How Does Runoff cause/affect Dead Zones and Ocean life within them?

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THE GLOBE PROGRAM
Global Learning and Observations to Benefit the Environment

Abstract

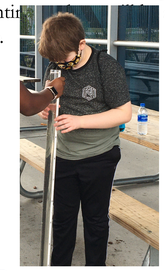
The hypothesis of this report is that if runoff that is made up of nitrogen, phosphorus, manure, chemicals, and fertilizers continue to be dumped into the Mississippi river, then biodiversity in the Gulf of Mexico will continue to decrease due to deoxygenation and dead zones. To test this hypothesis, we looked at several reports and articles related to this topic to find data. We also used other resources, such as the director of the Ahmad ibn Majid Project for Marine Mapping & Sustainable Development, and the Infinity Space Center. We concluded that our hypothesis was correct, and this real threat could cost us the remaining biodiversity in the Gulf of Mexico and our local watershed.

Introduction

Content Knowledge

- The annual dead zone in the Gulf of Mexico is caused by an overflow of nutrients from the Mississippi River, mainly nitrogen and phosphorus. The Mississippi River Watershed drains a large part of the USA, from Pennsylvania to Montana, and extends southward along the Mississippi River. Most of the nitrogen input comes from major farming states in the Mississippi River Valley, including Minnesota, Iowa, Illinois, Wisconsin, Missouri, Tennessee, Arkansas, Mississippi, and Louisiana. Nitrogen and phosphorus enter the river through runoff of fertilizers, soil erosion, animal wastes, and sewage, mostly from farming and animal husbandry. In a natural system, these nutrients aren't significant factors in algae growth because they are depleted in the soil by plants. However, with humans increasing nitrogen and phosphorus input, algae growth is no longer limited. Consequently, algal blooms develop, the food chain is altered, and dissolved oxygen in the watershed is depleted. This process is known as deoxygenation.

Farmers who use the fertile soil in the Mississippi River Basin dump fertilizers into the river. When this fertilizer reaches New Orleans and the Gulf of Mexico, algae eat the nutrients that come with the fertilizer, the population explodes, and oxygen levels drop. This loss of oxygen causes a dead zone, where plants and animals in the water die off. This is a major problem in our local watershed that is killing off our native sea creatures. If this practice contin[illegible] a shortage of biodiversity in the Gulf of Mexico.



Field Photos

(requires release forms)

Research Methods

Planning Investigations

Describes the planning process

We looked through multiple different websites to gather information and data relating to our question.

We talked to an actual scientist, Samantha Allyson Sooknarine, the Project Director for the Ahmad ibn Majid Project for Marine Mapping & Sustainable Development. We asked several questions related to our topic.

We traveled to the Infinity Space center to test water samples from the local Pearl River.

Carrying Out Investigations

Describes what happened

- Dissolved Oxygen is a measure of how much oxygen is dissolved in water. This is the oxygen that is available to living organisms in the water. Rapidly moving water tends to contain a lot of dissolved oxygen, and still water contains less. The amount of contaminants such as nitrate pollutants can also affect the amount of dissolved oxygen in the water allowing algae blooms and bacteria to grow creating dead zones.
- pH is a measure of how acidic or basic water is. pH is an important indicator of water quality and can be an indicator of increasing pollution.
- Water transparency, also referred to as turbidity, is a measure of the relative clarity of a liquid. It is a measurement of the amount of light that is scattered by material in the water.
- Excessive turbidity becomes a health concern for living organisms. Water temperature is taken with a thermometer to determine the temperature of the water in Celsius. Water temperature can indicate the type of organisms that may live in the water.

GLOBE Badges

Make an Impact

Description:

The report clearly describes how a local issue led to the research questions or makes connections between local and global impacts. The students need to clearly describe or show how the research contributed to a positive impact on their community through making recommendations or taking action based on findings.

Justification:

Our project meets the criteria for this badge. The dead zones forming annually in the Gulf of Mexico, where we live, are directly affecting our community in a negative way. They are killing our wildlife and sea creatures, which is not only hurting the environment, but also the economy and our health. By getting the word out about this issue, we can help protect the biodiversity in the species in our areas. This will have a positive impact not only on the environment, but also the economy through tourism, hospitality, and fishing.

Research Questions

Asking Questions

- What is runoff, and how does it cause algae blooms and deoxygenation?
- In what ways does runoff affect ocean life, and what are the causes?
- How does the amount of nitrogen, phosphorus, manure, fertilizers, and other runoff being dumped into the Mississippi River correlate with biodiversity in the Gulf of Mexico?
- How do fertilizers contribute to the development of dead zones in the Gulf of Mexico?

Results

Analyzing Data

Nutrient flux from the Mississippi River Basin is strongly influenced by changes in streamflow, which in turn is influenced by changes in precipitation and runoff.

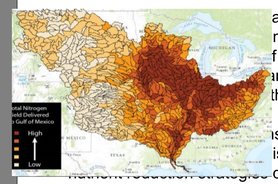
The hypoxic zone in the northern Gulf of Mexico is one of the largest in the world and its size is related to the flux of nutrients from the Mississippi River Basin

The 2007 Mississippi River Basin Science Advisory Board Panel recommended a dual nutrient reduction strategy targeting a 45% reduction in total nitrogen and total phosphorus loads flowing into the Gulf of Mexico to reduce the hypoxic zone to a five year running average of 5,000 km2....The total nitrogen five year moving average for 2011-2014 was about 18 %. Below is the baseline period:

Figure 1. Annual total nitrogen load/s in the Mississippi/Atchafalaya River basin transported to the Gulf of Mexico from 1980-2014.

Flow-normalized nitrate concentrations at the Mississippi River outlet to the Gulf of Mexico increased 12% from 2000 to 2010.

Nitrate levels in the Illinois River decreased by 21% between 2000 and 2010, marking the first time substantial, multiyear decreases in nitrate had been observed in the Mississippi River Basin since 1980. Nitrate levels during the same period decreased by about 10% in the Iowa River.



al inputs (i.e., manure, fertilizer, and legume nitrogen source (60% of the total), with farm f that amount.

nd fertilizers) were also the largest total he total, with 27% from chemical fertilizers and

sported to local water bodies in each of the 12 ississippi River can vary significantly. The developed by each of the HTF states provide comprehensive assessments of nutrient sources at the state scale and describe suites of actions to be taken to reduce nutrients

Figure #1

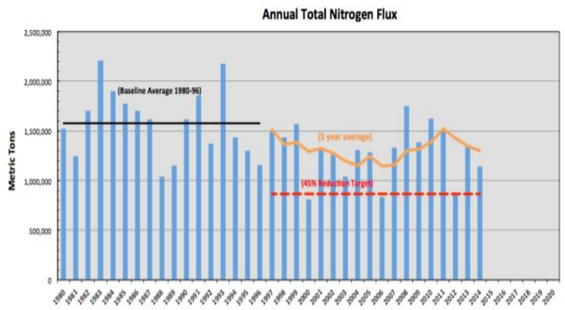
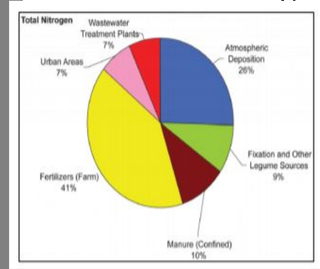
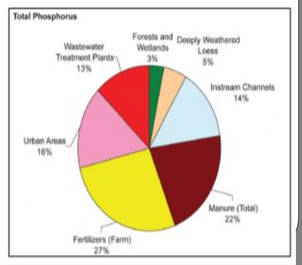


Figure #2





Discussion

Interpreting Data

New Orleans, the Ohio and Illinois river watersheds, and the main pathway of the Mississippi River have the most concentrated areas of nitrogen and other nutrients/fertilizers.

The watersheds of the Missouri, Red, and Arkansas rivers have the lowest concentration of nitrogen and other nutrients/fertilizers.

Conclusions

Drawing Conclusions & Next Steps

In conclusion, fertilizers and chemicals that runoff from farms into the Mississippi travel to the Gulf of Mexico, cause dead zones, and damage the biodiversity of the area. In response, efforts have been taken to reduce the toll taken by marine life in the Gulf of Mexico. An example is the recommendation of a dual nutrient reduction strategy targeting a 45% reduction of fertilizers entering the Mississippi river. If efforts like this continue to be at least mildly successful, then there is hope for our local watershed.

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