

COLD-WATER PROTECTIVE CLOTHING GUIDELINES

May 5, 2001 – after their raft flips in the cold waters of the South Fork Boise River, Russ Campbell and Amy Gerver cling to the upside down raft through a long rapid. They are experienced rafters and are dressed in “Farmer John” neoprene wetsuits, neoprene booties, neoprene gloves, waterproof paddle jackets, life jackets, and helmets. However, within only a few minutes in the very cold water, they are unable to respond to instructions, or swim to shore. They die soon thereafter of hypothermia or drowning. Their unfortunate deaths have been a catalyst for my research into water temperature ranges, survival time in cold water, and protective clothing for cold water boating.

Water temperatures March - July, in the Northern Rockies. These temperatures are a summary of measurements taken on Fish Creek, a tributary of Idaho’s Lochsa River, and at the Sawtooth Fish Hatchery near Stanley on Idaho’s Salmon River.

Month	Fish Cr. Temp	Salmon R. Temp
March	35-39°F	33-43°F
April	39-43°F	36-47°F
May	43-46°F	41-52°F
June	46-54°F	45-58°F
July	54-66°F	51-59°F

Fish Cr. measurements, courtesy of Idaho Dept of Fish & Game, Alan Byrne 1998 (My Lochsa River pundits tell me Fish Cr. is one of Lochsa River’s warmer tributaries. I use it because of good temperature data from Steelhead study)
Salmon River measurements, mean temps 1999-2000, courtesy of Sawtooth Fish Hatchery, Idaho Dept of Fish & Game

Water temperature is influenced by air temperature, percent of snow-pack melting, groundwater temps, and solar warming. Expect colder water at higher elevations and at further north latitudes. Also, dam control water may be significantly colder in the months of June-August. This is a major factor on South Fork Boise River, South Fork Payette below Deadwood River, and in the Grand Canyon below Lake Powell, where river temperatures remain in the 40°F range at mid-summer.

Cold Water Temperature Survival Time

Water conducts heat 22 times faster than air, quickly reducing body temperature.

Water temp °F	Time before Exhaustion or Unconsciousness
32.5°	Under 15 minutes
32.5-40°	15-30 minutes
40-50°	30-60 minutes
50-60°	1-2 hours
60-70°	2-7 hours
70-80°	3-12 hours
Over 80°	Indefinite

This table is widely available on line. Based on Alexander Report

Survival time in cold water is also affected by: body temperature, glycogen (blood sugar) level, percentage of body fat, physical conditioning, mental attitude, exertion, and most importantly—protective clothing worn.

Protective Clothing & Hypothermia

Protective clothing is important in the boat, as well as in the water. Kayakers will experience direct conductive cooling from cold water through the bottom of their boat. Both kayakers and rafters will cool down when out of direct sunlight. Also wind, rain, and wave splash will cool down boaters rapidly. A cold boater will react more slowly and is at higher risk of accident.

The very best Cold Water Survival advice is: Stay Warm while out of the water!!
If shivering starts: RE-WARM by stopping! Add more dry clothing, eat high sugar foods, and drink hot non-alcoholic fluids. Some dry-land exercise may help re-warming. Alcohol should not be consumed by cold boaters: it dilates the capillaries and causes further cooling of the skin.

As humans cool down: available glycogen (blood sugar) is depleted and core temperature drops from the normal 98.6 F. to the mid 90 degree range. A boater who is shivering, may show signs of weakness and fatigue and will probably be less coordinated (symptoms of Mild Hypothermia). They can make really stupid decisions, and may be irritable or apathetic. They are much more likely to have an accident and be forced to swim.

Since water is much denser than air: it conducts heat from the body approximately 22 times faster than air. When boaters with Mild Hypothermia enter water below 60 degrees F: remaining body heat is quickly lost. They will cool down very quickly into Moderate or Severe Hypothermia, because their body temperature is already lowered and their glycogen stores are depleted. Within a few minutes in water below 60°F ----- hands will lose dexterity; then the mind fogs and swimmers may be unable to save themselves.

Warmer boaters have a longer survival window in cold water because: higher body temperatures and higher glycogen levels allow a longer period of physical and mental agility.

Clothing for Cold-Water Survival

There is some agreement among cold-water survival experts as to what protective clothing should be worn to survive in water below 60°F. Most experienced boaters have a good idea about what water temperatures may be, and what clothing should be worn for a particular situation. Unfortunately a lot of beginning and intermediate boaters don't have a clue about water temperature, or correct clothing. In many cases, these are the people most likely to swim and least likely to have the right clothing for cold conditions.

The major choices are **DRYSUITS** and **WET SUITS**.

DRYSUITS are designed to keep you dry. They are generally constructed of waterproof nylon fabric, with a waterproof entry zipper. Neck and hand openings are sealed with waterproof latex gaskets. Feet may be encased in the suit or stick out through latex ankle gaskets. Drysuits are worn with a light insulating layer inside for warmer water, heavier insulating layers for colder water. Insulation worn under dry suits should be synthetic insulations or wool. Cotton or down will hold water and lose all insulating value when wet.

Survival time in a drysuit is lengthy, even in very cold water. Coated nylon drysuits can be sweatboxes in air temperatures above 60°F, but Goretex and some other water-proof breathable drysuits may be worn with relative comfort in air temperatures up to 90°F. Drysuits have become standard garb for most experienced cold-water boaters.

DRYSUIT PLUSES: They really are waterproof! Except for your head, there is no entry shock of cold water contacting your body. Trapped air inside adds considerably to swimmer buoyancy. (**NOTE!** Kayakers must immerse themselves in water and remove most trapped air from dry suits, "burp the suit," to retain neutral buoyancy needed to Eskimo roll). Dry suits also maintain body warmth when paddlers/rowers are experiencing cold air temperatures, shade, wind, rain, and wave splash

DRYSUIT MINUSES: by nature of their technical construction, drysuits are expensive: prices range from \$360.00 to \$1,000.00. Some new users find the latex gaskets, especially the neck gasket uncomfortable. The neck gaskets can be pre-stretched over bowls or smooth helmets, or cut to fit larger: but most users don't mind the snug gasket fit. Drysuits can be sweaty in warmer temperatures, but Goretex suits do have a very wide comfort range. The suits are somewhat time consuming to put on and take off, and bathroom stops do require partial suit removal, unless extra option zippers are installed.

Drysuit gaskets are natural latex rubber, should be regularly treated with 303 Protectant, and depending on use, will probably need to be replaced every two to five years. Drysuit fabric should also be periodically treated with durable water repellency treatments (DWR) to

prevent heat loss from the fabric “wetting out.” (Note on pricing: drysuits are generally less expensive than funerals.)

WETSUITS were originally made from neoprene, but now come in a wider range of stretchy fabrics. Suits range from one piece full coverage “STEAMERS” that are the warmest, to vests and shorts. Thickness of material also varies, but 1mm to 3mm thickness is available for river users, because thicker neoprene limits movement. Per the name, water enters the suits and is warmed by body heat. Fit should be snug to prevent circulation of cold water. Boaters can combine wetsuits with waterproof paddle tops to increase warmth when out of the water.

WETSUIT PLUSES Wetsuits are much less expensive than drysuits, ranging from \$80.00 to \$195.00. Other than occasional washing, there is little maintenance. The thicker suits do improve buoyancy and pad against impacts. Wetsuits help protect swimmers from hypothermia in all but the coldest water.

WETSUIT MINUSES The suits lack breathability and can be uncomfortable in hot weather. Full wetsuits can be difficult to put on and take off.

Swimmers have died of hypothermia in relatively short times in cold water in “Farmer John” wetsuits that leave the user’s arms unprotected. The deaths of wetsuit wearers Amy Gerver and Russ Campbell, is a sad lesson that wet suits do not maintain body warmth for survival in very active cold water. I have checked float time through the rapid they died in-----as less than 5 minutes. I believe they were already suffering Mild Hypothermia before the accident. That is the most likely explanation for why they became incapacitated so quickly.

People get hypothermia in wetsuits most quickly when the suits drain and refill: thus cooling body core temperatures. This can happen repeatedly when swimmers are clinging to the side of a raft that is going up and down through a rapid. It also happens when a boater is constantly getting slapped with waves while paddling. There can be a considerable loss of body heat from wind and water related evaporative cooling of a wet wetsuit. Some new wetsuit materials are designed to reduce evaporative cooling.

Insulated head, feet, and hand coverings will keep paddlers warmer both in and out of cold water.

Recommended Clothing for Water Temperature

Water Temperature	Recommended Clothing
Over 80° F	Minimal.
60-79° F	Light wetsuit vests, paddle tops, Kayakers-drytop 60-69° F.
50-59° F	3mm body, 2mm arms/legs Full or “Steamer” wetsuit, or drysuit with light insulating layer, Kayakers add drytop with insulation.
40-49° F	Drysuit-light to midweight insulation inside. 5mm “steamer” wetsuit (availability limited). Kayakers need heavier insulation: drysuits with head, hand and feet insulation.
Below 40° F	Drysuit with midweight or heavier insulation, head, hand, and feet insulation. Or just say no!

The U.S. Coast Guard, which has Gore-tex drysuits available for its small craft crews, mandates those crews wear drysuits when water temperature is below 50°F.

In Closing, I must agree no boaters expect to be swimming for more than a few minutes before they are rescued or make it to shore. Unfortunately, long swims take place. My experience with this was: chasing my sister-in-law down the very cold and flood swollen Bruneau River (3,300C.F.S.), after her raft flipped right in front of me. She was in the water, in a drysuit, for about 15 minutes in constant Class IV rapids, clinging to the flipped raft. When rescued she was very tired and slightly cold, but alive.

Further Suggestions:

Read a book on river rescue –Les Bechdel’s “River Rescue” is the classic.

Take a swift-water rescue course.

Take a comprehensive first aid course with a CPR component.

Boat with people who have taken the above suggestions.

Dress smart to stay warm, both in and out of the water. A cold shivering boater is going to cool down and become incapable of self-rescue much more quickly than a warm boater, when plunged into cold water.

Ray Brooks-2003, revised 2009.