RESEARCH PROJECT

OFFSHORE WINDS AND THEIR EFFECTS ON STAND UP PADDLEBOARDS

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Abstract

Stand Up Paddleboarding (SUP) has experienced a remarkable surge in popularity in recent years. However, along with this surge in participation, there has also been a substantial upswing in the number of individuals encountering difficulties while out on their SUPs. RNLI lifeguards, for instance, have witnessed a staggering 422% increase in the number of SUP paddlers seeking assistance. A substantial majority of these rescues have attributed their occurrence primarily to offshore winds.

This study aims to provide informed guidance to SUP users, British Canoeing leaders and coaches on the effects of offshore winds on SUP paddlers, and to make recommendations on the possible course of action to take should a SUP paddler find themselves being blown offshore.

In this study, a field-based methodology was utilised to gather empirical data concerning the impact of offshore winds on stand up paddleboard (SUP) paddlers in three primary positions: standing, kneeling and prone. The subsequent phase of data collection concentrated on assessing the efficacy of various techniques, including sitting with legs astride the SUP and using only the legs, and utilizing both legs and paddle to generate drag. The primary objective was to determine whether these factors exerted a substantial influence on the rate of drift in offshore wind conditions.

The study's findings provide clear evidence of the significant impact that moderate offshore winds have on SUP paddlers. Moreover, it highlights a more effective technique

for SUP paddlers to employ in case they find themselves in an offshore wind situation, known as the SUP Brake Position (refer to appendix 1.5). Currently, this technique is not widely advised to SUP paddlers, as the prevailing recommendation is to lie prone on the board and paddle back using their arms. However, this approach leads to rapid exhaustion for paddlers who are not adequately conditioned, and resting in a prone position results in a 36% faster drift rate compared to adopting the SUP Brake Position. The study's findings offer valuable insights that can be utilised to improve and enhance the existing safety information provided to SUP paddlers, coaches and leaders

1. Introduction

Stand Up Paddleboarding (SUP) has seen a huge increase in popularity over the last few years. The annual water sports participation survey 2022 showed that on average across the age ranges, 72% of people have been participating in SUP 2 years or less - with the majority having less than 5 years' experience. Linked to this, first time sales of SUP boards have been increasing year on year since 2020, with more SUPs sold in 2022 than any other personal watercraft in the UK.

The survey also highlighted that 67% of paddlesport activities take place independently and unsupervised by a third party such as a lifeguard, coach/guide, etc.

Given the increase in popularity, it is not surprising that the number of people getting into difficulty whilst out on their SUP boards has also increased. In a press release issued by the Royal National Lifeboat Institute (RNLI) in May 2023 - it states:

- An increase of 422% in the number of incidents requiring lifeguard intervention involving SUPs; from 247 in 2018 to 1,290 in 2022.

- Over the same time period, the RNLI have saved the lives of 77 SUP paddlers, 32 of those lives were saved in 2022 alone.
- 2022 also saw the largest annual increase (155%) in the number of RNLI lifeguard rescues involving SUP paddlers, while lifeboat rescues increased by 20%.

Using rescue data obtained from the RNLI, covering a period from 2020-2022, 54% of SUP rescues requiring RNLI assistance cited offshore winds as a contributing factor. This has increased from 33% in 2019.

To date, this is the only reliable data source that specifically relates to SUPs and offshore winds. Anecdotally, however, in addition to the figures above, there are likely to have been significantly more interventions by members of the public (experienced paddlers, small boat owners, commercial boats, etc.) that have taken place across the UK that have not been formally recorded anywhere.

It is against this backdrop of increased participation and increasing numbers of SUP paddlers getting into difficulties in offshore winds - that this research set out to achieve the following objectives:

- provide the evidence informed basis for guidance to SUP users, British Canoeing leaders and coaches on the effects of offshore winds on SUP paddlers;
- to make recommendations on the possible course of action to take should a SUP paddler find themselves being blown offshore on a SUP.

The findings from this research are in no way intended to be used as an “How to paddle in offshore winds” guide. The advice is, and will remain; avoid paddling SUPs (as well as all other non-powered watercraft) in offshore winds.

2. Methodology

The following methodology collected empirical data into the effects of offshore winds on SUP paddlers in the three main positions typically employed when on a SUP - namely standing, kneeling or prone (see appendix 1.1-1.3). Preliminary research led to discounting the option of the SUP paddler being in the water and acting as a drogue. This is due to a lack of appropriate insulation (wetsuits/drysuits) typically worn by novice SUP paddlers.

The second element to the evidence collection tested the effectiveness of sitting legs astride the SUP and dragging: legs only and legs and paddle (see appendix 1.4 and 1.5) to determine if these factors have any significant effect on the rate of drift in an offshore wind situation.

The testing was carried out at both inland and coastal venues.

This is an initial study into the effects of offshore winds and looks to establish a baseline of evidence from which subsequent research could be carried out from.

Due to the dynamic nature and the enormous amount of variation possible in this study, the following parameters have been selected in an attempt to, as accurately as possible, reflect the “typical” novice SUP paddler. It is these paddlers which RNLI rescue data has shown are the most likely cohort to be involved in a rescue situation.

3. **Wind Strength**

This range was selected using the RNLI callout data to SUP paddlers that have been blown offshore. The majority of incidents occurred in the F4 range with F5 being the second most common wind strength.

Inland/Coastal*	12 knots-17 knots 14-20mph**	This represents the mid-range of F4 and lower range F5. Fresh breeze.	Small trees in leaf begin to sway; crested wavelets form on inland waters.

*Paddling SUPs in strong winds is an inherently high-risk activity, all participants were experienced paddlers and appropriate safety frameworks were in place.
**Due to the more committed nature of the coastal environment, it is envisaged that testing in coastal areas will take place towards the lower end of the wind scale, while inland testing will take place towards the upper end of the scale where possible.

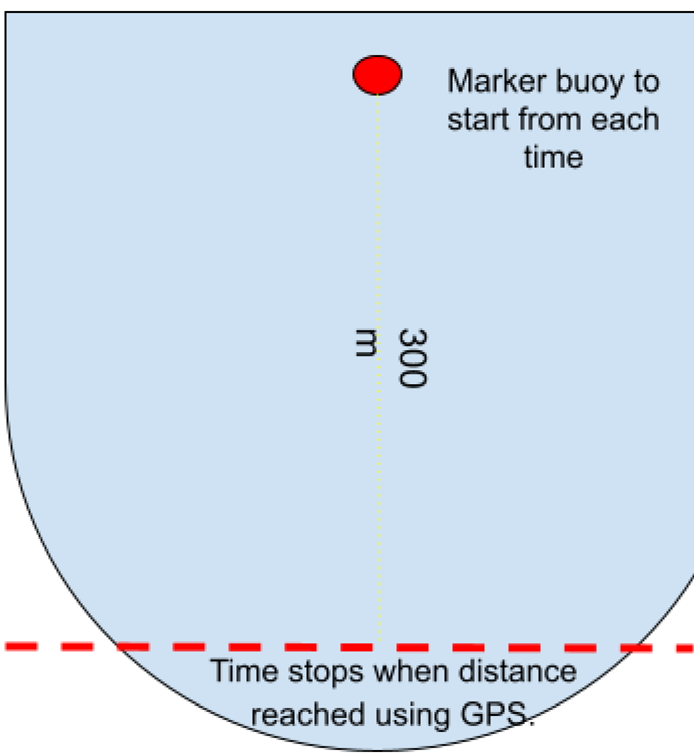
4. **Board Type**

Inflatable boards in the 10’-11’3’’ range were used for testing. As these are indicative of the type of board obtained by beginners, with most boards sold in the UK falling within this size range. The width of these boards will typically be 30’’- 36’’ wide.

5. **Paddle type**

   The paddles used for testing were representative of paddles typically used by new and novice paddlers. They ranged in price, with the cheapest being approximately £35 and the most expensive approximately £100 - they were all plastic blades on an aluminum shaft. A premium paddle was also tested for comparison which was made of full prepreg carbon fibre. See appendix 2.1 for paddle dimensions.

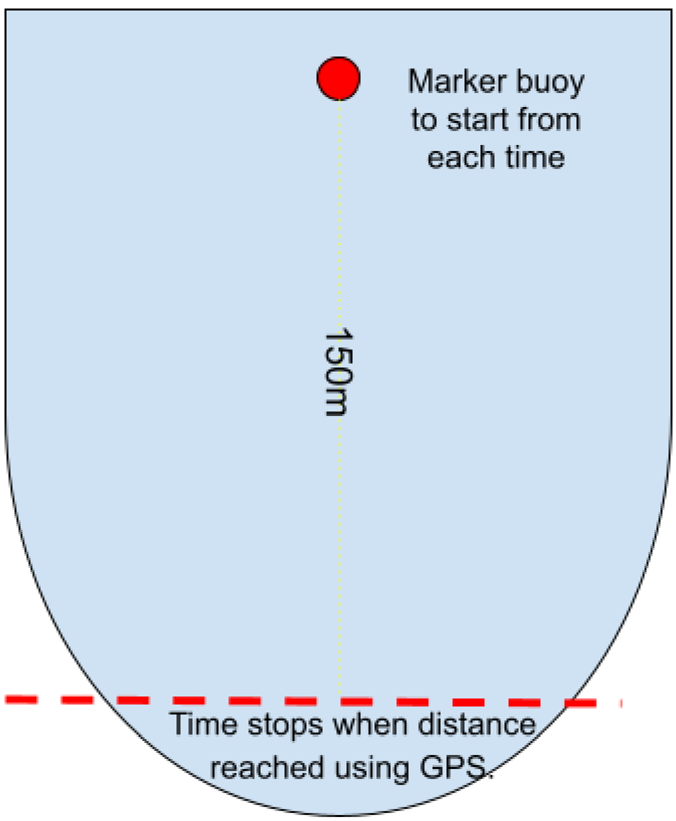
Inland test protocol



- Identification of a fixed starting point that is at least knee deep to ensure the fin is not dragging through weed or grounding and giving inaccurate readings.
- Wind speed recorded at the start point in an attempt to establish consistency.

- Marker buoy (or similar) used as a consistent start point each time - 300m measured using a GPS device Garmin, Sunnto, etc. When testing multiple subjects, a second buoy can be placed downwind to mark the 300m finish point.
- Participants have a mobile phone in a waterproof pouch (provided). The participant starts the timer as they take their feet off the bottom, pass the buoy etc. and needs to be in position, i.e.,prone, kneeling standing when they start the timer.
- Timer stops as the participant reaches 300m on their gps or reaches the finish buoy.
- Drift 1 - Standing (see appendix 1.1)
- Drift 2 - Kneeling - low kneeling position, i.e.,heels touching the buttocks (see appendix fig.1.2)
- Drift 3 - prone (see appendix 1.3)
- Drift 4 - sat on the point of the board where the bend of the knee meets the rails, feet dragging in water. Depending on the width of the board and height of the participant, this will most likely be somewhere between the central handle and the back of the board (see appendix 1.4)
- Drift 5 - SUP Brake Position (BSP) sat central between the mid-point of the board and the tail of the board, feet/shins in the water and the paddle used to provide drag (see appendix 1.5).

6. Coastal Test Protocol



The test protocol for the coast varied slightly to the inland protocol. Initial testing found that 300m in the coastal environment increased the likelihood of the test participant drifting into an area of tidal flow, effecting the measurements positively or negatively. As the aim of this study is to collect data on the effects of wind on SUPs, the test distance has been reduced. Testing took place on or around the period of slack water, again with an aim to reduce any anomalies caused by tidal flow. It was also reduced on the grounds of safety, typically the drift would start approximately 50-100m offshore to ensure the participant was out of the wind shadow created by the beach, meaning test subjects were 400m offshore at the end of the drift and starting to get into the same waters as motorised craft and sailing boats.

Initial testing found 150m to be sufficient to record meaningful data and, when compared with inland drift rates, found them to be broadly similar.

7. **Forecasting and measuring wind speed**
   The XC weather forecasting app was used to determine days we were likely to experience the required wind strengths. This was then confirmed in the field by using a BTMETER BT-816B Handheld Anemometer.

8. **Test Participant specification**
   Clearly it would be unethical to use genuine new and novice paddlers for this study as the risks are real and the level of fitness/ability need to be high to maintain safety. In order to take part in the testing, participants had to be confident and have experience of paddling in F4/5 winds. Participants downloaded the RYA SafeTrx app and used this while testing was taking place, ensuring that settings were set to continuous monitoring and that phones are fully charged before starting.

   The following data was gathered for each test participant, see appendix 4.1.

   - Height
   - Weight
   - Board length and width

   All personal data was anonymised and only used for this study. Any photos that have been used have been done so with the subject's full knowledge and agreement.

9. Results

Overview and observations from the data collection.

Testing was carried out at five different geographical locations across the South and South West of England at both inland and coastal venues (see appendix 3.1). A variety of different test participants were used and the author was the control test participant throughout the data collection, see appendix 4.1 for details. All paddleboards used fell within the parameters set out in the methodology, i.e., they were all inflatable and were either 10’ 6” or 10' 8'’ in length x 32” wide.

One of the consistent themes that was noticed throughout testing was the inconsistent and gusty nature of offshore winds, these winds travel over the land and get funneled and constricted by a variety of factors such as buildings and topography. This did lead to variation in the speed of drift, not only from location to location but within the different drifts themselves at any given location. The majority of the testing took place while the UK sat beneath an area of high pressure. Consequently, this led to some inaccuracies in the forecasts - on several occasions a given wind forecast on XC weather would not be present on the ground, or at a significantly lighter wind strength than forecast and testing would have to be postponed. This is highlighted in the data collection table (appendix 5.1), the testing that took place on the 6th June 2023 at Meon shore on the South coast, the forecast was for F3 (F4) and had been fairly consistent in the days preceding the test date. On the day, the winds were significantly lighter than forecast (see image 1). The testing was carried out and recorded, but has been omitted from the overall data results as the wind strength was significantly less than on all other test days.

These factors did not have an overall effect on the outcome and the results that follow show a constant pattern that would be reproducible in further studies if required.

Image 1.

Today Tue 6 Jun BST — 3 hr | 1 hr

Hour	Wind		Gust	Temp.	Rain
15:00	F3	to	F4	19 °C	0 mm
16:00	F3	to	F4	19 °C	0 mm
17:00	F3	to	F4	19 °C	0 mm
18:00	F3	to	F4	18 °C	0 mm
19:00	F3	to	F4	17 °C	0 mm
20:00	F3	to	F4	15 °C	0 mm
21:00	F3	to	F4	13 °C	0 mm
22:00	F3	to	F5	11 °C	0 mm
23:00	F4	to	F5	10 °C	0 mm

XC weather forecast 4.6mph/4knots/F1 6.4mph/6knots/F2

10. Outcomes of testing

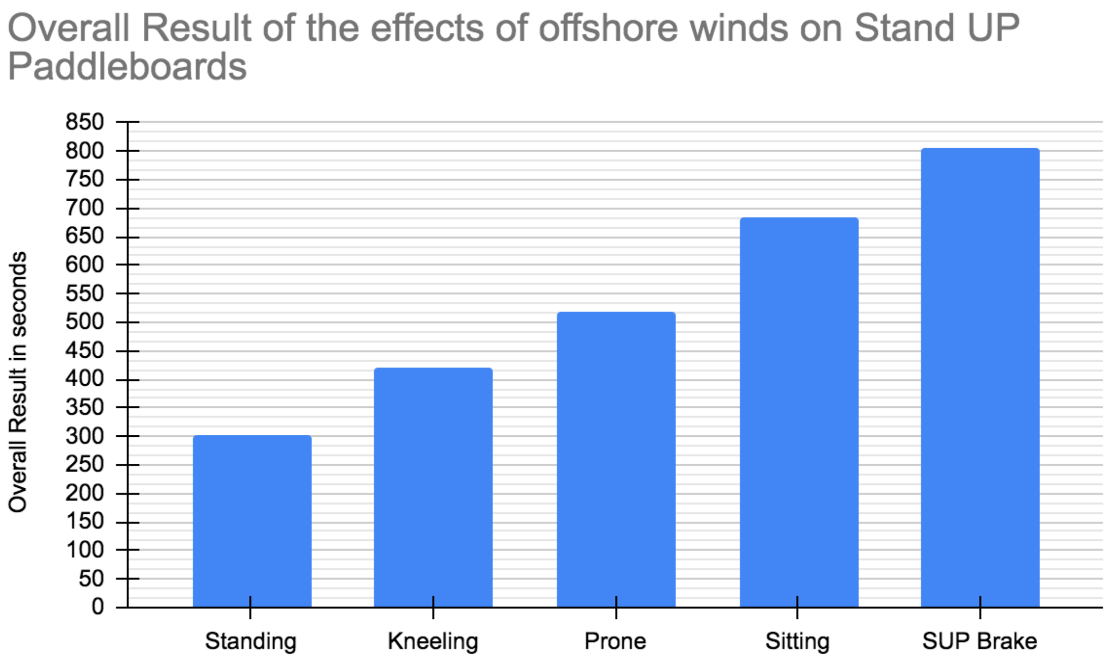
Figure 1 shows the combined averages for both inland testing and coastal testing combined - the coastal averages for the 150m test protocol have been doubled in order to make a direct comparison between inland and coastal venues.

The graph clearly shows the SUP Brake Position (SBP) (see appendix 1.5) to be the most effective position at reducing the rate a SUP paddler would be blown out to sea in an offshore wind scenario.

- The SBP is 63% more effective at reducing the speed at which a SUP paddler will be blown out to sea when compared to a SUP paddler standing on their board.
- 48% more effective than a SUP paddler knelt on their board.
- 36% more effective than a SUP paddler lying down (prone - appendix 1.3) on their board.
- 15% more effective than a SUP paddler sat on their board with just their legs in the water (appendix 1.4).

The SBP also meant that the paddler had a free hand that could be used to make an emergency call to the coastguard, use a whistle to attract attention, etc. It also drastically improved the visibility of the SUP paddler when compared to lying down prone, both from a casualty perspective their field of view is significantly greater than being prone on the board. As well as from the perspective of the rescue services, a SUP paddler sitting on their board is easier to spot than a paddler lying on their board in choppy conditions.

Figure 1.

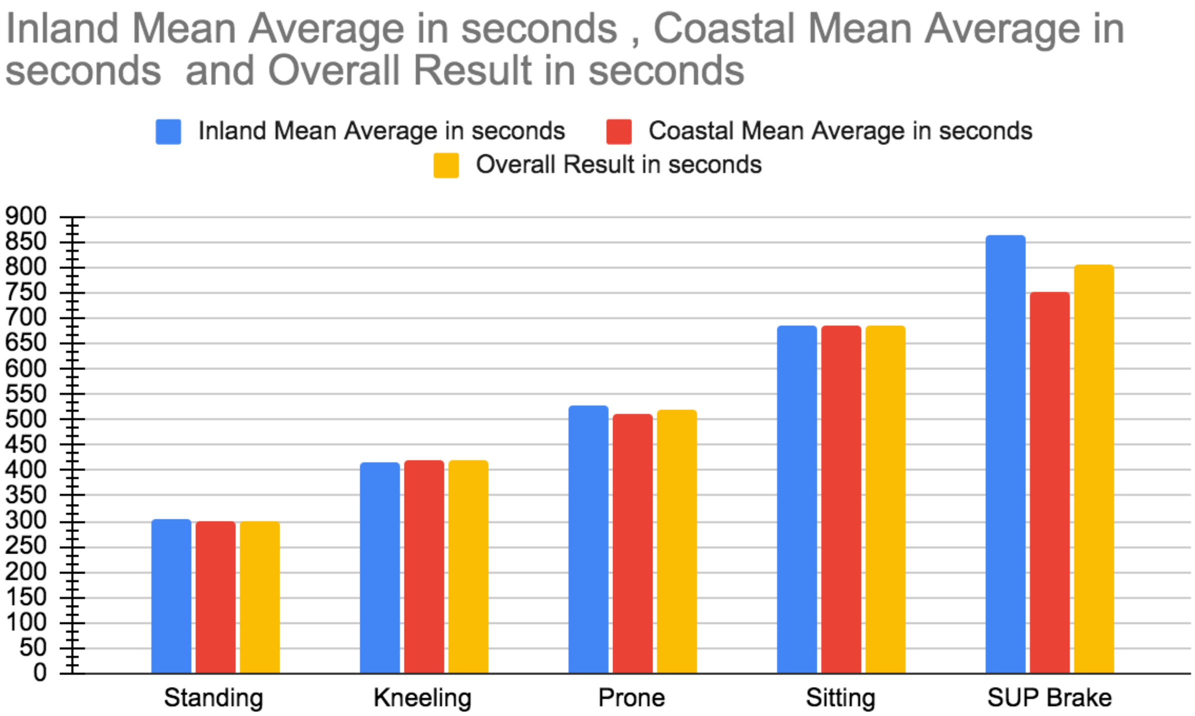


Position	Standing	Kneeling	Prone	Sitting	SUP Brake
Seconds	302	420	520	685	807
Minutes	5 mins 2 secs	7 mins	8 mins 40 secs	11 mins 25 secs	13 mins 27 secs

Figure 2 shows that there was little difference in the effects of offshore winds and the different body positions tested with regards to inland and coastal venues. With the exception of the SBP, there was an average difference of 1 minute 54 seconds or a decrease in effectiveness of 13% between inland results and coastal results. Every effort was made to try and negate the possible effect of the tide on the test results, trying to complete testing on or around slack-water. However, it was clear in the field that the presence of tidal flow was not entirely eliminated during testing - the decision was made to use venues where, although very weak, any tidal flow would be in the same direction as the wind as far as possible. This may explain the difference between the inland and coastal variation with regard to the difference in times for the SBP but, at this stage, this would be speculation and further research would need to be conducted to give a definitive answer.

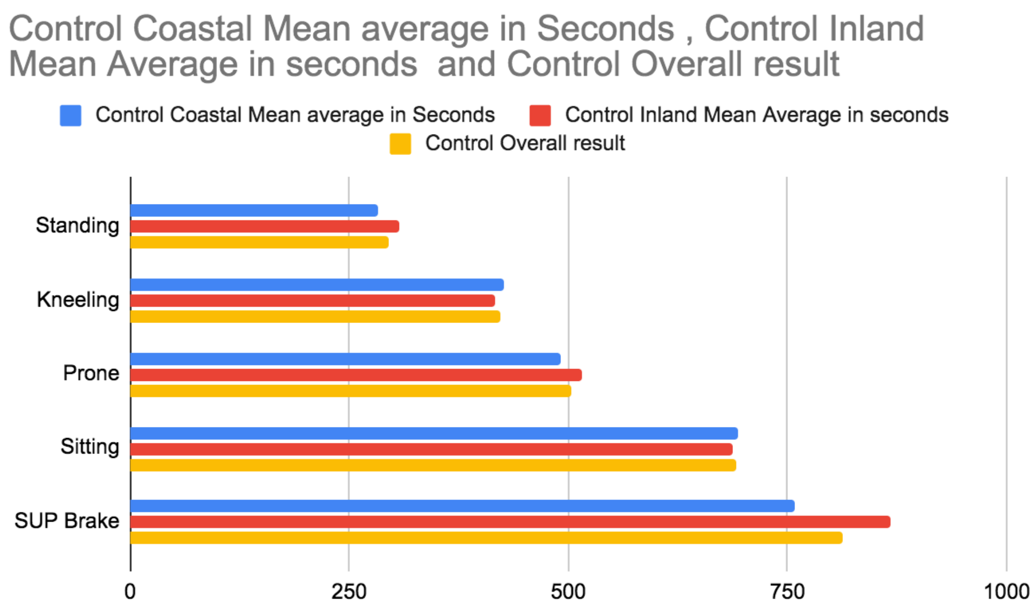
This difference was also present in the control subjects results as shown in figure 3 with only a difference of 4 seconds less, compared to the overall result. However, Figure 3.1 shows that, once averaged out, there is no real significant difference between the control subjects results and the overall results.

Figure 2.



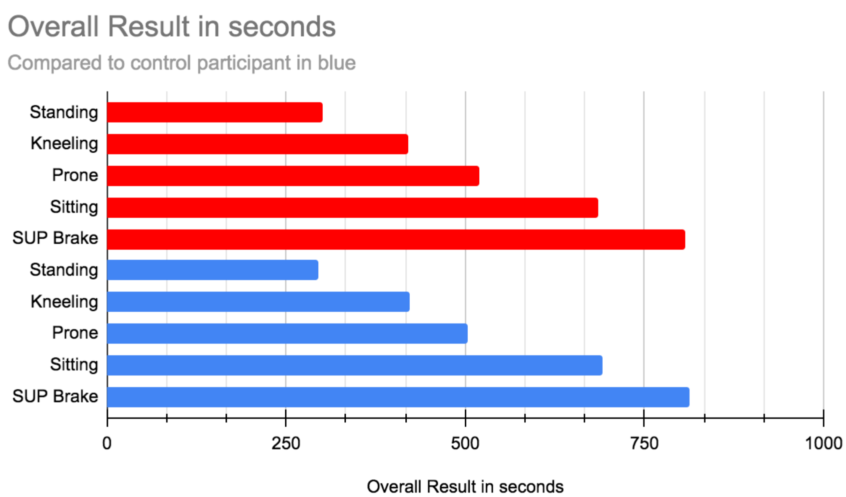
Position	Inland Mean Average in seconds	Coastal Mean Average in seconds	
Standing	304	300	302
Kneeling	418	422	420
Prone	530	510	520
Sitting	685	684	685
SUP Brake	864	750	807

Figure 3.



Position	Control Coastal Mean average in Seconds	Control Inland Mean Average in seconds	
Standing	282	308	295
Kneeling	426	417	422
Prone	492	516	504
Sitting	694	688	691
SUP Brake	758	868	813

Figure 3.1.



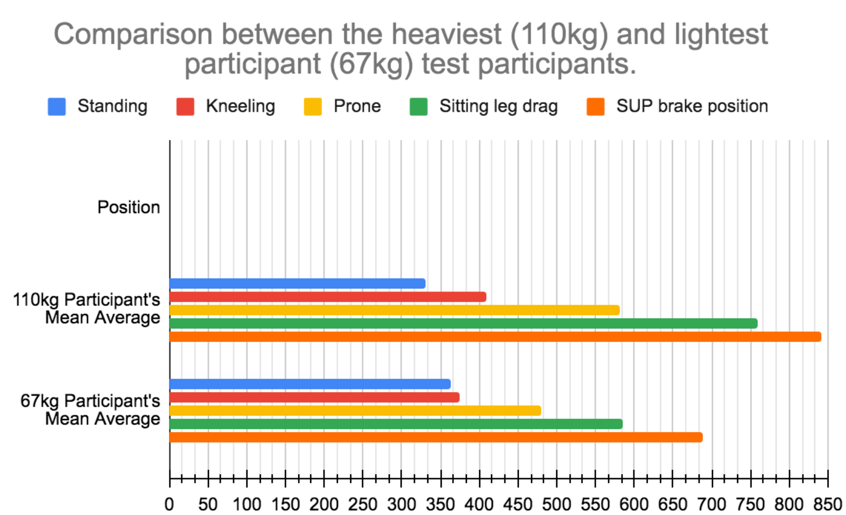
During the testing it became apparent that there was an effect on the rate of drift caused by the difference in participant height and weight. This, it was felt, warranted further investigation as this is a scenario that the typical recreational SUP paddler could face, e.g., an adult and a child.

Figure 4 shows that, when standing, the heavier subject drifted faster than the lightest subject and drifted significantly slower when an element of drag was introduced in the form of lower legs or legs and paddle (see appendix 1.4 and 1.5).

Another observation made in the field was that heavier paddlers generated a more pronounced trim profile on the board (nose to tail) when sat down, i.e., the tail was deeper in the water, while the nose was higher out of the water when compared to lighter paddlers. It was apparent that this increased drag in two ways; firstly, the tail of the board being lower in the water meant the lower legs of the paddler were deeper in the water. This presents a larger surface under the water increasing the amount of force (wind) needed to move the paddler and board. Secondly, because the trim of the board, nose to tail, was more extreme (see appendix figure 1.4, test subject pictured is 90kg) it significantly reduced the hydrodynamic effectiveness off the board, generated more of a “bulldozer” effect through the water, again increasing the amount of drag generated through the water. Both of these elements enhanced the effectiveness of the SBP when the paddle was introduced for heavier paddlers.

This trend was reversed with the lightest paddler and, looking at the data (appendix 5.1), the pattern broadly followed with the rest of the test subjects of 90kg and 100kg, in that heavier participants drifted faster when standing up and slower when drag was introduced to the drift. One reason for this would be that larger paddlers present a larger profile to the wind when standing. This is supported by the data when standing is compared to kneeling and kneeling to prone - a smaller profile to the wind reduces the rate of drift in wind. The faster drift rate when sitting has already been outlined above with the observations concerning heavier paddlers.

Figure 4.

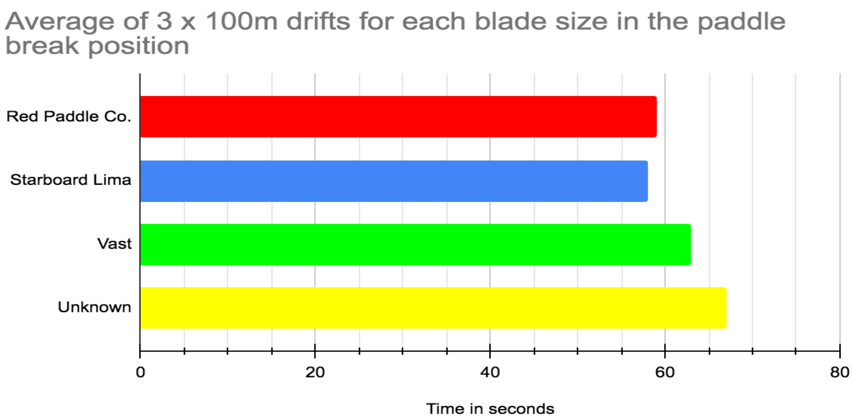


Position	110kg Participant's Mean Average	67kg Participant's Mean Average
Standing	330	364
Kneeling	410	374
Prone	582	480
Sitting	760	586
SUP Brake	842	688

11. Paddle blade size

The paddle blade size did have an effect on the drift rate of the control subject's board - figure 5 shows that the larger blade did create more drag as expected when compared to smaller blades. The graph also shows that there was not really any difference (less than 2%) between the basic paddle and the premium paddle in terms of drag generation. The Starboard paddle is slightly larger than the Red paddle (see appendix 2.1) which could account for this difference. While there was a difference that could be measured and observed, it has little relevance in a "real world" context as the difference is marginal and the paddles typically sold as part of a package are sufficient to reproduce the drag effect demonstrated in this study.

Figure 5.



Wimbleball Lake	30th May 100m	Time in seconds	SUP break position	
Paddle make	Drift 1	Drift 2	Drift 3	Average
Red Paddle Co.	58	63	55	59
Starboard	56	61	57	58
Vast	60	66	62	63
Unknown	64	67	66	67

12. Conclusions

This research set out to achieve the following:

- provide the evidence informed basis for guidance to SUP users, British Canoeing leaders and coaches on the effects of offshore winds on SUP paddlers;
- to make recommendations on the possible course of action to take should a SUP paddler find themselves being blown offshore.

With regards to the first point, the study clearly shows that the existing advice of avoiding paddling in offshore winds should be adhered to by new or novice SUP paddlers and serious consideration needs to be given by experienced SUP padders before launching in offshore winds. Image 2 shows a bright, warm, sunny day with a flat sea but the wind was a consistent F4, blowing directly off shore. Using the data collected in this study, a new paddler that realised they were being overpowered by the wind would be nearly 1km offshore in just 15 minutes in a standing position. In reality, this would probably be further offshore, field testing consistently demonstrated the need to move offshore to get out of the wind shadow created by the beach profile in the case of coastal venues and trees/topography with inland venues. Image 3 clearly shows this in action - the heat maps show an acceleration in drift denoted on the GPS track turning from blue (slow drift) to red (acceleration of drift) when approximately 250m from the shoreline. In this particular instance, due to the amount of motor boat traffic, it was not deemed safe to continue the drift any further out to sea as there was potential for a collision with motorised craft. A novice paddler may not have the decision-making ability, fitness or skill to not be blown into this area of increased danger under these conditions.

Image 2.

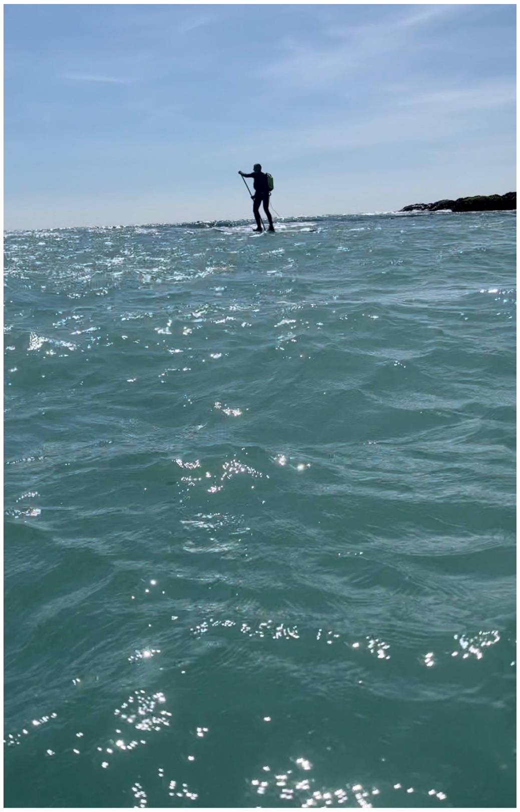
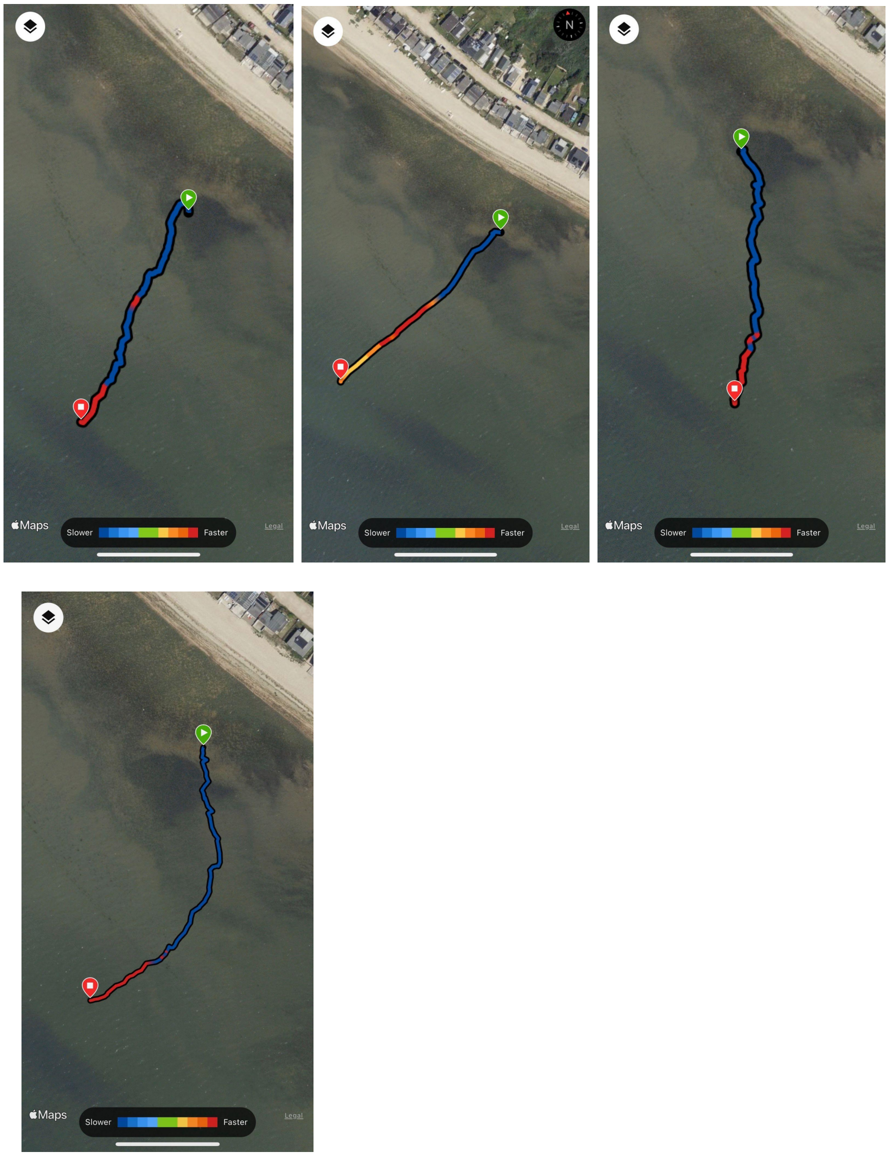


Image 3.



Based on the outcome of the research, leaders, coaches and course providers from British Canoeing and other SUP organisations may consider making explicit reference to the SUP brake position and how it could be employed in an emergency situation to reduce the effects of drift in a wind affected environment. Going through the RNLI’s online SUP rescue video catalog, every casualty is on their board either lying down or kneeling - from the results of this study, even lying on the board, although it reduces the speed you drift when compared to standing or kneeling, is still 36% less effective than the SPB and 15% less effective than sitting on the board and dragging legs through the water. If a casualty was being blown out to sea in a F4 wind for 1.5kms, it would take approximately 43 minutes over the same time period a paddler in the SBP would cover just over 900m. This also highlights the importance of making the call to the emergency services as soon as possible, although the SBP reduces drift it does not eliminate it and a casualty could still drift into a busy shipping lane, tide race, etc.

13. A consideration for the SBP

The study found that, in some instances, the board could blow across the wind reducing the effect of the paddle dragging through the water. This was simply remedied in one of two ways:

i) If you found you were side on to the wind, swap the side you have the paddle on.

Or

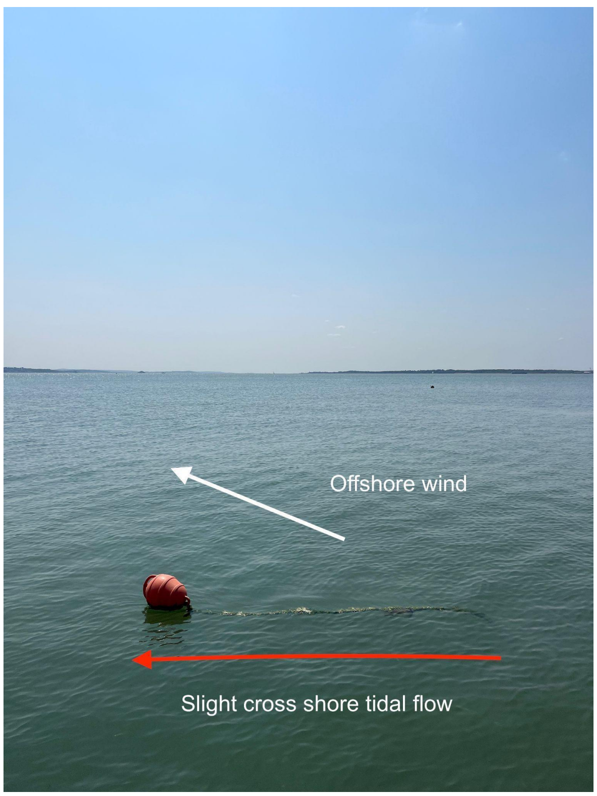
ii) Pivot the paddle shaft from a vertical position to a 45-degree angle, either angle away from the board or across the board. By employing this tactic, the SUP paddler can simply, and with very little effort, keep the board pointing downwind and maintain the drag on the paddle (see appendix 1.6 & 1.6.1).

Both of these strategies would benefit from being taught/shown in a practical setting, either face-face or through video, as it could seem overly complicated to a novice paddler when written down.

14. Tidal Flow

As mentioned in the results section, every effort was made to mitigate the effect of tidal currents on the test result. This was not entirely successful; using environmental cues such as buoys and boats at anchor; it was clear to the author that, albeit very slight, the presence of tidal flow was evident, see image 4 to illustrate.

Image 4.



Further research will need to be carried out to determine the true effects of tidal flow and the effects they may, or may not, have on SUP paddlers in offshore wind. Speculating, it could further increase the effectiveness of the SBP if the wind and tide are opposing each other or, as this study may suggest, reduce its effectiveness when the wind and tidal flow are moving in the same direction.

The study indirectly highlights the importance of a SUP paddler being able to effectively prone paddle their board should they find themselves in a wind effective environment. Using a well-known internet search engine, the author investigated what results were generated when the following was typed “what to do in wind on a SUP”, the first 14 results all mention prone paddling to a greater or lesser extent as a way of making progress in the wind. While the effectiveness of prone paddling is clear, it does require specific physical training. The most recent real life RNLI paddleboard rescue video released May 2023 (see references), interviews Sheena Thompson about her experience of being blown out to sea on a SUP. She states she attempted to prone-paddle back to shore but very quickly became exhausted and just laid on the board and waited to be rescued. While this is just one instance, it matches the author's experience as a course provider and National Trainer for Paddles Up Training, where prone paddling of a SUP was often very weak and an overlooked skill (even though they would be considered as experienced). Although anecdotal, it does show that prone paddling on a SUP is not an intuitive activity and needs to be explained and encouraged by SUP coaches and the SUP media/community about the importance of this fundamental core skill. Linking this directly back to the study, prone paddling coupled with the SUP brake position to take a rest when needed rather than just lying on the SUP, gives the paddler the best chance of getting themselves out of difficulty before needing to be rescued by a third party such as the RNLI.

With regard to the second of this study’s outcomes:

- to make recommendations on the possible course of action to take should a SUP paddler find themselves being blown offshore.

From the results and research carried out in this study, the recommendations would be as follows:

- Avoid paddling in offshore winds as a new or novice paddler, and experienced SUP paddlers should give careful consideration before launching in offshore winds. This study, along with RNLI rescue data, has shown just how susceptible SUPs are to the effects of offshore winds.
- On the beach, stop and think, if I do nothing where will I end up…is that a place of safety, i.e., back on the beach where I started? or a place of danger, i.e., out to sea or onto rocks? SUP Paddlers should keep asking this question as they paddle, as winds can pick up and conditions can change very quickly.
- If a SUP paddler finds themselves being blown out to sea, kneel down and paddle, or lay down and prone-paddle back to shore, this will however, in most cases, require a degree of physical conditioning to do for any real length of time.
- SUP paddlers should carry a mobile phone, have it accessible and be prepared to use it sooner rather than later once they realise they are in trouble and not able to make progress towards safety when kneeling or prone paddling. This study has shown we can significantly reduce our rate of drift but we cannot eliminate it, we will continue to drift away from the shore. The risks are potentially more obvious on the coast but no less significant on large bodies of inland water - a SUP paddler will not drift indefinitely as eventually they will arrive on the windward shore but this could involve, at best, a long walk back to their start point or worst, on remote lochs and lakes, getting trapped against steep sided cliffs/banks in exposed weather, ill-equipped to spend an extended amount of time in those conditions.
- Once the emergency call has been made, SUP paddlers should adopt the SBP, ensuring that their phone is still to hand should the need to call and update the emergency services be required. SUP paddlers should take

advantage of the increased visibility this position provides and keep looking around for help, they should not assume the lifeboat will see them. They should make themselves obvious, this can be greatly improved by wearing a brightly coloured buoyancy aid.

- If they have lost their paddle, then sitting on the board with a foot either side of the board is the next best option as shown in the results of this study.

15. Considerations for groups and casualties sharing boards

Further research will need to be carried out to get a definitive answer, but initial research and field trials have shown that, in a group situation, particularly where you have extremes of height and weight of participants, the potential course of action is for everyone to sit on their boards (legs in the water) and raft together using the paddles to keep the group together. This study has shown that the group will quickly separate due to the different drift rates of different sized SUP paddlers regardless of what position people are in on their boards. A separated group will make a rescue by the emergency services more complex.

For casualties sharing a board, i.e., a parent and child, initial testing showed that the SBP was still effective with the larger participant sat towards the tail of the board in the SBP and the lighter paddler in front of them, facing the same way with their paddle in the water if they have one. Extreme caution should be exercised when two people are on one board in windy conditions, one of the participants will not have a leash on if they were to fall off the SUP in strong winds and this could potentially make getting back to them very challenging and further strengthens the case that a buoyancy aid should be worn at all times when using any water craft.

16. Taking the research further in the future

In addition to the points already mentioned above with regards to tidal flow, group rafts and shared SUP rescue protocol - exploring the effects of higher wind strengths and seeing if the results from this study still hold true could be beneficial. F4 gusting F5 in the coastal environment, is on the edge of what can safely be studied without safety cover in the form of a powerboat. Paddling in winds more than F4 is, of course, possible and practiced by sections of the SUP community regularly but crucially they are not paddling entry level, all purpose, inflatable SUPs. To use more advanced, technical equipment in the form of race/all water boards would be to change the focus and real-world application of the results of the study - meaning that, in order to get a true picture, a powerboat with appropriately trained operators would need to be used.

17. Acknowledgements

Thank you to Adam Williams from City College Norwich, James Batchelor from Royal Navy Adventure Training and all the test participants who helped with the data collection. Samantha Ward from British Canoeing for the link with the RNLI and the use of their rescue data.

18. References

Annual Watersports participation survey 2022, published April 2023, Nursery Publications.

Golden, F., and Tipton, M. 2002. Essentials of sea survival. Leeds: Human Kinetics.

RNLI Press release May 2023

RNLI rescue video of Sheena Thompson 2023

(https://www.youtube.com/watch?v=ZHRky4QEqi0&t=3s)

Appendix

1.1 - picture standing

Note: The paddle blade is held edge on to the wind to remove the "sail effect" that the paddle blade faces on to the wind would have.

1.2 - picture kneeling

Note: Low kneel position - heels to buttocks to present a smaller profile to the wind.

1.3 - picture prone

1.4 - picture leg drag

Note: The test position was approximately mid-way from the central handle to the back of the board. This position was decided on after testing for the following reasons:

- Effectiveness - sitting on the mid-point of a 32”-36” board meant that the majority of people (including one test subject of a height of 190.5cm or 6’ 3”) had the rail of the board resting on their calf muscle, with only their feet just in the water. Moving back to the position above meant the board is narrower at this point and nearly all of the lower leg was in the water increasing the drag potential.
- Trim - the board is tail heavy. While this decreases the “wet area” of the board, it does also change the plane of the board, meaning it has to push through the

water, which in turn increases drag - this factor was reduced or amplified depending on the weight of the test subject.

- Comfort - SUPs are wide by design, moving backwards significantly increased comfort as the board was narrower at the position shown without reducing stability.

1.5 - SUP Brake Position - (SBP)

Note: The seated position is the same as the one detailed above. The paddle is choked in front of the knee against the rail of the board. Testing indicated that holding the paddle approximately a third of the way up the paddle shaft was the most comfortable over extended periods of time and required very little effort to keep in this position. Other positions were tested including:

- Dragging the paddle behind the paddler - effective from an increasing drag perspective but very hard to control, required good paddle dexterity and was physically demanding.
- Sat on the front of the board (in the position indicated in the picture) - did increase drag significantly but was unstable, hard to control and with the length of ankle leash typically supplied with entry level boards, may not be possible to achieve.

1.6 and 1.6.1 - Steering SBP pictures to follow.

2.1

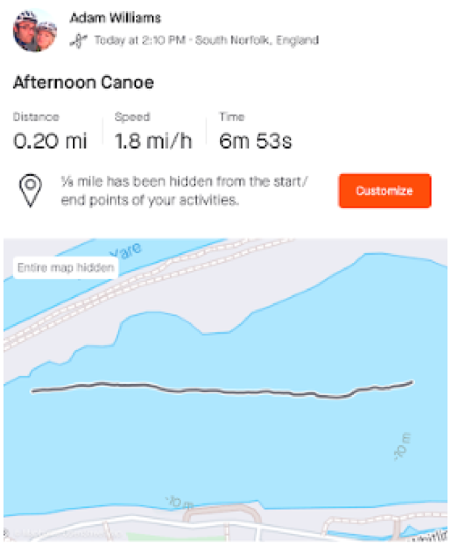
Paddle Types

Brand	Width	Length

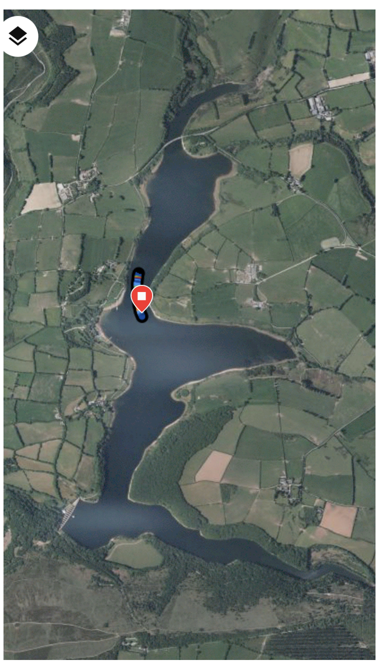
Unknown		
Vast		

Red		
Starboard Premium		

3.1 Test locations and wind strengths

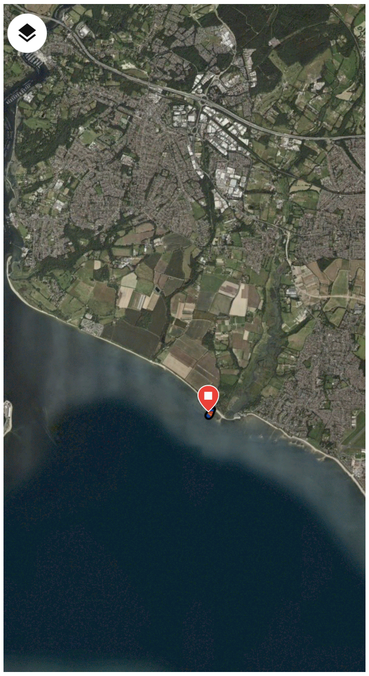


Whitlingham Broad

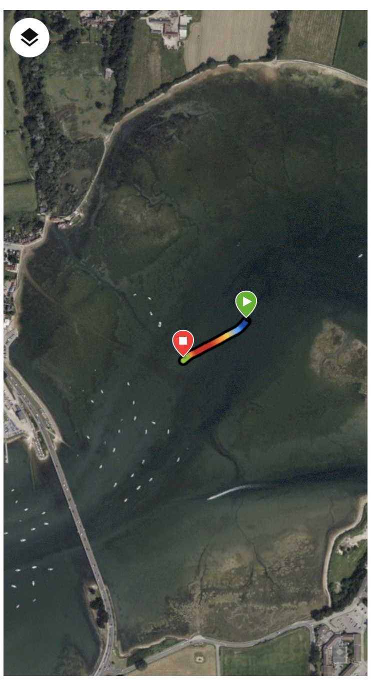


Wimbleball Lake

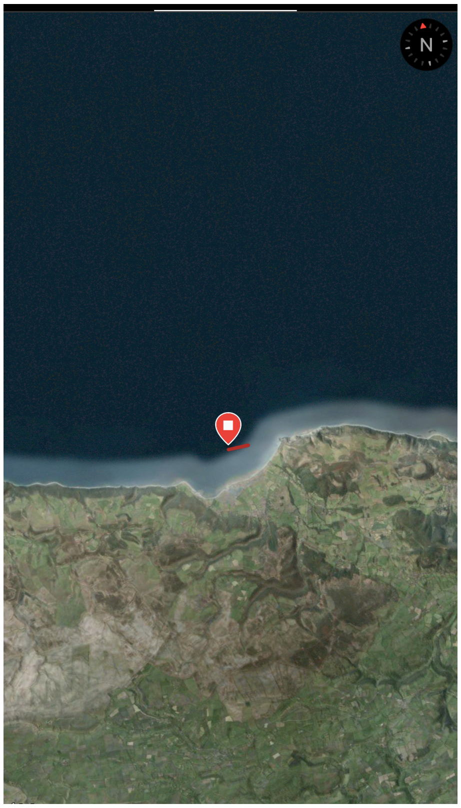
TL - 15th May, TR - 30th May, BC - 31st May



Meon Foreshore - Solent



Langstone - Portsmouth



Porlock Bay, West Somerset/North Devon

Tomorrow Sat 3 Jun BST — 3 hr | 1 hr

08:00	NE	F4	to	F5	9 °C	0 mm		11 %	1024 mb
09:00	NE	F4	to	F5	10 °C	0 mm		6 %	1024 mb
10:00	NE	F4	to	F5	12 °C	0 mm		5 %	1024 mb
11:00	NE	F4	to	F5	13 °C	0 mm		9 %	1024 mb
12:00	NE	F4	to	F4	15 °C	0 mm		30 %	1024 mb
13:00	NE	F4	to	F4	16 °C	0 mm		21 %	1024 mb
14:00	NE	F4	to	F4	17 °C	0 mm		3 %	1024 mb
15:00	NE	F4	to	F4	17 °C	0 mm		1 %	1023 mb
16:00	NE	F4	to	F4	17 °C	0 mm		12 %	1023 mb
17:00	NE	F4	to	F4	17 °C	0 mm		16 %	1023 mb

Anemometer not present for this battery of tests; wind was true to the forecast at the time of testing.

4.1 Participant and control data weights and heights.

Participant	Height cm	Weight kg	SUP dims
Control	178	90	10'6" x 34"
1	183cm	90	10'6" x32"
2	191	110	10'8" x32"
3	188	100	10'8" x32"
4	182	67	10'6" x32"
5	180	74	10'6" x32"

6	175	84	10'6" x32"

5.1 Data collection tables

Coastal	3rd June	NE F4 (F4)	N Devon	Av	6th June	NE F2	Southampton Water -Meon	Av	7th June	NE F4 (F5)	Portsmouth Harbour - Langstone				Av	Coastal Mean Average without 6th June x2 for inland comparison
Standing	152	144	167	154	280	217	231	243	129	154	148	176	128	140	146	300
Kneeling	218	200	225	214	311	312	321	315	211	208	205	187	187	241	207	422
Prone	247	253	250	250	466	366	409	414	241	230	282	238	268	300	260	510
Sitting	326	330	381	346	567	548	570	562	347	302	380	293	360	337	337	684
SUP Brake	374	388	386	383	812	802	827	814	376	367	410	351	363	337	367	750

Inland	15th May	F4 (F4)	Wimbleball	Average	Norfolk 26th May	F3 (F4)	Average	30th May	F4 (F5)	Wimbleball	Average	31st May	F4 (F5)	Average	Inland Mean Average
Standing	360	339	348	349	296	290	293	284	237	292	271	308	299	304	304
Kneeling	442	354	422	406	413	426	420	446	351	431	409	426	444	435	418
Prone	549	537	541	542	578	562	570	485	498	502	495	522	501	512	530
Sitting	762	718	731	737	677	671	674	633	697	655	662	690	640	665	685
SUP Brake	965	925	914	935	871	831	851	784	834	812	810	887	831	859	864

Position	Inland Mean Average in seconds	Coastal Mean Average in seconds	
Standing	304	300	302
Kneeling	418	422	420
Prone	530	510	520
Sitting	685	684	685
SUP Brake	864	750	807