

An underwater photograph showing several green eelgrass stalks growing from a sandy seabed. A purple starfish is visible on the sand in the lower left corner. The water is dark, and the lighting is focused on the plants.

Assessing impacts of shellfish aquaculture on eelgrass (*Zostera marina*) populations in Eastern Long Island Sound.

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Zostera marina in Long Island Sound



Eastern Long Island Sound Eelgrass Study



Historical Abundance

Pre-1930 common

~1931 99% died

Ecological Function

foraging

refuge

nursery

bags on racks - oysters



photo courtesy of Tessa Getchis

Typical Gear Deployment Techniques



long line - mussels



bag on bottom - oysters



ground culture -
hard shell clams

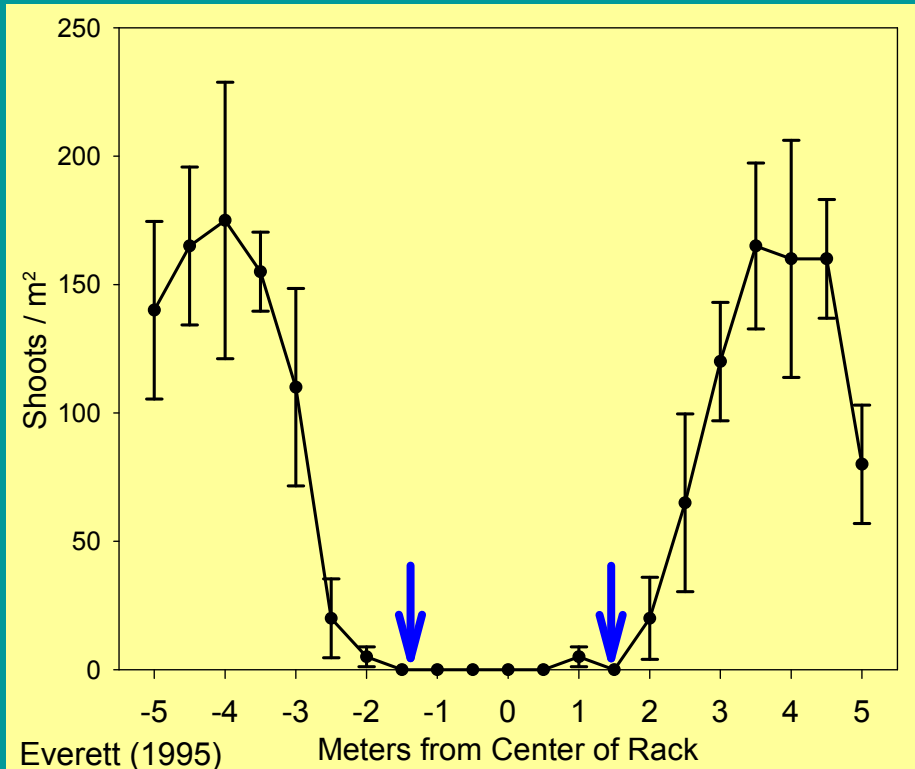


Aquaculture in Connecticut bottom cage with oysters (lid removed)



photo courtesy of Tessa Getchis

Conflicting Evidence



Everett et al. (1995) *Mar. Ecol. Prog. Ser.* 125: 205-217. Effect of oyster mariculture on submerged aquatic vegetation: an experimental test in a Pacific Northwest estuary.

Neckles, H.A., F.T. Short, S. Barker, and B.S. Kopp (2005) *Mar. Ecol. Prog. Ser.* 285: 57-73. Disturbance of eelgrass *Zostera marina* by commercial mussel *Mytilus edulis* harvesting in Maine: dragging impacts and habitat recovery.

Pregnall (1993) Thesis, Bard College. Regrowth and recruitment of eelgrass (*Zostera marina*) and recovery of benthic community structure in areas disturbed by commercial oyster(...).

Conflicting Evidence



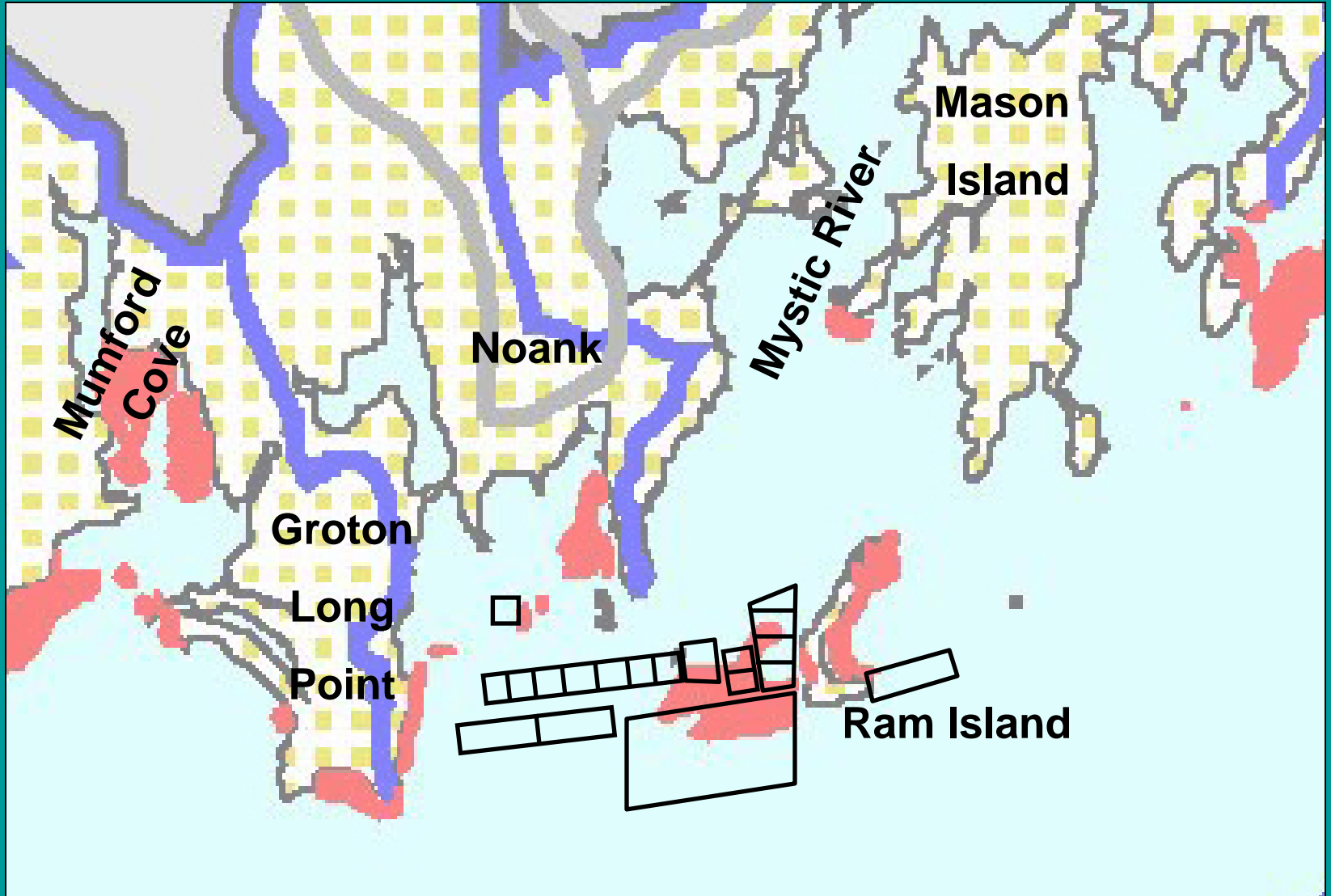
Lindahl et al. (2005) *Ambio* 34(2): 131-138. Improving marine water quality by mussel farming: a profitable solution for Swedish society.

Peterson and Heck (2001) *Mar. Ecol. Prog. Ser.* 213: 143-155. Positive interactions between suspension-feeding bivalves and seagrass – a facultative mechanism.

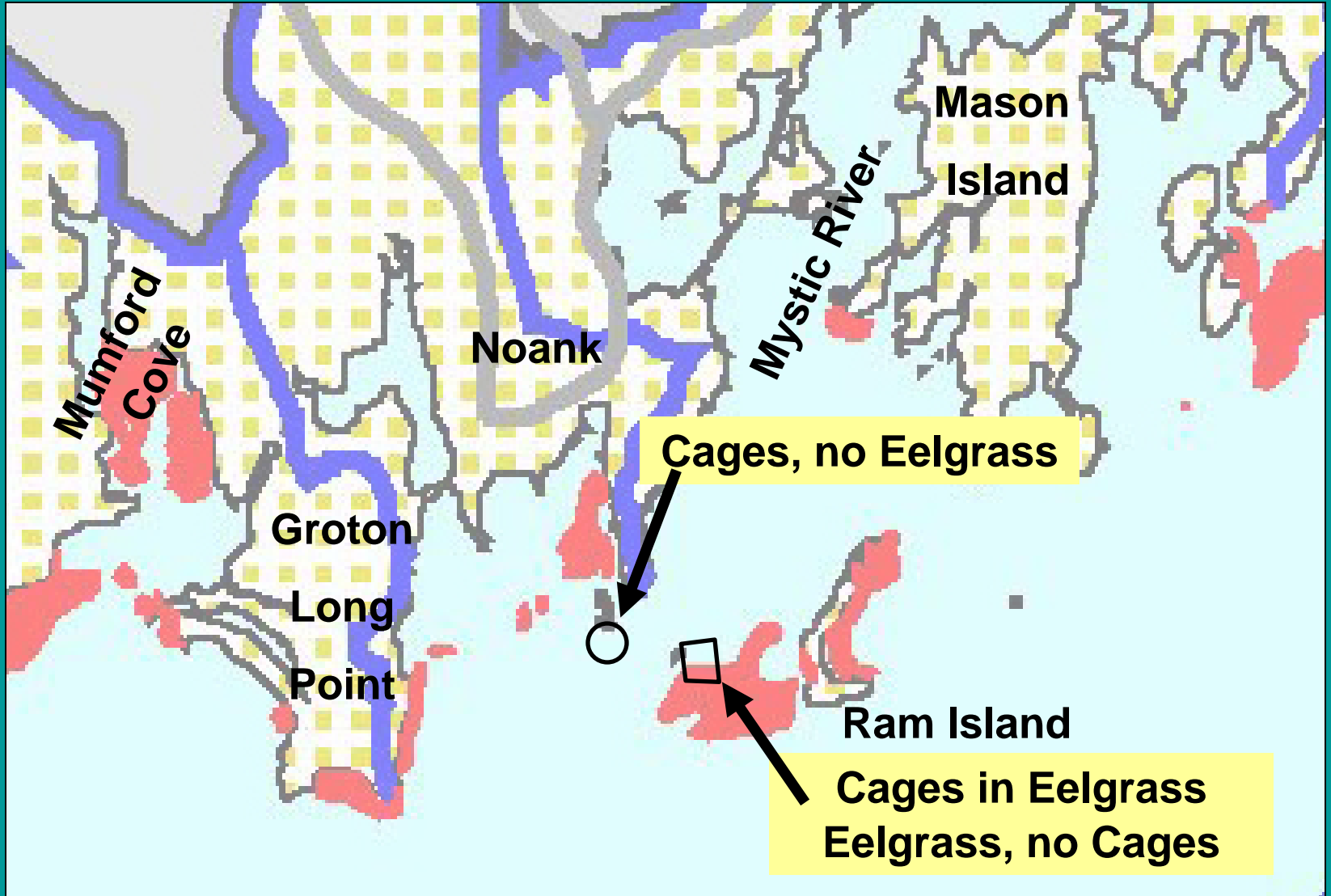
Griffin (1997) *Eelgrass Ecology and Commercial Oyster Cultivation in Tillamook Bay, Oregon*, Tillamook Bay National Estuary Report.

Crawford et al. (2003) *Aquaculture* 224: 117 – 140. Effects of shellfish farming on the benthic environment.

Competition For Space Aquaculture vs. Eelgrass

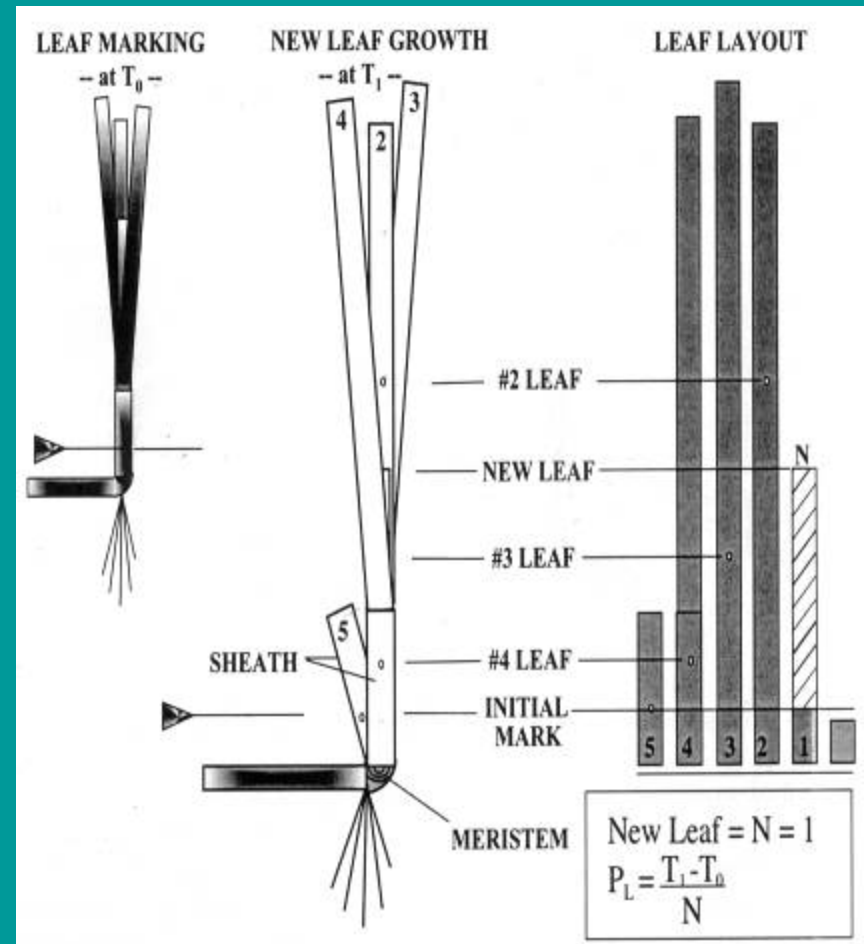


Experimental Set-Up



Direct Effects on Eelgrass Biomass and Growth

- dry weight biomass
- short shoot density
- canopy height
- sheath length
- plastochrone interval
- new leaf area



Short and Coles, eds. (2001) *Global Seagrass Research Methods*. Elsevier. 473p.



Typical Appearance of Eelgrass Area



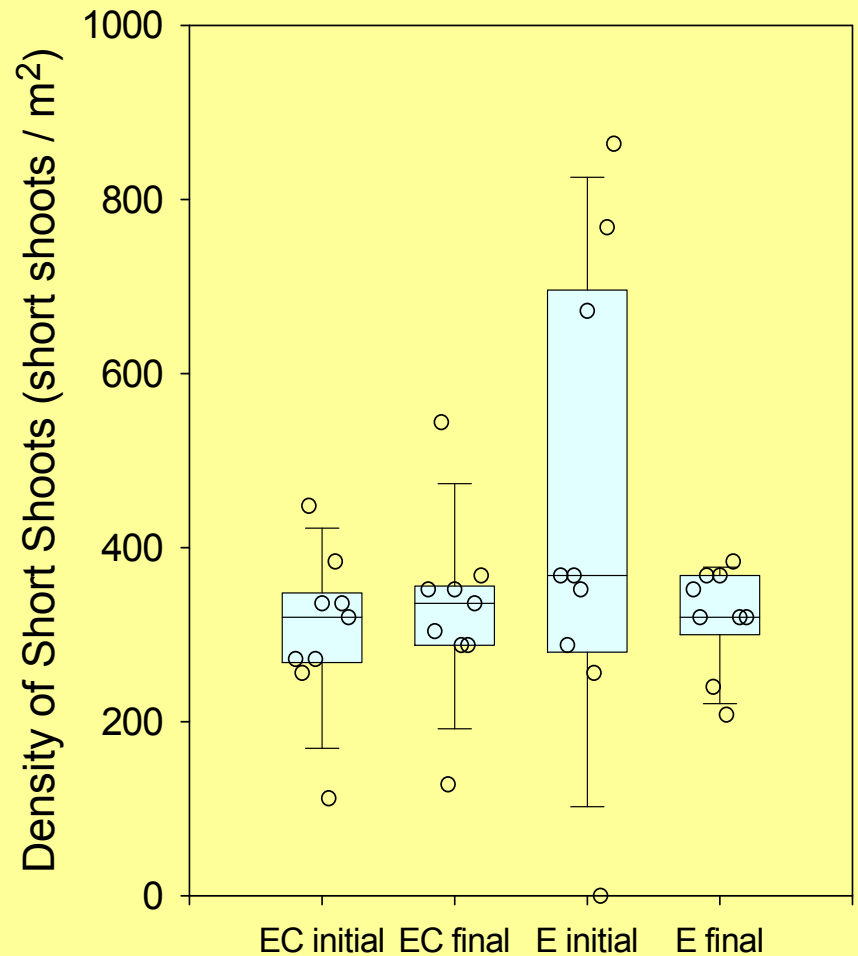
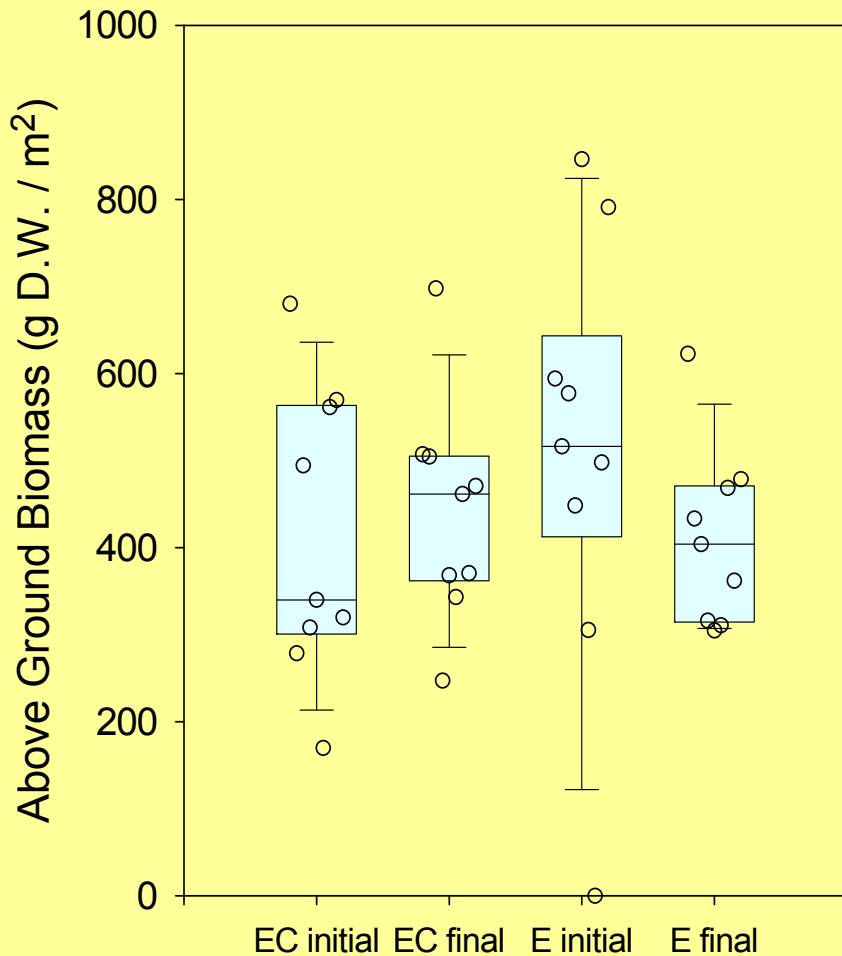


Lots of algae on the cages!



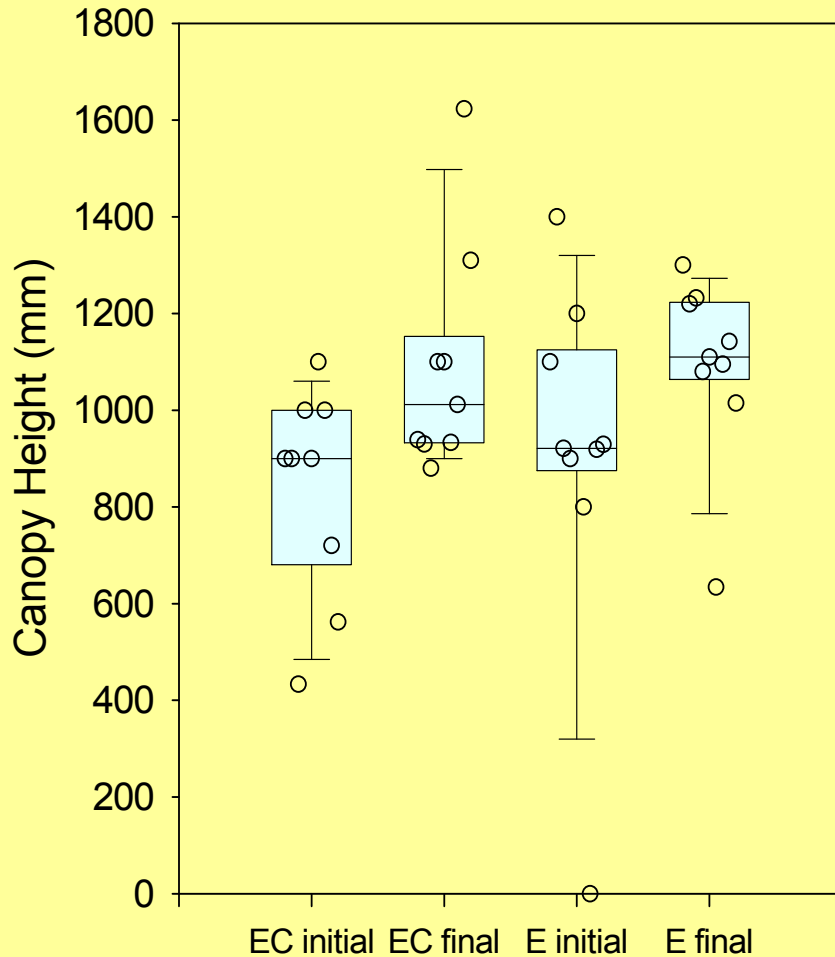
No Significant Difference

initial to final -and- EC to E
nested ANOVA – time nested in treatment



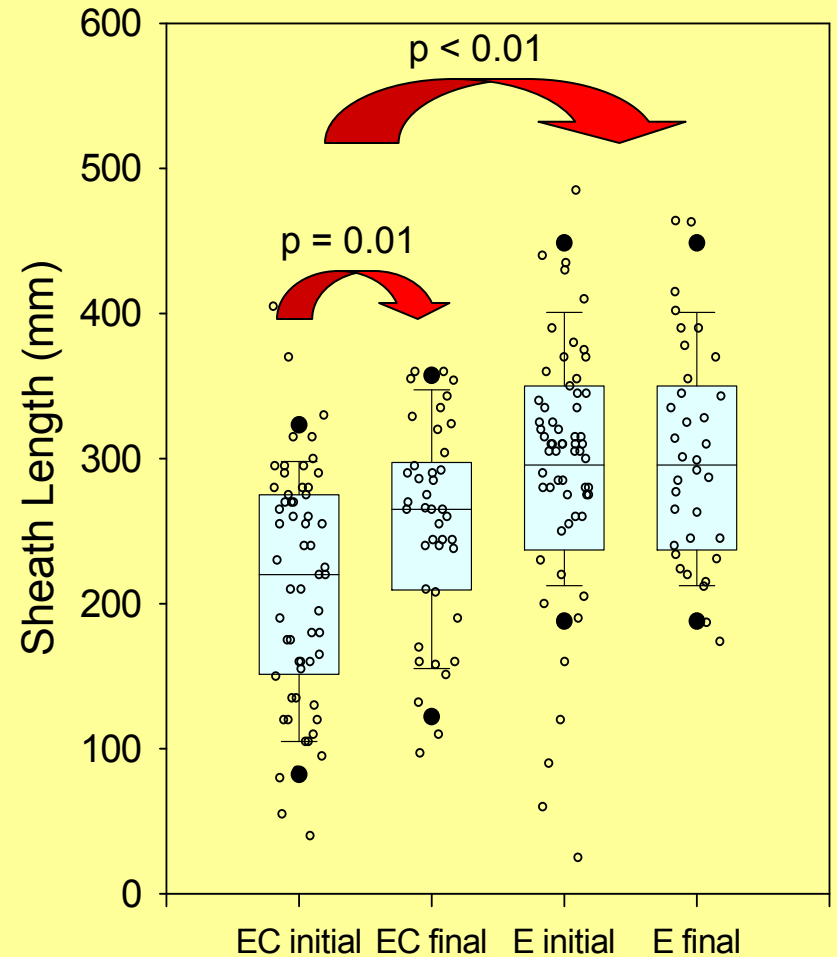
No Significant Difference

initial to final -and- EC to E
nested ANOVA – time nested in treatment



Significant Difference

EC initial to EC final -and- EC to E
nested ANOVA – time nested in treatment





Indirect Effects on Eelgrass

- Water Column
 - Dissolved oxygen
 - Chlorophyll (phytoplankton)
 - Turbidity
- Sediment
 - Benthic Microalgae
 - Sediment % Organics





Conclusions from the Pilot Study

- Indirect effects hard to detect.
 - Possibly negated by dilution?
- Growth possibly effected.
 - Sheath length a good indicator.
- Biomass – need many samples.
 - Not a good indicator.



Future Plans

- ✓ Monitor recovery in the cage footprint.
 - sediment % organics and benthic microalgae
- ✓ Verify eelgrass growth results (sheath length) and look for a cause.
 - tissue nutrients (CHN), sediment pore-water nutrients, light extinction coefficients
- ✓ Better characterize the eelgrass density.
 - video monitoring

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List of references
available – just ask!

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