Here are the 6 key points for the management of cold injury for sea kayak paddlers.

- Local freezing cold injury.
- Local non freezing cold injury.
- Cold water shock.
- Cold water incapacitation
- Hypothermia
- Circum Rescue Collapse.

1. **Local freezing cold injury**.

At zero or near zero degrees human cells can freeze, this causes injury as ice crystals damage cell membranes and circulation is restricted. This is known as frost nip or frost bite and can vary from superficial and inconsequential to deep, with subsequent loss of tissue mass. A combination of below freezing temperatures and high winds are the normal cause but touching cold metal or spilling stove fuel onto the skin can also bring risks. It's a rare condition out on the water but can happen around camp in winter. Face, hands and feet are most at risk. Frozen skin appears white and waxy, thaw it immediately through direct skin to skin contact. If it's resolved after 30 mins no further medical treatment is required. If the area is still obviously frozen or feels unusual after 30mins of rewarming then evacuate and seek medical attention. Do not apply direct heat, or burst blisters, or rub, or use creams. The best treatment is avoidance and regular visual checks of yourself and each other to catch the problem at an early stage.

2. **Local non freezing cold injury**.

If hands are feet are well below normal body temperature for many hours normal cell chemistry can be affected and damage occurs. This is sometimes called trench foot and can occur at air temperatures as high as 20 degrees, particularly in wet conditions. A paddler's feet and hands are vulnerable. The condition is painful with red skin and often swelling. Bathing in cold water will relieve the pain but actually causes further damage and this should be discouraged. Do not rub effected skin, do not warm by direct heat, do not burst blisters and do not apply moisturising creams. Avoidance and treatment are the same procedure, keep feet and hands dry and powdered for as long as possible each day. Don't sleep in wet socks, avoid prolonged periods in wet gloves.

3. **Cold Water shock.**

Cold water shock is the first of 4 risks associated with cold water emersion. http://www.beyondcoldwaterbootcamp.com/ Is a Canadian web page with a resources that kayak leaders will find useful, note particularly the mechanisms of heat loss and the 1:10:1 rule. Cold water shock is a combined physiological and psychological reaction to sudden changes in skin temperature – which occurs when the body is quickly submerged in cold water. The shock response varies from individual to individual and also depending on clothing and the difference between skin and water temperature. The effect is short lived and will last up to 90 seconds, it can be anything from very mild to fatal. Victims lose control of their breathing and can be confused, gasping for air and/or unable to hold their breath. In severe cases the heart can stop or the victim can gasp in water involuntarily and drown. A dry suit and neoprene head covering are good protection against cold water shock. If you must enter cold water without protection, try to enter slowly to reduce the effect of shock. If in cold water shock, accept it and float patiently at the surface until in passes. "Float to live".

4. **Cold water incapacitation**.

Most of us are familiar with the loss of fine motor control that happens when our hands are cold. In cold water the same effect can limit a swimmer's use of their arms and legs. If that swimmer needs to keep moving in order to maintain a free airway, they will eventually fall face down into the water and drown, as a result of the cold water, but well before they become hypothermic. In water around

5 degrees this effect takes about 10min to become significant for an unprotected simmer – so they have a window for action of around 10 mins; after shock has passed and before incapacitation. A paddling dry suit delays the onset of incapacitation but once it occurs paddlers are vulnerable because paddle sport PDFs only give buoyancy, they do not protect the airway. A kayaker, separated from their kayak in open water, will normally drown through incapacitation well before they start to become hypothermic. This is often incorrectly referred to as exhaustion in the media but good physical fitness or swimming ability are of very limited help. In the event of a fall into cold water, understand that you have a specific window to act, perhaps 10 to 20 mins. There is no need for panic, but well planned and deliberate action is required if you are to self-rescue.

5. Hypothermia

Hypothermia is the condition that occurs when the vital organs of the body; the brain and heart (the core), falls below the normal operating temperature of 37 degrees. This leads to a loss of physical and mental performance, then to unconsciousness, then eventually heart failure and death. In a paddling context it is difficult to measure body temperature, and the temperature under the tongue or under the arm pit are normally much lower than core temperature, so it's more useful to focus on symptoms. We have seen that a kayaker in the water will likely drown before they become hypothermic but the onset of hypothermia can occur gradually over a paddling day, or while sitting in a kayak raft, or around the camp site, or as a complication to a trauma or a medical condition – it's something a leader needs to be aware of. Initial symptoms include a loss of coordination, irritability or slurred speech. If you notice these signs in a group member take action fast, give them more clothing and get them moving (have a hat and storm cag available on the water, as part of your leader kit) – but also look at the rest of the group, if one has a problem the others may be close. Conditions dependent, even a marginal loss of coordination will make a supported tow necessary. Get that individual and the rest of the group to a place where you can do rewarming. Rewarming can be started while afloat but you need to be on land to do it effectively.

Rewarming takes two forms, passive and active. For passive rewarming remove wet clothes (or pack around a dry suit if you must) and use the Banak protocol; a waterproof layer close to the skin (like a bivi bag or plastic sheeting), then insulation (a sleeping bag, or two) then an additional water or wind proof layer (a bothy bag, Jerven duk or more plastic). Remember also to insulate from the ground and to cover the head. Rewarm inside a tent if possible. Active rewarming means putting a heat source into this passive packaging. For paddlers this will be a bottle of warm water, normally placed into a sock or hat (to prevent burns) and placed on the chest. All this equipment is your responsibility as a leader and on a one day trip a stove and bottle, sleeping bag, sleeping mat and plastic bags needs to be part of your leader kit, or shared within the group. Never leave a rewarming patient alone, monitor their level on consciousness constantly. Anyone who seems unconscious or at risk of unconsciousness should be placed on their side, maintain the airway and monitor breathing continuously. Anyone who is unconscious or has been unconscious should be evacuated by the authorities; if the casualty does not respond to questions or gentle shaking, call 120 (kyst radio) or 113 (AMK) and ask for help. If a patient is unconscious and not breathing normally, start HLR and call 113. Shivering, even violent shivering, is a good sign. Give hot sweet drinks if the patient coherent, to help replace the calories used in shivering. Patients that have displayed very mild hypothermia symptoms can sometimes return to paddling or walk out after 12 to 24 hours of rewarming, rest, rehydration and nutrition, but this is a leadership decision you must own.

6. **Circum Rescue Collapse**.

Patients that have been cold, and particularly those that have been immersed in water, can develop any of a number of significant medical complications in the hours after their rescue. Anyone who has been unconscious, or who is cold and has been in the sea for some time should be treated as gently as possible, and kept as horizontal as practical throughout the evacuation. Do not leave them alone, monitor consciousness and breathing levels constantly and be ready to start HLR if required.

When communicating with the authorities use the Swiss Scale to describe the patient's condition, if you can't remember the stages just use the symptoms; conscious or not? Shivering or not?

https://sjtrem.biomedcentral.com/articles/10.1186/s13049-016-0210-y/tables/1

Stage Number	Discription	Typical core temperature (°C)
Stage 1	Conscious, shivering	35 to 32
Stage 2	Impaired consciousness, not shivering	<32 to 28
Stage 3	Unconscious, not shivering, vital signs present	<28 to 24
Stage 4	No vital signs	<24

The Norwegian Guidelines for hypothermia are here, they are interesting reading for paddlers with a medical background, but it's not designed for use by recreational paddlers.

https://www.sjoredningsskolen.no/content/uploads/2018/01/Nasjonal-retningslinje-handtering-av-aksidentell-hypotermi-1.pdf

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