DISSOLVED OXYGEN DYNAMICS OF A COASTAL RHODE ISLAND SALT POND

Edward Callender, Salt Ponds Coalition and B. McArdle, College of Environmental and Life Sciences, University of Rhode Island
2 Schumann Road, Westerly, Rhode Island 02891

ABSTRACT

Quonochontaug Pond is one of the largest and healthiest of the coastal salt ponds along the southeast Rhode Island shoreline. However, this pond exhibits significant dissolved oxygen (DO) depletion in the bottom waters of the western basin during the summer months. These DO depletions are caused by restricted circulation of well-oxygenated ocean water that flows through a narrow opening into the eastern basin. This opening, or breachway, `will probably be dredged in the late fall and early spring of 2008-2009 in order to increase the flux of oxygenated water to the western basin.

The purpose of this study was to assess the dissolved oxygen status of the water column in Quonochontaug Pond prior to dredging of the breachway. Weekly DO, temperature, and salinity profiles were measured at six stations; one in the east basin and five in the west basin, from the middle of May until the end of September 2007. Secchi disk transparency measurements were made weekly, as well. DO saturation of eastern basin waters fluctuated slightly from 100% in the late spring and early summer to 90% in the summer months. Eastern basin waters exchange with Atlantic Ocean water on every tidal cycle. Only warm water temperatures (up to 25^0C) and moderate plankton blooms (chlorophyll-a, 6 μg/l) in late July and August caused the DO saturation to decrease to 70%.

In the western basin of Quonochontaug Pond, where five stations were monitored weekly for water-quality profiles, the oxygen status is much different. Even in the deeper waters of a 4-meter channel that extends from the eastern basin all the way through most of the western basin, DO saturation decreases from 100% in June to 85% in July and August to 70% in September. At shallower stations, bottom water (2-2.5 m) DO saturation decreases from 100% in early summer to 50% in early fall. Bottom water DO saturations would probably have decreased to even lower values if there had been more rain during the study period because freshwater inputs cause more intense water-column stratification.

The persistent dissolved oxygen depletion in the bottom waters of the western basin of Quonochontaug Pond is caused by circulation patterns within the pond. Eastern basin and channel waters of the southern part of the western basin receive a substantial flux of well-oxygenated ocean water during every flood cycle. However, this water does not reach the shallower areas in the western basin before the tide turns to ebb. Thus, the water column in these shallower areas becomes somewhat stagnated and aquatic biogeochemical processes such as respiration and oxidation of particulate organic matter tend to reduce dissolved oxygen levels.

KEYWORDS: Coastal Salt Ponds, Dissolved Oxygen, Biogeochemical Processes