
Australian
Canoeing
Education
Paddle your own...
An introduction to paddling kayaks, canoes and SOTs

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On the cover: With kayak, canoe or SOT you can explore Australia's waterways, here South Australian Murray backwaters.

Paddle your own...

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Introduction

Welcome to paddling in Australia on behalf of Australian Canoeing.

Australia has a huge variety of lakes, rivers and sea conditions making for a great range of paddling activities for all.

This variety, however, leads to different craft, different paddling skills and different dangers. All forms of paddling have a common base of skills and this booklet introduces you to:

- paddle strokes
- health and safety
- craft.

The variations on these central themes are learnt as experience is gained and, perhaps, specialisation takes place. Australian Canoeing also promotes the specialist areas of canoeing: Slalom, Freestyle, Sprint, Marathon, Polo, Down River and most recently, Ocean Racing. For more information on these in your State, contact local clubs or your State organisation.

Start your paddling conservatively and build up as your experience and fitness develops. Join a local club for more paddler contact and for experienced help.

Happy paddling!

Jason Dicker
Chair, Education and Safety Technical Committee

About this book

This book is based on the flatwater resources for the Australian Canoeing Award Scheme. It contains the foundation knowledge for paddling on waters described in the *Award Scheme Handbook* as “areas such as lakes, dams, slow moving rivers, etc.” In other words, waters without rapids of any grade, surf, effects of swell, tidal currents greater than 1 knot, distances greater than 400 metres from shore, and being in the entrance structure to an estuary or embayment.

That may sound restrictive, but it leaves a great many areas to be explored and enjoyed, and the skills and experience you gain can be extended with training from club, State association or other training provider, for paddling on whitewater and the sea.

Peter Carter
Editor, Education and Safety Technical Committee

Background

Which boat?

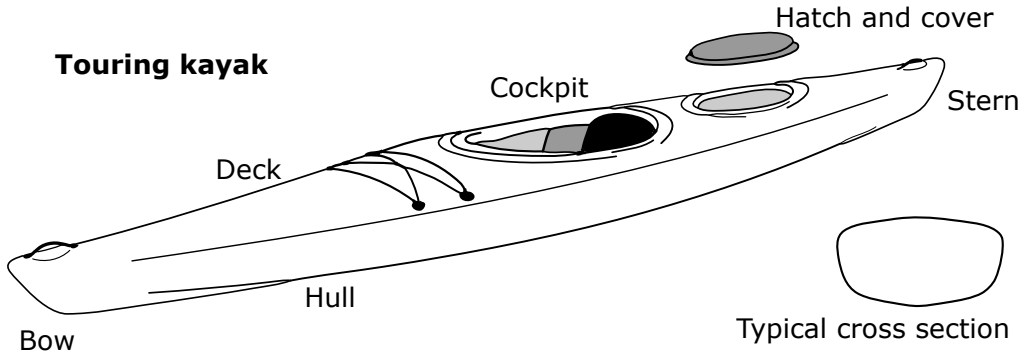
What sort of boat should you paddle? It depends. What sort of paddling do you want to do? In what waters? The answers to those questions will determine the choice of boat, because modern canoes and kayaks are specialised, and none will do everything.

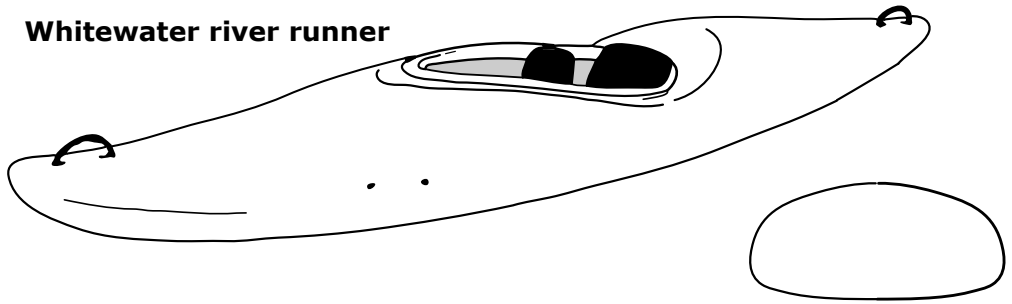
Kayaks derive from the hunting craft of the Arctic, seaworthy craft built of driftwood and sealskin. The paddler is seated, and uses a double blade paddle.

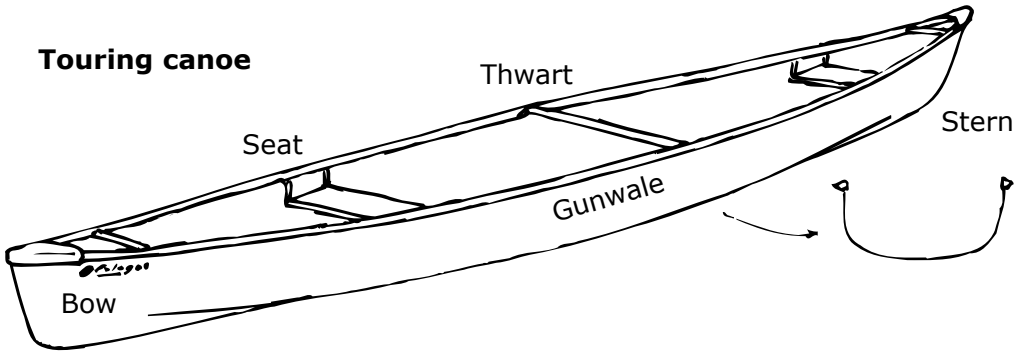
The low seating position gives stability, and decks fore and aft shed water, so that kayaks can withstand wind and wave better than open canoes. There are clear differences between kayaks designed for flat water and those intended for white water. Sea kayaks are another whole category.

Modern canoes are based on the birchbark craft of the North American native people, and are open boats paddled with single blade paddles. The originals were paddled from a kneeling position, as are modern competition canoes, but for touring a sitting position is more comfortable. Canoes are usually paddled as doubles, and suitable designs are ideal craft for exploring sheltered lakes, creeks and rivers.

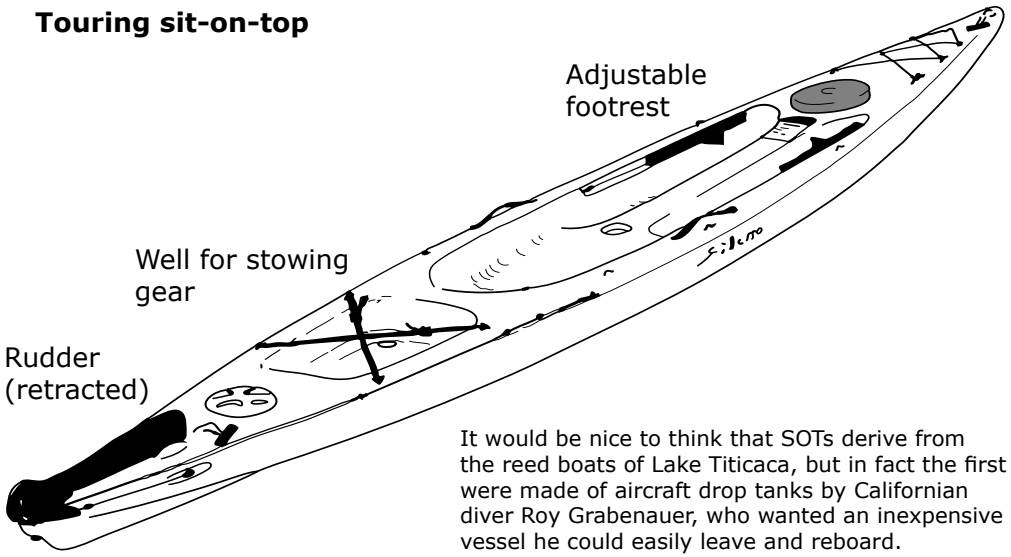
Sit-on-top (SOT) boats have become popular in recent times. They are paddled as kayaks, are easy to get on and off, and are the craft of choice for diving and fishing. However, they do not provide much wind and sun protection for the paddler. To maintain stability with the higher seating position, they tend to be wider than other kayaks, and this makes them slower. There are SOTs with one, two, or even three seats, and a range of shapes for paddling different waters.







Touring sit-on-top



It would be nice to think that SOTs derive from the reed boats of Lake Titicaca, but in fact the first were made of aircraft drop tanks by Californian diver Roy Grabenauer, who wanted an inexpensive vessel he could easily leave and reboard.

Materials

Two types of materials, composites and rotomoulded polyethylene, are the most common in kayak and canoe construction.

Composite materials are a mix of a synthetic resin—polyester, vinyl ester, or epoxy—and a reinforcing fibre: glass, synthetic (e.g. Kevlar®), or carbon. Glass fibre in polyester is the cheapest and most common, and, looked after, will last for many years. Composites of Kevlar and carbon, with epoxy resins, can be lighter and stiffer, but more expensive.

Rotomoulded boats are formed of polyethylene. For the same stiffness, polyethylene must be thicker than a composite, and rotomoulded boats tend to be heavier and slower than composite craft. The advantage of polyethylene is that boats made of it bounce off rocks almost undamaged.

Another plastic used in canoes is ABS (acrylonitrile-butadiene-styrene), often known by the trade name Royalex™. This tough material is vacuum formed, and the thickness can be varied to give strength where it is needed.

For lightness and performance composite boats have the edge, for the ability to absorb punishment the rotomoulded and ABS boats are the better choice.

With the availability of modern epoxy resins has come an interest in building kayaks and canoes in timber, either cedar strip or plywood, from plans or kits. The kayaks are often replicas of Arctic boats. Properly maintained, these boats perform as well as and last as long as composite craft. If you want to build your own, this is the best option.

Folding kayaks also have their place, especially for people who must travel with minimum equipment: it is much easier to arrive at the airport with a bag than 5 m or more of sea kayak. They tend to be expensive, and do require more care in surf and among the rocks.

Design

Other things being equal (which they will not be), a longer boat will be a faster one. On the other hand, the longer the boat, the less manoeuvrable it will be. Rocker, the curve of the keel, affects both manoeuvrability and speed, with more rocker making the boat easier to turn, but slower. Most touring kayaks are between 4 and 4.5 m long, with little rocker, so that they run straight. Whitewater boats are between 3 and 3.5 m in length and have considerable rocker: slow over a distance, but able to spin on the spot. Freestyle kayaks are even shorter and more rockered, and slower.

Double canoes range from 4.5 to 5.5m in length. Those designed for flat water have little rocker so that they run reasonably straight, while the whitewater types are rockered for ease of turning among the rocks and eddies.

The beam (width) and cross section affect lateral stability and speed. Wider boats are slower, but more stable. A boat with flat sections amidships will have good initial stability but less secondary stability, i.e. it will feel stable when upright but 'tippy' when on edge. A boat with more V in the midships sections will feel less stable upright, but more stable when edged for turning.

Deep V sections at bow and stern will give good tracking, the ability to go in a straight line, a characteristic wanted in a touring boat.

In canoes, some flare at bow and stern will help the canoe ride over waves, while tumblehome amidships makes paddling easier by keep-

ing the boat narrower at gunwale level. A high bow and stern may give more lift over waves, but will be blown about by wind, and open canoes are always affected by wind.

The lower the decks of a kayak, the less it will be affected by wind, but the internal volume for carrying gear will be less.

Any kayak (or other vessel) will tend to wander when travelling downwind. The solution used on some touring kayaks is a rudder. A rudder is not for steering—kayaks are steered by paddle and boat edging—but to trim the boat to run straight downwind. It's there to reduce the need for continual sweep and other correcting strokes downwind, and therefore to reduce fatigue. Learn to paddle the kayak without using its rudder, so that you can control the boat if the rudder fails (as they have been known to do).

All boats must have buoyancy built in. In kayaks that is usually in the form of blocks of expanded plastics, supporting the decks. Air bags either side provide even more buoyancy. Some touring kayaks may have bulkheads and hatches, forming compartments for buoyancy and gear stowage. Virtually all sea kayaks are built this way. Compartments should be filled with buoyancy material (e.g. the liners from wine, spring water, or fruit juice casks) as a 'fail safe' measure. All canoes and kayaks will need secure handholds at bow and stern, usually end loops or toggles. Decklines, of at least 6 mm rope, provide handholds along the length of the craft, and are fitted to sea and many kayaks.

Canoes normally have some form of buoyancy at bow and stern, and those used on whitewater will have airbags as well.

All design is compromise... The diagrams give some idea of the range available.

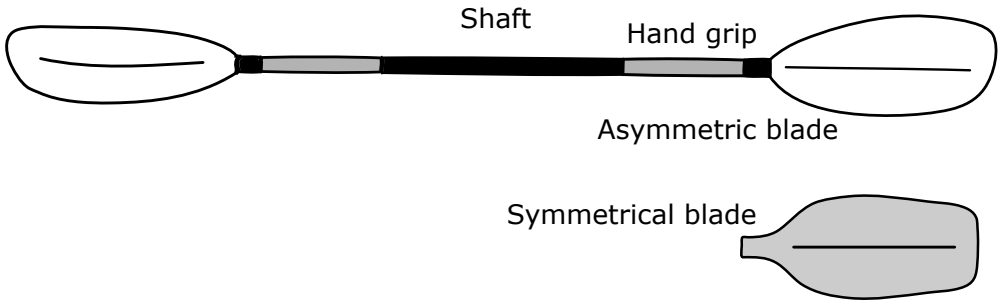
For learning to paddle kayaks, the usual choices are a whitewater play boat or a touring kayak, while touring canoes are a good choice for learning single-blade skills. In the whitewater boat you will probably learn boat control skills faster, but in the touring craft you will be better able to go places.

Other equipment

Paddle

Like boats, paddles come in various shapes and sizes, and are of various materials. Kayak paddles have two blades, usually feathered between 65° and 90°. The angle depends on a number of factors: the idea is to reduce wrist movement, and therefore likelihood of injury, as much as possible.

The type of boat and paddling determines the kayak paddle length. Slow boats, like the freestyle kayaks, are paddled with short paddles, while sea kayak paddles are rather longer. The reason is to maintain a comfortable cadence (rate of paddling) in the slower or faster boat.

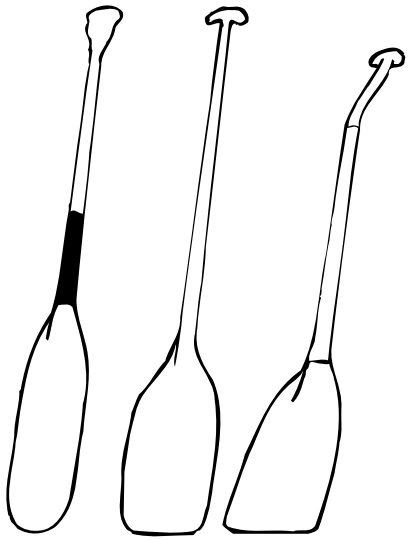


Blade shapes may vary, but the asymmetric shape, which reduces twisting, is now common in kayak paddles. Blade sizes also vary, and the temptation may be to use large blades thinking that they will give more power. However, bigger blades, especially on longer shafts, can lead to joint injuries. It's best to take advice before spending too much.

Blades may be of composite construction or injection moulded. Cheaper shafts are of aluminium, with carbon fibre and Kevlar composites favoured materials for quality shafts. There will either be an oval section or a formed hand grip to help give instinctive location in the hands.

In flatwater competition, kayak paddles are the 'wing' or 'propeller' type which slip less in the water in forward paddling. They do not work well in other strokes, require precise technique, and are best used only with faster craft on smooth water.

Canoe paddles have one blade and a T grip or pear grip. Traditional paddles are straight, with flat blades that can be used in either direction, while Marathon canoe paddlers use 'bent' paddles, for the 'sit and switch' technique.



Canoe paddles: touring, whitewater, marathon

Materials and construction are similar to those of kayak paddles. Many paddlers still prefer wooden paddles.

The most accurate means for determining the correct paddle length is to sit or kneel as appropriate in the boat: with the top arm just above horizontal the blade should just be immersed. Stern paddlers in doubles can use slightly longer paddles, while Marathon bent paddles can be slightly shorter. The top hand goes on the T grip, and the hands should be about elbow width apart.

You may have the paddle in your hands for hours on end, so the lighter it is, bearing in mind the need to be strong and durable, the better. It pays to spend a bit more on a quality paddle.

Personal Flotation Device

You will need an approved Type 2 or 3 PFD*. (The differences relate to safety colours, etc.) It must fit properly and be comfortable. Make sure all zips and buckles are secure, and stay that way.

The PFD will not save your life. It will support you in the water, and also give some protection if you are washed on to rocks.

Pockets are useful for small items when touring, but beware of filling them with heavy and unnecessary items that will get in the way during rescues. A whistle on a cord is a good idea.

* From 1 July 2010 new PFD terminology came into use, based on the upthrust of the garment measured in Newtons. PFD 2 garments are known as Level 50, PFD 3 as Level 50S.

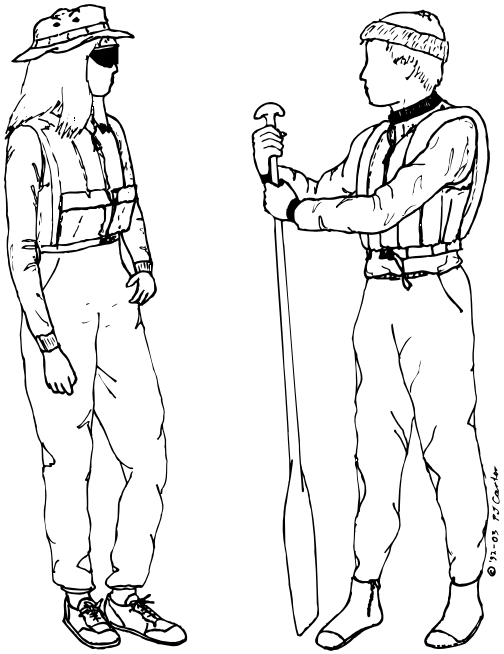
Spray deck

The two main materials are neoprene and proofed nylon or other synthetic fabric. Neoprene decks seal better, but can be less durable. They would be a better choice for paddling in heavy conditions, but a nylon deck may be more comfortable in light conditions in hot weather.

Clothing

As in all outdoor activities, you will need to dress for the conditions, and this normally means some kind of layer system. There is a wide range of clothing available, both in design and fabric, and you will need to choose according to the need for sun protection (e.g. Lycra® rash

Well-dressed kayak paddlers. She is dressed for summer in light fabrics with good sun protection, he for winter in wetsuit and windproof jacket. For whitewater or surf they'd be wearing helmets



Dress for canoe or SOT paddling. For summer, she is in light fabrics with good sun protection, and he dressed for winter in wetsuit and windproof jacket.

top) or insulation. Modern synthetics give some insulation when wet, and wick moisture away from the skin. Avoid cotton, and that includes jeans.

In cool weather you will need a windproof jacket, preferably with good seals at neck and wrists. In cold weather a wetsuit may be called for, one without sleeves to prevent chafing. The 'long john' style is the usual.

If you are in doubt, take the pessemistic view and add a layer. On the water, it is usually easier to take off a layer than add one. Carry spare clothing in the boat for when you arrive, or to cover contingencies.

Footwear

You may find yourself walking on sharp rocks, broken shells (or glass) and other uncomfortable surfaces. There is a wide range of wetsuit boots, aquatic sports shoes and sandals available. Old sneakers are often worn, although they tend to be bulky.

Choose something that is comfortable both on the ground (and does not pull off in mud) and in the boat, remembering that straps and laces must not tangle in footrests.

Sun protection

As a paddler, you are very much out in the open, exposed not only to direct radiation but also what is reflected from the water surface. Long sleeves and either a hat with full brim, legionnaire- style cap, or keffi-yeh-style headwear, tied on, at the very least. In open canoes and SOTs, long trousers to protect the legs.

Sunscreen on all exposed skin, including the lips, reapplied regularly as required. To cover the backs of the hands, fingerless and palmless gloves give protection without affecting paddle feel. Sunglasses to protect the eyes from the UV.

If you wear a helmet, as in whitewater or surfing, a visor gives some protection, and sunscreen will be required as well.

Stowing gear

Clothing, camping gear, food, and other items are carried in waterproof bags or other containers in the fore or aft compartments, or amidships in open canoes. Various sizes of waterproof bags are available, and you should choose according to the size of your boat and what you need to carry. Generally, several small containers are better than one large one.

You will need to pack according to where you are going, the duration of the trip, and so on, with reserves to cover contingencies.

Lighter gear should go in the ends of the boat, heavier items such as water, cans, and so on, amidships. This means that handling of the boat in waves will be affected less, and stowing heavy items low will aid stability. Nothing must be able to move about and affect trim. It goes without saying that first aid kits and similar gear will be readily accessible.

The only items on deck should be map or chart and other navigation items, paddle park, spare paddle, towline, and so on, all secure. Communications gear is perhaps best in a PFD pocket.

Inspection and maintenance

Before you launch, check that the rudder (if there is one) and everything else is in working order.

After the paddle, wash and clean everything, and make sure that sand and grit have been removed from any moving parts: rudder and pedals, sliding footrests, and so on. Check that toggle cords and other ropes and cords are not frayed, and moving parts are not excessively worn. Check the paddle, PFD, spraydeck, and all other gear.

If anything didn't work properly on the water or needs attention, fix it. Store everything appropriately, with the boat under cover.

The maintenance chapter gives more detail.

Safety and injury prevention

You can be hurt paddling, and not only by being run down by a powerboat. Some hazards are obvious, others are subtle.

To reduce the likelihood of being run down, follow the 'see and be seen' principle: bright colours on boat, clothing and PFD. Even the paddle,

which is often the first thing seen from a distance, can have some fluorescent and/or reflective tape on the blades. The other part of avoiding collisions is to keep clear of outher craft, out of shipping channels, and so on. Be particularly careful in places like marinas, where you may be hidden behind other craft and objects.

Then there are other environmental hazards: wind, rocks, currents, venomous sea creatures, broken glass and shells, heat, cold... Dress appropriately, and paddle only in areas and conditions that you can handle.

There is safety in numbers, and you should paddle in a group of at least three or four, and be prepared to support each other. (There are two kinds of people who paddle solo: the people of limited skill and experience who are surprised when things go wrong, and the others, highly skilled and experienced, who understand and are prepared to accept the risks.)

The section on paddles hinted at another hazard: muscle and joint injury. Paddling is not about brute force, but about coordination: the right amount of power developed by the right muscles, and in a way that does not put joints at risk. You may think at first that what seems right is right, and for a while your body may cope with that. But not forever. Pay attention to the sections on boat setup, posture and concepts like the 'paddlers' box' so that you can enjoy your paddling without causing damage to yourself.

While you will learn a lot from this book, we recommend that you take a course run by a club or State association, whose details are on the inside front cover.

A checklist

The minimum items you'll need for an outing:

- Boat, paddle, PFD, spraydeck (as appropriate), helmet (as appropriate): suitable for the water and conditions, in sound condition
- Clothing: appropriate to the conditions
- Spare clothing
- Food and water
- Basic first aid and repair materials
- Communications equipment: mobile phone and/or marine VHF transceiver
- Emergency gear (V-sheet, flares, EPIRB): as appropriate, as required by state boating regulations
- Float plan: completed, and left with responsible person.

Food and clothing, etc. needs to be carried in waterproof containers. A whistle is a good idea, a sponge for bailing, and a torch will be needed after dark.

Kayak paddling

Boat setup

From whitewater paddling we have the notion of 'wearing' the boat, to the extent of being strapped together in the case of C boats. All very well for a run down the rapid, but not necessary for flatwater paddling. You will need to set up the footrest, back strap (if present) and thigh braces so that you can sit comfortably relaxed, with room to wriggle, yet can brace when necessary in rough water.

The footrest should be set so that the knees are slightly bent, with the thighs against the thigh braces without pressure, and the ankles relaxed. The backstrap, if there is one, should be against the lower back, but again without pressure. To brace, extend the feet to tighten everything all round.

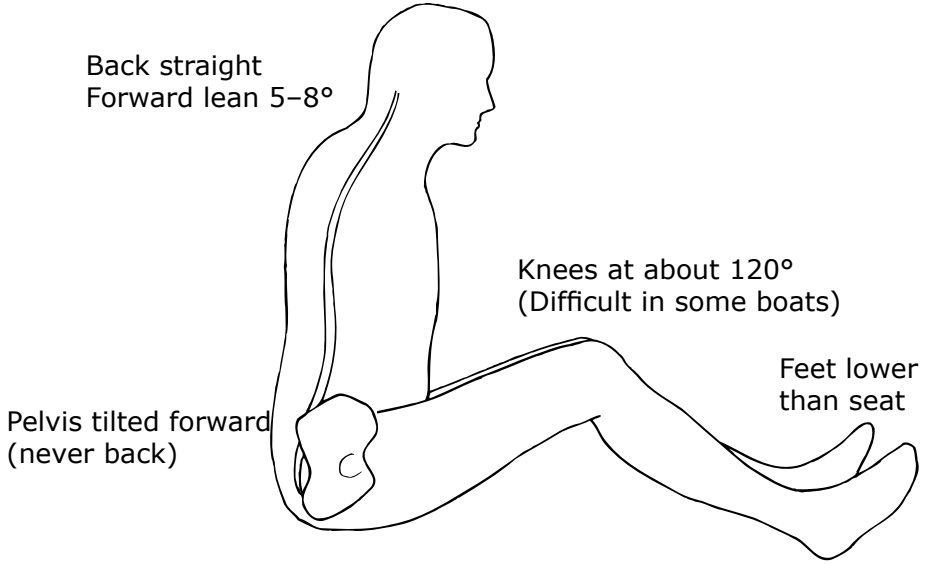
If necessary, pad the sides of the seat so that you do not slide from side to side. You want to be firm, but not tight.

On a SOT the rules and strokes are the same, and to begin you can paddle without thigh straps.

Paddling

You can be on the water for hours on end: for comfort and safety it pays to have an efficient, relaxed style that maximises power and minimises fatigue, strain and injury. Our understanding of the mechanics and biomechanics of paddling has greatly increased in recent years, thanks to the work of coaches in the competitive disciplines, particularly in flatwater racing. What follows for forward paddling, therefore, is a condensation of the instruction given to sprint and marathon paddlers. If you can arrange it, time spent in a K1 or TK1 under the watchful eye of a Flatwater Coach will be well repaid. (It will also sharpen your reflexes!)

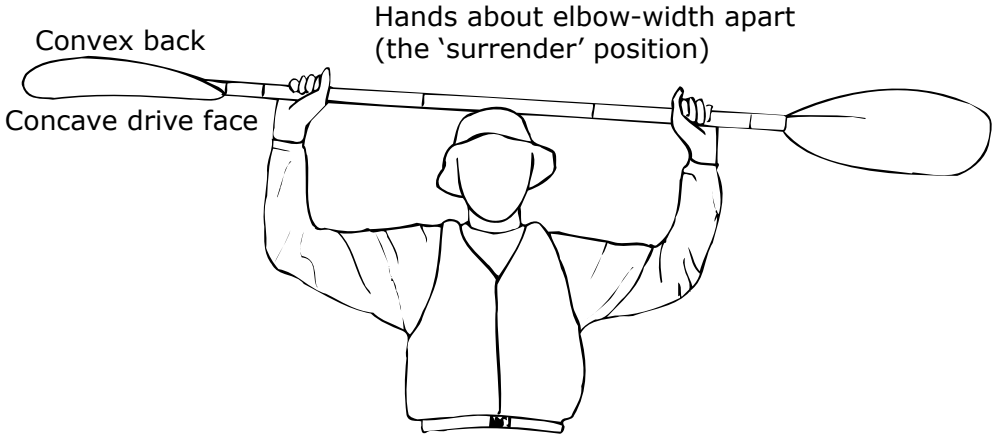
Correct ergonomics and posture are essential for paddling, and the diagram shows how you should look in a kayak or on a sit-on-top: slight

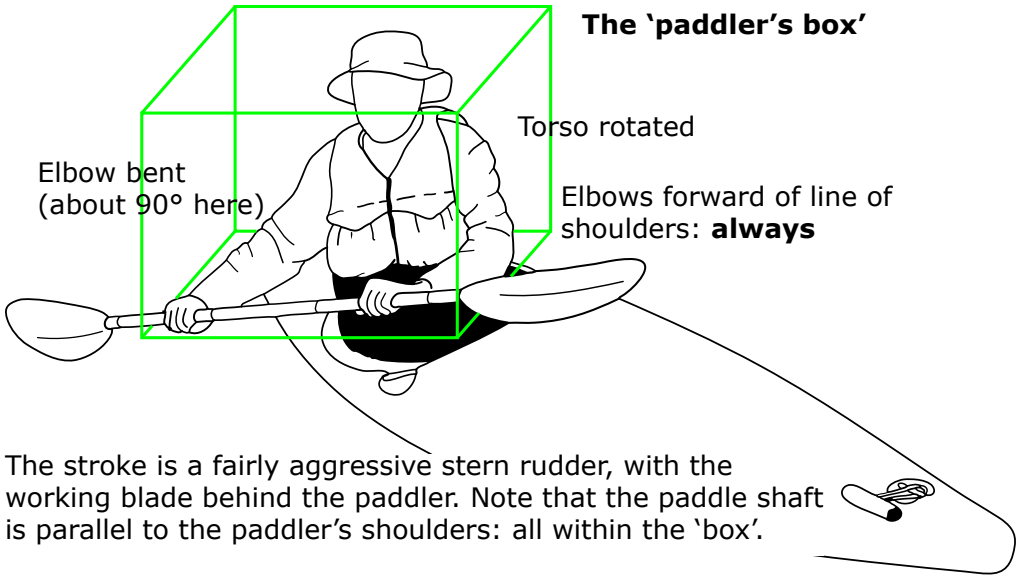


forward lean (5–8˚) from the pelvis, back straight without being forced, shoulders ahead of hips, head, neck and shoulders relaxed. The legs are slightly bent, enough that you can't quite push them straight without moving on the seat.

Lean too far forward and you restrict movement and lung capacity, lean back and again you will restrict movement (and perhaps cause injury).

Where are your most powerful muscles? No, not the arms. In paddling, your arms are little more than the linkage between the power source, the muscles of the body, and the paddle. Your arms are there to put the paddle into the water and take it out again: power comes from body rotation, right from the toes. It's body rotation that shares the load between the muscles, and smoothly produces more power and length of stroke. That's true of all strokes. (In a flatwater kayak it's possible to rotate the backside on the seat, indeed, some K1s have pivoting seats. That's not always easy in other kayaks, but if you can set up the seat to allow that movement it will help.)





The stroke is a fairly aggressive stern rudder, with the working blade behind the paddler. Note that the paddle shaft is parallel to the paddler's shoulders: all within the 'box'.

The paddle provides propulsion, control and stability, and you'll need to be able to use it instinctively. By putting it on your head as shown in the diagram, with your elbows at right angles and your right hand on the hand grip you'll have it in the correct position.

The right hand position is fixed: depending on the feather angle the left hand will allow the shaft to rotate. Keep those hand positions, forward, backward, sideways, turning, staying upright: lose control of the paddle and you'll lose control of the boat.

Keep a relaxed grip. Gripping tightly will lead to soreness.

The 'paddler's box'

The shoulder is the joint in the body with the greatest range of movement. It is also the most susceptible to dislocation and other injury. To reduce the likelihood of injury, and also to develop the most power, the elbows should always be in front of and below the line of the shoulders. The roughly rectangular volume in which the hands work is called the paddler's box, and that space rotates with the shoulders. If you want the paddle blade behind you, as in reverse strokes, it means that you rotate the body so that your elbows remain in front of the line of the shoulders.

Several things before you go too far...

Carrying the boat

The safest way is to have a person at each end. (Remember that end loops and toggles are really there to give you a safe handhold when you and the boat are in the water together.)

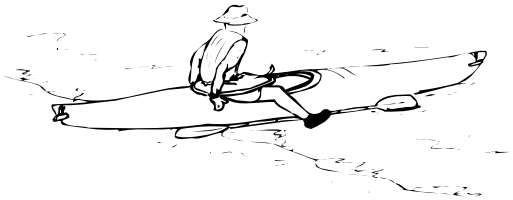
Over a short distance a kayak can be carried like a suitcase, and a **light** boat can be carried on one shoulder. Use two hands for the lift. To pick up the paddle, hook a toe under the middle of the shaft and lift.

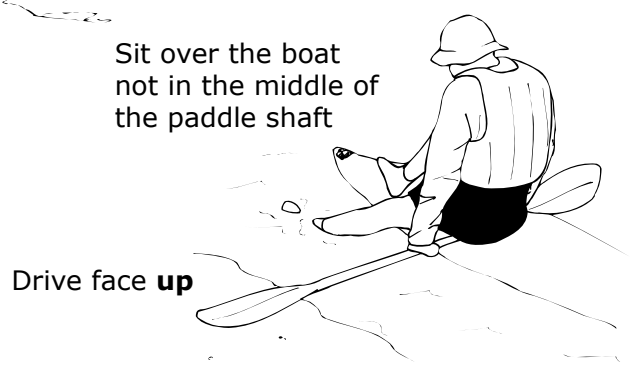
Launching

The easiest way to launch a kayak (the only way at sea) is to place it, facing the water, at the top of the swash zone on the beach. Park the paddle either on deck or alongside, being careful it isn't washed away. Sit astride the boat, wash the sand off your feet, and put them into the cockpit. Then with knees straight and weight supported on your hands, slide in. Fit the spraycover, aft end first.

When you're ready, and with the waves, 'walk' the boat on your hands until you're afloat. Paddle away. (Yes, the boat will be scratched. Get over it.)

On a beach with surf you will have to time things carefully.



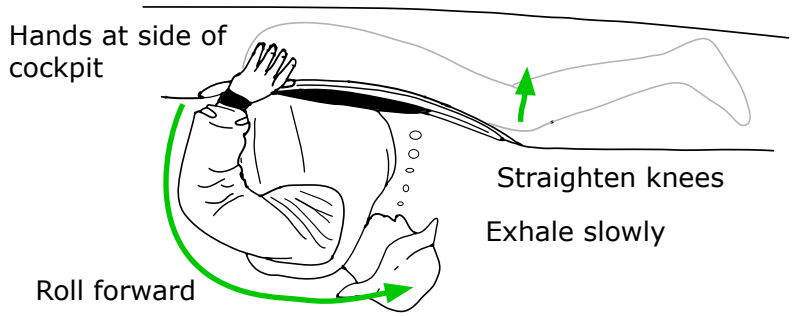


The other way is to have the boat afloat, parallel to the shore. Put the paddle across the deck behind the cockpit, with the blade on the ground facing upwards, to act as an outrigger. Sit over the aft end of the cockpit, wash off any sand or mud, and put your feet in, then with weight on hands, slide in. Fit the spray deck, pick up the paddle and paddle away. Reverse the procedure to disembark.

SOTs are easy. Stand alongside the floating boat, sit down, then swing around and bring your feet aboard.

Capsize

Capsizing is part of kayaking, and the sooner you experience a controlled capsize the better. On a course, your instructor will supervise, and will probably have some exercises. If the water is cold, you may want to prepare yourself with a few splashes, and swimming goggles or masks may make things more comfortable. Your first capsizes will be without a spraycover.
Keep hold of your paddle and lean to one side or the other until the boat capsizes. When it has stabilised inverted, tuck the paddle under one arm. Lean forward, grab the spraycover strap and release the spraycover. Put your two hands on the deck behind you, straighten your knees, and, rolling forward, push the boat away from you. While



this is going on, hum a tune to help keep most water out of your nose. Come up alongside the boat, paddle still under one arm, and take hold of the boat. Work your way along the deckline if there is one to the bow. Let go of anything and it will drift faster than you can swim. Either swim the boat ashore, keeping to seaward of it, or await rescue. **Leave the boat upside-down until you reach shore.**
Some instructors will want you to put your hands in the air and bang on the hull while you are upside down: a good confidence exercise.
When you capsize unexpectedly remember to tuck forward and not lean back. Tucking forward is a much safer position when you are being churned around, especially in shallow water.
Don't be afraid of being trapped in the boat. Capsized in rough water the challenge may be to stay in: get it wrong and you can be thrown out.

Emptying out

The easiest and safest method is to have a person at each end, raising and lowering alternately. Hold the boat about half a metre in from the end so that it does not roll upright.

On a steep bank you may be able to empty the boat by raising and lowering the end nearer the water. A **light** kayak can be rocked on one thigh.

Forward paddling

You want to go places, so forward paddling is the important stroke, and is usually described in three phases.

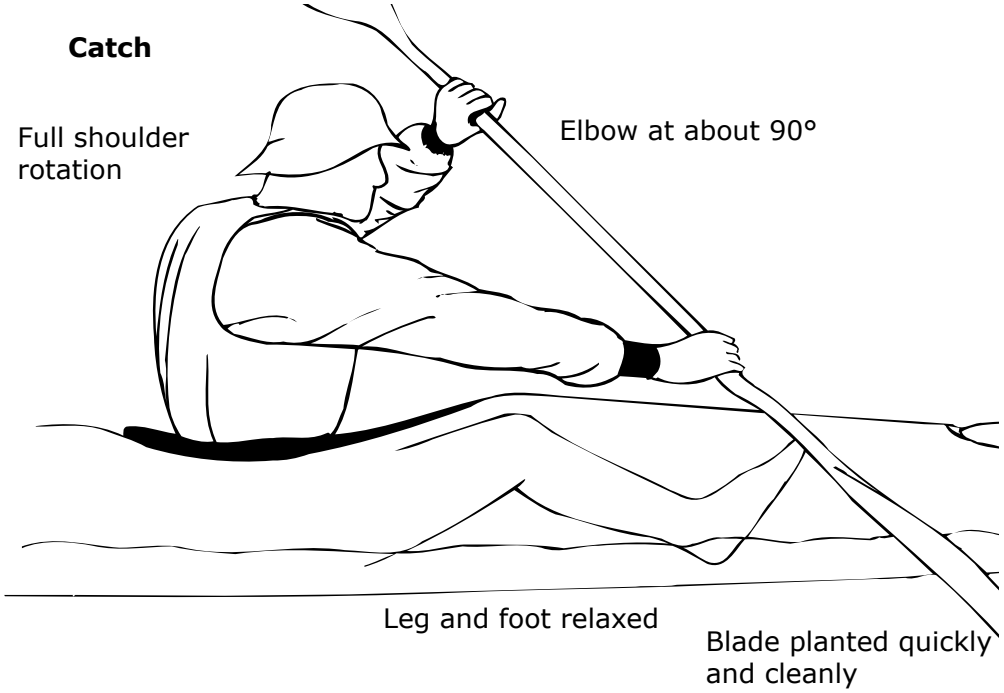
Catch

The catch is the start of the stroke, the entry of the blade into the water. The key points are:

- clean entry, as far ahead of the feet as possible, with the blade as vertical as possible
- full rotation of the torso, bottom hand shoulder forward
- quick development of power

Think about:

- taking the blade to the water: the bottom hand takes the blade to the water in a spearing motion, with the top hand following the shaft movement, but not pushing the blade in
- squaring the blade: the blade must be at right angles to the direction of travel — if the angle is wrong the blade will slide sideways
- burying the blade: completely immerse the blade as quickly as possible, keeping the bottom hand several centimetres clear of the water throughout the stroke



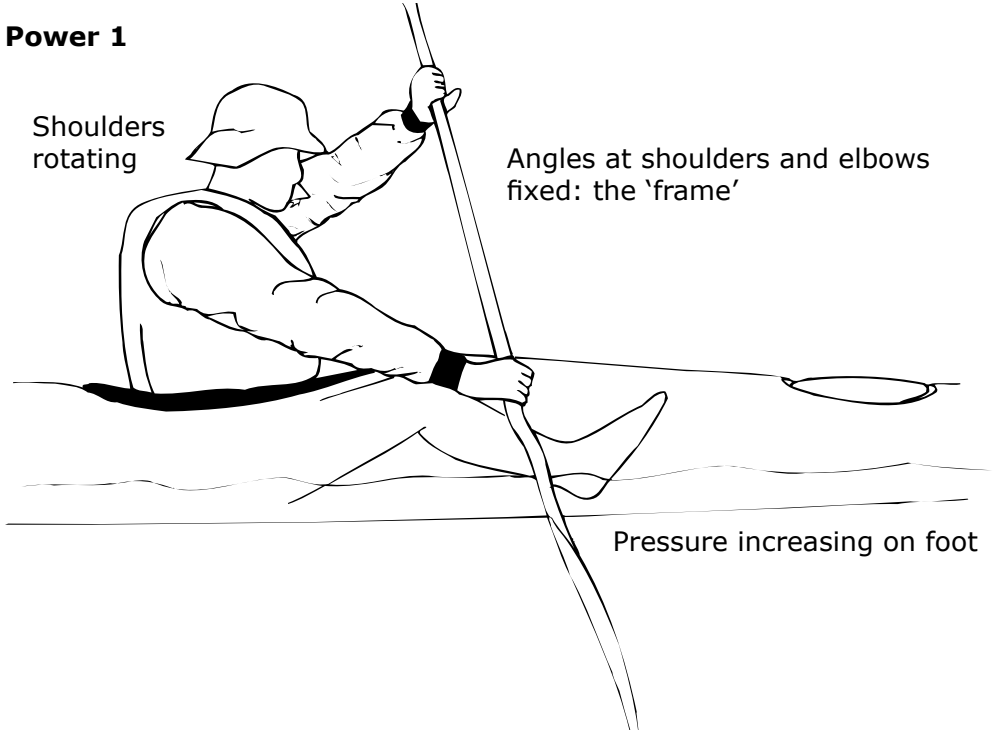
Power

Think of the blade as being fixed in the water: you pull the boat past it. From the catch, the stroke is 'taken' by the whole 'pulling' side of the body — toes, leg, hip, torso, and shoulder — all working smoothly together.

The bottom arm remains in a fairly extended extended position throughout this phase, with the top arm, elbow bent, and hand at around eye height and 30 – 40 cm in front of the head, following the rotation of the shoulders.

Flatwater paddlers talk of the 'frame', the arms and shoulders, remaining fixed through this phase: in other words the elbows are not bending or straightening but remaining at the same angles. The top hand does not push, it follows the shoulders.

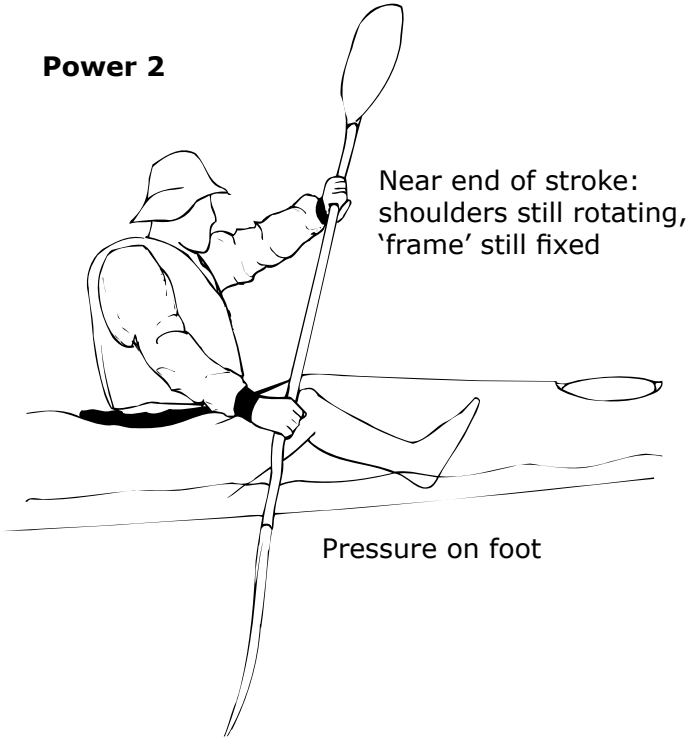
The blade will tend to follow the bow wave of the kayak, moving about 5 cm away from the boat, during the stroke. A blade that moves straight back, relative to the boat, may be a sign of insufficient body rotation.

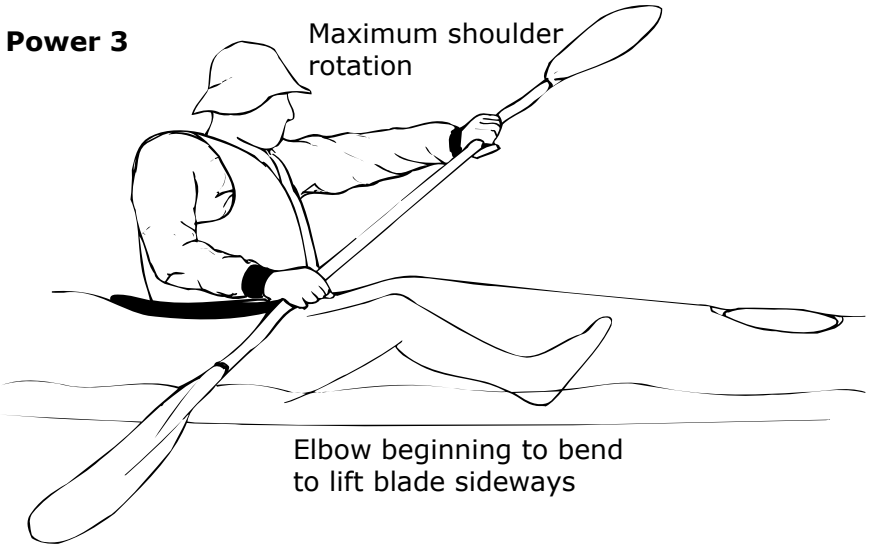


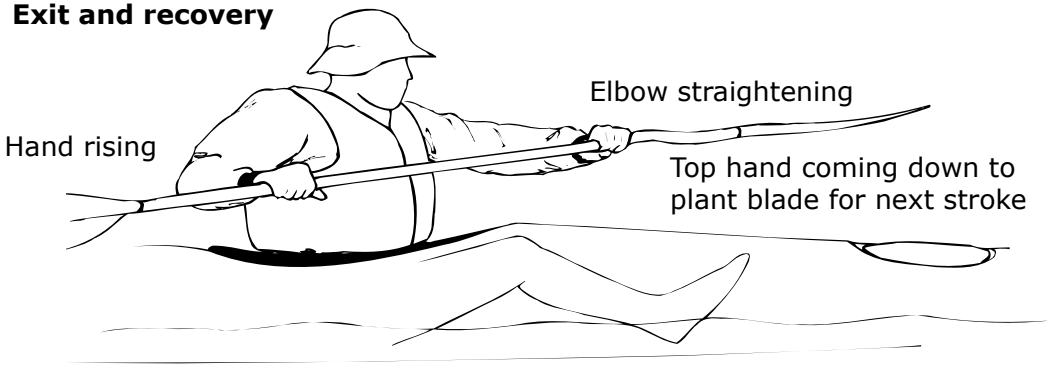
Exit and recovery

The stroke is finished when body rotation is complete. Taking the stroke too far is simply wasted effort. At exit, the blade moves out of the water to the side, with the top hand still high and the bottom elbow bending to lift the blade. That elbow should stay low and relaxed. At this stage the paddle is parallel to the centreline of the boat, but over the side.

You are now in position to set up for the catch on the other side, where the stroke is a mirror image.







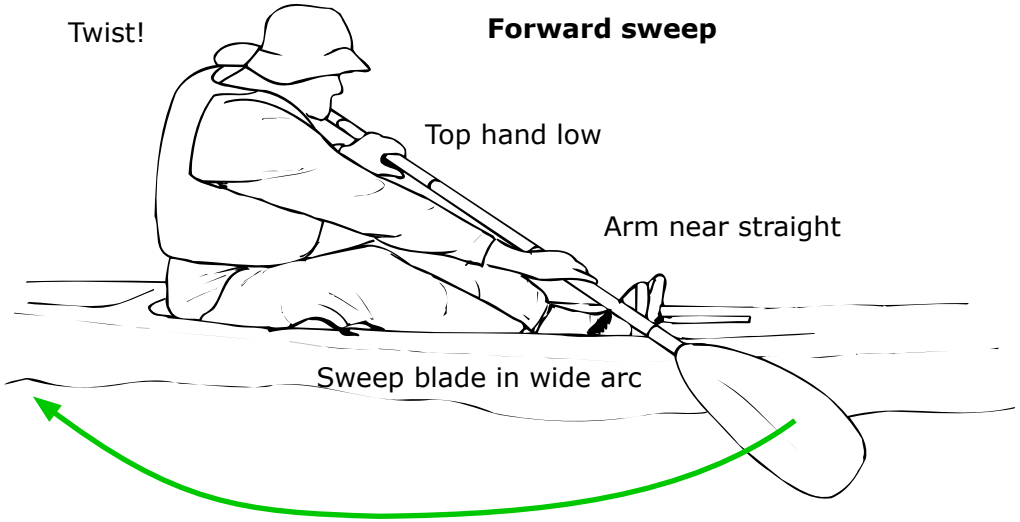
Key points

To revise:

- plant the blade by or ahead of the feet, bottom arm extended but not straight
- rotate the torso to pull back the shoulder and drive the stroke
- the top arm holds its position relative to the shoulders, crossing the boat with the shoulder rotation
- the power phase ends with the blade in line with the hips
- lift the blade out sideways
- keep the top hand high
- rotation continues, to set the shoulders and paddle for the next stroke

Things to avoid:

- excessively long strokes
- punching or dropping the top hand



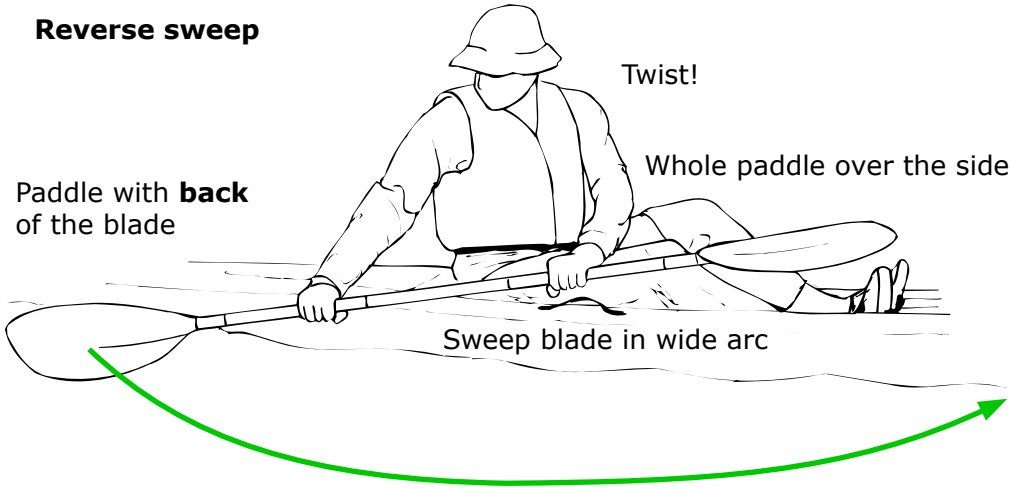
Sweep strokes

Sweep strokes are the main strokes for turning the boat at low speed, either to manouvre into position or to keep the boat running straight. Many instructors prefer to start with the forward sweep so that students can have some confidence that they can control the direction of the boat before they concentrate on forward paddling.

As with other strokes, power comes from the torso muscles, but here the stroke will be a long wide arc, the longer and wider the better. For a forward sweep, twist to reach forward and put the blade in as close to the bow as possible. The lower arm is slightly flexed, the top hand low, just high enough to clear the deck. The blade should be completely immersed, just beneath the surface.

Apply power by twisting the body in the opposite direction, keeping shoulder and elbow angles fixed, so that the blade moves (relative to the boat) in a wide arc all the way to the stern. While you are learning, watch the blade all the way around so that you develop the full twist necessary.

The reverse sweep works the same way, but in the opposite direction. Begin by twisting so that the whole paddle is over the side and put the blade in close to the stern. (No, don't change your grip on the padddle: all reverse strokes are with the back of the blade.) Now twist the other way to move the blade in a wide arc all the way to the bow.



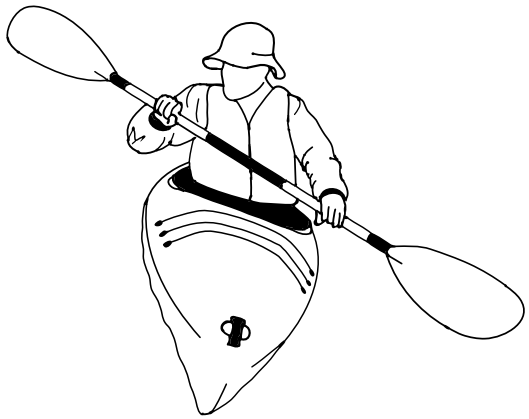
In many cases a series of forward or reverse sweep strokes can be used to control the boat. When you want to turn on the spot, alternate forward sweep on one side with reverse on the other.

As you develop confidence, look where you are going rather than watching the blade through its arc. Later you will also want to put a sea or touring kayak on edge as you sweep to increase its rate of turn, and in waves you will sweep on wave crests when bow and stern are out of the water.

Edging

Putting a kayak on edge changes its underwater shape, helping it turn more easily by lifting bow and stern, thereby increasing rocker.

To edge a kayak, use the muscles of hip, torso and legs to roll the kayak slightly while you keep your upper body upright. This is where the boat's secondary stability comes into play.



Kayak on edge: stable because centre of gravity is above centre of buoyancy

Lift your left knee to lower the the right side of the boat for sweep strokes on the right. This means that the boat is leaned outwards from the turn: the opposite to the way a bicycle is leaned.

Different boats react differently, so you'll need to experiment.

Paddling straight

Kayaks, particularly the whitewater types, appear to have minds of their own, wandering all over the place. Paddle behind an experienced paddler and you'll see that the boat does not travel in a straight line but yaws from side to side with each stroke, and that each stroke is a little different, perhaps a little wider, perhaps a little closer to the boat, so that the end result is a smooth movement across the water. You may see some edging used.

That comes with practice. At first you will tend to overcorrect too late. Be patient, make sure you are paddling evenly on each side, and be prepared to make a forward stroke into something of a sweep stroke when the bow wanders a bit too far. Don't watch the bow, but focus on a spot well ahead. Don't rush, but pause between strokes to see what the boat is doing, and perhaps give it time to come back into line. Anticipate.

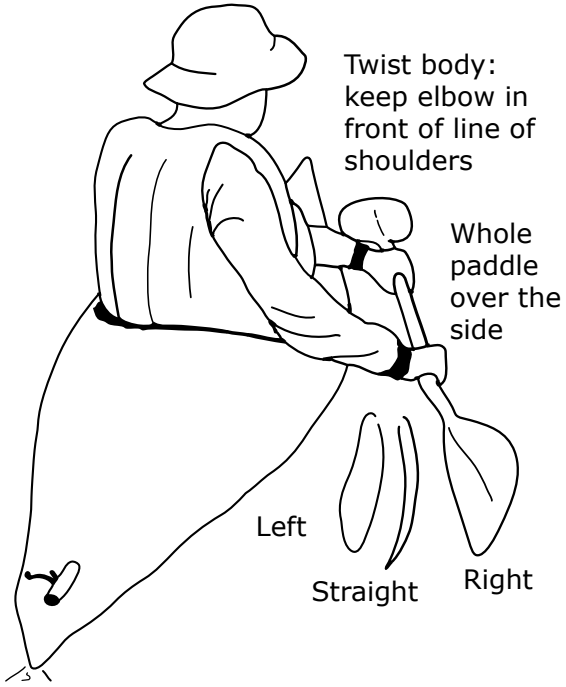
Into wind, you shouldn't have too much trouble keeping straight. Downwind, and it can be a different story. This is why sea boats have rudders or retractable fins, but you must learn to paddle without. Use sweep strokes wherever possible. The alternative is the stern rudder stroke.

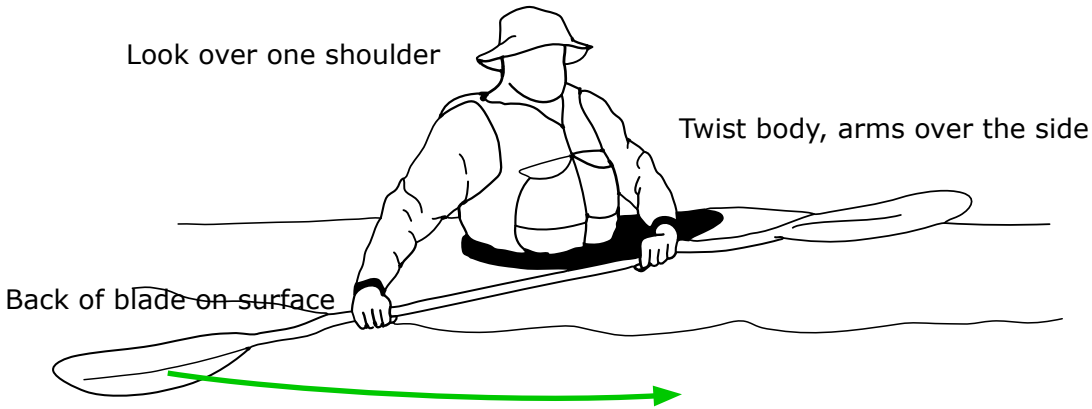
Stern rudder

In this stroke the blade is used as a control surface rather than to apply power. It therefore slows the boat.

The position is similar to the starting position for a reverse sweep, with the body twisted towards the paddle side. Often the blade will be trailed into that position at the end of a forward stroke. The blade is trailed in the water, with slight outwards pressure so that the boat turns towards the paddle side. (By changing the angles, the boat can also be made to turn the other way.)

When the boat is facing the desired direction, return to forward paddling.





Reverse paddling

There will be times when you will want to back into or out of some situation. The reverse stroke begins in much the same position as a reverse sweep, but instead of sweeping wide is kept closer to the boat for more power. As you twist to put the blade in on one side look over that shoulder so that you know what's behind you. Don't look over both shoulders: you'll drive yourself giddy.

Remember: power from torso twist—your arms are just the linkage.

Emergency stop

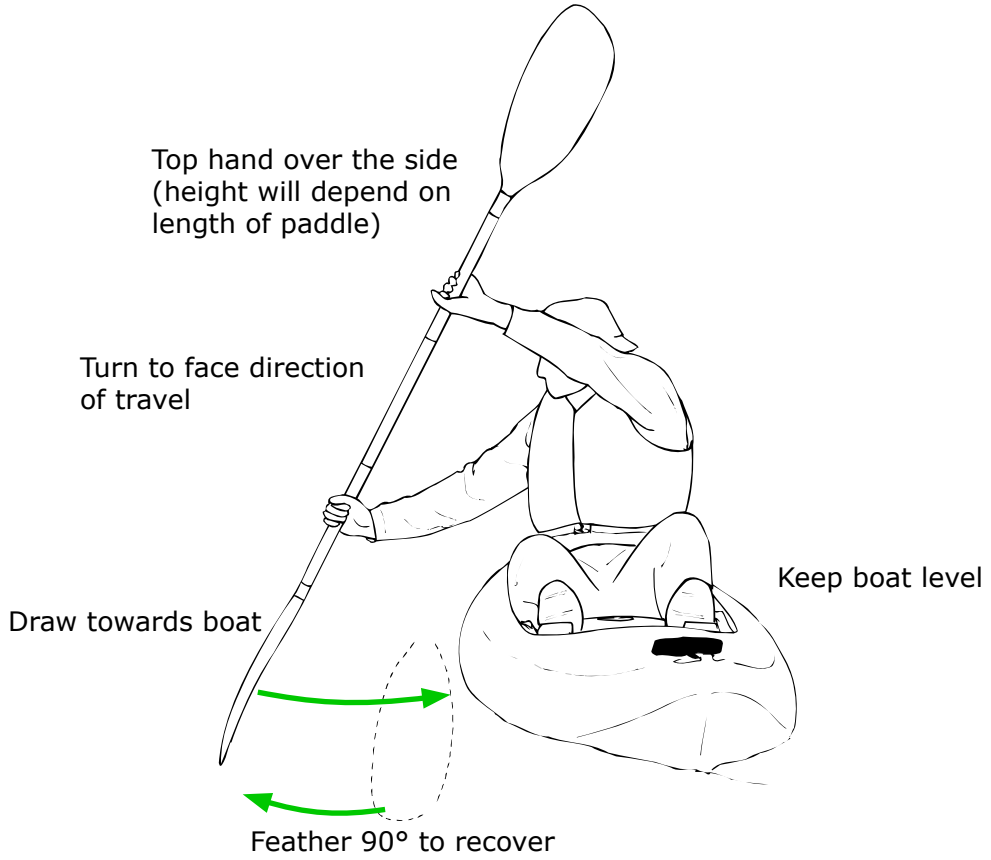
Short, sharp reverse strokes will stop a forwards moving kayak. Put the blade in close to the hips rather than well behind. The number of strokes doesn't matter: the important thing is to stop the boat quickly without it turning one way or the other.

In reverse, a couple of short, sharp forward strokes will stop the boat.

Draw stroke

You may want to go sideways towards or away from a jetty or raft of kayaks. The draw stroke is the method.

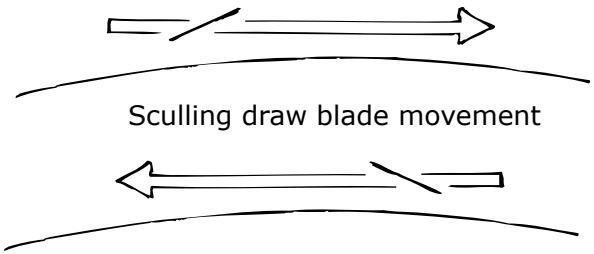
Begin by twisting the way you want to move. Reach out at right angles with the blade, with the top hand high, and over the side of the boat: the more vertical the paddle the more effective the stroke. Draw the



blade towards the boat, but before it reaches the hull lift the wrists to rotate the blade 90°. Slice the blade outwards again for the next stroke. The work is done with the lower arm, with the upper remaining steady.

Control the direction with blade position: towards the bow will turn the boat one way, towards the stern the other. Just right and the boat will go straight.

For the present, keep the boat flat. Some sea boats go sideways more easily if edged slightly towards the direction of travel. Low volume whitewater boats are edged the other way, to avoid being pulled under.



Variations

Sculling draw

The sculling draw is perhaps the most useful variation for moving sideways, and is a good exercise in understanding and control. The position is similar to that for a normal draw stroke, but the blade is moved fore and aft parallel to the boat, about 25 cm from the hull. As the blade changes direction the angle is changed, so that the blade is always 'climbing', drawing the boat sideways continuously.

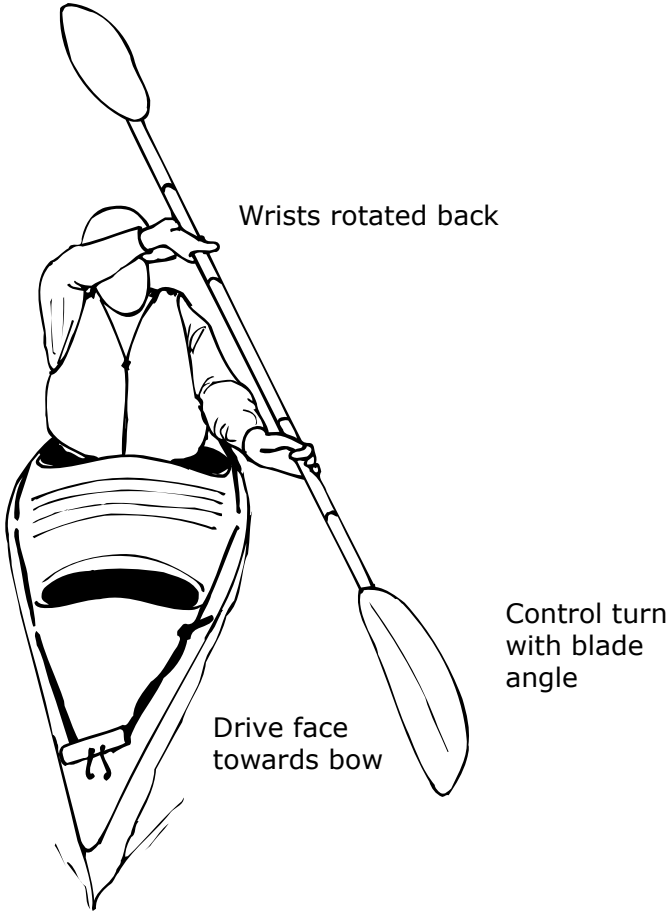
Begin with a small angle, and remember that the blade moves more or less in a straight line, not an arc.

Bow draw

Draw strokes made well forward can be used to move the bow one way or the other, either to line the boat up with a raft, or to avoid an obstacle. Apart from the blade position, the stroke is the same as a normal draw stroke.

Bow rudder

The bow rudder stroke uses a position similar to that of the bow draw, but the blade is held at an angle to the water flowing past the boat, turning the boat to the paddle side. The drive face of the blade faces the bow, which means the wrists have to be rotated back. A turn with bow rudder is usually started with a forward sweep on the opposite side: e.g. to turn left, a forward sweep on the right followed by bow rudder on the left. When the boat has turned sufficiently, lift the wrists and paddle forwards.



Support stroke

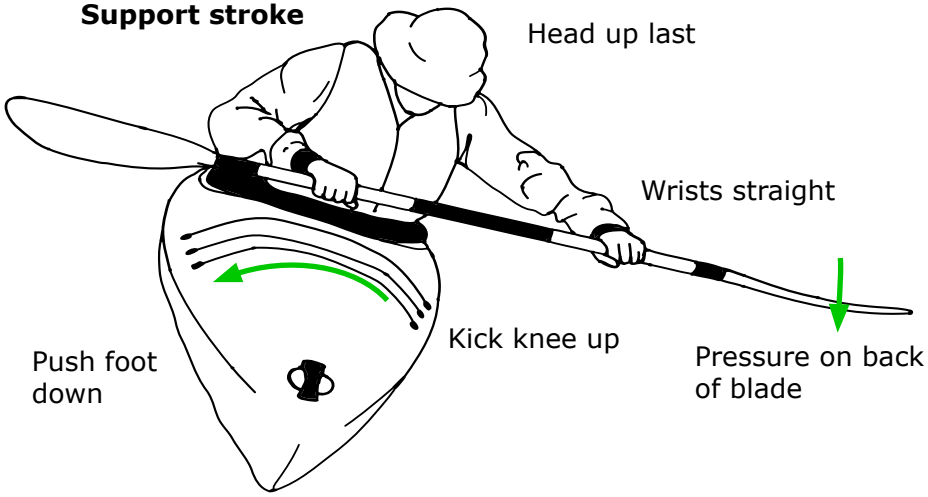
This is for those situations when you are about to go in. As with the other strokes, the key is body movement, and certainly not brute force.

The back of the blade is placed on the water, with the shaft low and near horizontal, wrist straight and elbows above the shaft. The boat is righted with hip movement (the 'hip flick'), with the blade on the water simply being something to react against.

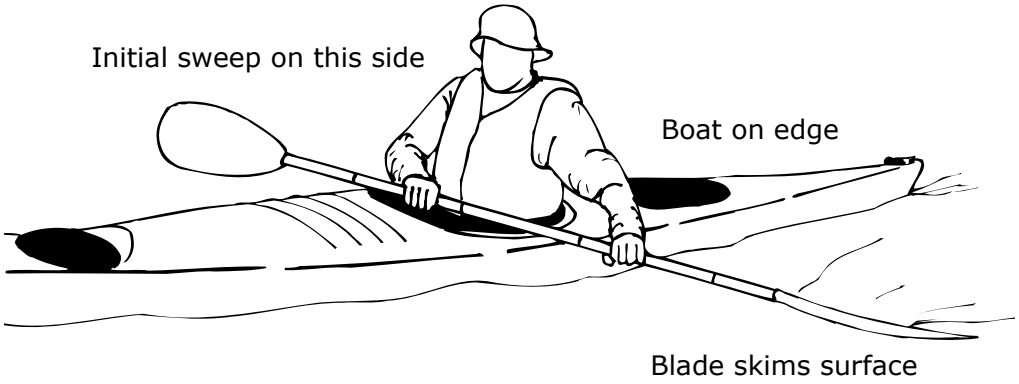
Don't try to lift your head—the natural reaction—but bring it up last: boat first, head last. Drop your wrists to slice the blade up again.

To practise this, sit comfortably, then lean until the boat becomes unstable, Recover. Try it on the opposite side. Another way to practise is in pairs, with your partner standing in hip-deep water and holding the aft end of your boat. Your task is to remain upright while your partner tries to tip you in.

Support stroke



Low brace turn

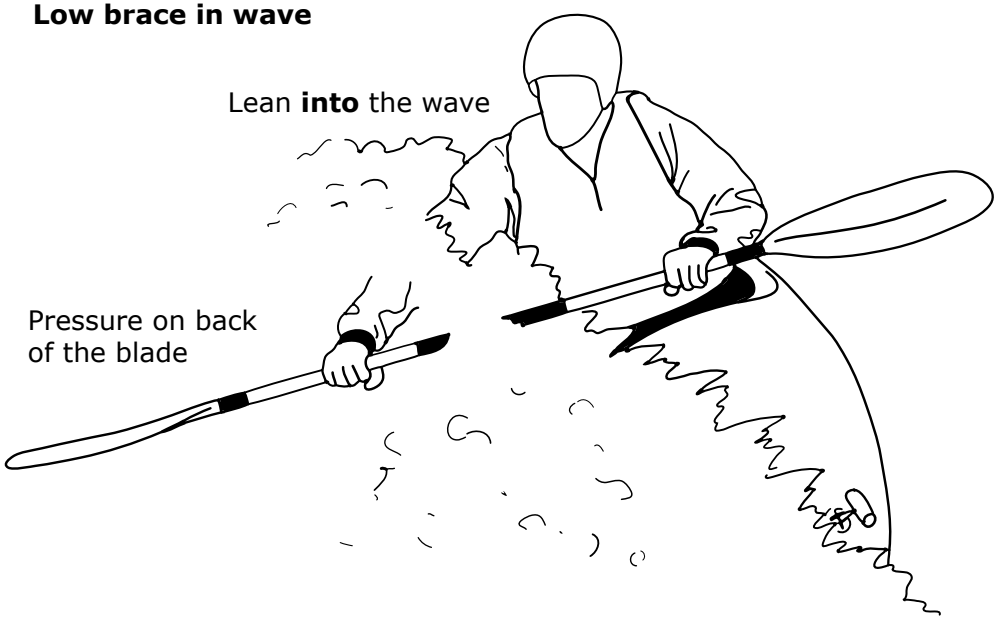


Another good exercise is the low brace turn. Begin by paddling forward, then make a forward sweep to begin the turn. Now put the boat on edge, on the side away from the initial sweep, and support yourself with a low brace. As the boat slows, right it with hip movement and resume forward paddling.

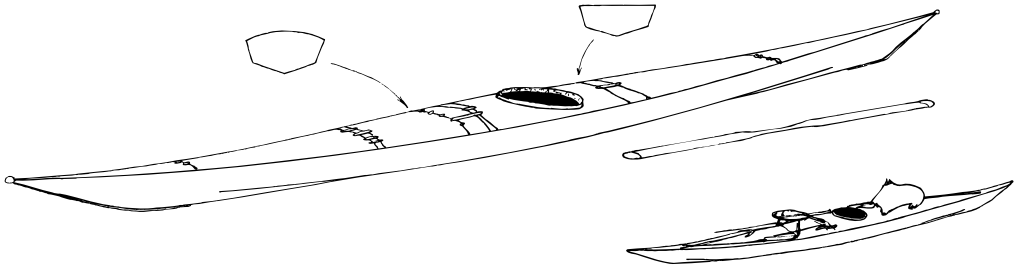
(This is the stroke beginners use in whitewater to enter and leave eddies. Experienced paddlers use bow rudders.)

This support is also the stroke you will use as you are pushed sideways in small surf, or meet a wave in moving water. Lean the boat **into** the waves, and support yourself on the blade. Lean away from the wave and the capsize will be instant.

Low brace in wave

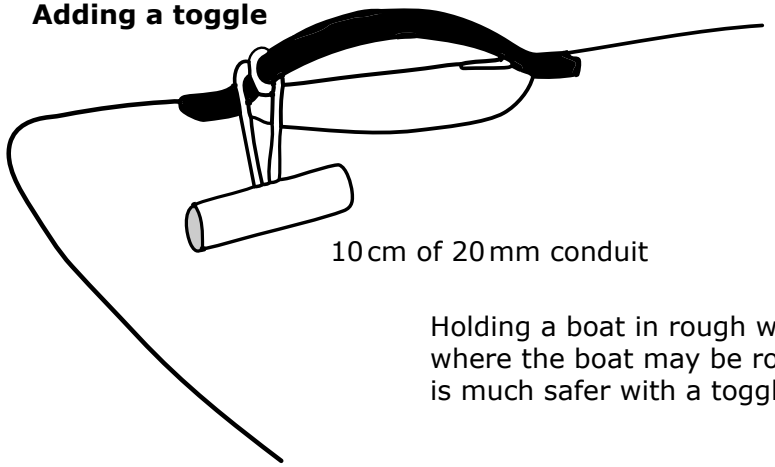


Note the difference between edging (page 13) and leaning. An edged boat is still on balance, a leaned boat is supported by the paddle because the centre of gravity is no longer over the centre of buoyancy



A kayak from Nuuk, Greenland, the ‘classic’ shape for a kayak. Built of driftwood and covered with sealskin, it was the hunter’s craft. The smaller view shows hunting equipment on deck: harpoon, harpoon line stand, and inflated sealskin float

Adding a toggle



Holding a boat in rough water where the boat may be rolled is much safer with a toggle

Canoe paddling

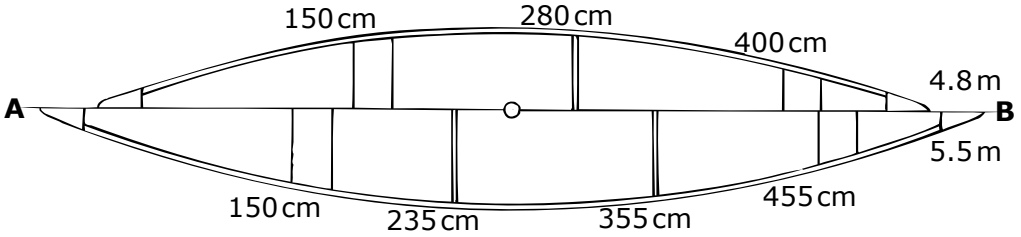
Boat setup

Sit or kneel? Sitting is more comfortable for long periods, but kneeling allows more power and is more stable in rough water. Ideally, you will be able to do both, but this is not possible in some boats. Flat seats, with the forward edge slightly lower, and ample space beneath are the best system.

Flat seats also make it possible to paddle the canoe in either direction — one way as a double, the other solo — while still keeping the boat in trim. Offset 'centre' thwarts can also be used for paddling doubles solo. The diagram shows seat and thwart layouts for 4.8 m and 5.5 m craft. The smaller boat is big enough to paddle as a double, but small enough for solo use. The longer boat is perhaps too big for easy solo paddling.

If you will be sitting in the boat, you will need to set up the footrest if there is one so that the knees are slightly bent. If you will be kneeling, make sure the pads are in the right places for your knees.

Lighter gear should go in the ends of the boat, heavier items amidships. This means that handling of the boat in waves will be affected less, and stowing heavy items low will aid stability. Packs and barrels should be lashed so that they do not move about and affect trim, and so that they can provide buoyancy if the canoe is swamped. It goes without saying that first aid kits and similar gear will be readily accessible.



For paddling as a double, end A is the bow. To paddle the 4.8m canoe solo, either sit on the seat at end A, with end B as the bow, or kneel against the thwart, facing A. The longer boat may be paddled solo seated on the A end seat or kneeling against the 235cm thwart, with end B as the bow.

(Dimensions shown are approximate, and are from end A.)

Also readily accessible will be map or chart and other navigation items, spare paddle, and so on, all secure. Communications gear is perhaps best in a PFD pocket.

Paddling

You can be on the water for hours on end: for comfort and safety it pays to have an efficient, relaxed style that maximises power and minimises fatigue, strain and injury. Our understanding of the mechanics and biomechanics of paddling has greatly increased in recent years, thanks to the work of coaches in the competitive disciplines, particularly in flatwater racing. What follows for forward paddling, therefore, is a condensation of the instruction given to sprint and marathon paddlers. If you can arrange it, time spent in a marathon canoe under the watchful eye of a Flatwater Coach will be well repaid. (It will also sharpen your reflexes!)

Correct ergonomics and posture are essential for paddling. Seated in a canoe you should have a slight forward lean (5 – 8°) from the pelvis, back straight without being forced, shoulders ahead of hips, head, neck and shoulders relaxed. The legs are slightly bent, enough that you can't quite push them straight without moving on the seat.

Lean too far forward and you restrict movement and lung capacity, lean back and again you will restrict movement (and perhaps cause injury).

If you're kneeling in the canoe your upper body will be as described. You won't be able to push on a footrest, but the rest of your body can be more flexible, in fact your whole posture can be better.

Where are your most powerful muscles? No, not the arms. In paddling, your arms are little more than the linkage between the power source, the muscles of the body, and the paddle. Your arms are there to put the paddle into the water and take it out again: power comes from body rotation, right from the toes. It's body rotation that shares the load between the muscles, and smoothly produces more power and length of stroke. That's true of all strokes.

The 'paddler's box'

The shoulder is the joint in the body with the greatest range of movement. It is also the most susceptible to dislocation and other injury. To reduce the likelihood of injury, and also to develop the most power, the elbows should always be in front of the line of the shoulders. The roughly rectangular volume in which the hands work is called the paddler's box, and that space rotates with the shoulders. If you want the paddle blade behind you, as in reverse strokes, it means that you rotate the body so that your elbows remain in front of the line of the shoulders. Take a look at the diagram in the kayak paddling chapter.

Several things before you go too far...

Carrying the canoe

The safest way is to have a person at each end, on opposite sides, holding the canoe by bow and stern thwarts or gunwales. Traditionally, canoes were portaged upside-down on the shoulders. Light solo canoes can be carried overhead, with centre thwart or seat across the shoulders. For serious portages yokes, or pads on thwarts, are more comfortable.

Launching

Put the canoe parallel to the shore, afloat. One paddler steadies the boat while the other embarks, both hands on gunwales, and first foot on the centreline. The first paddler then stabilises the canoe while the second boards. Disembarking reverses the procedure. Solo paddlers have to manage without assistance.

Capsize

Capsizing is part of canoeing , and the sooner you experience a controlled capsize the better. On a course, your instructor will supervise, and will probably have some exercises. If the water is cold, you may want to prepare yourself with a few splashes, and swimming goggles or masks may make things more comfortable.

Keep hold of your paddle and lean to one side or the other until the boat capsizes. When it has stabilised inverted, tuck the paddle under one arm and push yourself clear. If you're kneeling, slide your legs out from the seat or thwart first.

In a decked canoe, lean forward, grab the spraycover strap and release the spraycover if you're using one. Put your two hands on the deck behind you, straighten your knees, and, rolling forward, push the boat away from you.

While this is going on, hum a tune to help keep water out of your nose.

Come up alongside the boat, paddle still under one arm, and take hold of the boat. In a double, check that your partner's head is above water. Work your way to one end. Let go of anything and it will drift faster than you can swim, so ignore any loose gear for the moment. Either swim the boat ashore, upside-down, keeping to windward of it, or await rescue.

When you capsize unexpectedly remember to follow the appropriate procedure.

Who's in charge?

Paddling a double canoe is an exercise in cooperation, communication, and coordination. Each paddler must know what the other is doing, and understand how the canoe will react to each stroke. Effective teamwork takes practice.

The stern paddler has a better overview of the boat and its surroundings, and is better able to control its direction with steering strokes. On the other hand, the bow paddler has a better view of nearby obstructions, and is therefore able to warn of them and begin taking action. (In *voyageur* days bow paddlers were paid more because of their skill and responsibility in reading the water.)

Neither paddler should switch sides indiscriminately: the two should paddle on opposite sides to keep things in balance. They should also synchronise so that the boat moves smoothly. The roles can be listed this way:

Stern

- follow the proper course of the river, by choosing a route with the other paddler
- keep the canoe properly aligned with the current
- maintain spacing with other craft

Bow

- set the pace, the rate of paddling, remembering that the stern paddler will be making correcting strokes, which take longer
- read the immediate route in the river, and warn of obstructions
- decide appropriate strategies and communicate them
- take immediate action, expecting that the stern paddler will follow.

At first most communication will be verbal: with experience paddlers will react to each other's strokes and the environment. Verbal communication is best as 'turn left' or 'avoid that snag' rather than naming a stroke: 'draw'. This helps each other understand where the boat is to go rather than blindly following stroke instructions.

Stern paddlers will need slightly longer straight paddles, while bow paddlers can profitably use paddles with a few degress of bend.

Solo paddlers have it all to themselves...

Forward paddling

You want to go places, so forward paddling is the important stroke, and is usually described in three phases.

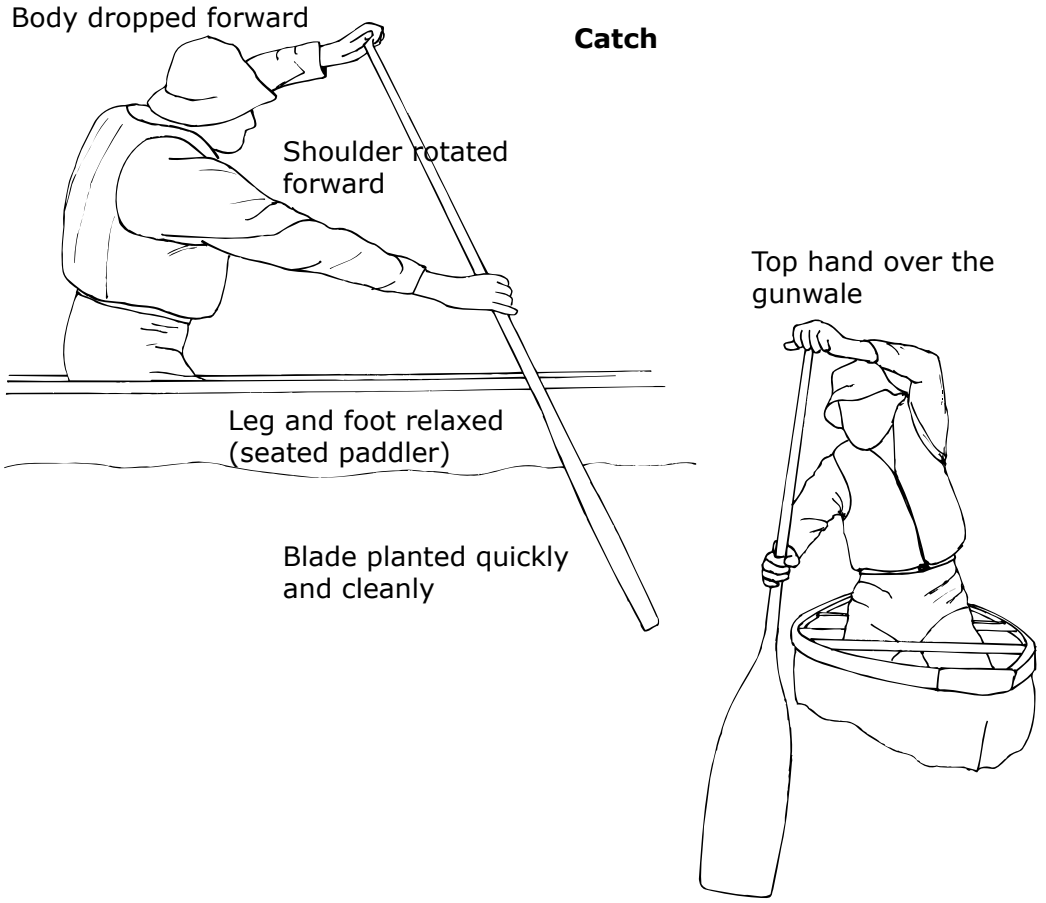
Catch

The catch is the start of the stroke, the entry of the blade into the water. The key points are:

- clean entry, as far ahead as possible, with the blade as vertical as possible
- full rotation of the torso, bottom hand shoulder forward
- quick development of power

Think about:

- taking the blade to the water: the bottom hand takes the blade to the water in a spearing motion, with the top hand following the shaft movement, but not pushing the blade in
- squaring the blade: the blade must be at right angles to the direction of travel — if the angle is wrong the blade will slide sideways
- burying the blade: completely immerse the blade as quickly as possible, keeping the bottom hand clear of the water throughout the stroke.



Power

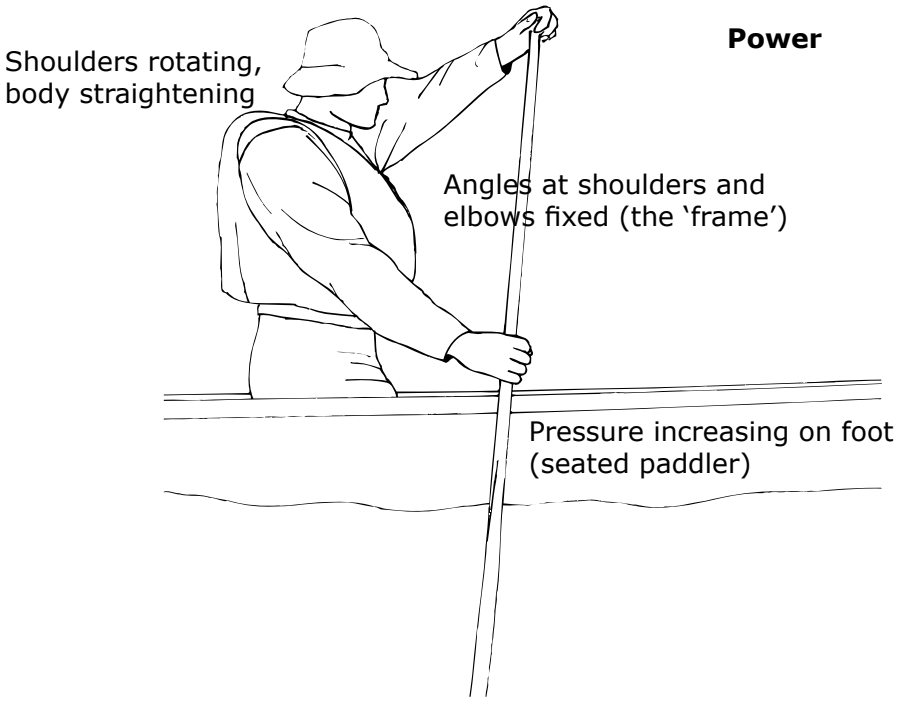
Think of the blade as being fixed in the water: you pull the boat past it. From the catch, the stroke is 'taken' by the whole 'pulling' side of the body—toes, leg, hip, torso, and shoulder—all working smoothly together.

The bottom arm remains in a fairly extended position throughout this phase, with the top arm, elbow bent, and hand at around 30–40 cm in front of the head and over the side of the canoe, following the rotation of the shoulders.

Racing paddlers talk of the 'frame', the arms and shoulders, remaining fixed through this phase: in other words the elbows are not bending or straightening but remaining at the same angles. The top hand does not push, it follows the shoulders.

Make sure you paddle parallel to the centreline, not the gunwale. If you're paddling solo, have the blade as close to the hull as possible: to do that have the top hand right across.

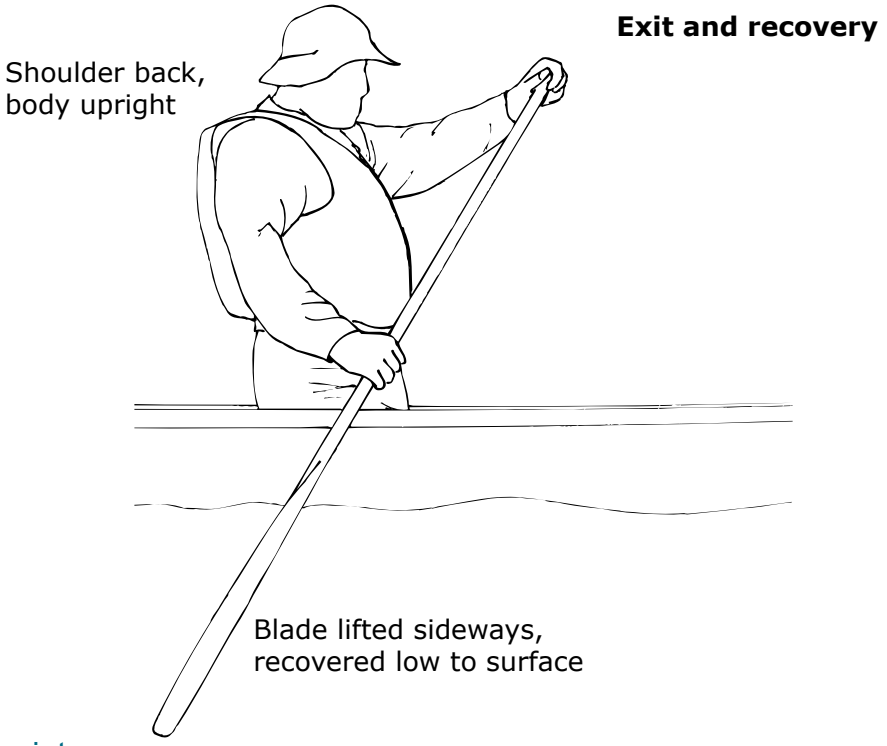
Power



Exit and recovery

The stroke is finished when body rotation is complete. Taking the stroke too far is simply wasted effort. At exit, the blade moves out of the water to the side, with the top hand still high and the bottom elbow bending to lift the blade. That elbow should stay low and relaxed. Take the blade forward for the next stroke, keeping it close to the water surface and flat so it does not catch the wind.

Exit and recovery



Key points

To revise:

- plant the blade by or ahead of the feet, bottom arm extended but not straight
- rotate the torso to pull back the shoulder and drive the stroke
- the top arm holds its position relative to the shoulders
- the power phase ends with the blade in line with the hips
- lift the blade out sideways
- keep the top hand high, and over the gunwale

Things to avoid:

• excessively long strokes

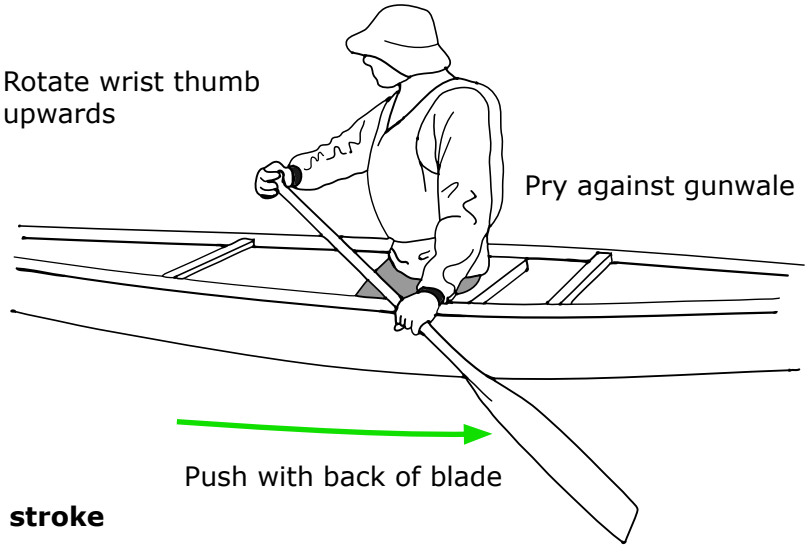
• punching or dropping the top hand

The canoe will almost certainly wander, usually by turning way from the stern paddler. To keep straight, two corrective strokes for the stern or solo paddler.

Trail stroke

Also known, disparagingly, as the 'Squaw' or 'Goon' stroke. To make the stroke, let the blade trail at the end of a forward stroke, twist the body to follow it, and apply pressure to the back of the blade. For maximum effect, lever the paddle against the gunwale.

The trail stroke is not as efficient for driving the boat forward, but it does give better control, and should be used only when necessary, e.g. when moving away from stationary. Note the twist of the body to have the blade well aft for maximum effect. Keep the lower arm straight.

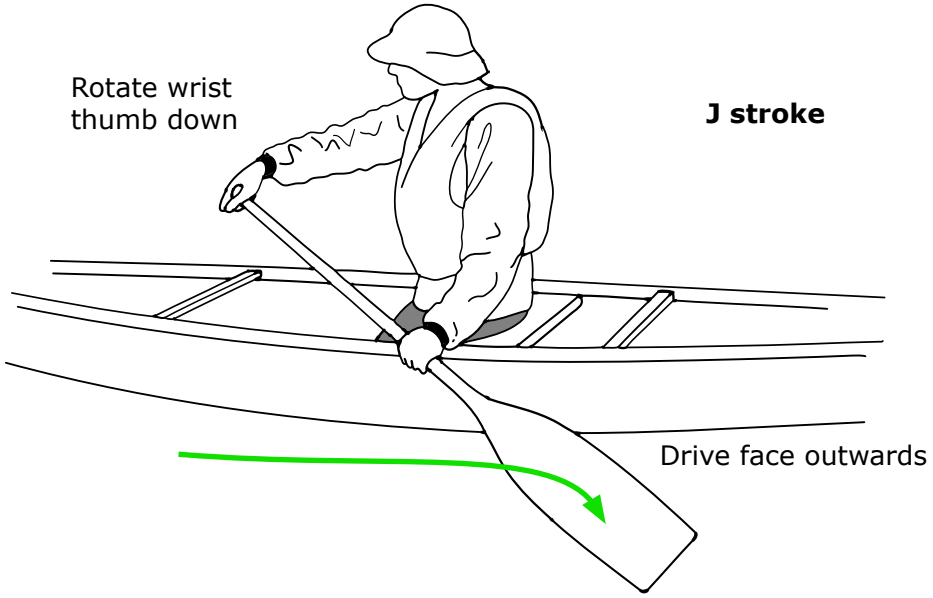


Trail stroke

J stroke

So called, because of the path followed by the blade. As the blade passes the thigh, rotate the wrists outwards so that the top thumb points forward. Keep pressure on the drive face of the blade throughout.

There are variations of the stroke. In the older style the paddle did not touch the gunwale, but the modern trend is to lever the paddle off the gunwale to make the pry action more powerful. Practise until you are fluent, and can go straight and turn in either direction under full control.



J stroke

Switch

Marathon paddlers don't bother with the J Stroke, but after a few strokes call 'Hut!' and swap sides without breaking the rhythm. As you lift the blade from the water, release the top hand. Lift the paddle across the boat and put the top hand beneath the lower hand: the top is now the bottom. Slide the new top hand up the shaft to the handgrip, adjust the bottom hand and make the next stroke.

For touring, change sides every 10–15 minutes.

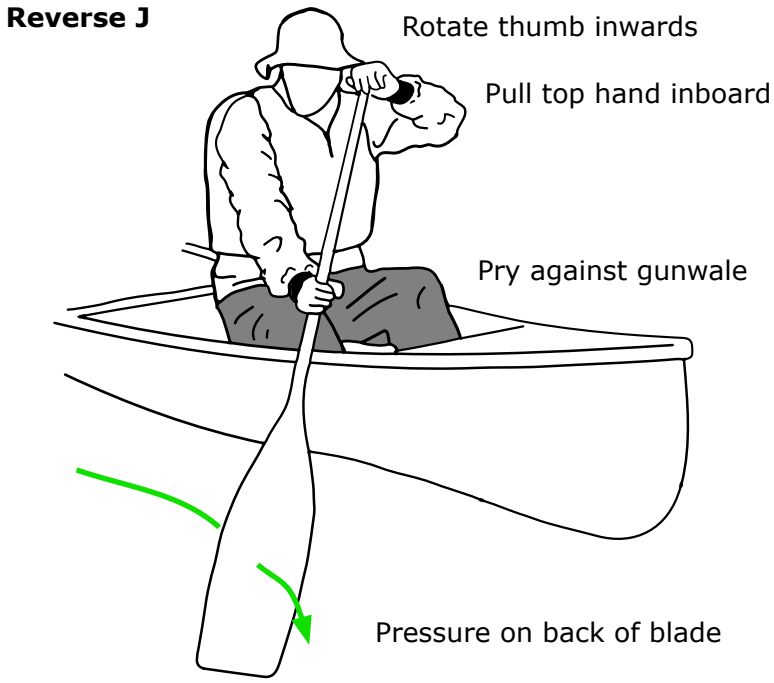
The solo canoe paddler must be able to J Stroke fluently, and should be proficient on both sides. Some boats are easier to paddle cross wind with the blade on the upwind side, some with it downwind: you'll need to experiment with your boat.

Reverse paddling

All reverse paddling strokes use the back of the blade and depend, as always, on body rotation for power.

To begin, turn round and with arms straight, put the paddle flat on the water. Keeping the arms straight, twist in the opposite direction, driving the blade towards the bow until it is near vertical. Lift the blade clear and wind up for the next stroke.

When paddling in reverse, the bow paddler will be controlling the direction. Reverse J strokes will be needed. Make the reverse stroke, then as the blade passes the hips, rotate it and pull the top hand across, levering off the gunwale.



Emergency stops

Use short, hard, quick reverse strokes when moving forwards, short quick forward strokes when in reverse.

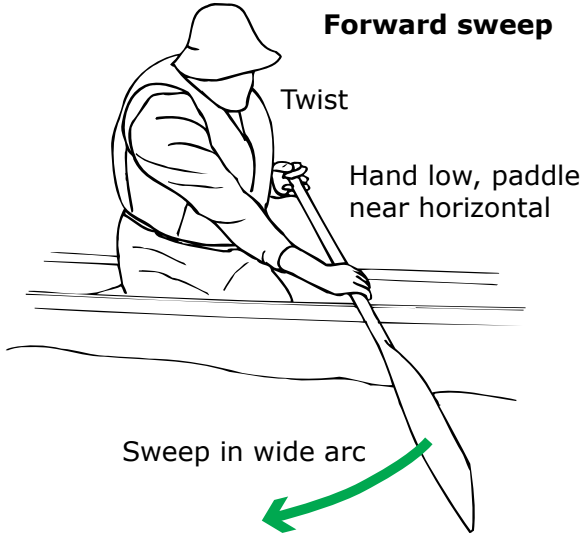
Sweep strokes

Sweep strokes are the main strokes for turning the boat at low speed.

As with other strokes, power comes from the torso muscles, but here the stroke will be a long wide arc, the longer and wider the better. Solo paddlers will make 180˚ sweeps, but paddlers in doubles must limit their sweeps to 90˚.

For a forward sweep, twist to reach forward and put the blade in as close to the bow as possible or at the 90˚position. The lower arm is slightly flexed, the top hand low, just high enough to clear the deck or gunwale. The blade should be completely immersed, just beneath the surface.

Apply power by twisting the body in the opposite direction, keeping shoulder and elbow angles fixed, so that the blade moves (relative to the boat) in a wide arc, either to the stern or the 90˚ position. While you are learning, watch the blade all the way around so that you develop the full twist necessary.

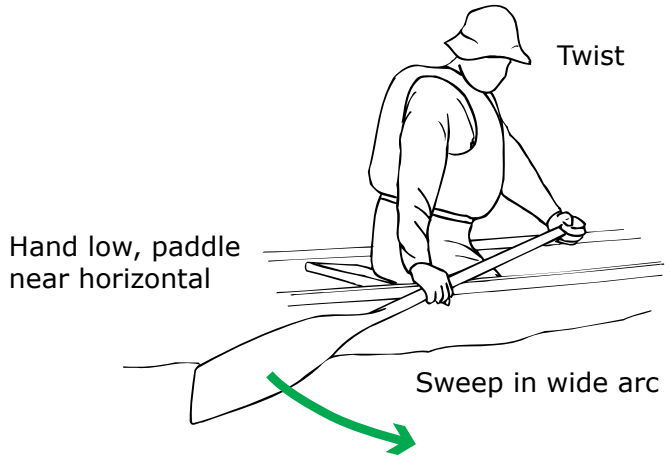


The reverse sweep works the same way, but in the opposite direction. Begin by twisting so that the whole paddle is over the side and put the blade in close to the stern or at the 90˚ position. Now twist the other way to move the blade in a wide arc.

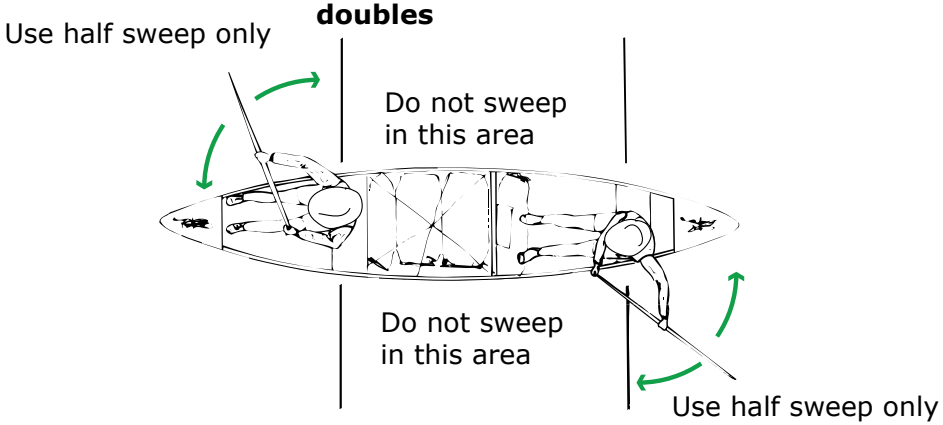
Note that double paddlers will be sweeping in opposite directions: if one is making a forward sweep the other will be making a reverse stroke. The canoe will spin on the spot.

As you develop confidence, look where you are going rather than watching the blade through its arc.

Reverse sweep



Sweep strokes in doubles



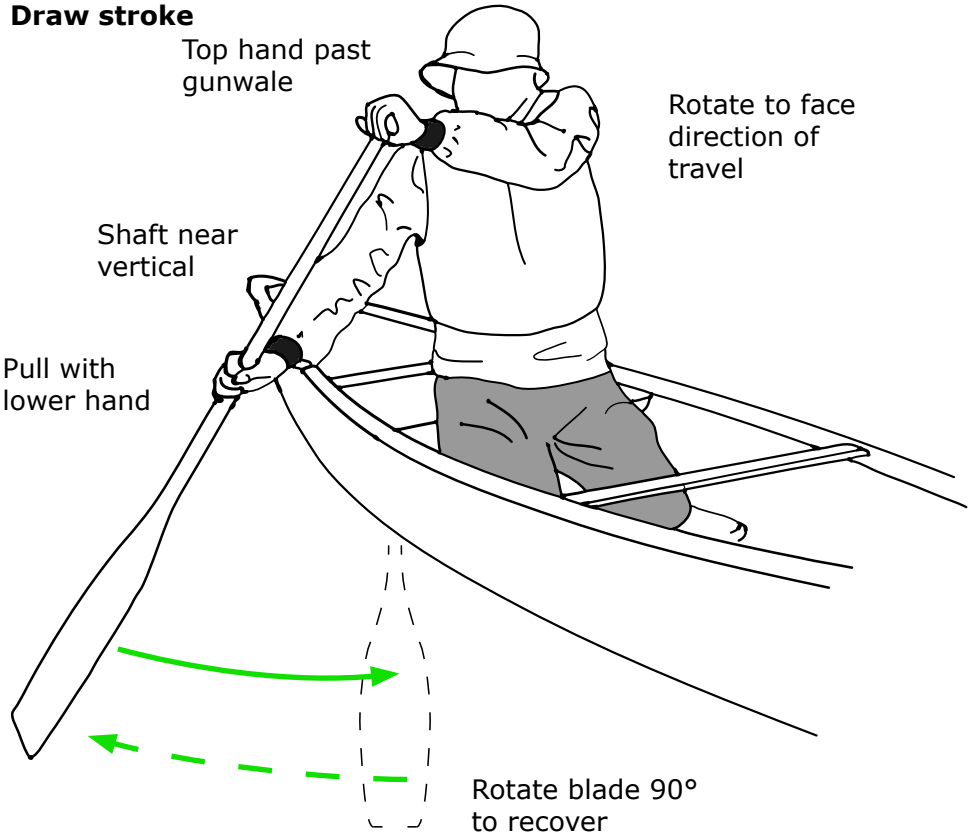
Draw

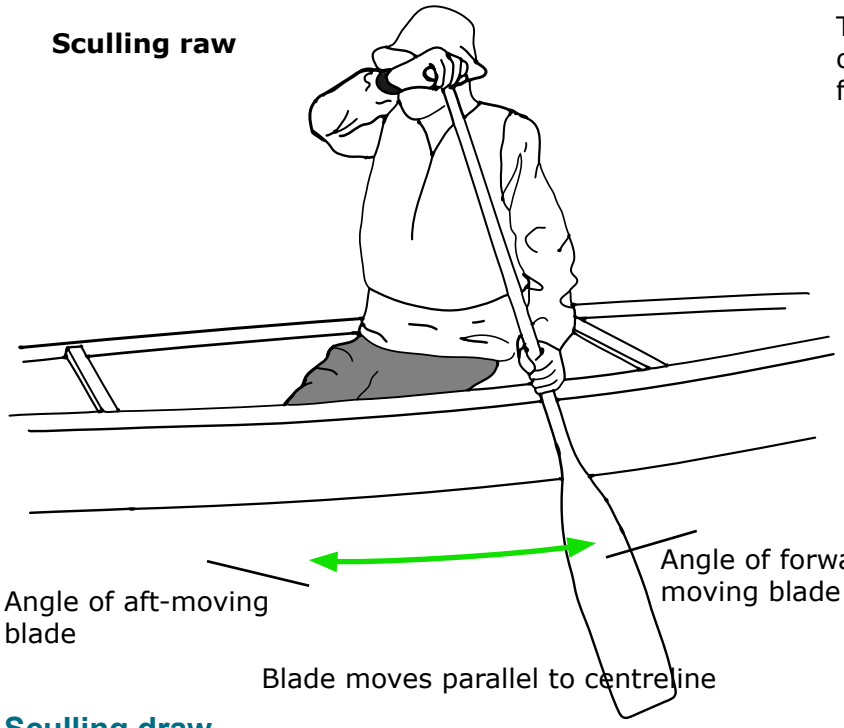
You may want to go sideways towards or away from a jetty or raft of canoes. The draw stroke is the method.

Begin by twisting the way you want to move. Reach out at right angles with the blade, with the top hand high, and over the side of the boat: the more vertical the paddle the more effective the stroke. Draw the blade towards the boat, but before it reaches the hull lift the wrists to rotate the blade 90˚. Slice the blade outwards again for the next stroke. The work is done with the lower arm, with the upper remaining steady.

The solo paddler will control the direction with blade position: towards the bow will turn the boat one way, towards the stern the other. Just right and the canoe will go straight.

Draw stroke





Sculling draw

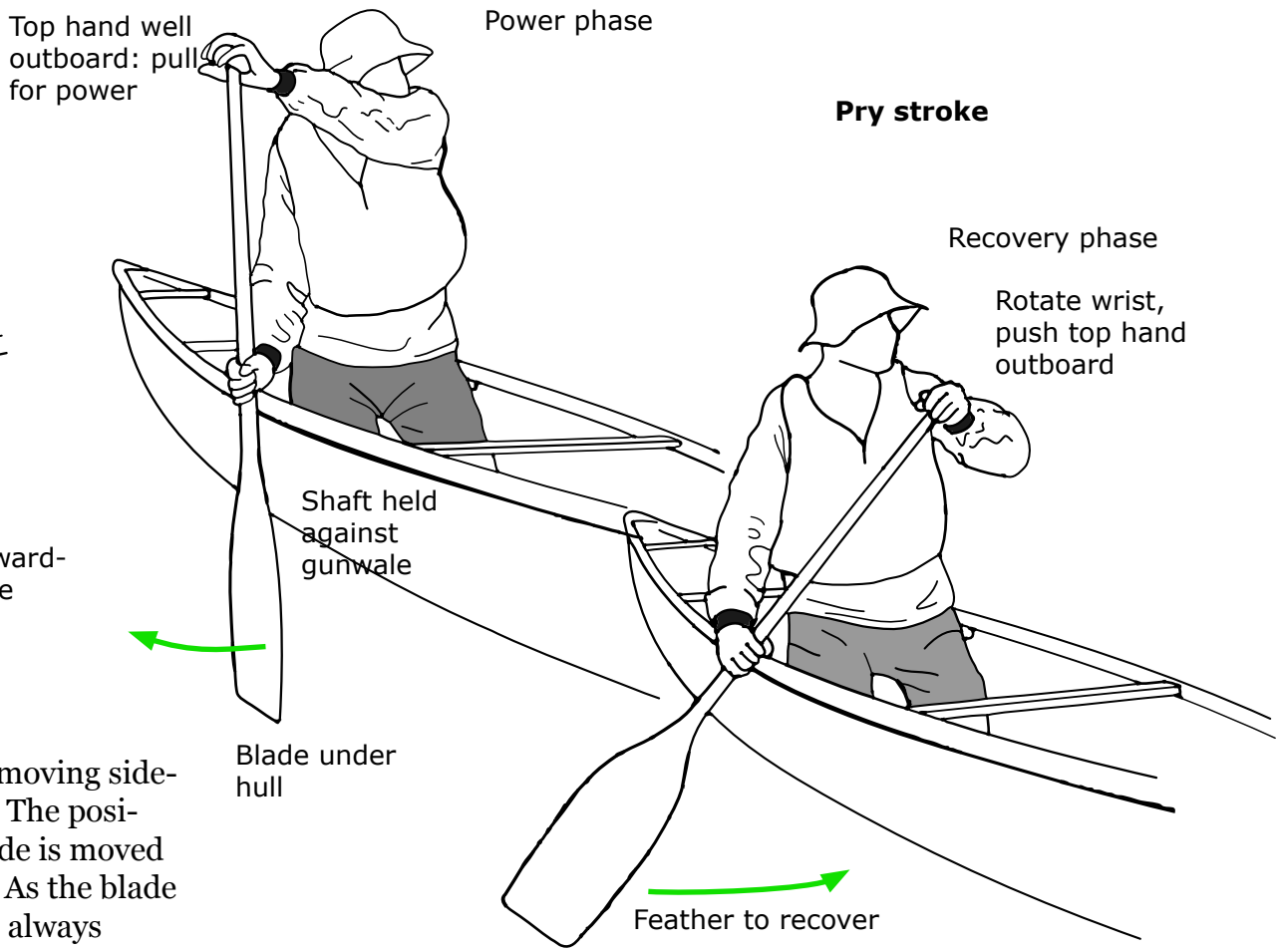
The sculling draw is perhaps the most useful variation for moving sideways, and is a good exercise in understanding and control. The position is similar to that for a normal draw stroke, but the blade is moved fore and aft parallel to the boat, about 25cm from the hull. As the blade changes direction the angle is changed, so that the blade is always 'climbing', drawing the boat sideways continuously.

Begin with a small angle, and remember that the blade moves more or less in a straight line, not an arc.

Pry

This stroke is equivalent to the Draw, but in the opposite direction. (Bow paddlers could use Cross Bow Draw in its place.)

Put the paddle vertically alongside, and hold the shaft against the gunwale. With the blade at 90˚ to the hull, push the top hand outwards so that the blade is under the hull. Rotate the wrists, and blade, and pull with the top hand. The boat will jerk sideways. Feather the blade and



push to swing the blade under the hull for the next stroke. The top hand does all the work, with the lower hand simply holding the shaft in position against the gunwale.

The movement is somewhat jerky. Make a series of short strokes rather than try one long stroke. Coordinate with the Draw at the other end.

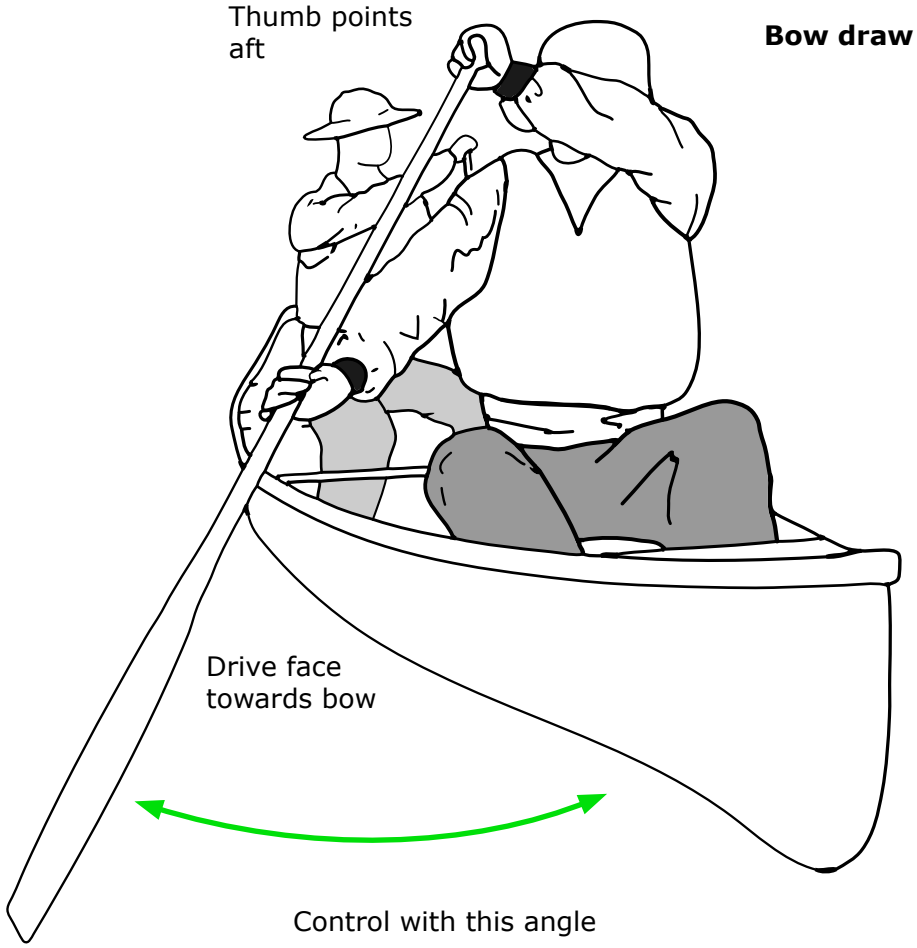
Be careful of this one when there are obstructions below the surface, especially when the boat is under way.

Experiment with combinations of Draw/Pry, Pry/Draw, Draw/Draw, Pry/Pry and part sweep strokes to move the boat sideways and/or rotate.

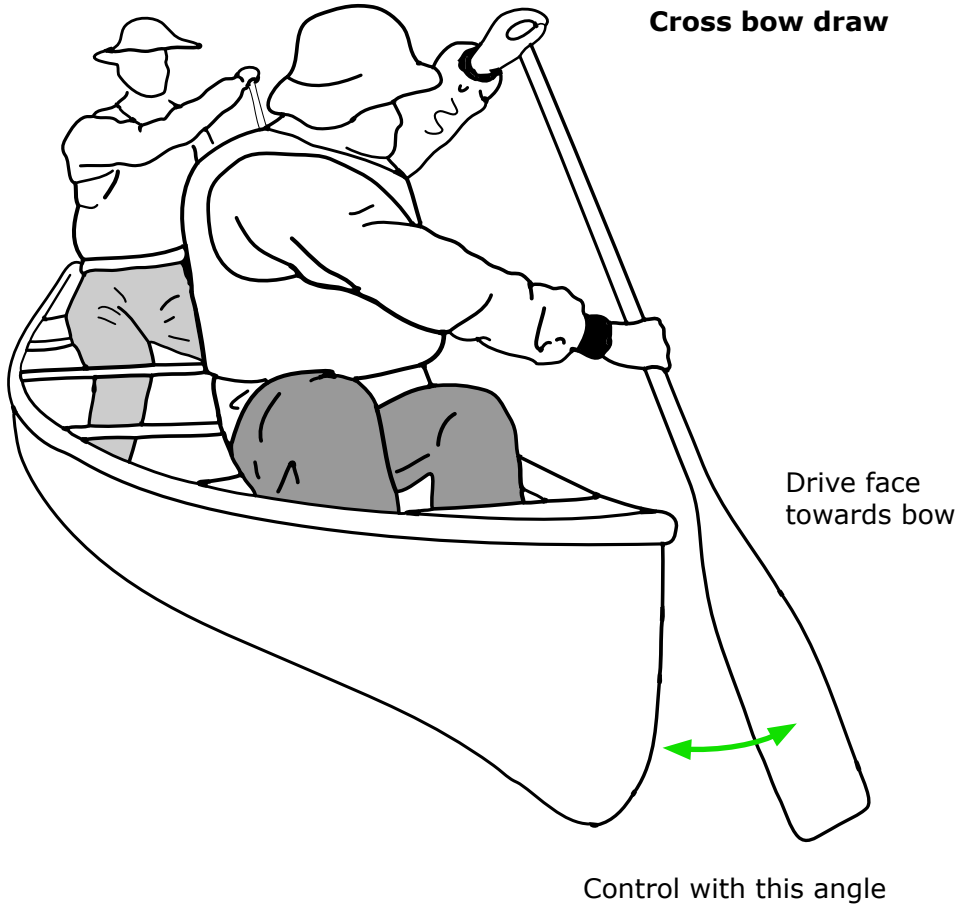
Bow draw

The Bow Draw is used to turn the canoe, by drawing the bow to the paddling side. The stern paddler will usually begin the turn with a forward sweep.

The position is for the beginning of a draw stroke, but lean forward to place the blade well forward. Keep the wrists flexed, and the drive face of the blade facing the bow.



To turn the opposite way, there's the Overside or Cross Bow Draw. Twist the body and lift the blade across to the other side of the boat. The pressure is still on the drive face of the blade, and control is with blade position and wrist angle. If the blade strikes an obstruction let go immediately with the bottom hand.



Support stroke

This is for those situations when you are about to go in. As with the other strokes, the key is body movement, and certainly not brute force.

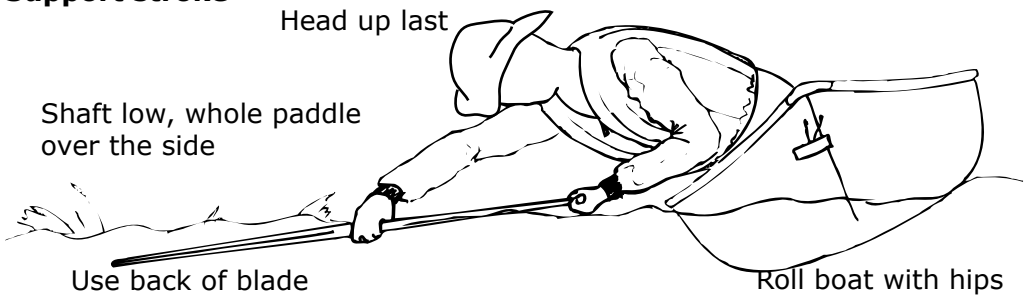
The back of the blade is placed on the water, with the shaft low and near horizontal, wrist straight and elbows above the shaft. The boat is righted with hip movement (the 'hip flick'), with the blade on the water simply being something to react against.

Don't try to lift your head—the natural reaction—but bring it up last: boat first, head last. Drop your wrists to slice the blade up again.

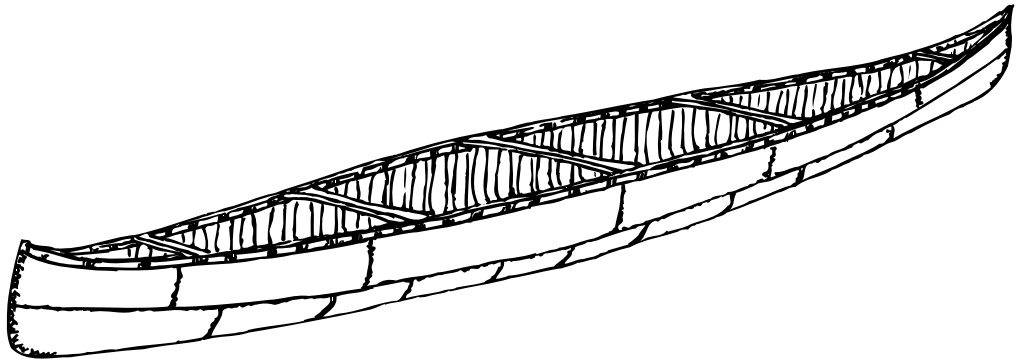
The solo paddler will normally be able to support on one side only, and will often need to decide before entering some areas of water on which side to paddle for better support. Paddlers in doubles will be able to support on both sides at once.

To practise this, sit comfortably, then lean until the boat becomes unstable, Recover. Try it on the opposite side.

Support stroke



Native American birchbark (Tètes de Boule, central Canada) The bark skin was sewn together and sealed with resin. Within the skin were wooden longitudinal splints and ribs. The gunwales and thwarts were lashed together: no nails or screws.



Single canoes were about 3m long, fur trade *mâitre canots* were some 10m in length

Deep water rescues

Rescues

You **will** capsize at some stage, probably when you least expect it. Why? You may be trying something new and over reach things, or wind and waves have risen to conditions beyond what you can normally handle. A 'rescue' is the emptying of a kayak or canoe and the return of the paddler(s) to the cockpit. The rescue must be done in the conditions that caused the capsize and will put the paddler back into those same conditions.

The more buoyancy in the boat, the easier it will be to rescue, so add more buoyancy, with airbags for example. All boats must have secure handholds at bow and stern, and those used on open water will be easier to handle with decklines as well. Toggles are the safest handholds, but many recent boats have simple handles that are difficult to reach and potentially injurious when capsized.

The first priority in all rescues is the capsized person. Make sure the person is calm and relaxed and ignore any floating gear until later.

A paddler who capsizes and exits the boat close to a safe landing may simply move to the bow, grasp the handhold with one hand and the paddle with the other, and swim to safety. In moving water they should be upstream (or seaward) of the kayak to avoid injury.

In extremely turbulent water maintaining contact with the boat may be too hazardous, so it may be let go and the swimmer should then head to the safest location for rescue. The boat is a danger to other users of the area so call out a warning to them if required. Be aware of other hazards in the area such as overhanging branches, rocks or possible underwater obstructions and other craft and avoid them. Once the boat is on shore, empty it by placing it on its edge: most of the water will flow out, then lift the bow and stern in turn to remove the rest.

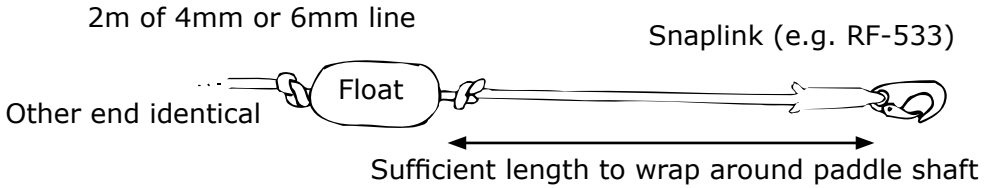
If it is not possible to swim to a safe landing a partner rescue will have to be used. There are several common types and it is good to know all of these and be able to use the best one for any given situation, considering the equipment on hand, the boat type and the conditions. The most important element of any rescue is to get the swimmer out of the water and back into their boat as quickly and safely as possible. Immersion in cold water quickly saps strength and coordination and is hazardous. As the rescuer you must take control, approach the swimmer quickly but in a safe, controlled manner: do not risk your own safety. If the swimmer has let go of their paddle collect it if practical, otherwise leave it to someone else or later.

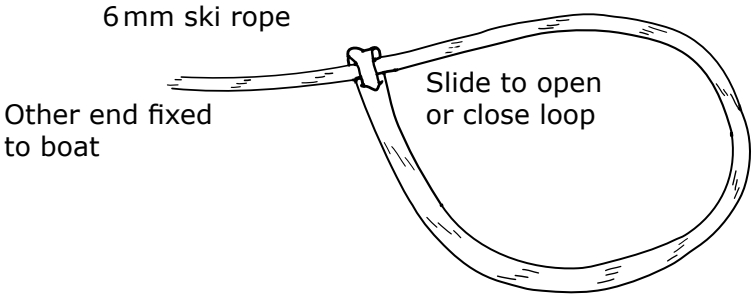
Check the condition of the swimmer and give reassurance and explain the rescue method: ensure they keep hold of the bow handhold of your craft: wind or currents can quickly separate the rescuer and rescuee. Carefully observe the swimmer throughout the rescue and look for signs of injury, hypothermia or shock. Once the rescue has been completed do not release the retrieved paddler until you are certain that they are capable of continuing paddling. Remember that the rescue has put the victim back into the conditions that caused the capsize. If you are unsure of their paddling confidence keep supporting them and organise a supported tow to the nearest safe landing.

There are conditions on rivers and in the sea where environmental hazards may make a partner rescue impracticable. In surf or caught in a rip traveling towards breakers, or when in or approaching rapids, see to your own safety first while keeping the victim in sight. When the hazard passes move in for the appropriate rescue. There is no point in becoming another casualty requiring rescue.

Equipment

An instructor or group leader will need to be prepared to do rescues and towing. Make sure your own boat is easy to rescue in case you have to rescue it yourself with minimal assistance. Keeping track of the paddle has always been a problem, and sea paddlers have long used some form of paddle leash or park, often one of the coiled springy things used by surfers. Another type is shown in the diagram. An even simpler one is formed from about a metre and a half of ski rope with a sliding loop in one end, with the other end fixed to the boat. As with all ropes, be aware of the possibility of entanglement.





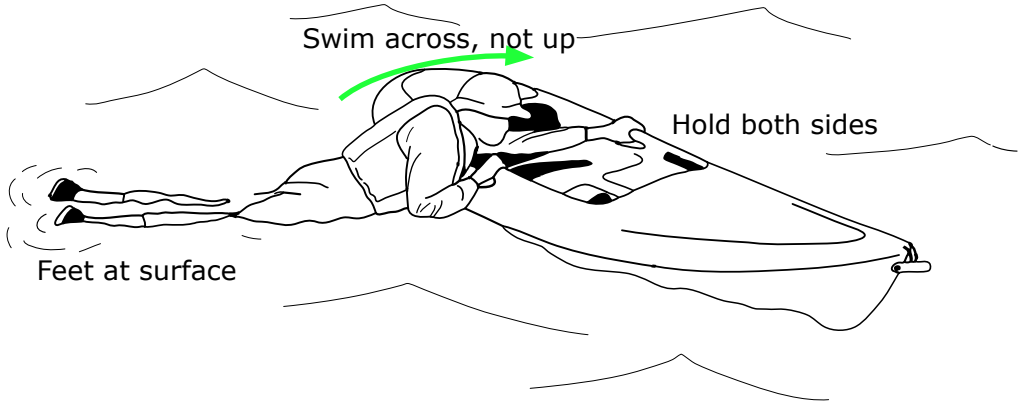
SOT rescues

Let's deal with the easy one first... After capsizing, free yourself from the thigh straps if you're using them, and come up alongside the boat. Hang on to it: in any breeze it can drift faster than you can swim. If you can reach the paddle, grab it too, but ignore anything else for the moment.

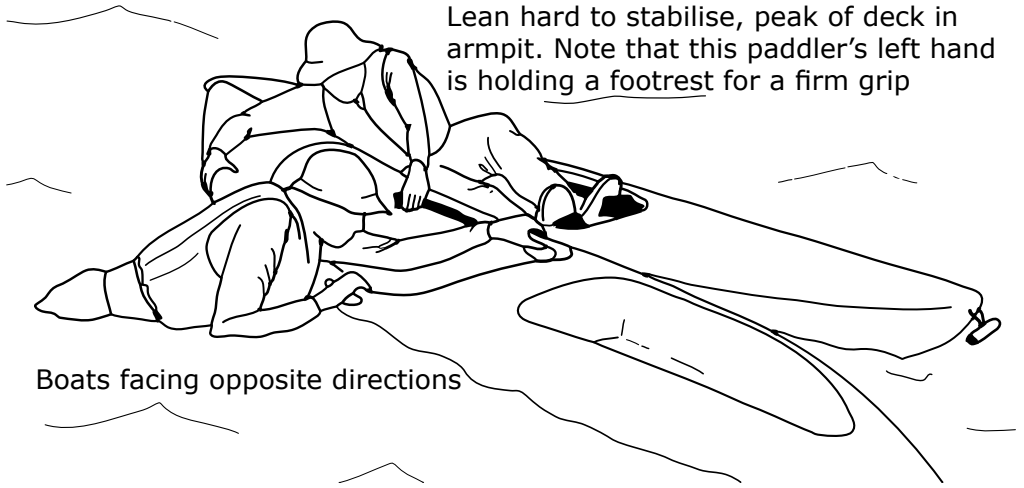
Right the boat, either by reaching across underneath to pull while pushing up on the nearer side, or by swimming over the upturned hull, grabbing the far side, then dropping back into the water, rolling the boat.

Drop the paddle into the boat. Reboard by reaching across with one hand with the other holding the nearer side. Swim your feet to the surface, then with a breastroke kick and a pull on the arms, swim across the boat. Don't try lifting yourself from a vertical position: you want to go across, not up.

Once you're back on, roll upright and turn into the seat. When you're properly settled you can go after any floating items.



If another member of the group capsizes keep an eye on him or her, and assist if necessary by rafting with the capsized boat to stabilise it. Group leaders might carry or improvise a 'step' to give people something to stand on to reboard, and these will work safely only with boats rafted together.



Reboarding

All rescue methods eventually have the swimmer reboarding, so it is worth considering first. There are alternative methods, depending on preferences and conditions, with all methods requiring a stable raft. That is achieved by having the boats facing in opposite directions and the rescuer putting as much weight as possible on to the swimmer's boat.

Reboarding is possible over the rescuer's or the swimmer's boat, with the choice often based on individual preference. By staying low and spreading weight across both boats the raft will be stable, and the swimmer less likely to slide off.

The rescue is not complete until the spray deck is in place and the rescuer satisfied that the paddler is ready to continue.

Key points

Rescuer: Stabilise

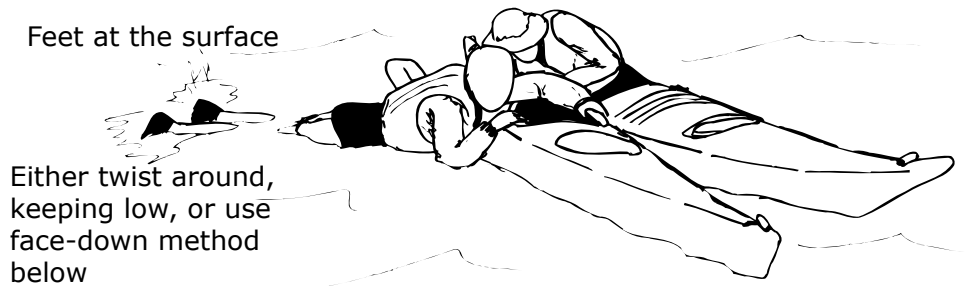
- Lean hard on the swimmer's boat, with the peak of the deck in your armpit. That hand can hold the swimmer's paddle
- Hold the cockpit rim with your other hand, ready to assist the swimmer if necessary

Swimmer: Reboard

- Move around the raft to the cockpit
- Put one hand each side of the cockpit rim
- Kick the feet to the surface
- Make a breaststroke kick and pull with the arms to come across the deck
- Keep moving, face down, until the feet are in the cockpit
- Roll face up, and wriggle forward until over the seat
- Sit up

Reboarding over rescuer's kayak

Reboarding over swimmer's kayak



The X rescue

This rescue is a versatile rescue used for general purpose and white water kayaks. The victim of the capsize leaves the kayak inverted and holds the bow (preferably) or stern handhold. On approach, the rescuer takes the boat from the swimmer who then grasps the bow handhold of the rescuer's kayak. The swimmer can take care of paddles. (The rescuer's is best leashed.) The rescuer then hauls the inverted kayak across their foredeck keeping both kayaks at right angles, and off the spray deck to avoid damage. The water is emptied from the kayak by seesawing it.

When the kayak is empty it is righted, then slid off the rescuer's boat and placed alongside the rescuer's kayak, facing the opposite direction, for the swimmer to reboard.

Although the victim can assist in hauling their kayak across the rescuer's boat, which may be necessary if the boat has insufficient buoyancy, the rescuer normally does the entire rescue.

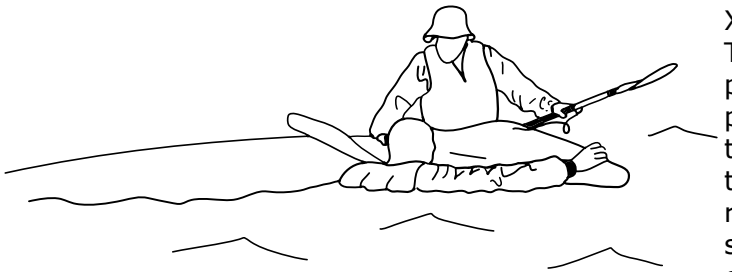
Key points

Swimmer:

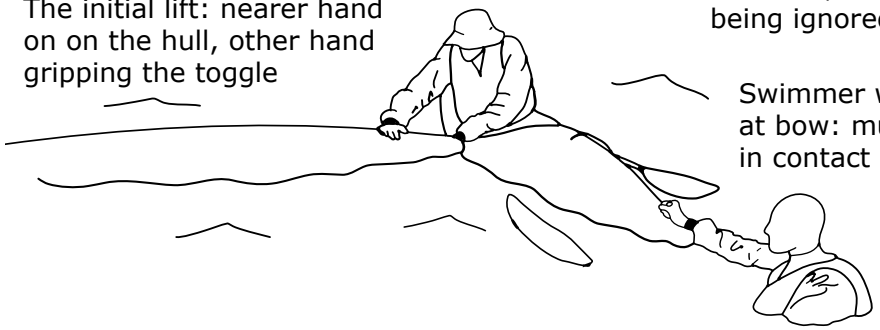
- **Leave the boat inverted**
- Hold it by the bow (preferably) in one hand, the paddle in the other
- Ignore anything floating away: let go of your boat and it can drift faster than you can swim
- Watch for your rescuer: if necessary swap sides so that your boat is between you and the rescuer's boat when it arrives.

Rescuer:

- Put your paddle into its leash
- Talk to the rescuee, giving clear, concise instructions
- Plan your approach to pick up the swimmer and boat in one move
- Have the swimmer transfer to your bow
- Place your nearer hand on the upturned hull
- With the other, grab the toggle or end loop
- Lean on the boat, and then push away to give some impetus for the lift

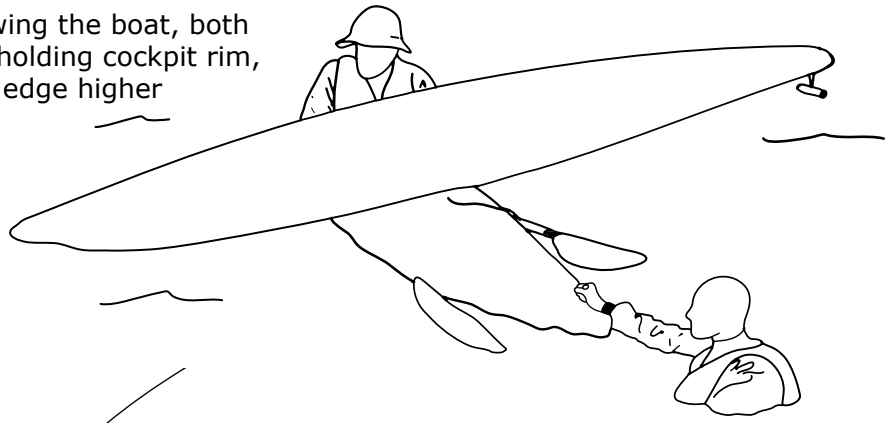


X rescue: contact
The rescuer is putting leashed paddle aside, the swimmer is transferring to the rescuer's boat. The swimmer's hat has come off, but is being ignored

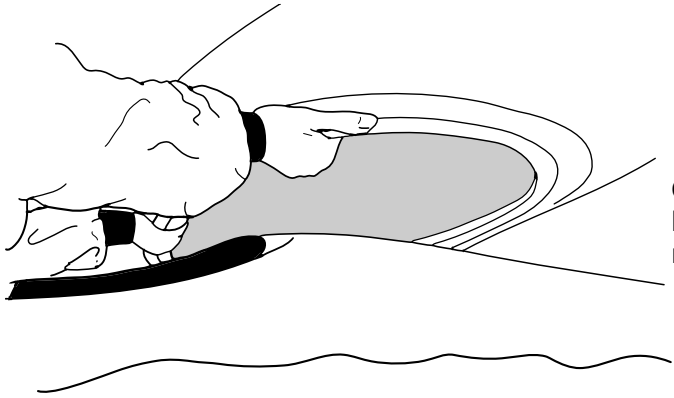


The initial lift: nearer hand on on the hull, other hand gripping the toggle

Swimmer waiting at bow: must stay in contact



Seasawing the boat, both hands holding cockpit rim, nearer edge higher



Gripping the boat: both hands on cockpit rim, boat resting on foredeck

- Use the deck lines (if present) to haul the boat across: be quick at this stage to avoid the stern filling
- Grab the cockpit rim as soon as you can reach it, then drag the boat to and fro to drain it
- Have the nearer side slightly higher so that it clears your own cockpit rim
- Do not try to remove every last drop: you will not be able to do so and will waste time if you try
- Do not try gripping the upturned hull unless you have hands like octopus tentacles
- If the boat is waterlogged (because of insufficient buoyancy), you may find it difficult to handle: let the swimmer do some work:
  - the swimmer reaches across the rescuer's deck to grasp the hand-hold of the capsized boat
  - drag it across the deck
  - with feet on the gunwale, keep pulling until the cockpit is over the rescuer's deck
  - pull downward to begin draining
  - the rescuer must hold the boat by the cockpit rim as usual
  - the swimmer must stay in contact at all times, and return to the rescuer's bow

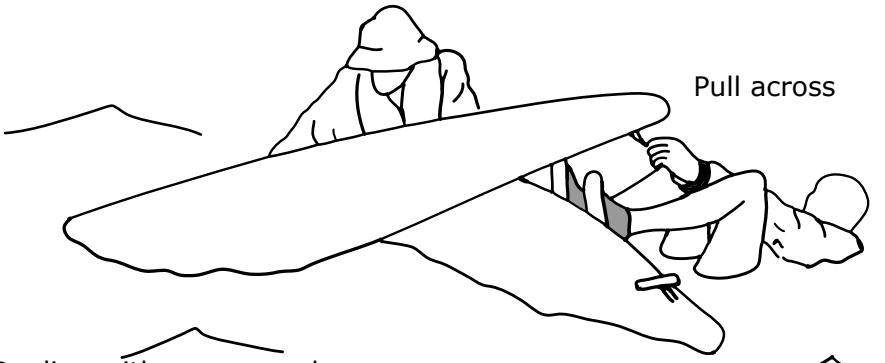
Launch

- Put the boat back into the water, on the side opposite from where you picked it up and facing the opposite direction

X rescue for open canoes

The method is similar to the X Rescue for kayaks, and for rescues from another open canoe, it is usually the stern paddler who does the work

- If necessary, and there is space among the gear, the bow paddler can turn round to assist
- The swimmer hanging on the bow of the rescuing canoe can help to stabilise it



Dealing with a swamped boat (insufficient buoyancy). Swimmer must stay in contact

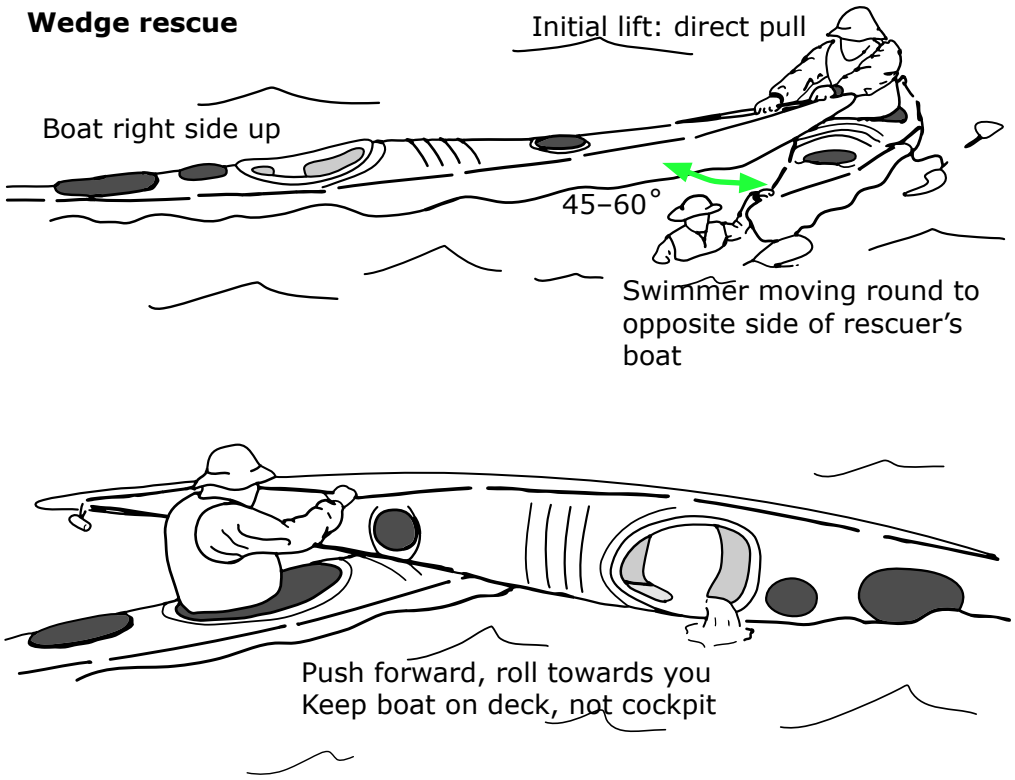
- The canoe may roll itself upright as you begin the lift. If that happens, simply keep lifting and dragging the boat across your own gunwale, and water will spill out as the boat rises
- Ignore any floating drums and other packages until the rescue is complete

Wedge rescue

Many recent touring kayaks have a bulkhead behind the cockpit, limiting the amount of water that can enter. Some have a forward bulkhead as well, further reducing the volume of the cockpit. Many have deck-lines as well. This makes it possible to use the fastest rescue for sea kayaks, the Wedge rescue, so named because the boat wedges itself up when pulled against the rescuer's boat.

After a capsize, the swimmer rights the kayak, contrary to normal practice, moves to the bow and waits. The rescuer approaches the swimmer's bow with an angle of 45 – 60° between the two. As the rescuer's bow crosses that of the swimmer, the swimmer transfers to the rescuer's bow. The rescuer grasps the swimmer's kayak by the deck lines and pulls so that it rides up onto their foredeck.

When the cockpit is clear of the water the boat is pushed forward on the deck clear of the rescuer's cockpit, and rolled towards the rescuer to drain. The kayak is then righted and slid off the deck and supported for the victim to re-enter.

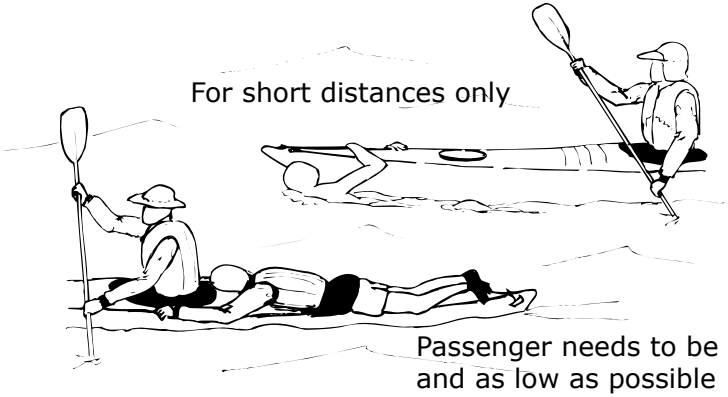


Key points

- Grab the bow of the boat by the deck lines, with an angle between the boats of 46 – 60°
- Pull the bow: it will come up and across in front of you
- Keep pulling until the cockpit is clear of the water
- Push the boat forward on the deck and roll it towards you and watch the water draining. (Do not try to remove every last drop: you will not be able to and will waste time if you try)
- Roll the boat upright and slide it back into the water facing the opposite direction
- Re-entry is by any of the methods shown above.

Deck carries

A paddler separated from their kayak or whose kayak has been severely damaged may need to be carried to safety on a rescuer's boat. A paddler may also come across a swimmer in need of assistance. There are several carry methods.



Towing

Anyone incapacitated by illness or injury, and then unable to keep up with the group's pace or even paddle on at all will need to be assisted to a safe landing.

If the distance is short, the tow can be done by having the incapacitated paddler lean on your foredeck while you continue paddling, reaching over the other boat to put the blade in on that side. Short tows can also be done using paddle leashes, loops in deck lines and so on. For paddling any distance however, a proper towline is needed.

Towlines exist in two main forms: those attached to the paddler, either as a belt or as part of a PFD harness, and those attached to the boat. The latter is preferred at sea, where the forces can be considerable, and tows tend to be over longer distances. A length of shock cord in the system can be used to take up the 'snatch'. Whichever system is used, it must be easy to deploy and have a reliable quick-release system.

The simplest towline is simply a length of floating rope with a Getaway hitch at both ends: quick release without hardware. No other knots should even be considered. (See the Knots appendix for details.)

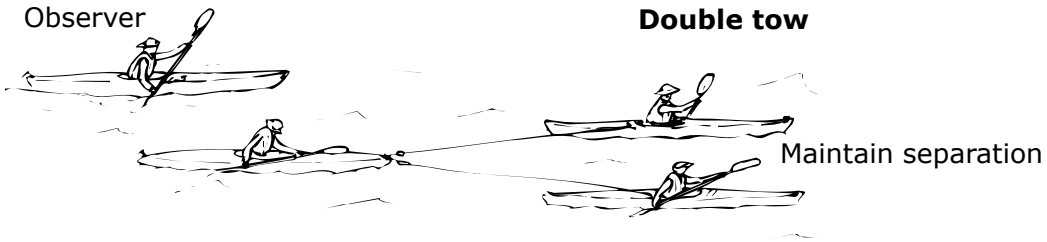
Towing requires skills that should be developed in calm conditions before they are needed for real. Towing in heavy seas and high winds or fast flowing water is demanding of both paddling skill and energy reserves, and is best done by group paddlers in the best condition. It also requires effective group management, and all group members need to be aware of their role. Regular practice is worthwhile.

The towline should be attached to the bow of the patient's kayak and deployed carefully to avoid tangles. This should be done quickly as there is a risk of injury or equipment damage if kayaks are thrown together in rough conditions. Towing requires more energy and concentration and be towers should be swapped at regular intervals. Compatible towline systems make it possible for a single line to be passed from paddler to paddler in turn.

Another paddler should be positioned alongside the patient to provide emotional support and monitor their condition. If the patient appears in danger of capsize the support paddler should raft alongside. A capsize in these circumstances will most certainly lead to complications.

Communications from the towers to the patient are difficult, particularly in windy conditions. As a tower it is difficult to turn around to check the condition of the patient, and the paddler out to the side of the tow can keep an eye on the whole set-up and relay messages.

There are several towing methods that can be used depending on the conditions, the ability of the group, and the level of incapacity. A single tow is used where the incapacity is slight or for a tired paddler who is able to provide some power and directional control.



Towed boats have a tendency to wander, and must be kept in line behind the towing craft by the paddler steering as necessary, and also taking care not to catch up to the towing craft or jerk the towline suddenly.

A double tow is performed by two paddlers assisting the incapacitated paddler and can be an in-line or V formation. This may be useful when battling into head winds or where the patient is unable to paddle, especially with a rafted support paddler. The tow will be faster, but the towers must be careful to maintain their direction and separation. The supporting paddler will use considerable energy controlling the patient's kayak and keeping the raft together, so supporters need to be changed at regular intervals.

Key points

- For flat water use the towline can be short, 5 meters or so, while sea boats will need towlines as long as 15 metres
- Stow the towline where it is readily accessible, but not where it will be in the way
- Single tows require that the rescuee steer straight behind the towing kayak, otherwise the boat will veer from side to side. If necessary, have a third person supporting the incapacitated paddler
- With someone completely unable to paddle and requiring constant support, the double tow may be required
- With a V tow, keep the towing boats parallel about two metres apart (interesting in heavy conditions)
- Having the strongest and fastest member of the group tow the slowest member can be a useful method of keeping a group together: almost like putting the two together in a double

Advice

Rescues and towing are serious business, and need regular practice. Many clubs therefore have a rescue session at the end of every event so that everyone stays current. The aim is to be able to follow the saying 'You got yourself into this, you get yourself out of it.'

Thinking about the weather

Introduction

Unless you're at a training session or playing Polo in an indoor pool the weather will be a key factor in your paddling. In particular, the wind can be critical. Obviously it will be harder to paddle into a wind than in other directions. (But paddling downwind can also be difficult.) The wind will generate waves, again making paddling difficult. Its third effect is that of wind chill, possibly leading to hypothermia.

You will need to decide, based on reliable information, whether or not to paddle. That information can include background knowledge, some of which is given in this chapter; statistics from the Burea of Meteorology and useful for advance planning; forecasts; and local knowledge, from people who work in the area you wish to paddle.

Background

It has been said that the only constant thing about the Australian climate is its variability. While our modern understanding of the Southern Oscillation and El Niño may help to explain the poetic 'droughts and flooding rains', there is still a lot we do not know, and cannot predict.

Why do we have weather? The simple answer is that the surface of the Earth is not uniformly heated by the Sun. At a local level that leads to convection, and sea and land breezes. On a global scale, the hot tropics and cold poles lead to warm air moving aloft towards the poles, and cold air moving at the surface towards the Equator. Much of the heat is carried by water vapour, thanks to the high latent heat of vaporisation of water. But the Earth is round, and rotating, with oceans and continents, and seasonal influences, so the actual circulation is very complex. Meteorology is not an exact science...

The Australian region stretches from cool temperate in the south to tropics in the north, with much of the inland being arid, and with an alpine region in the southeast. Tasmania, being farthest south and in line with prevailing westerlies, can be very cold, wet, and windy.

In the south, the succession of Highs and Lows, with their cold fronts, is responsible for much of the weather. In the north, nominally north of 30°S, the main influences are the SE trade winds, and the monsoons.

In general, places on the coast have lesser temperature ranges than places inland. They also tend to have higher rainfall, particluarly if they are open to the prevailing winds: westerly in the south, easterly along the east coast.

Air masses

A large body of air, such as that over the Australian continent, is termed an air mass.

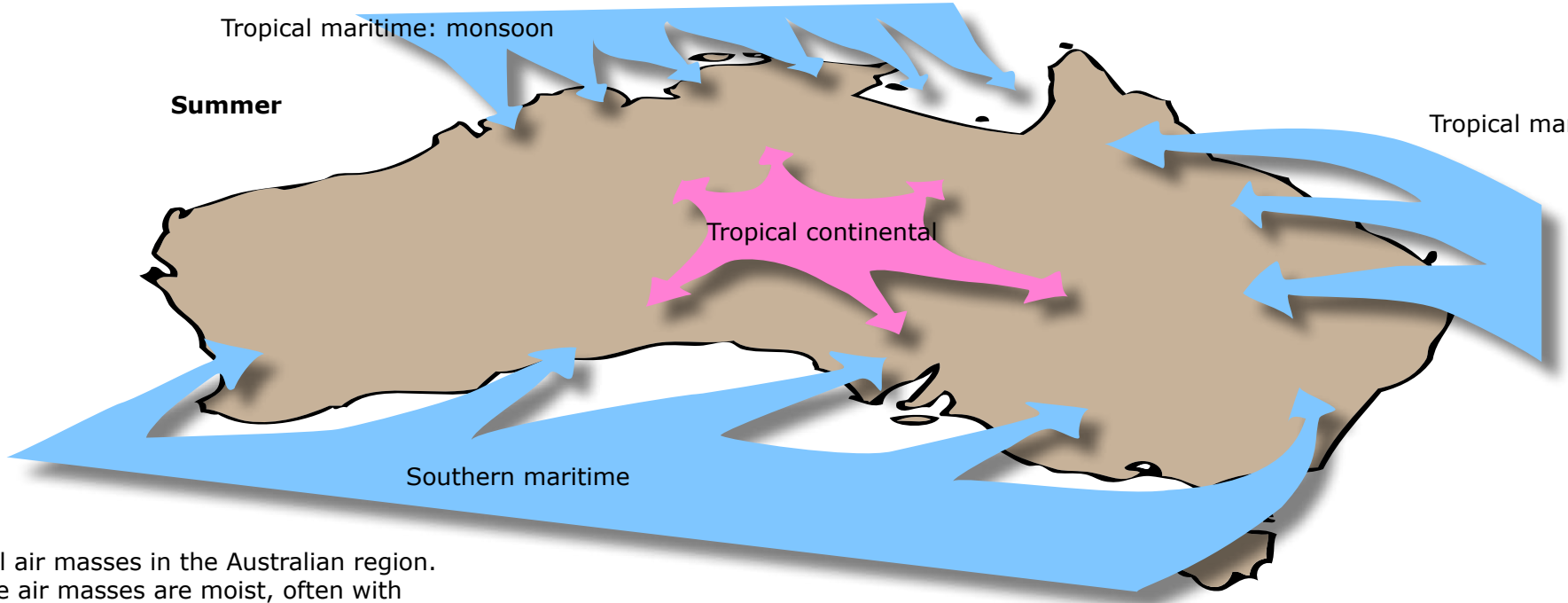
Air masses develop characteristics according to the surface beneath them: air over the continent becomes warm and dry for example. Inland Australian air, particularly in summer, becomes very hot and dry, and is often labelled as a continental tropical air mass.

Air over the oceans to the north of Australia becomes both warm and humid. A maritime tropical air mass moving over the continent, as happens in the wet season in the north, leads to storms and heavy rain.

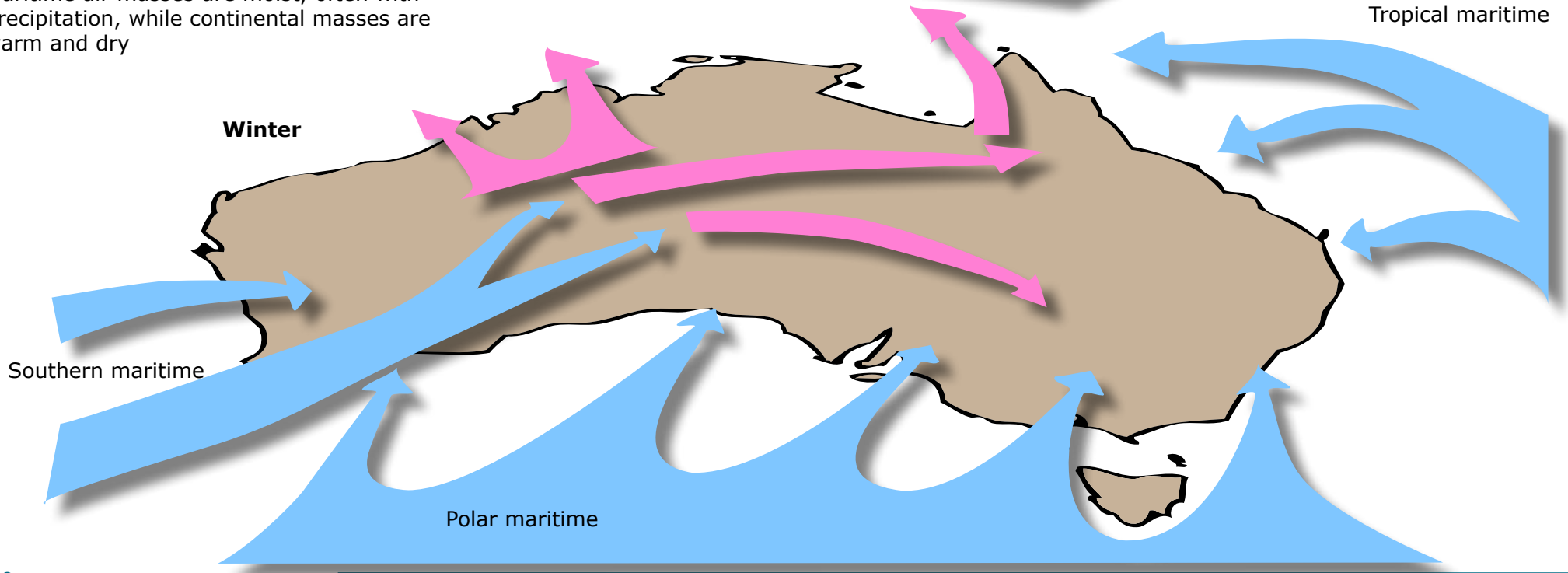
From over the oceans to the south come maritime polar air masses, moist but cool. It is from these air masses that the southern part of Australia receives most of its rainfall.

Farther south, there are polar continental air masses over Antarctica: cold and dry.

Changes of air mass bring changes in weather.



Principal air masses in the Australian region. Maritime air masses are moist, often with precipitation, while continental masses are warm and dry



Weather and canoeing

For paddlers on inland waters, the weather has direct and indirect influences. Depending on other factors, paddling in the rain may be enjoyable, but if that rain is raising river levels to dangerous heights then the fun ceases. Other forms of precipitation, like hail and snow, are best avoided. (And of course snow melt in spring will raise the river levels.)

Extremes of temperature will influence paddling. Events like the Murray Marathon in summer mean light clothing (with adequate Sun protection), the drinking of plenty of fluids, and so on. At the other extreme, hypothermia may be a real danger, and is always better prevented than treated.

The third factor is wind. Wind is measured, and forecast, at 10 m above the surface, averaged over 10 minutes. The highest wind speeds may be as much as 40% greater than the average: something to remember in windy conditions. Wind speeds are given in knots for marine and aeronautical users, kilometres per hour for others.

River paddlers may be sheltered from some of the wind, but if the general wind direction is the same as the river valley, then wind will be funnelled along it, making paddling difficult, and also leading to wind chill.

For the paddler on open water wind is perhaps the key factor. Unless you are paddling downwind (perhaps with sail assistance) wind will slow progress, and lead to fatigue. It will certainly make the water rougher, perhaps leading to capsizes. Add wind chill, and you find paddling in wind is not the most comfortable.

Describing weather

To describe the weather, both present and expected, various aspects can be measured: temperature, humidity, precipitation, wind, barometric pressure, and so on. That data can be represented in a number of ways, with synoptic charts perhaps being the most familiar.

Synoptic chart features

High

In the southern hemisphere the circulation is anticlockwise. Barometric pressure is high. Air in the centre is descending, but is relatively calm. There may be stratus or cumulus cloud. With no cloud, or traces of cirrus, expect fine, warm weather.

Low

Air is circulating clockwise, and air in the centre is rising. Barometric pressure is low. Cloud and showers are likely. The tropical cyclones of northern Australia are smaller, but violent versions, without fronts.

Isobars

Isobars join places of equal barometric pressure. As with contour lines on a topographic map, the closer the lines, the steeper the gradient. In this case the steep gradient indicates strong winds.

Winds are shown on charts with arrows, with the number of tails indicating wind strength. Precipitation is shown by shading.

Cold fronts

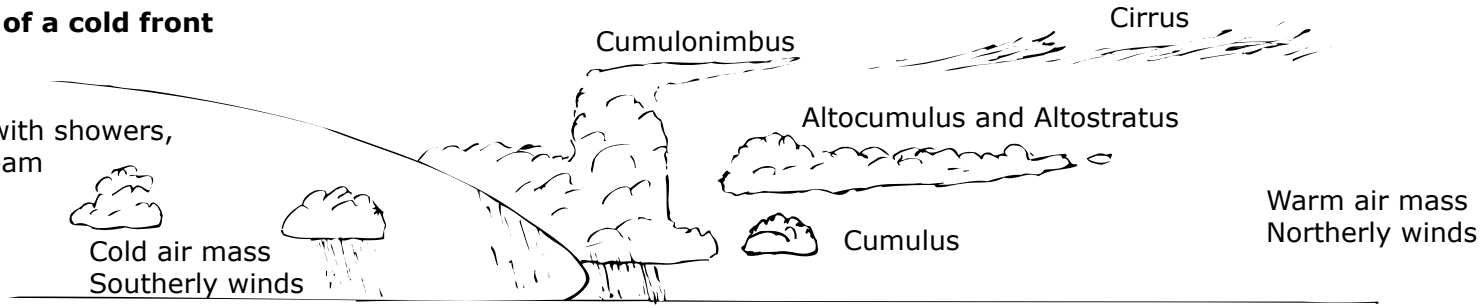
Cold fronts are associated with low pressure systems. Ahead of the front, the wind will be northerly, conditions will be warm (or even hot, because of the overland trajectory of the air (i.e. a continental air mass)), and the barometric pressure will be falling. The cloudbase will be lowering, and there may be rain. If the front is a vigorous one, winds can be strong.

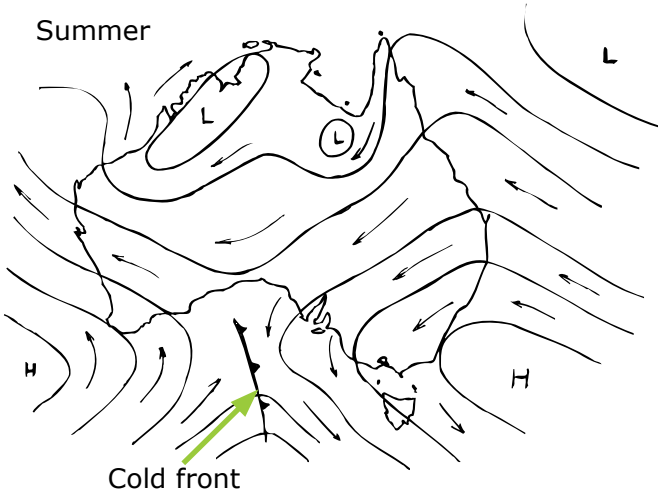
Behind the front, in the maritime air mass, the wind will be southerly (strong with a vigorous front), the air will be colder, there may be showers, and the barometric pressure will be rising. With some fronts there may be thunderstorms.

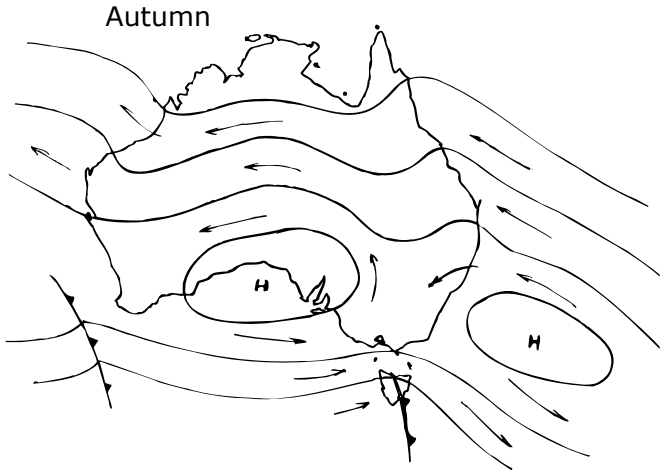
Although fronts are drawn as sharp lines, they are in fact several kilometres across: frontal zones.

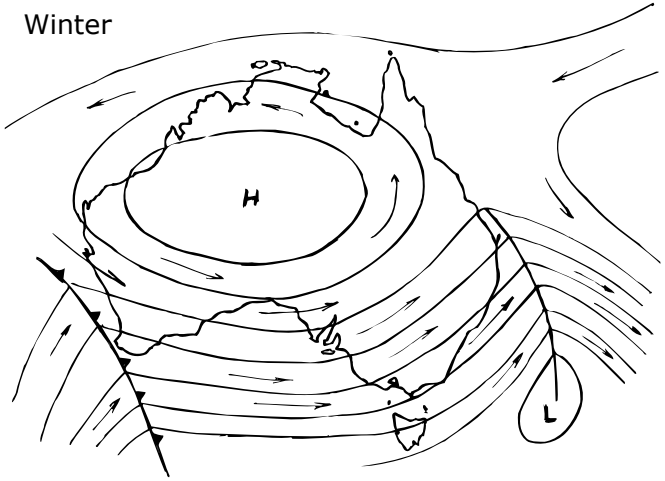
The four charts on the next page show typical patterns for the four seasons. Think about how they relate to your local weather.

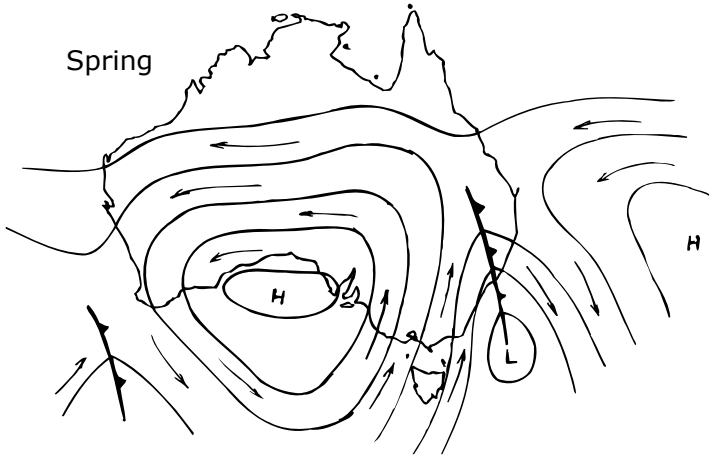
Cross section of a cold front











Synoptic charts showing typical seasonal features. Weather systems move from west to east across the region

Summer

Highs tend to be centred south of the continent, and may be stationary in the Tasman for several days, blocking the movement of other systems. Cold, fronts, for instance, will be slowed, and may miss the mainland. Conditions will be hot and dry over Victoria and South Australia due to the overland trajectory of the air, but the east coast may be wet in the on-shore stream. Sea breezes will be common along the coasts. Thunderstorms will be common in the north, with tropical cyclones between November and April.

Autumn

Highs are moving north, and winds generally become lighter.

Winter

Highs now track cross the continent, and fronts reach well inland, bringing wind and rain and showers (and snow on the highlands). Southern parts of the continent receive their greatest rainfall, and snowfall in alpine areas. The generally offshore winds in the north mean that weather is generally dry.

Spring

Highs are moving south, but fronts and lows still bring wind and precipitation.

Remember that synoptic charts will not show local weather like sea breezes.

Other information

Satellite images, visible and infra-red, are often interesting to look at, but they do require interpretation. Other data available from the Bureau includes maximum and minimum temperatures, rain and snowfall, barometric pressure and prevailing winds. Seasonal aspects of these will direct your planning of expeditions.

Forecasts

Based on the information from observers, automatic stations, satellites and so on, forecasters develop computer models of the weather, and with them, make their forecasts. Those forecasts are made available through the Bureau's website <www.bom.gov.au> and through the media: radio, television, and newspapers. Forecasts are generally reliable for about three days. Other websites, some requiring subscription, can also supply useful data. Become familiar with them to understand how the material is presented.

The standards of presentation have improved in recent years, but you still need to interpret forecasts for your own area and activity. How will the forecast weather affect river level, sea state, your own comfort? How will it affect alternate landing sites and escape routes?

Pay particular heed to warnings, in fact take the pessimistic view, and if in doubt, don't. You do not, for instance, want to be paddling under a thunderstorm. Quite apart from the obvious danger of lighting strikes, there can be very heavy showers and very strong downdrafts.

Strong Wind Warnings are issued if the wind is likely to exceed 25 kn (46 km/h), Gale Warnings for winds faster than 34 kn (63 km/h). Other warnings are issued for heavy rain and hail, storm, cyclone, and blizzard.

Other sources of information may be National Park rangers, who will have an understanding of how the weather affects their area, and its river levels and access. Other local people, especially those who work outdoors, can usually offer similar advice. Motoring organisations will be able to help with information about road conditions, and the ways they may be affected by heavy rain. Sea paddlers will find professional fishermen have an intimate knowledge of the weather in their area. Sea paddlers will also need to consider tides.

Conclusion

Nothing beats experience. Look at the forecasts, and relate them to what you see on the water. Play safe, and paddle within your limitations.

Example forecasts

Coastal waters forecasts

Following is a typical coastal waters forecast with comments on the details of each part.

Date and time of issue

```
Issued at 1555 hours on Wednesday the 18th of Sep-
tember 2002
```

```
For the period till midnight on Thursday
```

Ensure the forecast is relevant to your trip. Even future predictions are valid for around three days only.

```
PLEASE BE AWARE
```

```
Wind gusts may be a further 40 per cent stronger
than the averages given here, and maximum waves may
be up to twice the height.
```

This warning is pertinent to all paddlers, especially sea kayakers: the forecast may be 1.5 m swells with winds to 20 knots, but if you are going to go out in it, you must be able to handle 3 m swells and 28 knot winds.

```
SITUATION
```

This is a general section giving you an overview of what you will see on the synoptic chart

```
A cold front through Bass Strait, expected to reach
the south NSW coast this evening, reaching the Hunt-
er later Thursday.
```

The weather is about to change, it will get cooler and probably windier, starting at the border this evening and reaching to north of Sydney by late Thursday. If your activities are in exposed areas in the next 24 hours, you have wind and possibly rain coming.

```
WARNINGS
```

This is a section that needs careful attention: is something about to happen in your area?

```
A Storm Warning is current for waters south of Green
Cape.
```

```
A Gale warning is current for waters Seal Rocks to
Green Cape.
```

```
A Strong Wind Warning is current for waters Seal
Rocks to Port Macquarie
```

```
Weather
```

The weather section tells you whether it will be wet or dry. 'Rain' is steady and normally falls from stratiform (layer) cloud, 'showers' are short-lived and fall from convective cloud.

```
A few showers in the south.
```

If we are in southern NSW, we should plan for periods with showers.

```
Far North Coastal Waters:
```

There is one of these for each area of the coast: find the relevant map of the areas for your state.

```
Qld – NSW border to Wooli and 60nm seawards
```

The defined area

```
W'ly wind 20/25 knots. S/SW wind 20/25 knots Thurs-
day, tending S'ly 15/20 knots later.
```

The expected wind strength and direction. Remember it can be 40% stronger

```
Sea 1.5 to 2 metres. Swell 1.5 to 2 metres.
```

'Sea' is the waves caused by the local winds, 'swell' are the waves caused by distant conditions, the two act with each other, so that you can get areas of flat and areas of large combined waves.

```
Outlook for Friday
```

The future. Remember that accuracy decreases as you forecast farther into the future

```
S/SE wind 10/15 knots, afternoon E/NE seabreezes
10/15 knots
```

Standard district (inland) forecast

NORTH EAST DISTRICTS FORECAST

BUREAU OF METEOROLOGY

NEW SOUTH WALES REGIONAL OFFICE

Issued at 1603 hours on Wednesday the 18th of September 2002

For the period through to Sunday

Make sure the forecast is relevant to you.

NORTHERN RIVERS

Tonight

Very High fire danger.

Dry. Moderate to fresh westerly winds.

A warning not to light any type of fire and to be aware of smoke to your west. Note also, the words ‘moderate’ and ‘fresh’ have specific definitions, which can be read from the Beaufort scale below.

Wind and wave

Sea and Swell

Sea [in open sea]

Description	Height (metres)	Effect
Calm (glassy)	0	No waves breaking on beach
Calm (rippled)	0 - 0.1	No waves breaking on beach
Smooth	0.1 – 0.5	Slight waves breaking on beach
Slight	0.5 – 1.25	Waves rock buoys and small craft
Moderate	1.25 – 2.5	Sea becoming furrowed
Rough	2.5 – 4	Sea deeply furrowed
Very rough	4 – 6	Sea much disturbed with rollers having steep fronts
High	6 – 9	Sea much disturbed with rollers having steep fronts (damage to foreshore)
Very high	9 – 14	Towering seas
Phenomenal	over 14	Precipitous seas (experienced only in cyclones)

Swell

Description	Wave Length	Period	Wave Height
Low swell of short or average length	0 – 200 m	<11 sec	0-2 m
Long, low swell	> 200 m	> 11 sec	0 – 2 m
Short swell of moderate height	0 – 100 m	< 8 sec	2 – 4 m
Average swell of moderate height	100 – 200 m	> 8 sec, <11 sec	2 – 4 m
Long swell of moderate height	> 200 m	>11 sec	2 – 4 m
Short heavy swell	0 – 100 m	< 8 sec	>4 m
Average length heavy swell	100 – 200 m	> 8 sec, < 11 sec	>4 m
Long heavy swell	> 200 m	> 11 sec	>4 m

The Beaufort scale

Beaufort number	Descriptive term	Wind speed in km/h	Wind speed in knots	Description on land	Description at sea
0	Calm	0	0	Smoke rises vertically	Sea like a mirror
1 – 3	Light winds	19 km/h or less	10 kn or less	Wind felt on face; leaves rustle; ordinary vanes moved by wind	Small wavelets, ripples formed but do not break: a glassy appearance maintained
4	Moderate winds	20 – 29 km/h	11 – 16 kn	Raises dust and loose paper; small branches are moved	Small waves, becoming longer; fairly frequent white horses
5	Fresh winds	30 – 39 km/h	17 – 21 kn	Small trees in leaf begin to sway; crested wavelets form on inland water	Moderate waves, taking a more pronounced long form; many white horses are formed, a chance of some spray
6	Strong breeze	40 – 50 km/h	22 – 27 kn	Large branches in motion; whistling heard in telephone wires; umbrellas used with difficulty	Large waves begin to form; the white foam crests are more extensive with probably some spray
7	Near gale	51 – 62 km/h	28 – 33 kn	Whole trees in motion; inconvenience felt when walking against wind	Sea heaps up and white foam from breaking waves begins to be blown in streaks along direction of wind
8	Gale	63 – 75 km/h	34 – 40 kn	Twigs break off trees; progress generally impeded	Moderately high waves of greater length; edges of crests begin to break into spin drift; foam is blown in well marked streaks along the direction of the wind
9	Stong gale	76 – 87 km/h	41 – 47 kn	Slight structural damage occurs: roofing dislodged; larger branches break off	High waves; dense streaks of foam; crests of waves begin to topple, tumble and roll over; spray may affect visibility
10	Storm	88 – 102 km/h	48 – 55 kn	Seldom experienced inland; trees uprooted; considerable structural damage	Very high waves with long overhanging crests; the resulting foam in great patches is blown in dense white streaks; the surface of the sea takes on a white appearance; the tumbling of the sea becomes heavy with visibility affected
11	Violent storm	103 km/h or more	56 kn plus	Very rarely experienced: widespread damage	Exceptionally high waves; small and medium sized ships occasionally lost from view behind waves; the sea is completely covered with long white patches of foam; the edges of wave crests are blown into froth

Another view

Beaufort Number	General description	Sea	Canoeists' Criterion
0	Calm	Sea like mirror	Everybody goes out and gets sick! Open canoes cross English Channel. Surf kayakers commit suicide
1, 1 – 3 knots	Light air	Ripples appear	Same as for 0, except too rough for open canoes
2, 4 – 6 knots	Light breeze	Tiny waves. No breaking crests	Same as for 0, except too rough for open canoes
3, 7 – 10 knots	Gentle breeze	Small waves. Crests begin to form	Life gets interesting for all. Good for practice capsize drill. Getting tough for beginners
4, 11 – 16 knots	Moderate breeze	Medium waves building up. Some white horses	About the limit for the Sea Skills standard paddler if on journey
5, 17 – 21 knots	Fresh breeze	Decidedly lumpy sea Many white horses	Anybody over Sea Skills standard would enjoy this. Usually creates very good surf. Long distance travels are out
6, 22 – 27 knots	Strong breeze	Large waves everywhere. Continual white horses	Short journeys by advanced paddlers all right, but you are reaching the border line
7, 28 – 33 knots	Near Gale	Sea piles up and spindrift off tops of waves	Surf tends to be big. Experts are beginning to swear
8, 34 – 40 knots	Gale	The difference from a landsman's view of these is difficult to say except that the sea looks very lumpy, high breaking waves and spindrift following wind path	Surf gets to be very big, and you spend your time hanging on to your tent
9, 41 – 47 knots	Strong Gale		
10, 48 – 55 knots	Storm		Surf enormous, and you get blown away with your tent

Adapted from *BCU Coaching Handbook*, first edition, 1976

Finding the way

Introduction

These days you can find your way about with GPS, the satellite-based Global Positioning System. Key in some waypoints and follow the pointers... But yachtsmen have run aground while doing just that. And what happens if the GPS batteries are exhausted?

You still need to be able to navigate with the basic tools, map (or chart) and compass. Better still, navigation should be instinctive, based on mental maps and observation, but that requires local knowledge and experience.

What follows is a brief introduction to map and compass use where there are tracks or streams or other significant landmarks to follow.

Maps

A map is a graphic representation of a particular part of the Earth's surface drawn to scale from a 'bird's eye' view. There are many types of maps, including topographic, guide books and diagrams, hydrographic, charts and aerial photographs. The amount and type of detail shown on the map will depend on the scale and purpose of the map. For example, a large scale street map that shows footpaths and buildings will be no use for driving long distances along a freeway.

Common features on maps include title, scale, directional reference, legend, border, longitude and latitude, and grid references. Maps can range from the simple to the very complex, but no map can be expected to show every feature of the Earth's surface. The features shown are usually selected to meet a specific purpose, with colour, symbols and shading used to illustrate how features are arranged and distributed.

Suitable maps for paddling are topographic maps, marine charts and guide books.

Topographic maps

A topographic map is a detailed large scale map representing features of landform and built environments. It shows relief and slope of the land, vegetation, buildings, watercourses, and so on. Being able to analyse topographic maps is an important skill. It allows us to:

- interpret and describe the surrounding land
- identify relationships between features
- locate particular points, areas and routes.

Guide books

A guide book is a information usually in the form of a route plan written by fellow paddlers. Guide books contain detailed relevant information such as access, difficulty, hazards and obstacles of a a particular area. As the maps may not be detailed, guide books are best used in conjunction with topographic maps or charts.

Marine charts

Charts for marine use have some topographic detail, but concentrate on features at sea level and beneath. They will include tidal information, navigation lights and buoys, and submerged hazards. For marine charts, the legend is a booklet, Chart 5011, *Symbols and abbreviations used on Admiralty charts*.

Internet images

There is a growing number of Internet resources with aerial images and maps, with Google Earth perhaps the best known. Most state planning or environment departments and some universities have sites which allow users to view satellite and aerial photos with various versions of maps, and these sites are extremely useful for planning and allow detail previously not available to be researched. Do check the scale of such images.

Features

Legends and map symbols

Map symbols are used to show the location of selected features. Many symbols look like the features they represent, and the importance of a feature may be shown by the size of the symbol, the thickness of the line and the colour used. The meaning of each symbol is explained in the map's legend. which allows us to interpret the features on the map, and provides us with information relating to the scale and contour interval being used. Although many maps use similar symbols it is essential to check the legend. For example, a blue line may not always indicate a water system.

Scale

There is a direct relationship between the size of things on a map and their actual size on the ground. In other words, maps are a scaled down representation of part of the Earth's surface, and the map's scale must be shown on it. Scale is the ratio of distances on the map to distances on the ground, and can be expressed in three ways:

1 As a statement, in words: 'One centimetre represents 100 000 centimetres' or 'One centimetre represents one kilometre'

2 As a ratio or representative fraction: 1:100 000 or 1/100 000

3 As a linear scale.

On a marine chart the latitude scale on the east or west edge is the scale of distance: one minute of latitude is one nautical mile (1.852 km).

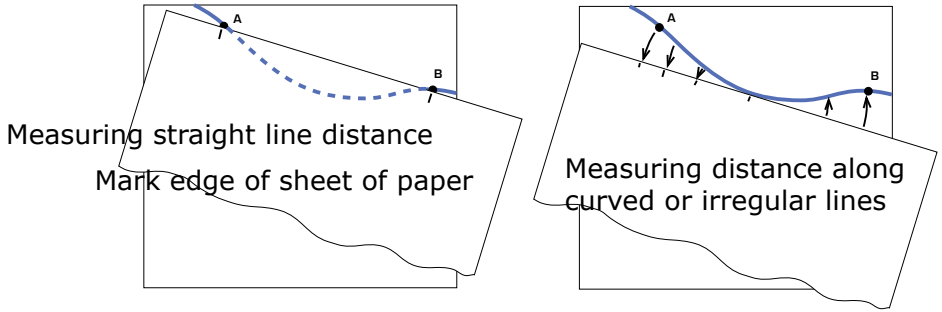
Maps drawn on progressively smaller scales increase the area of the Earth that can be shown, but reduce the amount of detail that can be included. Maps drawn on progressively larger scales decrease the area that can be shown but enable more detail to be shown. This means, for example, that a map drawn to a scale of 1:20 000 covers a smaller area of the Earth's surface but shows much more detail than a map drawn to a scale of 1:100 000. Because the scale of a map shows the relationship between distances on the map and distances on the ground it can be used to calculate distances and areas.

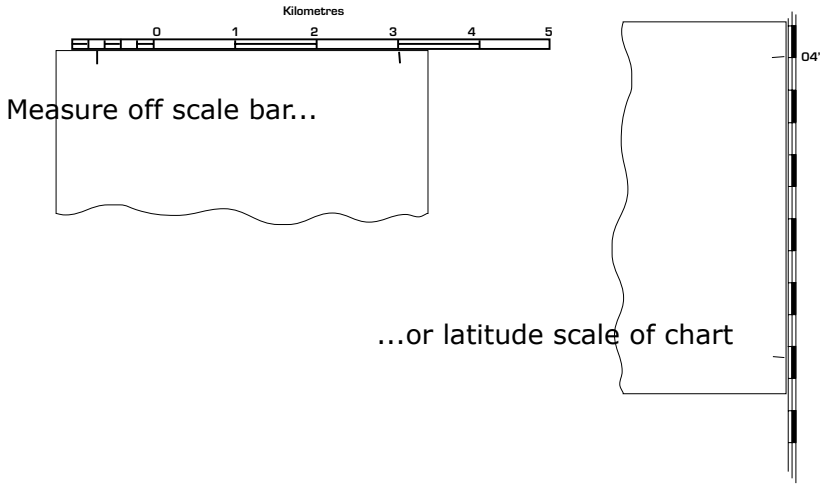
Using a map

Measuring distance on a map

The distance between two points on a map can be found by first measuring the distance shown on the map and then converting it from centimetres to kilometres and/or metres, or on marine charts, nautical miles. The way in which measurement is done may vary, and the following method is merely one example:

- To estimate a straight line distance, place the edge of a sheet of paper between the two points and mark on the paper the distance between the points. Place the paper along the map's linear scale. Read off the distance on the scale
- To estimate distances along a curved or irregular line, place a sheet of paper on the map and mark off the starting point. Move the paper so





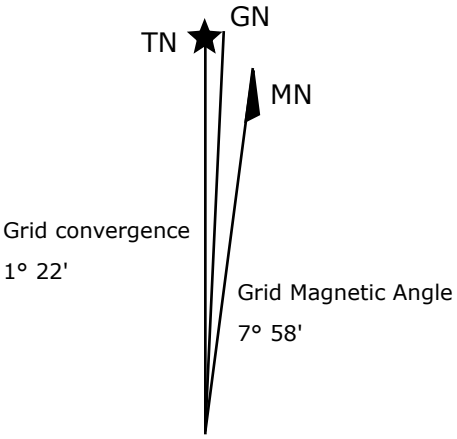
that its edge follows the curve, marking each section as you do. Mark the end point and then place your sheet of paper on the linear scale. Read off the distance on the scale.

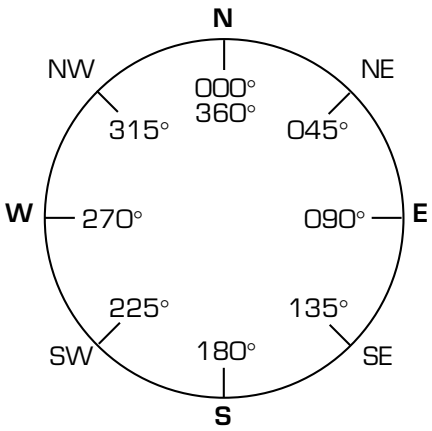
Direction and bearings

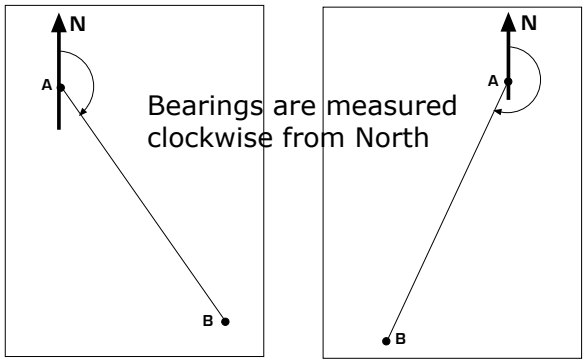
Direction helps us to determine the relative location of places and may be given as a bearing.

Most maps have a directional arrow indicating north, and topographic maps are generally designed so that north is at the top of the map. Just to make sure, check the direction arrow located near the legend. A compass can be used with a map in a number of ways. If we are observing a landscape, for example, we can lay out the map and then turn it around until the magnetic north arrow on the map is the same as the north shown on the compass. This is called orienting the map. It makes it easy to identify different features, which should be in the same direction as they appear on the map.

The bearing of a feature or place is expressed in terms of degrees from north, measuring the angle from north in a clockwise direction. North is 000°, east is 090°, and so on. (Note that bearings are always three figures to help avoid confusion.) True, magnetic and grid (i.e. map) bearings must be distingushed: 031° T, 038° M and 032° G may be all the same direction.

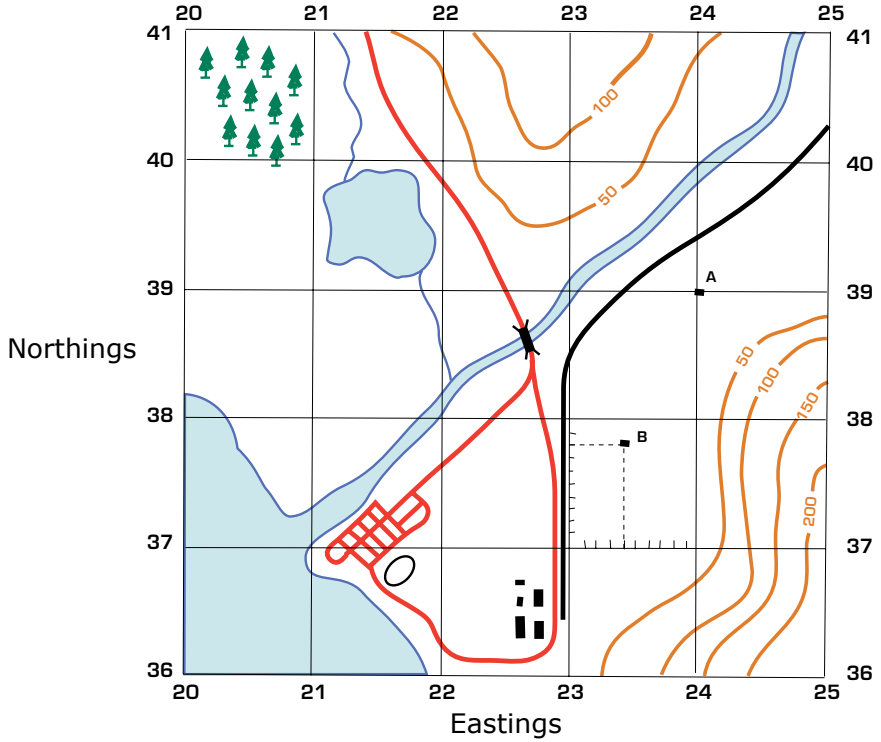






Grid references

The location of features on a topographic map can be found by using grid and area references. Grid lines are a series of numbered vertical and horizontal lines drawn on a map. The horizontal lines are called northings and the vertical lines are called eastings. Northings are numbered from the south to the north (bottom to top), and eastings are numbered from west to east (left to right).



To locate relatively small features on a topographic map a six figure grid reference is normally used. The first three digits refer to the eastings and the last three digits refer to the northings. Each set of three figures is referred to as a co-ordinate. The first two digits of each co-ordinate refer to the eastings and northings that surround the map. The third digit is obtained by dividing each easting and northing into tenths.

Example 1: Grid reference of point A

Point A is located exactly on the intersection of easting 24 and northing 39. The easting is therefore 240 (24 and zero tenths towards 25). The northing is 390 (39 and zero tenths towards 40). The grid reference of point A is 240 390.

Example 2: Grid reference of point B

Point B is located four tenths of the way between easting 23 and 24. The easting is therefore 234 (23 and four tenths towards 24). The northing is approximately eight tenths of the way between northings 37 and 38 so therefore it is 378. The grid reference of point B is 234 378.

Area references

Some map features (for example a lake or forest) can cover a relatively large area within a grid square. These features are usually located by means of a area reference. An area reference has only four digits. To find the area reference of a feature we first identify the easting line immediately before it and then the northing below it. This means that we refer to the eastings and northings of the lower left-hand corner of the grid square.

Where a feature extends beyond the one grid squares, the area should be based on the lower left-hand corner of the square that contains the main part of the feature.

Example: The area reference of the lake is 2139.

Latitude and longitude

On a marine chart latitude and longitude are used, not an arbitrary grid. Latitude is the angular distance north or south of the equator, measured in degrees, minutes and seconds: Adelaide is 34° 55' 42" S

Longitude is the angular distance east or west of the Greenwich meridian, also measured in degrees, minutes and seconds: Adelaide is 138° 35' 12" E

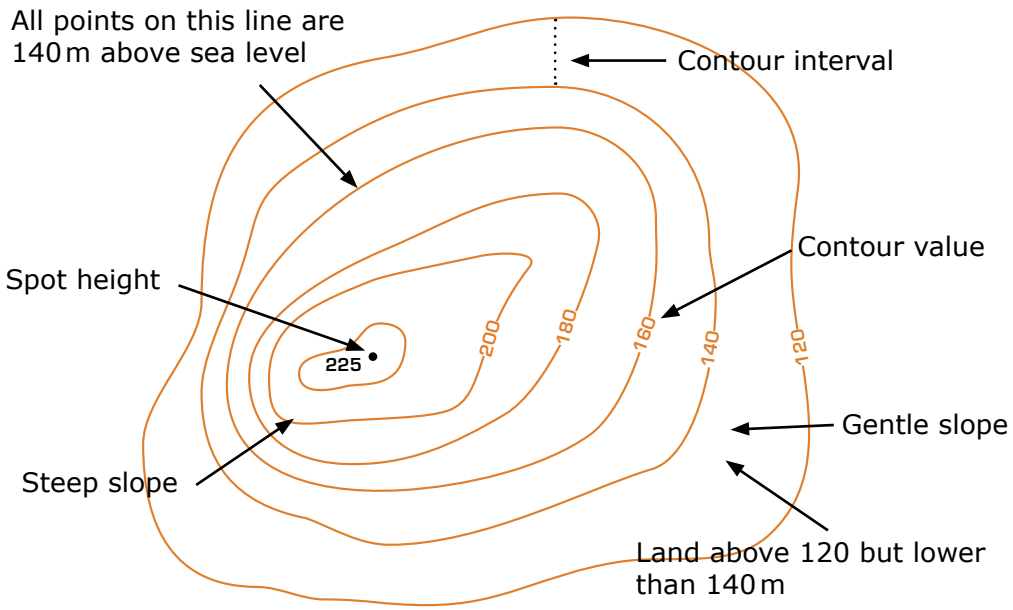
Minutes are often given in tenths rather than seconds (sixtieths).

Contour lines

Contour lines join places of equal height above sea level. Being able to interpret contour lines provides information about:

- the shape of the land
- the slope of the land
- the height of features above sea level.

Each contour line represents a particular height above sea level. The spacing of the contours on a map indicates the steepness of slopes. Areas where contour lines are close together have steep slopes, and areas where there are few contour lines widely spaced are very flat. The contour interval is the difference in height between two adjacent contour lines.



On the water

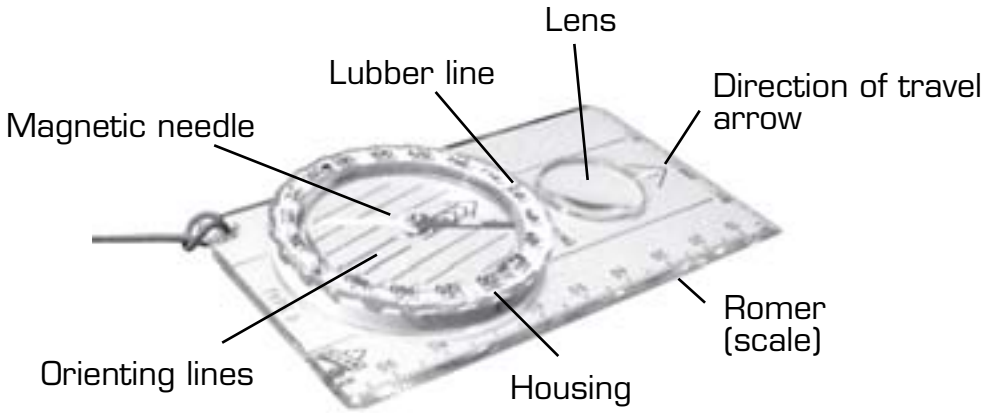
Estimating distances and time

An important part of trip planning to consider the distance ahead and the time needed to cover it. Factors that will affect the speed of a group include type of travel, load, weather conditions, water levels, and the ability and size of the group itself. Taking these variables into account, there are a few methods of judging distance travelled and the time still required to travel. One method is to count strokes and measuring time taken to travel between prominent features. Alternatively, you can measure the distance between two features on a map, and time the journey between these features to estimate the speed. Note that only practice and experience will enable accurate distance and time estimates.

For sea kayakers, a speed of 3 kn (3 nautical miles per hour) can be used in planning.

Compass use

A compass is a navigational instrument consisting essentially of a freely moving magnetised needle aligning itself with the Earth's magnetic field, indicating north and south. A compass is an essential item, and on orienteering compass has these main features:



Compass errors

The magnetic compass is subject to two errors: variation and deviation. Variation comes about because the Earth's magnetic field is not aligned with the geographic poles: compasses point to magnetic poles, not the true poles. Variation varies across the Eath's surface, and through time. Maps and charts will indicate the amount of variation, whether it is east or west, the year it was measured, and the rate of change.

Deviation is caused by magnetic objects near the compass. Make sure you are not near iron, steel or electronic objects when you use the compass. In canoes and kayaks, stow the cans and radios away from the compass.

When you are navigating you will need to convert between Magnetic and True bearings. The rhyme 'Variation east, magnetic least; variation west, magnetic best' may help to remember whether to add or subtract.

Examples

True	Variation	Magnetic
227°T	7° E	220°M
050°T	5° W	055°M

Practise conversions.

Finding the direction to travel

A compass provides a direction in which to travel. To take a compass bearing:

1 draw the desired route on the map

2 line up the 'Direction of travel arrow' on the compass to the line on the map

3 rotate the compass housing so that the orientation marks sit over the magnetic north arrow

4 read off the compass bearing

5 add or subtract the magnetic variation as required

6 travel on this set bearing.

A kayak, especially a sea kayak, may have a fixed compass, mounted well forward on deck rather than a hand compass. The paddler will then use it to steer a course. The intended track will be drawn on the chart from departure point to destination and the bearing measured. On a marine chart it is customary to read the bearing from the nearest compass rose on the chart with parallel rules, but protractors can also be used.

Route choice

An important part of planning a trip is choosing the route. In many cases this will be simple, as you will be following a water course. Much of the planning will be thinking about distances to be covered, landing sites for breaks and camping, and the like. Obviously you will prefer to paddle with the current or tidal flow than against it.

You will need to consider 'escape routes', the tracks to follow if you need to walk out in the case of illness or equipment failure. Mark them on the map, and make sure everyone knows where they are.

Plotting a course

Unlike bushwalkers who can stop and spread out their maps paddlers have limited deck space and never really stop, even when they are not paddling. Everything needs to be prepared and plotted in advance: route, alternates, distances, estimated times...

The prepared map or chart should contain at least:

- the course(s) with bearings marked
- distance marked along the course
- expected times along the course
- any transits (lining up of features) should also be marked for easy reference
- any notes on hazards, etc. should also be noted

It then needs to waterproofed, either by lamination or enclosed in a waterproof case, and then fixed on deck, readily visible, but secured so that it is not washed off.

Navigation data sheet or float plan

As part of your planning you should complete a navigation data sheet (or float plan). It will not only help in the route choice, but will indicate specific information regarding the group's itinerary, estimated times, locations and trip specific considerations.

Once completed, a navigation data sheet should be copied and given to a responsible person at home.

This will ensure that if any problems occur that enough people know of the group's whereabouts at specific times, so an effective response can be organised. National Parks and Wildlife in most States require that commercial or educational groups submit their plan to them. Often the requirement includes submitting the plan to the local police or rescue services as well. You need to check on the local requirements before embarking on any trip. Even on longer personal trips it is beneficial to submit your plans: it allows National Parks to inform you if back burning or other control processes are occurring in your area. It also gives them knowledge of your position in the event of bush fires or other environmental hazards. A minimalist format is shown below, and a more comprehensive form is elsewhere in the resources.

Navigation data sheet

Group name: .....

Date commenced:..... Date due to return: .....

Maps used: .....

Contact details: .....

Stage	Objective GR	Magnetic bearing	Distance	Time	Height change	Comments
Start						

Navigation techniques

Map to ground recognition

In some it is quite easy to either lose the path (if there is one to follow), or lose your sense of direction. In these circumstances a compass is invaluable, but there will be an occasion where either the bearing is misread or misjudged, or the map is inaccurate.

The most important skill in navigating is the ability to visualise the map's description of the land and apply it to what you can see (and should see) around you. In simple terms, to visualise the map three dimensionally.

In this way an experienced navigator needs only a map to travel in even the most difficult trackless terrain. In thick vegetation it can be difficult to locate large features shown on the map, but the lie of the land can give you a clue as to your surroundings. Let's say you are trying to find a creekline, for example. The contour lines on the map can be translated to a gradient on the ground, and this can you give a direction to follow.

Similarly, translating the ridgelines and spurs on the map and applying them to the ground around you can be all you need to relocate your position. By doing this it is possible to navigate by the use of features, no matter how subtle, as well as (or even without) your compass.

Interpreting what a map says and applying it to the ground around you, map to ground recognition, is a skill that increases with experience and is fundamental to navigation in difficult, trackless areas.

Backbearings and resections

A backbearing is the 180° opposite bearing on which you are travelling. To work out a backbearing, simply add or subtract 180° from the original bearing. For example, if you are travelling on a bearing of 120°, the backbearing would be 300°, the exact opposite direction (i.e. the direction back down your trail).

Backbearings are useful in retracing your steps, guiding people into your location, and locating your position in reference to someone or something (i.e. a feature).

A resection is a technique used to locate your position on a map. It can be used if you know you are somewhere on the map, but unsure of the exact location. As with all of the skills of navigation, although fairly simple in theory, resections require practice for accuracy. That practice is best done in familiar areas, so that you can readily check your accuracy.

The steps:

1 identify three prominent features on the ground and on the map (the more distinct, the better)

2 take compass bearings to them

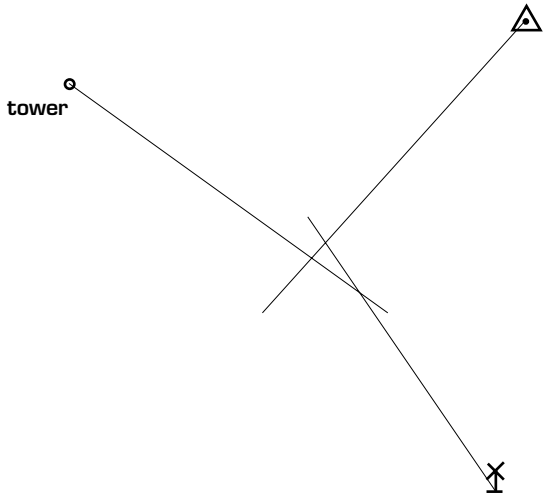
3 convert to grid bearings (add or subtract variation as required)

4 convert them to backbearings (+/- 180°) or simply use the compass backwards

5 draw in bearings on map to form a triangle of error (where the lines intersect)

6 locate your position inside the triangle using map to ground recognition.

A resection is a valuable technique in locating your position when you think you are lost.



Additional navigational aids

There are many more aids besides a map and compass available to the navigator. Mariners for hundreds of years have relied upon the use of the sun and the stars for precise position fixes. The Southern Cross constellation at night and the Sun during the day can be used to estimate direction.

GPS can locate your position to better than 25 m accuracy. Although very user-friendly, GPS receivers are affected by steep terrain, tree cover, weather conditions and battery power. They are an excellent aid, but like all aids, should never be used without the backup of a map, compass, and — most importantly — knowledge of the location.

GDA94

In 2000 Australia changed to a new geodesic datum, GDA94, equivalent to the WGS84 datum used by GPS. Maps based on GDA94 will bear the GDA logo and a table for converting latitude and longitude and the Australian Map Grid between old and new data. Charts will have notes referring to WGS84 and satellite derived positions. Be aware of the need to convert if you are using a mix of old and new maps or charts, or are using GPS with old maps.

Hazards and risks

You don't want to be front page news for the wrong reasons. To stay out of trouble you need to know your limits and paddle within them. Of course you can extend those limits through training and experience, and we encourage you to undertake training for Australian Canoeing Awards, which range from entry level to Advanced Instructor qualifications.

This book has been an overview of the techniques and knowledge required for paddling on flat water in good conditions. Paddling white water or the sea require additional skills and understanding that are beyond the scope of an introductory text like this one.

Unfortunately expertise can go the other way. Without regular practice your skills will diminish, so you will need regular paddling, in the kind of water and conditions you want to be proficient in.

There is safety in numbers, and you should therefore paddle in a group of three or four so that you can support each other in case of trouble. Two kinds of people paddle solo: the kind who have little or no knowledge and experience and are surprised when things go wrong, and the experts who fully understand the risks and accept them.

That word 'risk' is important. If there were no risk in paddling we probably wouldn't do it, but on the other hand, there are risks in paddling that are unacceptable. Risks are associated with hazards. Some are real, others are perceived. Perceived risks can motivate, real risks must be avoided or minimised.

Let's define a couple of terms:

Hazard: anything that has the potential to harm the health or safety of a person

Risk: the significance of the hazard in terms of likelihood and severity of any possible injury, illness or outcome.

An example of a hazard would be a fallen tree in a stream, commonly known as a 'strainer'. Water can flow through the branches but objects—boats and people—would be trapped and held. Risks associated with that hazard could include damaged boats, injured people, or in the worst case, loss of life.

This is not a treatise on risk analysis and management, but a brief look at the main hazards in canoeing and kayaking, and minimising associated risks.

Environmental hazards

Weather

Weather has been a key factor in paddling accidents in this country and overseas. In most cases whoever was in charge either ignored or did not appreciate the severity of forecast conditions.

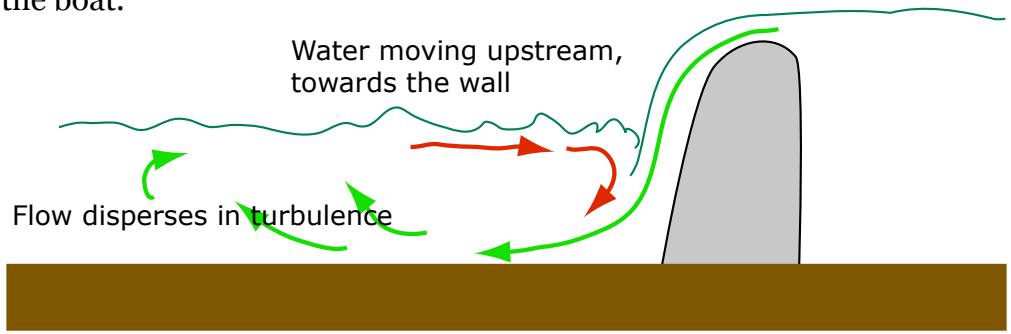
Before you go out, get the latest forecast and interpret it with your knowledge of the area you wish to paddle, remembering that the wind is the critical factor. Flooding and strong wind warnings are good reasons to stay home. Be pessemistic. Be prepared, especially in the early stages, to postpone the paddle.

Current

Water flows. There will be currents in streams and in tidal estuaries, and with currents come hazards. Strainers have already been mentioned, and others include rocks and other large objects, and weirs. Overhanging branches where the main current flows beneath them are also hazards: hands off.

The obvious answer is to keep well clear. If you are swept against an obstacle, lean **on to** the obstacle. The natural reaction is to lean away: do that and you will be instantly capsized and trapped against the obstacle.

Lean **towards** it, and push yourself clear, or if that is not possible, climb out on to the rock, log, or whatever it is. Be careful with open canoes that you do not put the downstream gunwale under, swamping the boat.



The problem with weirs is that water circulates on the downstream side, and there is no escape to either side, as there is with isolated rocks. Any floating object in that circulating flow can be trapped indefinitely. Portage.

If you want to paddle whitewater you'll need more training: whitewater paddling is serious business.

Sea

The sea is a very demanding environment, requiring equipment and skills that are beyond what are described here. If that's where you want to paddle undertake training with a club or state association.

The hazards of on-shore breezes are obvious, with waves crashing on the shore. Don't be deceived by the apparent calm of off-shore breezes. Not far out the water will become choppy, and it only gets worse the farther out you go. Which way will you drift if things go wrong?

What is the tide doing? Will you be going with it, or against it? Will there be sufficient depth to paddle?

Other traffic

If you're paddling in an area with other boating traffic you'll have to follow regular boating rules: keep to the right in channels, and so on. The rules are all explained in a booklet published by your state maritime authorities, and you should get a copy and be familiar with it.

For us, the rules might be summarised as 'If it's bigger, faster or more expensive than the kayak or canoe, keep out of its way.' Keep a good lookout, and make sure you are clearly visible, with bright clothing and so on. At night, you must be carrying a light. Where possible, keep clear of shipping channels. As someone observed long ago: 'A collision at sea can spoil your entire day'*

Equipment hazards

Is your boat suitable for the planned trip? Don't expect a sea boat to handle a small stream with tight bends, and it will not take long in a whitewater boat on open water to make you wish you were somewhere else.

Is it, and its associated paddle, spray deck, PFD and so on in sound condition? Is the internal buoyancy sufficient and secure? Are handholds and decklines secure? Are hatches sealing properly?

More than once paddlers have come to grief through unsuspected leaks and other failures. Check everything thoroughly before launch.

Personal hazards

How long is it since you paddled the kind of water and conditions you want to paddle?. As with other skills, you need to paddle regularly to maintain proficiency and fitness, not just in paddling, but in rescue techniques as well. And not just yourself, but your paddling partners.

Hypothermia

Hypothermia is the lowering of the body's core temperature through loss of heat. In the initial stages, people tend to become disinterested, and lose power and coordination. It can eventually lead to loss of consciousness and death.

In cold and windy conditions keep an eye on others in the group, and if they start showing signs of hypothermia, get off the water, take shelter and warm up.

* Attributed to the ancient Greek naval historian Thucydides, 460–404 BCE (?)

The condition is much easier to prevent that treat. Make sure you've had enough to eat, and keep eating snacks during the paddle to maintain energy. Wear sufficient insulation, such as polypropylene thermal garments, with a windproof jacket as the top layer, and a warm hat.

Hyperthermia

Hyperthermia is the opposite condition: the body's core temperature rising too high. Again, prevention is better than treatment: drink plenty of fluids, wear the appropriate clothing, and where possible, stay in the shade.

Safety equipment

State marine regulations will require that you carry certain equipment if you operate on certain waters, particularly the sea. Check the regulations and follow them. (Where they specify a 'bailing device' carry a sponge, the most effective bailer in a kayak.)

Someone in the group should be carrying some first aid supplies, and there should be some food and water. Also included should be some form of shelter. A spare paddle in the group is a good idea, and a roll of duct tape can fix a range of breakages. Someone should be carrying a towline, and on moving water a throwbag, and the ability to use it, is a good idea.

With mobile phone coverage across most of the country communication is not usually a problem these days, but remember that reception in areas such as steep valleys will not be good. Sea kayakers now carry handheld marine VHF transceivers (for which the Marine Radio Operator's VHF Certificate of Proficiency is needed) which give coverage along the main coastal areas.

Before you go

Before you launch make sure someone knows where you are going and when you expect to be back. The Australian Canoeing Float plan form is one way of doing this.

Serious incidents rarely have a single cause. Rather, there will have been a chain of seemingly minor factors which, eventually, lead to a failure somewhere in the system. As someone has put it: 'The perversity of the universe tends toward a maximum'. Develop and maintain your proficiency, plan thoroughly, and take care.

Canoe and kayak maintenance

Introduction

Unlike cars with their maintenance scheduled by distance travelled, or aircraft and other machinery by time in use, canoes and kayaks are kept in working order through *on-condition* maintenance. If you'd prefer an acronym, *IRAN* (**i**nspect and **r**epair **a**s **n**ecessary).

The 'inspect' part is important: every time a boat and its equipment is used it should be checked to make sure everything is as it should be. Anything that looks worn, cracked or otherwise suspect should be examined more closely, and then repaired or replaced as appropriate. Potential failures are best fixed before they become actual failures, and nasty surprises.

Arctic people were always careful about keeping their boats clean: any sand or grit between frame and skin could wear through as the boat flexed. That's less likely with our craft, but a clean boat is always easier to maintain. Wash the sand off your feet as you board, put hatchcovers on the deck and not on the beach, and so on. Whenever possible, rinse the boat before transporting it home, and always rinse PFDs, spray decks, etc. before storing them.

With the diverse range of designs and materials, these notes can only be an overview, not a detailed worshop manual, and where necessary you should consult the manufacturer. Most routine servicing can be done with basic tools — screwdriver, pliers, spanner, etc. — but structural repairs will need specialised equipment. A small mirror is useful for inspecting hidden areas.

Storage

Boats, paddles, PFDs, spray decks and other gear should be kept under cover, and allowed to dry and air. Although the plastics used in modern boats incorporate UV stabilisers, the sun will eventually take its toll.

A variety of rack systems are available commercially, or can be made. Racks should support the boat evenly, and curved racks or straps are better for plastic boats to reduce stress points. Leave hatches open to allow air circulation. Arctic people had to store their boats out of reach of the dogs: probably not something we need to bother about. On the other hand, cats and rodents have been known to scratch and chew buoyancy materials.

More boats are probably damaged in transport than on the water, so whatever system of roof rack or trailer and tiedowns is used it must be robust and secure. Dragging boats across lawn is unlikely to do much harm, but dragging across sand will eventually wear through. Rocks and hard surfaces will do the damage more rapidly.

Structure

Rotomoulded polyethylene boats are now the most common, with composites (glass, carbon or aramid fibre reinforced plastics) used where higher performance is needed. Home builders generally work in wood, either ply or strip, usually with an outer skin of glass fibre. Then there are the folding and other skin on frame types. Each has its own particular maintenance needs and methods.

Rotomoulded

The big advantage of the plastic boats is that they are robust, and bounce off rocks without much more than a scratch. They can be punctured by sharp objects and worn through by dragging.

Any whiskers from scratches can be cut off, if only for the cosmetics. Small holes and splits can be repaired by welding. This is not a difficult process, but takes some practice for best results, and a damaged boat is perhaps best taken to an experienced operator.

Tape and silicone can be used for temporary repairs, but must be completely removed before welding repairs.

Large cracks in highly stressed areas, such as the seat or cockpit rim, are difficult to repair satisfactorily. Reinforcement with a doubler, perhaps bolted in place, may be necessary. Cracks in these areas should be attended to as soon as possible, before they propagate.

The bulkheads used in plastic boats are often of expanded plastics ('foam') secured with silicone or similar adhesive. Adhesion to polyethylene is always poor, so such bulkheads should always be regarded with suspicion. If leaks are found (see 'Leak checking' below) they should be sealed with silicone, or whatever other material the manufacturer recommends.

Seats and other components are often fixed with bolts or screws. They should be checked and tightened as necessary. Loose or missing fasteners can lead to damage.

Composites

For the same weight, composites are stiffer than polyethylene, which makes them the choice when performance counts. The outer surface is harder, but still readily scratched by rocks and sharp objects. Impacts can cause delamination, damage within the structure.

Any scratches which go through the gelcoat, the outer coloured layer, into the laminate, need to be filled to prevent water seeping in. (Water within the laminate can slowly dissolve styrene, and salt crystals can inflict their own damage.) An epoxy putty such as Epifill is a useful material. It is easier to use than gelcoat, and certainly easier to obtain than gelcoat in matching colours.

Holes, cracks and splits require patches, preferably inside, but outside if the interior is inaccessible. The area must be thoroughly clean and dry, and then ground back to remove loose and damaged material, and to provide a rough surface for the new material to 'key' to. The patch, usually two layers, is cut slightly larger than the area to be repaired, then thoroughly 'wetted out' with resin. The resin used should be the type originally used in manufacture, polyester, vinyl ester or epoxy. Seek advice from the manufacturer if you are unsure. Epoxy resin will stick to the others, but the reverse is not true. Epoxy is useful on old boats, and polyester becomes more brittle and less able to take repairs as it ages.

Use appropriate protection when using power tools on composites or handling the materials. Major repairs are best taken to someone experienced with access to a range of materials and equipment.

Wood

Wood is the original composite, and as wooden canoes and kayaks are often sheathed with a layer of glass, repairs to the outer skin are similar to those of glass/carbon/aramid composites. Internal repairs to the skin can be made with suitably sized ply patches glued in place.

Water soaking into the structure is the danger, and you should seal any scratches or worn areas, after thoroughly drying the affected areas, as soon as possible.

If you've built your own boat, then you're familiar with the materials and techniques.

Skin on frame

Folding kayaks are often thought to be fragile. In reality they are tough and resilient, but do need to be treated properly. Manufacturers supply materials for repairing holes in the skin, and replacement frames and stringers.

Assembly and disassembly are obvious times for inspection. Check that hinges and other fittings are clean and not distorted, and that inflatable sponsons and their valves are in good order. Wooden parts need to have their varnish intact, and be revarnished if necessary. Metal components must be free of corrosion.

The older style of skin on frame boat is now rare, and they definitely tend to be fragile. Small tears and holes in the skin can be patched, but the boat will need reskinning every few years. That is the time to thoroughly inspect the frame and revarnish it. Broken frames and stringers should be repaired or replaced.

Leak checking

Often water will seep into a boat without there being any obvious hole or crack, but it will need to be found and repaired. Put the boat on secure supports, and pour 10–15 litres of water into the affected compartment.

Rest the boat at different angles, on its sides, even inverted, until you find water escaping. Mark the spot, drain the water and dry the boat ready for repair.

(Some people suggest pumping air into the boat and then tracing the escaping air. The water method does not require extra equipment, but does require caution, and perhaps an assistant, when moving the boat with the water sloshing around.)

Bits and pieces

Hatch covers

The thick synthetic rubber hatch covers generally require no attention. Early versions tended to perish and crack after some years, but current ones seem to be more durable. Small leaks can be sealed with Aquaseal® or silicone.

The neoprene covers can also be sealed if need be with Aquaseal or silicone. Worn shock cords should be replaced.

The straps and buckles on some hatch covers can become worn or broken. Replacement is the best solution.

Toggles and decklines

Contrary to popular opinion, toggles were not originally intended for carrying boats, but as safe handholds for when the boat was being rolled about, as in surf. (And the first toggles were made of a bit of old deer antler.)

Check that the cord is not worn, and replace as necessary. (Toggle cords on composite boats tend to wear, because the material is abrasive.)

Decklines ought to be tight enough not to flop about, but sufficiently slack to allow them to be readily grabbed. Check that all the deck fittings are secure.

Shock cords on deck will last for several years, and are usually easily replaced when they lose their elasticity.

Paddle parks and towlines should be checked to make sure the lines themselves are in good condition, and that snaplinks open and close without sticking. (Use only marine-grade stainless steel hardware, not alloy climbing karabiners.)

Footrests

Footrests are normally fairly sloppy on their rails, but that doesn't stop sand and mud jamming them in position. After each use check that the rails are clean, that the locking mechanism is working, and that the pedals can slide on their rails. (Jammed footrests are the bane of instructors' lives when trying to fit boats to students of different sizes.)

It's usually possible to free stuck footrests with them in the boat, but in bad cases it may be easier to take the whole thing out to work on. In most cases, there are two screws each side. Make sure they are tight when you put things back together.

Rudders and fins

If anything is going to cause trouble it will be the rudder. It has a number of moving parts, several cords or cables, sliding or pivoting things on the footrest, and a number of fasteners to come loose. Invariably, it will fail when it is most needed, and the person paddling the boat will be rudder dependent, i.e. unable to control the boat with paddle strokes, edging, etc. It's usually a cable that breaks, but rudders have been known to fall off completely.

Before and after use, check that everything is secure and moving freely. Metal cables need particular care as they can fail through fatigue, especially if they are flexed under tension. Spectra® cables are better in this regard, and don't require swaging of thimbles, etc. when replacing.

Retractable fin systems have only one moving part, and therefore have less to go wrong. The disadvantage is that mud and grit can jam the blade, so care needs to be taken when launching from such surfaces. A small loop of cord at the end of the blade can make it easier for

someone to wriggle and pull the blade to free it. Check the blade and its case are clean before and after use, and one item on the post-launch checklist can be to extend and retract it to make sure it's working.

The retraction cord and any shock cord in the system need to be checked, and replaced as necessary.

Pumps

Foot pumps are almost in the 'fit and forget' category, but still need checking. The occasional bit of sand or seaweed will usually flow through without problems, but wads of seaweed can block intakes. (Another good reason to keep the boat clean.)

Experience has shown that the UK-made Chimp pump will last for many years, but the diaphragm in the Taiwanese equivalent (67546 in the Whitworths catalog) perishes after a year or so. Replacement diaphragms are available (also to collapse after a similar time), but serviceable diaphragms can be cut from an old wetsuit or spray deck.

Check that mounting fasteners are secure, and tighten as necessary.

Electric pumps can be very effective, but require checking before every outing. Check that the battery is charged, and that the switch and all the wiring are secure. Replace the switch and wiring at the first sign of corrosion. If the battery is in a waterproof box, make sure the box is, in fact, waterproof. The shaft seals in some pumps are known to fail after a time, leading to failure of the bearings or the internal electrics. The repair is a new pump.

Paddles

The usual damage is to the ends of the blades, which will become scratched and chipped. There's not much you can do with plastic blades, but composite blades can be patched with epoxy putty.

Bent aluminium shafts and broken composite shafts are best replaced.

Cheap paddles tend to be tossed into the trailer, but you will want to treat your carbon fibre paddle with greater care.

Wearables

PFD

PFDs normally require only a rinse and drying after use, but the fabric will eventually fade, and wear at points, and the flotation material will lose some of its buoyancy.

Broken straps and buckles should be replaced. Zips eventually wear out, and by this time it's probably worth buying a new PFD.

Spray deck

The two main materials are proofed nylon and neoprene. The nylon types are cheaper and resist abrasion better, and some have a tape around the edge to resist that abrasion.

Rinse and dry after use, and check that there are no obvious holes, and that the release strap is secure. Aquaseal or silicone can be used to seal small holes, and other repairs can be made by sewing.

The neoprene types tend to wear around the forward edge. Again, Aquaseal or silicone can be used to seal small holes.

Instructors and others who do lots of rescues are hard on spray decks, and sometimes a couple of cheap decks may be better value than a more expensive one.

Materials

Aquaseal (McNett Corporation) is recommended by a number of makers of wetsuits and other gear. It's urethane based, and flexible and stretchy, making it ideal for the job. Keep it in the freezer, and thaw before use. Look for it in dive shops.

Selleys® Glass Silicone Sealant sticks to almost anything, and, being safe for aquariums, is less irritating than most. It's clear, and flexible, and comes in 75 g tubes.

Epifill (International Paints) is a two-part epoxy putty, available from marine chandlers. Use it to fill holes and scratches in composite materials.

Small quantities of glass fibre, resin, hardener, etc. are available from marine chandlers, including as ‘repair kits’. Marine chandlers also carry a range of other adhesives and sealants that may be of use, and of course fasteners, cord, rope, shock cord, and the like.

In the field

The old standby is duct tape, which can be used to hold almost anything together. On a day trip you may carry little more than that, but on an expedition of several days or longer you may want to carry some tools (the folding pliers with blades and screwdrivers, etc. are convenient), some Epifill and silicone, spare rudder cable, and so on. A serious expedition will also carry materials for hull repairs (resin and glass, etc.), spare fasteners and so on.

Appendix: Knots

Introduction

Paddlers need knots for a variety of purposes, including tying boats to roof racks and trailers, mooring boats during lunch stops, and the critical needs of rescue in white water.

Most synthetic ropes can be used for tying boats to vehicles, and polyester yachting sheet rope makes good decklines for sea kayaks (at least 6 mm diameter, preferably 8 or 10 mm). For rescue work, floating rope is preferred, polypropylene for throwbags, Spectra with a polypropylene sheath for hauling.

All ropes should be stored in the proverbial cool, dark, dry place, loosely coiled so that air can circulate. Climbers never tread on their ropes and neither should paddlers.

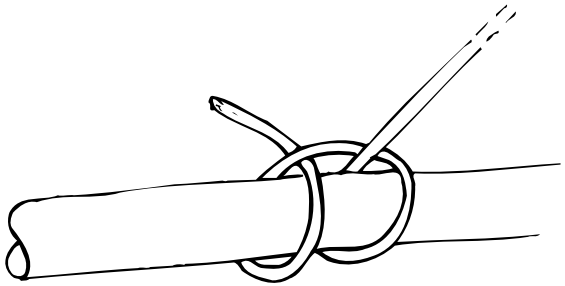
All knots weaken the rope, and the tighter the bends in the rope the more it is weakened.

Knots for tying on

Clove hitch

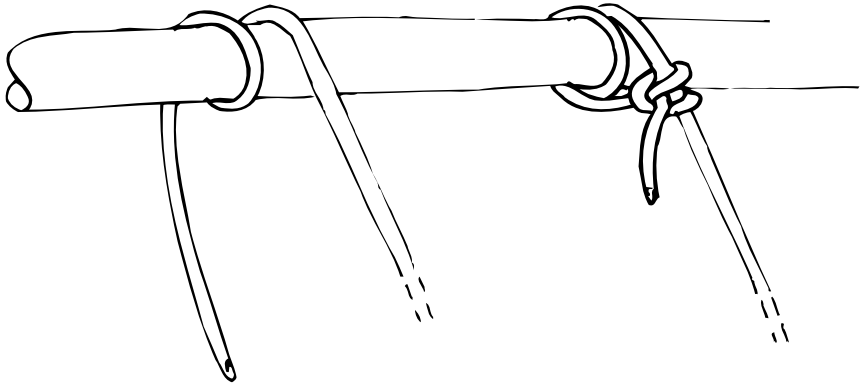
The clove hitch is suited to ties around poles where slip along the pole is not wanted. It is designed so that the rope tightens on itself and around the pole. Tension is required for an effective clove hitch. Half hitches formed by the loose end around the end with tension will make the knot more secure. If the tension is intermittent and/or the pole is slippery, the knot can work loose.

The main advantage of the clove hitch is that it can be tied when there is tension on the rope without losing the tension.



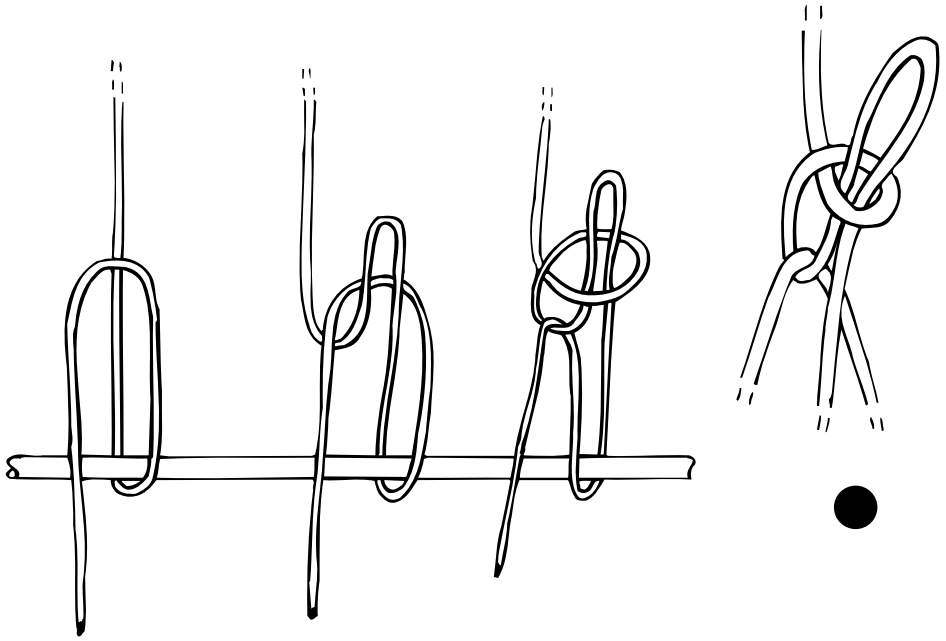
Round turn and two half hitches

This knot is useful for tying rope already under tension around a pole, branch or roof rack. It is very simple to tie, reliable and easily undone. It is possible to retain tension during tying. The first half hitch should be tightened before the second is tied.

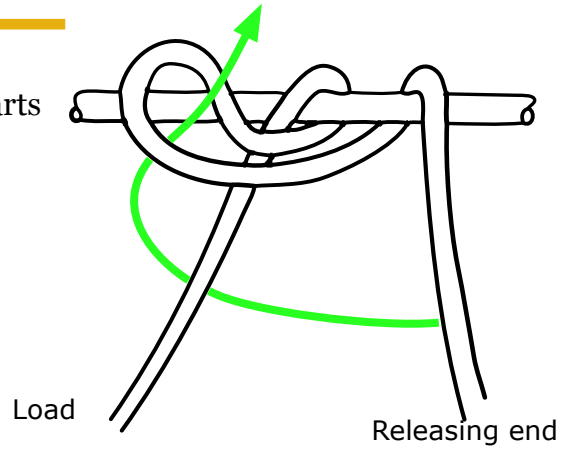


Truckies' hitch

This knot uses half a sheepshank to make a loop to gain mechanical advantage, and is useful for securing boats to vehicles. The free end is tied off with a clove hitch or round turn and half hitches.



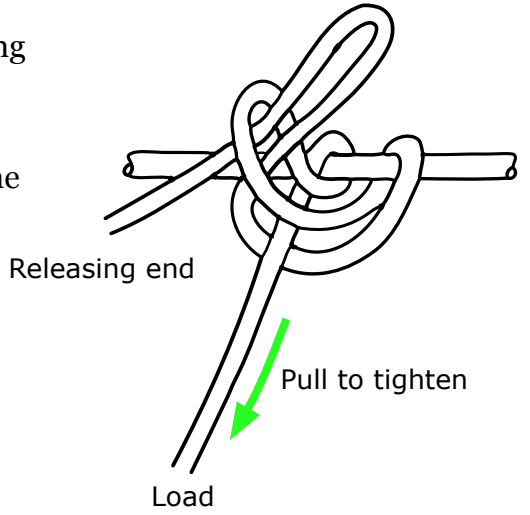
Pull the bight between the two parts and across the load side.



Now pull a bight of the releasing end behind the load side and through that bight.

Tighten the hitch by tugging the load side.

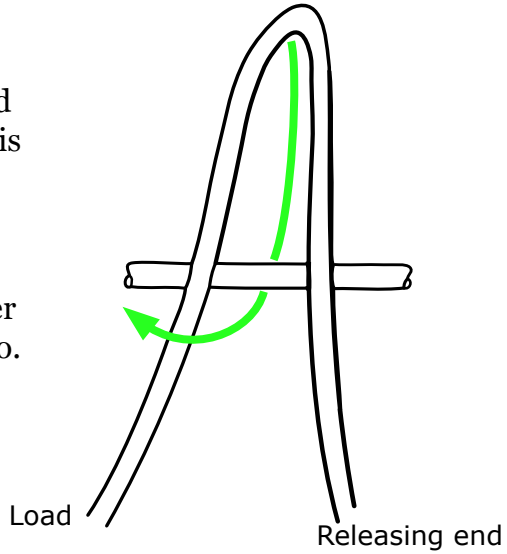
Check that it is secure.



Getaway hitch

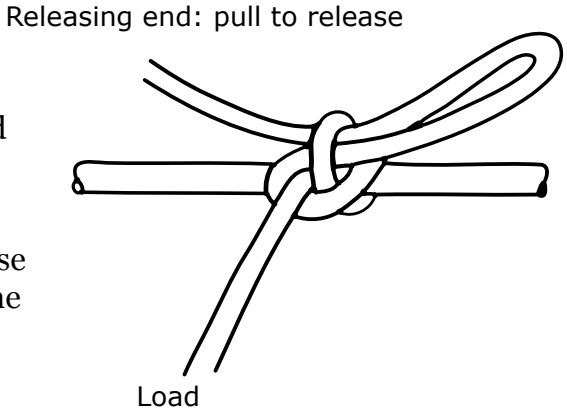
Easier to tie than the Tumble hitch and safer than the Highwayman's hitch, this hitch can be used to make a towline from any suitable length of rope, perhaps a throwbag.

Start by putting a bight of the rope over the deckline or whatever is to be tied to.



To release, pull the release end and the hitch will collapse.

With the hitch at both ends of the rope, there is a quick release at both ends, useful in a towline system.



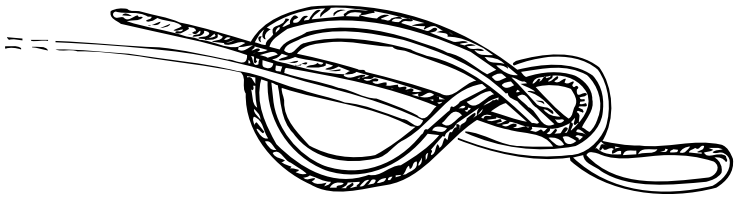
Knots for loops

Figure eight on a bight

This can be done anywhere on the rope as it doesn't require any threading through of an end. The knot will not slip even under high tension but can be undone with relative ease when tension is absent, even after large loading.

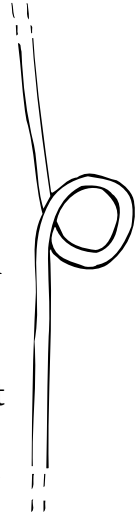
A half hitch with the loose end (if there is one) to the incoming rope helps the knot's security. Climbers depend on this knot to attach harnesses to ropes.

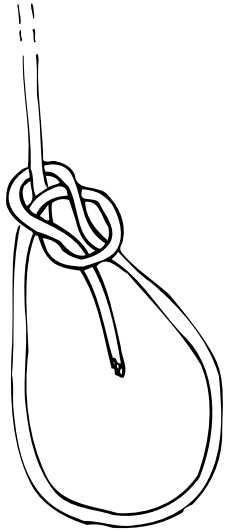
It is often used in place of the bowline, being stronger as well as easier.



Bowline

The bowline is useful for tying around a pole or solid object. The knot will not go tight around the object so ensure that the pole or object shape will not allow escape.





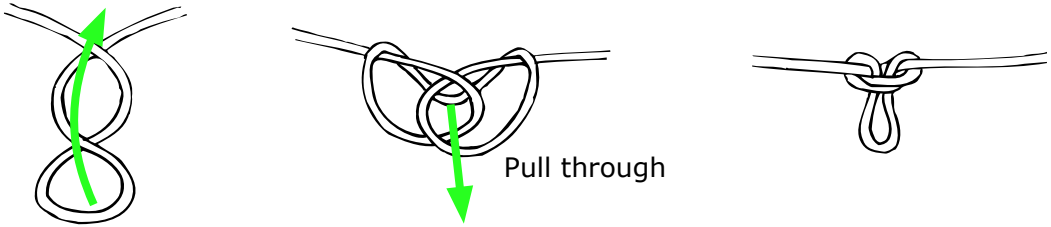
Form a loop and feed the rope up through the loop, and around then back down again.

An extra half hitch with the free end will ensure that the knot won't slip. Rope which won't bend or grab easily may tend to work loose if tension is intermittent.

This knot is difficult to tie while holding tension.

Butterfly knot

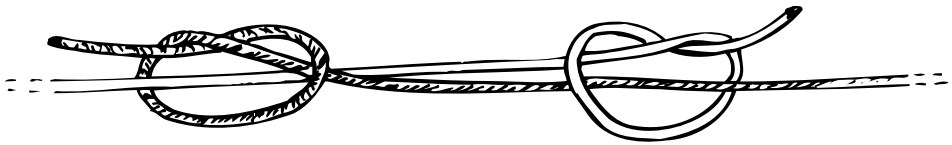
This is a mid-line loop knot that can be loaded in any direction and is good for attaching one system to the middle of another such as pig rigs or adding vector loads onto ropes.



Knots for joining

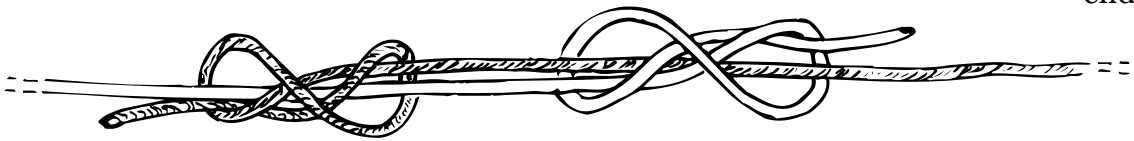
Fisherman's knot

Used for joining ropes together, but not very good when the ropes are very different in diameter, and not the most secure method. Tighten the two individual knots first and pull together until the knots sit nicely together.



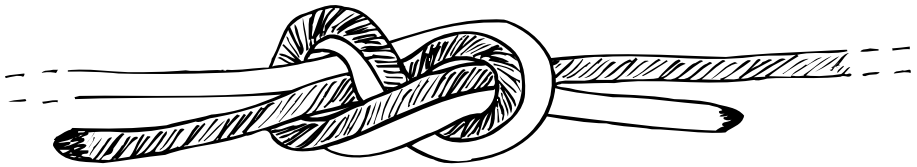
Double fisherman's

The double fisherman's knot is much more secure than the fisherman's knot for large loads. Rock climbers depend on this knot extensively, often using it to join the ends of Prusik loops. As with the fisherman's knot, both sides are tightened before being pulled together and tightened further.



Rethreaded figure eight

By forming a loose knot in one rope and then threading the end of the other through two ropes can be joined. It is easier to tie than the double fisherman's, and much easier to untie after loading.

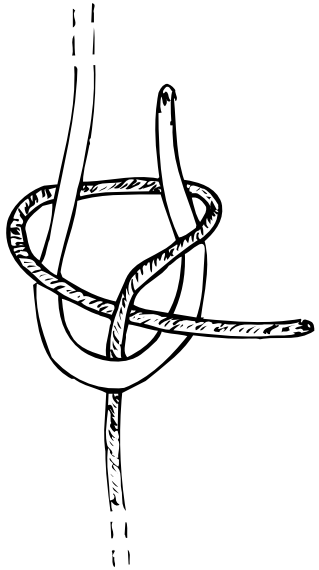


Sheet bend

A knot for joining ropes of dissimilar diameter. Form a loop with the larger rope as shown, then thread the smaller rope through.

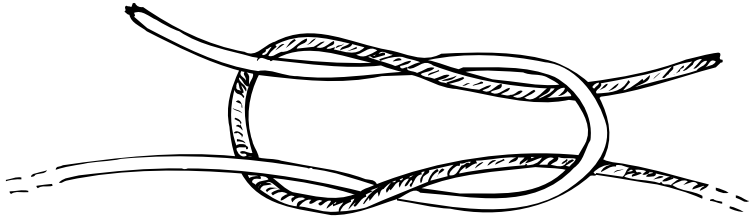
The sheet bend is not ideal for situations involving high tension, and the knot is less likely to hold great strains when the difference between the diameters of the two ropes is large.

Ensure the short ends are on the same side.



Reef knot

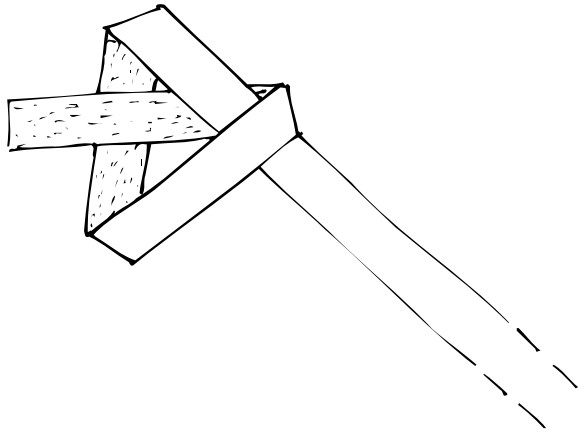
Not a good knot when the ropes are different diameters, and not ideal for large loading. It should be used only when the knot is against some surface, like the reefs in a sail. Half hitches on the loose ends can make it more secure. The ends should naturally lie along the incoming rope. If the ends point naturally to the side it is a granny's knot, and if one end is above and the other below it is a thief knot.



Tape knot

Climbing tape (or webbing) is lightweight but very strong. Lengths of tape with the ends joined make very useful slings, and are relied on extensively by rock climbers at belay stations.

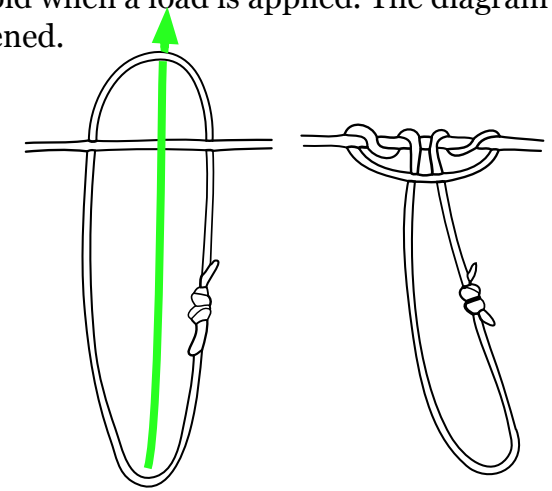
If tied properly the knot will have no twists but nice flat folds at every corner. Form one end first then trace through with the other and tighten.



Knots that move

Prusik knot

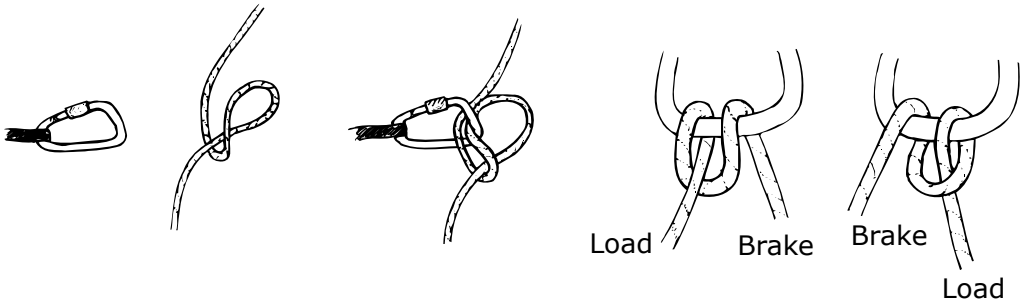
The Prusik knot, named for Dr Karl Prusik, a German climber of the 1930s, is used to attach a separate loop to a rope, so that the loop can be slid along the rope but will hold when a load is applied. The diagram shows the knot before it is tightened.



Munter hitch

Also known as the Italian hitch, this is a hitch that can be used on a karabiner to control descent of abseilers and swimmers. The hitch can belay in both directions.

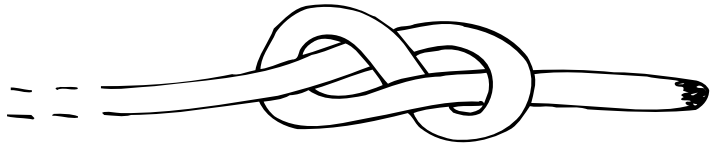
The hitch is named for Werner Munter, a Swiss mountain guide.



Stop knot

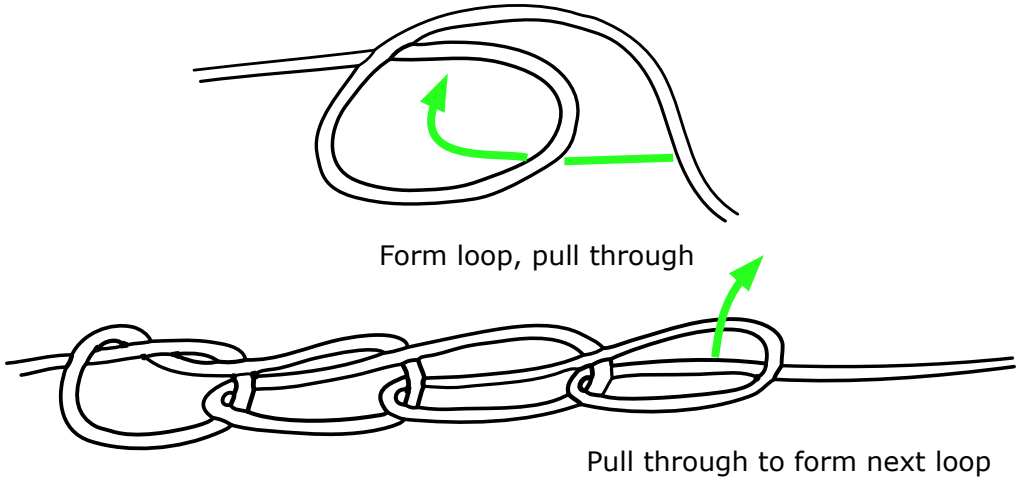
Figure eight knot

The standard figure eight knot makes a useful stop knot, and is easy to untie even after loading.



Chain sinnet

Also known as daisy chain, this allows a rope to be shortened for easy carrying and reduces the tendency to tangle. Start with a loop, then progressively pull new loops through the previous. Finish by clipping the snaplink to the last loop, or tying the last loop. To unravel, unclip or untie and pull.

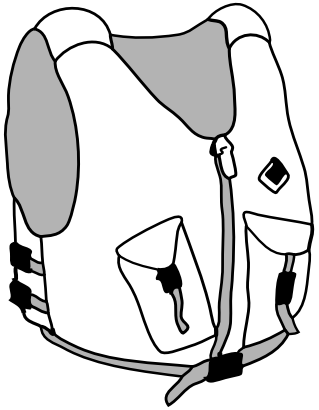


Appendix: Australian Canoeing Safety Code

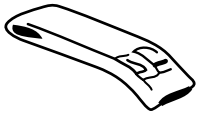
Before you go...

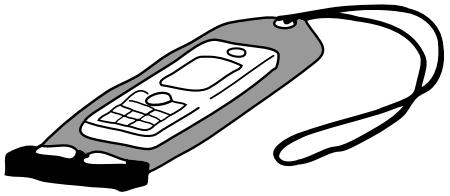
Besides the boat and paddle you'll need:

Clothing to suit the conditions

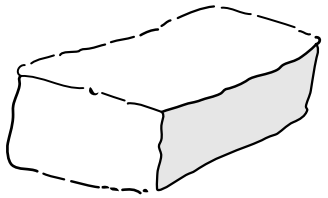


PFD, with whistle attached

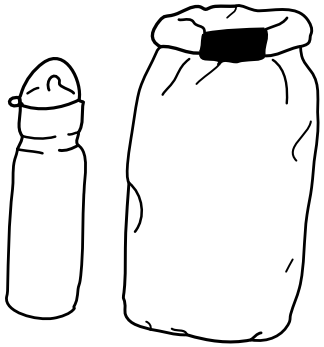




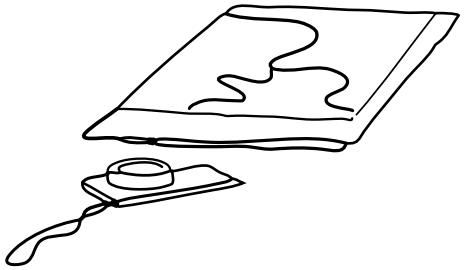
Mobile phone or other communications



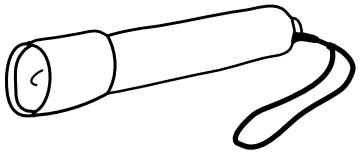
Bailing sponge



Food, water, spare clothing, first aid, etc.



Map and compass



At night, waterproof torch

Float plan completed and with responsible person

Group leaders require towline, paddle leash, throwbag and other emergency gear

Before you buy a kayak, sit-on-top or canoe

- Decide what you want to do with your craft. You may want to:
  - paddle in lakes and lagoons
  - paddle in the sea
  - paddle in white water
  - buy a craft for your children

  and each will require something different.
- Seek advice from qualified paddlers about which craft you will best do what you want. Any canoe club or its members will be eager to assist.
- Check the craft for fixed buoyancy, comfort when sitting, strength and quality.
- Don't expect to do more with your craft than the purpose you bought it for.

Yourself

- Be able to swim confidently and be confident in water, even with the clothing you will wear paddling.
- Always wear a Personal Flotation Device (either Type 2 or 3 (Level 50 or 50S)).
- Be honest with yourself about your ability. Paddling on quiet water doesn't qualify you for more difficult trips or conditions.
- The waters of rivers, lakes and oceans are all very different, and demand knowledge and skill. Develop your paddling incrementally, preferably with people more skilled than yourself.
- Beware of cold water and weather extremes. Swimming ability and PFDs cannot counteract for long the effects of very cold water. Wetsuits may sometimes be essential for safety.
- Be equipped for the conditions that could occur. Secure your spectacles, have appropriate footwear, allow for protection against the sun, wind, and rain.
- Learn how to capsize, to rescue yourself and others and learn first aid, so that you are prepared for an emergency.
- Seek training. We recommend the AC Basic Skills Award as a minimum. AC Instructors are available through many canoeing clubs and other bodies.
- Before accepting an invitation to undertake a trip, enquire about:
  - the group organising it
  - the leader
  - the trip itself.

If you accept, give the leader a frank assessment of your skill and experience and your full cooperation.

Equipment

- Make certain you have the right craft for the trip, and that it is in good condition.
- Test new and unfamiliar equipment before going into hazardous conditions. This includes alterations to gear.
- At sea, carry a spare paddle in a readily accessible position.
- The craft must be able to support its crew and gear in deep water even when swamped. Use expanded plastics, buoyancy bags or sealed air-tight compartments.
- Use spray covers whenever there is any possibility that water may come into the craft in quantity. The cover release must be immediate and function perfectly.
- Carry appropriate repair equipment, torch, map, compass, whistle and survival kit on wilderness trips. Leave a plan of your trip with a responsible person and an expected time of arrival at your destination: the AC Float Plan is designed for this.

The leader

- The leader should describe the conditions that could be experienced to prospective participants, before they accept invitations.

- The leader should not allow persons to participate beyond their proven ability, nor allow inappropriate craft to start.
- The leader must know the range of weather conditions which may occur and their influence on the water conditions
- Before starting and at any appropriate time, the leader should make it clear that his or her decisions in the interest of safety are final.
- The leader nominates the functions of other group members and the formation on the water.
- By example the leader should impart knowledge, skill and confidence.

On rivers

- Each participant should be aware of group plans, formations, the general nature of the river ahead, the location of any special gear and the signals to be used.
- The lead boat crew scouts all doubtful parts of the river, sets the course, and is never passed.
- The rear boat is equipped and trained for rescue.
- Each craft has a responsibility to the craft behind. It should not lose visual contact. It passes on signals, points out obstacles and tries to prevent its own errors being repeated.
- The party needs to be compact. Large formations should sub-divided into independent groups with an overall plan.

On lakes or the sea

- Do not travel beyond a returnable distance from shore under the worst conditions possible.
- Know the weather range. Have a current forecast. Conditions can change within minutes. Beware of off-shore winds.
- Have a sound knowledge of the effects of tides.
- Organise groups to prevent craft being dangerously dispersed.
- Before an ocean expedition kayak paddlers should practise rolling, and all paddlers should rehearse rescues so that capsized paddlers can be returned to their boats quickly and safely.

In the event of a capsize

- Keep calm but very much alert.
- Stay on the upstream or seaward side of your craft.
- Be aware of your responsibility to assist your partner (in the case of pairs).
- Follow your rescuers' instructions.
- Leave your craft only if this improves your safety. If rescue is not close at hand and the water is dangerously cold or worse rapids follow, then swim in the appropriate direction for the nearest point of personal safety. You are worth much more than the boat.
- If swept into a rapid, then swim feet first on your back, feet clear of the bottom. Keep your head clear of the water for good visibility.

As a rescuer

Go after the crew. The craft can wait until the crew and you are safe.