Names:

Brown Shrimp Student Investigation Sheet

Lesson 3 > Part 3 > Changing Ecosystems

Expert Group 5: Dead Zones in the Gulf of Mexico and Brown Shrimp

Refer to the Dead Zones: Fertilizing the Ocean with Nitrogen reading (below) and the Gulf of Mexico Dead Zone Map (page 31) to answer the questions below.

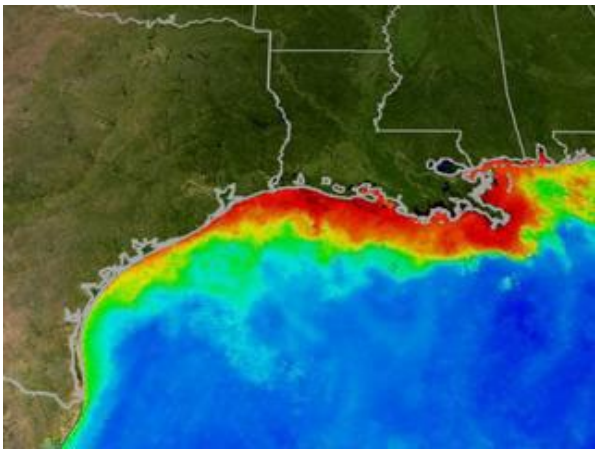
Dead Zones: Fertilizing the Ocean with Nitrogen

Plants need nitrogen to grow, but plants cannot use the nitrogen in the atmosphere for this, even though there is tons of it available. It's just not in a form that plants can use. So they get the nitrogen they need from the soil where bacteria have converted it into a usable form. In natural conditions, plant growth is limited in many places by the amount of usable nitrogen that is available in the soil.

To grow more crops, people have been transforming nitrogen from the atmosphere into nitrogen fertilizers and then adding the fertilizers to the plants. This has been very successful over the past century, allowing people to farm on lands that had not been as productive in the past, and to produce enough food for growing populations of people. However, fertilizers are often overused, and that can cause problems.

Nitrogen from fertilizers sinks into soils, often creating conditions that favor the growth of weeds rather than native plants. The nitrogen then washes into waterways, causing a surplus of nutrients, a situation called eutrophication. In freshwater lakes, rivers, and streams, eutrophication causes aquatic weeds to grow unchecked. They sometimes fill entire lakes, rivers, or streams. Algae cloud the water green and slimy algal scum coat shallow rocks.

When the nitrogen-rich waters make their way downstream to the ocean, they cause even more problems. Every summer for more than 30 years, high nitrogen levels at the Mississippi River Delta have caused a dead zone (shown in the picture above) where the water empties into the Gulf of Mexico. This



dead zone, in which oxygen levels are too low for animals to survive, covered more than 8000 square miles (more than 20,000 km2) of the ocean in 2001. It forms when nitrogen in the water causes algae to grow and reproduce very quickly. As the huge amounts of algae die and decompose, oxygen in the water is used up. Animals can not survive without oxygen. They flee to another part of the ocean if they can, or they die.

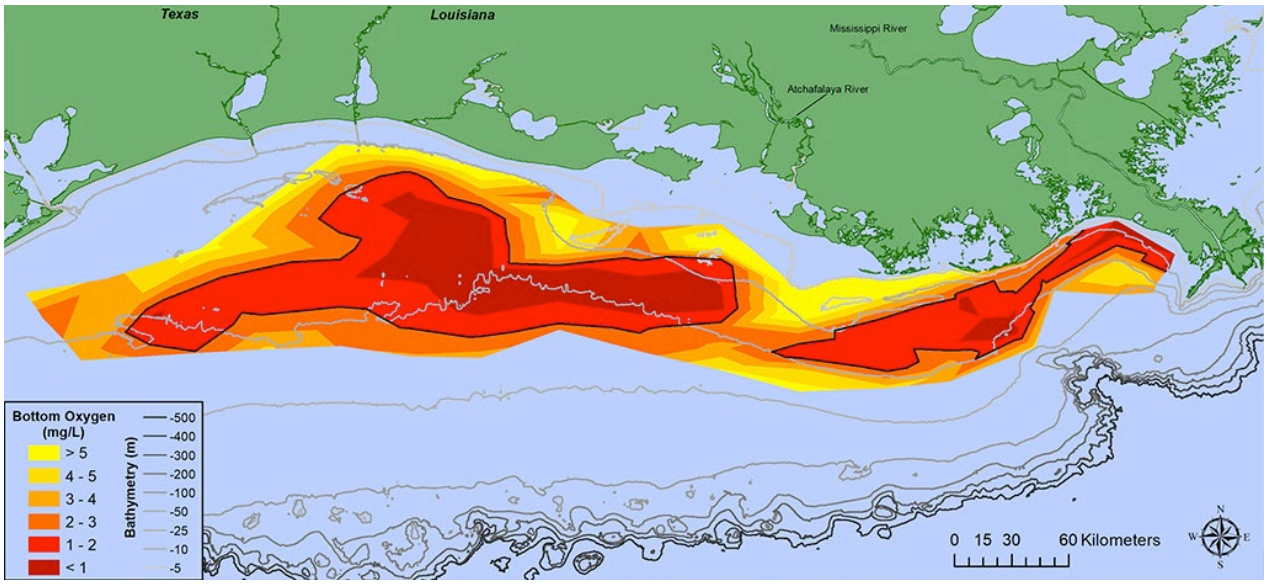
Although it is one of the larger dead zones, the one in the Gulf of Mexico is not the only one of its kind. There are about 150 dead zones in the world's oceans. Almost all of them are located at the mouths of rivers where fertilizers and other nutrient sources, like sewage and livestock waste, are added to the seawater.

Exerpt from UCAR Center for Science Education's Learning Zone scied.ucar.edu/learning-zone/impacts-climate-change/changing-nitrogen-cycle/changing-nitrogen-cycle

UCAR CENTER FOR SCIENCE EDUCATION

Gulf of Mexico Dead Zone Map (2019 Shelf-wide Cruise)

The scientists and crew worked from the Research Vessel Pelican to map the 2019 summer area of the 'Dead Zone' from July 23 through July 29 and returned to the dock on July 31. The 'Dead Zone' is the area of bottom-water considered hypoxic, which includes dissolved oxygen levels less than 2 milligrams per liter (equal to 2ppm). Low oxygen levels were found at 47 of 97 stations from the Mississippi River west along the Louisiana coast to the west of Galveston, Texas. Many other water quality and physical oceanographic data were collected along with the bottom-water values.



The bottom area of low oxygen in Louisiana coastal waters west of the Mississippi River was 6,952 square miles (18,000 square kilometers), approaching the land area of New Jersey. The 2019 summer size ranks the eighth largest among the 33 years with similarly mapped areas.

For the full press release go to gulfhypoxia.net/research/shelfwide-cruise/?y=2019

1. What causes a dead zone, and why are they bad for marine animals?

2. Why are dead zones located in specific coastal areas and not others? Why do dead zones develop in the summer months and recede in the winter?

3. How does the 2019 Gulf of Mexico Dead Zone compare to other years? How might the 2019 flooding of the Mississippi River have contributed to this?

4. How does this information relate to the investigation question for today: *How are brown shrimp impacted by the changing coastal environment? How does this affect the people of Louisiana?*