

# AQUACULTURAL PRODUCTION AND NITROGEN REMOVAL IN FALMOUTH, MA – CURRENT PROGRESS & PROJECTIONS

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# Shellfish for Water Quality Benefits

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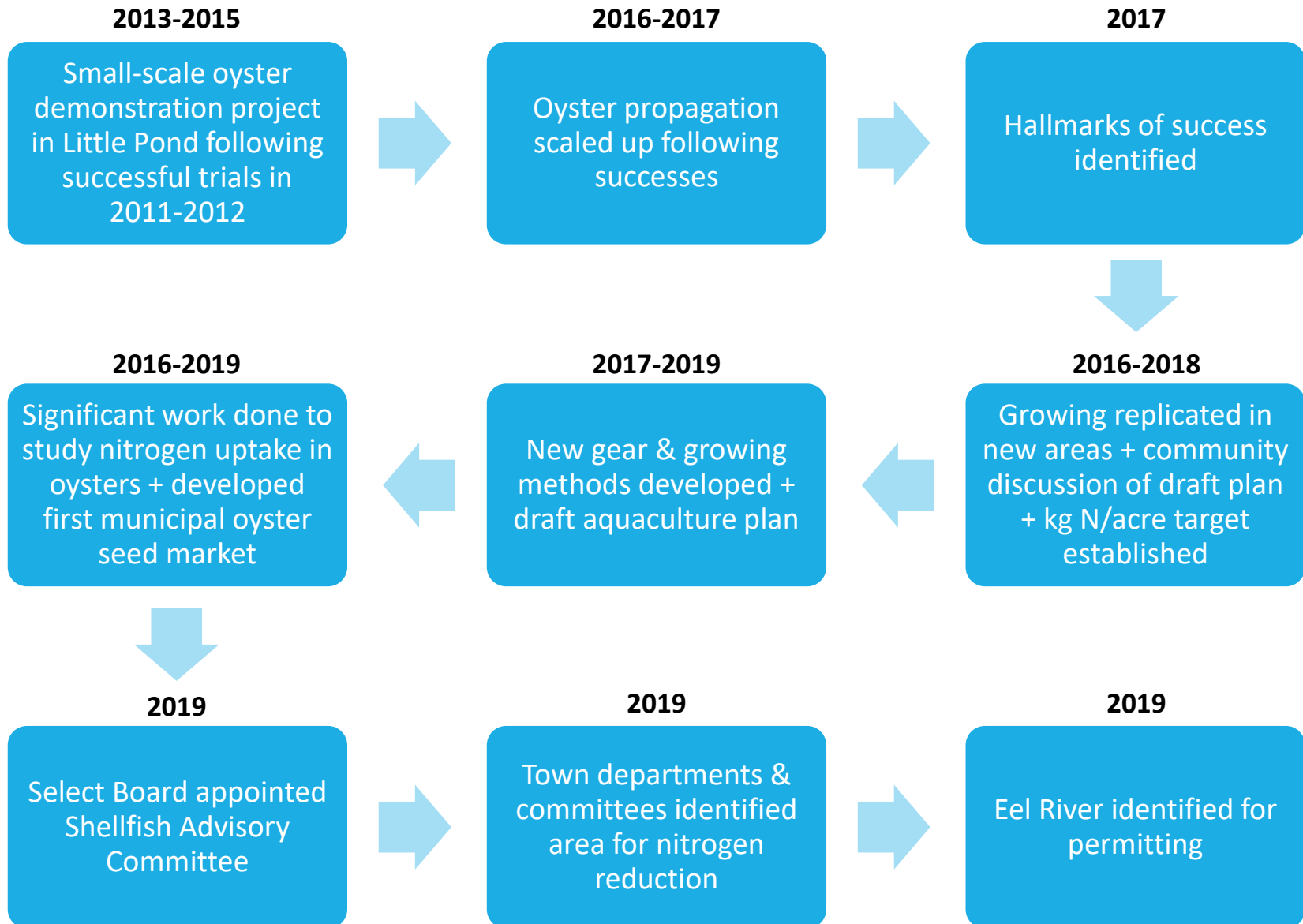
- The Falmouth Select Board tasked the Water Quality Management Committee to explore non-traditional ways to remove nitrogen from the estuaries in the least expensive and most environmentally-sensible ways possible.
- Over the last 12 years the Town has explored many non-traditional alternatives to sewerage and found that shellfish aquaculture is an alternative that has been quantitatively proven to work and has garnered community acceptance.
- In addition to nutrient removal benefits, the current municipal aquaculture design generates numerous positive economic benefits by creating jobs, creating a marketable product, and providing a revenue stream for municipal propagation of municipal shellfish.



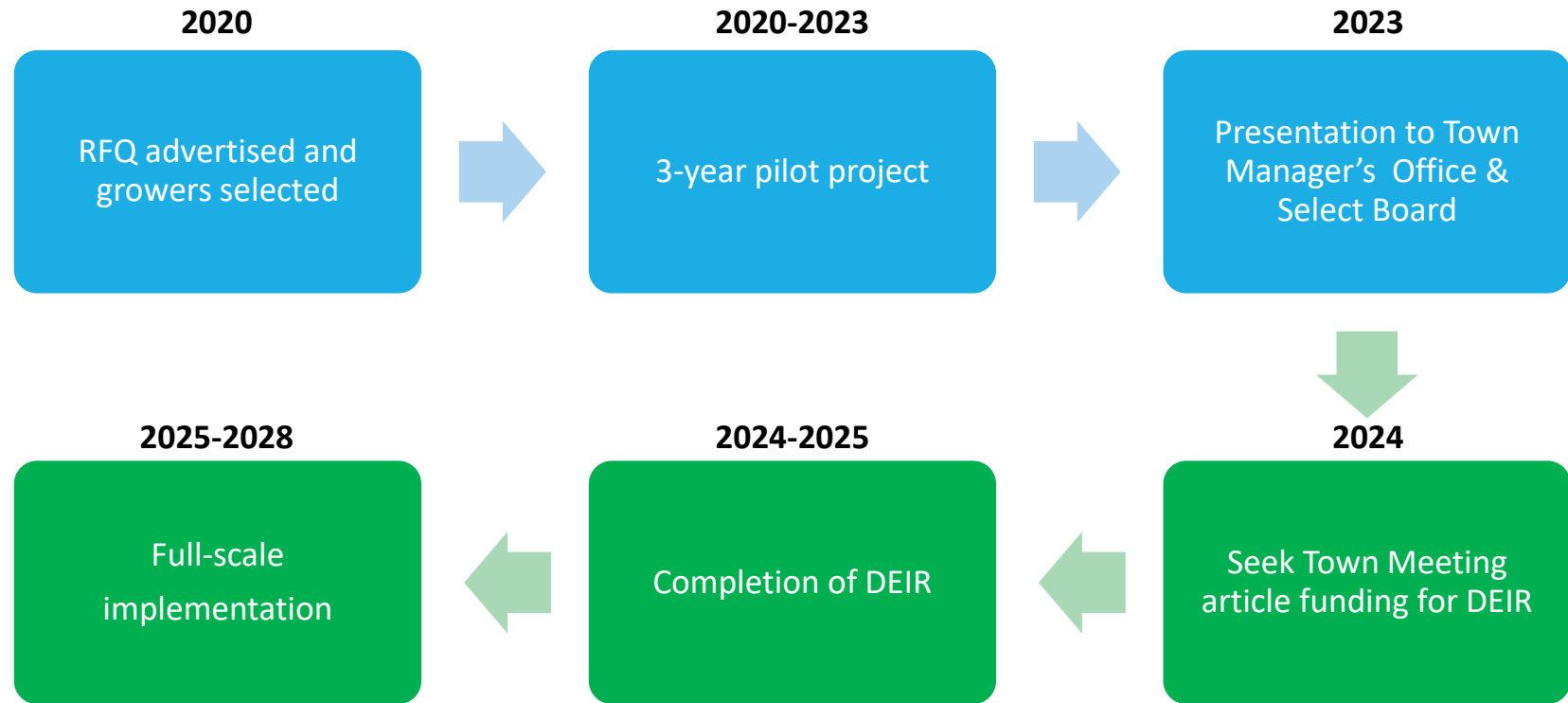




# Historical Development



# Historical, Current, & Future Development

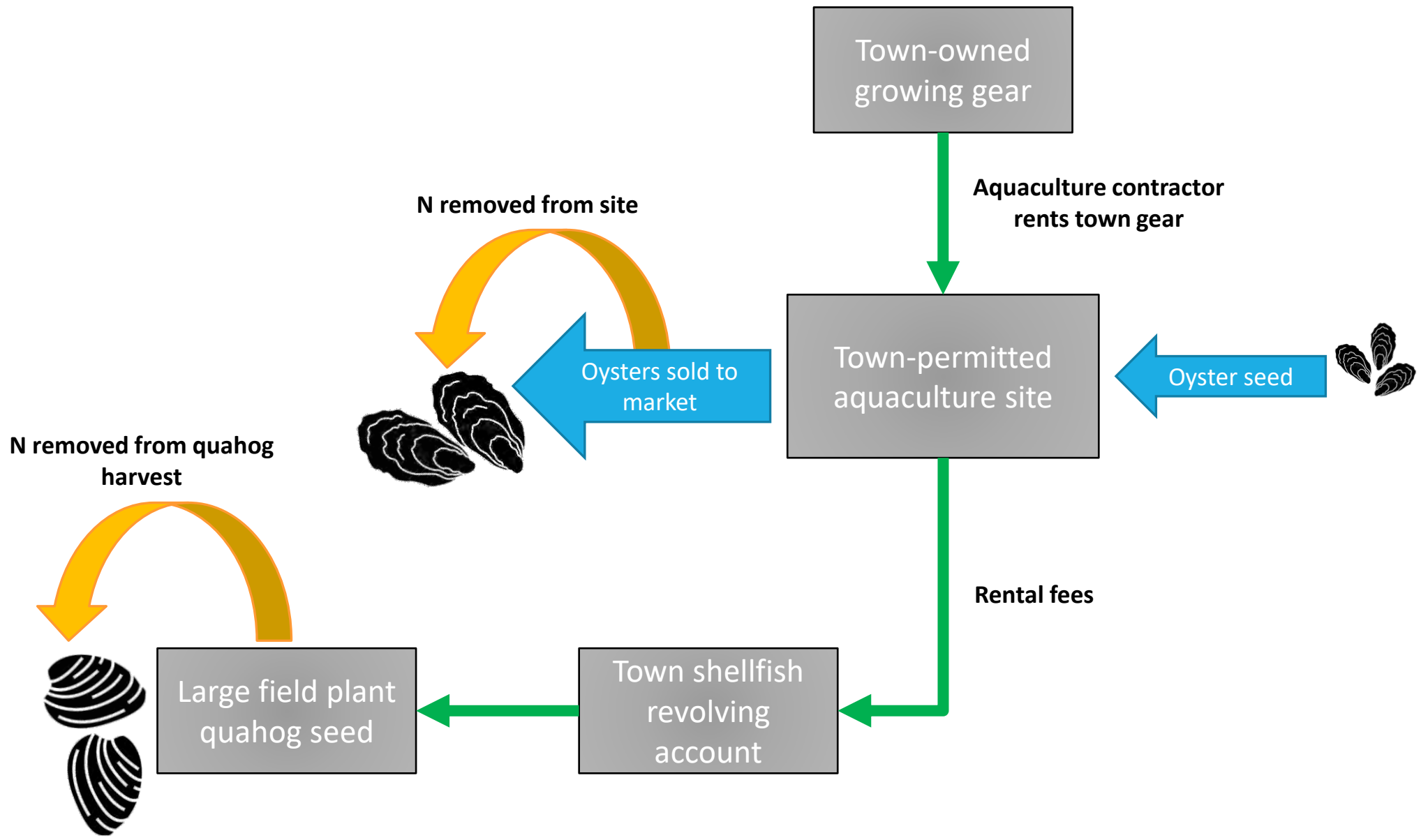


# Eel River Aquaculture Pilot Project

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- Trial sites to identify how nitrogen reduction-based shellfish farming could work as part of a significant alternative to address nitrogen reduction in Falmouth's estuaries.
- Evaluate the feasibility of engaging commercial aquaculture contractors to grow and harvest oysters using high-density floating gear.





# For Planning Purposes

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- Nitrogen removal potentials of 130 kg N/acre for oysters in Falmouth are based on the specifications and targets set forth in the Eel River pilot which have been demonstrated to be achievable if the outlined growing strategy is followed.
- There have been no validation studies of the N removal rates for quahogs or scallops developed specifically for Falmouth.



# Eel River Aquaculture Contractor Pilot Project Summary

	2020	2021	2022	2023
<b>Oysters Sold</b>	Grower A: 9,330 Grower B: 16,450 Grower C: 16,450  <b>Total: 42,230</b>	Grower A: 337,284 Grower B: 113,366 Grower C: 185,500  <b>Total: 636,150</b>	Grower A: 405,650 Grower B: 238,028 Grower C: 291,675  <b>Total: 935,353</b>	Grower A: 421,250 Grower B: 374,819 Grower C: 632,600  <b>Total: 1,428,669</b>
<b>Net Wt. Increase</b>	-	Grower A: 19,202.36 kg Grower B: 11,593.80 kg Grower C: 12,616.66 kg  <b>Total: 43,412.82 kg</b>	Grower A: 19,733.97 kg Grower B: 14,575.11 kg Grower C: 11,946.25 kg  <b>Total: 46,255.34 kg</b>	Grower A: 21,833.71 kg Grower B: 17,180.84 kg Grower C: 18,220.79 kg  <b>Total: 57,235.35 kg</b>
<b>Revenue</b>	Grower A: \$447.84 Grower B: \$789.60 Grower C: \$789.60  <b>Total: \$2,074.04</b>	Grower A: \$19,600.00 Grower B: \$8,042.02 Grower C: \$7,234.50  <b>Total: \$34,876.52</b>	Grower A: \$15,680.00 Grower B: \$19,600.00 Grower C: \$17,360.00  <b>Total: \$52,640.00</b>	Grower A: \$12,600.00 Grower B: \$19,600.00 Grower C: \$19,600.00  <b>Total: \$51,800.00</b>

**Total oysters sold: 3,042,402**

**Total revenue: \$141,390.56**

**Where do net weight increase values come from?**

*Weigh-in and weigh-out report data. Each grower must provide this data each growing season.*

Outgoing (harvest) weight – Incoming (seed) weight = **Net weight increase**

# Benefits of using Shellfish for Nutrient Management

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- Even if shellfish did not show a measurable impact on water quality in the immediate vicinity:
  - Nutrient removal is significant (in terms of quantity as well as the fact that it is at the critical location of impairment) and can be documented quantitatively (equivalent to tens to potentially hundreds of sewer connections).
  - Implementation generates sustainable economic growth (repeatable business revenues, consistent jobs) instead of being a burden on taxpayers.
  - Environmental and economic impacts are virtually immediate.
  - The Town has developed a model that showcases that a competitive resource can be successfully shared.
  - Community perception that the Town is utilizing alternative actions to costly sewerage.

# Expansion: Expectations

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- Due to the success of the pilot aquaculture program, Falmouth is looking to expand the program and develop it in the Town's full scale water quality planning efforts.
- At the very upper end, the expansion has the potential for up to 70 new farms, to include both public (municipal resource areas) and private (aquaculture grant) farms.
- Realistically, the projected range is over 35 new farms, with 100-200 acres of production.



# By the Numbers Case Study 2014-2024

## Combined in Falmouth Waters

- Municipal propagation
- Private aquaculture
- Public/private partnership
- Municipal demonstration farms

Town-wide oyster production	\$21,000,000.00
Value of oysters produced	\$10,000,000.00
Jobs created (full-time equivalent)	25
Volunteer hours on municipal oyster propagation <i>Total value @ \$20.35/hour</i>	13,194 hours <i>\$268,497.90</i>
Total ToF propagated oysters sold to other towns <i>Total value</i>	356,400 <i>\$69,793.00</i>
Total buying power of large quahog seed via gear rental + intermunicipal sales	\$211,183.56 or ~ 5 million animals







# Expansion: Next Steps

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- \$400K Town Meeting article for permitting, direct environmental impact review (DEIR), & engineering Fall 2024
- \$4M Town funding for full implementation
  - Gear development Fall 2025
- Collaborating with MIT Sloan School of Management to address business models for enhanced aquaculture
- Partnering with Barnstable County Sheriff Donna Buckley
  - Female inmate training program
- New position for public/private manager for documentation and daily management
- Expand volunteer corps from 300 to 500



# Eel River Nitrogen Bioextraction & Equivalent Avoided Capital Costs

Harvested weight gain (2021-2023 yearly avg/acre)	35,484 kg
Bioextracted nitrogen/acre (0.30% of harvest weight)	106.5 kg
Fraction of Eel River allocation (3210 kg/yr)	3.32%
"Equivalent" households (4.5kg N/yr)	23.7
Capital cost (urine diversion @ \$80)	\$1,896
Capital cost (I/A septic @ \$35K)	\$830K
Capital cost (Falmouth - Little Pond @ \$20K)	\$474K
Capital cost (Falmouth - Great & Green Ponds @ \$33K)	\$782K
Capital cost (Falmouth - Great & Green Ponds @ \$44K)	\$1.04M
Capital cost (Mashpee @ \$93.8K )	\$2.22M
Capital cost (Barnstable @ \$117K)	\$2.77M