



OPTIMIZING MANPOWER ALLOCATION FOR STB

Tiffany



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INCREASE IN
INCOME
DEFICIT

MANPOWER
EXPENSES

SCOPE OF
PROJECT

GOAL

INTRODUCTION

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

SINGAPORE TOURISM BOARD

STATEMENT OF CASH FLOWS
Year ended 31 March 2022

	Note	2022	2021
SINGAPORE TOURISM BOARD			
NOTES TO FINANCIAL STATEMENTS			
31 March 2022			
20	OPERATING INCOME		
		2022	2021
		\$'000	\$'000
	Events-related income	53	55
	Lease income	12,252	14,525
	Others	2,651	2,634
		<u>14,956</u>	<u>17,214</u>
21	EMPLOYEE BENEFIT EXPENSES		
		2022	2021
		\$'000	\$'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
		<u>94,869</u>	<u>88,001</u>
	Net cash used in operating activities	<u>(285,782)</u>	<u>(201,036)</u>



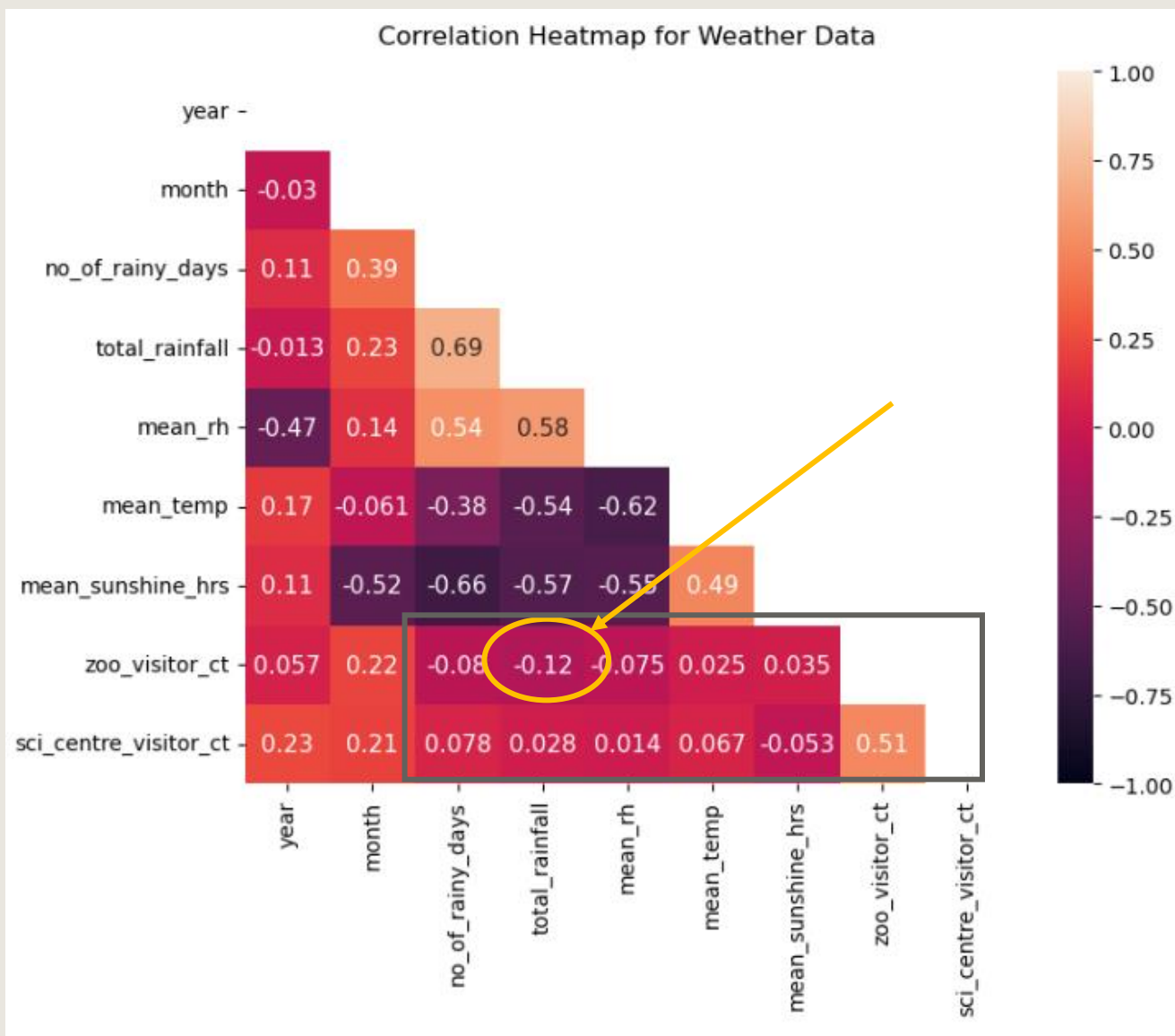
PROBLEM STATEMENT

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

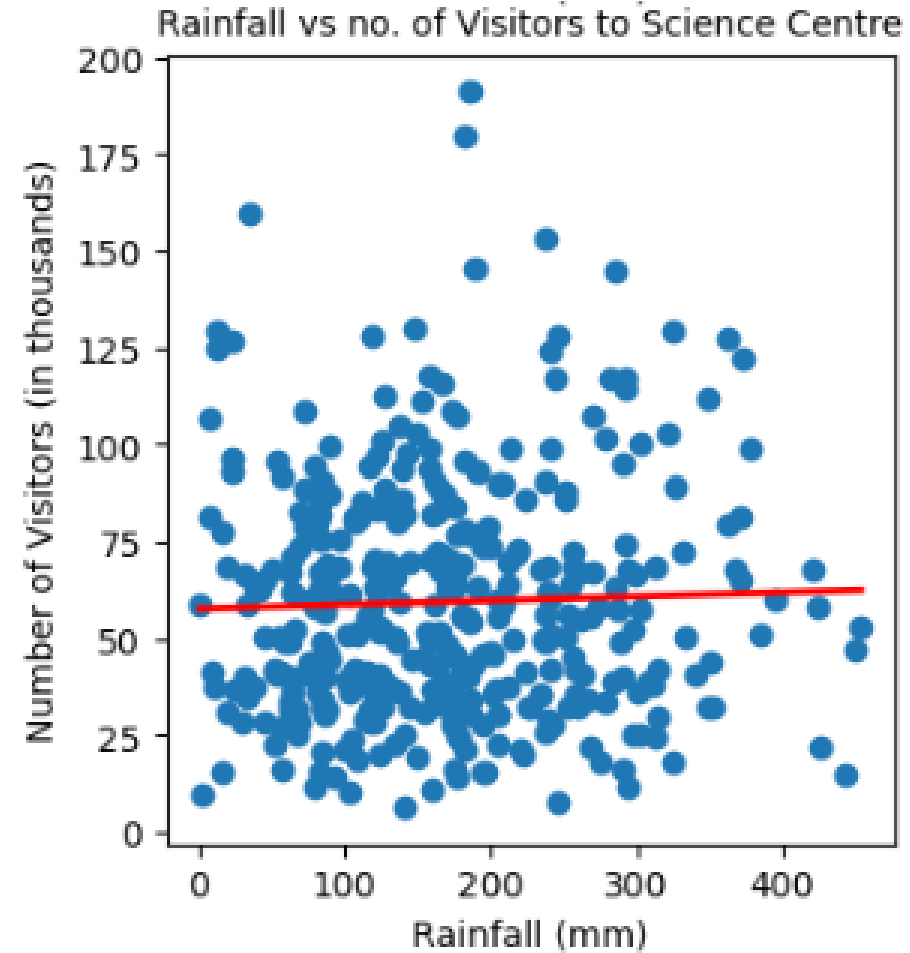
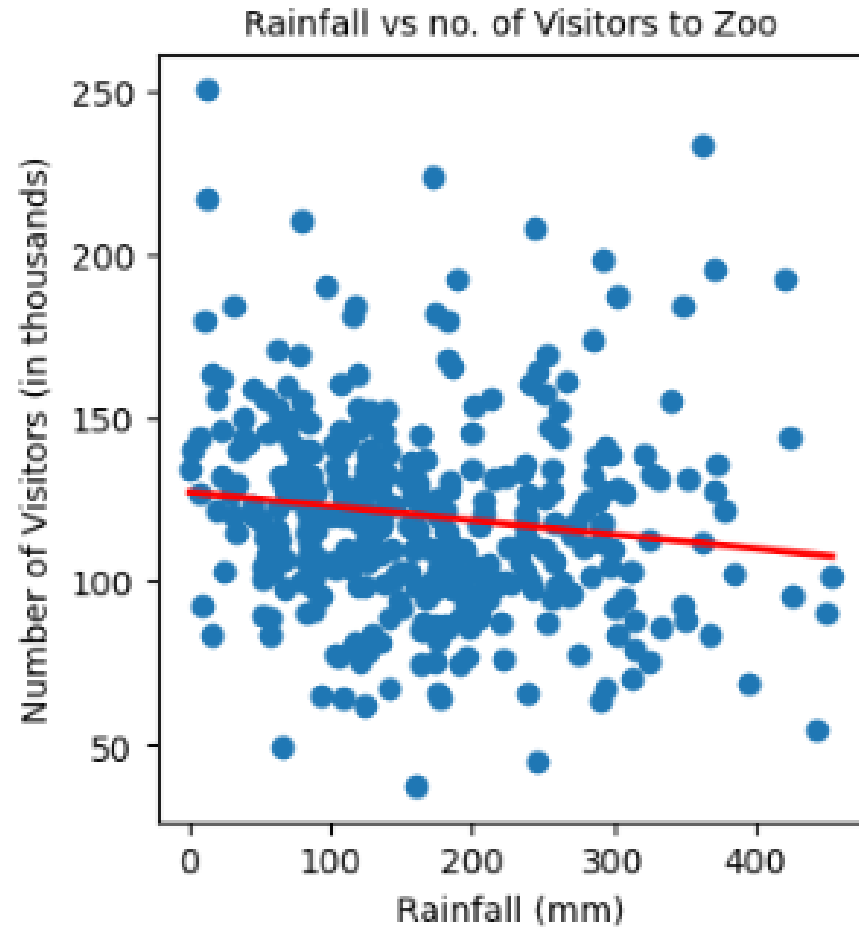
- No Null values hence no dropping of rows
- Data Date Range: April 1990 to Feb 2023



CHOOSING WHICH WEATHER FEATURE TO STUDY:

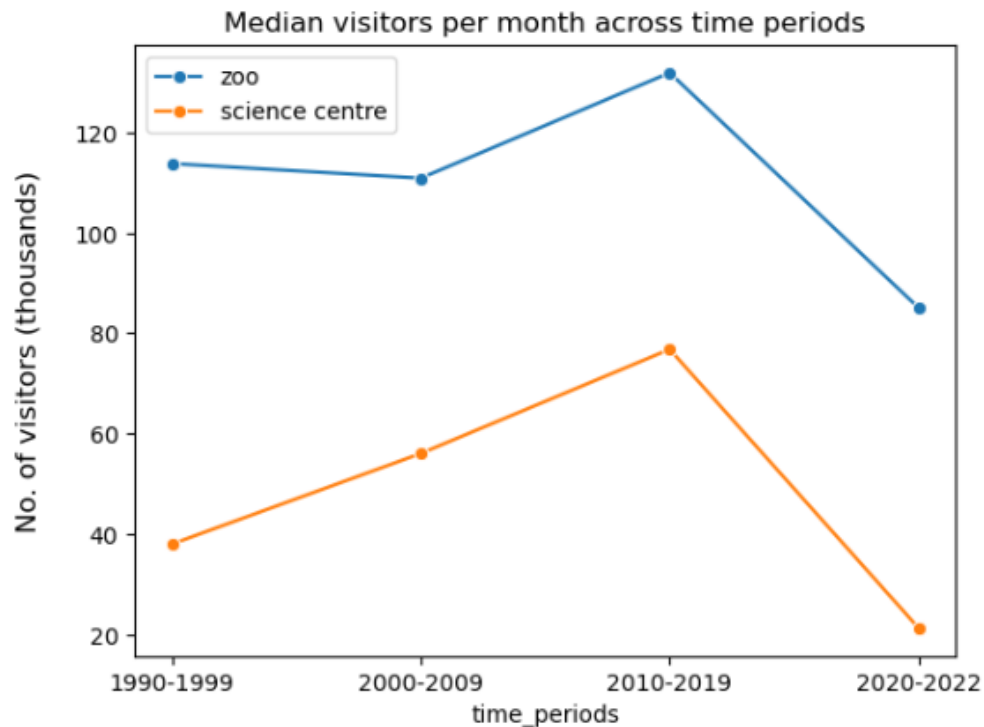
Out of all the weather features vs visitor counts, **total rainfall vs visitors to the zoo** has the *strongest correlation*

NEGATIVE CORRELATION BETWEEN TOTAL RAINFALL AND VISITORS TO THE ZOO, BUT NOT FOR SCIENCE CENTRE



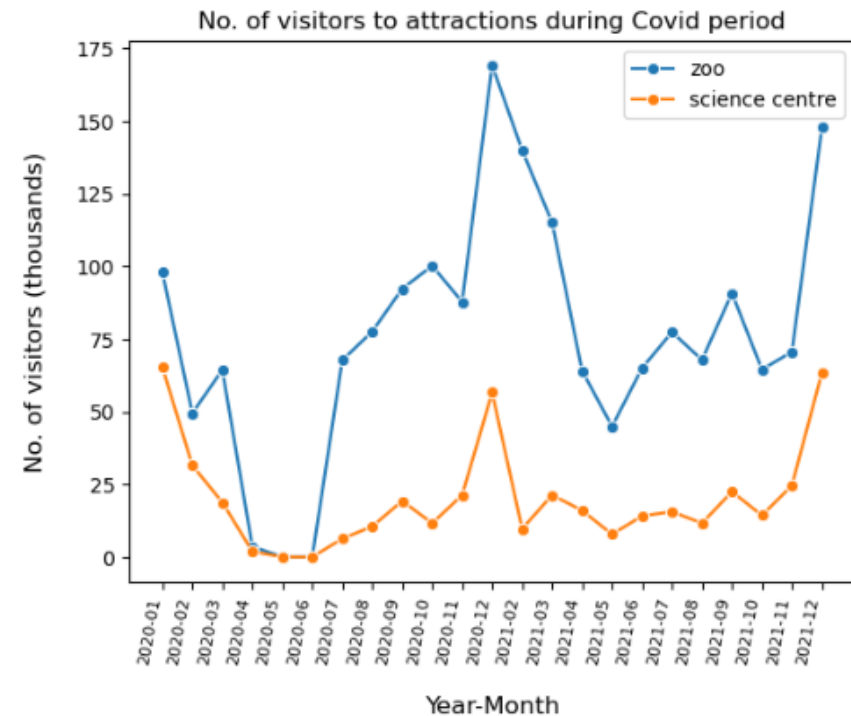
NARROWING THE SCOPE: SELECTING 2010 TO 2019 AS TIME PERIOD TO STUDY

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

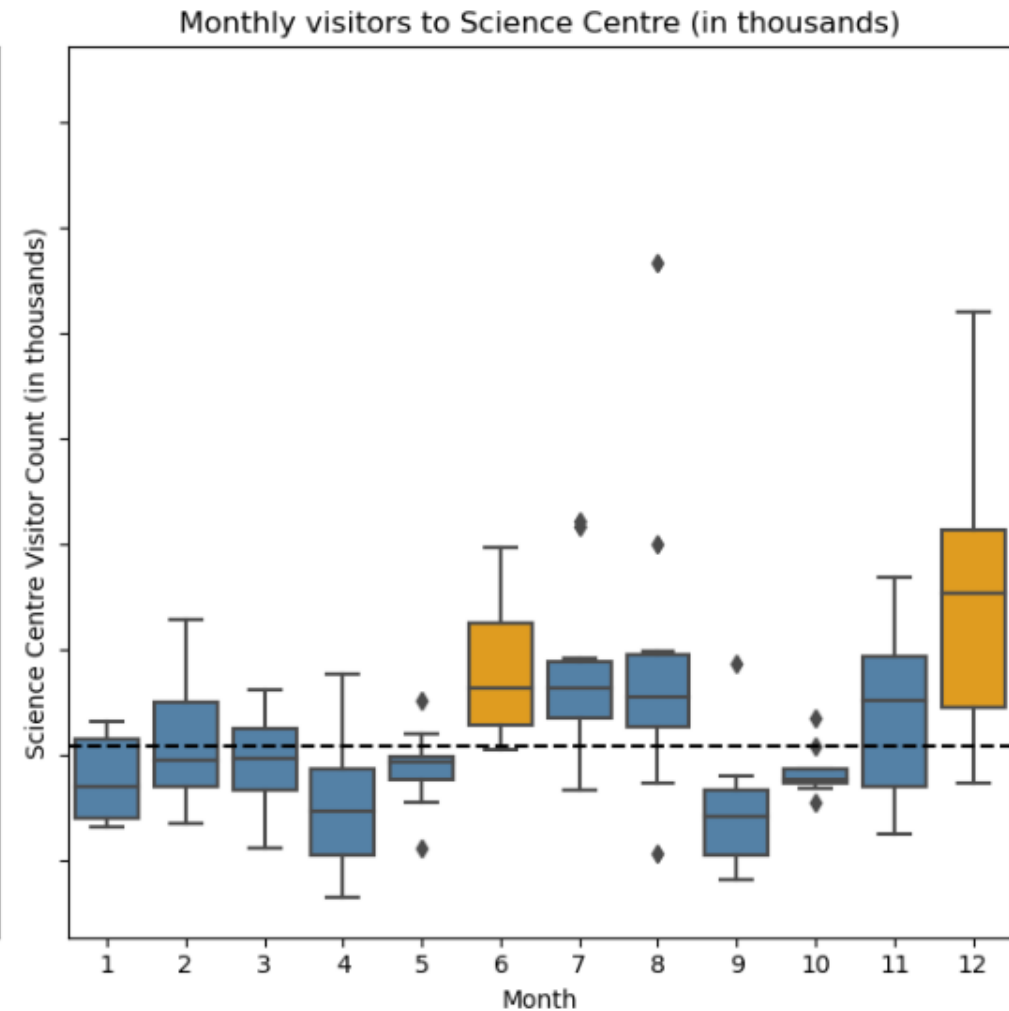
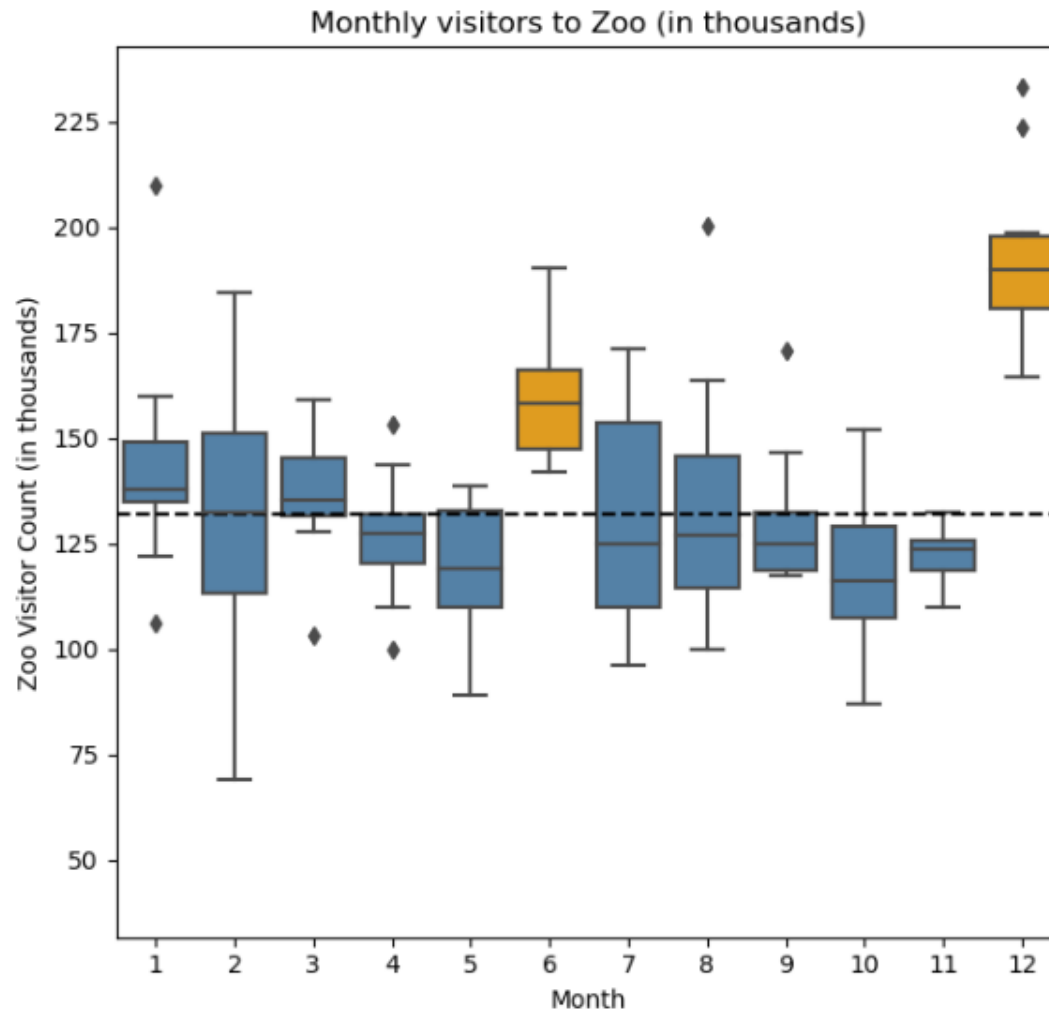


Time period **2020 to 2022** was an exception due to Covid:

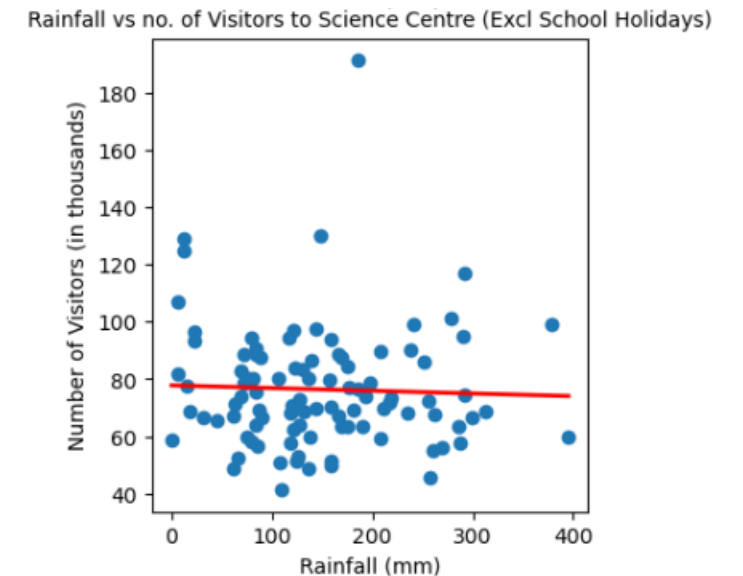
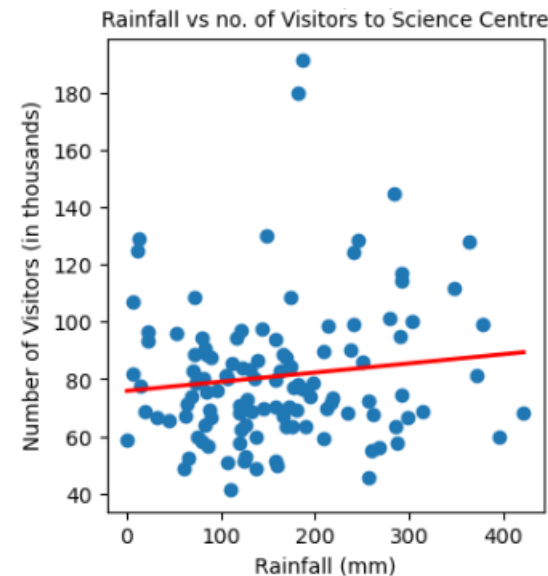
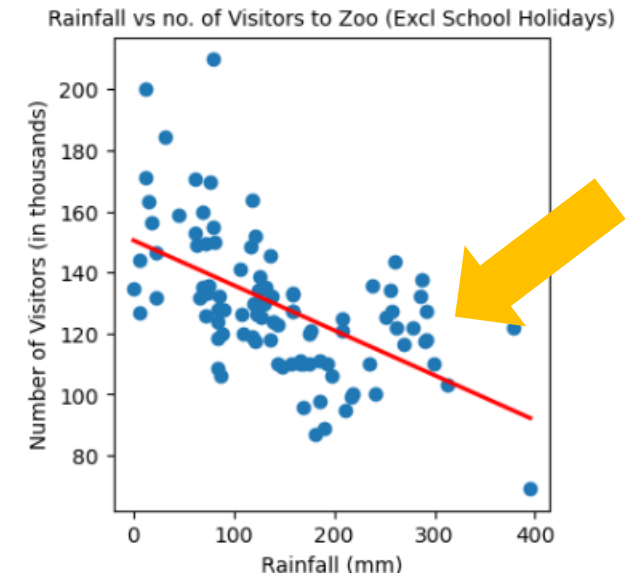
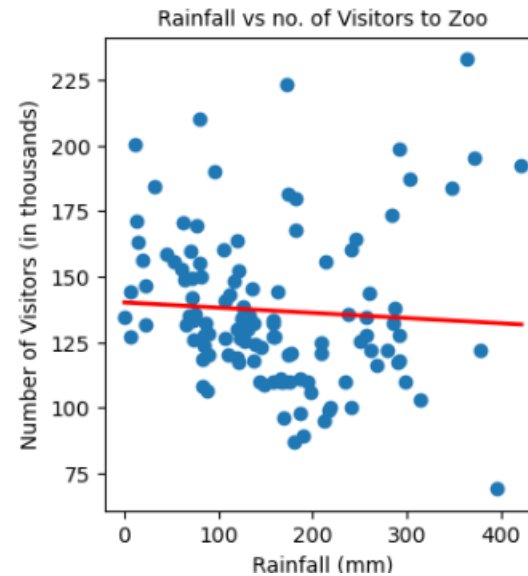
- During Covid period, median no. of visitors dropped greatly.
- Numbers surged slightly in Dec 2020, but was slow to pick up thereafter



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

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

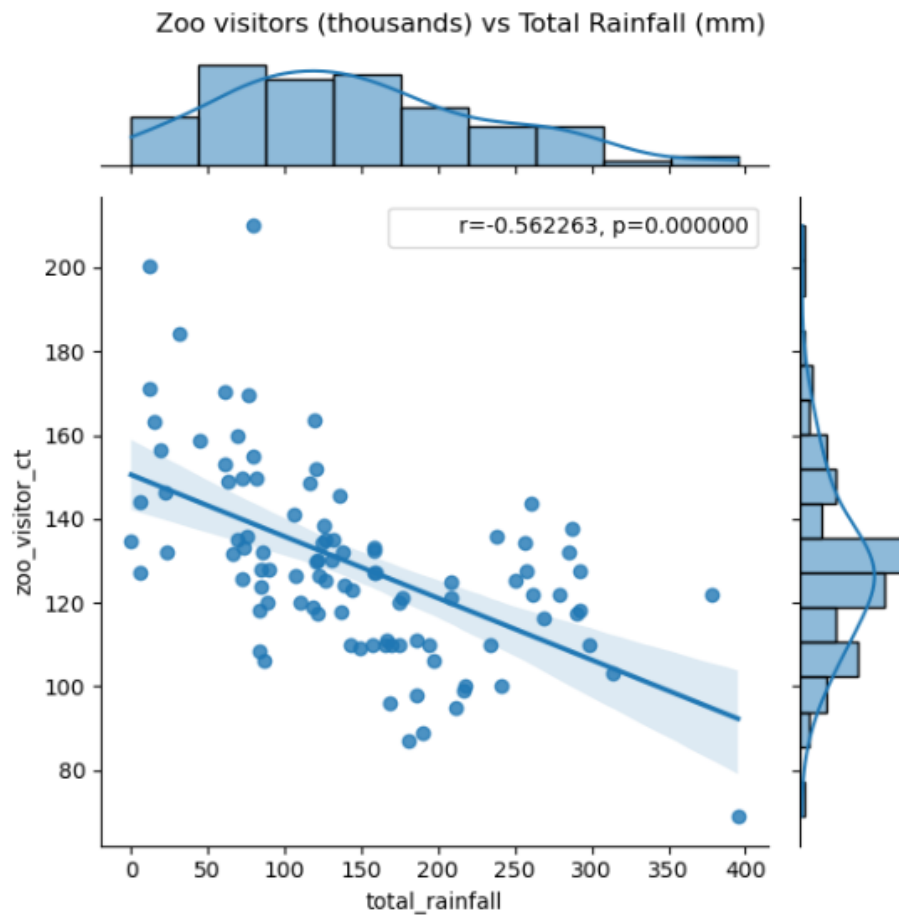
Df Model: 1

Covariance Type: nonrobust

	coef	std err	t	P> t	[0.025	0.975]
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const	150.5374	3.738	40.269	0.000	143.118	157.957
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total_rainfall	-0.1475	0.022	-6.696	0.000	-0.191	-0.104
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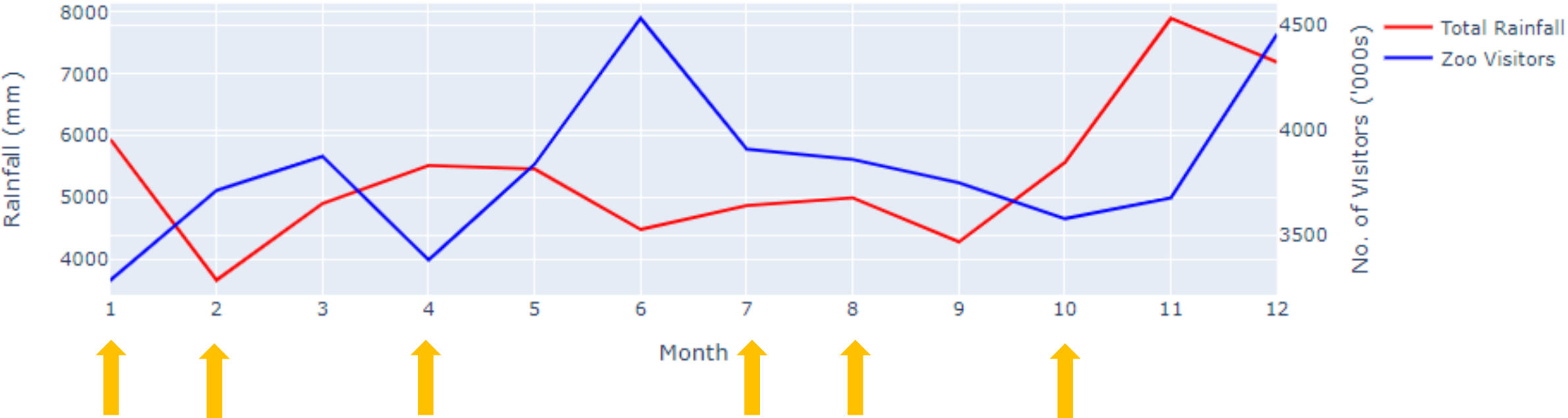
TOTAL RAINFALL IS HIGHEST IN NOV TO JAN,
AND LOWEST IN FEB TO MAR

Heatmap of Rainfall across Months

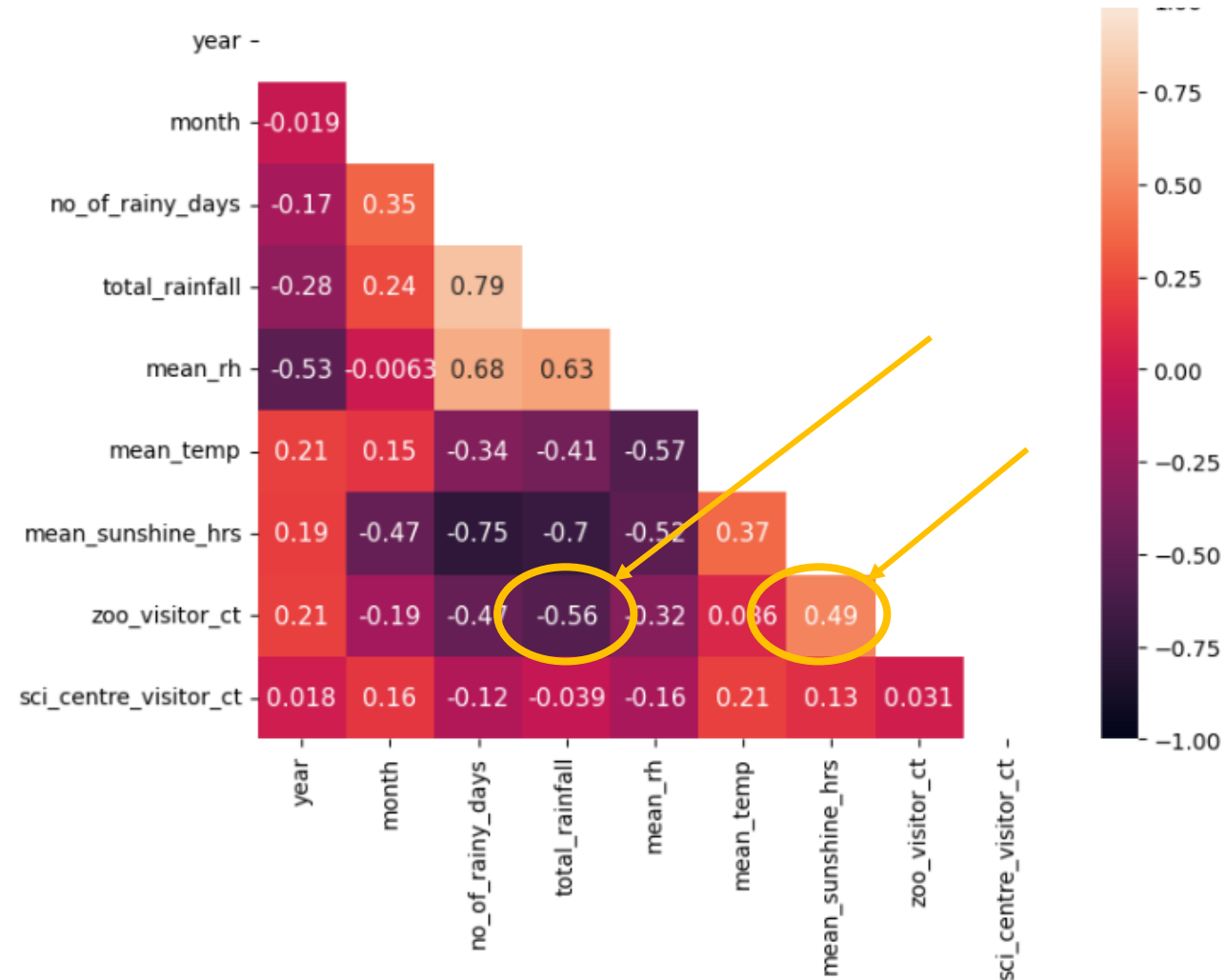


INVERSE RELATIONSHIP BETWEEN TOTAL VISITORS TO THE ZOO AND TOTAL RAINFALL IN MOST MONTHS

Rainfall and Total Zoo Visitors across Months

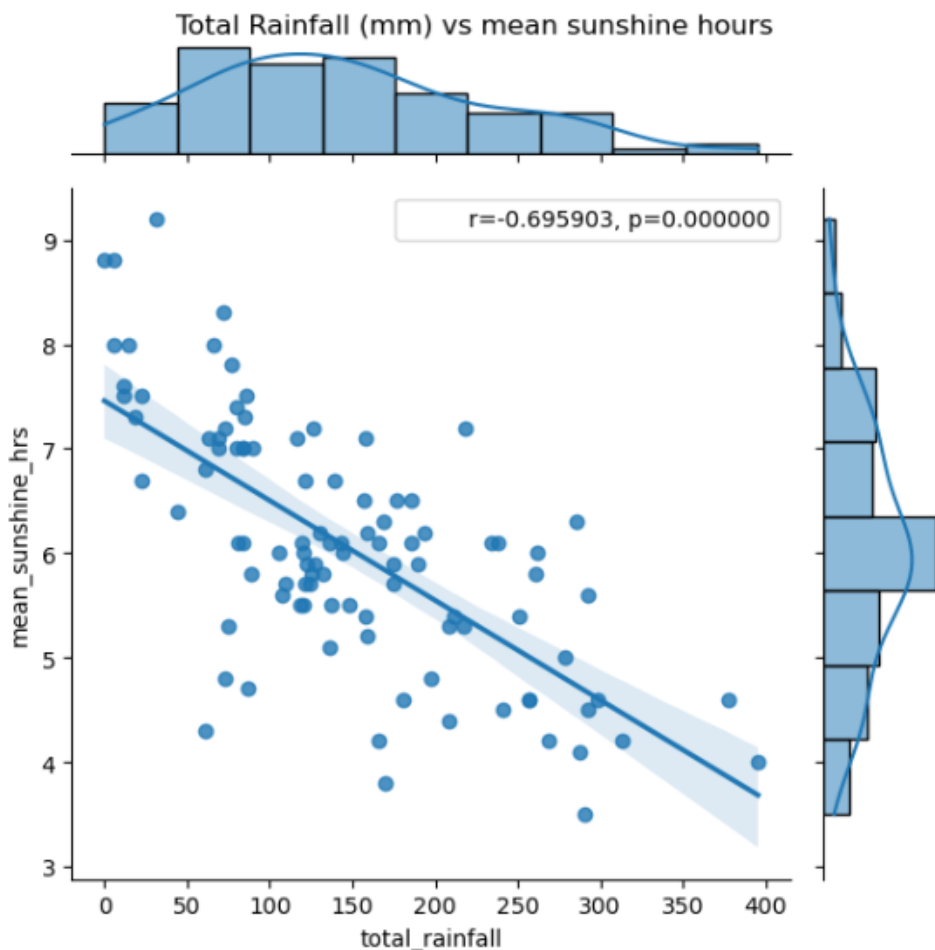


NEGATIVE CORRELATION BETWEEN AMOUNT OF RAINFALL AND VISITORS TO THE ZOO HAS BECOME **STRONGER**, FROM **-0.12** TO **-0.56**.
NEXT HIGHEST CORRELATION IS WITH **MEAN SUNSHINE HOURS** OF **0.49**

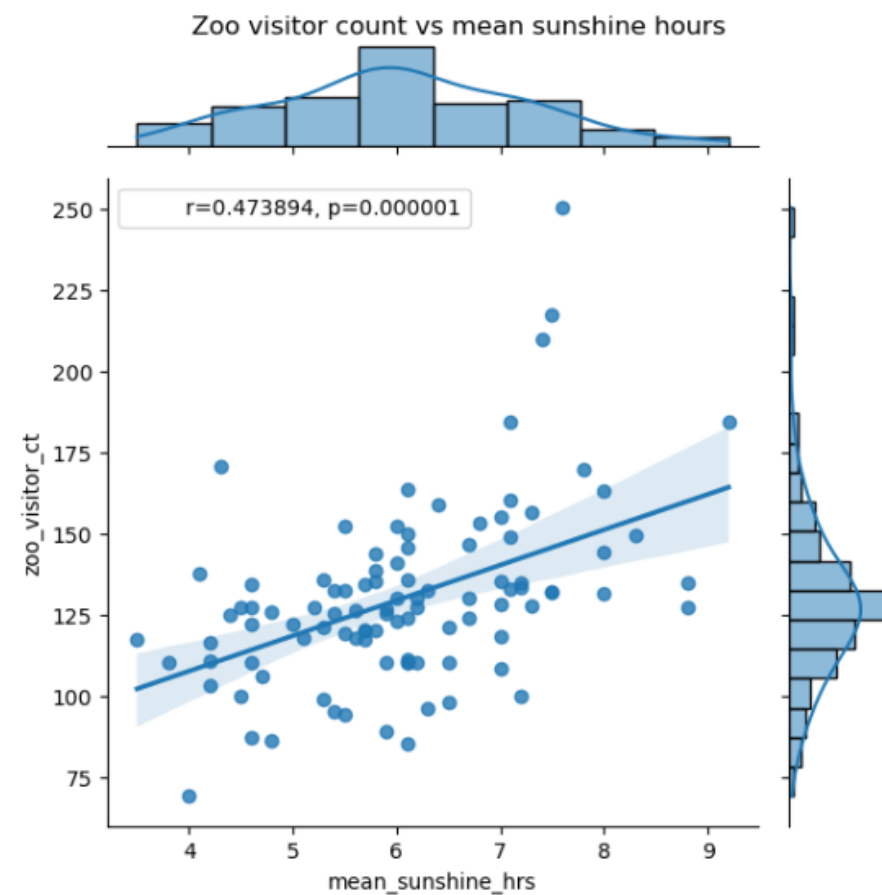


WE CAN USE MAIN DAILY SUNSHINE HOURS TO PREDICT NO. OF VISITORS TO THE ZOO TOO

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



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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