Orleans Water Quality Advisory Panel Stakeholder Workshop

Aquaculture/Shellfish Propagation Breakout Group

Thomas Parece, AECOM Technical Services, Inc.
Sia Karplus, Science Wares, Inc.
Anamarija Frankic, Biomimicry New England
Mark Begley, MT Environmental Restoration

January 20, 2016

Shellfish Overview: Oyster Aquaculture Singles

Seed

Upweller

Floating Bags and Trays

Shellfish Overview: Oyster Reef

Remote Set Bags

Grow-out in Trays

Grow-out in Floating Bags

Bottom Planting

Objectives of Demonstration and Full Scale Projects

- Demonstration Project
  - Evaluate Shellfish Growth and Survival
  - Monitor Water Quality Changes
  - Measure Denitrification and Other Habitat Improvements
  - Optimize Growing Systems
  - Validate Project Costs
  - Determine Magnitude of Scalability
- Full Scale Implementation
  - Grow Shellfish in Quantities Consistent with Consensus Plan
  - Quantifiable Improvement in Water Quality Parameters

Shellfish Demo and Full Scale Siting Evaluation Criteria

Site Suitability

- Available Growing Area/Adequacy of Acreage
- Water Quality Indicators
- Disease/Predation
- Ease of Access
- Aesthetic Impacts
- Representativeness of the Site (Transferability)
- Use Conflicts
- Ability to Co-Locate with other Non-Traditional Technologies

Permitting

- Abutter Compatibility
- Wild Harvest Conflicts
- Grow-Out to Harvest Size
- Permittability

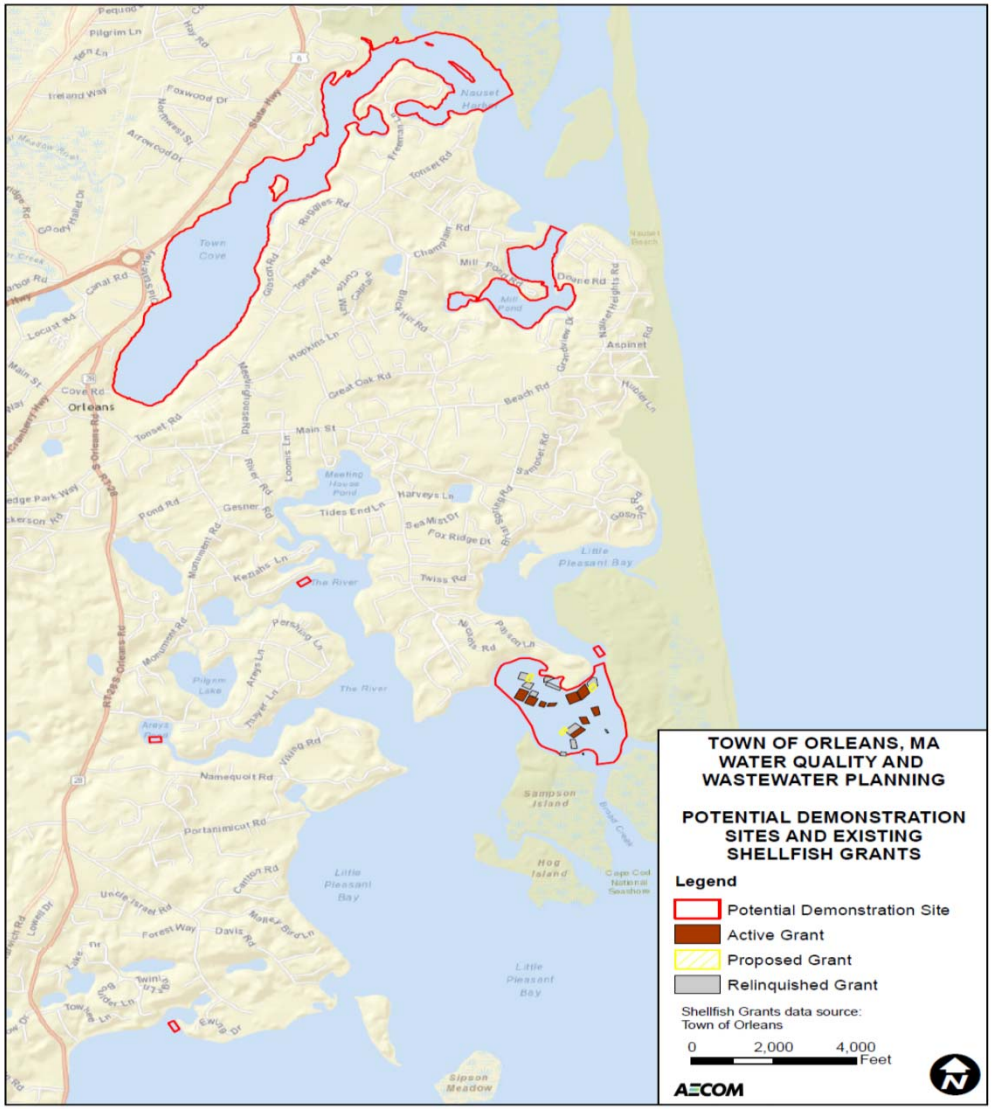
Project Evaluation

- Expected Survival
- Overall Likelihood of Monitoring Plan to Yield Quantified Results

Other/Overriding Considerations

Shellfish Locations Evaluated

- **Nauset Harbor**
  - Town Cove
  - Mill Pond
- **Pleasant Bay**
  - The River (upper)
  - Arey's Pond
  - Quanset Pond
  - Pochet
  - Little Pleasant Bay (existing grant areas)



Shellfish Demonstration Siting Evaluations

- Review Nauset Harbor and Pleasant Bay Watersheds to Identify Potential Demonstration Locations That May Not Have Been Identified During the First Phase of Planning
- Study Available Data (Water Quality and Other Data)
- Conduct Land Based and Water Based Field Investigations of Potential Sites
- Discuss Potential Demonstration Sites with Orleans Shellfish Constable and Harbormaster
- Refine Criteria to be Used in the Site Selection Matrix
- Rank Sites Based on Criteria Using Site Selection Matrix

Shellfish Demonstration Siting Evaluations (cont.)

- Assess the Relative Importance of Each Criteria to Establish a Weighting of Criteria, if appropriate
- Perform QA/QC of Initial Ranking and Criteria Weighting
- Review Preferred Demonstration Sites that Resulted from the Site Selection Matrix Process
- Submit Site Selection Matrix to Town of Orleans for Review
- Recommend Demonstration Site Locations

Shellfish Demonstration Site Evaluation Matrix

Criteria	Criteria Weight	Site A: Town Cove: Quahog Propagation		Site B: Mill Pond: Quahog Propagation		Site C: Little Pleasant Bay: Existing Grants		Site D: Pochet : Oyster Reef		Site E: Arey's Pond: Oyster Singles in Floating		Site F: Lower River: Oyster Singles in Floating		Site G: Quanset: Oyster Reef	
		Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
Site Suitability															
Available Growing Area/Adequacy of Acreage															
Water Quality Indicators															
Disease/Predation															
Ease of Access:															
Aesthetic Impacts															
Representativeness of the Site (Transferability)															
Use Conflicts															
Ability to Co-Locate with other Non-Traditional Technologies															
Permitting															
Abutter Comaptability															
Wild Harvest Conflicts (DMF)															
Grow-Out to harvest size Allowed (DMF)															
Permittability															
Project Evaluation															
Expected Survival															
Overall Likelihood of Monitoring Plan to Yield Quantified Results															
Other/Overriding Considerations															
Town Cove/Mill Pond: drills preclude oysters (per Mass Shellfish Growers Assn (communication with Shellfish Constable)			-	-	-	-	-	-	-	-	-	-	-	-	-
Town Cove: population study of quahogs needed prior to additional shellfish propagation/demo (communication with Shellfish Constable)			-		-	-	-	-	-	-	-	-	-	-	-
Pochet: monitoring difficult if LPB is also a demo		-	-	-	-	-	-	-	-	-	-	-	-	-	-
LPB: Shellfish Constable and Harbormaster recommended working with existing growers for demonstration	-	-	-		-		-	-	-	-	-	-	-	-	-
Total Criteria Points			-		-		-		-		-		-		-
Rating			-		-		-		-		-		-		-

- Scoring
  - A good ranking (1) was assigned if the criterion could be fully met.
  - A neutral ranking (0) was assigned if the criterion could be met in part, but there were some potential issues and/or difficulties.
  - A poor ranking (-1) was assigned if the criterion could not be met.

Shellfish Demonstration Site Preliminary Draft Ranking

Criteria	Criteria Weight	Site A Town Cove: Quahog Propagation		Site B Mill Pond: Quahog Propagation		Site C Little Pleasant Bay: Existing Grants		Site D Pochet : Oyster Reef		Site E Arey's Pond: Oyster Singles in Floating		Site F Lower River: Oyster Singles in Floating		Site G Quanset: Oyster Reef	
		Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
Site Suitability															
Available Growing Area/Adequacy of Acreage	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1
Water Quality Indicators	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Disease/Predation	1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	1	1
Ease of Access:	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Aesthetic Impacts	1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	1	1
Representativeness of the Site (Transferability)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Use Conflicts	1	1	1	1	1	1	1	1	1	0	0	-1	-1	1	1
Ability to Co-Locate with other Non-Traditional Technologies	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Permitting															
Abutter Comaptability	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wild Harvest Conflicts (DMF)	1	1	1	1	1	1	1	0	0	1	1	0	0	0	0
Grow-Out to harvest size Allowed (DMF)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Permittability	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
Project Evaluation															
Expected Survival	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overall Likelihood of Monitoring Plan to Yield Quantified Results	1	-1	-1	-1	-1	1	1	1	1	1	1	0	0	0	0
Other/Overriding Considerations															
Town Cove/Mill Pond: drills preclude oysters (per Mass Shellfish Growers Assn (communication with Shellfish Constable)			-	-	-	-	-	-	-	-	-	-	-	-	-
Town Cove: population study of quahogs needed prior to additional shellfish propagation/demo (communication with Shellfish Constable)			-		-	-	-	-	-	-	-	-	-	-	-
Pochet: monitoring difficult if LPB is also a demo		-	-	-	-	-	-	-	-	-	-	-	-	-	-
LPB: Shellfish Constable and Harbormaster recommended working with existing growers for demonstration	-	-	-		-		-	-	-	-	-	-	-	-	-
Total Criteria Points			9		9		12		10		9		7		12
Rating			4		4		1		3		4		7		1

Shellfish Demonstration Monitoring Overview

- Sampling Plan
  - High Spatial Resolution
  - High Temporal Resolution
- Continuous Monitoring of Chlorophyll a, DO and Transparency
- Benthic Cores for Denitrification

Shellfish Demonstration Monitoring Overview (cont.)

- Bi-weekly, Bottom and Surface Water Sampling (May – Sept) for:
  - Total Nitrogen (TN)
  - Nitrate
  - Ammonia
  - Dissolved Organic Nitrogen (DON)
  - Dissolved Inorganic Nitrogen (DIN)
  - Particulate Organic Nitrogen (PON)
  - Temperature
  - Total pigments: Chlorophyll a, Pheophytin a
  - Orthophosphate
  - Salinity
  - Dissolved Oxygen (DO)Transparency (Secchi Depth)

Shellfish Demonstration Next Steps

- Review with Town
- Finalize Site Evaluation
- Complete Engineering Work Plan
- Develop Cost Estimates (Project, O&M, Replacement and Monitoring)

Town of Orleans Massachusetts

Thank You

AECOM

Shellfish Demonstration Site Preliminary Draft Ranking

Criteria	Criteria Weight	Site A Town Cove: Quahog Propagation		Site B Mill Pond: Quahog Propagation		Site C Little Pleasant Bay: Existing Grants		Site D Pochet : Oyster Reef		Site E Arey's Pond: Oyster Singles in Floating		Site F Lower River: Oyster Singles in Floating		Site G Quanset: Oyster Reef	
		Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score
Site Suitability															
Available Growing Area/Adequacy of Acreage	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1
Water Quality Indicators	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Disease/Predation	1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	1	1
Ease of Access:	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Aesthetic Impacts	1	1	1	1	1	1	1	1	1	-1	-1	-1	-1	1	1
Representativeness of the Site (Transferability)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Use Conflicts	1	1	1	1	1	1	1	1	1	0	0	-1	-1	1	1
Ability to Co-Locate with other Non-Traditional Technologies	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Permitting															
Abutter Comaptability	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wild Harvest Conflicts (DMF)	1	1	1	1	1	1	1	0	0	1	1	0	0	0	0
Grow-Out to harvest size Allowed (DMF)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Permittability	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
Project Evaluation															
Expected Survival	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Overall Likelihood of Monitoring Plan to Yield Quantified Results	1	-1	-1	-1	-1	1	1	1	1	1	1	0	0	0	0
Other/Overriding Considerations															
Town Cove/Mill Pond: drills preclude oysters (per Mass Shellfish Growers Assn (communication with Shellfish Constable)			-	-	-	-	-	-	-	-	-	-	-	-	-
Town Cove: population study of quahogs needed prior to additional shellfish propagation/demo (communication with Shellfish Constable)			-		-	-	-	-	-	-	-	-	-	-	-
Pochet: monitoring difficult if LPB is also a demo		-	-	-	-	-	-	-	-	-	-	-	-	-	-
LPB: Shellfish Constable and Harbormaster recommended working with existing growers for demonstration	-	-	-		-		-	-	-	-	-	-	-	-	-
Total Criteria Points			**9**		**9**		**12**		**10**		**9**		**7**		**12**
Rating			**4**		**4**		**1**		**3**		**4**		**7**		**1**

Arey's, Lower River and parts of Town Cove, much of the bottom is anoxic, fine-grained sediment (muck). This precludes bottom planting of oysters

Arey's has narrow Namequoit neck allowing better quantification of input water nitrogen concetrations, which increases likelihood that monitoring plan will quantify N removal

Pochet permitting may involve National Seashore, and access involves permission from private landowner

Pochet only measurable from a monitoring perspective if LPB aquaculture is not a demonstration

Pochet: Shellfish Contable thought this location was suitable for a "no take" zone/oyster reef

LPB has number of oysters being grown and harvested from required annual Shellfish Grant reporting

Town Cove/Mill Pond should have a quahog population study completed to establish baseline numbers before further quahog propagation/demonstration

Town Cove/Mill Pond have significant drill population; planting of oysters is not recommended per Massachusetts Shellfish Officers Association Best Management Practice

The Lower River is an open cove, causal water quality improvements are hard to quantify by monitoring

The Lower River has visibilty, good for public education