

Final Project Proposal

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Overview and Background Knowledge

As the emission of greenhouse gases continues to increase into the 21st century, so does the level of carbon dioxide in our oceans. The ocean is the largest carbon sink in the world, meaning that it absorbs about 25% of the carbon dioxide that humans create. On the surface this sounds great, because we want to decrease the amount of carbon dioxide in the atmosphere. Unfortunately, the increase in emissions has caused the ocean to absorb greater quantities of carbon dioxide, which has led to the phenomenon of ocean acidification. When carbon dioxide is absorbed into seawater, chemical reactions occur that reduce seawater pH, carbonate ion concentration, and saturation states of biologically important calcium carbonate minerals. All this chemical technicality essentially means the acidity of the oceans is increasing. This is a problem because it makes it more difficult for marine organisms to form shells and skeletons, and existing shells may dissolve. The cascading effects (which have already begun) of OA can alter the structure of coral reefs (which are extremely important for biodiversity, coastal protection, fisheries, and medicine), alter marine food chains and ultimately negatively affect food supply to humans.

One method of battling this process is sustainable aquaculture (regenerative ocean farming). Among a myriad of benefits, reducing the amount of acidification in seawater is top priority in my agenda. To explore these effects, I will be looking at the trends over time of global aquaculture production and levels of ocean acidification. Because the benefits of aquaculture (carbon sequestration and reversing ocean acidification) come mainly from seaweed and shellfish farming, I will be focusing only on the production of those species.

Research Questions

- How has the rate of aquaculture production, globally and nationally, changed over time?
 - When have those rate changes occurred, and what can we attribute them to?
- How has the rate of pCO₂ (a measurement of OA) changed over time?
 - What time periods have a greater or lesser increase or decrease?
- How do these trends match up with each other?

Data

- Aquaculture data:
 - Gathered from the Food and Agriculture Organization of the United Nations, containing data on every species of global aquaculture production from 1950 until 2019.
 - Using their data portal FishStatJ I subsetted out data regarding only aquatic plants and shellfish, which left me with 494 rows of data.
- Ocean Acidification data:
 - Gathered from the National Centers for Environmental Information, containing data on global surface pCO₂, with measurements performed from 1957-2019. There are 1,048,576 observations in the raw data set.
 - The location observations are in the form of latitude and longitude points, so I plan to aggregate these measurements based on regional coast that matches the aquaculture locations.
- The two data sets can then be merged on location and year for further analysis

Project Plan

I plan to explore linear regression models because I want to compare the rates of production and acidification and see if any correlation can be drawn between them. The plan moving forward:

- Clean data sets, import into R, begin exploratory data analysis
- Create initial regression models, visualize, and validate
- Write up conclusions from initial analyses and investigate if I need to introduce and new variables and/or datasets into the project
- Repeat steps until complete