Influence of dissolved organic matter on declining oyster populations in the Western Mississippi Sound

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Oyster reefs in the Mississippi Sound depend on the salinity moderation provided by freshwater. Unfortunately, freshwater also brings in high amount of pollutants affecting the oysters negatively. Oyster diebacks happened as a result of hypoxia caused by excessive organic matter input to the Western Mississippi Sound (WMS) in 2017. The main objective of this study was to evaluate and understand the influence of dissolved organic matter (DOM) and its distribution on the oyster populations in WMS. Water samples from 52 sites were collected from three depths including surface, mid-depth, and bottom waters in the months of March, May, June, July, and December 2018 from over the Henderson Point and Pass Christian Oyster Reefs in WMS. The collected samples were analysed for dissolved organic carbon (DOC), cholorophyll *a*, dissolved inorganic carbon (DIC), colored dissolved organic matter (CDOM), and nutrients including PO_4^{3-} and NO^{3-}. Additionally, a Hanna multiparameter probe was used to measure the profiles of salinity, dissolved oxygen (DO), pH, and temperature at each site. The measured DOC, DIC, CDOM, salinity, and total alkalinity (TA) showed average values of 4.31±0.46 mg/l (n=29), 916.2±289.9 µM/kg (n=52), 0.0102±0.0049 m-1 (n=45), 11.68±4.70 psu (n=52), and 1256.5±358.3 µM/kg (n=52), respectively. Salinity concentrations showed a strong linear relationship with DOC (r = 0.85) and TA (r = 0.96) suggesting a conservative mixing. Additionally, DOC showed a significant negative correlation with DIC (r = 0.84), which indicates photochemical oxidation and biodegradation of DOC. Seasonal analysis of all these parameters indicated that freshwater input increased DOC, and photo- and bio-degradation of DOC produced DIC. Production of DIC decreased the DO concentrations and pH. Highest DIC and lowest DOC, DO, and pH was observed in the bottom waters. Hypoxia was observed in March, 2018 in the bottom waters with DO of 0.42±0.031 mg/l. At the same time, highest DOC (4.93±0.174 mg/l) and lowest DIC (662±77 µM/kg) and pH (7.55±0.136) was observed in the surface waters. At other times, hypoxia was not observed. Thus, DOM influences the biogeochemistry and oyster populations significantly.