



Deoxygenation in Riverine Ecosystems

For Prelims: Deoxygenation in Riverine Ecosystems, [Artificial Intelligence \(AI\)](#), [Greenhouse Gas Emissions \(GHG\)](#).

For Mains: Deoxygenation in Riverine Ecosystems and its implications on Environment and Human Health.

Source: [DTE](#)

Why in News?

Recently, in a study published in **Nature Climate Change** by Pennsylvania State University, the US, has highlighted the issue of **Deoxygenation in Riverine Ecosystems**.

- The team of Researchers utilized [Artificial Intelligence \(AI\)](#) to analyze water quality data from nearly 800 rivers across the United States and Central Europe.
- **Riverine water temperature and dissolved oxygen levels** are essential measures of water quality and ecosystem health.

What is Deoxygenation in Water Bodies?

- **About:**
 - Deoxygenation in water bodies **refers to the reduction or depletion of dissolved oxygen levels** in aquatic environments, such as rivers, lakes, oceans, and other bodies of water.
 - This decrease in oxygen availability can occur due to **various natural and anthropogenic factors**, disrupting the delicate balance necessary for the survival of aquatic organisms.
- **Impacts of Deoxygenation:**
 - **Aquatic Life:** Deoxygenation can **result in "dead zones"** where fish and marine life struggle to survive due to lack of oxygen. In severe cases, it can lead to mass fish kills and other marine organism die-offs.
 - Excessive nutrient runoff and pollution from industrial and urban sources have caused **oxygen depletion in the Baltic Sea**. The resulting **dead zones** have impacted fisheries and biodiversity.
 - Coastal areas, like the **Gulf of Mexico**, often have **dead zones** in the summer.
 - **Shifts in Species Distribution:** Some species may **move to other areas with higher oxygen levels**, disrupting the ecosystem's balance and potentially leading to the dominance of invasive species.
 - **Human Health:** Deoxygenation affects drinking water quality, potentially making it unsafe for human consumption if pollutants and contaminants are present in low-oxygen waters.
 - **Economic Impact:** Reduced fish populations impact fisheries, leading to **economic losses for fishing industries**. Additionally, diminished aesthetics and recreational opportunities due to impacted water quality **can negatively affect tourism**.

What are the Key Highlights of the Study?

- **Warming and Oxygen Loss:**
 - Rivers are **warming up and deoxygenating faster** than oceans, which could have serious **implications for aquatic life** -- and the lives of humans.
 - A significant portion of rivers, approximately 87%, experienced **warming, while 70% suffered from oxygen loss**. This indicates a pervasive issue affecting river ecosystems.
- **Urban vs. Rural Impact:**
 - Urban rivers demonstrated rapid warming, contrasting with rural rivers that showed slower warming but faster deoxygenation.
 - This differentiation **emphasizes the varying impacts in different environments**.
- **Greenhouse Gas Emissions and Toxic Metal Release:**
 - Deoxygenation is a driver for **Greenhouse Gas Emissions (GHG)** and the release of toxic metals, amplifying the multifaceted consequences of this phenomenon.
- **Future Projections:**
 - Within the next 70 years, river systems, especially in the **American South, are likely** to experience periods with **such low levels of oxygen** that the rivers could "induce acute death" for **certain species of fish and threaten aquatic diversity** at large.
 - Future deoxygenation rates are estimated to be 1.6 to 2.5 times higher than historical **rates across all studied rivers**.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Q. The acidification of oceans is increasing. Why is this phenomenon a cause of concern? (2012)

1. The growth and survival of calcareous phytoplankton will be adversely affected.
2. The growth and survival of coral reefs will be adversely affected.
3. The survival of some animals that have phytoplanktonic larvae will be adversely affected.
4. The cloud seeding and formation of clouds will be adversely affected.

Which of the statements given above is/are correct?

- (a) 1, 2 and 3 only
- (b) 2 only
- (c) 1 and 3 only
- (d) 1, 2, 3 and 4

Ans: (a)