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Dissolved Oxygen

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To survive, fish, crabs, oysters and other aquatic animals must have sufficient levels of dissolved oxygen (DO) in the water. The amount of dissolved oxygen in an estuary's water is the major factor that determines the type and abundance of organisms that can live there.

Low levels of dissolved oxygen in the water can cause marine life to become very lethargic. Along the eastern shore of Mobile Bay, Alabama, many aquatic animals move into shallow waters to try to get more oxygen. Local communities refer to this phenomenon as "Jubilee." During a Jubilee, residents walk along the shore and fill their ice chests with crabs and flounders. **Click on image** for a larger view.

Oxygen enters the water through two natural processes: (1) diffusion from the atmosphere and (2) photosynthesis by aquatic plants. The mixing of surface waters by wind and waves increases the rate at which oxygen from the air can be dissolved or absorbed into the water.

DO levels are influenced by temperature and salinity. The solubility of oxygen, or its ability to dissolve in water, decreases as the water's temperature and salinity increase. DO levels in an estuary also vary seasonally, with the lowest levels occurring during the late summer months when temperatures are highest.

Bacteria, fungi, and other decomposer organisms reduce DO levels in estuaries because they consume oxygen while breaking down organic matter.

Oxygen depletion may occur in estuaries when many plants die and decompose, or when wastewater with large amounts of organic material enters the estuary. In some estuaries, large nutrient inputs, typically from sewage, stimulate algal blooms. When the algae die, they begin to decompose. The process of decomposition depletes the surrounding water of oxygen and, in severe cases, leads to hypoxic (very low oxygen) conditions that kill aquatic animals. Shallow, well-mixed estuaries are less susceptible to this phenomenon because wave action and circulation patterns supply the waters with plentiful oxygen.

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Monitoring Estuaries

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The National Estuarine Research Reserve System or NERRS is a partnership program between NOAA and U.S. coastal states that protects more than one million acres of estuarine land and water. These estuarine reserves provide essential habitat for wildlife; offer educational opportunities for students, teachers and the public; and serve as living laboratories for scientists.

The health of every reserve is continuously monitored by the NERRS System-wide Monitoring Program or SWMP (pronounced "swamp"). SWMP measures changes in estuarine waters to record how human activities and natural events affect coastal habitats.

The NERRS SWMP uses automated data loggers to monitor the temperature, depth, salinity, dissolved oxygen, turbidity, and pH of each estuary's water. These variables are recorded every 30 minutes at four stations in each of the 26 NERRS sites. They are key indicators of water quality and environmental conditions for the plants and animals that live in or use the estuary. The reserves also sample the water for nutrients (nitrogen and phosphorus) and chlorophyll on a monthly basis.

Weather can have a major impact on water quality in estuaries. For example, rainfall can increase sediment runoff, which, in turn, influences dissolved oxygen, turbidity, pH

This is a YSI 6000 UPG Multi-Parameter Water Quality Monitor. This particular model measures dissolved oxygen, salinity, temperature, pH, depth, and turbidity. **Click on image** for more details. (Photo: North Carolina NERRS site)

and temperature. As part of SWMP, every reserve has a weather station that collects data every 15 minutes on temperature, relative humidity, atmospheric pressure, rainfall, wind speed and direction. Several reserves are able to send real-time data as they are collected directly to Web sites on the Internet.

These data have already helped scientists gain a better understanding of how environmental conditions fluctuate in estuaries. The SWMP data have been used to detect conditions related to oyster diseases, measure the recovery of estuaries after hurricanes, and evaluate restoration projects in estuaries.

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