3.1 Factors influencing manoeuvring

As in all operations, the handling of boats in close quarters varies depending on:

- external factors
  - wind strength and direction
  - tidal flow strength and direction
- the characteristics of the boat
  - underwater profile
  - windage
  - displacement and shape
  - inboard or outboard engines
  - single-screw or twin-screw
  - the size and configuration of the rudder(s)
  - the size and efficiency of the propeller(s).

However, there are several common factors influencing the success, or otherwise, of all close-quarter operations. The impact of each of the following influences must be thoroughly understood, bearing in mind that they may interact with each other differently in varying conditions.

Wind

Wind can move a boat forcibly and it makes a major difference to mooring and close-quarter tactics as to whether the wind is 'blowing you on' or 'keeping you off'.

However, of often greater importance is the turning effect the wind imposes on a boat. Most (not all) boats tend to drop their bows away from the wind when stationary or almost stationary. When going astern at slow speeds, most sterns tend to seek the wind. The uneven distribution of windage above the waterline and lateral resistance below it cause these effects. Many small boats have greater windage and less lateral resistance (less boat in the water) in the forward sections.

The third effect of wind is leeway—the angle between the boat's heading and its track through the water. This effect is at its greatest at slow speed and helm offsets may have to be made in close-quarter manoeuvring.

Tidal flows

The entire body of water in which the boat is floating moves because of tidal flow. The boat, accordingly, will be moved with the flow and adjustments will be necessary to counter this.

This flow will also affect stopping (and starting) distances in relation to fixed objects such as docks, jetties, mooring buoys and poles. It is much easier to bring a boat to a stop next to a fixed object when the tidal flow is counter to a boat's heading.

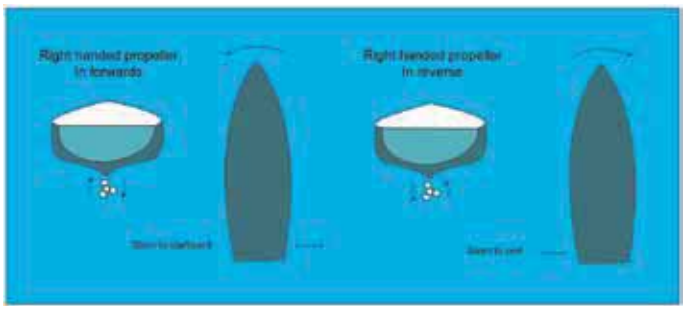
When inboard engine boats manoeuvre against the tide (stemming the tide), rudder efficiency is increased as it needs a flow across it to operate effectively. When stemming the tide, the rudder will experience a flow across it and steerage will be maintained, even when the boat is stationary in relation to a fixed object. With the tidal flow coming from astern, steerage will be lost as soon as the boat is moving at the same speed as the flow. This is a lesser issue for steerage systems not relying on a rudder (for example, outboard propulsion).

A strong tidal flow can also assist close-quarter manoeuvring in terms of a sheer effect on the hull (and rudder) and is used to help move a boat sidewards.

Transverse thrust

The force from a propeller driving a boat forwards or backwards is known as 'axial thrust'. Transverse thrust is a sideways force that is also generated by the action of a propeller and is commonly known as 'paddlewheel effect'.

Most propellers are 'right-handed' meaning they rotate clockwise in forward gear when viewed from astern. Such propellers tend to paddle the stern to starboard when going ahead and to port when going astern. The bow will appear to be tending in the opposite direction. 'Left handed' propellers will move the stern (and bow) in the opposite directions.



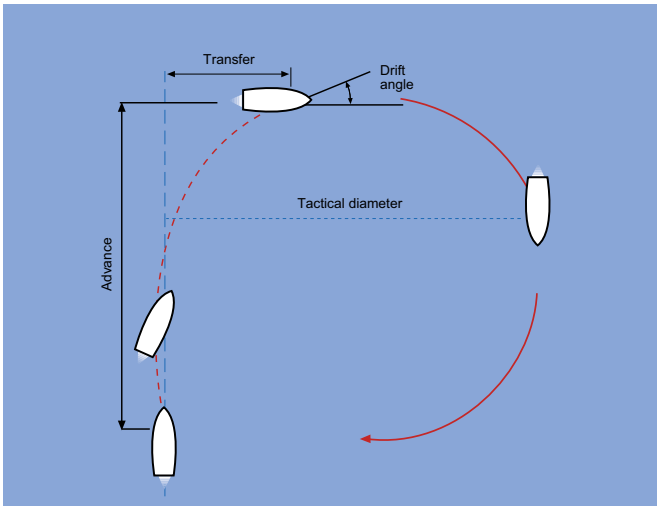
When moving ahead, transverse thrust will not be a major consideration as the rudder, across which the propeller is throwing a stream of water (axial thrust), will generally override it. In reverse, particularly at slow speeds, the rudder does not have a propeller-induced stream flowing across it and transverse thrust may dominate the steering effect. When operating in reverse, there may be no point in trying to counter transverse thrust with the rudder until the boat has significant 'way on'.

Transverse thrust can be particularly useful in close quarters manoeuvring of single-screw boats but its direction and effect must be correctly anticipated. Remember to focus on its effect on the reverse segment of close quarters manoeuvres.

Examples of transverse thrust (single-screw, right-handed propeller):

- Turning circle (tactical diameter)

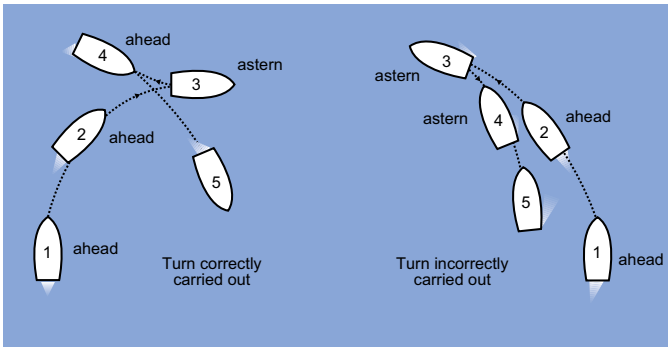
  A boat with a right-handed propeller will have a smaller tactical diameter if the turn ahead is to port (transverse thrust tends to move stern to starboard).



- Three-point turn

  To gain maximum advantage of transverse thrust during the reverse leg of a three-point turn, the initial leg must be a turn to starboard.

  Note: if the wind works against a three-point turn, dropping a bow anchor may assist.

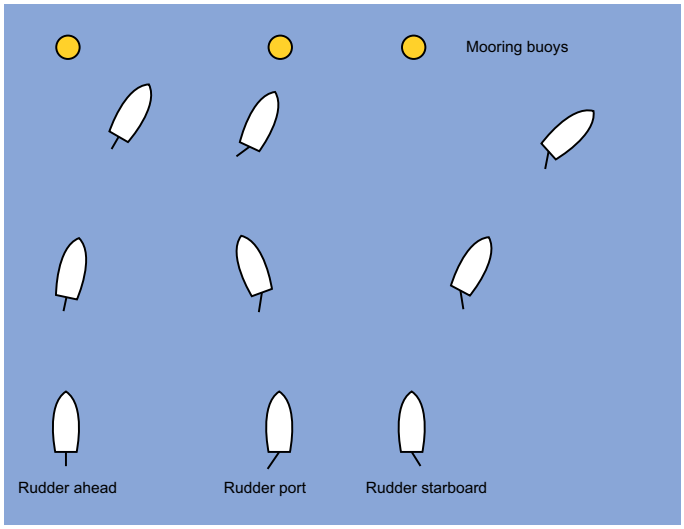


- Coming alongside

  With a right-handed propeller, it will generally be easier to come alongside port side to. When a bow line is secured and reverse propulsion engages the stern will 'walk' in alongside.

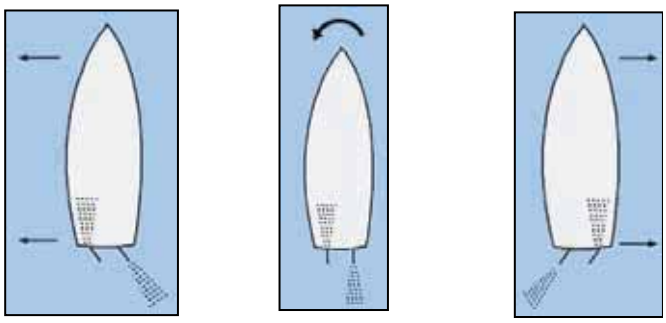
- Picking up a mooring buoy

  When approaching, keep the buoy marginally on the starboard bow because, when reverse is engaged to stop, the bow will tend to swing to starboard.



Twin-screw boats

Mostly on twin-screw boats the propellers will be counter-rotating with the starboard right-handed and the port left-handed. This ensures the transverse thrust effects work in with the intensions of canting engines (splitting one forwards, one reverse to turn around short). Outwards-rotating propellers allow the boat to turn very efficiently and they are generally easy to manoeuvre. Inward-rotating propellers result in a boat that is more difficult to turn short around but, used properly, may assist a boat to 'walk' sideways when needed.



Pivot points

A boat is turned by shifting the stern sidewards under the influence of a rudder (or, in the case of an outboard, by turning the direction of axial thrust). When going ahead, a boat has 'rear wheel steering' just like a forklift.

Because of this, the pivot point within the boat, and around which the boat turns, is located well forward of amidships. Three important considerations arise out of this for close-quarter manoeuvring.

1. The bow cannot be turned unless there is room for the stern to move in the opposite direction. (It is usually not feasible, for example, to steer a boat forwards away from a dock.)
2. To move the bow sideways will require a much larger movement of the stern in the opposite direction. For example, there is often insufficient stern room to correct a misplaced bow when entering a confined berth.
3. When turning in forwards, the stern of a boat will swing much more widely than the bow.

In reverse, the pivot point is usually slightly aft of amidships. Because of this, the bow will follow the stern quite well in reverse and it may often be easier to 'reverse park' in tight situations.

Lags in helm and throttle response

A boat does not respond instantly to the wheel or throttles—rather they give instructions that will be followed after a lag. The duration of these lags will vary among different boats and they need to be anticipated in close-quarter manoeuvres.

The lag in helm response is known as 'advance'—a segment of a turn in which a boat travels forward after a helm instruction and before the boat moves off its course line.

Practise steering manoeuvres at idling speed to understand the handling characteristics in different conditions.

3.2 Launching and retrieving

Launching

A systematic approach will enable successful launching of a small boat from a trailer. Courtesy to other ramp users is fundamental.

1. Most preparations should be undertaken prior to launching—not at the ramp:
   - putting the bungs in
   - checking all safety gear
   - checking the state of the batteries
   - checking fuel and oil.

   Before backing the boat down the ramp:
   - remove tie-down straps and trailer lights (disconnect trailer wiring)
   - secure lines to bow and stern to control the boat when it floats clear of the trailer
   - if launching a trailer-sailer, check for overhead wires before rigging or moving the boat
   - rig any remaining gear such as radio aerial or transom-mounted echo sounder transducers.

   Always walk carefully down a boat ramp you've never tried before—it may drop off or be slippery.
2. Drive to the ramp and back the boat and trailer down the ramp. Practice should be conducted in quiet carparks or home driveways, not at a busy boat ramp. If boating from various launching sites, it is worthwhile attaching a towball to the front of the vehicle.
3. Back in far enough to float the stern, but try to keep the tow vehicle's wheels out of the water. The distance the boat is backed into the water will depend on the incline of the beach or ramp. If the trailer is of the 'break-back' type you will not need to back it in as far as other trailers, but ensure there is enough water for the boat to float in as it is pushed off the rollers at a steeper angle.
4. Make sure you have attached a bow line to the boat, then release the winch and disconnect the winch line while holding onto the bow line. Launch the boat slowly.
5. Move the boat to an area away from the ramp to load additional equipment and passengers.

It's easy to forget the bung—but if you do, don't panic. Get the boat going and when it is moving fast enough, the water will drain away, and the bung can then be put in by one of the crew.

Remember the speed limit within 30 m of a boat ramp is 6 knots.

Retrieving

The steps for retrieving the boat are essentially the reverse of launching:

- Back the trailer into the water, again keeping the tyres of the tow vehicle at the water edge, not in the water. Pull out the winch cable and hook to the rear of the trailer.
- Manoeuvre the boat carefully onto the submerged trailer (ropes secured at both ends let the crew hold the boat aligned), attach the winch cable and shut off the engine prior to raising it.
- Winch the boat onto the trailer and secure it.
- Drive the trailer and boat out of the ramp for cleanup, reloading, securing equipment and safety check.
- Remove the drain plug to allow water to drain from the bilge.

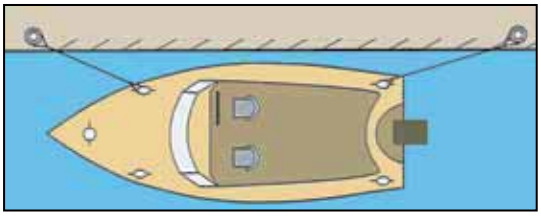
There is a variety of trailer products on the market to assist in launching and retrieving. See the local marine dealer.

3.3 Berthing and unberthing

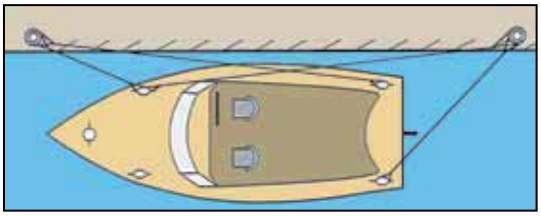
Manoeuvring alongside jetties and other boats in a seaman-like fashion avoids potential damage.

Tied up alongside

A small boat may need only a bow line and a stern line to be securely tied up alongside a jetty or pontoon. If the berth is not floating, these lines will have to be lengthened to allow for the rise and fall of the tide.

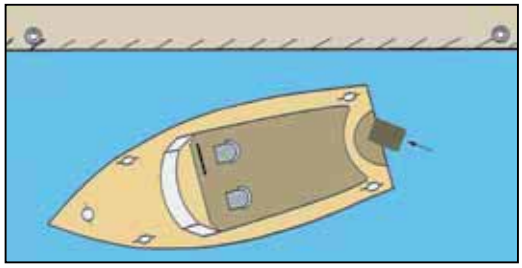


A larger boat should add a bow spring (runs aft from the bow of the boat) and a stern spring (runs forward from the stern of the boat) to ensure its security.



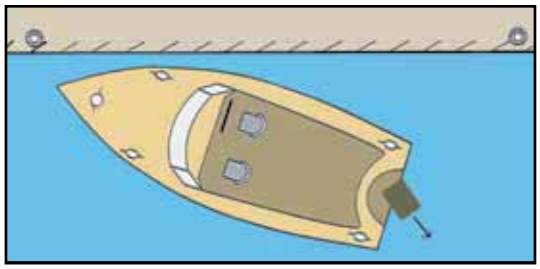
Leaving a jetty or pontoon

Because of the nature of boat steerage, it is not reasonable to drive ahead and steer away from a berth. To get the bow out, the stern must have room to move in.



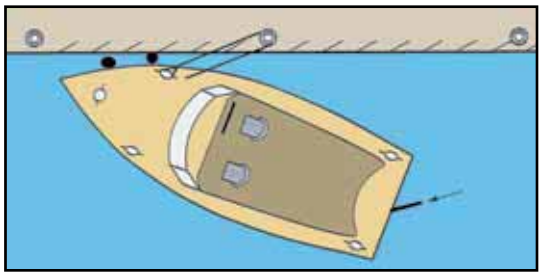
A very small boat may be manually pushed away from the berth after forward and aft lines are let go. Provided the boat moves well clear, it could then be driven ahead and slowly steered away from the berth. This may not be possible when the wind or tidal flow is keeping the boat on its berth.

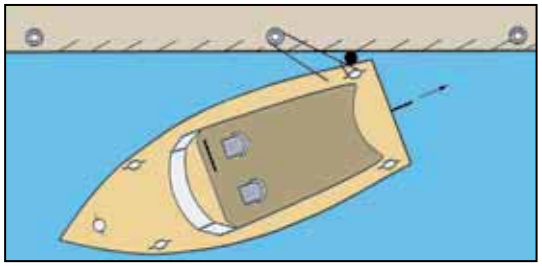
An outboard engine boat can (generally) more easily reverse away from a berth. Forward is not engaged until the boat is well away from its berth.



This relies on being able to redirect the reverse thrust of the outboard, an option not available on an inboard engine boat.

The optimum methods for inboard boats to leave the berth involve the use of spring lines where the berth bollards are temporarily doubled up so they can be recovered on board as the boat departs. Two methods of doing this are shown below.

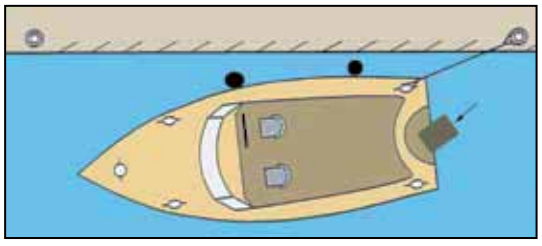




The better method will be influenced by the nature of the boat (ease of using fenders, overhangs forward and so forth) and the prevailing conditions of wind and tidal flow. These methods will also work effectively on outboard engine boats.

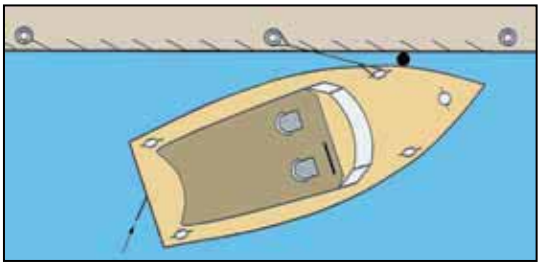
Coming alongside a jetty or pontoon

Where possible, a small boat may approach the berth at a fine angle, stopping alongside a dock bollard and placing a stern line on the bollard. By driving gently ahead the boat will be drawn alongside the berth and can be held there while other lines are secured.

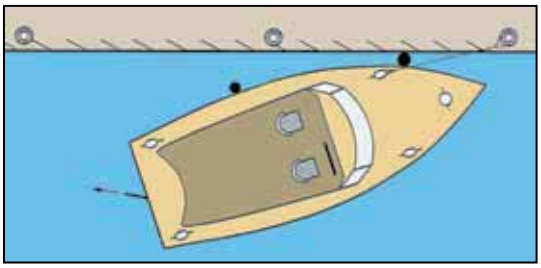


If the wind is blowing strongly off the berth, the boat may need to reverse into the bollard to secure the stern line and then motor ahead.

An alternative, suitable for inboard and outboard engine boats, is to approach the berth at a slightly broader angle and attach a bow spring. By gentle motoring ahead, using rudder or outboard to bring the stern in, the boat will seek the dock and remain alongside while other lines are secured.



A third technique is favoured for inboard engine boats. After attaching a bow line, reverse propulsion uses transverse thrust of the prop to bring the stern alongside. Assuming a right-handed propeller, port side alongside will be favoured for berthing using this technique.

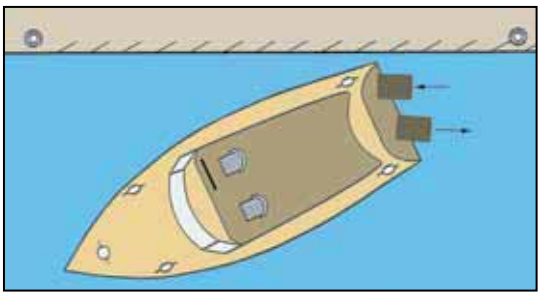


Skippers should avoid, as far as practicable, travelling in the same direction as a tidal stream or current when approaching a berth. This requires not only headway to be checked, but also sternway to be gained against the flow.

Berthing head to stream enables steerageway to be maintained and the tidal flow to be used to advantage in checking relative headway.

Twin engine boats

All the above manoeuvres can be achieved with twin-screw boats. Control during turning is enhanced by splitting engines (one forward and one in reverse). Remember to steer to the engine that is in forwards.



3.4 Attaching to a mooring

It might seem as simple as just grabbing or letting go a rope or two, but there's a right and wrong way to do it. Plan each step ahead.

To pick up a mooring:

- First observe other moored boats—their positions indicate wind and/or tidal flow. Different types of boats may lie in the opposite direction to the wind and current.
- The small pick-up buoy is also an indicator of drift direction.
- Approach from downwind or down-tide, using the stronger of the two as a brake.
- Come up slowly and don't over-run the mooring buoy—it risks fouling the propeller on mooring lines.
- Use a boat hook to capture the pick-up buoy. Secure line or chain to a bow cleat.

To leave a mooring:

- Warm up the engine and check for other boats nearby. If sailing, prepare the sails.
- If there is heavy strain on the mooring, use the motor or sails to come up to the mooring. Release the chain or rope from the bow cleat.
- Drift back to clear the buoy before moving away, avoiding lines in the water.

Note:

Most moorings belong to someone or are administered by a local agent/authority. Penalties apply for unauthorised use.

3.5 To anchor

An anchor is used when you want to stop and fish, swim, have lunch or stay overnight.

It is also an important item of safety equipment. Recommended requirements are highlighted in the minimum safety equipment table (page 25). Even if you do not plan to use it, an anchor is imperative if a boat breaks down. An anchor will keep the boat in the one location or reduce the rate of drift until help arrives.

When at anchor, remember changes in wind and sea conditions can affect the holding power of ground tackle, compromising the safety of the boat.

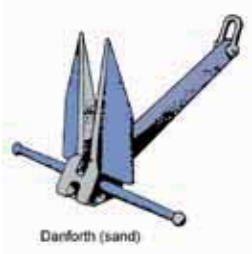
Anchors must be of a type that will work in the relevant seabed and with enough line to suit the depths in which you usually operate.

Other than for an emergency, boats must not anchor in channels, near navigation beacons or important notices on the shore such as cable crossing signs.

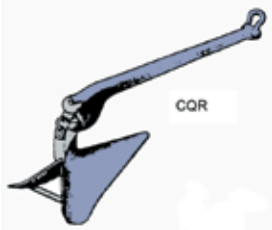
Types of anchors

There are types of anchors used for different applications:

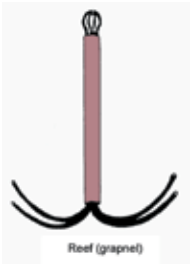
A **Danforth** anchor is most commonly recommended for, and used by, small craft. The Danforth is a small light anchor with excellent holding power in mud and sand and can be easily handled in a small boat. Reefs should be avoided as the flukes may wedge in between rocks, causing the retrieval of the anchor to be difficult.



CQR or plough anchors are the most commonly used by larger, heavier boats, but can be used in small craft. CQR or Plough anchors also have good holding power in sand and mud but should not be used on reefs.

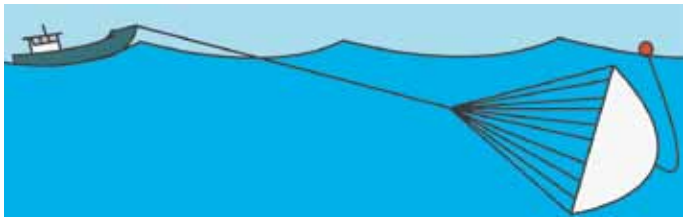


Reef or grapnel anchors are designed to hold on coral or rocks. Other types of anchors will lodge under coral and that's where they will remain. The prongs on a reef anchor are meant to straighten out when excessive load is applied and can then be bent back into position and you create less damage to the coral.



In coral reef areas it is better to anchor on sand where a Danforth or plough anchor is more suitable. Do not anchor on coral unless in an emergency.

A **sea anchor** or **drogue** is used in heavy seas to slow the drift and keep the bow of the boat into the wind and the waves. This will also provide more comfortable conditions when drifting in choppy seas.



If you plan to go boating offshore or on an extended trip, a sea anchor is a valuable piece of equipment.

Anchor lines

Anchors also must have something to attach them to the boat. This is called the anchor rode and may consist of line, chain or a combination of both. The whole system of gear including anchor, rope and shackles is called ground tackle.

Anchor lines are important. Don't use an anchor line that floats such as a polypropylene. It can hinder the anchor from digging in and holding and is also prone to being cut off by boat propellers. Nylon and silver rope are both suitable material for anchor lines. Nylon is best known for its strength and stretching ability plus being more resistant to abrasion. Silver rope has less tensile strength.

There should always be a good length of chain (at least 2–3 metres) between the anchor and the anchor line.The purpose of the chain is to keep the stock or shank of the anchor parallel to the seabed that then allows the flukes of the anchor to gain maximum penetration into the seabed. The chain also helps prevent the anchor line chafing on the bottom. Generally the bigger the boat, the more chain you require.

The length of the anchor line may need to exceed five times the depth of water in which you normally operate. If you mark off the rope at regular intervals with coloured twine, you'll know how much rope to release so that the anchor sets correctly.

The scope

Scope means the ratio of the length of anchor line let out to the depth of water in the place you are anchoring.

It is essential to use the proper length of anchor line to hold the ship in all conditions. To calculate how much line to let out, allow for a ratio of 5 to 1. If conditions are extreme, increase the ratio to 8 to 1. The flatter the pull on the anchor, then the better it will hold. The ability of the anchor to hold the ship will also vary with the nature of the seabed.

Anchoring

Keep the anchor, its chain and rope tidy—many boats have a chain locker or well. A plastic crate, bin or open bag keeps things neat. Leave the end out (or feed it through a hole in the crate or bin) to tie to the boat, then lay the rope down coil-by-coil, then the chain and anchor. Ensure the end is secured to the boat.

Charts or local knowledge will tell you where there is good holding ground—beware of submarine cables and other moorings.

When anchoring, lower the anchor to the bottom—don't pick a bundle of anchor chain and line and throw it over hoping it will untangle. Always lay your anchor line out—let it touch bottom and let the boat go astern until sufficient line is paid out.

Don't be tempted to anchor by the stern. Anchoring by the stern causes the stern of the ship to sit lower in the water. Any wave actions or even the wash of other ships can cause water to flow over the stern. Always anchor by the bow.

Ensure you take into account the rise and fall of the tide when selecting a long-stay anchorage.

Like anything else, there's a proper way to anchor:

- Select an area that offers maximum shelter from wind, current, boat traffic and so forth.
- Consider how your boat will lie in relation to others. Pick a spot with swinging room in all directions. Be aware that the boat will swing downward of current from the anchor.
- Determine depth and bottom conditions and calculate the amount of rope you will put out.
- Lay out the amount of rope you will need on deck in such a manner it will follow the anchor into the water smoothly without tangling. Ensure its end is secured to the boat.
- Motor slowly into the wind or tide to just ahead of your chosen spot.
- Wait until you start to drift backwards, then lower the anchor, checking the marks on the rope.
- When it touches bottom, slowly pay out the required scope (gentle reverse propulsion may assist), then secure the rope to a cleat.
- Motor gently back against the anchor to dig it in and ensure it is holding.
- While still in reverse, observe a transit between two fixed features to be sure the anchor isn't dragging. This can also be determined by observing the angle of the cable away from the boat and by placing fingers on top of the rope to feel for any vibration that would accompany the dragging of an anchor over the seabed.
- Check frequently to make sure you are not drifting.
- Don't forget to show the correct lights at night.

Raising the anchor

Warm up the engine and motor slowly along the line of the anchor rope, bringing in the rope and feeding it into the bin or locker. Don't over-run the rope.

In small boats always try to handle the anchor from the cockpit, not the foredeck.

When the boat is directly above the anchor, a good pull or, with the line secured on a cleat, a short push ahead under power should release it from the seabed. Once free, raise the anchor to the waterline. Clean if necessary and let the rope dry before stowing away.

If the anchor becomes caught, do not move the boat over the top of the anchor in an attempt to dislodge it as it may cause the boat to overturn. If you cannot dislodge the anchor, it is safest to cut it off.

A handy hint is to wear gloves when hauling in the anchor.

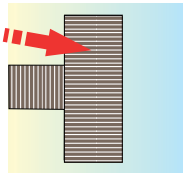
Section 3 activities

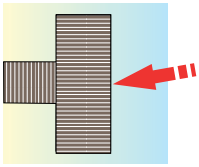
Activity 1

List some factors that affect the manoeuvring of a boat.

Activity 2

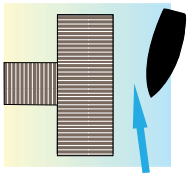
The diagrams below show two different windage situations. Out of the two which one would be easier to berth your boat alongside the jetty and why?

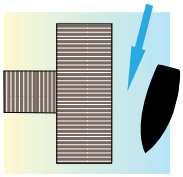




Activity 3

The diagrams below show two different tidal situations, out of the two which one would be easier to berth your boat alongside the jetty and why?





Activity 4

Propellers are either left or right handed, named by the direction they rotate in forward propulsion, in the following two pictures name the propellers.

Activity 5

Transverse thrust has a tendency to walk the stern of your boat in a certain direction depending on whether your propeller is left or right-handed. Which way will the stern walk on these two boats when in reverse?

Right-handed

Left-handed

Activity 6

With a right-handed propeller, it would be easier to berth alongside a jetty with:

A port side to jetty

B starboard side to jetty

Activity 7

List the main steps involved in launching a boat from a trailer.

Activity 8

What considerations should be made before anchoring a boat?

Activity 9

If you wished to anchor in 10 m of water, how much anchor line should be used in average weather conditions?