Daily Oxygen Fluctuations in Wequetequock Cove

By: Ryan Rubino & Elizabeth Karamavros

UCONN AVERY POINT

Background

Wequetequock Cove has become known because of it's poor water quality and overgrowth of *Cladophora*. In aquatic systems poor water quality is defined by low dissolved oxygen (DO) levels (CUSH, 2014). The amount of oxygen in the water is influenced by physical and biological processes. Physical processes being wind, flushing, sediment, rain, waves, and temperature. Fluctuations in oxygen concentration due to biological processes is due to photosynthesis and respiration. Photosynthesis is a metabolic process done by plants that produces oxygen during the day and takes up carbon dioxide. Respiration occurs when cells use oxygen and let out carbon dioxide. We focused on bacteria and zooplankton due to their consistent abundance in the area. Plants that we focused on were phytoplankton and *Cladophora*. When there are excess nutrients in the water, algal blooms occur. These respire at night and eventually decompose and reduce DO levels in the water column.

Objective

i. Examine the variation is daily dissolved oxygen values
ii. Determine the most influential physical factors affecting dissolved oxygen

Methods

1.Instruments were placed at the head of Wequetequock Cove.
2.Over a three week period wind, rain, solar radiation, and temperature data was recorded.
3.Dissolved Oxygen was recorded at 10 second interval
4.This data was transferred to a spread sheet, averaged, graphed & interpreted.

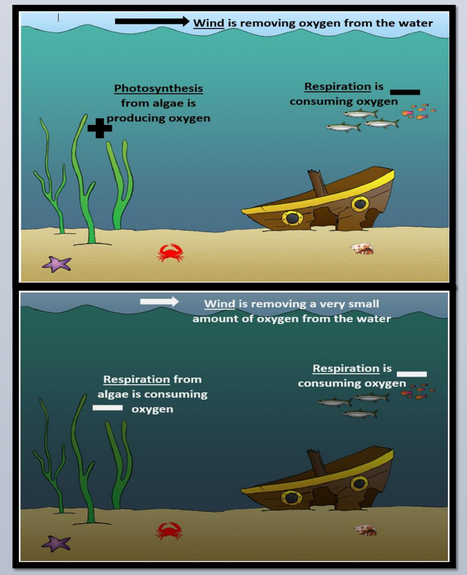

Figure 1: A schematic showing both physical and biological fluxes that influence the dissolved oxygen in an aquatic system during both day and night.

Oxygen Cycles in Wequetequock Cove

Results

- Dissolved oxygen increases during the day and decrease at night
- Presumably photosynthesis during the day time raises the dissolved oxygen whereas respiration consumes oxygen at night
- Wind is strongest during the day and weak at night
- Wind removes oxygen during the day and adds oxygen at night
- Low oxygen events correlate with rain storm events

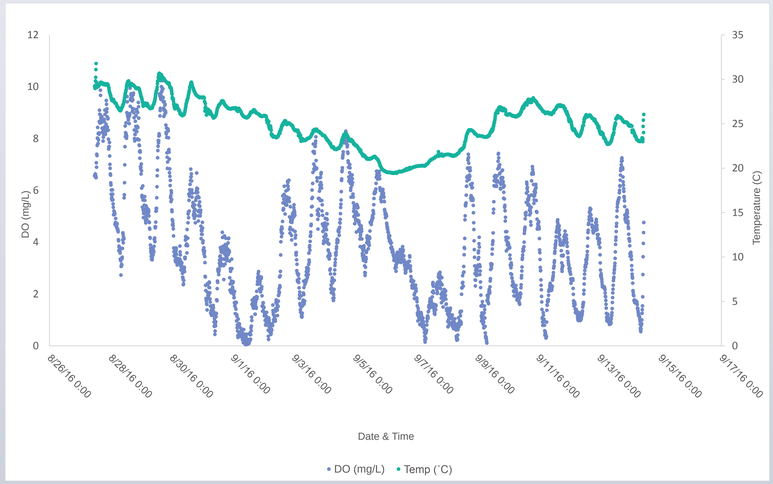

Figure 2: Showing the cycle of oxygen oscillating in a diel pattern (blue) over a three week period. Temperature (green) oscillates in unison with daily oxygen highs and lows.

Discussion

- Strong wind, during the day, causes dissolved oxygen levels in the water column to decrease due to wave disruption and over mixing of oxygen-producing organisms.
- Wind at night, which is lighter, increased the DO in the water column through bubble infusion, respiration rate is greater than the oxygen injection rate
- Rain, which is lighter & less dense than the saltwater, sits on the surface and causes stratification in the cove. This prevents mixing between the upper and lower layers of the water column.
- Rainfall makes water turbid, which leads to less light penetrating the water's surface and this allows less photosynthesis to happen.
- Rain most likely brings in organic matter from the rivers flowing into the cove and this increases the respiration rate in the water. Bacteria consuming this organic matter respires and uses up the oxygen in the water column.
- Temperature did not explain day to day oxygen variations.

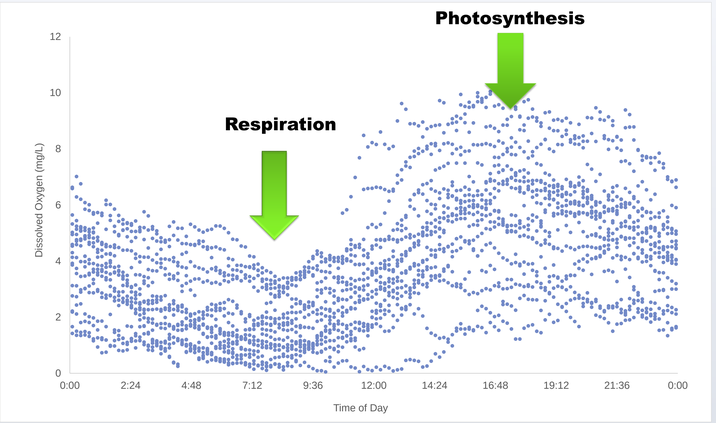

Figure 3: The measured dissolved oxygen concentrations (mg/l) over a 24 hour period. It shows that the values are high during the day and are low during the night and early morning.

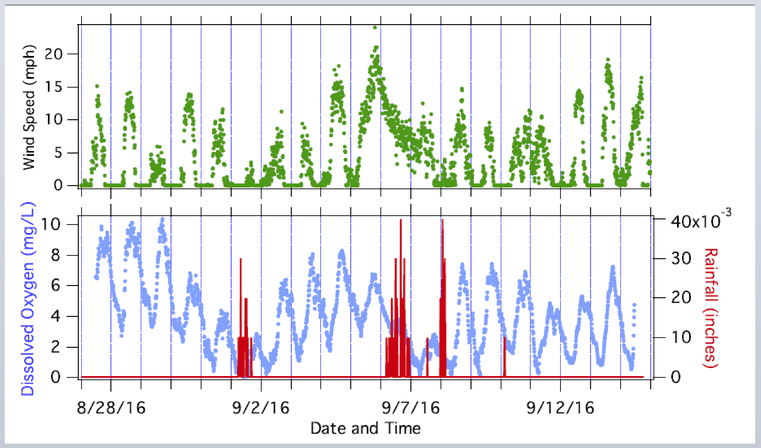

Figure 4 (a,b, & c): Showing the dissolved oxygen (mg/L) (blue), wind speed (mph) (green) and rainfall (inches) (red) over the three week sampling period. All three graphs start and end on the same date and time. The graphs show the influence the individual variables have on dissolved oxygen levels in Wequetequock Cove.

References

CUSH. (2014). *Water Quality in four Estuaries: in Coastal Stonington &Mystic, CT 2008 – 2013.* Clean up Sound and Harbors. www.cushinc.org