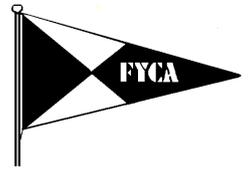


Forth Yacht Clubs Association Sternchase Management



Background:

Handicap racing using the RYA Portsmouth Yardstick system is a 'time on time' adjustment system based on calculating the corrected time for each boat from its elapsed time using a factor or handicap to normalise to a standard reference handicap. Boats are ranked in corrected time order to determine finish positions. Faster boats have lower handicap values than slower boats. The standard reference handicap is 1,000. Hence:

$$\text{Corrected time} = (\text{Elapsed time}) \times 1000/(\text{Handicap})$$

There are essentially only two ways to manage races using the PY system that will meet the requirements of the RYA Racing Charter, viz: *'racing that, as far as possible, is fair, enjoyable and safe.'*

- **Fixed Distance Races:** All boats sail the same course, usually after a mass start, and each boat's elapsed time is recorded as it crosses a defined finish line. The corrected times are calculated as above and ranked. The overwhelming majority of races are run in this fashion. There are sub-sets of this type of race such as:
 - **Average Lap Races:** Boats sail multiple laps with faster ones completing more laps than slower ones so that all sail for a similar period of time in similar wind conditions. This is useful for races with a very wide handicap range (e.g. Mirror dinghies to catamarans). Each boat's average lap time is calculated and corrected before ranking.
 - **Flight Starts:** Large fleets can be split into smaller groups or 'flights' with staggered start times to reduce overcrowding in a restricted start area space (e.g. PEYC breakwater start line). Finish times are corrected by the start time stagger to give actual elapsed times.
 - **Timegate Races:** The fleet has a start time 'window' (e.g. 3 hours) within which each boat can select its own optimum start time based on a judgement of tides, wind forecast and boat performance. Each boat's actual elapsed time is recorded and corrected before ranking.
- **Fixed Finish Time Races:** These are known as 'Pursuit Races' or 'Sternchases' and create the excitement of faster boats gradually overhauling slower ones to finish in a close bunch. A suitable race duration time is agreed based on the standard 1,000 PY handicap boat. A finish time is selected and individual start times are calculated for each boat, based on handicap, such that all boats should theoretically have achieved the same distance at the finish time. The defined race course must be longer than could be achieved by any of the boats with the forecast conditions in the time available. Whichever boat is leading on the water at the finish time is the winner. Recording subsequent finish places is difficult, particularly if the boats are beating at the time and have become spread across the course. The **RYA Pursuit Racing** document published in 2007 provides guidance on how to set up and manage pursuit races.

Sternchase Courses:

Portsmouth Yardstick handicaps are based on achieved performance analysis from races with a range of beating, reaching and running legs, and averaged over sufficient results to cover a variety of wind strengths. Races with a preponderance of upwind or downwind legs (e.g. beating all the way from Granton to Anstruther or down-wind running all the way from Granton to Dunbar) may significantly favour one design over another and can be intrinsically 'unfair' on handicapping. Setting a course to simply reach back and forth between two marks would almost certainly produce anomalous results. For this reason sternchases should generally be 'closed loop' (i.e. finishing where they started) and the various course legs should have a sensible mix of beats, reaches and runs.

Sternchase Duration:

Sternchases should be of sufficient duration to be of interest for the fastest boat, sailing the least time, without becoming an endurance marathon for the slowest boat. If the race takes many hours to complete, there is a risk that wind conditions will vary sufficiently to undermine the 'fairness' of the race (e.g. race begins in light conditions for early starters, then freshens as later boats join in). This risk is reduced if the time gap between first and last starters is short. PEYC generally sets sternchase durations at 100 minutes for a nominal 1,000 PY handicap boat. Hence boats with handicaps of 1,100 and 900 would sail for 110 and 90 minutes respectively, a gap of only 20 minutes in start times for a 20% spread of handicap values. Having decided the sternchase duration, start times for individual boats can be calculated and published well in advance of the race.

Sternchase Start Times:

For conventional fixed distance races with the OOD observing the finish line, finishing times can reasonably be timed to about one second. For a typical 100 minute or 6,000 second duration race, that represents a measurement accuracy of ~0.02%, a relatively trivial error. PEYC publishes sternchase start times rounded to the nearest minute, implying an accuracy of +/- 30 sec or ~0.5% for a 100 minute race. To put this in context, analysis of a very large sample of PEYC yacht racing results shows that the median corrected time gap between boats is ~1% out to 6th place. Hence rounding sternchase start times to the nearest minute represents a significant error compared to relative achieved performances. Start times could be given to half or quarter minutes, or even to one second, but would be harder to display and act upon by competitors. PEYC takes the pragmatic view that displaying one minute start signals, accompanied by a sound signal is both simple to do and well understood, hence the club accepts a certain level of 'unfairness' in start times. For yacht races where most boats have a VHF radio with channel 37, the OOD could broadcast a regular time check to allow competitors to time themselves against individual start times with sub-minute resolution. The OOD should be in a position to signal an individual recall with flag 'X' if a boat 'jumps the gun'.

Sternchase Finishing:

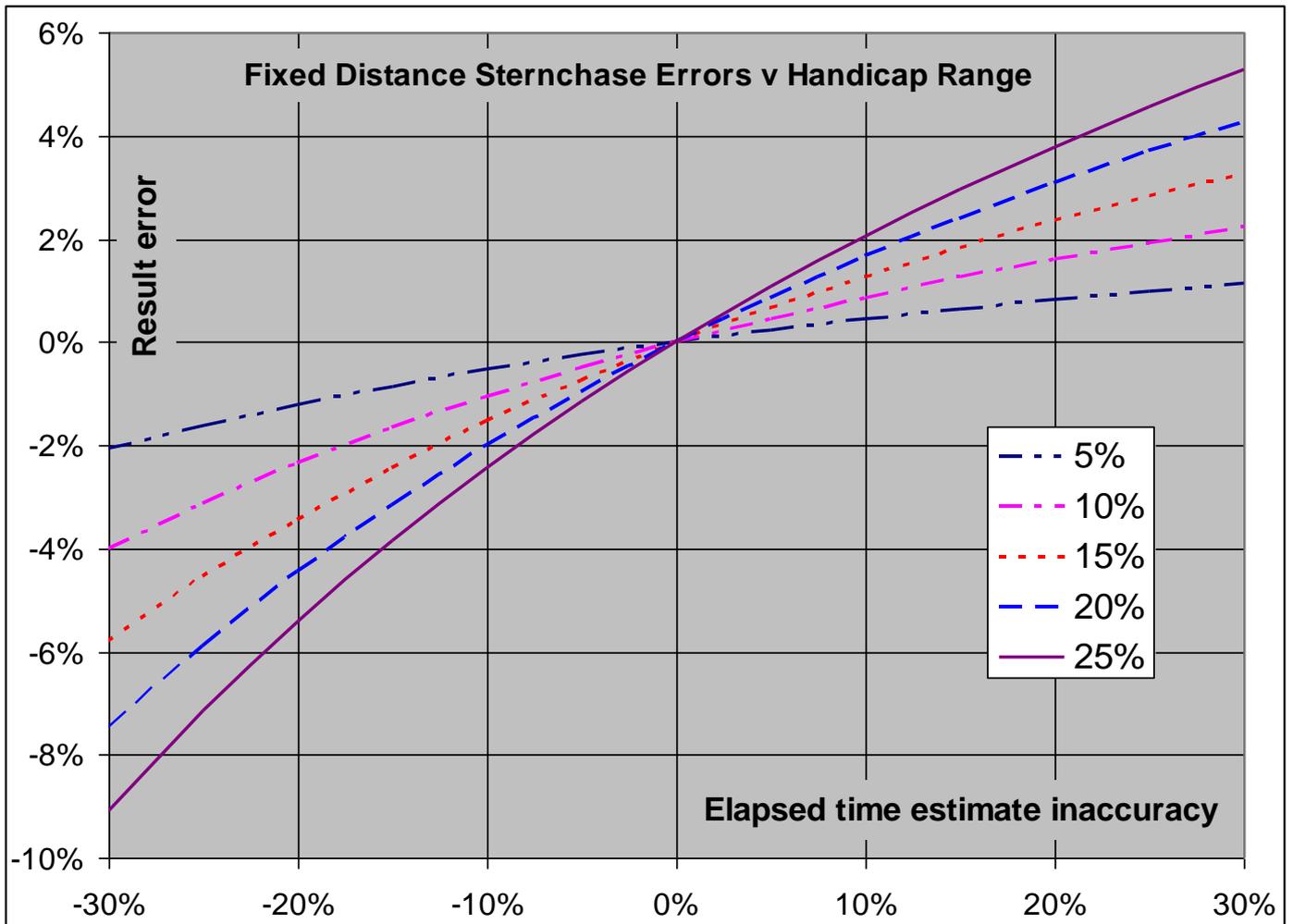
Managing an 'on the water' sternchase finish is best done with the OOD aboard a RIB keeping pace with the leaders. If the leading boats are on a beat as the time limit approaches, they must converge towards the rhumb-line to the next mark to allow the OOD to adjudicate who is ahead at the finish time. The Sailing Instructions must permit the OOD to require a boat, ahead and to leeward, to tack to cross either ahead or behind the next boat. This will require careful judgment on the part of the OOD and the **RYA Pursuit Racing** document provides some suggestions on other techniques. The last part of the course for the PEYC Chattan sternchase to Charlestown is a 'racetrack' loop between two navigation buoys about 1 nm apart. Boats cycle round this loop continuously until the finish time. Provided the OOD keeps track of the number of loops completed by the lead boat, this system works very well. Adjudicating the winner is even simpler if the loop doesn't have a true beat and boats can sail directly between the racetrack buoys.

Fixed Distance Sternchases:

Some clubs run sternchases with a fixed length course and individual start times for each boat, a contradiction in terms with respect to the RYA Pursuit Race definition. This approach must be based on an estimate of how long it will take a reference 1,000 PY handicap boat to sail the chosen course in the conditions on the day, a difficult calculation to do accurately. It follows that the individual start times can only be calculated on the day for the course length chosen and observed or forecast conditions. Hence there has to be some method of communicating start times to boats shortly before the first boat starts. It is hard to see how this type of race could ever be considered 'fair' because of the inherent inaccuracy in estimating how long the reference 1,000 boat will take to complete a given distance.

To gauge the possible errors, consider two boats with handicaps of 1,100 and 900 competing in a fixed distance sternchase where the OOD has estimated that a 1,000 handicap boat would take 100 minutes. Hence their start times would be 110 and 90 minutes respectively before the assumed finish time. Suppose both boats sail exactly to their handicaps, hence should dead heat at the finish, but that the OOD has overestimated the time a 1,000 handicap boat will take to sail the distance by 10%. The 1,100 handicap boat will thus take 99.0 minutes instead of 110, whereas the 900 handicap boat will take 81.0 minutes instead of 90. The difference in elapsed time between them is only 18 minutes compared to the 20 minute start time stagger. Hence despite both boats sailing exactly to handicap, the slower boat has been given a 2 minute (2%) advantage caused by the 10% error in estimating the race length for the reference 1,000 handicap boat. Similarly a 10% underestimate in the reference time would give the faster boat a 2 minute (1.7%) advantage. Overall errors for this type of race will depend on the inaccuracy of estimating the reference boat's time and the range of handicaps in the fleet.

The following graph shows the size of error generated by elapsed time estimation inaccuracies from -30% to +30%, for fleet handicap ranges from 5% to 25%. For the example above, the fleet handicap range for boats from 1,100 to 900 PY would be 20%. This gives result errors ranging from -7.5% to +4.3% for elapsed time estimate inaccuracy of -30% and +30%. Estimated elapsed time errors of 30% are quite conceivable and, given that the typical difference in achieved performance between places is ~1%, the result errors would overwhelm the competitors' achievements. Hence this type of race is bound to be a lottery and should only be considered a 'fun event' rather than a serious and fair race.



Sternchase Compromise:

If a club wants to run a fixed length sternchase because that's been their tradition, one possible compromise that would maintain 'fair' racing, would be to use staggered start times based on handicaps, take finish times and do a post-race calculation to determine the actual winner. This approach retains the excitement of faster boats gradually overhauling the slower ones during the race but would retain the integrity of a 'fair' race. The down-side is that the first finisher is not necessarily the winner. The OOD would estimate the time required by a reference 1,000 handicap boat for the chosen course length in the conditions on the day, calculate the staggered start times for individual boats and then record the finish times of all boats. The overall results would be based on the corrected times calculated from elapsed times. Hence it would be a sort of 'back to front' conventional race.

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20th July 2010*