

PHS handicapping – a sailor guide

PHS in this document means “Performance Handicap System”. It relates to a HC system that adjusts a boat’s HC after each race based on the “performance” of that boat relative to another boat(s) in that fleet.

From the TopYacht point of view, PHS is the mathematics used to calculate the new HC for a boat after each race. TY provides over 20 parameters that the club can adjust to calculate the next HC.

PHS means different things to different clubs.

At one end of the spectrum some clubs believe that PHS is a “revolving door” ie all boats will take it in turn to be the winner and the loser.

At the other end of the spectrum are clubs who to treat PHS as a quasi measurement system ie a boat is given what is deemed to be a “fair” HC for that type of boat and this will not be varied much over the duration of a Series. This tends to provide a consistent set of winners very similar to say IRC or AMS rating systems and the measured performance of the boat AND crew has only a small influence on the HC development over a Series.

Most clubs sit somewhere in the middle of these two extremes.

How can the maths provide such a range of outcomes?

For most clubs the premise is quite simple; to take into account the difference in measured performances of each boat/crew, a HC is allocated to each boat.

In a perfect world if each boat sailed exactly to their HC then all boats would have the same HC corrected time.

So how to establish the HC for each boat

After each race is run we start by assuming that some boat has sailed exactly to its HC. This is the “reference boat” for a particular race. For the vast majority of HCing methods this is assumed to be a boat that is approximately mid fleet on HC corrected time. [In reality the 45% boat has been shown to provide most stable HC adjustments over a season.] Those towards the top of the fleet are considered to have sailed above their HC and those towards the bottom of the fleet are considered to have sailed below their HC

First a few necessary definitions

AHC – the “Allocated HC” ie the HC Allocated to a boat for a particular race.

BCH – the “Back Calculated HC” for each boat. This is the HC the boat needed for this race to end up with the same HC corrected as that of the reference boat. This can only be calculated after the race – hence the terminology “Back” calculated. If each boat had started the race with their BCH as their AHC then all boats would have a virtually identical HC corrected times.

How to calculate the next race HC

While various parameters all significantly impact on the generation of the next race HC, probably the key element is the amount of BCH used in calculating the next race HC.

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There are two primary ways the new HC is corrected:

- Weighted average of the last X BCHs.
- Exponential average with a “gain” of X.

Weighted average of the last X BCHs

In essence this averages the last say 4 race's BCHs.

So at race 4 the next race HC is $(BCH1 + BCH2 + BCH3 + BCH4)/4$

At race 5 it is $(BCH2 + BCH3 + BCH4 + BCH5)/4$

At each new race the oldest BCH is dropped and the last race BCH added into the averaging process. This can have some apparently weird outcomes where a boat can win a race (or be in the top place getters) and have the next race HC go down. Likewise a boat towards the bottom of the fleet can actually have their HC go up after the race.

Often various “weighting” are applied to the BCHs to endeavour to cull out BCHs which are not truly representative of that boat's performance. Sometimes the best and/or worst BCH is not used; very often the BCH value is “clamped” so it cannot be above or below say 3% of the AHC for that race. There are a number of other “weightings” that can also be used.

Exponential average with a “gain” of X

This form of HCing has been shown to provide a very similar outcome to weighted Average HCing over the duration of a Series. To achieve this similarity the various parameters need to be appropriately set.

As an example, let's use a “gain” of 3. [As used by all Yachting Victoria clubs.]

The next race HC = $1/3$ of the BCH plus $2/3$ of the AHC.

Usually the BCH is clamped to say +/- 4% before the calculation is performed.

This system does not suffer from the issue of winners HCs having the potential to actually drop or losers HCs actually going up!

It is also very easy to understand; and if a boat performs well their HC goes up and conversely.

It also enables the club HCer to quickly address boats that were given an inappropriate initial HC as altering the AHC for a race has a significant impact on the next race HC whereas under weighted average, the HC is only affected by the running sum of the BCHs and can take quite a number of races to attain a sensible HC for a boat.

In either case the HC maths must endeavour to adjust each boat's HC so they are all sailing as close to their theoretically “perfect” HC as possible. If the system works well, then most boats HC corrected time will be very similar. The winner will be the boat that sailed most above their HC and the tail end Charlie will be the boat that sailed the most below their HC.

If a boat sails above their HC then it can be argued that their HC value was too low and thus needs to be moved up a bit so their HC corrected time is extended. Similarly if a boat performs below their HC then it can be argued their HC need adjustment down to reduce their HC corrected time.

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Now some observations and common myths

Myth – your place determines your HC for the next race.

This is not true. In Performance HCing it is the boat's *performance* not their *place* that adjusts their next race HC.

For example, a boat can win by 1 second, 1 minute or 30 minutes. If their HC is just adjusted just by the fact that they came first, then this is not reflecting their “performance”.

Reality – your relative place is an indicator of whether your next race HC is likely to go up or down; and the closer you are to the top of the winners list or bottom of the tail end Charlies list, the more your HC is likely to be adjusted (because you performed well above or well below your current HC).

Eg in a fleet of 20 boats.

If you are mid fleet then you are considered to have sailed to your HC and your HC will change very little for the following race. So those in places 8,9,10,11,12 will see little HC change. Places 1,2,3 are likely to see larger changes – not because of place but because to be in that place, they performed well above their HC. Ditto those towards the bottom end of the fleet.

Why don't the very bottom boats move much at all?

This is usually because the club has some clamps applied to reduce the effects of people sandbagging. Often the upper and lower clamps are set to different values to stop a boat having a large HC drop after a particularly poor performance.

To adjust quickly or slowly – that is the question??

More and more clubs are moving to Exponential HCing because of the advantages it offers. In this case the speed of HC adjustment is dependent on the Gain and the Clamps.

Smaller gain = faster change [and conversely].

Smaller clamps = slower change [and conversely].

Some clubs like to have the HC adjust quickly to catch changes in the boat eg new sails, new crew etc. Other clubs prefer the HC to change very slowly as they believe it is basically based on the design on the boat. These clubs are using less “performance” in making the next race adjustments. Which is better? This is up to the philosophy of your club.

Myth – the same boats wins on HC every year – *THEREFORE* the HC system is broken!

Many folks forget that if they don't sail often, then their Series points are weighed down by many DNC scores. This is NOT caused by poor HC maths!

Myth – my PHS HC at my club is 0.820 and it will be the same at other clubs/events!

An IRC or AMS HC is constant irrespective of where you sail. This is NOT true of a PHS HC. A performance HC is developed within a particular fleet of boats AND is based on an **arbitrary** starting value decided by your club. If you then go to another club or event, the mix of boats and/or arbitrary starting point may be significantly different.

Myth – boats sail exactly to their HC for every race. Not true

In fact most boat's performance varies up and down in a window of around +/-3%.

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