Results of the 2022 Continuous Dissolved Oxygen Monitoring

What is DO?

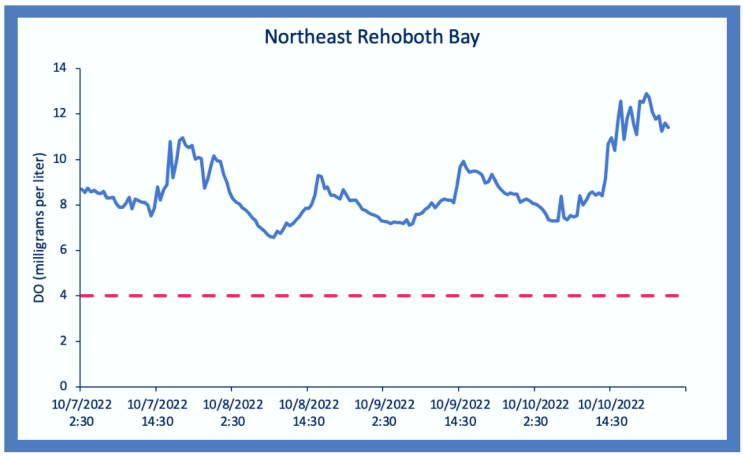
Aquatic life such as fish and crabs need oxygen to survive. While human lungs work to inhale oxygen from the air, aquatic animals use their gills to take oxygen dissolved in the surrounding water. "DO" is the abbreviation given to the amount of oxygen dissolved in the water – and aquatic life requires healthy amounts in order to live.

How Is DO Measured?

Using sensors, we measure the concentration of oxygen in the water – typically recorded in milligrams per liter – every half hour. The sensors are positioned under the water's surface, 6 inches above the sandy bottom as this is where the DO is usually at its lowest but many fish and crabs live.

What Does Healthy DO Look Like?

DO concentrations naturally fluctuate over the course of the day and night, but should stay above 4 milligrams per liter of water, and the fluctuations should only be a few milligrams in either direction.



Left: A snapshot of healthy DO conditions from Northeast Rehoboth Bay this past October. The DO varies but stays well above 4 milligrams per liter.

What Causes Poor DO?

Water has a natural capacity for how much DO it can have, which is affected by things like temperature, salinity, elevation, turbulence, and aquatic life. The overgrowth of aquatic algae (or algal blooms) often fueled by excess nutrients – like nitrogen and phosphorus from fertilizers, animal waste, urban runoff, and land-applied wastewater lead to much larger and potentially harmful swings in DO than pictured above. Algae create more DO during the daytime when, like trees, they photosynthesize. When the sun goes down, they switch to respiration, and like humans, consume the oxygen. When they die and decompose, this further reduces the amount of DO in the water.

Project Contact:

- Zachary Garmoe
  zgarmoe@inlandbays.org

Project Partners:

- Project WiCCED
- Delaware Cultured Seafood
- Rehoboth Bay Sailing Association
- Scott Andres
- A.G. Robbins
- Guy Fisher

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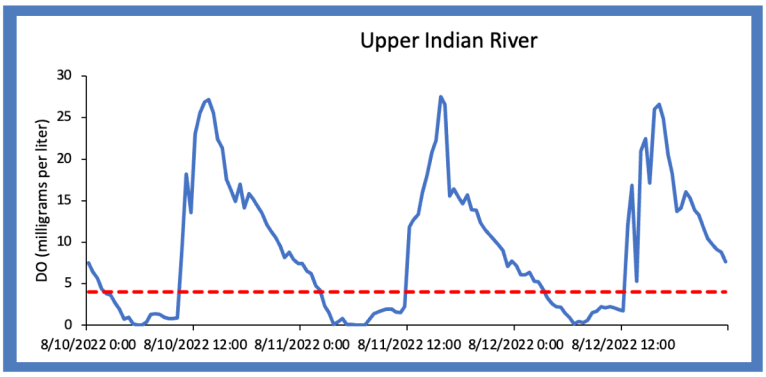
What Does Poor DO Look Like?

DO in an unhealthy system fluctuates wildly (higher highs and lower lows) over the course of 24 hours, and may remain lower than the standard of 4 milligrams per liter for several hours.

Right: A snapshot of unhealthy DO conditions from upper Indian River this past August. The DO shows large swings from daytime to nighttime, and routinely drops below 4 milligrams per liter for hours at a time.



How Does Poor DO Affect Aquatic Life?

Not all species of fish are equally sensitive to low DO conditions, and many will tolerate temporary drops below 4 milligrams per liter. Some species, however, are sensitive and will either vacate an area with low DO or hunker down and attempt to wait out the poor conditions. If DO does not improve quickly enough, a fish kill can occur, where thousands or hundreds of thousands of fish die in a single- or multi-day event.

If the oxygen falls below 2 milligrams per liter, its termed "hypoxic." Hypoxic waters are especially harmful to aquatic life as they hold very little oxygen – even species that tolerate DO below 4 milligrams per liter struggle or avoid hypoxic waters. The presence of hypoxic waters, and how frequently a water body is hypoxic, is a good indicator of how healthy the DO in a particular area is.

How The Center Monitors DO?

The Center has six full-time continuous monitoring stations – located in different tributaries or open Bay waters throughout the watershed – that collect DO measurements every half hour. This data is critical for understanding the health of local waterways. States are required to periodically report on the health of their water resources (Clean Water Act, Section 305(b)). If a waterway is considered unhealthy, a process for restoring the area will begin which focuses on preventing nutrients from reaching the waterway and may also involve projects to restore natural habitats.

How Are The Sites Doing?

Unfortunately, many of our monitored sites routinely fail to meet the standards set for healthy aquatic life, and even more concerningly, routinely display hypoxic conditions. The percent of summer mornings in 2022 when DO was below the standard and hypoxic are given below for each station.

Site	% of summer mornings where DO was 4.0 mg/L or less	% of summer mornings where DO was 2.0 mg/L or less
Lower Indian River	75.4	31.1
Upper Indian River	81.9	50.8
Upper Guinea Creek	81.9	44.7
Mid-Pepper Creek	87.7	60.6
Northeast Rehoboth Bay	83.1	8.4
Lower Little Assawoman Bay	0	0

How Can You Help?

The best way to support healthy dissolved oxygen levels and water clarity is by preventing algal blooms from happening in the first place. Salt marshes, vegetated buffers, and natural shorelines are all effective methods for removing and filtering pollutants from agricultural and stormwater runoff before they reach local waterways. For more information on these nature-based solutions along with additional actions that you can take to protect the Inland Bays starting right on your own property, check out the Center's waterfront property owner guidebook.

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39375 Inlet Rd
Rehoboth Beach, DE 19971
(302) 226-8105

The Delaware Center for the Inland Bays is a nonprofit organization established in 1994 to promote the wise use and enhancement of the Inland Bays and its watershed. With its many partners, the Center conducts public outreach and education, develops and implements restoration projects, encourages scientific inquiry and sponsors research. To learn how you can get on board with the bays, please visit www.inlandbays.org and follow us on Facebook and Instagram - @deinlandbays!