Biophysical Interactions Activity

Objective: Students will explore scenarios in real data sets to investigate how physics and biology interact to produce dead zones of various sizes and durations. Further questioning will challenge students to apply their new knowledge of dead zones to real-life questions.

Materials

- dead zone scenario cards (Figure 3a)

Procedure

1. Download data cards for the following four scenarios (www1.coseecoastaltrends.net/modules/dead_zones/access_classroom_resources/what_affects_dead_zones):
    - High nutrients, high wind
    - High nutrients, low wind
    - Low nutrients, high wind
    - Low nutrients, low wind
2. Using each of the data cards, students describe what happens to the size and duration of the dead zone under each of the scenarios.

Questions

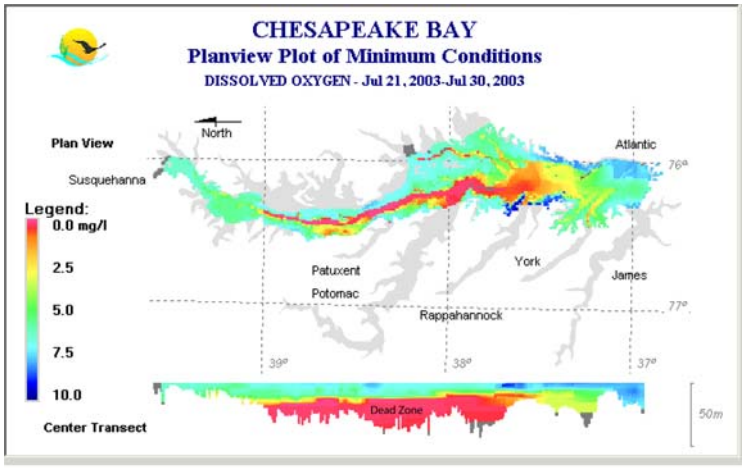
- How does wind and nutrient concentration affect the size and duration of the dead zone?

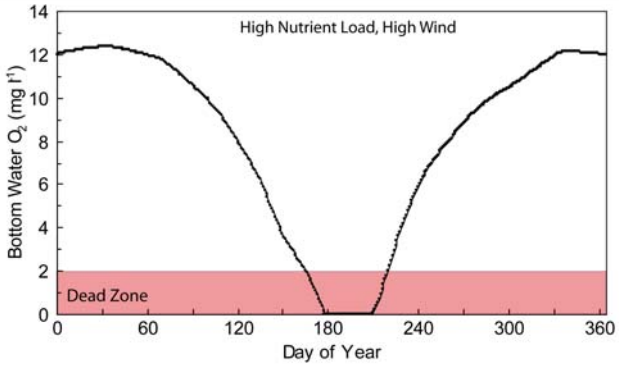
- What would happen to the dead zone if a hurricane occurred?
- In many aquatic ecosystems, sturgeon are historically important fish that live in bottom waters and are very sensitive to low oxygen levels. A restoration scientist is planning to release thousands of young sturgeon in the Chesapeake Bay. Which data card shows optimal conditions for the sturgeon release? What factors should the scientist consider in planning when to release the sturgeon?
- What solutions can you suggest to decrease the size and duration of dead zones?
- Do we expect the number of dead zones across the world to increase as the global human population grows to 9 billion in 2050? Why?
- What will be the affect of a warmer planet on the intensity of dead zones? Why?
- What can humans do to reduce the size and number of dead zones?
- Humans eat food produced by agriculture and also fish harvested from the sea. If increasing agricultural production to feed a growing population requires more fertilizer, but more fertilizer may lead to more dead zones and reduce fish populations, how can we balance the two?
- Can you think of any ways that human population can grow without increasing the number of dead zones and the size of current dead zones?

Figure 3a

Example data card.

This data card illustrates the spatial and temporal aspects of a dead zone in Chesapeake Bay under high nutrient loading, but also high wind conditions.





Map reprinted with permission from the Maryland Department of Natural Resources and Chesapeake Bay Program. Time-series oxygen plot is courtesy of the authors and is based on the results of a simple simulation model.