The Effect of Nutrient Removal Credits on the Commercial Viability of Oyster Aquaculture in Chesapeake Bay

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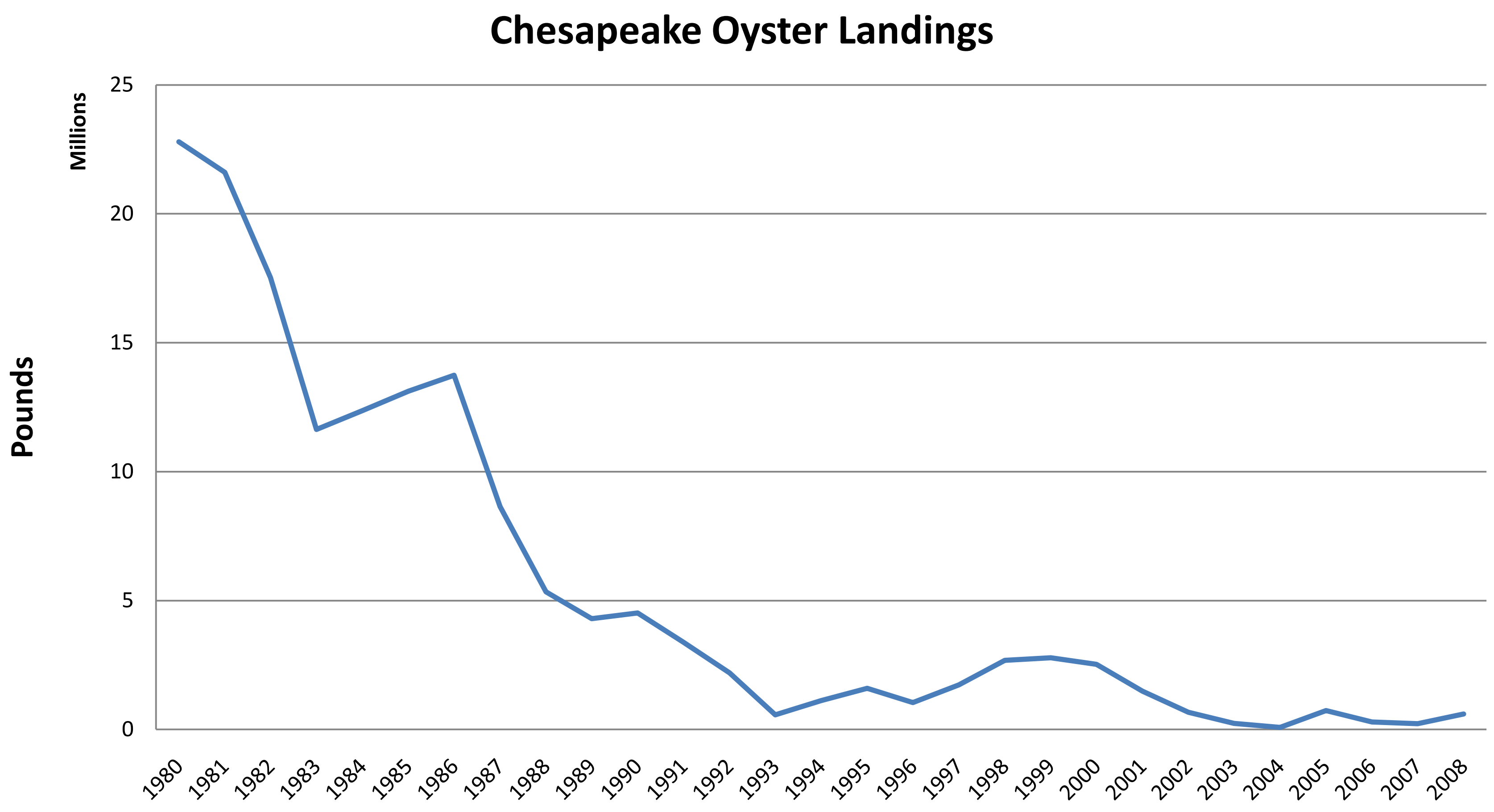
Maryland Aquaculture Conference
November 10, 2010

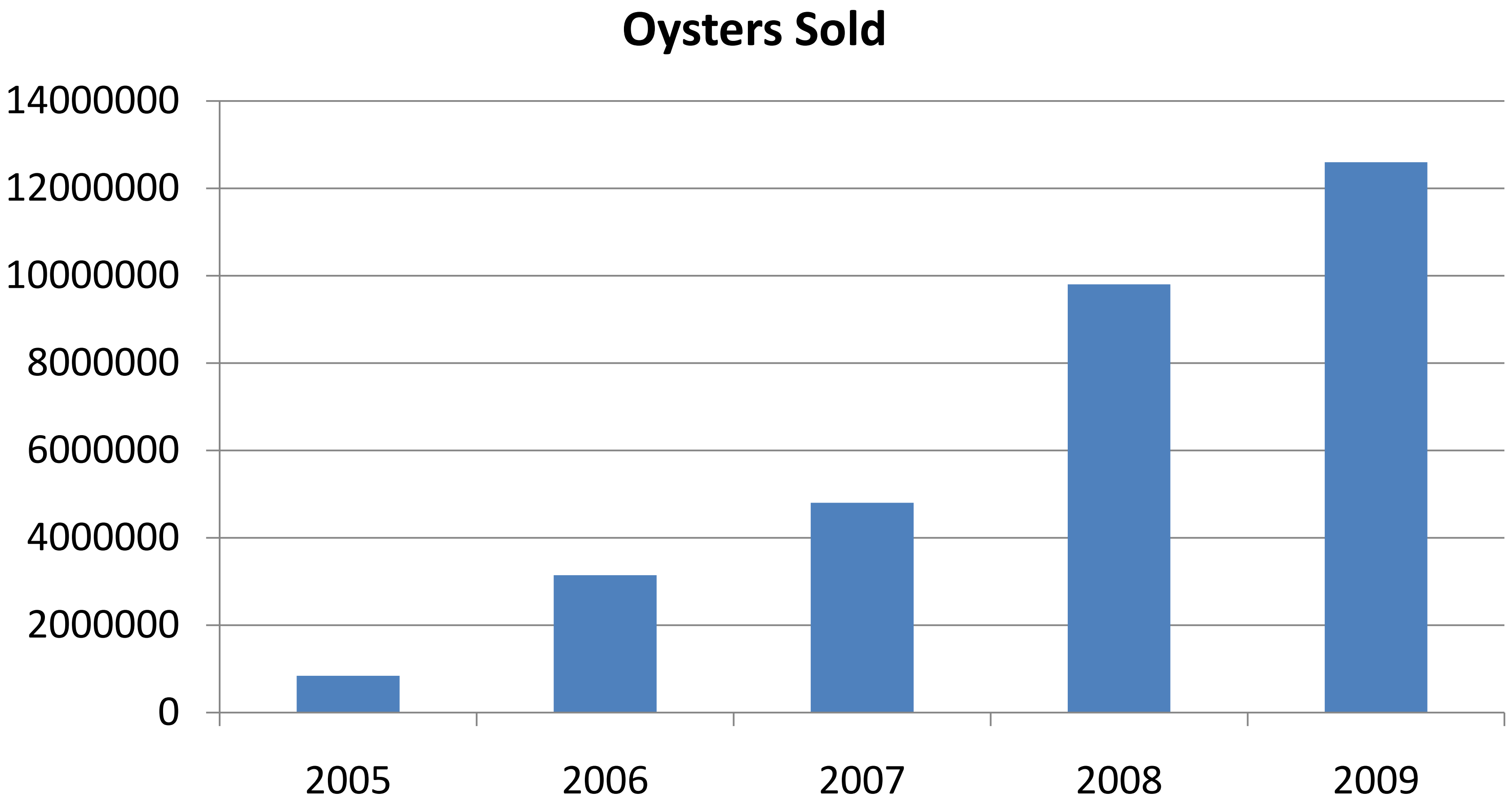
Outline

- Oyster aquaculture in Chesapeake Bay
- Eutrophication in Chesapeake Bay
- Nutrient Reduction Approach
  - TMDL's
  - Nutrient Trading
- Oyster farm financial simulations
  - Baseline
  - With nutrient credits
- Policy Implications

Chesapeake Bay Oyster Production
A Familiar Story



Virginia Aquacultured Oyster Harvest (2005-2009)

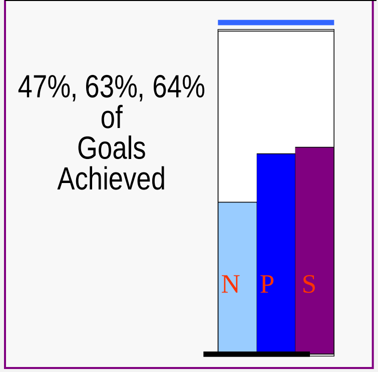


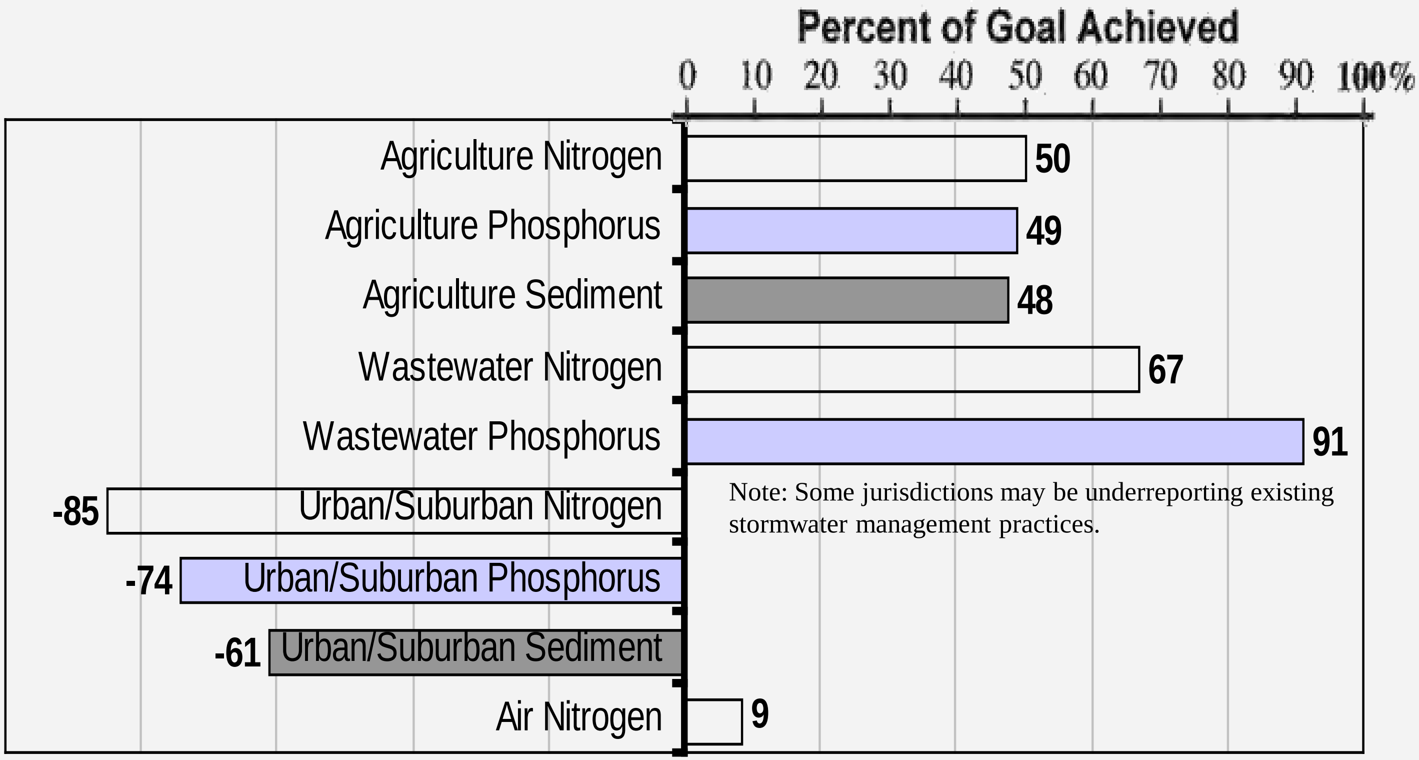
Source: Virginia Sea Grant ,2009

Chesapeake Bay Nutrient Reduction

Priority Area

Reducing Pollution





Data and Methods: www.chesapeakebay.net/status_reducingpollution.aspx

Draft CB TMDL on Nutrient Trading

- **10.2 Water Quality Trading**
  - EPA recognizes that a number of Bay jurisdictions already are implementing water quality trading programs. EPA supports implementation of the Bay TMDL through such programs, as long as they are established and implemented in a manner consistent with the CWA, its implementing regulations, and EPA's 2003 *Water Quality Trading Policy1 and 2007 Water Quality Trading Toolkit for NPDES Permit Writers.*

Draft CB TMDL on Filter Feeders

- **10.7 Filter Feeders**
  - Filter feeders play an important role in the uptake of nitrogen and phosphorus from the Chesapeake Bay
  - and have the potential significantly improve water quality if present in large numbers
  - The organisms of interest for their ability to improve water quality are the native Eastern oyster, *Crassostrea virginica, and menhaden fish, Brevoortia tyrannus.*

  - EPA is basing the TMDL on the current assimilative capacity of filter feeders at existing populations
  - if reductions in future filter feeder populations are observed that result in reduced nutrient assimilation, the 2-year milestone delivered load reductions can be adjusted to account for the change.

Methodology

1. Develop Baseline Indicators of Financial Performance

2. Apply Credits for Nutrient Removal

3. Examine Change in Financial Performance

Baseline Performance

- Monte Carlo Simulations
  – Probability distribution of key parameters
  – Model is run 1,000 times
- Ten- Year Timeframe
- Firm Survival
  – % of firms that remain financial viable at end of time frame
- Net Present Value
  – Discounted sum of net returns over ten years

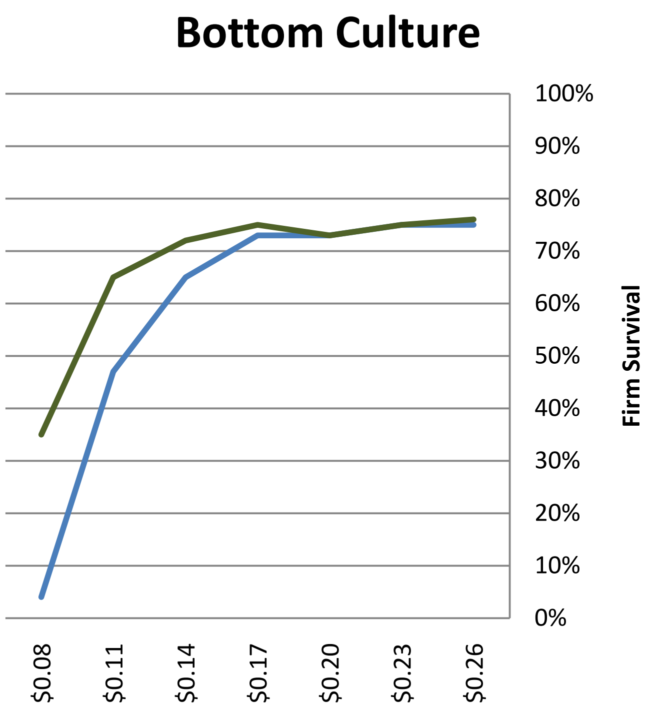
Nutrient Credits

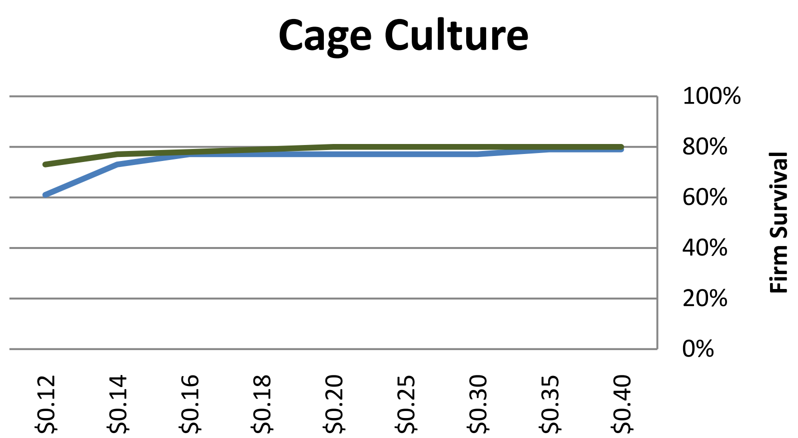
- Nutrient net removal rates based on literature values (e.g. Newell et al. various years; Cerco and Noel 2005; etc.Paynter et al. 2010)
  - In situ nutrient sequestration
  - Removal due to harvest
- Potential value of nutrient credits

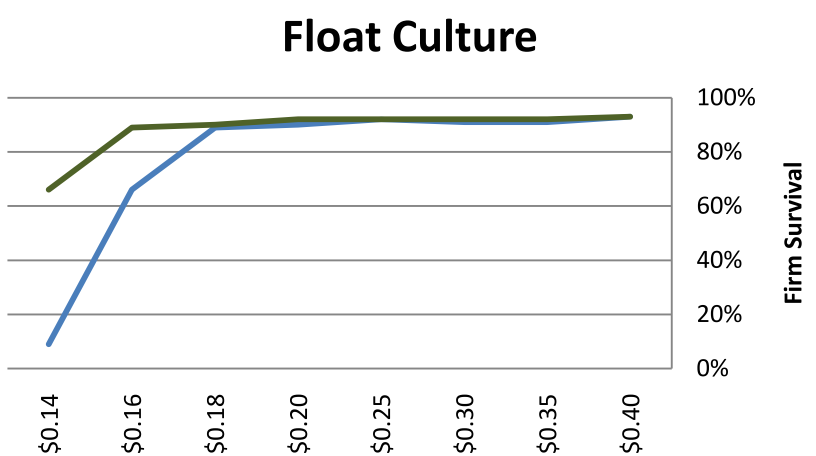
Range of Values Per Oyster for Nutrient Credits

Bottom Culture	Denitrified & buried Nitrogen (mg/oysters)	Nitrogen removed in shell & body (mg/oysters)	lbs nitrogen removed per oysters	Credit generated at $3.68/lb nitrogen	Credit generated at $10/lb. nitrogen
Minimum	104	216	0.00071	**$0.003**	**$0.007**
Maximum	723	216	0.00207	**$0.008**	**$0.021**
Average	328	216	0.00120	**$0.004**	**$0.012**
Cage Culture					
Minimum	58	216	0.00061	**$0.002**	**$0.006**
Maximum	442	216	0.00145	**$0.005**	**$0.015**
Average	222	216	0.00097	**$0.004**	**$0.010**
Surface Culture					
Minimum	72	216	0.00064	**$0.002**	**$0.006**
Maximum	544	216	0.00168	**$0.006**	**$0.017**
Average	269	216	0.00107	**$0.004**	**$0.011**

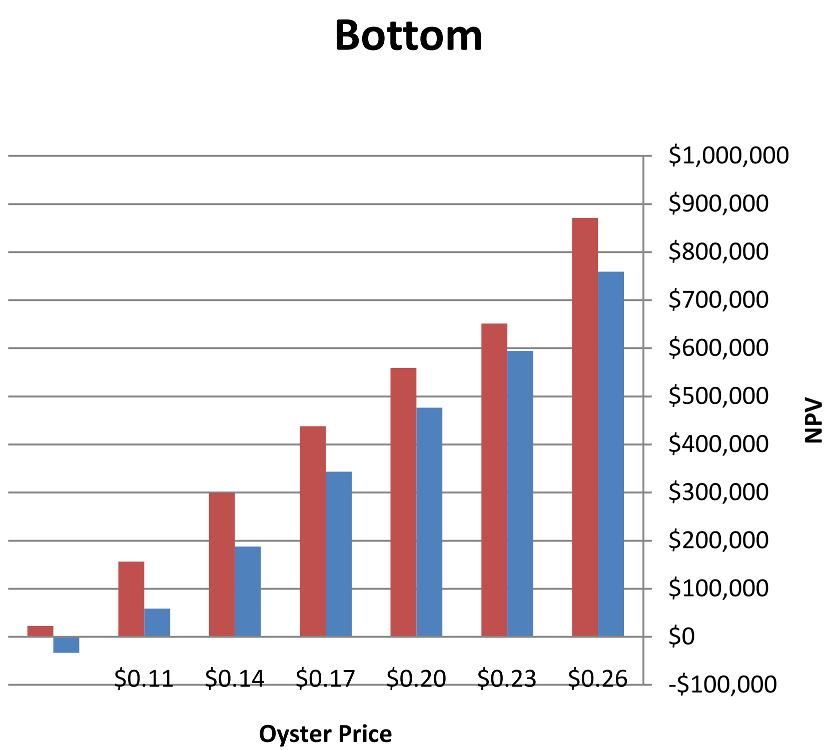
Firm Survival

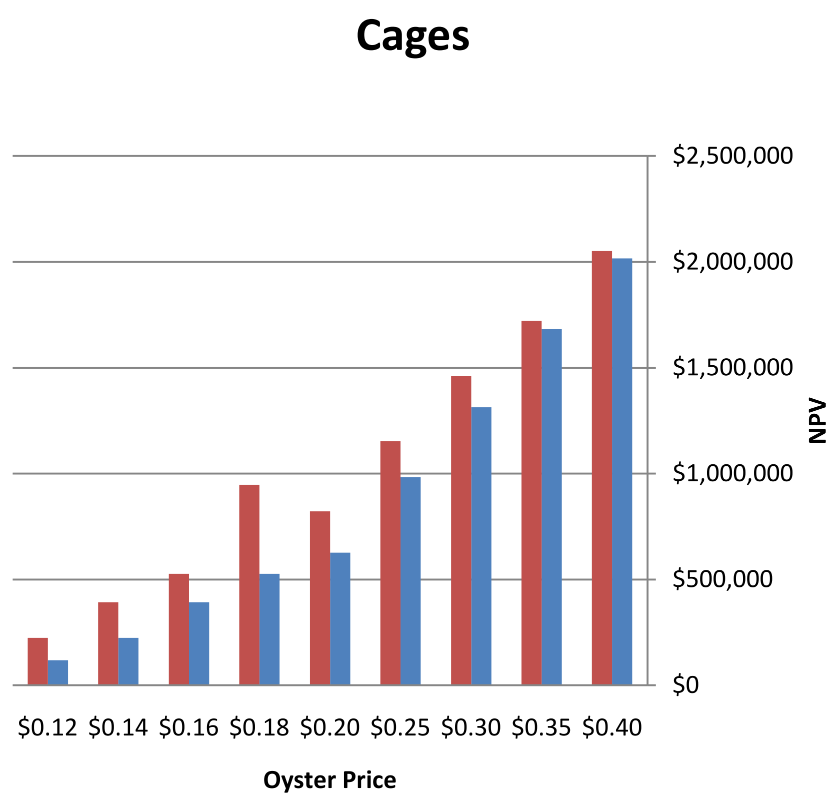






Net Present Value Change Due to Nutrient Credits





Summary & Conclusions

1. We make no assessment about the ability to meet CB water quality goals by increasing shellfish aquaculture
2. The science of net nutrient removal by oysters in Chesapeake Bay while limited, is as strong or stronger than many of the credits being applied for agricultural and other BMP’s
3. Payment to oyster growers for nutrient removal credits has the potential to reduce financial risk and increase returns in this newly forming industry in CB.
4. The impacts of firm survival are at the low end of the price range
5. Assumed linear growth, if growth is non-linear (e.g., logarithmic) nutrient removal credits would be higher in all systems
6. Small impact on firm survival, but could lead to major increase in NPV of firms that do survive.
7. Mechanisms to create a market for nutrient credits to oyster growers may be hindered by legal interpretation of the current regulatory structure because this is a post-discharge treatment

Questions?

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