# Diving Into Maldives

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Introduction to Maldives

The Maldives, a jewel in the Indian Ocean, is an archipelago of 1,200 stunning islands scattered like pearls across turquoise waters. Known for its pristine white sandy beaches, crystal-clear lagoons, and vibrant coral reefs, the Maldives offers unparalleled natural beauty and tranquility. This tropical paradise is home to luxury overwater bungalows, thriving marine ecosystems, and a culture shaped by its maritime heritage.

However, beneath its serene beauty lies a challenge – the Maldives is one of the most climate-vulnerable island nations, facing rising sea levels and environmental pressures. Its resilience and efforts toward sustainability and climate advocacy are as remarkable as its beauty.

Analysis on GDP of Maldives

Create a line plot with a LOESS trend line
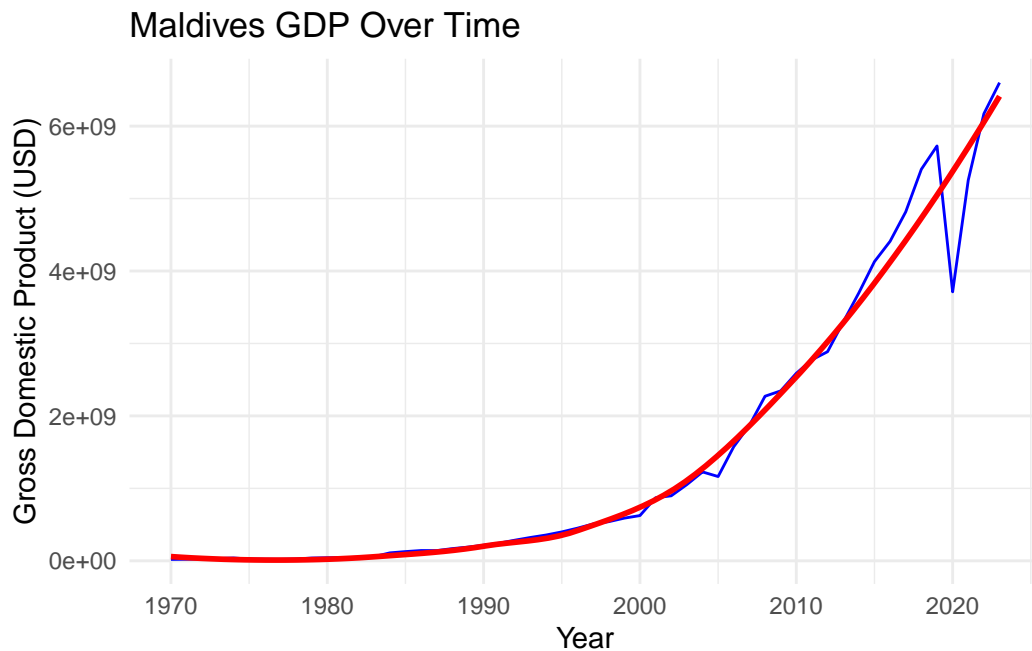
The graph shows how the Gross Domestic Product (GDP) of the Maldives has changed over time, with two components:

1. Blue Line: Represents the actual yearly GDP values for the Maldives.

2. Red Line: A LOESS smooth line, showing the general trend in GDP growth over time.

Results of ADF test of GDP

```
    Augmented Dickey-Fuller Test

data:  maldives_data_clean$GDP
Dickey-Fuller = 0.14961, Lag order = 3, p-value = 0.99
alternative hypothesis: stationary
```

Null Hypothesis: The time series has a unit root and is non-stationary.

The p-value(0.99) is very high (greater than common significance levels like 0.05), which means we fail to reject the null hypothesis. In other words, the GDP time series is non-stationary. We have to do some transformations to make it sastisfy the assumption of time series model.

Next Steps to Handle Non-Stationarity

```
        Augmented Dickey-Fuller Test

data:  gdp_diff
Dickey-Fuller = -3.062, Lag order = 3, p-value = 0.147
alternative hypothesis: stationary
```
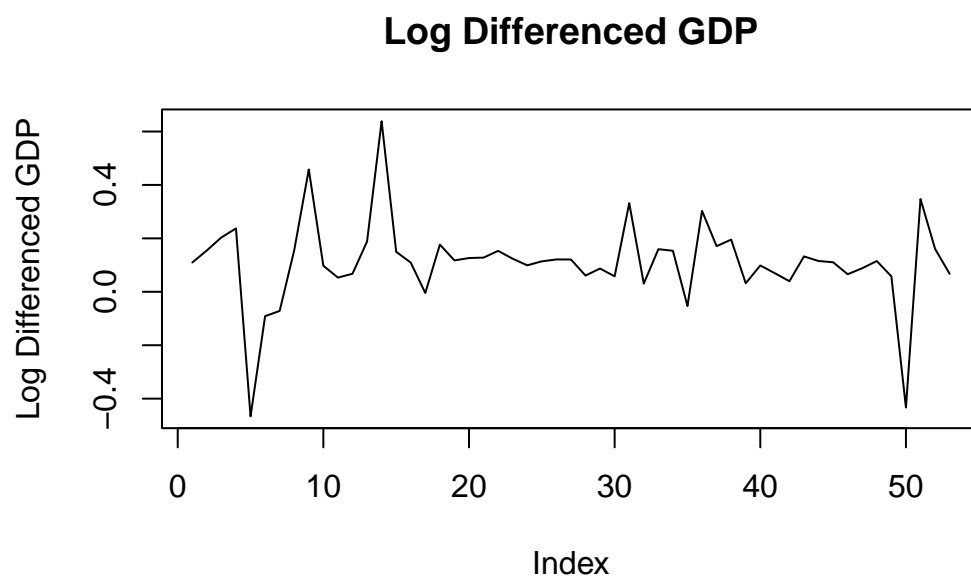
Differenced GDP Plot
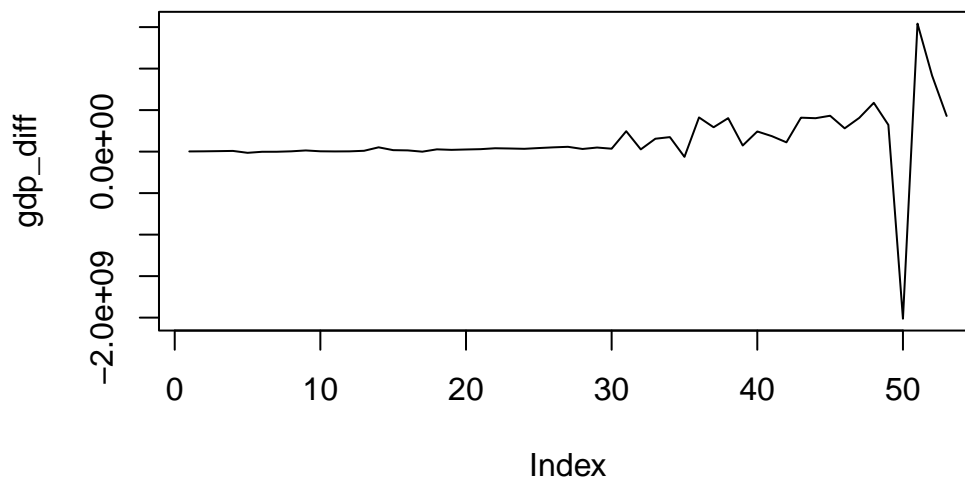
The p-value(0.147) is still larger than 0.05, indicating that we need more transformation.

```
        Augmented Dickey-Fuller Test

data:  log_gdp_diff
Dickey-Fuller = -4.5382, Lag order = 3, p-value = 0.01
alternative hypothesis: stationary
```

Log Differenced GDP

After the log-transformation, the result supports the conclusion that the series is stationary. We can now further our analysis.

Modeling and Forecasting of the GDP

ACF of Log Differenced GD **PACF of Log Differenced GD**
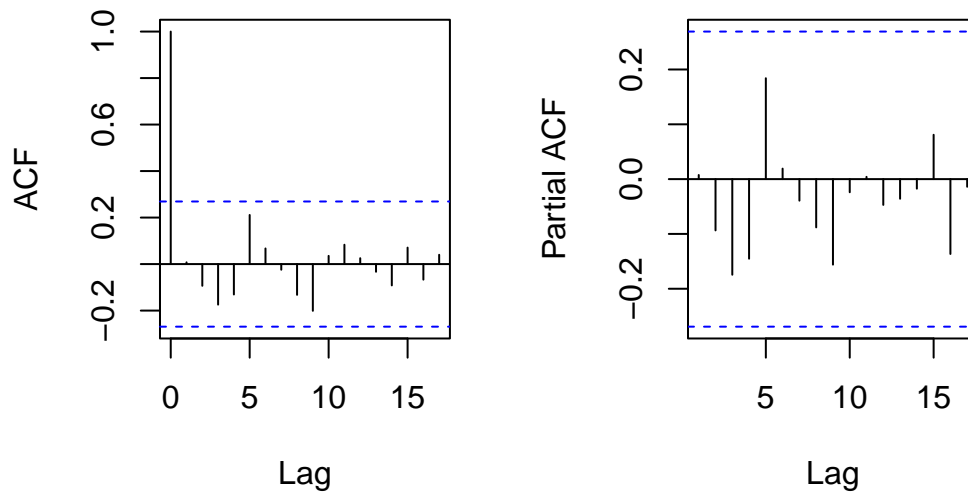
The combined pattern of the ACF and PACF suggests that the ARIMA(1,1,1) model is a good choice.

```
Series: log_gdp_diff
ARIMA(1,1,1)

Coefficients:
         ar1      ma1
      0.0264  -1.0000
s.e.  0.1389   0.0637

sigma^2 = 0.02768:  log likelihood = 18.54
AIC=-31.09   AICc=-30.59   BIC=-25.23

Training set error measures:
                       ME      RMSE       MAE      MPE     MAPE      MASE
Training set -0.0004449232 0.1615823 0.08969618 52.58805 110.6663 0.6307729
                  ACF1
Training set -0.007362309
```
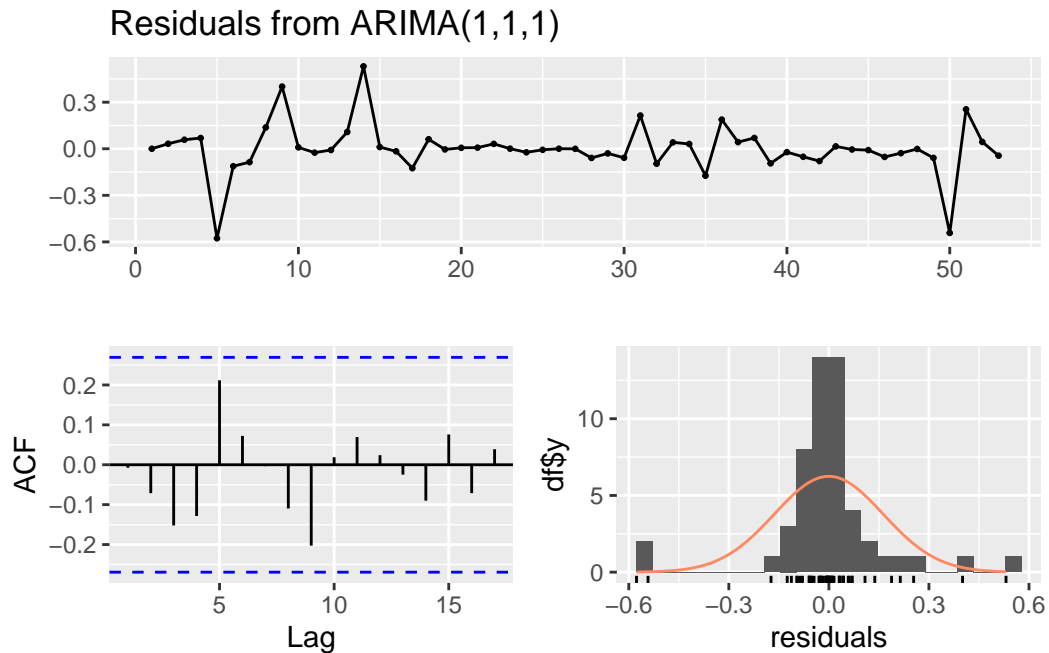
Residuals from ARIMA(1,1,1)


```
        Ljung-Box test

data:  Residuals from ARIMA(1,1,1)
Q* = 9.1947, df = 8, p-value = 0.3261

Model df: 2.   Total lags used: 10
```

The null hypothesis of the Ljung-Box test is that the residuals are white noise (no significant autocorrelations). Due to p-value(0.3261) > 0.05 , we fail to reject the null hypothesis.

The residuals behave like white noise, confirming that the ARIMA(1,1,1) model is a good fit.

Forecasting the GDP of next 10 years

GDP Forecast for the Next 10 Years
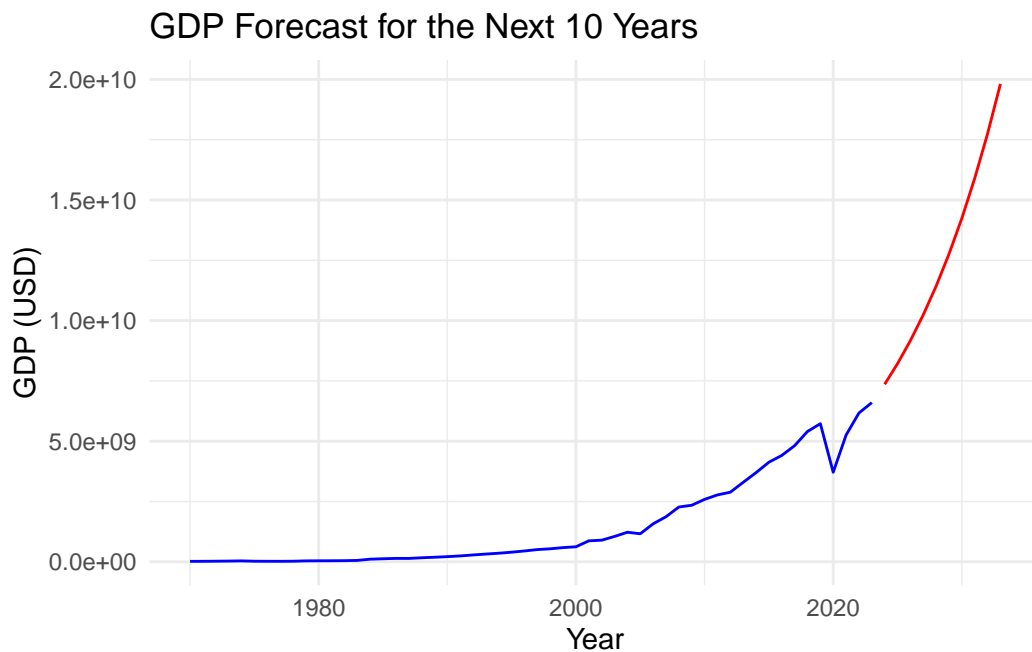
According to the forecast line, the GDP of Maldives will increase in the next 10 years.
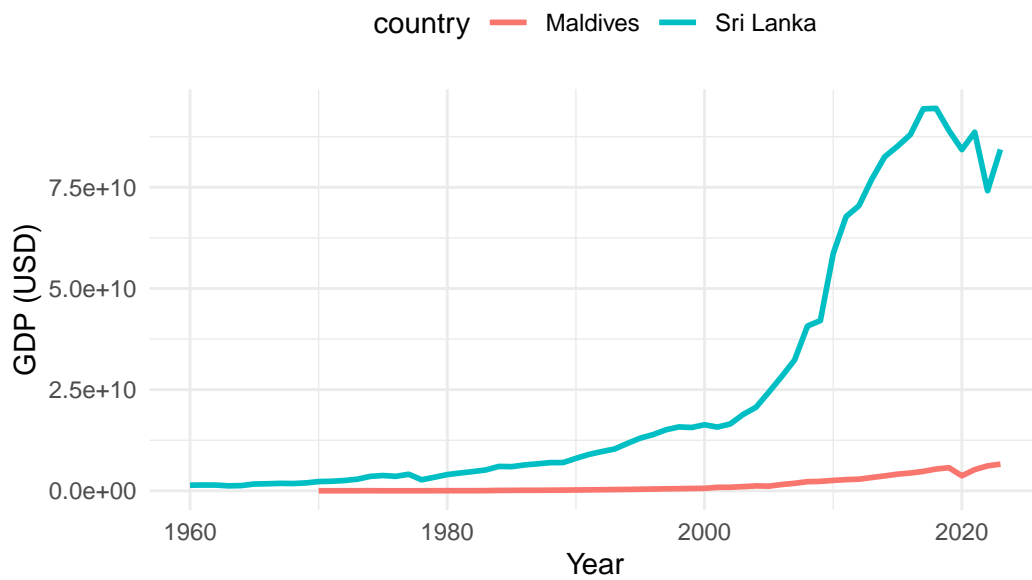
Comparison with Sri Lanka

This part compares two South Asian island nations, Sri Lanka and the Maldives, focusing on four key indicators: GDP, population, life expectancy, and international homicide rates. Although both countries share geographic proximity as island nations in the Indian Ocean, they differ significantly in terms of population size, economic structure, and socio-economic development. By examining GDP growth, overall population, life expectancy trends, and safety indicators (homicide rates), this comparison provides insight into their progress, challenges, and unique pathways of development over time.

Comparison on GDP

```
Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
i Please use `linewidth` instead.
```
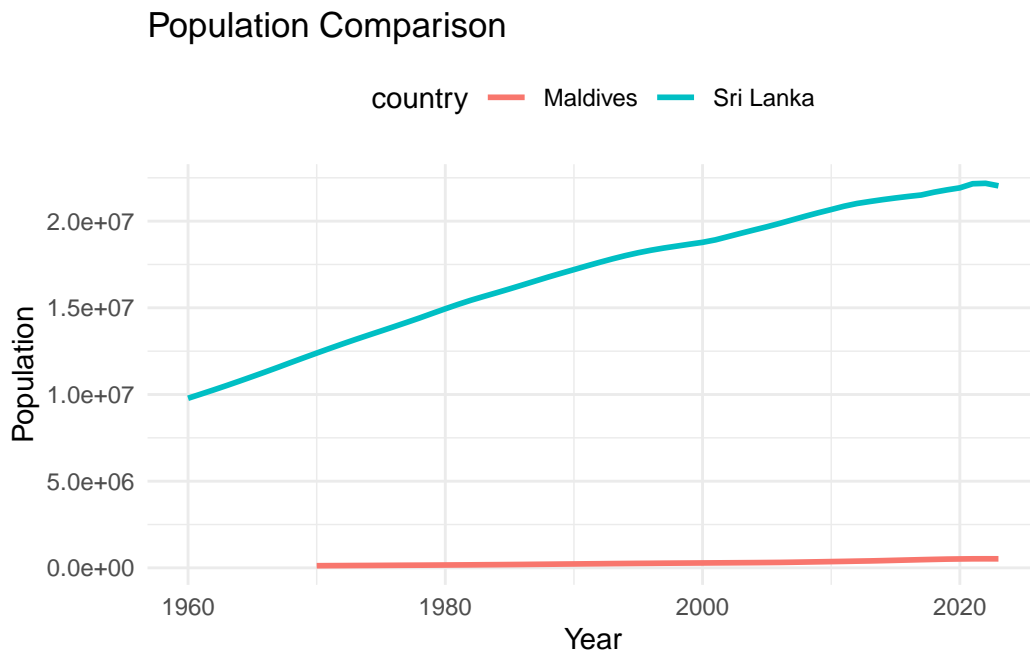
GDP Comparison

Sri Lanka has a larger and more established economy, showing exponential growth until recent disruptions.

Maldives, although starting smaller, has demonstrated steady and robust economic growth, driven by its tourism industry.

Comparison on Population

Population Comparison

country ── Maldives ── Sri Lanka

Sri Lanka's Population is steady growing over the decades, reaching over 20 million by 2023. The larger population supports a diversified economy but also poses challenges for resource management.

Maldives' Population is consistently much smaller, with a gradual increase to just under 1 million. The smaller population aligns with its economic reliance on tourism and resource limitations as an archipelago.
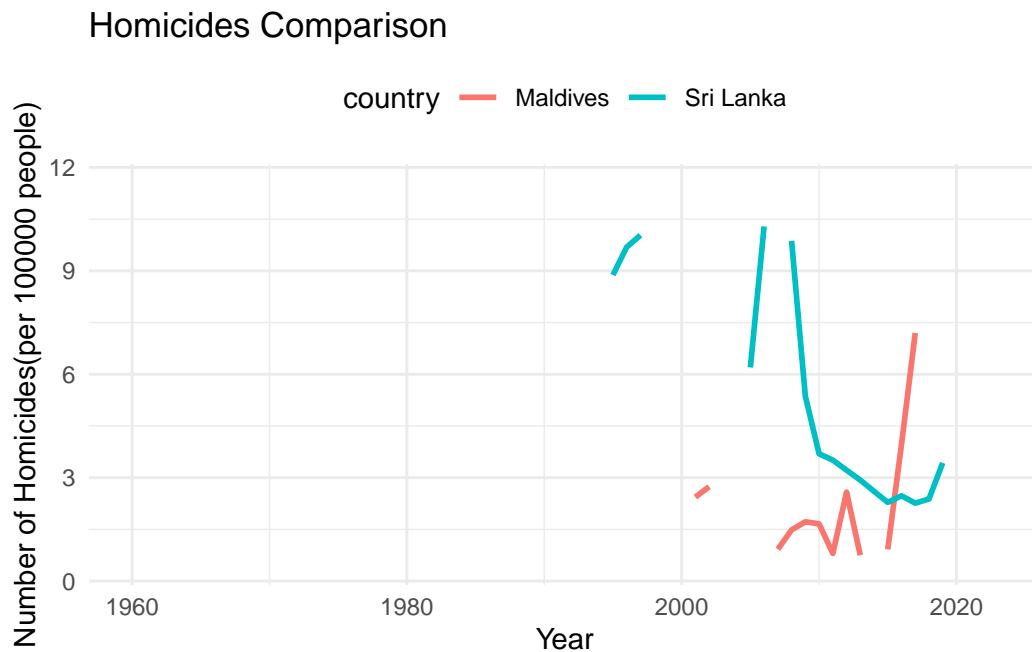
Comparison on Life Expectancy

Life Expectancy Comparison
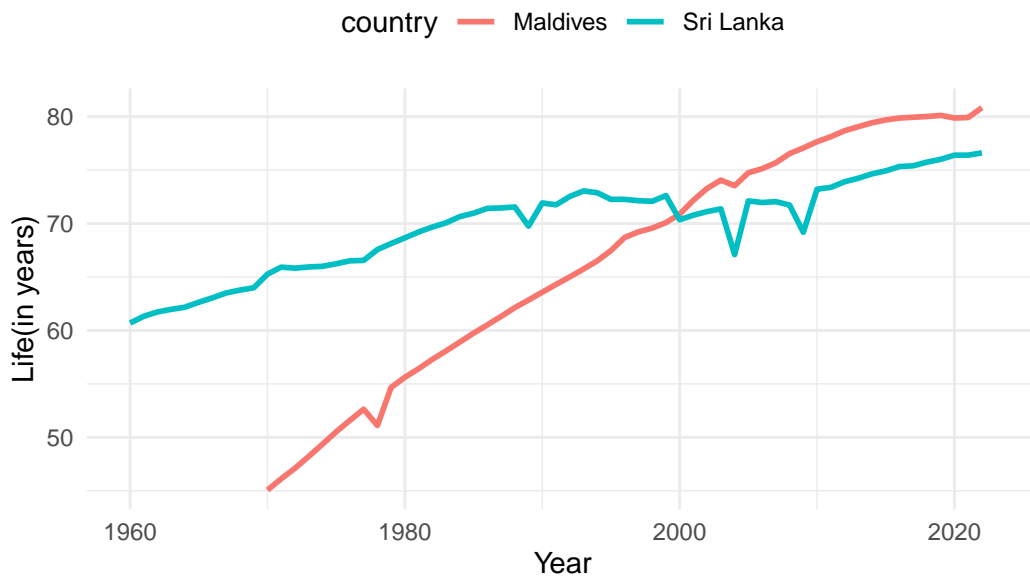
Sri Lanka has shown steady improvements, likely due to consistent investments in healthcare and education over decades.

Maldives has demonstrated exceptional progress, closing the life expectancy gap and ultimately exceeding Sri Lanka.

Comparison of Intentional Homicide

Homicides Comparison

For Sri Lanka: The higher initial rates may have been influenced by political instability or conflict-related violence during the late 20th century and the sharp decline suggests improvements in governance, peace, and law enforcement over the years.

For Maldives: The low and stable homicide rates align with its small population and limited social unrest and the spike in recent years may warrant further investigation into potential causes, such as economic stresses, organized crime, or social disruptions.

Current Challenges of Maldives

Sea-Level Rise and Land Loss

The Maldives, with over 80% of its land area less than 1 meter above sea level, is highly vulnerable to sea-level rise.

Studies indicate that by 2150, sea levels could rise by approximately 1.32 meter, potentially submerging significant portions of the Maldives.

Projected Sea–Level Rise in the Maldives (2020–2150)
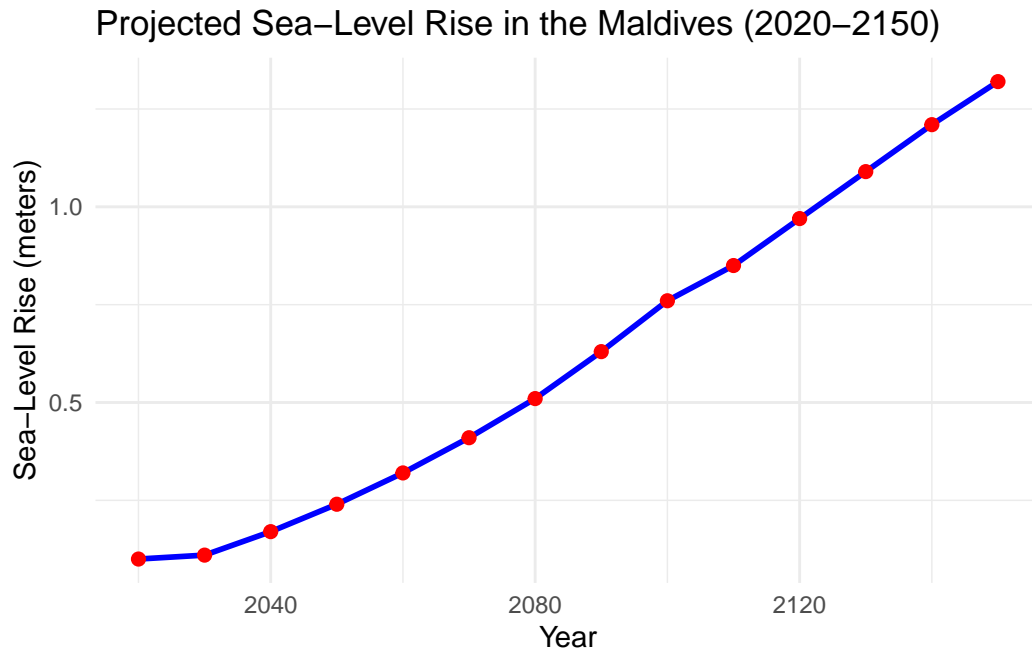
Explore the detailed projections for sea-level rise using the NASA Sea Level Projection Tool.

Coral Reef Bleaching

The Maldives has experienced significant coral bleaching events, notably in 1998, 2016, and 2020, leading to substantial coral mortality.

In 2016, over 60% of coral colonies were bleached, with some sites experiencing up to 90% bleaching.

Major Coral Bleaching Events in the Maldives
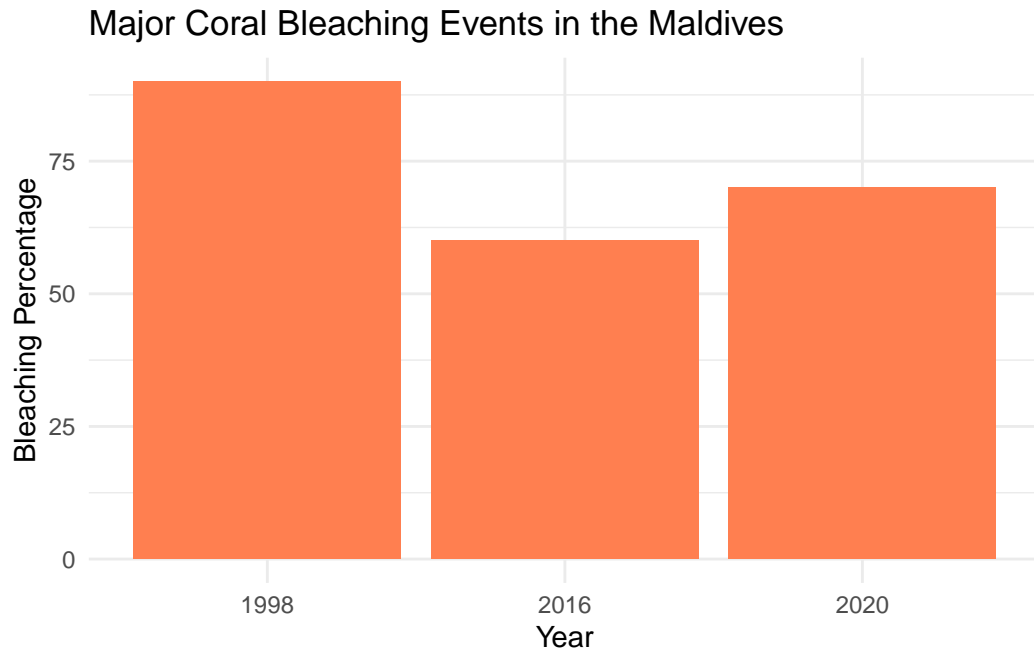
Access real-time coral bleaching data for the Maldives using the NOAA Coral Reef Watch Tool.