Cold Water - How to increase your chance of survival

Contents

Introduction

It's obvious, but it has to be said - the most important advice is whenever possible **stay in your boat**! This does require planning:

- Make sure your boat is fully buoyant, and in good order.
- Know and understand local collision avoidance and navigation rules.
- After dark make sure you have appropriate lighting, wear white/reflective clothing.
- Know and understand local hazards in the water.
- Check up to date local weather forecasts and water state before boating – and don't go out if conditions are not favourable, or may become unfavourable before you plan to return.

Having done all this you can happily hope for the best…but make sure you still prepare for the worst. Remember, once you are in cold water your life is at risk.

There is much you can do to increase your chances of survival. But first you have to accept that it may actually happen to you – it won't always be someone else.

Background

- **But I can swim, won't that help?**

Obviously it helps to be able to swim – if only for the psychological boost it gives when you find yourself in the water. But for those who drown in situations where swimming is possible, about as many swimmers drown as non-swimmers. (e.g. UK Home Office 1981 http://www.homeoffice.gov.uk/rds/pdfs2/hosb1880.pdf).

Many drownings occur within apparent "easy" reach of safety. In the UK in 1977 55% of open water drownings were within 3 metres of safety, and 42% within 2 metres (UK Home Office). In Canada 1991 – 2001 of those boating and drowned 41% were within 10 metres of the shore, and a further 22% were within 10-15 metres of the shore (Canadian Safe Boating Council / Smart risk survey).

Your ability to swim and stay afloat in warm water actually bears no relationship to your ability to swim in cold water.

Why is this? Apart from the effect of waves and current, your ability to swim, or just to stay afloat, is affected by several things e.g. the state you're in before immersion, dry drowning, cold shock, "swimming failure" and hypothermia . All of these can be controlled or mitigated to some degree – so get the knowledge and be prepared.

- **How cold is *cold*?**

Water temperatures below 26.5°C (80°F) will have an adverse effect on survival.

Inland water is generally colder than the sea.

Most inland water in the UK probably remains at temperatures below 10°C throughout most of the year.

The life threatening initial cold shock response begins at water temperatures below 25°C and peaks at temperatures between 10-15°C.

"Predicted survival curves", which give an expected survival time when immersed in water at various temperatures are of limited use. They are based on rates of body core cooling. However, the early localised effects of hypothermia may be fatal long before body core temperature reaches life-threatening levels. For example, manual dexterity is rapidly and severely degraded in water below 15°C, badly hampering the ability to carry out essential survival tasks.

FISA advises special safety precautions e.g. the use of a Personal Flotation Device (PFD) when the water temperature is 10°C or less.
See FISA Guidelines for Minimum Safety Standards Cold Water Guidelines p5
http://dps.twiihosting.net/fisa/doc/content/doc_7_1087.pdf

How should I prepare myself physically and mentally to survive?

1) Don't boat when you are not 100%

You are probably already aware that rowing when you are ill, fatigued, or affected by alcohol or "recreational" drugs means you will not perform well. It also means that you are more likely to get into trouble, and will be less able to cope with it when it happens.

For example alcohol adversely affects judgement, ability to make decisions, speed of reaction, physical capabilities, concentration and awareness of surroundings. It also predisposes you to hypothermia.

Hunger and dehydration are also enemies to clear thought and physical efficiency.

So give yourself the best chance - don't go rowing when you are affected by any of these conditions. Remember, if you're not functioning well then you may also be putting your fellow crew at risk. Water is a hazardous environment, and you need your wits about you when things go wrong.

2) Have a realistic idea of what you can do

"How hard can it be? If I capsize, I will right my boat and get back in – or swim it to the shore. If my boat sinks I'll hold onto it until I'm rescued. If I'm close to the shore I'll just swim for it – I can manage a few metres. It is only other people who get into trouble."

You'd only be human to have had these thoughts. But in cold water these manoeuvres are much harder than you imagine.

For example, you may have practised the "capsize drill" in a warm swimming pool, but performing this in a cold river or lake is completely different. In cold conditions the effort involved in righting the boat will hasten hypothermia and significantly reduce your survival time – and by the time you've done this your chances of being able to climb into the boat will be hampered by reduced grip strength and limb stiffness. It may be better instead to just pull yourself onto the upturned hull to get as much of your body core out of the water and await rescue.

Get to know the basic principles in the five "Hazards" sections, so in any given situation you can work out what is the best course of action.

3) Practice techniques

If you have never tried to swim with your rowing kit on, then you won't realise how much difference it makes. If you don't know what to expect then you may make wrong decisions about what to do when you're unexpectedly in the water.

Practice the capsize drill; use the opportunity to practice holding onto the boat to use it as a float, so you know what that feels like. Remember that a buoyant single offers much more support than a non-buoyant eight, which when swamped will "float" just submerged in the water.

Also practice trying to pull yourself onto the boat to get as much of your body core out of the water as possible.

Practice getting out of the water onto the poolside.

4) Wear the right kit

The problem with rowing is that the activity makes you warm, and requires unrestricted movement. Thus rowing kit has to be a compromise between what will keep you comfortable when rowing in the boat, and what will help prevent heat loss when in the water.

The ideal garment probably does not yet exist, but here are some pointers:

- Several layers of light clothing will help trap a layer of water (and possibly some air), thus reducing heat loss.
- A layer of breathable but waterproof fabric will be much more efficient at trapping a layer of air and water.
- 50% of heat loss is from the head. A waterproof hood stowed in a garment collar, which can be quickly pulled out with one hand, would be of benefit. If this is bright and reflective it would also help potential rescuers to see you in the water.
- Clothing should be close fitting, to reduce the risk of it being caught on equipment etc., and to reduce drag if you need to move about in the water.
- Several sources quote that wool clothing offers good protection.

Wearing a Personal Flotation Device (PFD) definitely increases the chances of survival, but is not a guarantee. Ideally, any such device should be in position at all times. Some suggest having the PFD in the boat, or in the coach boat, or to wear it stowed on the back of the waist – but all of these options are flawed. It would be a big struggle to put on a PFD, or even to pull one into its functional position with cold numb hands, especially if you are affected by cold shock.

Wearing a PFD aids survival in two ways:

- It helps to keep your face out of the water to avoid water inhalation – though in choppy water you must still remember to keep your back to the waves.
- It allows you to keep still and adopt the Heat Exchange Lessening Posture (HELP) to conserve body heat – without a PFD you are compelled to tread water or swim to stay afloat, thus reducing survival time by 50%.

5) *Plan your own rescue*

Before each outing take a moment to think through how you would be rescued or self rescue if you ended up in the water at this time, from this boat, with these people and in this location? If you already have a mental picture of what would be the best thing to do if it does happen, then after the normal initial panic you will quickly feel more in control – and this is crucial to increasing your chance of survival.

This is akin to personal "risk assessment": For example, ask yourself is this boat fully buoyant and in good order? Is there a safety launch in attendance? If so, will it be of any use? Is the rest of the crew safety aware? Will there be someone around to summon help if necessary. What are the banks like – could you climb out? Is it just too cold to risk it in this particular location? If going out alone (not recommended) does someone know you're on the water and know when to expect you back?

The Hazards of Cold Water Immersion – and how to cope with them

1) Dry drowning (risk from immediate, to any time after immersion)

a) What is it?

Unfortunately sometimes (up to a fifth of all drownings) instead of the sequence described as cold shock the body may respond differently. There may be a sudden reflex closing of the airway due to muscle spasm. No water can enter the lungs, but neither can air.

It is thought to be an automatic shock reflex due to cold water hitting the back of the nose or throat. It may happen the instant you hit the water.

b) How can I avoid it?

Dry drowning is more likely to occur if you enter the water feet first – which allows water to get up the nose. It is also more likely if you are tense and mentally unprepared – i.e. you weren't expecting to be immersed.

Of course any accident is unexpected (though most are avoidable!) but unless you are actually thrown into the water (e.g. by catching a crab) you will usually have a few seconds warning that immersion is going to happen. Use that moment to mentally take control – you know what to do to maximise survival, so now is the time to put it in to action.

If possible take a deep breath in, pinch your nose with your fingers to close the nostrils, keep your mouth closed and enter the water gently by rolling in, rather than feet first. Avoid jumping into cold water.

As described in the Cold Shock section, once immersed concentrate on keeping your face out of the water and keep your back to the waves to avoid getting spray into your nose and throat.

2) Cold Shock (max risk at 1- 5 minutes)

a) What is it?:

Cold shock is an increased respiratory response to cold water immersion. At first there is an involuntary gasp (indrawing of breath) which is followed by hyperventilation (rapid and disordered breathing). There is usually an associated degree of disorientation, so for a few moments you may not be sure which way is up, or where you are in relation to the boat, the bank etc.

The severity of the effects of cold shock are proportional to reduction in water temperature, with the maximum effect being at 10 – 15°C. Ability to breath hold is proportionally reduced the colder the water.

Cold shock only lasts for approx 1 – 3 minutes.

b) How do I cope with it?

For those first crucial few minutes just completely concentrate on not drowning! It may sound too simplistic, but if you are expecting the cold shock response, and you understand it will soon pass, then you have a better chance of surviving it.

If the first involuntary gasp takes place when your face in is the water, then you will get a lungful of water instead of air. If you are in choppy water and your breathing is uncontrolled and you are feeling disorientated then you may have difficulty co-ordinating breathing with gaps between the waves.

In order to NOT drown you must concentrate on keeping your face out of the water: turn your back to the waves to avoid inhaling spray and water and try your hardest to control your breathing. Remind yourself it will soon pass.

After your breathing begins to settle, and you get your bearings you will then have time to assess the situation and decide what is best to do for rescue.

3) Swimming Failure (risk increasing with time in the water)

a) What is it?

Your ability to swim is reduced in cold water. The colder the water the more your swimming deteriorates. This effect takes hold long before there is significant cooling of the body core, so is not due to core hypothermia.

Swimming stroke length is decreased and stroke rate is increased – so the stroke becomes less and less efficient, and more exhausting. The swim angle is increased, i.e. your body lies more upright in the water, so forward progress with each stroke is reduced. It becomes more and more difficult to straighten the limbs and to co-ordinate swimming movements. The fingers splay and start to flex.

These effects are thought to be due to local cooling of the limb muscles.

Wearing a personal flotation device does not prevent the onset of swimming failure.

b) How can I avoid it?

Unfortunately the only answer is to avoid swimming in cold water as much as you can.

Different people are affected by swimming failure to varying degrees. Some are affected very rapidly, and others are able to swim for reasonable distances before the effects take hold. In one experiment the significant factor seemed to be upper arm skinfold thickness. The more insulation around the muscles, the warmer and more efficient they remain.

Rescue by swimming should be a last resort measure only.

4) Hypothermia (max cause of death at 30 minutes plus)

a) What is it?

Hypothermia is defined as body core temperature below 35°C (normal body temperature is 37°C).

The body loses heat in water 25 – 30 times faster than in air.

The rate of heat loss is dependent on several factors:

- Temperature differential – how much hotter your body is compared to the water.
- Clothing insulation.
- Body fat thickness – inbuilt insulation.
- Ratio of body mass to surface area – the bulkier you are, the better you retain heat.
- Rate of agitation of the water – each bit of water next to the skin, and warmed by it, is constantly replaced by a new colder bit.
- Physical activity – movement draws warm blood out of the body core and into the muscles of the limbs, where heat loss is more rapid. Treading water or swimming increases the rate of heat loss by approx 40%.
- Body posture in the water – some parts of the body lose heat faster than others i.e. the head (50% of heat loss), neck, armpits, chest and groin.
- Physical fitness.
- Diet prior to immersion.

Predicted survival time for a fully clothed adult male wearing a lifejacket in water at 5°C is approx 1 hour, and 2 hours at 10°C. A thin youth, inadequately clothed, and without a life jacket would succumb much sooner.

However many people who die from cold water immersion do not die of core hypothermia. Many die before this has had a chance to fully take effect.

As the core body temperature cools usually the first obvious effect is on the brain. The victim becomes confused, unable to remember things and will become drowsy and ultimately unconscious. At first the heart rate slows, but then the heart muscle becomes irritable, and dangerous disturbances of rhythm may occur. Less oxygen gets to the body tissues. Urine production increases, leading to loss of blood volume and thickening of the blood. The airway protective cough reflex becomes impaired – so there is an increased risk of water getting into the lungs.

Hypothermia can kill even after the victim has been rescued from the water. Mortality rates at this stage vary from 20 – 80% according to age, fitness, degree of hypothermia and the quality and timing of medical treatment.

Before core hypothermia sets in there are the more immediate effects of local cooling of the limbs to contend with. This reduces grip strength and manual dexterity, and reduces the ability to feel with the fingers. This effect can occur very soon after immersion, and may severely hamper survival actions, such as clinging to the boat.

b) How can I reduce the risk?

Once you have recovered from the cold shock effect and have got your bearings, the most important priority is to get as much of your body as you can out of the water as quickly as possible, and then to cover your head, which accounts for 50% of body heat loss.

You could pull yourself onto your (possibly upturned) boat, or onto any other likely nearby object in the water. If this is not possible, then hold onto anything which floats and will give you some support – this will usually be the boat, unless it has sunk completely, or been swept away by the current.

If you are unable to get out of the water then the next priority is to stay as still as possible in the water, with your back to the waves to avoid water inhalation.

If you are wearing a Personal Flotation Device (PFD) then you will probably be able to adopt the Heat Escape Lessening Posture (HELP) – basically the “foetal position” – cross your arms across your chest, keeping the elbows close to your sides, and then draw the knees up to the chest. This gives added protection to the body areas of high heat loss i.e. armpits, groin and chest.

If there are several people in the water, all wearing PFDs then you can further conserve body heat by huddling close to each other, side by side in a circle. The most vulnerable, i.e. the smallest and thinnest, can be placed in the middle of the circle, to benefit from the body heat from those around.

If you are not wearing a PFD then you have no choice but to tread water while clinging to the boat or whatever is available. This markedly decreases survival time by up to 50%.

Now you will need to take stock and decide how best to proceed. Your decision will be based on several factors e.g. availability and timing of possible rescue by others, the proximity of dry land and how easy it would be to get out of the water onto the bank, whether you have been able to haul yourself onto your boat or other object, and whether there are any hazards nearby e.g. a weir or an unprotected sluice.

You must avoid all unnecessary movement. For example don't waste energy trying to right the boat if you are able to just climb onto the upturned hull – that is unless you are certain of very quick success. Remember in cold conditions the effort involved will be huge and will use precious energy and promote body heat loss. Having succeeded you will then need enough energy left to climb back into the boat, and by this time your hands and arms and legs will be numb, stiff and painful.

The decision to swim for self rescue must be the last resort, as this is the least likely to end successfully.

Remember:

- Get out of the water as much as you can, or hold onto something.
- Keep your back to the waves.
- Cover your head.
- Keep as still as you can.
- Take time to think through the best course of action for rescue.

5) Post- rescue collapse (risk on or shortly after rescue)

a) What is it?

Hypothermia produces profound disruption of normal body function, and this doesn't revert to normal the minute a victim is rescued from the cold water.

The haemodynamics of the body are impaired and there may be dehydration. If a victim has been in the water for any length of time there may be circulatory collapse as they are removed from the water.

The heart becomes very prone to disruption of the normal rhythm (arrhythmia). Even passive movement may precipitate a fatal arrhythmia.

Inappropriate warming may result in opening up the blood vessels to the extremities, drawing the warmer blood away from the core, and taking the colder stagnant blood from the extremities back into the core. This will cause a further drop in core temperature, which may prove fatal.

b) How can we reduce the risk?

A victim who has been in cold water for any length of time should be lifted out in the horizontal position to prevent circulatory collapse.

They should be treated with the utmost gentleness to avoid precipitating a cardiac arrhythmia. They should be kept as still as possible.

Prevent further heat loss by applying insulating blankets (or improvise with whatever is available) and carefully move to a warm environment.

Urgent removal to hospital is vital, as the treatment of hypothermia is complex.

Victims who are shivering, but who are rational and showing no other signs of hypothermia may just need removal of wet clothes, wrapping up and a warm environment. They should avoid activity until full recovery.

All other victims should be made to lie down, keep still and be wrapped up while awaiting transfer to hospital for full examination.

Useful websites and references:

Transport Canada : Document TP 13822E. Survival in Cold Waters
http://www.tc.gc.ca/marinesafety/TP/Tp13822/menu.htm

United States Search and Rescue Task Force. Cold Water Survival
http://www.ussartf.org/cold_water_survival.htm

Washington State Parks and Recreational Commission Boating Programs. Hypothermia and Cold Water Survival
http://www.boatwashington.org/hypothermia.htm

Summary

Cold water survival check-list

- Take all precautions to prevent immersion in the first place.
- Practice relevant techniques.
- Understand how cold water immersion affects physical and mental abilities.
- Don't boat if ill, tired, affected by drugs or alcohol, hungry or thirsty.
- Dress appropriately, consider PFD.
- Consider the circumstances of each outing to "plan your own rescue," and be prepared to adapt arrangements accordingly, or to cancel the outing if risk is too great.
- Avoid boating alone, or with no back-up.
- If forced into the water try to control position of entry to avoid water getting into the nose or throat.
- During "cold shock" concentrate on control of breathing and keeping mouth and nose out of the water.
- Hold onto something and try to get your body core out of the water as far as possible.
- Cover your head.
- Take time to think through best course of action in the circumstances.
- Keep your back to the waves.
- Keep as still as possible, avoid unnecessary manoeuvres.
- If wearing a PFD use HELP and Huddle to conserve body heat.
- Only swim as a last resort – and try to use something as a float.
- When out of the water, victims affected by the cold should lie down, be wrapped up and kept still while awaiting transfer to hospital.

Key messages

Stay alive…
Stay out of cold water

Cold water kills…
Before you go out, think how you'll get out

Hold on… to something
Pull out... onto something
Stay still…don't swim

Keep your face… out of the water
Turn your back… to the waves

Cold water cramps your style.
You can't swim when you're cold and stiff.
You can't grip with numb hands.