

2013

The Casco Bay “Mud Summit:” Local Efforts to Look at Acidification, Clams and Nutrients Powerpoint

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THE CASCO BAY “MUD SUMMIT”

Local efforts to look at acidification, clams and
nutrients

Curtis C. Bohlen

Director, Casco Bay Estuary Partnership



Casco Bay Estuary Partnership

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- ❑ One of 28 National Estuary Programs
- ❑ We build consensus, facilitate communications and attract funds for protection of the Bay
- ❑ Many partners
- ❑ Focused, collaborative
- ❑ Credible data and information
- ❑ Strategic direction



FOCB / CBEP 2012 Work on Acidification

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□ FOCB

- ▣ Identified issue— ‘Death by Dissolution’
- ▣ Initiated informal studies in 2011
 - ▣ Working with local scientists
 - ▣ Staff and interns collected preliminary data on pH of tidal flats
- ▣ Led efforts to collect data in 2012

□ CBEP

- ▣ Consulted on study design
- ▣ Provided partial funding for additional data – sediment chemistry
- ▣ Funded related clam abundance surveys
- ▣ Hosted “Mud Summit”



Casco Bay

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- About 200 Square Miles of Water
- More than 575 miles of shoreline
- 785 islands, islets and ledges
- A marine dominated coastal embayment
 - ▣ Tidal water exchange is (usually) much greater than river flow

Casco Bay Marine Resources

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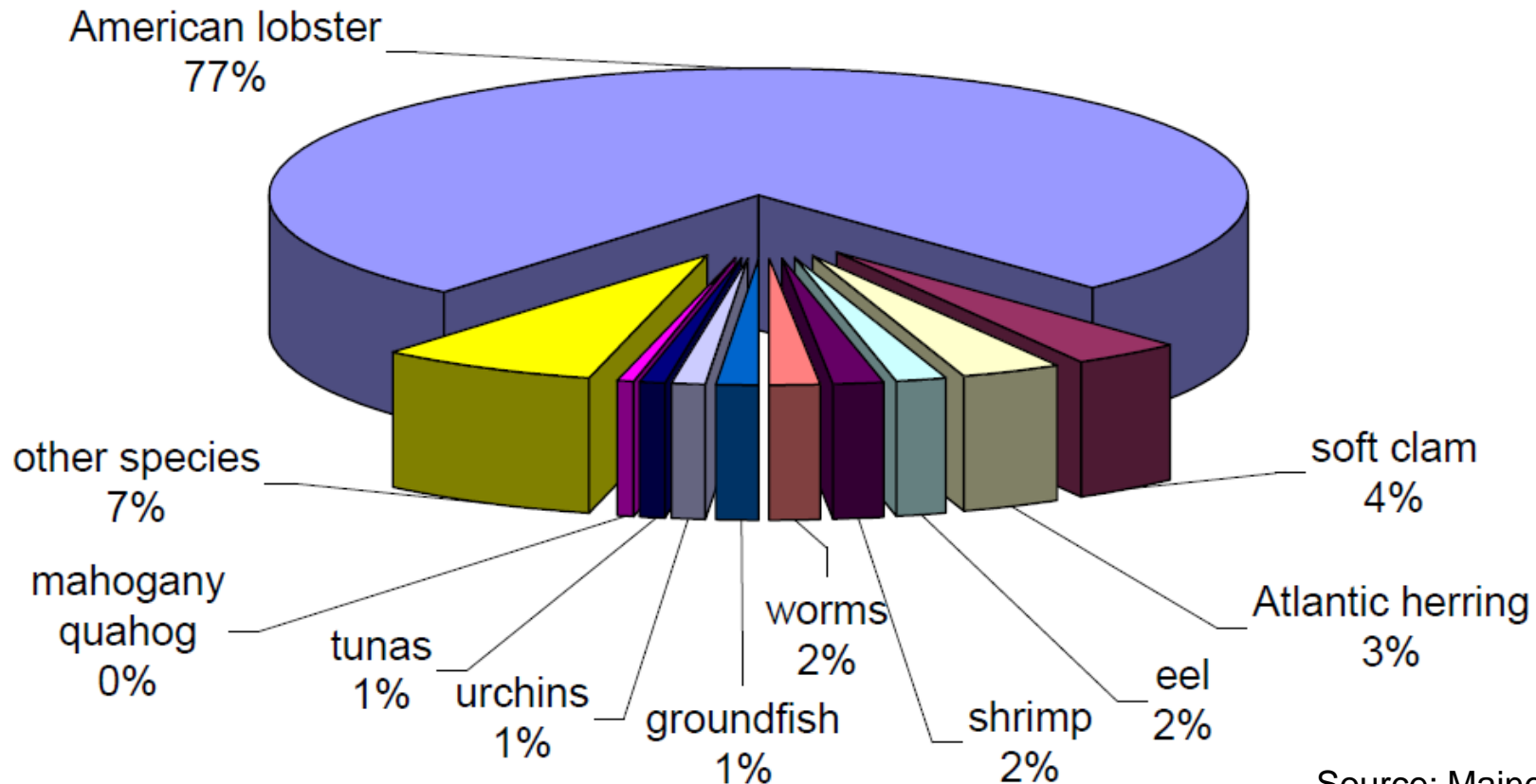


Maine Fisheries by Value

6

2011 Commercial Maine Landings By Ex-vessel Value

Total: \$435,030,033 as of 6/8/12



Source: Maine DMR 2013

Maine Shellfish Co-management

7

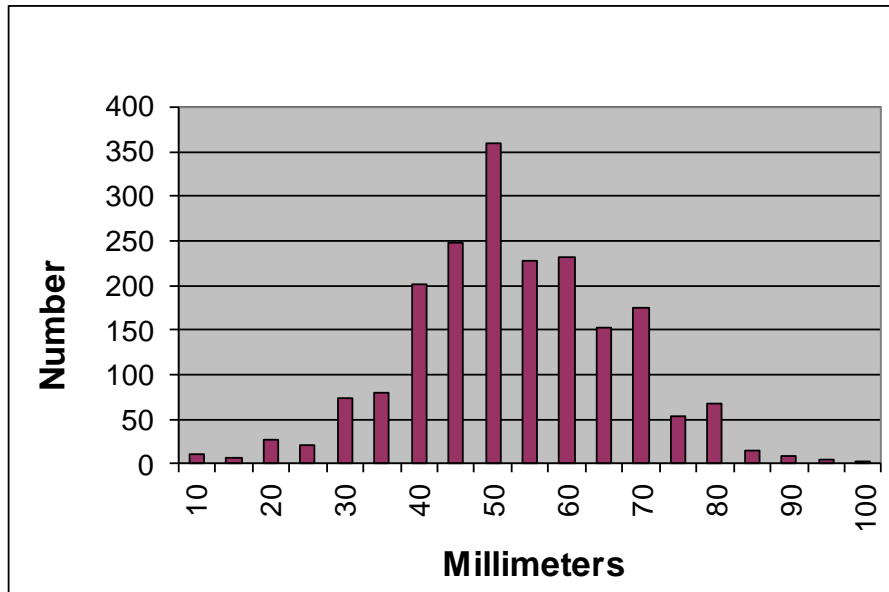
- Towns
 - ▣ Intertidal harvests only – Softshell clams
 - ▣ Shellfish Committees
 - Set number of licenses
 - Determine conservation measures
 - ▣ Harvesters required to contribute “conservation time”
 - Seeding of flats
 - Stock assessment
- State (DMR)
 - ▣ Professional biologists, make recommendations to Committees
 - ▣ Health closures
 - ▣ Subtidal harvests (quahogs)
- About 275 (Commercial) licenses in Casco Bay
 - ▣ Average cost ~ \$241



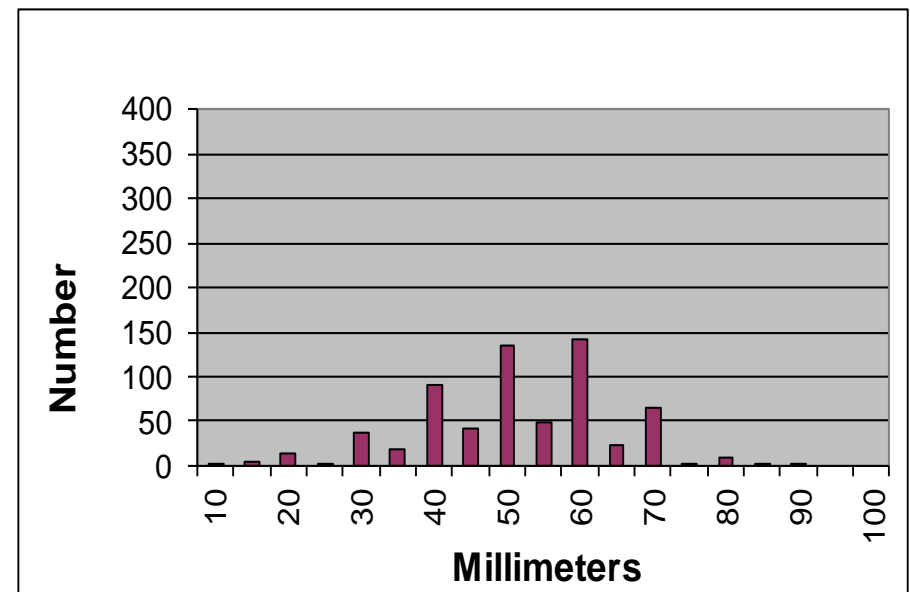
Softshell Clams at Lanes Island

8

2010



2012



Source: Marc-Nault, pers. com. 2013

Possible Factors

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- ❑ Poor Recruitment
- ❑ Predation
- ❑ Over Harvest
- ❑ Disease
- ❑ “Bad Mud” (Ocean Acidification?)
- ❑ All of the above



Carbon Dioxide And Water

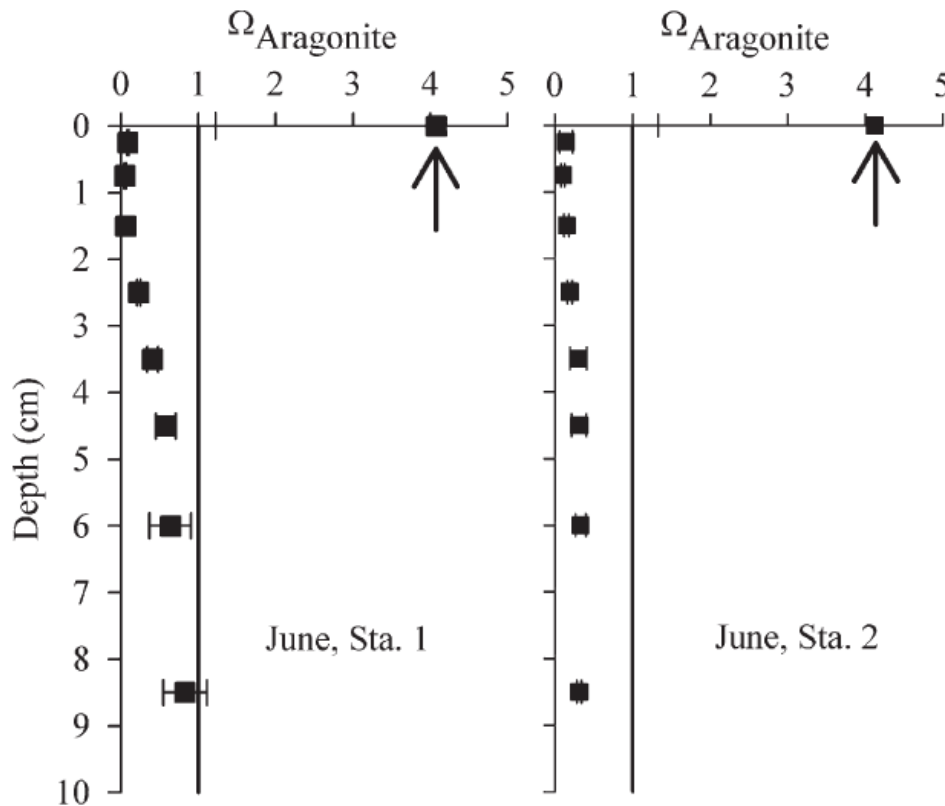
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- More CO₂ in the atmosphere leads to more CO₂ in the oceans
- When CO₂ dissolves in water, the water gets more acidic
- Changes in ocean chemistry
 - ▣ Carbonate saturation state, or “CSS”
- Challenges for marine organisms with shells
- Global CO₂
- Local sources of CO₂



Sediments in Casco Bay

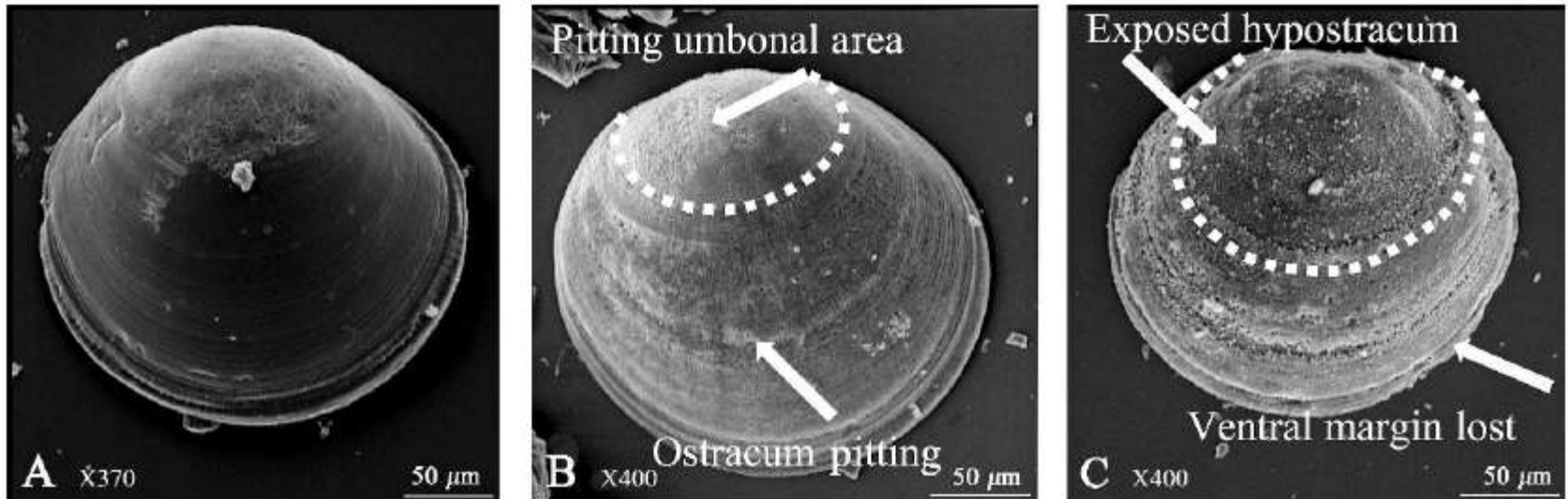
11



- Casco Bay Sediments offer a harsher microenvironment for calcifying organisms than does the overlying water
- At one Casco Bay tidal flat, median sediment CSS is around 0.75.

Negative Impacts of CO₂ on Mollusks In the Lab

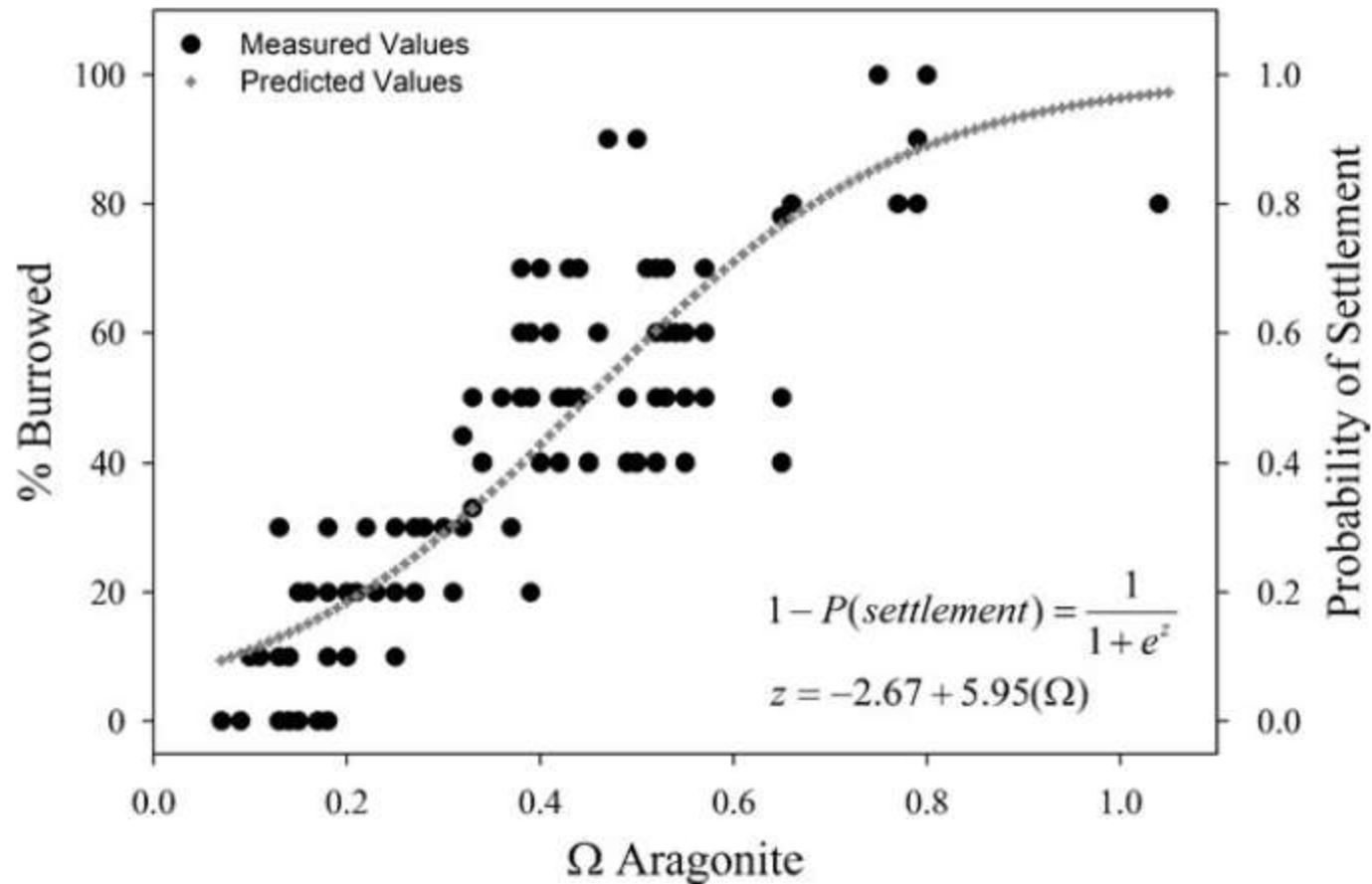
12



Tiny (0.2mm) Hardshell Clams (*Mercenaria mercenaria*) grown in the lab at low CSS for 0,4, And 7 days.

Behavioral Impacts

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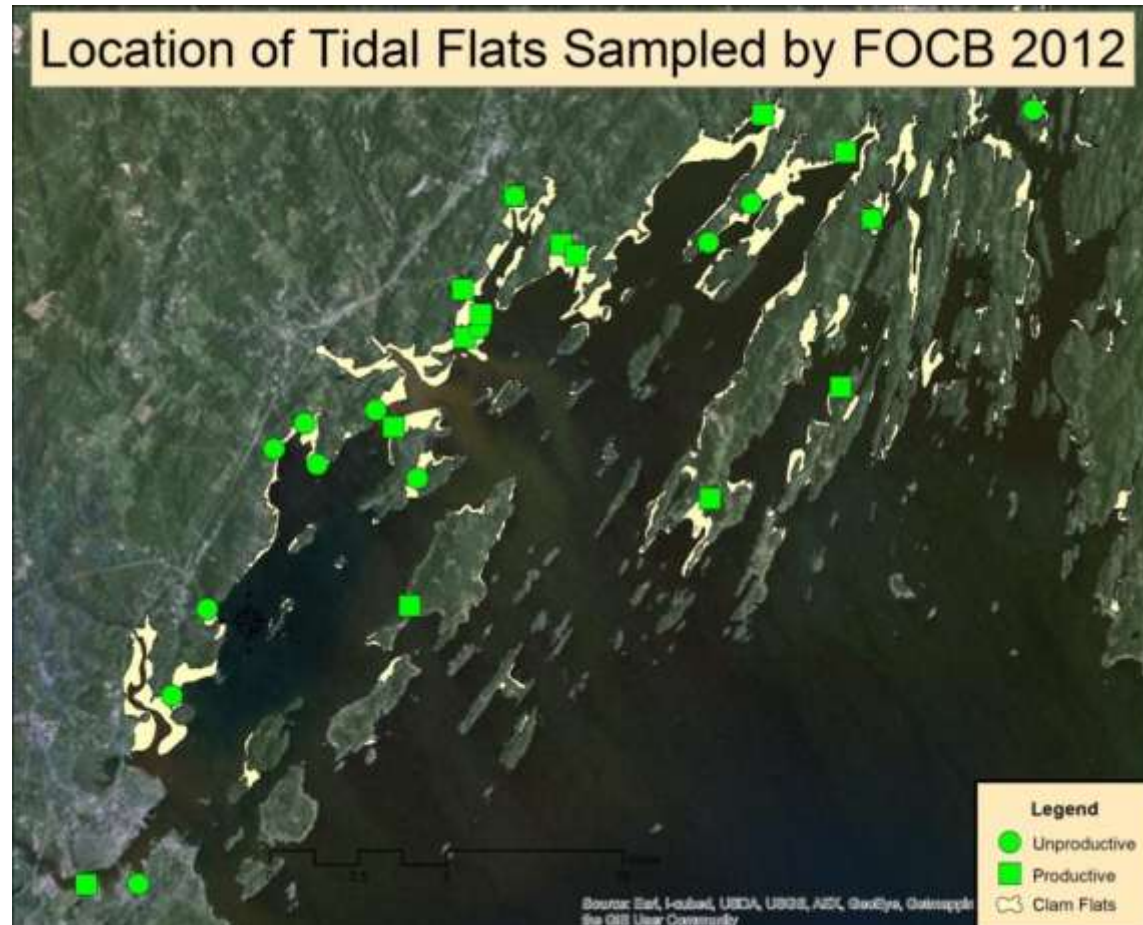
Settlement of *Mercenaria mercenaria* in the lab

Green et al. 2012

2012 Field Sample Sites

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- Thirty (30) sites selected by contacting local informants in each town
- Identify “Productive” and “Unproductive” flats
 - i.e., sites that are no longer considered productive



Casco Bay Clam Flat Monitoring Parameters 2012

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- Water pH and Temperature
- Sediment pH
- Sediment ORP
- Sediment % Carbon
- Sediment % Nitrogen
- Sediment Surface Area



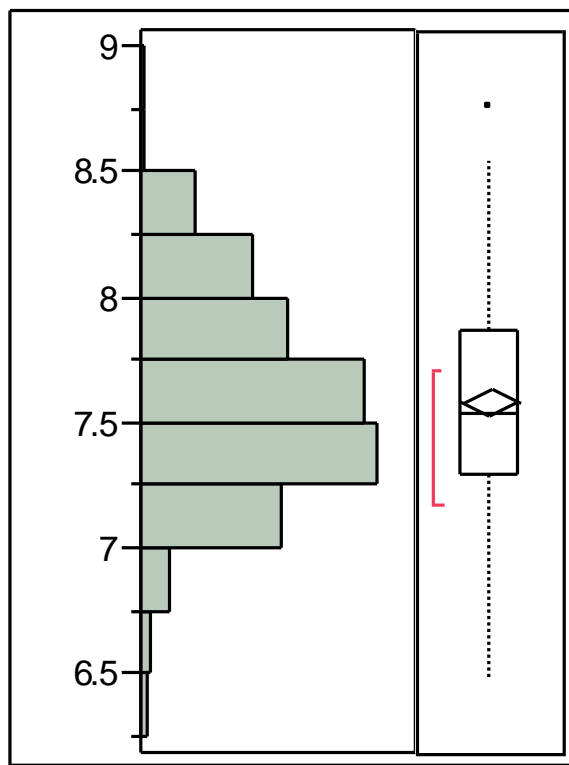
- Clam population assessments
- Limited data on Carbonate Saturation State (CSS)

Distribution of Sediment pH

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Distributions

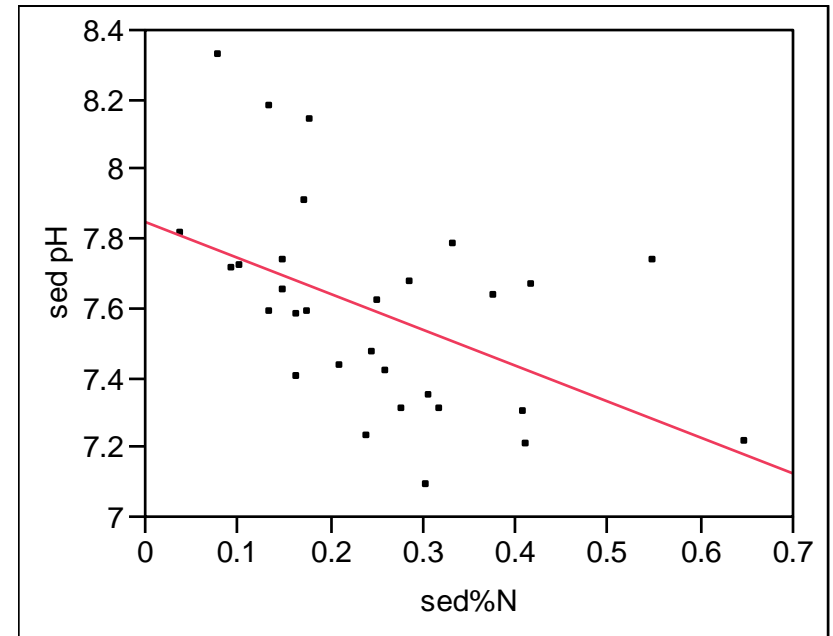
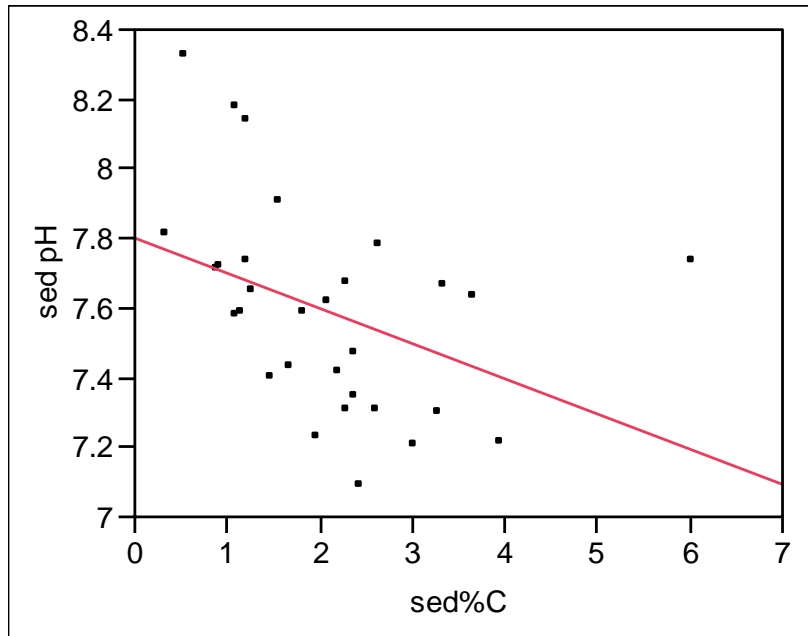
Sediment pH



Parameter	Value
Maximum	8.75
Median	7.54
Minimum	6.48
Mean	7.589
Standard Deviation	0.407
N	300

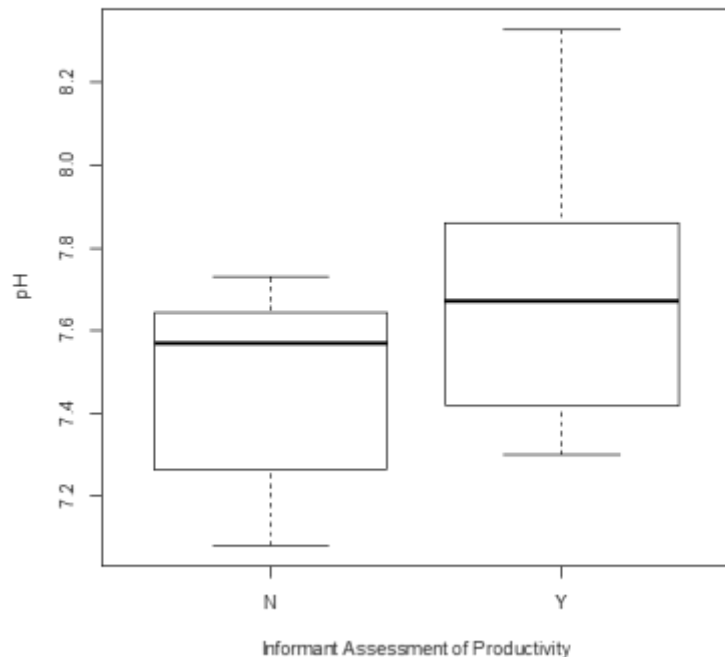
Sediment pH, Carbon and Nitrogen

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pH and Informant Assessment of Productivity

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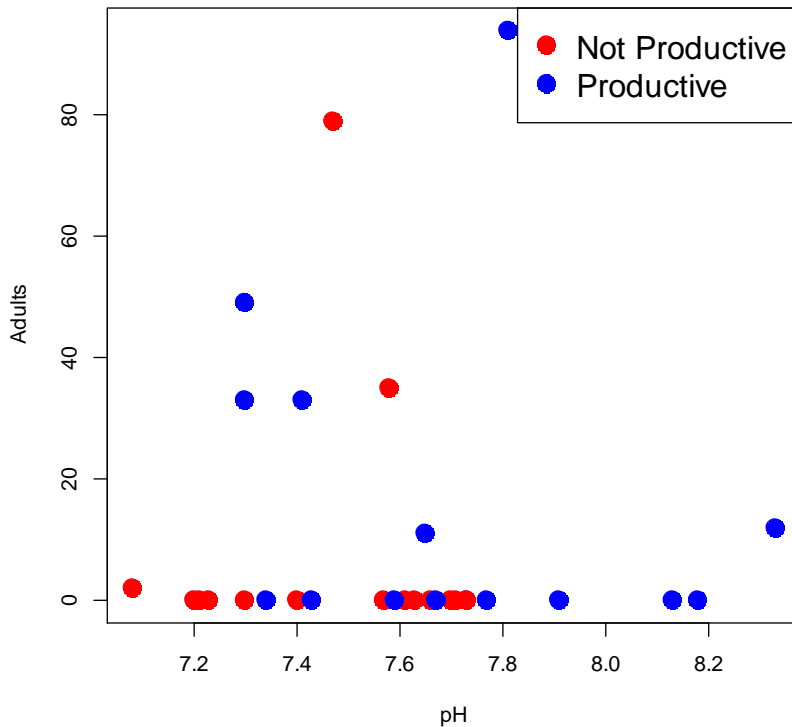


- “Productive” flats have higher average pH than “Unproductive” Flats
- Difference =
 0.23 ± 0.101
($p < 0.05$)

pH and Shellfish Abundance

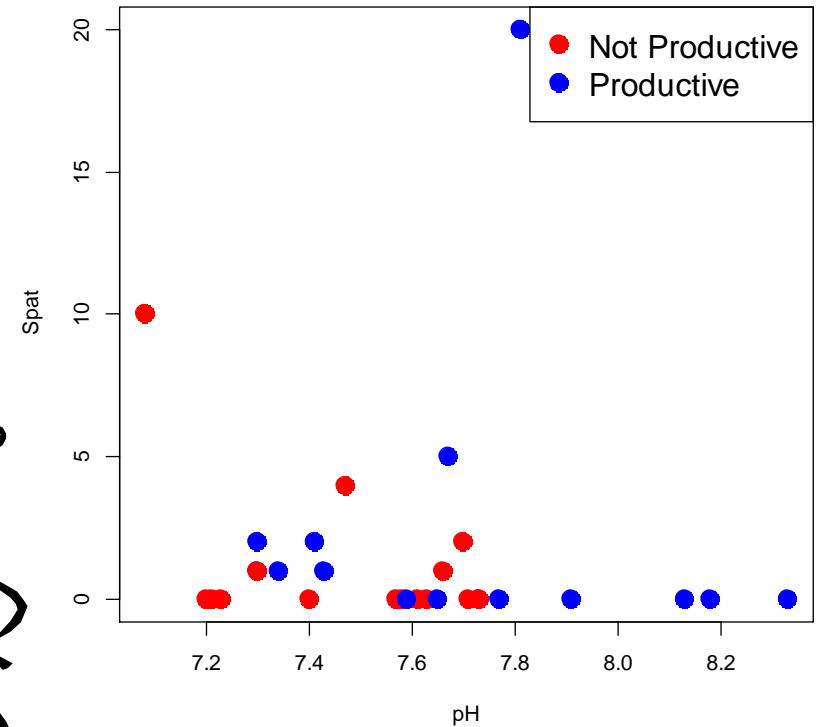
ADULTS

pH, Adult Clams, and
Informant Assessment of Productivity



SPAT

pH, Clam Spat, and
Informant Assessment of Productivity



2012 Results

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- Accurate and repeatable sediment pH measurements
- Some clam flats have very low sediment pH values
- Clam flats qualitatively categorized as “productive” had higher mean pH values than “not productive” flats
- But that pattern disappeared when compared to OBSERVED clam abundance
- Sediment with low pH values has relatively high %C and %N



Mud Summit

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- Originally imagined as a small working meeting
- Invited CBEP STAC
- Word got around, ended up with more than 30 people
- Review science
- Present results of 2012 field studies
- Seek advice on next steps
- Articulate local research priorities
- Assist FOCB in planning 2013 field studies

“Mud Summit” Results

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- Need to distinguish between two groups of questions:
 - ▣ Mechanisms of acidification
 - ▣ Effects on shellfish
- Specific research suggestions
 - ▣ Need to understand spatial and temporal variability of both pH /CSS and shellfish
 - ▣ Need to document relationship between pH – easy and inexpensive to measure – and carbonate saturation
- Recommendations for FOCB study 2013
 - ▣ Sample fewer sites, focus on spatial patterns
 - ▣ Transects across intertidal zone
 - ▣ Sample repeatedly
 - ▣ Collect more explanatory information