Working with Shellfish for Nitrogen Mitigation
(The Cape Cod experience thus far)

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Cape Cod’s water problem...

- Excess nitrogen (N) is deteriorating marine water quality
  - Water quality standards for wildlife habitat being exceeded
  - 80% from septic-wastewater
    - On average 50% removal to meet standard
  - Population is up (steep increase since 1960, 4x increase)
- 208 plan update in 2015 to address issue – region wide
  - Series of approaches, traditional and non
  - Provide management strategies for consideration
  - TMDL info based on Mass. Estuaries Project (MEP) monitoring
- Shellfish aquaculture one of 20+ potential methods for consideration
Quantifying the nitrogen extraction potential

• Extension looked harvestable shellfish – oysters and quahogs
• Looked at a range of water bodies, culture conditions, season
  • http://dx.doi.org/10.1016/j.marpolbul.2016.12.072
• There is some variability – SIZE, season, culture conditions
  • Avg market bound littleneck or oyster 0.2-0.3g N
• Isotope analysis – N source link to us (nutrients from us)
• Provided some review of denitrification science – variable
  • Needs further study
208 Technologies Review

• 2017 panel reviewed shellfish and PRB technologies
• Hope was to clarify numbers from pilot projects
• Updated numbers but a range was best
• Every project will be different depending on approach
  • Species
  • Size – full grow out or relay after a season
• Denitrification with sediments unlikely to be approved at this time
  • Just harvest of N through harvest of shellfish
• Shellfish culture/harvest still in pilot phase but can be an approved technology
Projects currently using shellfish

• Falmouth – Little Pond
• Orleans – Lonnies Pond
• Mashpee – town wide
  • Comprehensive Wastewater Management Plan - shellfish an approved part
Falmouth – Little Pond Pilot

- Degraded estuary with lots of development
- Planted 1.5M oyster seed in 2013 ramping up to 3M 2017
- 9 upwellers to floating oyster bag array
  - 4500 bags!
- 1 season of growth then relay to other areas – fishery enhancement
Falmouth – cont.

- Very successful propagation program
- Good outreach with neighbors
- Cost ~$250k per year
  - Mostly staff, 4-5 for growing season
- Selling some big seed to other towns
- Modest clearing of particulate N around oysters
- Target is 10-20% of load to Little Pond
- Still a pilot
Orleans – Lonnies Pond Pilot

- Smaller estuary off Pleasant Bay
- Targeting 100% of 300kg N if possible
- Working with 4500 floating bags in an acre
- Scaling up to 2.7M oysters in year 3 of pilot
  - $200-300k per year

- Locally reduced particulate N (algae)
- Town would like to have industry take over
  - After pilot is complete
  - Not cheap, don’t have the staff
  - Ideally as a nursery site with sale of seed or relay after one growing season

- Still working with DEP for approval
Mashpee

- First to have shellfish culture/harvest approved in CWMP

- Started in 2004 with 160 bags of oyster remote set to 2000 bags/year
  - Mashpee River – harvest 100-500k oysters per year mostly recreational
  - Target 10% of N load

- Quahogs – most of the other program areas
  - 1M to 3M to 5M to 8M (last year) and 10M this year
  - 10 upwellers and some field nursery trays
    - Initial plan called for buying large quahog seed – not doable
    - All for fishery enhancement – mostly commercial

- Also trying to include private shellfish farms
Mashpee - continued

• Still awaiting comprehensive water quality info
  • Should start seeing results in next year or 2?
• Mashpee River had fish kill in 2005
  • No fish kills since significant oyster planting
  • DO does not go below 2mg/L anymore
• Quantifying rec harvest with game cameras at landings
  • Review video and estimate shellfish quantity in buckets/baskets
  • In addition to sporadic spot checks
• Will continue ramp up
  • “Plan B” was required in CWMP in case shellfish does not work out
Universal Challenges thus far...

- Conclusive data...still waiting on the official success story
- Staffing for municipal oversight
  - Always complaints of being short handed
- How does private aquaculture fit in?
  - Public-private partnership needs to be worked out
- Seed availability, and sometimes quality
- Fiscal resources for gear and staff
  - Enforcement need increases
- Scaling up takes longer than expected
Other Challenges - Risks

- Predators
  - Crabs with quahogs – trapping programs seem to help
  - Drills with oysters planted on bottom

- Mortality events
  - Disease: MSX, Dermo, QPX, neoplasia
  - Could new diseases emerge?
  - Ice and storm loss
  - HAB’s
Other Challenges-Risks

• Social acceptability of use of space
  • User conflicts

• Harmful algal blooms and harvest closures
  • Affect harvest and market

• Market Challenges
  • Oysters too big or too ugly for half shell market
  • No harvest...no credit
Is Assumed Market a Risk With These Programs?

• Oyster aquaculture is growing everywhere
  • Steady growth
  • 95+% of cultured shellfish are oysters
  • Steady market that has been built for high end raw bar
• Similar growth up and down East Coast
• Will there be a saturation point???
Consideration for diversifying markets...

• Shucked or value added products
  • Avoid diluting the growing farmed oyster industry
  • Can harvest at larger sizes
    • More Nitrogen removed through bigger oysters
    • Less concern over time of year for harvest
  • Less stringent Vibrio controls
  • Can arrange harvest period for maximum N remediation and off-season for harvesters

• Increased volume of nitrogen remediation oysters could benefit with alternate market!
• But we have no infrastructure...
Preliminary Conclusions

• We have some solid pilot programs/projects going
• Time will tell how effective they are at reaching targets
• Nobody is approaching this as the sole solution to N issues
• Municipal shellfish programs have challenges/opportunities
  • Best suited to meet the town/publics goals (rather than profit driven)
  • Already know the waters and history
  • But need to really scale up to meet WQ goals
• Municipal shellfish programs should be engaged early
• Growing shellfish requires resources!
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