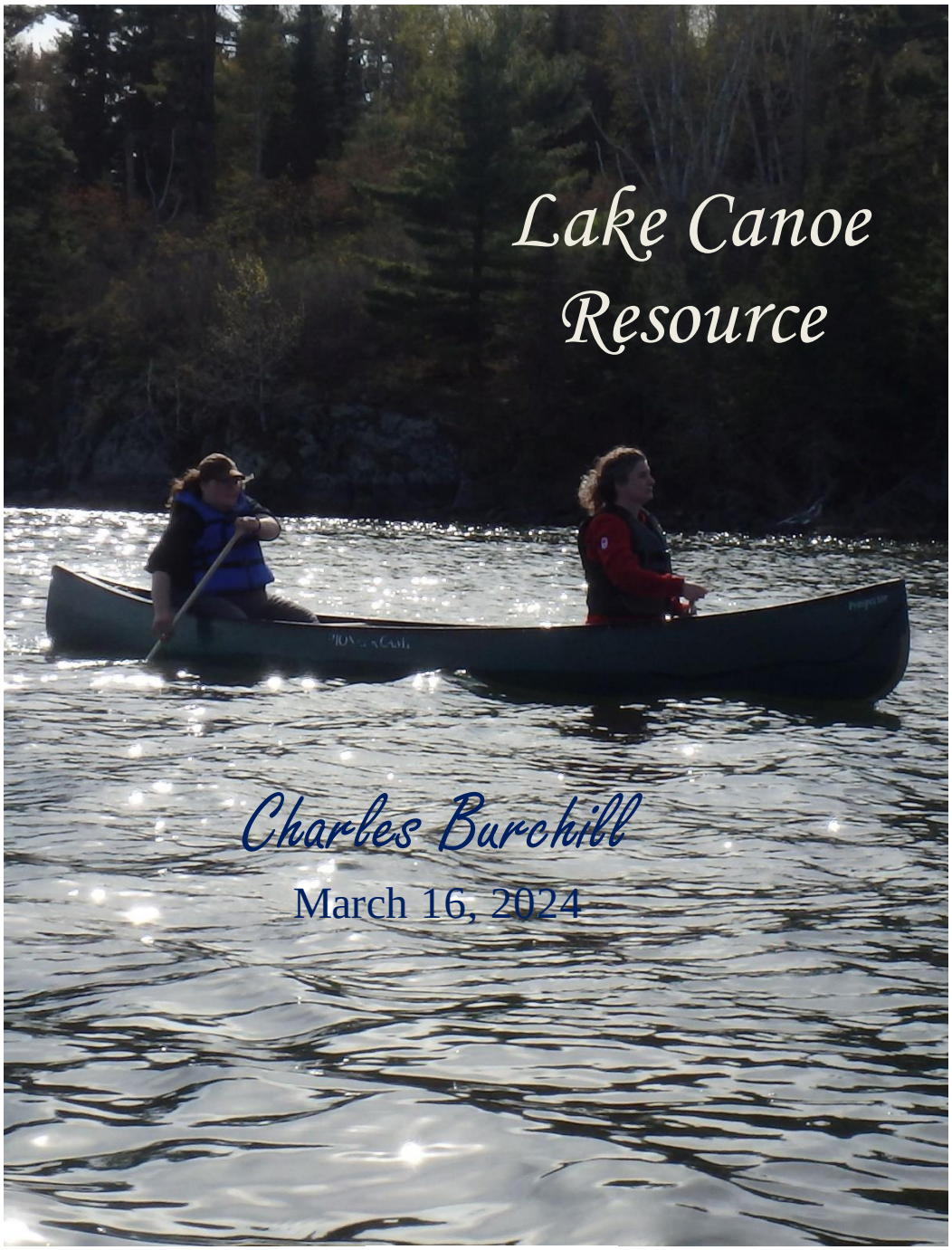
canoe school



Lake Canoe Resource

Charles Burchill

March 16, 2024

Paddle Manitoba
www.paddle.mb.ca

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A personal statement and acknowledgment

The canoe was gifted and used across Turtle Island through time immemorial; it is part of First Nations' culture and identity. This gift was appropriated by others for their own uses. It is now used to take us across the homelands and waters of First Nations and Metis people, the origins and spiritual importance being lost, forgotten, or ignored. The canoe is a metaphor for colonialism and its impact. We need to refloat or right the canoe and work toward reconciliation. This is both hope and challenge for us; what we strive towards as a real possibility for a shared future; to remind us that we're all in the same canoe and that to make this partnership work we must all paddle together.

I respect the Treaties that were made and acknowledge the harms and mistakes of the past, and dedicate myself to move forward in partnership with Indigenous People in a spirit of reconciliation and collaboration.

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Editors and contributors: Charles Burchill <burchil@cc.umanitoba.ca>, Eric Gyselman, Chris Milne, Jeremiah Heinrichs, Sharon Touchette

Charles Burchill

I learned how to hold a paddle at a young age while visiting my grandparents' cabin in the woods of Meadow Lake provincial park, Saskatchewan. Although I do not remember when I first paddled a canoe my passion was well developed as young teenager when I sp ent most of my small income from papers and camp honoraria on a paddle, PFD, and canoe.

My first formal canoe training happened at YMCA Camp Stephens as a camper and counsellor. I went through the early CRCA (Canadian Recreational Canoeing Association) paddling program in the mid-1970s. I taught canoeing and wilderness awareness for a City of Winnipeg camp in the late 1970s and early 80s. I received my Red Cross Small Craft Safety instructor certification in 1982. In 1999 I received my CRCA Flatwater instructor certification, Lake Water instructor in 2008, and poling instructor in 2014. I was involved with the development of the Paddle Canada "Style" Canoeing program in 2010/11.

Eric Gyselman

My history with canoeing is typical of my generation: family cottage, fleet of boats, vintage canoe. The canoe was the craft of choice for evening fishing and poking around the backwaters and streams. Over time, I realized that I was passionate about these simple craft. It just kind of snuck up on me.

I had no formal canoeing instruction. My paddling was strictly learned from experience: "I'm still dry and going in the right direction; I must be doing something right". That all changed when I joined Paddle Manitoba. Cam White was President at the time and Director of Paddle Camp. "You should come out and try for your Instructor's Certification" was how he started. Early hesitation on my part quickly gave way to Cam's persuasive nature and in May 2007, I found myself on the dock at Pioneer Camp. Well, as it turned out, I did get my Instructor level that year. With newfound enthusiasm, I began to teach and I took some other courses in Advanced Canoe Tripping and Moving Water, followed by two years of Mentoring at Canoe School to get my Instructor Trainers certification. That brings me to this year's Canoe School and another class of candidates who, like I was, may be more than a little apprehensive. But relax, you will learn a lot and you will have a tired smile on your face by the end of the weekend, no matter how it turns out.

Chris Milne

Chris' first love was hiking and backpacking (don't hold that against him) in central Ontario and in other places around North America. However he fell in love with the canoe in his mid twenties and has pursued this means of exploring the wilderness ever since. Chris believes that "the canoe holds in perfect tension, beauty and functionality". Chris in an Instructor Trainer in Advanced and Solo Lake Canoe with Paddle Canada and has been instructing since 2005. He worked for Pioneer Camp through the 2014 season.

Jeremiah Heinrichs

Jeremiah was born in a canoe. He also happens to be a long standing Canoe School veteran. He was first certified as a Paddle Canada Instructor in 2005 and has been active in the Manitoba paddling community ever since. Jeremiah has been an Instructor at Canoe School for the past 11 years. He is now an instructor Trainer in Advanced Tandem and Solo Lake Canoe with Paddle Canada. Jeremiah's passion for paddling (particularly solo) has been contagious in the Pioneer Camp community for years.

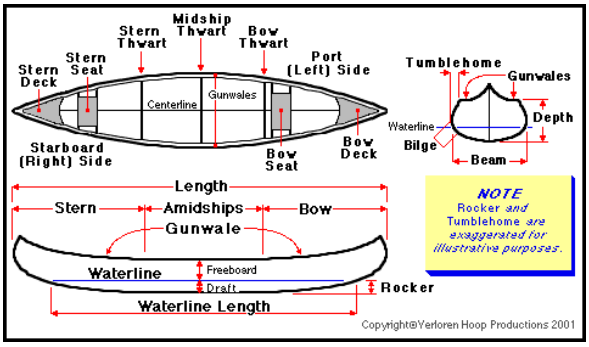
Sharon Touchette

In 2004 I stepped into a canoe for the first time. With an injured foot and a yearning to be out on an adventure into nature, I found a group leaving on a five day canoe trip willing to take me along. I had no knowledge of canoeing and no idea of what I was getting into. Amazed and with wonder, it was on that trip I discovered a passion within myself, a passion for canoeing that has driven me to want to continue learning and experiencing always more than I already have. I love to explore and my canoe takes me on magical exploring adventures. I took the first of many courses in 2005 at Pioneer Camp and in 2011, I reached instructor level. As an instructor, I discovered I am filled with new learning through my students. My association with Paddle Manitoba and Pioneer Camp has led me through taking courses to teaching courses, going on trips to leading trips, always finding an experience beyond where I have been only to find there is still so much more to experience.

Introduction

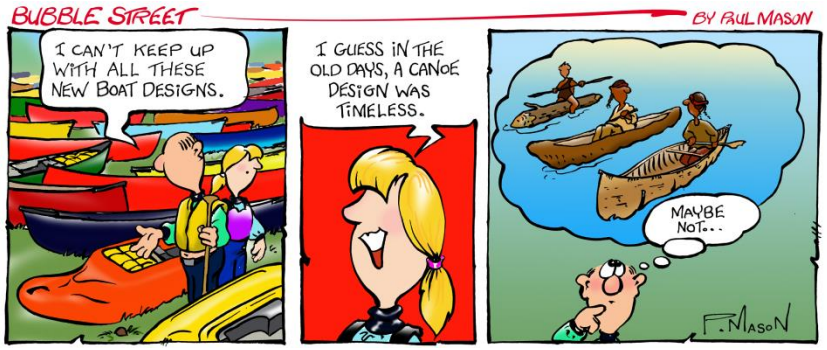
This manual was developed as a resource for participants of Canoe School, Paddle Canada Instructor and Skills courses held at Manitoba Pioneer Camp every spring. The manual is a general resource for Lake Paddling and includes information on equipment, skills, conditions, and risk management when canoeing in lake environments. It is not intended to be the sole source of information on canoeing but it does provide a broad set of information related to the Paddle Canada Lake Program. Paddle Canada program manuals, and Stroke resource manuals should be used for reference. A number of allied books and websites on canoeing and camp craft have been noted throughout the manual along with a reference section at the end. Use the resource for reference purposes, it is not meant to be a novel for reading.

The Canoe



The canoe is the craft that you sit in and paddle; it carries you and your equipment. It is the most important part of canoeing, without one you wouldn't be canoeing. Knowing a little about the boat equipment you are using makes understanding discussions, selection decisions, and completing skills easier. Many boats are outfitted with additional equipment features which assist with using, transporting, or rescuing the boat. Painters, kneepads, D-rings, kneeling thwarts, and kneeling pads all enhance the comfort, experience and safety of the paddler.

Types and Shapes



A canoe is a lightweight narrow boat with an open top and narrow (pointed) at both ends. Paddlers face the direction of travel and use a single-bladed paddle. Most canoe builders have a variety of hull shapes and styles meant for different purposes. (see: https://en.wikipedia.org/wiki/Canoe). The section on basic characteristics provides some idea of the different hull forms with advantages and disadvantages. The design of a hull is a compromise between a multitude of factors – speed, weight, carrying capacity, maneuverability, and stability. When considering a canoe you will need to consider the application and intended use. When selecting a canoe worry less about the 'name' and more about the characteristics of interest. One of the most popular names is 'Prospector', canoe builders have called many different canoes with a wide range of characteristics by this name.

There is a distinction, although possibly an arbitrary one, between a solo canoe and tandem canoe. Dedicated solo boats have a seat or saddle near the middle and are typically much narrower allowing the paddler to keep the boat at a level heel (no tilt). Tandem boats have two seats and are typically wider. There is a whole range of canoes that can be used both as solo or tandem canoes.

Canoes are displacement hulls which mean they move through the water, pushing it aside, rather than on top of the water like power boats and some sail boats (boats that speed on top of the water have a 'planing hull'). Archimedes' Principle explains why canoes float; "an object wholly or partially immersed in a fluid will be buoyed up by a force equal to the weight of the fluid it displaces". In the case of a canoe, the amount of water displaced is equal to the volume of the canoe under water; the displaced water weighs exactly the same as the canoe and its load. This is important because no matter where the load is located in the canoe displaces the same amount of water; changing the position of the load will change the underwater shape of the hull which may have dramatic effects on your ability control the canoe.

Shawn Burke has written a series of online articles on the science of paddling. His work covers a number of areas including padding in sync, solo/tandem, the effect of shallow water, propelling the canoe. There is math used in his discussions but I have found the material to be approachable and easy to understand – worth the read. The Science of Paddling can be found on the web: https://thescienceofpaddling.net/

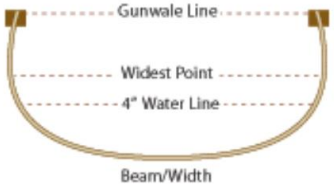
The speed a canoe can go is governed principally by: 1. power (how strong you are), 2. frictional resistance (the wetted surface, surface condition, and breadth [of entry]), and 3. wave creation as you push the canoe through the water. All of these forces need to be balanced for the particular use of the canoe (see the reference to 'The Shape of the Canoe' http://www.greenval.com/jwinters.html by J. Winters). Within reason a longer narrow canoe will be faster through the water, although at some point surface resistance will increase beyond the advantage that you get from length.

Basic Characteristics

Length

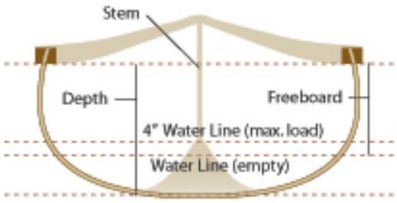
The distance from the tip of the stern to the tip of the bow, this simple measurement has a big impact on performance. Within reasonable canoe lengths, a longer canoe is faster, tracks a straighter line and provides more carrying capacity than a shorter one. The trade-off is decreased manoeuvrability: a longer canoe can't make the tight turns or respond as quickly as some paddling demands. But that doesn't mean a long canoe will be hard to steer–it just might not be the best choice for things like white-water. For most uses you may find that the efficiency gained in tracking will outweigh any extra effort required for turning when lake paddling.

Beam



Beam, or width, is measured at the widest part of the canoe. Most manufacturers provide three measurements: the gunwale, the waterline and the widest point. The 4" waterline accounts for displacement when fully loaded and tells you the most about performance. A narrow canoe tends to be faster but less stable, whereas a wider canoe provides more stability at the expense of some efficiency.

Depth



Also measured in three places – bow, stern and center– depth affects more subtle aspects of paddling. Increasing depth provides more carrying capacity and freeboard, allowing the canoe to paddle through waves with more ease. But it can also make the canoe heavier and less responsive in wind.

Hull Profile:

The cross-section of a canoe's hull hints at its true nature on the water. Most fall into one of four categories:

Flat Bottom

These hulls look just like they sound: the canoe's belly has very little curve, making it highly stable on calm water. This initial stability, however, comes at the expense of secondary stability. Flat bottomed canoes are vulnerable to wind, waves and even leaning. Once initial stability is breached, it's difficult to avoid capsizing.

Round Bottom

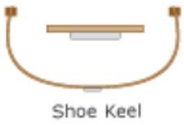
Exactly the opposite of the flat bottom, the belly of a round bottom canoe is extremely curved. Built for speed and efficiency, they can be difficult to balance in an upright position–particularly for inexperienced paddlers. In other words, initial stability is poor. In contrast, when leaned on an edge these canoes are more predictable. They feel tippy, but they're harder to tip!

Shallow Arch

Designed to give paddlers the stability of a flat hull and the flexibility of a round hull, shallow arches are increasingly popular. Design varies widely with manufacturer. Some err toward initial stability with less arch, and others strive to provide more manoeuvrability. The result is an impressive selection that promises something for everyone, but it does require research, talking to experts, and even trying canoes out before purchasing.

Shallow Vee

Another blend of the flat and round hull, the shallow vee incorporates a v-shape at the bottom of the arch. This creates decent initial and secondary stability, and improved tracking. It does, however, result in a higher surface area in the water, which can make the canoe less efficient.



Keels

Not a hull category per se, but important to understand. Keels were originally integrated into canoe designs for structural purposes; literally to help hold the canoe together. Experts disagree on whether keels, in general, have a significant impact on performance keels may make canoes track better but limit paddling efficiency, and they tend to catch on things below the surface. There are two types of keels–tee and shoe. Tee keels are best suited for deeper water and lake paddling. Shoe keels were designed with a low profile to slide over rocks found in both shallow and white water and are more commonly used on river tripping canoes.

Canoe Profile:

For more subtle indications of a canoe's personality, look to the shape of its sides. The shape of the sides of a canoe may vary throughout the length hull. Canoes built for waves or white water might have more flare near the bow, but tumblehome at the paddling stations, and straight through the middle.

Flare

If they flare out above the waterline, they will resist tipping and deflect water for a drier ride. Some paddlers find flared canoes uncomfortable to paddle because it requires reaching out over the side of the canoe.

Tumblehome

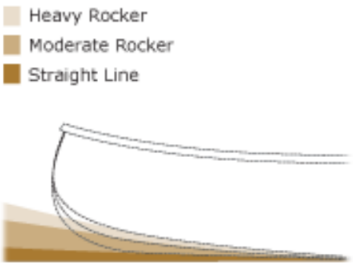
If ease and stroke perfection are required, such as in racing, a canoe may have tumblehome, with the gunwale width smaller than the waterline width. These canoes don't deflect water but are easier to paddle.

Straight Side

Design is not limited to flare or tumblehome. Some have straight sides, which provide no particular benefit or limitation, and others combine both in the same watercraft.

Additional Elements:

Once you have the basics, pay attention to a few additional characteristics that bend the rules: rocker, entry line, and fullness.

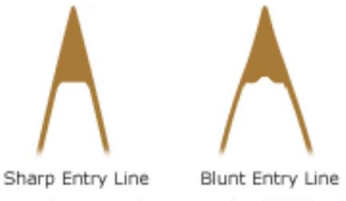


Rocker

Heavy, moderate or straight line–a canoe with a lot of rocker will act shorter because less of its belly actually sits in the water. This means it will have increased manoeuvrability but will not as track well. Canoes designed with moderate rocker will turn easily and track well. Straight line canoes have no rocker and track extremely well, but lack manoeuvrability. Rocker does not have to be symmetrical – some canoes have more rocker at the bow, and less at the stern. These provide a compromise for manoeuverability.

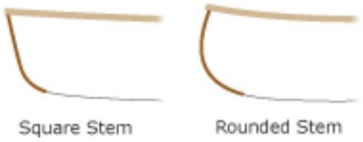
Entry Line

Canoes designed with a sharp entry lines will move with efficiency and speed but cut into saves. Canoes designed with blunt entry lines are less efficient but will provide more buoyancy in heavy waves.



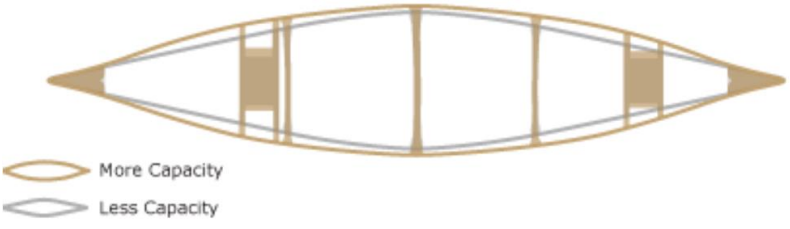
Stems

Stems create the shape of the bow and stern ends of a canoe and their profiles can be squared or rounded. A squared stem is more forward and almost parallel to the deck where as a rounded stem will come up in a curve to the bow. A square stem improves a canoe's tracking performance and a rounded stem improves a canoe's steering and manoeuvrability.



Fullness

A canoe shape or design, as measured from the bow, that reaches fullness quickly will provide more carrying capacity and stability. However, if the fullness is reached slowly, the canoe has been designed for speed; giving way capacity and stability.

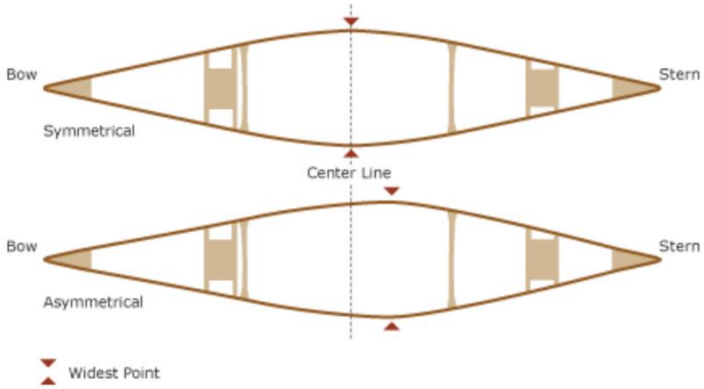


The fullness of the canoe through the length may be more important in a heeled canoe than the actual rocker. When heeled the side or chine of the canoe becomes

the ‘bottom’ and the rocker is identified by this line rather than the flat running rocker.

Symmetry

Canoes are design to be either symmetrical–having identical halves with the widest point being at the center, or asymmetrical–with a longer narrower bow and a shorter, more blunt stern. The widest point on an asymmetrical canoe is aft of center. Asymmetrical designs typically track better and are faster than similar sized canoes.



Hull Material

With hull material you can have any two of: strength/durability, weight, or cost. An inexpensive canoe, for example, will either weight a lot, or not be durable.

Canoe Hull Material Comparison Chart (Adapted from ACA Canoeing)

Material	Durability	Weight	Performance	Maintenance	Cost
Aluminum	High	Heavy	Limited, sticks to rocks, hot in the sun, cold.	Low	Low
Rotomold (Plastic, Polyethylene)	High	Heavy	Limited, slides over surfaces.	Low	Low
Royalex* (ABS)	High	Moderate	Good, slides over surfaces	Low	Moderate
Fiberglass	Moderate, repairable	Moderate to light	Excellent	Moderate to low	Moderate to high
Innegra/ Basalt (e.g. TuffStuff)	High	Moderate	Good, compromise flexes and stiff.	Moderate to low	Moderate to high
Carbon and/or Kevlar (e.g. BlueSteel)	Moderate, repairable	Light to ultralight	Excellent	Moderate	High
Wood	Moderate to low, restorable	Moderate to light	Excellent	High	High

* as of April 2014 PolyOne shut down production of Royalex due to low volume of sales.

Esquif has developed a replacement for Royalex (ABS[1]) called T-Formex with similar properties, it has been on the market since 2016. There have also been developments in a number of other products to replace Royalex by various companies. Most of the replacements are composite of fabric that are stiff but resistant to impact (e.g. TuffStuff from NovaCraft which is a blend of Innegra and basalt cloth). Composite canoes are generally made of multiple layers, usually of different types of cloth, providing a combination of qualities. A number of companies are making composite canoes with infused gunwales and thwarts, and without a gel coat, both allow for a considerable weight savings.

Cloth Comparison Chart (Adapted from H_2O Canoes)

Material *	Notes
Fiberglass	Common boat cloth, excellent resin retention, easily repairable, structural when saturated with resin. Inexpensive and easy to obtain. There are multiple kinds of Fiberglass.
Innegra	Polypropylene based material with excellent flex, and impact absorption. It does not make a stiff enough layup so it is ideally combined with another fabric in a blend to share bond and resilience characteristics. It does not wet out well so vacuum infusion is required. Thee are several kind of Innegra cloth.
Basalt	Earth mineral (basalt rock) resource melted and extruded in to filaments sharing characteristics similar to Fiberglass and Carbon Fiber. Wets out well with resin.
Aramid	Aramid is resistant to tear, impact absorbing and structural when wetted out. Sensitive to UV degradation. Kevlar and Twaron are brand name products within the Aramid family.
Carbon	Carbon Fiber is the most advanced material available for light weight composite construction. Produces a very stiff layup which may be brittle alone. Elegant aesthetically - replaces multiple layers of Fiberglass for structural rigidity.

* Only the most common fibers are included – nylon and spectra are also commonly used.

Finally, there is a difference in the kinds of resins used in composite canoes. The resin is infused (i.e. soaked) into the cloth and then cured to harden into the desired shape. The two common resins are Epoxy and Vinylester both of which have blends that provide both durable and flexible results. In both cases a UV inhibitor, gel coat, or both provide protection from damage from the sun (UV). Although the resins are inherently robust the main purpose of the resin matrix is to adhere to and transfer the loads to the fibers.

- **Epoxy Resin** - superior to other resins, it is however the most expensive and hardest resin to work with. The use of epoxy resins produces the most durable and resilient canoes. Epoxy also has superior bonding qualities that reduces the chances of delamination (i.e. the separation of the cloth and resin).
- **Epoxy/Vinylester Blend** - a blend of the epoxy and vinylester resins that at least one manufacturer of performance racing hulls claims is an improvement over epoxy resin alone.
- **Vinylester Resin** - the most common resin used in high-volume canoe production. Sometimes it won't cure if the atmospheric conditions are not right.

[1] Acrylonitrile Butadiene Styrene (ABS). Royalex is a composite material, comprising an outer layer of vinyl and hard ABS, and an inner layer of ABS foam. The layers are bonded by heat treatment. T-Formex is similar in structure and manufacture.

Best used with glass, it has typically lower adhesion to other materials (e.g. Kevlar/carbon). It also has difficulty in bonding dissimilar and already-cured materials. It is not unusual for repair patches on vinylester resin canoes to delaminate or peel off. That being said VE resins are used by many highly respected canoe builders that produce a quality, long lasting, product.

- **Polyester Resin** - the least expensive resin. Generally, used in very inexpensive "cottage-grade" canoes. Stay away from canoes made from this type of resin if you are considering any sort of wilderness tripping.

Sailing

Sailing canoes has a long history, probably as long as canoes have been around. During the 1860s John MacGregor built his *Rob Roy* canoes and sailed them in Europe, the Baltics, and the Middle East (see 1000 Miles in the Rob Roy Canoe, http://www.ibiblio.org/eldritch/jm/TM.HTM). Sailing canoes were apparently the fastest sailing boats until the introduction of the planing dinghy in 1927. By 1934 sailing canoes was so well established that the American Canoe Association officially endorsed canoe sailing competitions. Unfortunately this course will only provide a brief introduction to canoe sailing and is limited to sailing down wind. Sailing canoes properly and safely with sailing rigs is a topic that is beyond the time available in this course. If you are interested in sailing canoes start by taking a course that covers sailing small boats.

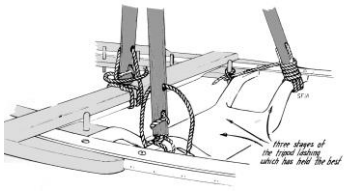
Simplest and most common kind of sail is a small tarp or poncho rigged for running before the wind using a simple mast such as a paddle or sturdy tent pole and spreading out the bottom of the tarp. This can be easily improved on by spreading the top of the tarp using two poles or adding a cross pole to the mast.

As a solo canoeist you will find it difficult to keep control of everything when using a simple tarp: deploying the sail, keeping it spread out, and controlling the canoe. WindPaddle[tm] makes and sells a fairly simple to use hoop sail that can be setup and deployed solo.

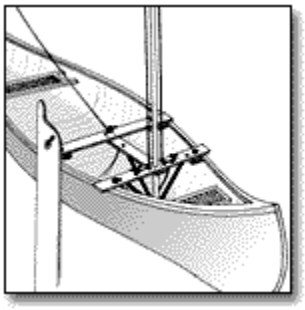
Rigging a simple sail is fairly straight forward using a small tarp or poncho and a couple of poles. The most significant problem you will have is properly stepping the mast – an incorrectly setup mast can quickly become a liability as it goes over the side and swamps the canoe. The mast is usually setup on the back side of the bow seat with guy-lines for support and a base plate on the floor or an additional support across the gunwales. A second pole is used to spread the tarp by running it diagonally across the tarp from the bottom of the mast and tarp. The cross piece should be able to rotate around the mast. A rope is run from the bottom free corner so you can control the sail. Use the paddle as a rudder to control the canoe. If the paddle is pulling away from the canoe then switch sides so the paddle is pushed against the side of the canoe where it can be held with one hand, as a lee board.

The mainsheet (rope) should never be tied to the canoe but held so it can be released quickly in case a change of wind or other emergency.

Some examples of mast steps.



If you want to sail on a reach (sideways to the wind direction) or close hauled (into the wind) you will need to add a leeboard and a sail that can be properly trimmed. A leeboard can be as simple as a paddle set so the blade stays in the water parallel to the length of the canoe near the mast. You will need to experiment in light winds to work out the best place for the board but it must be in front of the centre of effort so the canoe turns into the wind when not ruddering. My suggestion is to either build or buy a proper sailing rig for your canoe. You can find designs and discussions on how to rig a canoe for sailing on the Canoe Sailing Resources website



(http://freepages.genealogy.rootsweb.ancestry.com/~fassitt/canoe_mirror/canoe_sailing.html).

Canoe sailing and dinghy sailing are very similar with one very significant difference - balance. The canoe is a narrow featherweight craft that tips easily with a tall mast. As a rule, the floor is the safest sitting position from which to sail, possibly moving to the windward gunwale in a freshening breeze, but only if very comfortable sailing and the

canoe is appropriately rigged. Before sailing anything beyond a downwind direction you should become familiar with more traditional sail boats.

An alternative to sailing a solo boat is to lash together two canoes making a catamaran. This will provide a more stable platform for sailing. The two important things to remember about lashing together two canoes for sailing downwind are: 1) lash the canoes together using poles that span both canoes with the canoes separated by about a meter, 2) the bows of the canoes should be slightly closer together than the sterns. Setting up two smaller tarps or spreading one between both canoes with the masts rigged as above. When running with the wind on most inland lakes it is possible to overrun the waves and as the waves build-up between the canoes they can break over the sides of the canoe, eventually sinking one of the canoes (or bail). The first time I sailed canoes in this fashion was across the north end of Shoal Lake in the mid-1970s. We made a lot of miles but we had to stop several times to empty the canoes since we had lashed the canoes together without space between each canoe.

Lifts, Carries and Portages

Although we all love to paddle there are times when you will need to move your canoe and equipment from one place to another out of the water. You need to make sure that you can lift and move a canoe easily and safely ensuring that there is minimal risk to either yourself or your equipment.

Lifts

Canoes can be carried in a different few ways – over your head with one or two people, on your lap/hip, or underhand. Lifting your canoe is risky and it is the most likely place that you will inadvertently injure yourself. A canoe is very long for its weight and you can get into trouble quickly if you are not careful. At all times consider both your skill and strength. You should be willing to ask for help; it is better to lose a little pride and then suffer from some injury.

One person Carry: I suggest, if you can, use a solo overhead carry; it is easier to control the canoe and involves less walking in the bush. Having a proper carrying yoke helps out and makes a solo carry more comfortable. You should get one that fits you properly, or customize it so it fits. You might find that a yoke pad or some glued on closed cell foam will make carrying the canoe more comfortable. A few people use, and swear by, tump lines; try it out, based on your strength and build it might work or it might not. There are still a few people that use tied in paddles, I find this method a little disconcerting and worry about the paddles moving, or hurting myself if I run into problems. Many canoes only have a straight middle thwart, you should replace this bar with a proper yoke as it is easy to injure yourself if you are not careful. If you have a solo canoe, without a centre yoke, consider getting a clip on carrying yoke.

Doing an overhead lift and carries involves appropriate technique to minimize the risk of injuring yourself. The following is only a short overview, you can find more complete directions here: http://home.cc.umanitoba.ca/~burchil/pm_canoe/flip.html or in one of the hard copy references at the end of this manual.

Start by standing at the middle of the canoe and decide which way you will be facing when the canoe ends up on your shoulders. The hand that will be on the outside will go to the far side of the canoe during the lift. Let's assume you will be turning and facing left when you are finished. Roll the canoe away from yourself and place the chine against your thighs, pick up the canoe with both hands by the gunwale. You should be able to 'bounce' the canoe off of your thighs by pushing with your knees and pulling your hands in toward your waist. Flipping the canoe is just a continuation of this motion. Push the canoe with your knees so it pops up facing you with the gunwale on your lap. Reach for the far gunwale with your left hand. Push the canoe up with your knee, pull with your left hand, and let the canoe slide over onto your shoulders. The centre yoke should not go above your ears unless you are using something like a Grumman yoke with large pads. Place your hands on the inside of the gunwale and start to walk. Periodically drop one arm to allow your shoulders a rest. Many people tie a line from the front of the canoe to the back and have it hang about hand level (at your waist). This allows you to make some adjustments without having to have your hands up all the time. I have only used this technique a few times and find that it is just another loose rope to get caught in the bush.

An alternative way to flip the canoe is to leave the bow (or the stern) on the ground and flip just one end of the canoe. This is easier on yourself and your canoe then trying to flip the canoe and then dropping one end on the ground. Once canoe is over your head walk your hands along the gunwale until your reach the yoke. One important thing to remember if you are using the Tipi technique is to make sure that the end of the canoe that is on the ground is fixed in place by someone's foot, a rock, a tree root, or anything

else that is stable. When using this technique with a pack start at the back of the canoe, without a pack start at the front – try it both ways and figure out what works for you.

If there is a breeze it should be blowing into your face when the canoe is on the ground, use the breeze to help 'blow' the canoe over your head. If it is windy get help. Before you start to flip the canoe check your footing and the area around so you will not get hung up or catch anything with the canoe.

Before starting across a portage, or even before you leave home, check the weight and balance of the canoe. You should be able to stand/walk without hanging onto the canoe. Use a throw bag or paddles tied into your canoe to adjust the weight distribution until it is just right. I regularly walk around my back yard or down the street when I get new equipment just to make sure I know how it will behave once I am out on a trip.

Tandem Carry: When doing a tandem lift and carry the motion to lift the canoe is the same except that one person is near the front of the canoe (near the bow seat) and the other is near the back (either at the stern thwart or seat). Be sure you communicate with each other about how you are going to lift the canoe and direction you are going to face. For a spectator it is hilarious to see a couple pick up a canoe and end up as the Dr. Doolittle Push-me-Pull-you. Once the canoe is up on your shoulder have the person at the front move forward and put the deck on their shoulder allowing them to see and lead. Although tandem carries allow you to share the load it is more difficult to walk down narrow portage trails – it is a compromise. The two people should also be roughly the same height and build. If there is a little difference in height have the taller person walk at the front.

Hip Lift: If you only have to move the canoe a little way (really little) you can use a hip or thigh carry. Similar to the first step in the solo lift above lift the canoe by the gunwale with the chine on your thighs then shuffle around with the canoe in this position. Another alternative that people I know use with light weight solo canoes is to place the canoe on one shoulder, like a kayak. This works when there is no centre thwart or yoke for carrying the canoe.

Portage

Bill Mason once wrote *'Anyone who says they like portaging is either a liar or crazy'.* He was probably right but if you want to get between lakes and river systems it means finding and walking a portage. The Paddle Canada Lake courses are all about setting up day trips which often don't involve many portages but that possibility still exists so I thought I would throw in a few thoughts and pointers about getting you to the other side of a portage with the fewest problems. Whenever you start looking for portage and then when crossing a portage keep in mind issues of risk management for yourself and your

group. Remember to follow the Leave No Trace concepts trace mentioned near the end of this manual as well.

Finding a portage trail can be a little tricky when first starting on canoe trips. Portage trails are often not well marked either at the start or across the height of land. Before you leave on your trip ask someone familiar with the area, check the guide books, maps, etc… Look for places that would make sense using your topographic map – the shortest route without out marshes or wetlands. Most of us don't want to climb too much or walk through too much marsh mush. Often portages have a campsite at one end, or nearby, look for the telltale signs of a camping site.

Before you grab your canoe and head off into the bush take a scouting trip of at least the first part of the portage. This will confirm that you have actually found a portage and not an animal trail. Beaver drag lines can be a particular nuisance. Make the first crossing of the portage with your pack and maybe paddle(s) so you can look around, there is nothing quite as annoying as running into a partially fallen tree with your canoe – not to mention the increased possibility of getting lost. In unfamiliar areas take a back bearing on your compass just in case you get disoriented if the trail fades. Make sure all those annoying loose items are packed away. More things get forgotten on portage trails than anywhere else on a trip.

You may be tempted to try and carry everything can across a portage in one trip, it is better to take your time and take a couple (or three) trips rather than hurry and injure yourself. Enjoy the walk, smell the roses, see what there is to see. On the first trip over the portage take note of the footing, loose logs, rocks, and the route.

When walking a wet portage you might be tempted to walk around 'muddy' spots. Before making an alternate route consider why the area is muddy, and how much damage will be done to the surrounding area by your new trail, and by those that might follow you. Is it worth adding an extra trail and the associated ecological damage rather than getting a little mud on your shoes or slightly wet feet (you brought a change of socks right?). Stay on existing trails.

A few other suggestions

- When meeting someone with a canoe on a portage the canoeist gets the right of way.
- When crossing a portage a few times make sure your equipment is set off to the side of the portage so it does not get in the way, or cause a 'traffic' jam.
- Check the take-out and put-in areas of the portage one last time on every crossing to ensure that nothing has been left behind.

In the Boat

Launching and Entering

An unexpected Swim.
One of my early canoeing memories is going out for a paddle with a dear aunt – who I now know was not the canoeist I thought. We had arranged the floating canoe parallel to the dock but didn't ask anyone to hold or support the canoe. My aunt went for a swim when she stepped into the canoe and it moved away from the dock.

In the broadest context launching (or landing) can be done from a shallow shore line (such as a beach) or along a deep drop off (such as a dock or rocky ledge). In all cases launch (or land) with as much of the canoe in the water as possible – bridging between the shore and the water is very unstable and can damage the canoe.

Where possible launch the canoe parallel to the shore – this facilitates loading the canoe, and entry by the bow, stern, and passengers. Who gets into the canoe first is less critical then in moving water but it is something that should be communicated. I usually ask the most experienced paddler to get into the canoe and have the less experienced hold the canoe. If the canoe floats away then returning to the shore is quick and easy.

Place the paddle into the canoe first or carry it with you; use it for support by placing it across both gunwales. Step from the dock to the middle of the canoe, shifting your weight after you have good footing. When moving in the canoe lean forward and hold the gunwales rather than walking upright. When exiting the canoe reverse this move or shift your weight from the canoe to sitting on the dock.

Wait until the first person is sitting or kneeling comfortably, and lets you know, before getting into the canoe – announce your intention before climbing aboard.

If the shoreline is shallow (e.g. beach) then you may have to wade into the water to get enough water depth to float the canoe. You may also launch the canoe bow (or stern) first and enter from the stem end. Have the last paddler stabilize the canoe between their legs. If the end of the canoe is touching the bottom shift your weight toward the lake end of the canoe until the canoe floats enough to be released. DO NOT use your paddle like a pole and push….

To exit the canoe, reverse entry procedures. Bring the canoe into the beach without running up onto shore. Have the bow person exit first to steady the canoe for the stern paddler, who moves forward before exiting the canoe at the bow.

Sitting or kneeling, weight distribution

There are many potential environmental and human factors at play that will affect the manoeuvrability, stability and efficiency of the canoe. In every paddling scenario, you will need to determine what adjustments and precautions are necessary to move your canoe safely through the water.

While it is normal to sit upright on the bow and stern seats while paddling, this is also the most unstable position to be in (unless you are standing up or doing headstands in the canoe). There are many factors that make a canoe unstable including wind and waves, the shape of the canoe hull, a fidgety canoeing partner or if the canoe has been packed unevenly or too high.

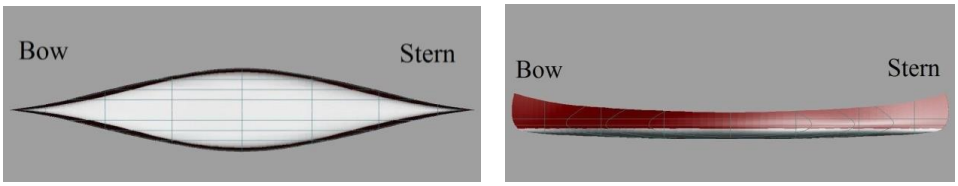
Increasing stability and control over the 'roll' of a canoe can be done by first lowering your knees to below the gunwales. This provides a significant increase in connection to the canoe and the ability for the canoe to roll or tilt without moving the center of gravity back and forth. Lowering your knees only lowers the centre of gravity slightly – but it might be enough. If more stability is needed, then the paddler can kneel in front of the seat while resting their bum on the edge of the seat. This kneeling position, with knees braced against the chine (or bilge) of the canoe, is the most stable paddling position. This simple switch from sitting to kneeling is often all that is needed to stabilize the canoe.

Modern marathon or long distance canoes have low hung bucket seats. These are not meant to kneel in front of, but sit on. Many of these canoes have foot braces that provide foot and leg support – similar to a kayak. The combination of low seats and foot braces provides a stable strong paddling position.

Weight and Trimming

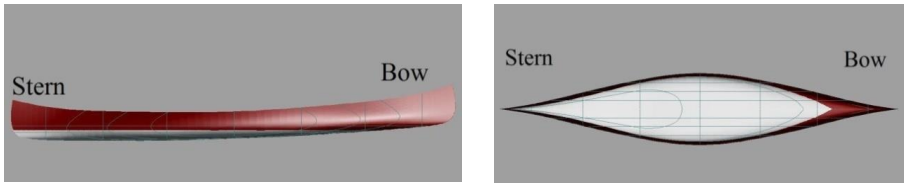
Remembering that the canoe acts as a displacement hull, the underwater shape of the canoe in the water will greatly affect the way it moves through the water. For example, if two paddlers are out for a day paddle with only a small backpack, there will be very little of the canoe in the water. In this case there will not be much effort required in pulling the canoe through the water. However, if two paddlers have packed their canoe for a two week trip, the canoe will displace more water and it will require a greater effort to pull the canoe through the water.

Typically, paddlers travel with an even trim (evenly distributed weight throughout the canoe). In calm waters, this would allow for efficiency and manoeuvrability.



(Bottom and side view of a canoe with even trim)

However, you cannot always anticipate calm days on the water. Wind will play a major factor into how you adjust the weight in your canoe. By adjusting the weight within the canoe, you are able to change the shape of the canoe hull that is in the water.



(Bottom and side view of a canoe with uneven, stern heavy trim)

Paddling Tandem, unless you are paddling into a moderate or strong headwind, you never want the bow to be heavier than the stern. This makes control of the canoe more difficult.

When soloing as kids we were told by our old instructors to kneel in the middle of the canoe off to one side; you would get use to it eventually. Unfortunately this is pretty limiting when you think about it, especially with new boats and paddling techniques. Canoes are big and there are lots of different styles of boats and places to sit or kneel. I happen to be a proponent of kneeling because of the additional balance and control, I also happen to paddle a tandem boat solo (no seat). How you weight the boat can have huge effects on your ability to paddle and control the canoe. How much weight is in the boat also makes a big difference. With this last thought I recommend heading out with a loaded canoe at least a few times every year. You will never know what it is like to try to paddle a wallowing barge in heavy seas unless you try, you don't want to find out when you have no other choice. Some canoes are more stable and predictable when weighted with gear. Heeling a canoe is not necessary or required, heeling provides better access to

the water and greater maneuverability (turning), but a trim, flat running canoe may be more efficient and less affected by the wind.

The amount a canoe needs to be heeled for optimal control and turning depends on the canoe profile and amount of rocker. Some canoes do not need to be heeled at all for normal paddling; others may work best with the gunwale pushed right to the water surface. Usually it is not necessary, or advantageous, to have a radical heel when paddling. The best way to determine the amount of heel necessary for the combination of yourself, your canoe, and equipment is to get out on the water and practice; see what works. To determine a reasonable heel a new canoe kneel in the chine and slowly tip the canoe, with most canoes there will be a point that the canoe no longer easily tips (it feels like it pushes back). This point is a reasonable amount of heel, beyond this there may be some advantage in turning, less than this the canoe may 'run' straighter. A river boat with 'hard' chines and flared profile may have a 'straighter' keel line when heeled then when flat. A wide rockerless lake canoe with some tumblehome may act more like a rockered river boat when moderately heeled.

When paddling solo in a tandem canoe you typically kneel just back of the middle and heeled to one side. There are a few kneeling positions that are commonly used:

Low kneel (Canadian)
This is a low kneeling position is a classic form, with body weight back on your heels. Your knees are together in the chine or bilge of the paddling side with a slight rotation toward paddling side.

High kneel
This is similar to the low kneel except your weight is high with your body straight up from your knees. When paddling in this position (and Transverse kneel) remember to keep your weight inside the canoe – think of keeping your head over your belly-button and inside the canoe. Shifting between low and high kneeling positions is often done to adjust the trim of your canoe during turns.

Spread kneel (three point kneel).
This is the kneeling position to use when you are solo paddling a narrow solo canoe or in wind and wave conditions. You are leaning against the bow seat or thwart, using a pedestal saddle or stuff sack, or just supporting your weight with your knees spread to either side of the canoe. This position allows easy transitions, cross strokes, and weight transfers on both sides of the canoe. The centred position provides better stability.

Kneeling for extended periods of time can be difficult on your knees and ankles. There are several things that can be done to minimize the stress. Warming-up, and regular movement, even if it is just periodically changing from low to high kneeling positions, allows for blood circulation and relief. Practice – the more time you spend practicing (without overuse injury) the easier it becomes. Kneeling pads – these should be large enough to cover the

area that you will be moving in the canoe and may be composed of thick neoprene, closed cell foam, or yoga-mats. Kneeling pads should not absorb water and should not be slippery when wet. Ankle support using a rolled towel or rolled end of the mat under the ankles is often very helpful. Some people have kneeling pads made with a 'lump' across one end to provide ankle support. Placing a thin closed cell foam pad behind your knees can also help.

Unfortunately kneeling is often presented as the only option when solo paddling. A large stuff sack or day pack full of a sleeping bag or spare clothing provides a nice saddle with good support while still allowing movement in the canoe. You will often see kneeling thwarts added to canoes; they are useful when just starting out. These thwarts encourage you to stay in one place making the chance of sore knees and ankles actually worse. The bow seat in many tandem boats is located in a good position for lake solo paddling and provides good support. A prayer stool or meditation bench has been suggested and tried fairly effectively – they allow the user to kneel like a kneeling thwart but may also be easily moved. A lateral angled removable bench (LARB) is also helpful, suggested by Mark Maier. Eric Gyselman started calling these a 'Welsh Plank' based on where this was first seen.

I have had some success with hanging or webbed seats. The concern that I have with these is the stress that it puts on the sidewall of the canoe – especially lighter composite or plastic canoes.

Lake solo boats have a seat situated in pretty much the right spot for appropriate trim and balance (use it). There is no golden rule that says you can't use a seat – sit on it, put one knee down, put both knees down, do whatever is comfortable. To a degree you can use baggage and equipment to trim your boat and then sit on the bow seat with your equipment in the stern compartment. The important thing is to understand how the weight changes the shape of the canoe the water.

Paddlers should try a variety of options and use something that fits their needs and limitations. Supports and seats help reduce pressure on knees and

ankles but they also limit movement in the canoe. Novice paddlers usually find seats helpful but as their paddling becomes more advanced thwarts and seats get in the way.

Remember you can move around the canoe when solo paddling. When I was first taught how to canoe the mantra was kneel and stay, this was unfortunate because staying in one place eventually becomes very tiring and painful. Feel free to move, be free, relax, sit, kneel, lie down, etc… do whatever works for you. Depending on where you sit or kneel you can change the hull shape in the water which in turn affects your ability to control the canoe, changing how the canoe tracks, and the impact of wind and waves.

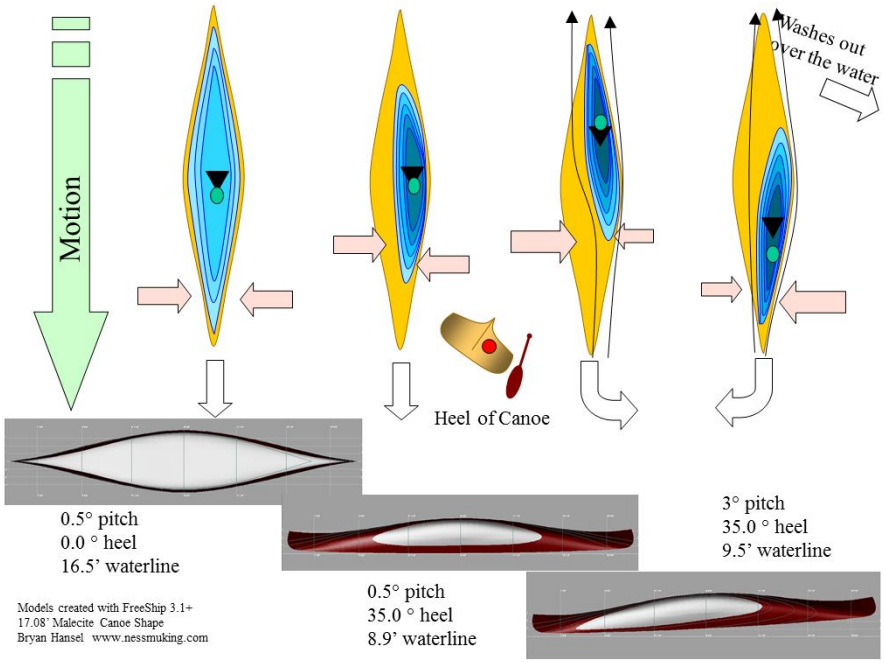
Paddling Positions – Strengths/Limitations

Position	Strength	Limitations
Kneeling	Good power position and greatest possibilities for movement, body, and boat control.	Difficult to stay in one position. Knee and ankle fatigue or injury possible.
Seats	Best for comfort and support. Bucket seats keep you in one position and when matched with foot braces provide good power transfer.	May be too high or difficult to get feet under. Rotation and forward/aft movement in canoe limited. Difficult to get and maintain a good edge. Limits movement in canoe. May not provide the best connection with the canoe. Recommend using a lower seat with a foot brace if necessary (e.g. marathon paddling).
Kneeling thwart	Good power position and connection to canoe.	Limits movement in canoe. Pressure on knees may still lead to injury.
'Saddle' bags	Provides support for kneeling position. Ability to move in canoe allows for weight transfers provides support.	Soft 'bag' may not allow good connection to boat. May be difficult to move enough. May not provide enough support.
Pedestal	Excellent power transfer and connection to canoe. Provides support and allows body rotation and contact with boat.	Movement restricted in canoe to location of Pedestal.
Meditation Bench, Welsh Plank, hanging seats	Good support. Allows good body position and some movement in canoe. Welsh Plank will provide correct or appropriate heel in tandem canoe.	Moves, difficult to keep in one spot. Hard to maintain connection with canoe. Kneeling position may still lead to long term injuries.

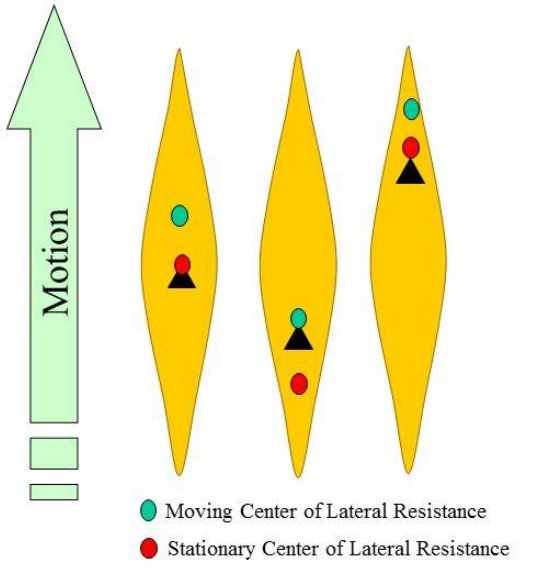
Weighting and Pivot Points

When solo canoeing in an empty boat you sit or kneel at or just behind the midpoint or centre of the canoe; your canoe may be heeled (or tipped) to the paddling side. This position provides the greatest flexibility in controlling the canoe since forces can be applied both forward and back of the pivot point. When carrying equipment in a tandem boat I usually sit on the bow seat facing the stern and trim the boat with my equipment closer to the stern.

Just like understanding the forces involved with paddling strokes it is critical you understand the underwater shape of the hull as the canoe is heeled and pitched in different ways. Although you can turn the canoe using the paddle, working with the forces from the water and hull shape will make manoeuvres easier to complete. It is important to remember that a canoe is a displacement hull – meaning the amount of water displaced is equal to the weight in the canoe. Changing the pitch or heel of the canoe will change the depth in the water as well as the hull shape. You have been told that the waterline of the canoe is shortened when the canoe is heeled and the apparent rocker is increased by 'pulling the ends out of the water'. But remember your canoe is a is a displacement hull so something has to sink. The maximum draft (depth) of the canoe is increased basically 'sticking' and holding the deeper spot in the water. This makes turning the canoe easier; an understanding of the actual shape of the canoe in the water helps with figuring out why the canoe turns faster (better) from some positions. If you move to one end of the canoe it sinks deeper in the water and lifts the other end out of the water.



If you ignore all of the other forces on the canoe a non-heeled (flat running) canoe has equal forces on both sides of the canoe and it will run straight. When you heel your canoe from near the middle there is a small turning force away from the paddling side –if you continue to move back slightly the turning force is balanced by the angle of the water across the non-paddling side and the 'skeg' effect of the trailing stem. Moving further back causes the angle and force to increase and your canoe will naturally turn toward your paddling side. When your canoe is heeled over and pitched toward the rear a 'J' is often no longer required. The opposite is true when you forward weight your canoe: there is more force against the paddling side bow and it will turn away from the paddling side. This is a very simplified description and reality is more complex. You also need to account for the additional torque from paddling, shape of the leading & trailing stems, and resistance over the hull but you should get the idea.



Measurements based on Bluewater Prospector at 4km/hr

When you move the canoe forward the pivot point also moves forward with the speed of the boat. When your canoe is stationary the natural pivot point will be close to the centre of mass as the canoe starts to move the pivot point moves forward as well. This is why a side slip is done using a running pry that is planted just in front of your knees. Don't forget the pivot point will also move toward the 'deepest' point of the canoe. Working out where all of everything lines up just takes practice.

The pivot point moves due to the nature of the canoe moving through the water. When moving forward the canoe 'climbs' on top of the water just a bit, creating a 'high' point near the front, and the bow wave holds the canoe in place. This also means there is a lower point near the back of the canoe as water closes in around the empty space left behind the boat. This high spot provides the 'pivot point, especially when the trailing end is not supported.

It is very helpful to develop or at least understand the 'stability curve' of the canoe you are paddling in. A canoe with a soft arch hull, rounded chines, and some tumblehome will feel a little unstable when flat but it will have a similar 'feel' as it is rolled on to the side (heeled), and then have a slightly 'stiffer' feel when the canoe starts to flare, just below the tumblehome. There is an excellent article by Nick Schade of Gullemont Kayaks that describes stability curves and how they should be interpreted (see: http://www.sksa-ltd.com/resource/BoatStab1.pdf, http://www.guillemot-kayaks.com/guillemot/information/kayak_design/kayak_stability,)

By understanding the forces on the canoe, the underwater hull shape, and the location of the pivot point, your weight turns can be controlled through the amount and direction of

the heel as well as the pitch of the boat. You can complete many turning manoeuvres without paddling by using momentum and subtle weight shifts. Practicing weight turns will give you an excellent idea of how the canoe will turn naturally as well as the effect of any momentum in the canoe from prior strokes.

You might ask 'if the diagram on the prior page is correct why does it appear that weight turns seem to go randomly in either direction?' Remember that the force from the water on the hull is not the only force acting on the canoe. Any existing inertia in the canoe may overcome the opposing force from the water. This effect is even more pronounced in a forward weighted canoe where the weighting sticks or holds the front end of the canoe in place and pulls the other end of the canoe up allowing it to 'skid' freely over the top of the water. The forces that cause the 'natural' turn mentioned above are overwhelmed by any existing inertia – the canoe will go in the direction initiated.

MITH (Momentum, Initiate, Tilt, Hold)

When paddling any turning manoeuvre consider the following fundamental components: Momentum, Initiate, Tilt, Hold (MITH). Although many people only think about MITH when soloing it is an important concept for boat control in all cases.

Momentum – for any successful manoeuvre the canoe must be moving or have some momentum to carry it through the move.

Initiate – initiate the move you want to complete (e.g. start the canoe turning with a sweep or J).

Tilt – at the same point that you initiate the move tilt the canoe (often to the inside); tilting the canoe allows it to turn freely. Usually the tilt is toward the inside of the curve or arc but some Lake canoes, with minimal rocker and square stems, will turn more efficiently when heeled to the outside. Experiment with your canoe to see which provides better efficiency and control.

Hold – during the move continue to hold the initial tilt and let the canoe carve. Generally a canoe that has an initiated turn will continue to turn until something changes. Levelling the canoe will cause a turn to slow or stop example.

The Loaded Boat

It is important to get out and paddle in a loaded boat, at least periodically. You may feel you have less control over the boat or it will feel 'sluggish'. This is not always true, some canoes paddle much better with some additional weight – another reason to experiment. Where you sit and how you heel the canoe also may need to change. The same principles apply but you can use your equipment to adjust the weighting in your canoe – you still want to maintain a relatively trim canoe. When soloing with equipment there is less reason to heel your canoe to reach or access the water. Use the equipment to provide a neutral heel while still sitting (or kneeling) off to one side.

Spray Deck

A spray deck is a cloth covering that partially or completely covers the open top of a canoe. A spray deck allows open canoes to travel through scientifically rougher water than an open canoe, typically decks are only used for expedition paddling. The preferred attachment is to anchor the decking to grommets or attachment points on the outside of the hull, although there are some models that use elastic to stretch around the gunwales. A fully covered deck has cockpits where the paddlers sit and skits to prevent water from entering the canoe – these should not be physically attached to the paddler in case of upset.

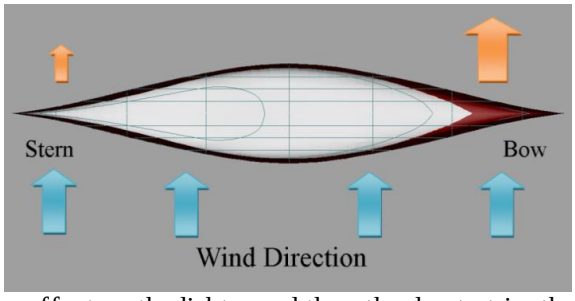
Things to consider in a spray deck include paddle attachment for spare paddles within easy reach, access to cargo areas, map holder, and other tie downs on the surface. You may want to consider a partial deck (over the bow) for moderate conditions, minimizing splash or plunging into waves but not a full wash over. Some decks come with partial hoops to minimize pooling of water on the surface.

Accidental tipping of a decked canoe does happen, you should be prepared since decks can make wet exits more complicated. When you expect to be travelling with a spray deck you should practice tipping a few times with equipment in a safe, controlled, environment so you have an understanding of the limitations.

Into the Wind

You cannot always anticipate calm days on the water and paddling in the wind opens up a whole set of challenges for the solo paddler. Wind will play a major factor into how you adjust the weight in your canoe. A canoe that is weighted slightly more to one end may be easier to paddle in a straight line but it is more difficult to control in the wind. Once

the wind picks up the less weighted end of the canoe will act as a sail or weathervane. The resulting effects of the wind on the canoe will look something like this:



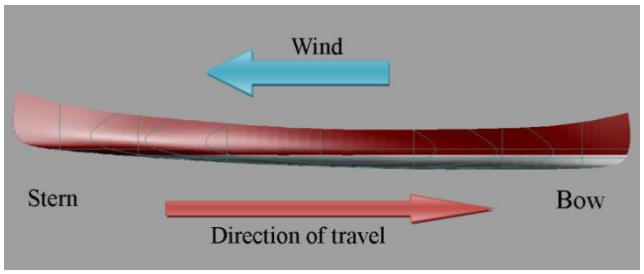
(Wind has greater effect on the lighter end than the due to trim that is stern heavy)

If left unchecked, a strong wind will always turn the boat until the heaviest end of the canoe is upwind and the lightest end of the canoe is downwind. In essence the canoe acts as a weathervane. When paddling in wind adjust the trim with your body or equipment for an appropriate trim, minimize or paddle with a neutral heel, and spread your knees to allow the canoe to roll or move underneath you. Paddling with extra weight (equipment) in the canoe often makes it easier to paddle in the wind.

Remember with wind there is often waves that need to be dealt with as well – review the section on waves near the end of this document.

Paddling into a headwind

Keeping the weathervane effect in mind, it is advisable for paddlers to have an even trim or weight the bow (upwind end of the canoe) slightly heavier than the stern (downwind end of the canoe) when paddling into a headwind. The wind will have less effect on the bow of the boat as you travel forward. Without consideration for the waves and depending on the trim paddling on the up wind side of the canoe may be easier. One thing to keep in mind when adjusting your trim in this scenario is that waves are often associated with wind.

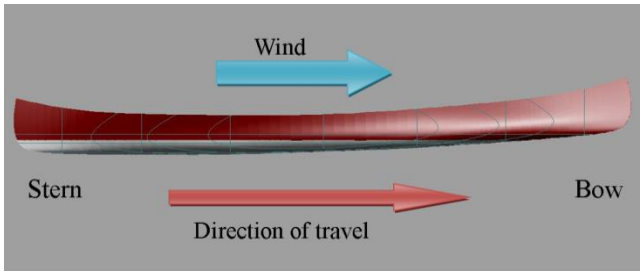


(the trim on the canoe in the picture is exaggerated)

Paddling with a tailwind

This is where most paddlers get really excited. A tailwind can turn a long, daunting day into a leisurely time where you can sit back and rudder yourself all the way to your campsite. However it can be just as hard to control a canoe in a strong tailwind as it is in a headwind. The same principal that applies to adjusting trim for a headwind applies to the tailwind, you will want to have an even trim or have your stern (upwind end of the canoe) slightly heavier that you bow (downwind side of the canoe). This will keep your

canoe pointed down wind. It is also good to keep in mind that in very wavy conditions, the canoe is most affected by wind when it is cresting a wave and much of the surface area of the canoe is exposed to the wind. Paddling on the downwind side, allowing the wind to 'correct' instead of using a J stroke may be easier.



(the trim on the canoe in the picture is exaggerated)

Cross Winds and 'Wind Ferry'
When paddling in a cross wind keeping the canoe with a neutral trim is important; typically I paddle on the windward side. Remember the wind will be moving you down wind so 'aim' your canoe upwind of your destination – balance the movement due to wind and the movement due to paddling to go directly to your destination. The canoe will appear to 'crab' a little, that is normal

Other effects of uneven trim
An uneven trim will also affect the performance of the canoe when attempting any kind of precision canoeing or manoeuvres. Before attempting a manoeuvre, be sure to check the trim of your canoe and anticipate how the canoe will be affected throughout the manoeuvre. For example, when a heavier person is sitting in the stern of the canoe, the center of gravity in the canoe will shift backwards and likewise, when a heavier person is in the bow seat the center of gravity in the canoe will shift forwards. The canoe will naturally want to pivot around this point and you should make appropriate adjustments to compensate for that. This could include shifting positions, increasing or decreasing the force of the stroke, or the types of strokes that each paddler uses. The trim of the canoe should also be on the instructor's radar when detecting and correcting. Failure to acknowledge uneven trim and to compensate for it first will result in a lot of wasted effort throughout the manoeuvre.


Kneeling in the Center with load forward gives better control in any wind (B. Mason)

PFDs

Paddle Canada courses require you to wear a properly fitting, done up, and approved PFD (Personal Floatation Device) or Lifejacket[2]. It is a good practice to wear a PFD in any case whether you are on a course or not; try putting a PFD on and doing it up when in deep water and you will see why. Lifejackets are included here as a comparison since they are not comfortable to wear when paddling due to the size and floatation requirements.

There are two types of approved PFDs:
Inherently buoyant PFD. These PFDs have buoyancy capabilities due to their construction from unicellular foam or macro cellular elements. Buoyancy must be 15 ½ pounds or 69 Newtons and are marked for people over 90 pounds. Almost all adults require only 7 pounds bouncy in the water – the 15 ½ pounds incorporates a safety factor of 2 for good measure. Although you might find PFD's comfortable to sit on – DON'T. Sitting on a PFD breaks down or 'squishes' the cellular foam which then has less buoyancy. PFDs should be checked and tested regularly for floatation and damage. A damaged or modified PFD is no longer certified.

*Inflatable PFD*s. These PFDs are fitted with an oral inflation device and a manually activated CO_2 inflation system. They may only be worn by adults (age 16+) and are not approved for white-water or personal watercraft (jet ski) operation. There are three types of inflatable PFDs that may be approved: 1. Vest or Suspender type with 150 Newtons buoyancy. 2. Pouch type with 100 Newtons (this type is considered a two stage donning device). 3. Automatic jacket type with 150 Newtons buoyancy. This last type is supposed to fill automatically on contact with water but you should be aware that exposure to extreme humidity or water washing over the craft may cause premature inflation. Inflatable PFDs may be reset, and CO_2 cartridges replaced following the manufacturers instruction. When traveling make sure you carry appropriate re-arming kits and you are familiar with use.

PFDs must be labelled appropriately and have at least the following statement:

"Approved by Department of Transport Canada" or
"Approved by Canadian Coast Guard, Department of Fisheries and Oceans

Because PFDs are made to be worn and come in many shapes, colours, and sizes you should choose one that is based on comfort and activity. There is only one way to

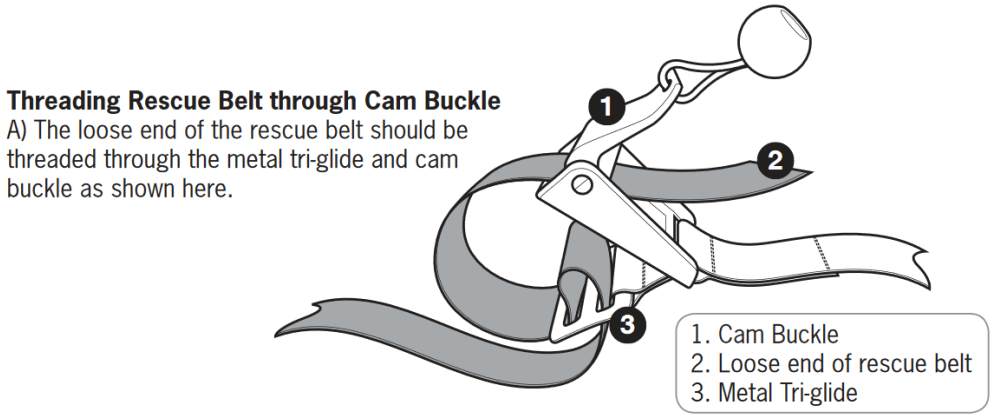
[2] Regarding educational material and posters referencing Lifejackets. In 2014 Paddle Canada signed on as a Safety Partner in the International Lifejacket Wear Principles project (http://www.lifejacketwear.com/). Advertising and education products associated with this project use the term 'Lifejacket' generically to include PFDs and Lifejackets to minimize confusion; legally there is still a distinction.

confirm that a PFD is going to work for you – try it on and test it both during the activity and in the water.

Lifejackets come in three different types: SOLAS (Foam filled or Inflatable), Standard Type, Small Vessel. Generally speaking these are all approved for use on commercial vessels and must meet one of a series of national or international requirements. Broadly the requirements include: the colour must be Red, Orange or Yellow, turn an unconscious victim on their back, and keep their face out of the water.

See the following Transport Canada website for more information:
https://www.tc.gc.ca/eng/marinesafety/debs-obs-equipment-lifejackets-information-1324.htm

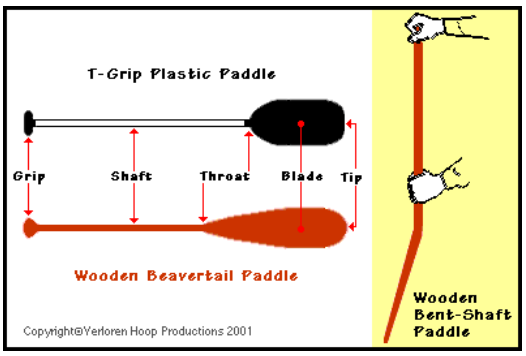
Quick Release Rescue Belt
If you have a quick release rescue belt or tow belt (either integrated or separate from your PFD) ensure that the QR webbing is correctly threaded and the loose end of the belt is trimmed appropriately. Practice releasing the belt prior to wearing the PFD in any situation where the release may be required to ensure you know the functioning and that the QR releases as expected.



Modified from: Force 6 Rescue Tech PFD. See: https://youtu.be/m1FzPZC5LbQ

QR belts are more commonly seen in some white-water conditions but the added utility for towing makes it a useful tool in lake conditions as well. In all cases you should be familiar with the use, practiced using the release, and understand the limitation. An unreleased belt with rescue line can become an entanglement risk. The release is not foolproof and it can jam and put the user in a dangerous spot.

The Paddle



Paddles are the most important tools that you have for canoeing. They come in many shapes and sizes for a variety of the tasks and abilities. My preference is for a hardwood otter tail paddle for deep water (lake) but that is not for everyone or every situation.

You hold a paddle by wrapping your fingers over the top of the grip, and near the throat (just above the blade). The paddle is used on the same side as your hand holding the shaft. When using bent shaft paddles the 'bend' has the blade angled forward. One of the most common mistakes that a paddler makes is keeping a overly strong grip on the paddle, especially on the shaft. This can cause 'cold fingers' and sore wrists. When paddling loosen your grip on the paddle; provide more power though torso rotation. Think of opening your fingers on recovery of the non-power portion of stroke.

Sizing is based on the type of paddling you are doing, your strength an build, and the size of the canoe. The critical consideration is not the overall paddle length but the length of the shaft, paddling conditions, and purpose. You may need to have several different paddles depending on the kind of paddling you are doing. For me the primary criterion for sizing is comfort – is it comfortable to hold and paddle. When doing a forward stroke the blade should be fully submerged through the power phase, with the grip roughly level with your nose. Any other way to size a paddle is only a rough approximation. A quick and dirty approximation is done by holding the paddle at the throat and grip and put the shaft on top of your head. If your elbows form 90° angles then it is roughly the correct size.

When paddling Lake Solo I suggest a straight Otter tail hardwood paddle with a width of 12-15cm. The whole paddle may have a little flex to avoid strain injuries. The edges should be fine and the blade tapered to the middle. Otter tail paddles are relatively forgiving and move through the water well, especially with slicing strokes. If I am paddling in a straight line and need to get someplace I will use a wide bladed [beaver tail] bent shaft paddle.

If you are fairly strong, a wider (15-18+cm) blade might be appropriate but be prepared for the shock of each stroke and the increased probability of overuse injuries. These paddles provide lots of power with each stroke and the increased surface area gives a strong platform for doing brace and running strokes.

If you have problems with carpal tunnel or other related injuries you might find asymmetric (ergonomic) groups more comfortable.

More on Paddle shapes and material:
https://www.rapidmedia.com/canoeroots/categories/skills/7822-choosing-the-best-canoe-paddle

Common Paddle Materials

Type of Material	Benefits	Drawbacks
Wood – may be either laminated (most common) or solid. When selecting look for shaft with continuous straight grain, and blade/shaft without knots or imperfections.	Warmer in hands, can feel the water movement of the water better, flexes to absorb shock, lighter than aluminum/polyethylene paddles.	Heavier than fibreglass paddles, requires some maintenance (varnish/oil, sanding). Solid wood paddles are prone to warping if not properly maintained.
Fibre Composite - materials (fibreglass, carbon and graphite) they are considerably lighter than wood and aluminum/plastic paddles.	Lighter than wood or aluminum paddles, has good flex. Good for extended period of paddling. Can be made with fine lines so will slice through the water easily.	Expensive, less durable than other materials.
Aluminum shaft/polyethylene blade	Inexpensive, durable, practically no maintenance.	Gets very cold, heavier than other materials. Shaft is hollow so it must remain sealed to prevent water entry. Blade typically has a large ‘spine’ which means it will not slice through the water quietly.

Blade Styles

Every paddle manufacturer will have their own names for various paddle blade shape and there are hundreds of variations between each style. In the end find something that suits your purposes generally and then go with a shape you like. The following provides an idea of the common overall shapes along with various names that have been used.

Standard/Common

This is a Standard (common) paddle. The sides are straight and the tip is mostly flat but slightly rounded at the edges. This is the most common kind of paddle found in most big box stores. Provides a compromise between a number of uses. May also be called a scout, freighter, river blade, canoe paddle

Beaver Tail

The Beaver Tail is an all-around paddle with the widest section toward the rounded tip. This shape of paddle is a good deep water paddle but provides some shallow water capabilities. It is good for control strokes but a little less forgiving than an Otter tail for mistakes. May also be called a Tripper paddle.

Otter Tail

Otter Tail paddles are good deep water paddles with the widest portion part way up the blade and fairly rounded tip. This is a good shape for long day trips with high cadence paddling. It will not provide good power in shallow water. This is a favoured shape of Canadian Solo style paddlers. Also comes with names like [Algonquin] guide.

Quill

This shape of paddle is a special case of an Otter tail known as a Quill. It is very long and narrow allowing. The length provides a lot of surface area for power as well provides an extended reach for specialty flat water ‘Canadian Style’ solo paddling. It is not a good shallow water paddle.

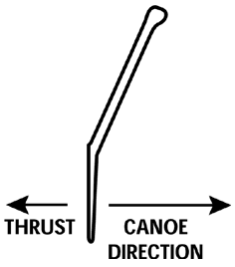
Voyageur

The Voyageur blade is squared at the tip and expands to the shoulders of the blade. Generally a narrower blade it is good for long day trips with high cadence paddling. It has similar characteristics to the Otter Tail. Rounding the tip and it becomes a Willow style blade.

Whitewater

A Whitewater blade is short and wide blade with lots of shallow water surface area. Excellent for braces and power bursts but can be tiring to use over a long period. May also be called a Hammerhead. When the blade is a little longer the name Sugar Island may be used. These larger sized blades are often used in American Freestyle Paddling

You may find the standard, beavertail and something akin to a Sugar Island blade with a bent shaft as well. Day tripping bends are usually around 12 degrees; racing paddles may be as much as 15 degrees. Through the power portion of the stroke the blade remains vertical in the water providing, apparently, 12-20% increase in efficiency. The size of the blade for bent shaft paddles is usually larger than an equivalent straight blade. Bent shaft paddles can be more awkward for braces, and draw strokes. Rolling strokes are not practical with a bent shaft paddle.



Grips

Grips broadly come in two types (Pear and T).

Pear shaped grips are the most comfortable to hold for long day paddles. Variations on this shape are good for rolling and specialty strokes. The grip is indented slightly just below the top for the palm. There is a very wide variation in shapes, look for something that fits your palm and is comfortable to use.

Asymmetric pear grips can be found in a lot of places now. Usually the rounded side sits in the palm and the fingers hold the more carved out side. I have seen a couple of places that make (and suggest) the asymmetry for use the opposite way.

T-grips provide a good positive grip and provide a good 'hook' for doing rescues, grabbing other canoe gunwales. T-grips are popular for white water paddling. Doing rolling strokes is more difficult so these are not recommended for lake paddling.

Sometimes you will see a Northwoods grip. These are occasionally made by custom paddler makers. The grip can be used like a pear grip but also provides the option for holding across the grip (for Northwoods style paddling).

Strokes

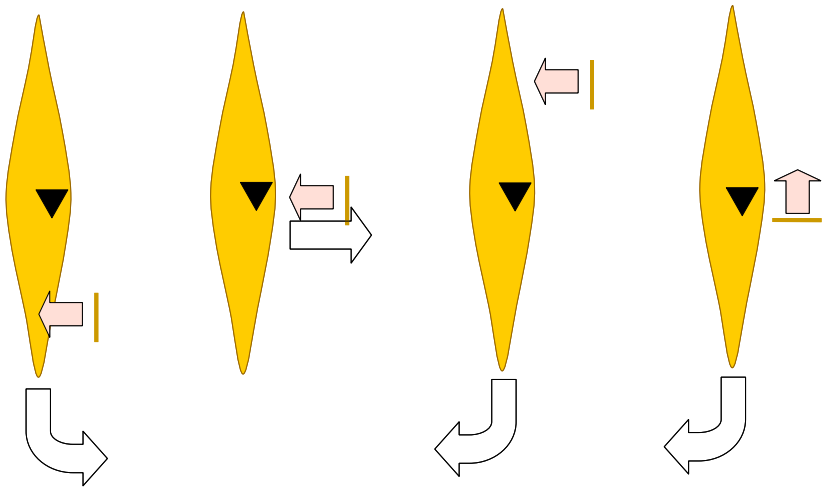
The Basic Idea – Forces and Torque

Basically a canoe stroke is something that is done with a paddle to move the canoe. An understanding of force & torque along with the associated relationship between body, canoe, paddle, and water is more important than knowing a 'set' of strokes.

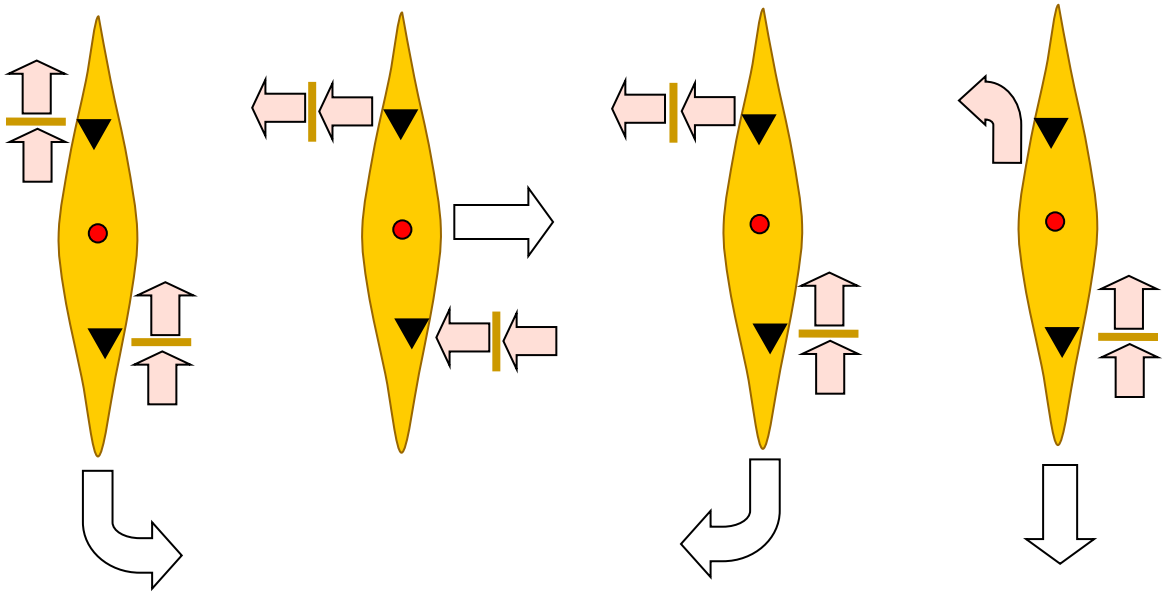
> *Force* – this is an influence that causes the canoe to change in speed and/or direction. It can often be thought of as a push or pull and has both a direction and magnitude. There are multiple forces that act on a canoe – one of those is the paddle force as it pushes on the water. Another is *Drag* – the resistance that oppose the relative motion of the canoe (water and wind). Finally related concepts of *inertia* or *momentum* which keeps the canoe going in a given direction once it has started.
>
> *Inertia* is an intrinsic characteristic of the canoe related to its mass. *Inertia* tells you how much force it will take to cause a particular acceleration (stop, turn, move). *Momentum* is a function of the canoe's mass and velocity. *Momentum* is a measure of the kinetic energy of the canoe.
>
> *Torque* – this is the tendency of a force to turn or rotate the canoe around a pivot point. It can be thought of as 'twisting'. The magnitude of torque is related to both the force applied, the distance from the pivot point, and the angle of the force (position of the paddle).

The paddle is used to apply a force to move the canoe – it is simple Newtonian mechanics. If the force is not through the pivot point then torque comes into play and the canoe turns. Both force and torque need to be balanced appropriately for any particular manoeuvre. It is important to remember that the forces are also applied by the water and apparent shape of the hull (see boat shape and weighting).

Note that you're actually pulling the boat past the paddle, rather than pulling the paddle along the boat, as it might appear from the canoe. Think of planting the paddle and pulling the boat up to it and you'll be more likely to have efficient strokes. Consider the paddle sticking in the water.



Examples of how the application of paddle force (pink) turns the canoe



Examples of how the application of paddle force turns the canoe, tandem. On the far left the canoe turns even though both sets of forces are pushing forward? Measure the distance from the center point to the paddle stroke – which is further from the centre (thus producing more torque)?

The Paddler's Box

When paddling you should use your torso muscles and limit the exertion or over extension of smaller muscles. Keeping your arms and hands within the "Paddler's box" will improve paddling efficiency and power and limit the possibility of injury. Engage your torso muscles by rotating your shoulders into the paddling stroke and unwind as necessary. This imaginary box extends out from your shoulders to the length your arms and down to the water or the boat. It is a misconception to think that this limits you to paddling in one direction, by rotating your shoulders the box moves. You do not want your hands to be extended [much] above your shoulders or trail behind the line of your back.

Actual strokes (see Paddle Canada Stoke manual for complete description)

A stroke is defined as: *A force, or series of forces, applied by one side of a blade (power face) in the water.*

The Paddle Canada Stroke Resource Manual has information on a wide variety of paddling strokes used in both Lake and Moving water. Each stoke identified in the manual has information on: Purpose – how it moves the canoe, Execution – basic information on the catch, power phase, follow through, and recovery, Common problems – where things often go wrong, Related Strokes – strokes that are similar in motion, have a similar or an opposing effect. See:
https://paddle-canada.s3.amazonaws.com/9cb1aff121fe3397af60bc6860bd60ee.pdf

Rather than cover many specific strokes, this section only covers four basic strokes – forward, backward, push away, and draw (pull) in. Conceptually these are all of the strokes that are required to move a canoe in any way necessary. Through an understanding of the forces and torque these four strokes can be combined to meet any paddling needs. Due to the torque cause by paddling on one side of the canoe most people include a fifth corrective stroke (e.g. J stroke) but this is only a combination of forward and push away strokes.

When paddling always consider how far you are from the pivot point and the direction of force compared to the point – is it through or tangential to the pivot point, if it is tangential then how far from the pivot point. The further you are from the pivot point the longer the lever, and with increased leverage you have more torque. Imagine a draw stroke with the line through the pivot point – you will go sideways; a draw toward the bow or stern will turn the canoe. An exaggerated draw to the bow/stern is a sweep (or if static a cut). Think about how you want to move the canoe then add a force (paddle stroke) that most efficiently provides that motion – always think about the direction of the force through or around the pivot point.

Forward stroke

Purpose

Move the canoe forward or in gradual turn away from paddling side. This is one of the 'basic' canoeing strokes.

Execution

Plant the blade in the water next to the canoe just in front of your knees; keep the grip hand outside of the canoe, near chin level. Draw the shaft hand backward and push out with your grip hand while 'unwinding' your torso. I find the starting with a slight forward lean, and then pushing my hips forward provides additional power. Continue to keep your chin up and look where you are going. Throughout the stoke keep the paddle

more or less perpendicular to the water surface.
http://home.cc.umanitoba.ca/~burchil/pm_canoe/forward.html

There is some variance on forward and reverse stroke where some paddlers keep both arms almost straight through out the stroke – all of the paddle motion is from torso rotation and push from hips. Some coaches and high level paddlers feel that the forward stroke is the first to learn but hardest to master.
http://www.daveyhearn.com/Coaching/Technique/Towards%20Paddling%20Perfection/c-boater.htm

Common problems

The two most common problems encountered with this stroke are: 1. not keeping the paddle perpendicular in the water (basically doing a sweep), and 2. Digging or lifting water up at the end of the stroke. This second problem is usually caused by trying to make the stroke too long.

Related Strokes

J, forward sweep, Canadian, Punch, Silent/Rolling J

Reverse stroke

Purpose

Move the canoe backward and/or turn the canoe away from the paddling side moving backward.

Execution

Slice the paddle in toward the canoe with the blade perpendicular to the line of the canoe. Push forward with the shaft hand starting with your torso rotated to the paddling side and shaft elbow bent. Pull back and up on the grip hand at the same time. Keeping your grip hand elbow high will help to keep the paddle blade in the right position. https://youtu.be/lgY6NL8e0jY

Common problems

Pitch on the blade; letting the blade drift out from the canoe (Paddle should be perpendicular in the water with the blade deep or under the canoe).

Related Strokes

Check, forward stroke, compound reverse stroke

Draw

Purpose

Moving the canoe sideways, toward paddle side.

Execution

This is a dynamic stroke with the paddle blade planted parallel to the length of the canoe about a straight arm distance out from the canoe with the shoulders rotated out of the canoe somewhat. The blade is drawn to near the side of the canoe. Recovery may be one of two forms: 1. in water recovery where the blade is turned perpendicular to the line of the canoe (grip thumb points out) and slices back to the starting point (https://youtu.be/QCSgB_1hdYI). 2. out of water recovery where the paddle slices backward and out of the water (solo: https://youtu.be/77_RCLyVWm8, Tandem: https://youtu.be/6t1rytEg6aw).

Common problems

Stopping the draw too late and having the paddle trapped against the side of the canoe. Angle or pitch on the blade or the draw so the pull is not directly sideways (or in the direction you want to go). Poor recovery so the recovery portion moves the canoe. Trying to lift the paddle straight up, rather than slice out backward rotate and slice away from the canoe.

Related strokes

Standing draw, pry, standing pry, bow rudder

Push (alternative Pry)

Purpose

Used for moving the canoe away from paddling side

Execution

Slice the paddle in from the back next to the canoe with blade deep and the grip hand thumb pointing back. The paddle shaft should be perpendicular to the water or pointed slightly under the canoe. Rotate the blade so it is parallel to the length of the canoe with the grip hand thumb backward. Push the paddle out from the canoe. Rotate the paddle blade (grip thumb pointing out) and slice into the canoe – repeat. Recovery may be one of two forms: 1. in water recovery where the blade is turned perpendicular to the line of the canoe (grip thumb points out) and slices back to the starting point (solo: https://youtu.be/o7w2MD5EhaI, tandem: https://youtu.be/6t1rytEg6aw). 2. out of water recovery where the paddle slices backward and out of the water, then it is sliced into the starting position from the back (https://youtu.be/nZHdjdeokV4).

Alternatively you can pry off of the gunwale – the stroke is shorter but more powerful. The recovery with a pry is in water.

Common problems

Getting thumb or fingers caught between the shaft and the gunwale. Choke up on the paddle shaft to get more leverage.

Related strokes

Bow jam, standing pry, forward sweep

Stroke Blending – see notes under force/torque. Each of the above basic strokes can be combined in different ways to make paddling more efficient and meet different needs. Review the Paddle Canada Stroke Resource Manual.

Correction Strokes

A simple set of combined or blended strokes are the correction strokes (e.g. J stroke) that allows for subtle correction or adjustment in direction.

http://home.cc.umanitoba.ca/~burchil/pm_canoe/subtle_correction.html

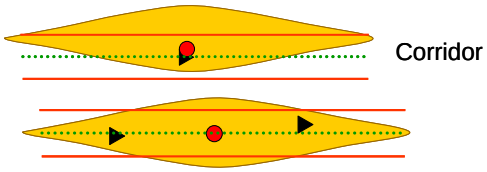
Manoeuvres (Actually Canoeing)

This section of the manual covers a few ways the canoe can moved through the water. Each level in the Lake Program has specific requirements within each manoeuvre, here the concept for each is described generally. Just as the paddle is used to apply a force to move the canoe you should consider the same factors when executing a canoe manoeuvre. Consider the forces and torque needed to move the canoe, and how and where they need to be applied. You will need to locate the pivot point of the canoe and how the various forces relate to that point throughout a manoeuvre. Take a look at your body position, will it help or hinder the motion of the canoe. Review the section on weighting the canoe and how the underwater hull shape changes and how it will resist the movement.

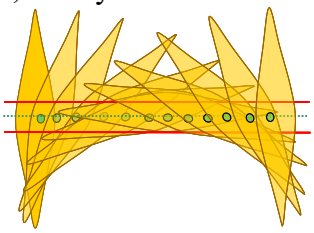
Corridors and Assessment

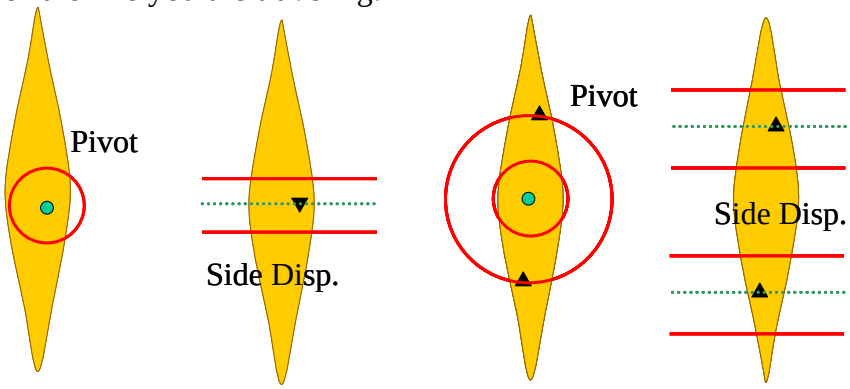
When completing any manoeuvre you should consider the corridor and the angle that you traverse through the corridor. The following are just some terms and thoughts about those terms.

Corridor



The corridor that a canoe travels during a particular manoeuvre is the first and most basic assessment criteria. When you are moving along a straight line, sitting still, or pivoting it is relatively easy to determine, understand and assess. The corridor is the total displacement allowed form the 'normal' direction of travel, it may be all in one direction or divided in both directions from the starting point. When executing more complex manoeuvres it can be more difficult to stay within the correct corridor. In the line pivot to the right notice the canoe moves around but the actual line taken by the pivot point is straight. With line/arc pivots, diagonal or offset lines, running side slips, and many other manoeuvres it may be helpful to setup multiple buoys to help keep track of the line you are traveling.





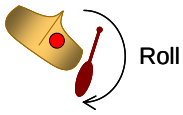
Pitch or Trim

Unwanted pitch is the motion or trim of the canoe from one end to the other. Canoes that are pitched forward can be more difficult to control. A very subtle imbalance can be difficult to detect but cane have significant implications on the way a canoe moves through the water.

Yaw

Yaw is the rotation around the vertical pivot axis of the canoe – think of a post going from through the top of your head and down through the canoe. Problems with yaw may be difficult to spot but the outcome later in the manoeuvre or routine will be obvious (e.g. outward pointing yaw in a circle will cause the canoe to spiral out or form a oblong circle with square corners). It is especially noticeable in connected circles where poor control in the first circle can completely mess up the second. The amount of unintentional yaw, like the displacement in a corridor, can be in either or both directions.

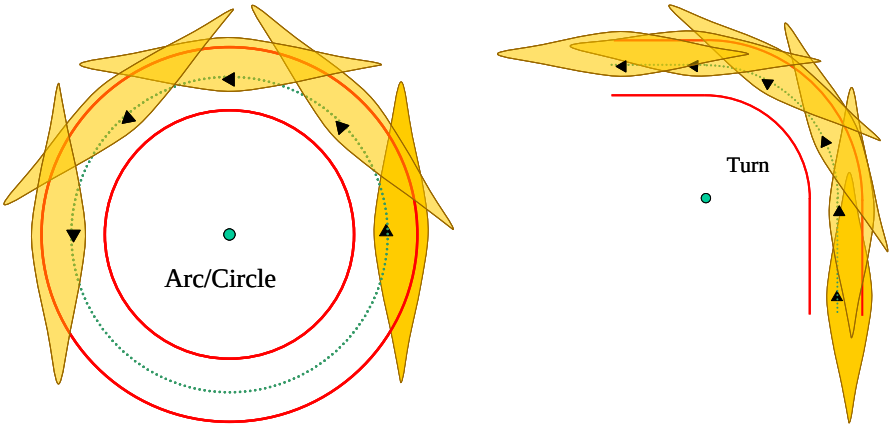
Roll



This is the unintentional rocking of your canoe side to side. In most solo canoeing there should be little unintended roll of the canoe when executing manoeuvres. Intentionally changing the heel of the canoe is acceptable.

Combined Corridor and Yaw

During any manoeuvre you must keep track of all of the criteria – the combination of both corridor and yaw are the most difficult to envision and monitor especially when scribing an arc or traversing a diagonal or offset line. Remember that an error or out of line portion of a manoeuvre may not be obvious until something else is really out later in the routine.



Forward Line

Forward straight line starts from a stationary position then stopping smoothly just short of the shore or dock. Watch for small sideways motion or 'crabbing' along the line. Setup two posts in line with each other about 2m apart, keeping these posts inline will help keep you going in a straight line. If you are having trouble going in a straight line when solo

paddling try using less heel and moving back, a little, in the boat. When paddling tandem the most common problem is the canoe is slightly bow heavy. If you have a sliding seat move it toward the stern, or adjust equipment further back in the canoe. The other common problem is the paddle is not vertical in the water, adjust your body position and reach if necessary.

The practical application of a forward line is going to a destination, across a lake, stream, or river. Weight distribution and paddling strokes will allow you to compensate for wind, waves and obstacles as necessary. Correction strokes may be needed (e.g. J stroke) or a sit-and-switch style of paddling may be used. Look for efficiency when paddling a straight forward line.

See: Solo: http://home.cc.umanitoba.ca/~burchil/pm_canoe/stop_go.html

Reverse Line
The reverse straight line starts from a stationary position paddling the canoe backward then stopping smoothly. I suggest using a marker so both the forward and reverse lines along with a controlled stop can be done as one group of manoeuvres. The most common problem is a poorly executed reverse J stroke either with the paddle angled (not vertical) in the water or the J not controlling the canoe (either over correcting or under correcting). When trying to correct an onside turn use a reverse stroke ending with a draw to the bow instead of a back sweep – it is more effective. When solo paddling moving right to the middle of the canoe and paddling without heeling the canoe will help. Solo reverse lines are tricky from a traditional sitting position since the stern is somewhat heavy and it becomes like driving a shopping cart backward.

The practical application of reverse lines is getting out of the way, launching, or reversing down a narrow channel in a marsh or small creek.

See: Solo https://youtu.be/AXntmuQezuc

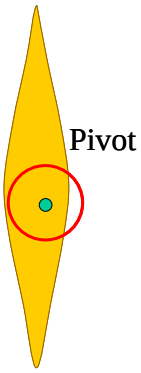
Controlled stop
A controlled stop means stopping the canoe with minimal side displacement or yaw. This is an important part of the forward/reverse lines, and turns (stop landings). Patience is the key to any controlled stops – start the stop far from the pivot point of the canoe and kill any momentum in the canoe before bring the paddle to your hip.

Stopping from forward motion is often easier if you use less heel and move back in the boat. Start with a standard reverse stroke but the paddle is initially placed flat on the top of the water with the palm on top of the grip. Tap the side of the canoe with the blade to ensure it is close to the canoe. Pitch the blade slightly (10° or less) opened toward the canoe. Press down the blade slowly dragging the blade under the canoe, the grip hand must be outside the canoe. One the momentum is gone you can either pull the paddle forward or slice it forward to your hip and execute a small (very small) reverse J to control any yaw.

Alternatively you can start the controlled forward stop with a compound reverse stroke. Because most of us cannot twist far enough around to initiate the stroke behind us there is some angle (like above) to the blade to help keep the canoe going in a straight line.

Stopping from a reverse line is done by initiating a forward stroke fairly far in front of the paddler and digging deep. Ensure the paddle is at least vertical or angled slightly under the canoe. As with the forward stop patience is the key killing most forward momentum before pulling the paddle to yourself.
See: http://home.cc.umanitoba.ca/~burchil/pm_canoe/stop_go.html

Pivots (360°)



Pivots must be done in both directions with the pivot point, individual, within a fairly narrow corridor, otherwise it is just a turn. The Paddle Canada course manual suggests using sweeps to execute pivots. When solo paddling it can be very difficult to complete a clean pivot with just a sweep stroke. I suggest using a box or modified box stroke. When tandem paddling using opposite sweeps (forward, backward) provides the fastest option for pivots with some loss of control. Using draw/push combination provides more control but may be less speedy. At Pioneer camp, if the water is deep enough the space between the docks is just a bit longer than a canoe length and offers an excellent, but unforgiving, place to practice pivots. See Tandem: https://youtu.be/6t1rytEg6aw Solo: http://home.cc.umanitoba.ca/~burchil/pm_canoe/pivot/index.html

In a practical sense pivots allow you to turn around within a confined space.

Circles (inside/outside) &
Connected Circles or Figure 8

Circles and connected circles have been included in the same section here as the only difference, although it is important, is the transition between both circles in the connected circle.

See: Solo simple circle https://youtu.be/N5loUrT25rw

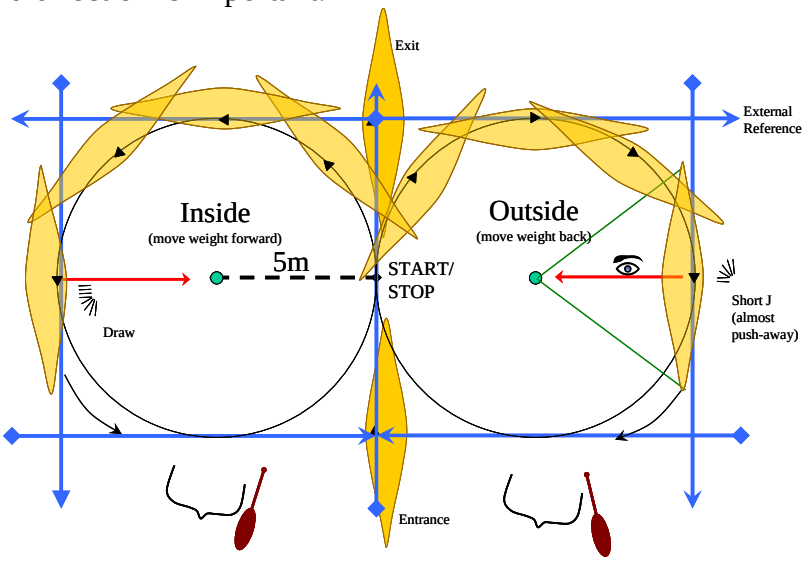
INSIDE/OUTSIDE. In the Paddle Canada program, the side is referenced to the stern paddler (Lake Manual 6th ed, page 17). Unfortunately, over time and different manuals this reference point has not been consistent. Moving water and old CRCA programs reference is to the bow. You may find it easier to communicate left/right depending on paddling sides.

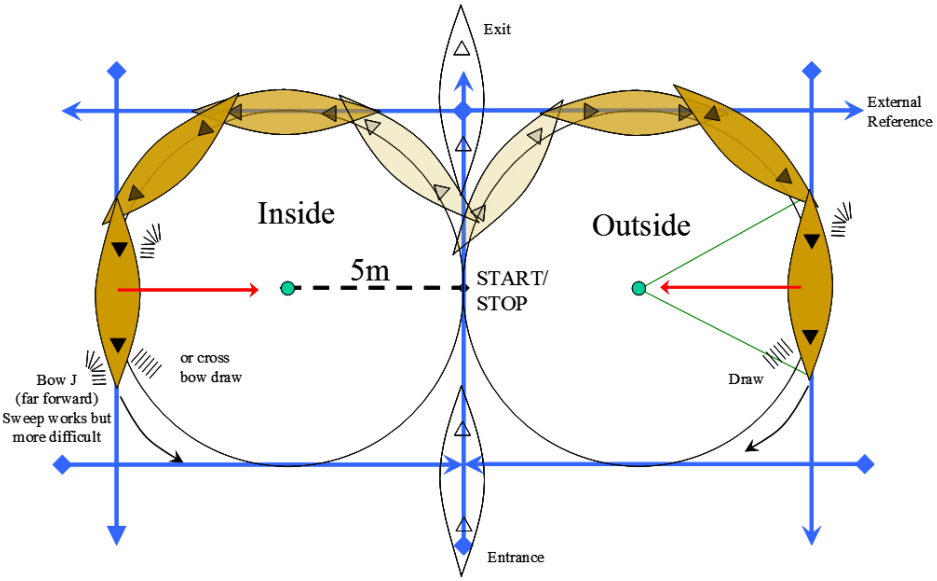
Although it seems counter intuitive to the discussion on the weighting a solo canoe you get more control over the circles by shifting your weight forward for inside circles and backward with less heel for outside circles. The reason for this opposite weighting is not to assist with turn but to control the rate of the turn. The weight shift only has to be subtle, moving from a low kneel to a high kneel for inside circles for example.

When tandem paddling the bow paddler usually has as much to do with controlling the canoe as the stern paddling. Often the bow paddler provides the direction with draw, cross draw, bow J, pry, or related strokes, with the stern paddler providing forward

power. With some correction when necessary. The tilt on the canoe is usually toward the direction of the turn, except on long canoes with little rocker. Marathon or flat lake canoes tilting away from the turn often works better.

Circles and Figure 8 can be the most annoying part of canoeing since you don't seem to go anywhere and the instructor seems to tell you to do it all over again, repeatedly. In a practical sense circles are a representation of the ability to control the canoe through a tight series of obstacles (rocks, trees, other paddlers) or down a narrow winding channel (creek or marsh). The ability to complete a tight circle has a good application when doing rescues. Having the bow and stern paddler synchronized and understanding the needs, tilt, and direction is important.





Turns (under power – turn 90° and continue)
Turning the canoe, either inside or outside and then continuing along a new line.

Solo

Outside – sweep, edge & hold, adding a jam or cross running draw (cut) can speed the turn but with less control then paddle out of turn.

Inside – strong J, edge & hold, forward running draw (cut), paddle out of turn

Tandem (bow strokes may be dynamic or static)

Outside – stern does a sweep, bow does a bow draw, or draw.

Inside – stern does a hard J or partial reverse sweep, bow does a pry or cross draw.

Like the circle completing a turn and continue provides a way to re-direct the canoe with minimal slowing of speed and continuing in a new direction. This is practical any time a change in direction is needed but in a more subtle sense the same concepts can be used in waves or other situations where there are external dynamic forces that need to be overcome.

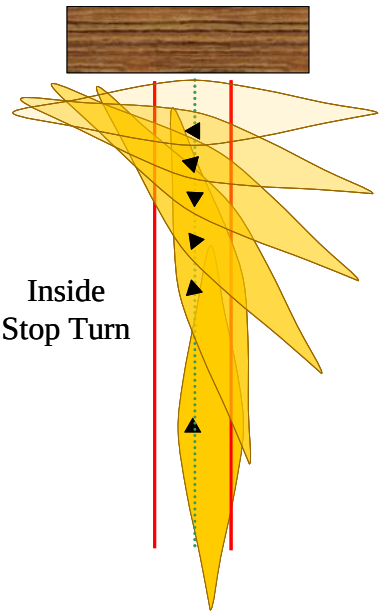
Weight turns (controlled) – generally solo

See the discussion under weighting the canoe earlier in this manual. The important thing to note is a weight turn that is initiated, with the canoe evenly trimmed and edged, will continue to turn in the initiated direction due to momentum irrespective of the apparent hull 'shape'. Weight turns are usually done for show in lake conditions but they do have a practical purpose. By understanding the existing momentum in the canoe and how the hull shape can change the movement of the canoe you can become a better safer paddler. An understanding how the canoe moves will help in waves when your canoe may start to surf or if you start to paddle in moving water.

http://home.cc.umanitoba.ca/~burchil/pm_canoe/landing.html#weight

Turns (landings – 90°)

Turning the canoe, either inside or outside then stopping within 1m square off of dock or shore line. The critical part about this is not making the actual turn but stopping the inertia of the turning canoe; stopping any over rotation, side displacement, or forward motion.



Solo

- Outside – sweep & edge, add jam or cross draw, stop edge, back paddle and pry. Alternative – sweep, edge, running back draw, stop edge, pry/back paddle.
- Inside – back sweep & edge, back paddle, stop edge, draw.

http://home.cc.umanitoba.ca/~burchil/pm_canoe/landing.html

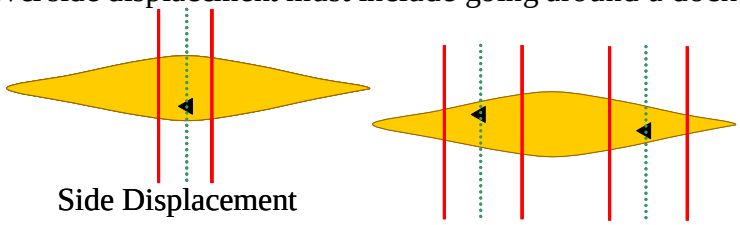
Tandem

- Inside – bow sweep & edge, add jam or cross draw. Stern does a back sweep to turn the canoe and stop forward (side) momentum. Stop edging, back paddle possibly with bow pry (stern draw). Alternative – sweep, edge, running back draw, stop edge, pry/back paddle.

- Outside – Strong bow draw (Duffek), stern sweep or strong draw. Edge the canoe at initiation, back paddle, stop edge, draw.

Landings parallel to the shore or dock are an important part of getting to shore. The ability to execute a quick landing may be very important when there are rough conditions, or limited amount of space or time. The other place where a stop turn is of great importance is in rescue situations.

Side Displacement (side slip)
This manoeuvre just moves the canoe directly sideways. This may be done with draw and/or pry/push away but there is much more control using a sculling draw/pry. Tandem paddlers would use opposite strokes, although the bow paddler may use a cross draw. At the advanced level side displacement must include going around a dock or other object.



Side Displacement

The ability to move the canoe directly sideways is an important skill when landing, leaving the shore, providing aid in rescues.

See: Tandem: https://youtu.be/Kpxt65C5qJQ Solo: https://youtu.be/PnZpqBSB3Bg

Running side slip
A running side slip is when the canoe continues to move in a forward direction but the canoe is shifted to the side. Typically a running draw or pry is used, near the paddling station. Dynamic draw/pry may be used with an out of water recovery when the speed of the canoe slows or more short term power is required.

Tandem

Communication is important when executing a running side slip since timing is important. The bow and the stern use opposite running draw/pry strokes, if the canoe is moving slowly or more power is required draw/pry may be used with an out of water recovery. The most common problem is one end of the canoe moves faster than the other – reducing the amount of pitch on the blade will help. Trim becomes important as well as the deeper end of the canoe will have more resistance. In some cases the bow paddler may use too much pitch and cause the back end of the canoe to 'swing' out of line.

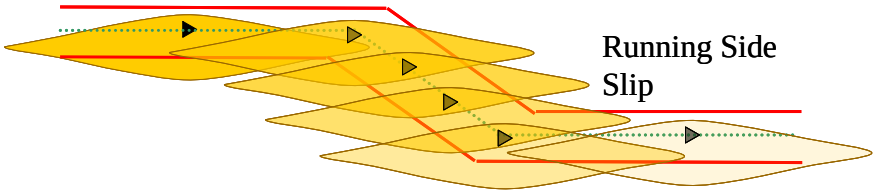
Solo:

Reduce amount of heel for either direction, heeling away from the direction of movement is the most efficient but may not be possible.
On side – running draw planted beside or slightly behind, open, dynamic draw with rotation into forward stroke, continue forward with J. Optimum heel is to the off side but this can be difficult in a tandem boat.
Off side – initiate slight turn off side (outside), plant running pry just back of the pivot point (typically just in front of hip/knees). Slide pry forward if necessary.

Dynamic push/forward stroke if necessary, continue to paddle forward with strong J to stop turning action.

http://home.cc.umanitoba.ca/~burchil/pm_canoe/side_slip.html

In a real world condition running side slips are used to move around obstacles without a change in direction and minimal loss in forward speed.



Open Water Course (Paddling in Wind and Waves)
This is not a particular manoeuvre but the ability to paddle in wind and waves is an important skill when paddling in open water (lakes). An understanding of how canoes can be weighted paddling in different wind conditions (for example Headwind: bow heavy paddle on windward; Tailwind: stern heavy paddle on downwind side). Paddling in the wind should include dealing with waves (see wind & waves section in this manual) in simple terms the weight should be centred. You must have confidence while paddling in winds and waves, effectively be able to control the canoe in varying conditions, and have an understanding of how those conditions alter the canoe's performance. Depending on the level this should be attempted in 15-20km winds (Beaufort scale of 3 or 4).

Slalom Course

English Gate

This is very simple course that uses only two posts (an *English Gate*), the canoeist follows a series of moves between and around the posts. The route that can be taken is variable depending on the source but in all cases it provides an excellent course for testing skills and building confidence. One route has been suggested here. The buoys are set roughly 2-3m apart (roughly twice the width of a canoe) in open water. Even without the gate the route taken is a very nice compact routine.

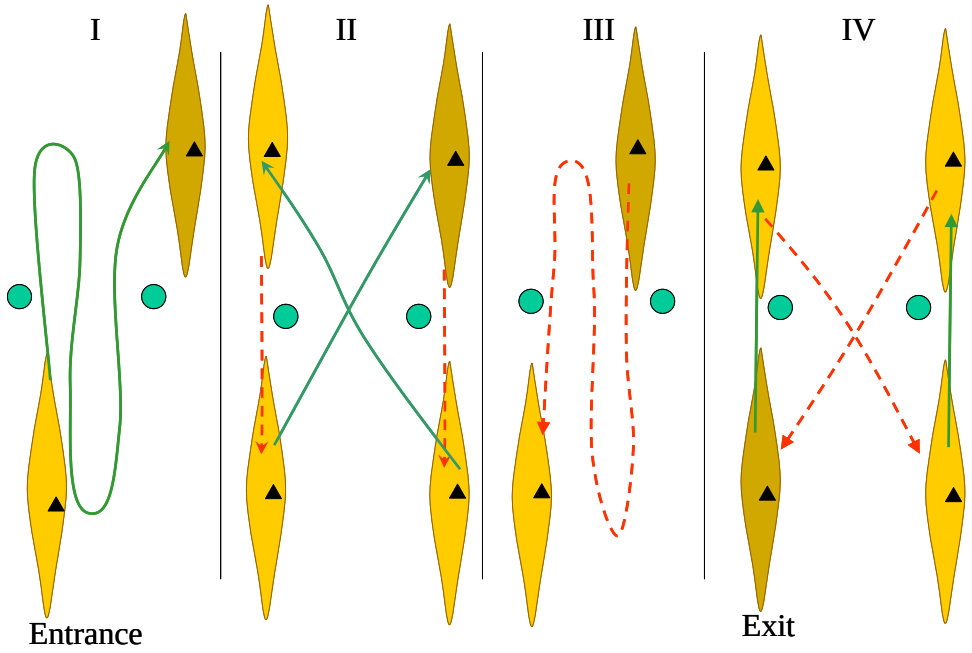
There are four components to the English Gate. Direction of the canoe is identified by the arrow and line colour – green is forward, red is reverse.

I. Forward and through: Enter and pass through the gate, pivot and return, pivot and go back through the gate.

II. Forward Crossover: Reverse passed the outside of the gate, cross over through the gate, reverse passed the gate, pass through the gate.

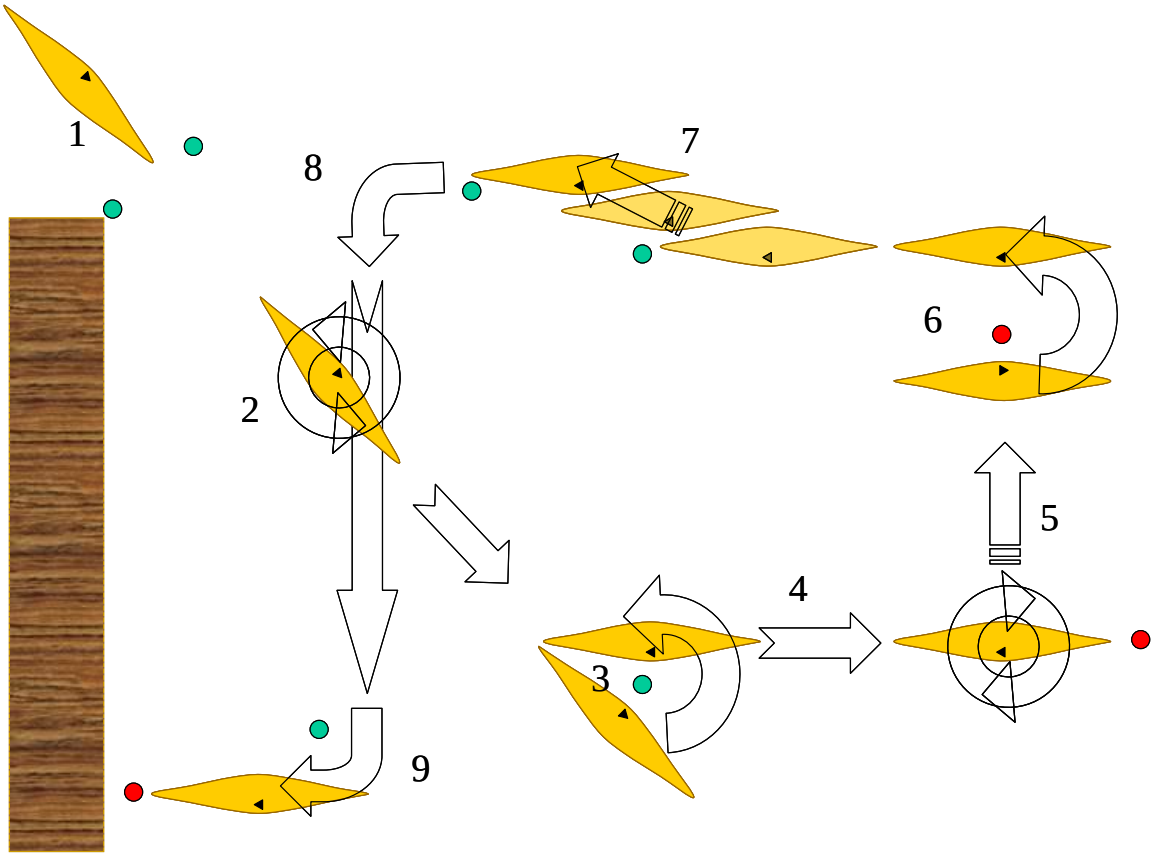
III. Backward and through: Reverse through the gate, pivot and return, pivot and go back through the gate. This is the same motion as I but in reverse.

IV. Reverse Crossover: Finally forward passed the outside of the gate, cross over the gate in reverse, forward past the gate, and lastly cross over to the original starting point.



Extended Course

A slalom course must have the canoeist paddle a series of manoeuvres that they have learned through a timed course. The course must be complex enough to stretch the paddler's skill but short enough to be easy to remember.



1. Enter into course, timing starts when passing first green buoys.
2. Half way across open water to stop and 360° pivot.
3. Continue to green buoy and circle around 1.5 times and stop.
4. Reverse to red buoy and stop, Pivot 180°
5. Side displacement to red buoy, pivot, sideslip
6. ½ circle facing green buoy.
7. Running side slip to next green buoy
8. Turn and continue toward shore
9. Stop turn around buoy.

Musculoskeletal Injuries

Canoeing may seem like a fun, benign sport, but many people are injured during both recreational and competitive canoeing events each year. There are a number of both acute and chronic injuries that can occur. You should be aware of these injuries and use proper paddling techniques to minimize your injury risk.

Although this section focuses on musculoskeletal injuries (muscle, tendon, and skeletal) injuries during outdoor pursuits also include sun burn, cold injuries, heat stress, infections, drowning and dehydration. Smaller injuries such as blisters, bruises, and abrasions should not be ignored since they can lead to problems just as debilitation as a broken bone.

Pre-Paddle Warm-up

It is critical when paddling, as it is with any sport, to warm up prior to the activity to avoid injury. You should incorporate exercises and stretches into your paddling and teaching routine. Contrary to what many people think, the upper body does not do all the work when paddling – power mostly comes from torso rotation and leg pressure. Make certain your pre-paddle warm-up includes the entire body. This will make paddling skills more efficient and will help lessen the chances of getting sprains, back pain, and injuries. Stretching is a touchy topic but it is generally recognized that stretching before a workout does not necessarily improve or prevent injuries. Warming up first is the key to ensure that there is good blood flow and oxygen getting to your muscles. Stretching after activity when muscles are warm and pliable or even better as an independent workout is more effective.

How to Warm Up before Paddling

Use basic activation exercises that get you warmed up, facilitate range of motion, and focused. Warm-up by elevating your heart rate and breathing before stepping into the canoe or kayak. Include whole body warmups – shoulders, chest, abdomen, hips, and legs.

- Gently get shoulders warmed up by holding paddle shaft in both hands shoulder distance apart with arms slightly bent, raise over paddle your head and back to hips (5-10 times)
- Warm up legs with squats, efficient paddling requires good leg drive. Hold the paddle on your shoulders across your back, or out in front of your body. Squat with hips back (bum out), and keep knees behind toes (5-10 times)
- Keeping paddle on shoulder, loosen up back and abdomen by rotating torso from hips through the shoulders in each direction, trying to look behind you. Do this slowly and gently, within your comfortable range (5-10 times)
- Stretch down to reach for your toes keeping your knees and back straight, return by rolling back up and curving through shoulders, loosening up back and shoulders (5-10 times)

- Release hip flexors using a lunge position (right knee down on ground, left leg stepped out, bent 90 degrees). Reach right hand and arm up then over your head, stretch right side muscles. Repeat with other side. (5-10 times)
- Push-ups are considered by many seasoned kayakers as the best way of improving shoulder strength and stability. Lightly running in place, doing some situps are also good activities to get the blood flowing.
- Do some yoga – Paddle Your Own Canoe by Gary and Joanie McGuffin has a chapter devoted to using yoga like poses to help the warm-up process. The American Canoe Association Canoeing has an excellent chapter on stretching specifically for canoeing – including a section on stretching in the boat.
- Start out paddling lightly, with basic paddling, this gets blood flowing and gets your muscles warmed up and ready for more intense activity.

Injuries

Most of the injuries experienced by paddlers are as a result of poor technique and/or over use. Being aware of the cause and location of injury will help you avoid problems. Unfortunately there is very little information on injuries within the recreational paddling community – most studies focus on professional or armature competitive activities. Kyriacos Eleftheriou (Sports Injury Bulletin) has suggested that acute injuries are more common in the general canoeing population possibly due to higher experience and safety requirements for competitive athletes.

Table 1: Frequency of injuries sustained by professional white-water paddlers

Type of Injury	Freq.
Sprains	32%
Tendonitis	20%
Chronic muscular pain	14%
Simple bruises	9%
Infections	8%
Dislocations	3%
Lacerations	2%

Kyriacos Eleftheriou, Canoeing injuries & kayaking injuries, Sports Injury Bulletin.

Consider using a paddle with a smaller surface area (such as an otter tail), and with some flex in the blade to help reduce the chance of repetitive strain injury, or during recovery. If you have or are recovering from a repetitive strain injury consult with an appropriate sport physician or physiotherapist.

Overuse or repetitive strain injuries are common in paddlers where there is repetitive strain from the catch is concentrated on the shoulder, elbow, wrist and lower back.

- **Shoulder** – The repetitive nature and forces required to pull the canoe through the water can cause both chronic (repetitive strain) as well as acute injuries (dislocation and rotator cuff injuries). In both cases paddling within the

Musculoskeletal Injury	181 (61.8%)
Shoulder	116 (39.6%)
Back	76 (25.9%)
Wrist/Hand	29 (9.9%)
Elbow	27 (9.2%)
Neck	26 (8.9%)
Leg	16 (5.5%)
Arm	15 (5.1%)
Knee	11 (3.8%)
Ankle	8 (2.7%)
Groin	2 (0.7%)

Amanda Haley, and Andrew Nichols, Hawaii Med J. 2009 Aug; 68(7): 162–165 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2769922/

"Paddler's Box" will minimize the potential for injury. The repetitive motion of paddling can cause the tendons to become irritated, weakened, and inflamed. As a result, the shoulder becomes stiff, weak, and sore. It may also be difficult to raise the arm above head or lay directly on the affected shoulder during sleep. If there is a strong 'jerk' or pull on the shoulder the muscles and tendons may tear causing a mild to severe strain.

Vulnerable positions occur when the upper limb is out straight with the hand above the elbow and the elbow above the height of the shoulder joint. Reaching up and back is even worse. As paddlers we often get into these vulnerable positions when performing high braces and sweep strokes.

- **Wrist & Elbow** – The repetitive motion of moving the paddle can, over time, lead to overuse injuries of the wrist (carpal tunnel syndrome), forearm (tenosynovitis) and elbow (lateral epicondylalgia). The injury is typified by numb or tingling in fingers and/or pain in the wrists, forearm, and elbow.

  The wrist extensor injury (tenosynovitis) in paddlers has been compared with the tendonitis found in weight lifters who do frequent curls. The injury presents with forearm pain, which can be elicited by repeated wrist extension performed with a closed fist.

  A common problem is gripping the paddle too tightly. Loosen your grip, think about opening your fingers at some point during each paddle stroke. Especially problematic is repeated correction (J) strokes; consider using alternative correction strokes (e.g. Canadian, Rolling), adjusting your grip position (e.g. Northwoods grip), and letting the shaft turn in your hand rather then turning the shaft with your hand. Some people find that ergonomic grips are more comfortable and provide a more neutral hand/wrist position.

- **Back** (lower) – Due to shearing force from paddling on one side lower back pain is common in canoe paddlers. In one study 15-25% of competitive canoeists reported lower back pain, the highest incidence being among the Canadian canoe style group (Kameyama O, Shibano K, Kawakita H, Ogawa R, Kumamoto M. Medical check of competitive canoeists. J Orthop Sci 1999;4- 4:243-9). In the same study more than half of the canoeists complained of some kind of back problem. Mainly this was caused by muscular or ligamentous strain, but spondylolysis (stress fracture in one of the vertebrae) was seen and prolapsed discs were also noted. Moving equipment and portaging also leads to significant stress on the lower back with the same kind of injuries that may be found in weight lifters.

  Spend time to warm up before more intense paddling, and paddle within the 'paddlers box'. During shore activities, such as portages, carefully lift equipment being conscious of your back and using your legs.

- **Knee** – Most canoeists will kneel when conditions are rough or when paddling with inexperienced paddlers. This position provides greater stability and control over the canoe but it puts pressure on the knee joints. A condition known as Canoeist's Knee (prepatella bursitis or housemaid's knee) is fairly common and presents as localized pain and swelling at the front of the knee, which is generally more painful when you press on it, or kneel on it. This condition is an inflammation of the prepatella bursa which sits in front of the kneecap (patella) and reduces friction between the patella and the skin.. Bursitis simply means inflammation of a bursa.

  Consider lowering the canoe seat (similar to a marathon style), try a variety of kneeling pads to find one you find comfortable, even when paddling with knees down keep more weight on the seat or kneeling thwart, don't be afraid to change positions regularly.

Primary Causes of Injury

- **Inexperience** – beginners may be more prone to injury because they do not have the skills or technique to meet the demands of the sport. Although many of us can learn from experience getting coaching or training speeds the process and understanding of technique.
- **Poor technique** – holding or moving the body incorrectly can put unnecessary strain on joints, muscles and ligaments.
- **Choosing an inappropriate waterway** – accidents and injuries are more likely to happen if you attempt to canoe or kayak in a waterway that is beyond your skill level or for which you are ill-equipped.
- **Overtraining** – training too much and too often can lead to a wide range of overuse injuries, particularly those of the wrist and shoulder.

Injury Avoidance

When paddling keeping your arms and hands within the "Paddlers Box" – keep your knuckles inline and below the line of your shoulders. This means when paddling, especially backward, that you should not reach behind you but rotate your torso to catch behind you paddling position.

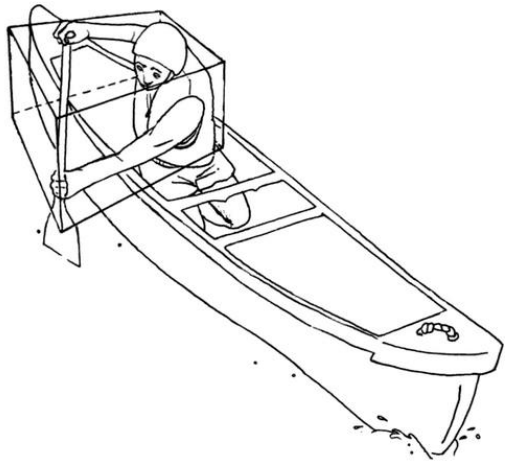
Maintain good posture and keep your body weight inside the boat. Sit in a slouched position and try to lift your arms up above your head. Now do the same with your back in an upright position, feel how much freer the arm movement is when the back is in a good position. If sitting slouched and lifting your arms you can feel the shoulder getting rammed into its socket. Now just imagine paddling for hours sitting in a poor position with the shoulder getting jammed on every stroke and it becomes easy to see how an injury will quickly become established.

The shoulder is at its most vulnerable if the arm is moved backward and above shoulder level. Avoid this position. The high brace is a high risk stroke for the shoulder if not performed carefully. Even if dislocation does not occur rotator cuff muscles can be strained or nerves damaged in this position.

One of the most common mistakes that a paddler makes is keeping an overly strong grip on the paddle, especially on the shaft. This can cause 'cold fingers' and sore wrists. When paddling loosen your grip on the paddle; provide more power though torso rotation. Think of opening your fingers on recovery of the non-power portion of stroke.

The Paddler's Box

To gain maximum power and reduce the chance of injury, a paddler should keep his hands inside an imaginary box. This box stays in front of the paddler's upper body, not the boat. The gunnels from the bottom, and the top of the paddler's head marks the top. The front of the box is as far forward as he can reach, and the back of the box is the plane of the paddler's shoulders. The box's sides are the width of the paddler's normal grip. To keep his hands in the box, the paddler must rotate his body when making a stroke on either side, exactly what we want.



Ray Slim, *The Canoe Handbook* 1992.

Repetitive strain in the shoulder, wrist and back can be caused by the 'shock' from the catch when using a paddle with a large stiff blade. Switching to a smaller or narrower blade such as an otter tail style will relieve some of the pressure.

Although most canoeists have a dominant preferred paddling side it is important to balance skills and strength – paddle on both sides. It is essential in addition to simple stretching exercises and conditioning, that particular attention is given to balanced shoulder and development. This does not mean that you should get into the habit of switching sides whenever there are issues but to practice on both sides to keep your muscles balanced. The US Canoe and Kayak Federation also suggests backwards paddling as an effective training technique, with warm-up and cool-down regimens

including up to 10 minutes of back paddling. If you do paddle backwards make sure you have an appropriate torso rotation to stay within the Paddling Box.

When moving a canoe or other heavy paddling equipment lift the equipment with your legs rather than your back.

Understanding of forces and torque to move the canoe through the water is important both for efficiency of paddling but also reducing injury. Understanding bio-mechanical requirements of both your body and the ways to move the canoe will make you a better paddler with a lower likelihood of an injury.

Water conditions such as waves and moving water force you to change paddling technique as well as work harder. Be aware of the conditions and how you are paddling and the stress that you are experiencing.

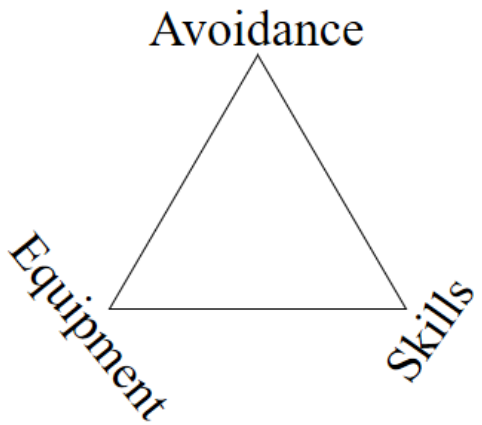
Weather conditions such as wind, cold, and heat increased stress. Paddling in strong wind, waves, and moving water increases the stress on the muscles and joints.

Make sure that the equipment that you are using is appropriately sized for you and the kin of paddling that you are doing. When paddling the grip of the blade should not be raised above your nose when the blade is fully submerged. Make sure you are wearing appropriate clothing for the conditions.

Finally keep yourself well rested, hydrated, and nourished.

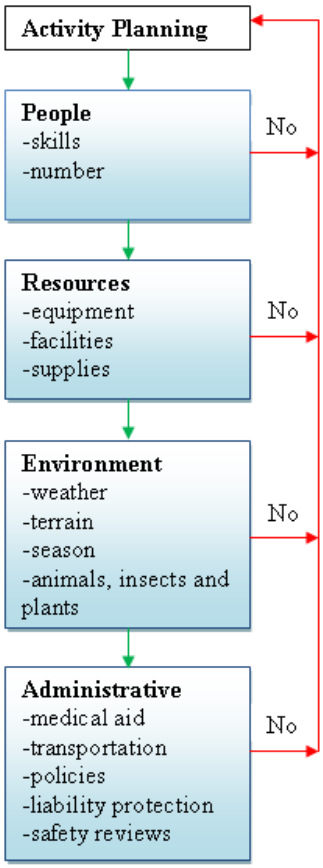
Accident Prevention & Rescues

The Safety Triangle brings together three concepts for avoiding accidents through risk management: Ensure that you have the proper equipment for meeting potential problems; Have the appropriate skills and training; and understand/recognize your limits to avoid problems. Over the years, I have done hundreds of rescues but only two or three in an actual emergency, I was very glad that I had practiced when it was actually needed.



One important facet of accident prevention is ensuring that your equipment is going to work as expected. At least once each season, and then after emergency equipment is used, you should check the condition and for any wear and tear. This includes pulling out all of your ropes, reviewing first aid kit content, testing floatation of both your canoe and PFDs, paddle condition, bailer, etc…

Paddling solo does not mean going alone.



Risk Management

Management and understanding of risks is important. There are sections in this manual already about weather (wind and waves), paddling skills, required safety equipment, first aid requirements, navigation skills, etc… Starting out with a good base in these areas already takes you down the road to limiting the risks. Having a realistic understanding of your own skills and of those around you is also critical. You should also acknowledge that a healthy growth process involves taking some risks and that we should not shy away from facing these risks. The goal is not to eliminate all forms of risk, but to understand risk and minimize the potential for accident or injury.

When planning an outing think about managing and understanding the associated risks. This process should be followed prior to any outing and reviewed during the outing when conditions change. Consider these four elements as you plan your activity, course, or trip: People, Resources, Environment and Administrative.

One of your roles as a leader will be to differentiate between "perceived risks" and "actual risks". Often, "perceived risks" are welcome as catalysts for growth and learning, while "actual risks" have the potential to do harm or injure the participant.

Activity	**Perceived Risk**	**Opportunity for growth**
Paddling in the rain	Getting wet and cold, hypothermia	Realizing that rain is not dangerous, preparing for adverse conditions
Tipping the Canoe	Drowning, losing gear	Familiarized with falling out of a canoe and learning how to get back in
Paddling in mild wind and waves	Tipping, drowning, getting swept away	Paddling endurance, control of the canoe

Sometimes the line between "perceived and "actual" risk can be blurred. It should go without saying that you should always move to the side of caution. Given the right circumstances and conditions, a "perceived risk" can quickly turn into an "actual risk". Your role as leader is to recognize the difference and the potential transition of perceived

risks and to mitigate the potential of injury from actual risks. Often, actual risks arise with varying environmental conditions.

Activity	Environmental Factor	Actual Risk	Steps Taken to Mitigate Risk
Paddling in the rain	Cold temperatures	Hypothermia	Ensure participants have good rain gear and insulating layers. Carry a dry bag with extra clothes
Tipping the Canoe	Cold water temperatures	Hypothermia, drowning	Safe canoeing techniques, wearing a PFD. Recognition and treatment, carrying extra dry clothing.
Paddling in mild wind and waves	The wind picks up	Separation from the group	Lead and sweep canoes are utilized. Know the ability of members in the group. Go to shore, accept being wind bound.

There are many risks both in the water and on land that you should be aware of as the leader. Be sure to anticipate them and plan accordingly. It might even be a good idea to list the risks and how you plan to address them in your trip plan.

A few considerations when you are thinking about heading out on a day trip: Wear a lifejacket or PFD, File a plan, Be honest, Know the water, Go in a group, Carry proper equipment, Carry first aid and get training, Don't overload, Balance your boat (stay low stay steady), Stay out of flood waters, Stay out of cold water, Stay warm (Hypothermia), Stay cool (Hyperthermia), Be hydrated, Know the weather, Know your partners, Watch the wind, Check for current, Don't Drink and Boat, Watch for obstacles, Time of day – return before dark, Respect Others, Know the rules/regulations, Be realistic about your own and others skills.

Who is a good leader?

They are organized, decisive, willing to change with conditions, positive, deals well with stress, good communication skills, good sense of humour, good outdoor and first aid skills, keeps track of people in group (not only where they are but how they are doing/feeling)

Whenever you are heading out be sure to file a plan that includes who you are going with, where you are going, and when you expect to be back. Make sure that you communicate this information to someone that is staying behind but also to the people that you are going with. Communication is of critical importance when traveling with a group of individuals, part of this is staying close enough that you can communicate and provide assistance if necessary. With this in mind you should agree on a set of whistle signals (e.g. 1 – attention, where are you, wait for me, 2 – attention come to me, 3 – emergency, help) and visual 'paddle' signals. Ensure that everyone has an understanding of their responsibilities. When in a paddling group have an agreed on leader (someone that knows where they are going and will be in front of the group, equally important identify a 'sweep' someone that

brings up the rear). Travel and risk level should be matched to the slowest and least experienced individual, this should be clear at the outset and no exceptions or finger pointing should be tolerated. Take a communication device (e.g. cell phone) with you in case of problems and ensure that everyone knows where it can be found.

Going alone? I certainly enjoy a solo trip now and then but it is important that you understand your own limits. When you are alone the risks that are taken are magnified. Ask yourself – can I do this alone if something unexpected happens; anything from a simple blister, dealing with a storm, what to do with a broken leg.

Risk Assessment

Determining the level of risk and where mitigation may be required is not always straight forward. The following has been provided as a guide to thinking about assessing risk before heading out on a trip. Five broad steps to risk assessment can be followed and considered:

1. Identify the hazards
2. Decide who might be harmed and how
3. Evaluate the risks and decide on control measures
4. Record your findings and implement them
5. Review your assessment and update if necessary

OutdoorEd.com has provided helpful information on understanding risk, risk assessment, and management: The Risk Assessment & Safety Management Model (RASM) (https://www.outdoored.com/articles/risk-assessment-safety-management-rasm-complete-risk-management-model-outdoor-programs)

First Aid

First aid kits are a requirement to have on guided excursions and best practice on other outings. A first aid kit should be reviewed regularly to ensure the content is complete and in good condition. You should know how to use the content of the kit appropriately and safely and make sure that your first aid training is current! Whenever you use anything from your first aid kit note it in the notebook so it can be replaced when you return home.

Prevention!
The most common ailments when you are out are the seemingly benign but still debilitating. These are conditions are easily avoided: blisters, sunburn, bruises, or diarrhoea.

The Canadian Shipping Act, Small Vessel Regulation, sets a minimum standard for first aid kits. The requirements may change depending on your group needs and legislated/professional requirements. The first aid kit should be stored in a water proof re-sealable container. You can find pre-packaged kits for various purposes at most outdoor and safety supply stores.

I have not included medications (muscle relaxants, stomach and Diarrhoea treatment, etc…). If you include these items you must ensure that you know how to use them, and they have not expired. Treatment of other individuals with medications may put you at some liability.

Small Vessel Regulation, First Aid Requirements (May 5, 2017)

http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-91/page-2.html#h-8

A first aid kit required by SVR shall be packed in a waterproof case capable of being tightly closed after use, or first aid kit meeting the Maritime Occupational Health and Safety Regulations or provincial regulations covering Workers' compensation.

- An up-to-date first aid manual or up-to-date first aid instructions, in English and French
- 48 doses of analgesic medication of a non-narcotic type
- Six safety pins or one roll of adhesive first aid tape
- One pair of bandage scissors or safety scissors
- One resuscitation face shield
- Two pairs of examination gloves
- 10 applications of antiseptic preparations
- 12 applications of burn preparations
- 20 adhesive plasters in assorted sizes
- 10 sterile compression bandages in assorted sizes
- 4 metres of elastic bandage
- Two sterile gauze compresses
- Two triangular bandages
- A waterproof list of the contents, in English and French.

First Aid Kit Suggested Minimum Content for Small Group Day Trips, in Waterproof container

First Aid Manual
Note book with pencil/patient assessment form.
Flashlight + extra batteries
Content of kit list
EMS contact 911 & local #'s

Bandage scissors
Splinter forceps/Tweezers
Assorted safety pins
Resuscitation face shield

Sterile examination gloves (latex free)
Emergency blanket
CPR pocket mask
20cc irrigation syringe

Triangular bandages x3
Adhesive tape (athletic)
Transpore or 'hurt free' paper tape
Stretch and hold wrap
OPSITE Film
Tensor bandage

Hand sanitizer
Antiseptic wipes
Soap
Polysporin

Thermometer

Variety of bandages
- Straight
- Knuckle
- Fingertip
- Patch
- Wound closure strips
- Liquid band aid (spray)

Sterile dressings
- Roll gauze
- Non-adherent pads
- Gauze pads
- Trauma pad
- Eye patch

Moleskin & Blister dressing (2nd skin)\

Tums
Anti-histamine
Re-hydration salts
Water purification (e.g. Aqua-tabs)
Analgesic mediation (non-narcotic)

Vaseline
Sting/bite treatment (e.g. Afterbite)
Antibiotic cream (e.g. polysporin)
Instant Ice or Cold packs

Exposure

There is always a risk of exposure when you are out and about and you should learn to recognize the symptoms in yourself and others. If you are a leader then you have responsibility to keep an eye on the other people adventuring.

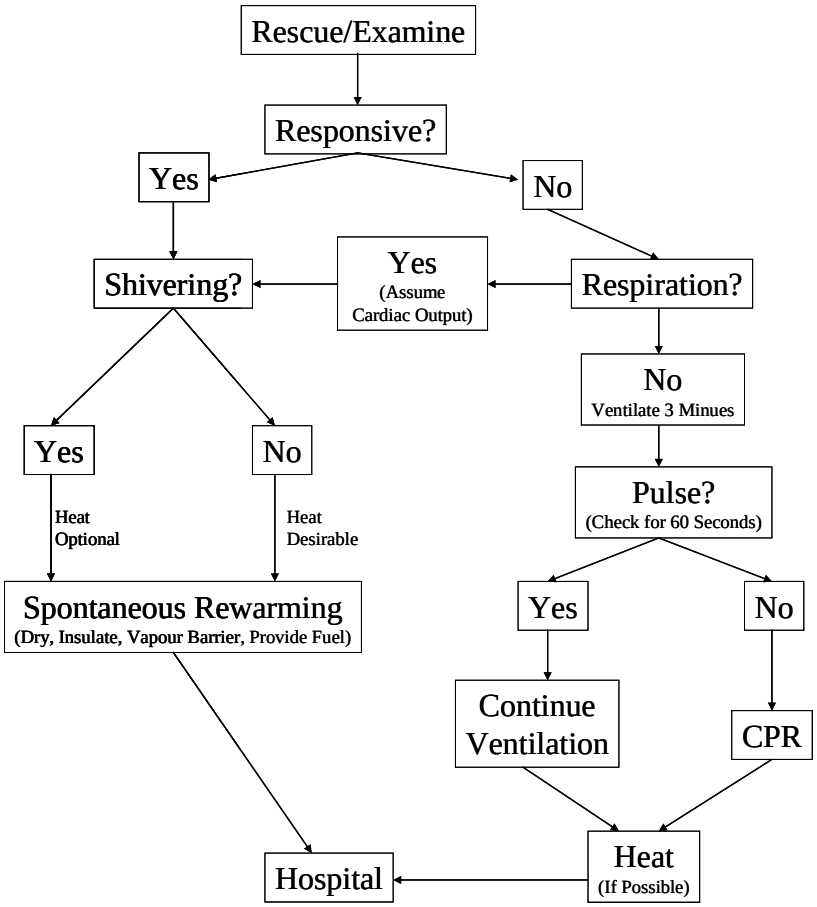
Hypothermia

Our normal body temperature is maintained around 37°C, when it starts to fall below about 35°C you are suffering from hypothermia. Because the water temperatures in many of the lakes in the Canadian Shield, even in the summer, can be cold watch for hypothermia whenever there is a capsize. Cool/cold overcast, rainy days are the obvious times to be concerned but hypothermia can creep up other times as well. Heat loss can happen through several routes - heat conduction convection, respiration, radiation, evaporation.

Hypothermia Symptoms by Body Temperature			
Celsius	**Fahrenheit**	**Description**	**Symptoms**
37	98.6	No hypothermia	No hypothermia
Below 35	95	Definition of hypothermia	N/A
32 to 35	89.6 to 95	Mild hypothermia	Shivering Lethargy, apathy, confusion Rapid heart rate
28 to 32	82.4 to 89.6	Moderate hypothermia	Shivering stops Increased confusion or delirium Slowing heart rate; may be come irregular
Below 28	Below 82.4	Severe hypothermia	Coma Ventricular fibrillation May appear deceased
20	68		Brain activity stops

After recognizing the signs of hypothermia you must treated it seriously. At the initial stages the victim should be able to re-warm themselves by getting them to a warm site, with dry clothing, and wrapped in a blanket. More serious hypothermia cases must be evacuated for emergency services. When moving someone with severe or moderate hypothermia be gentle as possible since rough handling or jostling can cause ventricular fibrillation (abnormal heart rhythms). Keep the victim horizontal to help maintain blood pressure and minimize stress on the heart. Remove wet clothing and blot the person dry rather than rubbing then wrap them in dry insulating blankets or clothing, with a wind/moisture barrier over top (tarp/vapour barrier). If the victim is awake and alert give them a drink with high sugar content (hot cocoa). If they are moderately or severely hypothermic, losing consciousness and aren't able to shiver, apply external heat sources, if available, to the chest and armpit areas to aid rewarming[3]. Seek medical attention.

[3] The use of warming devices should be very carefully done with input from medical support. After drop, the continued drop in core temperature after starting to rewarm due to blood moving from extremities to the core, is likely to happen and can bring on additional complications.



For more information see:

- Gordon G. Giesbrecht, Accidental Hypothermia, http://www.umanitoba.ca/faculties/kinrec/hlhpri/media/Hypothermia.pdf, or Beyond Cold Water Boot Camp http://www.beyondcoldwaterbootcamp.com
- Paul Kirtley's Blog on Hypothermia is also a good resource: http://paulkirtley.co.uk/2010/hypothermia

Dehydration

Not drinking enough water is probably the number one reason that that people get sick (nauseous) and have headaches when out on trips. Often dehydration leads to other complications, especially when it is hot, such as heat exhaustion and heat stroke.

It is especially problematic when the temperature is not very high since people don't think about drinking when they are not hot. When you feel thirsty it may mean that you have waited too long to take a drink. Drink small amounts regularly rather than large amounts at one time since your body is better able to process and absorb water a bit at a time. One way to tell if you are dehydrated is the colour of your pee. If you frequently pass clear urine you are doing well, on the other hand if it is a deep yellow colour with a strong odour then you likely need more fluids. Alcohol and caffeinated beverages don't count for re-hydrating!

Hyperthermia

Hyperthermia is a general name given to one of several heat related illnesses including heat exhaustion, heat cramps, heat stroke. Usually your body can keep your temperature at about 37°C through sweating but if the temperature is high for long periods or acutely heat stressed your body may fail to properly regulate its temperature. If someone appears to be showing the signs or symptoms of any heat related ailment get them out of the sun (or away from the heat source), provide small amounts of water (as they are often also dehydrated). In the case of heat stroke seek medical attention, sponge off with cool damp cloth or shower.

Signs and symptoms of heat related conditions include:

- Heat exhaustion/fatigue: feeling faint, cool wet/clammy skin, weakness, weakened pulse, lack of co-ordination, giddiness, possibly nauseated.
- Heat cramps: These are painful muscle cramps that are brought on by overheating.
- Heat stroke: This is a life threatening condition. High body temperature, hot, dry flushed skin, confusion, delirium, strong rapid pulse.

As with all of the other conditions avoidance is the best practice. Do not overexert yourself, stay cool, and drink appropriate liquids. When suffering from heat related conditions be careful about cooling down since it is easy to go to far and start to suffer from hypothermia – pay close attention to people with heat and cold related exposure symptoms.

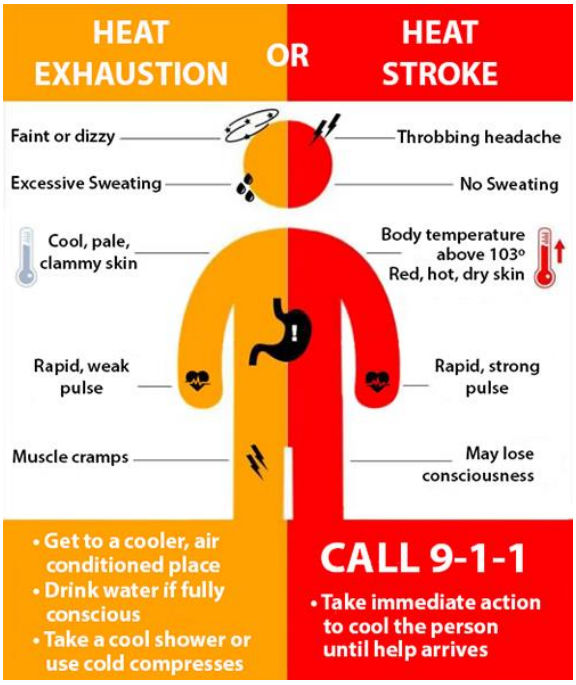


Image from Sparwood Search and Rescue

Cleanliness:

This is the opposite to exposure – this is exposure avoidance. Keep your hands clean at least. It is amazing how many people that are fastidious about washing their hands in the

city forget that bacteria and other germs live in the wild as well – routinely wash your hands with soap and/or hand sanitizer! Follow appropriate food preparation and sanitation practices – see Leave No Trace section for more information.

Bee and wasp stings:
Bees, wasps, hornets, yellow jackets all inject venom using a stinger. Bee stingers are barbed and get stuck on the first sting, the bee usually dies when trying to escape. Wasp stingers on the other hand come out allowing wasps to sting multiple times. In both cases the immediate reaction is to swat the location, unfortunately this often pushes more venom into the sting. In the case of a bee sting, if you can keep peace of mind, look at the location of the sting to see if the stinger is still there and remove it from below the venom sack by swiping with a fingernail, the edge of a credit card, or knife.

Both bee and wasp stings really hurt and some people will react with a serious allergic reaction; watch for this. The sting usually produces a burning sensation followed by redness and swelling that might last some time. Wash the area with soap and water or use an antiseptic as infections can sometimes occur, place on a cold compress, calamine lotion, or baking soda plaster. Antihistamine may help reduce swelling and hives if they appear. If there is the possibility of a serious reaction get medical attention, if the stung individual knows they have a serious allergy then find out if they require their Epi-Pen and assist them as necessary.

Avoiding stings is the best practice (the following suggestions are from the US Dept. of Agriculture & Ontario Health.

- Avoid perfumed soaps, shampoos, and deodorants. Don't wear cologne or perfume. Avoid bananas and banana-scented toiletries.
- Stay clean as sweat aggravates bees
- Avoid flowers
- Social wasps collect where food (especially sweets or high protein food) is left out.
- Avoid disturbing likely beehive sites, such as large trees, tree stumps, logs, and large rocks.
- If a colony is disturbed, run and find cover as soon as possible. Running in a zigzag pattern may be helpful.
- Never stand still or crawl into a hole or other space with no way out.
- Do not slap at the bees. Swinging or swatting at bees and wasps may cause them to sting.
- Cover as much of the head and face as possible, without obscuring vision, while running.
- Once clear of the bees, remove stingers and seek medical care if necessary, especially if there is a history of allergy to bee venom

Rescues

We never want it to happen but occasionally our canoe will tip; sometimes things just go awry. Just like first aid treatment prevention is your first order of business don't go out into situations where you are likely to tip over. An additional reason for not heading out in rough conditions is that doing a rescue will be very difficult. Learn the necessary rescue skills and practice; the more you practice both as rescuer and victim the better you will get. You might find it surprising that it is just as important to understand how to be a victim in the water as it is to be the rescuer.

When approaching a victim, talk to them and find out if they are OK, ask if they need help. Keep communication open and calm, let them know what you are doing and include them, if possible, in the rescue process. When doing any kind of canoe rescue it is important to keep track of where the victims are in the water. Getting whacked by a canoe or having your fingers crushed between two gunwales is not very much fun. Loosing a victim is an unfortunate possibility, have them hold onto the rescue canoe, so you don't blow away. Often a canoe will tip in windy conditions, at some point during the rescue both canoes may be floating with the victims still in the water. The upright canoes will act as a sail and be blown away.

A consideration in any rescue is dealing with packs and other baggage. Some consideration should be made ahead of time about conditions and rescue requirements with regard to how equipment is stored in the boat. Unfortunately most of the rescue techniques involve lifting the canoe in some way and equipment is heavy when water logged (even if waterproof). Equipment may interfere with rescue/recovery attempts, by catching on the rescuing canoe. It is also important to practice rescues with equipment once you are comfortable with the basic technique. How, and if, equipment should be secured is an age-old question. On short lake trips I usually don't tie packs in, on long hauls I will run a clipped line through the shoulder straps or grab loops and hook the rope to the last pack with a carabineer. This will allow the packs to float free but also be easily disconnected from the swamped canoe. Unfortunately floating packs attached by a line can be an entanglement hazard. In moving water most people tie packs and other equipment in tight so it will act as floatation, although some in pool and drop environments advocate leaving equipment loose and picking it up at the next pool. The Canadian Shipping Act, Small Craft Regulations require non-used equipment to be secured in place when on excursions or with passengers. The whole concept is a good topic of polite conversation while sitting around the fire at night.

Rescue Procedures (TARETHROG = talk/reach/throw/row/go)

Consider your own safety and the risk to yourself and others in the group in any rescue attempt. Although the time that it takes to review any rescue method should be minimized. An understanding of procedures is helpful and should be discussed prior to any trip. Start with the least risk – talk to individual in the water, ascertain if a rescue necessary. The need to be rescued is not limited to people in the water and a swamped canoe – there are cases where paddlers may not be able to deal with the conditions and need assistance (e.g. need a tow).

Practice is important since it will provide a level of confidence as well as a good understanding of process when the skills are needed in a critical situation.

Throw Lines (Throw bag, Heaving line)

You are required to carry a buoyant heaving line, of at least 15m, when out in a canoe or kayak. The most convenient and useful way of carrying, and deploying, a throw line is from a bag with the line tied to the bottom. The line should be packed by stuffing a little at a time from the bag end first – this will ensure that it runs out easily when thrown. The common consensus is throw lines should not have a knot (stopper knot) tied at the free end as it poses a snagging hazard.

Practice deploying (throwing) on dry land first to get the hang of throwing the line and then move to the shore or water. The most common way to throw is by griping the open throw bag by the lip and tossing underhand.

Get the attention of the victim in the water by calling their name and indicate that a throw line is coming. Concentrate on throwing the bag beyond the point that it is needed – the line should come down on top of, or near, the victim (note: there are some variances in moving water). The safest location to attempt a throw line rescue is from the shore (remember reach/throw/row/go).

The swimmer grabs the rope (not the bag), ensuring that it is not looped around any body part (such as around a wrist). The rescuer drops to a crouch and pulls the rope in hand over hand with thumbs up. The swimmer holds the rope over their shoulder to their chest and is pulled backward, kicking their feet. This keeps their face out of the water, feet off the bottom, and may provide some help for the rescuer.

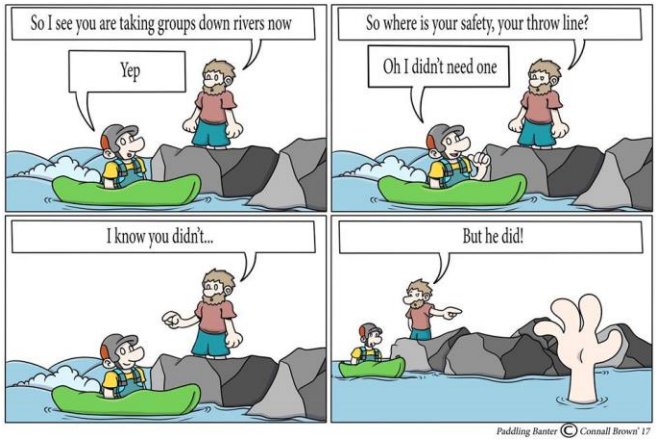
http://magazine.rnli.org/Article/How-to-throw-a-line-107

If you miss a throw, pull the line in placing it in opposite direction loops (butterfly coil) over your throwing hand; alternatively use the Thompson River University (TRU)

technique (https://paddling.com/learn/how-to-quickly-coil-a-throw-rope/). Once you have the bag, or enough loops, in your hand you can re-throw the line, again. A re-throw does not provide the same distance as the initial throw but it provides a second chance, the wet line and bag will have additional weight to carry the line in the throw.

Keep the throw bag in a location that is quick and convenient to reach. Typically, it is attached to a thwart or handle in front of the paddler with a quick release strap, many people 'bungee' the bag to a bow or stern deck within reach. Many guides are now also wearing a throw bag for quick access and deployment.

Throw lines are a safety/rescue tool and should only be used for that purpose. Check the line periodically, at least once each season, for wear and that it is stored correctly. Lines should be dried, if possible, before packing.



Tow a Swimmer

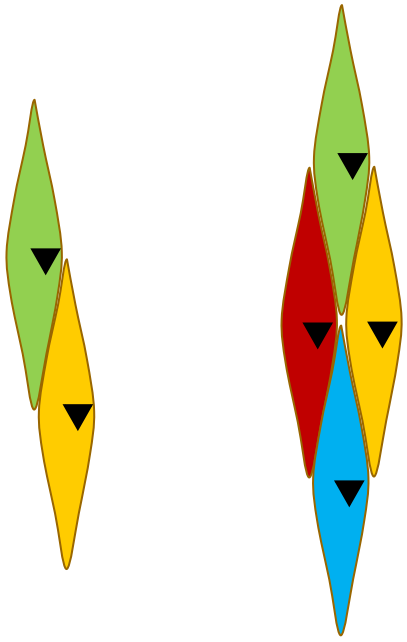
Towing a swimmer is fairly straightforward – have them hang onto the gunwale just behind you and paddle. Remember to keep track of the person in the water in case they let go or become tired.

Tow a Canoe

Towing a canoe can be done in several ways. The easiest is to hold, or sit on, one of the painters of the towed canoe and paddle away. You should not tie the two canoes together in case there are problems. You can also sit on the bow seat (if solo) and drape you leg into the other canoe and paddle away – this is not really comfortable but it is possible. If you have a little time and further to go, tie a harness on the canoe to be towed. This is done by running a long rope around the canoe with one and a half wraps around the bow seat (or bow thwart). Tie the end so the knot is just under the stem of the towed canoe. This will allow you to pull from the bottom of the canoe making it more stable and it will pull in a straighter line – this is the same kind of harness that would be used in lining a canoe in rapids. The towing canoe should not be tied (sit or hold the rope), or use a quick release knot such as highwayman's hitch. The towed canoe should be weighted toward the trailing stem, this helps to keep the canoe in line with the rescue boat.

Many guiding PFDs have a quick release integrated belt with a loop or pig-tail. Although these were originally designed for towing from a kayak they can be used in a canoe or support for shore line rescues. The pig-tail may need to be longer, and more care needs to be taken from a canoe since your centre of gravity is usually higher. If you are using a quick release belt ensure that the webbing is fed through throw the strain release first, and the end of the webbing is trimmed appropriately.

A great alternative to towing a canoe is to link boats in a line with the paddling canoe in the rear. This allows the supporting paddler(s) to see the assisted canoe and paddlers. The painter on the supporting canoe is run through middle thwart and threaded back along the canoe through the carry handle and back to the middle thwart of the supporting canoe with a double wrap. The bow of the supported canoe must be pulled tight to the supporting canoe, this allows both canoes to be paddled as a single unit (link). More than two canoes can be tied together this way. Four canoes can be tied together to form a diamond shape.



Move a Swamped Canoe

A swamped canoe will continue to float, climb into the canoe and sit on the bottom and paddle to the shore. The canoe will be fairly unstable so I find doing a form of elementary back stroke pulling with your arms works the best method. Once a canoe full of water starts moving it will keep moving. A canoe that has air bags, or equipment tied down, is much easier to move when swamped as the air bags displace water. In moving water there are additional considerations.

Getting Back In

The ability to get back into an upright canoe is an important skill when you fall out and your canoe does not tip, when you are successful doing a self-rescue, or when you just

want to go for a mid-lake dip. It takes practice to climb in over the gunwale of the canoe near the middle. My preference is to basically swim into the canoe with my feet outstretched behind me (near the surface), place my hands on the bottom of the canoe, give a big whip kick and roll into the canoe over the gunwale. Some people find dragging themselves over the canoe using one of the thwarts (or yoke) easier. A few people re-enter the canoe over the stern or bow decks – similar to a kayak cowboy scramble. I am not sure I can provide much advice except to try it out and find something that works. There are a number of paddlers that recommend re-entry from opposite sides of the canoe at the same time.

With a rescue canoe re-entry over the side or between canoes is easier with support. Over the side is similar to re-entry solo. A number of people have recommended making a temporary stirrup on the end of a line and hanging the line over the side of the canoe. This typically has to be done with a supporting canoe to stop the canoe from rolling over. (Mark Schleier on using a rescue sling - https://youtu.be/B4UoYkkp1vI).

A method that has been well documented in the kayaking world is a heel-hook-rescue. The American Canoe Association has a produced PDF with images demonstrating this technique from a canoe.

Canoe Recovery

Canoe over Canoe

The most common technique for recovering a swamped canoe is to pull the swamped canoe over top of your upright canoe. With practice it can be quickly even with larger canoes or in rough conditions. There are a number of alternatives that can be taken at several points in the process – the steps below describe only one technique.

Steps:

- If the water is cold make sure the victim(s) are out of the water before dealing with the equipment. If the water is warm then have the victim help you. Ensure that the victims know where their paddles are and to hang on to them, or take the paddles and put them in your canoe. Where are multiple canoes assign one or two of the canoes to collect equipment and paddles.
- Although this was ordinally called a T-rescue it is not necessary to create a T, but be able to gab the deck or grab loop on the canoe and pull it onto the rescue canoe – this can be done at an angle or even parallel. The rescuer should move toward the middle of their canoe and kneel to provide good balance and stability. In a tandem rescue canoe the free paddler continues to do a sculling brace opposite the swamped canoe, and keeps track of the victims in the water.
- Have one victim move down to the far end of the swamped canoe and hold on to the stem. They can help turn the canoe upside down making sure there is lots of air captured under the hull. The other people in the water should be asked to work hand over hand to the stern or bow of the rescue canoe – remember to keep track and in contact with people in the water.
- The rescuer should reach down and grab the grad loop or deck of the swamped canoe then let the canoe roll into their shoulder or bicep for support. Just as the canoe rolls the air trap will be broken along the high gunwale and the rescuer must lift the end of the swamped canoe.

- As the rescuer pulls up on the swamped canoe the victim pushes down on the other end – this downward push will basically pop up the rescuers end so the rescuer can pull the swamped canoe over the rescue canoe.

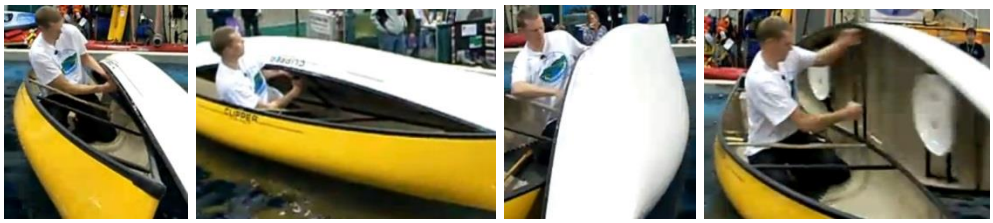
- Once the swamped canoe is stable on the rescuing canoe have the victim go hand over hand to the rescuing canoe and hold on to the stern (or bow) deck. At this point the rescuing canoe has a large out-rigger and is very stable.
- Pull the canoe half way over the rescuing canoe, turn it over by rolling it toward yourself and slide it back into the water. Hold the canoes together by hanging onto the rescued canoe, don't hook your thumbs over gunwale of one and fingers into the other.
- The victim can climb into the now upright canoe from between the two canoes or over the far gunwale of the rescued canoe. I find going in over the gunwale the easiest route especially if the rescuer supports the canoe and allows the far gunwale to roll near the surface of the water. The victim should kick their feet bringing their body (and feet) near the surface. With a large kick they can pull themselves into the canoe. I find rolling in, like a Flounders flop in high jump the best method.

Parallel Rescue

A parallel rescue is fast and easy with smaller canoes or with canoes that have air bags. With larger canoes it is much more difficult and the canoe-over-canoe rescue may be a more appropriate choice. This technique is also more difficult to do in wavy and windy conditions such as those on open lakes because the technique puts the rescuer in an unstable position (standing). This rescue is also trickier to do solo.

The steps involved in this reduce.

- Similar to the canoe-over-canoe rescue make sure that the victims are stable first. If appropriate have them hold onto the stern and/or bow of the rescue canoe. In a tandem rescue canoe the free paddler continues to do a sculling brace on the side opposite the swamped canoe.
- Bring both the canoes parallel to each other and have the rescuing paddler move to the middle of the rescuing canoe.
- Grab the gunwale of the submerged canoe and roll it facing the rescuing canoe.
- With fingers on the inside of the swamped canoe and hands held at waist height stand up slowly dragging the swamped canoe up along the rescuing gunwales allowing the water to drain out.
- Once the water is drained out push the top gunwale out, lean down and gab the other gunwale.
- Have the victim re-enter the canoe in an manner that is most appropriate for themselves.



Self-rescue (Splash out, Capistrano flip, swim to shore)
There are three basic self-rescue techniques identified here.

Splash Out

Roll the swamped canoe upright from near the middle of the canoe (about where you kneel when soloing). Roll the canoe slowly so the water in the washes back and forth – you will notice at one point the water splashes out towards you. Continue to rock the canoe back and forth pushing down on the gunwale to allow more water to splash out with each rock. With a wooden canoe with some tumblehome and an inwale/outwale it takes about 30 seconds to splash out most of the water. This is a difficult technique in canoes with a lot of tumblehome and large inwales (e.g. most aluminium canoes). Canoes with a lot of flare are also more difficult since water tends to flow back in. An alternative starting point is pushing the bow or stern deck down and away from you to 'slosh' out some of the water first.

Capistrano Flip

Swim under the overturned canoe at the middle (or if there are two of you in the compartments either side of the centre thwart). Make sure there is as much air under the canoe as possible. Grab onto the gunwales and push up with a strong whip kick and throw the canoe over pushing up on one gunwale more than the other. This is a technique best used with light weight canoes and is easier done tandem. Having a really buoyant PFD or life jacket also helps. Remember to grab the upright canoe so it does not blow away.

With larger canoes using a floating pack (e.g. waterproof pack, dry bag or barrel) and flipping the canoe from the end or rolling the canoe over the pack is possible. A canoe with additional floatation bags also makes a self-rescue much easier.

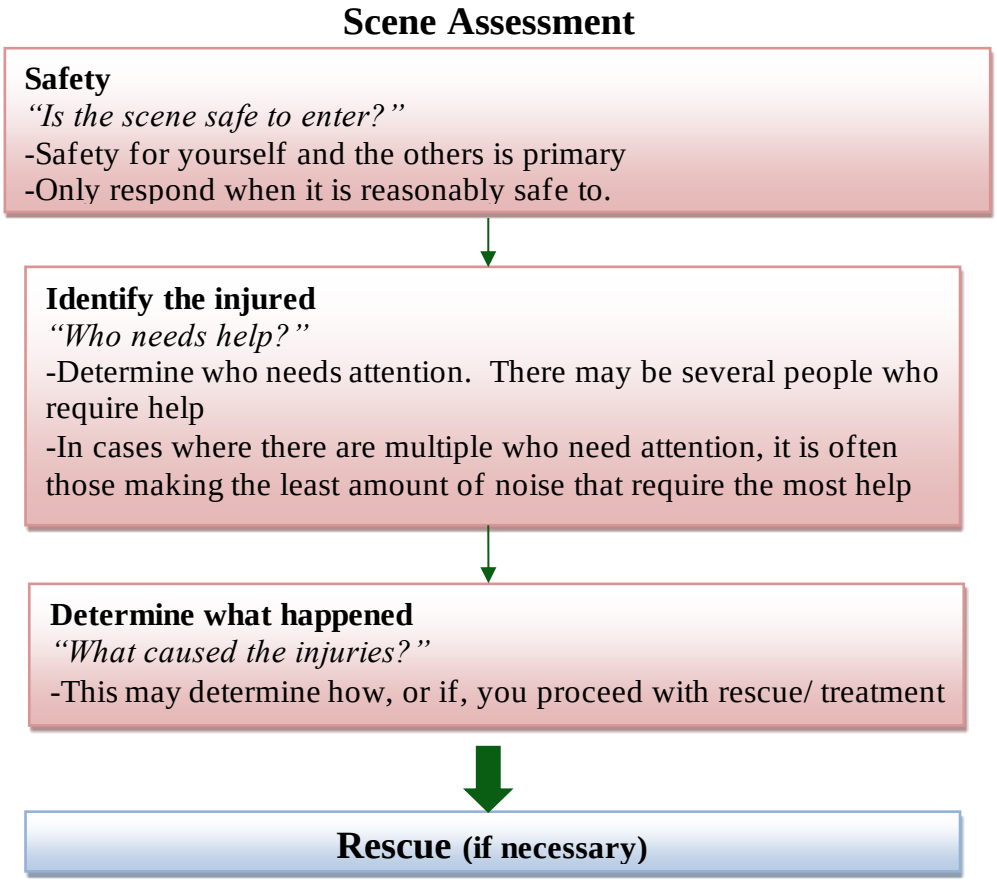
There are two methods I have seeing using a floating pack or barrel:
1. Set one end of the upside down canoe on the floating pack, swim to the opposite end of the canoe. Tip the canoe to break the seal if necessary, lift and roll the canoe over. The pack will provide a surface to support the canoe.
2. Position the floating pack, or barrel, beside the canoe at the centre yoke, and tie a short line to the centre yoke to keep the pack in place. Run another line overtop

of the canoe and pack and tie to the other side of the yoke – pull on the line, over the pack to roll the canoe over the floating pack. Ray Goodwin has a nice series of images showing this process:
https://www.facebook.com/ray.goodwin.549/media_set?set=a.10156434000310165.1073742214.651805164&type=3

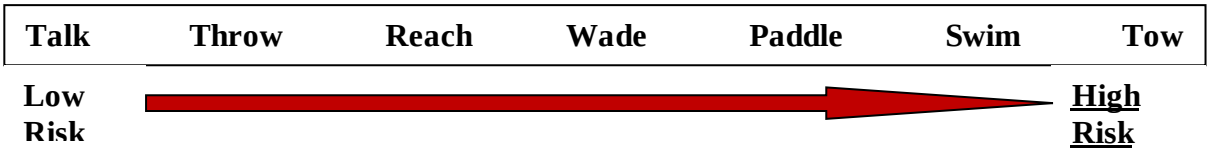
Incident Response

As you plan your canoe trip, you should anticipate potential risks to yourself and others and proactively address them (see Risk Management). However, even the most careful risk management planning will not guarantee an incident free trip. Remember that your priorities are 1) people, 2) boats, 3) gear.

The following chart outlines a basic approach to incident response on the water.



When attempting a rescue, paddlers should follow the basic guidelines established by the Royal Life Saving Society Canada for rescue situations. This is outlined as a "Risk Ladder" or continuum where the rescuer increases personal risk as he or she moves up the ladder. This continuum should always be considered when executing a rescue to ensure that the rescuer or rescue team is not in jeopardy. If involved in a high risk rescue, make sure the rescue team is prepared and trained to perform an effective and efficient rescue.



Patient Assessment

ABC's
"Are the circulatory, reparatory or nervous systems compromised?"
-treat the patient as necessary (you as the leader should have a current first aid certification)

Monitoring of Patient/ Seek Medical Aid
"What does the patient need next?"
-Determine whether the patient needs further medical assistance (it may be helpful to involve them in this decision if they are able)
-Make the patient as comfortable as possible and address their needs as they arise

Record/report the Incident

Incident Report
"What needs to be recorded, and what information should be communicated to whom?"
-Record any incident that happens during a course in a bound book or journal. Be sure to include as many details as possible. If available use a Standard Patient Assessment form.
-If necessary, report the incident to appropriate authorities

Other Equipment

Personal

Every time you head out for the day you should take a few things along 'just in case'. Put together a dry bag with the following items and then whenever you head out the door toss the bag in your day pack: 'Ouch kit' (small personal first aid), compass, matches (or flint/lighter, fire starter), an energy bar or two, water (& treatment), whistle, TP, hat, sun screen, spare clothing, rain gear, insect repellent, a pocket knife, and a fleece or sweater. You might want to include some of the group items like a small tarp in this list as well if you are solo.

Group

Repair kits

Every once and a while you will need to repair something. Although this is a more appropriate topic for tripping it deserves a quick note for day tripping as well.

- *Canoe Kit*: Epoxy, duck tape, a piece of fiber glass, fine sandpaper, some hand rivets, some self-taping screws, multi-tool (with needle nose pliers, and screw drivers that fit the hardware on your canoe), saw, hammer (back of an axe will do in a pinch). There are lots of other things but this seems to do the trick. *Paddling*.net has a some examples of repair kits: http://www.paddling.net/guidelines/showArticle.html?718
- *General Kit:* Packs, clothing, tents: Needle (I like to take a curved needle), thread, nylon patches, wax, some spare webbing, a few buckles, safety pins, buttons, and other odds and ends. Dental floss is for more than just your teeth. ☺

First Aid Kit

Take one, know how to use it, and where it is stored – see section on First Aid. This should be kept in a water tight container.

Safety Equipment

Ensure that each boat has at least the minimum required safety equipment. Although regulations only require a paddle, or anchor, it is generally a good practice to carry a spare paddle. A buoyant heaving line and sound signal are required. Everyone must have an appropriately fitting PFD or lifejacket. In moving water, class 3 or above, helmets must be worn. When appropriate a flashlight and radar reflector.

Water treatment: Filters, tablets, boiling

A source of clean water is critical on any wilderness outing.

- At one time I just drank out of the lake with a cup and didn't worry about what else I might have been drinking. Now that I have children and have met people that have caught 'something' I am a little more careful.
- I now carry a micro pore filter when I go out as a leader. When there is turbidity or algae in the water I use a pre-filter to keep the primary ceramic or labyrinth filter cleaner.
- I always throw a few Aquatabs tablets in my first aid kit – these work in a 1L Nalgene water bottle, they are really small and light weight. They do require

30minutes contact time to disinfect the water. There are a number of other non-iodine treatments out on the market now, read the labels and follow the directions.

- I often carry a small pot, boiled water, even on a day trip, is an option.

High energy snacks
I strongly suggest having a few high energy snacks or bars in your day pack. Don't forget a regular lunch/dinner if you are out for the whole day. If you are gone for the whole day you might want to take a stove.

Tarp
I like my 2.1x2.3m SIL tarp. It is light and small enough to carry easily and yet large enough to protect myself and a few others in a squall. I carry some parachute cord in the bag to assist in setting up. With a small group I take a two or three person Bothy Shelter.

Light rope
Parachute cord, or nylon/polypropylene twine

Map
A map of the local area should be taken along. A topographic map is the best but local maps (e.g. park maps) will often meet the needs for day trips. See the navigation section for more information.

Contact
Cell phone, Spot, or InReach… – some way to call out for help. Before heading out ensure that you communication device works, and if taking a cell phone ensure there is coverage.

Equipment – to tie in or not
There has been an ongoing discussion for many years about how, and if, equipment should be tied into a canoe. The current regulations require equipment to be stored safely when to boat is in motion but there is flexibility in the interpretation of what this means. Different areas and conditions may warrant different procedures. For example: on a clear day with no wind there may be no worry about not securing your gear to the canoe. However if it turns windy and there is an upset retrieving loose gear that is floating away will be a problem or some gear may even sink. Gear that is loose may also move around in the canoe and impair or distract the paddler. On larger lakes tethering packs into canoe with a line running from one of the thwarts to the last pack stops equipment from floating away in the case of an upset but it is still easy to move/remove as needed. Loose lines in a canoe can be a entanglement hazard. Unlike moving water situations where equipment tied in tightly might provide extra floatation, in lake conditions is less of an issue.
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Emergency Protection (Tarps and other options)

The start to your day paddle was perfect – early start, beautiful calm morning, great shore lunch, and a nice nap on a sunny rock. Something, a shadow, wakes you from your slumber. Where did the sun go? Those clouds sure look black. I think I'm going to get wet. Time for action!

First, you were paying attention in your course, so you do have the suggested emergency equipment and, yes, you did leave a proper trip plan with a responsible person so if you have to stay the night, the emergency contacts on your list will get a phone call to come looking for you. Because you have planned and packed properly, this is, at worse, an inconvenience.

What action to take? First, assess what is likely to happen when the black cloud gets to you. Can you see lightening? Can you hear thunder? You remember your lessons on weather. Is it just black clouds that will dump some rain on you or is it a cold front that signals the start of several hours of bad weather? Once you can make a reasonable guess about what is about to happen, you can plan a course of action.

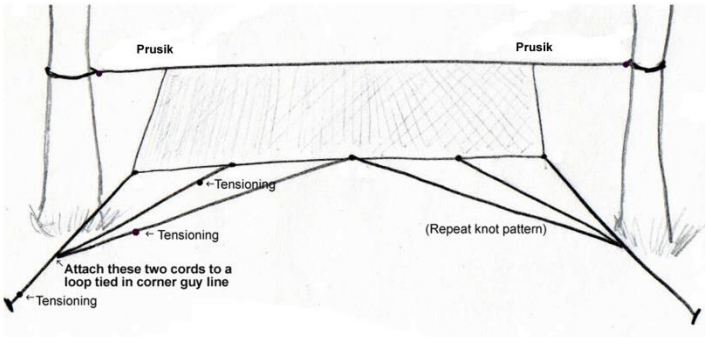
If the black cloud is just a passing event and no lightening is going to accompany the storm, maybe all you need to do is secure your canoe and gear, don your rain gear (yes, you did pack it even though the forecast said sunny all day), and find a nice big white spruce or cedar to lean against to shelter you from the rain. Perhaps a nice a convenient rock overhang is available. All of these are options for shorter periods of protection. If you think the storm may be building into something serious, now is the time to take action before the weather turns. Dig down to the bottom of your pack and find the tarp that lives there for occasions such as this.

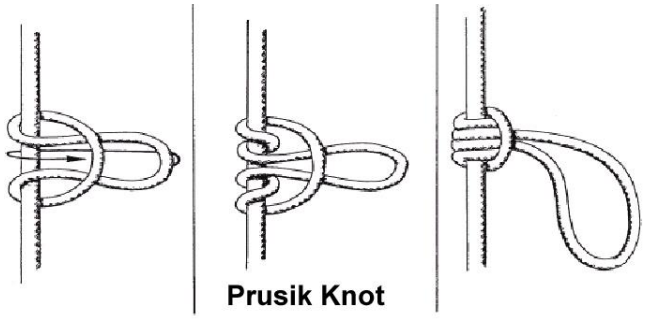
First a few words about tarps in general. They can be anything from a dollar store 'space' blanket, a big box store construction-grade blue plastic model, or a high end outdoor wonder designed by an aerospace engineer. They will all keep you dry if set up properly. However, you often get what you pay for, so make a wise purchase. The tarp alone is not of much use without cord of some kind, paracord being the standard but any light cordage will do in a pinch. A good 30-m is about right for the emergency kit. Here, I will concentrate on setting up a basic square tarp, be it 'space' blanket, blue plastic, or outdoor store specialty unit.

Before, you actually start to set up your tarp, you need to pick the right spot. If a storm is coming, winds will likely be an issue. Look for a sheltered spot close to your canoe. Since rain may be a problem, don't pick a low site where water might collect. Rather find a bit of a knoll or rise where the runoff will go around you. Remember also that you will likely want some breeze. Bugs can be a real problem right after a rain storm when it's warm and damp. If you think you may be forced to spend the night or may need to dry gear, choose a site where you can build a fire safely in front of your tarp. Don't forget to collect firewood before the storm and store it under the tarp to keep it dry.

The suggestions above would also apply to other situations when you may have to set up a tarp such as following an accident when someone needs first aid or if you damage your canoe and can't continue. Sometimes it's just nice to set up a tarp for shade if the weather is really hot or for a little of that 'homey' feeling if it's a bit of a nasty day.

Finally, it's time to actually set up the tarp. The simplest method is to use a ridge line to suspend the centerline of the tarp. Tie a ridge line roughly parallel to the ground between two trees that are at least a few feet further apart than the width of your tarp. The ridge line should be at right-angles to the expected direction of the wind to provide maximum protection. Ideally, the site should have no shrubs or undergrowth within the footprint area of the tarp. Sometimes this isn't possible so you can either work around the undergrowth or do a little judicious pruning if it doesn't go against your 'Leave no Trace' conscience. Try to pick two trees that have no other trees off to the side that might prevent you from pulling your tarp tight. Your first tendency might be to simply throw your tarp over the rope or worse, tie the center grommets of the tarp directly to the tree. Bad idea! The independent movement of the trees in the wind will be constantly pulling your tarp tight and then relaxing it. This is particularly hard on the tarp. Similarly, if you simply throw the tarp over the rope, the constant movement of the rope can chafe the tarp or cause it to flap unduly. It is much better to suspend the tarp from the rope (not obvious in the sketch) at the center grommets using Prusik knots. Using a short piece of paracord or equivalent, tie the Prusik on the main ridge rope near where either side of the ridge of the tarp will be tied. Tie the center grommets of the tarp to the loop on the Prusik. By simply sliding the Prusik away from the tarp, the ridge line of the tarp will tighten and form a nice smooth curve. The beauty of the Prusik knot is it immediately tightens on the ridge line as soon as you let it go. To adjust it, you simply have to take the strain off the Prusik and it will loosen allowing you to slide it along the ridge rope loosening or tightening the tarp.





Once the ridge of the tarp is set, stake the corners out using sticks as stakes or simply tie the guy line to a convenient tree or rock. Start with the corners using the taut line shown in the knots section of this manual. It is important to tie the taut line near the stakes at the corners. Next tie the secondary lines from the corner lines to the intermediate grommets in the tarp as shown in the sketch. The taut lines for the secondary lines should be through the grommets. With this arrangement, the tension of each side of the tarp can be adjusted by just changing the tension on the stakes with the corner line and the fine

tuning for the intermediate lines can be done without affecting the overall tension of the tarp.

That's about it for the basic tarp. This setup will do for most situations.

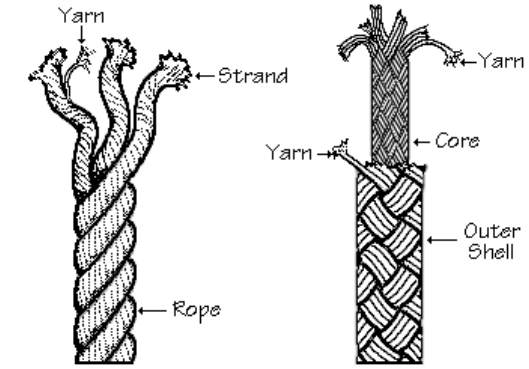
Rope and Knots

You should know a few more knots than the one you use to tie your shoes. Knowing knots will keep your canoe from blowing away, tie a painter onto the end of your boat, connect two ropes together, and keep your tent taut. There are many (many) knots and just a few have been listed in this manual; check the reference section for books and websites on knots and related information. When possible use braided rope since it is easier to handle. Check your ropes regularly for fraying, discoloration, kinks, reduced diameter sections, or damage & replace them often.

Type of Rope:

Twisted or Laid: Most rope is known as twisted rope, or sometimes called laid rope, which consists of a number of strands of yarn twisted together to make them more sturdy. Each of these strands may be made up of smaller strands, each of which is in turn comprised of the basic fibres of the rope spun together. Most rope is made of three strands, a style of rope known as plain rope.

Braided: The rope is made of an equal number of strands braided in opposite directions into a circular pattern. They are generally made from nylon, polyester or polypropylene. Since braided ropes have no lay or inherent twist, they will coil and uncoil without kinking. There are three main types of braided rope: a solid braid, a diamond braid with no core, and a diamond braid with a core. Solid braid rope is extremely strong and cannot be unravelled, even when cut. It is one of the sturdiest types of rope, but it cannot be spliced. Diamond braid is the simplest type of braided rope, in which the ends are woven together tightly. Most diamond braid has a solid core, but some is coreless, in which case it may be spliced together.



Laid or Twisted Rope Braided Rope

Rope Material:

Cotton, Jutte, and other natural fibre ropes are only mentioned here so you know they still exist. New synthetic rope materials have many advantages over natural fibre ropes – stronger, more durable and sometimes cheaper. *Nylon, Polyester, and Polypropylene* each have strengths and weaknesses and the material should be matched to the intended use.

Synthetic Rope Comparison Table

From: http://www.christinedemerchant.com/rope_material_comparison.html

Material	Advantages	Dis-advantages	Uses
Polypropylene Polyethylene	• Floats • Inexpensive • Not sensitive to chemical attack • Tough, abrasion resistant • Resists wetting • No loss of strength in water	• Degrades in UV • Not as strong as other synthetics • Stiff, slippery, knots come undone (some softer braids are made) • Low melting point • Stretches (especially Polyethylene)	Rescue and tow lines, Water ski lines, light anchor lines. Polypropylene is not as sturdy, is stiffer, more resistant to chemicals but more sensitive to UV, easily heat damaged (e.g. in car on hot day), and has less stretch.
Nylon® Perlon®	• Good UV Resistance • Absorbs shock (stretches) • Good chemical resistance • Moderately priced • High strength	• Very stretchy • Weaker when wet • Smoke is nasty when burning (cyanide)	Stretch reduces shock load so Anchor lines, Some tow lines, Mooring lines, Safety lines.
Polyester Dacron®	• Excellent UV resistance • Moderate stretch • Abrasion resistant • Good chemical resistance • Keeps strength when wet • Moderately priced • Not unpleasant to handle	• Sinks • Quite stiff • Difficult to handle (depending how laid)	Best all round line when you don't need ultra strong or light lines. Most common halyard rope material for boat use.
UHMWPE Spectra®, Dyneema®	• Very Strong • Doesn't wet • Very Chemically resistant • Abrasion Resistant • UV resistant • Light and floats • Good flex fatigue resistance	• Slippery, hard to knot • Low melting point • Creeps under constant load • Ropes tend to distort under load unless coated • Knots tend to undo • Expensive	High performance lines, winch lines, fishing lines.
Aramid Kevlar, Twaron®, Technora®, Nomex®	• Very Strong • Low stretch • Low creep • Fire Resistant • Good chemical resistance • Cut resistant • Not Electrically Conductive	• UV sensitive • Sensitive to shock loads • Sensitive to Chlorine, protective gloves cannot be bleached with chlorine. • Poor flex/fatigue resistance • Weakened by knots, often special terminals. • Sensitive to internal friction • Expensive	Winch lines, Sometimes as steel rope replacement where weight saving is important. Non conductive cable. Not much used in boats except for stays. Lifting straps, paracord, survival line. HRC has technora/nomex sheath.

Nylon, polyester, polypropylene are the most common types of ropes used with canoeing. Polypropylene rope is used for throw ropes since it floats. Be sure to check and replace all rope regularly as they are susceptible to damage over time. Ropes that have an intended safety or rescue purpose should not be used for other things (e.g. use a throw line only for rescues – not for hanging clothing or tarps).

See the following websites for some additional notes on ropes:
http://www.bevisrope.com/rope-info/rope-characteristics
http://www.boatsafe.com/marlinespike/material.htm

Caring for Rope

Rope that is going to be used in safety or rescue situations needs to be carefully cared for both at home and in the field. Rope that is used for non-critical rigging can be considered expendable or consumable and requires no special attention beyond storage so it does not knot itself – hanging clothing, some tarps, some low risk securing (e.g. into a lake day/trip canoe).

Treat your rope well and it will last and provide good secure service.

- Keep rope dry and clean.
- Don't step on rope
- Keep away from solvents, petroleum products, and other chemicals.
- Whip, tape, or seal the ends to prevent fraying.
- Avoid sharp corners or rough surfaces.
- Coil neatly and securely before storing or transporting.
- Store in dark, cool, and dry locations. Dry rope before storage.

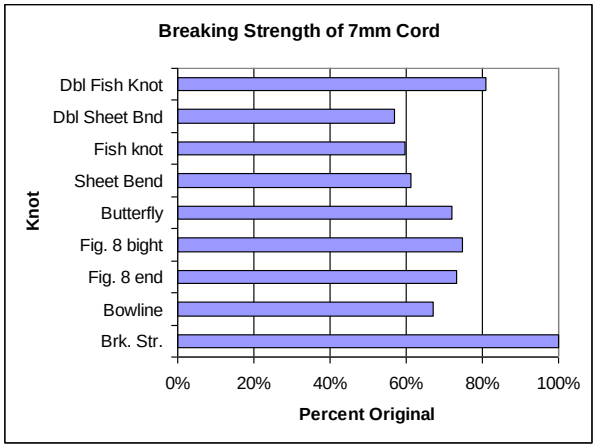
Knots

Many people think of knots as just a 'tangle of string' with a name. Knots serve a very important function in our daily and paddling lives providing everything form keeping our shoes on to securing our canoes and safety lines. Understanding how to tie various knots and the purpose they serve is important part of our paddling knowledge. When you tie a knot make sure you choose the right knot for the situation and trim (or tighten) it appropriately before use. Safety and security of yourself and equipment is important, test before use.

It is one thing to tie a knot in the classroom, or study, and another to tie it in the field. Practice the common knots regularly without any books or directions until you can complete them easily and quickly from memory.

Important criteria for knots: 1. Easy to tie, 2. Easy to untie, 3. Does not slip (unexpectedly), and 4. It does not reduce the strength of the line more than necessary for the identified purpose.

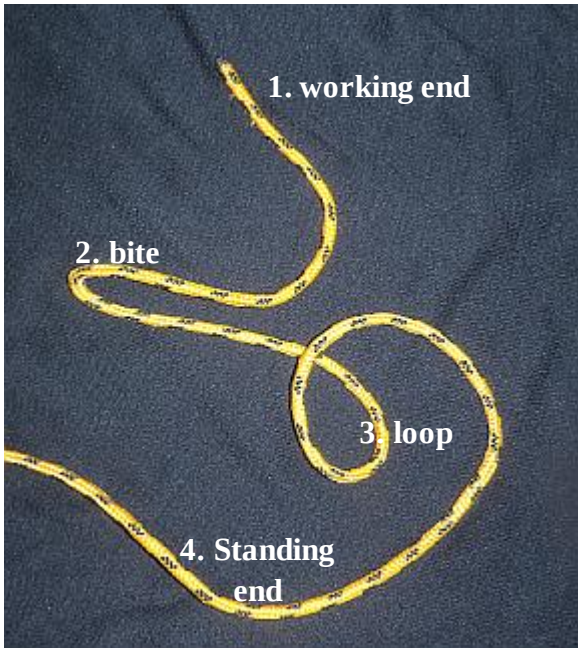
Yes - knots weaken rope, and in some cases significantly. Respect the rated working strength for any rope or cord that you are working with and then assume that any knot used will reduce the strength by a further 50%. Dave Richards' Knot Break Strength vs Rope Break Strength on the National Speleological Society Website provides some idea of the reduced rope strength for various knots. When a knot is combined with a rope that has been poorly treated, repeatedly tied, or damaged the strength will be even less.



http://caves.org/section/vertical/nh/50/knotrope-hold.html

There are a number of very good websites that provide information on knots. The following material provides some common and useful knots, to find more information and animations see Animated Knots by Grog (http://www.animatedknots.com/).

There are a few basic terms that might help when working through the following knot descriptions or when looking at books or articles on how to tie knots. The end you are working with is called the **working end** followed behind that by the **working part**. The other part of the rope that may not be in use is the **standing part** and the very end not be used is the **standing end**. Folding the rope back on its self is called a **bite**. Making a loop with the rope crossing itself is a **loop** or crossing turn. Wrapping a rope around an object is a **turn**, with two turns called a **round turn**.



Bowline

This knot is used to put a secure loop on the end of a line. 1. Form an overhand loop in the rope with the running end going over the standing end. 2. Pass the working end through the back of the loop and around the back of the standing end. 3. Put the working end back through the original loop and tighten. This knot may slip when repeatedly loaded, when wet, or when the standing end is not tight so be careful. Leave the free end on the rope as long as the loop and if worried add a half hitch as a stopper knot.

1. 
2. 
3. 
4. 

Half Hitch (Round turn and two half hitches)

The simplest of all knots here it is used to tie off the end of a line to a column or post. It is often best to go round the tie down twice and finish off with two or three half hitches. 1. Pass the running end around the post one full turn and pass the running end of the rope over the standing end and back through the formed loop (hitch). 2., 3. Repeat and tighten the half hitches together. An option, although much less secure is to use a bite in the standing end so you can just tug the knot loose.

1. 
2. 

3. 

Truckers Hitch

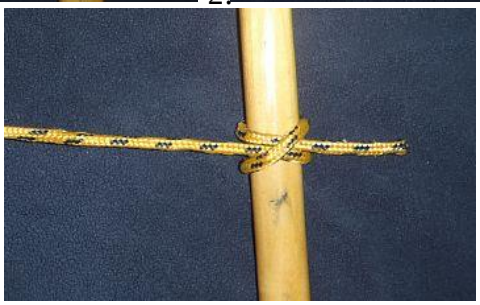
A great knot that anyone tying a canoe down to the roof of a car or trailer needs to know. It also works to rig rain tarps, tighten clotheslines. Kevin Callan calls this the ultimate combination knot-and-pulley system. 1. Create an overhand loop in the rope (using two twists make the knot easier to untie), pass the running end of the rope around a fixed object or post. 2. Pass a bite from the running end, next to the loop, through the back of the overhand loop. 3. Run the free (running) end of the rope through the bite and pull (tighten the standing end of the rope. 4. Finish the knot with two or three half hitches. In places that do not require constant security using a bite to finish the half hitches off allows you to pull the knot out easily.

1.  2.  3.  4. 

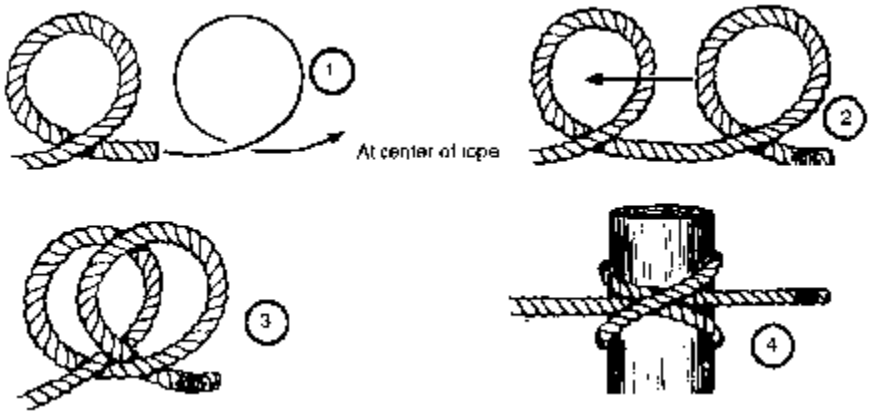
Clove Hitch

This is a quick and effective way to tie a line to a post or tree. It is effective when the strain is perpendicular to the post but will loosen when pulled or strained diagonally. 1. wrap the rope around the post and 2. back over the top. 3. pass the running end under the last pass over the post and tighten. Alternatively if the top of the post is free by overlaying two underhand loops, with the second loop on top of the first. Place the loops over the top of the post and tighten.

1.  2.  3.



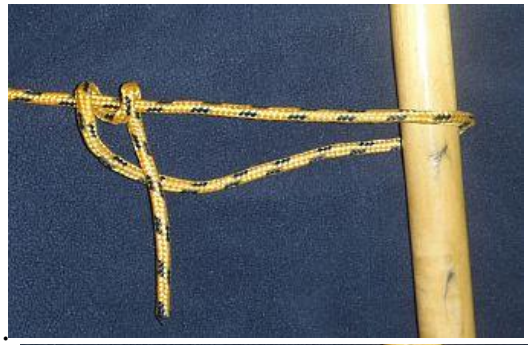
An alternative method for creating a clove hitch in the middle of a rope:



Related to a clove hitch is a constrictor knot. It is more secure, and often used to tie the top of bags, but more difficult to undo (https://youtu.be/NUSO8zuJzEY).

Taut Line

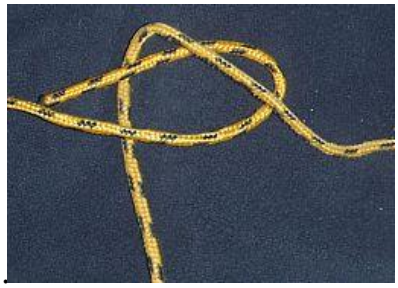
Have you ever set up a tent and wondered how to set out guy lines and tighten them up? Well this is the solution; an adjustable sliding knot useful for tying tents or tarps to stakes or trees. The knot can be slid up, or down, and then it binds when under pressure. This is the same general knot as a prusik. 1. form a bite by passing the running end around a post or through a grommet. 2. Loop the rope twice around the standing end of the rope closer to the post. 3. Loop the running end around the standing end above the earlier two loops and pass through the loop. 4. Move the knot and tension the rope. The Taut line is basically a Prusik knot with a free end.

1.  2.  3.  4. 

A Farimond Friction Hitch is a great alternative to the taut line as it holds its place on the line better and is easier to release. The down side to the Farimond is it is slightly more work to tie.

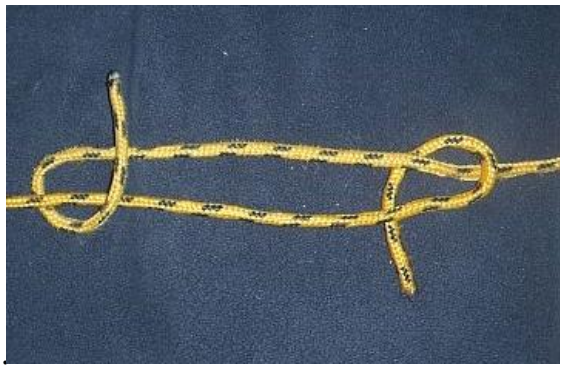
Sheet Bend

This knot was originally made for securing two ropes (called sheets) to sails. It is one of the most commonly used bends and it can be used to securely bind ropes of different sizes. 1. Form a bite with one [larger] rope. 2. Pass the running end of the other [smaller] rope around the back of the bite. 3. Go over the standing end of the smaller rope and through the larger rope bite. 4. Tighten the knot.

1.  2.  3.  4. 

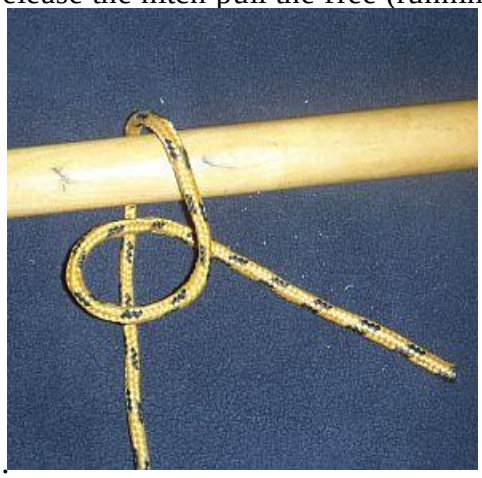
Fisherman's Knot

This is the quickest way to tie two ropes together. Not as effective as a double fisherman's knot but is easy. 1. Place the running ends of two ropes parallel to each other. 2,3 Tie overhand knots over the standing end of the opposite rope. 4. Tighten. The running, or free ends, of the rope should run out along the standing rope. When tightened or pulled together the two knots should fit together cleanly.

1. 
2. 
3. 
4. 

Mooring Hitch

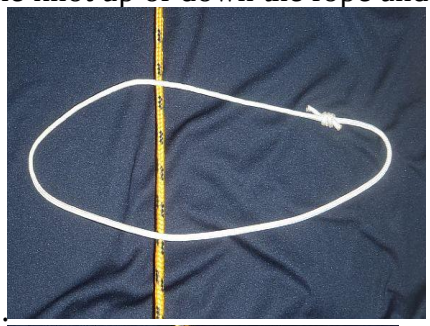
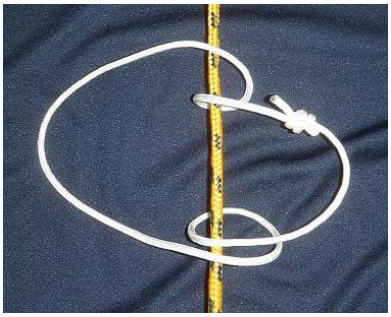
This is a secure knot that holds well under tension but can be simply released by pulling on the free end. 1. pass the rope around a post. 2. Form an underhand loop, with the loop over the standing end of the rope. 3. Pull the standing end up through the loop to form a bite. 4. Pass a bite made from the running end through the standing end bite. 5. Tighten the mooring hitch. To release the hitch pull the free (running) end of the rope.

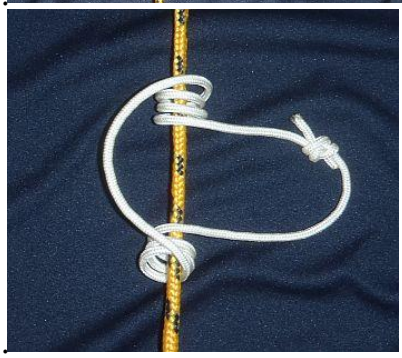
1. 
2. 
3. 

4.  5. 

Prusik

This knot was developed in 1931 to add a moveable loop to a rope. When under tension the loop locks in place and when the stress is released the knot can be moved up and down the rope. Originally developed for climbing up and down a rope this knot has many uses where a moveable loop needs to be added to a rope (see tarp setup later in this manual. The loop rope should be at least half the size of the main rope and the ends tied neatly, perhaps with a double fisherman's knot. The knot of the loop should never be in the turns around the main rope. In wet, icy, or slippery conditions a couple of extra turns should be made. 1. Lay the loop over the main rope. 2. Bring the right side of the loop around the main rope and through the loop on the left. 3. repeat this three our four times. 4. Pull the rounds tight and down to 'set' the knot in place. Release the stress and push the knot up or down the rope and re-tension.

1.  2. 

3.  4. 

Linesman's Loop (Alpine Butterfly Knot)
This knot is used to create a loop in the middle of a line. Strain can be taken in any direction (up/down, loop). 1. Wrap the rope around your hand three turns and cross the left turn over the middle. 2. Take the new left turn and bring it over both other turns. 3. Pass the bite behind the loops and pull through. 4. Tighten.

1. 
2. 
3. 
4. 

Figure-of-Eight
This knot (also called a Flemish loop) allows you to create a loop at any point in a line. The loop is easy to make and then check because of its distinctive '8' shape. This is a strong knot that is unlikely to slip under repeated loading but it can be very difficult to untie after it has been put under a load. Make sure both lines in the loop are neat and flat within the knot. 1. Create a bite in the rope and pass it over top, 2. Pass the bite behind the lines, and back through the loop (in front), and 4. tighten.

1. 
2. 

3. 

Figure-of-Eight (threaded)

A figure of eight can also be made with by tying a figure-of-eight only with the working end of the rope and then threading the working end back through the knot. This allows you to create a loop around another fixed object, post, or tree. A figure-of-eight tied on the end of a line is often used as a stopper.

1. 
2. 
3. 
4. 

Repairs (Basic)

The following is a very brief list of common problems and repairs that you might have with canoes and paddles. An example of the contents of a repair kit is provided earlier in the manual. This section is really dedicated to canoes and paddles but don't forget about maintenance and care of other equipment such as tarps, packs, safety equipment, and ropes.

> Regarding repairs of PFDs and Lifejackets: Once a floatation device or lifejacket is modified it is no longer certified.

Prevention is worth every bit of time and effort. If you treat your equipment well and are careful about storage, cleaning, maintenance equipment failure is less likely. Attending to minor problems minimizes the chance of significant problems later. When using your equipment don't drag it up on the shore or ram into obstacles, carefully pickup and put things down, don't stand or sit in/on canoes when they are sitting out of water. With the advent of tough, abrasion resistant, hull material many paddlers have become laissez–faire about dragging their boats to, and from, the water edge. Scratches, dings, and dents happen but they should be from accidental mishaps rather than intentional abuse.

Canoes

Storage

If possible store your canoe off the ground and upside down. This should be in a place that is protected from the elements (inside if possible), and secured from wind and theft. Inside a garage or shed provides the best protection but that is not always possible. If the canoe is left outside consider covering it with a large tarp to protect it from sun damage – the tricky part is you don't want the tarp touching the canoe so there is good airflow and the potential for color transfer (from the tarp) is minimized. If you store your canoe outside ensure that it is in place that large quantities of snow will not fall on the canoe (e.g. next to a building) or ensure that the snow is kept clear of the canoe. Weight from snow has crushed many canoes sitting on sawhorses in the back yard. Consider adding protectant (e.g. 303 or similar) to the hull before seasonal storage.

Cleanliness

Keeping your canoe clean helps identify small problems and helps prevent deterioration of components. Dirt or mud from portages or landings can carry around invasive species – washing minimizes the potential transfer between water sheds. Simply using a mild soap and water is enough in most cases. If you have wooden decks and trim you might consider leaving the canoe upright briefly to dry and drain water from under the decks.

UV Exposure

Even though most resins and gelcoats have UV inhibitors over long periods of time the sun will cause damage and discolouration. After washing your canoe add a layer of protectant such as 303 or UV inhibiting wax (same wax you would use on your boat, cab, or car). You should be careful about applying protectant on the inside of your canoe as these typically will make the surfaces slippery. Remember to store your canoe out of the elements.

Wood Trim

Many canoes have wooden trim and other details, these provide an esthetical pleasing look and feel but add some additional maintenance requirements. Most trim is oiled and this needs to have some touch-up over the season – use a good exterior or marine wood oil (although I have been known to use canola or olive oil when on the trail and there are nicks that need attending). I usually use an oil with some UV inhibitor included. Follow the directions for application and treatment at least twice each season; canoes that are out regularly (e.g. daily) apply oil more often.

Canoes with varnished wood will require re-varnishing after hard use. I recommend a Marine Spar Urethane. Wood cane and wood web seats may require re-varnishing after hard use as well.

Pay careful attention to finishing the ends of the gunwales and the insides of the decks. The gunwale ends are exposed and often sit on the ground (at least sometimes). The inside of the decks tend to collect water, especially when inverted after paddling, and then do not dry well.

Unfortunately accidents, age, and general wear and tear happen. Canoeing.com has provide a great review page and links for common (and not so common) repairs that you can do yourself (http://canoeing.com/canoes/canoe-repair/). The following are things that need to be dealt with to avoid a mishap: cracked or bent gunwales, cracks that appear on both inside and outside of the hull, damaged or cracked yoke or thwarts, damaged or racked floatation tanks, and loose components (rivets, screws, thwarts, yoke, grab bars, or seats). Don't forget the detailing items as well – painters, throw lines, grab-loops, etc…)

Canoe Repairs on the Trail

Duck tape….. This resource manual is around day tripping, save the more permanent repairs for home…. I will admit that depending the what canoe(s) are coming I will bring along muffler tape for the aluminum canoes. There are a lot of people that recommend 'Copter' tape – Helicopter Surface Guard – this is used a lot for bicycle and car enthusiasts to protect paint jobs. A number of people use this as a sacrificial layer instead of skid plates.

Canoe Seats

Replacement canoe seats can be purchased at most canoe suppliers and retailers. The seats are typically un-trimmed and will fit most canoes. Use the old seat, if possible, as a template to mark the length (then cut after measuring again). Use a saw that will provide a clean straight cut, and the oil or finish the cut ends before installing. You might require new seat hangers and bolts.

Skid Plates

Skid plats are usually made of Kevlar or fiberglass and epoxied to the bottom stems at the bow and stern to provide some protection to the canoe. Skid plate kits, epoxy, and instructions can usually be purchased from canoe retailers. If you notice a lightening of the outer coat or fabric shows along the bow and stern stems it might be time to add some skid plats.

If you are less adventurous or want an easier solution you can also get Patch and Protect type (peel off/stick on) patches. These are typically not as durable as Kevlar/fiberglass epoxied protection but many people find they do the job.

Skid plates, usually, change the esthetic appearance but do not significantly change the overall efficiency of the canoe though the water.

Wooden Gunwales

Mostly what was said above regarding oil/varnish, cleaning, and maintaining. If gunwales have started to turn gray and peel then it is time to sand and re-oil. If you are sanding down to restore the look of gunwales you will likely need to reapply multiple oil coatings. Gunwales are not terribly difficult to replace but it can be finicky (and beyond basic repairs) – Northwest Canoe has some basic information (http://www.northwestcanoe.com/repair.html). At this point I would go find my friend Eric or Doug….

Restoring the 'look'.

This might be as easy as apply 303 protectant – done. Super quick super easy. If the surface is really oxidized you might want to use a buffer (same thing for a car or boat) and re-buff then use protectant or wax to finish. Refinishing a whole gel-coat canoe is beyond the scope of this manual (but small patches can be done – see below).

If you have a Kevlar or fiber canoe without a gel coat you may be able to sand and varnish the hull for a 'brand-new' look. Killarney Outfitters has a nice page that provides instructions for the process:
http://www.killarneyoutfitters.com/refinish_kevlar_canoes.php

Poly or ABS canoes you might be limited to a protectant (such as 303), or using touch-up paint or something like Krylon Fusion (color matched as close as possible). Small 'dings' in ABS canoes can often be smoothed out or restored by applying heat to the hull and re-expanding the foam core.

(Over) Painting Gel Coat

There has been lots of discussion about painting canoes and what should be used. Start with a good cleaning – I use a little ammonia (e.g. Windex) to ensure I get any grease and wax off the hull. This may take the oil off of your gunwales so be prepared to re-oil your gunwales. A one-part marine polyurethane paint has been suggested, and is probably the best thing, from a outdoor boat supply store. My solution is to use a (several) can of Krylon Fusion spray paint – I expect it is not as tough as marine poly, and certainly not as long lasting as new gel coat but it is really easy – just remember to tape and paper the edges.

Gash Repair for Your Canoe

Gashes and larger chips in your canoe can be repaired.

Most canoe resellers and manufacturers sell restoration gel-coat kits. NovaCraft for example sells repair kits and has a nice online video of doing a repair: http://www.novacraft.com/blog/gelcoat-repair/

ABS or plastic canoes with a gash can be repaired using something like PlasticWeld from JB Weld, or epoxy putty made to bond with ABS, and then cleaned up with touch up paint from the manufacturer or Krylon Fusion. Ensure that you clean the area well with acetone and carefully follow the instructions for the putty.

A lot of people recommend the 4 ounce bottles of West System G-flex. It mixes 1:1, and the measuring is not critical. It will soak into glass or Kevlar adequately, and its adhesion is outstanding.

Paddles

Right after the actual canoe, a paddle is the tool that allows you to 'canoe'. Looking after this piece of equipment will mean less chance for breakage and damage. Always check for damage before and after paddling – a quick scan – look for split blades, chipped varnish, soft-spots. Aluminum and plastic (or other synthetics) look for cracks and bends.

Store your paddles, if possible, hanging from the grip. This primarily keeps them out of the way and less likely to fall over or get stepped on and broken, but for wooden paddles it keeps them dry and less likely to warp over time. Like canoes, paddles should be kept clean, allows you to check for damage prevents moving invasive species. Repair damage, even small nicks and scars promptly.

Bending Branches has this advice for restoration of their paddles:

- Sand the area with a fine grit abrasive until it is smooth and dull.

- Apply two or three thin coats of solvent based (not water based) outdoor or marine grade polyurethane. Follow the application instructions on the container.
- Rub lightly with a fine abrasive between coats for a better finish.
- When the last coat is dry you are ready for the water!
- If the wood is damaged, sand the area aggressively with 100 or 120 grit sandpaper to smooth the wood and remove the discoloration and treat the sanded area with 3 or 4 coats of polyurethane as described above.

My preference is to have oiled wood shaft and grip for my paddles, I find them more comfortable and I have a better feel or connection to the paddle. This is a personal preference, so it is not for everyone. If you have an oiled paddle, just like canoe trim, you need to reoil more often, when ever the wood starts to look dry.

Carbon paddles are becoming more common every year – the weight advantage and the fine blades provide significant advantages over wood, and especially aluminum/plastic paddles.

Cliff Jacobson provided some advice through Paddlling.com:

- Carbon blades can chip if you hit a rock real hard. If the chip goes unchecked, it can grow into a crack or break. Use a nail-board or the file on your multi-tool to smooth the edge when on the trail then back at home, sand the edge smooth. The edges of most carbon-fiber paddle blades are solid for about three-eights of an inch all around the blade. Some carbon blades have a mold line that shows where the solid material ends. Don't sand beyond that line. Important: Never run your finger along the edge of a carbon-fiber blade to test for nicks. Small nicks expose microscopic carbon-fibers which act like fine saw-teeth. Carbon-fiber cuts are extremely painful! Instead, examine the edge in bright light, as you would when checking a knife for nicks and dull spots.
- Carbon-fiber grips and shafts will slightly "roughen" over time. Sand them silky-smooth with 000 wet sandpaper.
- Sunlight (ultraviolet) degrades the epoxy resin used to build these paddles and over time, the finish begins to look chalky. Use something like 303 Protectant. Wipe it on, wipe it off. Done deal. One application lasts for weeks.
- Carbon-black paddles are difficult to see on land and still more difficult to see in the water. You'll improve visibility if you add some colorful stickers to the blade and/or wrap bright plastic tape around the shaft.
- Use "pry" strokes gently and sparingly! Carbon-fiber paddle shafts are hollow. Prying a carbon shaft smartly across the bilge or gunnel of a canoe can cause the shaft to break or produce a weak "hinge" spot which may later become a break. "Cross-draws" in the bow and short "reverse-sweeps" in the stern are as nearly as effective as pry's and will save your carbon-fiber paddle.

Transporting a Canoe on a Car

Unless you live at a lake or river, you will inevitably be transporting your canoe on top of a vehicle or trailer at some point. It is important that you know how to do this safely and securely in order to avoid any unfortunate damage to your canoe, your car, or anyone else for that matter.

Foam Blocks

Foam block systems normally include 4 car top foam blocks that snap onto the gunwales of your canoe. The canoe can then be placed upside down on your car roof, and held in place by two or three nylon load straps which circle through the car's open doors (not windows!). Foam blocks and load straps typically come packaged together. Lines should also be tied from the bow and stern of the canoe to the front and rear of the car to further secure the load.

Foam block systems are popular with recreational paddlers because they're inexpensive, easy to use and easy to remove and store. When properly used, they provide a safe and secure way to transport a canoe. You should mount the blocks reasonably far toward the front and back of the car top, placing them on the strongest points of the roof to prevent dents. The roof and blocks should be free of any sand or dirt to prevent marking the paint.

Roof Mounted Racks

Another way to carry a canoe on a vehicle is to use a roof-mounted car rack system. These systems can be secure and stable, and they can be used to carry just about any type of outdoor gear. Today's most popular roof-mounted systems (e.g. Thule or Yakima) can be fitted to almost any regular-sized car, truck or van. Proper selection and fitting to your specific vehicle is the key to safe use of these systems. Buy from an experienced dealer of roof rack systems.

Loading and Unloading

To load a canoe onto your car, use a standard two-person overhead lift. Once you've lifted the canoe over your heads, carry it over until it's directly above your car's roof, then set it down gently. Center the boat fore and aft. Ensure that the canoe does not touch the roof – this is common with foam blocks and newer cars with curved roofs.

To unload the canoe, simply reverse this process, making sure the boat is completely untied from the car before you begin. Pause briefly with your partner when the boat is on your shoulders to make sure you agree on which direction you'll be rolling the boat to the ground.

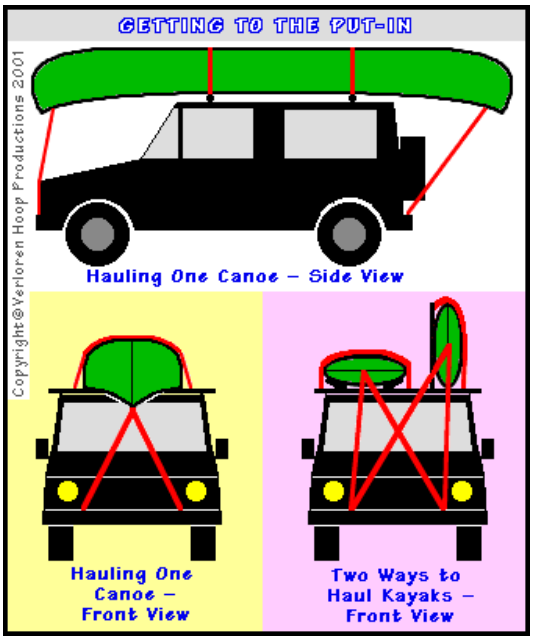
Tie-down Strategies

Straps
Nylon load straps distribute tie-down pressure over a wider hull area than ropes. They also tend to chafe less against the canoe's surface. When combined with good quality, self-locking cam buckles, they're easy to use and quick to cinch down, providing excellent overall grip without the hassle of lots of knots. When using straps and buckles, remember to:

- Place some sort of padding directly underneath the buckle (where it makes contact with the canoe hull). This will help minimize hull damage during transport. Better straps will have a pad sewn in behind the buckle to protect the canoe.
- Tie off the extra strap directly above the buckle once it's been cinched tight. This will provide added security in case the buckle releases while the car is moving.
- If using straps with a ratcheting mechanism, be very careful not to over tighten.

Ropes
Only use ropes when straps with cam-buckles are not available. Use appropriate knots and understand the limitations of the rope that you are using (e.g. nylon rope stretches, especially when wet, and will need to be checked). Knots may slip if not properly finished and should be checked regularly when traveling for longer periods.

Basic Tie-down Procedures
No matter what type of tie-downs you use, follow these basic procedures whenever you secure your canoe to your vehicle:



Use at least four lines or straps to hold the body of your canoe in place. Two of these lines should run perpendicular to your car, the other two securing the canoe ends.

Tie rope or straps from the ends of the canoe to your car's bumpers or other fastening points. Thread these lines through a sturdy part of the end of the canoe, then angle them out in an inverted "V" to both ends of the closest bumper. Pull them taut and secure them with reliable knots. Avoid over tightening.

In the image to the right the top frame shows tie downs going backward from the rear bumper, this is not optimal but in some cases there is not much of an alternative – in this case an additional tie down should go from the rear bumper to the rear thwart or possibly yoke to prevent the canoe from sliding forward.

Many newer cars do not have tie down points near or under the bumpers. Webbing may be attached to mounting points under the hood and when needed pulled out at the side of the hood as a tie down point. Alternatively a loop of webbing may be attached to a short piece of hose that is 'trapped' under the hood or trunk.

http://www.instructables.com/id/Adding-a-Mounting-Point-to-a-Vehicle-That-Has-Nowh/

Driving With a Canoe on Your Vehicle
It is important to do a safety check before departing and frequently during your trip. Knots can loosen and ropes can stretch.

Once tied down try to move your canoe from side to side. If your car moves instead of your canoe, the boat is secure.

Make sure that the boat is centered on the vehicle and that you drive cautiously as the canoe will be affect steering and control in winds.

Navigation (Staying Found)

We all like to think that some form of 6th navigation sense exists that will allow us to figure out where we are and how to get out when lost. Humans have no inherent sense of direction or knowledge of place, you need to work to keeping track of where you are using a little knowledge and some tools. Navigation requires four things – knowledge of place, distance, direction, and time. Maps give us some knowledge of all of these things when you can see usable landmarks. Other tools such as a compass and GPS come into play when landmarks become difficult to use. Most of the time when canoeing a map is all that you require since most shore lines have enough features to give you a knowledge of place. Sometimes you may become unsure where you are when shore lines are featureless, you run into fog, you lose track of the number of bends in a river, the portage you are walking is overgrown, etc… When this happens keeping your head and knowing how to use a compass and other tools becomes more critical.

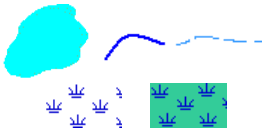
Keeping track of where you are is probably the most critical part of staying found. Periodically take a look around, especially behind you so you will know where you have come from. Those people that appear to have a keen 'sense' of place are just a little more observant, even if they don't realize what they are doing.

Kevin Callan (The Happy Camper) made three short videos that provide a very simple (simplistic) introduction to compass, map, and map & compass. It might be worth just watching these to start and then going into more detail.

Compass: https://www.youtube.com/watch?v=eVkKqeilim8
Map: https://www.youtube.com/watch?v=QDlUK_jgYjo
Map & Compass: https://www.youtube.com/watch?v=4QoLRTUrvj4

Maps – Topographic

After being observant maps are the most useful tool in your navigation tool kit for staying found. Understanding a map and having the ability to read it is crucial on any trip. Along with helping you navigate maps can tell you a lot about where you are going and help to plan a ahead. As paddlers topographic maps (maps that give us an idea of the topology (hills, valleys, rivers, lakes, and ground cover) are probably the most important kind of map to have in the wilderness. There are other maps that can also be useful including road maps, charts, drawings, local maps, etc… This manual focuses on the use of topographic maps.

Road - hard surface, all season	
Road - loose or stabilized surface, all season	
Trail or portage	
Contours; index, intermediate, depression. Check the contour interval on the map for units.	
Wooded area	
Lakes & Rivers, Streams, Intermittent Marshes (no trees), Swamps (treed)	

Topographic Map Symbols

Topographic maps have many different symbols and shading but there are only a few that must be known – the rest can be looked up when necessary. The back of most Topo's have a legend that provides information on the symbols used on the map.

A more thorough legend through CanMaps:
http://www.canmaps.com/topo/help/pdf/legend.pdf

When you are using a topographic map try to align the actual map with the lay of the land; it is not necessary to keep north to the top. Look around and match what is on the map to what you see. One of the most common problems people have when working with a map is not having a 'feel' for the distance or correspondence between the map and the real world. Unless you have almost mystical spatial relations this is something that you need to practice. Try keeping a map out when you are traveling in an area that you already know well, practice using the map, and associating the map with what you know about distances and the way things look.

Contours lines are one of your best friends when using a topographic map. They will help you identify visible landscapes (hills) for orientating the map and give you and idea how much you will have to climb over the next portage. Each beige line on the map represents a line between points of constant elevation. Every 5th line is darker and called an "index contour"; somewhere along that line there will be and elevation marked. The distance or change between contour lines can change between maps so check the bottom of the map to find out the contour interval (it will be in either feet or meters depending on the publication date). Lines close together represent a steep slope, further apart lines indicate a gentle slope. A height of land will be marked with a single point labelled with the elevation.

Metric Contour Interval Guidelines

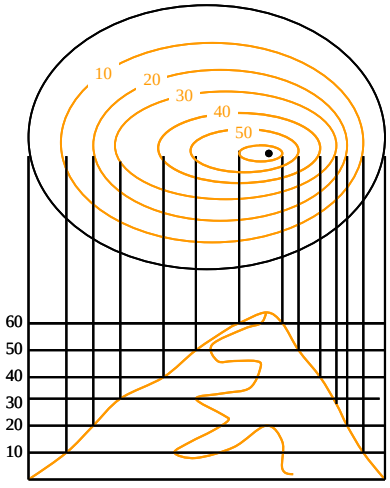
MAP SCALE	TERRAIN TYPES		
1/50 000	Flat or normal	Hilly	Steep
	10 metres	20 metres	40 metres

Imperial Contour Interval Guidelines

MAP SCALE	TERRAIN TYPES			
1/50 000	Flat	Normal	Hilly	Steep
	25 ft	50 ft	100 ft	200 ft

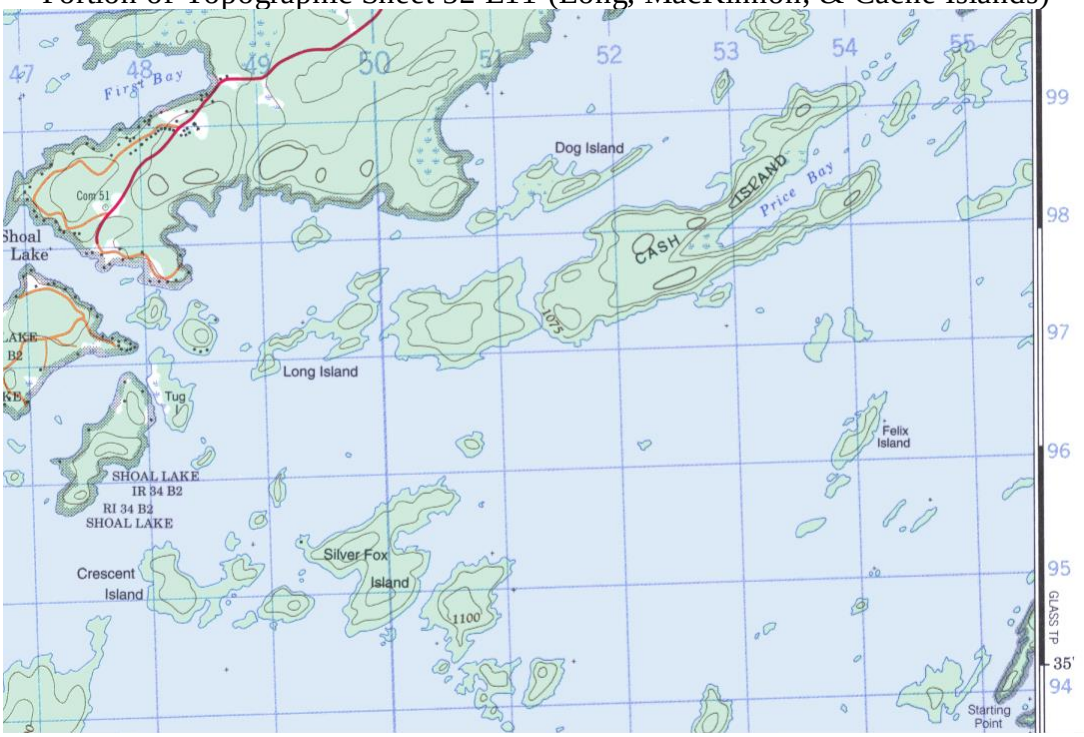
Conversion: Imperial to Metric

IMPERIAL UNITS	METRIC UNITS
25 feet	10 metres
50 feet	20 metres
100 feet	40 metres
200 feet	40 metres



One of the ways you can get a feeling of the 'lay of the land' over a trail or portage is to use a piece of graph paper and string. Stretch the string along the map to finding the distance along the trail, mark each contour line on the string. Place the string along a piece of graph paper and at each contour point mark the elevation on the graph paper. You will have a cross section of the trail along with the length when you are done.

Portion of Topographic Sheet 52 E11 (Long, MacKinnon, & Cache Islands)

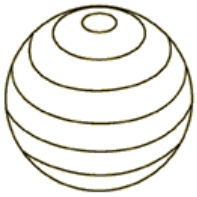


Grid Reference Systems

On all of the topographic maps used in Canada there are two sets of grids marked.

Latitude and Longitude

Latitude



A point north or south of the equator, perpendicular to the lines of longitude. Latitude is measured in degrees from 0 (equator) to 90 (pole). One minute of latitude equals one nautical mile. Think of lines of latitude as a series of hoops around the earth parallel to the equator.

Longitude

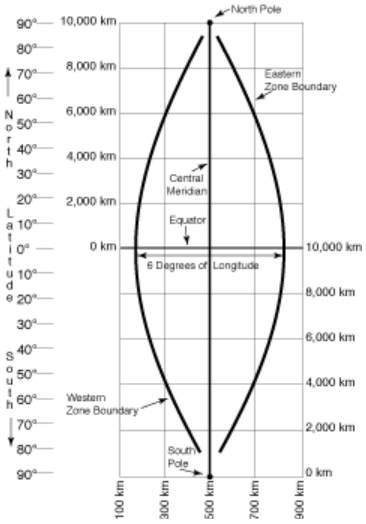
This is the distance east or west of the prime meridian measured in degrees. Lines (meridians) create a geographic grid around the world that meet at the poles are furthest apart at the equator. The lines give the impression of a pumpkin.

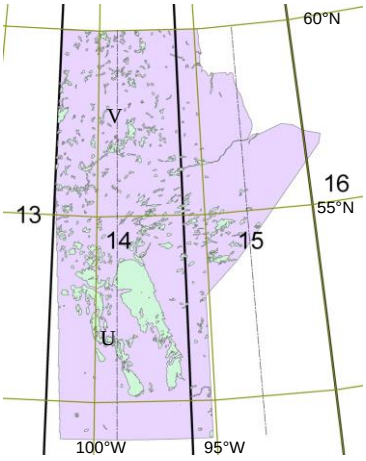
UTM/MGRS

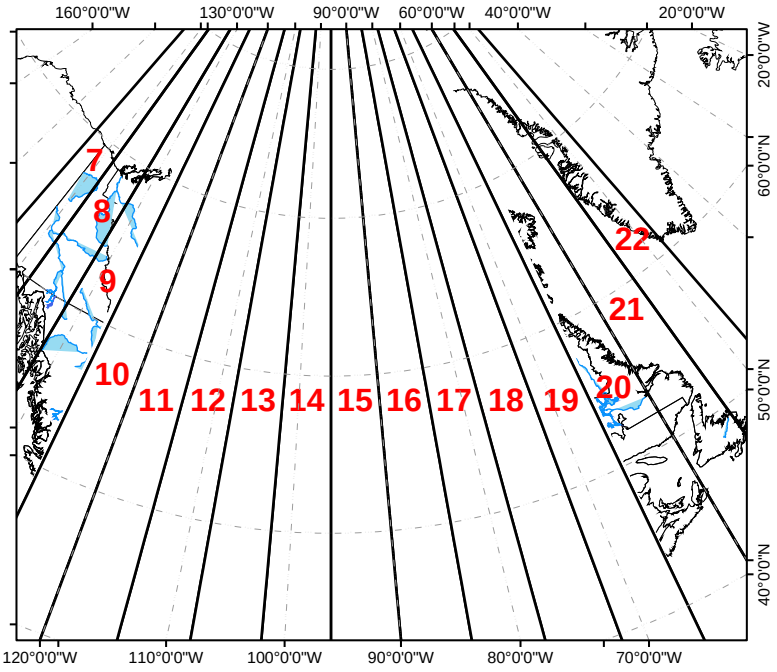
UTM (Universal Transverse Mercator) grid coordinates are expressed as a distance within each zone in meters measured from the west, referred to as the "easting", and

from the south, referred to as the "northing". UTM zones are setup so there is minimal measurement error across the whole zone with the biggest difference being 0.9996 of the true scale. True scale occurs about 180km on each side of the central meridian of each zone. MGRS (Military Grid Reference System) is a special format for describing UTM co-ordinates in an abbreviated format that follows a 100000 meter grid.

Co-ordinates are read across the map (start from west), then up the map (start from south). If you are sharing this information with others you will want to quote the UTM and/or MGRS grid reference or map ID along with the datum.
(e.g. `NAD 83, 14U 633826 5518867`, or `14U PA 338188`).

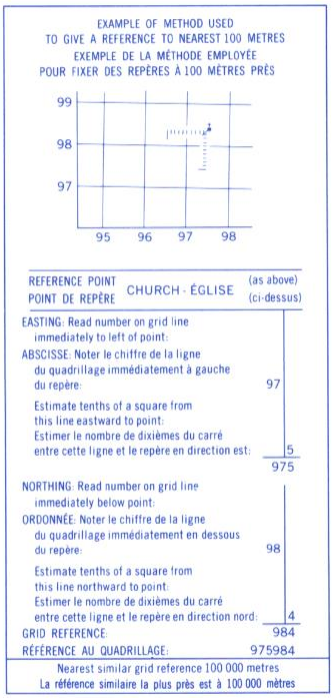






Grid Reference and marking points

When working with Canadian topographic maps I generally recommend using UTM or MGRS measurements because distances are easy to measure with a simple metric ruler.



When reading off of Canadian Topographic maps UTM units (meters) are the light blue numbers running along the sides of the map. When reporting UTM or MGRS numbers they are typically listed as easting then northing numbers. I find it easy to remember as '*enter the door, take the elevator*'. If you forget every topographic map has a brief example of reading co-ordinates on the side near the map and declination information.

The blue numbers and lines on 1:50,000 maps are shown every 1000meters (2cm=1000m). This makes direct measurements with a ruler or even an approximation by 'eye' very simple. One simple way to measure portages or trails is to use a piece of string and overlay it on the map following the trail. Take the string off and measure the length. This does not account for the added distance from the slope of any hills but unless you are climbing cliffs that distance is usually not significant compared to the horizontal distance.

The full UTM co-ordinates are listed at each corner of the map with abbreviated numbers (matching the MGRS 100 000m square reference) listed at every interval. When using MGRS an even number of digits are always listed; more numbers provide greater precision. Typically two character grid identification should also be listed prior to the numbers. This identification is used to identify the specific 100 000m square within the particular UTM zone. Although in practice this may not be necessary as the next closest reference will be 100km away.

An example of UTM/MGRS location within UTM zone 14, MGRS square PA. The full reference for either would start with 14 U.

UTM:	14 U 633827m E 5518867m N	
MGRS:	14 U PA 338188	(6 characters indicates 100m)
	14 U PA 33821886	(8 characters indicates 10m)
	14 U PA 3382718867	(10 characters indicates 1m)

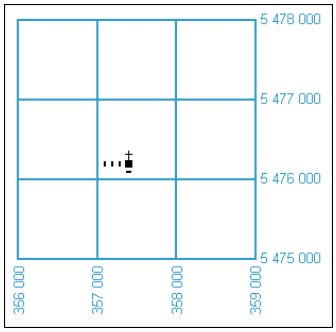
Reading Civilian UTM Grid

Vertical blue lines are measured from an imaginary line located 500,000 meters west of the zone's central meridian. This starting point is set because it is a nice round number and falls just outside the widest point in any zone. In northern Canada, zone widths shrink to as little as 80,000 meters (40000 meters on either side of the central meridian). In practice, this means that vertical lines are counted from the central meridian or 500,000 meter line, those to the left of it having an "easting" value of less than 500,000

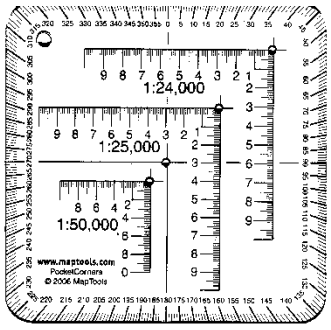
meters, and those on the right having a value above that. The full easting value is marked on the map on the first and last UTM line along the bottom and top of the map.

Horizontal blue lines on the map are designated by their distance from the equator in meters. The number of meters north of the equator represented by the bottom horizontal grid line on a map is always shown in the lower left-hand corner of the map. Similarly, the number of meters east of the zero vertical line represented by the left vertical grid line is also shown in the lower left-hand corner.

If a given point on a map is positioned exactly at the intersection of a vertical and horizontal line, its location may be read off simply from the map margins. Its full designation or its "coordinates" would include the zone number, followed by the easting and northing values. On a 1,000-metrer grid, these coordinates might read: **Zone 14 U 357000 5476000**. The values of the first vertical and horizontal lines appearing in the southwest corner of the map are given in full. The other grid lines are numbered in an abbreviated fashion matching the MGRS grid.



Few points, however, are conveniently located at grid intersections. Usually the point to be described (such as in the figure to the right) is somewhere between lines. In this case, it is necessary to measure or estimate the distance to the nearest vertical line to the west and to the nearest horizontal line to the south and to add these metric values to the grid values given at the margin. Since each grid represents 1000m it is generally fairly easy to estimate but you can also use a roamer or ruler for more accurate measurements.

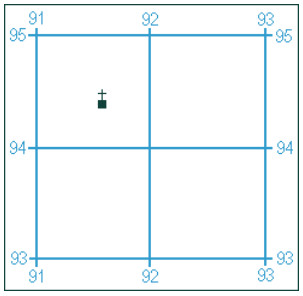


As in the above example, if a point is located 400 meters east of the vertical line of 357 000, and 200 meters north of the horizontal line of 5476000, its coordinates would be: **Zone 14 357400 5476200**. With these three numbers, any point on the northern hemisphere can be unmistakably identified.

The civilian system of designating UTM Grid coordinates is straightforward however it does require the use of large and somewhat cumbersome figures. To get around this, military map-makers have developed a somewhat different system consisting of a combination of letter and numbers, the Military Grid Reference System.

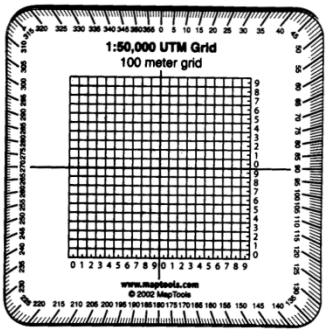
This material updated from ***The Universal Transverse Mercator Grid***, Department of Energy, Mines and Resources Canada, Surveys and Mapping Branch, Ottawa, © 1969, The Queen's Printer. See: http://maps.nrcan.gc.ca/topo101/index_e.php

Reading Military Grid Reference System



If there is no possible confusion about the map sheet on which the reference falls, the Military Grid Reference System (MGRS) provides a very quick and easy method of referencing. As previously mentioned, topographic maps carry a rectangular grid with numbers in the margin identifying the horizontal and vertical lines. On large-scale maps (1/50 000 and larger) each number consists of two digits

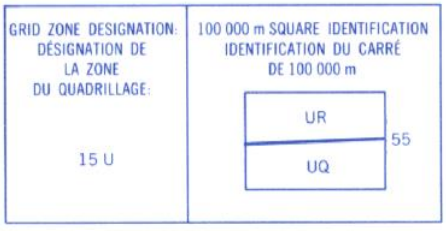
To arrive at a map reference for the church shown in the figure, we would first note the numbering of the lines that form the west and south of the square by noting eastings then northings. The designation of the square containing the church would be **9194**.



To give a reference for the church itself, we must imagine the square divided into 100 smaller squares (ten by ten). Then we estimate by eye that the church is six tenths of the way between lines 91 and 92, and four tenths of the way between lines 94 and 95. Using these figures, we can quote the easting as being **916** and the northing as **944**. By convention these are combined into a reference of **916944**.

Even more precision can be obtained by using a **roamer** (a small transparent card graduated with units of the proper scale) as shown to the left. With the roamer, the reference can now be given as **91559435**. Note that the reference always has an even number of digits, the first half representing the easting, the second half the northing.

The Military Grid Reference System is convenient, but unfortunately reference numbers repeat themselves every 100 000 meters (100 km or about 62 miles). Therefore a method has been devised to identify the 100 000-metre squares by letters which are printed in blue on the face of all NTS maps and on the left side. This is particularly important in the case of medium- and small-scale maps (1/250 000 and smaller), as unlettered references are ambiguous on a single map. The identifying letters (two of them) are always given before the numbers.



Here the church would be at **UQ916944**. This reference is still not unique, but the same reference does not occur again for about 2900 km. For most purposes this is sufficiently unambiguous. If a reference is required that is unique in the world, one must look in the margin of the map for the Grid Zone Designation. The zone number is followed by a letter which gives the general area north or south of the equator in bands of 8 degrees. Therefore the unique designation of the church if it were in the Ottawa area would be **15 U UQ916944**.

This material updated from ***The Universal Transverse Mercator Grid***, Department of Energy, Mines and Resources Canada, Surveys and Mapping Branch, Ottawa, © 1969, The Queen's Printer. See:
http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9779

Map Scale
This is the ratio of map space to 'real' space. Typical scales for topographic maps in Canada are 1:50,000 (1cm=500m), 1:250,000 (1cm=2500m). There are other scales available but they are typically special purpose maps (e.g. 1:20,000 for Riding Mountain National Park). Scale is a relative measure: *Larger* scale maps show greater detail but less of the earth; *Smaller* scale maps show more of the earth but less detail.

Datum
On each topographic map you should find an indication of the 'Datum' for the map. It seems pretty esoteric but this is something that you should check and account for especially when transferring points to or from a GPS, or giving co-ordinates to someone else. Current Canadian Topographic maps will all be based on the North American Datum 83 (NAD83) but some older maps may be in NAD27 – the difference can cause difficulties in finding things like portages. In Manitoba and north-western Ontario the difference can be over 200m north/south.

Coordinate Conversion NAD 83 (WGS 84) to NAD 27
Mean values for this map

Geographic:	Latitude -	subtract	0.1"
	Longitude -	subtract	1.0"
Grid:	Northing -	subtract	221m
	Easting -	add	14m

Compass

Although you can pretty much get away with using just a map when canoeing there are times that landmarks are difficult to see (e.g. when walking a portage) and a compass can be a really handy tool.

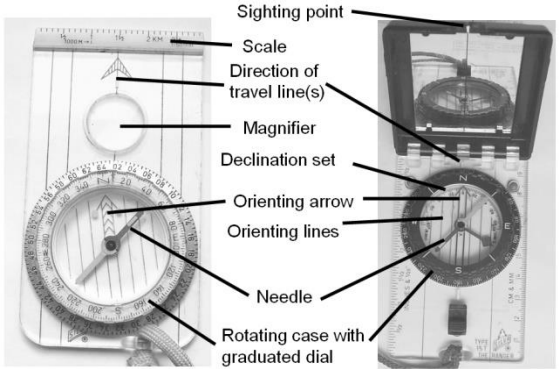
There are two types of compass that you will often find in outdoor stores. A base plate or orienteering compass is the most common and the type described in this manual. You may also find compasses called lensatic, geologist, or military compass. The claim is you can get much better accuracy when taking bearing readings from this second type of compass, which is may be true when using high end compasses, but transferring information to/from a map is more difficult.

How does a magnetic compass work? The earth has a magnetic field that generally runs in a north-south direction. The compass itself has a magnetic needle balanced inside that aligns with the earths' magnetic field (north/south). This provides a constant direction and allows you to measure direction by counting the number of degrees off of this line.

When using a magnetic compass remember that there are things that will attract the magnetic needle or disrupt the earth's magnetic field. Most things that are steel or iron such as a knife, belt buckle, batteries, or car engine will cause problems When traveling in areas with iron ore deposits you can often come across significant magnetic anomalies – be aware that this might happen and adjust as necessary.

Using a Compass (base plate or Orienteering)

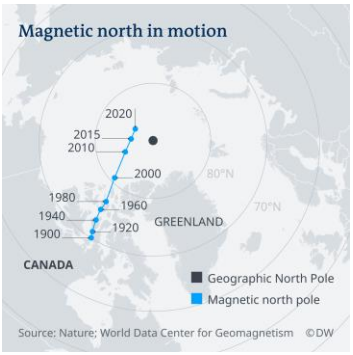
- Hold the compass level, at waist height, with the direction of travel arrow pointed in the direction you want to go, or at a known land mark. Align yourself and the compass so they are pointing (facing) the same direction. Make sure there is nothing metallic near the compass.
- Turn the rotating case until the red end of the needle is inside the orienting arrow.
- Read the bearing from the direction of travel line at the front of the rotating case. Some compasses have the words 'READ BEARING HERE' stamped on the base plate.

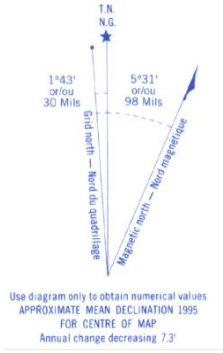


When walking take a periodic look at the compass to ensure you are still going in the same direction. Unfortunately even when following a bearing you will occasionally wander off course sideways a bit. The best method to avoid this drift is to locate a visible object along the bearing, walk to that point and take another bearing to another visible object. When returning along a bearing make sure that you are headed for a base line, or that you know what features bracket your destination. In most cases you will want to 'aim off' from your destination so when you find your base line you know which direction your destination is located.

Map and Compass

When working with both a map and a compass it is important to realize that magnetic north and grid north will not always align. This is because magnetic north moves around and is not situated directly at the north pole. Right now the pole is wandering around north of Elsemere Island and making tracks toward Russia. In the Shoal Lake area the difference between magnetic north and true north is currently only 1° 14' east. In some areas the difference can be over twenty degrees – that is a BIG difference. When transferring bearings too or from a map a correction for declination must always be made.

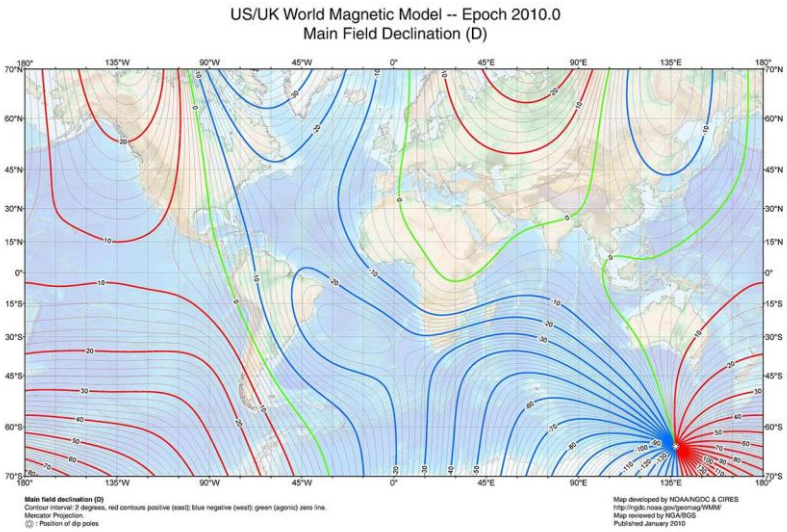




On each map there will be an image that identifies the difference from true north for both the grid lines and magnetic north. It is really important to check the date since the magnetic pole moves. Fortunately it has been moving at a fairly constant rate and the change is noted on the map. When adjusting for change over years remember there are 60 minutes in each degree so you can't just subtract (or add) minutes. The image to the right is for the Shoal Lake area in 1995 so subtract (7.3'minutes*21years or 1° 56') to get 3° 36' east of grid north or about 1° east of true north.

If you want to avoid all of that calculation there is a real time declination determination calculator that NRC has put on the web at: http://geomag.nrcan.gc.ca/apps/mdcal-eng.php. Mark the declination adjustment in pencil (remember it changes) on your map each spring.

Some compasses have a declination correction screw. This can make life really easy if you always stay on one map – set it at the start of the year and don't worry. Unfortunately you if you move about you need to remember to re-set the declination adjustment every time you move to a new location.



http://www.solarpathfinder.com/magnetic

Transferring a bearing between Map and Compass.

Map (grid) to Compass (magnetic)

- Line up the side of the compass between your current position and the position you want to reach. Make sure the direction of travel arrow is pointed to the position you want to reach.
- Turn the rotating case until the orienting lines are parallel to the grid lines on the map and the orienting arrow is pointed to the top (north) of the map.
- Remove the compass from the map and adjust for the declination. If the declination is east then subtract the declination correction.

Compass (magnetic) to Map (grid)

- Take a bearing from your current position to a known map location or landmark.
- Adjust for the declination. If the declination is east then add the declination correction.
- Place the front corner of the compass on the landmark and rotate the base plate until the orienting lines run parallel to the grid lines on the map. With a pencil draw a line using the side of the compass through your current point. Repeat the process with one or two more landmarks to triangulate your position.

Easy ways to remember which way to correct for declination:

- Map to compass, east is least.
- Empty sea, add water (Map To Compass, Add West)
- Use a compass with a declination adjustment feature (just don't forget to re-set)
- Some people pencil in a magnetic north grid on the map before leaving home.

Triangulation

I don't often use this in real life but it is an important tool to stick in your belt if you have a general idea where you are compared to some easily visible landmarks – a hill, the point of an island or bay, microwave/cell tower, etc… By taking a bearing to two known points and drawing lines back from those points where the lines intersect on the map is your location.

GPS

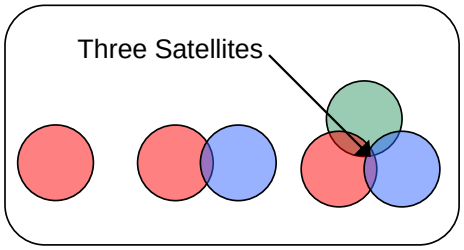
Using a GPS receiver is pretty easy: 1. Check to see how much of the sky you can see, the more the better. 2. Turn on the GPS receiver and let it sit for a while to get a fix. 3. Read the co-ordinates. This section provides an overview of the GPS system, terminology, some jargon, and a little on usage.

Theory

GPS, or Global Positioning System, is the generic name given to several space based satellite navigation systems, the most widely used and known is the American NAVSTAR (Globally other systems include: Russia with GLONASS, Europeans run

GNSS, and China BNS). When most of us think or hear GPS we think of a hand held receiver these are the smallest end user components of the system. The system as a whole also includes at least 24 satellites and a number of known ground stations that all work in concert.

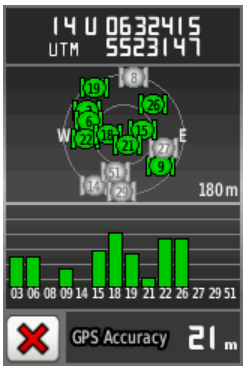
In very general terms all of the satellites 'know' exactly where they in space relative to each other and to the ground stations. Each satellite transmits a radio signal with a time stamp and some information on the location of the satellite (this is a GPS sentence). Using this information your small receiver can calculate where exactly it is located on the surface of the earth through something called trilateration. If the GPS receiver can only 'see' one satellite the distance (time) to the satellite is known (e.g. somewhere in a 20,000km circle) , with two satellites the GPS can narrow things down a bit by finding where the two distance circles overlap (still a really big area). With three satellites the point at which all of the circles overlap is the location. With four satellites a rough elevation can be calculated. Most current GPS receivers will use more than the minimum of satellites at the same time to provide an over determined solution.



Considering the satellites are 20,000km above the surface of the earth it is pretty impressive that the basic accuracy is usually within 10-15m. This accuracy can be improved by using a Wide Area Augmentation System (WAAS) taking the accuracy down to 3-5m.

The final determined location is not perfect; there is always some level of error associated with the final point. This error comes from a few sources and understanding these sources will help if you want to improve the location estimate. There is some error caused by the signal travelling through the atmosphere and a little because there is possibly some 'wobble' in the satellite orbit and clock accuracy. These are things that we can't do anything about ourselves but the WAAS can help correct.

There are some sources of error that we can adjust for by understanding the limitations of the signal and how locations are calculated. The radio signals that are used by GPS are relatively weak and are blocked by anything containing water, metal or rock. In a very basic sense if you can see the sky you should be able to get a signal. Buildings, trees, and cliffs all block the signal so move to where you have a better sky view. The other significant cause of error is the arrangement of the satellites in the sky. If the satellites are all clumped together then getting a good location is often a problem. If the satellites are spread out over the sky it is easier to get a good location. Since the satellites move at 2.6km/second wait a bit and the constellation arrangement will improve. Because the GPS needs to receive a whole sentence from each Satellite the first fix or location that the receiver gets after turning it on may not be the best. Wait a while, sometimes 15 or 20 minutes will be required, for more information to be collected from more satellites to obtain the 'best' possible solution. The system was made specifically to work in all kinds of weather; if it is raining or snowing hard enough to cause a significant degradation to the signals then you probably have much worse things to worry about.



Getting a pin point within 10m is pretty impressive, but when we are canoeing with map and compass getting within 100m should be enough for most purposes. You might hear people talking about the American government adding a random error in the signals. This degradation was called Selective Availability (SA) and was turned off at midnight May 1, 2000 at the direction of President Bill Clinton.

Datums

Under the maps section we looked at datums and why they might be important. When working with a GPS receiver the default datum is WGS84 (which is basically the same as NAD83). If you are using only a GPS receiver by itself which datum you set is generally not important since the whole system references back to its base system. If you are working with a map and GPS receiver or someone else is giving you co-ordinates then the Datum in your GPS receiver must be set to match the source.

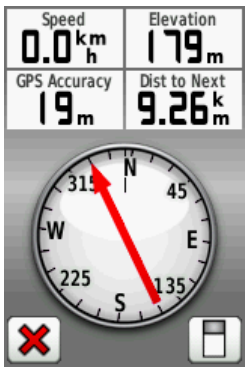
Waypoints

You can use GPS receivers to mark and save electronic markers called Waypoints. These waypoints are associated with a location on the surface of the earth. Once a waypoint is set you can 'ask' the GPS receiver to give you the direction (Bearing) and distance to that point. Many GPS receivers will display something that looks like a compass rose with an arrow to the destination – be warned that until you start moving the arrow may not point in the direction you need to go, only the bearing itself will be correct. A GPS receiver is not a compass.

Marking a waypoint in your GPS receiver can be done in two ways: 1. When you are standing at a particular point you can 'Mark' the waypoint. Usually there is a button on the GPS receiver that allows you to mark the current

location. 2. If you have received a location from another source (e.g. read it off of a map) you can enter that location into the GPS.

One of the great things about most GPS receivers is that you can set them to work in any number of different co-ordinate systems and datums. When we looked at maps on the prior page we talked about two co-ordinate systems (Latitude/Longitude and UTM). Once you have set the co-ordinate system you can read or enter the co-ordinates directly. When working with Latitude and Longitude there are three different formats people often used – be careful you don't get them mixed up: 1. decimal degrees (N50.003050 W095.185264), 2. degrees decimal minutes (N50°00.1830' W095°11.1158'), 3. degrees minutes seconds (N50°00'10.98" W095°11'06.95"). When working with UTM there are two common formats that give you a location within a meter: 1. UTM (15U 343405 5541258), and 2. MGRS (15UUR 43405 41258).

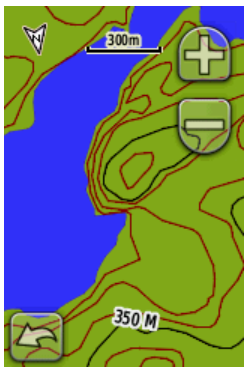


Direction and Speed

A GPS receiver when sitting by itself can tell you the bearing and distance to a waypoint. Once you start moving the receiver can also point the direction to a waypoint and tell you how fast you are going. It can even provide estimated time of arrival, distance covered, etc… Speed is calculated based on knowing the location changes over time and some radio wave magic called Doppler shift.

Other GPS Doo-dads and information

A basic GPS receiver will only give you numbers back (lat/long, bearing, distance, speed). There are more expensive receivers that can be loaded with maps (including topographic maps). I would strongly recommend taking actual topographic maps with you for two reasons: 1. GPS receivers run on batteries and, as electronic gizmos, they can be dropped, broken, stop working, run out of power, etc… 2. the screen real estate is quite small on a GPS, great for where am I right now but problematic for planning over a day of paddling.



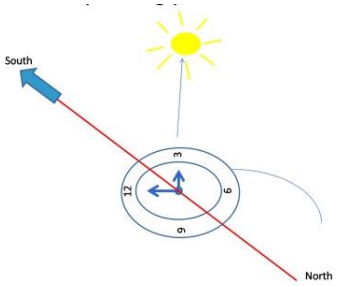
If you move more than about 300km or have left the GPS receiver turned off for a long period (e.g. a month) then it will not know where it is or the time. In these situations it might take a while (e.g. 15minutes) for the GPS receiver to find satellites, listen to their whole sentences, and calculate a location fix. If the GPS receiver has been turned on recently and it has not moved very much since the last time it was used, getting a locked on fix generally takes much less time (e.g. 30 seconds).

Remember GPS receivers run on batteries so you will likely want to bring some extras. Typically when I am out wandering (paddling) around in the wilderness I turn on the GPS receiver only occasionally when I need to find out where I am or mark a waypoint. Between those times I use my map and compass which allows me to maximize my battery life so the GPS receiver will work when I really need it.

Other Navigation (hints)

If you are really lost – don't wander around. You filed a plan (right?), someone will come to find you when you are late returning. Occasionally you will end up a little disoriented and just need some help (don't count on your intuition unless you want to walk in circles). Remember the first in the manual, periodically take a look around, sometimes just stopping and taking a rest, eating a snack, and thinking about what you noticed before will help you orient yourself.

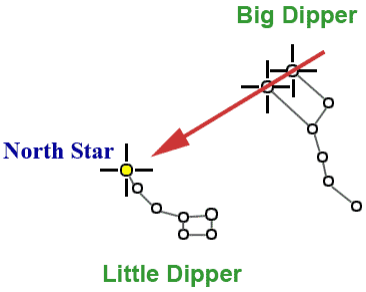
If you know there is a large baseline or handrail (like a river) in a certain direction you can use some environmental references for working out direction.



- In the northern hemisphere if you point the hour hand on your watch toward the sun the half-way point to 12 is roughly south. The error can be pretty substantial depending on the time of year, daylight savings time, which side of the time zone you are in, etc… but if the baseline is big enough it might not matter.
- Push a stick into the ground in a sunny clear location. Mark the top of the stick periodically and see where the top of the shadow moves. Knowing that the sun rises in the east (west shadow) and sets in the west (east shadow) you can fairly easily create an east-west line over time.


South - for the northern hemisphere

- If the moon is in a crescent phase simply draw an imaginary line through the tips of its "horns" down to the horizon. The point where it touches is roughly South for the northern hemisphere. This is a pretty crude measure but, again, if your baseline is big it might just get you to a point you recognize. Personally I would strongly suggest staying put (don't walk around) in the dark.
- Use the North Star or Pole Star to determine the direction. Unfortunately the Pole Star is not very bright and can be difficult to find. Fortunately it does not move around and there are a few markers that point where to look. The Big Dipper, Little Dipper, and Cassiopeia are helpful when looking for the Pole Star.
    - Find the Big Dipper in the sky. Follow the edge of the cup 5 times its length toward a medium bright star on the end of the little dipper handle. You have found the North Star.
    - To double check that it's really the North Star, locate Cassiopeia. The North Star resides halfway between Cassiopeia and the Big Dipper.



If you want to find your Latitude all you need to do is measure the angle formed between the horizon and the polestar. Using your Latitude and Longitude you can generate a sky map with the TAU Astronomy Club Website (http://astroclub.tau.ac.il/skymaps/monthly/index.php)

- There are a few other stories out there about ways to find general directions – these are all pretty unreliable and are greatly affected by local conditions. Sea breezes (including some very large lakes) blow onto the land in the afternoon and at night blows back to the sea. In the north, near the tree line, branches on the stunted trees are often smaller or sheared off on the north/north west side. Moss and lichens grow more richly on the north side of the tree (rock) where there is more moisture (really don't count on this).

Weather (Continental North America)

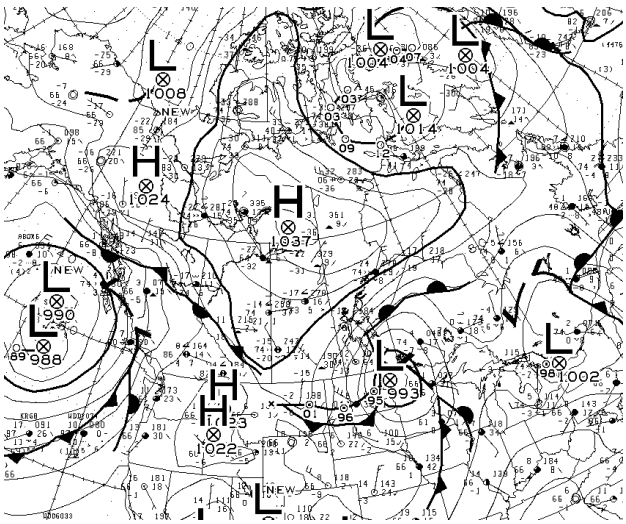
When out canoeing it is important to keep track of the weather. Watching the clouds, feeling the wind, and noticing temperature change can tell you a lot about what kinds of weather are coming. If you have a barometer (either in your GPS receiver or watch) keeping track of the change in pressure including the rate of change is also useful. Before leaving on any outing you should have an idea of what the weather will be like during the day – listen to the radio, check with Environment Canada, get a forecast. Even if the weather looks like it will be 'good' be prepared for a change. There are a few little verses that can provide some hints for what is coming as well.

To begin with it is important to know something about why weather happens. Weather, simply put, is the local and current state of the atmosphere – is it sunny, rainy, windy, etc… It is driven by differences in air density due to moisture and temperature between one place and another. Weather forecasting is trying to figure out what the weather will be in the future by understanding what causes weather to change – it is not easy.

On a global (or even continental scale) weather is driven by a small number of factors. 1. The sun warms the earth, 2. Air flows (wind) between warm and cold or low and high pressure areas, 3. The rotation of earth modifies how the air flows.

The air forms into large 'masses' that do not mix well on a continental scale. Over the middle and north of the continent cooler high pressure masses form and warmer lower pressure masses form over the water. Air does flow from higher pressure areas to lower pressure & where these air masses meet there is a region of significant weather change called a front. Typically whole air masses move from west to east. Air pressure is typically measured in millibars(mb) which have a typical range 980-1050. The normal sea level pressure is 1013.23(mb). In SI units the equivalent is a hectopascal or 100 pascals (just in case you hear that word). Environment Canada reports kilopascals (kPa) or 1000 pascals with a range of 98-105.

Due to the rotation of the earth air flowing into a low pressure area will cycle around in a counter clockwise direction (in the northern hemisphere). This is important to remember since changing unstable weather is often associated with low pressure systems and keeping track of these lower pressure systems will help with forecasting weather over the next day, or possibly two.



Environment Canada Surface Analysis Chart

Fronts

Cold Fronts

Cold fronts are formed at the leading edge of cooler air usually in association with a high pressure air mass. These fronts move fairly quickly (750km/day)

and squeeze underneath the air mass that they are pushing causing it to rise. There is a sharp change in weather often with showers or thunderstorms forming. After the front passes high pressure areas are typically associated with dryer clearing weather.

Look for cirrus, cirrostratus, and cumulonimbus as the front approaches, generally in fairly quick succession. The cumulonimbus clouds often form thundershowers that are followed by light showers and clearing with west or north-west winds after the front passes.

Warm Fronts

Warm fronts are formed on the leading edge of warmer lighter air masses. They are usually slower moving (500km/day) and come with longer periods of cloud and rain. They push up slowly over higher pressure air and form extensive cloud cover and precipitation. After the front passes expect little change in temperature and continued light precipitation.

Look for broad slowly increasing cloud cover in the order cirrus, cirrostratus, altostratus, nimbostratus, and then stratus with fog possibly forming. Occasionally in the summer cumulonimbus clouds also form indicating more violent weather. Generally precipitation starts as the front approaches and continues as it passes.

Occluded and Stationary Fronts

Just to make life more interesting the world will throw some curve balls. Cold fronts will often catch up to warm fronts creating what is called an occluded front which is usually associated with gusty unpredictable and possibly violent weather. These fronts are generally associated with a mature slow moving low pressure system. The passage of an occluded front usually means a dryer air mass is on its way. Stationary fronts can also happen, basically the weather stalls and you keep getting the same thing…

With a little bit of knowledge you can sometimes figure out what weather might be coming your way later in the day or the next day. Beyond the next day you might want to just guess. Not any one factor works all the time but put a few of them together over the period of a day and you might do pretty well at impressing your friends.

Knowing the Low

Low pressure systems (often approaching as warm fronts) tend to have stronger associated winds than the lighter more fickle high pressure winds. As a paddler you should be more interested in the less pleasant weather associated with warm fronts and low pressure systems.

To figure out where you are in relation to a low, put your back to the wind and point your left hand straight out; your hand points to the nearest low. This is also known as Buys Ballot's Law. Knowing that weather patterns tend to move west to east; if the low is

west then unsettled weather will be on its way – and you will likely have a few days of 'weather'. You might want to check a few times during the day to see where the low might be tracking.

If you have a barometric pressure monitor (or barometric altimeter) it can help predict changes in weather as well. Since we are not climbing in Manitoba or NW Ontario use your barometer for watching the weather instead of elevation. High and low pressure values by themselves are not really that useful but a change can say a lot. If there is a dramatic change, especially decreasing, watch out for more violent weather. The more rapid and extreme the pressure change over a few hours, the more extreme the weather change. This is particularly true when barometric pressure changes are associated with wind changes. If the pressure is changing by more than 1 mb/hour with a downward tendency expect stormy weather. If you see an upward and quick change, storminess is moving out and clearing may be coming in the very near future although it may be quite windy.

Typical Wind and Pressure Patterns (modified from Tim Herd)

Wind Direction	Barometric Pressure (mb)	Pressure Tendency	Weather Indications
SW to NW	1010-1023	Steady	Fair with slight temperature changes for 24-48 hours
SW to NW	1019-1023	Rising rapidly	Fair, followed by precipitations within 48 hours
SW to NW	1023 & above	Falling slowly	Slowly rising temperature and fair next 48 hours
S to SE	1019-1023	Falling slowly	Precipitation within 24 hours
S to SE	1019-1023	Falling rapidly	Increasing wind, precipitation within 12-24 hours.
SE to NE	1019-1023	Falling slowly	Precipitation within 12-18 hours
SE to NE	1016 & below	Falling slowly	Precipitation continues 24-48 hours
SE to NE	1016 & below	Falling rapidly	Precipitation, with high wind, followed by clearing within 36 hours, and in winter, by colder temperatures.
E to NE	1019 & above	Falling slowly	Summer: light wind, no rain for several days. Winter: precipitation within 24 hours.
E to NE	1019 & above	Falling rapidly	Summer: rain probably within 12-24 hours. Winter: precipitation with increasing winds.
S to SW	1016 & below	Rising slowly	Clearing within a few hours, then fair for several days.
S to E	1009 & below	Falling rapidly	Severe storm imminent, clearing within 24 hours followed by colder in winter.
E to N	1009 & below	Falling rapidly	Severe gale and heavy precipitation; in winter followed by colder temperatures
Toward W	1009 & below	Rising rapidly	Clearing, colder.

Watch the clouds
Cirrus clouds, those high altitude wispy things, are your long-range forecasters. Keep an eye on them if you see these gradually thickening and forming cirro-stratus or 'mackerel skies' you have a warm front on the way with a lower pressure system. Tie this in with the wind direction and pressure change and you are getting somewhere.

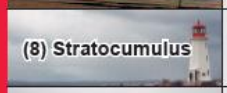
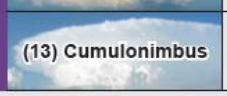
Cumulus clouds, or "fair-weather clouds," are the middle range of cloud which are characteristically white, fluffy, and lend themselves to imaginary shape-shifting. These are the happy-go-lucky clouds of the trade winds and high-pressure systems. If uncomplicated by further development, a parade of these simple cumulus clouds against a blue sky, absent of any cirrus or cirro-cumulus background, is a good indicator of decent or calm weather ahead

Cumulo-nimbus clouds result when cumulus clouds build up into the shape of a blacksmith's anvil. The heat of a summer day often causes morning's innocent cumulus fluff-balls to develop into towering anvils with white tops and very dark lower edges (squall lines) by late afternoon. The good news is that cumulo-nimbus developments tend to be very localized, though potentially extremely powerful in their vicinity. Because of their tremendous height from top to bottom, you can spot them a long way off on the water.

Red Sky at night sailors delight (breaking clouds to the west with sun below)

Know your Clouds
Clouds form when warm moisture carrying air moves upward through the troposphere and cools down causing the moisture to precipitate out into water droplets. The upward movement may be caused by several things: a cooler air mass undercutting a warm air mass, a warm air mass pushing up over a cooler mass, motion of air and wind over a rough terrain, convective currents over an unevenly heated surface. Upward movement next to mountains also happens but that is not really a significant feature here in north-western Ontario.

Clouds form in four very broad families based on the height of the cloud base and upward air movement – low, middle, high, and convective. Convective clouds are formed by convective currents, those that gliders like to use, rising from the ground level. The bases of convective clouds overlap the low and middle level clouds. Clouds within these four families are named for their appearance and the approximate height of their bases. The names are derived from combinations of the Latin words cirrus (curl or lock of hair), stratus (stretched out or layered), cumulus (heap), alto (middle), and nimbus (rain).

	Cloud type	Approximate height of bases	Average height	Composition
HIGH	 (1) Cirrus	6 to 12 km	9 km in summer 8 km in winter	mainly ice crystals
	 (2) Cirrocumulus	6 to 12 km	9 km in summer 8 km in winter	mainly ice crystals
	 (3) Cirrostratus	6 to 12 km	8 km in summer 6 km in winter	mainly ice crystals
MIDDLE	 (4) Altocumulus and (6) Lenticular	2 to 6 km	5 km	droplets or ice crystals
	 (5) Altostratus	2 to 6 km	2 ½ km higher if sun visible	droplets or ice crystals
LOW	 (7) Stratus	near surface to 450 m	usually below 300 m	droplets or ice crystals
	 (8) Stratocumulus	near surface to 2 km		droplets or ice crystals
	 (9) Nimbostratus	near surface to 2 km		droplets or ice crystals
CONVECTIVE	 (11) Cumulus	450 m to 3 km		droplets or ice crystals
	 (12) Towering Cumulus	450 m to 3 km		droplets and ice crystals
	 (13) Cumulonimbus	450 m to 3 km		droplets and ice crystals

Canada Cloud Chart (2010)

Cloud Types & Meaning

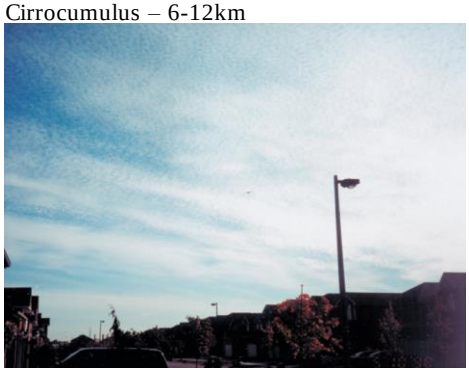
The descriptions of the clouds and cloud types are based primarily from the Environment Canada Cloud Chart (2010).

High Clouds

Cirrus Clouds – 6-12km

Delicate; detached, stringy bands; isolated tufts; mare's tales. If they drift slowly or stay still, fair weather indicated. Moving rapidly, followed by more clouds, foul
weather

Cirrocumulus – 6-12km



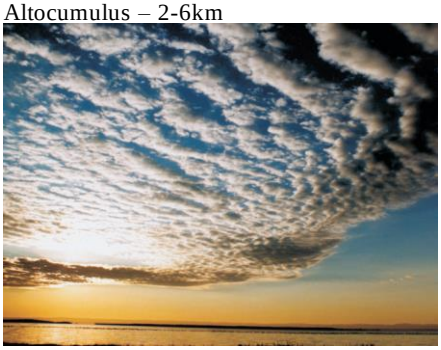
Ringlet heap; 'mackerel sky', Often appearing as extensive sheets. Often seen on the fringes of low pressure systems. No shadows. Changeable weather

Cirrostratus – 6-12km

White, thin sheet; may cover sky completely or appear in bands.. May form a halo around sun or moon. Usually indicates a large weather system and a change in weather within 24 hours. Rain when they thicken

Midlevel Clouds

Altocumulus – 2-6km



Lumpy pattern of flat, globular masses; white or grayish. Often forming bands across the sky. Often in larger group, closely packed with edges unclear. If in domed shape, a thunderstorm is possible. Small, isolated patches likely mean good weather. If thickens into solid bank and moves from south or west expect rain within 12 hours.

Altostratus – 2-6km

Thick sheet; grey or blue/grey. White spot in region of moon or sun but no halo. There is no shadow cast by objects on the ground. Often progress from Cirrostratus.. Thickening may mean rain

Lower Clouds

Stratocumulus – near surface to 2km

Large globular masses or rolls of dark clouds with a flat bottom. May evolve from Cumulus clouds that have lost form. May cover whole sky but blue patches often present. May precede or follow a storm and rain from these clouds alone is not intense.

Stratus – surface to 450m

Low, uniform; indefinite shape with little internal air movement. Gives a hazy appearance. May become fog on water's surface. Often present during a light steady rain or drizzle. When formed at ground level this is fog.

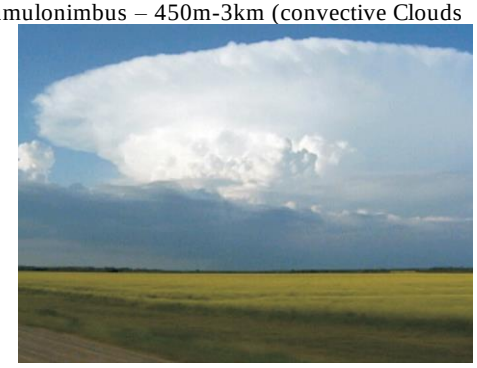
Nimbostratus – near surface to 2km

Dark, dense, thick covering entire sky that blocks sun completely; no shape, ragged edges. Steady all day rainfall

Cumulus – 450m-3km (Convective clouds)

Upper edges curved, lower edges flat; clean, detached fluffy puff balls with defined base. Flattened tops indicate stable air mass above limiting growth. When black or grey, possible thunderstorm. If they grow in elevation, they may develop into cumulonimbus. Small isolated patches indicate good weather

Cumulonimbus – 450m-3km (convective Clouds



Possibly the most dangerous Thunderstorm clouds. High vertical development; anvil top. Storm, weak or strong. Expect strong winds and heavy rain. Passes quickly, over a relatively small area of the earth's surface

Cumulonimbus Mammatus

Subsiding or sinking air causes these bulging structures to form on the bottom of cumulonimbus clouds. Although typically harmless the parent cloud may produce severe weather.

Fog
When visibility drops below 1km at ground level you have fog, at this distance keeping track of where you are on lakes can be difficult. The formation of a fog layer occurs when a moist air mass is cooled to its saturation point (dew point): cold water and relatively warm air often create fog, or warm water and colder air, a drop in temperature with high humidity can cause fog. Generally fog will only form when there is little or no wind. Fog often forms early in the morning and will burn off before lunch. Fog can be disorienting and it is easy to get lost, being lost in the fog is no laughing matter. Keep close to the shore or don't go out. Use a compass or GPS to ensure you keep moving in an appropriate direction.

Thunderstorms, lightning.
You should always watch and understand the weather that is coming and get to shore before bad weather forms. When there is a risk of lightning keep away from lone trees and open areas (outcrops/hills), stay low crouching with your feet together on a mat or sitting on your pack. More lightning fatalities occur from current traveling across the ground than from a direct strike so minimize the chance of being part of the ground current. The time between a flash and thunder gives you an idea of the distance of the storm (count seconds and divide by 5 to get miles, divide by 3 for km). A distance of at least 10km (30 seconds) is a reasonably safe distance when seeing a flash. You should wait for at least 30 minutes after the last flash is seen or thunder is heard before heading out again. Most lightning experts agree, either the sound of thunder or seeing lightning, no matter how far away, means you should take shelter.

Wind

Wind forms from the movement of air from high pressure areas to lower pressure areas. The strength and direction can provide a lot of information about the local weather, and what might be coming. As paddlers it is important to understand the interaction of the wind on the water, forming waves, and how the canoe can act as a sail and be blown around. Larger bodies of water can even create wind based on the temperature differential between the water and the land. Onshore during the day, off shore in the evening and night, these winds are not typically very strong.

Before setting out from a shore you should check if you are on the windward or in the lee side of land. When on the lee side the wind is blowing off shore and it is often difficult to tell how strong the wind is and how large the waves will be out on the lake. When leaving a lee shore check the wind by looking, and listening, to the wind as it flows through the trees above you. Do not plan to make open crossings from this situation because by the time you realize that it is stronger than you can handle it will often be too late. At best you can expect to rough it out, at worst, well... When on the windward side you will have the full force of the wind and waves. It is difficult to launch and land in these conditions.

When there are windy conditions, or you expect wind, plan to paddle where there is protection, if not from the wind at least from the waves. Islands and the lee side of shallow water areas help break up the waves.

Estimating Speed (Beaufort Scale)

In 1805 Francis Beaufort, a British Navel officer, introduced a scale from 0 -12 for measuring the speed of the wind at sea. He used everyday terms for each level of his scale. It is now used to describe the effect of wind on the surface of the water as well as on a range of everyday objects on the land – from smoke to flags, trees and roof tiles. Since it uses common everyday items it is a useful tool for estimating the speed of the wind which will help you decide if you should head out and the potential size of the waves. The following table is for general information you should decide on the conditions yourself based on experience if it is safe to paddle.

Beaufort Scale		Wind Speed			Conditions
		KM/H *	MPH	Knots	
0	Calm	0-1	0	0	Smoke rises vertically. Water surface is like a mirror. Nice paddling.
1	Light Air	1-5	1-3	0.8-2.6	Smoke drifts. Ripples on the water without foam crests.
2	Slight Breeze	6-11	4-7	3.5-6.1	Leaves rustle, weather vanes move, wind felt on face. Small wavelets without breaking crests.
3	Gentle Breeze	12-19	8-12	7.0-10.4	Light flags unfurl, leaves and twigs on trees move steadily Large wavelets some scattered white horses. Solo paddling becomes difficult.
4	Moderate Breeze	20-28	13-18	11.3-15.6	Small branches move, loose dust and paper fly about. Small waves frequent white caps,. Inexperienced should stay on shore. Tandem paddling becomes difficult.
5	Fresh Breeze	29-38	19-24	16.5-20.9	Leafy shrubs and trees sway. Moderate waves, many white caps. Very difficult to paddle tandem, rescues will be very difficult. Limit for most canoeists.
6	Strong Breeze	39-49	25-31	21.7-26.9	Big branches move, wind pulls umbrellas, whistling in telegraph/power wires. Large waves, many white caps. White foam forms and some spray off of the waves. Small craft warnings issued. Limit for most kayaks.
7	High Wind	50-61	32-38	27.8-33.0	Trees sway, walkers push into the wind. Large waves, white foam forms and blown in streaks. Communication is difficult.
8	Gale	62-74	39-46	33.9-40.0	Twigs break off trees, walking is hard.. Very large waves, crests break into spindrift.
9	Strong Gale	75-88	47-54	40.8-46.9	Shingles, slates, and branches are blown off. Slight building damage. High waves, dense streaks of foam, sea begins to role, spray.
10	Storm	89-102	55-63	47.8-54.7	Serious building damage trees uprooted
11	Violent Storm	103-117	64-72	55.6-62.6	Widespread damage, wild storm.
12	Hurricane	117>	73>	63.4>	Violent destruction of buildings & vehicles

https://en.wikipedia.org/wiki/Beaufort_scale

Coping with wind

Adjust canoe trim either by shifting packs or changing paddling positions. Keeping the canoe trim or slightly weighted into the wind helps, most of the weight should be centred in the canoe allowing the bow and stern to ride up and over waves. Care must be taken when using canoes that have high sides or bow/stern decks which will catch the wind and blow the canoe around. The traditional ‘prospector’ designs, most white water boats, and many general purpose tripping canoes have problems with catching wind.

Use a kneeling position or lower seats for increased stability and more powerful paddling. When paddling into the wind, shift your weight forward so that the canoe becomes slightly heavier in the bow. When travelling downwind, shift weight aft so that the canoe becomes heavier in the stern. In both cases, the downwind end of the canoe rides somewhat higher in the water with the hull acting like a wind vane. This is a balance because the heaver end may cut into approaching waves and take on water.

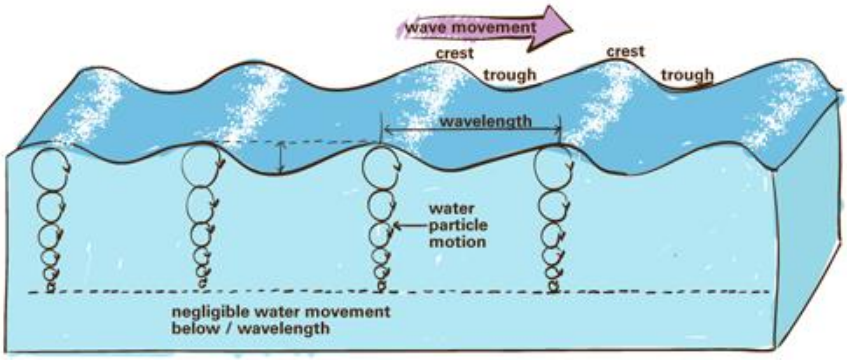
Adjust the trim of your canoe when paddling solo in wind to reduce the need for corrective strokes. If paddling on the leeward side, move slightly aft of amidships to lighten the bow. Use any appropriate stroke for maintaining a straight-line course such as the J stroke or forward sweep. If paddling on the windward side, move slightly forward to lighten the stern. Use any appropriate stroke for maintaining a straight-line course such as the C stroke.

When crossing areas of open water aim your canoe somewhat up wind of your destination. This will allow you to 'wind ferry' during the crossing and maintain a straight line of travel.

Dealing with Wind and Waves – some additional information
http://www.paddling.net/guidelines/showArticle.html?83
http://www.myccr.com/preparation/wind-and-waves

Understanding Waves

When the wind blows across the water, it adds energy to the water's surface, first as ripples and then into waves. Strong winds and storms can make enormous waves, particularly if the wind blows in the same direction for any length of time. You should keep in mind that waves are energy that moves across the water's surface and that the water only moves a little, in a small circle or ellipse, with each passing wave. The best way to understand waves as energy is to think of a long rope laid on the ground. Pick up one end and give it a good snap to create a ripple effect to the other end. This is just like the waves on the lake! Energy that is applied at one end moves to the other end as a wave. The energy is released at the other end of the rope, just as the energy of waves is released on shore. The energy to produce waves, in our case, is provided by the wind.



The size of a wave depends on:

1. The distance the wind blows (over open water) which is known as the "fetch",
2. The length of time the wind blows, and
3. The speed of the wind.

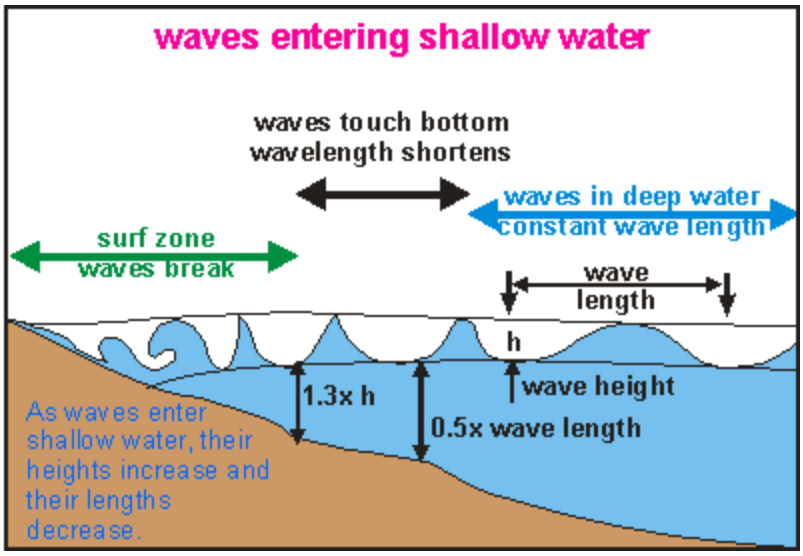
Undeveloped waves, usually from a short fetch, recent wind, or shallow(ish) water, generally have a shorter wave length and are typically fairly steep. The wind will continue to add energy and eventually waves will approach the speed of the wind. As deep water waves 'mature' they become more rounded with a longer wavelength. These long waves are called swells. Except on large deep lakes swells are not often seen in our area. When approaching shallower water (the shore) waves become steeper due to 'dragging' along the bottom. This drag causes the bottom of the wave to slow down, the top to starts to lean forward; the wave length is shortened at the same time. Steep waves will begin to topple over on themselves forming breakers when the steepness approaches an angle of 1:7. Waves start to drag when the water is shallower than half the wave length.

An idea of deep water wave height and wave length based on wind speed and fetch.

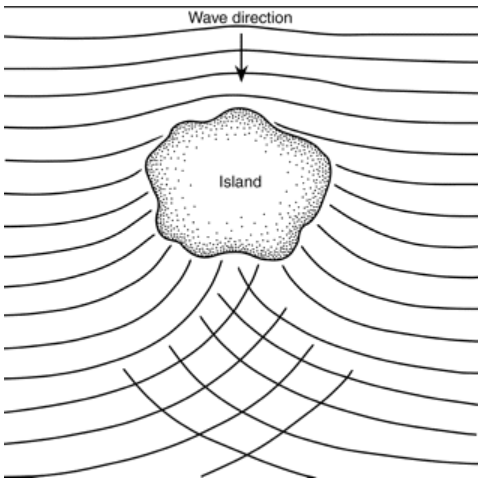
Wind		2km Fetch			5km Fetch			10km Fetch		
km/hr	m/s	Height	Length	period s	Height	Length	period s	Height	Length	period s
5	1.39	0.02	0.27	0.61	0.02	0.31	0.70	0.03	0.41	0.76
10	2.78	0.05	0.67	0.97	0.08	1.07	1.22	0.11	1.44	1.41
15	4.17	0.09	1.09	1.18	0.14	1.77	1.54	0.19	2.46	1.83
20	5.56	0.13	1.48	1.35	0.21	2.50	1.78	0.28	3.48	2.14
25	6.94	0.17	1.87	1.49	0.27	3.11	1.96	0.38	4.51	2.39
30	8.33	0.21	2.22	1.6	0.34	3.78	2.13	0.47	5.44	2.6
35	9.72	0.26	2.61	1.7	0.41	4.43	2.28	0.57	6.37	2.77
40	11.11	0.31	3.00	1.8	0.48	5.05	2.41	0.66	7.26	2.94

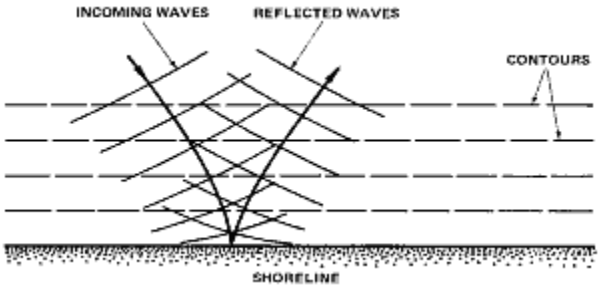
Measurements: wind as meters/second, height in meters, length in meters, period as seconds.

The numbers in the above table are for fully developed waves in open water with several hours of constant wind. Shorter periods of time might produce smaller steeper waves with shorter periods. As the waves approach the shore or shallow water they will become steeper (breaking), with shorter wave lengths.
The calculations were based on: USGS Fetch and Depth limited wave calculations
http://csherwood-usgs.github.io/jsed/Fetch%20and%20Depth%20Limited%20Waves,%20USGS.html
and http://wiki.answers.com/Q/How_do_you_calculate_wavelength_without_velocity
Further calculations using the above deep water wave to get information on breaking, refraction, and shoaling information:
https://www.comet.ucar.edu/portfolio/samples/SWW/sww_calc/sww_calc.htm#



Just too really confuse things the lakes that we generally paddle on have islands and bays which cause waves to refract and reflect. This can cause choppy appearing surfaces due to waves going in several directions. To make matters worse often these reflected and refracted waves can get together to form high steep peaks – it very difficult to paddle in this kind of mess.





Although water only moves a little with the passage of each wave, over a long period of wind water can pile up at the end of a large lake through being pushed by the wind and by air pressure. This feature is often referred to as wind set-up and can raise the water level on larger lakes fairly substantially – especially if the lake is relatively shallow (Lake Winnipeg for example) so there is less reverse flow along the bottom. Once the wind dies down the water will flow back as a long wave called a seiche (French meaning "to sway back and forth"), this wave will slosh back and forth across the lake raising and dropping the water level until it settles at an equilibrium. This long wave is often confused with tides (seiche tide) on larger lakes. Although this type of event will usually not be noticed on smaller lakes it is important to remember when beaching on shallow shore lines of large lakes since the water level can rise and fall on both sides of the lake

for some time after a sustained wind or strong weather system passes; if you are not wary your boats can float away.

Wave Parts

The crest is the highest part of the wave and the trough is the lowest. The distance between the crest and the trough is the wave height. The distance from crest to crest is the wave length. The period of a wave is the time it takes for each crest to pass a certain point.

- STILL-WATER LINE - The level of the lake if it were flat without any waves.
- CREST - The highest part of the wave above the still-water line.
- TROUGH - The lowest part of the wave below the still-water line.
- WAVE HEIGHT - The vertical distance between the crest and the trough.
- WAVE LENGTH - The horizontal distance between each crest or each trough.
- WAVE STEEPNESS - The ratio of wave height to wavelength is the wave's steepness.
- WAVE PERIOD - The time it takes for two successive waves to pass a particular point. For example, it you are standing on a pier and start a stopwatch as the crest of a wave passes and then stop the stopwatch as the crest of the next wave passes, you have measured the wave period.
- WAVE FREQUENCY - The number of waves that pass a particular point in a given time period.
- AMPLITUDE - The amplitude is equal to one-half the wave height or the distance from either the crest or the trough to the still-water line.

More information on waves:

http://www.waterencyclopedia.com/Tw-Z/Waves.html
http://en.wikipedia.org/wiki/Wind_wave
http://www.seafriends.org.nz/oceano/waves.htm

Paddling in Waves

When it is windy with significant waves the best advice is to stay on shore. If you are out in waves remember that they will become steeper and break near the shore or in places where the water is shallower (shoals), watch for this as you approach or leave the shore. All waves are not equal – waves can be quite variable with individual larger waves appearing. Always check the wind conditions before heading out across a lake or a bay, even if the fetch is not great (e.g. 1km) since waves can come up un-noticed from off shore winds. Another problematic area is where wind waves are pushed into current coming out from a river, the opposition between the two create large steep breaking and inconsistent or erratic waves. You should plan extra time if you need to cross large areas of open water or long exposed shore lines. This gives you the opportunity to wait out bad conditions without fretting and lets you enjoy the break.

It can be tricky paddling in waves as they push the canoe around a lot. Even small breaking waves can swamp a canoe. Keep paddling – with your paddle in the water you have a chance to brace and the paddle may act as a simple out-rigger. Keep your trim appropriate. Common dogma has the canoe riding a little light in the bow makes going into waves a little more stable and easier to control, but the canoe is more affected by the wind. Kneel for better balance and limit the amount of heel. Moving toward the middle of the canoe will allow the bow and the stern to ride up and over waves for a dryer more stable ride.

Some people argue that the canoe should be weighted forward so it will turn into the wind (waves) if you stop paddling or have problems the wind – this may provide a safer and more stable paddling position. In a forward weighted canoe, when solo, paddling on the up-wind (waves approaching) side. This means if you start to 'slide' off of the front of a wave a low brace will be onto the higher wave and movement will be away from the paddling side (minimizing the chance of the paddling digging into the wave and causing a capsize).

The shape of the canoe you are using can make a considerable difference. Canoes that have full or blunt entry lines (e.g. moving water and most tripping boats) will ride over the waves, canoes with narrower entry lines will cut into waves. Canoes with more flare, rather than straight sides or tumblehome, will deflect waves out and away from the canoe. Canoes with rocker will be easier to turn and manoeuvre when necessary and may ride over waves. Use of a spray skirt will minimize the amount of water that comes into the canoe if a wave does break over the bow.

Wave length is almost as important to understand as the height of the wave. Watch the length of the waves and if they are about the length of your boat or shorter you will need to be careful since you can be pushed into leading (or following waves) or 'take air' off of the top of the waves. When paddling in waves some people suggest that you should quarter into or with the waves. This may be important consideration with shorter waves since it provides a longer apparent wave length and less chance of surfing and/or reduces the chance of the bow or stern submerging into oncoming waves. The problem with quartering the waves is keeping control of the canoe, every time you go up or come down

from a wave the canoe will tend to slide off of the wave and be pushed broadside (broach); you will need to work hard at keeping control. Sliding off the wave is exacerbated by the wind.

I find padding in trailing winds difficult and stressful because you cannot see what is coming and turning to look can make you particularly unstable. When a wave lifts up the back end of the canoe you may start to 'surf' and cut into next wave if the wavelength is about the length of the canoe. The other complicating factor are those circles mentioned earlier – when running with the wind the top of the wave gives you a little forward push, the bottom a backward push. When coming off the top of a wave the stern is being pushed forward and the bow backward making control very difficult, the canoe will 'want' to turn broadside. Alternatively trying to paddle up the back side of a wave can slow the canoe; the canoe may even start to slide back or wallow and a wave could overcome the stern. Having the bow or stern submerged is less likely when the weight is shifted inward to the middle.

Paddling broadside or parallel to breaking waves is perhaps the most difficult position to be in; if you must head out try pick a route that limits crossing he wind, and use a wind ferry to carry you in your desired direction. In longer non-breaking swells it is not as problematic since as the canoe will just ride up and down, like a cork. You still need to be careful and allow the canoe to roll, to some degree, underneath you; when you approach the shore or shallow areas be prepared for shorter, taller, breaking waves. If you are broadside to waves that are about 1 to 1.5 times the width of your canoe you are in very difficult situations even if the waves are not breaking since the time you have to react (adjust) to keep your centre over the boat, is very short. Bracing is typically done up on the top of the oncoming wave (Upwind).

Landing or launching in large breaking waves can be a tricky adventure. In all cases rocky and steep shorelines should be avoided if at all possible. When landing don't hurry and don't panic, look for a sheltered stretch, inlet, or island without breakers. Determining the size of breakers against the shore is difficult; sometimes it is just guess work and luck. Proceed with caution and let the most experienced paddler land first so they can help the rest of the group. When launching – wait! Remember you have left a trip plan and you have spare equipment and food in case of emergency. In both cases land and launch perpendicular to the shore since waves will easily overwhelm the canoe if you let it go broadside.

Landing in steep shorter waves that often found on smaller lakes (e.g. Shoal Lake) is difficult, the following is what I have found to work on beaches and shallow shores (remember rocky steep shores should be avoided). You need to be quick and willing to get wet since you must step out as you approach the shore so a following wave cannot overcome the boat. If possible follow the crest of a wave into the shore to give you the best depth possible but avoid surfing. Surfing into the shore can be hard to control and you can easily bottom out the front of the boat in the trough causing you broach and tumble. Just as the water becomes shallow enough to step out ship your paddle, push up on the gunwales and step over the side of the canoe, quickly move forward and pull the

boat up through the surf zone as the next wave pushes the canoe forward. The advantage of a shallow shore or beach is the boat can float up to a position that you can stand in the water. Timing is everything and it requires practice!

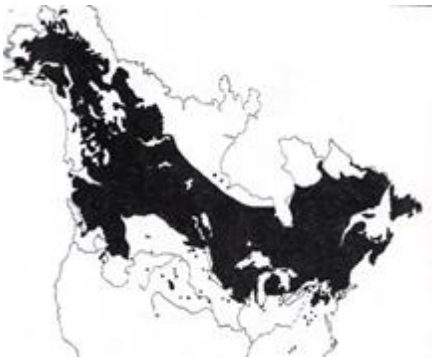
See the following site for more information on paddling in waves and wind:
http://paddling.net/guidelines/showArticle.html?83

Canoe – A brief history

The word 'Canoe' simply means 'boat' and comes from the Arawak language of the West Indies; it was translated through French (or Spanish) and picked up by the English. The word has come to mean a slender boat, pointed at both ends, and propelled by paddles – this is why in many places the word has come to represent both open canoes and kayaks. In our part of the world the canoe has become synonymous with the shape of an open bark or skin boat with an internal frame, but there were also many dugouts built and used where there were large enough trees, and skin boats were used in many places (esp. in the north) where any kind of trees were not common. There were even boats that we would now think of as coracles, and in the mid-west and southern areas boats that looked more like SOTs.

Canoe design came out of experimentation and use; just trying things out over many [thousand] years and generations. The basic shape has stood the test of time. John Winters pointed out that "…it doesn't require an extraordinary amount of design knowledge to build a canoe. If you pinch the ends of the boat, it's hard to screw it up. You will get a decent boat as long as you don't do too much to it. It doesn't matter whether you use PVC pipe, or wood. Just let rigid materials bend in a more less a natural way, do the least you can to control it, and you'll get a boat that somebody will think is the best thing since sliced bread. I can guarantee it, especially if it's a pretty colour."

In our area the quintessential canoe is the birch bark canoe, typified by those made by the Ojibwas of the upper Great Lakes. Bark from white (or paper) birch composed the structure of the canoe hull. The bark was laid up first in a rough form; fine roots from white pines, or other conifers, were used to sew the birch together. The seams were sealed with pine resin. Wood from white cedars was used for the internal frame, and put in last to support and strengthen the boats natural shape. Bark boats were lighter and could be made into more shapes than dugout canoes.



Extent of Paper Birch in N. America

Bark, skin, and dugout boats gave way to a more modern form with wood strips covered by canvas or paper. Most recently even those materials have been replaced by aluminum, epoxy & fiber (e.g. fiberglass), and plastic (including ABS).

Based on archeological evidence, canoes have played a significant role in North America for transportation, culture, survival, and trade since the first travelers appeared. There are suggestions that the basic canoe (at least in concept) was developed in Asia, possibly Japan, before migration to North America. The original design may have been brought across the Bearing land bridge putting the original North American canoe at 10-12 thousand years old. There are suggestions of boat travel long before this time in Asia and Europe, some suggestions put basic development of boats as long ago as 40 thousand years.

(Attributed: D. Gordon E. Robertson)

The most romanticised period in North America started shortly after the French explorers and fur traders arrived during the 17th century. They adopted the canoe for navigating rivers and lakes. The canoe was used by colonial powers for trade and exploration. Alexander Mackenzie, David Thompson, and Lewis and Clark used the canoe while traveling across the continent. Until the late 19th century, the birch bark canoe was the fastest way to cross vast inland areas. When many of us talk about the use of the canoe for trade and travel we think about the Voyageur. The Voyageur and Coureur de Bois period was a relatively short time period starting sometime in the late 1600s or early 1700s when fur trading companies started actively traveling into the 'wilderness'. The end of the voyageur era was marked by the completion of the Canadian Pacific rail line and the closure of Fort William as a rendezvous point in 1892. Unfortunately, this time period represents a period of cultural appropriation of the canoe – the original inhabitants, their culture and lifestyle are all but ignored in popular literature and education.

The zenith of modern canoe popularity was probably in the early 1900s with companies such as Old Town, Peterborough, and Chestnut building wood-and-canvas canoes. During this time other materials were experimented with including paper. The invention of continuous sheet paper, for printing, allowed companies such as Waters & Sons of Troy (New York) to build boats with a seamless hull. Wet paper was stretched over a form and glued then sanded; the process was repeated until the hull was of sufficient strength. These canoes were popular in the north eastern United States. Paper racing shells were highly competitive during the late 19th century.

Although canoes were originally a means of transport, with industrialization and mechanization of transport they became popular for recreation and sports. John MacGregor popularized canoeing through his books, and in 1866 founded the Royal Canoe Club in London and in 1880 the American Canoe Association. The Canadian Canoe Association was founded in 1900, and the British Canoe Union in 1936. Paddle Canada (originally Canadian Recreational Canoe Association) was late into this field having been formed in 1971.

Flatwater canoeing was a demonstration sport at the 1924 Paris Olympics and became an Olympic discipline at the 1936 Berlin Olympics. The International Canoe Federation was

formed in 1946 and is the umbrella organization of all national canoe organizations worldwide.

Just after WW II Grumman Aircraft corp. was looking for something to build and company executive William Hoffman used the aircraft aluminum and forming techniques to build canoes. This was the advent of the artificial skin canoes. Aluminium was relatively light, had become common and easy to use, and most importantly it did not decompose. It did have some downsides – they were noisy and cold, were not inherently buoyant, and sheet metal had limitations on how it could be formed. Aluminum canoes did last and are still manufactured and used today.

A little later (1950s) Fiberglass canoes started to appear. Before this time the resins used were just too brittle to make a boat that would last. The first actual fiberglass was made by accident at Corning Glass by Dale Kleist who was trying to weld together two glass blocks to make a vacuum-tight seal when a jet of compressed air inadvertently hit a stream of molten glass. The resulting spray of fine glass fibers turned out to be a significant finding. On an equal weight basis, a strand of fiberglass is actually stronger than a strand of steel. Other lighter stronger fibers have been developed over time that have, in part, replaced fiberglass: Kevlar developed by Dupont in 1965 was available commercially by the late 1970s; carbon fiber was developed Royal Aircraft Establishment in 1963 but was not really extensively used until the later 20th century. There are a number of other fibers that are used alone or in combination in cloth used in composite canoes (e.g. Innegra, basalt, Spectra, Nylon). With Royalex being discontinued a number of companies have started working with a variety of fibers in an attempt to develop a material that is useful in similar conditions. Fiber canoes are light and strong and replaced aluminum as the most popular building materials at the low and high end of the field.

Plastic composites entered the canoeing field sometime in the late 1960s. ABS (brand name Royalex developed by Uniroyal) is a composite material, comprising an outer layer of vinyl and hard acrylonitrile butadiene styrene plastic (ABS) and an inner layer of ABS foam, bonded by heat treatment. ABS canoes are more expensive than aluminium or molded (roto-molded) polyethylene hulls. The material is heaver and less suited for high-performance paddling than fiber composite canoes. The significant benefit to ABS, and polyethylene, is the material can be bent, folded and generally abused with minimal hull damage. Unlike aluminum ABS canoes tend to slide over rocks, and along with shape memory, this feature makes the canoes popular in white-water and canoe tripping. As of April 2014 Royalex is no longer being made, Esquif has started to produce a similar material called T-Formex.

Today, the canoe remains a symbol of Canadian identity. It provides people with a sense of wilderness and an image of the routes and lives of the past. It also serves as a symbol of navigation, alliance, grandeur and territorial expansion. In 1935, Canada's first silver dollar was made for circulation. The reverse of the silver dollar was a modern design showing an Indigenous person and a voyageur paddling a canoe by the islet on which there are two wind-swept trees. In the canoe are bundles of goods; the bundle at the right

has HB, representing the Hudson's Bay Company. There are vertical lines in the background represent the northern lights.

> *The canoe carried aboriginal people for thousands of years, followed then by the explorers and the missionaries and the engineers and the surveyors….until in modern times it gives us the gift of freedom. The canoe is a vehicle that carries you into pretty exciting places, not only into whitewater but into the byways and off-beaten places….You are removed entirely from the mundane aspects of ordinary life. You're witnessing first hand beauty and peace and freedom – especially freedom….Flirtation with the wilderness is contact with truth, because the truth is in nature….I like to identify myself with something that is stable and enduring. Although [nature] is in a state of flux, it is enduring. It is where reality is. I appreciate the canoe for its gifts in that direction*. - Kirk Wipper

On a final note it is important to remember that the canoe was a practical tool that was in use by the First Nations of this land long before they shared their tools and knowledge, it was gifted for others to use. Although canoes (or at least long skinny boats, pointed at both ends) were used world wide they were a prominent and pervasive tool for travel, culture, and trade across North America. What we consider wilderness was "Home", the water-ways and portages were the "Streets and Highways" for the First Nation inhabitants. When we visit someone's home and city, even if it seems abandon [Wilderness] we need to respect the context.

> *The canoe increased our reach to shape the Canada we know today, carrying many to otherwise inaccessible landscapes. The canoe was a gift from First Nations to the immigrants from distant lands who used inadequate modes of transport, reflective of a different worldview. It was a gift that allowed the newcomers to flourish and grow. Most certainly, the canoe played a pivotal role in our collective past but it also has a significant role to play in our future.*
>
> *The canoe worked... with our geography to navigate waterways that connected people for trading and sharing. The shapes and patterns of each craft reflected individual personality, local culture and various functions, but often sharing the same general principles of design and construction. The canoe epitomized balance, strength, beauty, function and adaptability. It was built from various gifts of Mother Earth, shaped from the bounty of our wilderness, its design handed down through the generations, infused with spirit and responsible connections to a sustainable environment.*
>
> *Today the canoe continues to teach us. It offers us an opportunity to understand and celebrate the accomplishments and contributions of First Nations peoples. These contributions have long been absent from our historical narratives. It invites authentic questions and encourages connected thinking in a variety of different ways. It can serve as a catalyst*

for a transdisciplinary, wholistic approach that can offer meaning and insight into the values and worldviews of the people who created it. It provides opportunities to learn about each other.

We need to refloat or right the canoe that is Canada, especially as we work towards reconciliation. This is both hope and challenge for us; what we strive towards as real possibility for a shared future; to remind Canadians that we're all in the same canoe and that to make this country work we should all be paddling together.

https://4nishart.wordpress.com/2017/03/08/re-canoe-figuration/

Mike Ormsby

Further Reading:

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Dean, Misao. *Inheriting A Canoe Paddle.* University of Toronto Press. 2013

MacGregor, Roy. *Canoe Country, The Making of Canada*. Vintage Canada. 2016

Neuzil, Mark, and Norman Sims. *Canoes, A Natural History in North America.* University of Minnesota Press. 2016.

Raffan, James. *Bark, Skin and Cedar.* Harper Collins Pub. Ltd. 1999.

Roberts, Kenneth G and Philip Shakleton. *The Canoe*. Macmillan of Canada. 1983

Canoe types, All About Canoes (canoe.ca)
http://www.canoe.ca/AllAboutCanoes/canoe_types.html

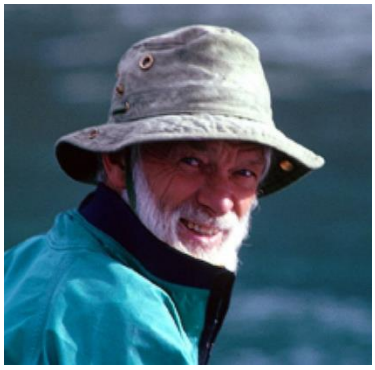
The Canoe (McGill University Digital exhibitions & collections)
http://digital.library.mcgill.ca/nwc/history/12.htm

History of the Canoe (by Ray Klebba's White Salmon Boat Works)
http://www.raysdreamboats.com/canoehistory.asp

Recreational Canoeing in Canada: Its History and Hazards, Canadian Geographic.
https://www.canadiangeographic.ca/sites/cgcorp/files/images/web_articles/magazine/ja12/recreational_canoeing_web.pdf

Bill Mason, A Canoeing Legacy

Born 1929 in Winnipeg Manitoba, Died October 29, 1988 at Meech Lake



> "He is a man enthralled with the sheer joy of guiding a canoe through challenging rapids in the early spring, awestruck by the beauty of nature as seen over the bow of a canoe silently traversing a mirror-smooth lake in the early morning…" –Pierre Trudeau (October 18, 1919 – September 28, 2000)

Bill Mason was an award winning naturalist, artist, film maker, author and canoeist. Throughout his adult life and afterward he has had a profound influence on modern canoeing across Canada and around the world. His skills, methods, and techniques were adopted by many Canadian Canoe and Youth Camps, canoe clubs, wilderness expedition companies, and other canoeing organizations. He canoed all of his life, ranging widely over the wilderness areas of Canada and the United States. He brought canoeing to life for me during the 1970s and 80s through his books, films, and artwork.

Bill was heavily influenced by his experiences at Pioneer Camp both in his love for the wilderness and canoeing, and his Christians belief and ethics. "Pioneer Camp has been the greatest single influence on my life. When I say Pioneer Camp, I mean both the place and the people. I went to camp as a fifteen-year-old with a natural love of the wilderness, canoeing and a fairly basic knowledge of God. It was camp where all these aspects of my life first took off and never came down. My memories of how my counsellors shared their knowledge of Jesus Christ, canoeing, the wilderness and all that goes with it are very vivid…" [1]

His interest in teaching and sharing his canoeing experiences and passions started with Pioneer Camp. During the early 1950s he developed the Pioneer Camp Canoeing program, the canoeing skills and techniques developed and taught at this time carried him forward through the rest of his life. His first film *Wilderness Treasure* was about a Pioneer Camp canoe trip. "…I thought the ultimate thing for me to make a film on, of course, is a canoe. Well, it would be a canoe trip because I'd been going to Pioneer Camps for years as a camper and then as a counsellor…it was just the canoe trip!"[2]

My first introduction to Bill Mason was as a child, in the early 1970s, in grade school. Our class had been talking about the Great Lakes and our teacher brought in a National Film Board film called *The Rise and Fall of the Great Lakes*. I have to admit it was not until I re-watched the film as an adult that I realized that the film was not about canoeing. Bill was not the star of the film but it did bring solo canoeing to life for me and made me search out more of Bill Mason's work.

Although I had been taught canoeing by many talented people over the years the gift of Bill Mason's book *Path of the Paddle* for a birthday present shortly after it was published was probably one of biggest influences on my canoeing. This book pulled together and

confirmed many of my beliefs about canoeing, it also expanded my understanding of canoeing skills immensely. Even today, after so many other books on canoeing have been published, I still believe that this book about canoeing is the best starting place for anyone wanting to learn the basics. For the solo paddler it covers everything in an easily readable and understandable format with good images and descriptions. The canoe, sitting/kneeling positions, strokes, mechanics, equipment, dealing with wind and waves, and our responsibilities with regard to the wilderness are all covered.

The *Path of the Paddle* film series is an excellent set for any canoeists library. The *Solo Basic* film, for example, covers all of the basic strokes used to control the canoe with clarity. But it also brings to life the joy and poetry of paddling solo. This is an inspirational film but for those wanting to learn more it provides all the fundamentals to the art of canoeing.

"Wilderness canoeing is a creative art, the paddling positions and endless combinations of strokes harmonize with the ever changing wilderness"[3]. Through films, books, and art Bill Mason has been an ongoing inspiration and continues to bring the wilderness and canoeing to life.

Books

- Path of the Paddle; An Illustrated Guide to the Art of Canoeing (1980, revised: 1995)
- Song of the Paddle; An Illustrated Guide to Wilderness Camping (1988, revised: 2004)
- Canoescapes (1995)

Films

- Path of the Paddle (1977) - a series of films on the techniques of canoeing
- Song of the Paddle (1978) - a film of one of Bill Mason's family wilderness canoeing
- Waterwalker (1984) - a feature-length film of Bill Mason's journey on Lake Superior

Honours and awards

- 1984: Award of Merit by the Canadian Recreational Canoeing Association "In deepest gratitude for your very meaningful contributions to the growth and development of canoeing in Canada."
- 1984: National Parks Centennial Award by the Ministry of the Environment, Government of Canada "In grateful recognition of the special contribution made by Bill Mason to the celebration of the National Parks Centennial".
- 1988: The Bill Mason Outdoor Education and Environmental Studies Centre opens in Ottawa
- 1989: Canadian Parks Service Heritage Award by the Ministry of the Environment, Government of Canada "Presented on behalf of the Canadian people to Bill Mason in recognition of your exceptional and significant contribution to Canada's heritage."
- 1989: Interpretation Canada Distinguished Service by Interpretation Canada "for excellence in the field of interpretation."

- 1990: Paddle Canada establishes the Bill Mason Memorial Scholarship Fund
- 1998: Bill Mason was honoured with a Canadian Postage Stamp depicting him in a whitewater canoe. Eight Million stamps were issued
- 2003: The Canadian Heritage Rivers Society creates the “Bill Mason Award” and presents it to a Canadian Citizen who has made an outstanding contribution to the canoeing heritage in Canada.
- 2009: Inducted into the International Whitewater Hall of Fame

Further Information on BillMason:
Mason Family Biography of Bill Mason: http://www.redcanoes.ca/bill/index.html
Bill Mason Wikipedia entry: http://en.wikipedia.org/wiki/Bill_Mason

References:
1. Bill Mason's Comments on Pioneer Camps, April 3, 2011
2. An Interview with Bill Mason Crux magazine, Vol. 9 No 4, Summer 1972
3. Path of the Paddle Solo Basic, 1977

Protection of Lakes and Waterways

Canoeists, as a group, have a responsibility to protect the lakes and waterways we use for our sport and enjoyment. In some cases, this is a legal requirement through Federal, Provincial, and local authorities. But generally, we have a moral obligation to ensure that we and those we paddle with 'do no harm' to the waters and land we use. Some of these principals are covered in other sections of this manual (e.g. '*Leave not Trace'* principals). This section will deal more specifically with the legally mandated requirements.

All of the Federal, Provincial, and local regulations covering lakes and waterways would make a substantial pile. Jurisdictions and authorities are complicated. The following is only a brief and certainly not comprehensive listing of Acts and Regulations but the list will include the major pieces of legislation affecting canoeists in Manitoba. While the legal documentation is complex, canoeists can be reasonably comfortable in knowing that if they follow basic common sense, treat the environment with respect, and learn practical advice such as '*Leave not Trace'* principals, they are unlikely to violate any legal statutes, regulations, or by-laws.

The first major hurdle is deciding which legislative authority has responsibility for what. The Federal Government has responsibility for sea coast and marine fisheries, navigation and shipping, international treaties or interprovincial regulations, federal works and undertakings, First Nations and lands reserved for First Nations, and canals, harbours, rivers and lake improvements. Provincial Governments administer activities completely within their provincial boundaries. So, resource management such as freshwater fisheries and mining development are handled by the provinces. Local governments are generally restricted to regulating local activities such as land development (through zoning), licensing private campgrounds, etc. So how does this really work and what do you need to know.

<u>Federal Legislation</u>

The majority of the Federal Legislation that affects lakes and waterways lies in 3 major pieces of legislation and 1 international treaty:

1. **The Canadian Environmental Protection Act**: In its simplest form, this Act lays out what humans can and cannot do with respect to potential impacts on the environment. Think of it as the law that keeps us from polluting ourselves to death. It is a large and comprehensive act but think of it as the single most important piece of Canadian legislation that protects the environment. (https://laws-lois.justice.gc.ca/eng/acts/c-15.31/).
2. **Fisheries Act:** The Fisheries Act does for fish and other aquatic life what the Environmental Protection Act does for the environment. It lays out what humans can and cannot do to the animal and plant life in marine and freshwaters in Canada. Note that the Federal Government has delegated authority for the management of freshwater fish to the Provinces but has not done so in the 3 Territories. This is why you buy a Provincial fishing licence. Again, most of what is in the Act is common sense and if you treat aquatic life with respect, you are unlikely to contravene this Act. (https://laws-lois.justice.gc.ca/eng/acts/f-14/)

3. **Navigable Waters Act:** An interesting Canadian invention, this Act. Basically, it regulates what can and cannot be done on 'navigable waters'. The Act authorizes and regulates interferences with the public right of navigation. A primary purpose of the NWA is to regulate works and obstructions that may interfere with navigation in Canada's navigable waters. The waterways are named in a List of Scheduled Waters as part of the NWA – there is a significant difference between the treatment of 'Scheduled' and 'Non-Scheduled' waterways.

   Transport Canada has developed a Navigability Assessment Framework to consistently assess whether a waterway is navigable. The framework includes criteria it must consider in each assessment. These criteria are summarized as:
   - Navigable in fact: Do the physical characteristics of the waterway support carrying a vessel of any size from one point to another?
   - Use by the public for navigation: Is the public currently using the waterway as an aqueous highway?
   - Historical use: Did the public historically use the waterway as an aqueous highway?
   - Reasonable appeal for public use: Is there a reasonable likelihood that the public will use the waterway as an aqueous highway?

   The Act: https://laws.justice.gc.ca/eng/acts/N-22/, also see: Determining navigability https://www.canada.ca/en/services/environment/conservation/assessments/environmental-reviews/navigation-protection/fact-sheet-determining-navigability.html)
4. **International Boundary Waters Treaty**: This is joint agreement between Canada and the United States that defines how the 2 countries will deal with trans-boundary waters. Rivers that flow across the border and lakes that straddle border plus waters affected by the actions of the other country are included. Most of the act is straight forward but interestingly, it has been used for some environmental issues such as acid rain. Canada argued that US air pollution contravened parts of this act when the fallout acidified Canadian lakes. (http://laws-lois.justice.gc.ca/eng/acts/I-17/).

While many more pieces of Federal legislation have roles in regulating lakes and waterways, these are the main players. Have a look at one or two of the Acts, you might find it interesting to see how a senior government views the environment.

Provincial Legislation

The Province of Manitoba has taken the lead in Canada by bringing together various components in the Department of Sustainable Development, Water Stewardship and Biodiversity Division (https://www.gov.mb.ca/sd/water/index.html). These include everything from fishing regulations to water use and licensing to water district licensing. Essentially, the Province's responsibility is to practically manage the water and water resources in Manitoba. While this is certainly an oversimplification, it is sufficient for the discussion here.

Local Governments

Local governments including cities, towns, and municipalities have the most limited legal impact on lakes and rivers. They are primarily the providers of services and, as such,

must adhere to the legislation of higher levels of government (Federal and Provincial). That being said, they do have the authority for some local licensing and regulation particularly of businesses. So, if you are thinking of using the services of a local business, it may be wise to check with the local government to make sure they are licenced and are operating legally where you will be paddling.

What if?

Legislation is designed to accomplish goals, in this case environmental protection and resource management. The idea is to have wild places and pristine wilderness for Canadians to enjoy for this and future generations. But we do live in an industrialized highly economic country. The environment and wilderness areas are constantly under pressure. Not everyone sees canoe country when they look at a forest. What to do if you become aware of problem.

If you suspect a violation of existing law has taken place, contact the proper authorities. Sometimes this takes a bit of effort because the law and jurisdictional responsibility is not always obvious. The local Provincial Conservation office is a good place to start. These folks know their region and they know the law. If the issue is immediate or potentially criminal, contact the local RCMP. What about less immediate but larger environmental issues? First, pay attention. Read and learn about the issue. Nothing kills good intentions faster than misinformation. Get other paddlers involved through organizations like Paddle Manitoba and Paddle Canada. They have members that can help. Manitoba is fortunate to have many organizations that can help. Try the local chapter of Canadian Parks and Wilderness Society, the Manitoba Eco-Network, or Nature Manitoba National organizations like The Sierra Club of Canada, The David Suzuki Foundation, or Greenpeace Canada may provide help or solutions (websites listed at the end of this document). If you think the problem is with the legislation itself, your Federal Member of Parliament or your Provincial Member of the Legislative Assembly needs to hear from you.

You now have a basic understanding of how various Acts and Regulations by 3 levels of government affect lakes and waterways. Not completely comprehensive but certainly the major items are covered. You also have a list of actions you can take if you see a potential violation of existing laws or if you think political or environmental activism is the solution.

Aquatic Invasive Species (Clean, Drain, Dry)

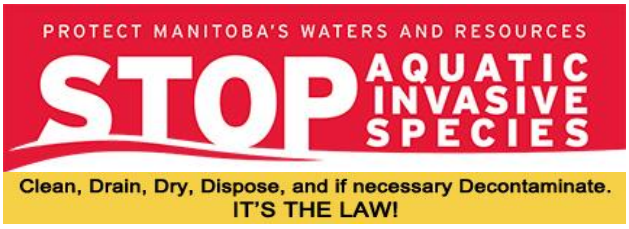
Currently there are only significant 15 aquatic invasive species (AIS) but they are all potentially damaging to aquatic environments. These non-native species have no natural controls and will grow unchecked, decimating local species and damaging habitat. The species include both animals (Zebra and Quagga mussels, Spiny Waterflea, Rusty Crayfish, Asian Carp, and others) as well as plants (Eurasian Watermilfoil, Curly Leaf Pondweed, Black Algae and others). The invertebrates and plants often ride along in mud/dirt and attach to surfaces in the water.

Taking a few precautions can help protect water bodies. Do not let your canoe sit in the water longer than necessary – generally crossing water bodies will not provide enough time for organisms to attach, but mud from portages and landings will carry hitchhikers. When leaving a water body: 1) Clean your canoe, including all equipment and gear by removing all visible plants, animals, and mud; 2) Drain any containers (including hull space) that holds water; 3) Dry all surfaces.

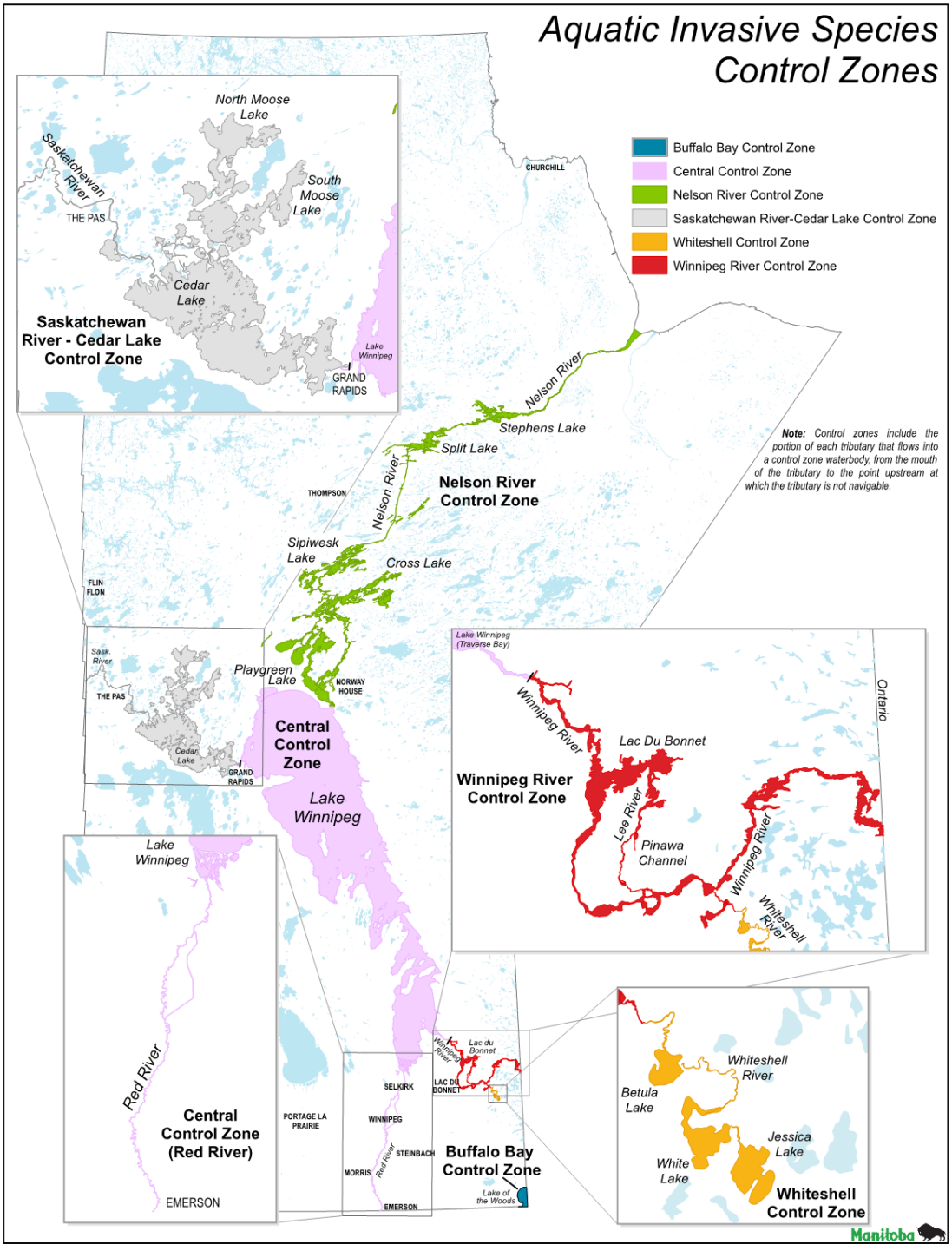
If you are leaving a designated Control Zone your canoe and any equipment that contacts the water will need to be decontaminated. This can be problematic if you cross a control zone as part of a trip. See the Decontamination page for full details: https://www.gov.mb.ca/stopais/spread/decontamination.html

Moving your boat without appropriately dealing with potential aquatic invasive species comes with fines ranging from $486.00 - $1296.00 (summary: https://www.gov.mb.ca/asset_library/en/ais/preset_fines.pdf). If you are working for a company then the fines may be double.

The province has setup Watercraft Inspection Program stations across the province with attention to primary transport routes and common points of public egress. National Parks have separate requirements, inspections and fines.



More information can be found from the Invasive Species Council of Manitoba (http://invasivespeciesmanitoba.com/site/index.php) and Department of Sustainable Development (https://www.gov.mb.ca/stopais/index.html)



from: https://www.gov.mb.ca/stopais/spread/controlzone.html

Leave No Trace Principles

Leave No Trace (LNT) Canada is a national non-profit organization dedicated to promoting and inspiring responsible outdoor recreation through education, research and partnerships. Leave No Trace builds awareness, appreciation and respect for our wildlands. Paddle Canada is a partner member with Leave No Trace Canada.

The Leave No Trace Principles of outdoor ethics form the framework of Leave No Trace's message:

1. **Plan Ahead and Prepare**
    - Know the regulations and special concerns for the area you'll visit.
    - Prepare for extreme weather, hazards, and emergencies.
    - Schedule your trip to avoid times of high use.
    - Visit in small groups. Split larger parties into groups of 4-6.
    - Repackage food to minimize waste.
    - Use a map and compass to eliminate the use of marking paint, rock cairns or flagging.
2. **Travel and Camp on Durable Surfaces**
    - Durable surfaces include established trails and campsites, rock, gravel, dry grasses or snow.
    - Protect riparian areas by camping at least 70 meters from lakes and streams.
    - Good campsites are found, not made. Altering a site is not necessary.
    - In popular areas:
        - Concentrate use on existing trails and campsites.
        - Walk single file in the middle of the trail, even when wet or muddy.
        - Keep campsites small. Focus activity in areas where vegetation is absent.
    - In pristine areas:
        - Disperse use to prevent the creation of campsites and trails.
        - Avoid places where impacts are just beginning.
3. **Dispose of Waste Properly**
    - Pack it in, pack it out. Inspect your campsite and rest areas for trash or spilled foods. Pack out all trash, leftover food, and litter.
    - Deposit solid human waste in catholes dug 15 to 20 centimeters deep at least 70 meters from water, camp, and trails. Cover and disguise the cathole when finished.
    - Pack out toilet paper and hygiene products.
    - To wash yourself or your dishes, carry water 70 meters away from streams or lakes and use small amounts of biodegradable soap. Scatter strained dishwater.

4. **Leave What You Find**
    - Preserve the past: examine, but do not touch, cultural or historic structures and artifacts.
    - Leave rocks, plants and other natural objects as you find them.
    - Avoid introducing or transporting non-native species.
    - Do not build structures, furniture, or dig trenches.
5. **Minimize Campfire Impacts**
    - Campfires can cause lasting impacts to the backcountry. Use a lightweight stove for cooking and enjoy a candle lantern for light.
    - Where fires are permitted, use established fire rings, fire pans, or mound fires.
    - Keep fires small. Only use sticks from the ground that can be broken by hand.
    - Burn all wood and coals to ash, put out campfires completely, then scatter cool ashes.
6. **Respect Wildlife**
    - Observe wildlife from a distance. Do not follow or approach them.
    - Never feed animals. Feeding wildlife damages their health, alters natural behaviours, and exposes them to predators and other dangers.
    - Protect wildlife and your food by storing rations and trash securely.
    - Control pets at all times, or leave them at home.
    - Avoid wildlife during sensitive times: mating, nesting, raising young, or winter.
7. **Be Considerate of Others**
    - Respect other visitors and protect the quality of their experience.
    - Be courteous. Yield to other users on the trail.
    - Step to the downhill side of the trail when encountering pack stock.
    - Take breaks and camp away from trails and other visitors.
    - Let nature's sounds prevail. Avoid loud voices and noises

More information on Leave No Trace Canada can be found on their website: http://www.leavenotrace.ca/

Paddle Canada – Information and Programs

In 1971, Paddle Canada (formerly the Canadian Recreational Canoeing Association) was formed to help co-ordinate the efforts of non-competitive canoeing and kayaking across Canada. The long term goals of the association included the development of standard skill sets for safe and enjoyable recreational canoeing and kayaking. By examining many avenues including existing programs, current trends and growth trends, Paddle Canada's first success was the creation of a national program for Canoeing. National standards for Sea and River Kayak and Stand-Up Paddleboard have also been developed as those activities have grown in popularity among recreational paddlers.

Paddle Canada currently represents over 2,500 instructor members. Through members and programs Paddle Canada has been able to successfully and consistently deliver the message of safe and enjoyable paddling to more than 10,000 paddlers annually.

Further information about Paddle Canada, its programs, and mandate can be found on their website: www.paddlecanada.com

Paddle Canada Vision, Mission, Values and Goals:

Vision: *We are a community of trusted leaders that inspires connections to Canadians and nature through paddling.*
Mission: *We promote, educate, and support the recreational paddling community, paddling instructors, and partners.*
Values: Professionalism, Authority, Respectful, Innovation, Quality, Welcoming, Green
Goals:

1. Inclusive and effective leadership
2. Innovative resources and supports for Instructors
3. Resilient Operations
4. Collaboration that supports and diversifies the Paddling Community

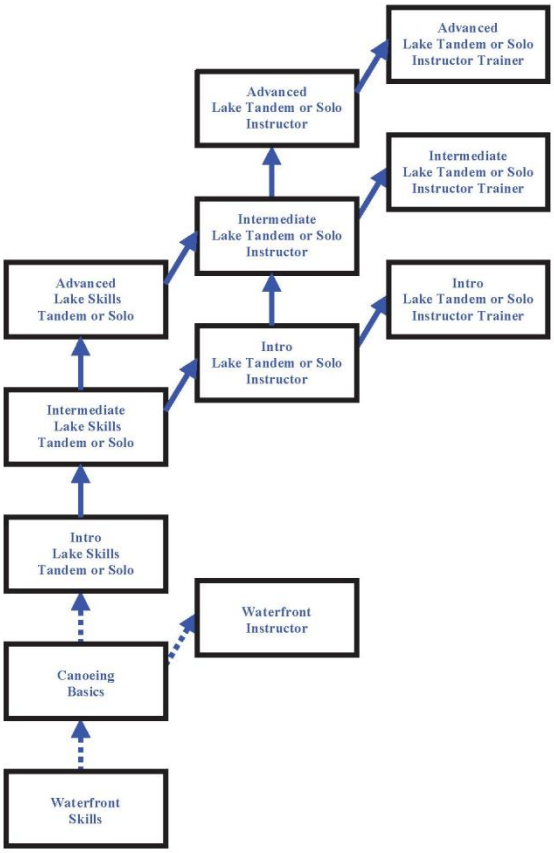
Paddle Canada Programs

- Canoeing
    - Waterfront program
    - Canoeing Basics
    - Lake Canoe
    - Moving Water
    - Canoe Tripping[4]
    - Canoe Poling
    - Coastal Canoeing
    - Big Canoe Program
    - Style Canoeing
- Sea Kayaking
- River Kayaking
- Stand Up Paddleboard
- Camping Skills

[4] In 2019 the Canoe Tripping program was discontinued and replaced by a unified Camping program that is consistent across Canoe, SUP, and Kayak programs.

Lake Canoe

From Waterfront to advanced Lake Skills programs, the Paddle Canada Lake Canoe program is designed to introduce paddlers to the activity of canoeing. Emphasis is placed on boat control and teaching the participants the necessary skills and knowledge to be safe and have fun while on the water.



Moving Water Canoe

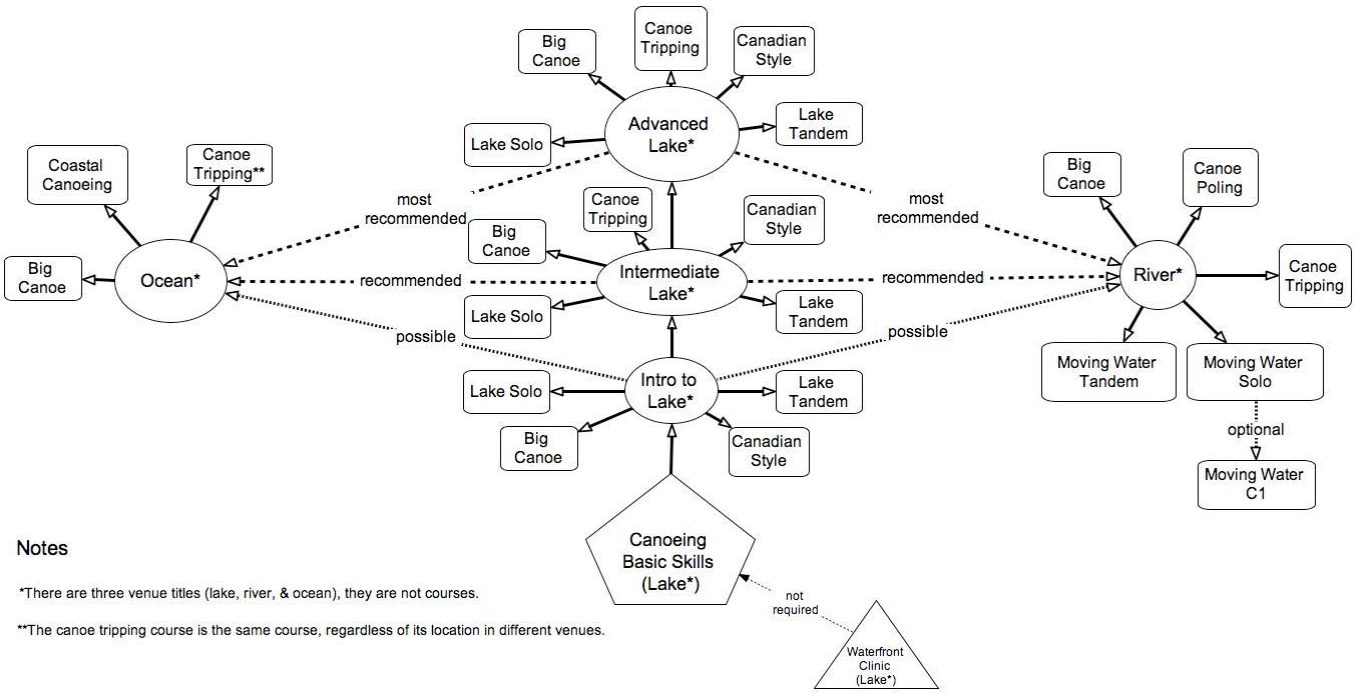
The Moving Water Canoe program offers paddlers the opportunity to increase their skill and knowledge of white-water paddling skills from small currents to progressively more challenging white-water (Class III rapids) conditions. Emphasis is placed on greater boat control, safety, and the thrill of white-water paddling.

It is recommended that those interested in Moving Water have Intermediate Lake Skills before entering the Moving water discipline.

Style Canoeing

The Style Canoeing program follows in the footsteps of Omer Stringer, Bill Mason, Becky Mason, and others paddling in a classic Canadian form also called “Omering”, Canadian Style, or Classic Solo Canoeing. This is a quiet water solo paddling style where the canoe is moved across the water in free flowing graceful motions and routines. It uses a traditional tandem canoe paddled on one side, with occasional cross strokes. The canoe is heeled to the paddling side with the gunwale near the water surface and the canoeist is quiet [sitting still almost invisible]; the focus is on the movement of the canoe.

Paddle Canada Hierarchical Canoe Program Venue Chart



Notes

*There are three venue titles (lake, river, & ocean), they are not courses.

**The canoe tripping course is the same course, regardless of its location in different venues.

Paddle Canada Canoe Program Progression Chart

	Big Canoe	Coastal Canoeing	Canadian Style	Lake Solo	Lake Tandem	Canoe Poling	Canoe Tripping	Moving Water C1	Moving Water Solo	Moving Water Tandem
Advanced	Big Canoe Leader	Coastal Canoeing	Canadian Style	Lake Solo	Lake Tandem	Canoe Poling	Canoe Tripping	Moving	Moving Water Solo	Moving Water Tandem
Intermediate	Big Canoe Leader	Coastal Canoeing	Canadian Style	Lake Solo	Lake Tandem	Canoe Poling		Water	Moving Water Solo	Moving Water Tandem
Introduction to	Big Canoe Paddler	Coastal Canoeing	Canadian Style	Lake Solo	Lake Tandem	Canoe Poling	Canoe Tripping	C1 (1 module)	Moving Water Solo	Moving Water Tandem

Canoeing Basic Skills

Waterfront Instructor

Waterfront Clinic ↔ not required

start here

Terminology

Amidships: The center or middle of a canoe.
Astern: behind the canoe
Bailer: A scoop (usually made from an empty bleach jug by cutting off the bottom) for dipping accumulated water from the bottom of the canoe.
Bang Plate (skid plate): A strip of material along the stems and bottom of the bow and stern of the canoe that protects the hull.
Beam: The width of the canoe, typically provided in three measurements: waterline, gunwale and maximum width.
Belly: The bottom of the canoe.
Bilge (Chine): The point of greatest curvature between the bottom and side of a canoe.
Bilge keels: Additional keels that run along the bottom of the canoe toward the bilge. Providing additional structure to large canoes.
Bow: The front end of the canoe.
Buoyancy chamber: Airtight champers usually at the bow and stern that provide floatation for canoes that are not inherently buoyant. May be filled with air or foam. May also be along the side of a canoe as a sponson.
Brace (Bracing Stroke): A stoke used to stabilize the canoe.
Bridle: A loop of rope around the canoe used for towing.
Bridging: When a canoe rests partially on water and on land. Makes the canoe unstable.
Broach (Broaching): To turn suddenly into the wind.
Broadside: A canoe, which is moving perpendicular to the current of a river, thus exposing its broad side to obstacles in the water.
Carry: See portage.
Chine: The point of greatest curvature between the bottom and side of a canoe.
Deck (Deck plate): Panels attached to the inwales at the bow and stern ends of the canoe.
Depth: The distance from the top of the gunnels to the bottom of the canoe when measured at the beam (sometimes called center depth, as opposed to the depth at the extreme ends of the canoe).
Dock: a platform built along or out from the shore (wharf/pier).
Draft: The amount of water a canoe draws.
Duffer: The middle or passenger in a canoe.
Entry Line: Shape of the bow where it cuts through the water.
Feather: Slicing the paddle back through the air as part of the recovery between strokes. See slice.
Flare: Occurs when the sides of the canoe are wider above the waterline, particularly at or near the gunwales.
Flat Water (Lake Water): Water without rapids, such as a lake or slow-moving river.
Floorboard: Temporary boards (usually in wooden canoes) running along the canoe to protect the ribs and planking, and distribute weight.
Flotation: Buoyant material set into the ends (or other panels) of a canoe to make it float if upset. Additional floatation is often installed in canoes.
Freeboard: Distance between the gunwale and waterline at the lowest point.
Foot-brace: A wood or metal bar against which a paddler braces his or her feet. Foot-braces help secure the paddler in

he canoe and so add to the efficiency of his or her strokes.

Fullness: Shape of canoe determined by how quickly the hull widens. A full canoe widens sooner and stays wide longer.

Grip: The handle of a canoe paddle, held by the 'grip' or 'control' hand.

Gunnels (Gunwales): Both outside and inside, top finished edges of a canoe. Also referred to as rails.

Heel: When the canoe is tilted continuously to one side.

Hull: Frame or body of the canoe.

Hogged: A canoe with a bent-in keel or keel-line.

Inwale: Inside top finished edge of a canoe.

Initial/Primary Stability: Steadiness when upright and paddled under calm conditions.

Keel: External ridge along the centerline of the canoe. Can improve tracking and stability.

Keel Line: Centerline of the canoe running from bow to stern along the belly of the canoe.

Lash: to securely tie an pack or other object into a canoe, or canoes together.

Leeward (Lee): A sheltered place out of the wind. Also, the direction toward which the wind is blowing.

Lining: The act of moving a canoe up stream or around obstacles with a lining rope.

Lining Rope: Rope used to tie up a canoe or pull it around obstacles in the water. Also refers to working a canoe downstream around obstacles in the water with the aid of ropes (lines) attached to the bow and stern.

Moving Water: Usually references a river that is moving quickly, may include rapids.

Outwale: The outside top finished edge of a canoe.

Painter: A length of cord or rope tied to the bow or stern of the canoe. Considerable discussion has gone into how long a painter should be.

Painter's ring: Brass ring anchored to the stem or deck of a canoe to attach a rope.

PFD: Personal Floatation Device.

Planking: Lightweight boards nailed to the ribs on wood-canvas canoes. Its main purpose is to support the canvas.

Port: Left side of the canoe when facing forward.

Portage: The physical act of carrying the canoe over land.

Powerface: the side of a paddle blade that pushes against the water.

Rails: The gunwales (gunnels) of a canoe.

Rapids: A section of river that is quickly moving with obstructions and turbulence (see River Rating Scale, White Water)

Ribs: Lateral supports which run at angles to the keel on the inside of a canoe. Ribs provide hull rigidity and structural strength.

Riffles: A shallow section over gravel or and creating small waves (usually in moving water)

River Rating Scale: A nationally recognized scale used by white-water canoeists to rate the difficulty of rapids. Rankings from Class I to Class VI. See Water Class and Characteristics.

Rocker: Indicates curvature of the keel line.

Secondary/Final stability: The resistance to capsizing in wind, waves or lean.

Shaft: This is the section of the paddle between the grip and the blade.

Skid plate: A piece of thick Kevlar that is glued to the bottom ends of a

canoe. Prevents abrasion of the skin of the canoe.

Slice: The movement of the paddle through the water with the flat of the blade perpendicular to the direction of movement – minimal drag during recovery between strokes.

Solo: Alone, single person. May also reference the kind of canoe – a Solo Canoe.

Splash skirt/cover: A fitted cover designed to keep water out of a canoe. Splash covers are useful in rough rapids and big waves.

Sponson: Buoyancy chambers that run along the sides of a canoe between the chine and the gunwale.

Spray Skirt: A water proof fabric covering over the canoe.

Starboard: Right side of the canoe when facing forward.

Stems: Finished edge/piece in the bow and stern ends of a canoe.

Stern: The rear end of the canoe.

Swamp: To sink the canoe by filling it with water.

Tandem: Two people or a canoe designed for two people.

Throat: The part of a canoe paddle just above the blade.

Thwarts: Crossbars toward the bow and stern of the canoe. Structurally maintains the canoe shape.

Tracking: (Canoe) The ease with which a canoe can be paddled along a straight line.

Tracking: (Canoeing) Working a canoe upstream, against the current, with the aid of ropes (lines) attached to the bow and stern.

Trim (pitch): The difference in the draft at the bow from that at the stern of a canoe. A properly trimmed canoe will sit dead level in the water.

Tumblehome: The inward curve of the sides of a canoe above the waterline.

Water Class and Characteristics: This nationally recognized scale is used by white-water canoeists to rate the difficulty of rapids.

Class I: Easy–easy bends, small rapids with low waves. Obstacles like fallen trees and bridge pilings. River speed less than hard back-paddling speed.

Class II: Medium–fairly frequent but unobstructed rapids with regular waves and low ledges. River speed occasionally exceeding hard back-paddling speed.

Class III: Difficult–small falls: large, regular waves covering boat. Expert maneuvering required. Course not always easily recognizable. Current speed usually less than fast forward-paddling speed. Splash skirt useful.

Class IV: Very Difficult–high, powerful waves and difficult eddies. Abrupt bends and difficult broken water. Powerful and precise maneuvering mandatory. Splash skirt essential.

Class V: Exceedingly Difficult–very fast eddies, violent current, steep drops. Splash skirt essential.

Class VI: Limit of Navigability–navigable only at select water conditions by teams of experts in covered canoes. Cannot be attempted without risk of life.

Waterline: The place to which water comes on the hull of the canoe when it is set in the water.

Weir: A low-head dam on a river. May also reference

Whitewater: Foamy (air-filled) turbulent water.

Yoke: A strong crossbar in the middle of the canoe designed for carrying the canoe on the shoulders. Often includes two yoke pads for more comfort.

Additional Resources

Books

Canoeing

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Environment Canada, Cloud Chart (Catalogue no. En56-134/1999E), Environment Canada, 2010

Herd, Tim. Discover Nature in the Weather. Stackpole Books, 2001

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Charles goes Canoeing – some eclectic information (http://home.cc.umanitoba.ca/~burchil/pm_canoe/)

Canadian Canoe Routes (http://www.myccr.com/)

Canoe Sailing Resources 2010 (http://freepages.genealogy.rootsweb.ancestry.com/~fassitt/canoe_mirror/canoe_sailing.html)

Canoeing.com (http://www.canoeing.com/)

John Winters Page (http://www.greenval.com/jwinters.html)

Nick Schade of Guillemot Kayaks, Kayak Stability (http://www.guillemot-kayaks.com/guillemot/information/kayak_design/kayak_stability)

Paddle Manitoba (http://www.paddle.mb.ca/)

Small Vessel Regulation (http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-91/)

Contraventions Regulations (Part II) (http://www.laws-lois.justice.gc.ca/eng/regulations/SOR-96-313/page-4.html

Compliance Guide For Human-Powered Non-Pleasure Vessels - TP 15204. TP 15204. Transport Canada. http://www.tc.gc.ca/media/documents/marinesafety/TP15204E.PDF

Rolf Kraiker, CCR Forum Discussion on Canoe Physics.
(http://www.myccr.com/SectionForums/viewtopic.php?f=20&t=3469)

Navigation
Atlas of Canada (Topographic Maps) http://atlas.gc.ca/toporama/en/index.html
QGIS (GIS software) http://www.qgis.org/en/site/
GeoGratis (PDF/TIF of Topographic Maps) (http://www.geogratis.gc.ca)
GPS Terms and Jargon
(http://home.cc.umanitoba.ca/~burchil/mantario/gps/terms_jargon.pdf)
GPS Information (http://gpsinformation.net/)
GPS Utility (http://www.gpsu.co.uk/)
Manitoba Land Initiative (http://web2.gov.mb.ca/mli/)
Online Declination Calculator (http://geomag.nrcan.gc.ca/apps/mdcal-eng.php)
Paddle Manitoba Ripple 2007
(https://paddlemb.clickonce.ca/files/ripple/archive/Ripple_fall_07.pdf)
Paddle Manitoba Ripple 2008
(http://paddlemb.clickonce.ca/files/ripple/archive/Ripple_winter_08.pdf)
Topographic Maps the Basics
(http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/topo101/pdf/mapping_basics_e.pdf)

Knots
Knots by Grog (http://www.animatedknots.com/index.php)
NETKNOTS (http://www.netknots.com/html/paddling_knots.html)

Weather
Mare's Tails and Mackerel Skies (http://www.landfallnavigation.com/mares.html)
Coping with Wind, Canoeing (http://www.paddling.net/guidelines/showArticle.html?83)

Risk Exposure
Cold Water Boot Camp (http://www.coldwaterbootcamp.com/)
Beyond Cold Water Boot Camp (http://www.beyondcoldwaterbootcamp.com/)

Web based videos
Canoe Dance, Karen Knight (https://www.youtube.com/watch?v=fMyTTjKV-1U)
Canoe Strokes and Control (http://www.youtube.com/watch?v=MhrQ8yDnnm4)
Canoe Paddling – Canadian Style (http://www.youtube.com/watch?v=_4RJAeP7pDI)
Canoe Paddling Basics – (http://www.youtube.com/watch?v=lYiWydC8TjA)
Canoe Rescues – (http://www.youtube.com/watch?v=6GgdT5uUUes)
Classic Solo Canoeing – Becky Mason
Going Sideways Solo (http://home.cc.umanitoba.ca/~burchil/pm_canoe/side_slip.html)
Kanuballet 2 (http://www.youtube.com/watch?v=aqIZAeUCsm0&feature=related)
Kanuballet (http://www.youtube.com/watch?v=ncGoZoQDDbY)
Sculling a canoe (http://www.youtube.com/watch?v=MhrQ8yDnnm4)
Solo Pivots (http://home.cc.umanitoba.ca/~burchil/pm_canoe/pivot/index.html)
Weight turns (http://home.cc.umanitoba.ca/~burchil/pm_canoe/landing.html#weight)

Clubs and Associations

Paddling and Outdoor

Paddle Canada (http://www.paddlecanada.com)
Paddle Manitoba (http://www.paddle.mb.ca)
Nature Manitoba (http://www.naturemanitoba.ca/)
Manitoba Pioneer Camp (http://www.manitobapioneercamp.ca/)
Leave no Trace Canada (http://www.leavenotrace.ca/home)

Environmental Advocacy

The Canadian Parks and Wilderness Society - http://www.cpaws.org/
The Sierra Club of Canada - http://www.sierraclub.ca/
The David Suzuki Foundation - http://www.davidsuzuki.org/
The Manitoba Eco-Network - http://mbeconetwork.org/
Greenpeace Canada - http://www.greenpeace.org/canada/

Minimum Required Safety Equipment

Canoes, Kayaks, Rowboats and Rowing Shells (not over 6m in length)
Adapted from: Canadian Shipping Act Small Vessel Regulation (SOR/2010-91)
Refer to official regulations for complete and up to date information

Personal Lifesaving Appliances

- One Canadian-approved personal flotation device or lifejacket of appropriate size for each person on board. These must be worn on a guided excursion. Must be inherently buoyant for white-water and under age 16

- One buoyant heaving line of not less than 15 m in length.

- During a guided excursion when on class 3 or above waters, a helmet of an appropriate size must be worn.

Vessel Safety Equipment

- One bailer - bailers must hold at least 750 ml, have an opening of at least 65 cm^2 (10 in^2) and be made of plastic or metal, or one manual water pump fitted with or accompanied by sufficient hose to enable a person using the pump to pump water from the bilge of the vessel over the side of the vessel.

Navigation Equipment & Visual Signals

- A sound-signalling device such as a pealess whistle.
- One magnetic compass - Canoes or Kayaks less than 8m in length and within sight of navigation marks do not require a compass.

- Navigation lights that meet the applicable standards set out in the Collision Regulations – a waterproof flash light is suitable in a canoe or kayak if operated after sunset and before sunrise or in periods of restricted visibility

First Aid

- Instructors, Guides, and Leaders on guided excursions or with passengers are required to carry: A First Aid Kit (meeting regulations) packed in a water proof container. If water is less than 15ºC then equipment or procedures must be in place to protect participants from hypothermia or cold shock.

Other

- Instructors, Guides, and Leaders on guided excursions or with passengers must provide a float plan along with the number of participants to a designated person on shore. A safety briefing must be conducted at the start of a course or outing providing an overview safety and emergency procedures. Equipment not in use must be secured in place.

Missing something? (fines): PFD – $200 (+$100 additional), heaving line – $200, bailer or manual water pump – $200, sound signalling device – $200, navigation lights – $200
Small Vessel Regulation: http://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-91/
Contraventions Regulations (Part II), Small Vessel Regulations:
http://laws.justice.gc.ca/eng/regulations/SOR-96-313/page-4.html