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# Dynamics in Using Shellfish Harvest for Nitrogen Mitigation

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# Using shellfish to address nitrogen pollution

- Not sponges of nitrogen
- Accumulate nitrogen as they grow
  - Nitrogen feeds algae > algae feeds shellfish > shellfish grow



# N Content in Local Shellfish

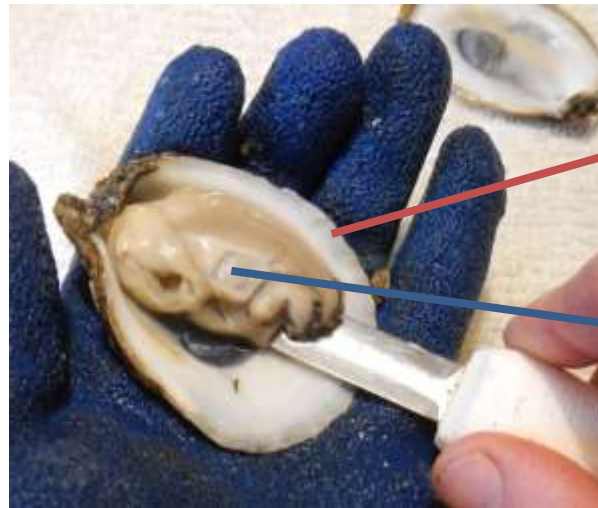
- How much?
- Do oysters have more than quahogs?
- Does it vary by waterbody?
- Is there seasonal variability?



# Shellfish Nitrogen Content

Kg of N:

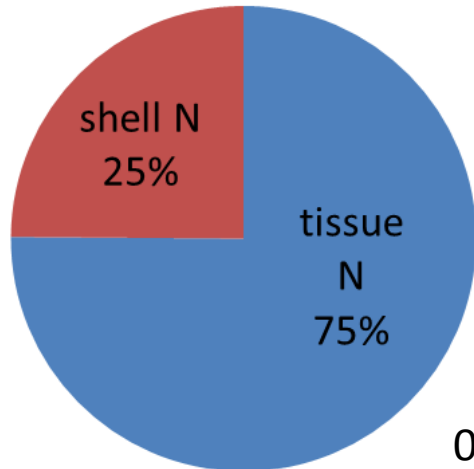
- 3600 oysters
- 4500 quahogs



Shell

Tissue = Meat

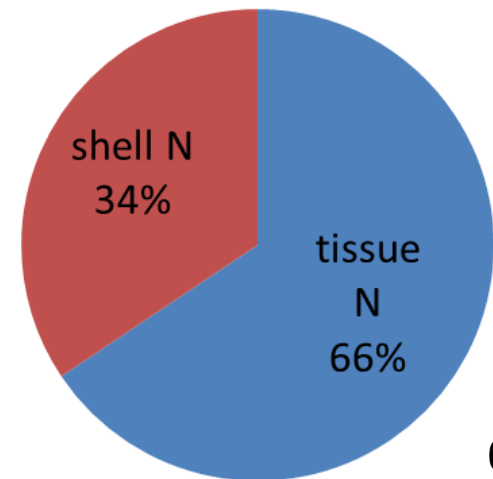
## Quahog N Distribution



0.22g N  
Total

A

## Oyster N Distribution



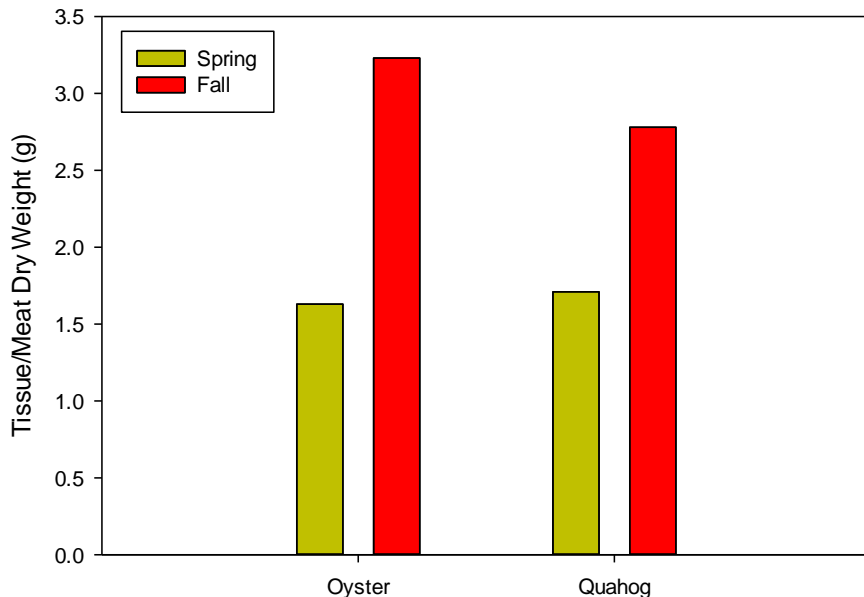
0.28g N  
Total

B

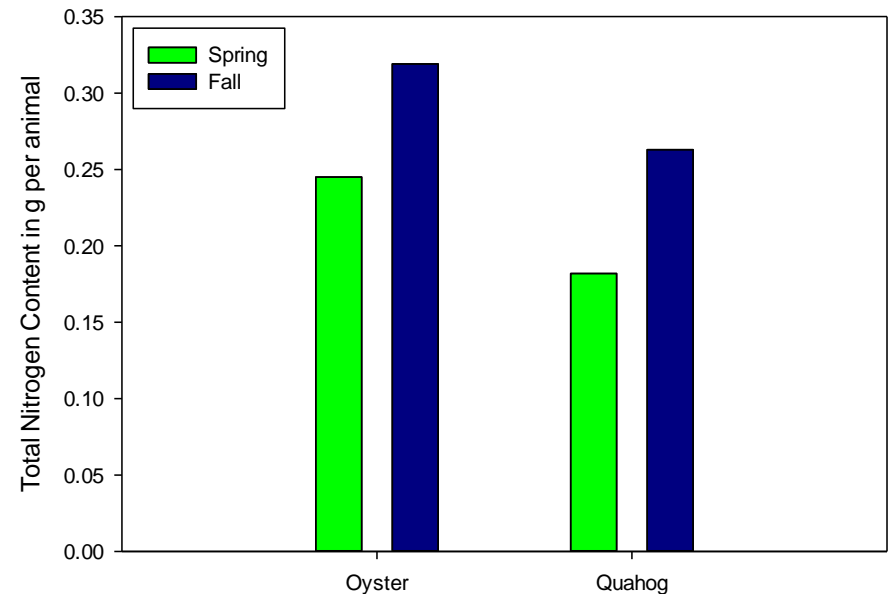
# Difference by Season

- Meat content is much higher in Fall
  - 98% and 63% more for oysters and quahogs
- Fall/winter harvest would maximize potential

Differences in Oyster and Quahog Tissue by Season



Oyster and Quahog Total N Content by Season



# Does Source of Shellfish Matter?

- Some but may be related to age and/or health of shellfish harvested
- Worth verifying in each stock

	Shell Length (mm)	Shell DW (g)	Tissue DW (g)	Tissue %N	Shell %N	Total N (g)	Total % N (DW)
<i>Quahogs from Cape Cod (this study)</i>							
Wild	57.1	32.6	2.43	7.50	0.18	0.24	0.67
Cultured	55.0	29.6	1.99	7.90	0.17	0.21	0.66
Quahog avg	56.1	31.2	2.22	7.69	0.18	0.22	0.67
<i>Wild quahogs from Virginia (Sisson et al. 2011)</i>							
	NS	NS	NS	5.96	0.15	NS	NS
<i>Oysters from Cape Cod (this study)</i>							
Wild	82.7	46.0	2.42	8.20	0.26	0.31	0.67
Cultured On	84.9	47.4	2.70	7.89	0.26	0.32	0.65
Cultured Off	83.1	35.7	2.36	7.95	0.21	0.26	0.70
Off Triploid	86.5	22.3	1.36	8.50	0.32	0.19	0.82
Oyster avg	83.8	40.9	2.43	8.01	0.24	0.28	0.69
<i>Wild oysters from reefs in Chesapeake (Newell 2004)</i>							
	76.0	150.0	1.00	7.00	0.30	0.52	0.34
<i>Cultured floating cage oysters - Chesapeake (Higgins et al. 2011)</i>							
	85.5	37.6	1.58	7.28	0.17	0.18	0.45

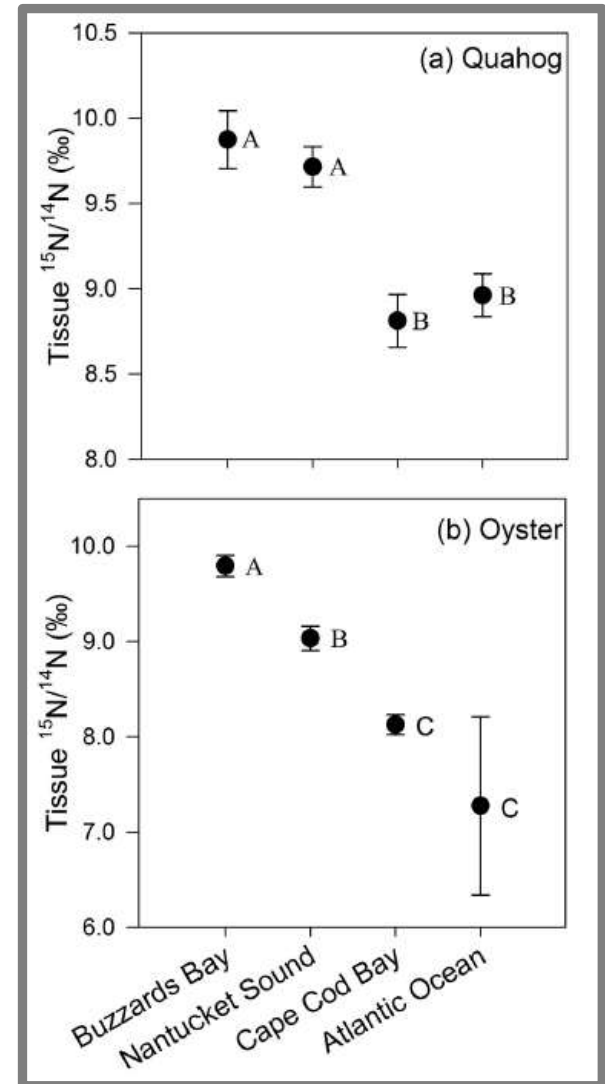
Adapted from: Newell and Mann 2012

**Table 3** Quahog and oyster data summary with literature comparisons. Adapted from Newell and Mann 2012. NS indicates values were not specified.



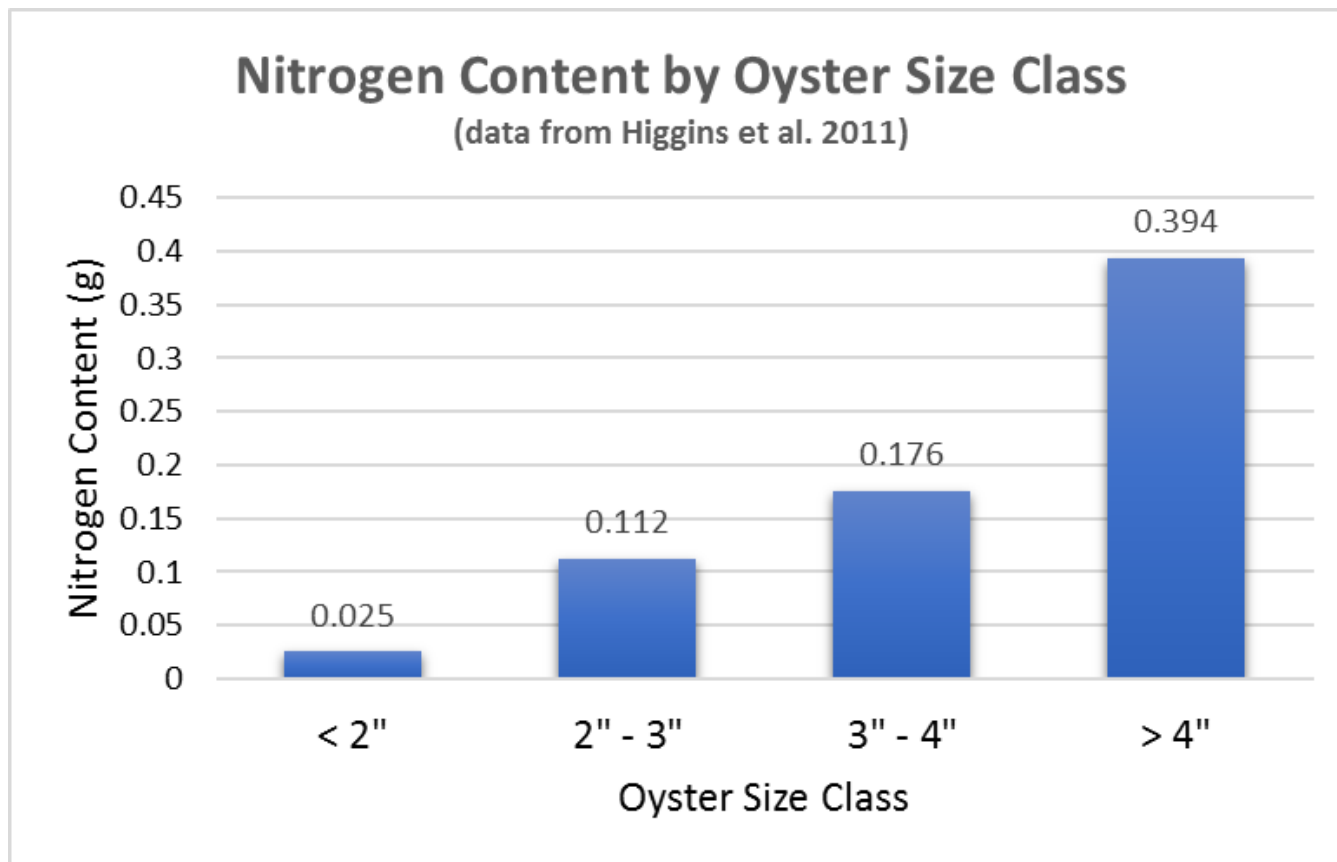
# Source of Nitrogen?

- N signature indicated some of that nitrogen originated from human sources
- Buzzards Bay and South Cape



# The Bigger the Better

- More nitrogen as they grow larger
  - Also more risk to losing them





# Challenges with Shellfish

- Adequate resources
- Social acceptability of use of space
- Seed availability
- Weather – storms/ice
- Disease
- Harmful algal blooms
- Predation



# Another Challenge?

- Making sure they get to market



Photo: Chris Linder



# Ramping up...

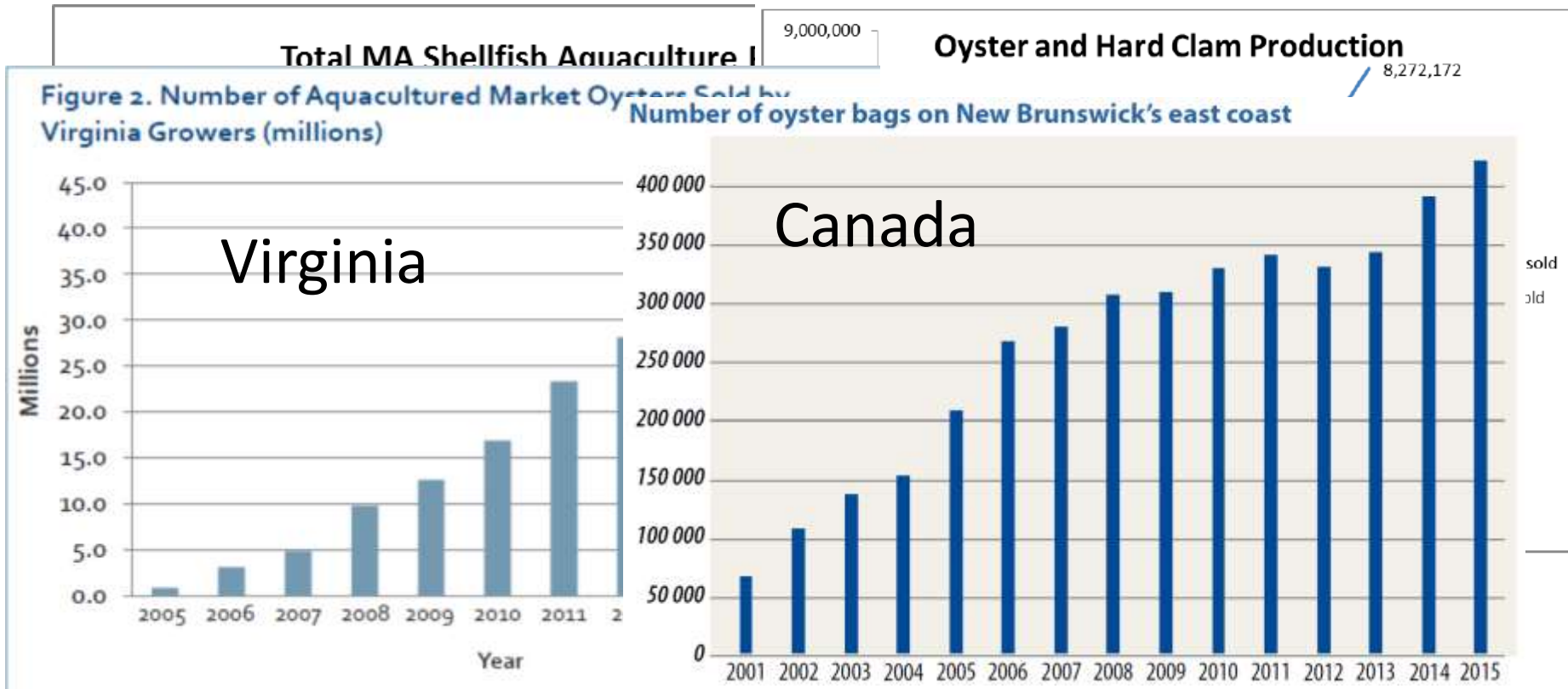
- ...Requires infrastructure
  - Public landings/docks/piers/waters
  - Are they adequate for ramped up production?
  - Will there be competition with other users?



Photos: Chris Linder

# Lots of Production

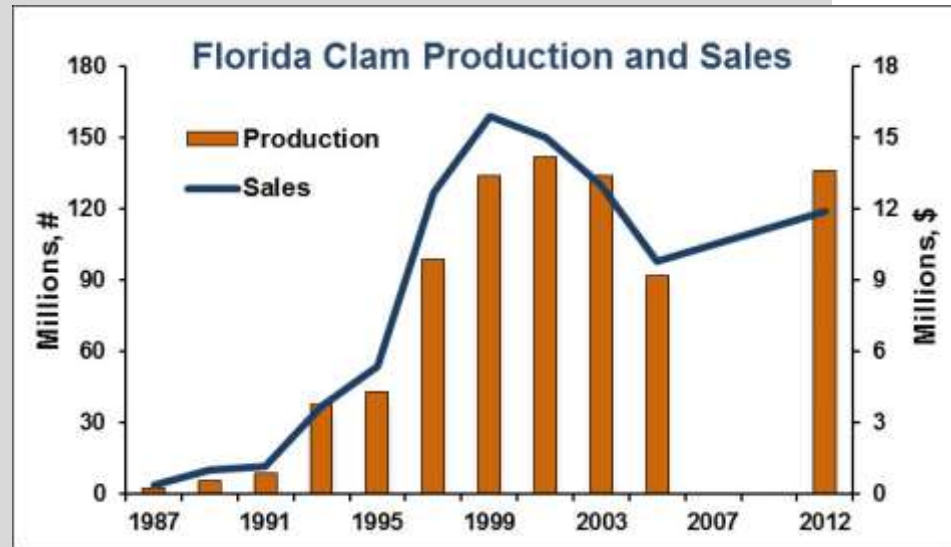
- North America is investing heavily in oyster production...is market side ready for it?



# Quahog - flat value example

Rough prices to harvester per littleneck (MA):

- 1981, 14 to 22 cents
- 1994, 13-18 cents
- 2002, 18 cents
- 2013, 22 cents
- 2018, 22-25 cents

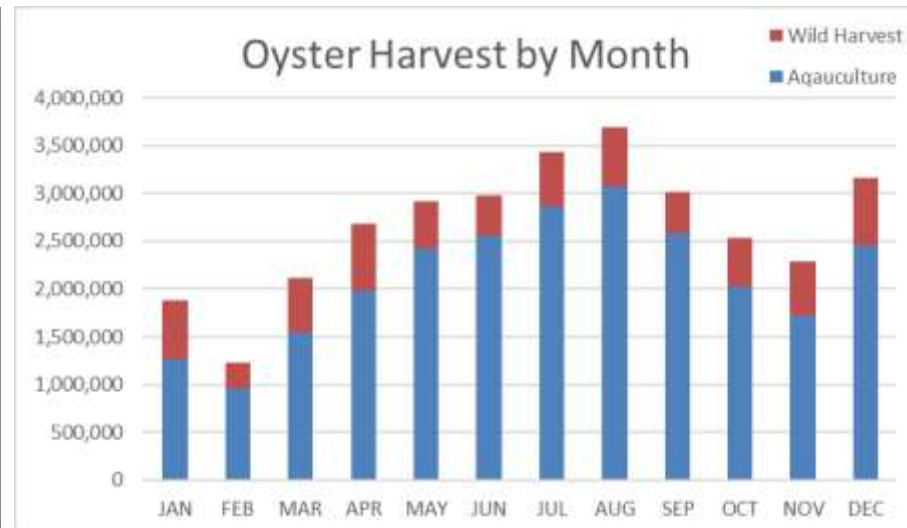
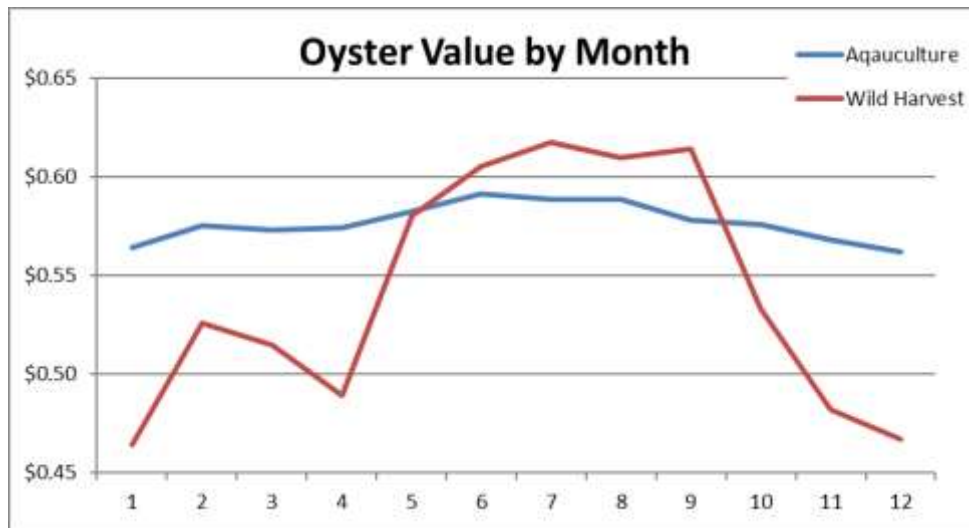


- Fairly flat, not rising with inflation
  - Coastwide production is up
- Value in FL is around 10 cents per clam, little change

# Oyster Value Volatility

- More so in “wild” fisheries
- Wild harvesters have nothing invested so they can accept much cheaper prices
  - “cannibalize” some of current market share and drive down the price
  - Lack control over growth/size and appearance in wild oysters

2015 MA data



# Other Oyster Market Opportunities?

- Shucked meats
  - Smoked, tinned, etc.



# Why would we do shucked product?

- Market is not picky – don't have to be pretty
  - Production can be less labor intensive
- Bigger oyster meats usually worth more
  - Better N mitigation potential
- Reduced handling for harvesters (I think)
- Value added possibilities
- Expands current markets






# Why are we not doing this?

- Lower value per piece
- It requires infrastructure
  - Especially to aid in shucking process
- Labor force can be a challenge
- Slim margins = little interest
  - May require some help up front
  - N removal credits?



# Food for Thought

- Removing nitrogen through shellfish requires a lot of shellfish...
  - Ramping up shellfish production requires a market strategy...
- 
- Can we grow market opportunities & protect current aquaculture markets-value?
  - Where do we see these projects long term?

# Acknowledgements

- Shellfish samples for nitrogen content from private growers and municipal shellfish programs
- Boston University Stable Isotope Lab
- Barnstable County for funding nitrogen portion
- NOAA Sea Grant for funding market work
  
- For more information:
  - <https://www.capecodextension.org/>
  - <https://web.whoi.edu/seagrant/>