Assessing the Potential Effects of Channel Deepening on Oyster Restoration in the Hudson River Estuary

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Introduction

- The Hudson River Estuary (HRE), located within the New York/New Jersey area, historically maintained high population densities of the Eastern oyster, *Crassostrea virginica*
- Oyster populations in the HRE declined drastically during the late 19th and early 20th centuries due to overharvesting and poor water quality
- Recently, efforts by the Hudson River Foundation and others were undertaken to restore oyster populations, in part to improve water quality within the HRE
- One potential obstacle to oyster restoration is channel deepening (harbor dredging), which is projected to change the salinity gradient within the HRE

To understand how salinity could affect oyster restoration in the HRE, we carried out a modeling study focusing on the growth rate of a single hypothetical oyster using environmental data collected by Grizzle et al. (2012).

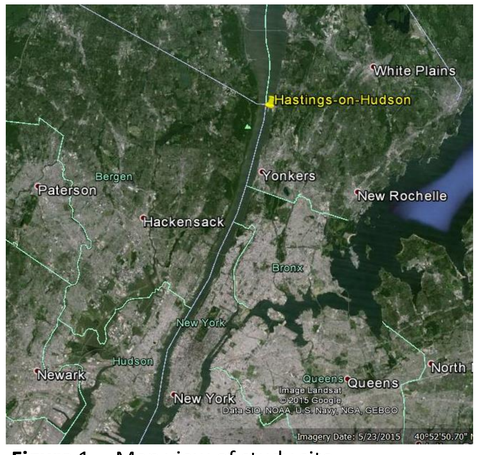


Figure 1 -- Map view of study site

Methods

Study Area

- The study focuses on Hastings-on-Hudson, a small area within the HRE in Westchester County **(Figure 1).** This location was chosen because it was identified by numerous restoration reports as a site with high potential for reef restoration
- Hastings-on-Hudson is characterized by low salinity concentrations which frequently drop to zero

Data Collection

- Environmental data was collected at Hastings-on-Hudson by Grizzle et al. (2012) from May 2011 to August 2011
- Hourly measurements of salinity, temperature, turbidity, chlorophyll were recorded

Post-settlement Oyster Model

- The model is an adaptation of the oyster growth model developed by Powell et al. (1992) (**Figure 2**)
- Net production was calculated to determine oyster growth using the data from May to August 2011 in terms of mg dry weight/oyster/day

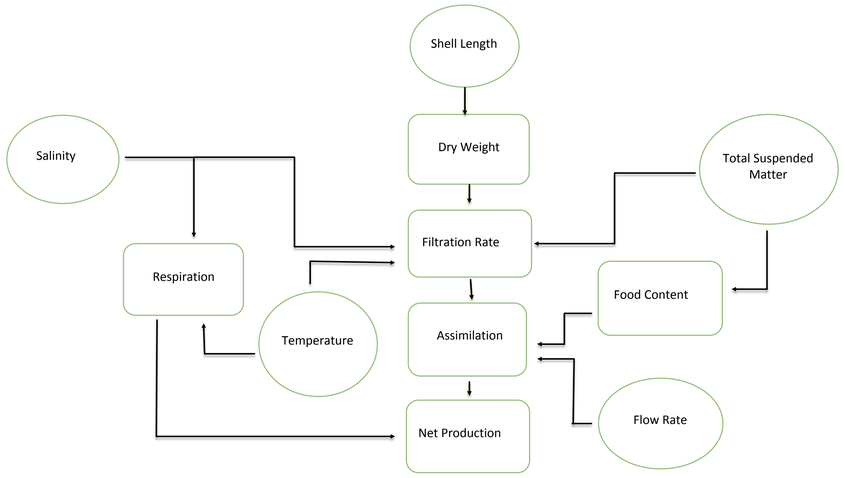
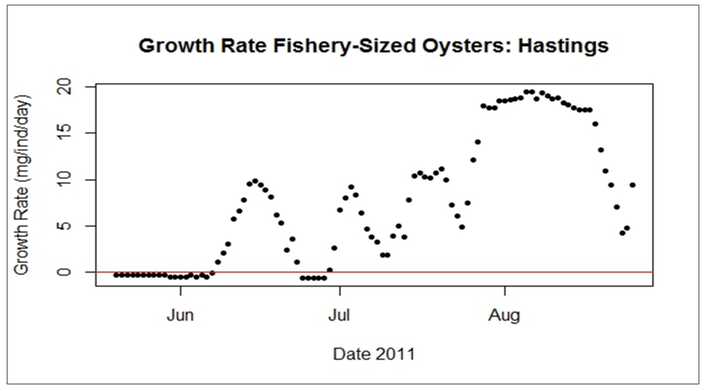
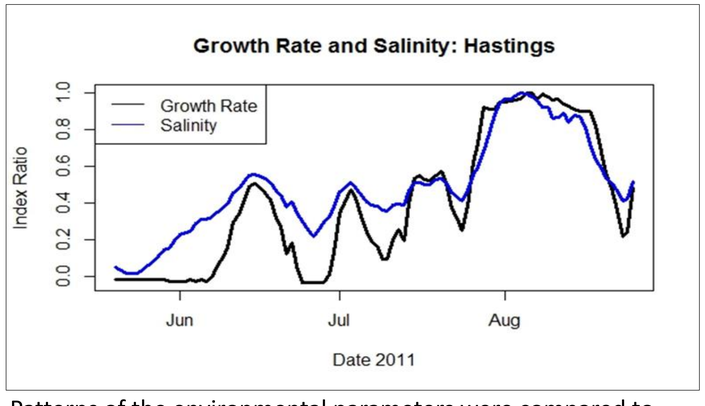


Figure 2 -- Schematic of post-settlement oyster model adaptation

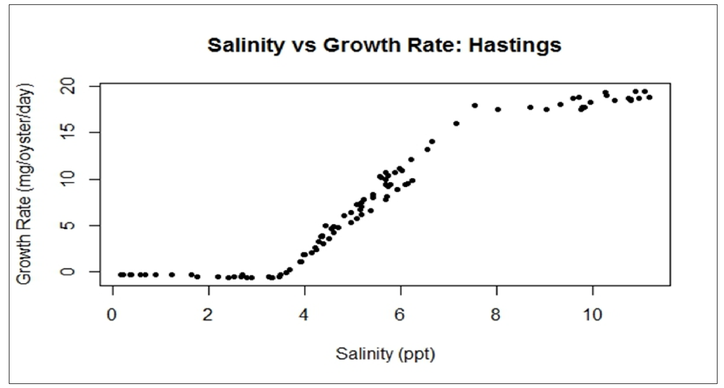
Results



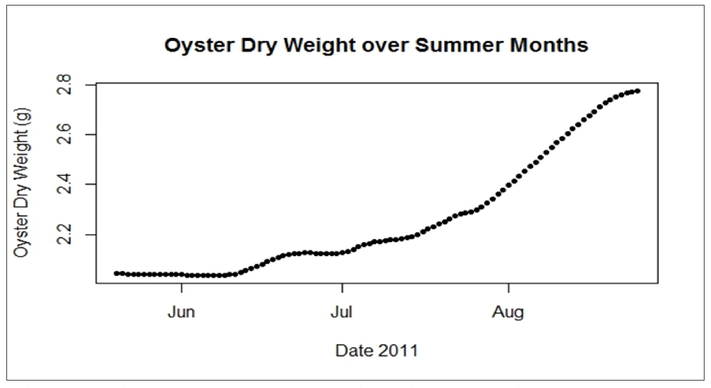
A pattern of alternating high and low growth patterns were observed, where growth would increase on two week time scales



Patterns of the environmental parameters were compared to the growth pattern seen. The oyster growth rate closely tracks the pattern seen in the salinity level.



Growth rate was plotted against salinity to determine how growth rate was changing with salinity



The growth rates were converted to changes in biomass. The simulations showed an increase of 0.7 g dry weight during the summer of 2011.

Discussion and Conclusion

- Through these simulations, it was possible to examine the relationship between oyster growth at Hastings-on-Hudson and salinity, showing that low salinity levels resulted in possible loss in biomass
- The rise and fall of the growth rates can be explained by the tidal patterns within the HRE
- Because Hastings-on-Hudson is a low salinity area, it is inferred that an increase in salinity levels due to channel dredging may increase oyster productivity in the area
- Further research would involve incorporating output from a hydrodynamic model to track changes in oyster productivity in an environment pre- and post-dredging and linking the individual growth model to a population growth model to track the growth patterns of an entire reef.