Anonymized

ENWR 1510-15

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<div align="center">Investigating Dead Zones in the Chesapeake Bay</div>

I began this unit with the following question:

1. What are Dead Zones, and how do they impact the Chesapeake Bay?

I then refined it to the following questions:

1) What are the main causes of algal blooms, and what is the process in which algal blooms form dead-zones?

2) What human impacts cause dead zones in the Chesapeake Bay?

3) What do Dead Zones do to the marine ecosystem in the Chesapeake Bay?

4) How do students in Charlottesville have an impact on the Bay, since the Bay's watershed runs through Virginia?

During this discovery unit, I utilized several resources in order to understand what was occurring in the Bay and the consequences of the conditions.

Peer Reviewed Article #1

I began my research process during our first library visit, and I came across an article called "Dead Zones", written by Mark Schrope. This source introduced me to a wealth of information, including general information about dead zones, how they've become so common overtime, and its impacts on marine ecosystems. It was through this source that I initially discovered the conditions and factors that cause dead zones, which includes a low oxygen zone impacted by increased levels of nutrients like nitrogen and phosphorus, agricultural runoff, sewage, and

rainwater that carries nitrous oxides through the watershed into the Bay. I also learned about stratification, and how a water column in the Bay is stratified at one point (or layered in salinity and temperature). Finally, this source opened my eyes to how dead zones impact humans, because of its ability to deprive fisheries of many species of fish, as many fish are victims to the algal bloom and dead zone conditions. This source was extremely helpful in providing me the initial information that I took with me through the research process. Within the same library session, I sought out another initial source of information to introduce me to key terms and concepts for my research topic.

Peer Reviewed Article #2

Written by Fred Powledge, the article "Chesapeake Bay Restoration: A Model of What?" was an additional peer reviewed article that I utilized in my research. At this point, I was looking for foundational information to help me discover what I wanted to focus my research on in the long run. In this source, Fred Powledge introduced me to the politics and policy issues behind the issue, as well as how costs have served as one of the largest obstacles for human involvement in restoring the Bay. Another major topic that was important to my research was the foundational information about the Chesapeake Bay Watershed, and some crucial key background information about how significant it is on the East Coast. For example, he talks about the Susquehanna River, the watershed's largest tributary, and how the estuary includes up to 3600 species, because the tidal action and salinity gradient promote a diverse number of species to thrive here. Overall, this article claimed that there is a theme of pointing fingers on the east coast, on state, city, and individual levels. However, given the knowledge I had gained at this point, I understood that

blame was not the issue, but rather the acknowledgment and taking responsibility for the conditions of the Bay.

Newspaper Article #1

After the library session, I took the internet with a new vision on my topic, and I was eager to find a recent and reliable article that would further expand what I had learned thus far. In a newspaper article named "Lawsuit: EPA Fails to Enforce Chesapeake Bay Pollution Caps", written by Ben Finely for ABC News, Finley talks about a lawsuit involving the EPA and New York and Pennsylvania, because of the states failure to adhere guidelines given by the EPA, and the EPA's passive nature in allowing them to exceed deadlines. These deadlines involved restriction in runoff and emissions. For example, Pennsylvania is a state that is currently planning to impose a restriction on runoff, and was approved by the EPA to meet 75% of nitrogen reduction requirements by 2025. New York additionally would achieve only 66% of its nitrogen reduction requirements by 2025. Limits included nitrogen and phosphorus and other sediments, as they were main sources of pollution from runoff of farms and cities. This source showed how there has been progress in the Bay, but government and organization involvement, like by the Chesapeake Bay Foundation and Maryland Watermen's Association, is crucial to assure that states are taking necessary measures to protect the Bay.

Newspaper Article #2

 At this point, I was feeling very confident in the information I had gathered about dead zones and environmental impacts. I utilized another newspaper article, named "Experts warn of 'dead zone' in Chesapeake Bay from pollution", written by David McFadden for the Baltimore Sun.

David discussed the tributaries connected to the Chesapeake Bay, and the sediments that travel with them. He talks about the effectiveness of Dams and how sediment travels more when there are increasing rates of precipitation. Overall, this article focussed more on climate change, which I had not seen a focus on in any of my past articles. I found that climate was a huge cause of the conditions of the Bay, but I had not seen it explicitly in my sources yet. This article emphasized how climate change will continue to make wetter conditions, and more downpours, which will be difficult to counteract in stopping the sediment from racing down to the Chesapeake.

Book #1

While using the library databases, I discovered a published book/report by the Congressional Research Service, titled *Marine Dead Zones: Understanding the Problem.* This source introduced me to a new term I had not seen before. The author, whose name was redacted, discussed hypoxia, a condition of depressed concentrations of dissolved oxygen in water. The author also further discussed how these hypoxic events are caused and how they are connected to dead zones. In addition to this, the author highlighted eutrophication, and how it occurs from human activities of point sources (sewage) and nonpoint sources of nutrients (run off), as well as emissions. This is connected to dead zones, because natural eutrophication occurs when nutrients and sunlight stimulate the algal growth that then sink and die, as organisms consume them and deplete the oxygen levels in the water. This source exposed me to new terminology, and also highlighted the initial discovery of the Chesapeake Bay Dead Zone in 2003, as a 250 square mile hypoxic water zone. After using this source, I felt that I needed to find another book source as this source was one of the most helpful sources in my research process, and I was successful at finding crucial and credible information for my project.

Book #2

My next source that I used was a book written by Renee Hetherington, calle *Living in a Dangerous Climate: Climate Change and Human Evolution*. This source was interesting because the author discussed a personal experience she had when the abundance of cod dissipated in Newfoundland, where she fished with her family. She also discussed ocean acidification which was a concept I had not yet considered in my research process. She strongly urged in her book that people must acknowledge the downstream actions disturbs the condition of the ocean. This source was extremely helpful because its personal application about how dead zones affect communities on various levels. I was very interested in the scientific side of my research, but the personal insight and way that the author wrote her work was very intriguing.

Interview

I planned to interview Professor Thomas Smith, an associate professor in environmental science here at UVA, because he is knowledgeable in many fields of science, but has focussed his research on vegetation dynamics. His involvement in research studies practicing field experiments drew me to him in order to get a better understanding of my topic. I looked forward to his responses and insight on my topic, given his own professional experiences researching topics in environmental topics. At this point of my research, I was looking to connect my topic to the community I live and study in. However, I sent an email to my professor over a week ago and I am still waiting for a response on my questions. I believe he will respond as he encourages our questions and to contact him. However, if I do not get a response within the next week, I will follow up with an additional email. If this is not successful, I plan on utilizing a new interviewee,

which most likely will be with a researcher at the Brock Environmental Center, which would be a very reliable and interesting source of information.

Opinion Survey

My next step in my process was to gather opinionated information from my classmates. I conducted an opinion based survey, and the respondents were all first year students at UVA in ENWR 1510. This data helped me get an idea about how educated my classmates were about my topic, and allowed me to gain insight on what additional information they knew. This source opened my eyes to a lot of impact the deterioration of the Bay has on the watershed and surrounding cities, that I had not thought about up until this point in the project. For example, when students were asked about what they believed occurred as a result of dead zones, they concluded that "marine life/surrounding bay would be affected", such as the "supply of seafood decreased, and number of jobs affected". In addition to this, 58% of respondents believe that they make an impact on the state of the Chesapeake Bay from Charlottesville. This helped me understand that more than half of respondents are aware of their footprint on the ecosystem around us as it affects surrounding ones like the Bay. Overall, this source was extremely helpful and I felt very confident at this point of my research.

Empirical Study

I decided to conduct an empirical study in order to gather data regarding my topic. Rather than conducting a test, considering traveling to the Bay was not feasible for me, I resorted to gaining additional information from other UVA students. Using Qualtrics, I sent a survey to first year students living in Echols and Humphries on McCormick Road. It was also sent through social

media to additional first years in order to retrieve more responses. Some highlights of the empirical study include that only 4 out of 25 respondents claim that they were not aware at all about the conditions of the Bay, and of these respondents, only 1 student was an out of state student. Additionally, 56% of respondents claim that they believe it's important to use sustainable practices in their lives daily. This statistic was significant because sustainable practices was a concept I discovered throughout my research to be a solution to the Bay, or a way to prevent it from further deteriorating. My graphs and other results are highlighted on the slides.

Archival Material

As I neared the end of my discovery process, I required one more source of information to supplement my research. In 2019, my high school visited the Brock Environmental Center to learn about sustainability in the Chesapeake Bay and how we could incorporate sustainability and positively impact the environment and the watershed. A classmate took a picture of a friend and I by the Chesapeake Bay during our visit to Virginia Beach, VA as we reflected what we had discovered during our visit at Brock. This image was extremely important and significant to my research sources, because it allowed me to reflect on the past knowledge I have had about what has been occurring to the Bay. During an international leadership conference, I was introduced to design thinking and how it applied to protecting the Bay. Additionally, the conference introduced me to a wide range of issues occurring in the Bay that I was not aware of beforehand. This source is personal to me and my life, as I live on the Chesapeake Bay watershed, and this source represents the time when the deterioration of the Bay was initially brought to my attention and emphasized in importance.

Refined Topic

Overall, I found that a common theme in my work was the sediments (phosphorus and nitrogen) that make their way into the Bay through natural and unnatural causes. However, these pollutants are still man made, making it a human responsibility. Therefore, I believe my working essay title currently will be "Running from Runoff", because of the theme of runoff and sediments being major contributors for the dead zones in the Chesapeake Bay. In addition to this, my working essay thesis will be "Dead Zones in the Chesapeake Bay are continuing to grow, because of runoff of pollution, caused by agriculture, industrial groups, and other human caused pollution".

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