Ocean Indicators and Climate Change

Robert Grenda - INFSCI 1520 Final Report

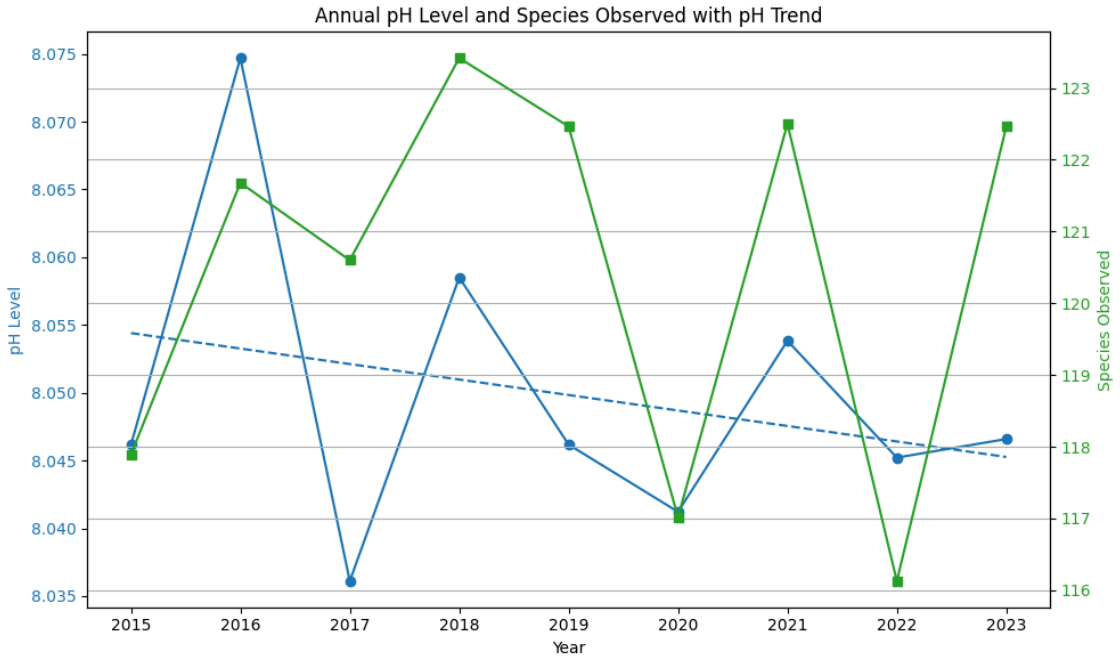

Figure 1.

Introduction

Climate change poses a critical threat to marine ecosystems, influencing ocean chemistry, temperature, and biodiversity. This project explores these impacts by visualizing key ocean indicators over time, including sea surface temperature (SST), pH levels, and species diversity. Drawing from a dataset of global marine observations, this report uses Python-based visualizations to examine the relationships among climate stressors and biological outcomes like coral bleaching. The goal is to translate complex environmental data into actionable insights that emphasize the urgency of marine conservation.

Figure 1. A dual-axis line chart showing declining ocean pH levels alongside marine species observed per year globally. There is a clear correlation between ocean pH levels and observed marine species, which can be seen in the matching peaks and dips of the line chart.

Legend:

- **Blue Line:** Represents annual average ocean pH levels.
- **Green Line:** Represents annual average number of marine species observed.
- **Blue Dotted Line:** Regression trend for ocean acidification (pH decline)

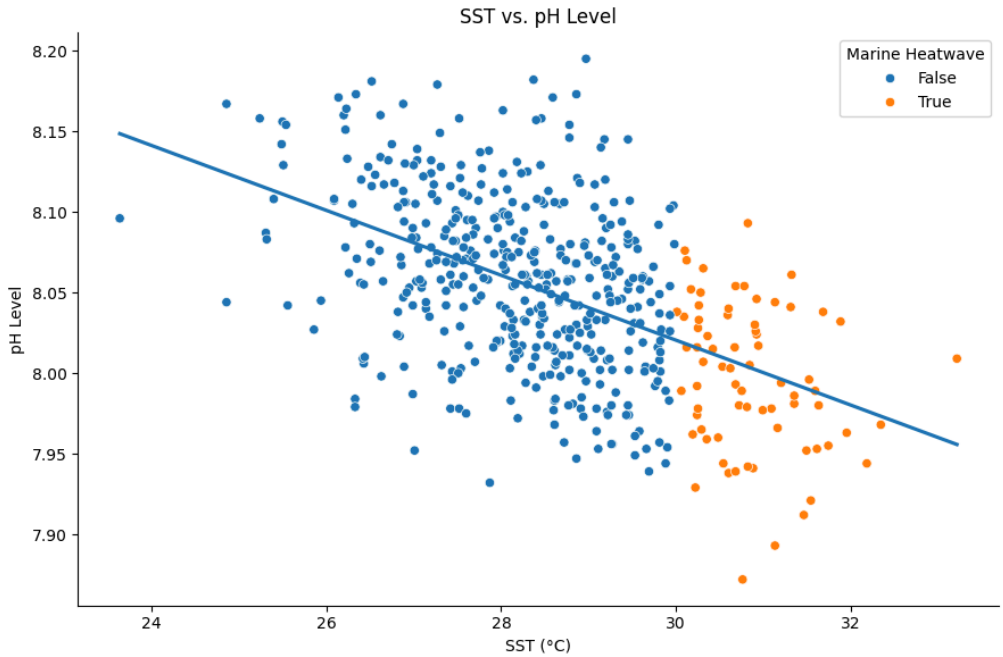

Figure 2.

Figure 2. A scatterplot with a regression line showing a clear negative correlation between pH levels and SSTs. pH levels that correspond to SSTs of over 30 degrees Celsius are marked in orange.

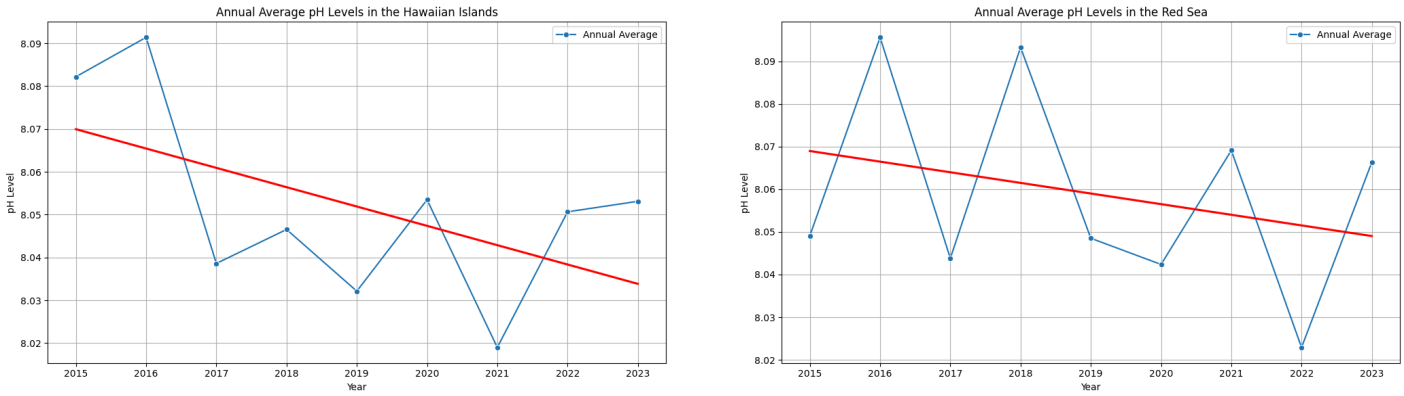

Figure 3.

Figure 3. Two line charts that show the annual average pH levels of the Hawaiian Islands and the Red Sea. Both regression lines (shown in red) show a clear decrease in pH level over time.

Key Findings:

- Global ocean pH has been consistently declining, signaling increased acidification due to rising atmospheric CO2 levels.
- Due to increased acidification, the SST of global waters is steadily increasing, confirmed by regression analysis.
- Marine species observed have shown declines in correlation with falling pH and rising SST.
- pH data from the Hawaiian Islands and the Red Sea both dip well below 8.10, signalling marine heatwaves. These are periods of unusually high SSTs that persist for extended periods of time.

Data and Method:

- The dataset used includes climate and oceanographic metrics (pH level, SST, species observed) across several global marine locations.
- Data was cleaned and aggregated by year using pandas. Visualizations were created using seaborn and matplotlib.
- Regression trends were fitted using SciPy (scipy.stats)

Significance: This report underscores the global threat of climate change on marine ecosystems. Ocean acidification and warming not only affect biodiversity but also disrupt global food chains and coastal economies. By visualizing these patterns over time, we can clearly see urgent trends that require international climate policy makers to take action.

GitHub Link: https://github.com/rsg48/Ocean-Indicators-and-Climate-Change