Surviving cold shock

What happens to your body when you fall into the water? Gilbert Park explains physiological effects, and what you should do to survive

If you fall into the water on a hot, calm summer's day with the water temperature above 20°C, not a lot will happen to you unless you have a health problem or injury. However, more often than not when we're sailing, it's cold and windy, and the water temperature is likely to be below 15°C. On a day like this, if you fall in you could die in just a couple of minutes.

The effects on the body of falling in the water are usually divided into four phases.

First phase

The first phase is called cold shock: this lasts for two to three minutes, and is often fatal.

It happens when you suddenly and unexpectedly find yourself in the water: the body immediately responds by pushing up your heart rate to as high as 200 beats per minute and increasing the normal breathing rate from 12-15 to more than 60 times a minute.

Conscious control of breathing is lost, but if you do try holding your breath it is limited to a few seconds. If you gasp as you go underwater or just as a big wave lands on top of you, the water will go straight into your lungs.

Because you are not only breathing quickly but also more deeply, you can easily take in the three pints of water which is all that's required for you to drown.

At the same time your heart rate and blood pressure will increase, and this combination puts the older sailor at risk of a heart attack. When underwater you may lose your glasses, contact lenses or hearing aid, any of which will worsen disorientation.

If you fall in, even in a calm sea with just a Force 2 blowing, you can still drown if the water is cold – so preventing the first phase should always be your highest priority. When conditions demand it, clip on. Always wear a correctly fitted and properly maintained lifejacket with a sprayhood when on deck and under way: if you have been hit on the head by a boom and have fallen unconscious into the water, you are unlikely to survive without a lifejacket.

Second phase

If you have survived cold shock, the second phase lasts about 30 minutes and is marked by a gradual loss of the ability to coordinate limb movements as the connections between nerves and muscles stop working properly.

The start of this phase is the time to plan how you are going to be saved, while you still have the strength and mental ability required. If you are relying on your own efforts to save yourself, early plans and actions are critical to your survival.

Third phase

The third phase is when hypothermia (defined as a body temperature of less than 35°C) starts to become a threat.

Heat is lost 20 times faster in water than in air, so getting out of the water into a liferaft or onto wreckage is imperative. Besides the physical symptoms there is significant mental deterioration, with memory loss and an inability to think clearly.

All of the theory and experiments are based on fit, healthy and young volunteers – unlike many sailors, including the author, who have seen many years of sailing, who perhaps have heart disease and are taking a variety of medicines that may interfere with the response to cold. Many factors may influence the rate of onset of hypothermia, some of which are shown in the diagram.

As the hypothermia worsens, drowsiness and eventually unconsciousness occurs. Blood pressure and heart rate start to slow down until the heart eventually stops. It is very important that resuscitation is started even if the heart stopped some time before rescue: survival after 60-70 minutes of the heart stopping with effective CPR is well recognised in hypothermia.

Fourth phase

The first three phases account for equal proportions of deaths in reports of drownings.

The fourth (recovery) phase accounts for fewer deaths, but the risk is still significant. Rough handling of the survivor may cause heart irregularities, while moving them from lying down to a standing or sitting position may produce a collapse of the cardiovascular system. Even when the survivor is safely rescued, his or her body temperature may still drop by several degrees, and careful re-warming is needed to prevent this.

Devising a plan to recover an unconscious crew member (whether from an injury, illness or hypothermia) in a horizontal position should be an essential part of every boat's standard safety briefings. I recently weighed some crew members in their sailing gear with a lifejacket and boots, first dry and then after they had been fully submerged. The increase in weight was another 10kg for the women and 15kg for the men. The total weight needed to be lifted in some cases was more than 110kg: a substantial problem, especially in motorboats which do not have masts and the potential for effective lifting equipment.

Earlier, I talked about prevention: and that requires preparation. Go on a sea survival course, and make sure you use your own lifejacket and clothes. When your liferaft next needs servicing, go and watch it being inflated so you know exactly what it looks like. Should catastrophe occur and you need to use your equipment, you'll have a much better idea of what to expect. PBO

Some of the many influences on the rate of decrease of body temperature when you are in the water

Clothing You will cool quickly if you are only wearing a swimming costume

Wave height The rougher the sea, the greater the cold water flush effect through your clothes

Gender There's no difference when fat is allowed for

Water temperature The colder the water, the faster you cool down

Depth of submersion The deeper you are in the water, the faster you will cool

Time of immersion The longer you are in the water, the greater the temperature drop

Age The young and old get colder more quickly

Body fat Fat insulates you and slows the rate of cooling

Exercise Movement increases heat loss

Seasickness Makes cooling faster