

Maine Coastal Observing Alliance

Fact Sheet: Dissolved Oxygen



Why do we monitor dissolved oxygen?



Most estuarine and marine organisms require adequate oxygen and this measurement tells us how much oxygen is available for marine life. Tolerance of low oxygen or hypoxia, varies from species to species. Many animals experience chronic effects such as slow growth and low survival of larval forms at dissolved oxygen levels below 80%. Below 60% oxygen adult organisms begin to die. If organisms are stressed from low oxygen, or die, this can have a cascading effect through the ecosystem. Dissolved oxygen measurements give us insight into estuarine health.

Dissolved Oxygen at Depth, in the Mouths of Estuaries

MCOA conducts water quality monitoring within estuaries and bays throughout midcoast Maine at a minimum of four times per year between August and October. MCOA data is collected according to a Quality Assurance Project Plan. Monitoring is focused on projected worst-case conditions of late summer, when the water temperatures are highest, biological activity is greatest, and low pH and dissolved oxygen are most likely to occur.

The monitoring is spatially spread out over each estuary, or bay, and is temporally tide – and daylight – dependent. Monitoring begins around the high tide, moving upriver against an outgoing tide where applicable. Occasionally, low tide monitoring is conducted for comparative purposes. MCOA sampling stations are spread out from Belfast Bay to Harraseeket Bay.

In the MCOA program, dissolved oxygen is measured with sensors that are lowered into the water column with a cable. The output was measured as a concentration and reported both as DO% and as mg/l.

Understanding the Graphs

Because the monitoring station depths vary considerably, the lowest point at which we can measure dissolved oxygen also varies. Dissolved oxygen readings were averaged below the depths at right to produce the data for the graphs.

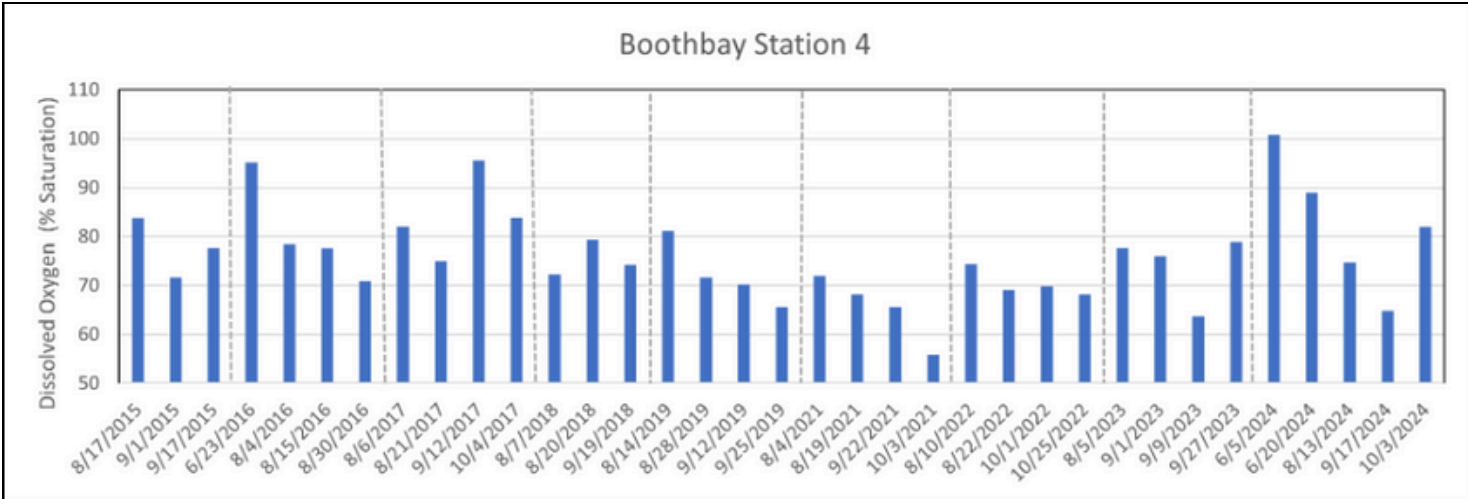
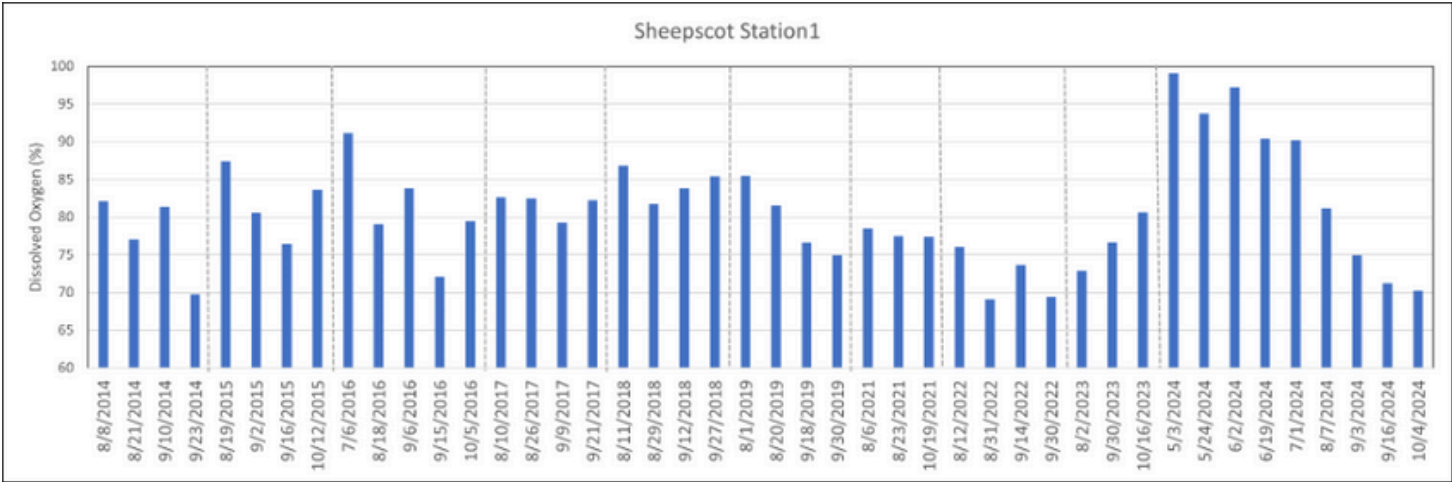
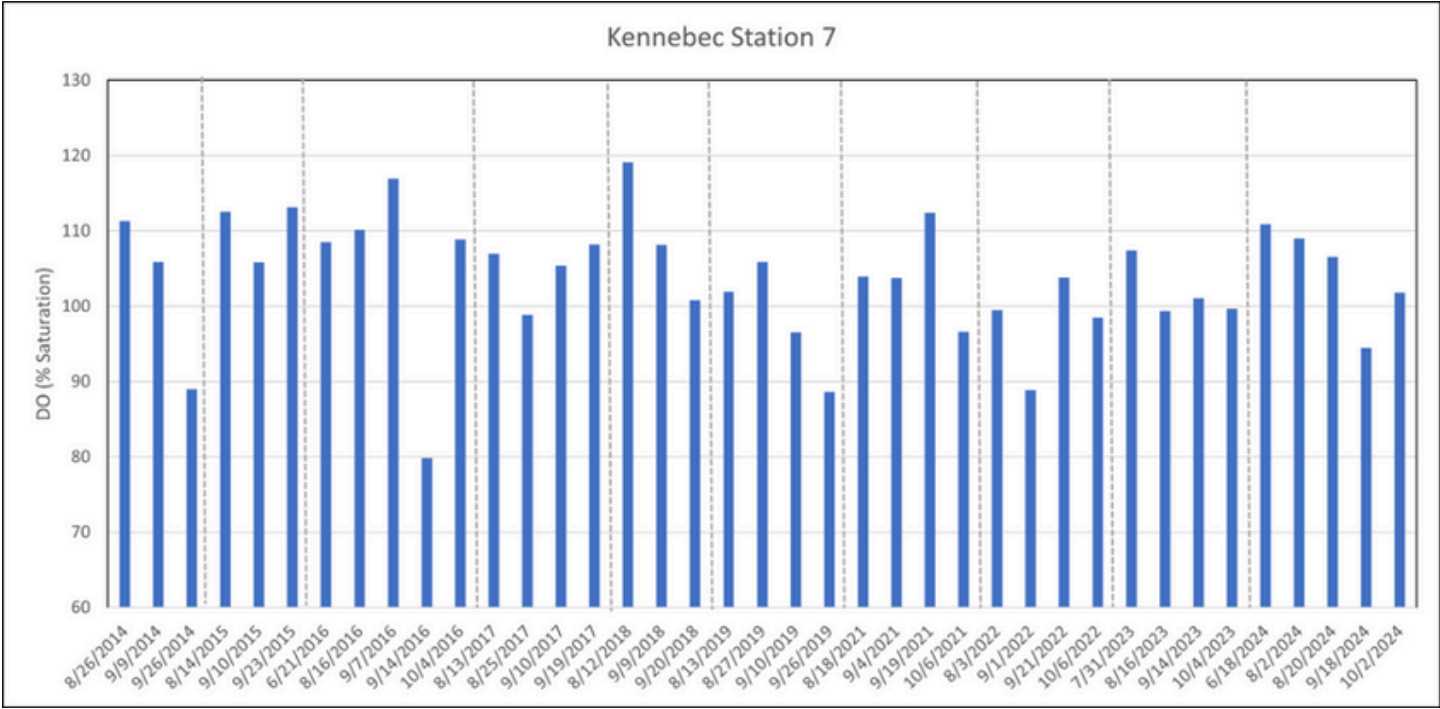
Dates are shown across the x-axis while the y-axis indicates the percent dissolved oxygen. Note that the y-axis scale varies from one graph to another. The stations chosen for these graphs are located at the mouths of the estuaries because we have seen indications that sometimes, in the late summer, there are areas of depleted oxygen in the mouths of these estuaries. The graphs are arranged from southwest to northeast. In the Boothbay region Station 4 is at the mouth of Linekin Bay and in Belfast Bay Station 5 is most oceanward site.

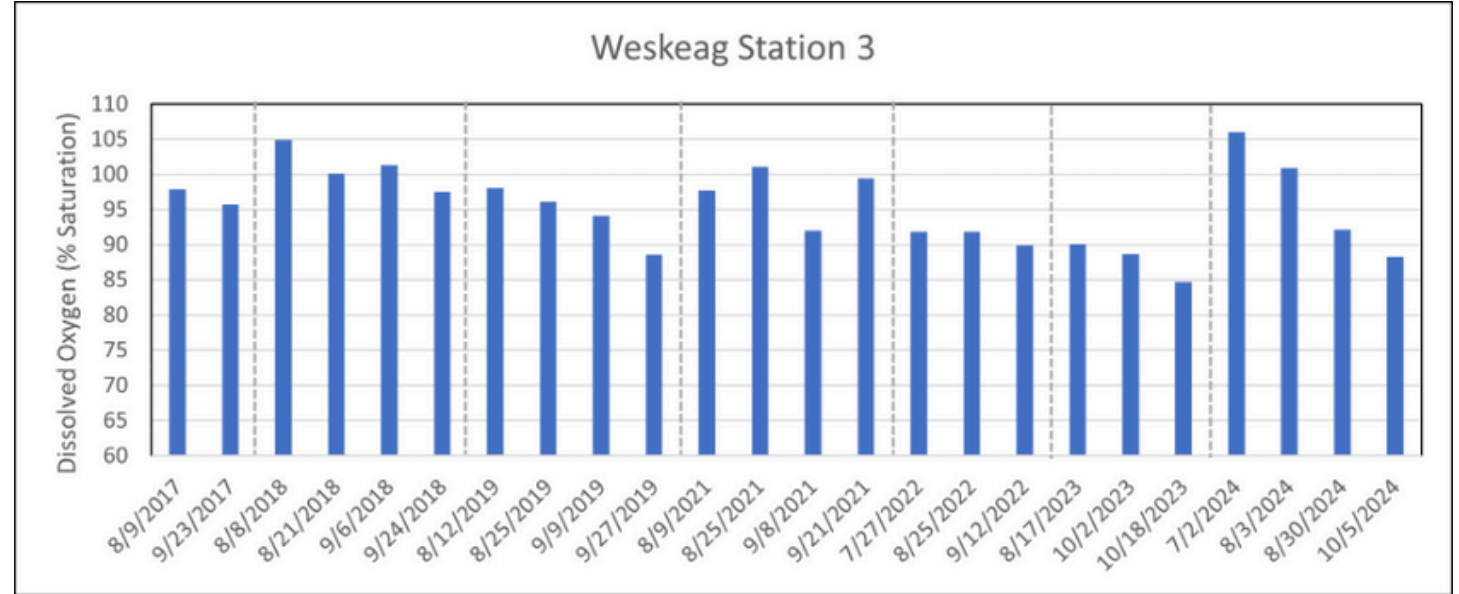
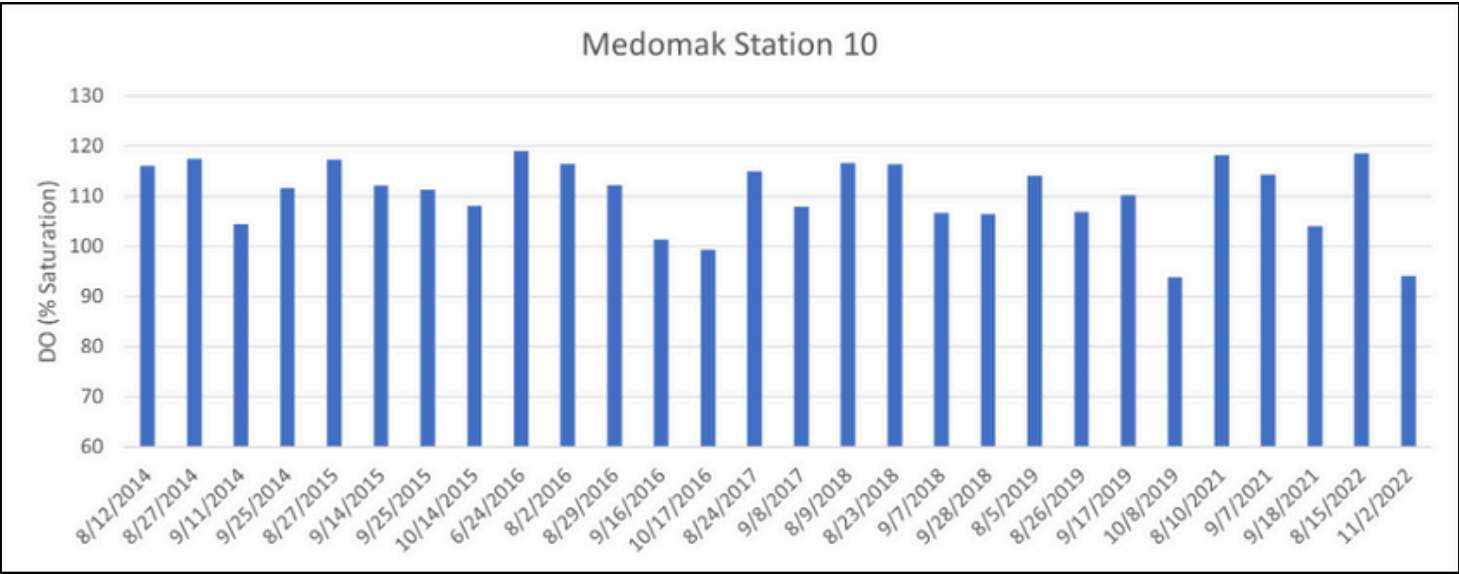
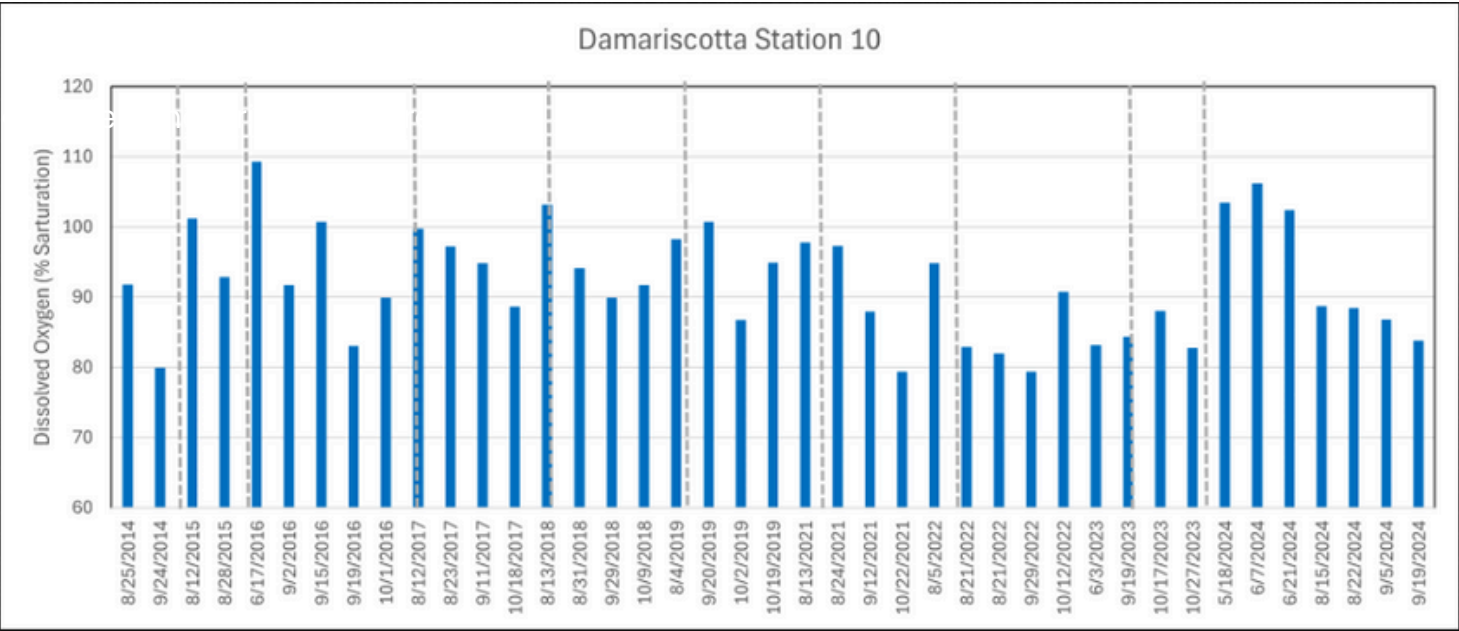
The chart to the right lists the depths below which dissolved oxygen measurements were taken for the following graphs. We are interested in the oxygen levels at these depths where the water can become stratified in the late summer. Note that the Sheepscot station is particularly deep and our cable is not long enough to approach the bottom.

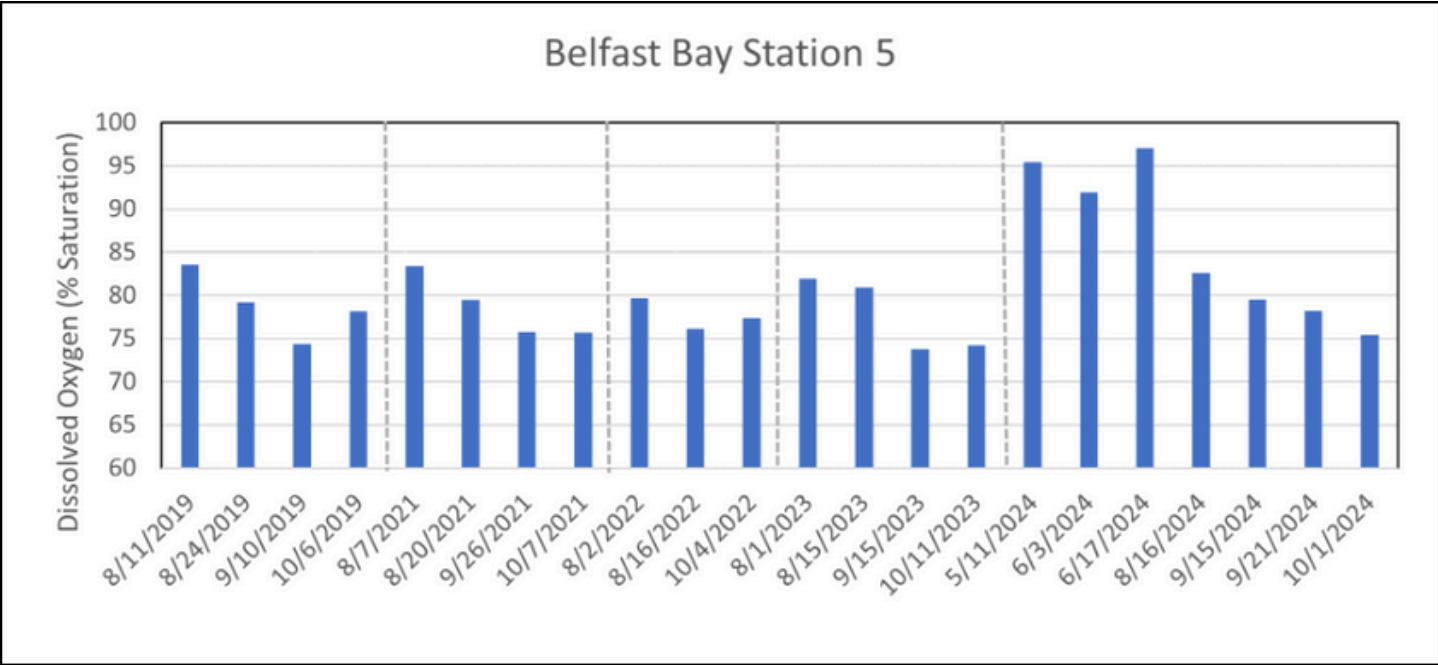
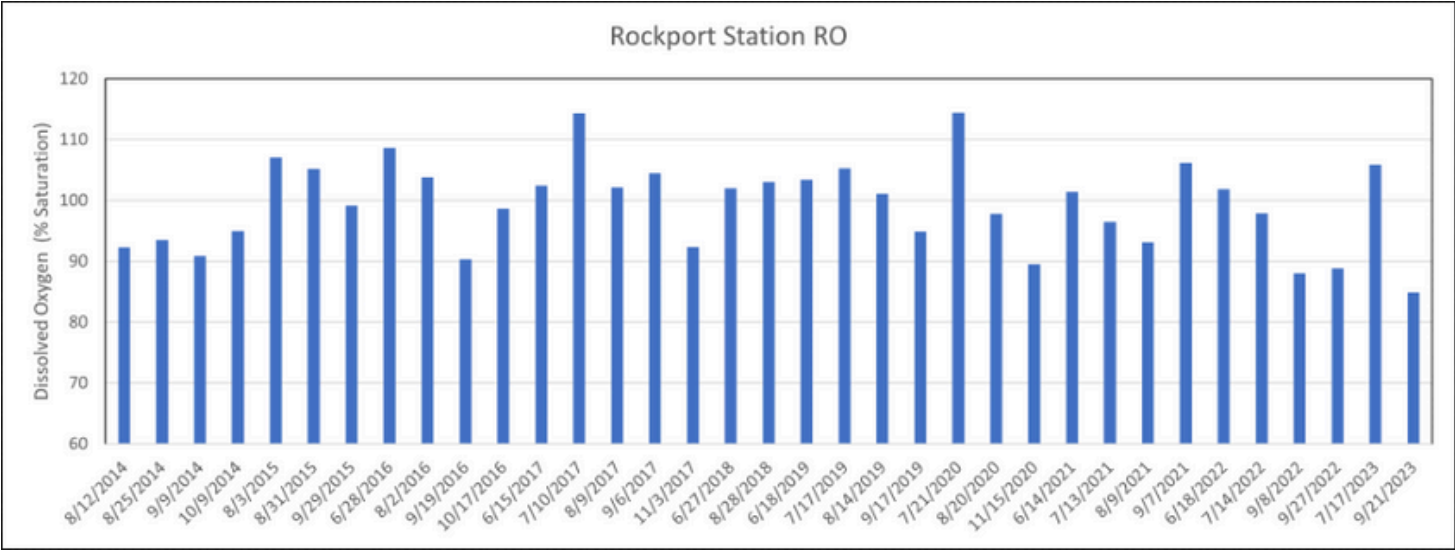
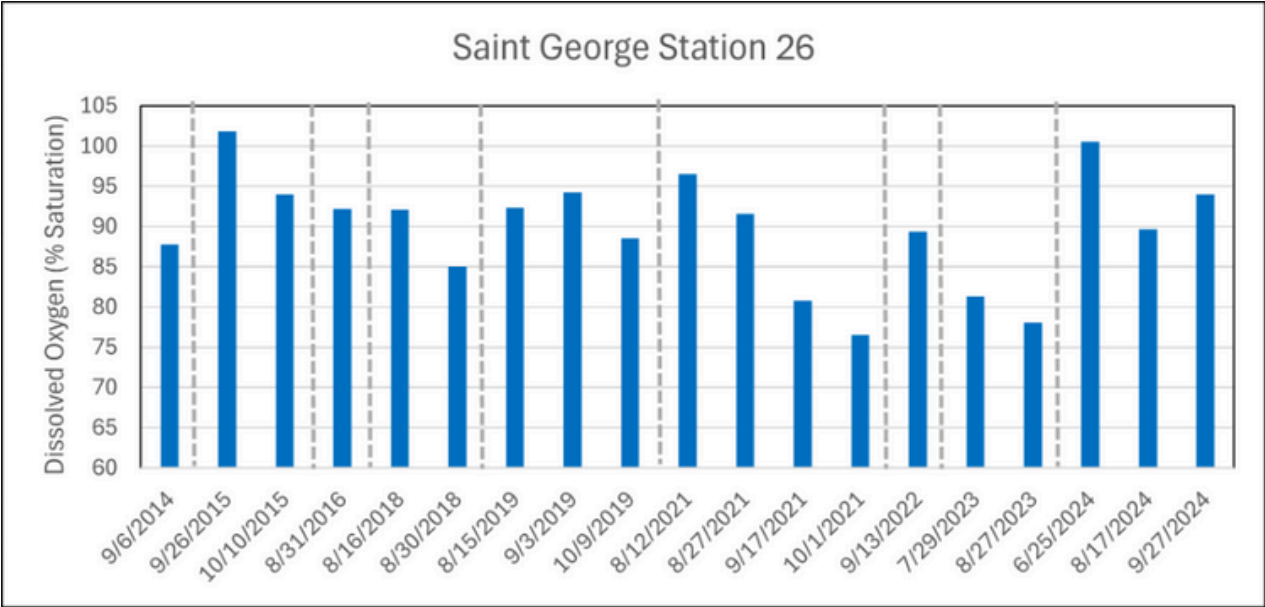
The following graphs shows dissolved oxygen, at the mouths of the estuarine rivers, at depth, over the past 10 years.



Coastal Region	Depth below which Dissolved Oxygen Measurements were averaged
Harraseeket	10 meters
Kennebec	10 meters
Sheepscot	20 meters
Boothbay	15 meters
Damariscotta	20 meters
Medomak	15 meters
Weskeg	15 meters
St. George	15 meters
Rockport	10 meters
Belfast	15 meters







Summary

In years where estuaries were sampled in the spring; 2016, 2023 and 2024, dissolved oxygen concentrations were generally higher than in August through October. Low dissolved oxygen is evident in some estuaries in late August, September and October with most estuaries showing recovery of oxygen levels in October. In late summer and fall, estuarine waters can become stratified trapping a layer of water with depleted oxygen on the bottom of the water column. The reasons for variations from one year to the next and from one estuary to another, have yet to be fully understood and warrant further analysis.

Interestingly, the Belfast and Boothbay stations exhibit a high percentage (68% and 74% respectively) of days with dissolved oxygen below 80 percent. While some areas, like the Weskeag, never dip below 80% dissolved oxygen. Certainly this is related to the bathymetry of the coastal areas and also the impacts of upwelling and oceanic influences. There is tremendous variation from one estuary to another throughout the region.

In addition, most – though not all – estuaries and coastal areas have low dissolved oxygen events (lower than 80%) more frequently post 2020. That is to say, these low dissolved oxygen events seem to be occurring more frequently through this time series. However, some estuaries, like Rockport, do not exhibit low dissolved oxygen events.

MCOA Partners

Belfast Bay Watershed Coalition
Boothbay Region Land Trust
Coastal Rivers Conservation Trust
Friends of Casco Bay
Friends of the Weskeag
Georges River Land Trust
Kennebec Estuary Land Trust
Midcoast Conservancy
Rockport Conservation Commission

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