



Cold Water Immersion

On a November night, a crab fishing boat was off B.C.'s north coast. The crewmembers were re-baiting a crab pot on deck when the vessel took a port turn. They had been pulling traps on the starboard side, leaving the buoy line in the water. The line became caught in the propeller and started to pull the trap off the table. One of the crew reached for the trap as it slid over the side of the boat and was pulled into the water with it. As he entered the water, he let go of the trap and remained at the surface. Lines and floating objects were thrown well within his reach but he made no attempt to hold onto them.

The crewmember was finally pulled on board after about 11 minutes in the water. He was unconscious and could not be revived. Neither he nor the other crewmembers were wearing a personal flotation device (PFD), life jacket, or immersion suit. The water temperature was 9°C (48°F).



Cold water is deadly

Drowning is the number one cause of death in B.C.'s fishing industry. It is also a major cause of death wherever people must work on or near the water, such as on tugboats. One of the reasons for these high fatality rates is the cold temperature of our waters. Accident investigations have shown again and again that a person's physical fitness or ability to swim in warm water will not save him or her from drowning in cold water. Hypothermia can be a factor but that takes time – usually more than 30 minutes. The killing factor is often that first shock of cold water on the body.

Cold water is defined as water below 25°C but the greatest effects occur below 15°C. Our waters are usually below 15°C. As the fatal crab fishing accident shows, the effects are so powerful that you may not be able to help yourself. Exposure to cold water changes how your body functions. The first shock takes your breath away. Within a few minutes, your hands are so cold you cannot hold onto anything. You cannot pull yourself out of the water. Swimming becomes difficult or impossible as your breathing and muscles are affected by the cold. Eventually hypothermia sets in. Even if you are rescued, you may still die.

Keep yourself safe by being aware of what could happen to you in cold water. Know what to do to prevent you or other crewmembers from falling into the water and what to do if that occurs.

What happens when you fall into cold water

The effects of cold water on the body happen in four stages (described on pages 2–3). Cold shock (stage 1) and swimming failure (stage 2) are responsible for more drowning fatalities in B.C. than hypothermia (stage 3) or post-rescue collapse (stage 4).

Anyone who works on, near, or over the water is at risk

Ironworkers were using a jet boat to pull a cable across a fast-moving river. The cable became lodged on the river bottom, anchoring the boat by the stern. Water poured onto the boat, and the two workers jumped into the river. Neither was wearing a flotation device. Only one was able to swim to shore.

If you work on or near lakes, rivers, or the ocean, you could be in danger. Lakes and rivers in B.C. are usually at temperatures similar to the ocean (below 15°C) and may be even colder in winter. Use safe work practices wherever you are.

- Always wear a PFD, life jacket, or immersion suit when working on or near water (wherever there is a risk of drowning).
- Ensure that the equipment used for a specific procedure has been designed to perform that procedure.
- Make sure you have an effective means to call for help when working in remote locations.
- Use fall arrest equipment when working on bridges or over the side of vessels.

1. Cold shock

Cold shock occurs immediately – as you enter the cold water. It lasts three to five minutes but it can result in quick drowning because of the way the body reacts. You cannot control these reactions:

- A large intake of breath
- A rapid increase in breathing rate (up to four times as fast)
- A reduced ability to hold your breath (to as little as 10 seconds)
- A massive increase in heart rate and blood pressure

Drowning may result from cold shock reactions. If your head goes below the surface, you might breathe in water with that first large intake of breath. As little as half a cup of water in your lungs can cause drowning. Problems with breathing can lead to panic, which only reduces your chance of survival.

You are most likely to survive stage 1 if you:

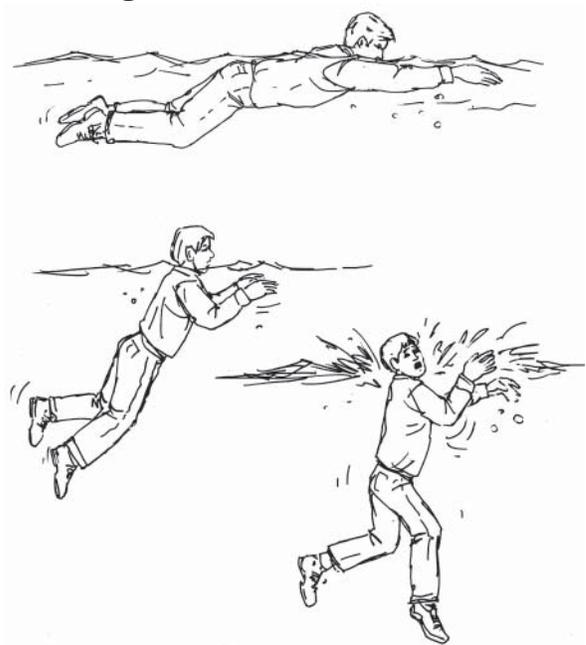
- Do not inhale water
- Stay afloat
- Keep your head above water

A PFD, life jacket, or immersion suit is essential.

2. Swimming failure

Swimming failure occurs after you have been in cold water for 5 to 30 minutes. Its effects include:

- Loss of manual dexterity
- Inability to match breathing rate to swimming stroke
- Loss of coordination in the muscles in your arms and legs as they get cooler, increasing your swimming angle
- Increased swimming angle, requiring more energy to keep your head above water
- Drowning



Being a good swimmer in warm water will not help you in cold water. In warm water, a swimmer takes one breath per stroke. In cold water, the breathing rate and stroke rate increase but not together. Your muscles and joints also get stiffer in the cold water and your strokes get shorter. These changes result in an increase in the body's swimming angle, with more of your body farther under the water instead of near the surface. There is now more drag on your body, and you must use more energy to swim. Finally, your swimming strokes become totally uncoordinated and ineffective, and you may drown.

3. Hypothermia

You have probably already heard about the effects of hypothermia. Hypothermia is the cooling of your body's core. It affects your brain, heart, and other internal organs. Your body begins to cool as soon as you enter the water, but the full effect of hypothermia usually takes at least 30 minutes. The effects of hypothermia are:

- A reduction of blood flow to the hands, feet, and surface of the body
- Intense shivering, in the early stages, as the body tries to maintain body core temperature
- Lack of shivering in the later stages
- Loss of consciousness
- Heart failure

The body loses heat four times faster in water than in air. As the body cools, the will to survive decreases. Eventually you lose consciousness and drown, or your heart fails.

4. Post-rescue collapse

The effects on your body after you are pulled from the water can include the following:

- Loss of hydrostatic pressure from the water causes a sudden drop in blood pressure. This can cause heart or brain failure.
- Your heart is cold and cannot pump cold blood effectively to maintain blood pressure.
- Your lungs are damaged from the water you inhaled. This can cause a pneumonia-like illness.
- Fatal bleeding from injuries may occur as your body warms up and your blood flows more

freely. You may have internal injuries or injuries to your head and neck that you and your rescuers are not aware of.

People should be recovered from cold water horizontally rather than vertically. Rescue may not mean survival, however. Up to 20 percent of all survivors die during rescue or shortly after.

How to avoid cold water immersion

The key to dealing with the risks of sudden, unexpected cold water immersion is to stay out of the water. If you do fall in, do not breathe in water, do not panic, and keep as much of your body out of the water as possible.

Stay out of the water

Arrange the vessel's decks and work procedures to reduce the risk of crew entering the water. Install guard rails where it is practical and where they do not create hazards associated with the fishing process. For example, salmon trollers could set up rails along the sides of the vessel since fishing takes place at the stern.

Keep work areas free of slipping or tripping hazards. Many people have fallen overboard while drawing water with a pail or urinating over the rail when the vessel was under way. When doing either of these activities, hold onto the vessel with one hand at all times.

Wear an immersion suit, PFD, or life jacket

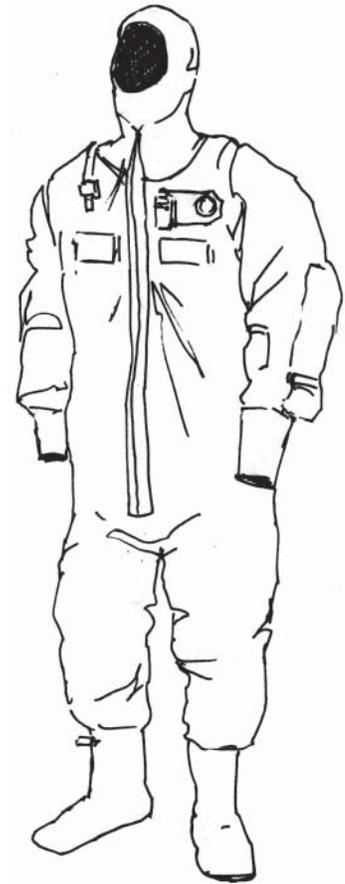
If there is a risk of entering the water, be prepared to stay afloat to survive the effects of cold shock, reduce the need to swim, and give rescuers time to react. Wearing a flotation device can be the difference between living and dying because it can hold your head above water. It also helps to maintain your body temperature. Immersion suits also provide a large, bright target for rescuers to see.



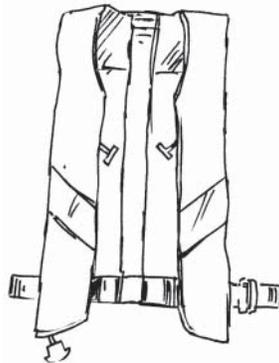
Using a PFD, life jacket, or immersion suit

Many different types of PFDs, life jackets, and immersion suits are available. For example, PFDs with automatic inflators provide excellent flotation in a small, lightweight, unrestrictive package. Immersion suits (survival suits) are required by provincial regulation for each crewmember on every commercial fishing vessel. Carrying immersion suits is good policy for all vessels and anyone working on or near cold water. Remember to stow them in an accessible location and to practise putting them on.

Immersion suits may be too bulky to work in, but they save lives when the crew or other workers have enough warning to get the suits on before they find themselves in the water. An immersion suit helps you conserve body heat and keeps you afloat, greatly increasing the likelihood that you will survive. See *WorkSafe Bulletin WS 04-06* for more information on immersion suits.



inherently buoyant PFD



inflatable PFD

Develop and practise rescue procedures

A person who is unprotected by a flotation device can drown very quickly – in as little as three minutes. The master of a vessel must ensure that suitable equipment is on board and that the crew regularly practises emergency procedures to rescue a crewmember overboard. Every vessel should have the means for a person to get back on board as soon as possible. All crewmembers should know how to:

- Get back on board quickly if they fall in the water
- Recover someone quickly who has fallen overboard
- Perform first aid safely on someone who may be suffering from near-drowning or hypothermia

Abandon ship safely

If you must abandon ship, try to avoid entering the water. Develop procedures that allow crew to go directly into life rafts to avoid getting wet. Make sure to put on immersion suits, PFDs, or life jackets.

The effects of sudden, unexpected cold water immersion are deadly. Be prepared!

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