

Data Lab Report of The Worldwide Change in Ocean Acidification

Jake Choi

Korea International School, Jeju Campus / Chemistry 10 (Period 4) / Ms. Shea

Introduction

Background

For more than 200 years since the beginning of the industrial revolution, ocean acidification, a phenomenon of the pH value in Earth's oceans continuously decreasing, has been occurring. It is mainly caused by the CO₂ gas in the atmosphere dissolving into the oceans due to the use of fossil fuels. The pH value, a scale used to measure the acidity of an aqueous solution, is continuously decreasing, indicating that the ocean is becoming more acidic.

Purpose and Question

The purpose of this lab is to find out how the ocean acidification has changed from past and how it is predicted to change in the future. The question is "Is the worldwide rate of change in ocean acidification predicted to increase, decrease, or remain constant over time in all locations?"

Hypothesis

The worldwide rate of change in ocean acidification will increase over time in all locations.

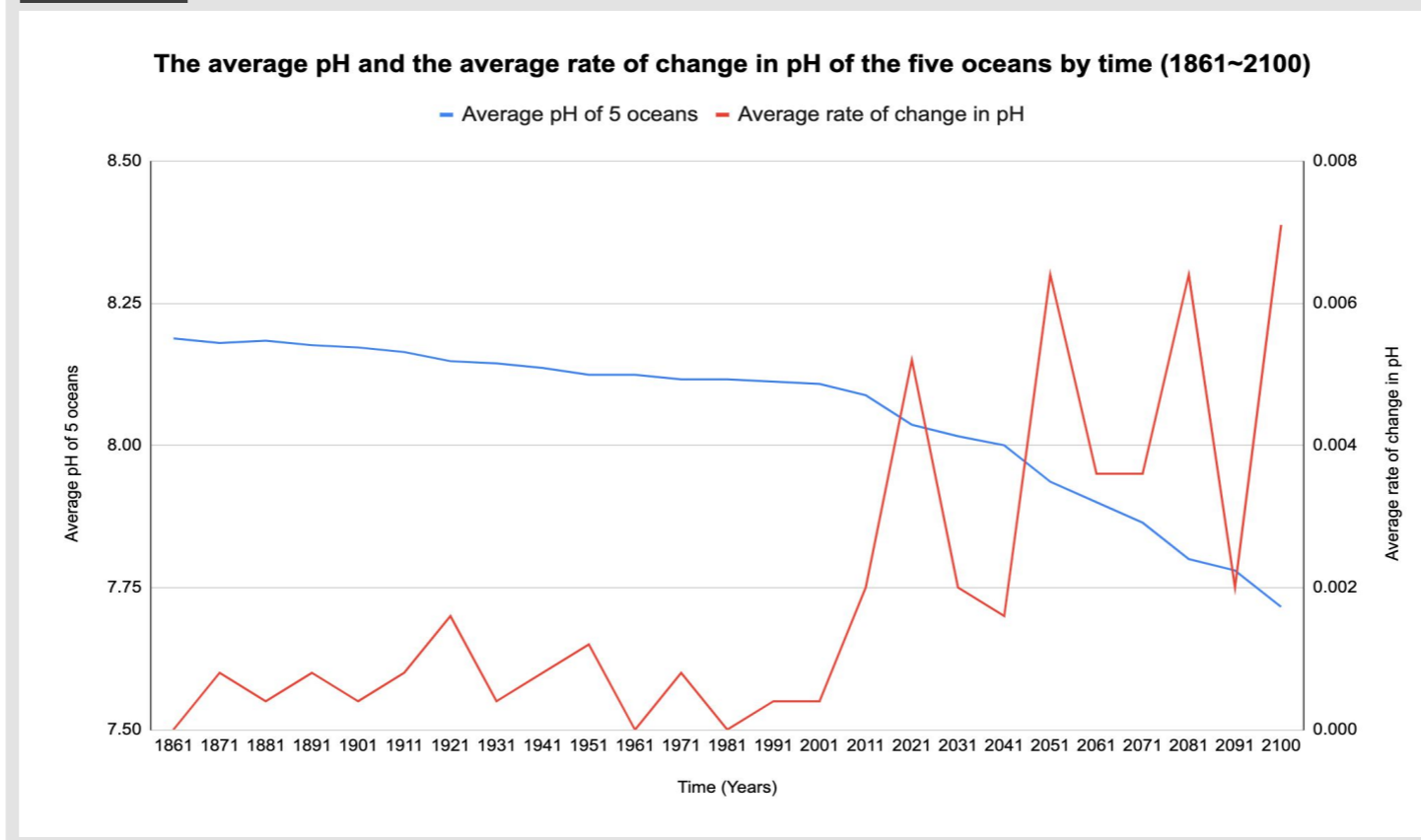
Procedure

I collected data every 10 years from 1861 to 2100. Since the values can differ from the region even in the same ocean, I measured the pH values at 5 different points apart in each ocean and calculated the average values of those pH values that show up in each ocean at the specific year.

Independent variable: Time(Years) is the independent variable. I collected the data from 1861 to 2100 every 10 years by altering the control bar of the website.

Dependent variable: Ocean acidity, measured by the pH scale, is the dependent variable.

Results



Results

The average pH and the average rate of change in pH of the five oceans (1861~2100)

Time (Years)	Average pH of 5 oceans	Average rate of change in pH
1861	8.188	0
1871	8.18	0.0008
1881	8.184	0.0004
1891	8.176	0.0008
1901	8.172	0.0004
1911	8.164	0.0008
1921	8.148	0.0016
1931	8.144	0.0004
1941	8.136	0.0008
1951	8.124	0.0012
1961	8.124	0
1971	8.116	0.0008
1981	8.116	0
1991	8.112	0.0004
2001	8.108	0.0004
2011	8.088	0.002
2021	8.036	0.0052
2031	8.016	0.002

2041	8	0.0016
2051	7.936	0.0064
2061	7.9	0.0036
2071	7.864	0.0036
2081	7.8	0.0064
2091	7.78	0.002
2100	7.716	0.0071

Link to Spreadsheet of data tables and graph:
<https://docs.google.com/spreadsheets/d/11VQZOU1F-OsgifvsbZQYpwU28yF1fVRBeswM-dbJEXA/edit?usp=sharing>

Calculation

Average rate of change:

$$\frac{\text{Average pH of year 2} - \text{Average pH of year 1}}{\text{Year 2} - \text{Year 1}}$$

Average pH:

pH of Pacific Ocean + pH of Atlantic Ocean + pH of Indian Ocean + pH of Arctic Ocean + pH of Southern Ocean / 5

Discussion

According to the data collected, the average pH values of the five oceans are decreasing, meaning that all the five oceans are becoming more acidic. Furthermore, the average rate of change in the ocean pH values are predicted to increase over time in all locations. It means that the ocean will become acidic more quickly than before.

Even though the collected data is a prediction that is almost accurate, it has several limitations. First, the oceans are too large to predict with only 5 points. Second, the prediction is just a calculation that is only based on the past data and the current rate of change, meaning that it can be different from the measurement in the real world. So, the rate of change can decrease or be constant over time in the real world. To overcome these limitations, I can add more points on each ocean and increase the intricacy of the data.

Conclusion

The problem being investigated in this lab is to determine whether the worldwide rate of change in ocean acidification predicted to increase, decrease, or remain constant over time in all locations. According to the graph constructed based on data, it is determined that the ocean is getting more acidic, and the rate of change is predicted to increase over time in all locations. The results of this data lab shows that the excessive use of fossil fuels is damaging the ocean environment by making it more acidic, and this change is happening more quickly than the past.

Citations

NOAA View Global Data Explorer,
www.nv1.noaa.gov/view/globaldata.html#ACID.

"What Causes Ocean Acidification?" *Natural History Museum*,
www.nhm.ac.uk/discover/quick-questions/what-causes-ocean-acidification.html.