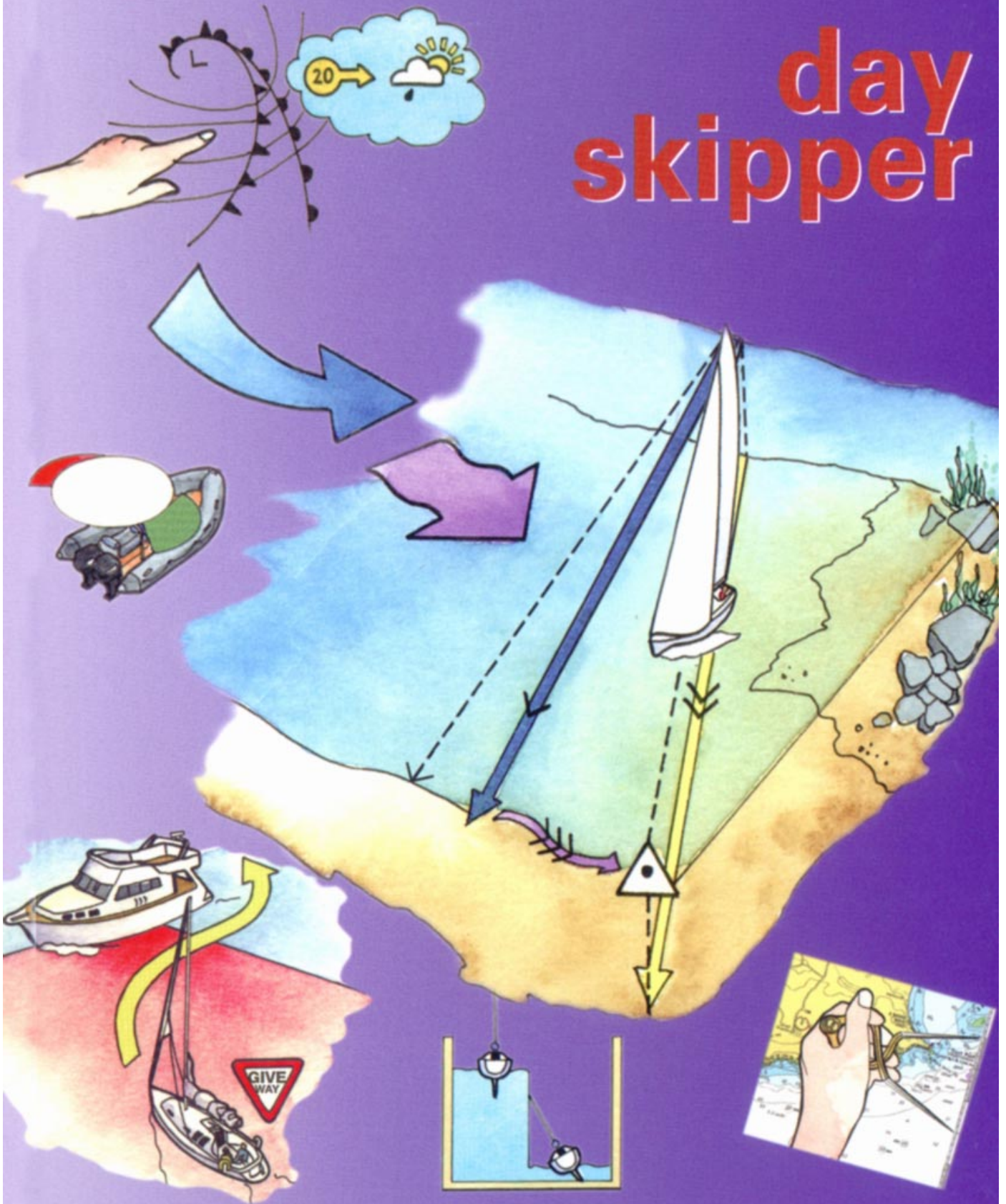


RYA

an **RYA training** publication

day skipper



Introduction to navigation theory, safety and seamanship

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Written by Penny Haire
Illustrations by Sarah Selman

Charts reproduced throughout this book are for training purposes only.
On no account should they be used for navigation.



Royal Yachting Association

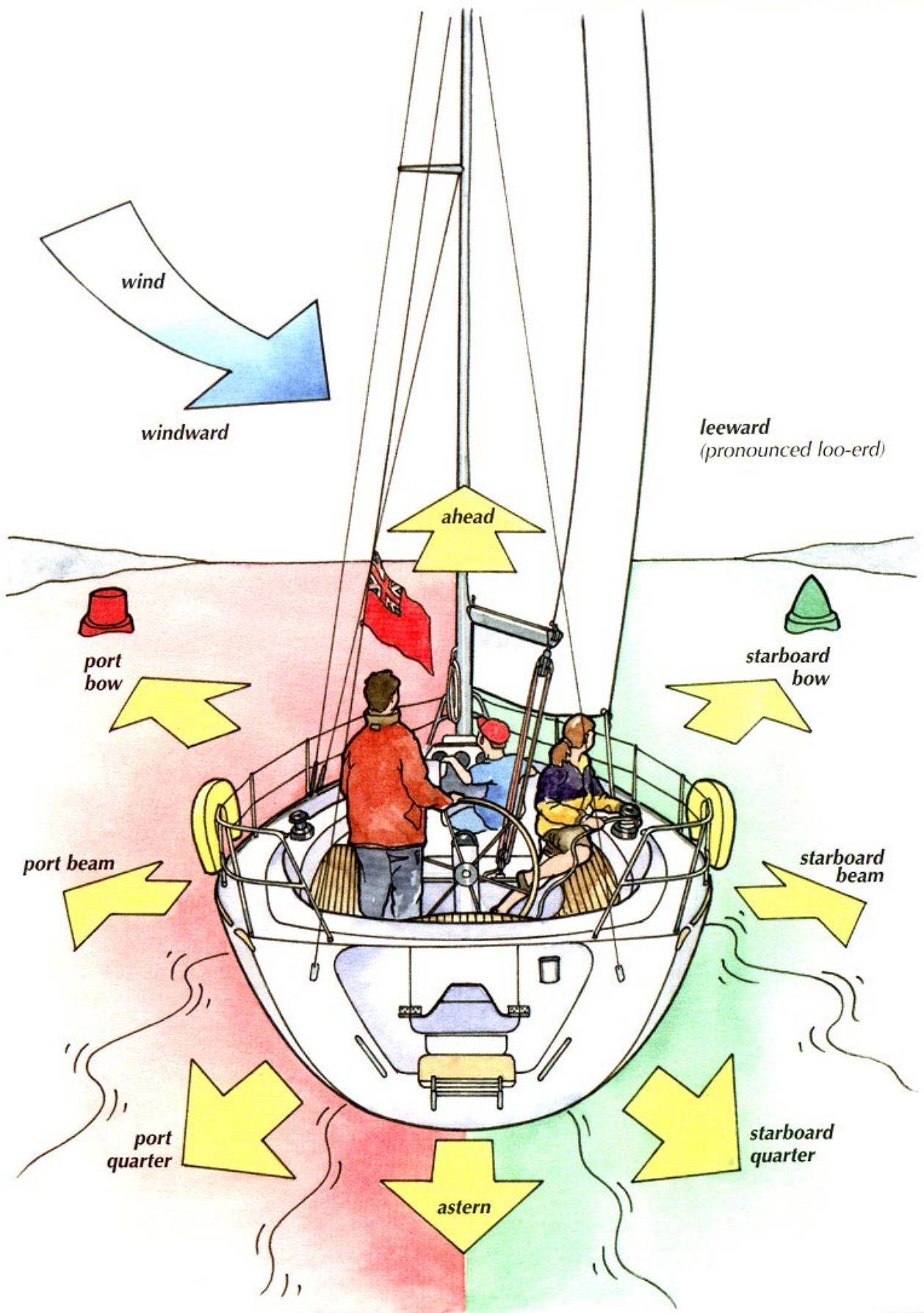
Romsey Road Eastleigh Hampshire SO50 9YA

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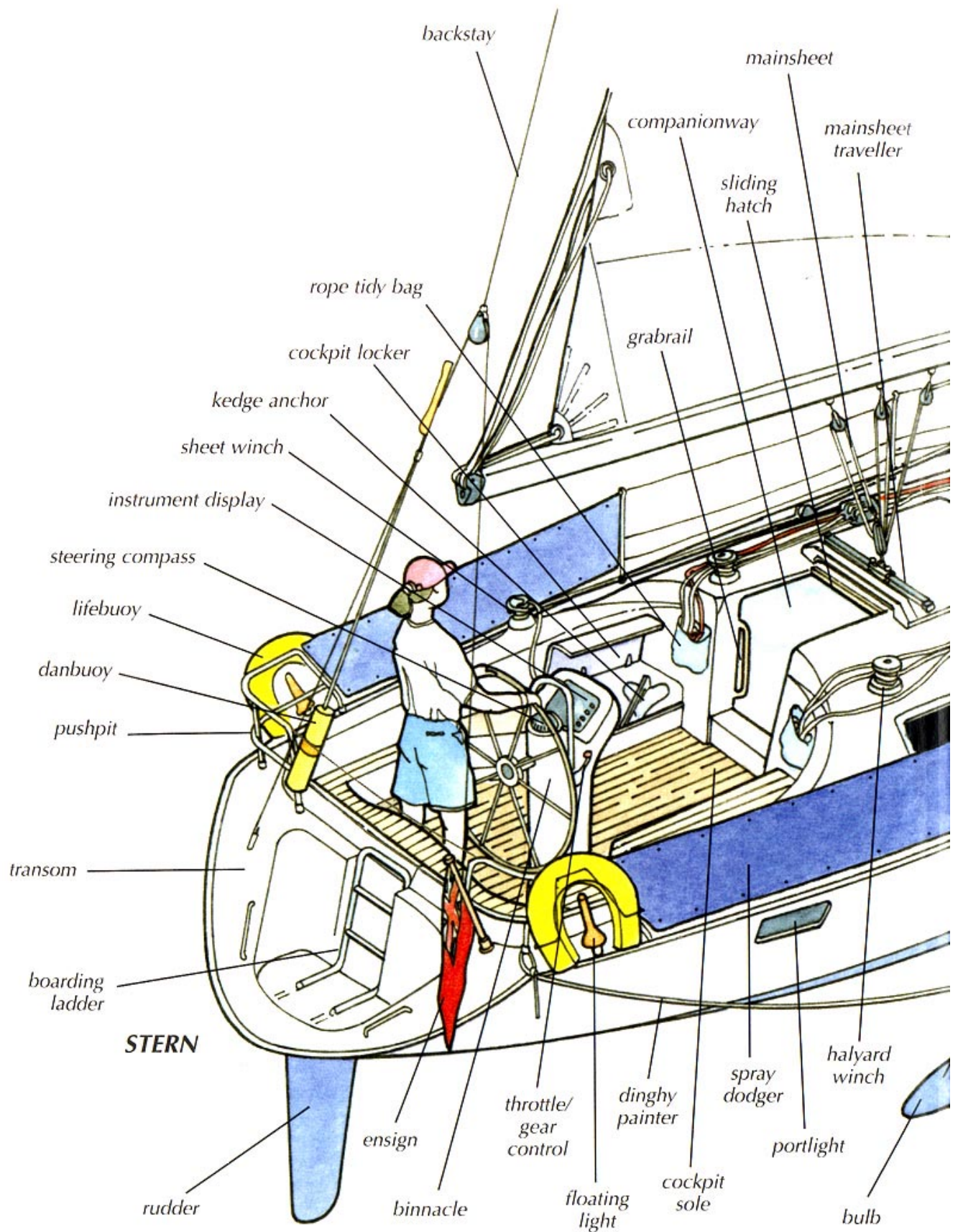
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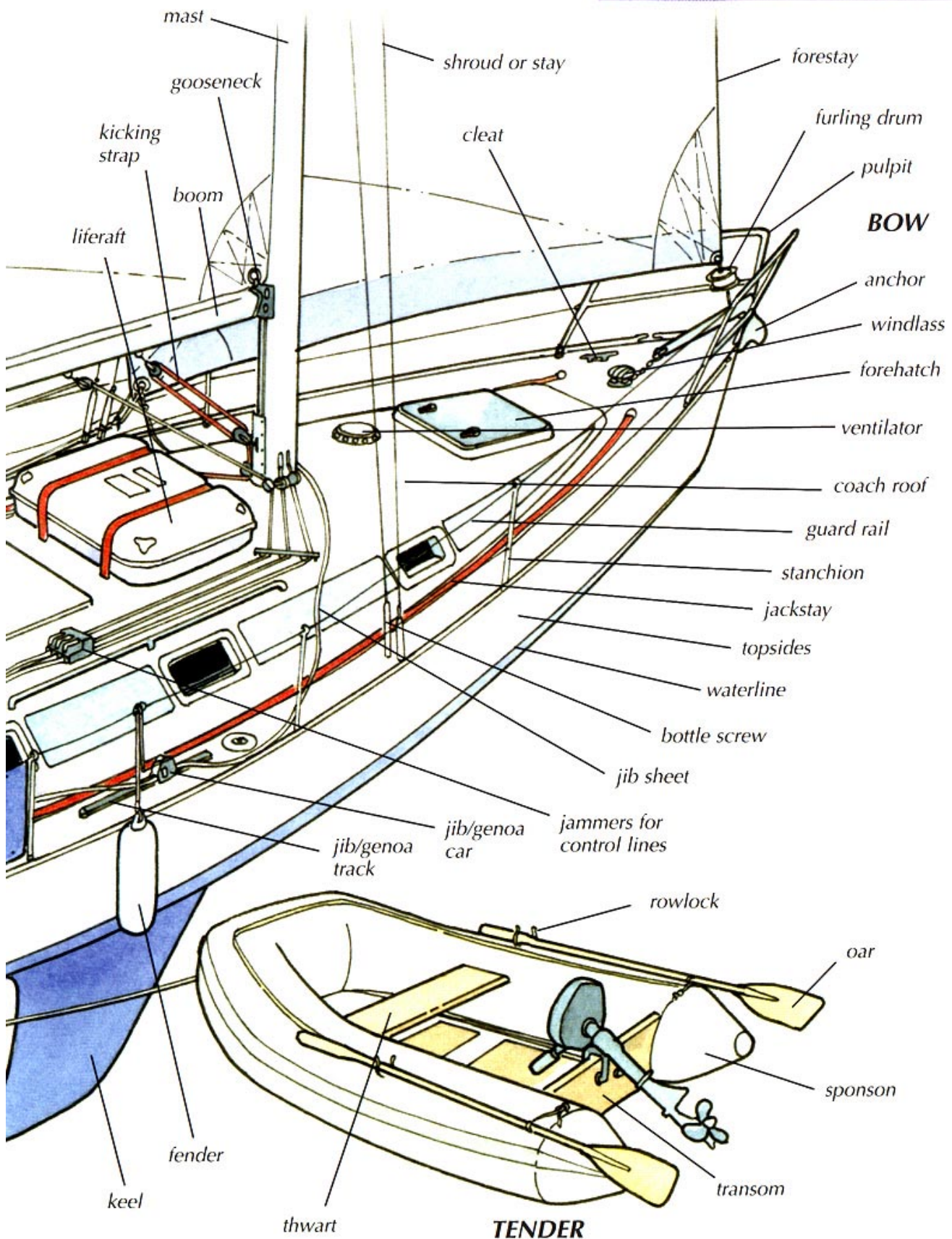
NAUTICAL TERMS



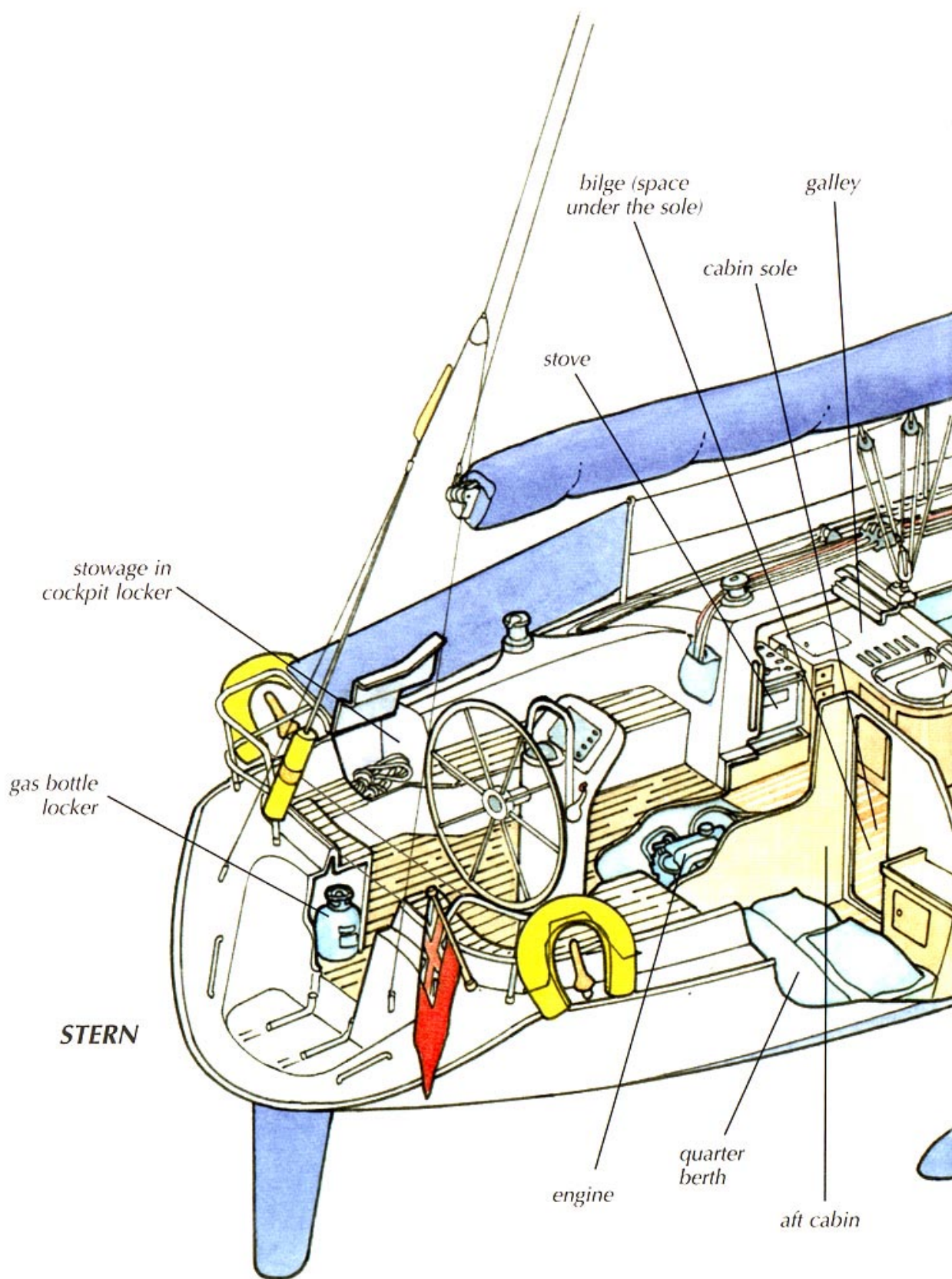
TYPICAL CRUISING YACHT



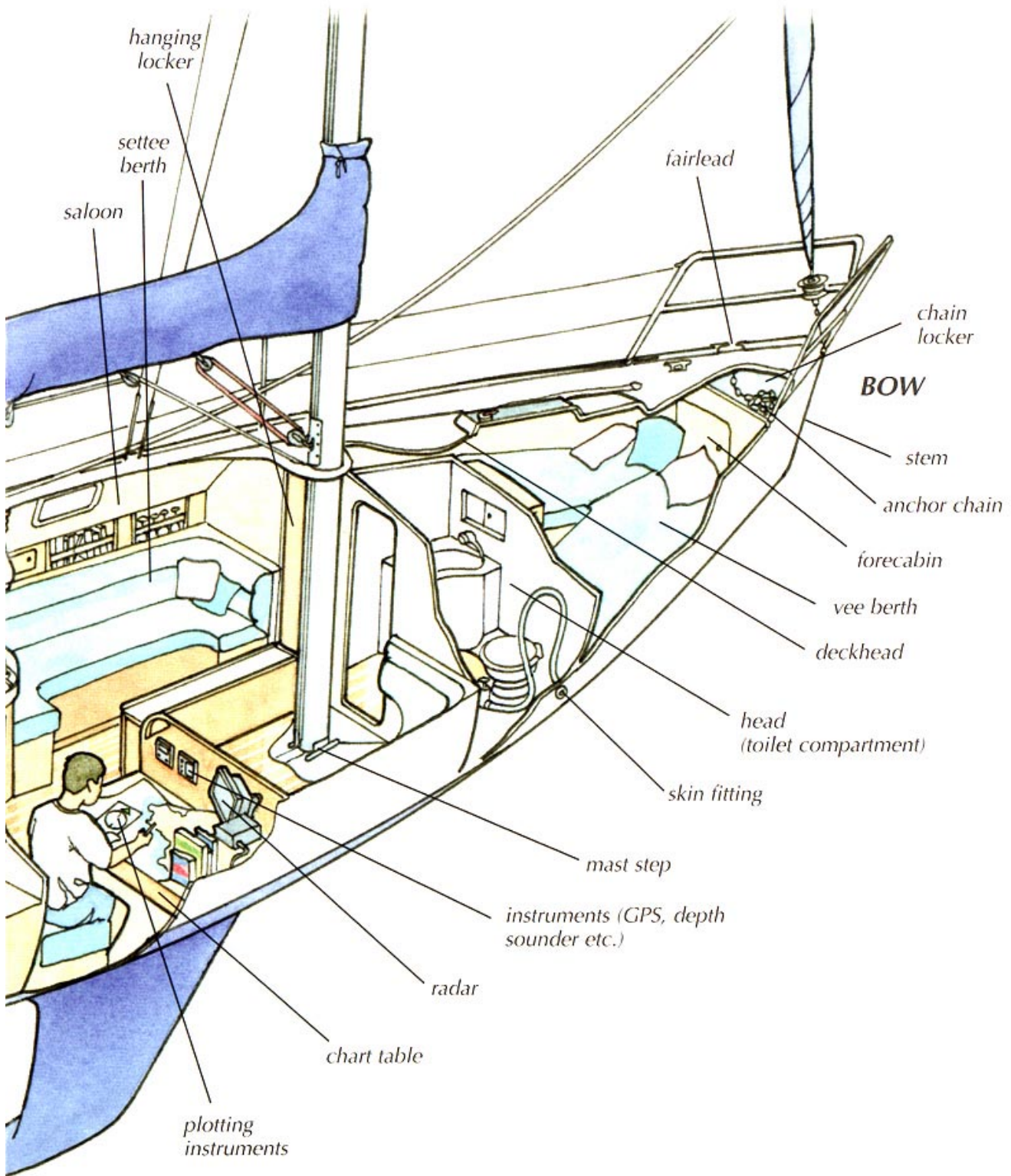
TYPICAL CRUISING YACHT



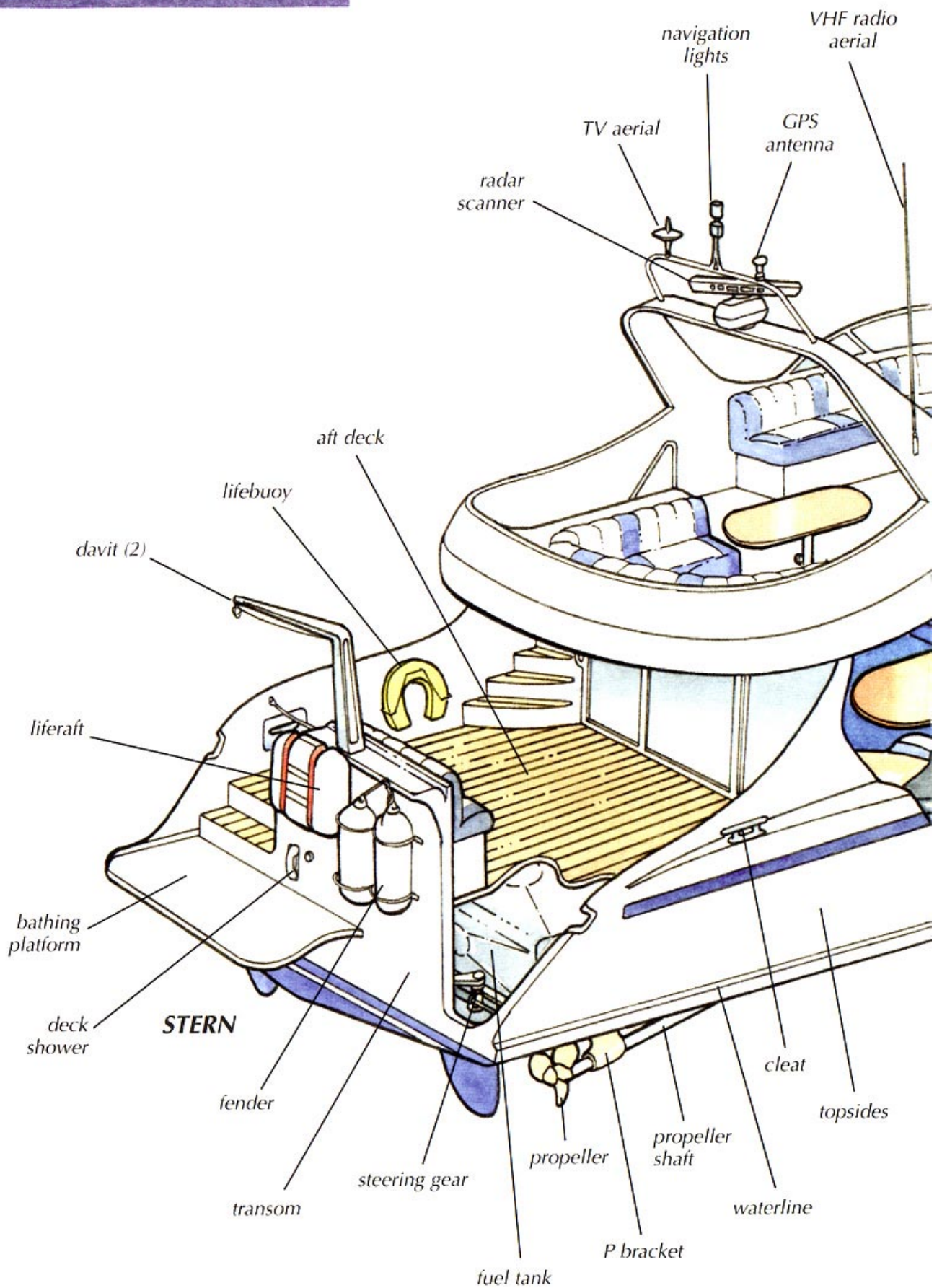
BELOW DECK



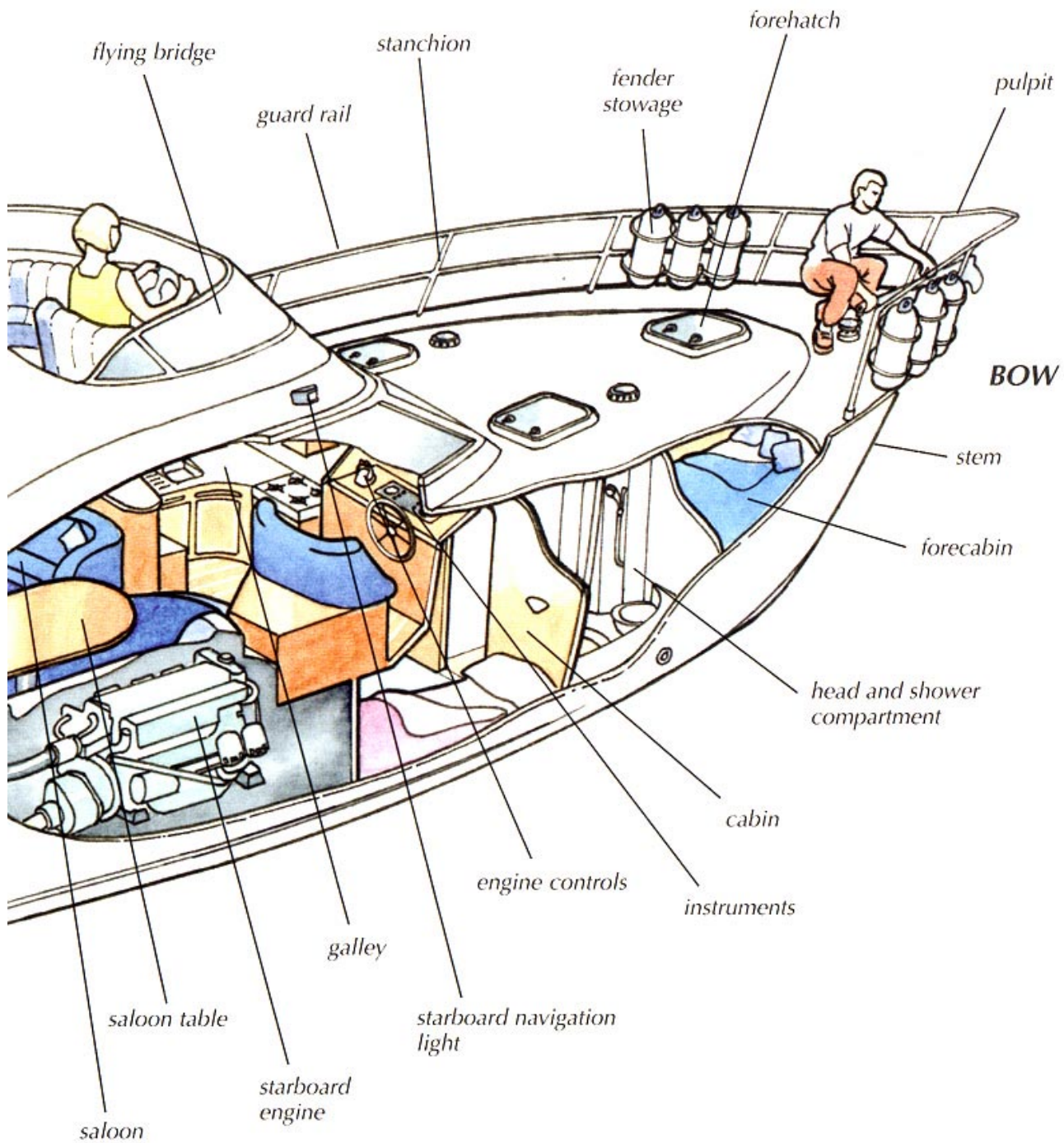
BELOW DECK



TYPICAL MOTOR CRUISER



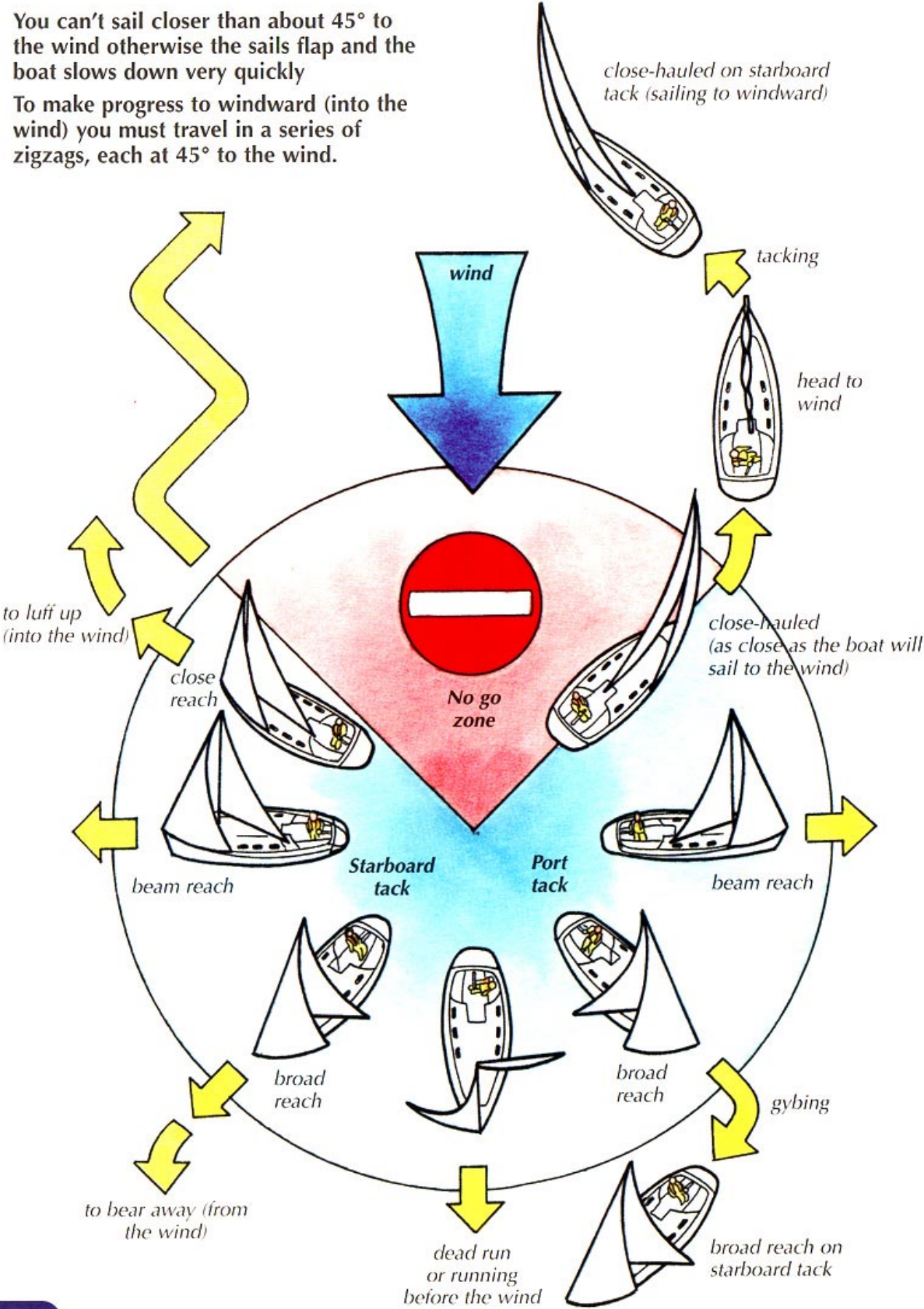
TYPICAL MOTOR CRUISER



POINTS OF SAILING

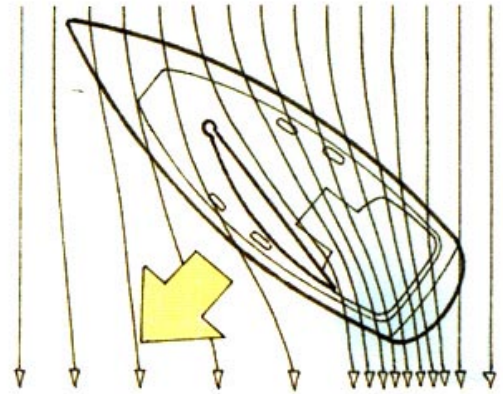
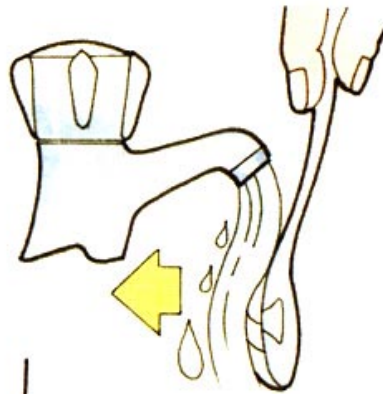
You can't sail closer than about 45° to the wind otherwise the sails flap and the boat slows down very quickly

To make progress to windward (into the wind) you must travel in a series of zigzags, each at 45° to the wind.

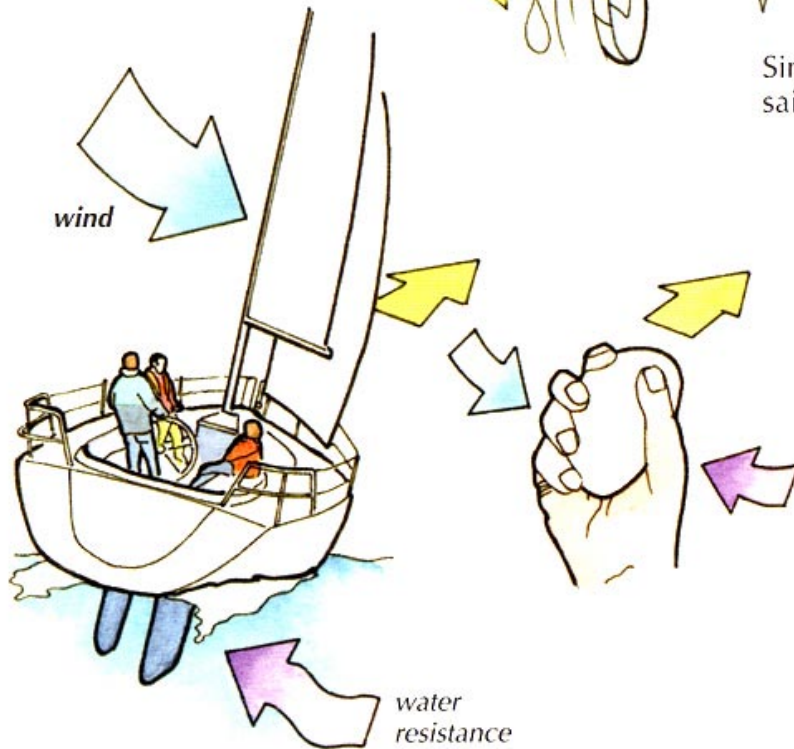


SIMPLE SAILING THEORY

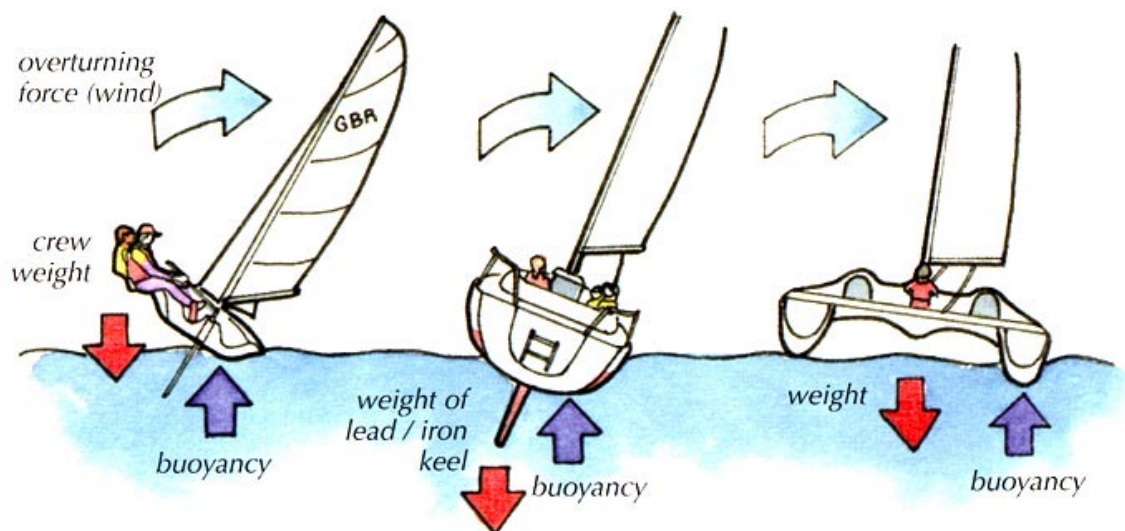
When you put a spoon into running water it is sucked into the flow.



Similarly, when air flows over a sail it creates a sideways force.

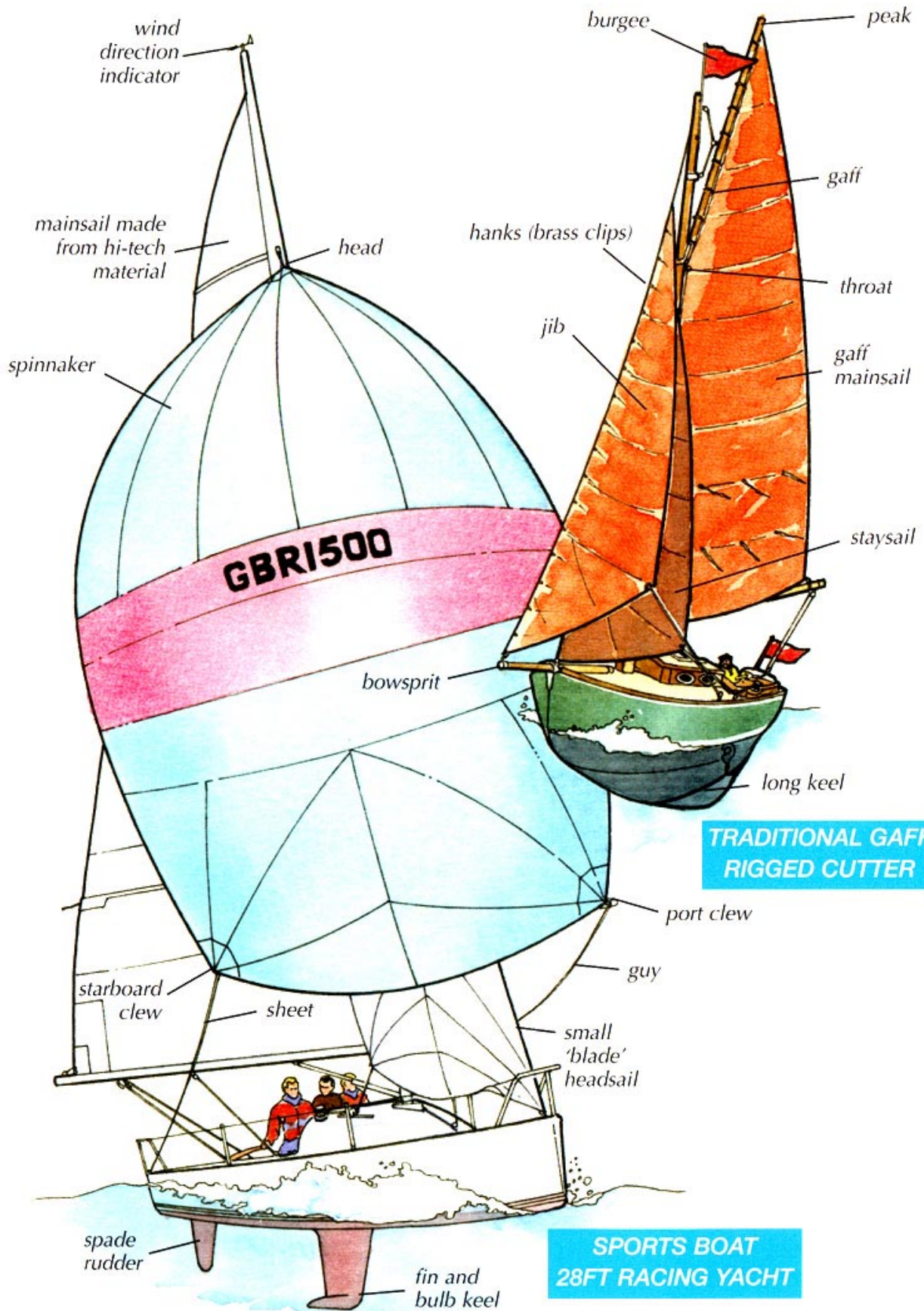


A combination of a sideways force from the sail and opposite resistance from the water pushes the boat forward like squeezing a bar of wet soap.



A sailing boat does not blow over as the force of the wind is counterbalanced by weight and buoyancy.

OTHER TYPES OF YACHT

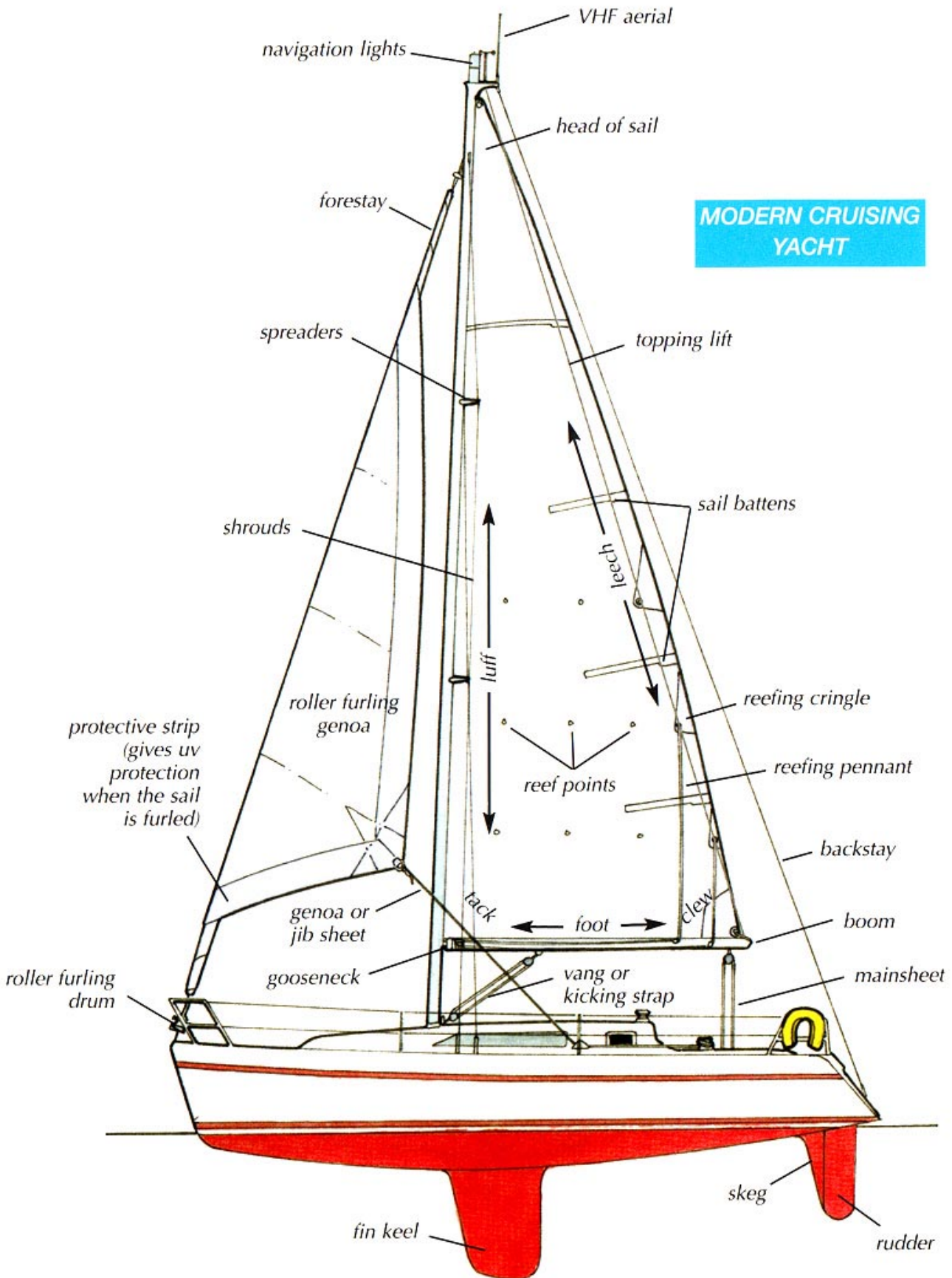


TRADITIONAL GAFF RIGGED CUTTER

SPORTS BOAT 28FT RACING YACHT

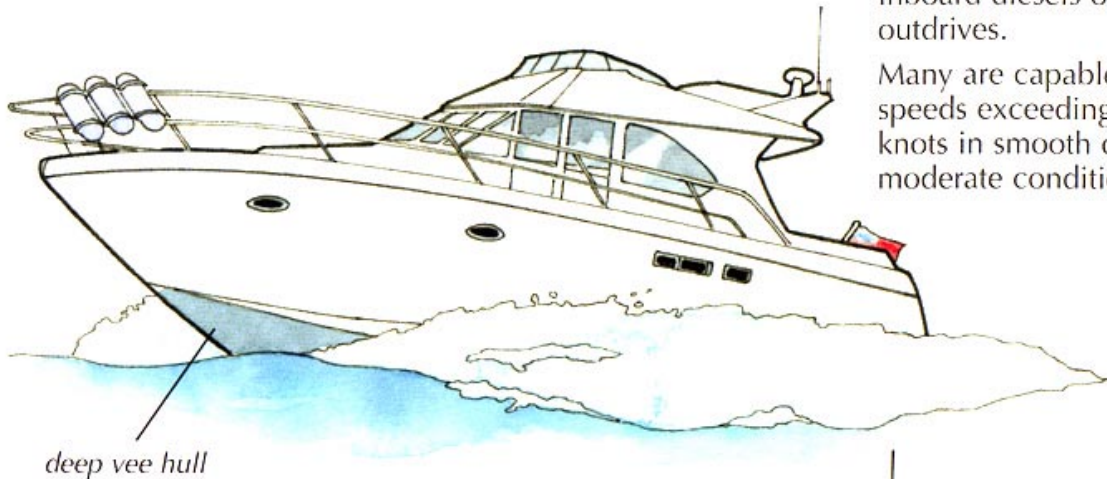
OTHER TYPES OF YACHT

MODERN CRUISING YACHT



DIFFERENT MOTOR VESSELS

Flying bridge cruiser



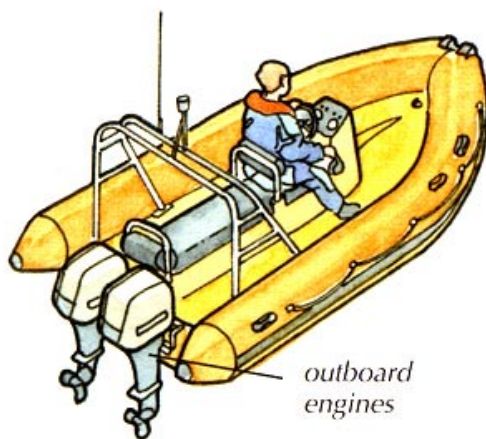
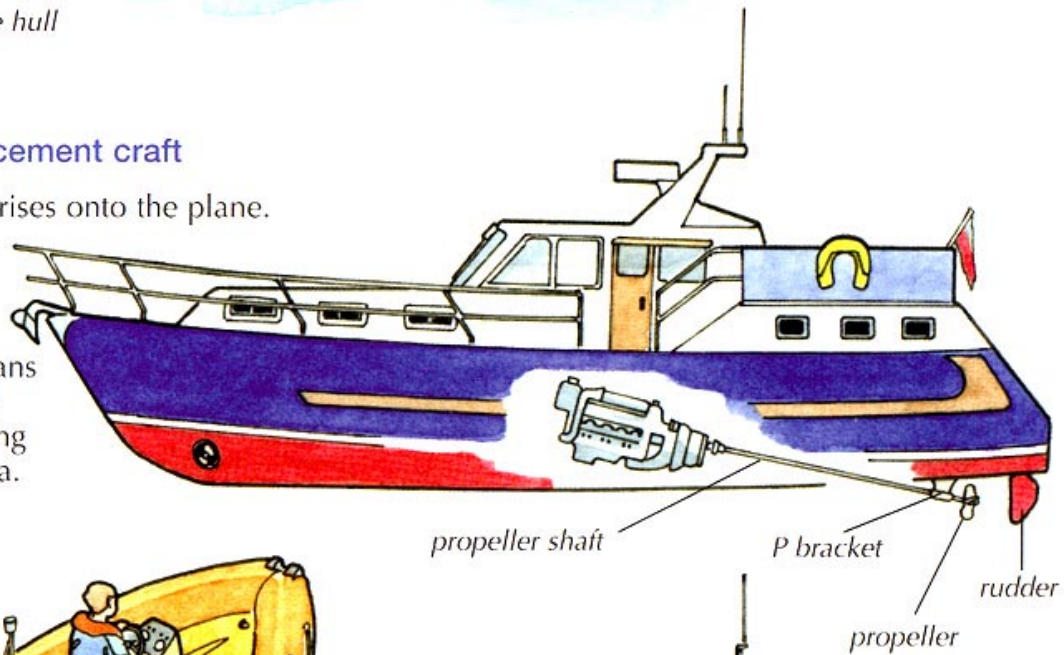
High performance planing craft powered by twin inboard diesels or twin outdrives.

Many are capable of speeds exceeding 30 knots in smooth or moderate conditions.

Semi-displacement craft

Hull partially rises onto the plane.

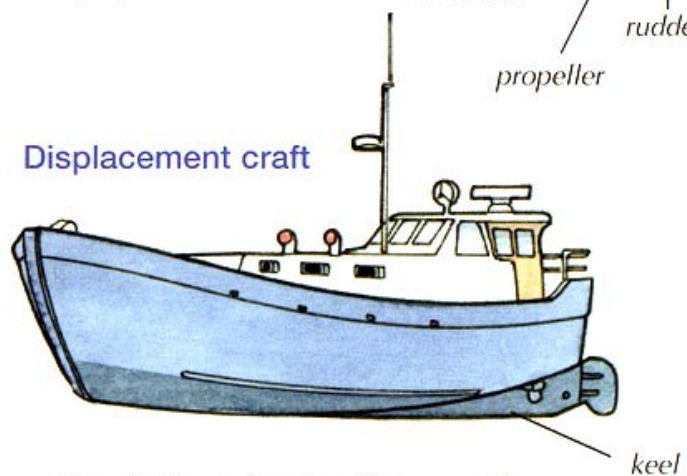
Fine entry means a comfortable ride when going into a head sea.



RIB (rigid inflatable boat)

Fast open boat - separate inflatable compartments make it unsinkable.

Displacement craft

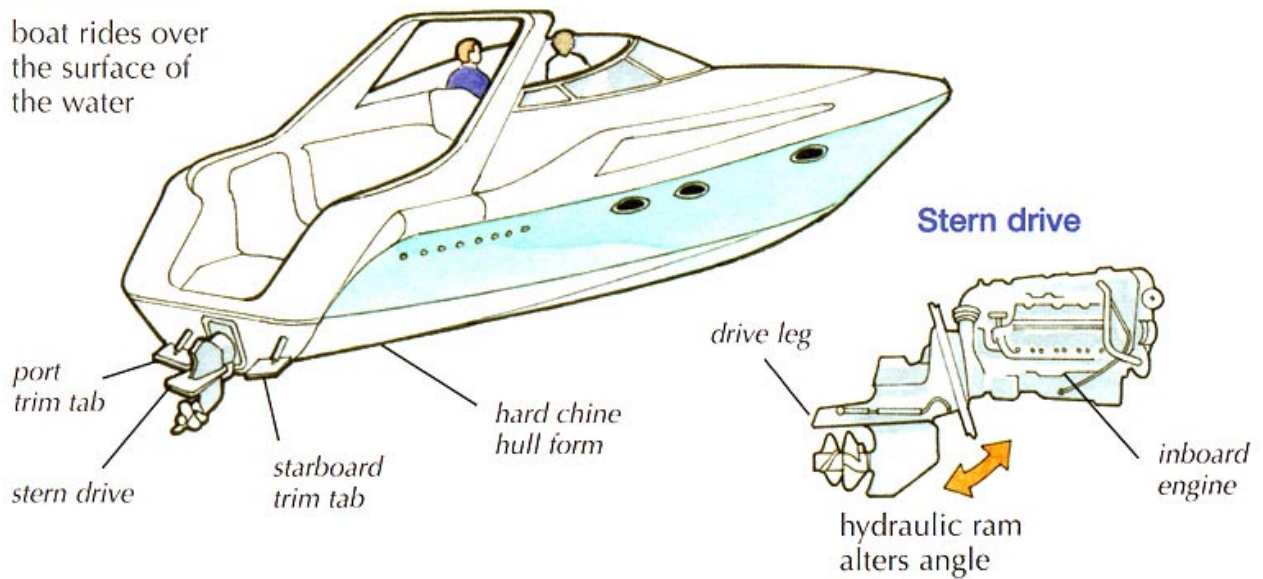


Travels through rather than over the water - this conventional hull type is slower than planing craft but has good sea keeping properties.

DIFFERENT MOTOR VESSELS

High performance planing craft

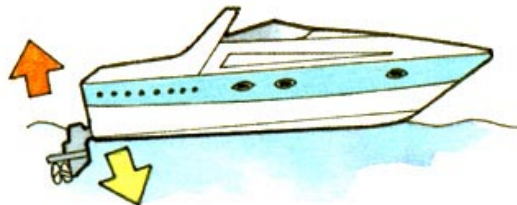
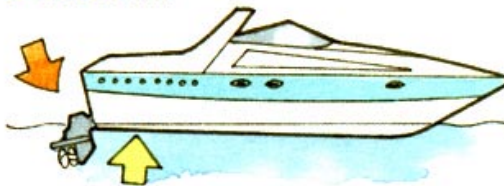
boat rides over the surface of the water



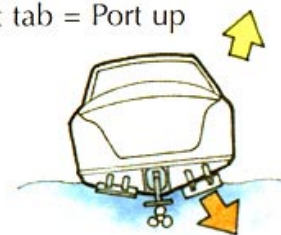
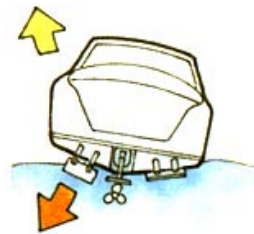
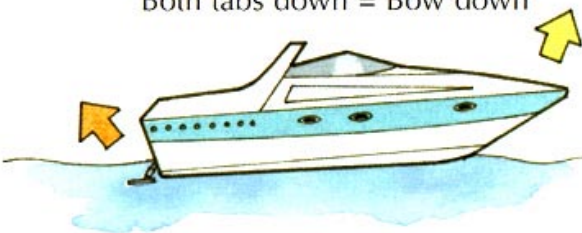
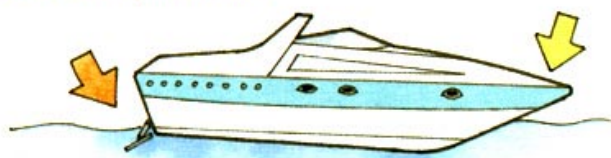
TRIM

Changing the trim will affect the way a boat behaves in different conditions. Experiment to find how your boat reacts.

Power trim



Trim tabs in operation



KNOTS



Rolling hitch

Used when you need a knot that won't slip when pulled at an angle. Ideal for taking the strain off another rope.



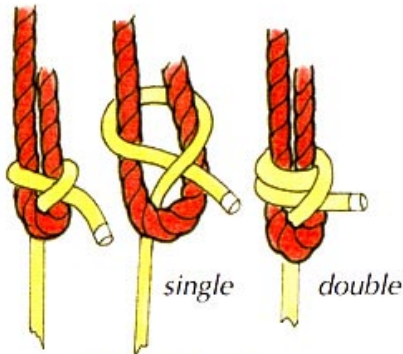
Round turn and two half hitches

Multipurpose knot. Can be untied under tension.



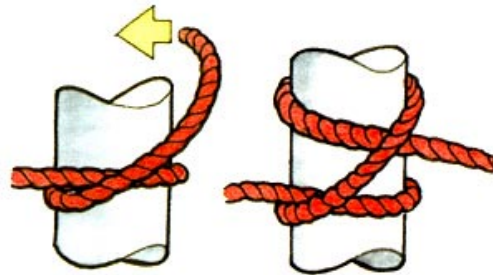
Reef knot

Mainly used for tying in reef points. Not very secure.



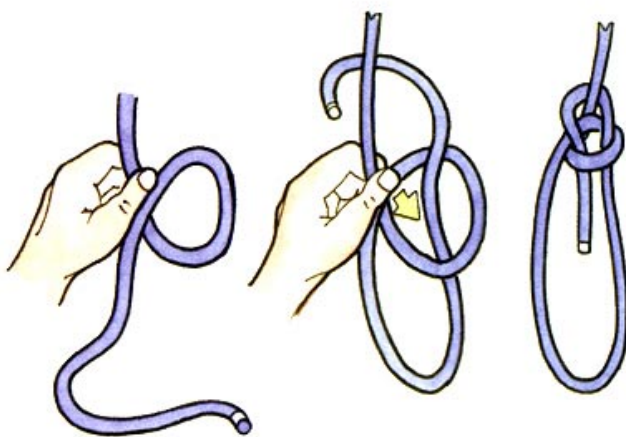
Sheet bend

Used for joining two ropes.



Clove hitch

Quick to tie and easy to adjust. Ideal for securing fenders.

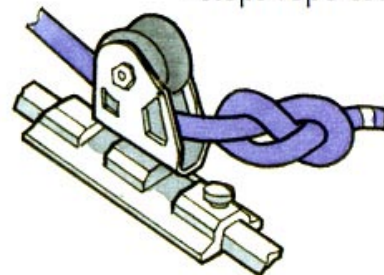


Bowline

Makes a fixed eye in a rope which is very secure but can't be untied under tension. Many uses such as attaching jibsheet to sails and for loops in mooring lines.

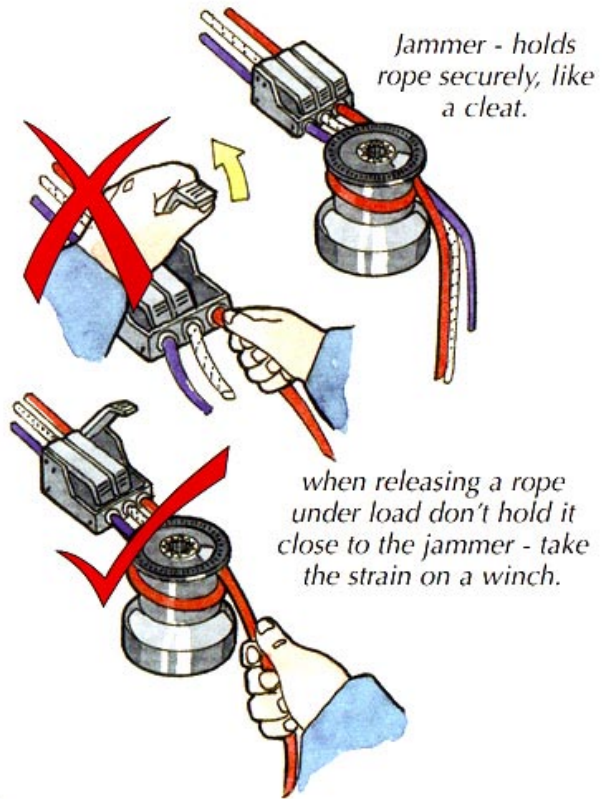
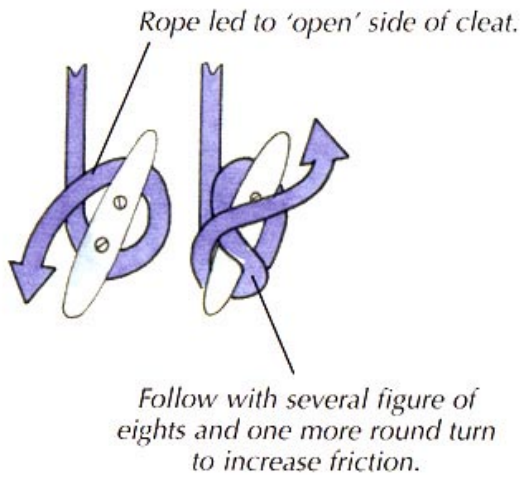
Figure of eight

Easy to tie stopper knot - stops rope escaping.



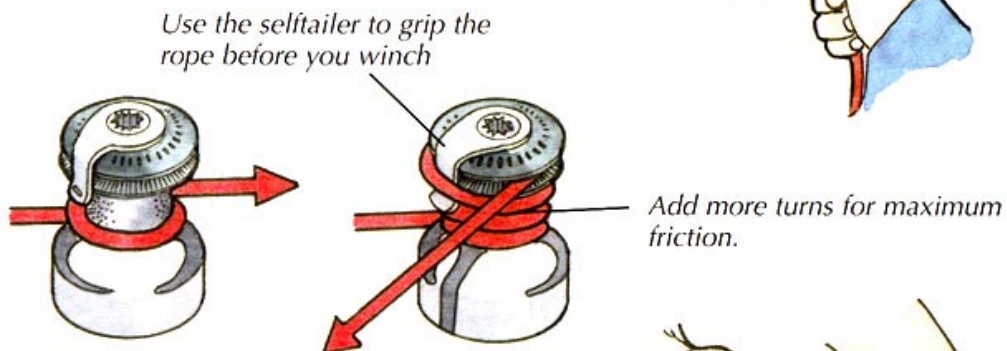
ROPEWORK

Making fast to a cleat



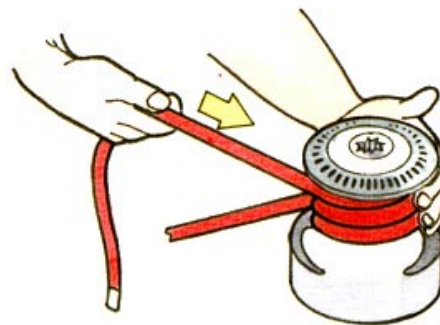
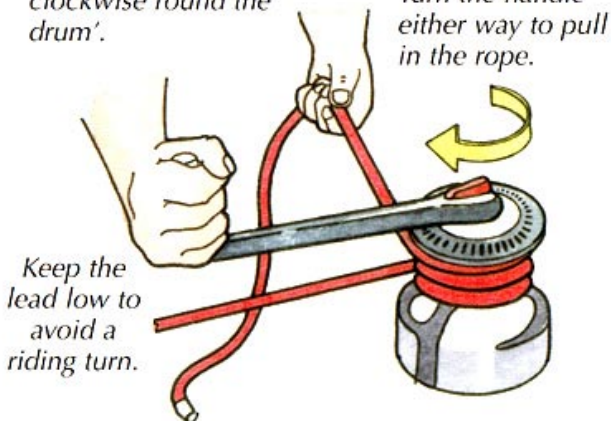
Winching techniques

Using a winch gives more power for pulling in ropes

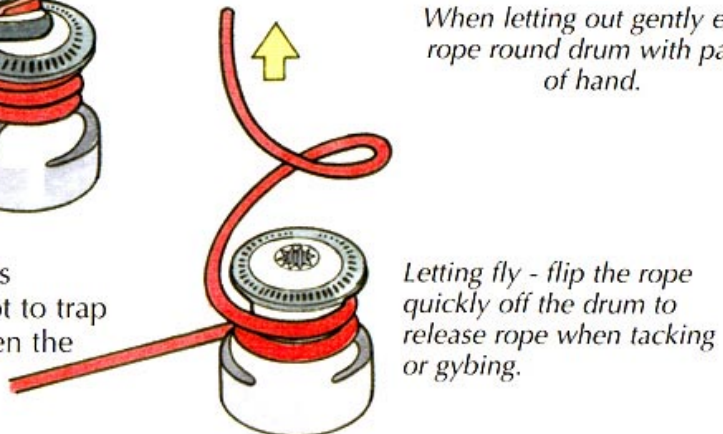


Always wind the rope clockwise round the drum.

Turn the handle either way to pull in the rope.

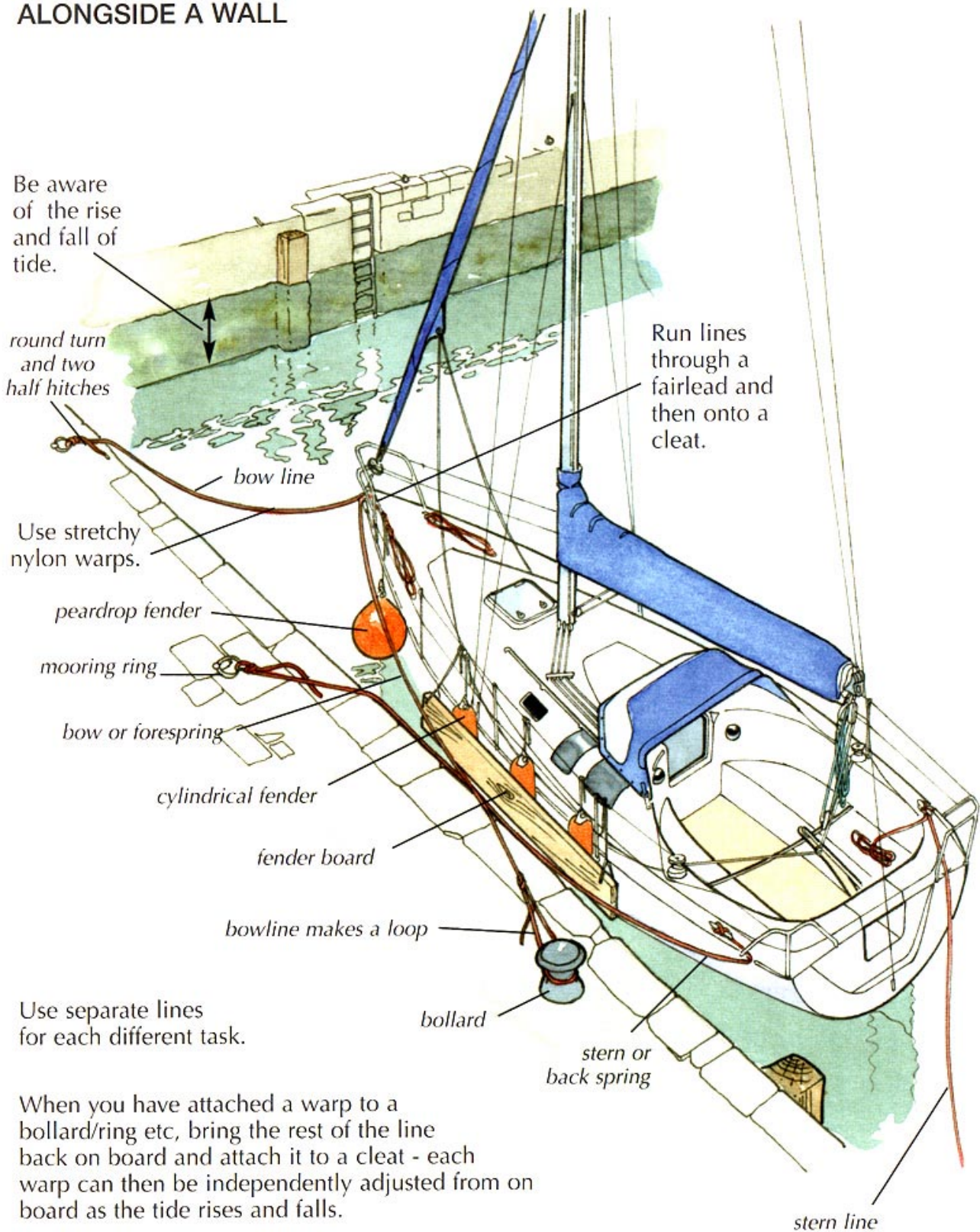


Always have your thumbs uppermost - take care not to trap fingers or thumbs between the rope and the winch



MOORING ALONGSIDE

ALONGSIDE A WALL

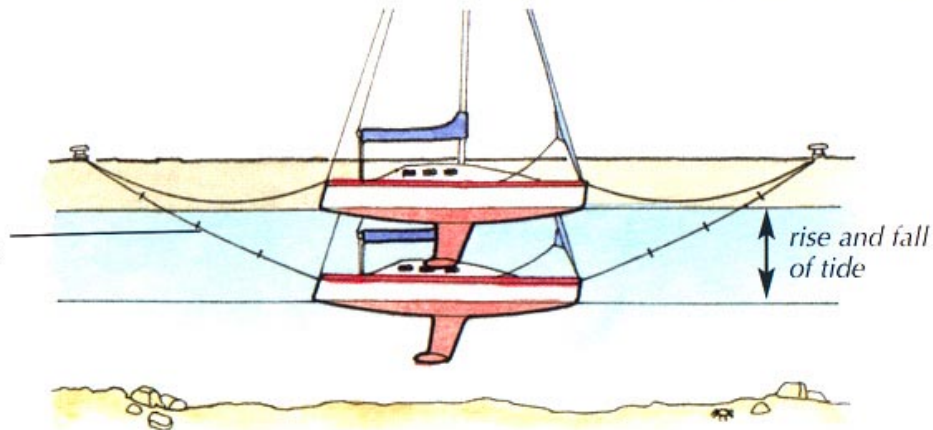


Use separate lines for each different task.

When you have attached a warp to a bollard/ring etc, bring the rest of the line back on board and attach it to a cleat - each warp can then be independently adjusted from on board as the tide rises and falls.

MOORING ALONGSIDE

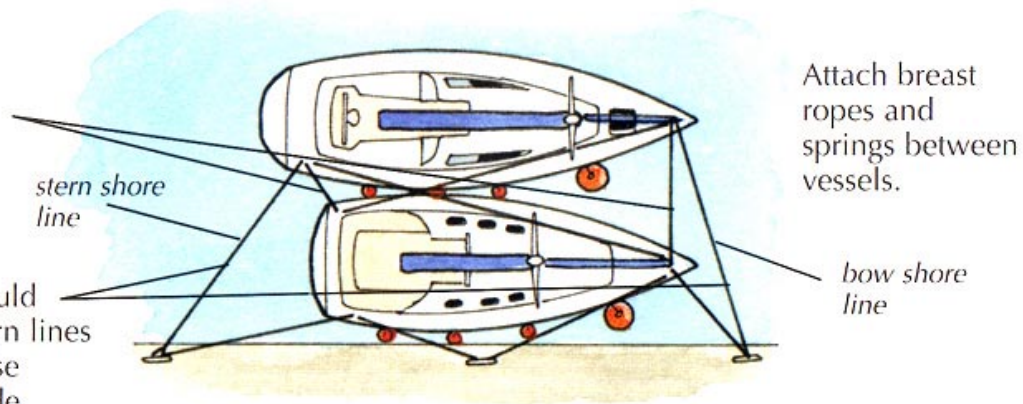
Length of warps should be at least 4 x the rise and fall of tide.



In a raft

Attach breast ropes between vessels at bow and stern.

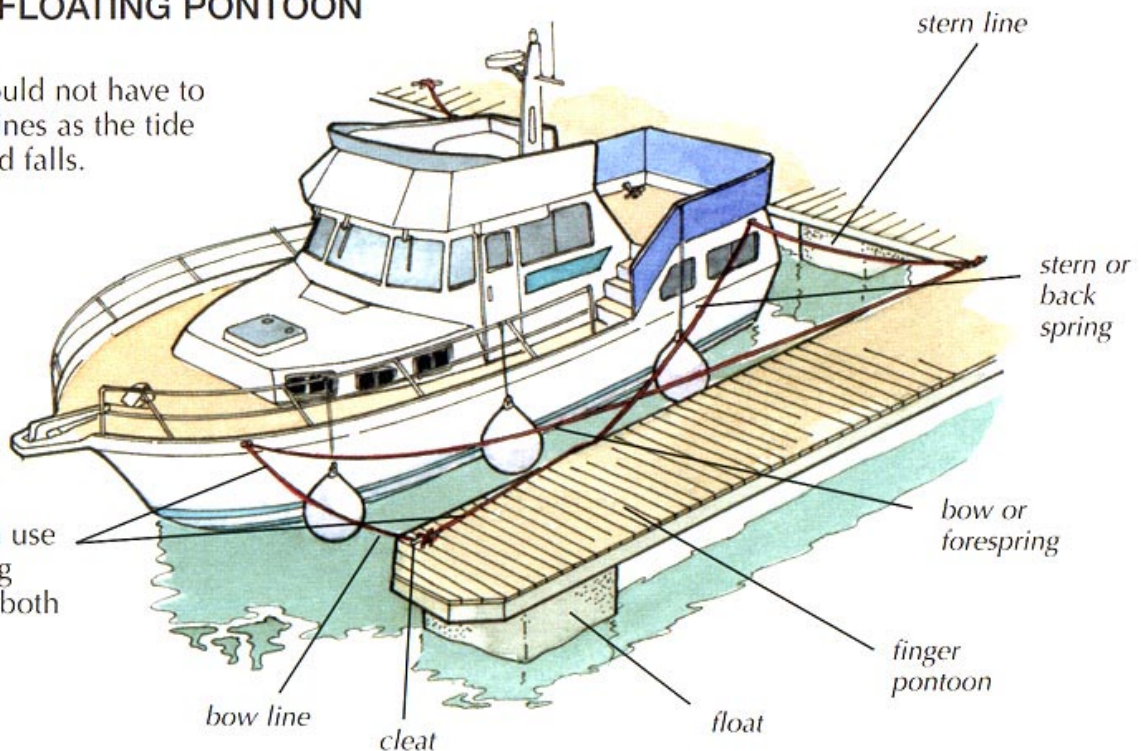
Outside boat should take bow and stern lines ashore to minimise strain on the inside boat's shore lines.



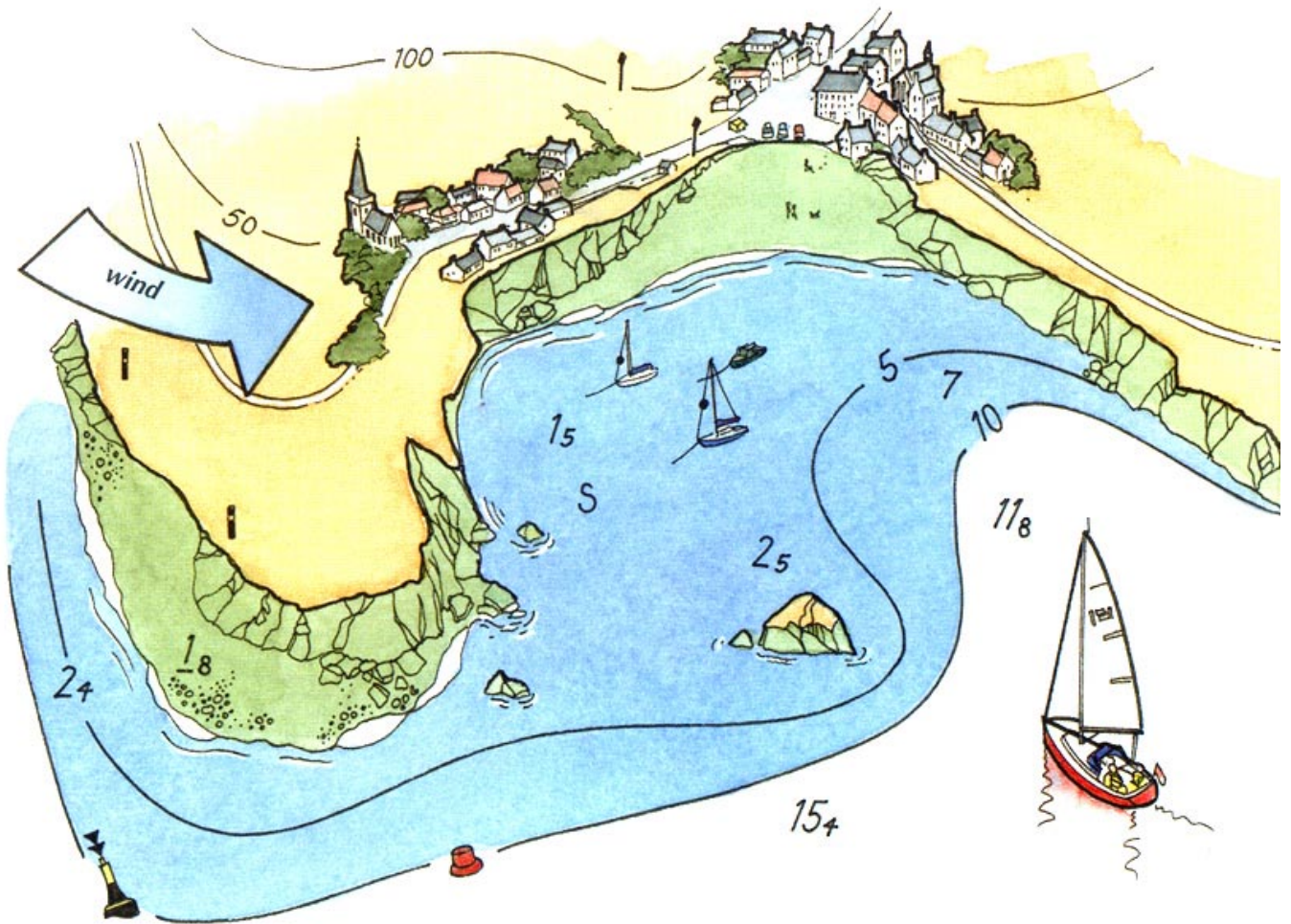
ON A FLOATING PONTOON

You should not have to adjust lines as the tide rises and falls.

You can use one long line for both tasks.



ANCHORING

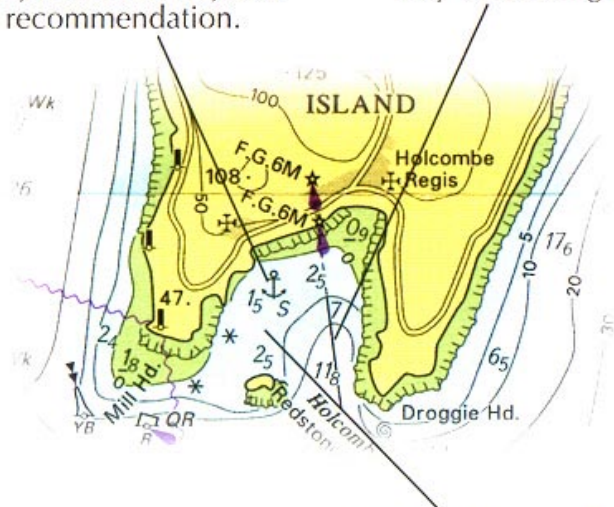


Selecting an anchorage

- Will you be sheltered? - look for maximum protection from wind, swell and tide.
- What is the sea bed like? - look at the chart symbols - mud and sand give better holding than rock or shingle.
- What will the tide do during your stay? - calculate the tide times and heights - make sure that you don't pick a spot where you will ground as the tide falls.
- Will you have enough swinging room? - allow for other boats, isolated rocks etc.
- Prepare the amount of anchor chain or warp that you need before dropping the anchor.

You don't necessarily need to anchor at the position of the anchor symbol. This is just a recommendation.

Avoid anchoring on or near the leading line - other boats may be coming in.

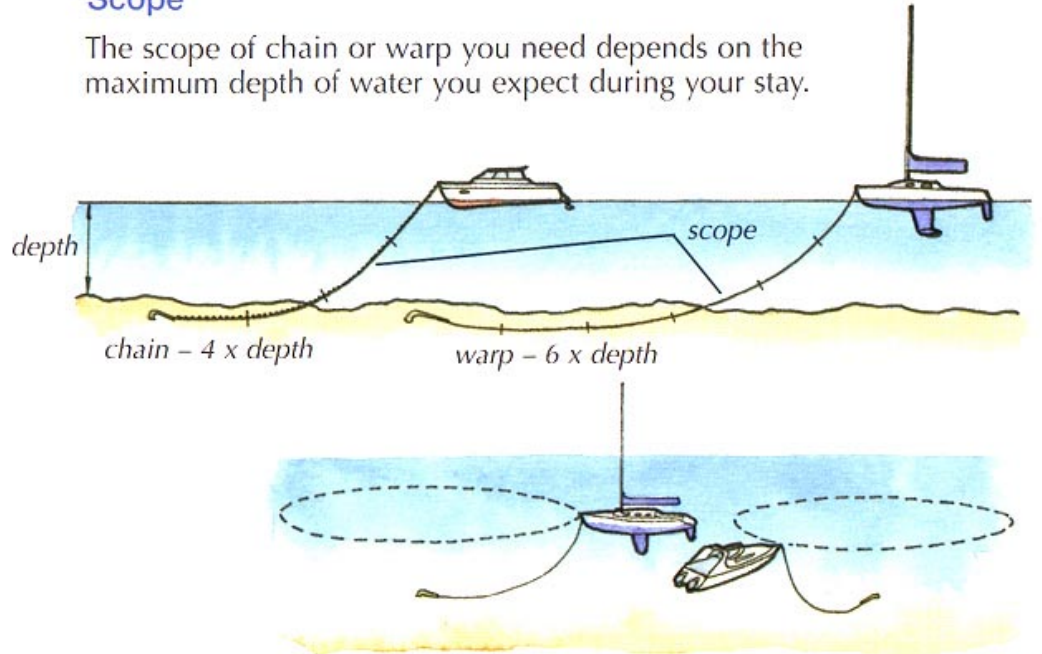


There will be much less tidal flow in the bay than outside.

ANCHORING

Scope

The scope of chain or warp you need depends on the maximum depth of water you expect during your stay.



Always allow enough swinging room to account for wind and tide. Bear in mind that light/flat-bottomed boats will lie differently to deeper draft/low windage boats.

TYPES OF ANCHOR

Bruce
Good holding to weight ratio – awkward to stow in a small anchor locker.

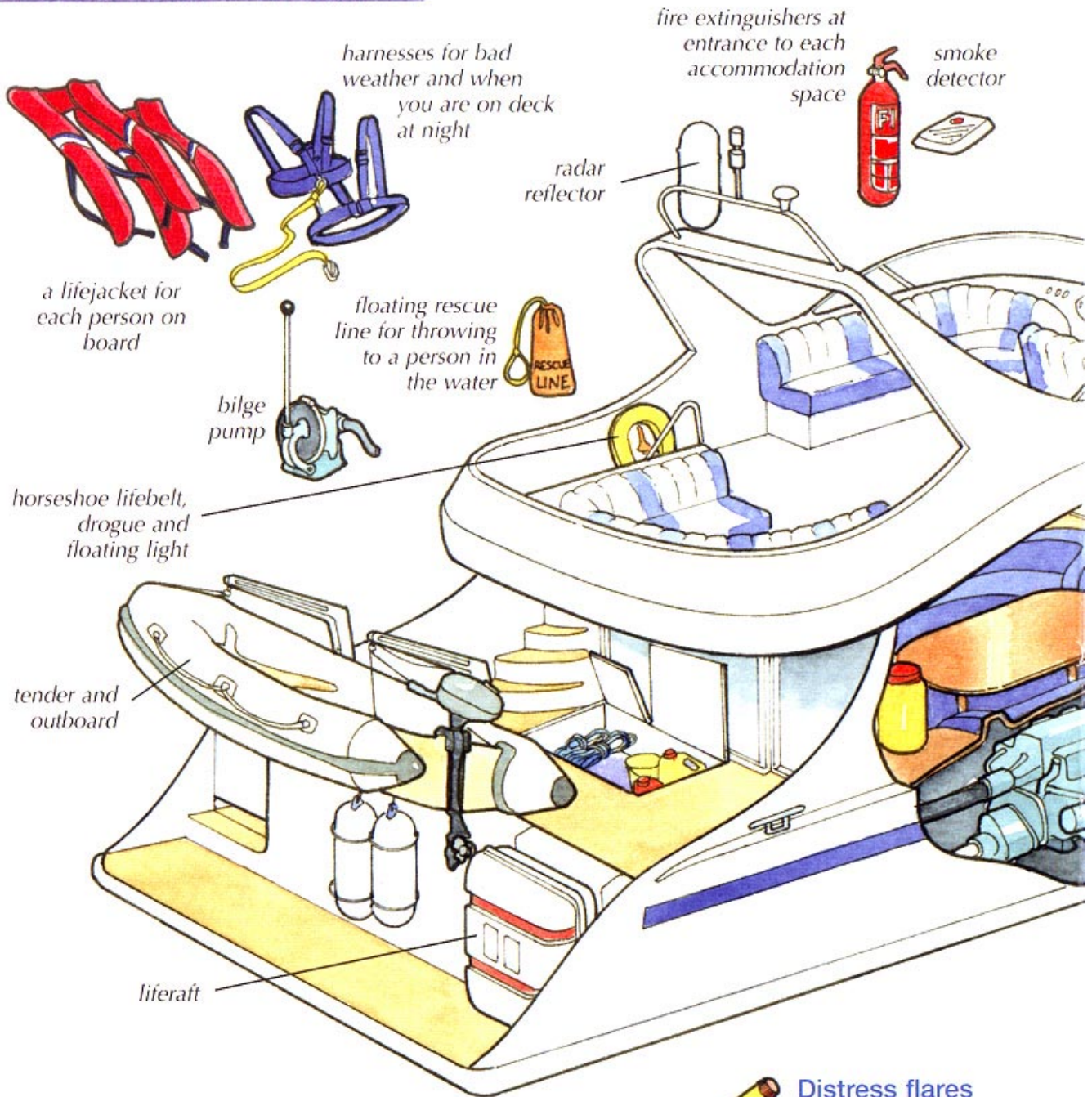
Delta
Good holding to weight ratio - designed to stay on bow roller for self launching.

Danforth
Good holding to weight ratio - stows flat, can be hard to break out of mud.

Fishermans
Traditional type, good for rocky & weedy bottoms – awkward to stow and poor holding power in sand and mud.

CQR or Plough
Good holding to weight ratio - hard to stow and moving parts can capsize.

SAFETY EQUIPMENT



harnesses for bad weather and when you are on deck at night

a lifejacket for each person on board

floating rescue line for throwing to a person in the water

bilge pump

fire extinguishers at entrance to each accommodation space

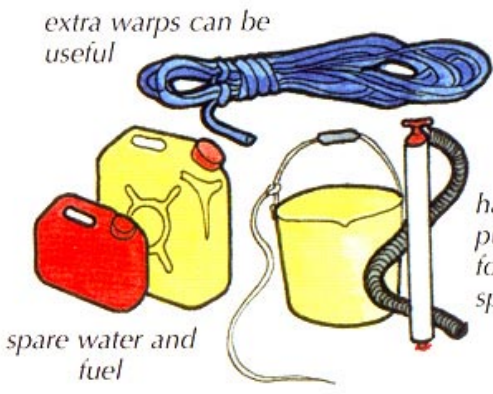
smoke detector

radar reflector

horseshoe lifebelt, drogue and floating light

tender and outboard

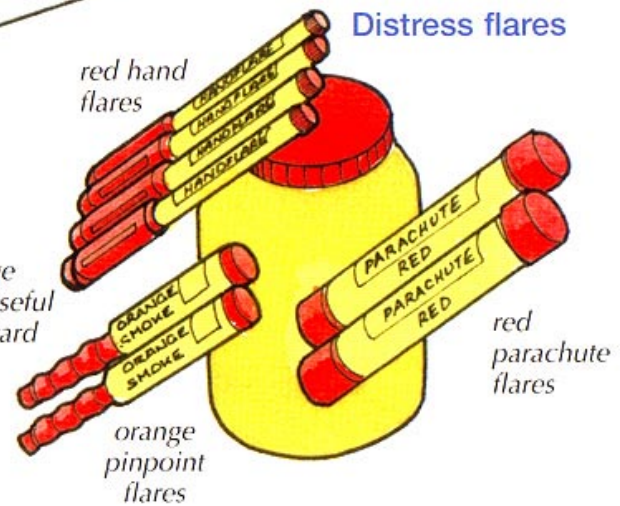
liferaft



extra warps can be useful

hand bilge pump - useful for awkward spaces

spare water and fuel



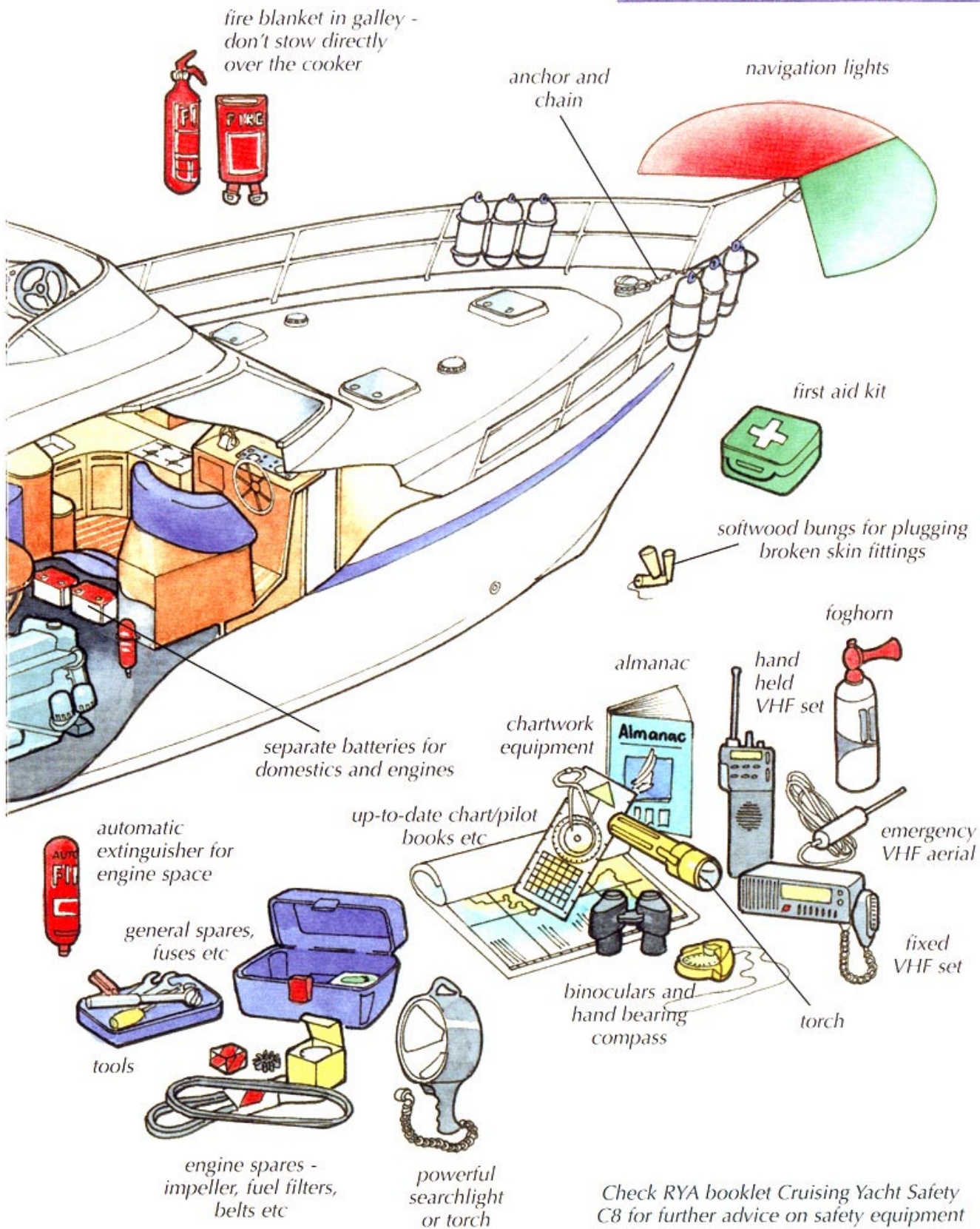
Distress flares

red hand flares

orange pinpoint flares

red parachute flares

SAFETY EQUIPMENT

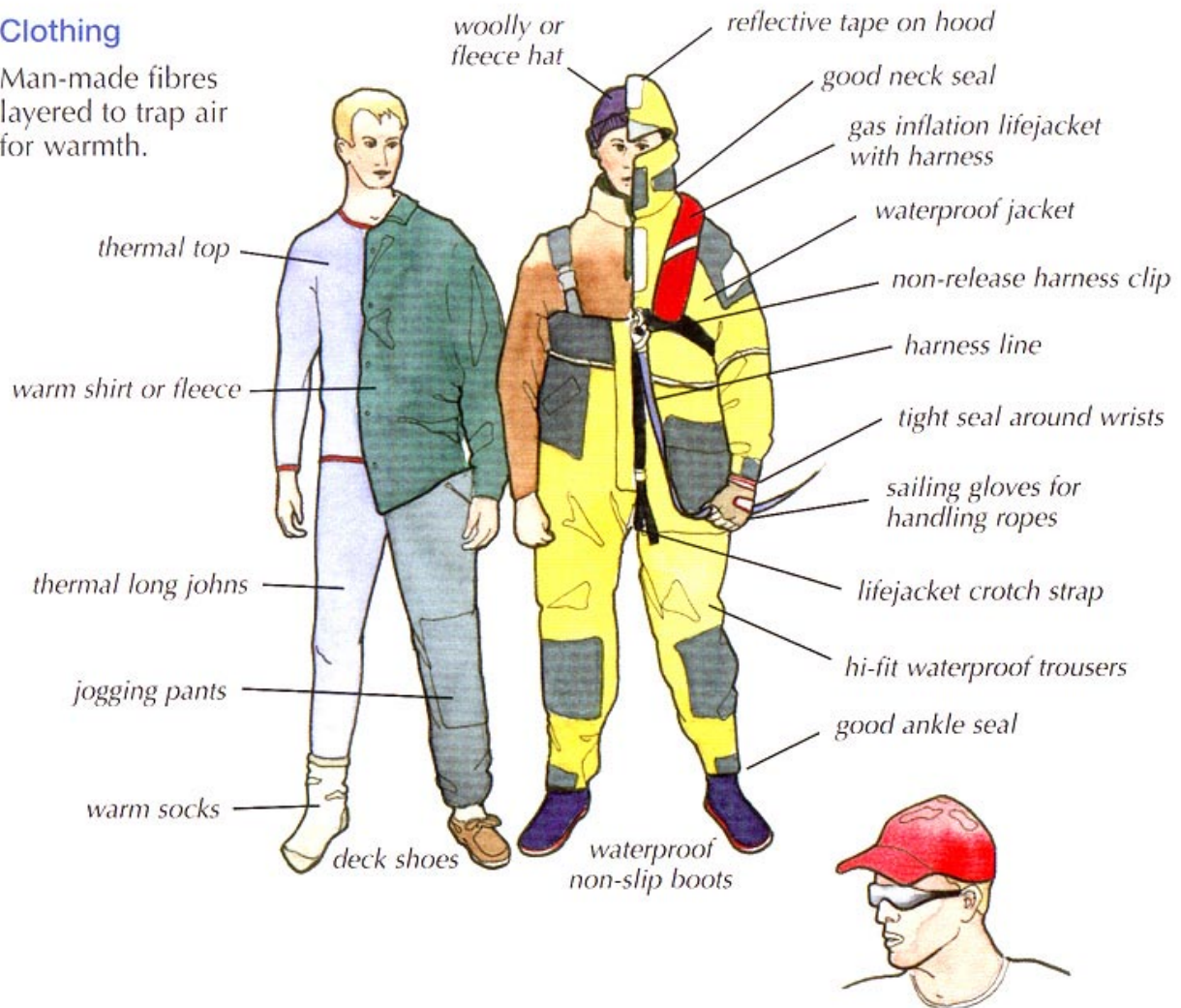


Check RYA booklet *Cruising Yacht Safety C8* for further advice on safety equipment

PERSONAL SAFETY AND COMFORT

Clothing

Man-made fibres layered to trap air for warmth.



Seasickness & hypothermia



Reflection from the water increases the effect of the sun – wear sunblock, good sunglasses and a hat to protect yourself



Symptoms of seasickness

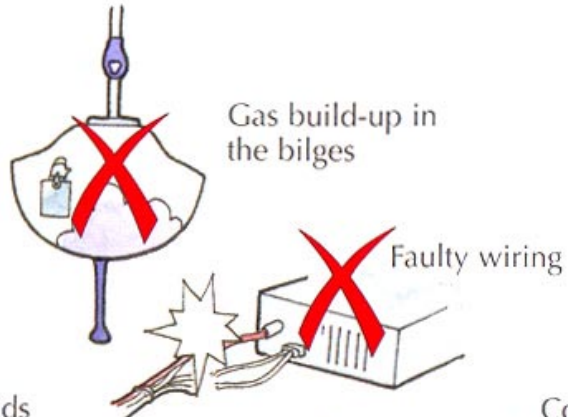
Lethargic/disinterested - pale colour

Symptoms of hypothermia

Shivering, pale colour, irrational behaviour, disoriented

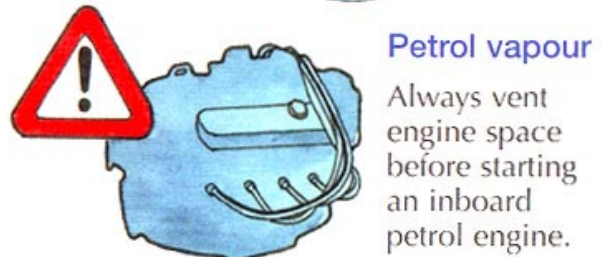
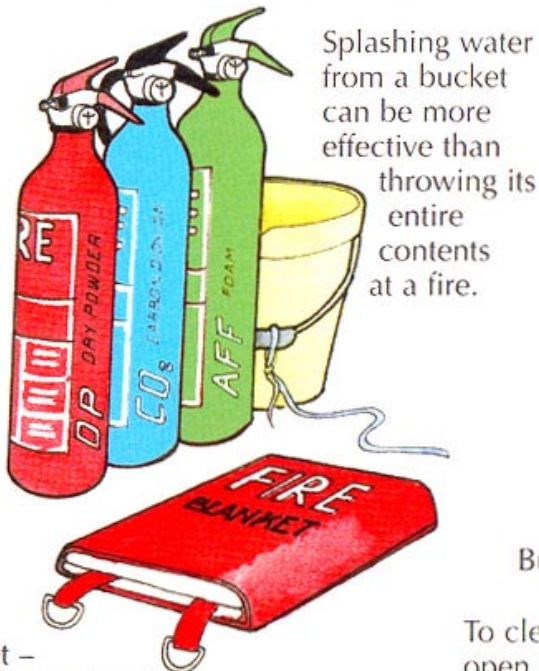
FIRE SAFETY

Common causes of fire



Extinguishers

Dry powder – don't use on flammable liquids
 CO₂ – good for enclosed spaces
 AFFF - foam, good for flammable liquids



Keep outboards on deck to avoid the build-up of petrol vapour below.

Blanket – good for smothering flames and if clothing is on fire

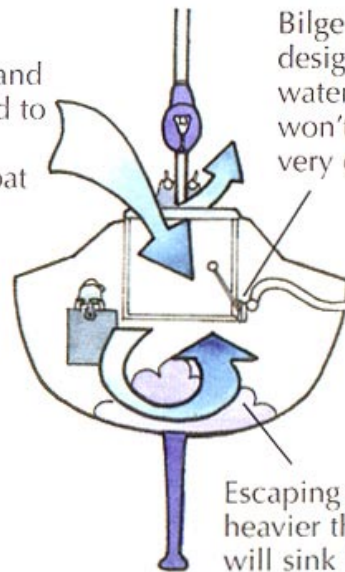


Gas safety

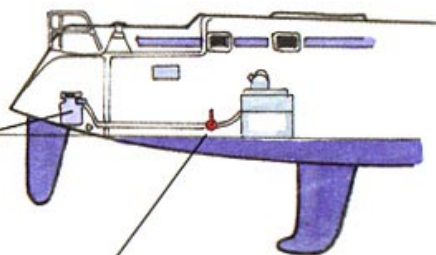
Butane and propane can be highly dangerous.

To clear gas - open hatches and turn downwind to vent fresh air through the boat

Bilge pumps are designed to pump water - many won't clear gas very effectively



Keep gas bottle in a sealed locker that drains overboard



Shut-off valve inside near cooker

Don't attempt DIY repairs to your system - always call in a qualified fitter.

EMERGENCY PROCEDURES

Boating is generally a safe pastime but, should the worst happen, make sure you and your crew know what to do.

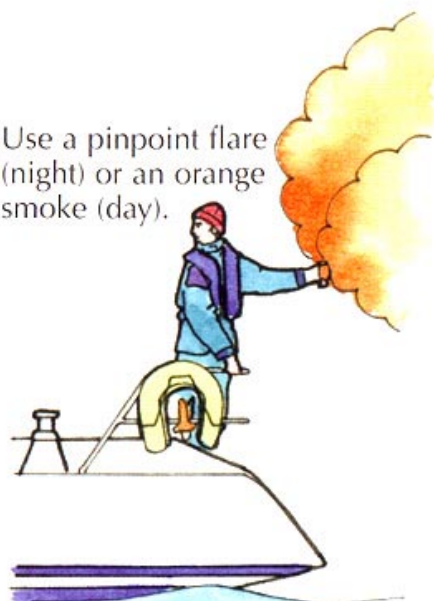


Put on a lifejacket.



Alert the coastguard.

Use a pinpoint flare (night) or an orange smoke (day).

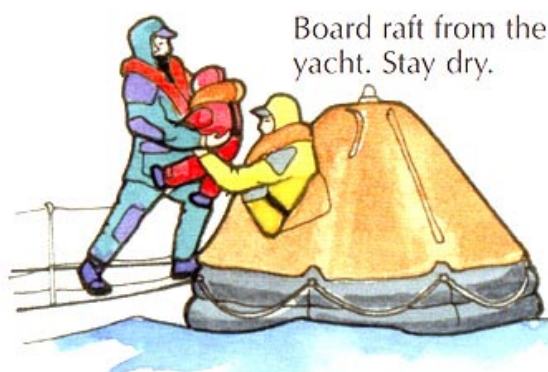


ABANDONING TO THE LIFERAFT



Make sure the painter is tied on.

Throw raft to leeward and tug painter to inflate.



Board raft from the yacht. Stay dry.

Put heaviest, strongest crew in first to stabilise the raft and assist others in boarding.

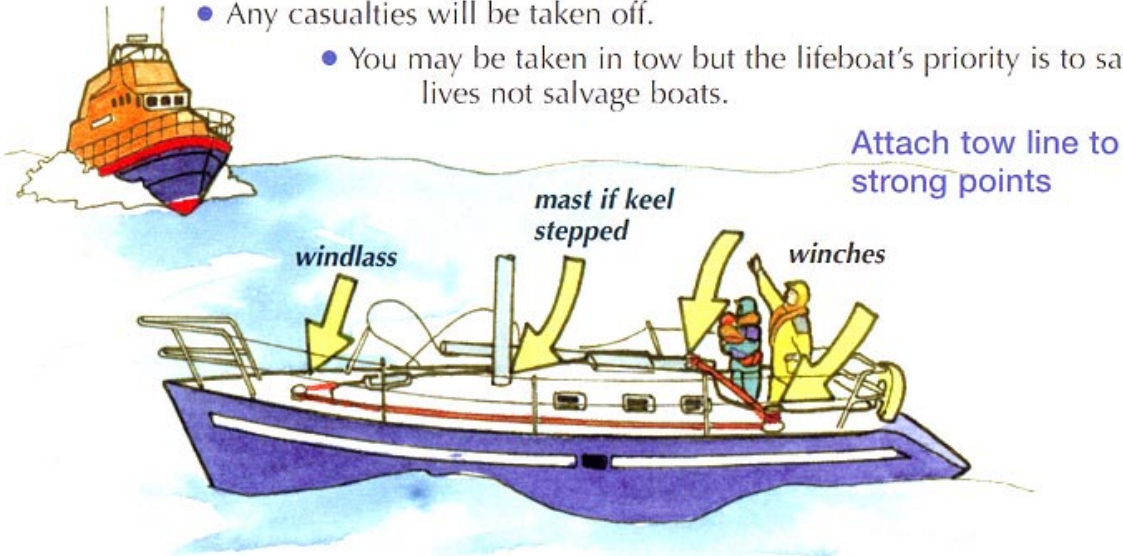


Once aboard

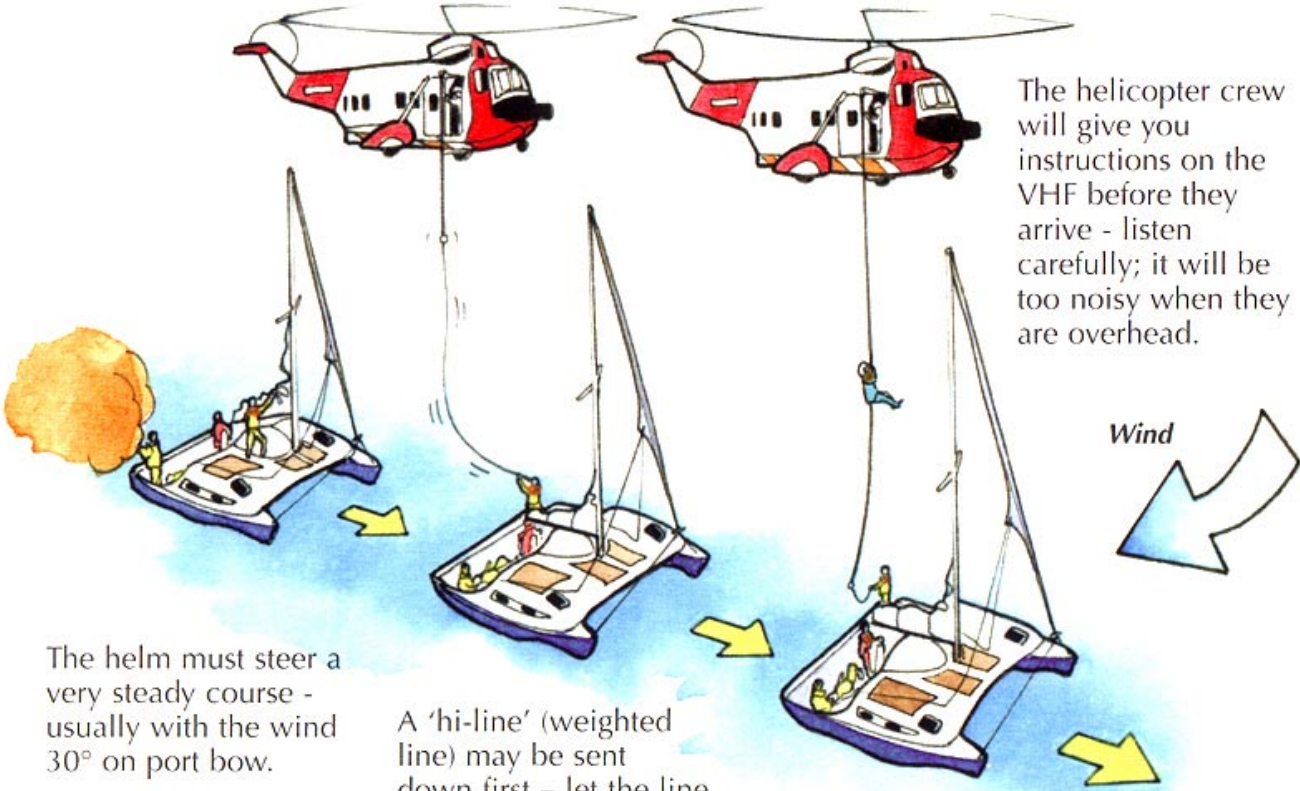
- cut painter
- paddle away
- stream drogue
- close door
- take seasickness tablets
- keep as warm and dry as possible

RESCUE BY LIFEBOAT

- The lifeboat coxswain will need to talk to you to assess the situation.
- Make sure there are no lines in the water which could foul the lifeboat's propeller.
- Any casualties will be taken off.
- You may be taken in tow but the lifeboat's priority is to save lives not salvage boats.



RESCUE BY HELICOPTER



The helm must steer a very steady course - usually with the wind 30° on port bow.

A 'hi-line' (weighted line) may be sent down first - let the line earth by touching the water - then gather in slack but don't attach it to the boat.

One of the crew will be lowered down the wire - pull him towards boat as directed.

The helicopter crew will give you instructions on the VHF before they arrive - listen carefully; it will be too noisy when they are overhead.

RAISING THE ALARM

VHF VOICE CALL

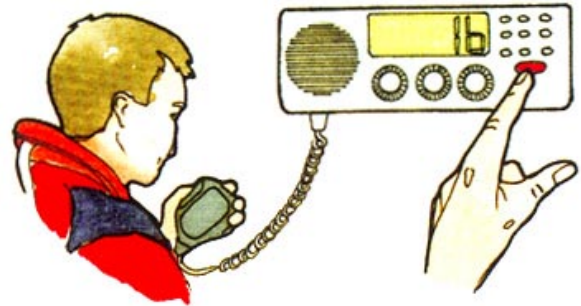
Use VHF to alert the coastguard and other vessels in your area.

You must tell them:

- your boat's name
- your position
- how many people are on board
- what assistance you require.

VHF is better than a mobile phone for distress calling - other vessels in your area will hear your call and the coastguard can use VHF transmissions to fix your position.

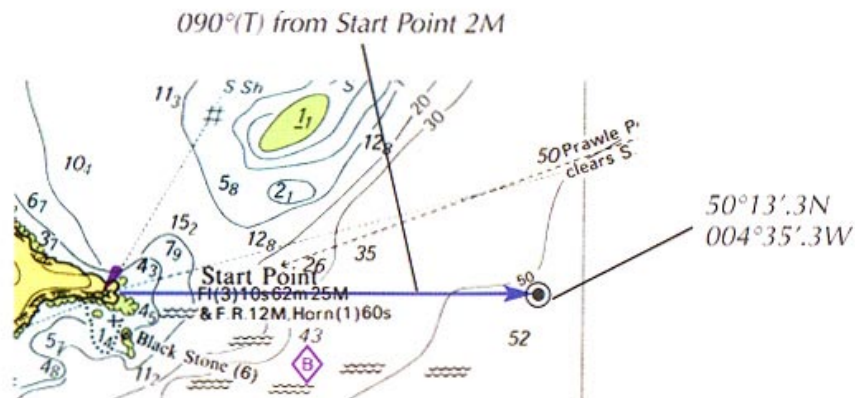
A mobile phone will only tell one person that you are in trouble; the network coverage is patchy away from land and you won't be able to talk direct to a helicopter or lifeboat.



DIGITAL VHF (DSC) CALL

You may not have time to send a voice call but some modern VHF sets can:

- send a distress alert or urgency call at the press of a button
- be linked to a GPS to give your position.



MAYDAY

When life or vessel are in grave and imminent danger

Mayday x 3
This is motor yacht *Puffin* x 3
Mayday yacht *Puffin*
(give MMSI if fitted with DSC)
My position is 50°13'.3N 04°35'.3W
We are holed and sinking and require immediate assistance
Six persons on board
Over

PAN PAN

Urgency message - if crew or vessel need assistance

Pan Pan x 3
All ships x 3
This is yacht *Seaspray* x 3
(give MMSI if fitted with DSC)
My position is 090°(T) from Start Point 4.3 miles
I have a broken rudder and require a tow
Four persons on board
Over

You may use a VHF radio under the supervision of a qualified person or to make a distress call - otherwise you need an operator's certificate. Contact the RYA for details of courses.

RAISING THE ALARM

FLARES

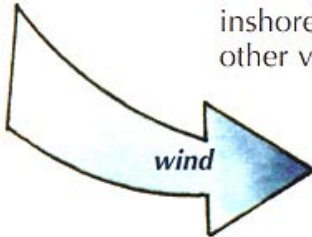
NEVER fire a parachute flare if a helicopter is approaching.

Fire rocket vertically.

If windy fire 15° downwind.

Handheld pinpoint flare shows exactly where you are - use inshore or in sight of other vessels.

In low cloud fire at 45°.

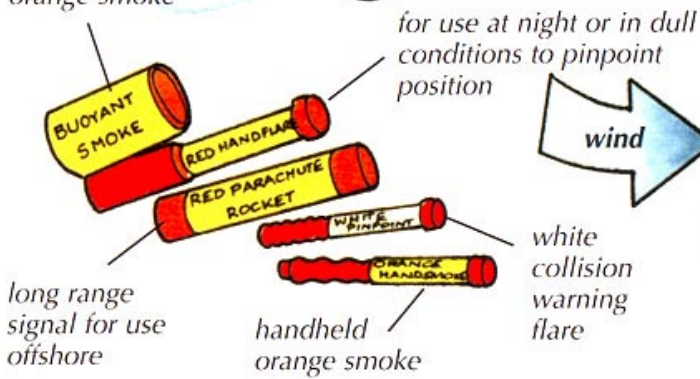


NEVER fire into the wind.

floating orange smoke



Orange smoke for use by day - especially in bright sunlight.

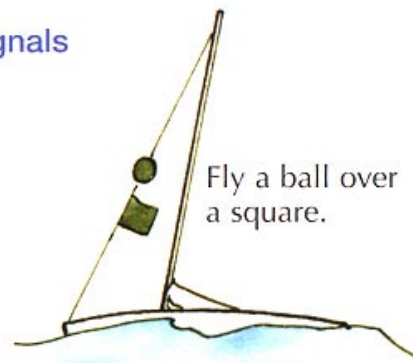


Hold at arm's length downwind - don't look directly at the flare.

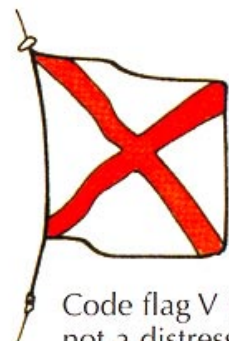
Other distress signals



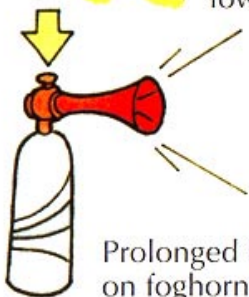
Raising and lowering arms.



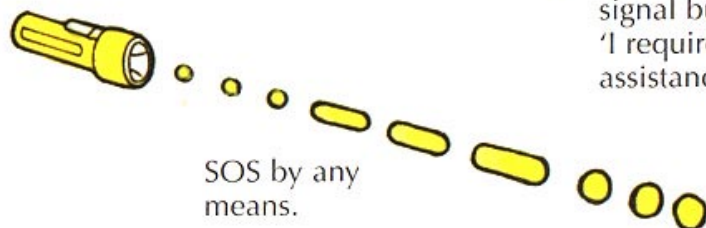
Fly a ball over a square.



Code flag V is not a distress signal but means 'I require assistance'.



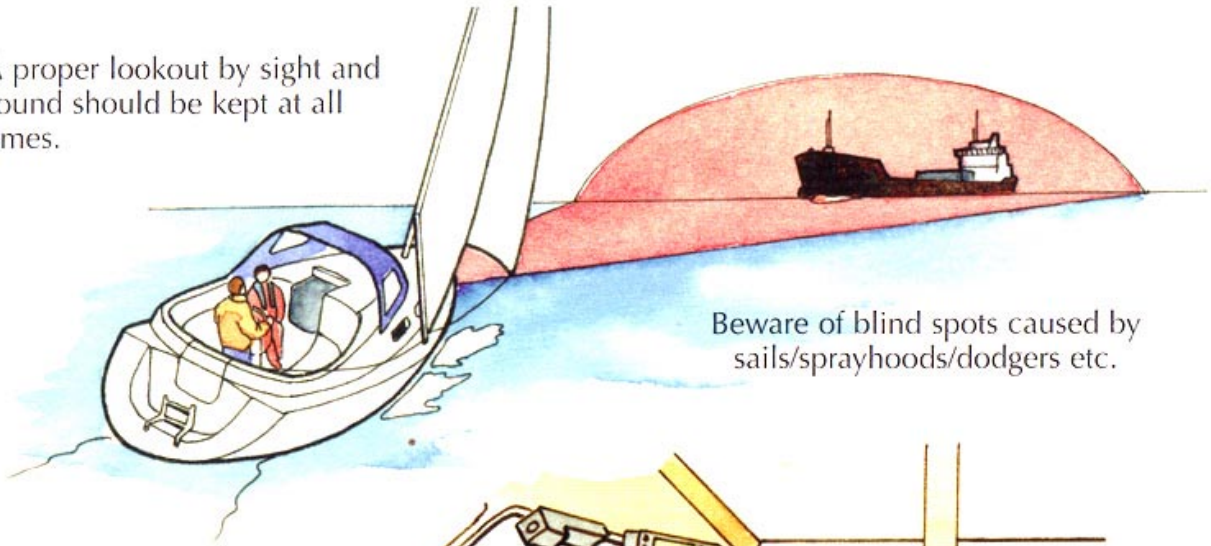
Prolonged blast on foghorn.



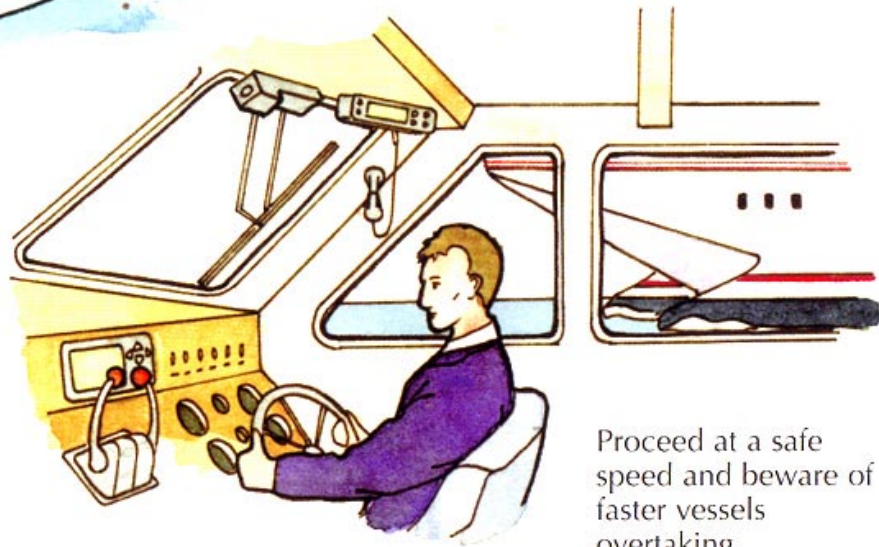
SOS by any means.

RULES OF THE ROAD

A proper lookout by sight and sound should be kept at all times.

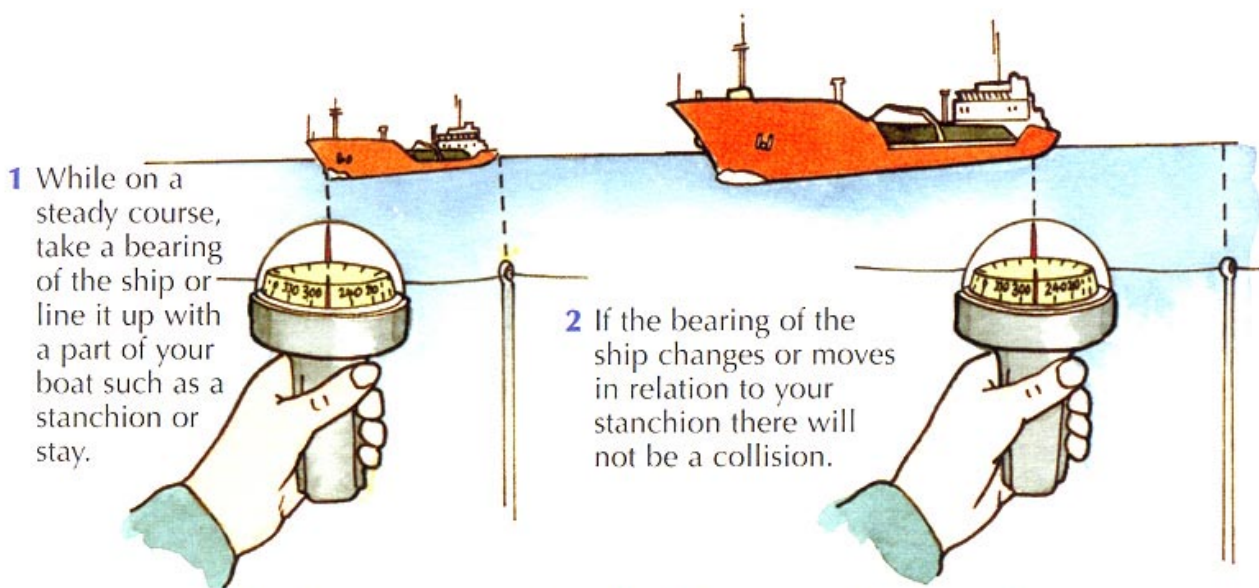


Beware of blind spots caused by sails/sprayhoods/dodgers etc.



Proceed at a safe speed and beware of faster vessels overtaking.

How can we tell if a risk of collision exists?



1 While on a steady course, take a bearing of the ship or line it up with a part of your boat such as a stanchion or stay.

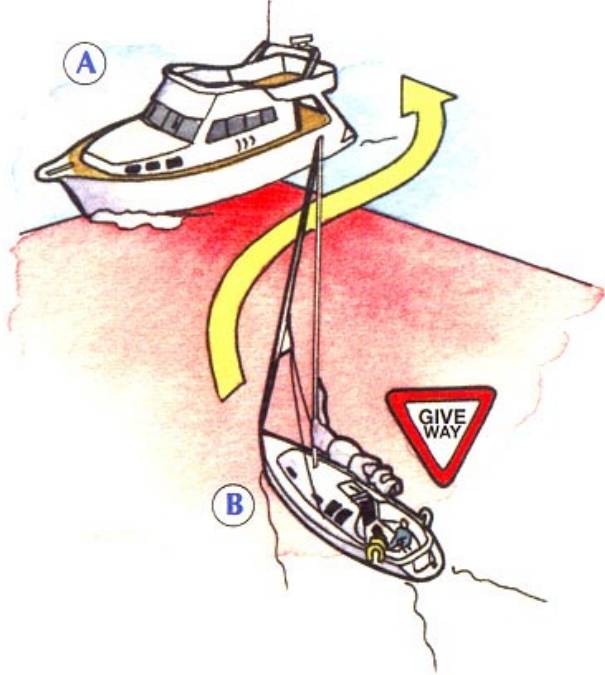
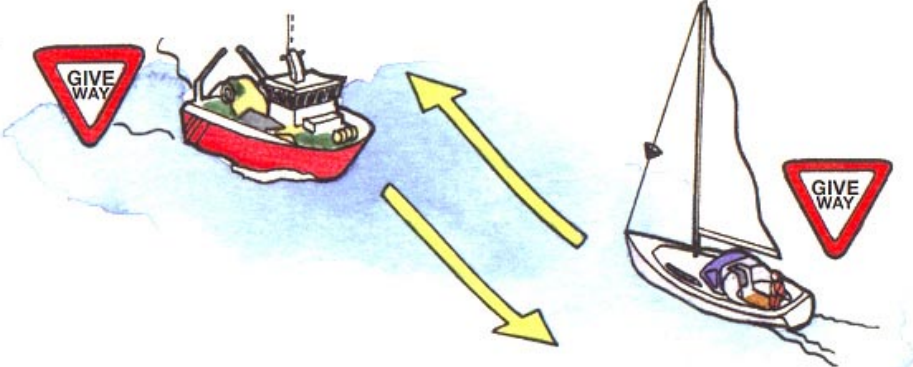
2 If the bearing of the ship changes or moves in relation to your stanchion there will not be a collision.

If the bearing stays steady or the ship remains lined up with your stanchion - a risk of collision exists.

WHO GIVES WAY?

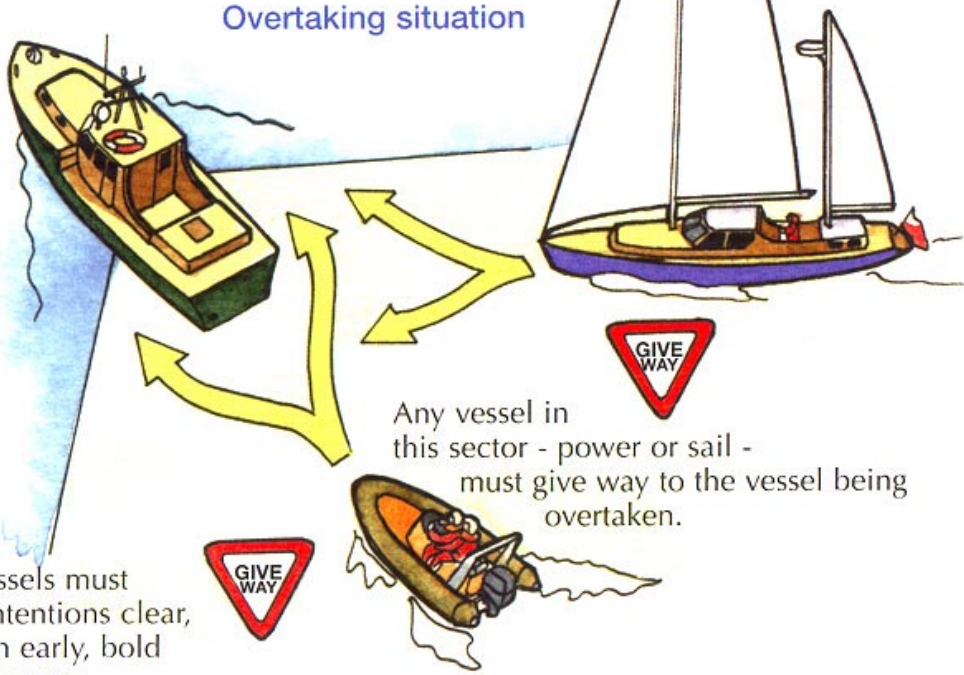
Head-on situation -

Both vessels turn to starboard.



Crossing situation -

A is on the starboard side of B
B gives way to A.

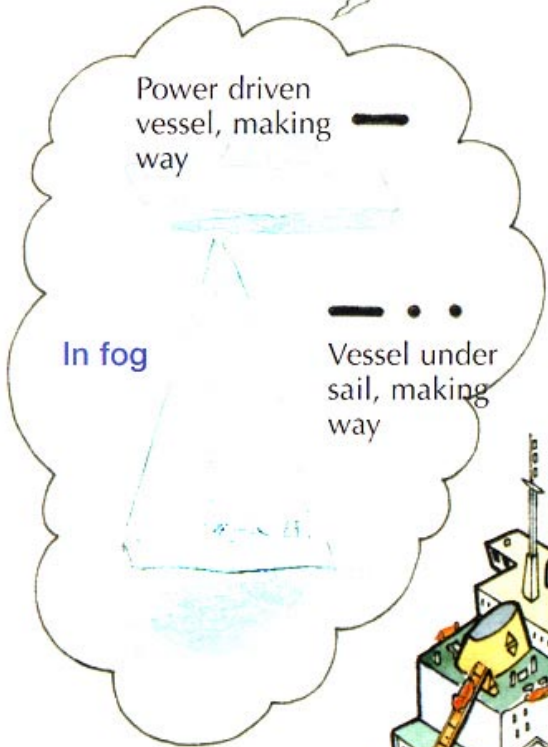
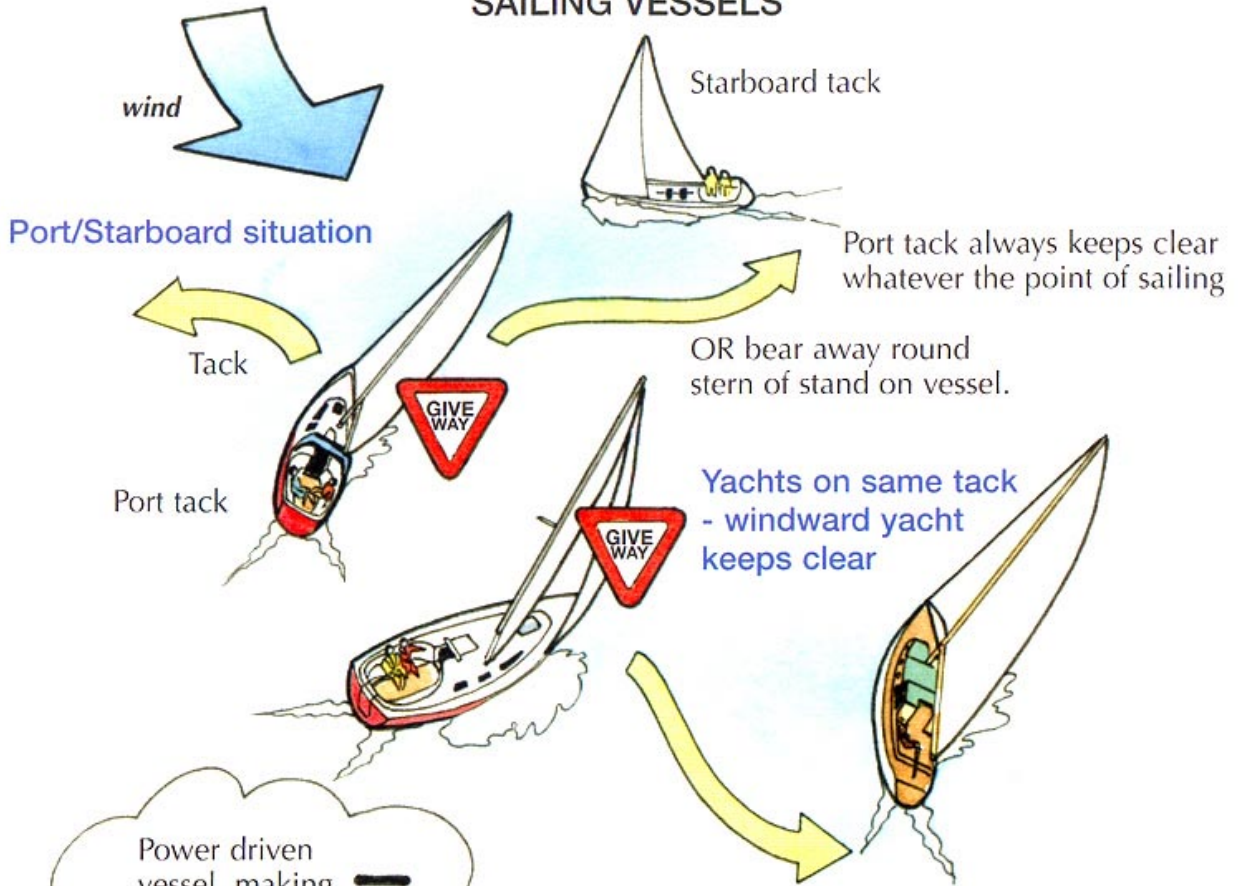


Stand-on vessels must keep a steady course and speed.

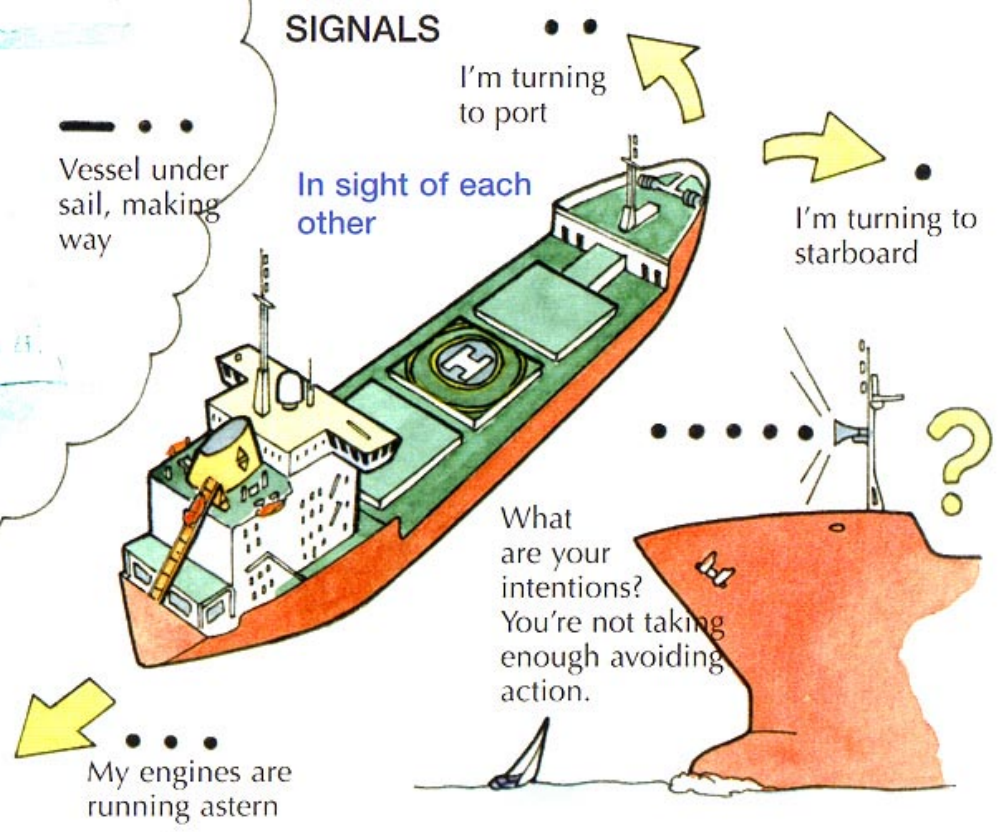
Give-way vessels must make their intentions clear, by making an early, bold alteration of course.

WHO GIVES WAY?

SAILING VESSELS



SOUND SIGNALS



WHO GIVES WAY?

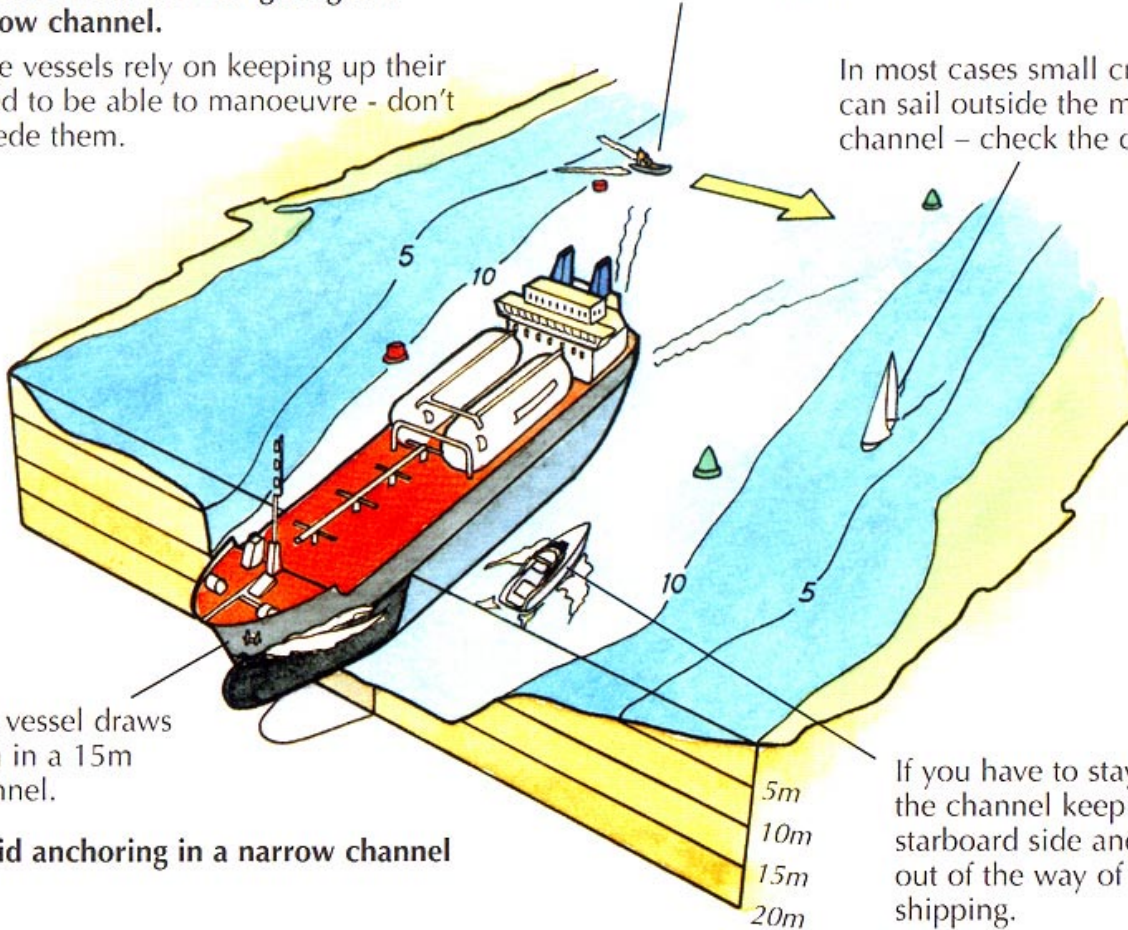
NARROW CHANNELS

Power does not necessarily give way to sail when both are navigating in a narrow channel.

Large vessels rely on keeping up their speed to be able to manoeuvre - don't impede them.

If you need to cross a channel your heading should be at 90° to channel.

In most cases small craft can sail outside the main channel - check the chart.



This vessel draws 10m in a 15m channel.

Avoid anchoring in a narrow channel

If you have to stay in the channel keep to the starboard side and stay out of the way of shipping.

IN ORDER OF PRIORITY

Vessel restricted in ability to manoeuvre (laying marks, dredging etc.)



Vessel constrained by draught



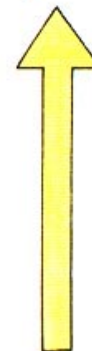
Vessel engaged in fishing



Vessel under sail



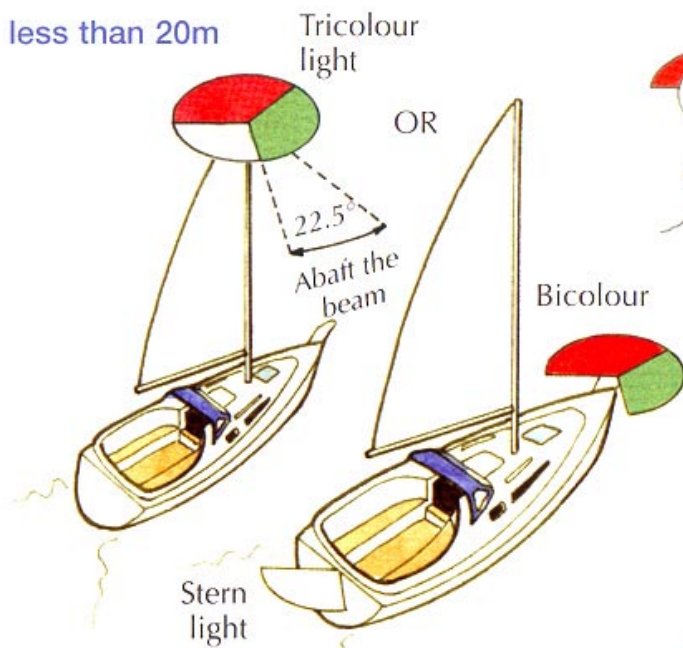
Power-driven vessel



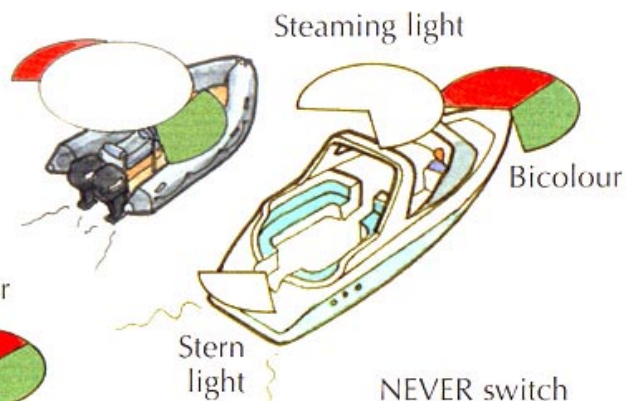
LIGHTS AND SHAPES

UNDER SAIL

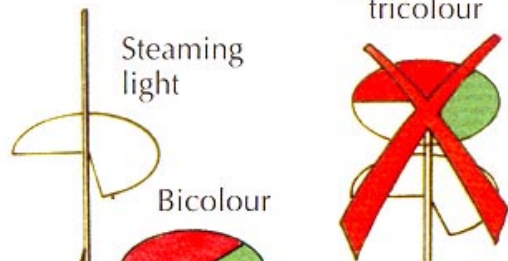
less than 20m



POWER-DRIVEN VESSELS

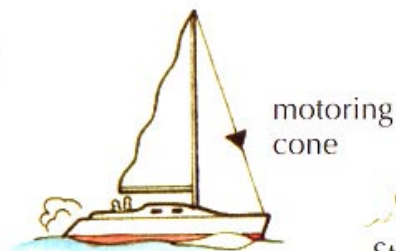


NEVER switch on steaming light as well as tricolour



SAILING VESSEL UNDER POWER

By day

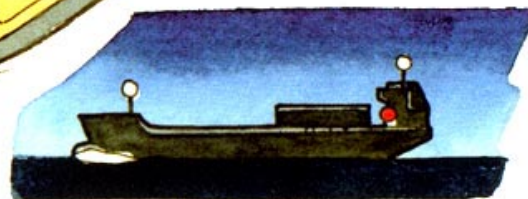
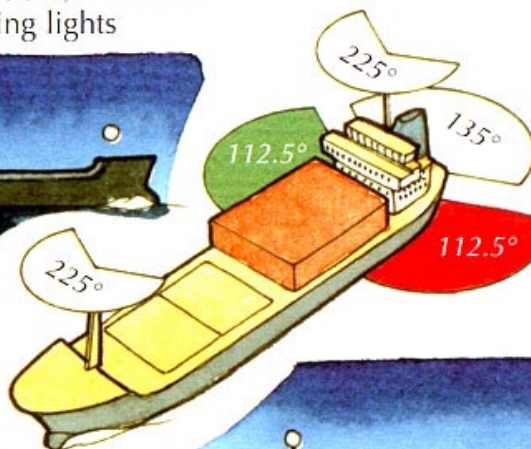
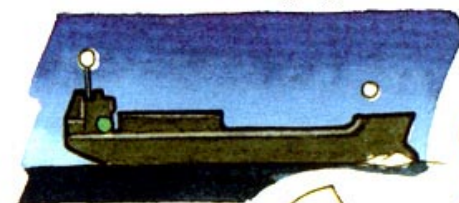


Stern light

At night



Larger ships (over 50m) must have two steaming lights



For a full explanation of the Collision Regulations see RYA book G2.

LIGHTS AND SHAPES

by day

At anchor

by day

Restricted in ability to manoeuvre

eg. dredging cable laying etc

by day

Carrying out underwater work

eg. large container ships or tankers in a narrow channel

by day

3 all round reds

Constrained by draught

by day

Fishing trawling

Other types of fishing

by day

Towing

by day

over 200m

white lights have same sector as steaming light

from astern

under 200m

by day

Minesweeping

by day

Air cushion vessel

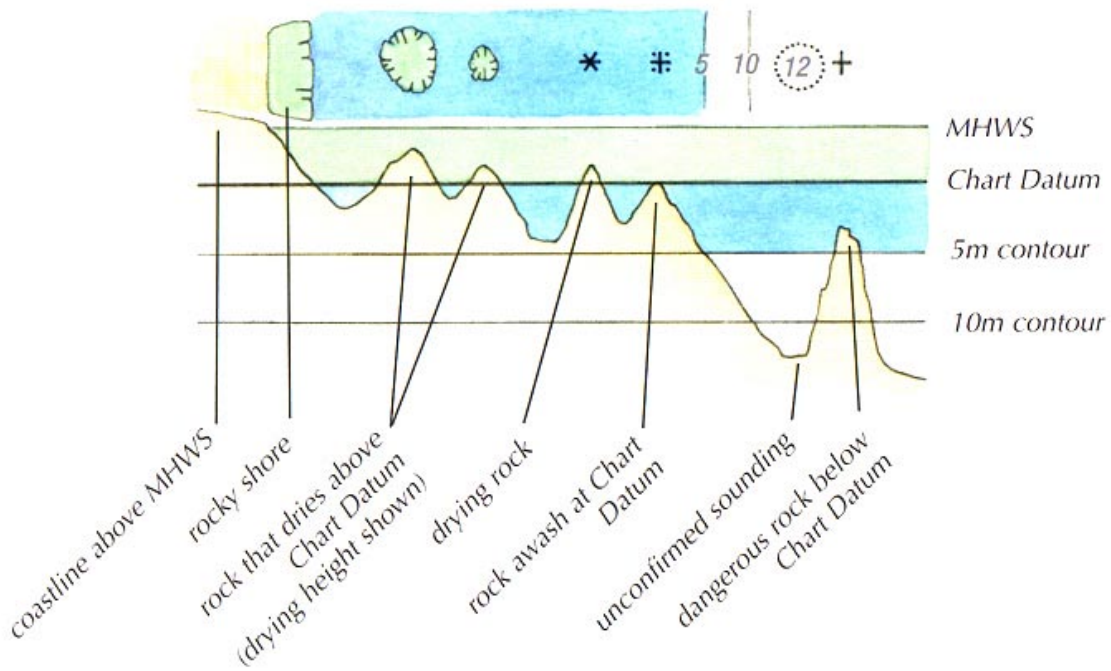
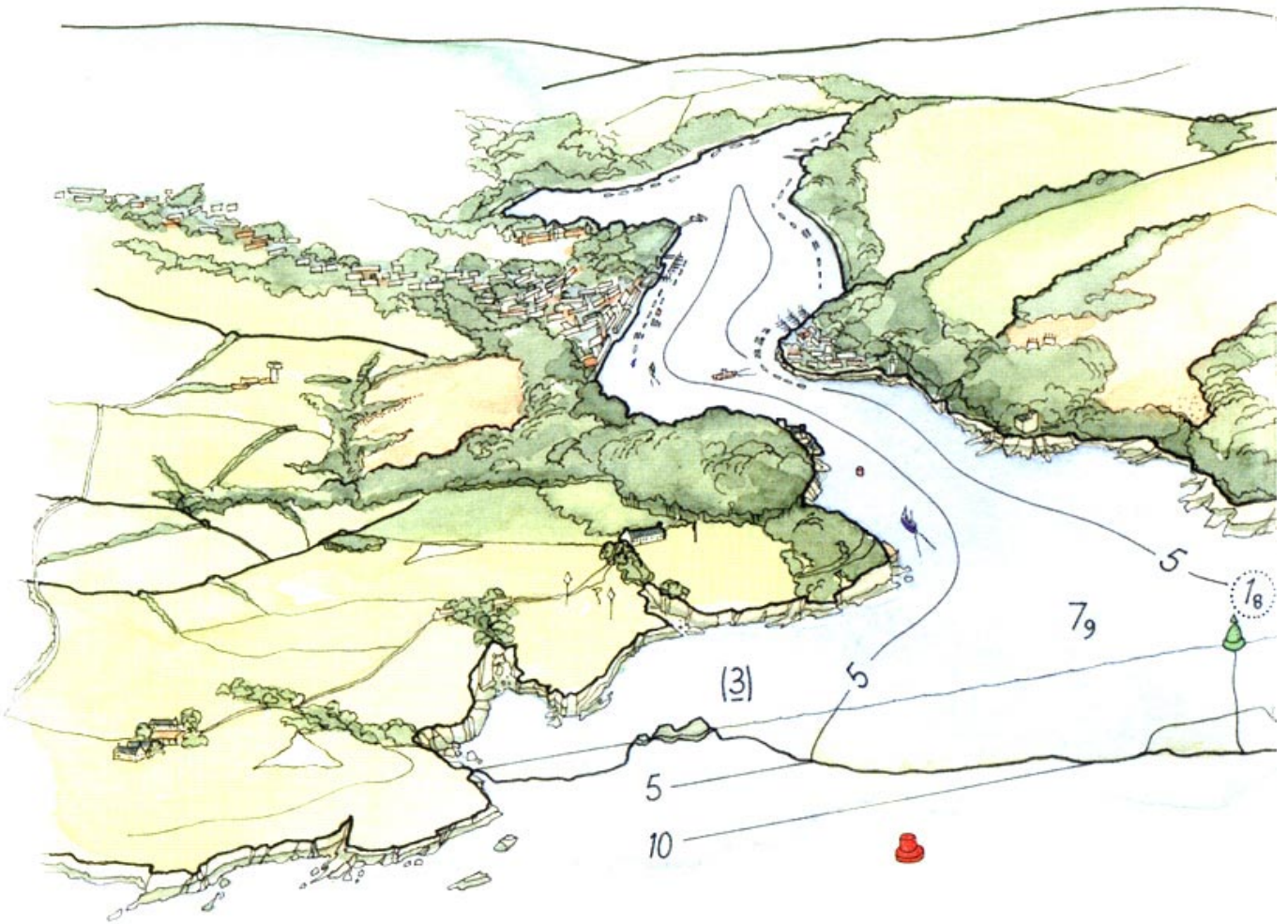
all round

On pilot duty

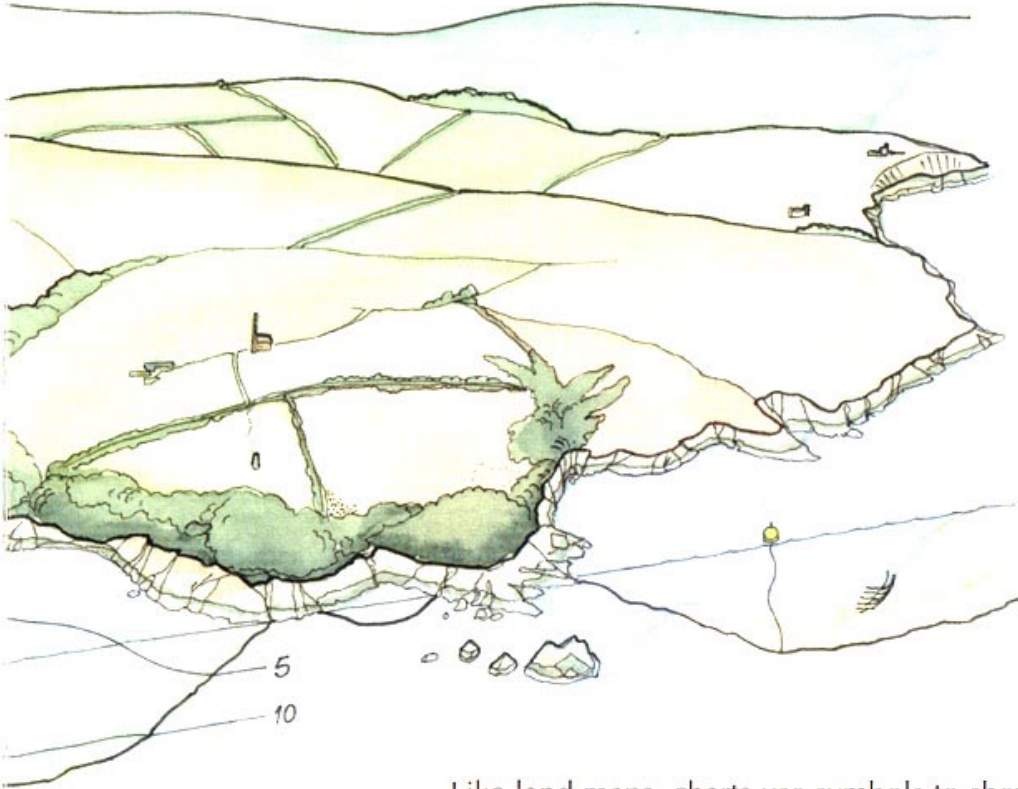
by day

Diving

INTERPRETING CHARTS











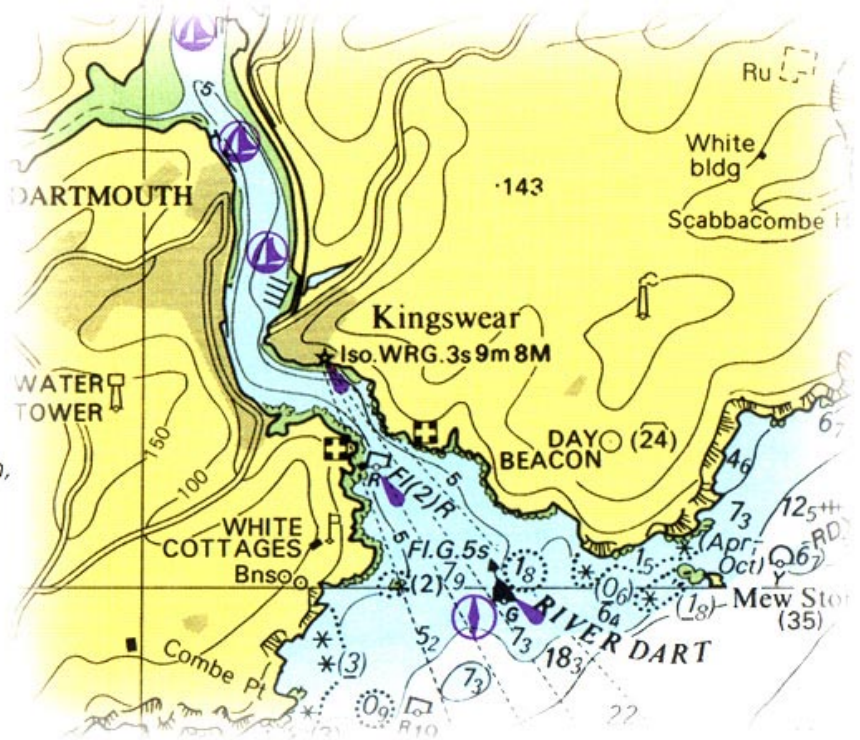
INTERPRETING CHARTS



Like land maps, charts use symbols to show useful and important features. Information is carefully chosen to show hazards clearly and to help identify features that are visible from a boat at sea.

Symbols & Abbreviations (5011) published by the Hydrographic Office can be used to identify features and symbols on the chart.

-  Beacon
-  Yacht harbour/marina
-  Can buoy, cylindrical buoy
-  Wreck, depth unknown, not considered dangerous to surface navigation.
-  Battery, small fort
-  Chimney
-  Steep coast, cliffs
-  Building



PLOTTING YOUR POSITION

BY LATITUDE AND LONGITUDE

Lines of Longitude run from pole to pole dividing the earth into segments rather like an orange.

Lines of Latitude are obtained by projecting angles made from the centre of the earth to points on its surface.

Distance and speed

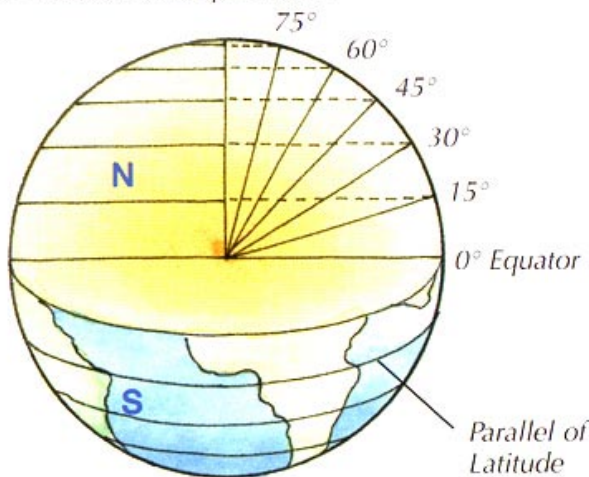
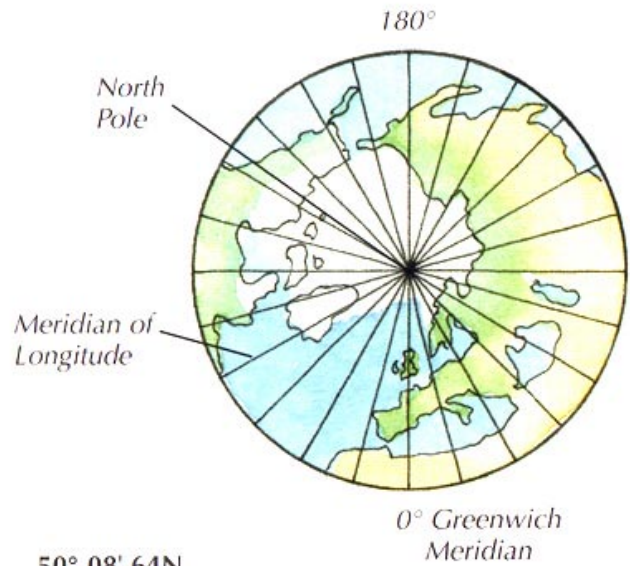
For all practical purposes a mile at sea is 1852 metres.

$1^\circ = 60'$ minutes of Latitude

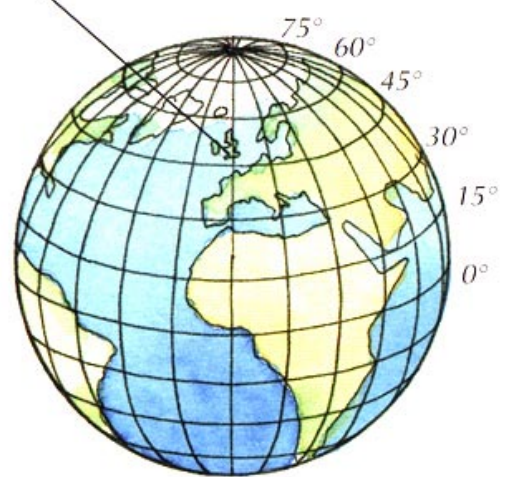
$1' = 1$ nautical mile

Speed is measured in knots.

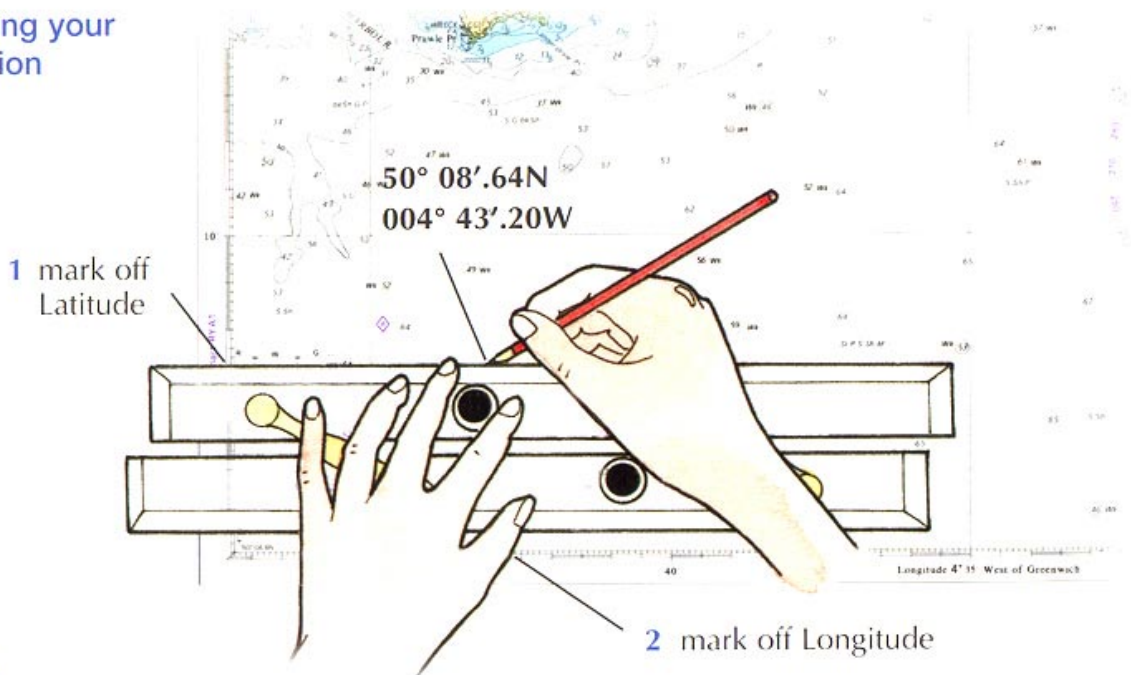
A knot is one nautical mile per hour.



$50^\circ 08'.64N$
 $004^\circ 43'.20W$



Plotting your position



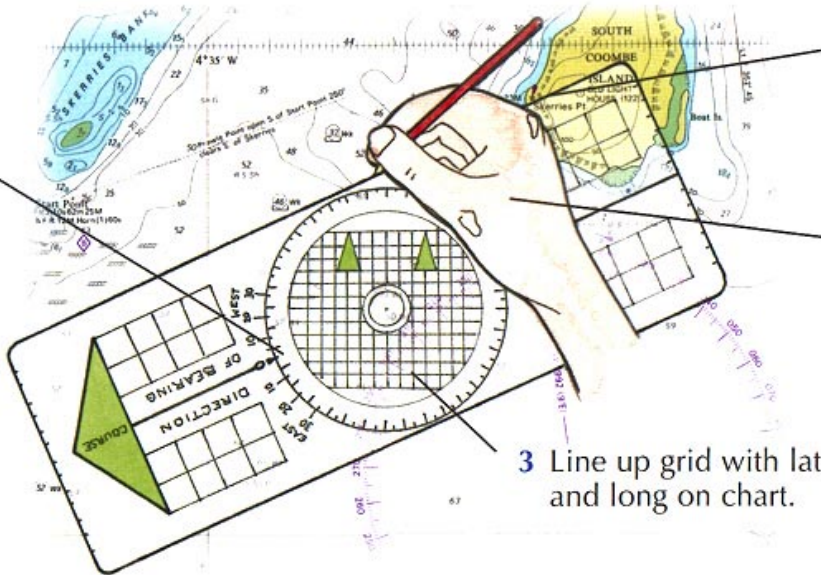
PLOTTING YOUR POSITION

BY DISTANCE AND BEARING

eg. $246^\circ(T)$ from Skerries Point 1.6M

With a plotter

1 Dial in $246^\circ(T)$



2 Line up edge of plotter with Skerries Point.

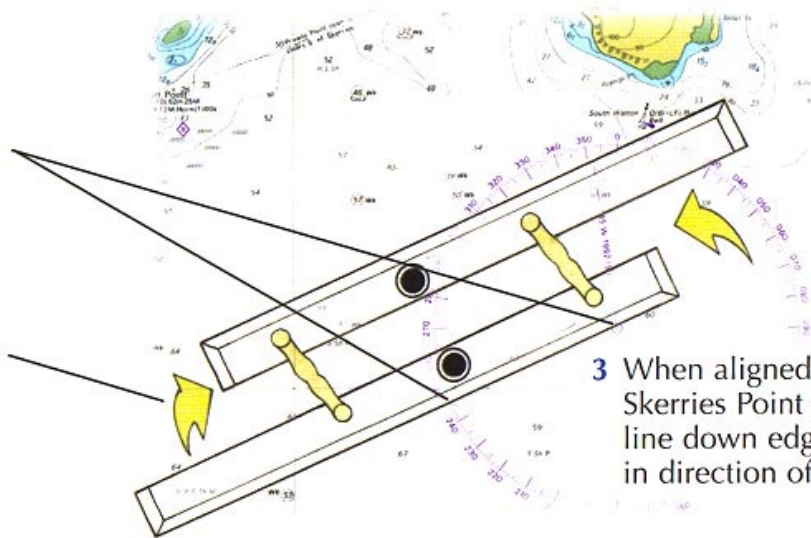
4 Draw line down edge of plotter in direction of bearing.

3 Line up grid with lat and long on chart.

With parallel rules

1 Line up edge of parallel rule with centre of compass rose and $246^\circ(T)$

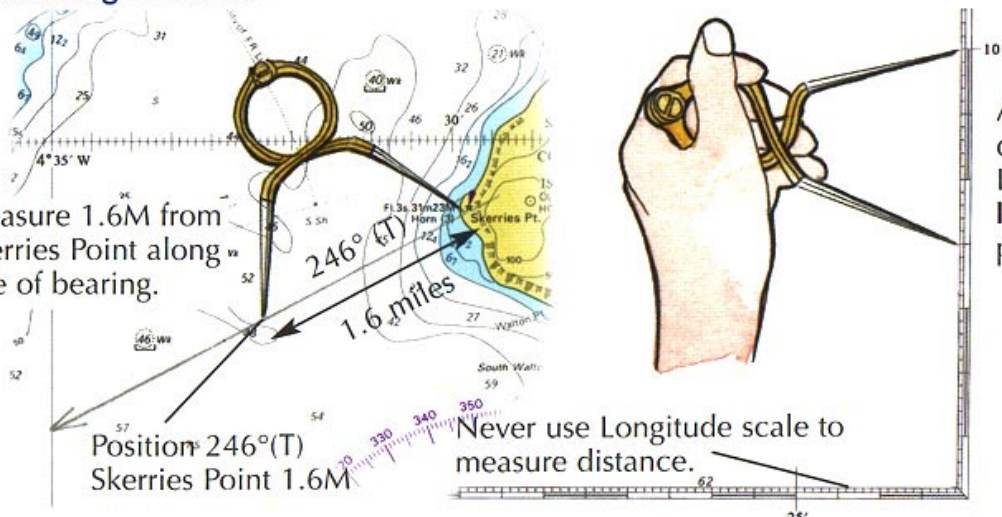
2 Keeping rules steady, walk them to line up with Skerries Point.



3 When aligned with Skerries Point draw line down edge of rules in direction of bearing.

Measuring distance

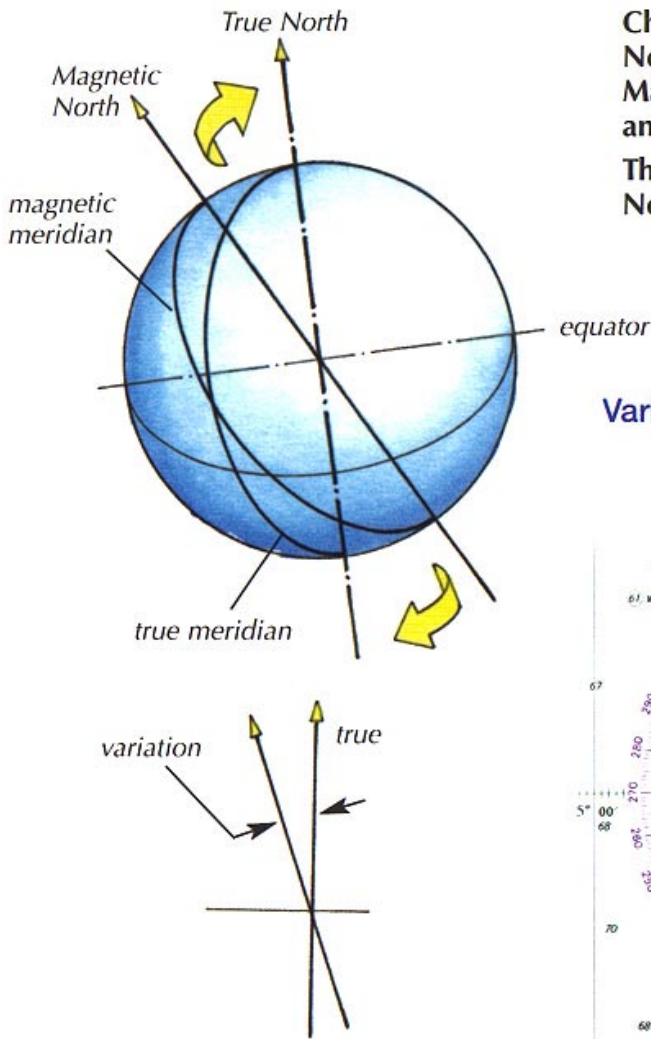
Measure 1.6M from Skerries Point along line of bearing.



Always measure distance at Latitude scale level with your position.

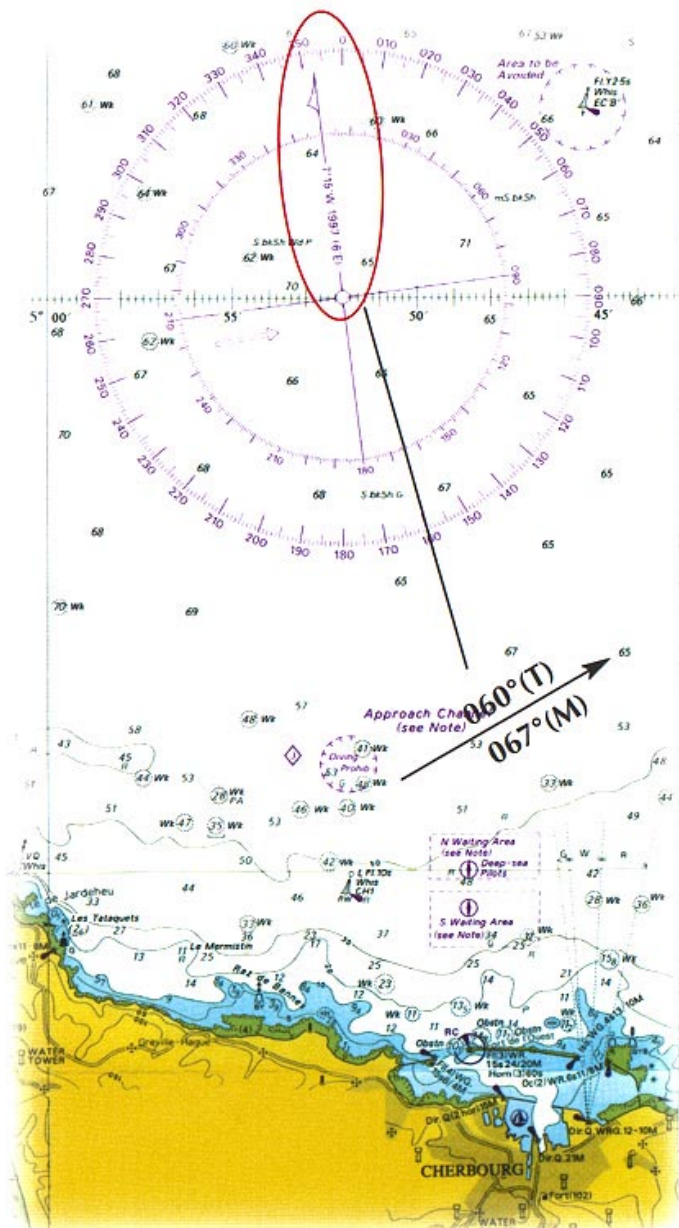
Never use Longitude scale to measure distance.

VARIATION



Charts show North as True (geographic) North. A compass can only point to Magnetic North, which changes with time and according to your position. The difference between True and Magnetic North is called *variation*.

Variation for your position is found on the nearest compass rose



If variation is **West**, magnetic bearing is **greater** than true bearing.
If variation is **East**, magnetic bearing is **smaller**.

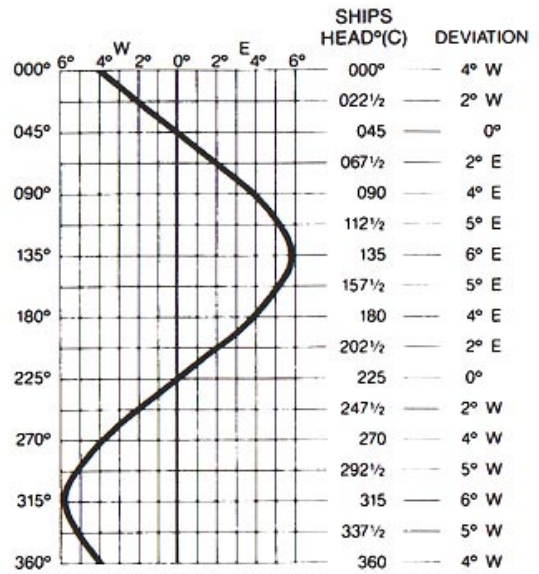
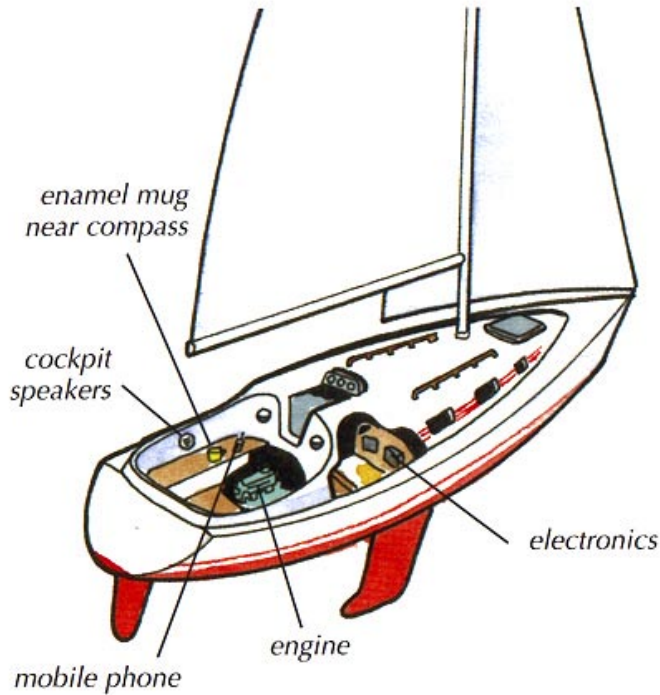
for example

With 5°W variation
 $070^{\circ}(T) = 075^{\circ}(M)$

With 5°E variation
 $070^{\circ}(T) = 065^{\circ}(M)$

DEVIATION

Deviation is caused by ferrous metals and electro-magnetic fields on board which will affect the accuracy of the compass.

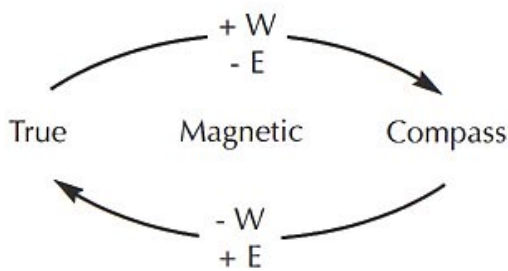


The ship's compass is swung to check the effect of magnetic influences on board, this will vary as the boat's heading changes.

A card can be produced for your steering compass showing the deviation for each heading.

How to apply variation and deviation

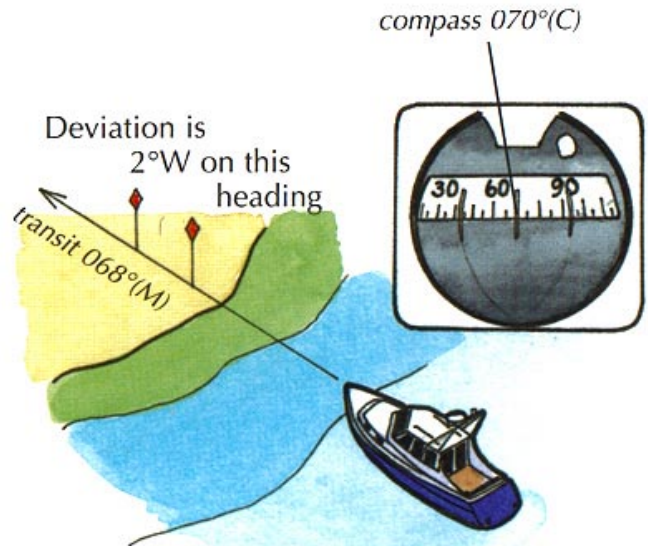
Chartwork is in °True -
compass courses must be in °Compass



Finding a compass course

True bearing from chart 060°(T)
Variation + 7°W
Magnetic bearing = 067°(M)
Apply deviation from card - 2°E

Compass course = 065°(C)

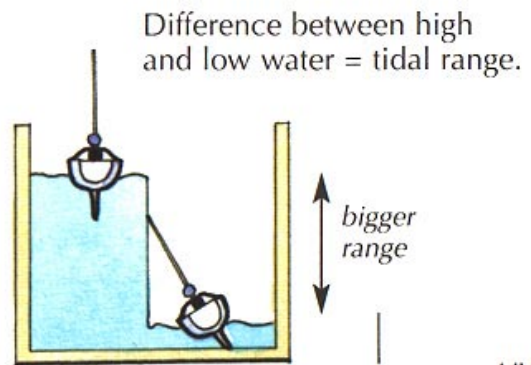
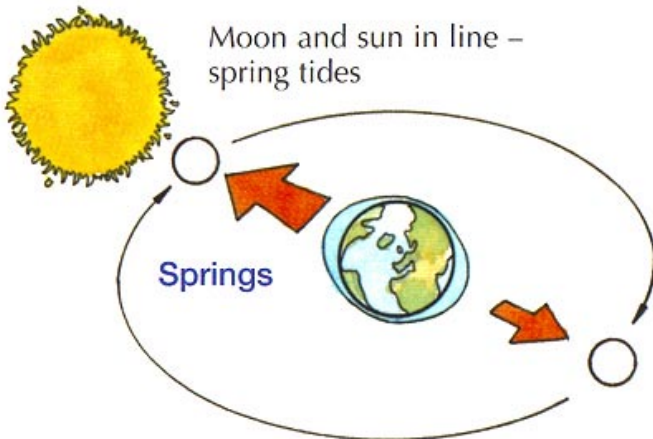
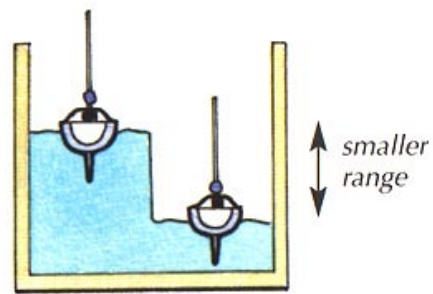
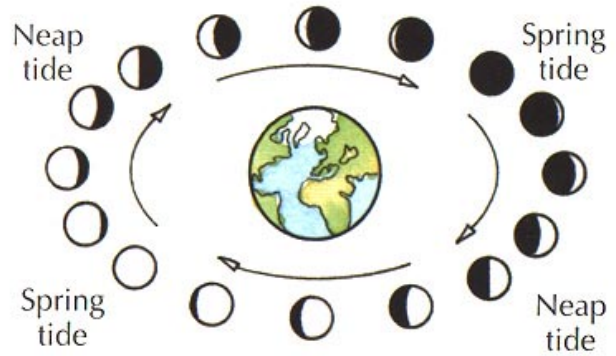
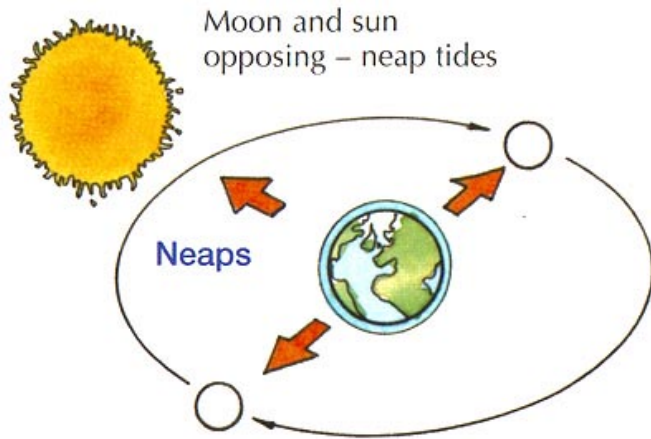


Checking for deviation

Point the boat straight at a transit and compare results.

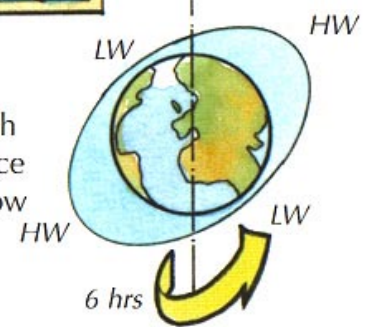
TIDES

The gravitational pull of the moon and sun is the main cause of tides.

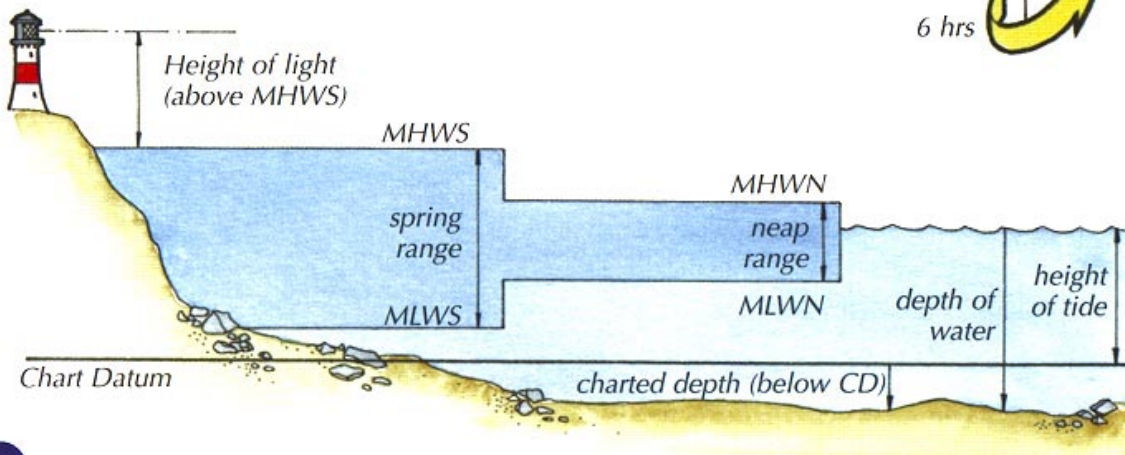


Daily tides

Each day as the earth rotates we experience two high and two low waters.



Tidal terms



HOW MUCH WATER?

The depth of water under your boat is measured with an echo sounder – ultrasonic signals are transmitted to and reflected from the seabed to give the depth of water on a digital or analogue display.

The transducer is sited below the waterline - allow for this when reading the display.

You can also calibrate for the display to read from waterline or bottom of keel.

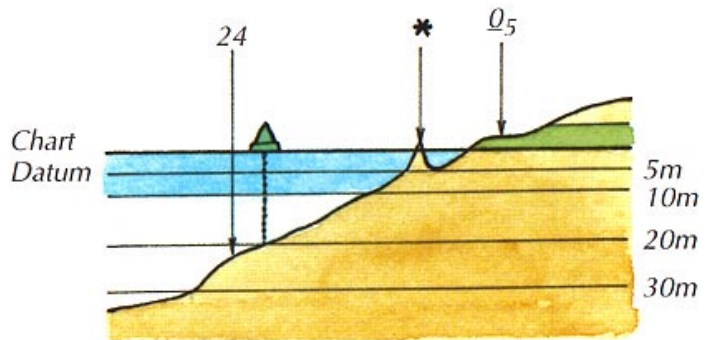
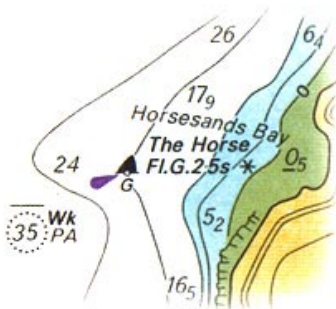
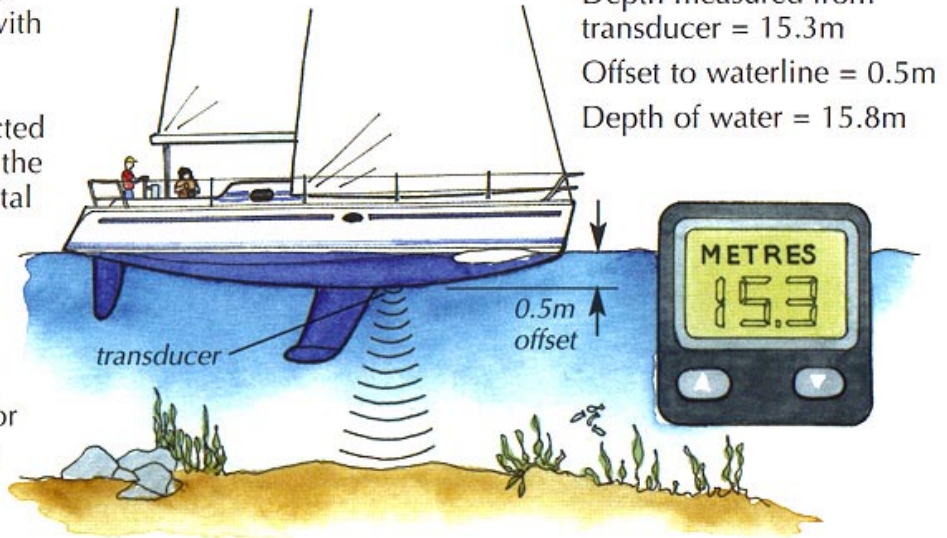


Chart shows depths you are likely to meet at the lowest predicted tide – Chart Datum (CD).

16	Time	m
	0043	4.5
	0715	2.0
TU	1316	4.6
	1957	1.8

Height of tide is measured above CD

Tide tables give the times and heights of high and low water for different ports.

17	0206	4.7
	0835	1.7
	W 1440	4.8

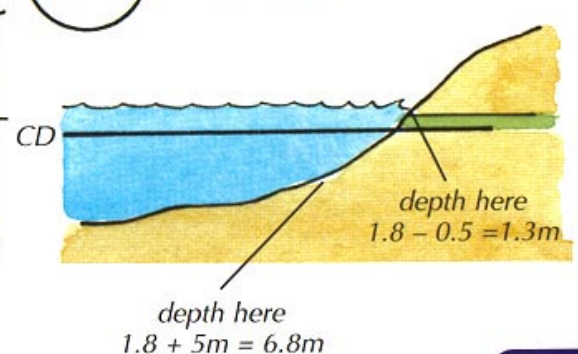
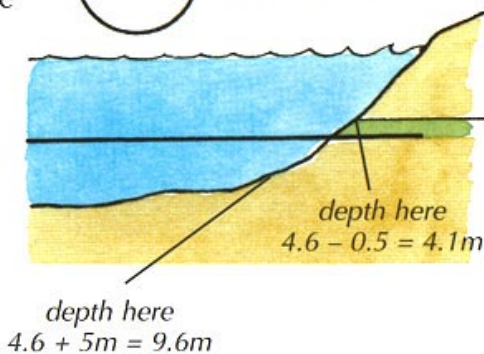
ADD depths below CD to the height of tide
 SUBTRACT drying heights from the height of tide.



High water
1316 4.6m



Low water
1957 1.8m



STANDARD PORTS

Standard ports – tide tables are produced for larger ports and give times and heights of high and low water for every day of the year.

MARCH				APRIL			
	m	Time	m		Time	m	
HW height	4.4	16 0245	4.8	1 0354	4.9	16 0422	5.3
	2.0	0917	1.4	1013	1.3	1047	0.6
	4.4	SA 1526	4.8	M 1621	4.9	TU 1651	5.3
LW height	1.9	2148	1.3	2231	1.3	2309	0.6
	4.7	17 0350	5.2	2 0437	5.1	17 0509	5.5
	1.6	1018	0.9	1054	1.1	1132	0.4
	4.7	SU 1624	5.1	TU 1703	5.1	W 1735	5.4
	1.5	2243	0.8	2312	1.0	• 2353	0.4

For summer time add 1 hr in non-shaded area.

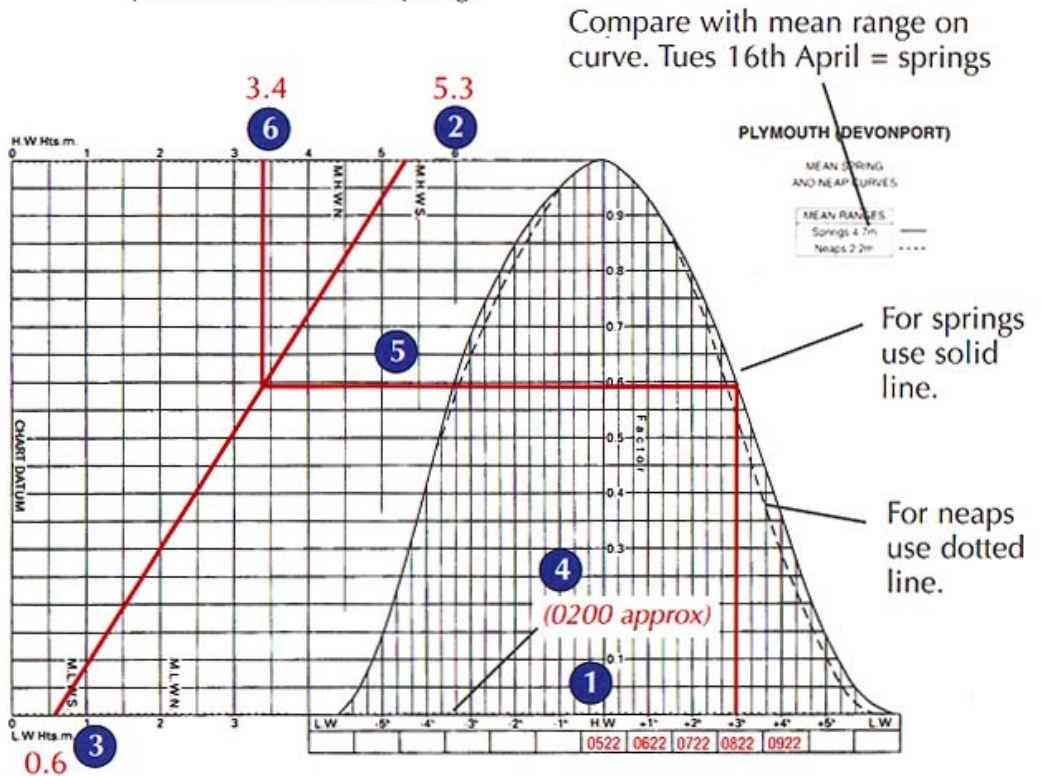
To find out if a certain day is on springs or neaps subtract LW from HW to give the range:
 $5.3\text{m} - 0.6\text{m} = 4.7\text{m}$

Moon symbol tells you that you are on or near springs

Tidal curves

Use these for finding out depth of water at any time between high and low water.

APRIL		
Time	m	
16	0422	5.3
	1047	0.6
TU	1651	5.3
	2309	0.6



e.g. What will be the height of tide at 0820 on Tues 16th April?

- 1 enter HW ht (local time) and fill in the boxes for each hour after HW
- 2 & 3 mark in the heights of HW and LW and draw a line between them
- 4 find 0820 on bottom scale
- 5 draw line upwards to hit the curve, across to meet the HW/LW line then up to the HW scale
- 6 there will be **3.4m at 0820**

You can also find out when there will be a specific depth - ie at what time will there be 3.4m height of tide?

Go down to the HW/LW line from the HW scale, across to the curve and down to the time scale = 0820

SECONDARY PORTS

Secondary ports – tide tables are not produced for minor ports. To find the height and times of HW and LW at these secondary ports you will need to apply corrections, usually found in an almanac, to the times and heights of the nearest standard port.

CARTERET Manche
Standard Port ST-MALO (→)

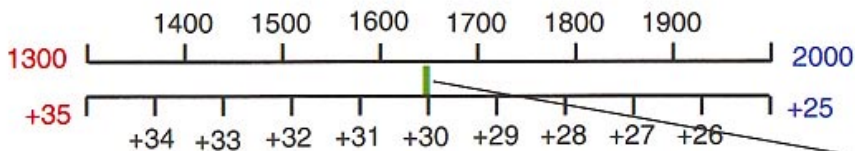
Times		Height (metres)			
High Water	Low Water	MHWS	MHWN	MLWN	MLWS
0100 1300	0300 1500 0800 2000	12.2	9.2	4.3	1.6
Differences CARTERET		-1.6	-1.1	-0.6	-0.3
+0035 +0025	+0020 +0035				

Time difference – if HW St. Malo is at 0100 or 1300 HW Carteret is 35 minutes later but when HW St. Malo is at 0800 or 2000 HW Carteret is 25 minutes later.

Height difference – when HW at St Malo is 12.2m it is 1.6m less at Carteret. When HW is 9.2m, it is 1.1m less at Carteret.

However if HW and LW times fall between these set times you will need to interpolate between the 'differences' figures -

e.g. if HW St. Malo is at 1630 what time is HW Carteret?



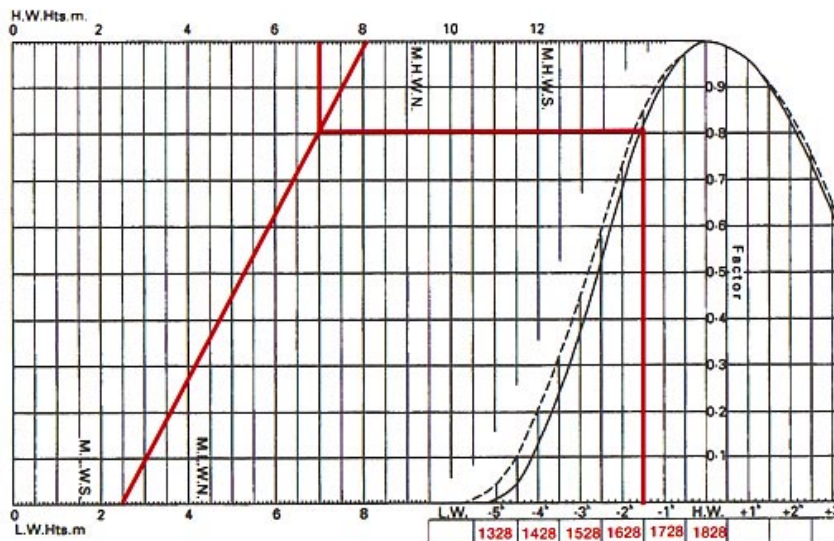
HW Carteret (30 mins later than HW St. Malo) = 1700.

Use the same method to interpolate height differences.

To find the height of tide between HW and LW at a secondary port use a tidal curve in the same way as for a standard port.

Use the related standard port.

For example to find tidal information for Carteret you should use the curve for St. Malo.



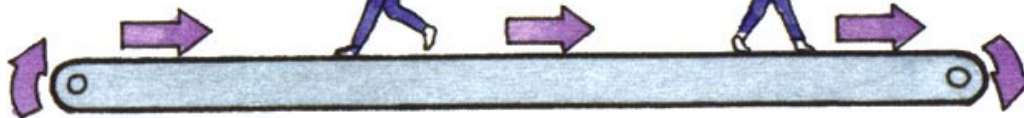
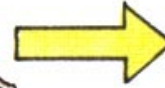
TIDAL STREAMS

Consider the tide as a travelator

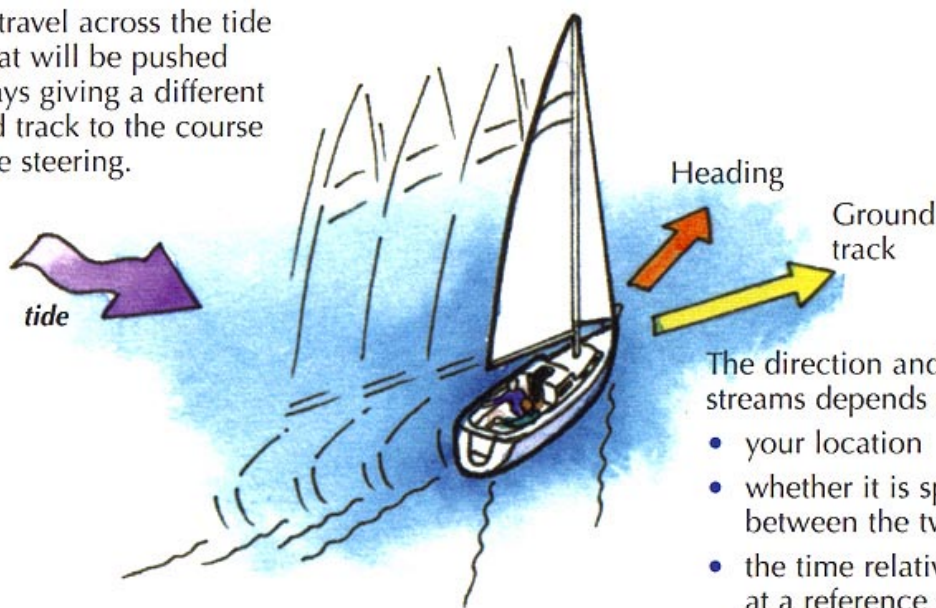
Go against the flow
- travel slowly



Go with the flow
- travel quickly



If you travel across the tide the boat will be pushed sideways giving a different ground track to the course you are steering.



- The direction and strength of tidal streams depends on
- your location
 - whether it is springs, neaps or between the two
 - the time relative to high water at a reference port.

FINDING THE STRENGTH AND DIRECTION OF THE TIDE

Tidal stream atlas

direction
(measure with
plotter)

03.07

spring rate
07 = 0.7kn

neap rate
03 = 0.3kn



time
1 hour before HW Plymouth
(6 hours after HW Dover)

Tidal diamond

Tidal Streams referred to
HW at PLYMOUTH

Hours	E 50°02'65 N 5 50-10W		
6	227	1.0	0.5
5	232	1.4	0.7
4	234	1.5	0.7
3	241	0.8	0.4
2	307	0.3	0.1
1	034	0.7	0.3
High Water	048	1.1	0.6
1	055	1.4	0.7
2	061	1.4	0.7
3	060	0.8	0.4
4	074	0.3	0.2
5	201	0.2	0.1
6	222	0.8	0.4

spring rate (kn)

neap rate (kn)

direction (°T)

time

TIDAL STREAMS

Example

What is the rate and direction of the tidal stream at a position near Plymouth at 0815 BST on Fri 23rd Aug?

- 1 Find the time of HW and the heights of HW & LW at Plymouth on Fri 23rd Aug

	Time	m	
23	0505	1.9	1135 UT 1235 BST is the nearest HW to 0815
	1135	4.5	
	F 1758	2.0	
24	0006	4.4	
	0649	2.0	
	SA 1258	4.5	

- 2 Is it springs, neaps or in between?

$$\begin{array}{r} 4.5 \\ - 1.9 \\ \hline \text{range } 2.6\text{m} \end{array} = \text{Neaps (more or less)}$$

- 3 How many hours before or after HW is 0815?

-5	0735	0705	
-4	0835	0805	0815 falls in this hour
		0905	
-3	0935	1005	
-2	1035	1105	HW is taken as being the midpoint of the hour i.e. the rate & direction given is an average for between 1205 - 1305
-1	1135	1205	
HW	1235	1305	

- 4 Find the nearest \diamond to your position = $\diamond C$

Spring rate = 2.3kn
Neap rate = 1.1kn
Direction of tidal stream = 278°(T)

$\diamond C$	50°12'55N 5 05 00W		
- 4hrs	277	1.9	1.0
	280	2.3	1.1
	278	2.3	1.1
	279	1.7	0.8
	296	0.6	0.3
HW	063	0.8	0.4
	081	1.9	0.9
	083	2.2	1.1
	077	2.2	1.1
	070	1.9	0.9
	055	1.0	0.5
	310	0.5	0.3
	280	1.4	0.7

- 5 Or using a tidal stream atlas which is the nearest arrow?



Neap rate = 1.1kn
Measure direction of arrow = 278°(T)

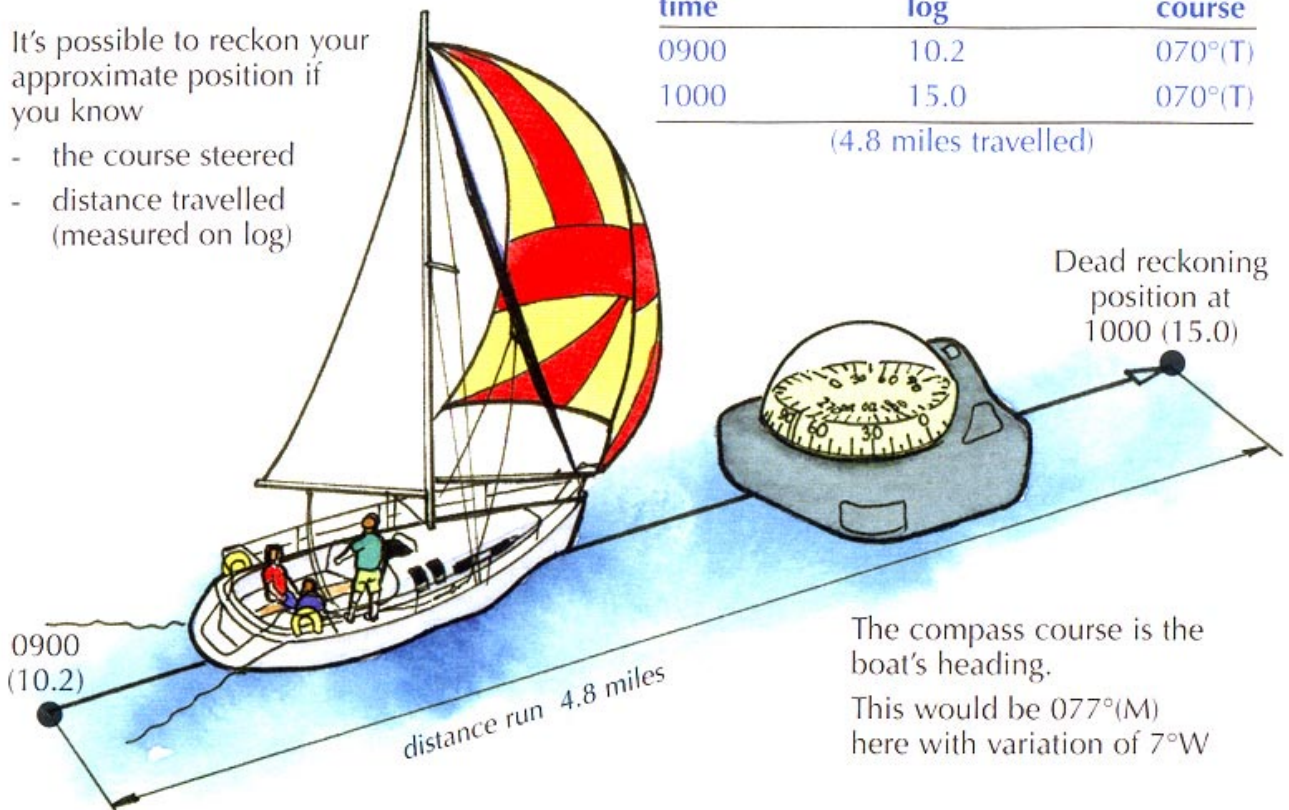
DEAD RECKONING POSITION

It's possible to reckon your approximate position if you know

- the course steered
- distance travelled (measured on log)

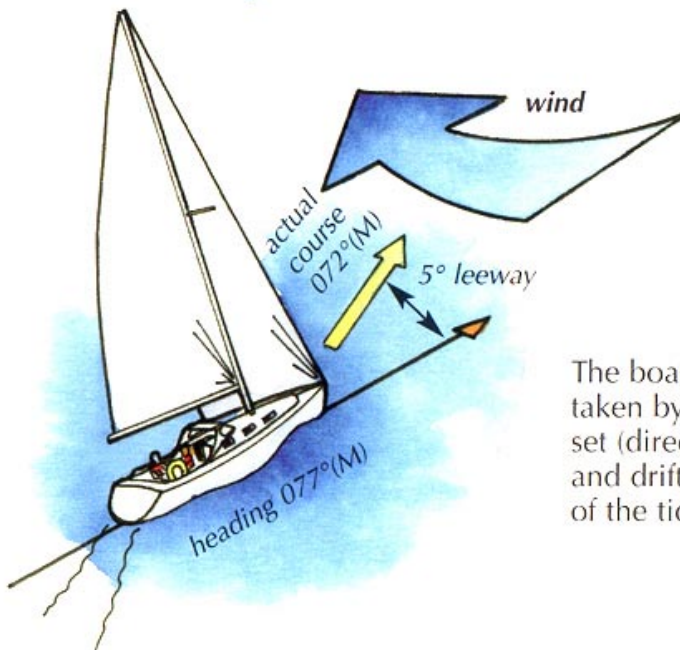
time	log	course
0900	10.2	070°(T)
1000	15.0	070°(T)

(4.8 miles travelled)

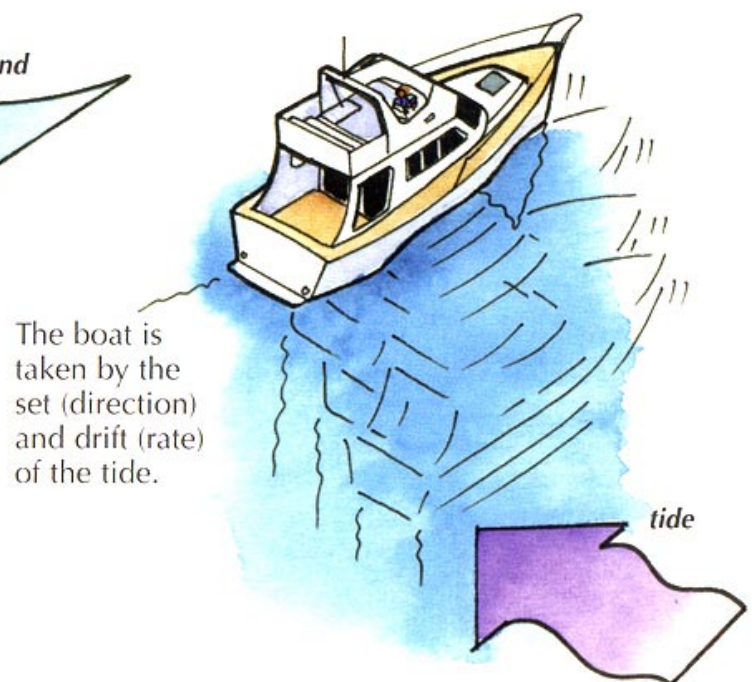


The effect of wind and tide means we don't always travel in the same direction as the compass course steered.

Effect of leeway



Effect of tide

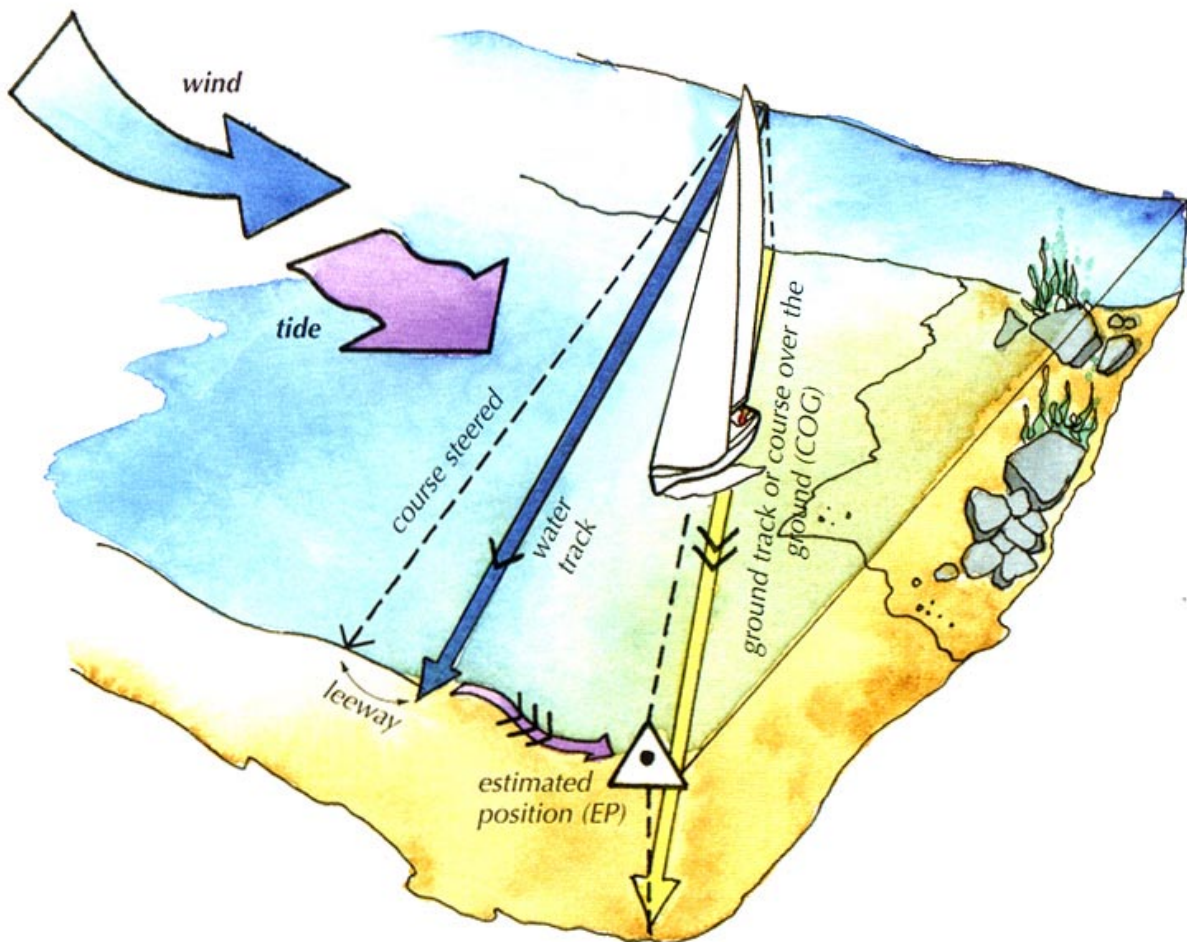
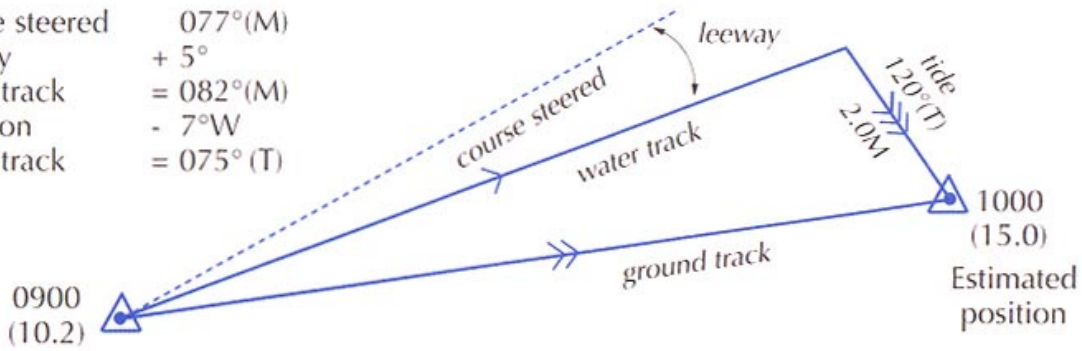


ESTIMATED POSITION

To plot an EP

time	log	course	leeway	wind	tide
0900	10.2	077°(M)	5°	N5	140°(T) 1.4kn
1000	15.0	077°(M)	5°	N5	120°(T) 2.0kn tide for 0900-1000

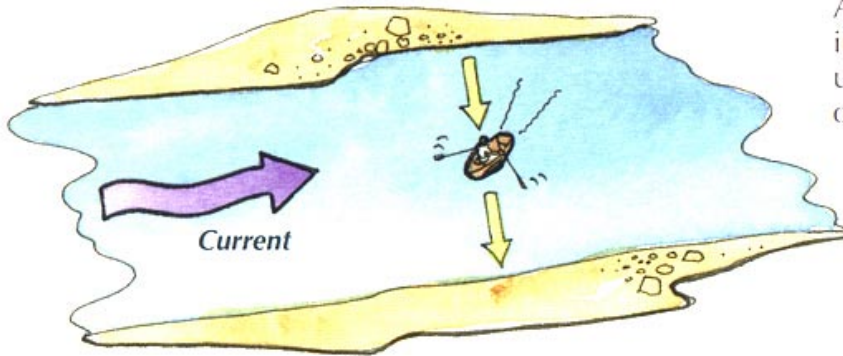
Course steered 077°(M)
 Leeway + 5°
 Water track = 082°(M)
 Variation - 7°W
 Water track = 075° (T)



symbols used in chartwork

water track		EP	
ground track		fix	
tide set and drift		waypoint	
DR position			

COURSE TO STEER



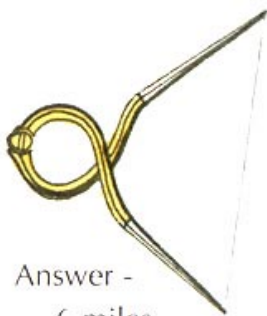
A person rowing across a river instinctively angles the boat upstream to counter the effect of the current.

At sea we often can't see our destination so we need to calculate how much to angle into the tide to make the most direct passage.

For example:

If I am at position A at 2100 Wed 17th April, what is the course to steer to waypoint B?

1 How far is it from A to B?



Answer -
6 miles

2 If I think my boat will be capable of 9kn on this passage how long will it take to travel 6 miles?



Answer – roughly an hour because it appears that the tide will push me back.

COURSE TO STEER

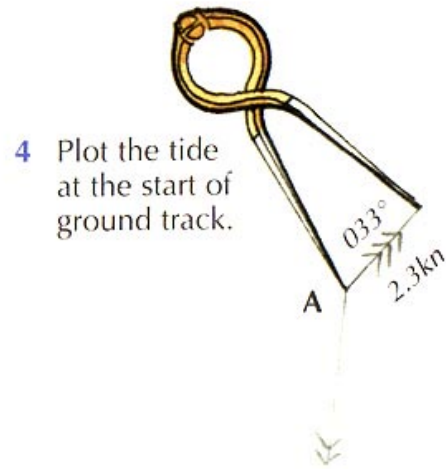
3 Leaving at 2105 how will the tide affect my passage for the next hour?
Use diamond \diamond (RYA Training Chart 1)

Wed 17th April HW Plymouth = 1835 BST springs

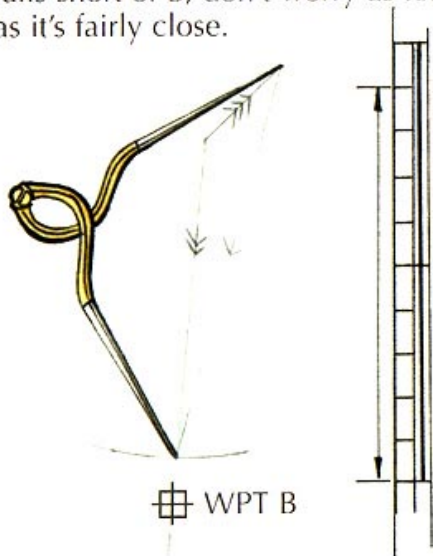
HW	1835	{	1905	= 1835 BST springs
+1	1935	{	2005	
+2	2035	{	2105	
+3	2135	{	2205	

2100 - 2200 = HW +3

Answer 033°(T) 2.3kn

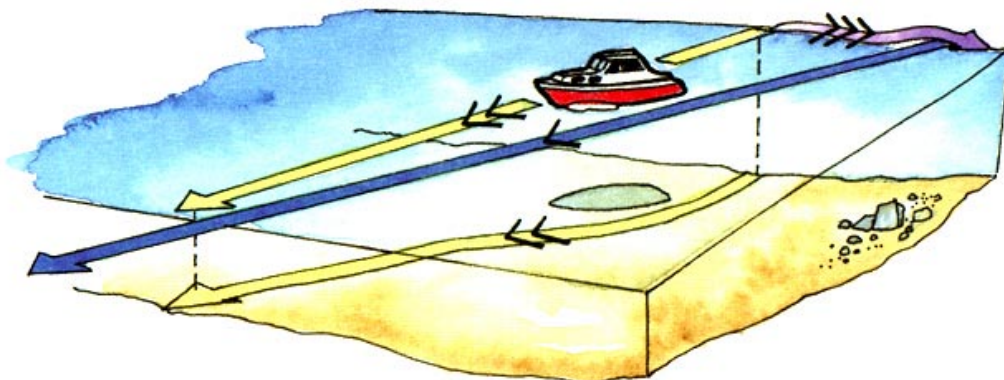
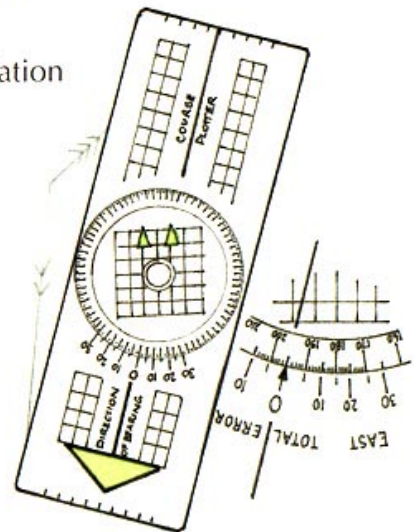


5 Measure the expected boat speed for one hour (9kn) and arc dividers from end of tide to cross ground track, this usually goes beyond or falls short of B, don't worry as long as it's fairly close.



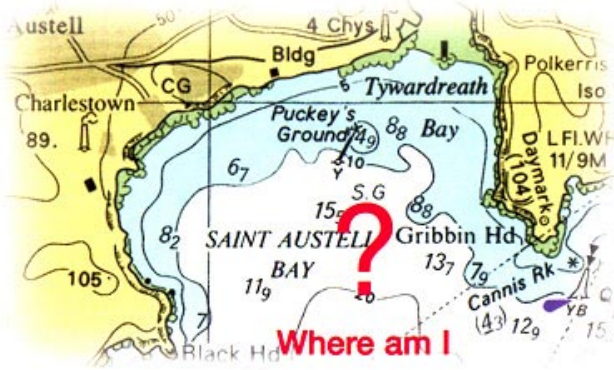
6 Measure bearing of water track - this will be your **course to steer**.

$$\begin{array}{r} 193^\circ(T) \\ + 7^\circ W \text{ variation} \\ \hline 200^\circ(M) \end{array}$$



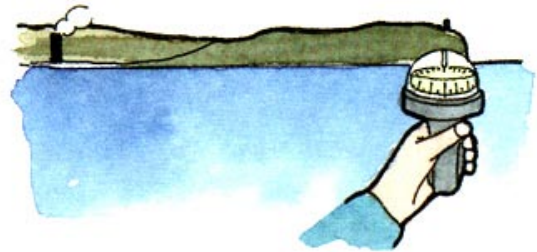
Although you are steering 200°(M) your ground track will be the shortest route from A to B.

A VISUAL FIX

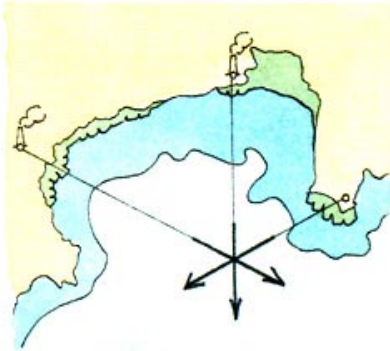


Three point fix

Take bearings on charted objects to fix your position.

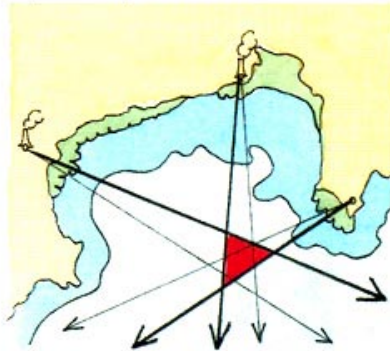


Draw the bearings on the chart.



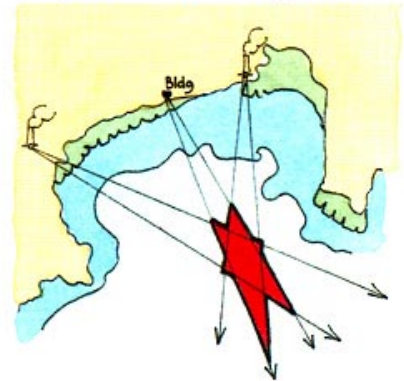
Your position will be where the lines intersect. Use closer objects for greater accuracy.

Bearings rarely line up as a perfect fix.

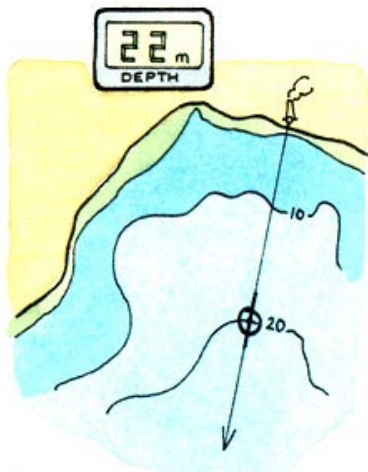


Error produces a cocked hat.

If bearings are too close together - error is greater.



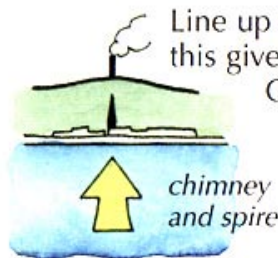
Don't use objects that will give a poor angle of cut.



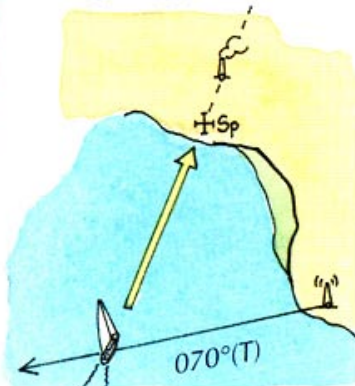
Bearing and contour

Fix your position by taking a bearing on a charted object as you cross a contour - don't forget to allow for the height of tide.

Transit and bearing



Line up two charted objects to make a transit - this gives you a very accurate position line. Obtain a fix by taking a bearing on another object, preferably at about 90° to the transit.



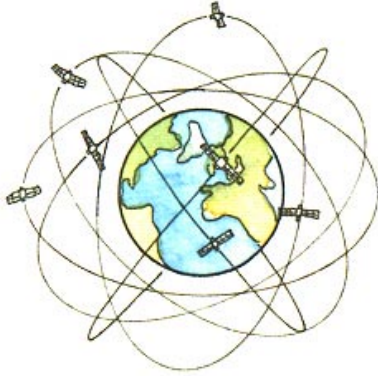
The simplest fix

Plot your position as you pass a charted object.

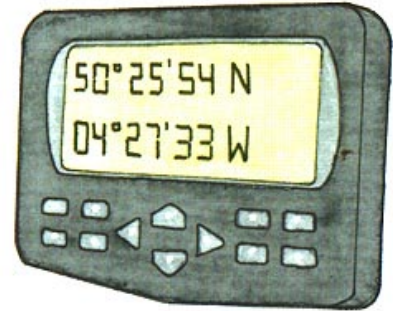


A GPS FIX

A GPS receiver obtains a fix from signals transmitted by orbiting satellites - this gives a position which is accurate to about 15 metres.



The simplest way to use GPS is to plot your position from the Latitude and Longitude given on the display.

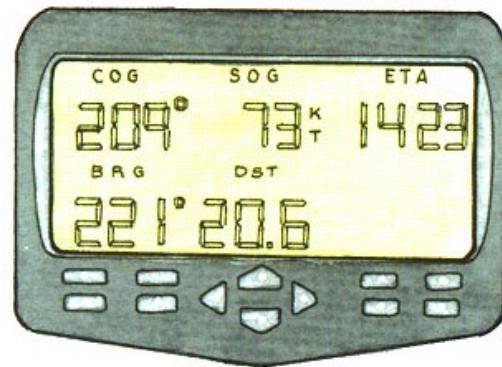


It can also give:

- your current course and speed over the ground
- information about your position in relation to waypoints (see next page).

GPS is generally reliable and accurate but, as with all electronics, it can go wrong. The main things that can affect it are:

- power or aerial failure
- transmissions from mobile phones
- interruption or changes to the satellite system.



Always back up your GPS position with information from another source such as:



Bearing



A charted object.



Depth allowing for tide.

Keep a record of your position at regular intervals on the chart and in the ship's log.



WAYPOINTS

Waypoints (WPTs) are tools to help you navigate. They are positions stored in the memory of a GPS and used as reference points.



For example you could use a WPT placed at the entrance of a harbour to help guide you safely into port.



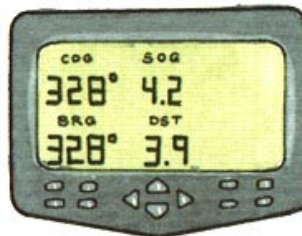
You obtain WPTs from:

- the chart – double check you have the correct lat and long
- publications such as almanacs, directories and magazines.

The GPS display can show the distance and bearing to a WPT and your current course and speed.

Be careful when you input a WPT into a GPS. It's as easy to put in the wrong position as it is to dial a wrong phone number.

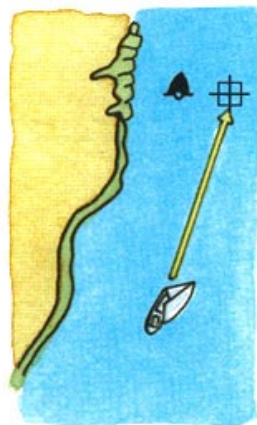
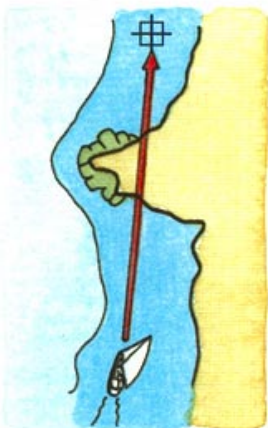
When you input a WPT always check that the distance and bearing given by the GPS matches the distance and bearing that you have measured on the chart. Any difference means you have probably input the WPT lat and long incorrectly.



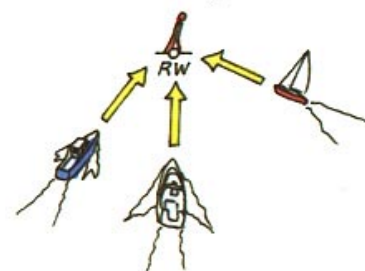
Never input a WPT straight from a book or magazine.

Always plot it on a chart to check your route.

Plot your WPT adjacent to rather than directly on charted objects - you could hit them.

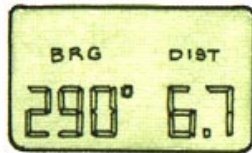


In busy areas bear in mind that lots of boats could be using the same WPT.



OTHER WAYS OF USING WAYPOINTS

You can plot your position quickly and simply by entering easily found positions as WPTs. The GPS will give you a distance and bearing to the WPT and you can plot these to give a fix. This is easier, quicker and less prone to error than plotting by lat and long but double check that you have entered the WPT correctly.



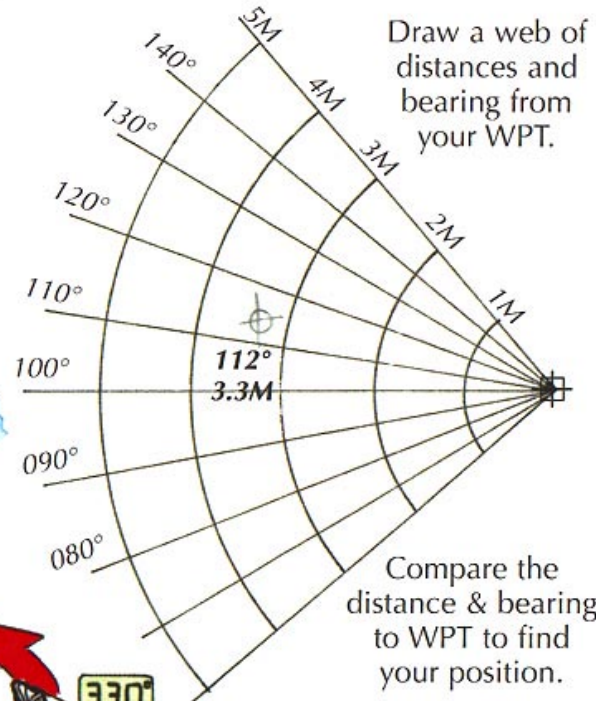
Plotter reference on chart

You can also use the WPT that you are travelling to.



Plotting at speed

Conventional plotting can be difficult on a fast boat at speed. Navigation must be pre-planned.

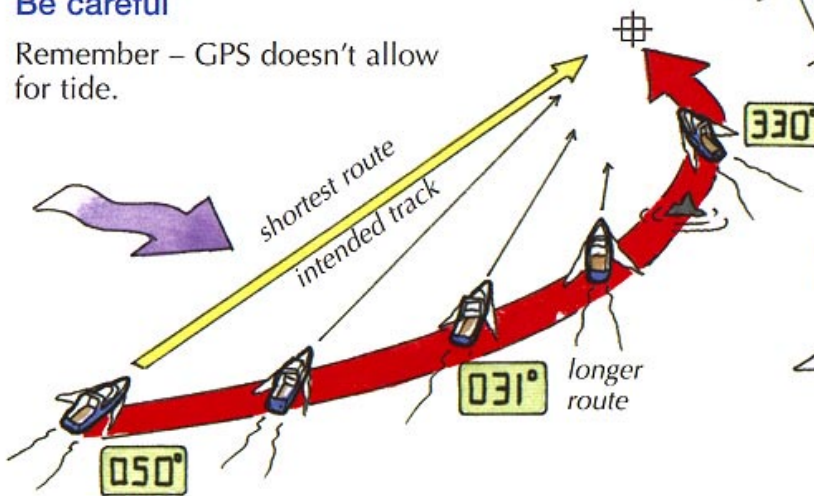


Draw a web of distances and bearing from your WPT.

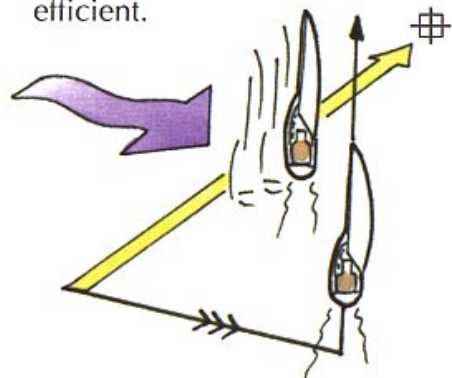
Compare the distance & bearing to WPT to find your position.

Be careful

Remember – GPS doesn't allow for tide.



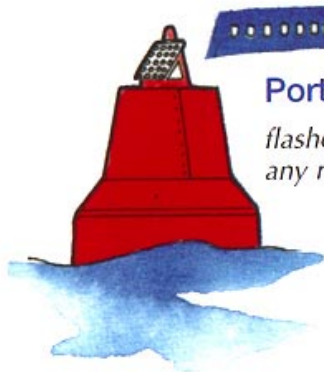
Always pre-plan a course to steer to allow for tide – it's more efficient.



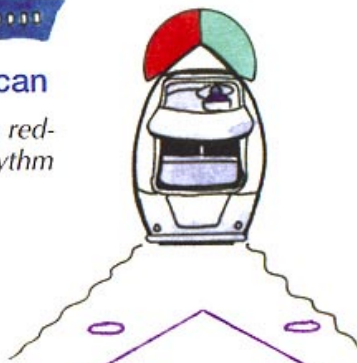
It seems easy to just steer the bearing that the GPS gives you to a WPT but if there is significant cross tide you:

- will sail a longer route
- could put the boat in danger.

BUOYAGE



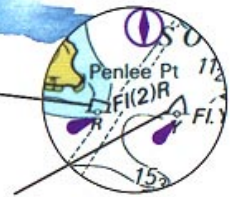
Port can
flashes red-
any rhythm



direction of
buoyage



Starboard cone
flashes green-
any rhythm



port can

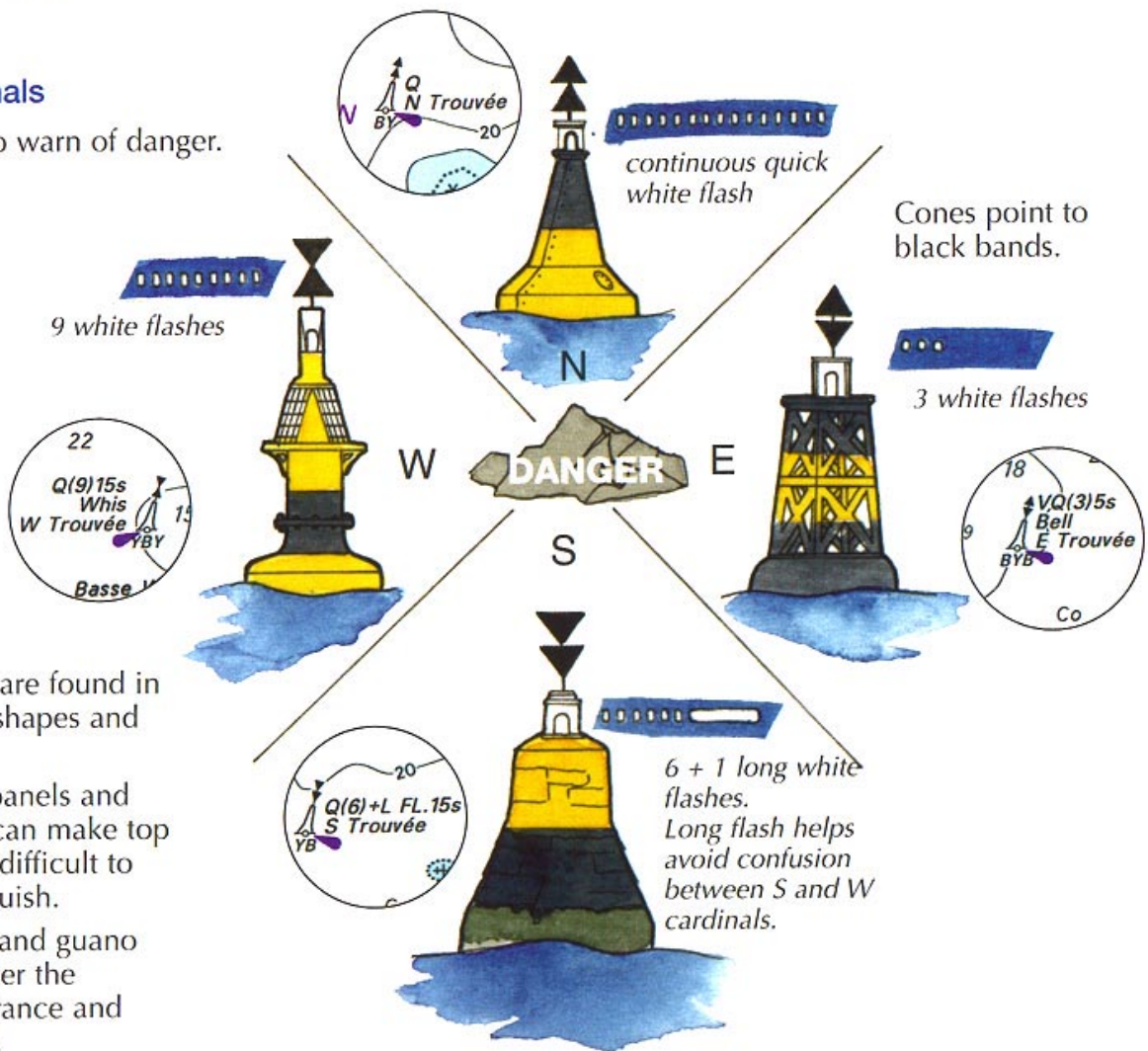
starboard
cone

Lateral marks

Used to mark channels.
Leave starboard cone to your
starboard side when going
into harbour.

Cardinals

Used to warn of danger.



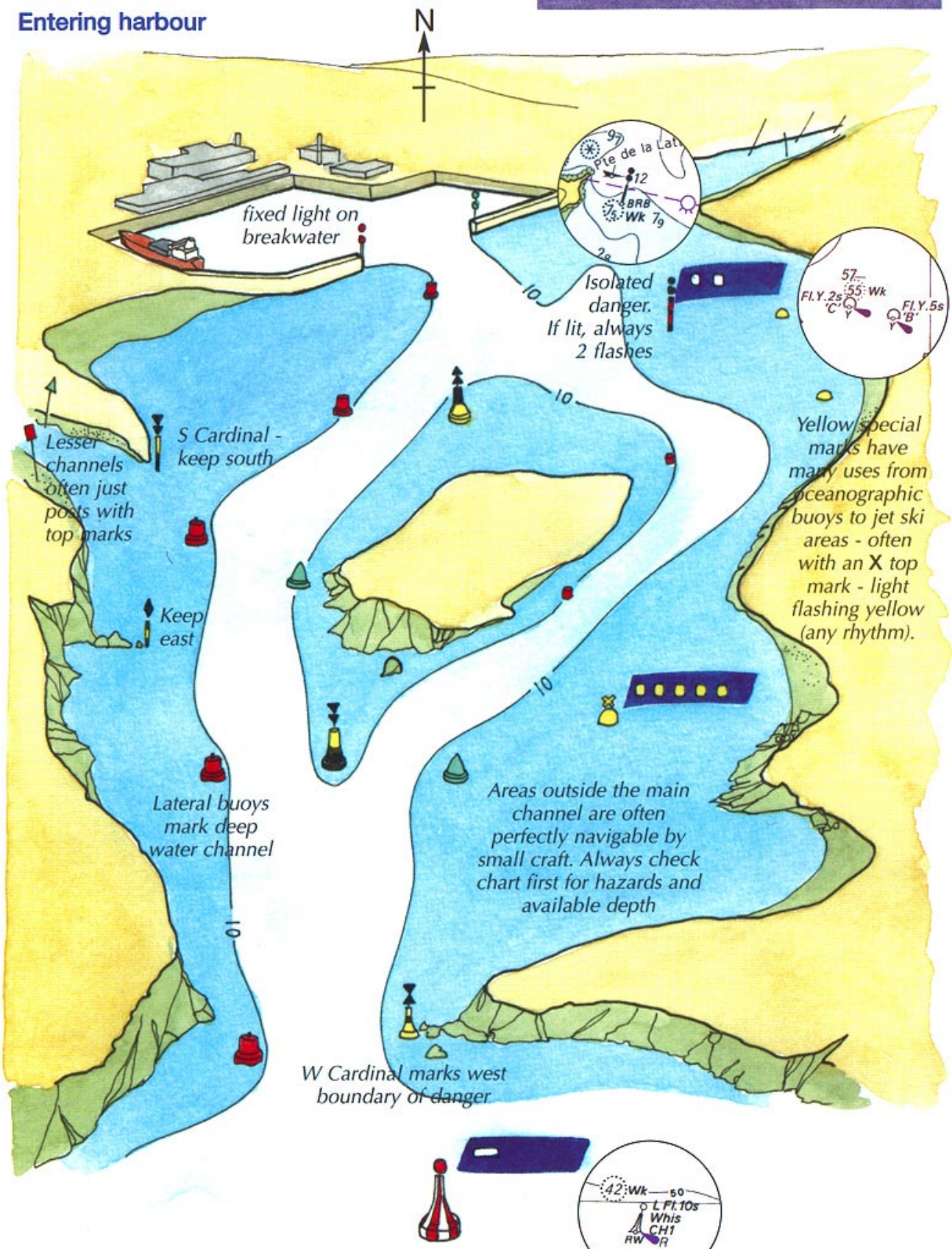
Buoys are found in
many shapes and
sizes.

Solar panels and
lights can make top
marks difficult to
distinguish.

Weed and guano
can alter the
appearance and
colour.

LIGHTS

Entering harbour



fixed light on breakwater

9
Pte de la Lat
12
BRB
5:Wk 7₉
2_a

Isolated danger.
If lit, always 2 flashes

57
FLY.2s
:55:Wk
FLY.5s

Lesser channels often just posts with top marks

S Cardinal - keep south

Keep east

Lateral buoys mark deep water channel

Yellow special marks have many uses from oceanographic buoys to jet ski areas - often with an X top mark - light flashing yellow (any rhythm).

Areas outside the main channel are often perfectly navigable by small craft. Always check chart first for hazards and available depth

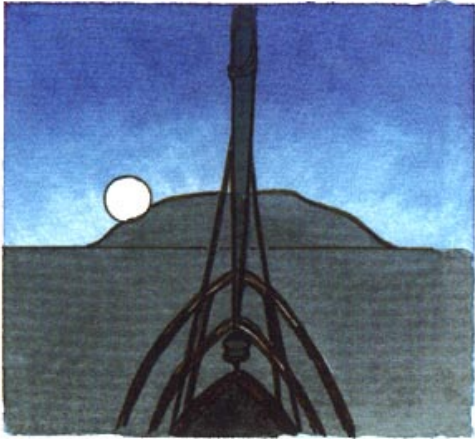
W Cardinal marks west boundary of danger

42:Wk-50
L Pt. 10s
Whis CH1
RW/R

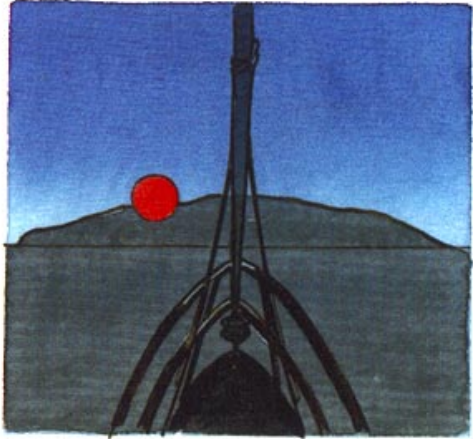
Fairway buoy - safe water mark at entrance to harbour or start of buoyed channel

LIGHTS

SECTOR LIGHTS



A In white sector



B In red sector

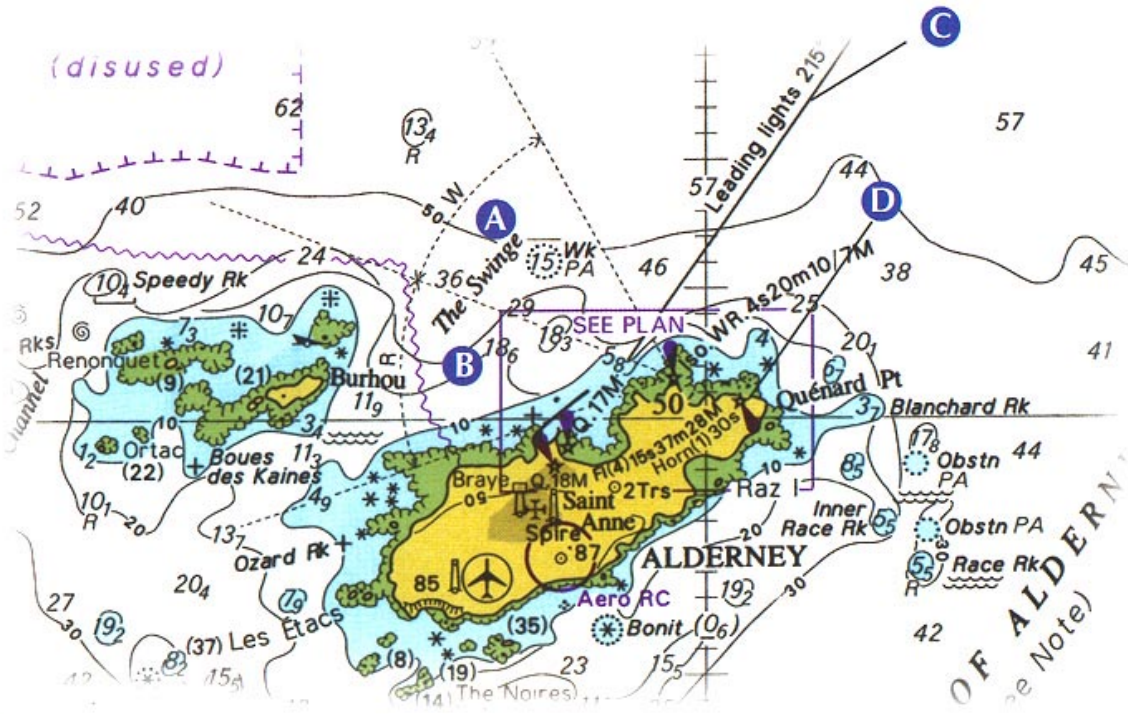


4 secs



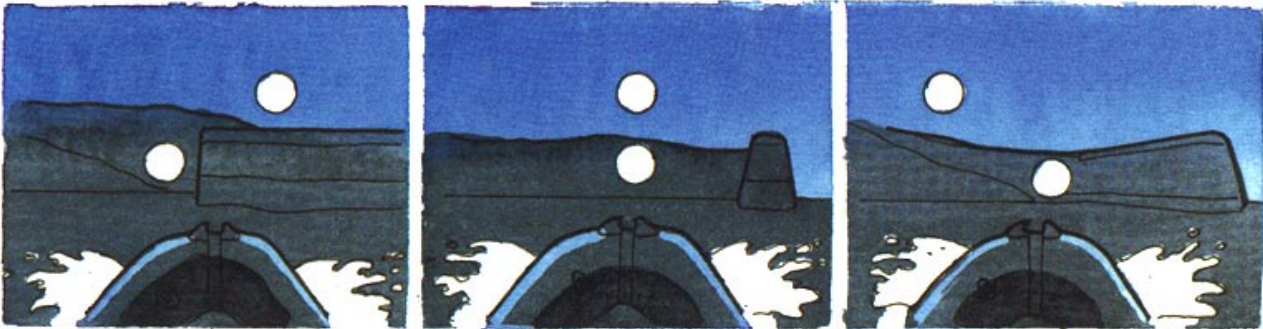
Iso. WR. 4s 20m 10 / 7M

equal light and dark 20m above MHWS white - visible 10 miles in good conditions red - visible 7 miles in good conditions



LIGHTS

C LEADING LIGHTS guide you in and out of harbour



Too far to starboard

On course

Too far to port

Upper light

Q 17M visible 17 miles

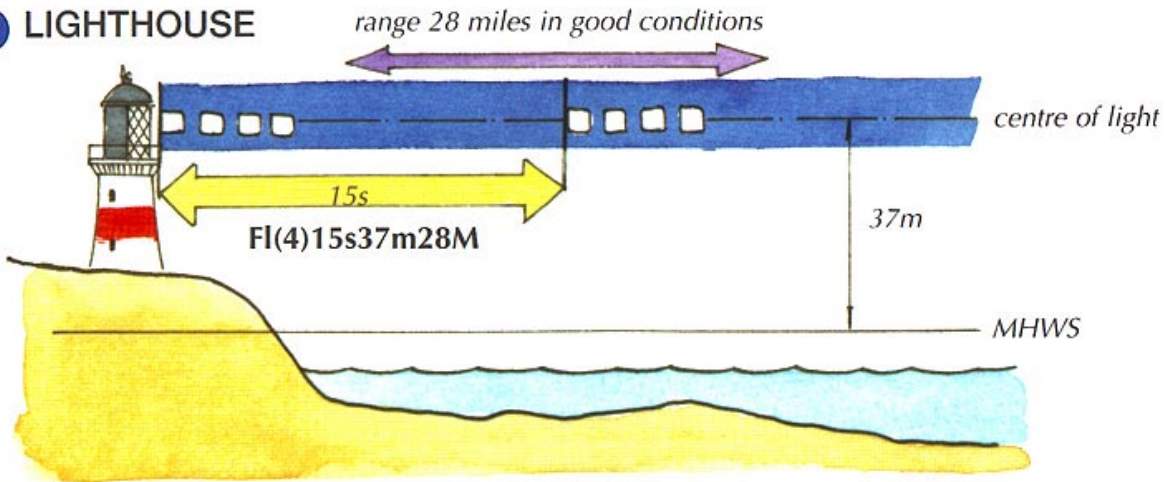
Lower light

Q 18M visible 18 miles

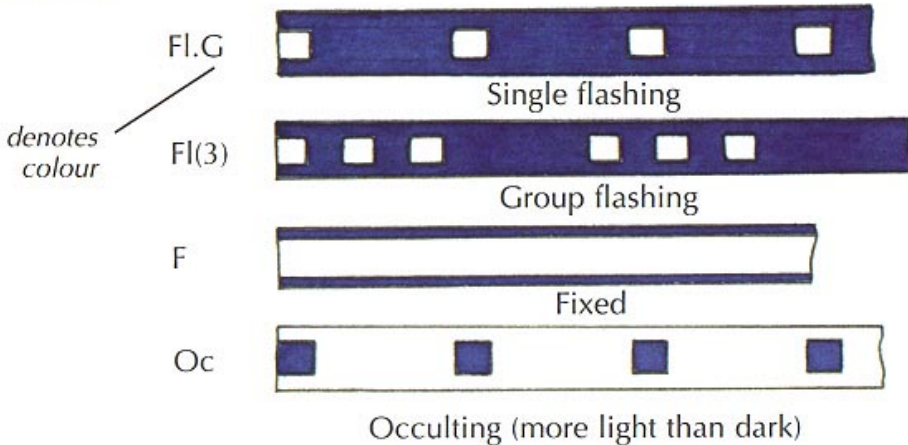
quick white continuously flashing

in good conditions

D LIGHTHOUSE



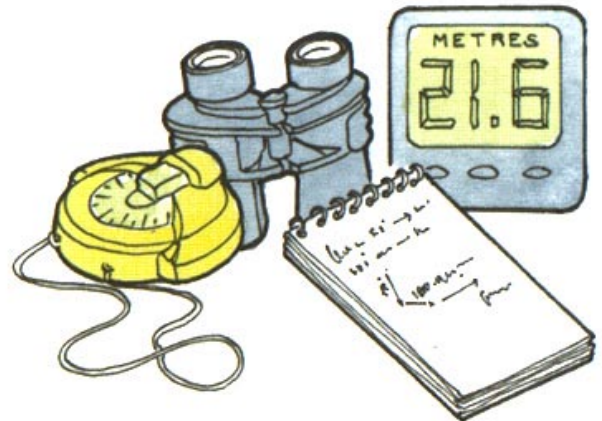
Other light characteristics



PILOTAGE

Pilotage is the art of inshore navigation when you have visual references to help you find your way along the coast and in and out of harbour.

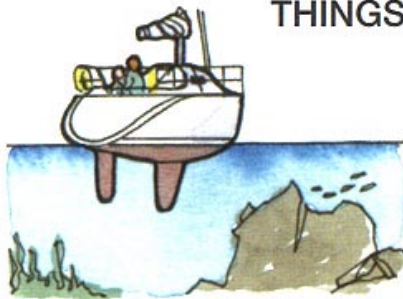
There may be lots of different hazards so good planning is essential.



Don't spend too much time down below – you will soon lose track of where you are and put yourself in danger.

Making a good plan means you can navigate from on deck.

THINGS YOU MIGHT NEED TO PLAN FOR



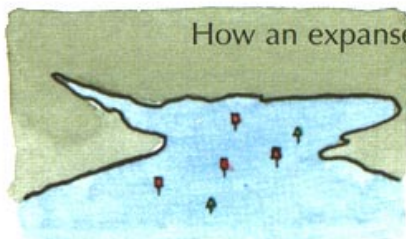
Rocks



Shoals & shallows

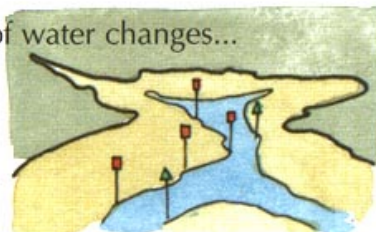


Shipping channels



How an expanse of water changes...

at high water



and low water



Chain ferries

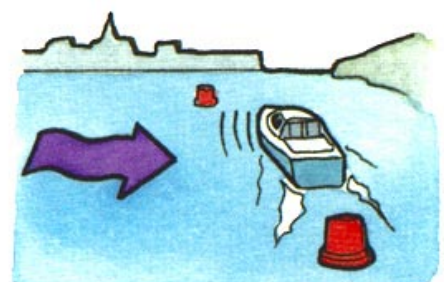


Harbour byelaws

e.g. Small craft channels



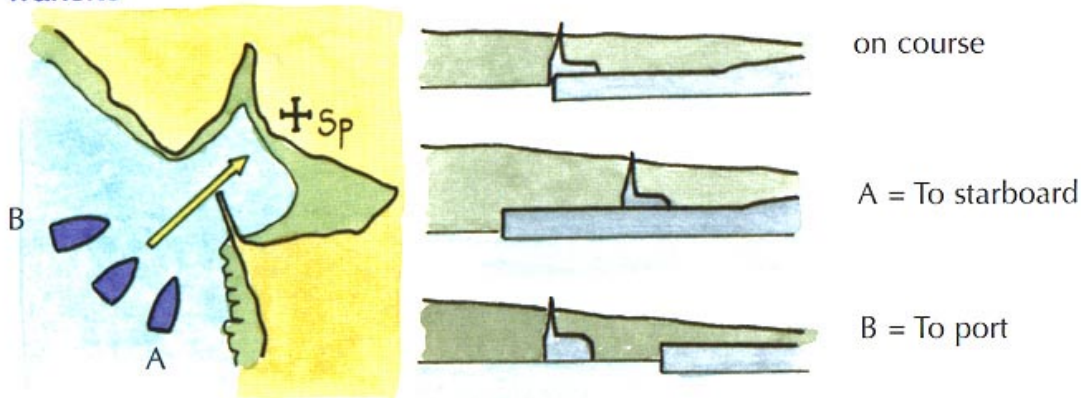
Speed restriction in channel



Effect of tide

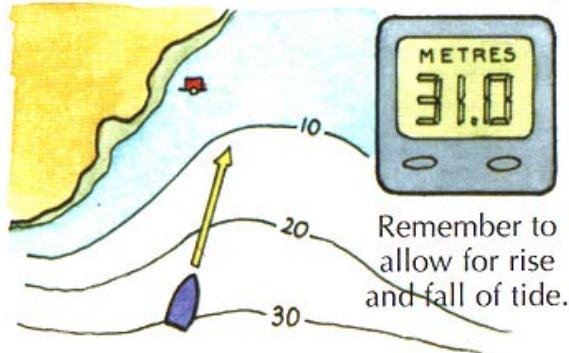
PILOTAGE TECHNIQUES

Transits

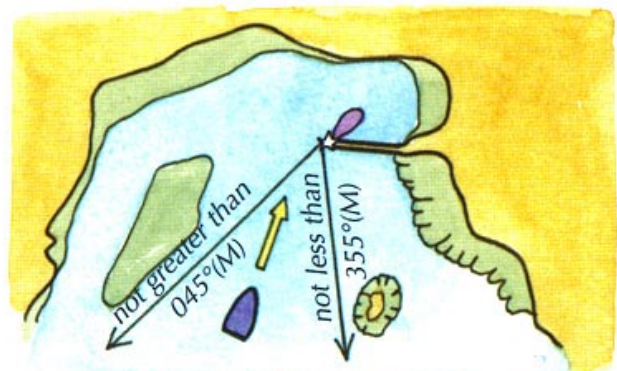


Contours

You can work out where you are when you cross a contour and they can be followed in poor visibility.

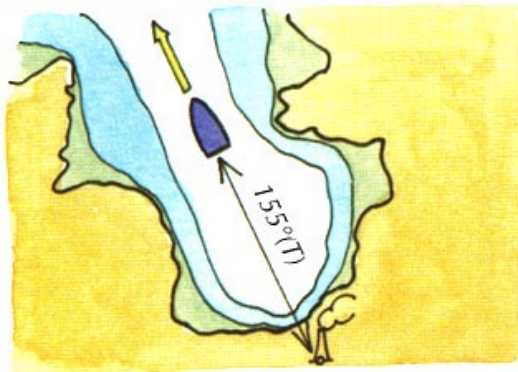


Clearing bearing

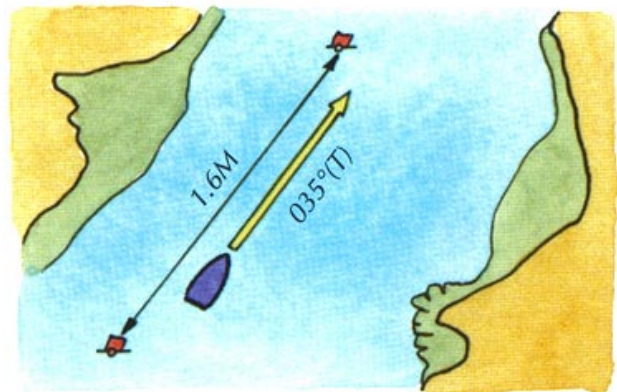


You can go anywhere between the two bearings.

Back bearing

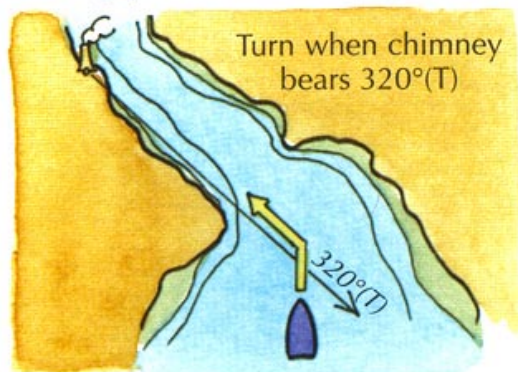


Bearing + distance

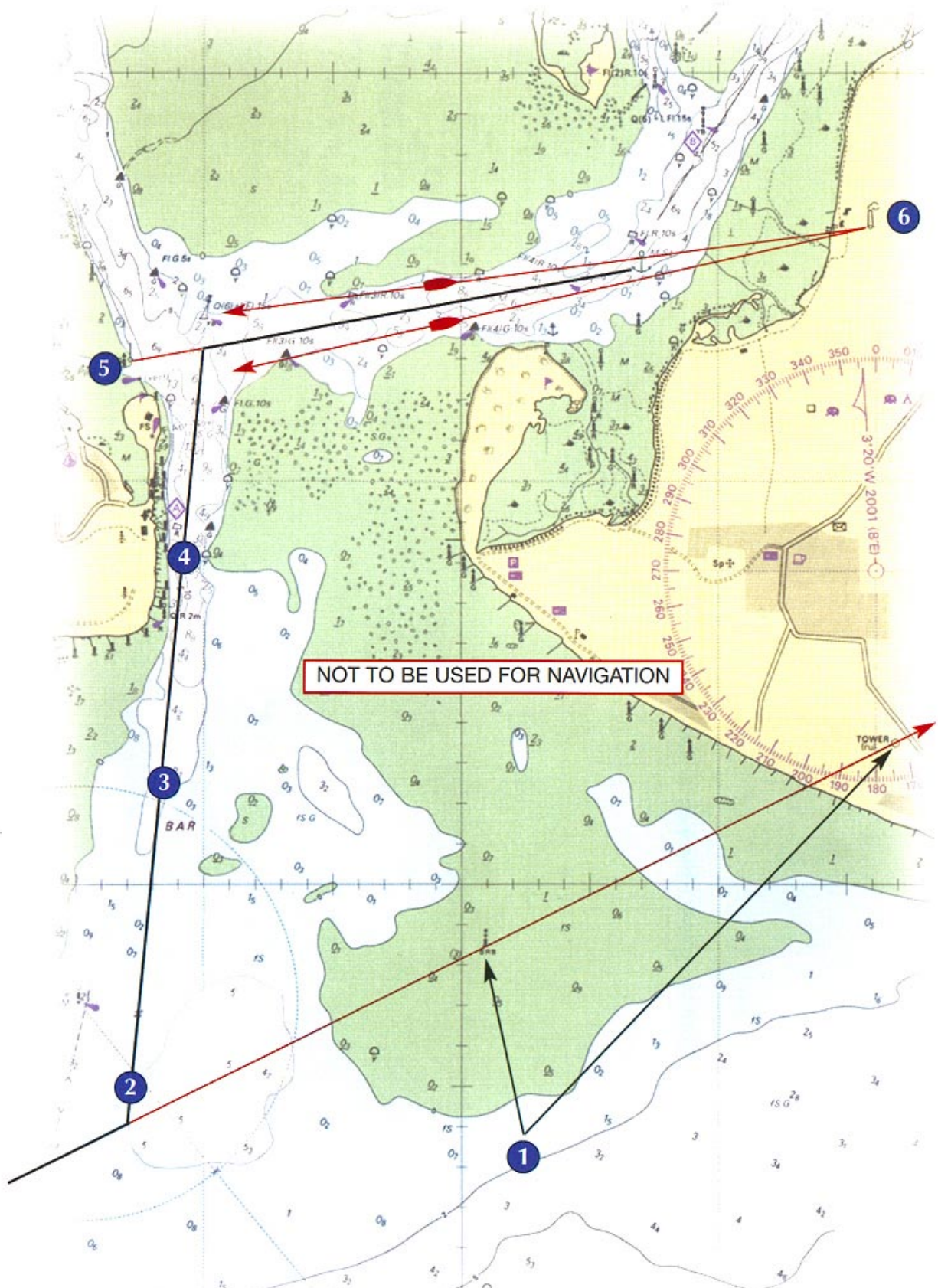


Work this out in advance so you know when and where to expect the next buoy

Turning points



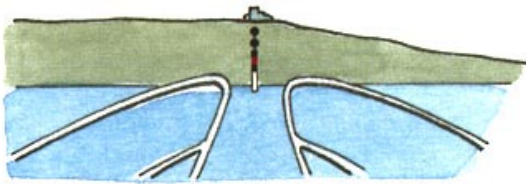
MAKING A PILOTAGE PLAN



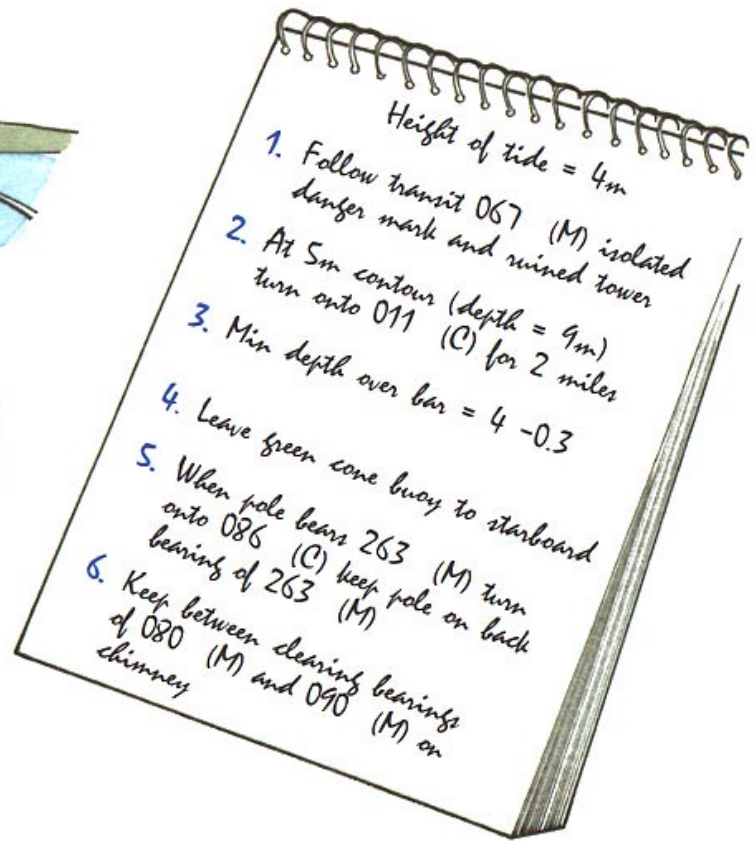
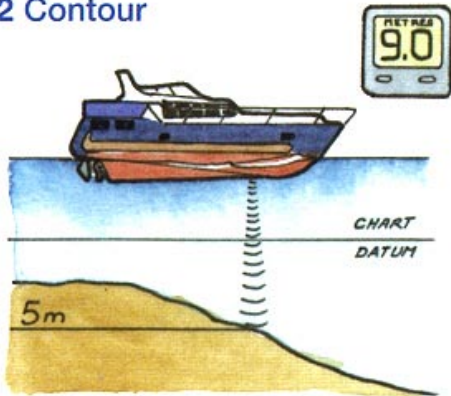
Reproduced from Admiralty Small Craft Chart 5600.10 by permission of the controller of Her Majesty's Stationery Office and the UK Hydrographic Office.

FOLLOWING YOUR PLAN

1 Transit



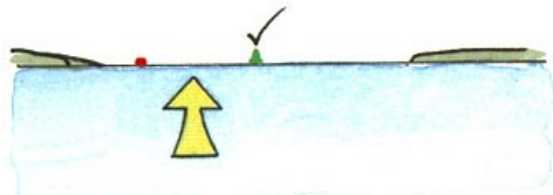
2 Contour



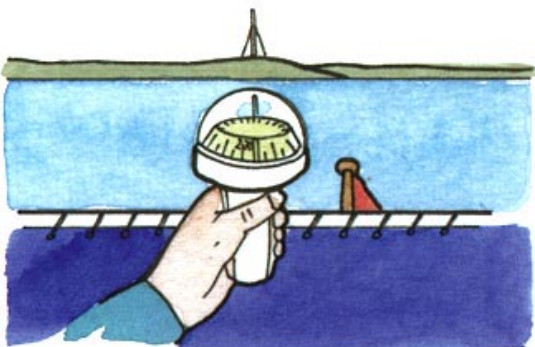
3 Clearance over bar



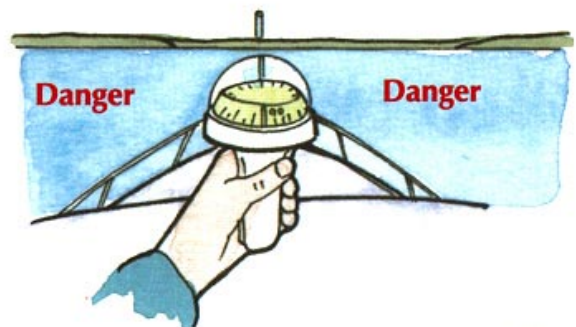
4 Positive identification of marks



5 Back bearing

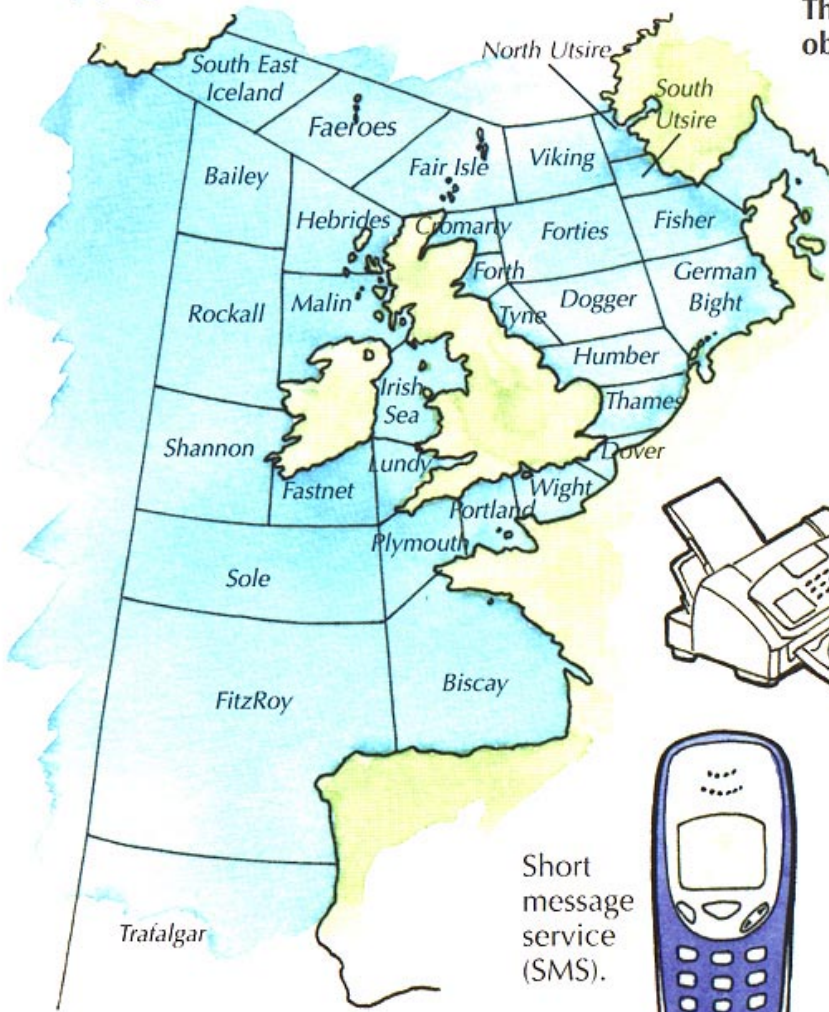


6 Clearing lines



WEATHER FORECASTS

Shipping Forecast Areas



There are many different ways to obtain a forecast.



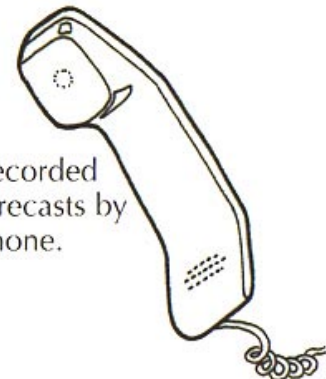
Marine safety information broadcasts on VHF by Coastguard.



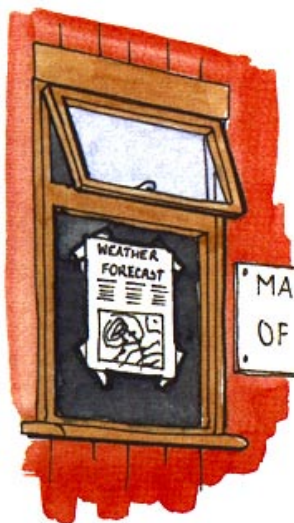
Metfax



Short message service (SMS).



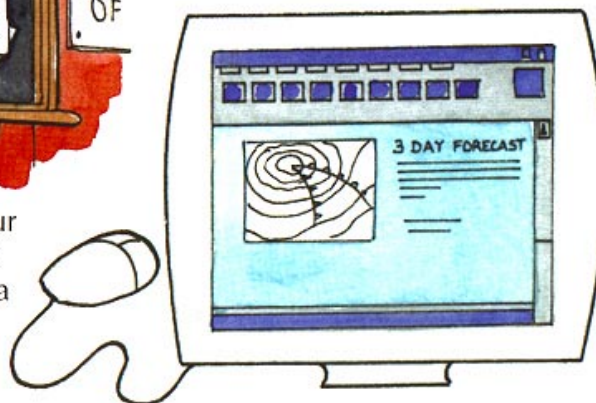
Recorded forecasts by phone.



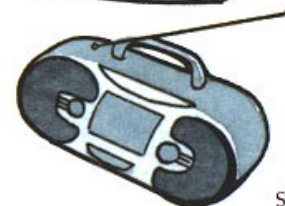
Many harbour and marina offices post a forecast.

For details of forecast times etc. look in an almanac or RYA book of Weather Forecasts (G5)

Internet

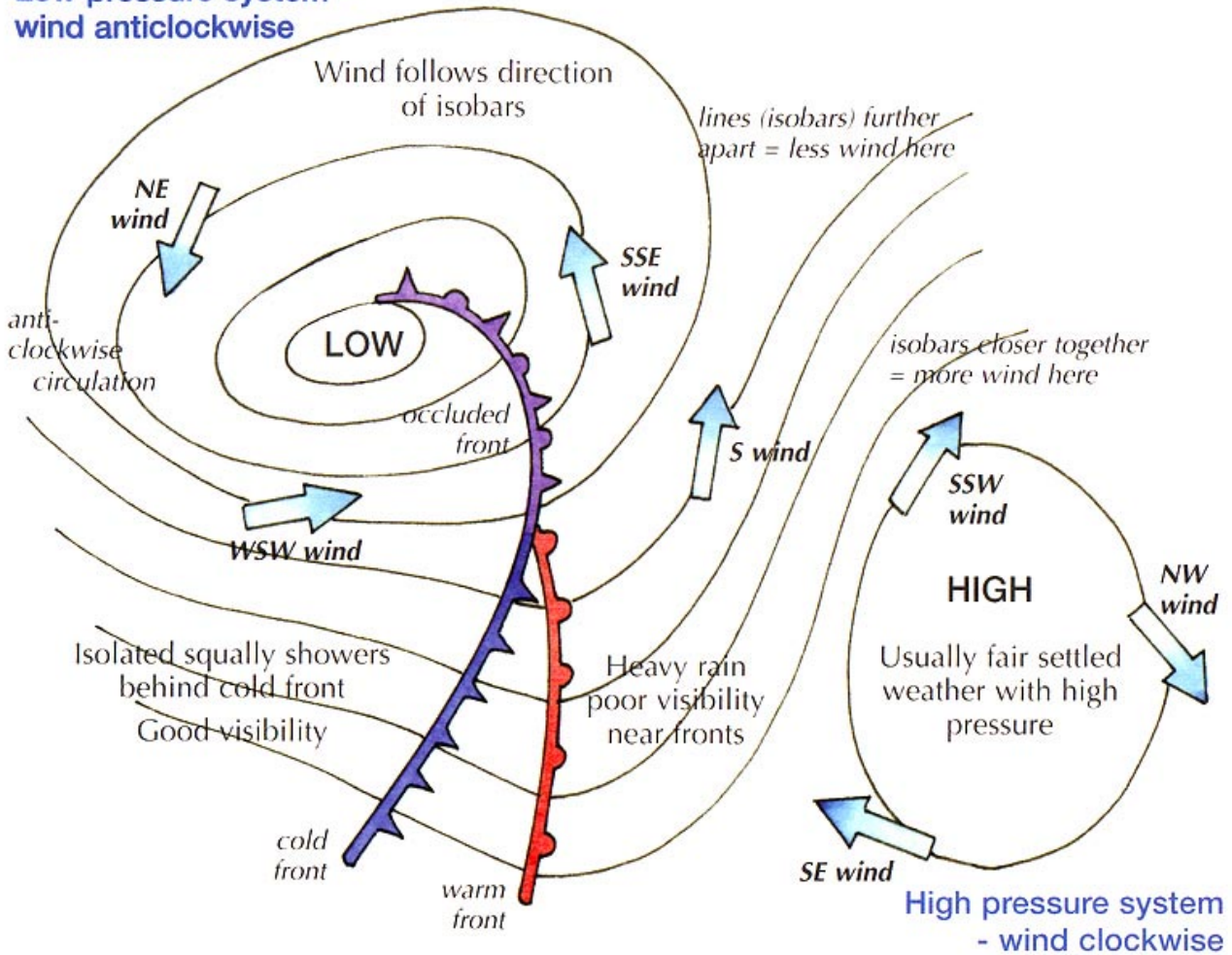


Teletext



Local radio stations.

Low pressure system - wind anticlockwise

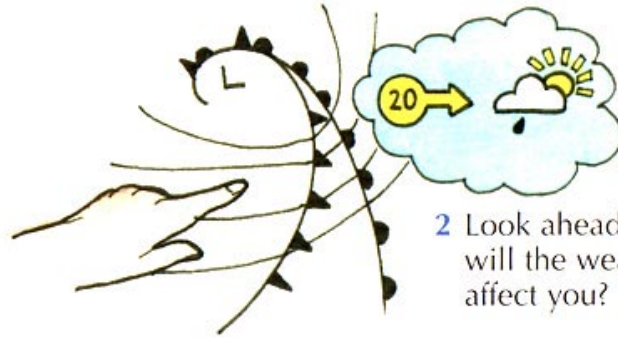


TERMS USED IN FORECASTS

- Gale warnings** If average wind is expected to be F8 or more, or gusts 43-51kn.
- Strong wind warnings** If average wind is expected to be F6 or F7. F6 is often called a 'yachtsman's gale'.
- Imminent** Within 6 hrs of time of issue of warning.
- Soon** Within 6-12 hrs of time of issue of warning.
- Later** More than 12 hrs from time of issue of warning.
- Visibility** *Good* - greater than 5 miles *Moderate* - between 2 - 5 miles. *Poor* - 1,000m to 2 miles. Fog less than 1,000m.
- Fair** No significant precipitation.
- Backing** Wind changing in an anticlockwise direction eg NW to SW.
- Veering** Wind changing in a clockwise direction eg NE to SE.
- General synopsis** How and where the weather systems are moving.
- Sea states** *Smooth* - wave height 0.2 - 0.5m *Slight* - wave height 0.5 - 1.25m. *Moderate* - wave height 1.25 - 2.5m *Rough* - wave height 2.5 - 4m. *Very rough* - wave height 4 - 6m.

WEATHER AND PLANNING A PASSAGE

1 Obtain a forecast.

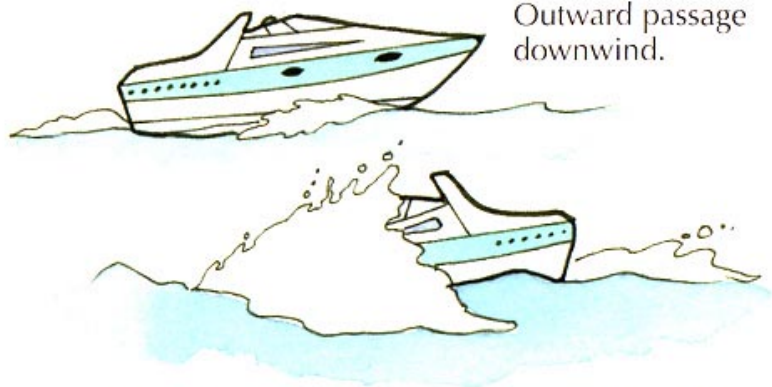


2 Look ahead - how will the weather affect you?

3 How does the wind affect your plan?



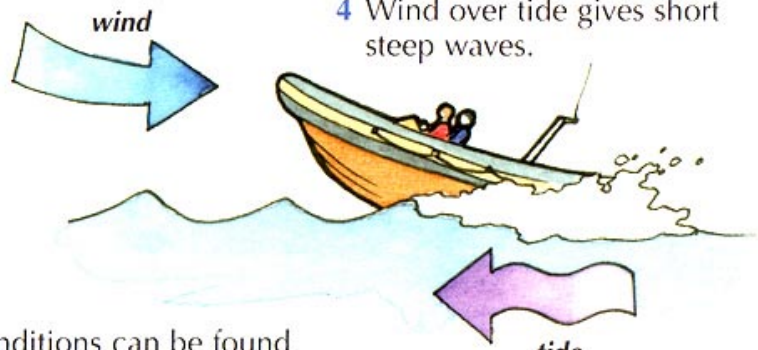
Be prepared to change your plans.



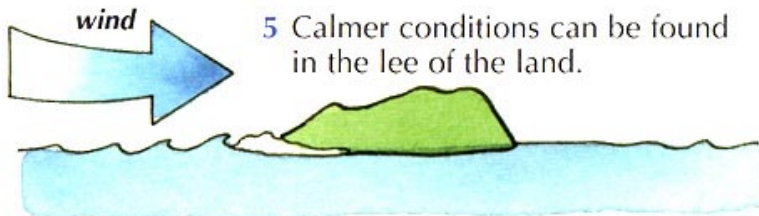
Outward passage downwind.

Return passage into wind - very uncomfortable.

Make sure you and your crew are prepared for what the weather will bring.

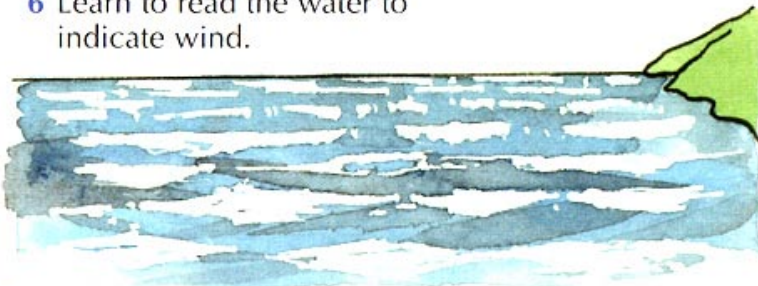


4 Wind over tide gives short steep waves.

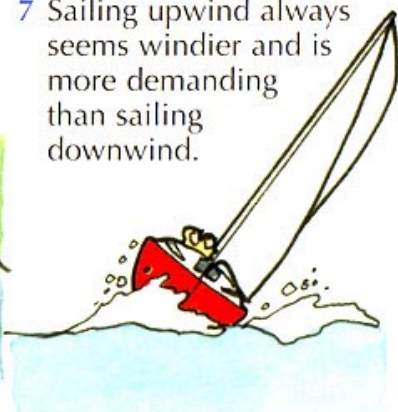


5 Calmer conditions can be found in the lee of the land.

6 Learn to read the water to indicate wind.



7 Sailing upwind always seems windier and is more demanding than sailing downwind.



BEAUFORT WIND SCALE



- 1** **Light airs** 1 - 3 knots
Ripples.
Sail - drifting conditions
Power - fast planing conditions
- 2** **Light breeze** 4 - 6 knots
Small wavelets.
Sail - full mainsail and large genoa
Power - fast planing conditions
- 3** **Gentle breeze** 7 - 10 knots
Occasional crests.
Sail - full sail
Power - fast planing conditions
- 4** **Moderate** 11 - 16 knots
Frequent white horses.
Sail - reduce headsail size
Power - may have to slow down if wind against tide
- 5** **Fresh breeze** 17 - 21 knots
Moderate waves, many white crests.
Sail - reef mainsail
Power - reduce speed to prevent slamming when going upwind
- 6** **Strong breeze** 22 - 27 knots
Large waves, white foam crests.
Sail - reef main and reduce headsail
Power - displacement speed
- 7** **Near gale** 28 - 33 knots
Sea heaps up, spray, breaking waves, foam blows in streaks.
Sail - deep reefed main, small jib
Power - displacement speed
- 8** **Gale** 34 - 40 knots
Moderately high waves, breaking crests.
Sail - deep reefed main, storm jib
Power - displacement speed, stem waves
- 9** **Severe gale** 41 - 47 knots
High waves, spray affects visibility.
Sail - trysail and storm jib
Power - displacement speed, stem waves
- 10** **Storm** 48 - 55 knots
Very high waves, long breaking crests.
Survival conditions