Basic Kayak Navigation

By Terry Barry

Covered in this Unit-

- Understanding the map/chart legend
- Understanding of scale
- The 16 Cardinal Points
- Taking Compass Bearings to objects
- Taking Compass Bearings on map/chart
- Magnetic Vs True North
- Transferring bearings between map and land & vice versa
- Back Bearings
- Compass variation
- Compass deviation
- Orienting the map/chart
- Relating map/chart to ground
- Measuring distance on map/chart
- Application of navigation strategies, in particular, aiming off, attack points, handrails.
- Triangulation
- Understanding & apply the grid reference system
- Tides - the rule of 12ths & the 50/90 rule
- Bouyage System
- Clock navigation
- Transit line ferry glides

❖ Understanding the map/chart legend

CHART VS. MAP - Kayakers, being amphibious, will be able to utilize both charts and topographical maps in planning and enjoying their voyage. What are the differences and advantages?

CHARTS:

A chart is a map for nautical use. A chart will detail information that is of interest to mariners, such as water depth, rocks, wrecks, shoreline terrain; and aids to navigation, such as buoys or lights.

A chart utilizes a "compass rose" consisting of three concentric rings showing all 360 degrees, like a round protractor; the outer one oriented for true north, the middle one for magnetic north.

The innermost ring shows all the compass points, north, east, south and west, etc, just like a compass, without the abbreviations. As kayakers we will want to use the middle ring for numerical magnetic "bearings."

Distances can be measured on a chart using the "scale" (in nautical miles) or the "latitude scale" along the right and left borders of the chart, NOT the longitude, top and bottom. A nautical mile (abbreviated as NM or nm) is equal to 1.15 statute miles or 1.85 kilometres. There is not that much difference but it can add up fast and give you problems if you are not aware of the difference.

TOPOGRAPHICAL MAPS:

A "topographical map" will detail information that is of interest to landlubbers. Topographical maps will show the contours of the land in great detail, roads, trails, springs and "non navigable" (to ships and large power boats) waters that may not be detailed on charts.

This type of map may be the only kind available for inland lakes and rivers. A topographical map will also show the declination (or difference) of true north and magnetic north, depicted as an angle. There is however no compass rose.

A topographical map has a scale like any other map, and it is in kilometres, just like the ones we use while driving. To make measurements of distance on any map or chart, use a piece of string, ruler, your fingers or the measuring edge of a compass. Make a measurement of your route and compare to the scale or vise versa. While at home, not in the field, you could use dividers or a compass (the kind you draw circles with) as a measuring instrument. Topographical maps have a legend usually in the corner.

Marine Charts vs. Topographical maps in Brief

Marine Charts: show depth*, tidal stream directions & max. speed, known underwater obstacles (reefs, shipwrecks, overfalls,), buoyage (navigational buoys, beacons, lights,), nature of sea bed.

Some landmarks (tall towers, prominent hilltops)

Read carefully all notes on every marine chart.

Seek most recent chart date (charts updated frequently: moving sandbars & hence channels, lighting location &/or frequency,)

What charts WON'T show you… that sea kayaker's need

Land features that may be needed for journey start, end, mid-trip access or emergency. Eg:

- Towns and Roads
- Vehicle access points to beach/coast

- Walking tracks

➢ Understanding of scale

On a chart the distance between two objects is measured in Nautical Miles. You calculate the distance by using the 'Latitude scale' located on the left and right hand side of the chart. The Latitude is in Degrees, minutes and seconds one minute of latitude is equal to one nautical mile. One degree is equal to 60 minutes; one minute is equal to 60 seconds. The lines crossing the chart are spaced at minutes.

A topographical map is measured in Kilometres'. The lines crossing the chart in both directions are spaced at one kilometre on most maps but a larger scale map it could be 10 kilometres. Always check the information on the map to check the scale.
Contour lines are spaced at regular intervals such as every 20m in height. This varies form map to map, so again you need to check the scale information marked on the map.

❖ The 16 Cardinal Points

The rose on a compass is divided into 360 degrees.
0 degrees or 360 degrees is north
South being directly opposite is 180 degrees these are two of the 16 cardinal Points

Fill in the missing degrees of the 16 cardinal points

1. N _____
2. NNE _____
3. NE _____
4. ENE _____
5. E _____
6. ESE _____
7. SE _____
8. SSE _____
9. S _____
10. SSW _____
11. SW _____
12. WSW _____
13. W _____
14. WNW _____
15. NW _____
16. NNW _____

❖ Taking Compass Bearings to objects

To take a compass bearing to an object use a hand held compass.
Hold the compass level so the magnetic needle can move freely. Point the compass at the object. (Be sure to have the compass 'direction of travel 'arrow pointing at the object or you will be 180 out!). Whilst holding the compass turn the bezel (Real name is azimuth ring) to align the painted 'red arrow' in the centre of the bezel with the magnetic pointer. ("Put red in the shed" is a common way of remembering this)The compass is now able to be moved so you can read the degrees of the bearing on the bezel. This is the magnetic bearing to the object from your current position.

❖ Taking Compass Bearings on map/chart

Taking a bearing on a map/chart is just as easy.
HINT- Take no notice of the magnetic needle when doing this.
Place your compass on the chart the end at the point you will be starting from
Point the other end towards where you want to go (make sure the direction of travel arrow is pointing the right way or you will be 180 degrees out)
Now turn the bezel so that the parallel lines in the centre of the bezel are parallel with the grid lines on the map/chart. (Be sure that the compass doesn't swivel on the map as you do this, only move the bezel)
The bezel will now be reading the bearing to follow.

❖ Magnetic Vs True North

In the two exercises just followed outside we took a bearing to an object we used the magnetic needle of the compass. Therefore this was a **magnetic bearing**.
When we took a bearing form a map/chart we did not use the magnetic needle therefore this was a true bearing.
In other words if we take bearings from the real world they are magnetic, from a map or chart they are True.

But what is the difference?

Maps & charts are drawn using grid and lines of Latitude and Longitude artificially drawn around the world. All lies of longitude start and finish at the top and bottom of the globe (The north and south poles). In much the same way as the lines on a basketball. We call this artificial north **TRUE NORTH**
However the compass needle points to **magnetic north**. This is not in exactly the same position as the artificial top of the globe. This magnetic position changes over time. Maps and charts indicate the difference. This is called magnetic variation and is different in different parts of the world. However in our part of the word the difference is between 12 & 13 degrees. We use 12 degrees as the general rule.
The difference is to the East

❖ Transferring bearings between map and land & vice versa

Here is how this works in real life-

If we take a bearing to an object the bearing is magnetic. We can simply follow the compass bearing and it will be correct.
If we take a bearing in the artificial world of a map/chart it will true and be 12 degrees out in the real world so once we take a bearing from a map/ chart we then subtract 12 degrees to give us the correct bearing (Magnetic)to follow in the real world.

It therefore stands to reason that if we want to use a real world bearing (magnetic) and transfer this information onto the map/chart then we must first add 12 degrees to change the bearing from Magnetic to True'
A simple way to remember this is-
Compass **TO** map = **ADD** 12 degrees
From map to Compass = **MINUS** 12 degrees

❖ Back Bearings

This is the term used to describe the bearing to be follow 'BACK' to where we came from it is the opposite direction and therefore 180 degrees different to the bearing to an object (either magnetic or true)
A back bearing can also be used to find your position, more on this later.

Q. if you are heading towards an object on a bearing of 230 degrees what would be the back bearing?

_____.

❖ Compass variation

All compasses are not created equal! You may find your compass reads a different bearing when pointed at the same object to everyone else.
This 'manufacturing' fault is what is called Compass Variation- the difference between one compass to another.
It pays to check you compass and allow for any variation when using it.

❖ Compass deviation

This is when the compass is being a 'bit devious' and not pointing correctly at magnetic north.
If you place your compass near anything that is magnetic it will cause the needle to move away from magnetic north.
This is important to know when packing your kayak, if you place magnetic metal object below it in the hatch it will give false reading. Operating Electrical equipment will also affect it due to the magnetic fields associated with electricity.

There are also places in the world that have there own magnet effects and this will cause compass deviation. This information is usually contained on the map/chart.

❖ Orienting the map/chart

Making sense of the map/chart to your surroundings is often helped by getting the map/chart in the same orientation to the real world around you. This is called orienting the map and should be one of the first things you do when looking at a map/chart for information on your surroundings. It helps to save confusion.

There are two ways to orient a map/chart-

1. Matching the features on the map/chart to the features you can see around you. This is usually sufficient and is quick and easy in most situations.
2. Place your compass on the map/chart and turn the map until the top of the map/chart is north as indicated by the magnetic needle of the compass.

➢ Relating map/chart to ground

Once the map/chart is oriented, using your observations you should be able to relate the information & features on the map/chart to what you can observe around you. Look for features such as hills, channel markers, headlands and the like. As you travel your map/chart should be easily accessible, a laminated copy attached to the top of your deck allows you to easily keep track of your position as you travel. In this way you should always be aware of your position and be anticipating what lies ahead This is vital in decision making of where your next stopping point may be, how far you have travelled and if you are still on course.

➢ Measuring distance on map/chart

As discussed earlier you need to be aware of the scale of you map/chart. Either kilometre on a topographical map or nautical miles on a chart.

To measure distances use a piece of string, place on end at the starting point and the other at the finish. Simply transfer this to the latitude scale at the side of the chart and measure how many minutes the string is long, each minute is equal to one nautical mile. On a map transfer the string to the scale to read the kilometres or use the gridlines and count the kilometres (assuming your grid interval is one kilometre). You can also use dividers of a compass (the type you draw circles with) to step out the course but this is more for ‘at home’ calculations than in the field.

A string also allows you to ‘contour the coast’ by mimicking the shape of the coast as you lay it on the map/chart to give an accurate measurement of you course rather than a straight line which we usually do not paddle.

Measuring distances and your rate of travel will allow you to determine more precisely where you are on your map/chart. To do this you will have to do some experimentation. You will need a wristwatch, and two points with a known distance between. This is something you will have to work on for a while to get a feel for it before you can rely on it in the field.

Use your map/chart to determine a distance, maybe between two islands, "point A" to "point B" that you have measured to be 1 nm apart for example. Paddle at your regular rate, noting the time you started at "point A", and the time when you get to "point B".

Now you can figure your speed. If it took you 15 minutes to go one nautical mile then you are paddling at 4 nautical miles per hour, pretty good for a kayak. You can use Knots as a

measurement of speed, but most of us think in terms of kilometres per hour. (One Knot = 1.8 KPH.)

Try this several times in a combination of currents and winds from different directions and different strengths. Also use a couple different routes and distances between points. You will now be able to estimate your rate of speed in a variety of conditions based on your test paddling using this method. Simply take note of your starting time.

As you paddle your route estimate your rate of speed based on your previous experiments and any observations of distances along the way. You may figure that you are going 3 NMPH, possibly into a light breeze or current. Then when you need to know where you are on the route, that line you have drawn on your map, a nautical mile and a half crossing of open water, for example, you look at your watch and see you have been paddling for 20 minutes. You determine that you have gone a nautical mile and are now two-thirds the way to the other side.

❖ Application of navigation strategies, in particular, aiming off, attack points, handrails, position lines.

In a perfect world we would be able to paddle a line following a bearing and arrive at the precise place we aimed for. However this is not reality. Wind, currents, and miscalculation all play a part and making travelling an exact bearing difficult if not impossible.
Therefore we use a few simple strategies to ensure we arrive where we intended without 'geographical embarrassment'!

Aiming Off- If you are crossing say to an island, and need to find a small bay or inlet or don't want to miss the island completely then aiming off is a good technique. This means you aim intentionally when calculating the bearing off course to either the east of west of your target. Once you get to the island you then know that your intended target is to the east or west of your position rather than being unsure in which direction your target lays. It is also a good technique to use if there is a cross current, aiming off allows you to arrive 'upstream' of your target and therefore paddle with the current to find the exact place without paddling into the current.

Attack Points- This is the term used to use a large easily identifiable feature as an 'attack point' to find a more difficult object nearby. For example to find a difficult to small creek or inlet you could navigate to a larger nearby feature such as a headland or hill nearby and once there 'attack' the problem of finding the more difficult object. It allows you to get closer before searching. Making the task easier, rather than trying to make a direct bearing for the hard to find object.

Handrails- These are any linier feature that you can use to guide your direction. In fact as we usually follow the coastline. This is a 'handrail'. Other handrails can be tracks, roads, creeks ECT. All can aid us to keep on course whether on sea or land.

Collecting Features
Another navigational technique is to use a prominent feature or features to track progress along your route. For example as you paddle along the coastline you will pass a pier, small sandy bay, headland and the like. You should be anticipating these feature from studying your route from the map/chart

before your voyage and mentally tick them off as you progress. In this way you will develop awareness of you approximate position at all times.

Catching Features

A catching feature is a prominent feature beyond your intended destination. Should you overshoot your target then this feature will stop you from continuing in the wrong direction. For example it could be a headland. Your target is before the headland so if you reach the headland you know you have gone too far and need to turn back to find your target.

❖ Triangulation

If you are not sure of where you are on the map during a days paddle you can use your compass to help you figure out where you are. Hopefully you have some kind of idea of where you are and what landmarks are in sight. A sharp grease pencil, protractor and a chart in a waterproof map case will greatly help.

Find a landmark that you are certain of, maybe a lighthouse. Point your kayak at it, or compass, and take a bearing. Draw a line on your map starting at the landmark and going in the direction of your estimated location. Use your compass rose or protractor to create this line with the back bearing, opposite of your compass reading.

For example if the bearing to the lighthouse is 45 degrees (North East) then the back bearing will be 225 degrees (South West). Your line on the map should represent this.

Now you know that you are on this line, somewhere. If you are lucky you may be close to a feature that will help you pin point your location, like a shoreline or island. If the line you have made crosses only one island in many then it is likely you are on or near that island. If it crosses two islands then you are still not sure where you are. This is called triangulation after all.

Take a second bearing, maybe a prominent point of land with a location you are sure of on the map. Follow the same directions to make a second line. Your position should be where the two lines cross. A feature, like the island may pin point your location, but life is not always that simple. For accuracy take a third and final bearing, possibly a known island or buoy. You now have three lines on the map; they all intersect making a triangle. You are in that triangle, for sure. The smaller your triangle the more accurate you were in your readings, line drawing and land mark selection.

❖ Understanding & applying position fix's with Latitude & Longitude and the grid reference system

The lines of latitude and longitude are used to communicate your exact position anywhere in the world. Pretty handy if you are talking with an outside party wanting to locate you!
It uses the latitude and longitude lines as a grid reference expresses in Degrees minutes and seconds.

Draw a parallel line from your position to the latitude markings at the side of the chart. For example I am now sitting at latitude 38 degrees, 15 minute, 3 second expressed as 38o15'3" Then draw a parallel line from your position across the chart to the longitude marking at the top or bottom of the chart. For example at Longitude 145 degrees,01 minutes,0 second expressed as 145o01'0"38 degrees, 15 minute, 3 second expressed as 38o15'3"
So my position is- 038o15'3"- 145o01'0" (Mt Martha Victoria) This is the information I would relay to outside assistance in order to find me.
A good way to remember which to calculate first is **"Latitude like a ladder climbing up the earth"**

The process on a topographical map is the same.

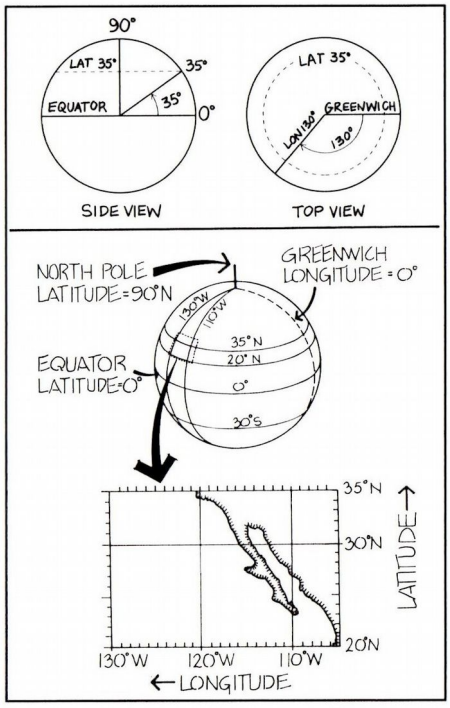


Figure 2-13. Latitude and longitude as they appear on the globe and on nautical charts. Top section shows how latitude and longitude angles are defined.

Check out the this youtube clip- How to find longitude and latitude on a topographic map. You tube clip - https://www.youtube.com/watch?v=ztzNh4bzL_M

Question- What is located at 38o24'40" 145o16'10" ?

The Grid Reference system

The grid reference system can also be used BUT is for a specific map, it is not a world wide system. A simple example of this is the use of 'Melways' map books where a location may be given as "map 47 G 10".

On Topographic maps we use the grid lines marked on the map similar to lines of Latitude and longitude and would be expressed as GR 515633
Using the Nadgee Topographic map what is located at the above GR ?

This is you six figure grid reference and located you to within 10 square meters on the map, it does not use lines on Longitude & latitude but the grid lines found on the map which are usually spaced at one kilometer intervals

❖ Tides - the rule of 12ths & the 50/90 rule

The rule of 12ths

A useful guide to estimating the depth of water over a given spot at a time other than high or low water.
Firstly we must be expecting a diurnal tide that is that there will be two low and two high tides in one day.
Chart Datum is the water depth at the lowest low tide
The rule of twelfths works on the assumption that the height of the tide changes one twelfth of its total range in the first hour, two twelfths in the second hour, 3 twelfths in the third & forth hours two twelfths in the fifth hour and one twelfth in the sixth hour. IE the tide rises and falls every 6 hours.
The twelfths rule states that in the first hour of the cycle the tide will rise 1/12 of its range; the second hour 2/12, the third 3/12, the fourth 3/12, fifth 2/12, sixth 1/12. The same relationship applies to the fall of the tide. If on a given day low water (LW) is 1.2 m at 09:00 and high water is 3.6 m at 15:00 the tidal range is 2.4 m. Dividing the range by 12 gives 0.2.
At LW the depth is 1.2 m above chart datum
At 10:00 the depth is 1.4 m (1.2 + 0.2 or LW + 1/12)
At 11:00 the depth is 1.8 m (1.2 + 0.2 + 0.4 or LW +1/12 + 2/12)

1-2-3-3-2-1 simple!

The 50/90 Rule

The 50/90 rule states that one hour after the tide turns the tidal stream will be moving at 50% of its maximum flow. Two hours after the tide turns it will be flowing at 90% of its maximum flow. Three hours after it will be flowing at its maximum rate. At the fourth hour it will be back to 90% and at fifth 50%. So if a tidal stream is stated at four knots in a given location one hour after

slack water the current will be 2kn, two hours after
slack water it will be 3.6kn, and three hours after
slack water it will be 4kn.

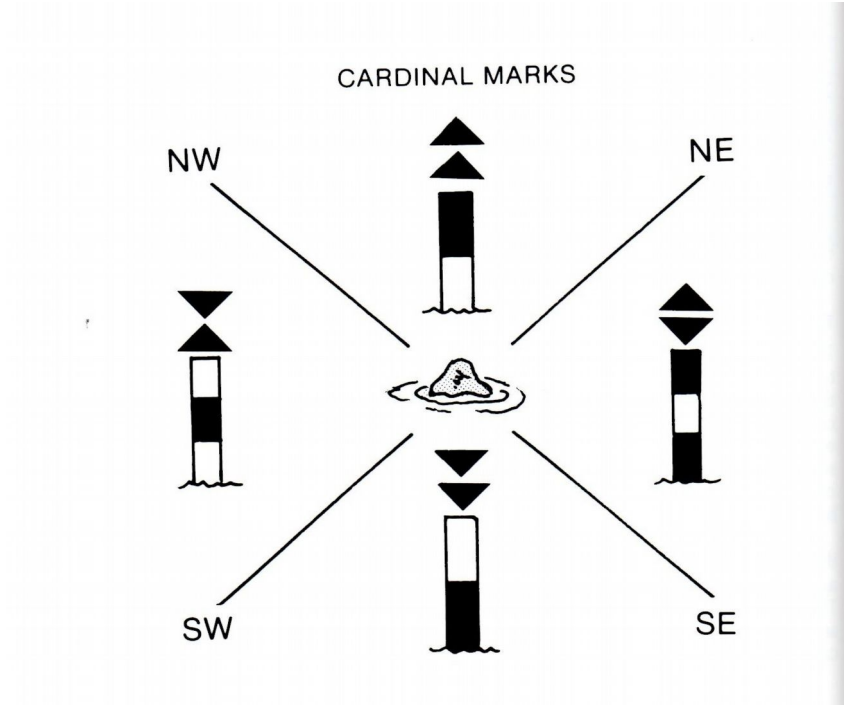
Very useful in determining current flow for kayaking!

❖ Bouyage System

The Bouyage system is worldwide and provides guidance to mariners. It comprises two basic Bouyage systems - Cardinal and Lateral – which are often used together guide vessels through channels and around hazards.

The Cardinal system

The system uses a series of yellow and black painted buoys to indicate the compass direction of a danger. The topmark and light characteristic on the buoy indicates the direction of the hazard .



The Lateral System

Consists or Red and green buoys or marks indicating respectively the port and starboard sides of the channel- **coming into port**.

❖ Clock navigation

Clock navigation is used to communicate to the group a target or direction to paddle to. It simply uses the common time clock to indicate direction and assumes that dead ahead is 12 o'clock.
For example you may wish to change direction to a landmark that is not very distinctive to other surrounding it so you may say. "head for the point at 10 o'clock" meaning the target is at about 70 degrees left of your current heading.

❖ Transit line ferry glides

A transit line ferry glide is a simple way to paddle across a channel or area effected by tidal streams without being pushed off line by the current.

Transit Lines- This is a common tactic used in sea kayaking, It allows you to keep on course and check your position when being effected by wind, currents and drift.

There are a couple of common methods-

Imagine that you are paddling across a big lake to your destination that is due west. The wind is blowing forcefully from the north to the south. You dutifully paddle following your preplanned course, keeping your compass bearing. Meanwhile the wind has been blowing you to the south. If you maintain a heading following your pre planned compass bearing you will make land some where south of your intended landing spot.

Without a lot of fancy calculations and estimations of wind or current speed, the use of a "transit line" will keep you on course.

Before you get too far on your route look for two objects directly in your course line. Look for something like a mountain or hill behind a river mouth. Or maybe you can see a large tree in front of a church steeple or tower. Any two fixed objects that stand one behind the other. Now you have a transit line, sometimes called a ‘range’ or position line.

If you see that the two landmarks start to separate than you know that you are no longer in line with them and not on your course line any more. You have been blown off your course line by wind or have drifted off with the current. Paddle up wind or up current to a point where the two landmarks are in line again and you are back on your course line.

You will find that you have to "ferry" your kayak across the wind or current. Point your bow up stream or up wind just a bit. The stronger the wind or current the more you will have to point. You will think that you are no longer going to your intended destination. You are, but you are just paddling against the wind or current as well.

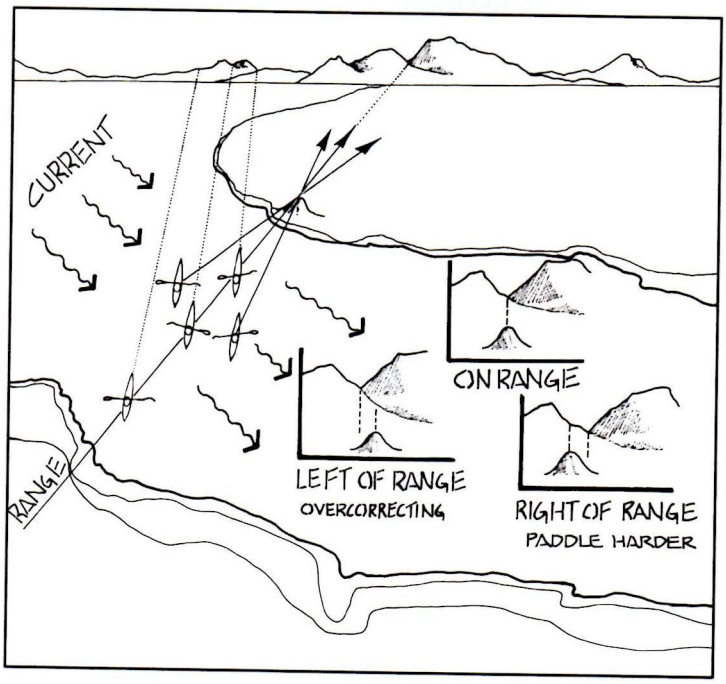


Figure 9-7. Ferrying across current using a natural range in front of the boat. Once the proper ferry angle has been found, distant landmarks can be used for a steering guide, as shown. With waves or swells running, your course also can be maintained by the relative angle at which you meet the waves. This can help in the fog when no landmarks are in sight.

Take note of your compass reading. You can still use your original course, just not your original bearing. You are now on a "heading." Use your heading to keep you on course. If the current/wind is relatively constant then this will be easy. Otherwise your heading will need to be checked and changed periodically.

Keep track of your transit line. Sometimes you will lose sight of one of your landmarks due to your changing perspective as you move along. Be ready to find new transit lines as necessary.

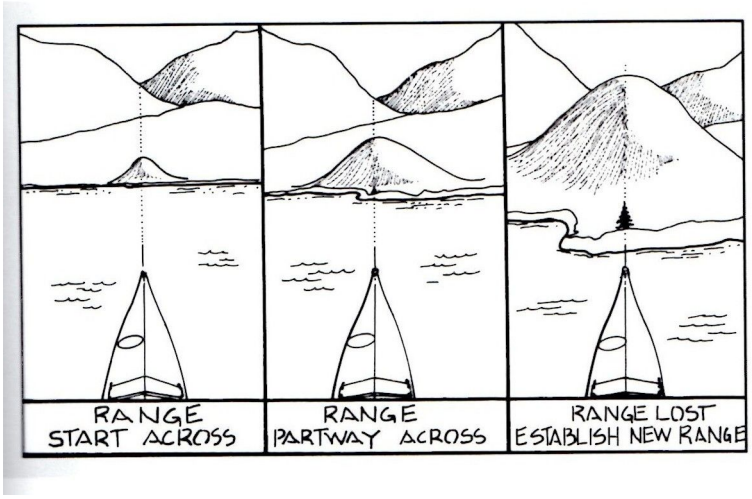


Figure 9-8. Losing a front range. Keep this common problem in mind when relying on front ranges alone. When you lose a front range, choose another guide range or look for other ranges to the side to check your progress across.

Another method is to find an object in front of you and behind you. In this way if you drift of course they will no longer be in position and you are off line and will need to adjust you angle to get back into position.

You will not be able to use a transit line if there is any possibility that visibility will decrease to a point where you no longer can see your land marks. If this is the case you will need to estimate current or wind speed and calculate your ferry angle and heading.

The 50/50 Method

The simplest way to do this is to calculate how long the crossing wil take and depart on the crossing so that you will be half way across when slack water arrives. In this way the current will push you off course in one direction for the first half of the paddle then in the other direction for the second half. In this way the current in opposite directions for 50% of the time cancels each other out and you arrive at your destination. For example if you calculate the crossing will take 4 hours and slack water is at 1100 hrs depart at 0900hrs (two hours before slack) and you should arrive at 1300hrs on target.

Therefore throughout the paddle you stay on your compass bearing regardless of how far off course you go and you will be pulled/pushed back on course as the tide changes.

Ferry Glide Angle Calculations

You'll need to calculate the ferry angle, based on your paddling speed vs current speed. Most paddlers in a sea kayak can maintain a paddling speed of 3 knots, so for now we'll assume a 3 knot paddling speed. To determine current speed, you'll need a tide table or tidal current chart (readily available for most areas with significant tidal current). The current chart will give you current speeds at given locations throughout the tidal cycle and the table will give you the currents on any given date. Take an average current for the channel (it will usually vary across the channel, as the current chart will show) during the time period you'll be crossing.

Calculating the Ferry Angle

Once you know the current speed you can estimate your ferry angle using the following formula:

Ferry angle = current speed ÷ paddling speed x 60

Examples, using a paddling speed of 3 knots:

Current speed 1 knot: 1 ÷ 3 x 60 = **20^0 ferry angle**

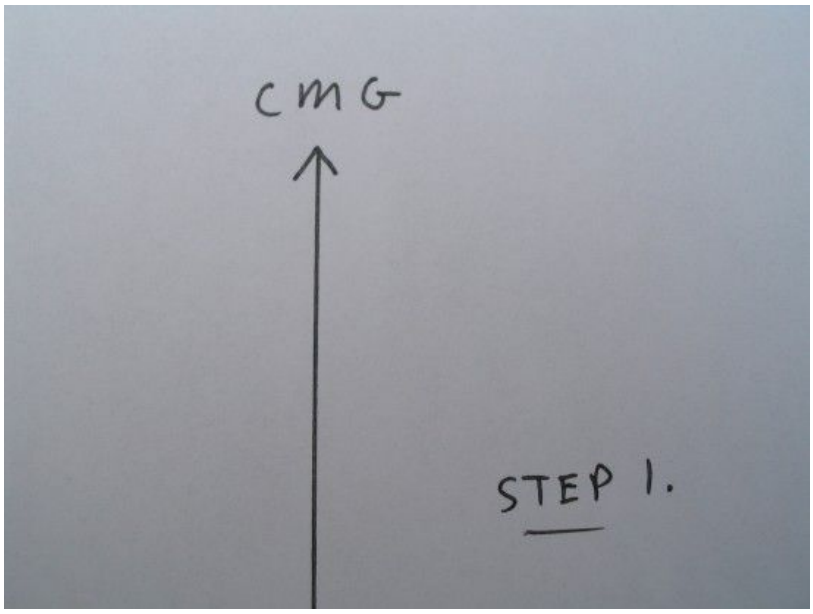
With current speed close to paddling speed, the formula is no longer accurate. So to maintain a course without being set downstream across a 3 knot current, you have to paddle faster than 3 knots.

Current speed 3 knots; paddling speed 4 knots:

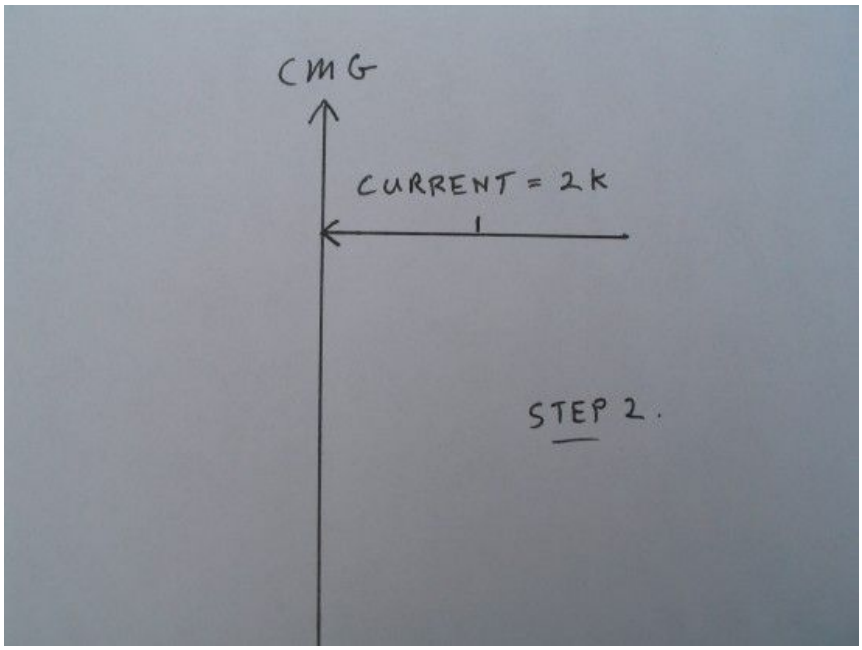
3 ÷ 4 x 60 = **45^0 ferry angle**

These are estimates, assuming a beam current (current perpendicular to your desired course). A more accurate, and visual, way to calculate a ferry angle is to use a vector solution. Looking at the diagrams below, keep in mind a vector is a measure of force acting in a certain direction; it's NOT a distance measurement. Pick any convenient scale (say 1 cm = 1 knot) and draw up a vector diagram as follows:

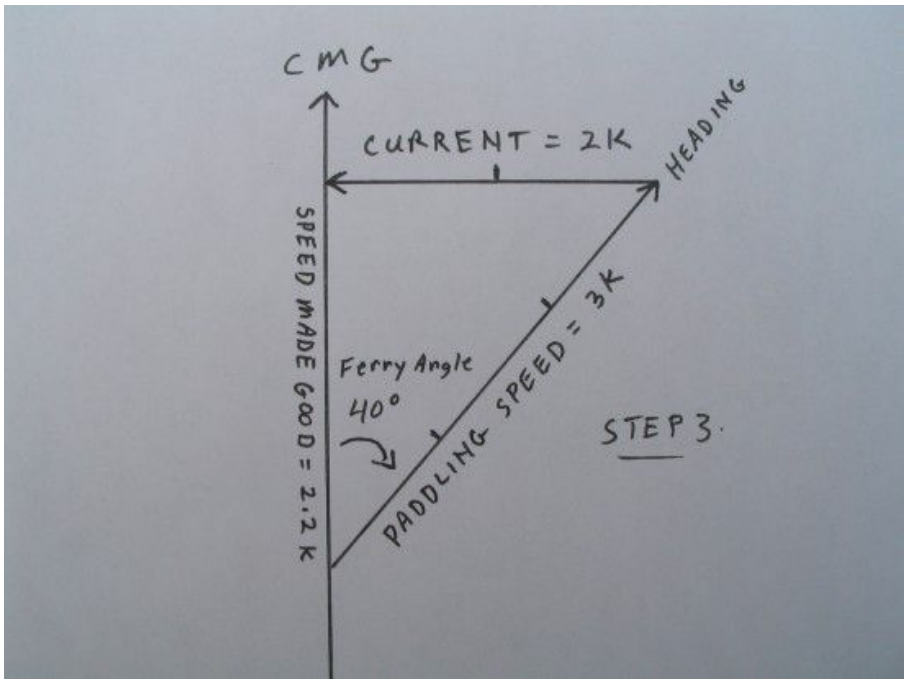
Step 1: Draw a line representing your course made good (CMG) across the current.



Step 2: Draw a current vector showing the current direction relative to the course, with vector arrowhead meeting the course line. Scale the vector in knots.



Step 3: Construct a paddling speed vector by setting dividers (or use a ruler) to your paddling speed in knots, using the same scale units as the current vector. Then place one end of the dividers at the base of the current vector and swing the other end to intersect the course line. Connect these two points, giving you your ferry angle and heading. If you don't have dividers a ruler can be used.



Once you know the ferry angle (whether you estimate it with the formula or vector solution) you can adjust your heading on the water accordingly. In the vector example above, if your course is 045 (magnetic north) your heading will be 085 (add the 40° ferry angle because the current is coming from your right; if the current was from your left, you'd subtract). Follow a compass heading of 085 and maintain a steady paddling speed of 3 knots and you will stay on course. Your actual course across the current will be 045.

The ferry angle only works if you maintain a relatively steady paddling speed. If you slow down or stop paddling, you'll be set downstream. If you need to stop and hold your position, turn directly into the current and paddle at roughly the same speed as the current. Also, on a sidenote, if the current varies across the channel, you'll be using an average current speed to determine your ferry angle. So your course will be slightly zigzag; the ferry angle will be too large in the area of weaker current, and not large enough in the stronger current. But that's all right because it will average out to the same destination as the straight-line course.

So far we've assumed the current is directly on your beam (at 90° to your course). This is often the case when going directly across a channel, but if your destination is at an angle across the current, simply construct the vector diagram with the current vector at the appropriate angle. Ideally you'll have the current on your stern quarter (coming at you at an angle from behind) because then it will be helping you along and your speed made good will be greater than your paddling speed. If the current is on your bow quarter, it will be impeding your progress and your speed made good will be much slower than your paddling speed. Vector solutions will show this clearly, if you plot them with the current vector at different angles to your course line.

Obviously if you can maintain a faster paddling speed (say 4 knots), you can cross more quickly and efficiently. Paddling at 4 knots, you can also hold a ferry angle easily when crossing a 3 knot current, where a 3 knot paddling speed wouldn't be sufficient to maintain your course. Try plotting the vector diagram using a 4 knot paddling speed vs. 3 knot paddling speed, measure 'speed made good' along the course line, and this will be apparent.

The above might sound like a lot of theoretical mathematics, but it's really pretty simple in practice. You can even draw a rough vector diagram in the sand, using a paddle or a stick for scale and your compass to determine the angles (or just estimate the angles). That will be well within the margin of error. And once you know you need a ferry angle of 40^{o} to cross a 2 knot current when paddling 3 knots, you never have to calculate it again (until you forget and want to check to be sure).

Finally remember that current is your friend (usually) because you can use it to your advantage. Not to mention the fun of playing in tide rips! But you definitely want to be aware of current because it is possible to paddle on a 'treadmill' if you're fighting the current and not aware of it.

FINDING YOUR WAY HOME

Looking back as you start your journey, and as you go along through its twists and turns, is one of the easiest things to do to keep from getting lost. After you have paddled a bit away from shore look behind you to see what your landing looks like when you head "home" or back to your starting point. That way it will look familiar to you on the way back and help guide you in.

It is surprising how different the same island or beach can look from different perspectives. Take a good look back any time you come around a point of land, circumnavigate an island, or paddle a significant distance. This way you will have taken lots of mental snapshots, and you will know the way back because you have seen it before. This will also work on hiking trails.

For this reason it is always wise to take a back bearing in case of confusion or poor visibility from rain, fog or low light.

Navigation Terms

- Azimuth Ring = rotating outer ring on some hand compasses marked with degrees.
- Bearing = compass direction to a landmark.
- Chart = a detailed map for nautical use.
- Course = direction you want to go.
- Dividers = an instrument for dividing and measuring lines.
- GPS, Global Positing System: A network of satellites and mobile receivers used in electronic navigation.
- Heading = compass direction boat is pointing.
- Knot = a nautical unit of speed measurement equal to 1.8 KMH.
- Map Case = a waterproof bag made for maps. Freezer quality, Ziplock type bags may do.
- Nautical Mile = the average distance on the Earth's surface represented by one minute of latitude.
- Parallel Rulers = two rulers, or rules, hinged so that they are always parallel.
- Pointer = found on some hand compasses, turns with azimuth ring to align with compass needle.
- Protractor = a graduated, semi circular instrument for plotting and measuring angles.
- Range = Two fixed objects, one behind the other, in line with you and your destination.
- Scale: The ratio of distance between the "real" distances on the earth and the distance on the map. Example 1 centimetre = 10 kilometres.
- Topographical Map = a detailed map for overland travel.
- Waypoint: A location defined by coordinates from a GPS or read from a map.