

# Anchoring

## Overview

Anchoring is something that many boaties take for granted and pay little attention to the process or potential associated variables. Yet this is one of the most important exercises you will undertake. In effect, your anchor and rode is the equivalent of the handbrake in your car BUT there are many more variables to consider when anchoring your boat.

These variables include -

- ) Depth of water;
- ) Type of bottom ;
- ) Weather forecast;
- ) Tides;
- ) Length of your stay;
- ) Other vessels in the area;
- ) Should you set your anchor alarm;
- ) Should you set depth alarms;
- ) Are you anchoring in a raft and therefore for more than one boat.

Anchoring should never be taken for granted. Consider your situation carefully including the environment and the purpose of your stay before you lower the anchor. Anchoring is a process and requires setting the anchor carefully then checking that your vessel is where you want it to be and that the anchor is holding before your turn off your engine and begin to relax.

Anchors are designed to either bury themselves into the bottom sediments or to grab onto the rocks and coral so it is vital that they be used appropriately to be effective.

It is also important to understand the various concepts proposed to anchor so that you are aware how other vessels may have anchored given the forecast weather or length of your anticipated stay. For example, a 20 metre yacht using the formula of 5x the water depth and in Sydney Harbour where it can be 20 metres deep, results in a swing radius of around 100 metres. If you anchored 30 metres in front of it and use the formula of 1x depth plus boat length, then you could be in serious danger if there is a strong wind change.

One should also remember that if you have an engine failure, dropping an anchor may prevent your boat from drifting with the current or being blown by winds towards rocks or into a zone of danger such as into a surf break or main navigation channel. In really deep water the anchor can be used as a drogue or attached to something that can act as a drogue.

## Introduction

When I did my Marine Radio Operators course, many years ago, I overheard a conversation between two owners of large cruisers regarding how to best anchor their vessels 'out in the bay'. The response was 'I just dump all my chain on the bottom'.

I was mortified, but since I only had a Whittley, I was not going to get involved in the discussions of these two wealthy boaties. I just figured that I should stay as far away as practical from all such boats when I anchor.

The NSW Marine Safety (General) Regulation 2009 - Schedule 4, Standard of safety equipment carried on recreational vessels (Clauses 83 and 84) indicates that

- ) *The anchor and chain and/or line must be suitable for the purpose of securing the vessel given the vessel's size, weight and the area of operation.*
- ) *The chain and/or line must be of sufficient strength and durability for the purpose and is to be securely attached to both the anchor and the vessel.*
- ) *Where applicable, the anchor should comply with Australian Standard **AS:2198-1983, Anchors for small boats**.*

This covers nearly everything about the physical items required to anchor a vessel but really doesn't tell you anything; typical of red tape.

There is an abundance of information on anchors and anchoring on the internet. The information below has been extracted from some of the numerous documents available.

## Types of Anchors and Rodes

Anchors 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, rode, shackles etc. is called ground tackle.

Anchors work in two ways. They can be massive, such as mooring blocks, and use their mass to hold a vessel from drifting. Lightweight anchors either hold on to the bottom (rocky areas) or bury themselves in the bottom sediments to hold the vessel.

There is no single anchor design that is best in all conditions. In fact, it is not uncommon for a vessel to carry several types of anchors to cater for differing conditions or for different requirements. The anchors below are commonly used by cruising boats, however, there are numerous variations of these as well as many additional styles of anchors which may offer superior holding for a given bottom environment or boat sizes.

	<p>CQR (Plough)</p>	<p>One of the most commonly used anchors on small cruisers but best stored on a bow roller.</p> <p>Good holding power in sand, mud, sea grass, pebble and coral.</p> <p>Can have problems in compacted sand and very thick seagrass.</p> <p>Reasonable when the direction of pull changes because of wind shifts or tide changes.</p>
	<p>Danforth (Fluke)</p>	<p>Excellent holding power in sand, mud and clay.</p> <p>Is lightweight and stores flat.</p>
	<p>Folding Grapnel</p>	<p>Small Grapnel anchors are often used in dinghies because of their holding power on rocks, light weight and can be folded for storage.</p>
	<p>Grapnel (Reef)</p>	<p>Excellent in coral, stone and heavy weed.</p> <p>An advantage is that if snagged, can be loaded so that the flukes bend and release.</p> <p>Some versions can be folded flat or the flukes straightened for storage.</p>

Table 1 – Some Anchor Styles and Uses

The size or weight of the anchor and the size of the chain and rope vary depending in accordance with the size and shape of the vessel and to a lesser extent, the environmental conditions expected.

Boat Length (ft)	CQR	Bruce	Danforth	Chain Dia mm	Rope Dia mm
15	15	4.5	15	6	8
20	20	11	20	6	10
25	25	11	25	6	10
30	30	16.5	30	8	12
35	35	22	35	10	14
40	40	33	40	10	16
45	45	47	45	12	18
50	50	63	60	12	20
60	70	63	70	12	22
70	100		100	14	24

*Table 2 – Recommendations for anchor types and weights, with the boat length being in feet, the anchor weights being in pounds, while the chain sizes and rope sizes are in millimetres.*

- ) These are average recommendations, and if your boat is particularly heavy for its size or has a lot windage, it may be worth moving up a size. The recommendations here are for your main anchor.*
- ) The anchor needs to be shackled to the chain with a shackle at least as strong as the chain itself.*

An anchor rode should always include enough chain to ensure a horizontal pull along the bottom as is shown in Figure 5 below. Whitworths recommends that a minimum of 10 metres of chain or the boat length (whichever is the lesser) is used.

### **Types of rope**

*Rope is available in a variety of materials and combination of materials. The type of material used for the rope is the main determinant of the rope’s strength, abrasion resistance, ease of use, and price. For this reason it is important to have a basic understanding of the basic differences between the various rope materials available.*

*Nylon rope - is the strongest easily available rope material. Although it is quite strong it does lose about 15% of its strength when wet. In most cases, this is not significant, but it should be factored into the rope-buying decision for applications where the rope will be exposed to water. It should also be noted that it is very dense and sinks in water.*

*Nylon is the best choice of rope for many applications. This includes marine, general purpose, and towing. It is very strong, but perhaps more importantly highly UV and abrasion resistant, so it lasts a long time. The most commonly available nylon ropes are white and may be marketed as “dock lines” or “anchor lines”. Nylon ropes excel at both of these tasks.*

Polypropylene rope - is most popular due to its price. Of the synthetic fibers it is the cheapest. It is strong for its weight, but it is not very UV, heat, or abrasion resistant. For this reason, it is generally not a good choice for long term applications where the rope would be exposed to sun or abrasion (e.g. a dock line). Polypropylene's only redeeming characteristic other than its excellent price is that it floats. In some applications (e.g. rescue line) this is an important feature.

Polypropylene is the best choice for budget conscious applications where the rope will not be exposed to abrasion or UV for extended periods of time or where buoyancy is needed. This includes cheap disposable twine, general purpose budget ropes, and infrequently used ropes. This rope is commonly available in yellow as "value packs" or as cheap twine sold in hardware stores.

Polyester rope - is almost as strong as nylon, but it does not lose strength when wet. It also has the highest resistance to abrasion, UV and heat. The main difference between nylon and polyester is the elasticity – nylon stretches significantly more than polyester. Polyester is also more expensive and not as easy to work with. It is also more difficult to untie than nylon.

Because of these factors, nylon is more appropriate for applications where slight stretch is desirable such as dock lines or the core of dynamic climbing ropes. Similarly, polyester line is more appropriate for applications where stretch is not desired, such as lifting slings and hammock guy lines.

Natural fibers - in general are heavier, weaker and less resistance to all forms of abrasion than synthetic fabrics. For this reason, there are few applications in which a natural fiber is preferred. Some specific applications where natural fibers are preferred include those where the roughness of the rope is beneficial (e.g. climbing rope). Natural fiber rope is also commonly used for decorative purposes. Not recommended for load bearing usage.

### **What type of rope should I use?**

The best type of rope to use when anchoring is probably nylon. Besides being light and strong, it is very flexible. It will absorb the shock from waves and it sinks which mitigates peak loads on your anchor and boat thereby reducing the possibility of dislodging the anchor from the bottom. Unfortunately, the very fact that nylon stretches means that it creates heat and will eventually break down and need to be replaced.

However, there are other characteristics of rope that make them more appropriate for some situations and may be more suitable for your needs. Ropes can be braided or twisted and each has its advantages and disadvantages.



*Figure 1 – Braided Rope*

Braided rope is less stiff and more flexible, frequently stronger than twisted rope, easier on the hands, difficult to splice and has less stretch than twisted rope. It is ideal for dock lines.



Figure 2 – Twisted Rope

Twisted rope is fairly easy to splice, generally less expensive, has more stretch than braided rope, has a tendency to kink, is more stiff and less flexible.

### What type of chain

If you are using an anchor windlass then your choices are limited and you must use only the type and size of chain specified by the windlass manufacturer. Normally this type of chain will be G4 or BBB chain. Refer to your windlass manual regarding the chain size for you.

If you are using a windlass with chain and rope, remember that you must *splice* your rope to your chain as a shackle going through your windlass gypsy will be bad news. You can purchase a pre-spliced rope and chain package or you can splice your own.

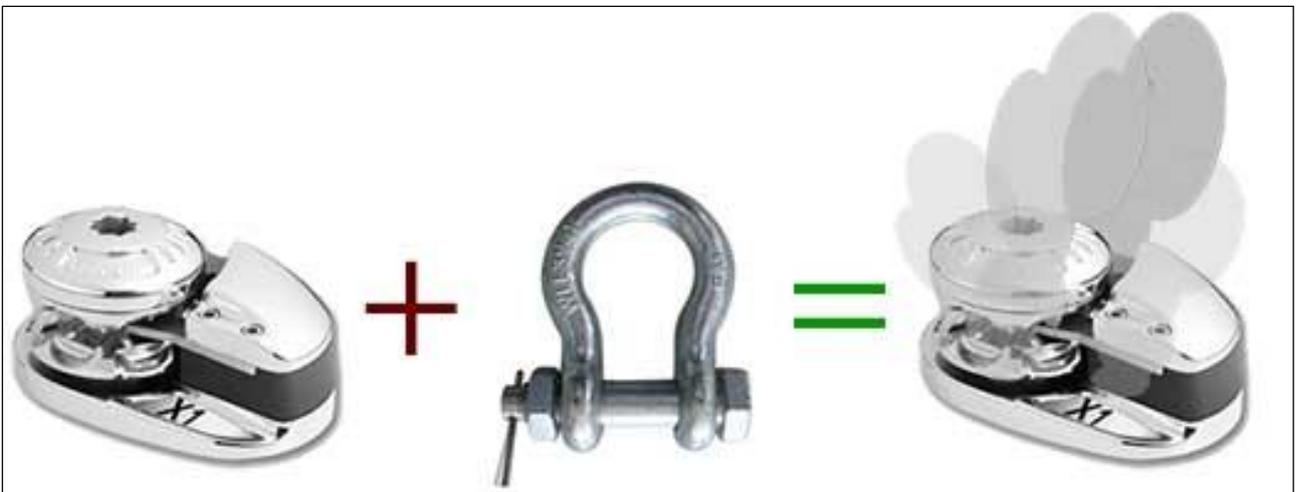


Figure 3 -Thinking about using a shackle with your windlass? **Don't do it!**

### How much anchor rope is required and what size?

There appears to be a few 'rules of thumb' that are used for calculating how much and how big an anchor rope to use: One is as follows -

- ) 8 feet of rope for every 1 foot of water you will be anchoring in
- ) 1/8" of rope diameter for every 9' of boat.

So a 28' boat would need at least a 3/8" or 1/2" diameter rope. However, rope is one of those things, like anchors, where a little bigger is normally better.

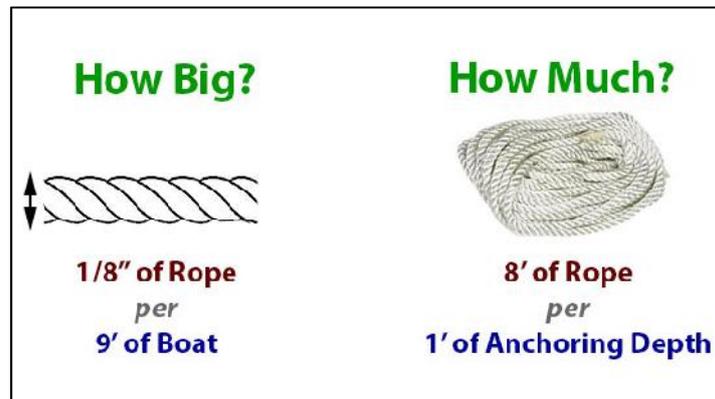


Figure 4 – Rope Sizes and Quantities

### Anchoring Principles

Anchors hold best when the pull of the "rode" on the anchor is as near to horizontal as possible.

According to some groups, the critical element of anchoring is to have enough rode out (enough scope is the jargon).

The scope is the ratio of the length of cable used for the depth of water.

Figure 5 shows a typical layout with a horizontal pull on the anchor and with a scope of 3:1. The height is defined as the depth of water plus the height of the bow sprit above the water as shown in Figure 6.

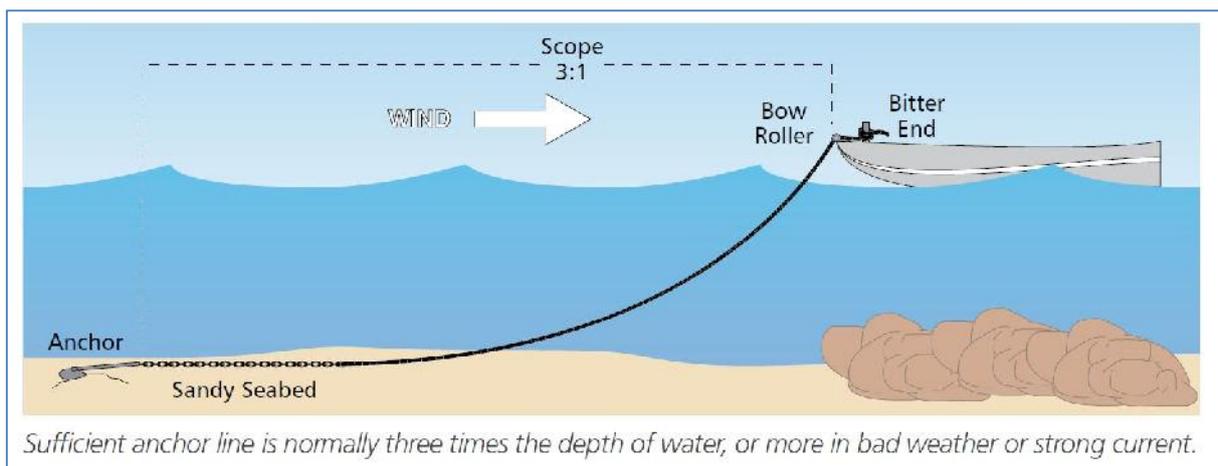


Figure 5 – Typical anchoring setup with a Scope of 3:1

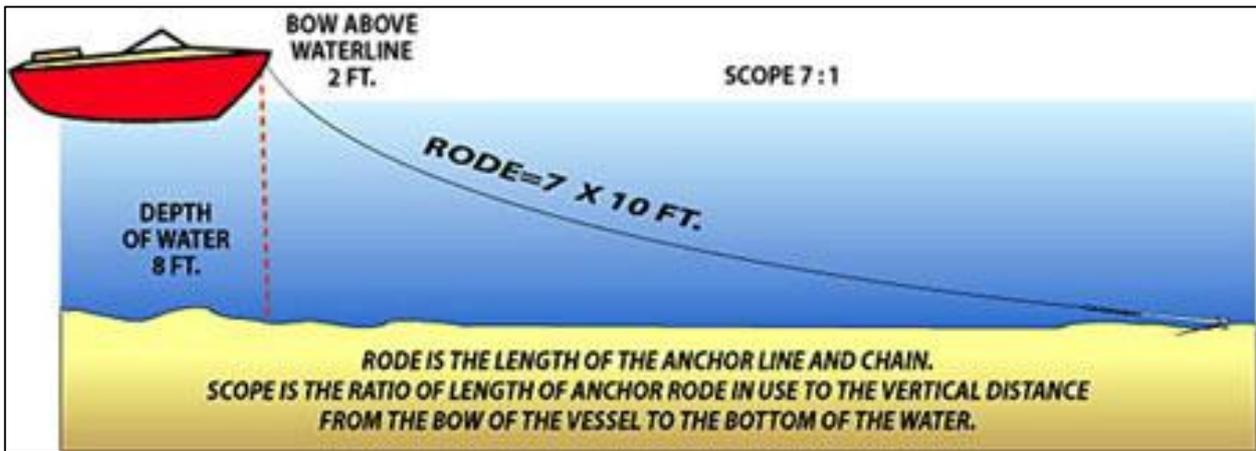


Figure 6 – Scope versus Rode using a ratio of 7:1. Note that the height includes the depth plus height of the bowsprit above the water.

A scope ratio of 3:1 is standard minimum in shallow water, although shallow water is not defined.

The absolute minimum scope is 3 times the depth of water, and 5 or 7 is better. Strong current or wind or a choppy sea puts more load on the cable and makes a bigger scope more desirable. In such conditions it may be worth using a scope of 10:1.

Boatsafe.com suggests that *“the deeper the water and the more severe the weather, the more rode you will put out. For recreational boaters, at a minimum you should have out five to eight times (5 to 1 scope for day anchoring and 6 to 8 to 1 for overnight). For example, if you measure water depth and it shows four feet and it is three feet from the top of the water to your bow cleat, you would multiply seven feet by six to eight to get the amount of rode to put out.”*

The NSW Boating Handbook suggests that sufficient rode *“normally means three times as much line as the depth of water or if the weather deteriorates, increase the ratio to 5:1 or more.”*

Another group states that *“the holding power of an anchor increases as the “scope” ratio increases. A ratio of 7:1 is standard; 10:1 is better in rough water. For example, if boating in eight feet of water and the bow is two feet above the waterline, 70 feet (20 metres) of rode is recommended.”*

The late Leif Albertson was a well-respected Sydney-based marine identity and a practical on-water boat trainer. A copy of his DVD, *“Trailer Boat Handling Made Easy”*, has been made available to all new NSW Whittley Club members for the past few years Leif conducted numerous boat handling courses for NSW Whittley Club members. He proposed an anchoring method based upon the length of the boat plus depth of water. For example, a CR2600 Whittley in 6 metres of water would require 8 metres (overall boat length) plus 6 metres (water depth) giving a total rode of 14 metres. By comparison, using a 3x multiple would require 18 metres of rode minimum. This technique works well in calm waters and results in significantly less rode than the alternative methods proposed by most other organisations. However, this technique does have its limitations and will be discussed further below.

## General Anchoring Procedure

- ) Select an area that offers maximum shelter from wind, current, boat traffic etc.
- ) Pick a spot with swinging room in all directions. Should the wind change, your boat will swing bow to the wind or current, whichever is stronger.
- ) Determine depth and bottom conditions and calculate the amount of rode you will put out.
- ) If other boats are anchored in the area you select, ask the boat adjacent to the spot you select what scope they have out so that you can anchor in such a manner that you will not bump into the neighbouring vessel.
- ) Anchor with the same method used by nearby boats. If they are anchored bow and stern, you should too. If they are anchored with a single anchor from the bow, do not anchor bow and stern. ***Small boats should never anchor from the stern alone, this could cause the boat to swamp or capsize.***
- ) Cleat off the anchor line at the point you want it to stop. (Don't forget or you'll be diving for your anchor.)
- ) When at the relevant point, back down on the anchor with engine in idle reverse to help set the anchor. (Be careful not to get the anchor line caught in your prop.)
- ) While reversing on a set anchor, keep a hand or eye on the anchor line. A dragging anchor may telegraph itself as it bumps along the bottom but not always. An anchor that is set will not shake the line.
- ) When the anchor is firmly set, look around for reference points in relation to the boat. You can sight over your compass to get the bearing of two different fixed points (house, rock, tower, etc.) Over the next hour or so, make sure those reference points are in the same place. If not you're probably dragging anchor.
- ) Begin anchor watch. Everyone should check occasionally to make sure you're not drifting
- ) If the water is fairly shallow, you may have to periodically adjust the amount of line you have out to allow for changes in depth caused by tides.

## General Anchor Retrieval Procedure

- ) Retrieve the anchor by pulling or powering forward slowly until the anchor rode hangs vertically at the bow.
- ) Cleat the line as the boat moves slowly past the vertical. This will use the weight of the boat to free the anchor and protect you from being dragged over the bow.
- ) Once free, raise the anchor to the waterline.
- ) Clean if necessary and then stow in bowsprit.

## Discussion

Anchoring is not just a matter of throwing the anchor over the side and tying off on a bollard. That is a recipe for disaster. There are many factors to consider before dropping your anchor and making sure it is set firmly and is holding your vessel where you want it.

Issues to be considered when determining how much rode you should use include:-

) Depth of water – This can be determined from your sounder but remember that in very shallow water you need to add the height about the water to your bowsprit. Most organisations recommend that the scope ratio should be higher for shallow water than deep water given similar conditions.

) Type of bottom – soft sand, compacted sand (eg Jibbon Beach due to wave action), mud, weed, rocky, coral, slope (gentle –steep; the end of many bays have steep slopes and anchors pulling down a slope may not hold, eg Audley and the Southwest Arm on the Port Hacking and Sugarloaf Bay on Middle Harbour) .

*It is better not to anchor on a weed bed for both environmental reasons, and because most anchors find it difficult to grip.*

) Weather forecast – It is vital that you know what the forecast is as this will determine whether it is safe to anchor in a proposed area, the method of your anchoring and length of your proposed stay.

For example, if a southerly change is forecast then anchoring in front of Taronga Park Zoo may not be the safest alternative, or at least be ready to move quickly.

Moderate to strong winds result in the vessel moving side to side with each movement changing the direction of force on the anchor. Continuous working of an anchor by the wind can result in it being dislodged. It is therefore imperative that you monitor your position when it is windy and especially if the wind speeds increase.

Also, winds create waves. Again, continuous action of the waves on the bow of your boat can work the chain and anchor and also result in dislodgement.

Everyone knows that weather forecasts can be wrong, as such, you should always have a **Plan B** in the event that a change occurs but is much stronger than anticipated or earlier than anticipated or is from a different direction than forecast. Many boaties have scary tales to tell because of incorrect forecasts.

If the wind or current does increase then be prepared to release additional rode but you must be aware of what other boats vessels in your immediate vicinity are doing. It may be safer to up anchor and move to a new location, ie, Plan B.

) Tides:-

- Tide height variations/changes (Lake Macquarie and Lakes Entrance have small tidal changes whereas the Whitsundays have moderate tidal ranges)
- Tidal flow rate – changes in rate of flow or direction of flow

A change in the tide will probably result in a change in direction of current. Turning of the vessel into the current will result in a change in direction of the force on the anchor within the bottom sediment and may result in the anchor being dislodged completely or slipping until it sets again. Either way, the change could result in your boat being put in danger from being too close to other boats or the shore or drifting into shipping lanes etc.

) Length of stay - Short or long stay (overnight?). Will there be a tide change during this period? What is the weather forecast? Will you need to use an anchor light?

) Other vessels in the area. If so,:-

- How big are they?
- What is their knowledge of anchoring? Do not assume that they know what they are doing.
- Will they use multiples of bottom depth? If so, how big a swing will they require?

Large vessels, particularly sailing yachts, tend to use depth multiples and have a very different response to winds and waves than smaller vessels such as a Whittley. If there are other large vessels nearby, you should consider how they have anchored and it may even be appropriate to ask them how much rode they are using.

Remember that a 20 metre vessel anchoring in 10 metres of water and using a scope of 3:1 will have a swing radius of 50 metres by its stern. That is a 100 metre diameter circle if there is a 180 degree tide or wind change. If the wind increases in strength and the skipper decides to go for a 5:1 or greater scope, then the radius increases to at least 70 metres.

This can be particularly significant on Sydney Harbour during festive events such as the New Year's Eve fireworks if southerly wind changes are predicted.

The reverse applies in areas of fixed moorings. If the wind picks up then you may need to increase your rode but the mooring rodes will remain the same, which could create problems.

If there is a mixture of moorings and vessels at anchor, such as occurs in many bays on Sydney's waterways, especially the Hawkesbury River, then changes in wind directions can result in a very complicated mix of vessel positions following the change. Vigilance is required if a change is predicted or occurs without warning.

) Anchor Alarm – Have you considered setting the anchor alarm on your GPS/Chart Plotter? If you suspect a weather change, or change in the tide, then setting an anchor alarm can provide additional eyes on your position. This should become part of your standard anchoring procedure, especially if you are anchoring for an overnight stay.

) Depth Alarms - Both shallow water and deep water alarms can be set on your Sounder/Chart Plotter. Setting such alarms can act as a warning should your anchor drag and you drift into either deep water or shallow water. Setting these alarms is recommended as standard procedure when anchoring overnight.

) Rafting - Are you part of a raft? If so, and if you have been requested to drop an anchor, there are several factors you should consider. It is common practice for only every second or third boat to drop and anchor. As such, **your anchor is being used for 2 to 3 boats** and that is more than your anchor is probably designed to do.

Rafts are only used when the situation is such that the weather is good. But by that most people assume that it is not going to be windy or that wave action will be minimal. Increasing winds can put enormous loads on an anchor, particularly if the wind is at an angle to the raft. In addition, strong currents can result in extremely large loads being placed on an anchor. The increased load of several boats can result in the anchor breaking away. If this happens, then the situation can deteriorate rapidly with disastrous consequences.

The anchoring procedure of 'water depth plus boat length' is a minimum for a single boat and is **not** recommended for multiple boats such as in a raft.

Therefore if you have been requested to drop an anchor to assist with stabilising a raft, then it is extremely important that that you consider the following factors:-

- What is the wind direction, or direction of current and is a change of tide expected? You do not want the raft rotating and anchor lines being crossed and tangled. A change in direction of the raft will also result in a change in the force on your anchor. If the force is too big, then the anchor will not hold
- Are there other vessels anchored or moored in the area that can impact on where you drop your anchor?
- Should you drop an anchor out at an angle rather than directly in front of the raft?
- Do not use the boat plus water depth method unless you are in an extremely protected area and the bottom sediment allows a good hold.
- Ensure that the anchor is set firmly before you enter the raft.

This last point is critical. I have seen many boats drop and anchor, then slowly motor back to the raft and tie up and then pull back in a little chain or rope but not set the anchor.

After you determine where you want the anchor to be, the best procedure is to drop the anchor to the bottom and up to a boat length of extra rode. Engage reverse and move astern with the motor in idle and aiming the stern towards a position several boat widths to the side of the raft. When the anchor is set and with the motor still in idle reverse, slowly release additional rode whilst maintaining tension on the anchor but keep heading in a direction to the side of the raft. When you assess that you have let out enough rode to join the raft, cleat the rode or turn off the winch release and turn the steering wheel so that the stern of the boat is drawn slowly towards the raft using the anchor as a pivot. This procedure ensures that firstly, the anchor is set and secondly, that you approach the raft slowly and in total control of your vessel. When you are adjacent to the raft, you will need to release a little more rode to release the tension on the anchor and take the motor out of gear.

- J Breakdown – In the event that you have a breakdown then consider dropping an anchor to maintain your position and stop drifting into danger. If your winch requires your motor to be going then either use the hand release or consider dropping an auxiliary anchor. In an emergency, almost any anchor will be better than nothing. If the water is too deep to reach the bottom, then releasing your anchor with a lot of rode can act as a drogue and slow down the movement until help arrives.
- J Anchor Set and Engine Off! – Even if you have done all of the above, you should remain vigilant, especially in the first few moments after turning off your motor. Take note of various landmarks or adjacent vessels in your immediate area and make regular checks to ensure that your boat is not moving and that the anchor is holding.

Safe and fun boating!

Garry Baglin  
21 May 2017

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