# Review of the Kayaking Expedition Route

## *for the 9-Day Singapore Youth Outdoor (SYO) Programme*

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# Team (Programme unit)

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# Agenda

- Organisation
- Problem Statement
- Deliverables
- Data Analysis
- Recommendation
- Q&A

# Background

- National Outdoor Adventure Singapore (NOAS)
- Outdoor adventure provider
- 9-days Singapore Youth Outdoor (SYO) Programme for institute of higher learning (IHL) students

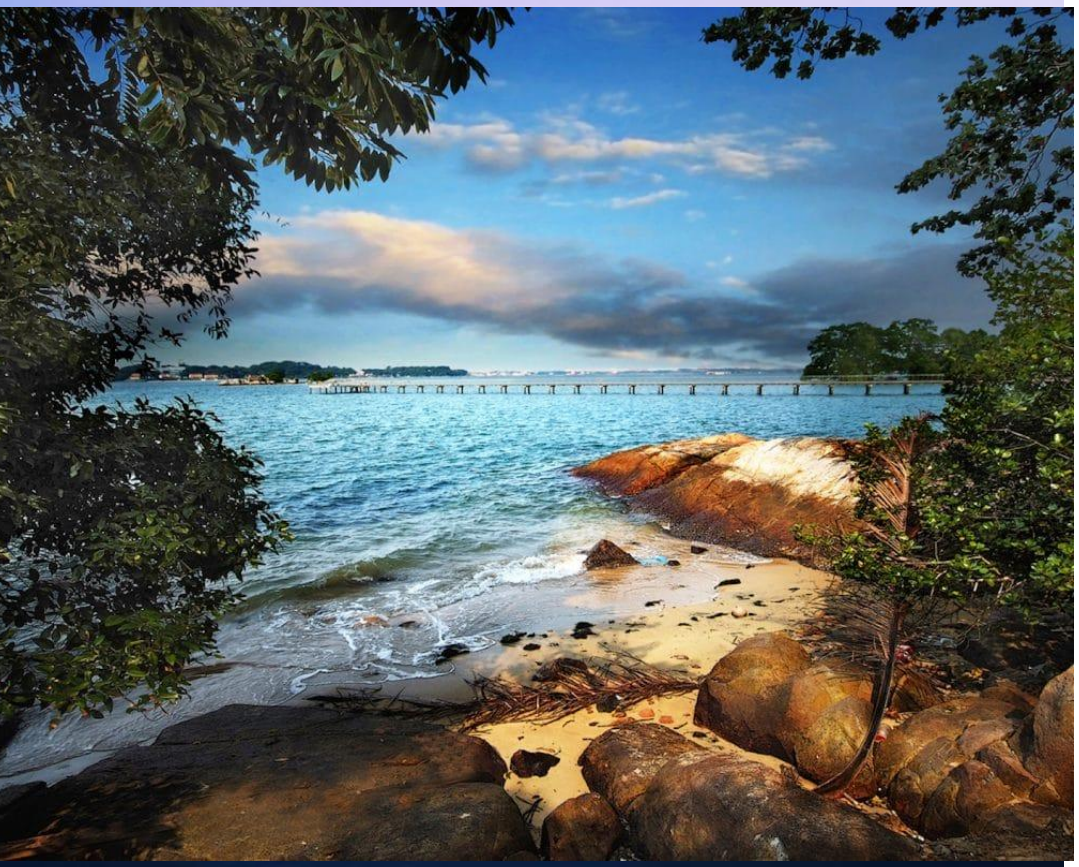
SYO Feedback

- Kayaking sea expedition route around Pulau Ubin is too easy
- Prefer a longer expedition route that will stretch the students physically, mentally and emotionally

# Problem Statement

What is the optimal kayaking expedition route, that is challenging for the students?

# Problem Statement



Request

- Review the current sea expedition route which is kayaking around Pulau Ubin

Action Plan

- NOAS Safety Committee Members (SCM) aims to trial the new kayaking sea expedition route from NOAS Pulau Ubin Campus to NOAS East Coast Campus

# Expedition Route Map

## Current Kayaking Route *(round Pulau Ubin)*


1. Start and end point
2. Distance = 18km
3. Average completion: 6hours

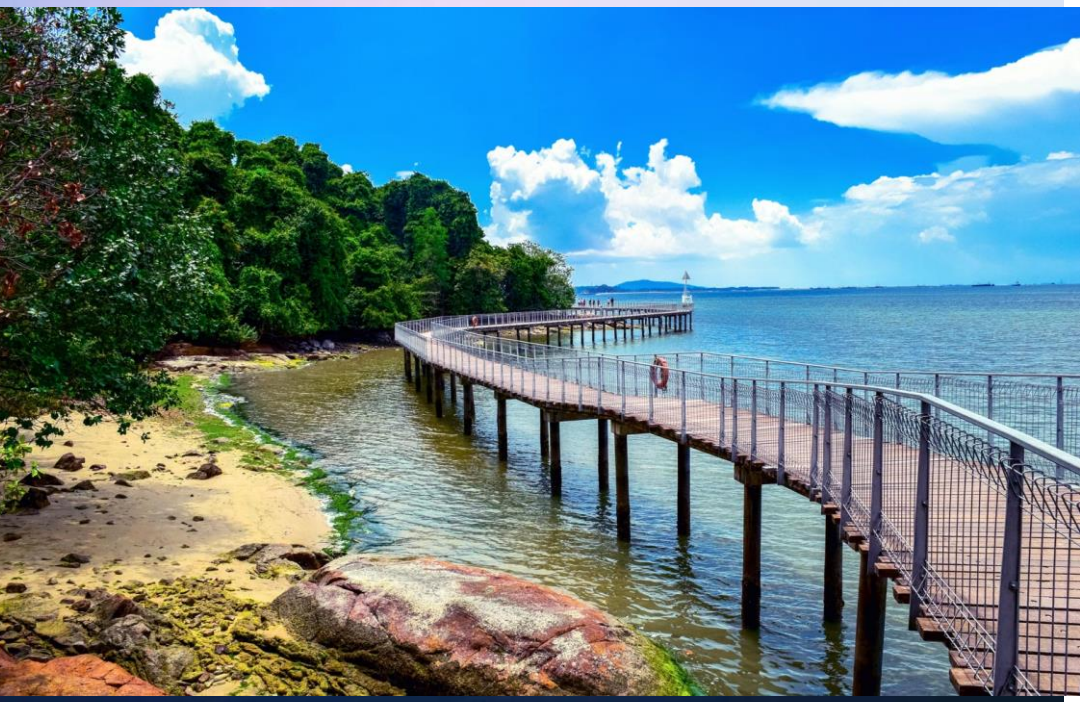
# Expedition Route Map

## New Trial Route
*(Pulau Ubin to East Coast)*

1. Distance: 33km
2. Projected completion: 10hrs
3. Overnight pit stop: Changi Beach if necessary



# Considerations & Assumptions



Principal Considerations

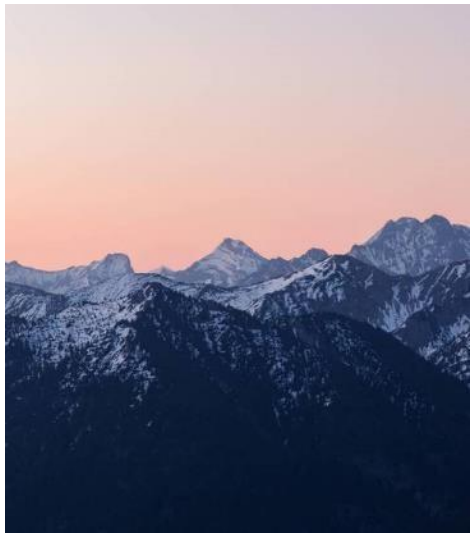
1. Little to minimal rainfall
2. Longer sunshine hours

Assumptions

1. high level of rainfall results in choppy sea conditions, and students cannot manage the potential waves;
2. strong winds during thunderstorms will also pose a challenge for students because they cannot control their kayak effectively; and
3. poor visibility with a heavy rainfall and thunderstorm will affect Instructors ability to provide effective safety management for the students.

# Deliverables

Inform the Safety Committee Members **which month is most ideal to conduct the new sea expedition trial route** that is from Pulau Ubin to East Coast Campus (Mainland Singapore).



# Exploratory Data Analysis

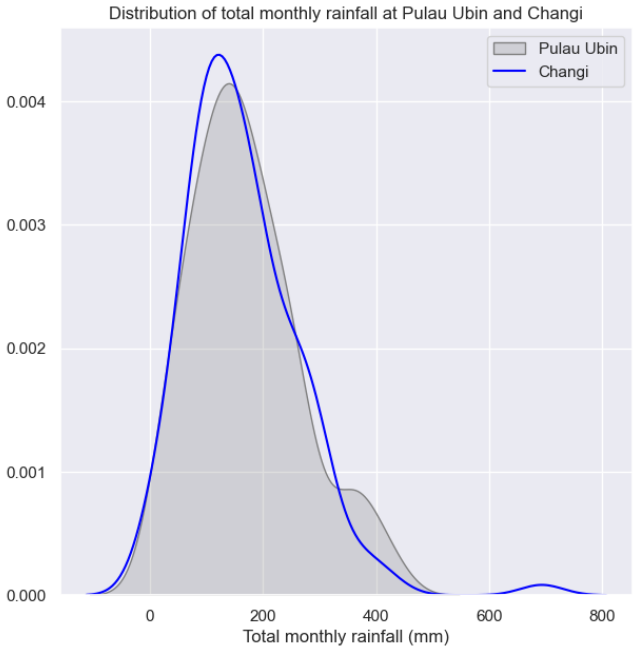
**Rainfall**

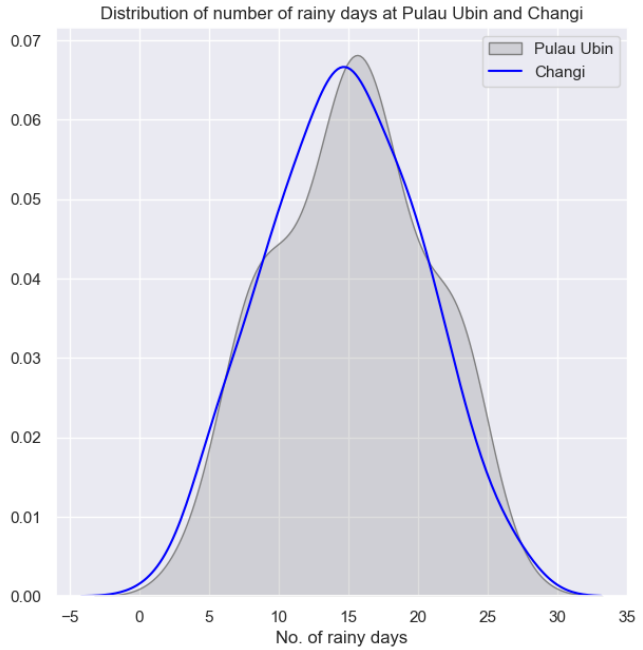
**Temperature, Humidity**

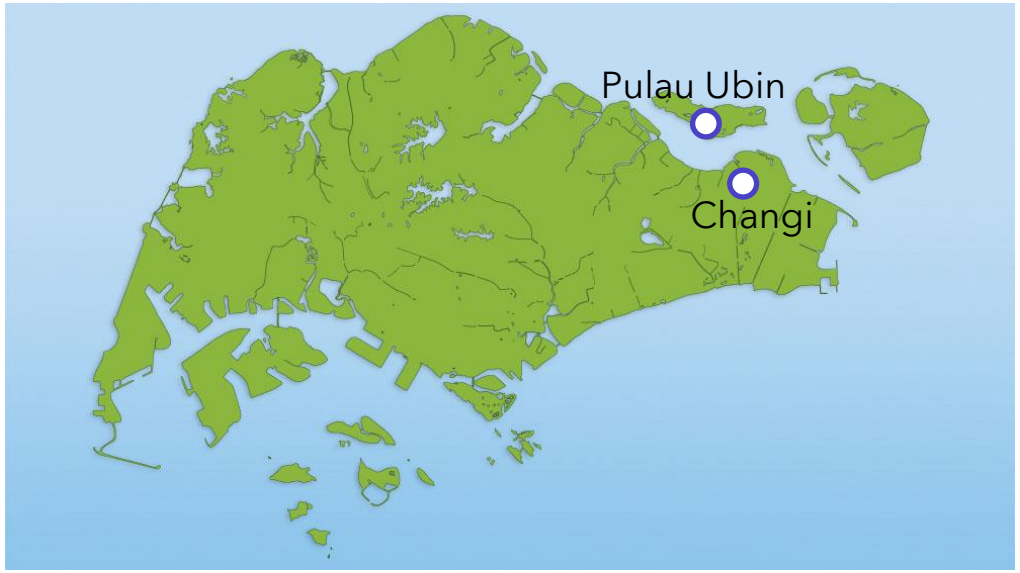
**Tidal**

# Exploratory Data Analysis

## Which month is best to conduct the trial?



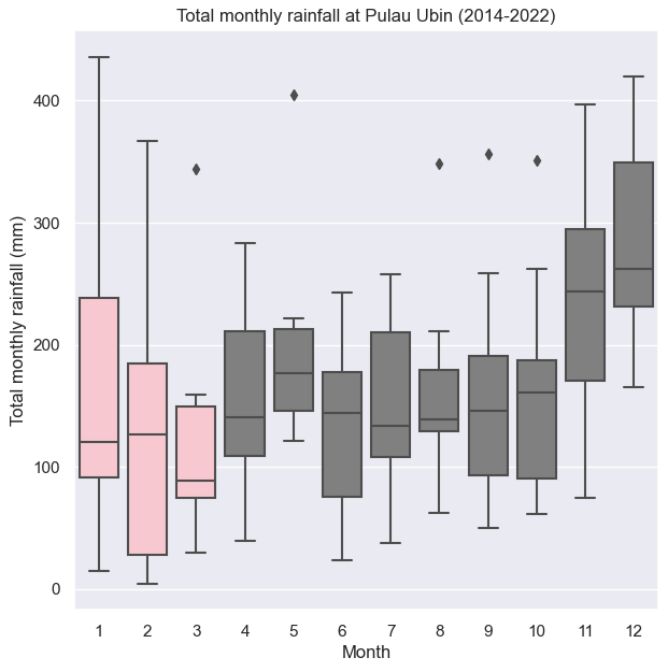

**Findings:**

Rain behaviours and Pulau Ubin are **similar** due to their close proximity

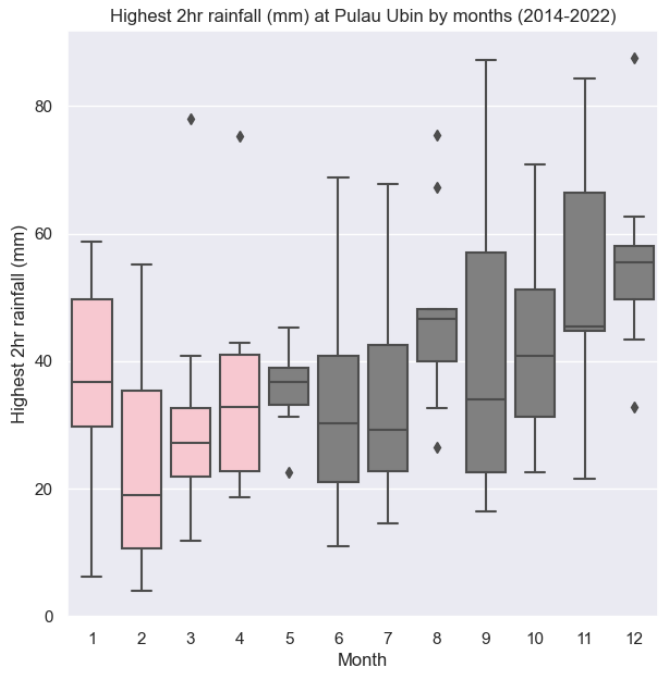
# Exploratory Data Analysis

## Which month is best to conduct the trial?

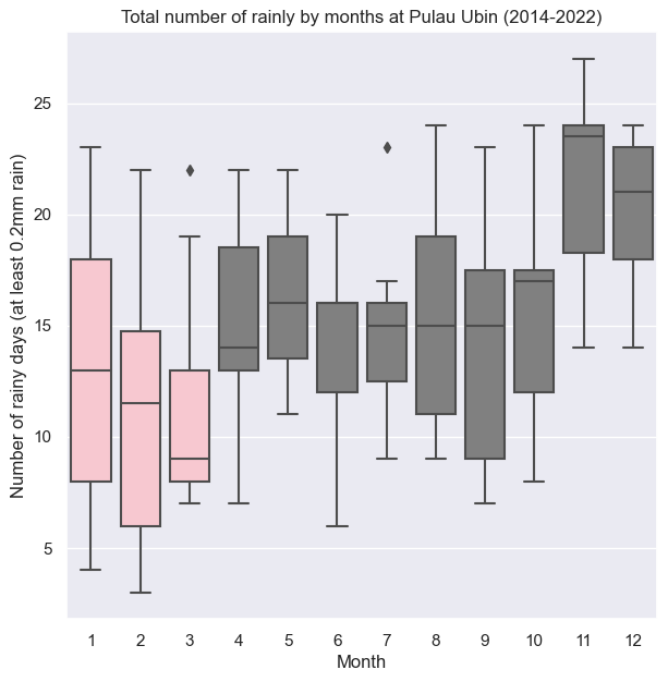
### First Chart




### Second Chart




### Third Chart



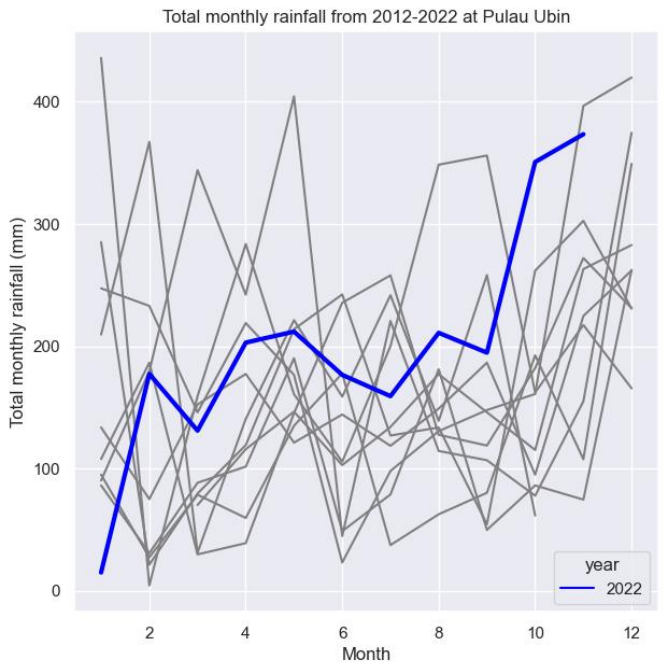

**Findings:**

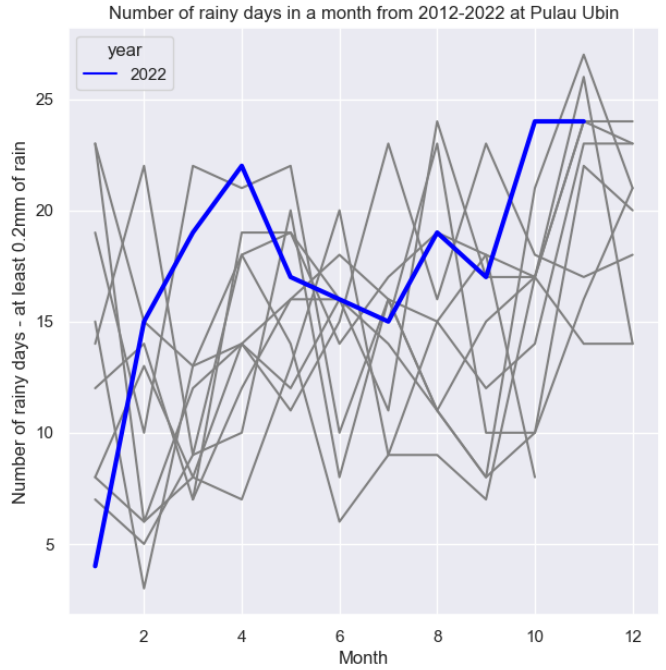
From 2014-2022 at Pulau Ubin, **Jan-Mar** generally experience lower total rainfall, less heavy prolonged showers (2hr rainfall), and lesser rainy days:

- about 4mm of rain per day
- About 3mm of prolonged rain
- About 12 days with rain per month

# Exploratory Data Analysis

## Which month is best to conduct the trial?

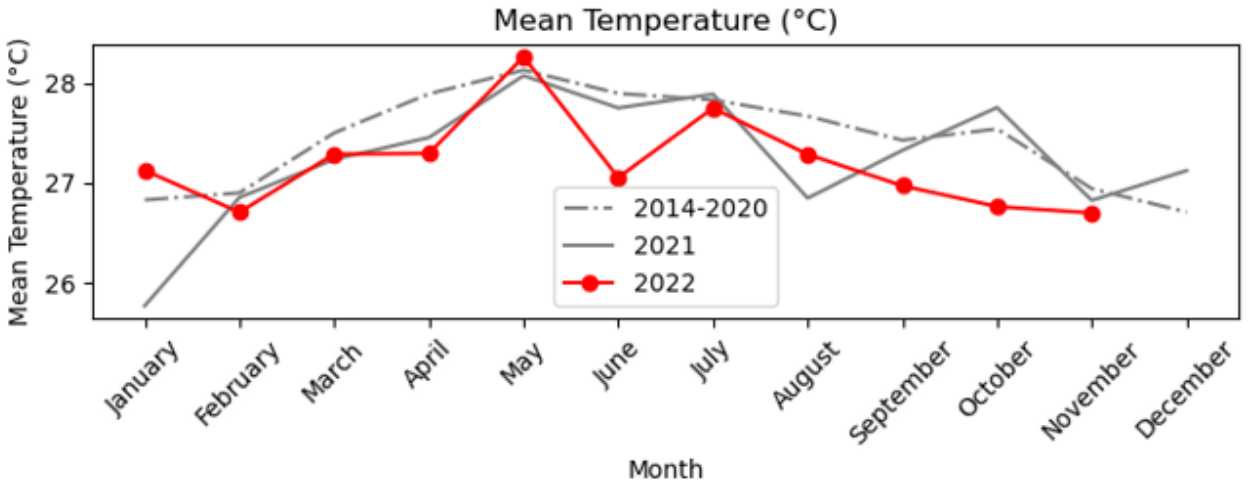


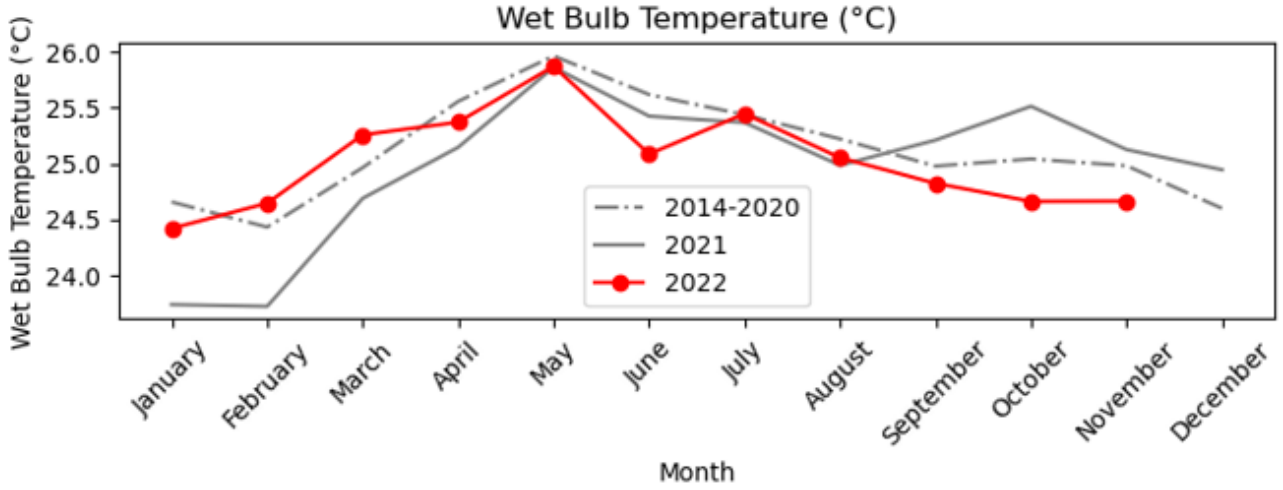




**Findings:**

However, as there are wide variation of rain behaviour across years, we have focused on 2022 data since it most recent. The month with the **lowest rain fall is January.**

# Trend of temperature from 2014-2022



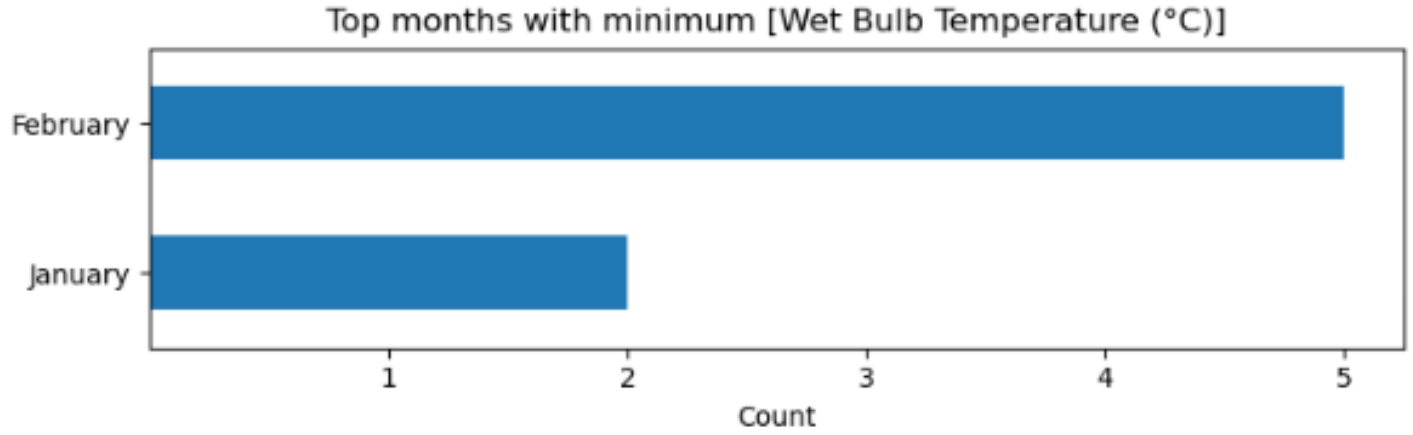



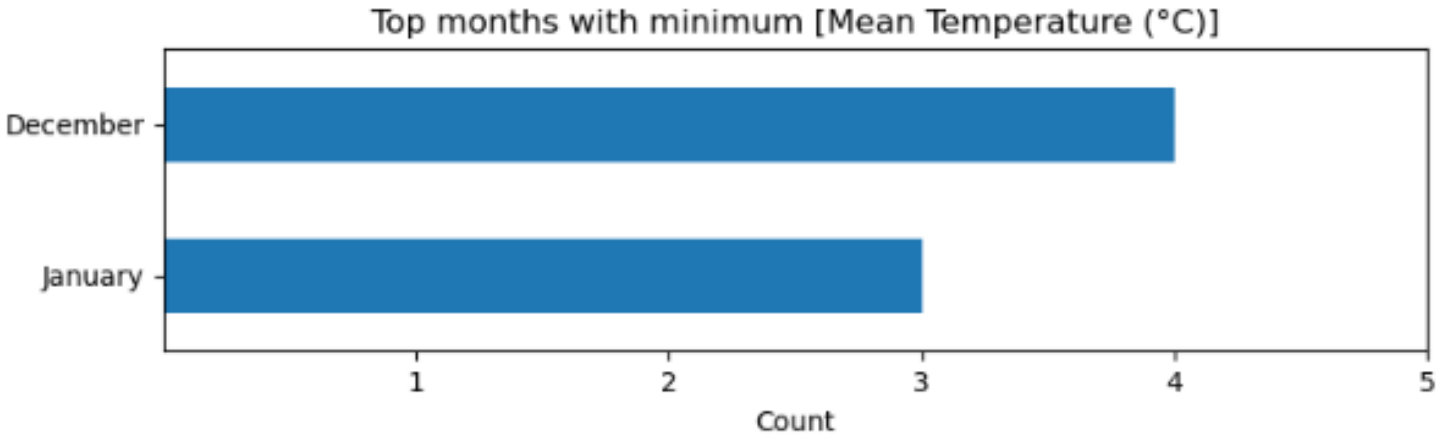

**Findings:**

1. Mean temperature and wet bulb temperature is lower in months of **January-February** and **November-December**.
2. There is a dip in temperatures in June 2022.
3. Both mean temperature and wet bulb temperature are positively correlated.

Wet-bulb temperature is a combination of heat and humidity, and reflects the ability for human body to cool down. A low wet-bulb temp is recommended to prevent heat-related injuries during sporting events.

# Comparison of months for lowest temperatures

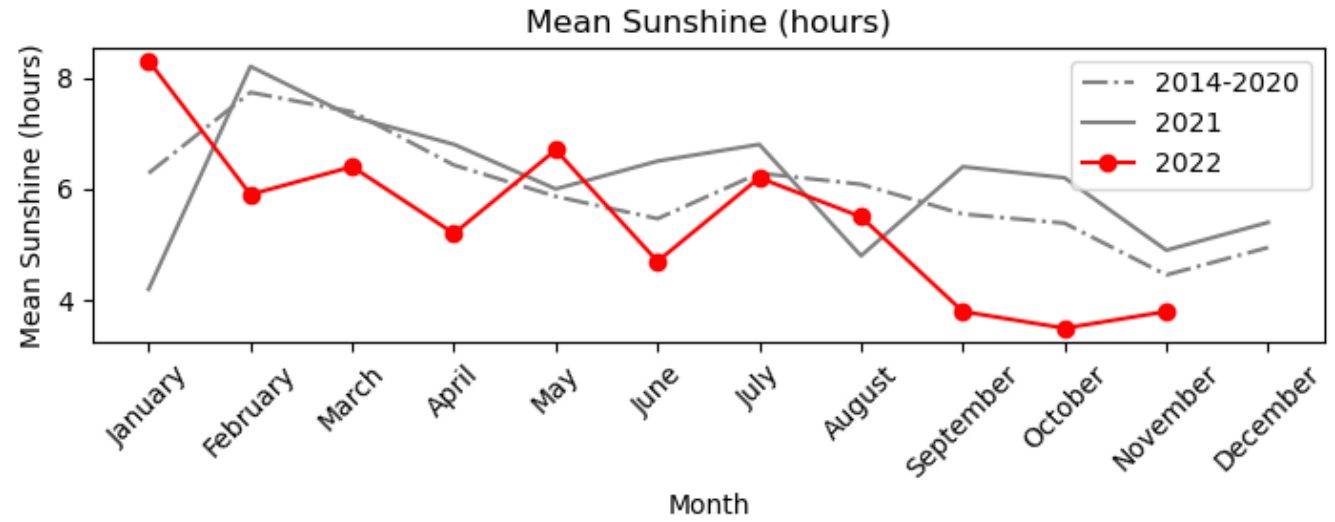


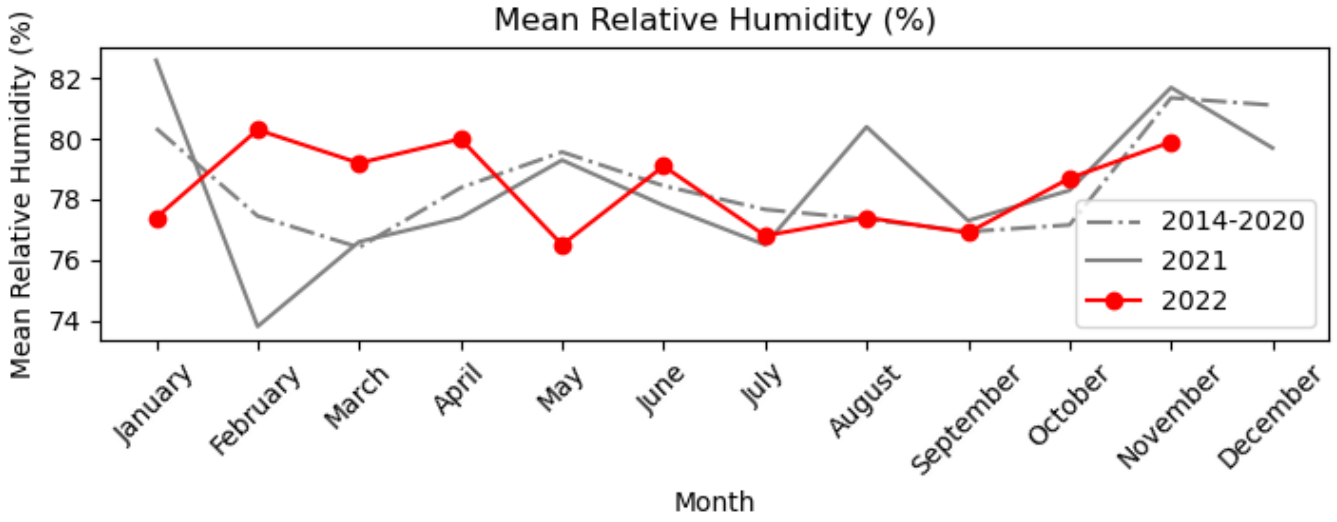




**Findings:**

1. **January** and **February** have lowest wet-bulb temperature ideal for outdoors kayaking.

# Trend of sunshine and humidity from 2014-2022

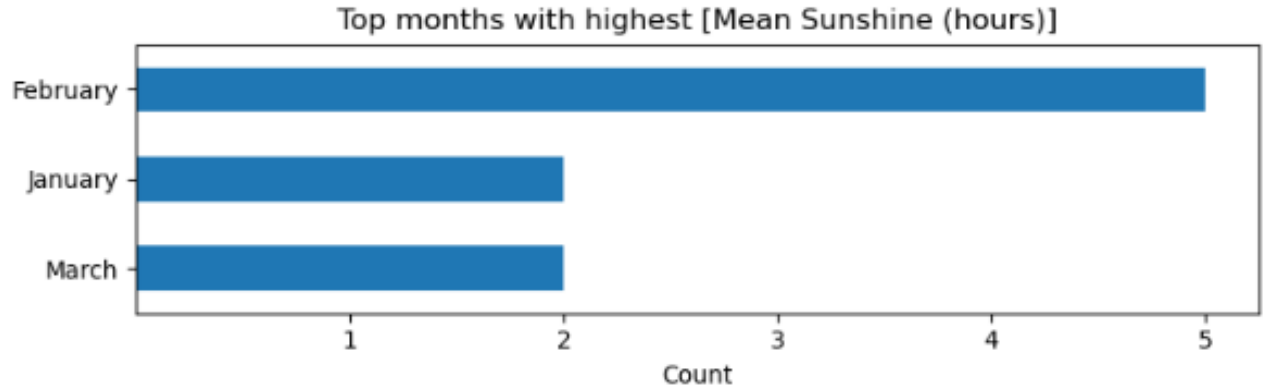


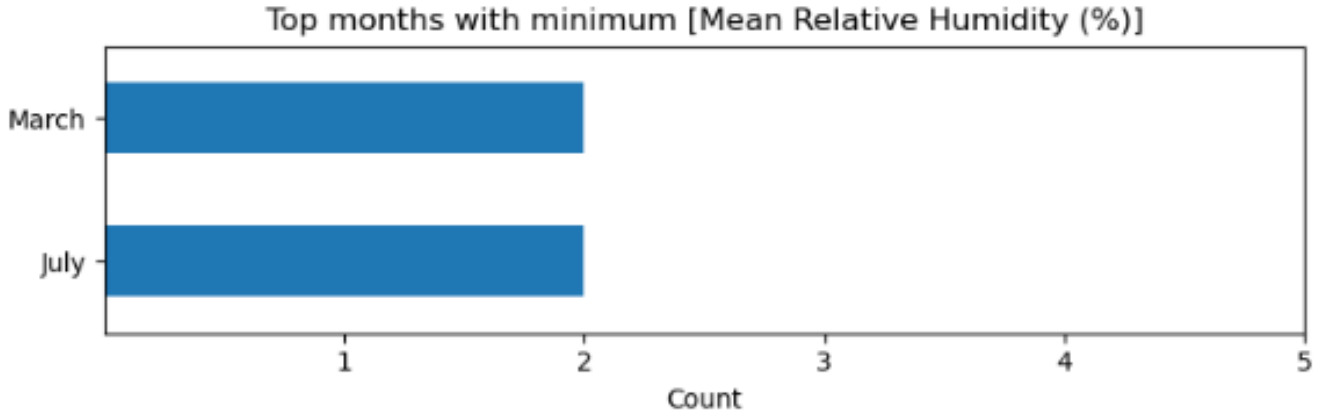




**Findings:**

1. Sunshine hours is higher in **January.**
2. Relative humidity is lower in **January.**
3. Both sunshine hours and humidity are negatively correlated e.g.dip in sunshine hours in June 2022 has an **inverse rise** in humidity.

# Comparison of months for ideal humidity and sunshine hours



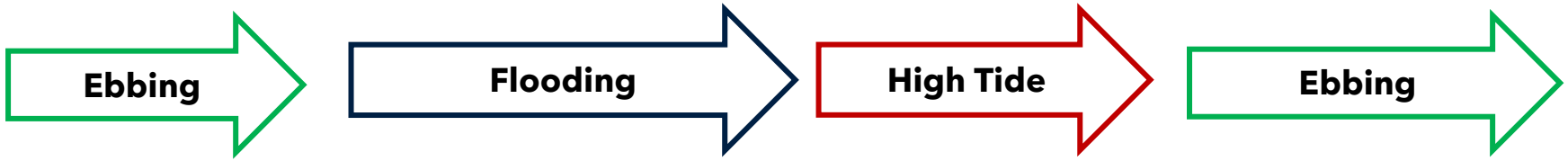



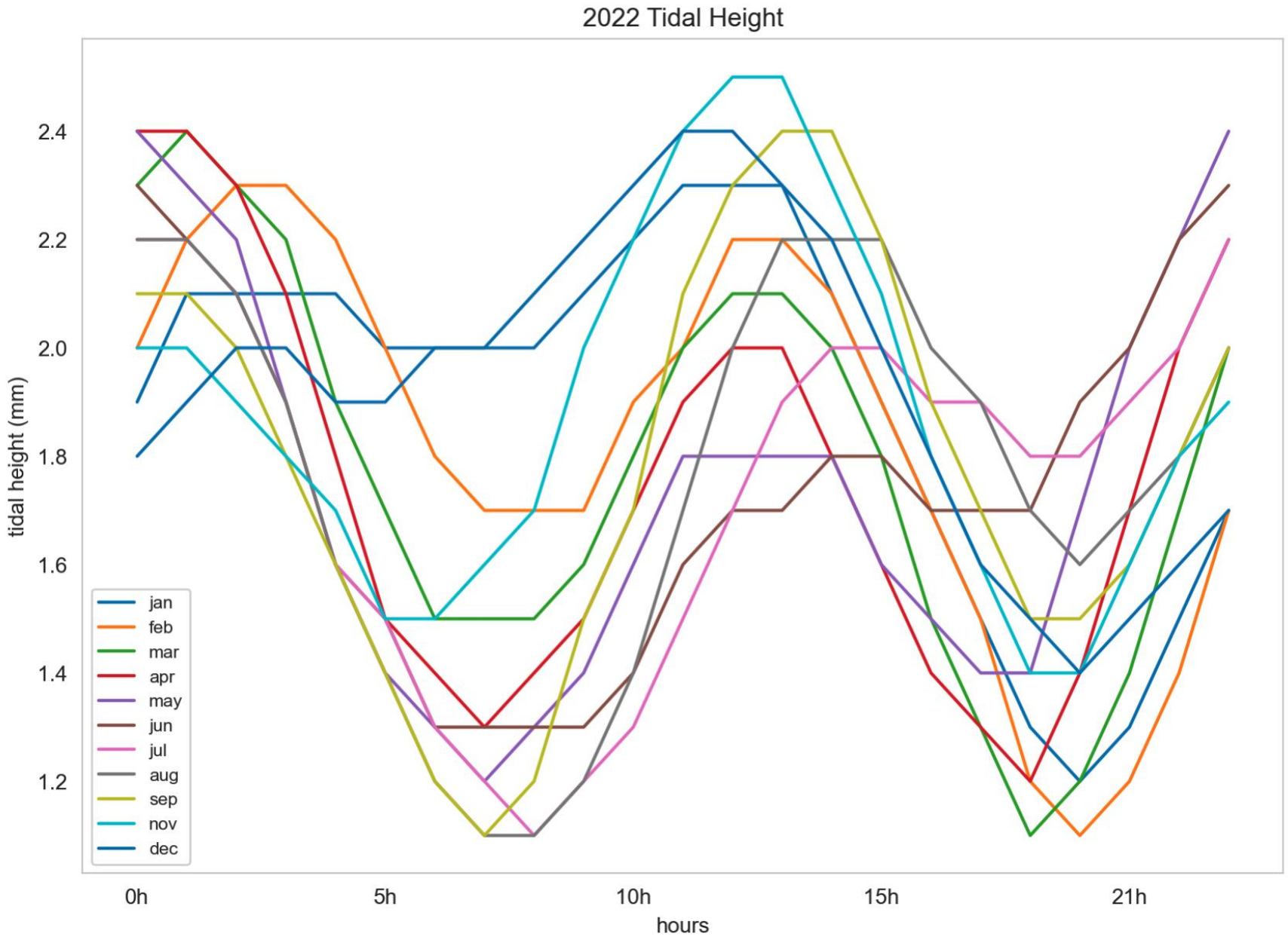

**Findings:**

1. **January**, **February** and **March** have the ideal combination of long sunshine hours and low relative humidity for outdoors kayaking.

# Tidal ebb and flow in 2022

| month | year | month_num | 0h | 1h | 2h | 3h | 4h | 5h | 6h | 7h | 8h | 9h | 10h | 11h | 12h | 13h | 14h | 15h | 16h | 17h | 18h | 20h | 21h | 22h | 23h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 2022.0 | 1.0 | 1.9 | 2.1 | 2.1 | 2.1 | 2.1 | 2.0 | 2.0 | 2.0 | 2.0 | 2.1 | 2.2 | 2.3 | 2.3 | 2.3 | 2.1 | 1.9 | 1.7 | 1.5 | 1.3 | 1.2 | 1.3 | 1.5 | 1.7 |
| February | 2022.0 | 2.0 | 2.0 | 2.2 | 2.3 | 2.3 | 2.2 | 2.0 | 1.8 | 1.7 | 1.7 | 1.7 | 1.9 | 2.0 | 2.2 | 2.2 | 2.1 | 1.9 | 1.7 | 1.5 | 1.2 | 1.1 | 1.2 | 1.4 | 1.7 |
| March | 2022.0 | 3.0 | 2.3 | 2.4 | 2.3 | 2.2 | 1.9 | 1.7 | 1.5 | 1.5 | 1.5 | 1.6 | 1.8 | 2.0 | 2.1 | 2.1 | 2.0 | 1.8 | 1.5 | 1.3 | 1.1 | 1.2 | 1.4 | 1.7 | 2.0 |
| April | 2022.0 | 4.0 | 2.4 | 2.4 | 2.3 | 2.1 | 1.8 | 1.5 | 1.4 | 1.3 | 1.4 | 1.5 | 1.7 | 1.9 | 2.0 | 2.0 | 1.8 | 1.6 | 1.4 | 1.3 | 1.2 | 1.4 | 1.7 | 2.0 | 2.2 |
| May | 2022.0 | 5.0 | 2.4 | 2.3 | 2.2 | 1.9 | 1.6 | 1.4 | 1.3 | 1.2 | 1.3 | 1.4 | 1.6 | 1.8 | 1.8 | 1.8 | 1.8 | 1.6 | 1.5 | 1.4 | 1.4 | 1.7 | 2.0 | 2.2 | 2.4 |
| June | 2022.0 | 6.0 | 2.3 | 2.2 | 2.1 | 1.9 | 1.6 | 1.5 | 1.3 | 1.3 | 1.3 | 1.3 | 1.4 | 1.6 | 1.7 | 1.7 | 1.8 | 1.8 | 1.7 | 1.7 | 1.7 | 1.9 | 2.0 | 2.2 | 2.3 |
| July | 2022.0 | 7.0 | 2.2 | 2.2 | 2.1 | 1.9 | 1.6 | 1.5 | 1.3 | 1.2 | 1.1 | 1.2 | 1.3 | 1.5 | 1.7 | 1.9 | 2.0 | 2.0 | 1.9 | 1.9 | 1.8 | 1.8 | 1.9 | 2.0 | 2.2 |
| August | 2022.0 | 8.0 | 2.2 | 2.2 | 2.1 | 1.9 | 1.6 | 1.4 | 1.2 | 1.1 | 1.1 | 1.2 | 1.4 | 1.7 | 2.0 | 2.2 | 2.2 | 2.2 | 2.0 | 1.9 | 1.7 | 1.6 | 1.7 | 1.8 | 2.0 |
| September | 2022.0 | 9.0 | 2.1 | 2.1 | 2.0 | 1.8 | 1.6 | 1.4 | 1.2 | 1.1 | 1.2 | 1.5 | 1.7 | 2.1 | 2.3 | 2.4 | 2.4 | 2.2 | 1.9 | 1.7 | 1.5 | 1.5 | 1.6 | 1.8 | 2.0 |
| November | 2022.0 | 10.5 | 2.0 | 2.0 | 1.9 | 1.8 | 1.7 | 1.5 | 1.5 | 1.6 | 1.7 | 2.0 | 2.2 | 2.4 | 2.5 | 2.5 | 2.3 | 2.1 | 1.8 | 1.6 | 1.4 | 1.4 | 1.6 | 1.8 | 1.9 |
| December | 2022.0 | 12.0 | 1.8 | 1.9 | 2.0 | 2.0 | 1.9 | 1.9 | 2.0 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.4 | 2.3 | 2.2 | 2.0 | 1.8 | 1.6 | 1.5 | 1.4 | 1.5 | 1.6 | 1.7 |






## Findings:

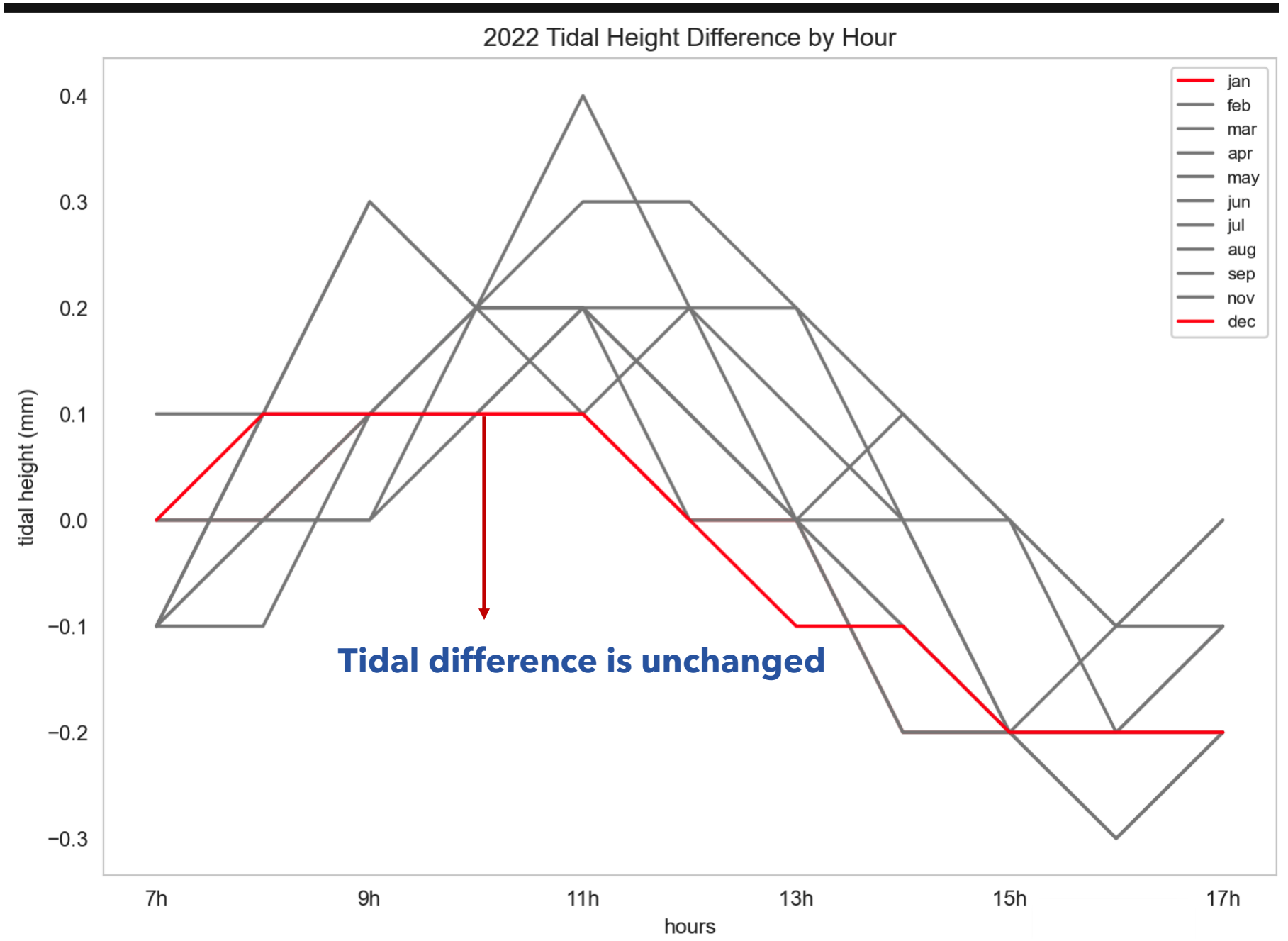
1. The highest tidal height typically is at noon
2. Tidal height changes in the early morning, afternoon and evening
3. Ave of every 6-8hours there will be a tidal change

# Tidal difference by hour

| month | 7h | 8h | 9h | 10h | 11h | 12h | 13h | 14h | 15h | 16h | 17h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | -0.2 | -0.2 | -0.2 | -0.2 |
| Feb | -0.1 | 0.0 | 0.0 | 0.2 | 0.1 | 0.2 | 0.0 | -0.1 | -0.2 | -0.2 | -0.2 |
| Mar | 0.0 | 0.0 | 0.1 | 0.2 | 0.2 | 0.1 | 0.0 | -0.1 | -0.2 | -0.3 | -0.2 |
| Apr | -0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.0 | -0.2 | -0.2 | -0.2 | -0.1 |
| May | -0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | -0.2 | -0.1 | -0.1 |
| Jun | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.1 | 0.0 | 0.1 | 0.0 | -0.1 | 0.0 |
| Jul | -0.1 | -0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.0 | -0.1 | 0.0 |
| Aug | -0.1 | 0.0 | 0.1 | 0.2 | 0.3 | 0.3 | 0.2 | 0.0 | 0.0 | -0.2 | -0.1 |
| Sep | -0.1 | 0.1 | 0.3 | 0.2 | 0.4 | 0.2 | 0.1 | 0.0 | -0.2 | -0.3 | -0.2 |
| Nov | 0.1 | 0.1 | 0.3 | 0.2 | 0.2 | 0.1 | 0.0 | -0.2 | -0.2 | -0.3 | -0.2 |
| Dec | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | -0.1 | -0.1 | -0.2 | -0.2 | -0.2 |

**Findings:**

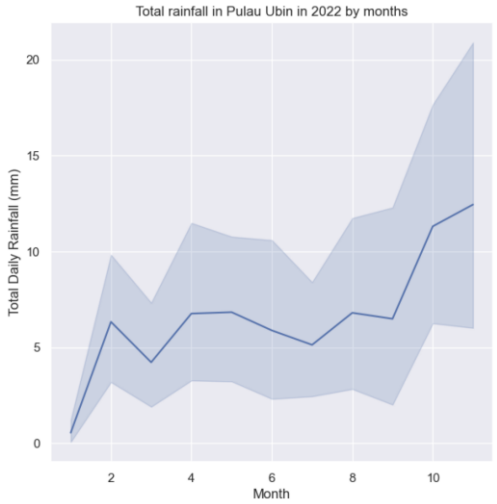
1. **January** and **June** have the ideal tidal difference because it has the most hours denoted by 0.0 where the tidal difference is unchanged.


2022 Tidal Height Difference by Hour
jan
feb
mar
apr
may
jun
jul
aug
sep
nov
dec
0.4
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
tidal height (mm)
7h
9h
11h
13h
15h
17h
hours
Tidal difference is unchanged

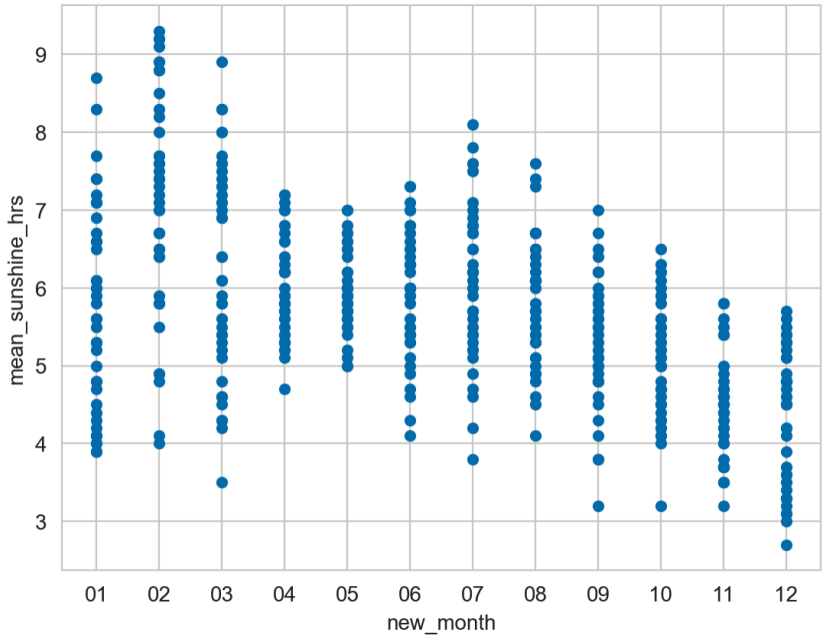
# Conclusions & Recommendation

**Factoring the tidal data which has a significant impact on the success for the kayaking trial route, our conclusion and recommendation is to conduct the trial in  Jan 2022 because of these 4 factors:**

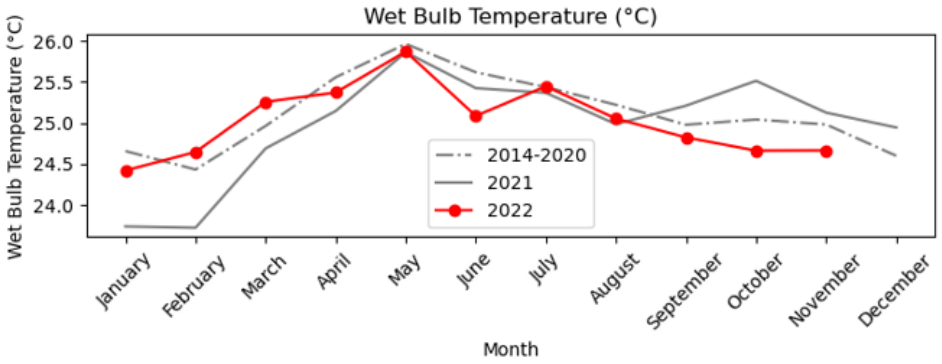
## 1. Jan has the least rainfall




## 2. Longer sunshine duration




## 3. Favourable humidity temp




## 4. Favourable tidal conditions

| 7h | 8h | 9h | 10h | 11h | 12h | 13h | 14h | 15h | 16h | 17h |
|---|---|---|---|---|---|---|---|---|---|---|
| 2.0 | 2.0 | 2.1 | 2.2 | 2.3 | 2.3 | 2.3 | 2.1 | 1.9 | 1.7 | 1.5 |


The way to get started is to quit talking and begin doing.
Walt Disney
Thank you