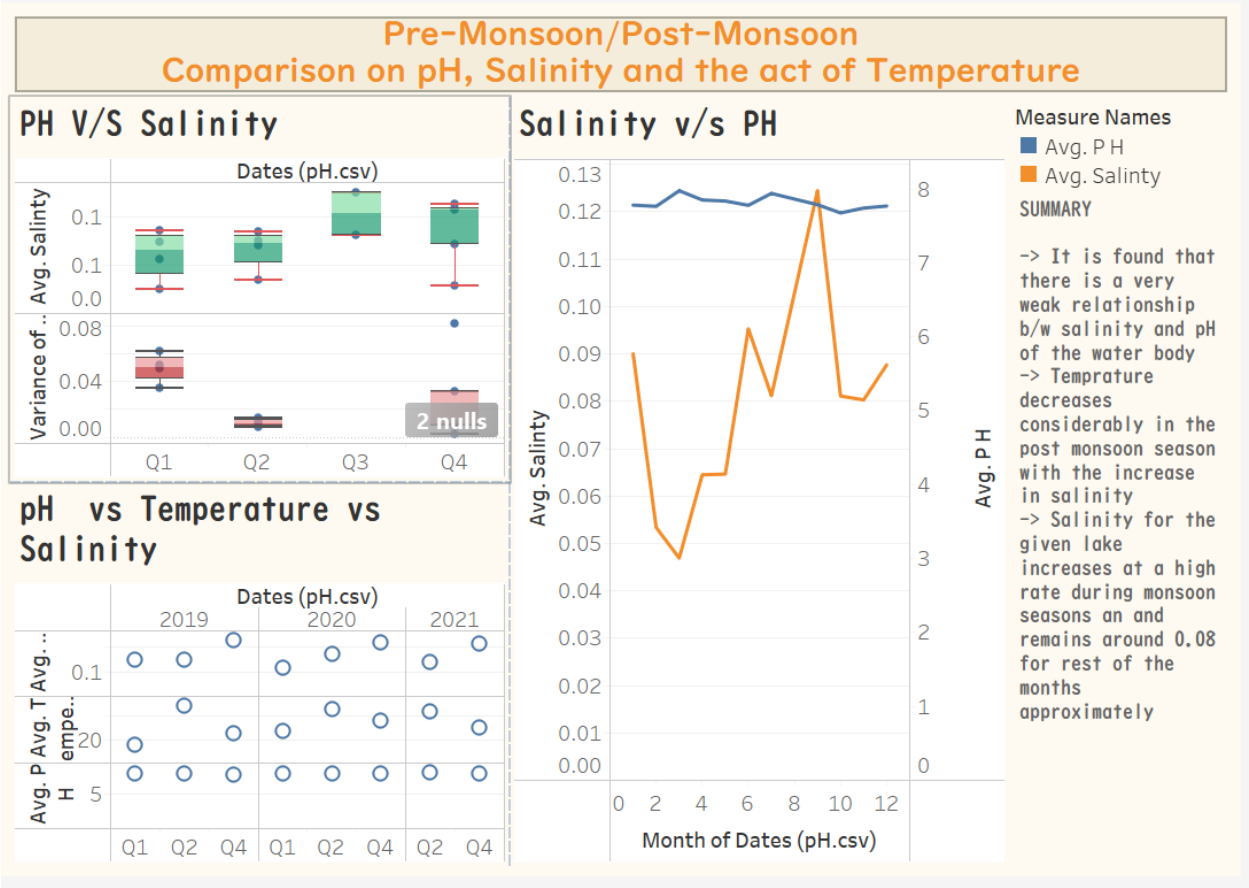
Water quality analysis of Nawab Munshi Hussain Khan Lake

Water quality of a lake can be determined by many factors including Chlorophyll A , Turbidity , Temperature, Dissolved Oxygen etc., whose data has been collected by the help of various satellites and google earth engine .
However , seasons and as we know the pandemic has affected the water sources in their own way and hence the analysis for the water parameters have been classified into two ways that is

1) Pre-Monsoon/Post-Monsoon Analysis
2) Pre-Covid/Post-Covid Analysis

PRE-MONSOON/POST-MONSOON ANALYSIS



The following data visualization depicts the relationship between pH, Salinity of 'Nawab Munshi Hussain Khan Lake' and how are they affected by the act of Temperature, as we

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can notice from graph 2 and graph 3 , On an average the pH doesn't vary much for all the season but there is a huge change in the values of Salinity

Pre-Monsoon

Variance : Variance of Salinity is measured to be ranging from 0.02 - 0.08 in quarter 1 with 0.06 as the median value for the quarter 1 and 0.03-0.08 with the median value of 0.07 for the quarter 2 whereas variance for pH is shown as 0.03-0.06 and 0.007-0.01 for Q1 and Q2 respectively

from the graph 2 we can notice that there is a constant drop for the value of Salinity in the first 3 months and shows a gradual upward trend there onwards
whereas there is a small drop in month february for the pH and then a hike of 0.2 in march and then shows a gradual trend downwards

also we can see that Avg pH and Salinity remains constant for the pre monsoon season with the increase of 33 Degrees in Temperature ranging from 15-45 degrees approximately

Post-Monsoon

Variance : We can notice that the Variance of Salinity shows a huge difference in post monsoon analysis with the range of 0.08-0.12 in quarter 3 and 0.02 -0.1 in Quarter 4, where as Variance of pH for Q4 is shown to range between 0.002 -0.03 and also there is an outlier at the variance 0.08 for the pH

from graph 2 we can say that there was a great increase in the Avg Value for Salinity from the month of July to month of September that is 0.08 - 0.12 and then a sudden drop to 0.08 again by the month of october likewise we can notice a very small increase in the value of pH in the monsoon months and a decline trend afterwards

also we can see that the avg temp for Q4 was found out to be 25C with the pH of 7.6 and avg salinity of 0.11

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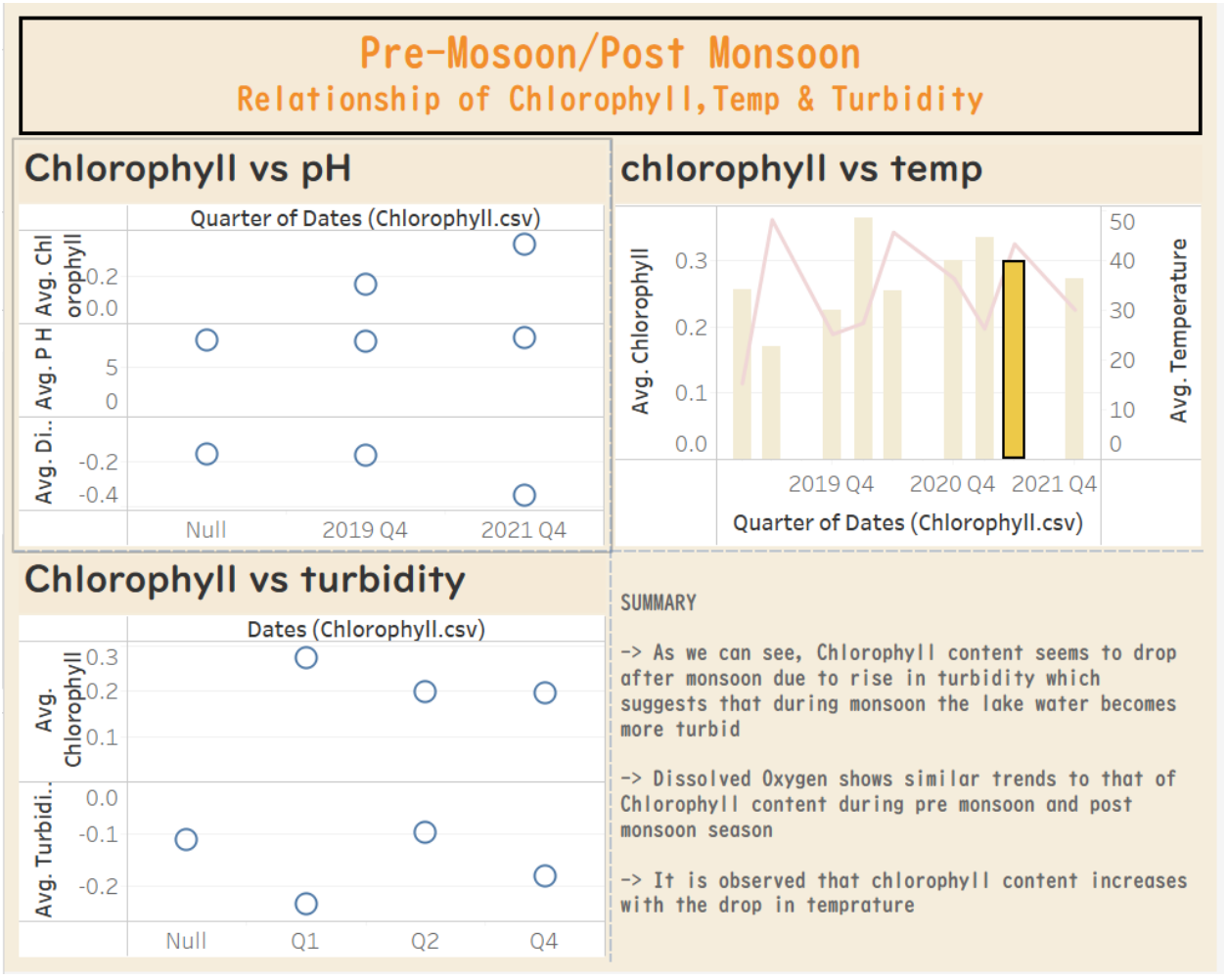
Conclusion :

We have found a very weak relationship between Salinity and the pH of the given lake , Increase in Salinity barely increases the value of pH.

Both the pH and Salinity for the lake increases on a little scale during the monsoon and remains constant for the pre monsoon and post monsoon period.

Also we found a significant role of Temperature in the variation of Salinity as the Salinity of water Increases considerably during the post monsoon period , we found that Temperature is inversely related to Salinity of the given water source.



The following visualization depicts the relationship between chlorophyll , pH and the Turbidity of the given lake

Pre-Monsoon

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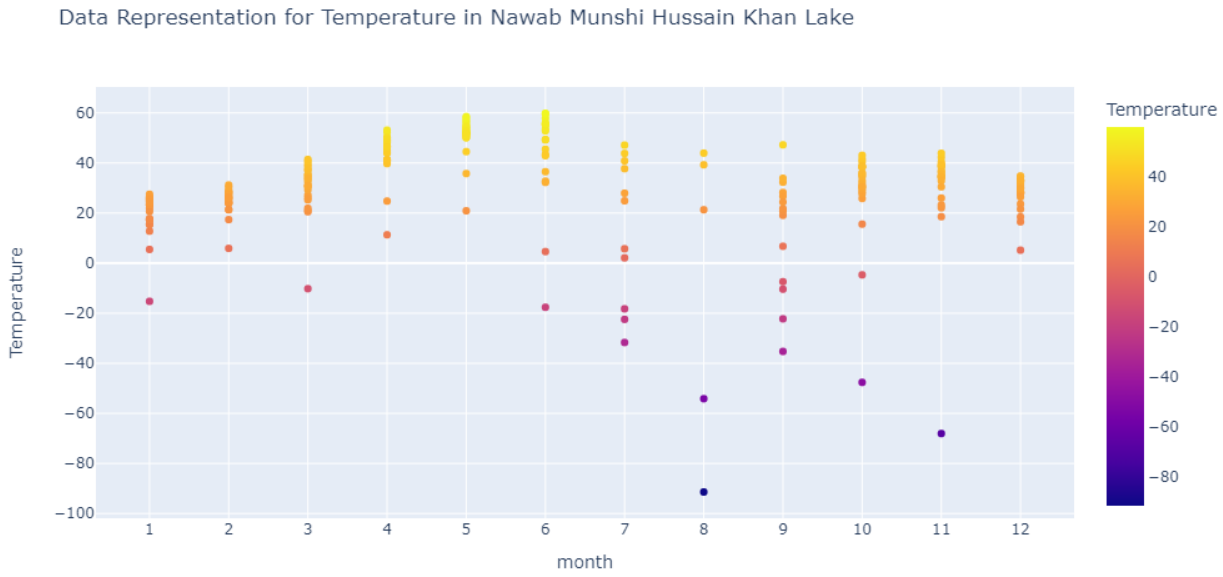
As we can observe the average chlorophyll for the Q1 and Q2 is 0.27 and 0.19 respectively whereas Turbidity of the lake is -0.23 and -0.09 for Q1 and Q2 respectively and pH remains approximately near 7.6 ,

Post Monsoon

During post monsoon period , the value for chlorophyll shows a declining behavior with the opposite trend in the turbidity of the water and also an increase in pH to 7.9

Conclusion : It is observable that for Munshi hussain khan lake , the chlorophyll content increases with drop in temperature but at the same time , there is a sudden drop in chlorophyll during the monsoon season which increases the turbidity in the water with the small increase in the pH as well.
We can also say that water from Munshi Husain Khan Lake is more fit for irrigation during the pre monsoon period , whereas the water seems to be fit for drinking purposes in both the seasons .



From the following visualization we can also conclude that the temperature of the water stays below 30 degrees during pre monsoon season but delivers a gradual rise with the

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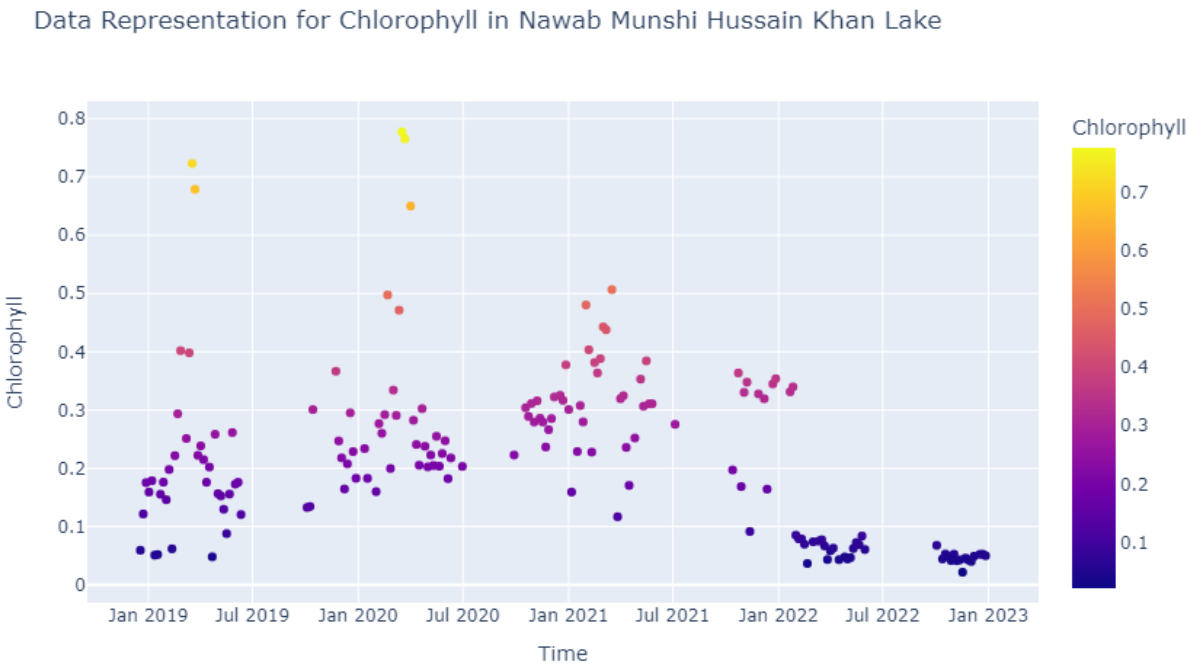
approach of monsoon and the same trend as that of pre monsoon season during the post monsoon seasons.

Pre-Covid/Post-Covid Analysis

ChlorophyllA : Chlorophyll a is a specific form of chlorophyll used in oxygenic photosynthesis. It absorbs most energy from wavelengths of violet-blue and orange-red light, and it is a poor absorber of green and near-green portions of the spectrum.



Pre covid

The Chlorophyll content in pre covid years that is during 2019 , seems to range between 0.1 to 0.3 , whereas it shows an upward trend from 0.1 to 0.3 during the first half of the year and then the downward trend to 0.1 again during the other half of the year .

During 2020, that is the start of COVID,

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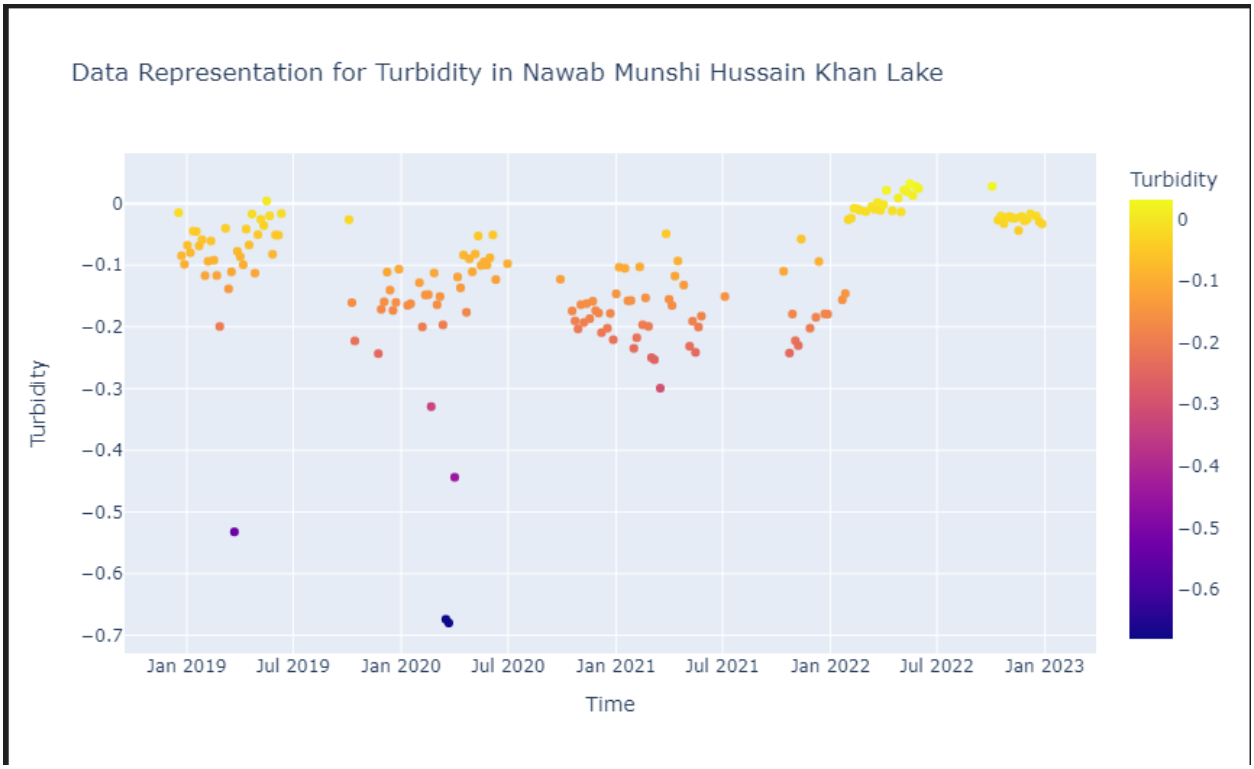
The chlorophyll content for the lake shows a sudden increase that ranges for appx 0.2 - 0.3 and continues the similar upward trend in the following year that is 0.2 - 0.4

Post-Covid

During the post covid years i.e after 2021 , there is observed a sharp and concerning decrease in the value of chlorophyll content of the lake that ranges from 0-0.1 .

Conclusion : Pre covid years depicted better quality of water which also indicated towards better aquatic life , and during the start of covid there was an indication of improvement of chlorophyll content in the water but it can be assumed that the decline of chlorophyll content in water during post covid was either an side effect of pandemic or the lockdown during pandemic reduced the quantity of wastes being dumped in water improving the water quality and during the post covid years , the dumping of wastes and wastewater increased at the double rate.

Turbidity : It is the measure of clarity of a liquid . It is an optical characteristic of water and a measurement of the amount of light that is scattered by material in water when the light is shined through the water sample



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Pre Covid Year:

Unlike Chlorophyll, Turbidity shows the opposite trend for the Nawab Munshi Hussain Khan Lake .

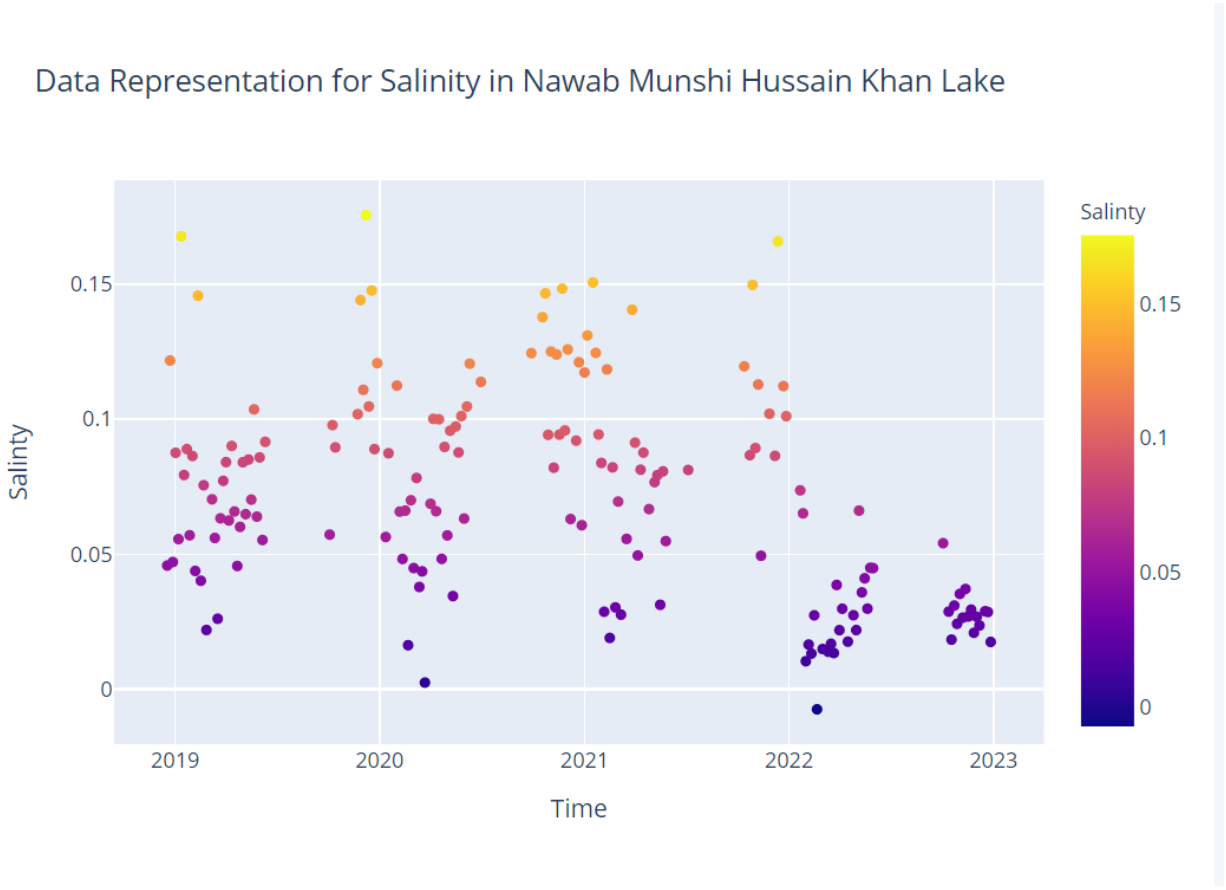
In the year 2019 the water seems to be less turbid with the value ranging between -0.2 to 0 where it shows a further decline in turbidity during the year of 2020-2021 that is during COVID uproar

Post Covid years:

There has been a sudden hike to the range of -0.1 to 1 in post covid years that is year 2022-2023 indicating towards the increasing turbidity in the water

Hence it can be concluded that the water quality has been deteriorating in post covid years .

Salinity : Salinity refers to the concentration of salt in a particular water body , Salinity of Munshi Husain khan lake has been showing interesting variations



Pre covid years:

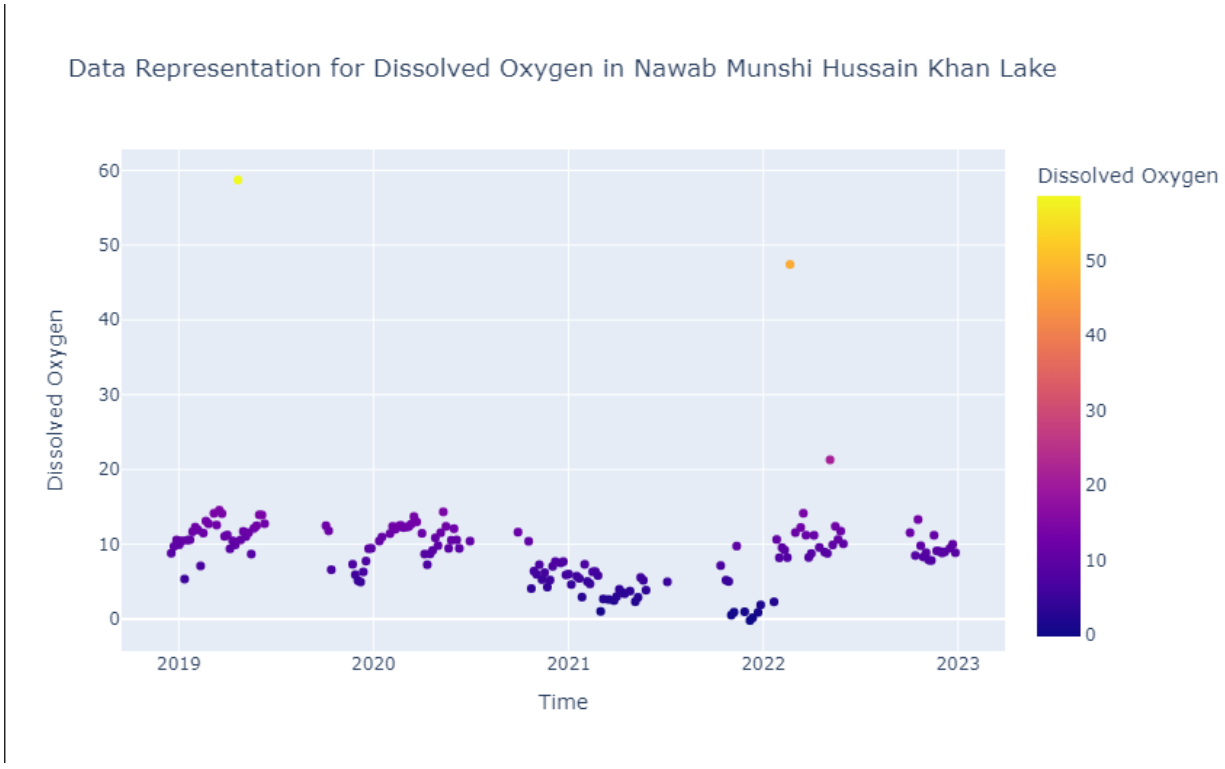
Water quality analysis of Nawab Munshi Hussain Khan Lake

It is observed that the salinity of the water was scattered between the values 0.05 to 0.1 in the year 2019 whereas there was barely any difference in the salinity of the water during the years of uproar of COVID .
During 2020-2021 , the values of Salinity has varied between 0.04-0.1 approximately

Post Covid years:
It is observed that the Salinity of water has shown a sudden decline in post covid years that is year 2022-2023 that is ranging between 0-0.05

Hence it can be concluded that after the strike of Covid , the lake water is noticed to be less saline in the post covid period.

Dissolved Oxygen : Dissolved oxygen refers to the level of free, non compound oxygen present in water or other liquids.



Pre Covid years :

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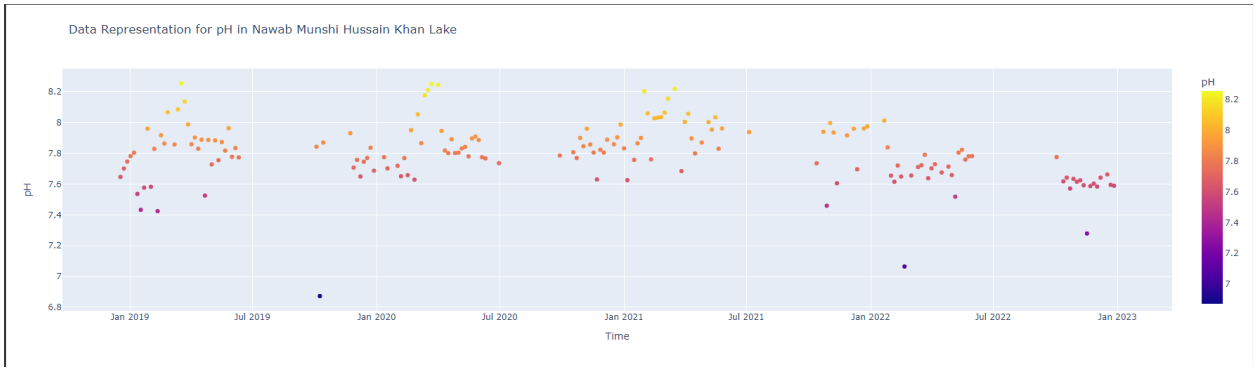
The values for Dissolved oxygen are found to be lying between 9 -15 during the year 2019-2020 that is the pre covid and the first half of the covid years .
As per the given data it is observed that there is a small decline in the dissolved oxygen for the given lake during the COVID that ranges between 0-10

Post Covid years:
The Dissolved Oxygen has shown an increase for the given lake during the post covid years that indicates a better quality for the aquatic life

Hence we can conclude that the COVID affected the Dissolved Oxygen for the lake as there has been a noticeable decrease in the Dissolved Oxygen in the year 2020-2021.

pH : pH is a measure of concentration of Acidity or Basicity in the liquid



Pre covid :
As we can observe , In the year 2019 that is before the strike of covid , the pH of the lake ranges between 7.5 - 8 which is slightly basic in nature.
In year 2020, with the rise of covid , there isn't much change in the quality of pH as it ranges between 7.6-8 , year 2021 follows to have the same trend than that of year 2020

Post Covid:
It can be observed that there is a decline in pH value of the lake towards the acidic behavior from the start of year 2022 that can be considered as post covid period ,
The value of pH during the year 2022 seems to range between 7.6-7.8 , and further declines to 7.6-7.7 in 2023.

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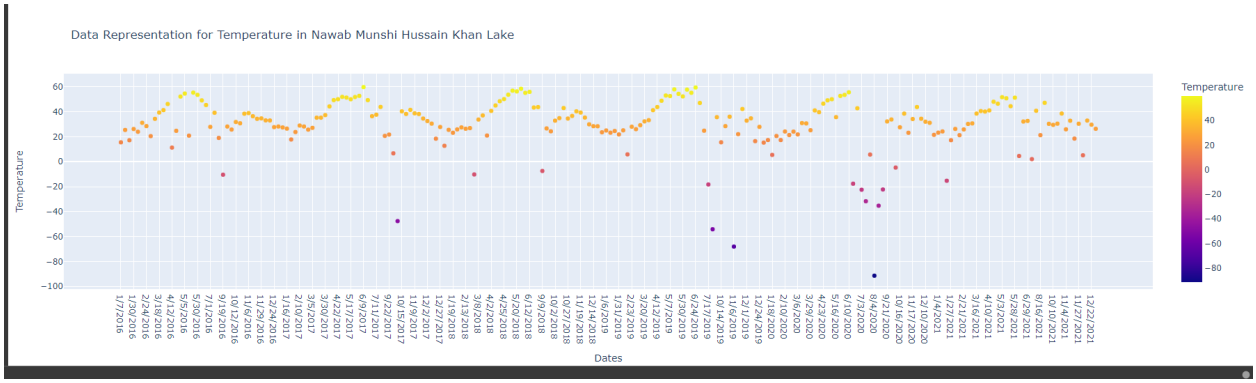
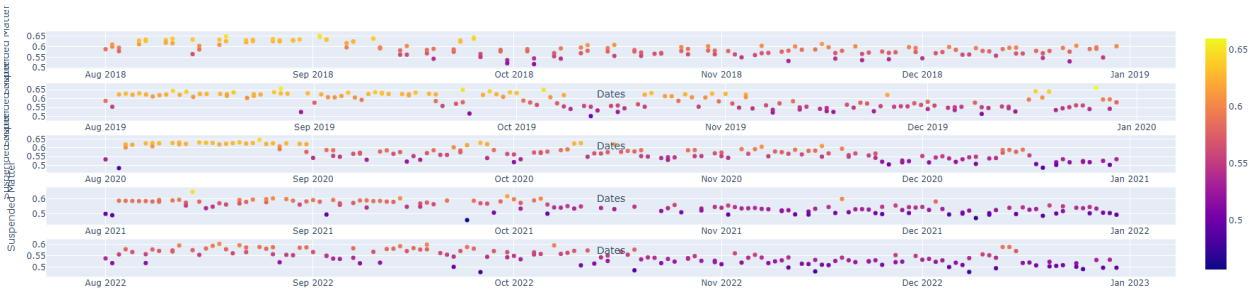
Hence we can conclude that there has been a significant decline in the pH value of the lake after Covid,

Temperature : it is a physical quantity that measures quantitatively the perceptions of degree of hotness or coldness



As we can observe from the given graph , there is no effect of COVID on the following parameter , Temperature seems to follow the similar wave like trend from year 2019 to year 2022,
It is found that , Temperature has been ranging between 15C to 50C for the lake at the pre covid and the post covid years.
However , Temperature has its own effect in determining the other parameters such as Chlorophyll , Dissolved Oxygen , etc…

Suspended Matter: Suspended matter is made up of fine particles. Some are present naturally in river water, such as plankton, fine plant debris and minerals, while others stem from human activity (organic and inorganic matter).



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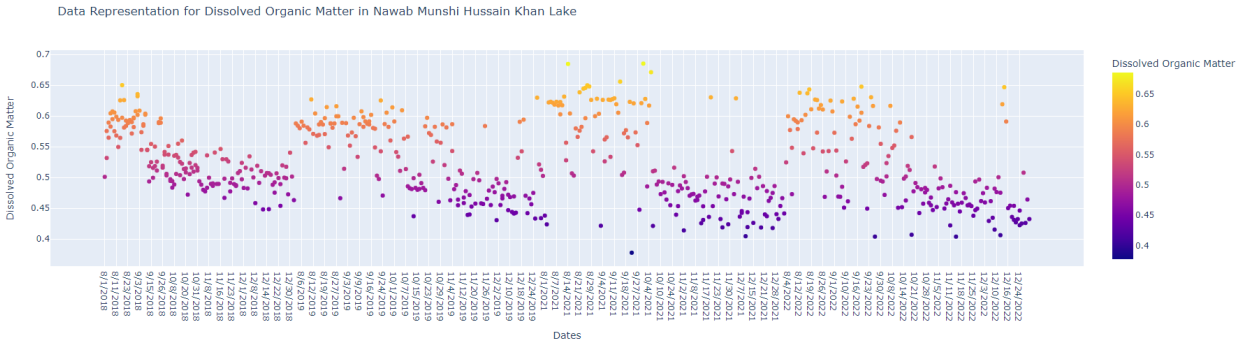
Likewise temperature , there is no noticeable effect of covid in the values of suspended matter .
Suspended matter for the lake seems to range similar in all the years that is pre covid and post covid to about 0.55-0.65 ,
However suspended matter has its own effect on the turbidity of the water .
We can also notice that , the values for suspended matter changes slightly during pre monsoon and post monsoon season , so hence we can conclude that there is a very small effect of monsoon on the value of suspended matter for the lake

Dissolved organic matter: It is a heterogeneous mixture , derived primarily from decomposition products of plant material , bacteria and algae .

As a common observation for the organic matter in the lake , we can observe a trend that there is a decline in the value of organic matter during winters while it remains high during the monsoon period .



Pre covid :

As we have observed in 2018-2019 , similar to that of suspended matter, the value for organic matter has shown a range between 0.55 - 0.65 whereas during the winter months of the same year gap , it has shown a drop to 0.45 - 0.55 in it's value.

During the Covid , we can see that there is a slow rise in the value of organic matter , though not much difference but the values seems to be more scattered and also it is observed that the difference in the variance of the values has increased for monsoon-winter analysis, there shows a sudden drop in winters and that to 0.40 - 0.55 .

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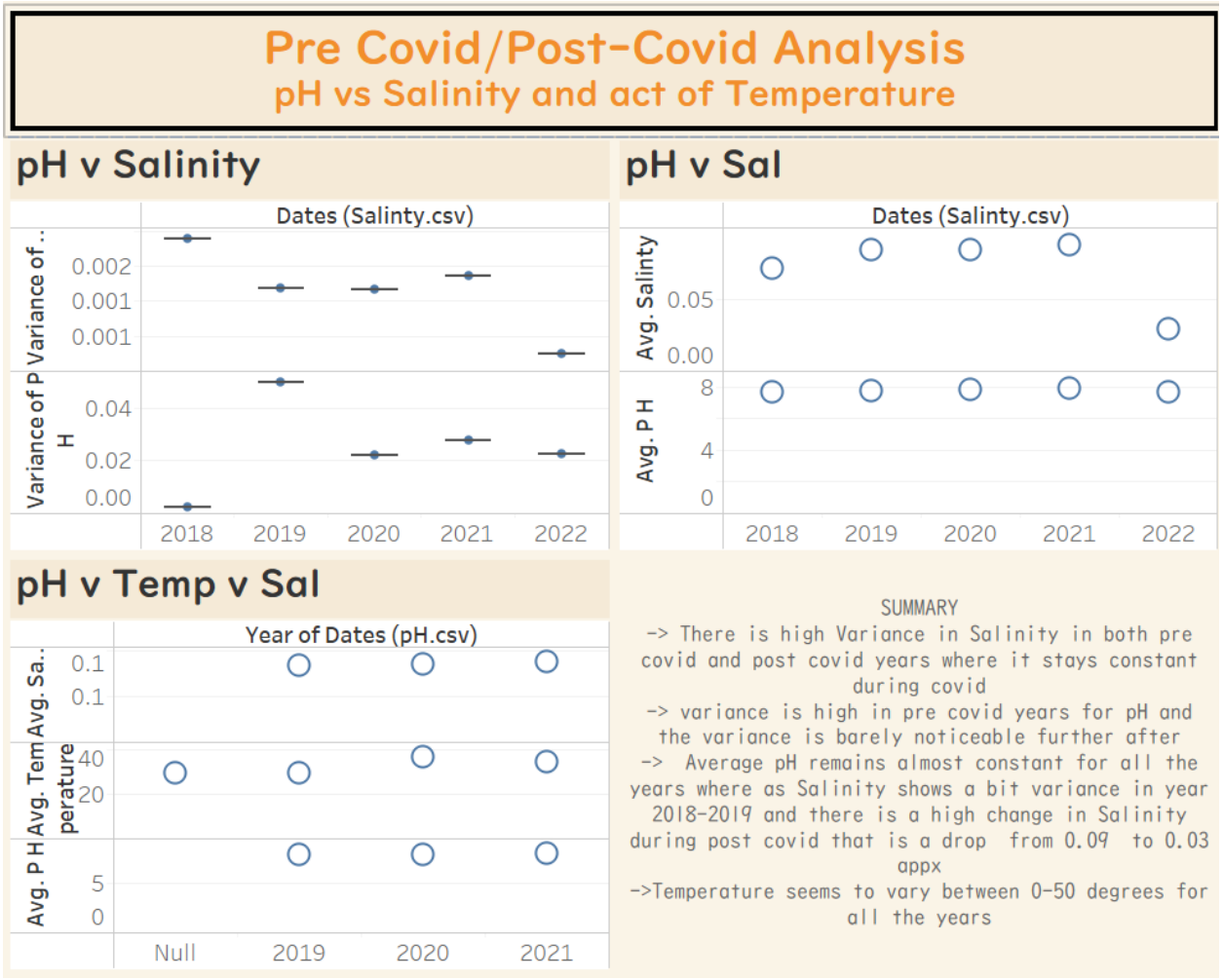
Post Covid :

There is very little to no difference in the value for organic matter for the lake in post covid years from the above analysis . it ranges from maximum - 0.55-0.7 and minimum towards 0.4-0.6 during the winter period.

Hence we can assume that less human activity that was during covid has contributed towards the growth of organic matter with the decrease in the industrial wastes and toxins being dumped .



As we can see there is a decline in the variance of Salinity but the increase in the variance of pH in the year 2018-2019 , which shows a drop from 0.002 - 0.001 in Salinity

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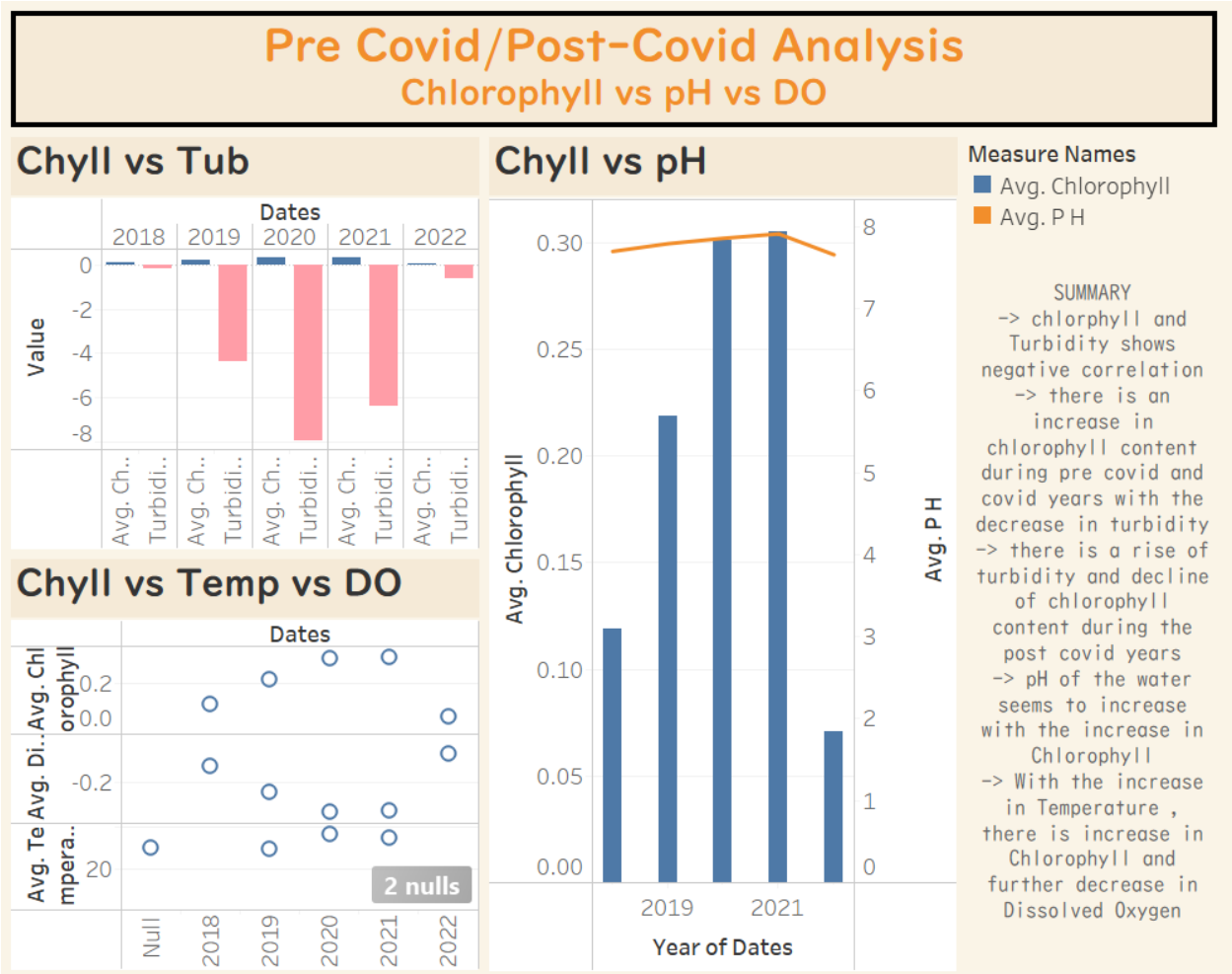
Whereas a hike from 0.00-0.04 in Variance of pH, which shows a negative correlation between pH and Salinity , but from the values of Variance , we can say that the relationship is very weak.

It is also observable that on an average with the rise in temperature we can see that there is a significant increase in Salinity as well



As for the following visualization , the first graph suggests that there is a negative correlation between Turbidity and Chlorophyll as well

We can observe that during pre covid period that is 2018 - 2019, there has been a significant rise in the value of chlorophyll with the decline in the value for the turbidity. From the year 2018 , chlorophyll has shown a hike from 0.119 to 0.219 in 2019 whereas turbidity declines -0.198 to -4.37 from the year 2018 to 2019.

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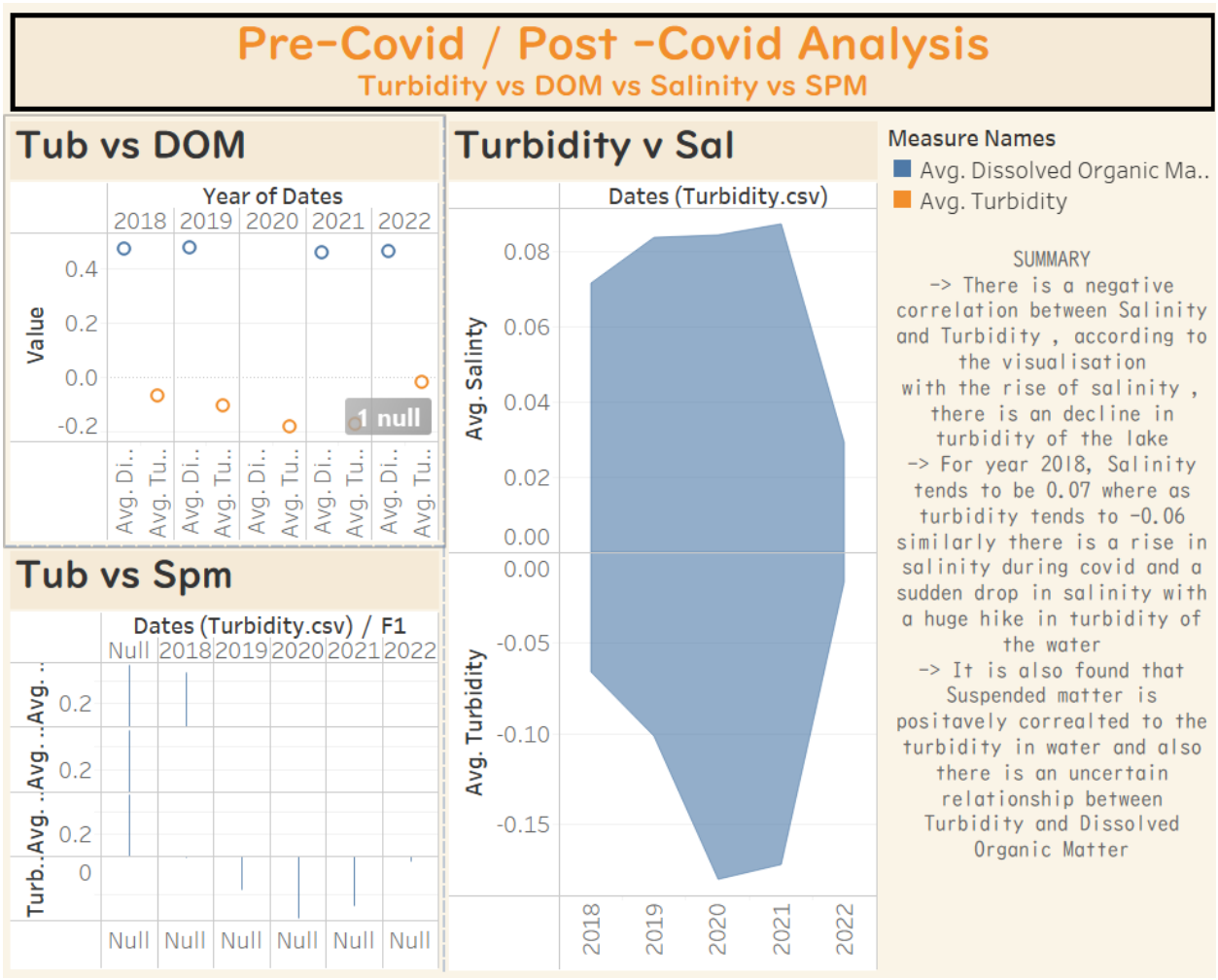
However During the time of covid during year 2020-2021, we see the maximum of Chlorophyll and minimum for turbidity and also the start of declining chlorophyll content and tending towards more turbidity in the water as the value ranges from 0.301 to a decline to 0.076 for the chlorophyll content in the post covid period , with also an hike to turbidity from -7.9 to -0.6.

From the above visualization, we also came to know that there is a positive correlation between pH and Chlorophyll, we can see that pH of the water rises with the rise in the chlorophyll content and both seems to decline during the post covid period.
As we can see that there is also a positive correlation between Dissolved Oxygen and the chlorophyll content , however the last two values seems to contradict the relation and hence can be assumed that it is an error in data that could have been recorded due to an error in calculation or technical errors with the satellites



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The following visualization , we get to know about the relationship of Turbidity, Dissolved Organic Matter , Salinity and the Suspended Matter of the lake .

It is observed that there is a negative correlation between Turbidity and Salinity of the water, With the rise in Salinity from the pre covid period towards the covid period, Turbidity has shown a significant decline till year 2020 i.e from 0 to -0.15 where as salinity showed an hike from 0 to 0.08 and then we can see a decline in Salinity and the rise in turbidity back to 0 during the post covid period.

It is also observed that SPM is a major contributing factor in the increasing turbidity of the water and also there is an uncertain relationship between dissolved organic matter and Turbidity of the lake , we can notice that with the increase in Organic matter there has been a decline in turbidity during the pre covid season , however we can see an increase in both turbidity and organic matter during the post covid period.

CONCLUSION : With the help of following EDA, it can be concluded that both monsoon and COVID made its own effect on the water quality of the lakes , where there are some parameters who were not affected by the COVID or by the outbreak of Monsoon , and we can also say that both COVID and Monsoon came with both ill effects on some parameters and positive effects on some .