*

Safety Equipment

The most important piece of equipment is a **personal flotation device (PFD)**. A PFD would not be the first piece of equipment that most ice fishermen would think of to take on an outing to the local lake, yet it should be. A PFD will help keep you afloat and aids in retaining body heat both above the ice and if you fall into the water. Dressing in layers is the key to creating air pockets between layers that act as insulation to keep your body temperature from escaping as fast.



Ice fishermen or anyone who spends a lot of time on the ice should always carry **ice claws** or **ice picks**. These pieces of equipment must be attached to your body at all times so if you fall through the ice you will be able to reach them quickly. You can purchase these necessary pieces of equipment from various companies or you can make them yourself. Simply put, they are a pair of wood handles with a nail driven into one end sharpened to a point like an ice pick. Next, attach an eyelet screw or loop or drill a hole through the handle with a length of strong rope tying the two handles together. Two sharpened screwdrivers tied together with a length of strong rope will work too. If you are a victim of falling through the ice, use the claws or picks to aid in your rescue. Stab the ice claws into firm ice, pulling with your arms while scissor kicking (like swimming) with your legs to get back on top of the ice.



A **safety rescue station**² with lifesaving equipment used during the swimming season will also be beneficial during winter season activities. Items such as a life buoy with enough rope to reach more than halfway across the pond and/or a lightweight bamboo pole are good pieces of safety equipment to have on hand for reaching out to victims. Emergency phone numbers and the location of the closest help are recommended. Signs to indicate the ice conditions (“safe” or “stay off”) are recommended to show areas to avoid and areas safe for skating or fishing. Graphics or pictures are another good idea for younger youth who may not read or understand written signs of danger.

Using the Buddy System

Going with a partner is always best as it makes the activity more fun and safer. If something should happen to one of you, the other could help with the rescue and get help. Also have an itinerary with other people so that if you do not show up or make contact at the designated time, they can begin the search process. If you take children with you, teach them the basics of safety and be sure they are watched closely. Drowning is the third leading cause of accidental death of children. Most drownings and near-drownings happen when a child accidentally falls into a pool or pond, or is left alone in the tub. Drownings happen in a matter of seconds. By you knowing what to do and by teaching children what to do, their chance of surviving an accidental falling through the ice increases.

If you think that falling into the icy water is no big deal, try submerging your bare hands or feet into a bucket of ice-cold water. If you can last more than a few minutes without extreme pain, you are tougher than the average person. The body reacts immediately to the cold and can start shutting down to conserve energy and heat. Act promptly and quickly while staying calm and your chances of survival will increase.

Rescue Procedures

What If You Fall into the Water?

The most important thing is to stay calm and always look and work your way toward the shore (remember the weakest ice is in the center of the water body). Call out for help to others if they are close by. Place your hands up on the unbroken ice. This is why ice claws or ice picks are excellent safety devices to carry with you. Try to swim onto the ice by pulling with your hands and ice claws, and by kicking your legs. If the ice breaks, keep trying. Once upon the ice, **do not** stand up. Distribute your weight out over a larger area by crawling, sliding, or rolling toward shore following your tracks made going out on the ice as you know the ice was safe to the point where you fell in.

What If Someone Else Falls into the Water?

Keep calm and look for others to help with a rescue plan. **Do not** run to the hole as you may go from rescuer to becoming a victim. Once you have more than one person to help, form a chain and crawl toward the hole. Throw a flotation device (like those mentioned under the “Safety Equipment” section) to the victim. Use anything of length to reach out to the victim like rope, cloths, ski poles or skis, jumper cables, tree limbs, or push a boat or other flotation device toward the hole. Follow the path taken by the victim, as the ice was safe to be on up to the point where the victim fell into the water. Distribute the weight of all rescuers by crawling, sliding, or rolling toward the victim and away from the rescue site.

After the Rescue

Hypothermia

Under the Greek translation, *hypo* means “below,” and *thermic* means “temperature,” so *hypothermic* means “below temperature.” Hypothermia is the condition when the body loses heat faster than the body can produce heat, causing the body’s inner core temperature to drop³. Normal body temperature is 98.6° but when the core body temperature drops below 95° the body starts into the condition called hypothermia. Cold water can drain away body heat 25 to 30 times faster than cold air. Immediate treatment for any victim falling through the ice must start as soon as the victim is on safe ground. The victim’s length of time under exposure, temperature of water, and clothes they are wearing will determine how fast they succumb to the effects of hypothermia. Shivering is the uncontrolled expansion and contraction of the muscles, and it is the body’s first line of defense against hypothermia.

Symptoms of Hypothermia

- Shivering
- Blue tint to skin color
- Poor coordination
- Slowing pace in walking or other activities
- Increasing numbness and loss of dexterity
- Dazed or confused look and actions
- Slurred and slow speech and slow to respond to questions
- Dilated pupils
- Hallucinations
- Decreased attention span and changes in personality

Field Treatment for the Victim of Hypothermia

- Get professional treatment as soon as possible, even if signs of hypothermia are no longer evident, as health-related problems can still arise from even slight encounters with hypothermic symptoms. A potentially fatal condition called “after drop” can occur when cold

blood from the body’s extremities starts to mix with the warmed blood circulating through the body.

- Get the victim into a shelter where the area can be heated slowly. Do not set the victim right by a fire or heat source, as a slow warm-up is better.
- If in an open area, block the victim from wind with a boat, sleeping bag, tree limbs, etc. If no shelter and no heat source are available, congregate as many people into as small an area as possible to allow body heat to warm the victim’s environment.
- Encourage movement of victim, but don’t make movements for them.
- Slowly feed the victim warm (approximately 110°F/43°C) sugary liquids like tea, hot chocolate, bouillon, or plain hot water; do not give them alcoholic beverages.
- Wrap the victim in warm blankets or sleeping bags.
- If using people to warm a victim, remove wet clothes as they draw heat from the body. The warmer (person aiding the victim) and the victim should be nude (underwear can be left on), as body-to-body contact is needed to start warming the victim. Each warmer should exercise vigorously before and after contact with the victim to maintain his or her own body temperature. The warmers should rotate every 30 minutes to allow them time to get their body temperature up to normal.
- Keep the victim’s head level with body with slight elevation of legs and feet.

What NEVER to Do with a Victim of Hypothermia

- Never leave alone.
- Never apply ice.
- Never rub, massage, or force movement of victim’s body.
- Never apply heat directly to victim’s skin.
- Never give alcoholic or caffeinated beverages as it thins the blood giving a false sense of warming up when it actually works against the body’s efforts to warm the blood.
- Never allow smoking as it curtails blood circulation.
- Never give medications like painkillers, sedatives, or aspirin because you and they need to know real time symptoms and conditions and not have them masked by drugs.

Frostbite

Even if you don’t fall through the ice you can still succumb to the effects of frostbite due to the prolonged exposure to extremely cold temperatures. Frostbite is the freezing of body tissue. The freezing cuts off blood circulation to the affected areas. Toes, feet, fingers, ears, cheeks, and nose are the first to feel the effect, especially in people with inherently poor circulation problems. There are three stages of frostbite: frostnip, superficial frostbite,

and deep frostbite. Frostnip, the least severe, is the tingling or “pins-and-needles” feeling in the affected area. Warm air (blowing hot breath) and warm water will quickly warm up affected area. The last two stages of frostbite are severe and require immediate medical attention. Superficial frostbite is the freezing of the skin cells, but the tissue under the skin remains flexible. Superficial frostbite is identified by a waxy, frozen, numb feeling and blistering of the skin may be present. Deep frostbite is the freezing of tissue, blood vessels, veins, muscles, tendons, nerves, and even bones. Any of these frozen parts can undergo irreversible damage in a short time period through serious infection and loss of the appendages and limbs, as well as the onset of blood clots and gangrene. Victims of frostbite may experience frostbite faster after affected the first time due to the long-term effects of frostbite damage.

Symptoms of Frostbite

- Tingling (pins-and-needles) feeling in area
- Numbness and loss of sensation to touch
- Area may feel hard to the touch
- Blisters on the skin may appear
- White tint or pale, even marbled-looking colored skin that can look waxy
- Absence of pain in affected area
- Slurred speech, memory loss

Treatment for Frostbite

- Follow similar guidelines as hypothermia.
- Get the victim indoors.
- Get immediate medical attention.
- **Never rub** affected areas as it causes damage to frozen tissue.
- Warm affected area slowly.
- Do not place direct heat on affected areas.
- Immerse frozen parts in warm water or wrap in a warm compress (100°F or 38°C) for 20 to 30 minutes. Do not let the victim control the water temperature or heat source, as they will not be able to feel the effects of water too hot and can suffer burns.
- Keep affected area elevated.
- Wrap area in warm blankets once pink or redness color returns.
- Do not let affected area be exposed to the cold again.
- Serving a warm beverage is good but not alcoholic beverages.

Tips to Remember for Safety on Ice

- Test and inspect the ice thickness by drilling holes and taking measurements every 10 feet (3 m) each time you go out on the ice.
- Know what good ice is (“thick and blue”).
- Never be on ice less than 4 inches (10 cm).
- Wear a personal flotation device (PFD) for warmth and safety.
- Dress warmly in layers especially around head, neck, chest, sides, and groin due to primary high heat loss areas. Good gloves will keep hands nimble.
- Carry ice claws or ice picks and know how to rescue yourself or someone else.
- Go out with a partner—it’s more fun and safer.
- Take energy foods and hot drinks, but not alcoholic beverages.
- Have a first-aid kit, extra set of clothes, and blankets along for emergencies.
- Don’t take vehicles onto ice as their weight alone can cause problems for even good ice.
- Don’t build fires on the ice.
- The weakest ice will be in the center and along the edge of the water.
- Be aware that snow can cover open water areas, so use extreme caution.
- Be aware of wet cracks, slushy and darker areas, as well as water edges that are normally weaker.
- The only absolute safe ice is the ice you stay **OFF**.

Conclusion

Precautions need to be taken to assure that ice is safe for your winter recreational activities. Always inspect the ice before going out on it. Be aware that ice thickness and strength can vary from location to location. Know how to rescue yourself and others if you or they fall into the icy waters. By following some general safety procedures you can bundle up, be safe, and enjoy the many winter activities in our great Ohio outdoors.

Notes

¹ Safety On Floating Ice Sheets. U.S. Army Corps of Engineers: Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.

² For more information on constructing a pond rescue station or safety pole, obtain “Farm Pond Safety” OSU Extension Fact Sheet AEX-390 at <http://ohioline.osu.edu/aex-fact/0390.html>

³ Hypothermia: The Cold Facts, Minnesota Department of Natural Resources, Boat and Water Safety, St. Paul, Minnesota.

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