OPTIMIZING MANPOWER ALLOCATION FOR STB

Singapore TOURISM BOARD

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INCREASE IN INCOME DEFICIT

Singapore Tourism Board (STB) has been facing a YoY increase in deficit, from **$7MM in 2021 to $51MM in 2022**

MANPOWER EXPENSES

Of the $51MM, **$6.8MM is due to increase in Expenditure on Manpower**

SCOPE OF PROJECT

STB has identified the **Zoo** and **Science Centre** to have particularly high manpower expenses

GOAL

Study if there is a correlation between **weather data** and **number of visitors** to these attractions to **adjust number of staff on shift**, while maintaining ratio of visitors to staff for customer service quality

INTRODUCTION

SINGAPORE TOURISM BOARD

STATEMENT OF CASH FLOWS
Year ended 31 March 2022

	Note	2022 $'000	2021 $'000
Operating activities			
Deficit for the year		(50,895)	(7,727)
Adjustments for:			
Operating grants		(274,793)	(242,193)
Allowance for (Reversal of) credit losses	24	17	(75)
Depreciation of property, plant and equipment	10	21,266	23,371
Depreciation of right-of-use assets	11	31,490	32,780
Amortisation of intangible assets	12	8,364	6,726
Loss on disposal of property, plant and equipment		-	8
Gain on disposal of right-of-use assets		(30)	(9)
Interest income		(6,905)	(8,429)
Amortisation of deferred capital grant	16	(16,582)	(16,147)
Fair value loss/(gain) on financial assets under fund management		16,412	(15,341)
Finance lease income		(1,068)	(1,650)
Lease interest expense		1,573	2,127
Operating cash flows before movements in working capital		(271,151)	(226,559)
Deposits, prepayments and other receivables		(50,028)	26,860
Accruals and other payables		30,587	(10,367)
Advances and deposits received		(1,590)	1,078
Cash used in operations		(292,182)	(208,988)
Interest received		7,973	10,079
Interest paid		(1,573)	(2,127)
Net cash used in operating activities		(285,782)	(201,036)

SINGAPORE TOURISM BOARD

NOTES TO FINANCIAL STATEMENTS
31 March 2022

20 OPERATING INCOME

	2022 $'000	2021 $'000
Events-related income	53	55
Lease income	12,252	14,525
Others	2,651	2,634
	14,956	17,214

21 EMPLOYEE BENEFIT EXPENSES

|	2022 $'000	2021 $'000
Wages and salaries	76,862	68,460
Contributions to defined contribution plan	8,452	8,135
Other staff benefits	8,044	9,293
Depreciation on residential units (Note 11)	1,511	2,113
	94,869	88,001

PROBLEM STATEMENT

1. **Correlation:** Is there any correlation between total rainfall and the number visitors to the Singapore Zoo and Science Centre?

2. **Difference in Impact:** Given that the Singapore Zoo is an outdoor attraction, does the total rainfall have a greater influence on its number of visitors as compared to the Science Centre?

3. **Other Predictors:** Are there any other weather features that might be a predictor of number of visitors to both attractions?

DATA INTRODUCTION

FEATURE	UNITS	DESCRIPTION
Total Rainfall	mm	Total rainfall
Mean Daily Temperature		Mean daily temperature
No. of Rainy Days		Number of days that rained (day with rainfall amount of 0.2mm or more)
Mean Relative Humidity	%	Monthly mean relative humidity
Mean Sunshine Hours		Monthly mean sunshine hours in a day
Zoo Visitors	'000s	Number of visitors to the zoo
Science Centre Visitors	'000s	Number of visitors to science centre
Year		Year that data was collected
Month		Month that data was collected

- No Null values hence no dropping of rows
- Data Date Range: April 1990 to Feb 2023

Correlation Heatmap for Weather Data
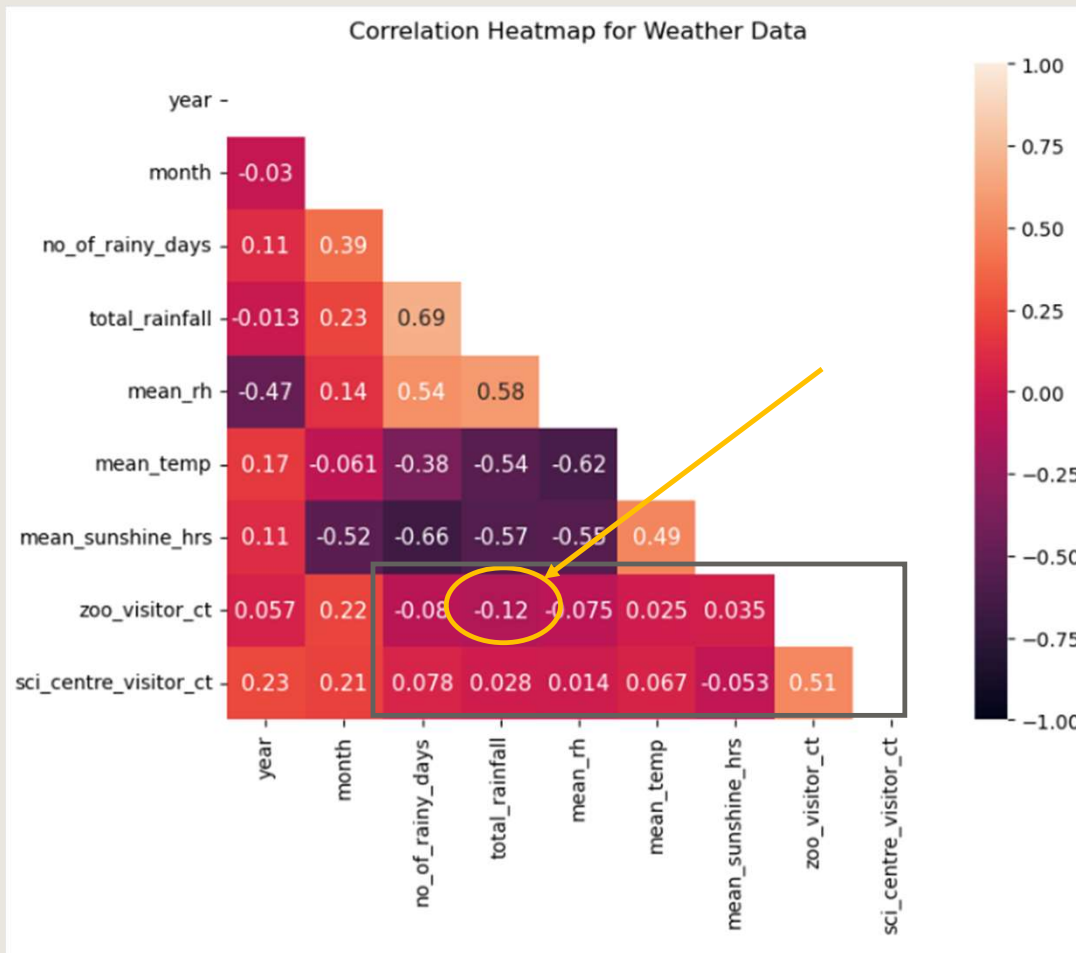
CHOOSING WHICH WEATHER FEATURE TO STUDY:

Out of all the weather features vs visitor counts, **total rainfall vs visitors to the zoo** has the *strongest correlation*

# NEGATIVE CORRELATION BETWEEN TOTAL RAINFALL AND VISITORS TO THE ZOO, BUT NOT FOR SCIENCE CENTRE
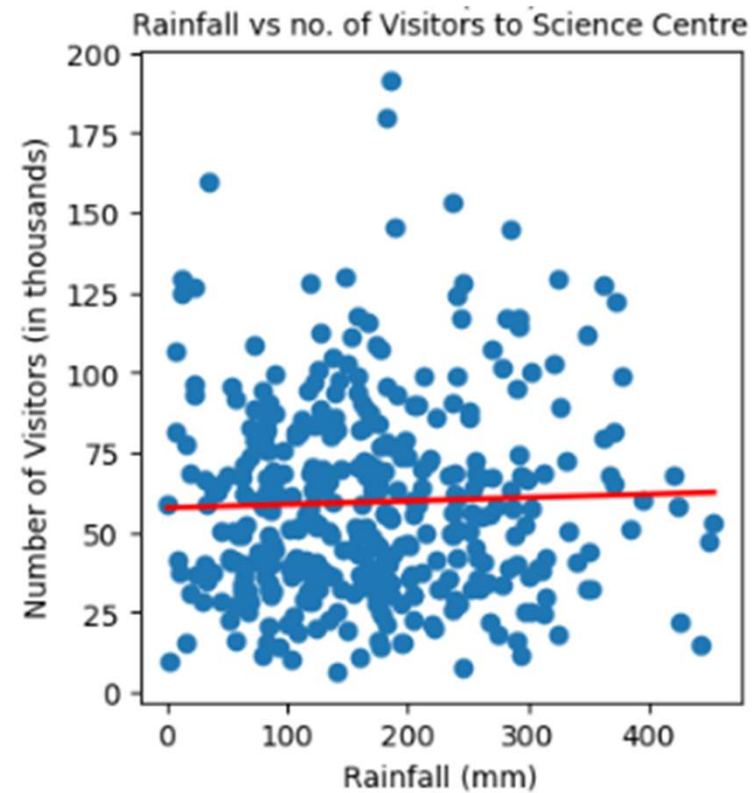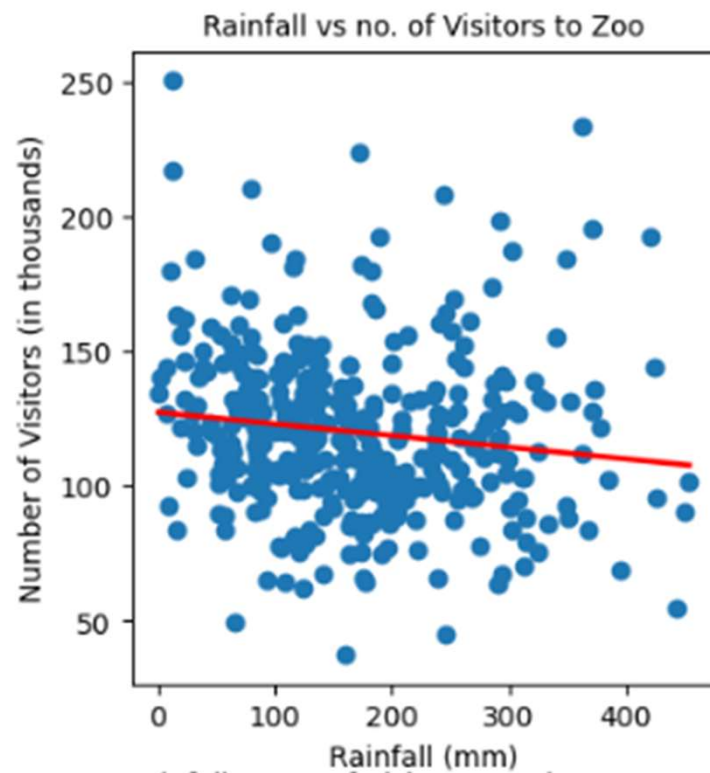
NARROWING THE SCOPE:
SELECTING **2010 TO 2019** AS TIME PERIOD TO STUDY

Overall upward trend in median number of visitors per month
(probably due to improvement in attractions, better economy)

Median visitors per month across time periods
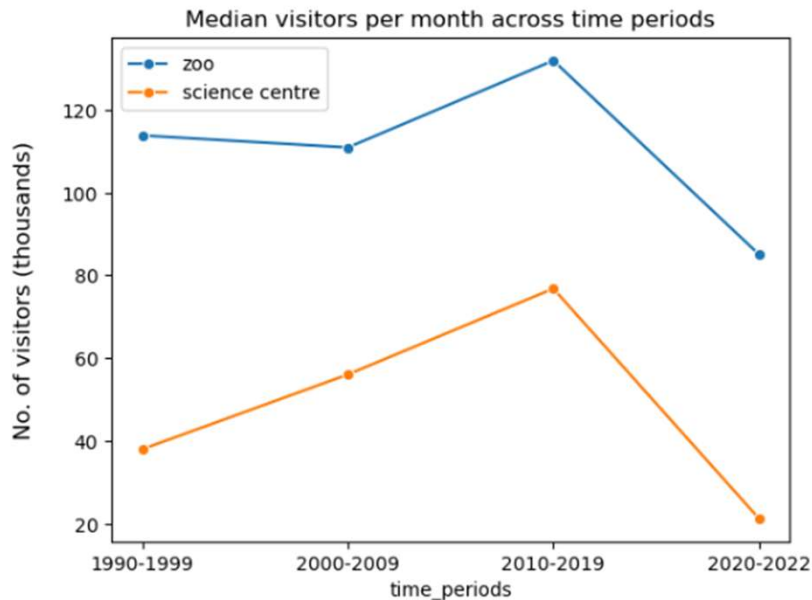
Time period **2020 to 2022** was an exception due to Covid:

- During Covid period, median no. of visitors dropped greatly.
- Numbers surged slightly in Dec 2020, but was slow to pick up thereafter

No. of visitors to attractions during Covid period
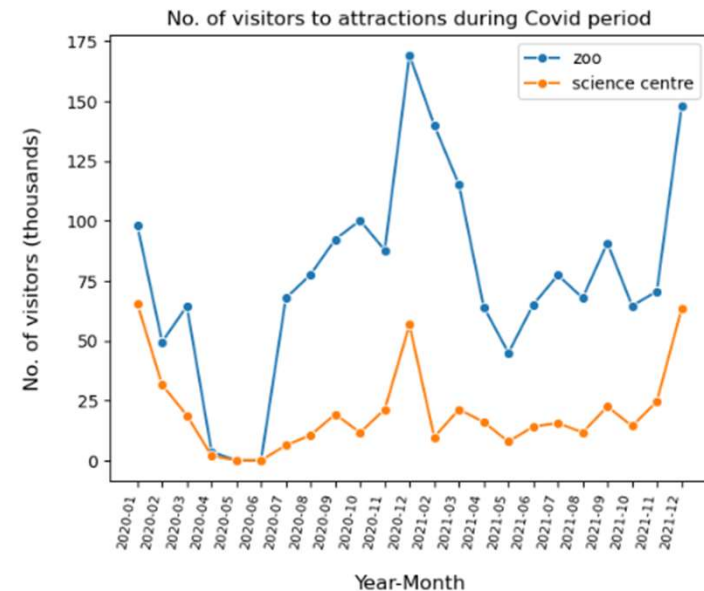
SEEMS LIKE NUMBER OF VISITORS DURING SCHOOL HOLIDAYS IS ALWAYS HIGHER THAN THE MEDIAN MONTHLY VISITORS
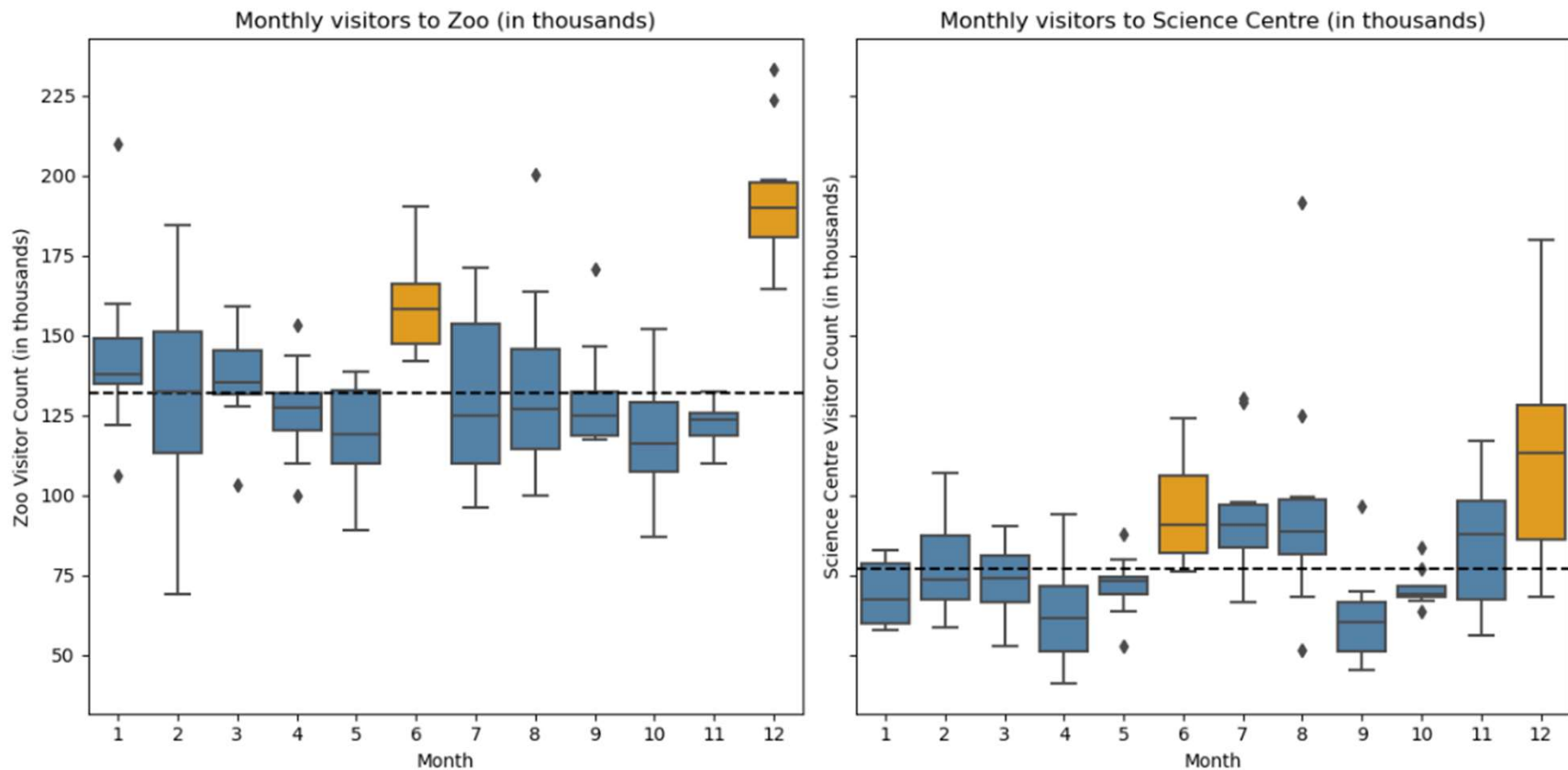
NARROWING THE SCOPE: WHAT HAPPENS TO THE CORRELATION BETWEEN RAINFALL AND VISITORS IF WE **REMOVE SCHOOL HOLIDAY MONTHS**?
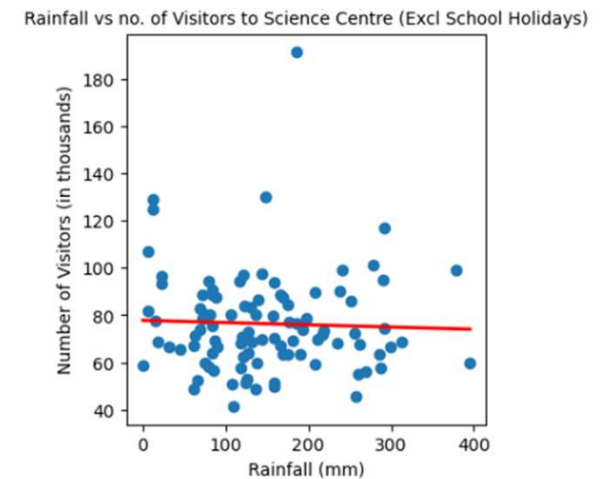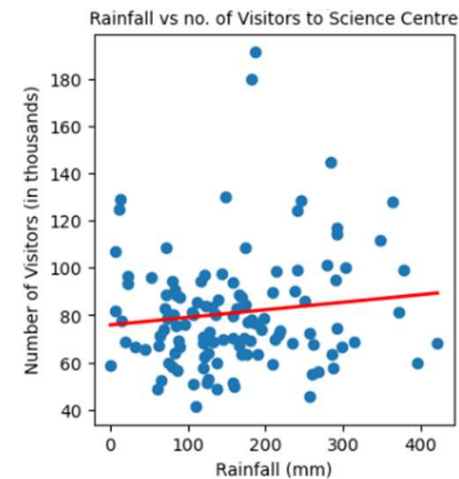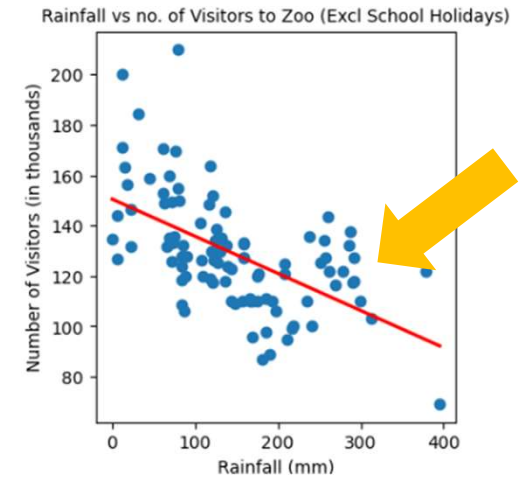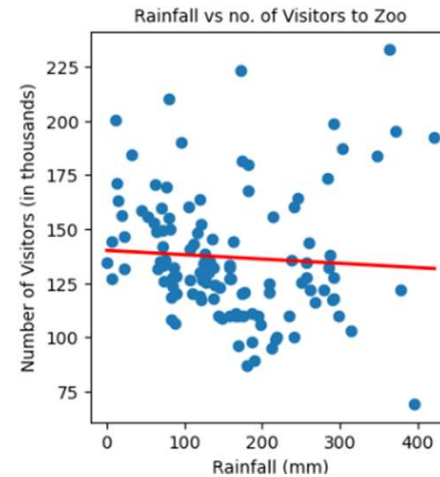
IN GENERAL, FOR EVERY 1MM OF INCREASE IN RAINFALL, THERE IS A DECREASE IN 148 VISITORS


Zoo visitors (thousands) vs Total Rainfall (mm)

r=-0.562263, p=0.000000
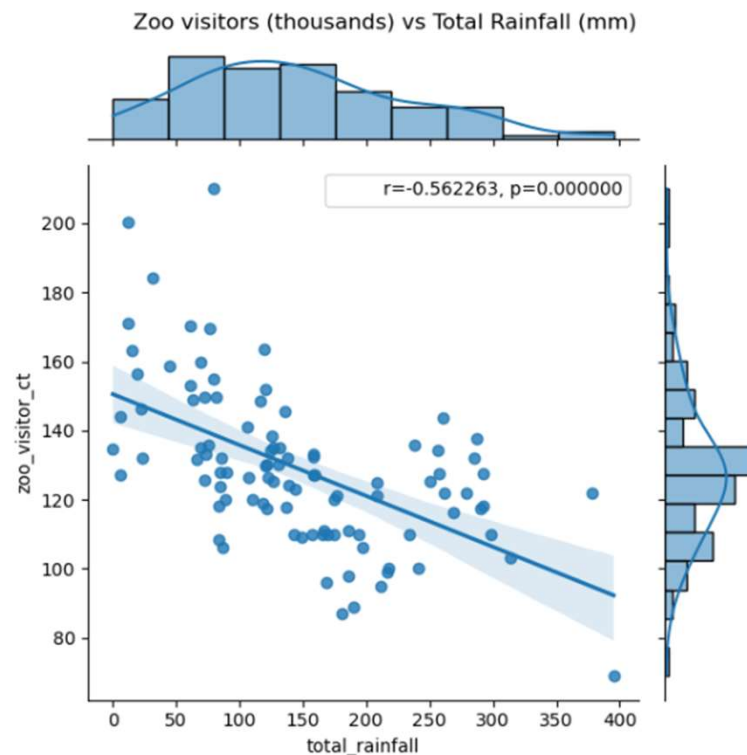
OLS Regression Results

Dep. Variable:	zoo_visitor_ct	R-squared:	0.316
Model:	OLS	Adj. R-squared:	0.309
Method:	Least Squares	F-statistic:	44.84
Date:	Wed, 02 Aug 2023	Prob (F-statistic):	1.39e-09
Time:	17:47:20	Log-Likelihood:	-430.13
No. Observations:	99	AIC:	864.3
Df Residuals:	97	BIC:	869.5
Df Model:	1		
Covariance Type:	nonrobust		

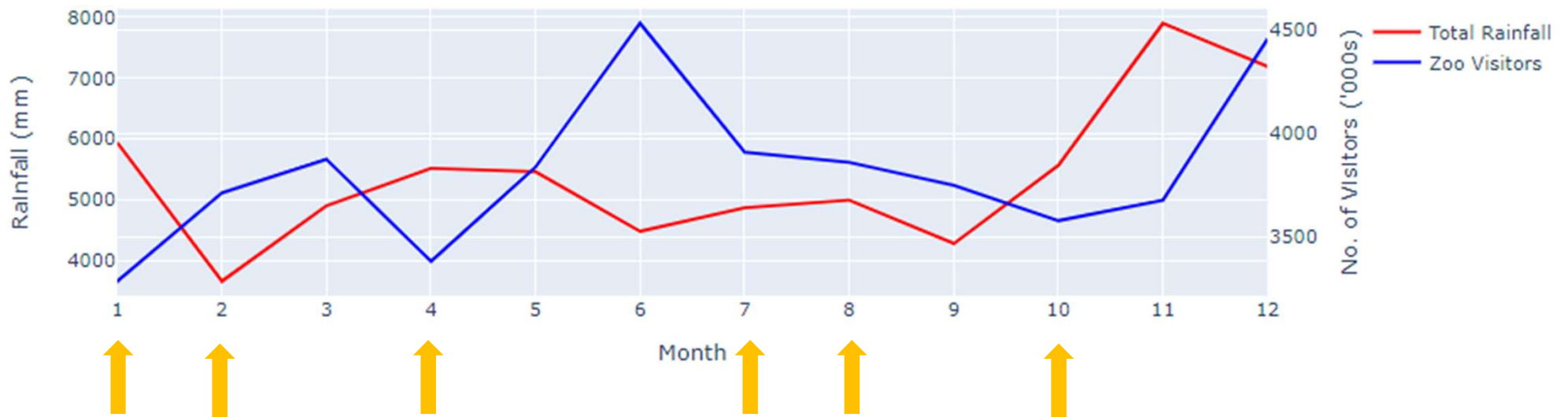|	coef	std err	t	P>|t|	[0.025	0.975]
const	150.5374	3.738	40.269	0.000	143.118	157.957
total_rainfall	-0.1475	0.022	-6.696	0.000	-0.191	-0.104

TOTAL RAINFALL IS HIGHEST IN NOV TO JAN, AND LOWEST IN FEB TO MAR

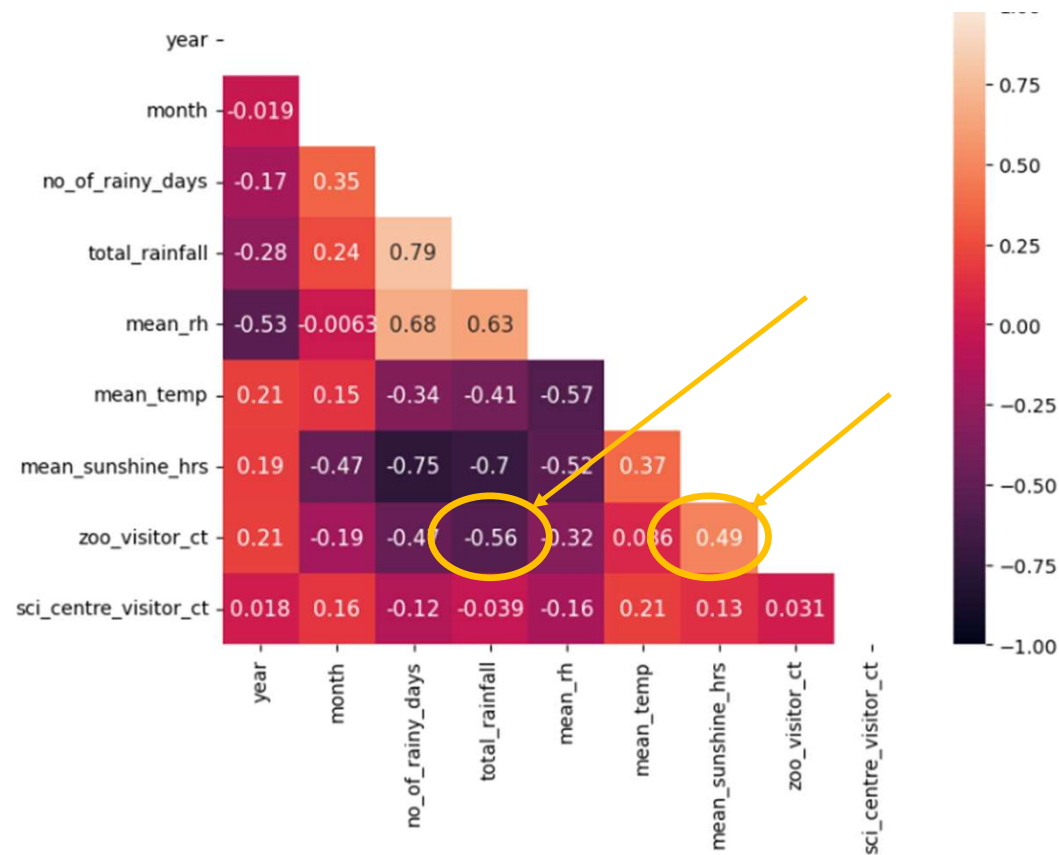Heatmap of Rainfall across Months
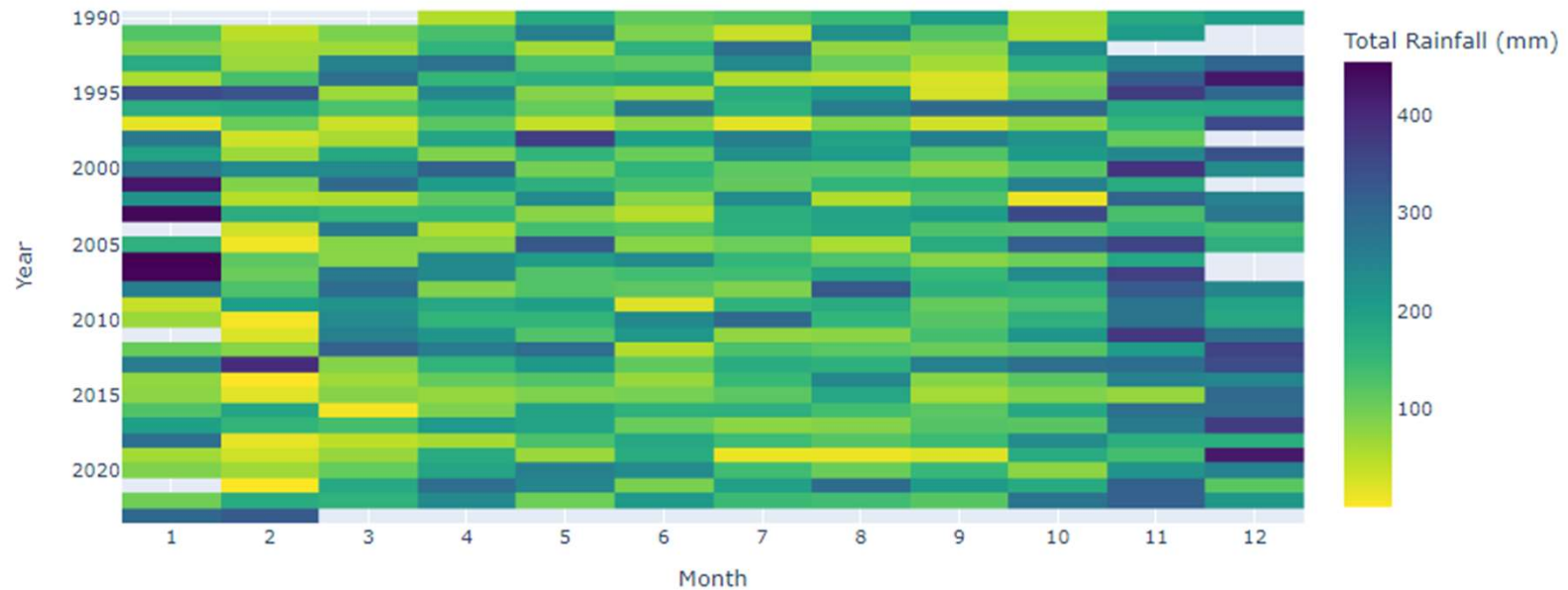
INVERSE RELATIONSHIP BETWEEN TOTAL VISITORS TO THE ZOO AND TOTAL RAINFALL IN *MOST* MONTHS


Rainfall and Total Zoo Visitors across Months

NEGATIVE CORRELATION BETWEEN AMOUNT OF RAINFALL AND VISITORS TO THE ZOO HAS BECOME **STRONGER**, FROM **-0.12 TO -0.56**.
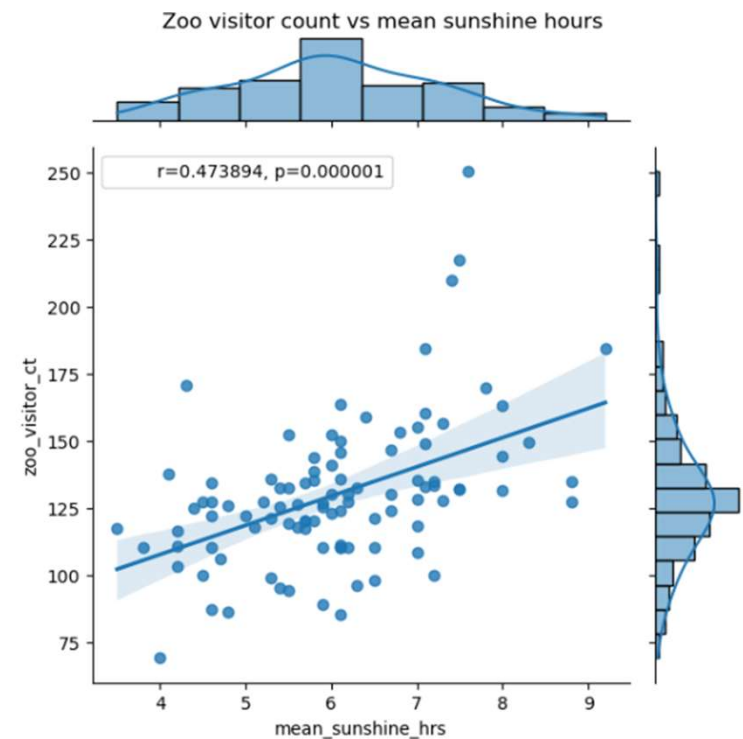## NEXT HIGHEST CORRELATION IS WITH **MEAN SUNSHINE** HOURS OF **0.49**

WE CAN USE MAIN DAILY SUNSHINE HOURS TO PREDICT NO. OF VISITORS TO THE ZOO TOO

Negative Correlation Exists Between Total Rainfall And Mean Daily Sunshine Hours
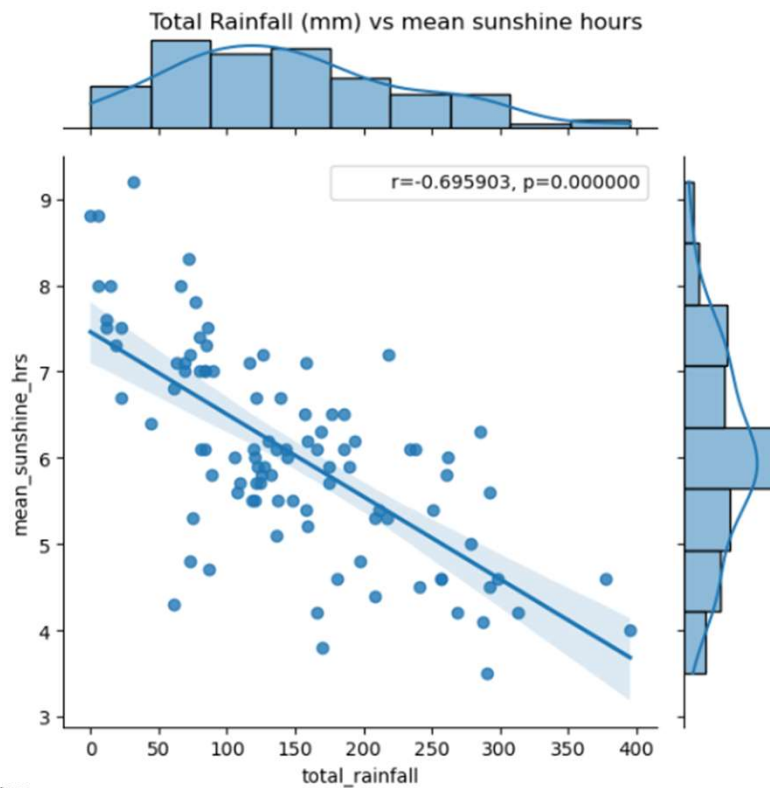
Correspondingly, ***Positive Correlation*** Exists Between Total Rainfall And Mean Daily Sunshine Hours

LIMITATIONS

1. BLACK SWAN EVENTS: COVID

Covid-19 resulted in a closure of tourist attractions across Singapore, slow economic recovery and limited global travel. Might have long term effects too.

2. MARKETING EFFORTS & CAMPAIGNS

Successful marketing efforts might have the potential to influence visitors' arrivals despite bad weather. Not accounted for in data.

CONCLUSION

1. NEGATIVE CORRELATION BETWEEN TOTAL RAINFALL AND VISITORS TO THE ZOO

2. HOLIDAY MONTHS HAS AN IMPACT ON VISITORS TO THE ZOO

3. POSITIVE CORRELATION BETWEEN SUNSHINE HOURS AND VISITORS TO THE ZOO

*Trend of number of tourists across months from STB

RECOMMENDATIONS

1. Focus on optimising Manpower at Zoo

2. Adjust Staffing during months with higher rainfall

3. Reduce Outdoor Shows during Wet Months

4. Leverage Technology to Supplement Staff

5. Extend the study to other outdoor attractions

THANK YOU

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