

Patterns of dissolved oxygen dynamics in a Pacific Northwest slough and tide channel.

Pacific Northwest (PNW) estuaries and tide channels are habitats or migratory corridors for societally prized salmonids. These fish have high oxygen requirements, and an adequate level of dissolved oxygen is considered an important gauge of a PNW water body's condition. We report on the patterns of oxygen concentration and the oxygen deficit (defined as the difference between the observed oxygen concentration and the oxygen concentration at 100% saturation) from two side channels of Oregon's Yaquina River. Datasondes that recorded temperature, salinity, and dissolved oxygen were deployed at these locations and collected readings at 15 minute intervals. One location was a large slough that remained flooded at low tide, and the second was a nearby tidal channel that dewatered at low tide. We examined these time series to identify the characteristic oxygen levels, along with the influence of seasonal, day/night, and tidal cycles on oxygen concentrations in the two channels. Patterns of oxygen levels were observed at annual to tidal time scales, and were similar at the two sites. Oxygen concentrations remained at levels ca. 9 to 11 mg/l during the months of November to May. In June through October the oxygen levels declined to ca. 6 to 9 mg/l and occasionally dropped to 4 mg/l. Oxygen levels were also notably much more variable during June through October. Spectral analysis indicated periodic patterns of dissolved oxygen concentration at time scales of roughly 6, 12, and 24 hours, consistent with the influence of the strong semidiurnal tide at the study site. The calculated oxygen deficit mirrored these patterns, rising at lower oxygen levels and showing variability comparable to that of oxygen. An analysis of the oxygen level's relationship to flooding or ebbing tides and day/night patterns showed that oxygen levels were independent of the tide during the night. However, during daylight the oxygen levels were lower during ebbing tides than flooding tides, indicating an import of oxygen from the main stem of the estuary during daylight. Our results also indicate that extended monitoring of oxygen levels in PNW channels needs to consider these long and short term patterns of oxygen concentration.