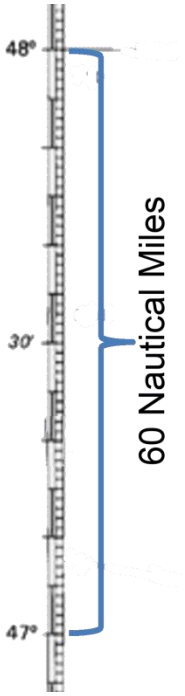
Distance at Sea by Capt. Geoff

On the water (unless you are on a lake or small river), we use Nautical Miles to measure distance. The value for the length of a Nautical Mile comes from the circumference of the earth. Early navigators generally stayed within sight of land and used approximations such as “leagues” to roughly measure distance. With the development of tools such as the Astrolabe they were able to use the sun and stars to determine more precisely how far north (or south) of the equator they were. (Measurement of East and West, once away from land was much more complicated and took the arrival of a precise timepiece for most navigators to accurately calculate.)

The measurement North or South was done by measuring the angle of the sun, moon or stars above the horizon and applying corrections for the time of year etc. For example, on the day of the equinox (when the sun is right above the equator), if the corrected angle you measured was 90 degrees, you are directly under the sun, and therefore you are somewhere on the equator. If the angle was 0 degrees, you are at either the North or South Pole.

A scale of 90 (angle from equator to pole, measured from the centre of the Earth), was too coarse a measure for the small changes involved in early navigation. As mariners back then didn’t want to work with fractions, they divided each degree into 60 minutes. Like minutes in an hour, 60 was chosen because it can be divided many ways without involving fractions. Each minute of latitude is a Nautical Mile.

If you have taken chartwork (such as taught in our Boating course), you know that you can only measure nautical miles from the minutes used on the latitude scale. Reading the distance can be a bit tricky as the mark values depends on the scale of the chart.



A small scale chart, such as 3000 (shown to left), which covers the entire BC coast will cover a degree (60 Nautical Miles) in only a few inches (or two and a half times the amount of centimeters), so on the scale, each minor mark is one mile.

For a large scale chart, such as the insert of 3539 (shown to the right), approximately the same number of inches that measured 60 miles on chart 3000, only measures 1 mile, as all the details for that area are expanded to show greater detail.

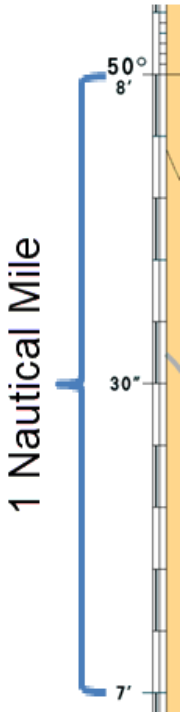
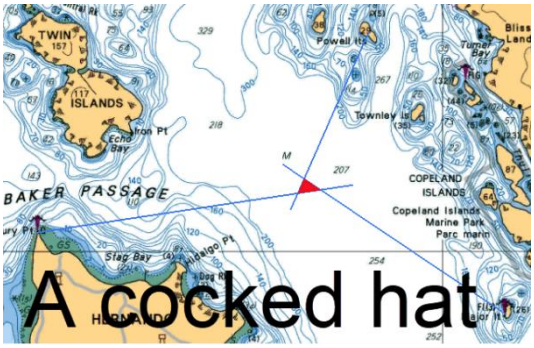


Chart 3000 doesn't lend itself to plotting a very accurate position, as about the best accuracy you could hope to use would be ½ of a mile. But if you are using it offshore, you don't need that much accuracy, as you are not at risk of going aground. In fact, when position offshore is determined by Sextant observation, trying to measure the angle between the horizon and the body while on the moving deck, to an accuracy of a 60th of a degree is recognized as nearly impossible. Yet each 60th of a degree, changes the outcome of the calculation by a Nautical Mile. A sextant based fix that put you within 3 miles of your actual position is considered quite accurate.

Even within sight of shore, navigating using pre-electronic methods was not particularly accurate. The traditional method of taking a fix using visual bearings could easily be a degree or more out, particularly if one is "shooting" something that is not well defined (the high point on a gradually sloping hill etc.). A 1 degree error at a range of 10 miles results in a position line 0.17 of a nautical mile (or approx. 1060 ft. or 320 meters) away from the correct position line. Even when using three bearings for a fix, a "cocked hat" (where the bearings don't all meet) is common. Accuracy obviously improves closer to shore, where most of the dangers are, but the inherent lack of accuracy made mariners keep a good "offing" around shoals not close to navigation marks. Recognizing these limitations, mariners often rounded positions to the nearest mile offshore, and tenth of a mile inshore. When describing distances of less than a mile, rather than saying zero point three miles, each tenth of a mile is referred to as a cable, so the distance would be stated as three cables.



With the advent of GPS, the situation is reversed, at least at first glance. The GPS display will give you a position with many decimals of accuracy. But a GPS signal by itself will tend to move the position around. You can test this by leaving your plotter track on while at the dock. After a few hours there is a good chance it will appear that your boat has visited a number of berths around you. This can be caused by Multipath, Scintillation or Refraction issues. Another problem shows up when you zoom in enough to expand the size of your vessel icon on the screen. The problem is that the GPS is showing you the exact positon of its antenna. If your antenna is at the bow or stern, it will offset the plotter icon (which assumes the antenna is at the centre point of the icon, unless you have adjusted the offset). Even then, if you don't have a heading sensor, the icon, and therefore the offset may not be pointing in the correct direction (more info? Boating course.)

The take away for using GPS is that while it can be displaying a position with an incredible amount of accuracy, it may not be the correct position. An error of 5-10 meters is not an issue in the middle of Discovery Passage, but if you set a GPS waypoint to pass Sky Pilot rock close enough to wave at the starfish, you might get a nasty surprise.

Campbell River is a beautiful area to go boating, but it comes with some challenges, mainly strong currents in the narrow passages. If you want to know more, consider taking our Boating 2&3 course, where we provide some local knowledge along with how to read a chart and compass and lots of other things to keep you safer on the water. Google Ripple Rock Squadron for more info.