Dead Zones – not a science fiction movie.
But just as scary

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Nature is all about connections; one thing is related to another, and they seemingly work together in harmony, but when artificial connections are made, whether induced by human activity or naturally occurring, it is often times not for the better. This is another story about connections.

Dead zones are found all around the world. Some are naturally occurring, but they are primarily the result of agricultural and industrial activity spilling nutrients into the water. Other culprits are sewage, vehicular, and industrial emissions. It is estimated that there are about 500 dead zones worldwide. Many are seasonable but no less important to the health of lakes and oceans.

Definitions/Causes:

Hypoxia, eutrophication, algae, and anthropogenic are not your common everyday words, but all related to what is called a Dead Zone.

Dead Zones are areas of low oxygen in the world's oceans and lakes; they are hypoxic. According to the National Oceanic and Atmospheric Association (NOAA), these areas are caused by, "excessive nutrient pollution from human activities coupled with other factors that deplete the oxygen required to support most marine life in the bottom or near-bottom water."

Eutrophication of lakes or oceans is caused by an increase in nutrients, such as nitrogen and phosphorus. These chemicals are the building blocks of single-celled, plant-like organisms or phytoplankton. A rapid increase in the density of these organisms is called an algal bloom, often referred to as a red or brown tide.

There are several groups of algae: Cyanobacteria, green algae, dinoflagellates, Coccolithophores, and Diatom algae. With an increase in nitrogen and phosphates entering the water Cyanobacteria blooms and the other algae are consumed. Algae blooms prevent light from penetrating the surface of the water and it prevents oxygen from being absorbed by the organisms living beneath. Human illnesses are also related to algae as shellfish and other filter feeders absorb microbes associated with algal blooms and many of those microbes are toxic to humans.

Anthropogenic, a recently coined word that simply means caused by or influenced by humans. Use of chemical fertilizers is considered the major human-related cause of dead zones. Sewage, urban land use, overpopulation and fertilizers contribute to the formation or add to dead zones.

Dead zones are classified by the length of their occurrence:

- Permanent dead zones: deep water occurrences in the benthic zone where the oxygen level is usually below 2mg/L.
- Temporary dead zones: short lived, lasting hours or days.
- Seasonal dead zones: annually occurring, typically in warm months.
- Diel cycling hypoxia: specific seasonal dead zone occurring only at night.

There are also natural dead zones caused by changes in wind, water circulation and upwellings. Areas in the eastern tropical Pacific Ocean have low oxygen concentrations that are believed to be caused by minimal circulation that does not replace the oxygen that is naturally consumed.

Where are the major dead zones?

The Baltic Sea is home to seven of the 10 largest dead zones in the world. Recently, the area has been targeted by the European Union as a 'macro-region' to combat pollution, dead zones, overfishing, and regional disputes. Eight EU countries border the Baltic Sea (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, and Sweden).

> Overfishing of the Baltic cod, runoff from fertilizers and sewers are the significant contributors to the decline of the region's fishing industry. Speaking of connections: Baltic cod eat sprats, sprats eat algae. Fewer cod resulted in more sprats, and more sprats meant more algae and less oxygen = a dead zone.

The Gulf of Mexico dead zone is the largest in the United States; the size is seasonal-dependent. NOAA scientists predict that this year's forecasted dead zone, due to flooding of the Missouri River Basin and Mississippi could be 50% larger than average. May 2019 was the wettest 12 months in U.S. history.

> Historically, as early as the 1950 shrimpers reported a dead zone in the Gulf of Mexico, but it was not until 1970 that scientists began investigating why the dead zone was increasing in size.
> The formation of the dead zone in the Gulf of Mexico has been connected to the conversion of vast forests for agriculture use, in the Missouri River Basin and the Lower Mississippi, between 1950 and 1976. The Energy Independence and Security Act of 2007, calls for energy independence by 2022. To meet the mandated requirements of the energy independence programs necessitates an increase in corn production. This, in turn, leads to a proportional increase in agro-fertilizer runoff and nitrogen loading of the dead zone at the mouth of the Mississippi. The result is twice the level recommended by the Mississippi River Watershed Conservation Program.

Dead zones in the U.S. are the Chesapeake Bay; Elizabeth River, Virginia; Lake Erie; Cape Perpetua, Oregon, and the Lower St. Lawrence Estuary. Worldwide, dead zones are found in the Baltic Sea, the coastlines of Japan, Korea, Great Britain, Australia, South, and Central America.

A large oxygen-derived region found in the Gulf of Oman is suspected to be the largest in the world, but due to political instability and threats of ocean piracy; ocean researchers have only just returned. A study by Bastien Queste, a research fellow with the University of East Anglia in England, found that the dead zone had expanded beyond all predictive computer models.

Effect of dead zones

These dead zones have quadrupled since 1950. It foretells of dire consequences to the millions of people who depend on lakes and oceans. Lakes and oceans provide food for an estimated 500 million people worldwide and provide jobs for another 350 million people. The socio-economic/monetary effect of coastal dead zones and a decline in oxygen in the open ocean is truly difficult to estimate. Most aquatic critters cannot survive, and it could lead to mass extinction. Fish can flee the potential of suffocation unless rendered unconscious; bottom dwellers like clams and oysters are unable to escape, even colonial animals are doomed. Low oxygen levels also lead to reproductive problems, low egg counts and lack of spawning.

Dead zones are reversible

"This is a problem we can solve," said Denise Breitburg, at the Smithsonian Environmental Research Center in June 2019, "halting climate change requires a global effort; even local actions can help with nutrient-driven oxygen decline."

> The best example of recovery is what occurred in the Black Sea in the 1990s after the fall of the Soviet Union. The cost of fertilizers became too costly to use resulting in a drop in an out of control use of fertilizers. The dead zone in the Black Sea, previously the largest, has now diminished to a point that fishing has once again become an economic activity in the region.

Cleanups are occurring around the world. Since 1985, the North Sea dead zone has been reduced by as much as 37%, countries along the Rhine River have reduced industrial, and sewage emissions, the Hudson River and San Francisco Bay are also working to reduce dead zones.

Dead zones are reversible, but unfortunately, organisms that are lost due to its presence are not.