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### Homework 13 Writing Assignment

#### Part 1: Krumhardt et al. 2019 Paper

##### Abstract

- Introduction
  - CO<sub>2</sub> emissions cause ocean acidification
  - Coccolithophores are potentially affected/influenced by ocean acidification
  - Changes in their distribution may have ecological and biogeochemical impacts
- Methods
  - They isolate effects of increasing CO<sub>2</sub> on coccolithophores
  - They achieve this through explicit coccolithophore phytoplankton functional type parameterization in the Community Earth System Model
- Results
  - Global annual calcification is 6% higher under present-day CO<sub>2</sub> levels relative to preindustrial CO<sub>2</sub>
  - Under 900  $\mu$ atm CO<sub>2</sub>, global annual calcification is 11% lower than under preindustrial CO<sub>2</sub> levels
- Discussion
  - Increasing CO<sub>2</sub> concentrations result in decreasing coccolithophore calcium carbonate production
- Conclusion
  - In conclusion, coccolithophores become more abundant but less calcified as CO<sub>2</sub> increases with a tipping point in global calcification at approximately  $\sim 600\mu$ atm

##### Introduction

##### Paragraph 1:

- Subject sentence: “These primary producers exert a unique influence on the global carbon cycle by way of their ability to perform both calcification and photosynthesis.”
  - Coccolithophores take up bicarbonate and calcium ions to precipitate calcium carbonate, decreasing sea water alkalinity and increasing CO<sub>2</sub>
  - Coccolithophores can influence both the biological carbon pump and the alkalinity pump

- Coccolithophores account for between 1% and 20% of the phytoplankton carbon pools in diverse ocean regions ,are responsible for ~10% of carbon export, and comprise a major fraction of carbonate in the sediments
- The balance between coccolithophore photosynthesis and calcification could be important for ocean carbon cycle processes
  - Broader purpose: Changes in coccolithophore photosynthesis and calcification from ocean acidification (OA) would not only impact regional plankton ecology but could also influence how carbon moves from the atmosphere into the surface ocean, and finally into the deep sea. (Stressing importance of coccolithophore alteration/ Providing background info on coccolithophores)

#### Paragraph 2:

- Subject sentence: “Coccolithophores have been the focus of numerous laboratory studies due to their potential susceptibility to OA, but these have yielded contradictory results.”
  - Recent efforts have made progress to reconcile these contradictions
  - These studies resolved that culturing conditions, such as the way CO<sub>2</sub> is manipulated, can help to explain differences in experimental results
  - Across-species data compilation recently resolved that coccolithophores generally tend to calcify less relative to photosynthesis as CO<sub>2</sub> increases
  - Additional CO<sub>2</sub> in the water column could have competing effects on coccolithophore physiological function
    - Broader purpose: These contrasting effects complicate future projections of marine calcification by coccolithophores. (Introducing contradictory results that poses as confounding factor)

#### Paragraph 3:

- Subject sentence: “On a global scale, predicting the effects of increasing anthropogenic CO<sub>2</sub> on coccolithophores is important for estimating changes in total global upper ocean calcification and to assess the potential for these changes in calcification to affect other critical carbon cycle processes.”
  - None of the Earth System Models participating in the 5<sup>th</sup> Coupled Model Intercomparison Project represent a coccolithophore phytoplankton functional type that is sensitive in growth and calcification to changing ocean carbonate chemistry
    - Broader purpose: In this study, we describe a novel explicit coccolithophore parameterization in a state-of-the-art Earth System Model, the Community Earth System Model. (Introduces a problem/fault that leads into solution (study))

#### Paragraph 4:

- Subject sentence: “A number of studies have modeled pelagic calcifiers, such as coccolithophores, on global and regional scales.”
  - These modeling studies found that including the influence of changing carbonate chemistry on the production and/or dissolution of  $\text{CaCO}_3$  fosters important climate-carbon feedbacks in the Earthsystem
  - Here we test this conclusion and build upon these previous studies by parameterizing an across-species coccolithophore PFT in a state-of-the-art Earth System Model
    - Broader purpose: The main goal of this work is to assess global- and regional-scale impacts of increasing  $\text{CO}_2$  on coccolithophores, to evaluate the influence of these impacts on phytoplankton community structure, and to examine how these changes could affect important carbon cycle processes, such as carbon export and air-sea  $\text{CO}_2$  exchange. (Touches base on the efforts of others while defining goals of study)

#### Paragraph 5:

- Subject sentence: “Here we perform sensitivity studies with our novel model configuration to explore how coccolithophore growth and calcification may change under increasing atmospheric  $\text{CO}_2$ .”
  - We isolate the effects of increasing  $\text{CO}_2$
  - These experiments demonstrate that increasing atmospheric  $\text{CO}_2$  stimulates coccolithophore growth but decreases coccolithophore calcification
    - Broader Purpose: Briefly going over results

### Part 2: Final Project Proposal

#### Abstract

- Introduction
  - Red Drum (*Sciaenops ocellatus*) are a species of great recreational significance in south Texas
  - Despite their significance, the amount of research/studies done on the species in the southernmost area of Texas is lacking.
- Methods
  - The goal of this project is to portray their distribution in these water systems through scatter plots.
  - The most efficient method of capture as well as length class will also be assessed through scatter plots and histograms.

## Introduction

### Paragraph 1:

- Subject sentence: “Red Drum, also referred to as red fish, are a popular game fish in coastal waters ranging from Massachusetts to Mexico and are of great recreational/commercial significance.”
  - This species spawns primarily in the Gulf of Mexico
  - Surface currents then transport the larvae to estuaries where they will continue the maturation process until fully mature resulting in movement offshore(TPWD, 2010)
  - In the 1970’s heavy, unregulated fishing contributed significantly to a decline in the populations of Red Drum
  - Red Drum are currently state-managed due to their status as a highly sought after game species
  - Hatchery programs implemented for stock enhancement and research purposes are maintained by some Gulf states in efforts of population maintenance

(I didn’t divide the introduction into paragraphs so I will separate ideas here)

### Paragraph 2:

- Subject sentence: “Comparatively within the state of Texas, there is a lack of studies of Red Drum in the southernmost area.”
  - A characterization of their distribution in the water systems of south Texas can begin the process of fulfilling the area’s knowledge gap and offer insights into their habitat utilization
  - The data obtained from this project may also prove valuable for improving fisheries management practices to mitigate future resource depletion as Red Drum are a recreationally highly sought after species by the extensive population of fisherman that occupy south Texas.
  - This species also serves as a vital food source for the high rate of people living in poverty that inhabit the area as well.

## Rewritten Abstract and Introduction:

### Abstract

Red Drum (*Sciaenops ocellatus*) are a species of great recreational significance in south Texas. Due to previous heavy fishing the species is regulated and monitored for depletion mitigation efforts, as it constitutes as a vital resource. Despite their significance, the amount of research/studies done on the species in the southernmost area of Texas is lacking. To better understand/protect Red Drum and their habitat there needs to be a greater understanding of their

utilization of the water systems of south Texas. The goal of this project is to portray their distribution in these water systems through scatter plots. The most efficient method of capture as well as length class will also be assessed through scatter plots and histograms.

## Introduction

Red Drum, also referred to as red fish, are a popular game fish in coastal waters ranging from Massachusetts to Mexico and are of great recreational/commercial significance. This species spawns primarily in the Gulf of Mexico. Surface currents then transport the larvae to estuaries where they will continue the maturation process until fully mature resulting in movement offshore (TPWD, 2010). In the 1970's heavy, unregulated fishing contributed significantly to a decline in the populations of Red Drum (Love et al., 2013). This decline also resulted in the closing of commercial fishing in federal waters around the later 1980's for the species. Red Drum are currently state-managed due to their status as a highly sought after game species. Hatchery programs implemented for stock enhancement and research purposes are maintained by some Gulf states in efforts of population maintenance (Love et al., 2013).

Comparatively within the state of Texas, there is a lack of studies of Red Drum in the southernmost area. They are a significant species that utilize the water systems of south Texas for nursery grounds/spawning purposes. A characterization of their distribution in the water systems of south Texas can begin the process of fulfilling the area's knowledge gap and offer insights into their habitat utilization. Such understanding will be beneficial in the innovation of management techniques for this species. The data obtained from this project may also prove valuable for improving fisheries management practices to mitigate future resource depletion as Red Drum are a recreationally highly sought after species by the extensive population of fisherman that occupy south Texas. This species also serves as a vital food source for the high rate of people living in poverty that inhabit the area as well.

## References:

- Davis, J. T. (1990). Red drum: Biology and life history. (Southern Regional Aquaculture Center Publication No. 320). College Station, TX: Texas A&M University. Retrieved from <https://srac.tamu.edu/index.cfm/event/getFactSheet/whichfactsheet/59/>
- Love, M., Baldera, A., Yeung, C., Robbins, C. (2013). The Gulf of Mexico Ecosystem: A Coastal and Marine Atlas. New Orleans, LA: Ocean Conservancy, Gulf Restoration Center
- Texas Parks and Wildlife Department (TPWD). (2010, August 26). Red Drum (*Sciaenops ocellatus*). Retrieved from [http://www.tpwd.state.tx.us/hunt\\_wild/wild/species/reddrum/](http://www.tpwd.state.tx.us/hunt_wild/wild/species/reddrum/)