

Ecosystem services of restored oyster reefs in lower Chesapeake Bay



Investigators:

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Locations



Great Wicomico

Piankatank?

Lafayette River

Lynnhaven

Objectives



- Determine blue crab and finfish utilization of oyster reefs in relation to reef characteristics, environmental conditions, geographic location
- Quantify secondary production by prey availability and predator gut contents
- Compare various geographical locations of the lower western shore of Chesapeake Bay
 - Great Wicomico River (GWR),
 - Lynnhaven River (LyR),
 - Lafayette River (LaR),
 - Piankatank River?



Advantages



- High spat settlement and survival on natural and artificial reefs
- Successful restoration effort
- Historical record of oyster reefs
- Complementary studies on water quality, hydrodynamics, metapopulation dynamics, nutrient availability, predation intensity, and habitat availability

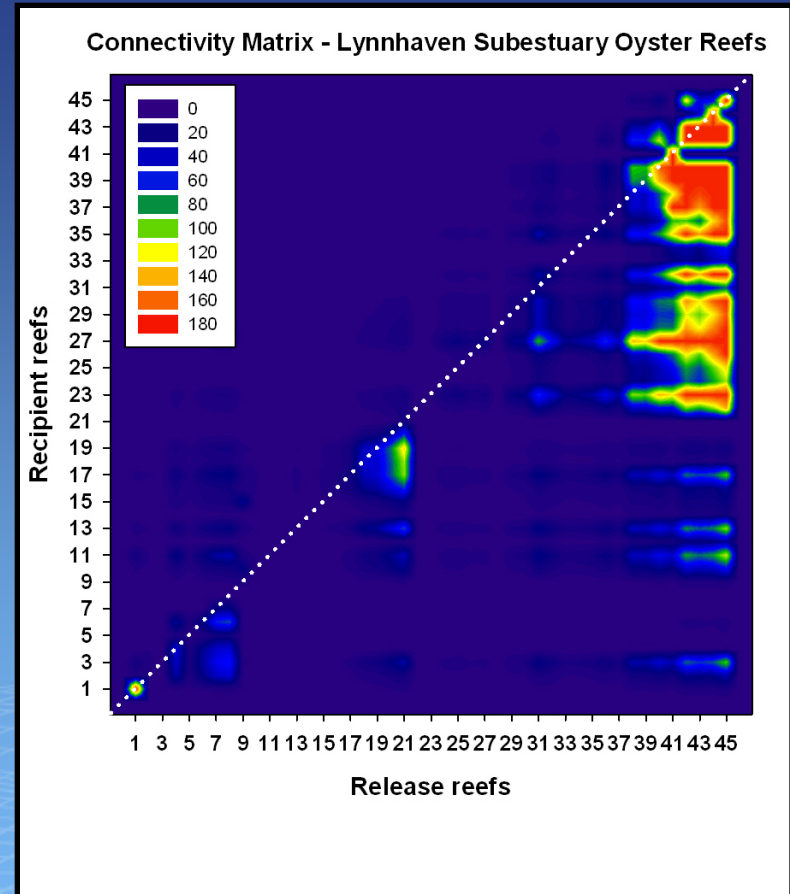
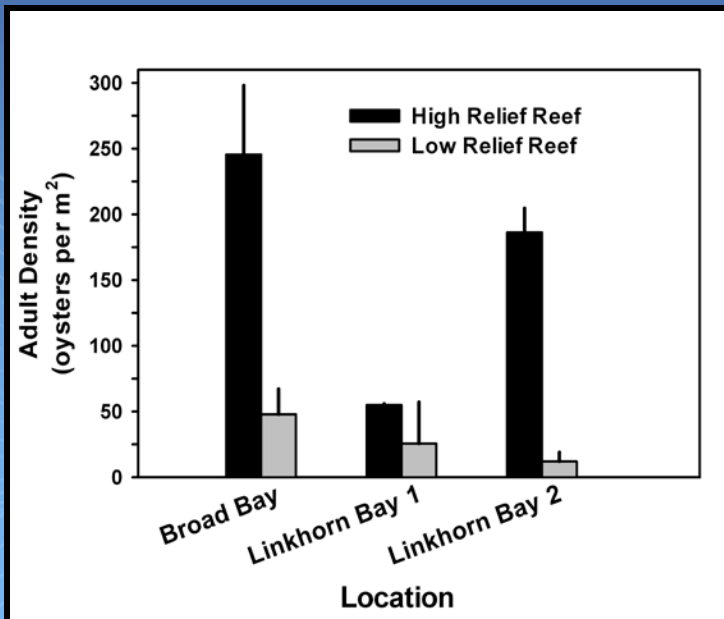




Advantages



- Variation in reef features (e.g. height)
- Hydrodynamic model and metapopulation dynamics



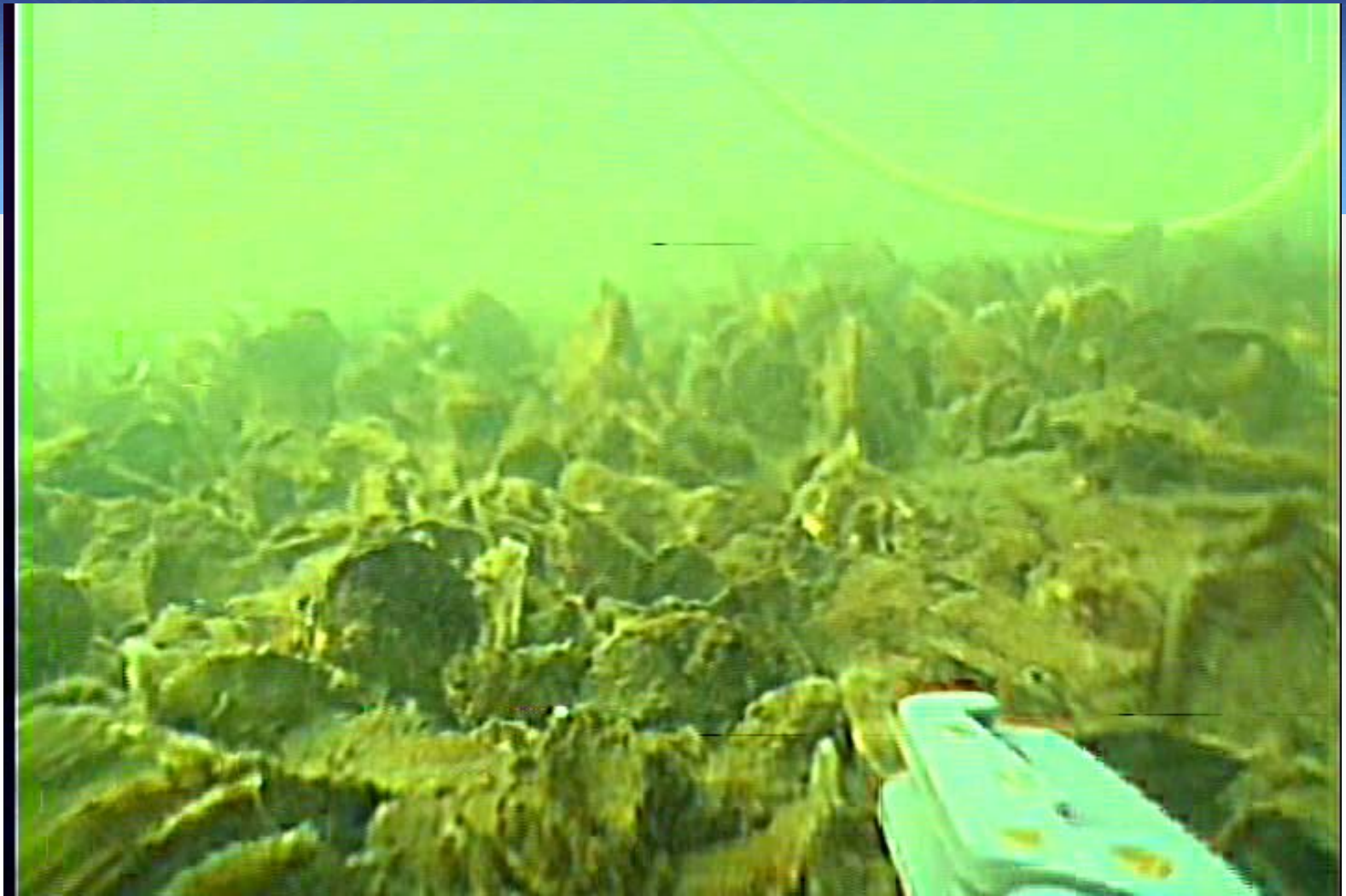


Low-Relief Reefs





High-Relief Reefs

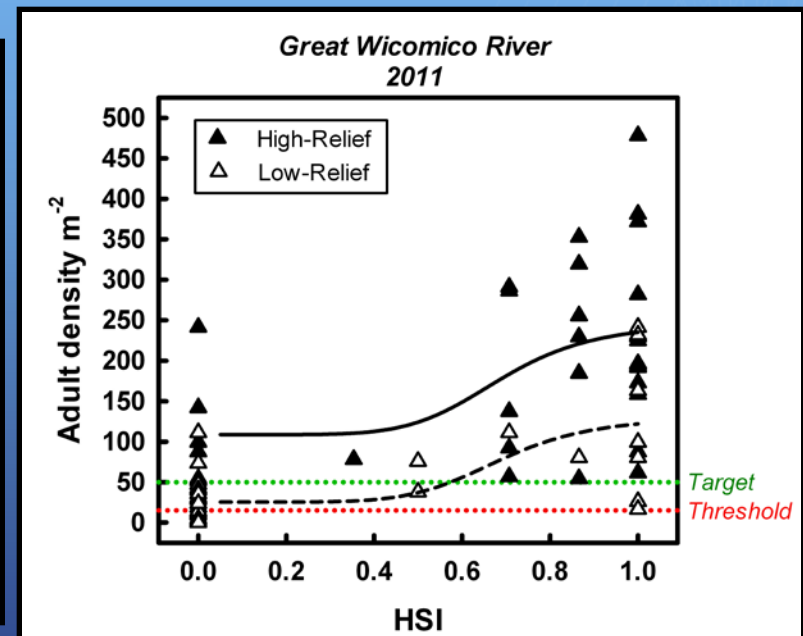
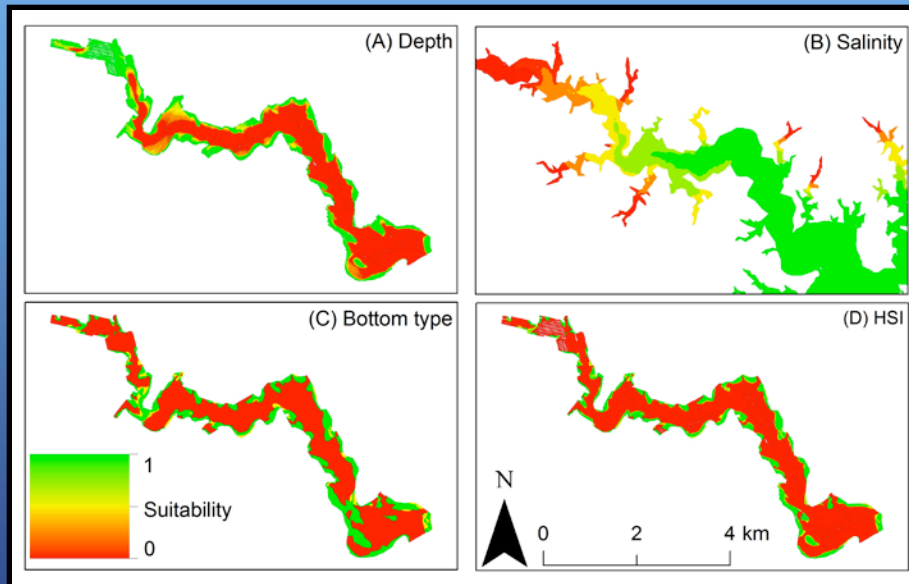




Habitat Suitability Index



● Great Wicomico River





Other relevant information used:



- **Bottom side-scan surveys by NOAA and the Army Corps of Engineers, Norfolk District**
- **Monitoring surveys by VIMS**
- **Hydrodynamic model by VIMS**



Live Oysters:

Oyster shell:

Degraded oyster shell:

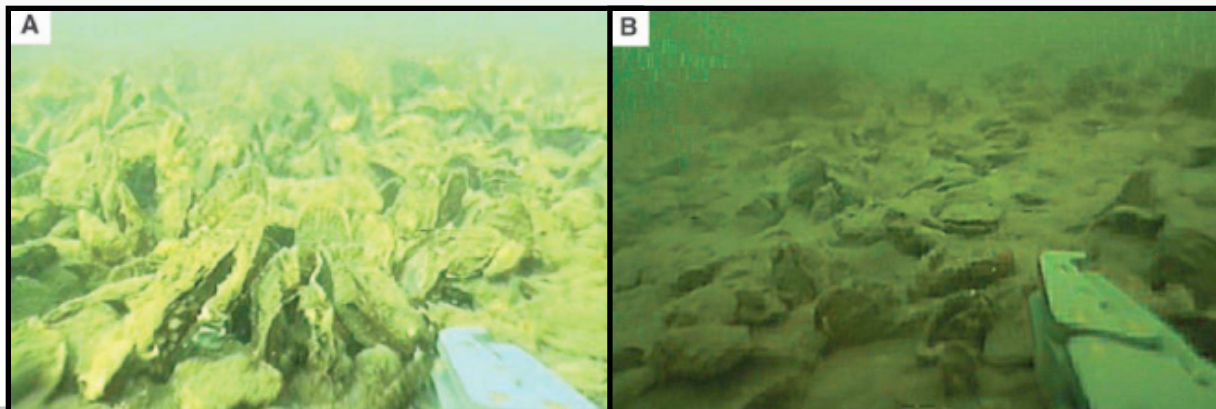
Sediment:

$$\frac{dO}{dt} = RO f(d) \left(1 - \frac{O}{K}\right) - \mu f(d) O - \epsilon(1 - f(d)) O$$

$$\frac{dB}{dt} = \mu f(d) O + \epsilon(1 - f(d)) O - \gamma B$$

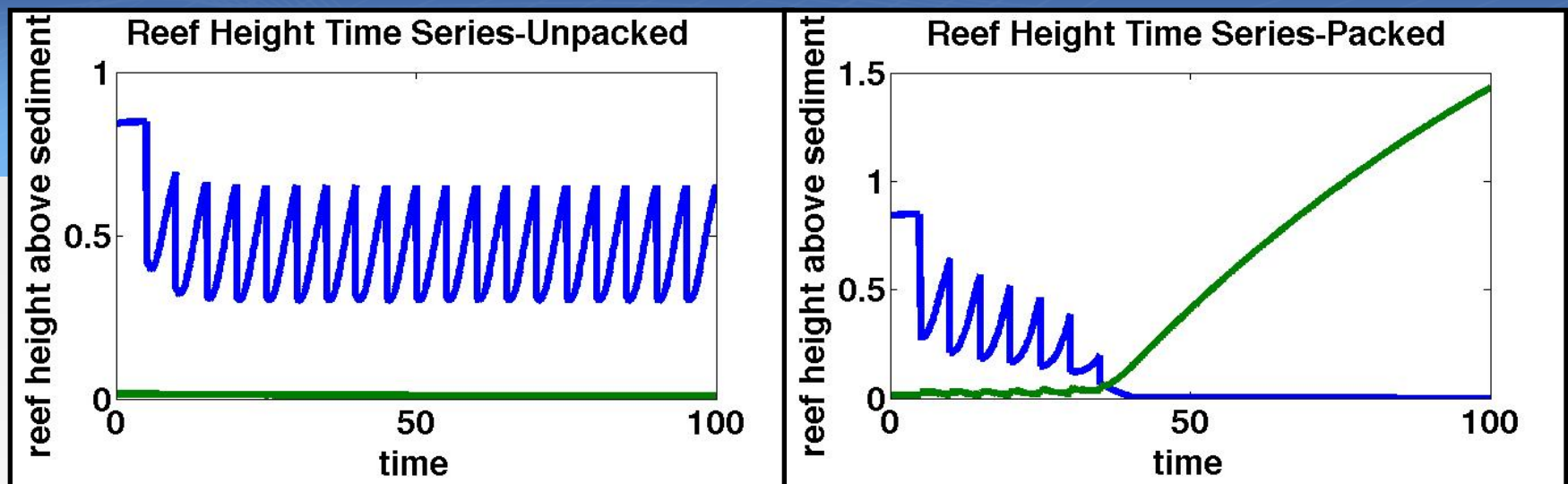
$$\frac{dB_c}{dt} = -\gamma B_c$$

$$\frac{dS}{dt} = -\beta S + Cg(x) e^{-\frac{F(Cg(x))O}{Cg(x)}}$$





Effects of Habitat Degradation on Population Abundance

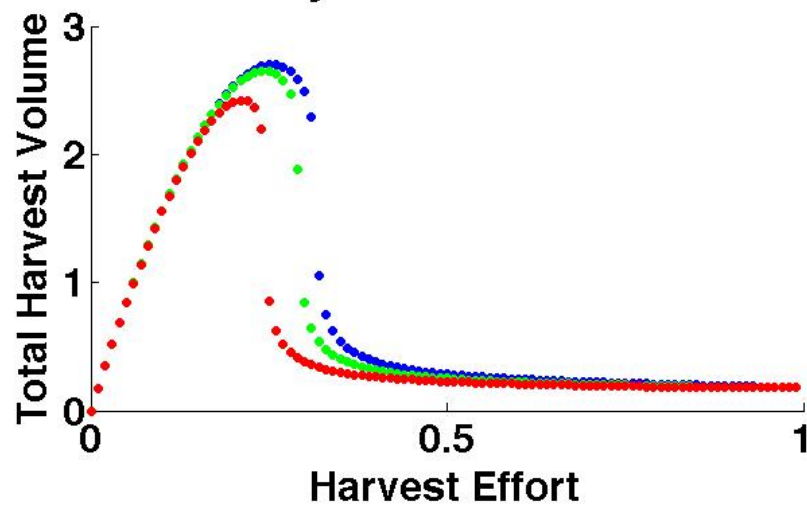




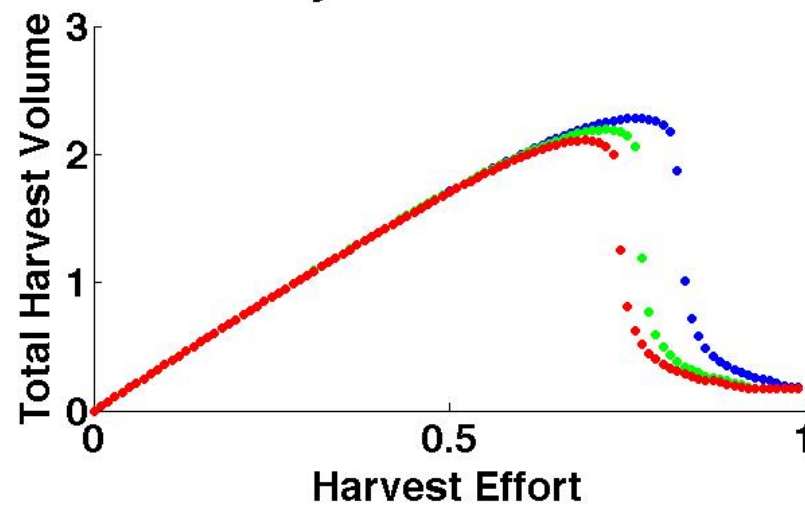
Effects of Habitat Degradation on Fishery Yield



1yr Harvest MSY



5yr Harvest MSY



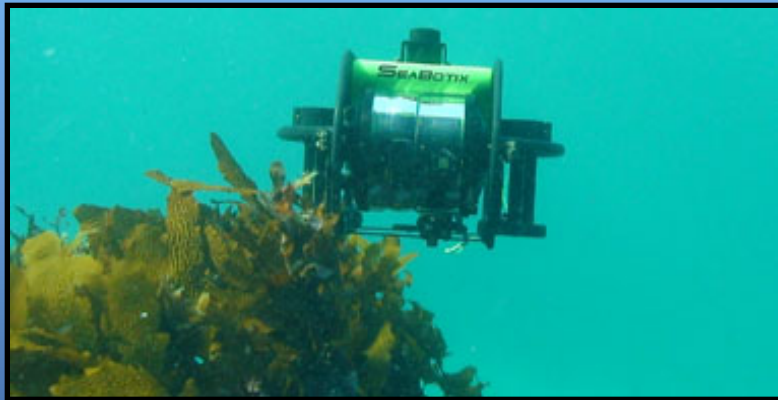
- Quantify finfish and blue crab utilization of oyster reefs
 - UW video (baited and unbaited) (GWR & LyR)
 - Traps (baited and unbaited) (GWR & LyR)
- Quantify benthic prey availability (H & L relief; GWR & LyR)
 - Experimental trays
- Assess bias of baited and unbaited traps
- Characterize diet of finfish and crabs (gill netting) (GWR & LyR)
- Compare use with reef height, prey availability, and location



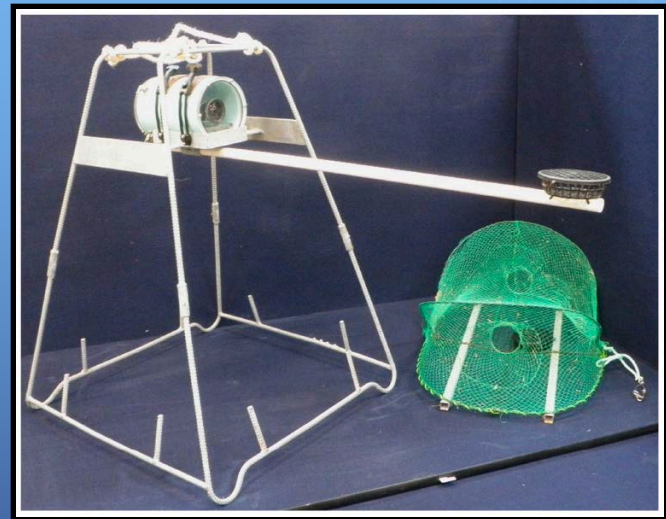
UW video surveys



ROV



4-Camera Video





Diet analysis



- **by location and reef height**

