OYSTERS AS MODIFIERS OF BENTHIC MICROALGAL PRODUCTION

Troy Alphin, Larry Cahoon, Martin Posey and Anne Markwith

Creeks Vary in Population and Development Historically

- These tidal creek systems generally range from 3-5km; able to look at whole system
- Extensive background information
- Most development is residential
- May act as models for larger systems
- Do chronic background conditions influence key ecosystem components?

	Creek		
Parameter	Hewletts	Howe	Pages
area (ha)	2393	1210	1230
human population	13000	3937	4185
average chl-a (µg-N)	11.9 (203.8)	9.4 (88.4)	2.8 (40.7)
average turbidity (NTU)	----	6.5 (18.7)	4.9 (14.1)

Mallin et al 2000

Today

- Key ecosystem components
  - Oyster communities
  - Benthic Microalgae (BMA)
- Previous work
  - Changing Conditions
  - Oyster responses
- Oyster associated BMA

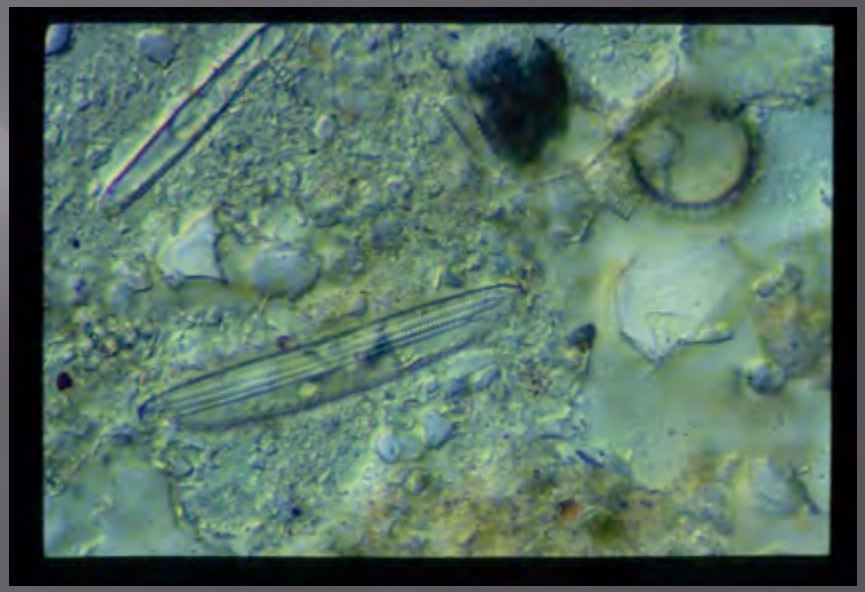
Oyster Habit

Oysters?

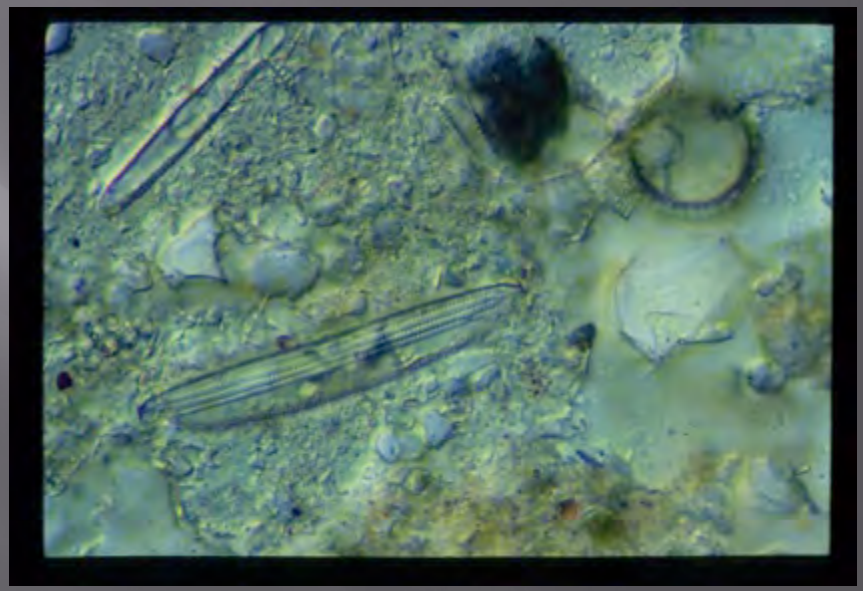
- Heritage species
- Ecosystem engineers
- Stabilize habitats
- Ecosystem services
  - Filtration
  - Habitat
  - Erosion control- protect marsh and upland areas
  - Nutrient cycling

Benthic Microalgae (BMA)

- Primary production – oxygen release; carbon dioxide uptake leads to pH buffering
- Food for consumers, including shrimps and small fishes – enhanced PNA function
- Nutrient uptake and conversion into food supply (N becomes protein, etc.)



- Adsorption of fine particulates, including fine sediment and bacteria, from water, reducing turbidity and pollution levels.
- Creation of a microhabitat community (microalgae and associated bacteria, etc.) that metabolizes dissolved organic compounds, including pollutants
- Possibly adsorption of metals



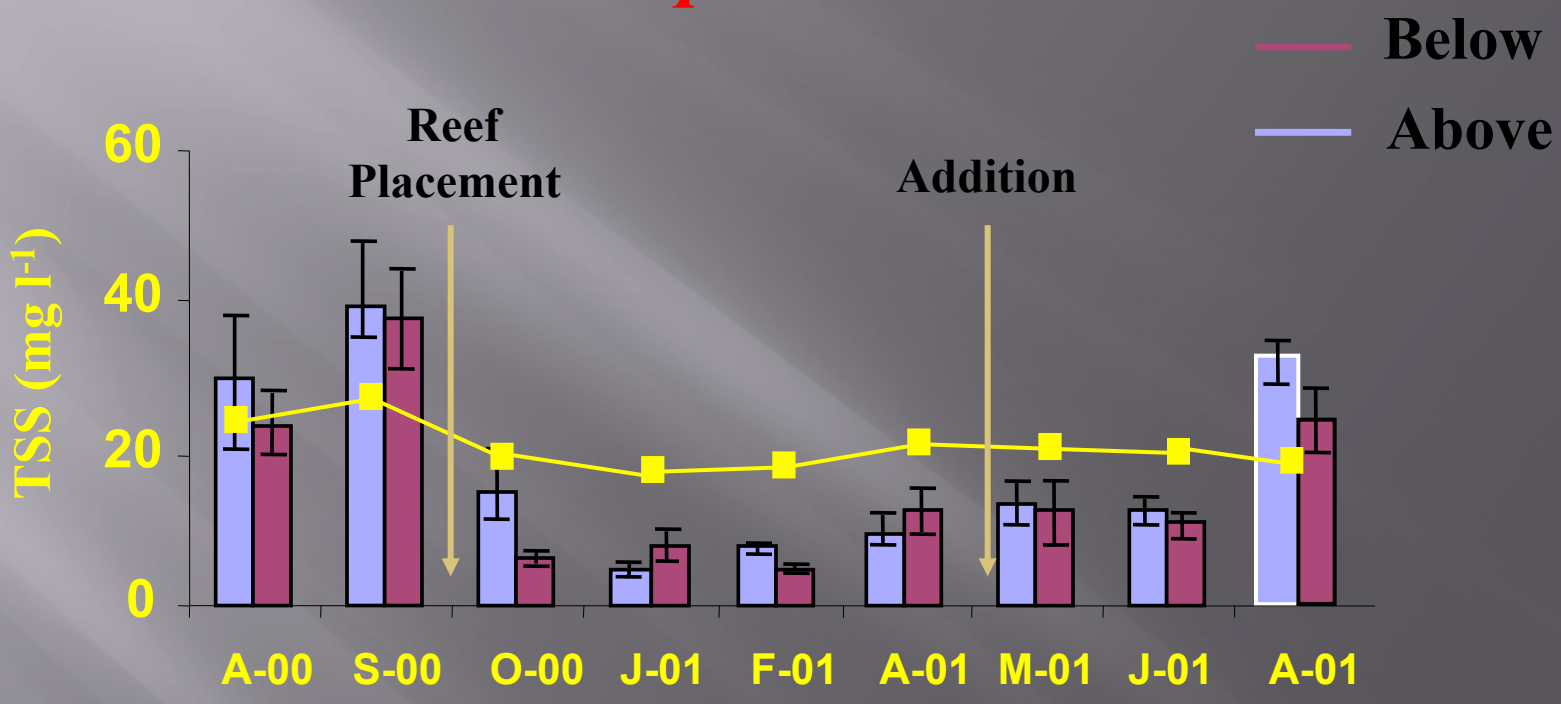
Where do we start?

- 1995: Clams and other bivalves largely absent from many areas.
- Sedimentation evident among most habitats.
- Anecdotal evidence of changes in the bivalve distribution
- Are there impacts to the oyster population?
- Water quality monitoring
  - Oligotrophic to mesotrophic system
  - Sediments seem to be one of the greatest contaminants

Previous work

- Land use plan in early 1990's
- Tidal Creeks program initiated in 1992
- Modifications to water quality (2003-2004)

Total Suspended Solids

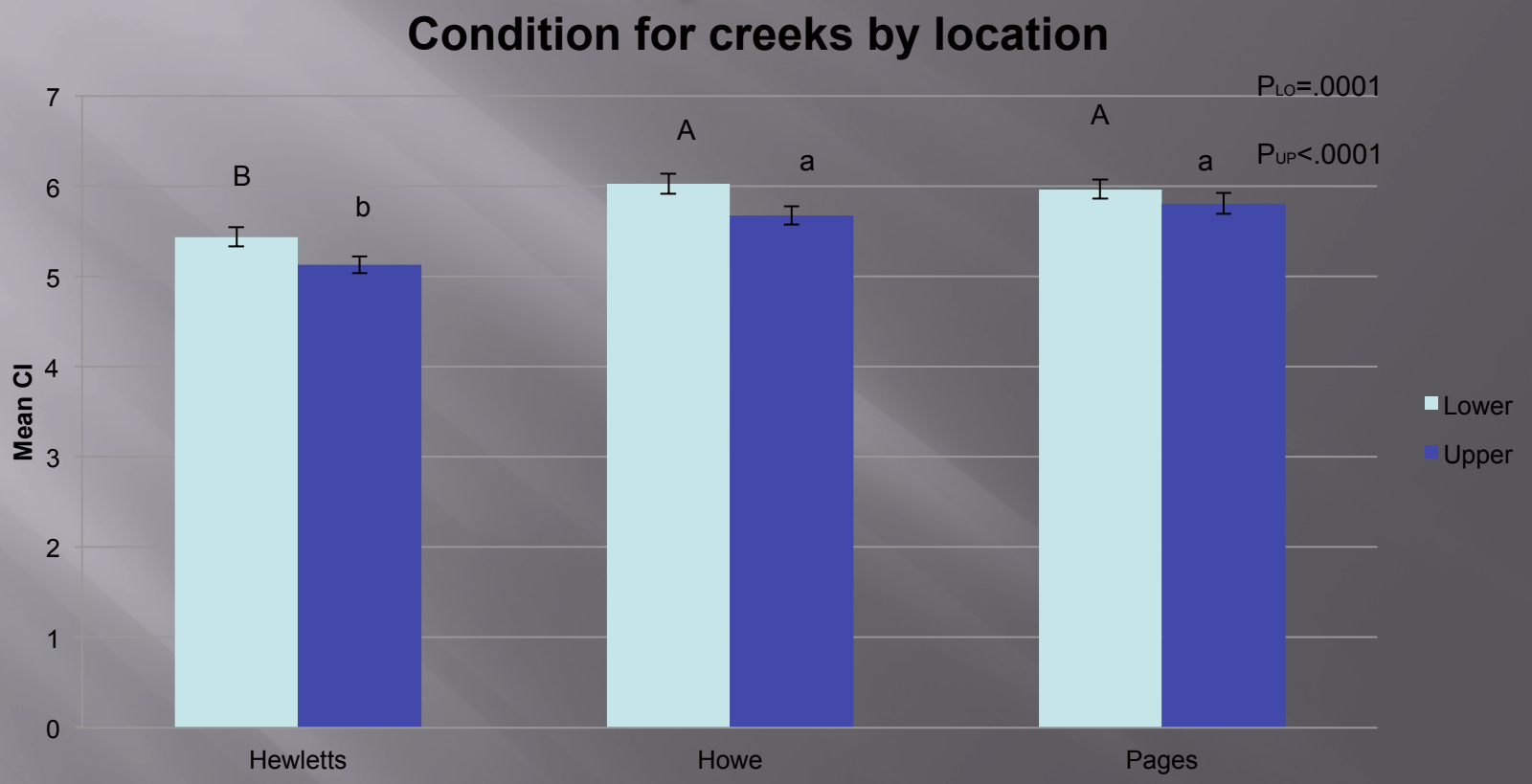


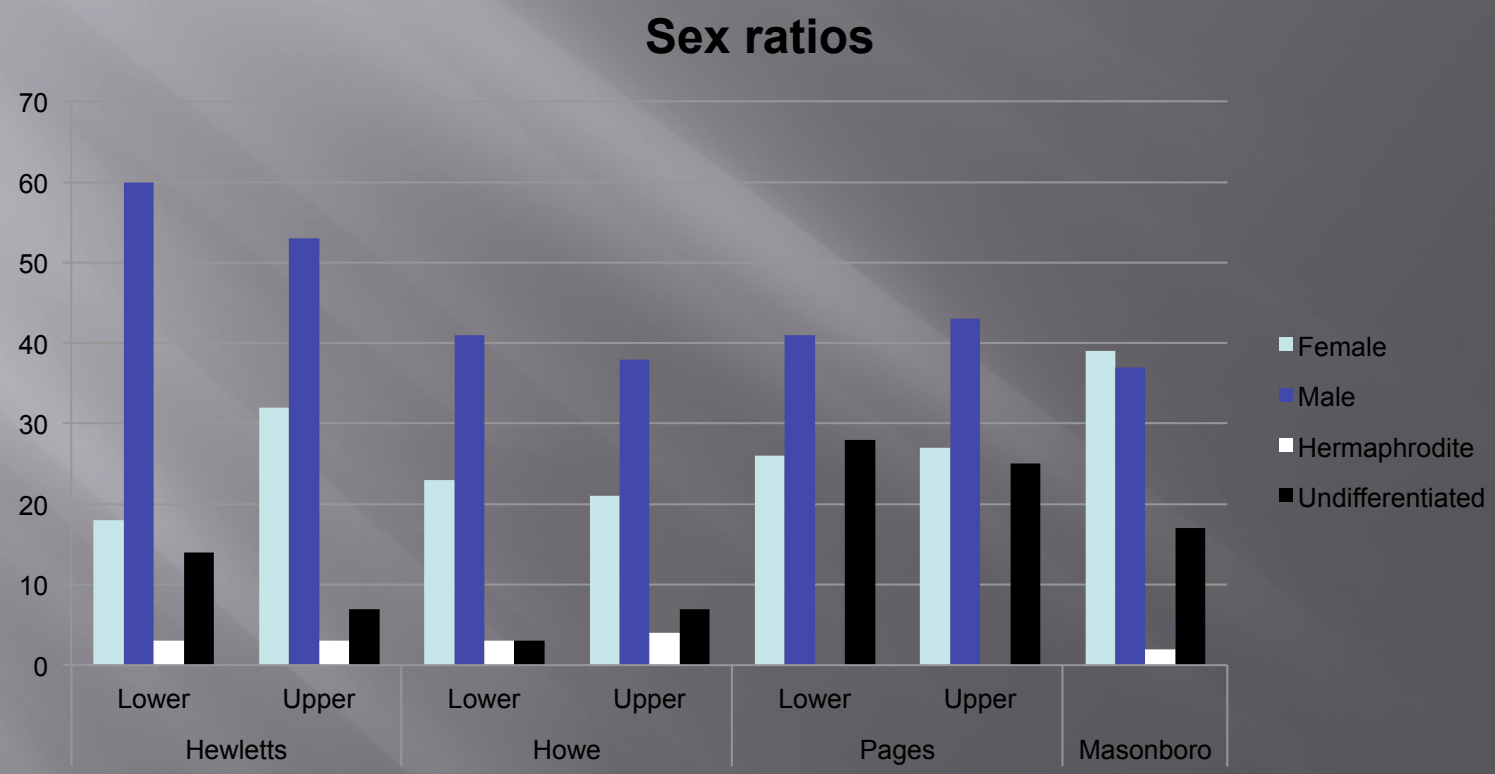
Post-reef

From Nelson et al. 2004

- Based on previous work focused on oyster reefs in the systems
- Mouth sites and upper locations near headwaters
- Impacts among the creeks based on background conditions

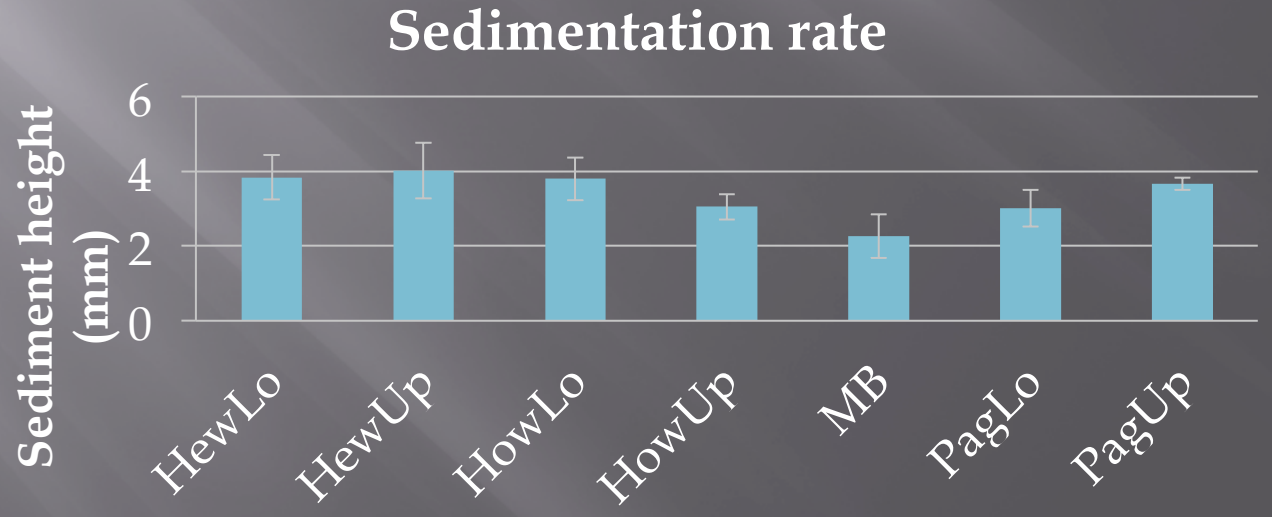
What are the impacts on the oyster




Sex ratios
70
60
50
40
30
20
10
0
Lower
Upper
Lower
Upper
Lower
Upper
Hewletts
Howe
Pages
Masonboro
Female
Male
Hermaphrodite
Undifferentiated

As more material washes into the creeks we see greater

- Differences in sediment accumulation
- May be a function of oyster structure and particulate loads and boundary layer effects

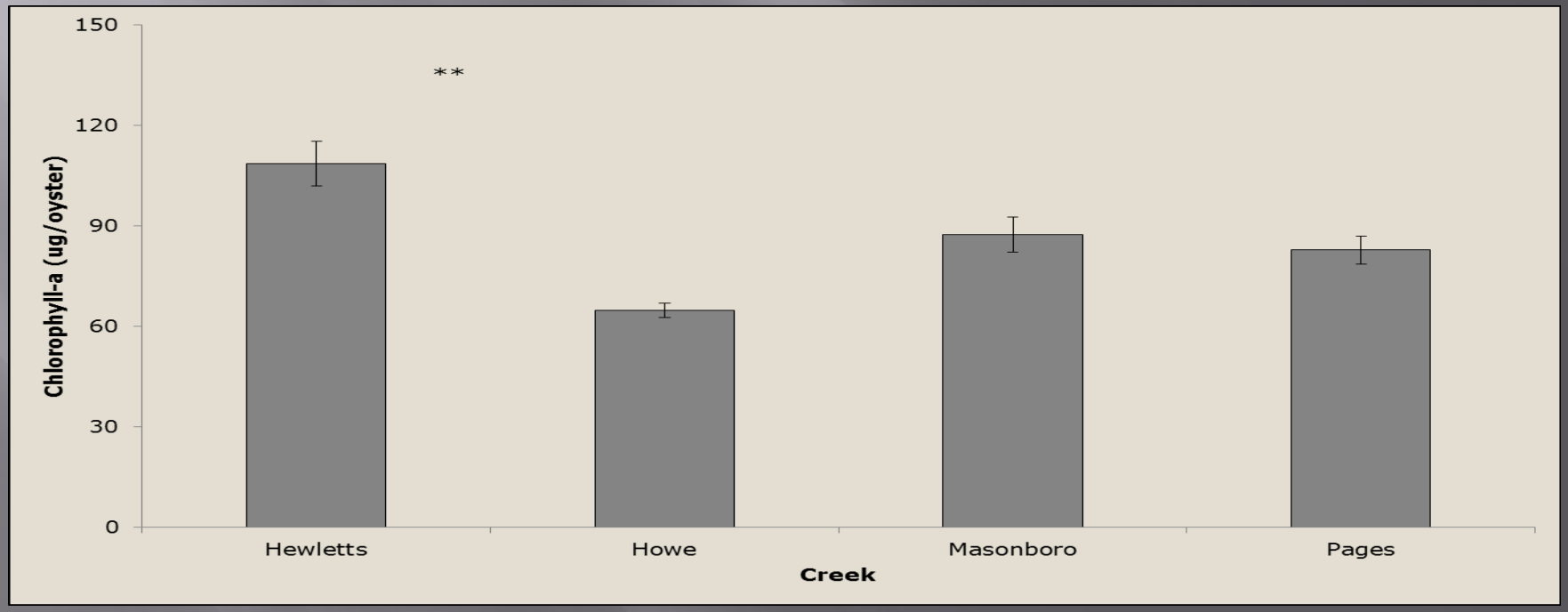


Oyster/BMA

- What is the relationship between oysters and BMA?
- Overall per/oyster?
- Does the BMA change based on position within the reef?
- How does the presence of BMA generated biofilms influence oysters

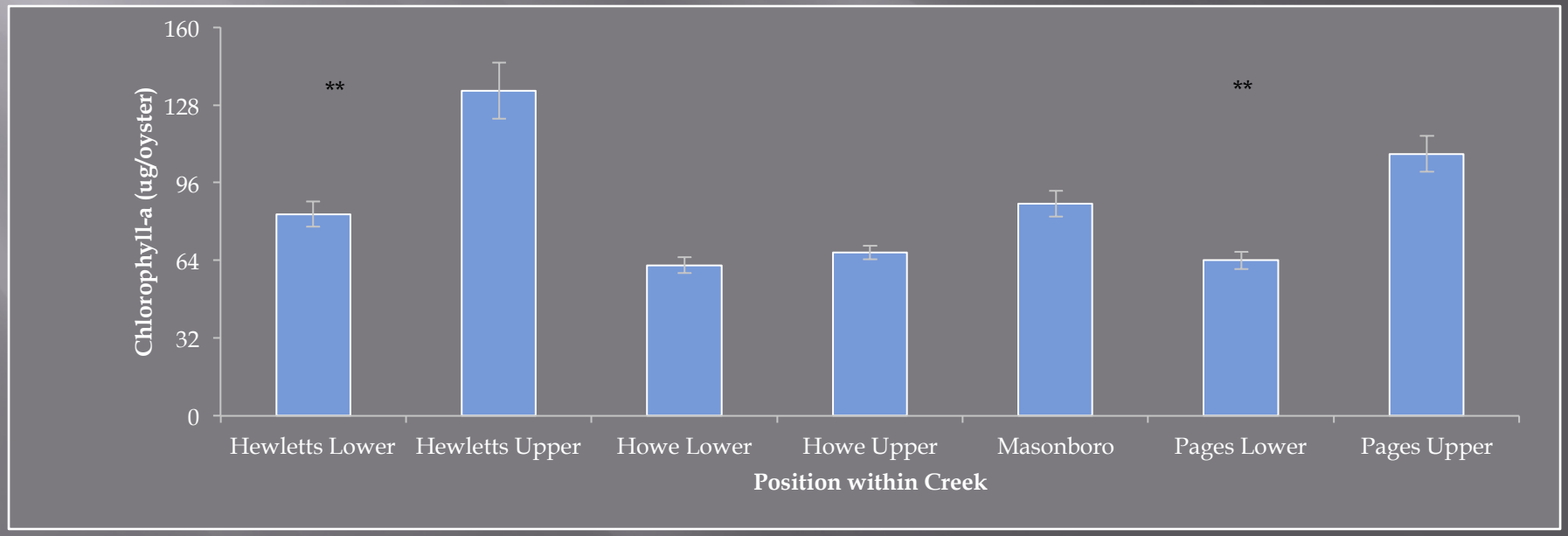
Significant differences in per oyster chl a

- Hewletts ck greater than all others
- Pattern consistent among seasons

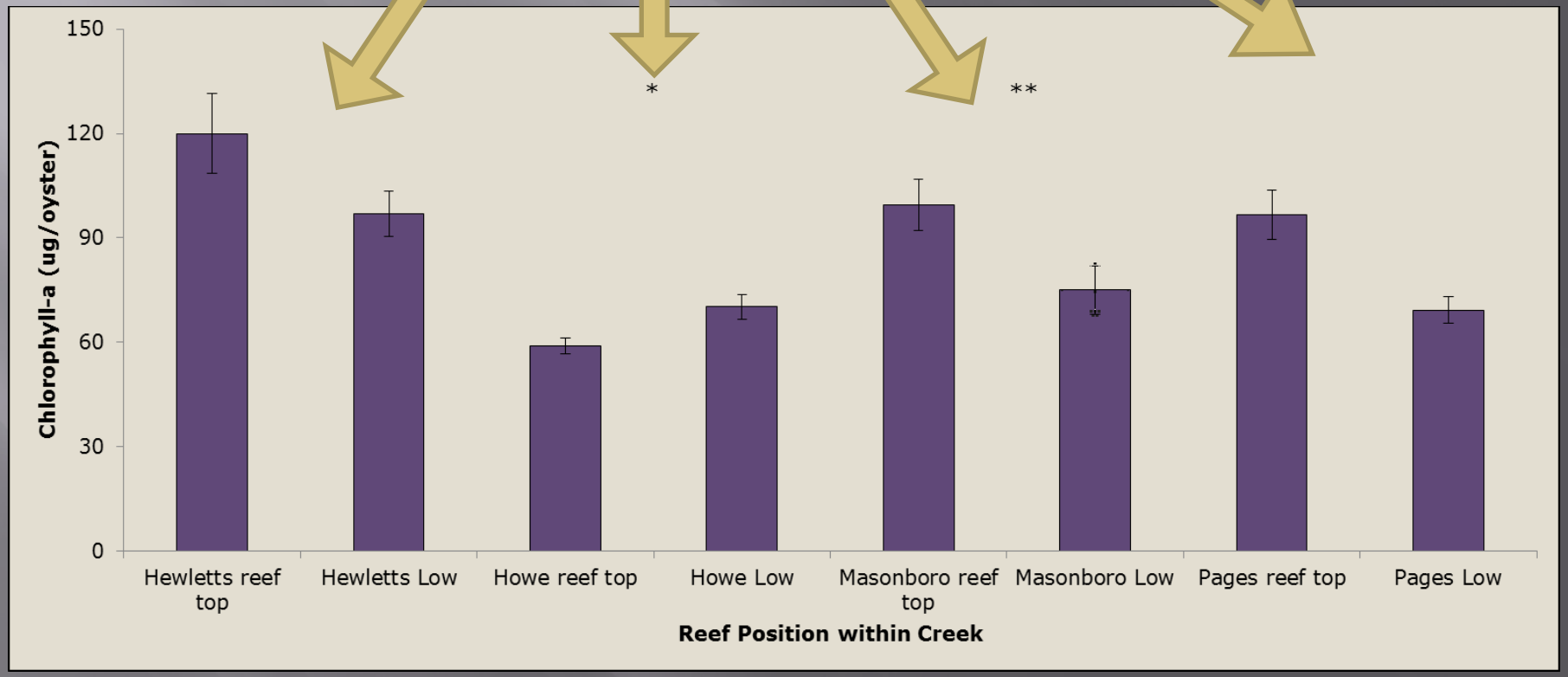


Within Creek

- Differences among sites within creeks.
- Differences among creeks
- Note estimates are several times higher than sediment chl *a*

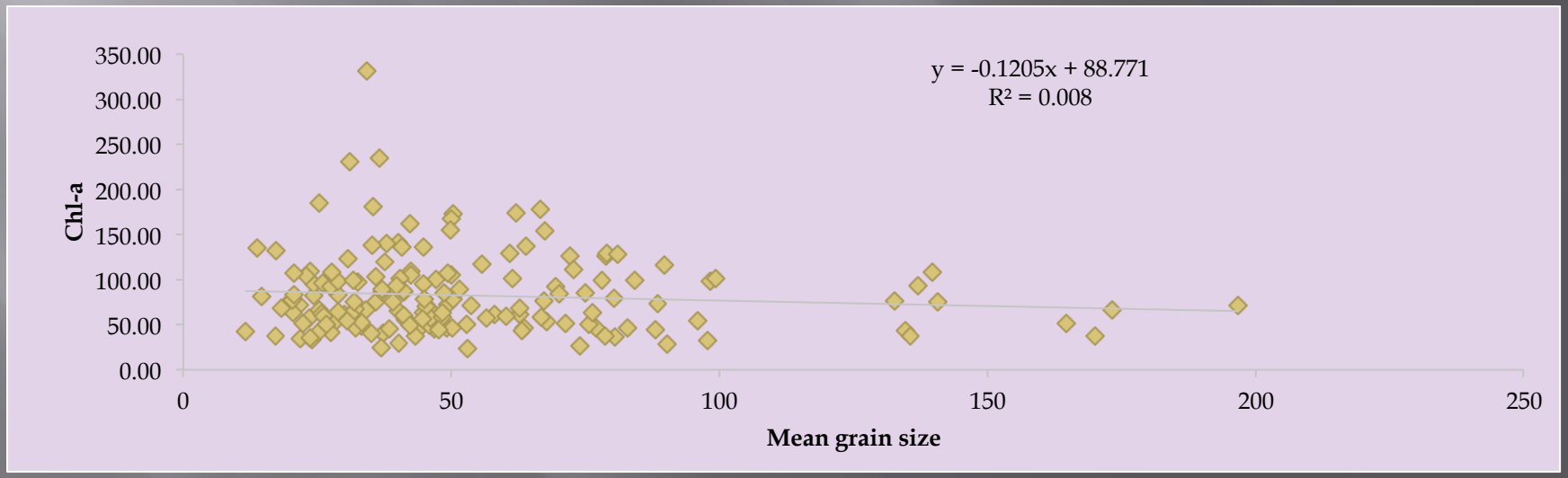


Significant differences between positions on the reef



Biofilms trap smaller particles

- Chl a estimates strongest finer particles
- Biofilms trap smaller particles- reflecting the materials being washed into the creeks



Summary

- Oyster structure keeps the BMA in contact with flow.
- Benthic microalgae

  -produce biofilms

  –trap fine particles
- Biofilms may limit larval settlement with negative effects on oysters

Continuing Studies

- Species composition of BMA
  - –influences particle trapping
  - -nutrient cycling

Acknowledgments

- North Carolina Sea Grant Program
- Benthic Lab, UNCW- Anne Markwith, Robert Corbett, Kyle Dilliplaine, Samantha Ehnert, Marc Hanke, James Hargrove, Amanda Kelly, Mary Grace Lemon, Preston Luce, Madison Lytle, Heather Page, Jenae Progar, Keith Walls, Ashley Whitt

Sea Grant
North Carolina

UNCW