

Water Awareness and Charge Certificate Manual

Module 30: Introduction to the Sailing Boat

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Outcomes

After completing this module, the certificate holder will:

- Be able to explain how sails work.
- Be able to identify parts of the boat and points of sail.
- Be able to perform sea worthiness checks and rig a sailing dinghy.
- Be able to recover from capsize and man overboard situations.

1 INTRODUCTION TO THE SAILING BOAT

1.1 How Sails Work

It is a common misconception that a sail is a big sheet that the wind pushes along. Unless you're on a dead run with the wind right behind you (which is usually to be avoided), the sails should be acting in much the same way as an aircraft wing. A well trimmed sail is shaped like an aerofoil and pulls a yacht through the water in much the same way as the wings lift an aircraft.

The air flowing smoothly across the sails will create a high pressure area on the windward side, and a low pressure area on the leeward side.

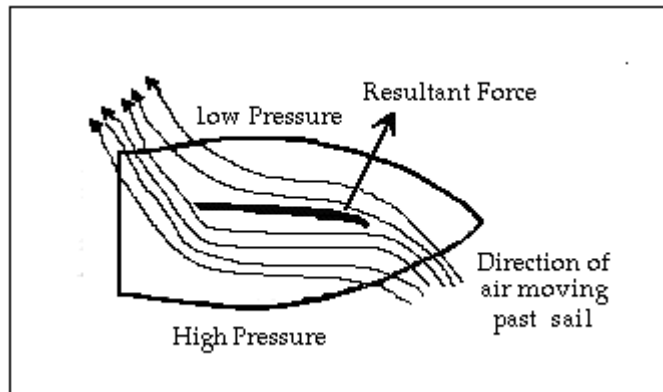


Figure 1: Forces acting on a sail

The yacht is pulled towards the low pressure and the keel will stop the yacht from going sideways, resolving the forces into a heeling moment and forwards movement

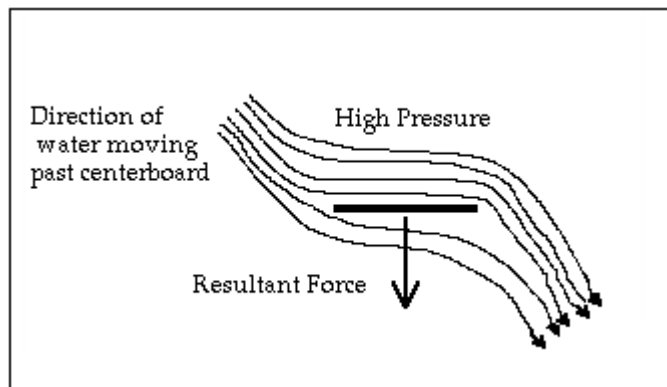


Figure 2: Forces acting on a centreboard

To get the best out of a yacht, we need to create as near a perfect aerofoil shape to each of the sails as possible by adjusting tension on the sails using the sheets, halyards and kicker. When the wind is light, we want the sails to be fuller in order to create more lift; when it's blowing hard, we want the sails to be flatter so as not to overpower the yacht.

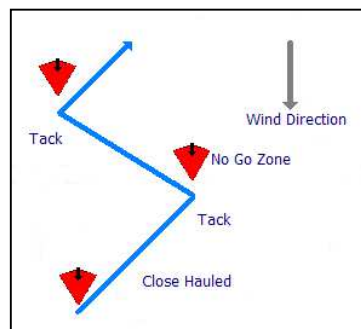
1.2 Points of Sailing: Terminology

Bearing Away: Also known as coming off the wind. Altering course away from the wind until the boat begins to gybe.

Bearing up: Also known as coming onto the wind. Altering course towards from the wind until the boat begins to tack

Beating: Sailing close hauled on a series of alternate tacks to reach a windward destination

Since a boat cannot sail directly into the wind, but the destination is often upwind, one can only get there by sailing close-hauled on port tack then tacking and sailing on starboard tack in a zig zag fashion. By this method, it is possible to reach that destination directly upwind.

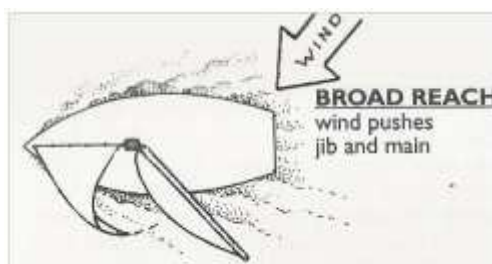


The stronger the wind, the closer you can sail to the wind. Also known as pointing

Beam Reach: Sailing with the true wind on the beam (90 degrees to the bow).

Broaching: A boat broaches when its heading suddenly changes towards the wind due to the aerodynamic force on the rig greatly exceeding the hydrodynamic force on the hull, usually due to a sudden increase in wind strength. The boat will heel dramatically and rapid reaction is necessary to prevent a capsize.

Broad Reach: Sailing with the true wind between the beam and on the quarter



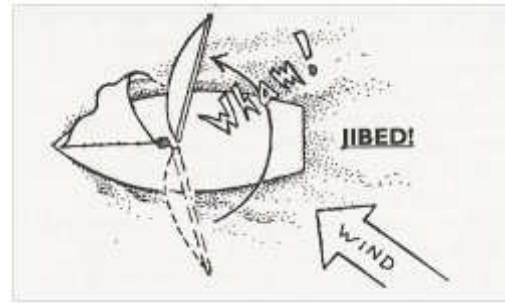
Close Hauled: A boat is close hauled if, sailing with her sheets hauled in and her sails drawing, she is sailing as close to the wind as she can lie with advantage in working to windward.

Close Reach: Sailing with the true wind forward of the beam, but not quite close hauled. Also called fetching

Goosewing: To sail before the wind with the mainsail set on one side of the boat and the jib set on the other side.

Gybing:

The act of bringing the boat around by placing the stern through the eye of the wind. A boat begins to gybe at the moment when, with the wind aft, the foot of her mainsail crosses her centreline and completes the gybe when the mainsail fills on the other tack.



Gybes can often be violent, resulting in injuries to the crew and damage to the boat if the gybe is not properly controlled.

A Chinese gybe is what we all fear most as it is when the boat crash gybes without warning and leaves your vessel on her side with everything disorganised.

In Irons

When the tack has not been successfully completed and the sails are not drawing on the new tack. Sometimes used to take all way off the boat for whatever reason

Lee Helm:

A Boat is said to carry lee helm if, with the helm amidships, she tends to pay off from the wind.

Luffing:

Altering course toward the wind until head to wind.

On a Tack:

A boat is on a tack except when she is tacking (going about) or gybing.

Port Tack:

A boat is on port tack when the wind is on her port side.

Reaching:

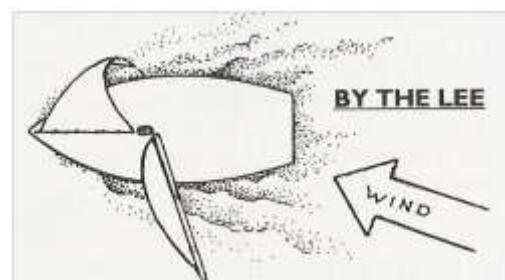
When the boat is travelling approximately perpendicular to the wind, this is called reaching. Reaching is the fastest way to sail.

Running:

Sailing with the true wind blowing from abaft the quarters. This is the easiest point of sail in terms of comfort, but it can also be the most dangerous as there is no easy way to stop the boat when running. Loss of attention by the helmsman could lead to an uncontrolled gybe or pitch pole capsize.

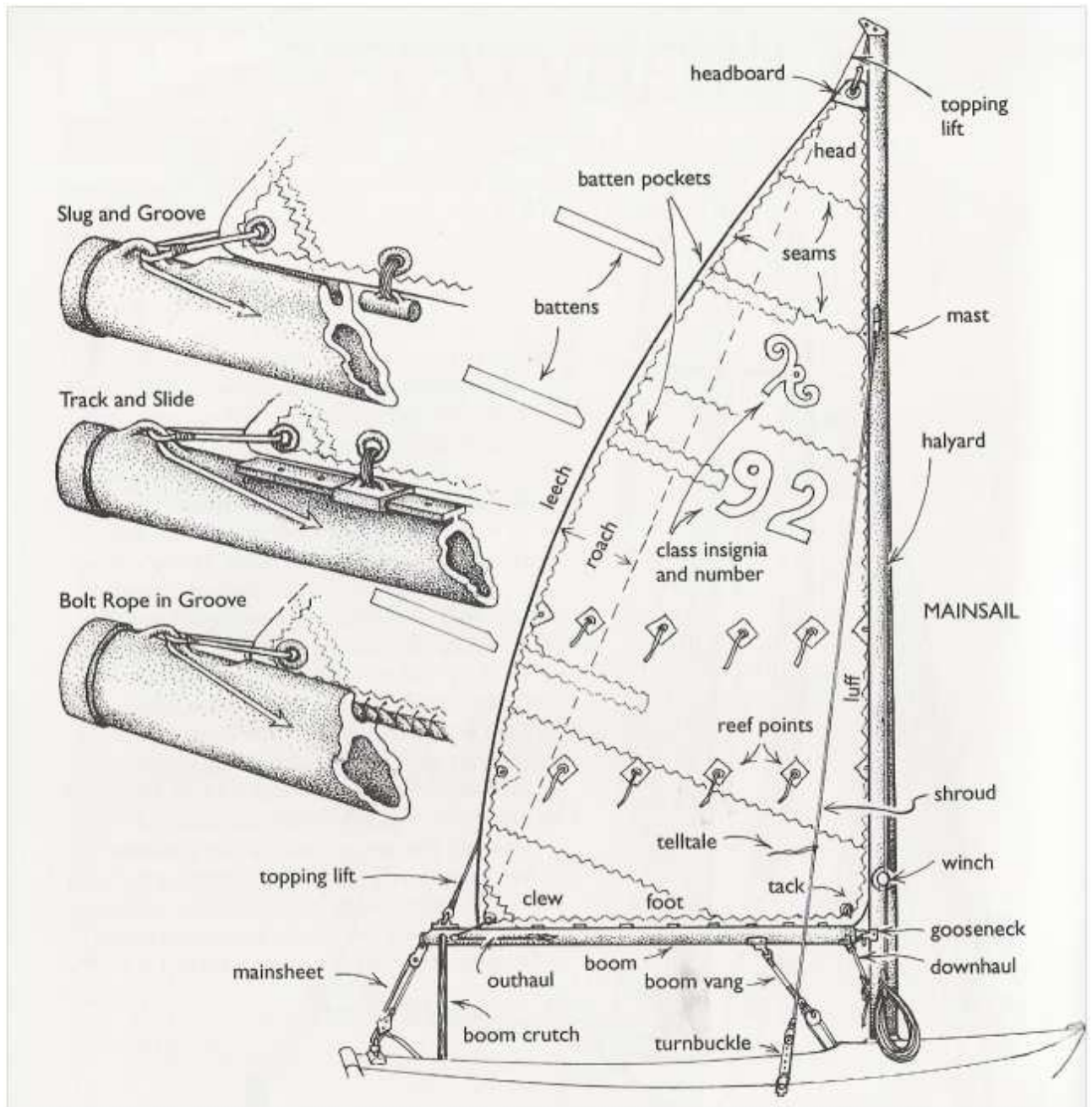
Running by the Lee

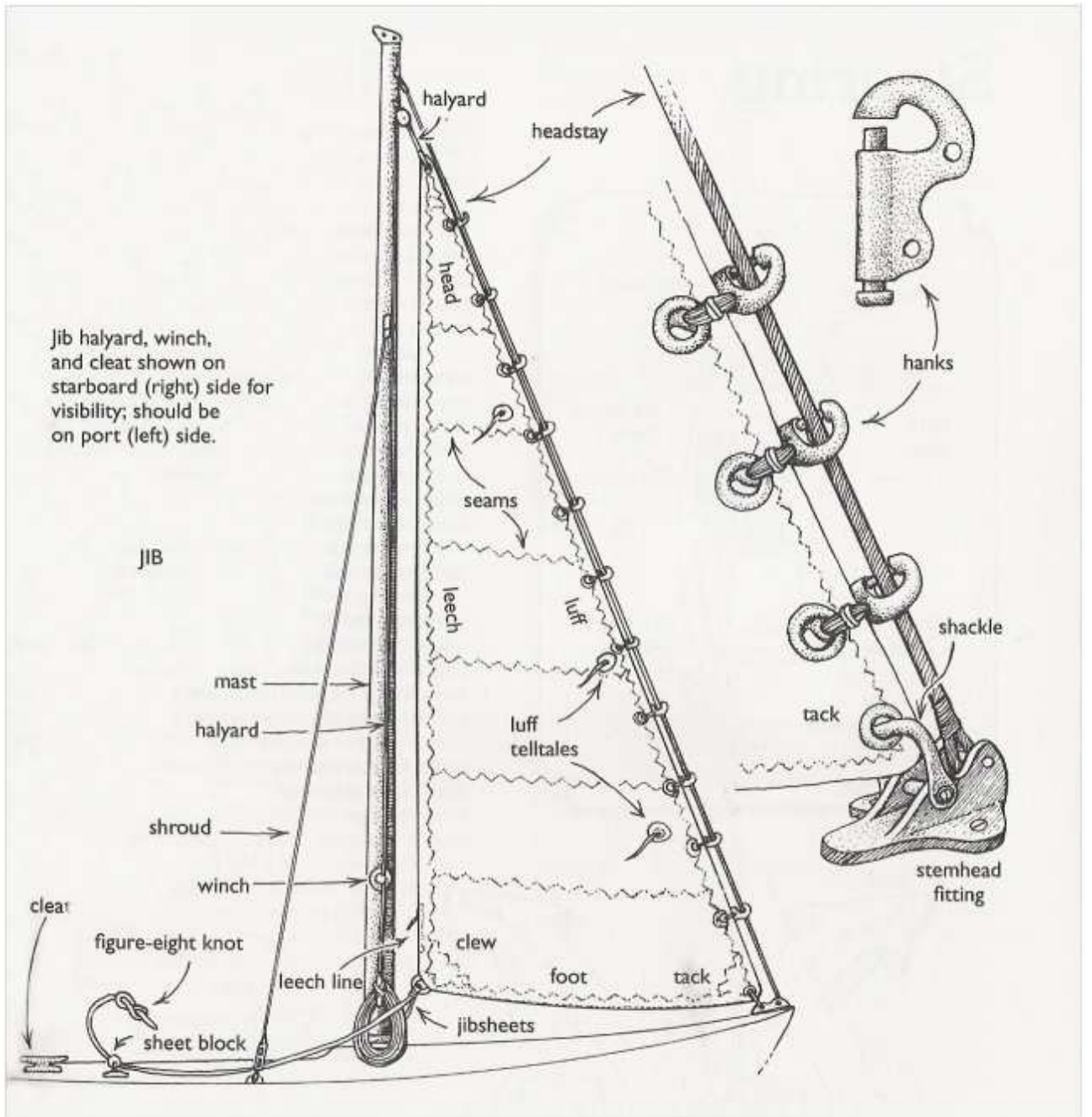
A boat is running by the lee when she is running with her mainsail set on the windward side. This can lead to uncontrolled gybes, so is extremely dangerous and should be avoided

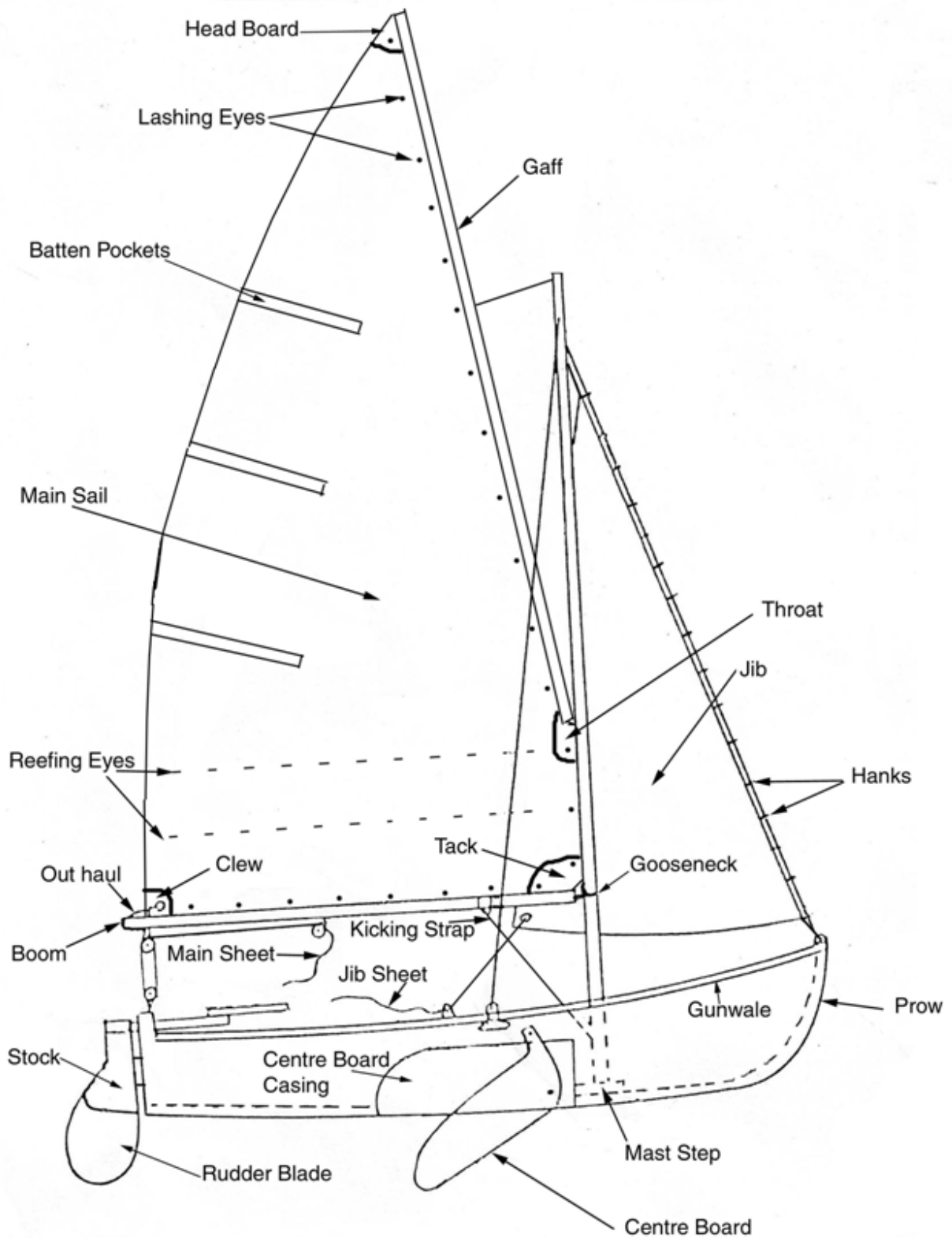


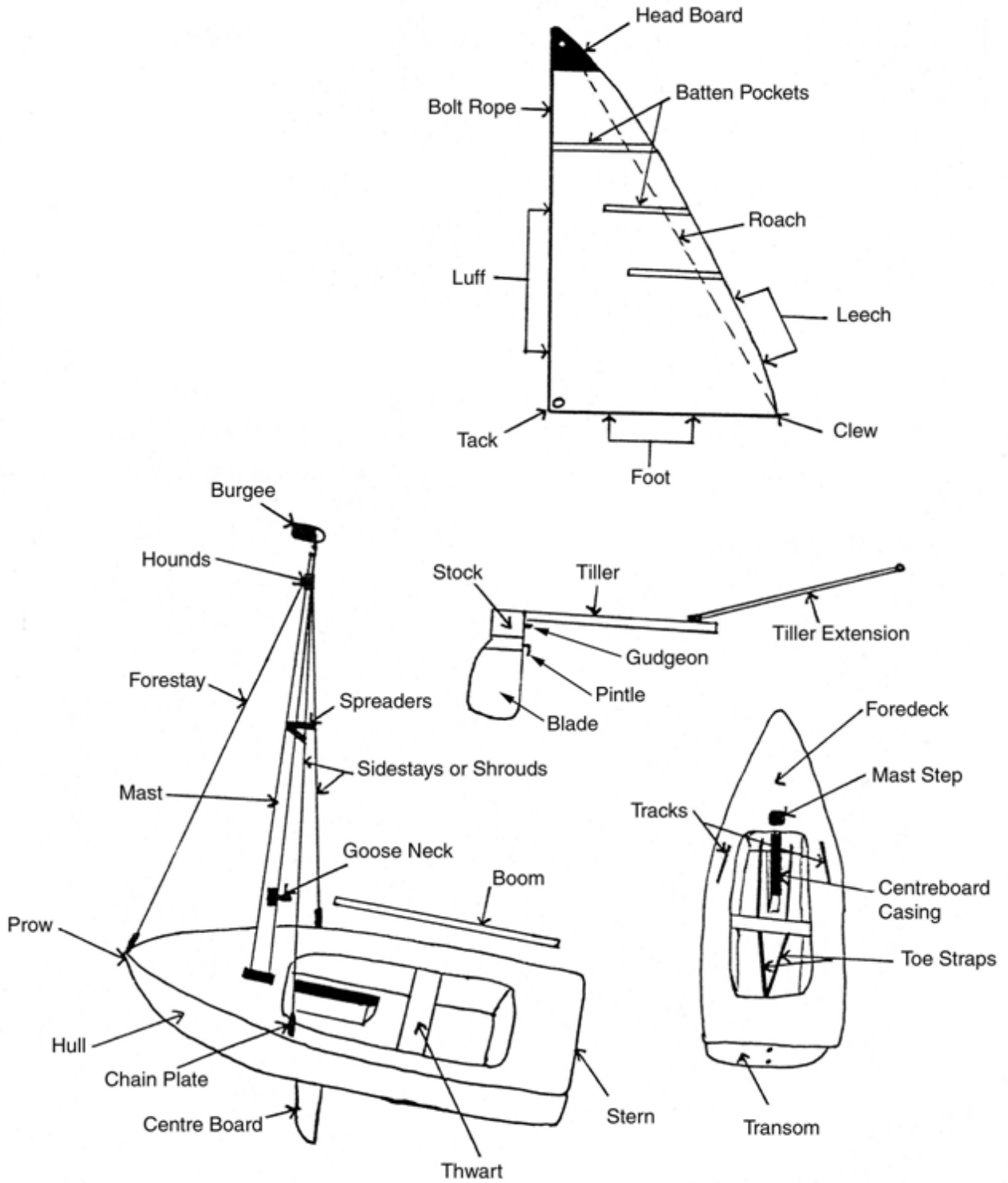
Sailing Free	A boat is sailing free whenever her sails are filled and she is not sailing close hauled.
Starboard Tack:	A boat is on starboard tack when the wind is on her starboard side.
Tacking:	This is the act of putting the helm down to bring the boat to a new tack by placing the bow through the eye of the wind. Tacking is gentler than gybing and should be the preferred method of coming around. Also called going about
Wearing	This is basically an extended tack starting from a broad reach or run and ending on a new broad reach or run with the main boom on the opposite side. It is considered a safer option than gybing in heavy weather.
Weather Helm:	A boat is said to carry weather helm if, with the helm amidships, she tends to turn into wind.

1.3 Parts of the Boat

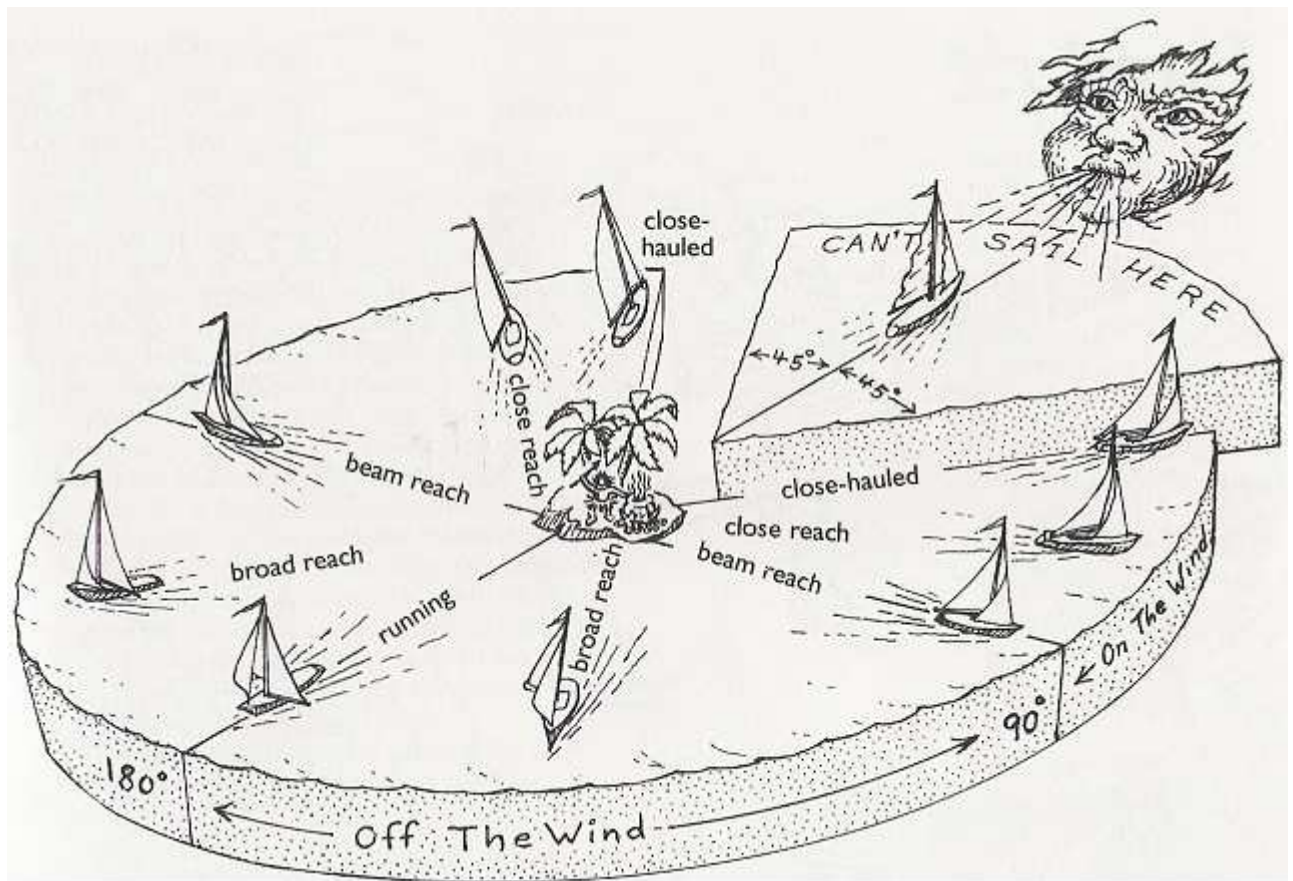








1.4 Points of Sailing: Wind Direction



2 Operating and Maneuvering

It cannot be overstated that before you begin, have someone who is experienced show you the rigging on your boat. This is beyond the scope of this course, as all boats are different. This will cover the fittings present on most small sailboats and common sailing techniques and insert many definitions of terms above. You should know the names of the different fittings on your boat, running and standing rigging, and should have rigged your boat at least once by yourself before proceeding. Your first sailing experience should be on a small inland lake. Pick a nice day with a steady light onshore breeze and no inclement weather.

2.1 Rigging

If your boat doesn't have a burgee or some other kind of wind direction indicator, tie a couple 20cm pieces of old cassette or video tape (video might be easier to see) or brightly coloured knitting yarn to the shrouds on each side, about 1.5m up from the gunwales.

Perform a check of all the standing rigging (wires and ropes) including the shackles and pins securing the standing rigging to the mast. Many sailboats have dismasted because a 50-cent circle cotter pin was missing. Check the ropes (lines) that hoist and control the sails (halyard and sheet respectively). Make sure that they are not wrapped around each other or anything else. There should be nothing binding any line; all should be free to move and be clear at this point.

You can now step and rig the mast and secure it by attaching the shrouds to the hull.

Before hoisting any sails, turn the boat head to wind. The idea is to hoist the sails where they will give the least resistance, with the sails feathering more or less aft. With the sails in this position, they will not be snagging on any shrouds or any other fittings or standing rigging.

Hoist the foresail (jib or genoa) by first securing the sail to the hull, then to its correct halyard. Hoist it up all the way and secure the halyard to its cleat. It will flap (luffing) if the wind is strong, but that's OK for a short period of time (excessive luffing will drastically reduce the life and durability of the sail).

Insert the boom into the gooseneck and attach the kicking strap. Secure the mainsail to the boom (using the boltrope, if applicable, or by means of the tack and clew lines). Attach the halyard to the headboard and hoist the mainsail by pulling down on its halyard, all the way until the headboard reaches the black bands near the top of the mast. The leading edge of the sail (luff) should be tight enough to remove folds, but not so tight as to create vertical creases in the sail. There should be a cleat in the vicinity of where the halyard comes down; tie it off, and make up the halyard so that it can easily be released in an emergency. DO NOT wind excess halyard round and round the mast foot. Tension the sail through the tack downhaul and clew outhaul.

Rig all the sheets to control the sails. Tie a figure eight knot in the ends of all sheets and lines to prevent them from going through the last fairlead, block, or jamb cleat that they pass through.

2.2 Operating

Once you get away from the shore, and have secured the foils (rudder blade and centreboard or dagger board), set the heading on the most appropriate tack so it's about 90 degrees off the wind. This is known as a beam reach. Haul in the main sheet until the sail is around 45 degrees away from the fore and aft line of the boat. It's a safe place for the main while you trim the jib. You will start making way and heeling away from the wind. A heel of more than 20 degrees usually indicates that you're being overpowered. Releasing the mainsheet will spill wind from the sail and lessen the amount of heel.

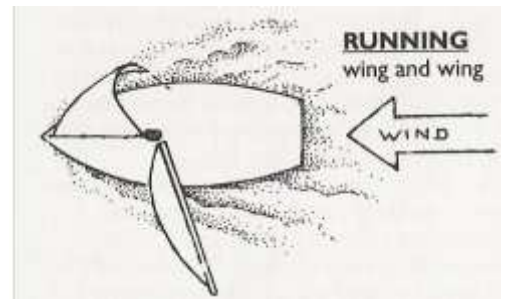
There are two jib sheets, one on each side of the boat. Haul in the jib sheet on the leeward side. The jib will stop luffing; trim the sail just until the leading edge just stops back winding (luffing). Keep your hand on the tiller or helm, and stay on course, while keeping a sharp lookout for other boats or obstacles. Learn before you skipper a boat under what circumstances you have right of way, and avoid collisions by all means available to you.

Trim the mainsail in the same manner, adjusting the main sheet until it also stops luffing or back winding. The sails are now efficiently set, but if your course or wind direction changes, you have to adjust them accordingly.

Watch the leading edge of the sail edge on the main and jib. If either starts to luff, you have two choices. Either haul in the sail sheet until it stops luffing, or steer away from the wind (bear off). When the sail luffs, it means that you are going too close into the wind for your current sail setting. If you steer slightly away from the wind your sails will stop luffing. Alternatively, change direction or change sail setting, as fits the circumstance (use your judgement).

Many sails have telltales on them as well; pieces of coloured material attached to the front sail edge. Your sail is trimmed properly when the ALL telltales are streaming aft. If you see it change so that the wind is coming from a direction that is more behind you, you will be wasting energy. Let out the sail. You will be doing this constantly; watching the sails, the telltales, and trimming sails if for no other reason than to maintain the most efficient settings. When the wind is abaft the beam, it's called a broad reach. This is the most efficient point of sail as both sails are full of wind and pushing the boat at best speed.

When the wind is coming from approximately dead aft, you are running with the wind. Not as efficient as reaching, because the boat speed can never exceed the wind speed. Sometimes you can pull the jib over to the other side of the boat where it will fill. This is called goose winging and you have to maintain a steady hand on the tiller to keep this sail configuration, be sure to be vigilant of obstacles and other vessels as having both sails in front of you



blocks a significant portion of your view. BE CAREFUL THOUGH - when the boat is running the sails will be way off to the side, and because the wind is basically behind you the boom can or change sides suddenly, coming across the cockpit with quite a bit of force, sometimes with catastrophic consequences which we will not go into here. If you have a wind-direction indicator at the top of your mast, do NOT allow the arrow to point at the mainsail. If it does, you are sailing with the boom on the windward side (sailing by the lee) and are at high risk of an accidental gybe. When this happens the boom can hit you and often with enough force to knock you unconscious and/or out of the boat (overboard). Watch for this when running with the wind.

Now that you've done some of the easier points of sail, turn the boat slightly into the wind, maybe 75 degrees off the wind. You will have to pull the sheets tighter so the sails are nearer the fore and aft line the boat. This is called a close reach; your sails are acting like the wing design of an airplane, A boat with the sails set as such is called close reach. Continue to turn into the wind (bear up) and haul in the sheets, until you can go no farther (the jib should NEVER touch the spreaders on the mast). This is called close-hauled, and is as close an angle as you can go into the wind on your boat (about 45 degrees off the wind). On a gusty day, you will have all kinds of fun with this point of sail! Pointing close to wind is not the fastest point of sailing, but is sometimes necessary to achieve the most desirable course for the circumstances.

Sail into the wind to a destination, sail a heading that is as close to the wind as you can get. On most sailboats this will be about 45 degrees to the wind. When you've gone as far as you think prudent. After you have checked that it is safe and clear to do so, warn the crew of your intentions and swiftly head up and turn the boat across the wind, pulling the jib sheet out of its cleat as the bow turns through and crosses the wind. This is known as tacking. The main and boom will come across, but they don't have far to go, and probably won't hit you in the head as they do not have the wind behind them to provide a striking force; the main will self-set on the other side, providing you have not let it out while changing over your helming position.. You will have to quickly haul in the jib sheet on the opposite side and cleat it while steering the boat just to the point where the mainsail begins to draw again. If you do this correctly, the boat won't slow down much and you will be sailing

across the wind in the other direction. If you're too slow, and the boat stops, you will lose steering ability but don't panic. The boat will be pushed astern a little. You can either lay off on the original tack to gain speed again or by reversing the rudder angle get the bow to pay off on the new tack.. This is known as being "in irons", Being in irons is easily remedied. When the boat begins moving backwards you will regain (reverse) steerage. Point the tiller in the direction you wish to go and tighten the jib sheet to windward, (backwinding the sail). The wind will push the bow through the wind. Once you've completed your tack, release the sheet from the cleat on the windward side and pull in the sheet to leeward and you'll be on your way again. Because speed is so easily lost when going in a zigzag fashion into the wind (tacking) you'll want to perform this manoeuvre as smoothly and quickly as possible.

Understand that you have some practice on calm days, learn to reef your boat (make the sails smaller). You need to do this when the wind is too strong. Reefing almost always needs to be done before you think you need to! It's also a good idea to practice capsize procedures on a calm day too; learn to right the boat should you happen to tip over. If the boat capsizes, do not panic, and perform your capsize drills to right the boat and regain control of it.

When sailing, your very life may depend on preparing for a manoeuvre and then executing it at the correct time. If you wait until after it needs to be done, it may be too late or very difficult. Follow your instincts. Don't let enthusiasm overcome your good judgement on a day you should not go out. Ask for and take advice from experienced sailors whom you know and trust.

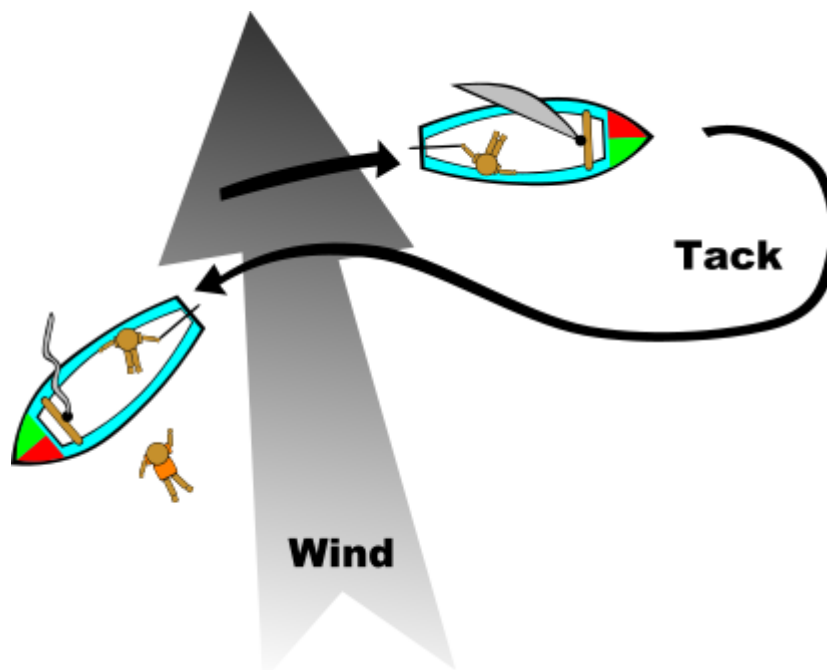
2.3 Man Overboard

2.3.1 Introduction

A person going overboard from a keelboat is generally considered an emergency, with considerable danger of that person being lost. In a dinghy, on the other hand, a person going overboard is unwisely sometimes considered a joke. In certain circumstances it can be dangerous, for example, if the water is extremely cold or if there is panic. Man overboard from a dinghy rarely occurs and that is usually when toe straps break or during capsizes.

2.3.2 Man Overboard procedure

- If you are the skipper immediately someone goes overboard, and check that man's position in the water, and continue to keep the person in view as best as possible while performing your other duties. If the dinghy or yacht has more than two crew, designate one person to constantly watch the position of the person in the water.
- Take most of the way off the boat (slow down) by letting out the sheets, and then tack as soon as possible.
- Bear slightly away to make sure you get downwind of the man. Keep watching for the position of the man.
-
- As you approach an imaginary line from the person directly downwind (you should be between 4-12 metres away), start to bear up and slow down. This will need constant small adjustments of the main sheet (to control mainly the speed of the boat) and the tiller (to control the direction).
- The aim is to put the boat in irons within easy reach of the man, to be able to grasp the man on your windward side and pull him aboard around the shrouds or jib sheet.



2.4 Capsizing

Every sailor, irrespective of experience, will experience a capsize at some or other time during his/her sailing career. It is therefore important to know what you are doing when such a capsize occurs and that there exists teamwork between the coxswain and his/her crew member.

One important point to bear in mind before we even tackle the procedure to follow when a capsize occurs is that you must **NEVER** leave your boat. In heavy winds especially, your boat will drift faster than you can swim, which could endanger firstly your own life or that of the crew and secondly cause expensive damage to your boat.

The first duty of any crew member after a capsize is to check on the well being of your buddy or other crew members

A boat can capsize either towards the wind (windward capsize) or away from the wind (leeward capsize). The leeward capsize is the most common form of capsize that you will experience and is normally a gentle capsize where the boat will heel over and fill up with water. The windward capsize is most often a sudden capsize, usually due to a sudden drop in wind strength giving the coxswain and crew little time to take any pre-emptive measures.

Buoyancy plays a most important aspect of recovery from a capsize, and the ideal is that when a capsize has taken place that the boat lies parallel to the water with the centreboard about 50cm above the waterline and the sails parallel with the water.

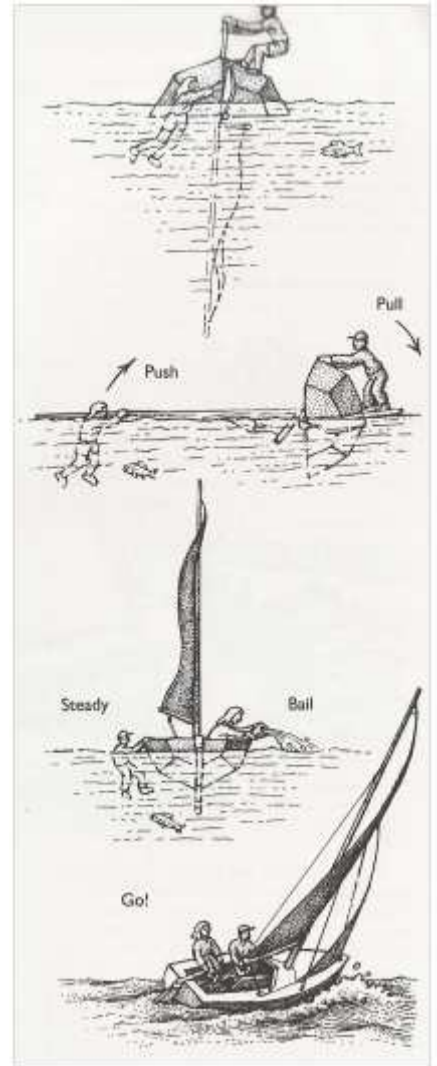
The crew should swim to the bow and hold it head to wind, so that the skipper can first prepare the boat for righting by releasing any cleated or tangled sheets and ensuring that the centreboard or dagger board is extended to assist applying the counterweight forces of his body close to the root of the foil.

Obviously each class of dinghy has its own best righting procedure, and this should be learned from more experienced sailors of boats in that class, but they all have similar basic processes.

If the righting procedure is not successful after 3 or 4 attempts for whatever reason, relax, expend minimum energy and wait for assistance from outside sources. NEVER leave the boat and swim for the shore.

2.5 Recovery from a Capsize

- In a capsize situation, **never ever** leave the vessel as it will drift faster than you can swim. Any up-turned hull is an immediate sign of distress and it is far easier for rescuers to locate the vessel than a single person in the water.
- After the capsize, check that
- The other crew member is accounted for and safe. (buddy system)
- the centreboard is fully extended (down)
- the sails are not cleated,
- The coxswain warns the crew member and climbs on the centreboard.
- Once the boat has righted itself the skipper climbs back aboard and prepares the boat.
- Depending on the design of the boat the skipper may be required to bail out some of the water to increase the buoyancy so that it is sufficient to accept the crew on board again.
- The crew member then proceeds to lie parallel to the vessel along its lee gunwale. The crew then hooks a leg over the gunwale if possible and the skipper can assist to pull him aboard while still maintaining as best as possible the stability of the boat.



2.6 Righting an Inverted Boat

- Find the jib sheet and swim to the opposite side of the inverted boat.
- Kneeling on the gunwale, gently pull on the jib sheet and centreboard until the boat comes to the horizontal position and proceed as normal.

NB: Never stand on the hull of the boat to right it, and use only gentle movements otherwise you will damage the centreboard and the hull of the boat.

2.7 Righting a Boat with Mast in the Mud

- If your boat has its mast stuck in the mud, swim the boat around the mast until the inner hull and sails are facing the wind.
- Using the wind to assist you, swim the boat in the direction of the wind until the mast breaks free from the mud.
- Right the boat in the normal procedure.

3 Yacht Racing

3.1 Starting Procedures

NOTE: These start procedures are as laid down by SAS and are used in all Yacht Club Racing regattas. It must however be stressed that that adaptations may occur from Club to Club but the basics must be adhered to at all times. It is therefore important to ensure that you read the Sailing instructions before the race to ensure that you are to date with the starting instructions.

30 minutes before the start of the race a sound signal will be given and the notice flag will be raised. You will be required to check the notice board to check on your starting order and class flag and where necessary sign the sign-on sheet for that race.

Minutes before starting signal	Visual signal	Sound signal	Means
5*	Class flag	One	Warning signal
4	P, I, Z, Z with I, or black flag	One	Preparatory signal
1	Preparatory flag removed	One long	One minute
0	Class flag removed	One	Starting signal

*or as stated in the sailing instructions

1. 5 minutes before the official starting time of the race (or at a time as stated in the sailing instructions) a sound signal will be given and the class flag will be raised.
2. One minute later another sound signal will be given and the preparatory flag will be raised. At this stage all boats racing must be on the water and floating free.
3. One min before the start a long sound signal will be given and the preparatory flag will be lowered. There is one minute left to the start.
4. On start time a sound signal will be given and the class flag lowered. The race is underway.

If there is a second start, one min later there will be a sound signal and the second class start flag will be raised, the same procedure will then follow as from point 2 above.

In the event of a general recall due to a false start etc, all races will be delayed until the class has been restarted. Skippers must be alert to the flags as displayed from the bridge.

3.2 Racing Rules

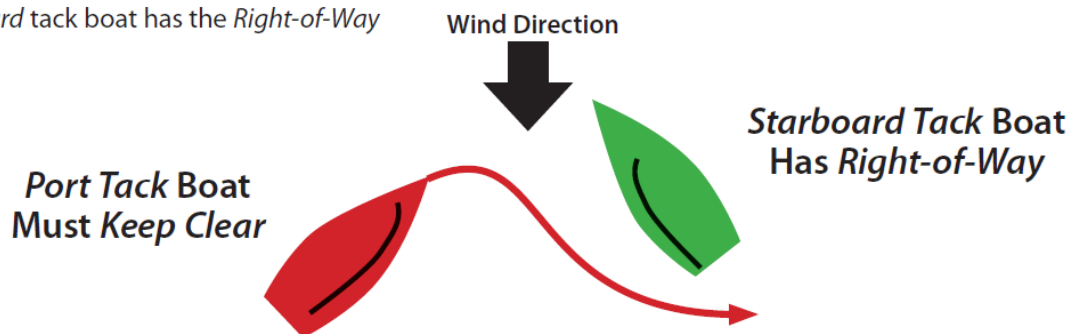
The specifics of the racing rules are mind-numbingly detailed and written to cover all potential incidents. The following represents the major rules. By reading and understanding the following rules and terms, you should be able to get around the course without fouling another boat or causing an accident

In sailboat racing there are no out-of-bounds lines on the floor or referees to call fouls. The rules are self enforced and administered within the fleet.

In all of the following scenarios, the green boat has right of way and the red boat must keep clear

Two Boats Converging on Opposite Tacks

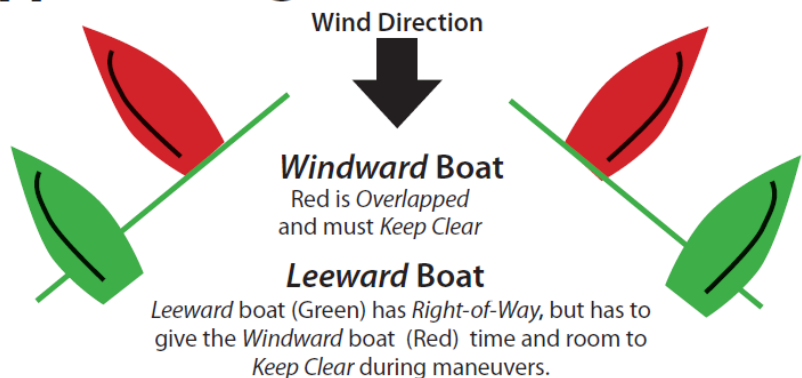
A Starboard tack boat has the *Right-of-Way*



Two Boats Overlapped Sailing On the Same Tack

Leeward boat has the *Right-of-Way*

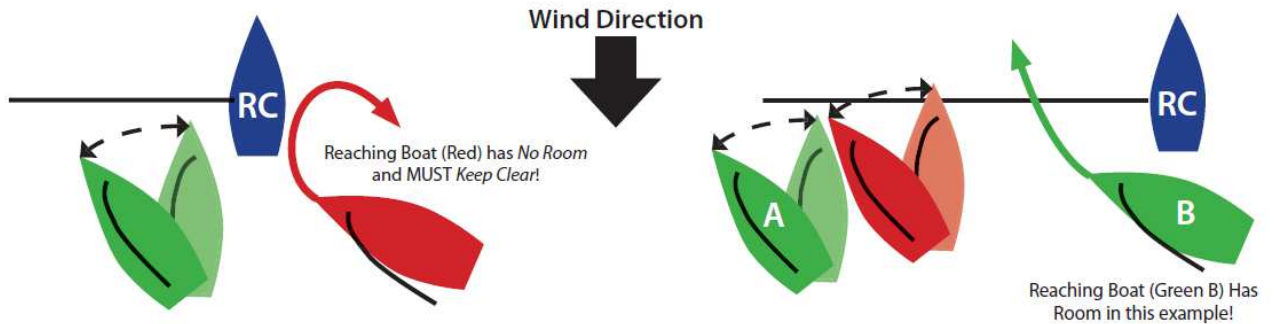
NOTE: This Rule applies for two boats near each other on the same tack. However, remember that any approaching *Starboard Tack* boat will have *Right-of-Way* over all *Port Tack* boats



No Barging at Start

A *Leeward* boat has *Right-of-Way* at the start and is allowed to sail above her *Proper Course* to shut-out any boat heading into the start before the start signal. After the start signal, the *Leeward* boat must assume her proper course.

Basically, any boat to leeward that you can potentially hit should be considered a brick wall.



REACHING BOAT (RED) IS BARGING!

Before the start signal, Green has the right to go "head-to-wind" and force a *Windward Overlapped* boat (RED) over the start line or into a position that it must avoid the Committee Boat or Start Mark by turning away.

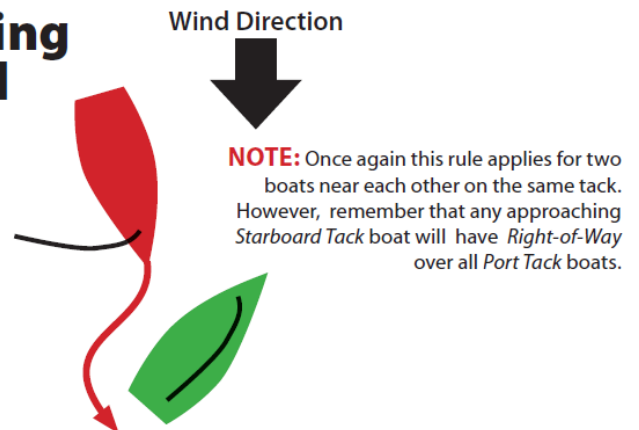
LEEWARD BOAT (GREEN A) HAS RIGHT-OF-WAY RED MUST KEEP CLEAR OF GREEN A!

Green A has the right to go "head-to-wind" to force Red over the start line before the start signal. Green A is not close enough to committee boat to shut-out Green B.

Same Tack Boats Converging on Different Points-of-Sail

Leeward Boat has Right-of Way

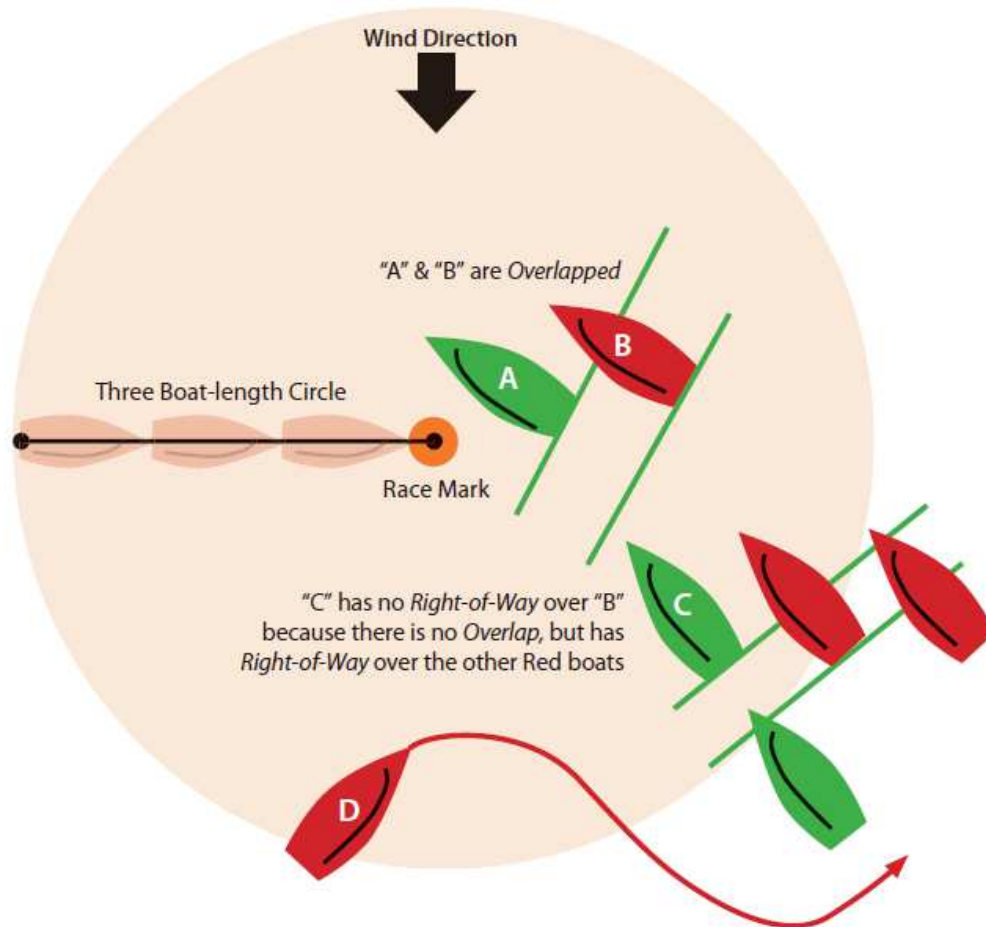
In this example, both boats are on *Port Tack*. As they converge, the *windward* boat (Red), which is sailing downwind, has to *Keep Clear* of the *leeward* boat (Green).



Boats Converging at Mark

An *Inside* and *Overlapped* boat (Green A) within three boat-lengths of the mark has the *Right-of-Way*. In general, any *Overlapped* outside boat (Red B) must *Keep Clear* and give room to any boat between them and the mark.

A boat coming into the mark on *Port Tack* (Red D) must be able to complete its tack without obstructing the progress of an incoming *Starboard Tack* boat. If a *Starboard Tack* boat has to adjust course, you fouled them.



If You Are Fouled

1. Avoid Contact!
2. Hail the word, "PROTEST" to the boat that you believe created the foul.
3. Raise a Red Protest Flag somewhere visible from your stern
4. At the finish, notify the Race Committee that you plan to issue a protest giving the name and/or sail number of the off ending boat.
5. Once onshore, find a race official to fill out the appropriate paperwork.

If You Foul Another Boat

1. Avoid Contact!
2. If you believe you fouled another boat, promptly get clear of all other boats and do two complete circles in the same direction consisting of two tacks and two gybes. Once the circles are complete, you can rejoin the race without further penalty.
3. If you do not think there was a foul, continue sailing the race with the understanding that you are racing under protest. Once the race is complete, and not necessarily on the same day, a protest committee will hear the incident to determine which boat was correct. If you are wrong, you will be Disqualified (DQ) from that race.

If You Hit A Mark

1. Promptly get clear of all other boats and do one complete circle in the same direction consisting of one tack and one gybe.

You have **NO** rights over any other boat during the time you are doing penalty circles. Make sure you are clear in both time and distance from all other racers during starting your circles.