PRACTICAL SEAMANSHIP

Duncan Wells, an RYA intructor and principal of Westview Sailing, cruises a Hallberg-Rassy 352

PHOTO: ALAMY

With confidence in your ability to work out secondary port tide heights, a whole new world of cruising awaits

What's the best way to find secondary port tide heights?

The maths is easy, plotters, apps and websites are easier still, but can you trust them? Duncan Wells compares several methods to find out

Why is it that, when faced with a secondary port exercise, many Yachtmaster students are immediately overcome with a fit of the vapours? It's not that complicated to work them out manually. In fact, they easy enough that we can actually do them in our heads. And with mastery of secondary ports comes confidence, which may well open up cruising grounds and anchorages that you might have been hesitant to try before. Keyhaven for example is a lovely place to anchor, or there's Christchurch to explore, Bridport, Tenby, Lindisfarne... the list is endless. Further afield we have the Gulf of Morbihan in Southern Brittany – every bay, every delightful harbour a secondary port to Brest. Not one of them difficult to work out, as you will see.

Of course, today we don't need to work them out manually. There is a wealth of tidal height information online, in apps, embedded within chartplotter software, even on your wrist if you have a Quatix watch. So outside the classroom there is probably no need to work out a secondary port tidal height by hand. But how accurate is all this digital information? We compared seven sources of tidal information – the UK Hydrographic Office (UKHO) tide table using differences in the almanac, versus online and in-app offerings, plus the data from our Garmin chartplotter – against each other for the standard and secondary port. Then we went to a secondary port, Yarmouth on the Isle of Wight, and measured the height of tide over six hours.

Why secondary ports?

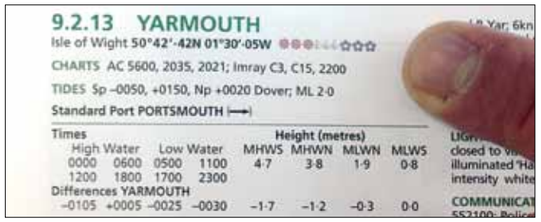
It would be an impossible task to compile tide tables for every single port and harbour throughout the UK, let alone abroad, so the UKHO publishes tide tables for all of the British standard ports, of which there are 30, and then any port that is near one of these becomes a secondary port. The differences in times and heights of High Water (HW) and Low Water (LW) between our secondary port and the standard port are listed in the almanac.

Secondary ports using interpolation

The information for the secondary port of Yarmouth, Isle of Wight, is presented like this (see photo, right) in the almanac. It tells us where it is, what it's like (red wheels rate ease of access, green thumbs facilities and purple rosettes ambience), which charts cover the area, the offset for the tides compared to Dover, mean sea level and duration of the tide, that the standard port is Portsmouth and which way to go in the almanac to find its tide table. Below that is the information we need to calculate tidal times and heights in this secondary port.

So, when HW Portsmouth is 0000 or 1200, HW Yarmouth will be -0105, meaning one hour and five minutes (65 mins) earlier. When HW Portsmouth is 0600 or 1800, HW Yarmouth will be +0005, meaning five minutes later. If HW Portsmouth is not exactly on one of these times, we interpolate.

PHOTO: REEDS NAUTICAL ALMANAC



9.2.13 YARMOUTH

Isle of Wight 50°42'·42N 01°30'·05W

CHARTS AC 5600, 2035, 2021; Imray C3, C15, 2200

TIDES Sp –0050, +0150, Np +0020 Dover; ML 2·0

Standard Port PORTSMOUTH (⟶)

Times				Height (metres)			
High Water		Low Water		MHWS	MHWN	MLWN	MLWS
0000	0600	0500	1100	4·7	3·8	1·9	0·8
1200	1800	1700	2300				
Differences YARMOUTH							
–0105	+0005	–0025	–0030	–1·7	–1·2	–0·3	0·0

Time of HW Portsmouth

0000	2300	2200	2100	2000	1900	1800
1200	1300	1400	1500	1600	1700	1800
1200	1100	1000	0900	0800	0700	0600
0000	0100	0200	0300	0400	0500	0600

-0105 +0005

Differences at Yarmouth

This line from -0105 to +0005, which spans the six hours from 0000-0600 (and 0600-1200, 1200-1800, 1800-0000) is our time differences line. It is 70 minutes long (-0105 to +0005). If we divide 70 minutes of time difference by 6 hours is 11.67 minutes of difference for each hour. I can't deal with 11.67 so I will round it up. Thus, every hour we move along the line, the time difference changes by about 12 minutes.

Time of HW Portsmouth

0000 0100 0200 0230 0300 0400 0500 0600

-0105 -0035 +0005

Differences at Yarmouth

Say HW Portsmouth is 0230. This is 2.5 hours along from 0000 so we will move 2.5x12 mins, or 30 mins, along our time difference line from -0105 (or -65 mins), which is -35 mins. HW Yarmouth therefore is 0230-35mins, which is 0155.

Height differences

The almanac tells us that when MHWS (Mean High Water Springs) at Portsmouth is 4.7m, we have 1.7m less at Yarmouth. When MHWN (Mean High Water Neaps) is 3.8m at Portsmouth we have 1.2m less at Yarmouth.

The range between Portsmouth's heights (4.7m to 3.8m) is 0.9m, and the range between Yarmouth's differences (-1.7m to -1.2m, so always lower than Portsmouth) is 0.5m. Divide 0.9m by 0.5m to get 1.8, or 2 in my rounding world: a 2:1 ratio Portsmouth: Yarmouth.

So if the height of HW Portsmouth is 4.4m, that's 0.6m higher than MHWN (3.8m). Our 2:1 ratio means the height difference at Yarmouth is half that, or 0.3m, lower than MHWN (-1.2m) so 1.5m lower. So the height at HW Yarmouth is (4.4m-1.5m) 2.9m. You can do the same interpolations in your head for LW times and heights.

As all secondary port times relate to the standard time zone of the country, GMT in Britain, we take the HW time from the tide table, establish the secondary port difference and then allow for BST.

Standard ports in UK and Ireland

Secondary port tidal times and heights are calculated relative to a standard port

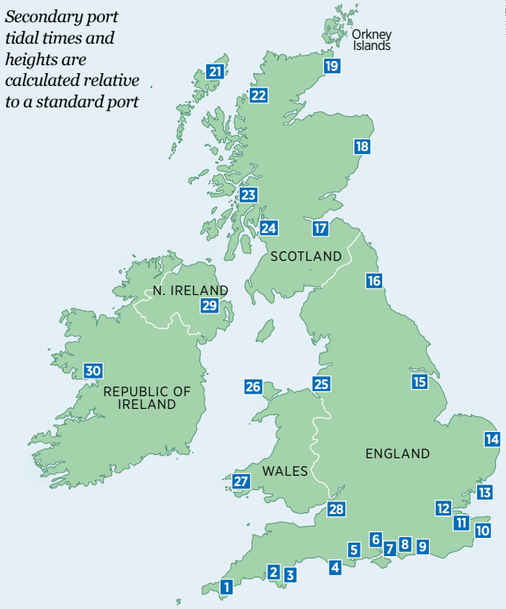


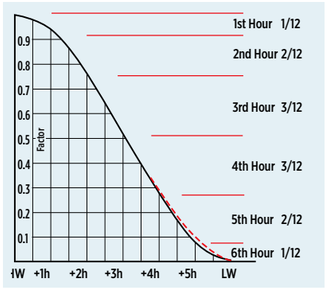
CHART: MAXINE HEATH

1 Falmouth 2 Plymouth 3 Dartmouth 4 Portland 5 Poole 6 Southampton 7 Portsmouth 8 Chichester 9 Shoreham 10 Dover 11 Sheerness 12 London Bridge 13 Walton-on-the-Naze 14 Lowestoft 15 Immingham 16 North Shields 17 Leith 18 Aberdeen 19 Wick 20 Lerwick 21 Stornoway 22 Ullapool 23 Oban 24 Greenock 25 Liverpool 26 Holyhead 27 Milford Haven 28 Bristol 29 Belfast 30 Galway Bay

Rule of Twelfths

In a perfect world, the tide uniformly follows the pull of moon and sun in a neat parabolic curve. Of course, continents and coastlines make the tide much less neat, but a generic tidal curve can still give us a rough of what the tide should be doing. The Rule of Twelfths is a simple way of converting this curve into meaningful numbers, for both tidal height and rate of flow. You might not want to risk your keel on the result, but it's a good start, and it's easy enough to do in your head while you are on the helm with mainsheet in hand.

Take the range of the tide and divide it by 12

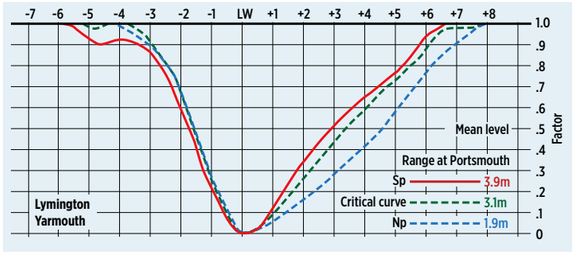


So from HW (or LW) the tide will fall (or rise) by:

1/12 in HW+1 (1/12 of the range)
2/12 in HW+2 (3/12 of the range)
3/12 in HW+3 (6/12 of the range)
3/12 in HW+4 (9/12 of the range)
2/12 in HW+5 (11/12 of the range)
1/12 in HW+6 (12/12 of the range)

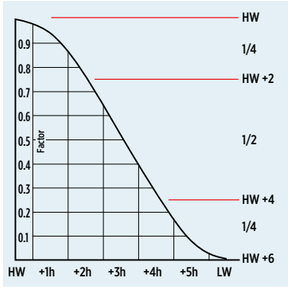
For example, if HW is 4.6m and LW is 1.0m, the range is 3.6m. Divide that by 12 and you get 0.3m. If we want to know the drop in tidal height at HW+4, a drop of 9/12 of the range, it is (9x0.3m) 2.7m. So at HW+4 the height will be (4.6-2.7) 1.9m.

The Yarmouth curve



As the Rule of Twelfths applies only to fairly regular parabolic curves, it shouldn't be much use in Yarmouth as the tide here has a double HW similar to Southampton and does not flood and ebb evenly. The duration of the tide varies from 4½ to 8 hours and on the day we visited there was a seven-hour tide. We'll try it anyway, to see how it fares.

Bill Anderson's rule of quarters



***Yachting Monthly's* seamanship expert Bill Anderson uses a simplified Rule of Quarters, where the tide range is divided by 4. From HW (or LW) the tide will fall (or rise) by:**

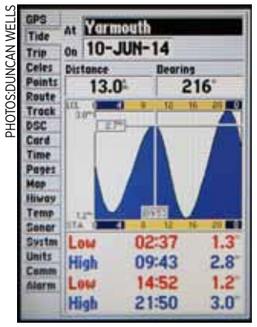
1/4 from HW to HW+2 (1/4 of the range)
2/4 from HW+2 to HW+4 (3/4 of the range)
1/4 from HW+4 to HW+6 (4/4 of the range)

For the example above, divide the range by 4 (3.6/4) to get 0.9m. HW+4 is a drop of ¾ of the range, or (3 x 0.9m) 2.7m. So at HW+4 the height will be (4.6-2.7) 1.9m.

Chartplotter tide tables

Plotter tide tables will never be as accurate as the UKHO tables because UKHO supplies the plotter companies with simplified tidal data rather than the full harmonic information that's available on UKHO's own Easytide website. In places that might have two high waters, such as Southampton, simplified data might read as one HW. That said, the Garmin data in our comparison was quite accurate. It is very handy having this information available on our chartplotters and if we are in an area where there are tidal anomalies, we can always refer to the almanac.

PHOTOS:DUNCAN WELLS



Many chartplotters have tidal curves in their cartography software

App tide tables

There are several tidal prediction apps on the market and we decided to test two of them.

Navionics

The popular Navionics app includes tidal times and heights, as well as tidal flow direction and speed

The tidal data you get from Navionics depends on the area covered by the chart you buy (£44.99 for Navionics Marine Europe HD). Predictions are given in local time and they seem to vary from the original UKHO data. Select a location and you can scroll through four days' worth of predictions showing tidal heights and a simplified tidal curve without access to the internet.

Aye Tides

We also put the AyeTides app to the test. It's data was pretty close to that of the UKHO, although it comes from the USA

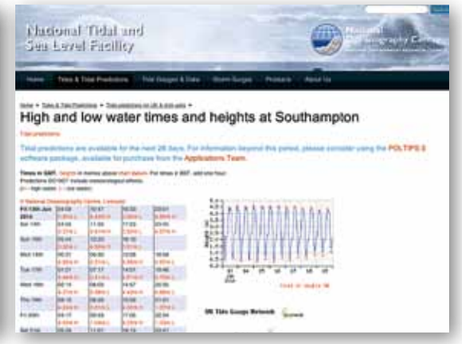
Aye Tides (£5.49) is an iPhone app that also works on iPad, but for the same price you can get Aye Tides XL, which has some interesting features like a month's tidal curves. Click on any one and you get a much bigger, but still simplified, curve. It's a US app so, although it covers 10,000 ports, it's not much use if you live on the east coast for instance. The data is from NOAA (National Oceanographic and Atmospheric Administration).

Tide tables on the Web

There are three main tide tables online for UK data and they are all excellent:

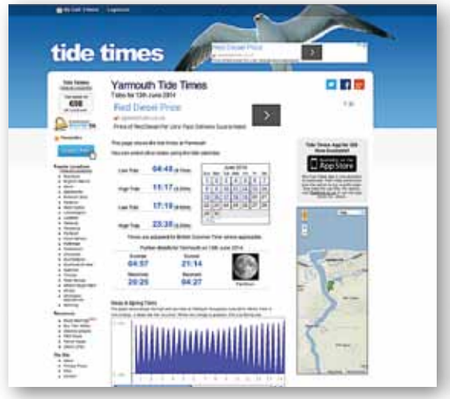
www.ntslf.org

This site provides NOC (British National Oceanography Centre) data for 51 UK ports. Most of them are standard ports, though. It provides tidal data for the next 28 days, which is good, and you can buy software to provide tidal predictions beyond that. However, the tidal curve provided, showing the week ahead, is too small to offer much information about the nature of the curve.



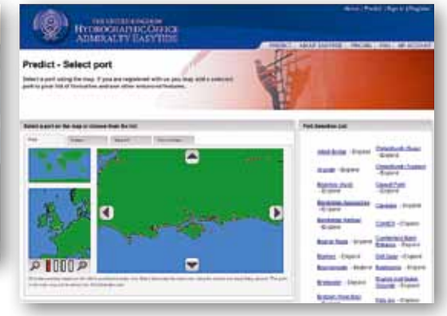
www.tidetimes.org.uk

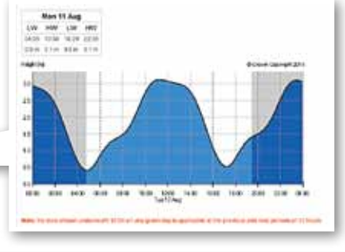
Tidetimes covers 698 British ports, far more comprehensive than NTSLF and you can get at the UKHO tidal predictions by clicking on one of the green dots around the coast of the UK map. Data is free for the next seven days, as is the tidal curve, but, as with NTSLF, you can't scrutinise the curve to reveal its detail.



www.easytide.ukho.gov.uk

Easytide covers hundreds of UK ports, too. The data for the week ahead is free, and you can choose between GMT or BST. The default curve is for the week ahead, again, not too revealing, or you can choose a one-day graph to get a much better idea of the curve's peculiarities. You can pay £1 and get enhanced data, including lunar phases, sunrise and sunset for 7,000 standard and secondary ports worldwide. Pay £1.75 and get the same for the next 14 days.





LEFT: Select data for just one day to to view the tidal curve in more detail

PHOTO: PUBLIC SECTOR INFORMATION (OPEN GOVERNMENT LICENCE V2.0). UKHO

Real time comparison

We went to Yarmouth on Tuesday 10 June and measured the flood tide from 1445 to 2145 using the tide gauge, which shows height of tide above the base level of 2.0m below Chart Datum. We tracked the heights according to our various sources and methods to find out how accurate their secondary port tide prediction was.

We also used a leadline. Our readings were on average 45cm deeper than the tide gauge readings, so depth of the berth where we sounded was not 2.00m but 2.45m below Chart Datum.

Hour	UKHO* Yarmouth	Aye Tides	Navionics	Imray	Garmin	1/12s	1/4s	Yarmouth Tide Gauge**
LW	1.3m 1445	0.52m 1519	1.26m 1526	1.2m 1445	1.2m 1452	1.3m 1445	1.3m 1445	1.10/1.17m 1445
HW-6	1.4m 1545	0.90m 1619	1.57m 1626	1.3m 1545	1.3m 1552	1.4m 1545	1.5m 1545	1.35/1.42m 1545
HW-5	1.7m 1645	1.42m 1719	1.95m 1726	1.5m 1645	1.5m 1652	1.7m 1645	1.7m 1645	1.75/1.82m 1645
HW-4	1.9m 1745	1.94m 1819	2.22m 1826	1.8m 1745	1.9m 1752	2.1m 1745	2.1m 1745	1.90/1.98m 1745
HW-3	2.1m 1845	2.56m 1919	2.51m 1926	2.0m 1845	2.3m 1852	2.5m 1845	2.5m 1845	2.10/2.18m 1845
HW-2	2.4m 1945	3.26m 2019	2.81m 2026	2.4m 1945	2.6m 1952	2.8m 1945	2.7m 1945	2.40/2.48m 1945
HW-1	2.6m 2045	3.69m 2119	2.98m 2126	2.7m 2045	2.9m 2052	2.9m 2045	2.9m 2045	2.70/2.79m 2045
HW	2.8m 2145	3.73m 2143	2.99m 2159	2.9m 2145	3.0m 2150			2.80/2.89m 2145

*Calculated using the Yarmouth tidal curve in the Almanac

** Every millibar (mb) above standard pressure (1013.25mb) lowers sea level by 1cm, and vice versa. The second set of figures shows what the height would have been if it were not for the high pressure on the day, which dropped levels by 6.75-8.75cm, throughout the tide. Yarmouth Harbourmaster confirmed that the south-westerly Force 4 breeze did not affect the water level in the harbour.

We confirmed our readings by leadline and discovered that our berth was 2.45m below CD, not 2m as listed

PHOTOS: DUNCAN WELLS

Yarmouth tide guage

LW 14.45

HW -5 16.45

HW -3 18.45

HW 21.45

Yarmouth has an odd tidal curve and on the day we tested, High Water to Low Water was seven hours

Conclusion

I would definitely use these web and app offerings but I would always check them by doing the secondary port calculation using the almanac. Interestingly, the Rule of Twelfths tracked the UKHO/almanac calculation remarkably closely, given that it ran over six hours and not the seven hours which was the actual duration of the tide. For those who dislike dividing by 12, there is also the Rule of Quarters, which also fared well.

There is quite a lot of variance in the results, so why am I happy to use inaccurate data? First, because the UKHO does not licence its harmonic data to apps and plotters, they will never be as accurate as the UKHO data, so I always double-check using the almanac. But how accurate do we really need to be? I am instantly suspicious of any man offering me a tidal height to the last centimetre. I am only really interested in tidal heights to the nearest 0.5m. Even if we have worked things out to the *n*th degree, a slight swell will still require us to add in a margin of safety, depth-wise. I call it the 'ish' factor. Does it matter that one app has a time of LW that is forty minutes after the UKHO time? As long as we understand that the more accurate data is available in our almanac, we can always check the instant information we get from our digital device against this. And now we can do secondary ports in our heads, there should be no stopping us.