

Cross-Breeding and Field Trials for Disease Resistant Oysters

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Northeast Regional
Aquaculture Center



Founded in 1888 as the Marine Biological Laboratory

Disease – One of the most serious impediments to aquaculture production of eastern oysters, *Crassostrea virginica*.

Southern New England

Protistan diseases MSX and Dermo – dramatic increase in frequency and prevalence over past several decades has resulted in severe decline in oyster production.

Northern New England

High incidence of *Roseovarius* oyster disease (ROD) reported to cause crop losses >90%.



Selective Breeding for Improved Disease Resistance (and growth performance).

- **Selective Breeding Program at Haskins Shellfish Lab (>30 generations of selection):**

New England Hybrid Line (NEH)

Putative Resistance to Dermo and MSX

Most widely used line in New Jersey and southern New England

Selective Breeding for Improved Disease Resistance (and growth performance).

- **Selective Breeding Program at the University of Maine (~ 3 generations of selection):**

Univ. Maine Flowers Select Line (UMFS)

Improved cold-water growth performance

Putative Resistance to ROD

Most widely used line in Maine



**Individually, programs have been successful.
However.....**

**UMFS line (ROD resistant) typically experiences 100% mortality
when grown in locations impacted by MSX / Dermo**

And

**NEH line (Dermo / MSX resistant) experienced >70% mortality
when grown in locations impacted by ROD and does not grow
well in colder water.**

Cross-breeding for improved disease resistance

Goals:

1) Compare performance of interline hybrids constructed between currently available lines (UMFS and NEH) at sites impacted by ROD, Dermo & MSX.

2) Examine whether oysters selected from local natural environments in southern New England that have survived heavy disease pressure perform as well or better than commercially available lines at sites throughout southern New England.

Cross-breeding for improved disease resistance

Part I: Seed Oysters from 5 “lines”

UMFS

NEH

UMFS x NEH F1 hybrid

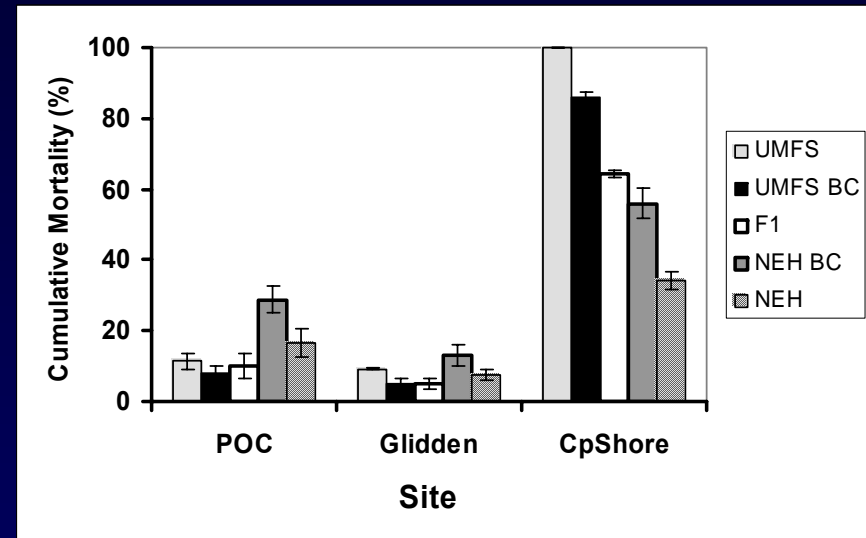
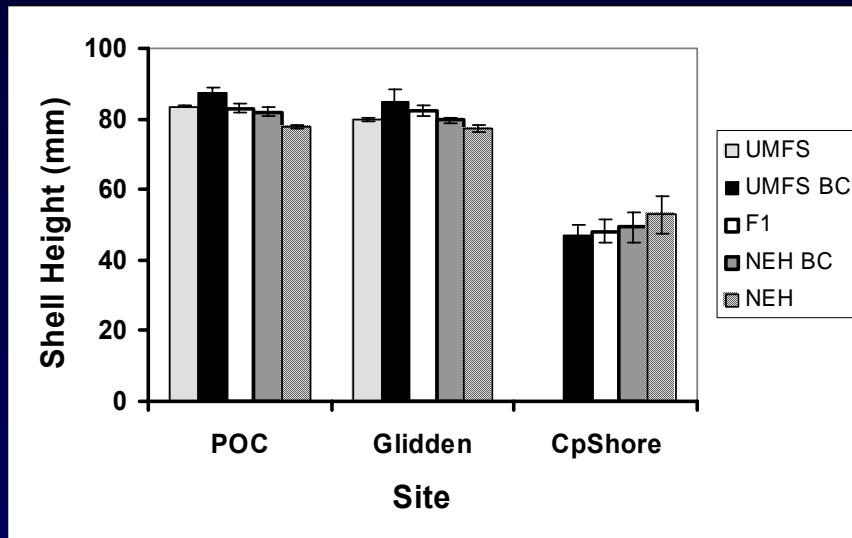
F1 X UMFS Backcross

F1 x NEH Backcross

Deployed at 3 sites in Maine and Rutgers' Cape Shore site in New Jersey in June of 2007.

Results (as of December 2008)

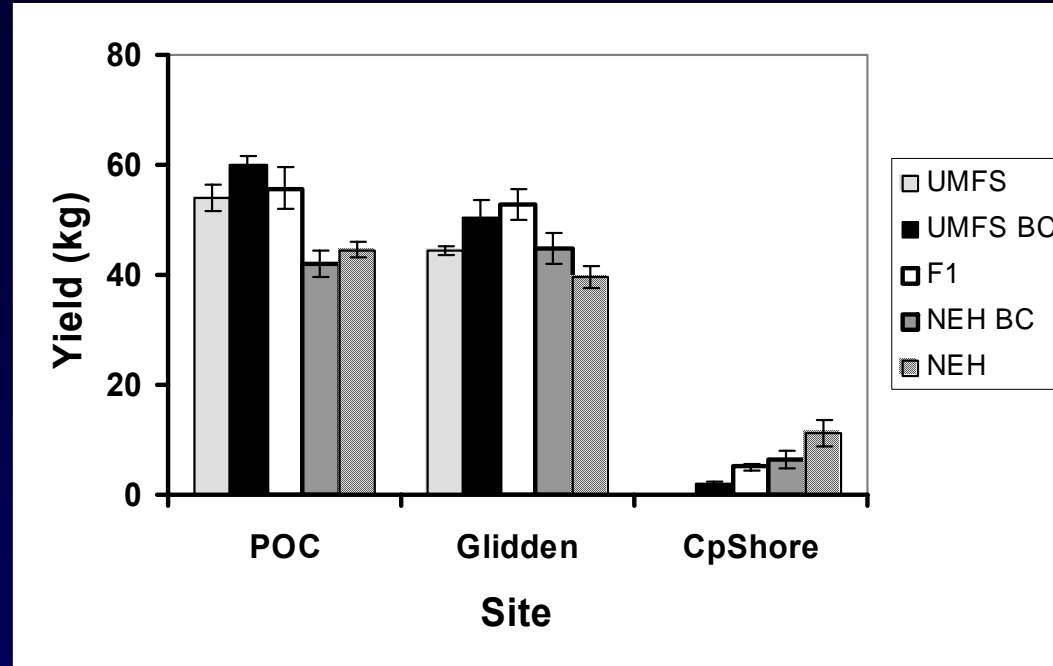
UMFS x NEH Crossbred Lines Maine – New Jersey



- Little variation in growth among lines.
- Only minor variation in mortality among lines at Maine sites except for NEH and NEH BC at Glidden Point (no obvious signs of disease)
- Mortality near 100% for UMFS at New Jersey site.

YIELD [WET WEIGHT * SURVIVAL IN KG]

Estimates “final weight” realized from original 1000 animals deployed.



Marginal Yield (across all three sites)

F1 ≈ UMFS BC > UMFS ≈ NEH BC ≈ NEH

Cross-breeding for improved disease resistance

Part II.

Seed Oysters from 5 “lines”

EGP (local)

Clinton (local)

NEH

UMFS x NEH F1 hybrid

F1 x NEH backcross

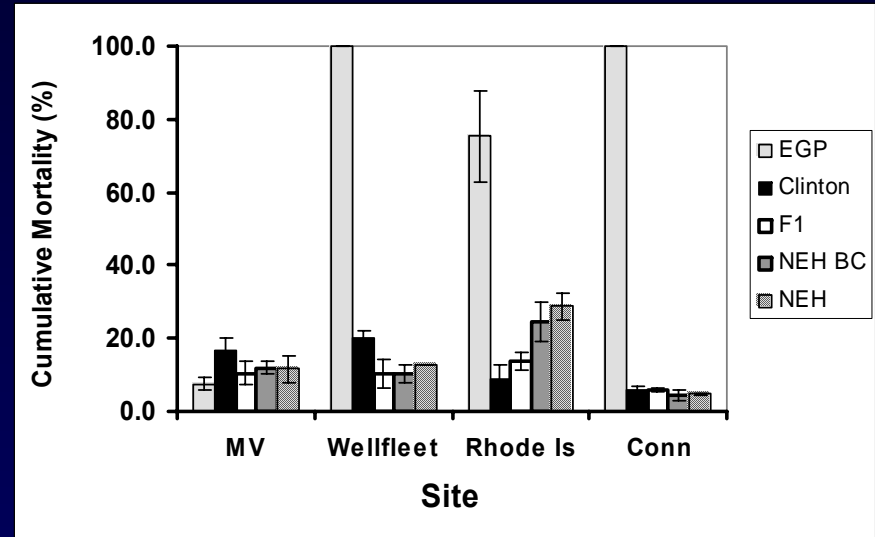
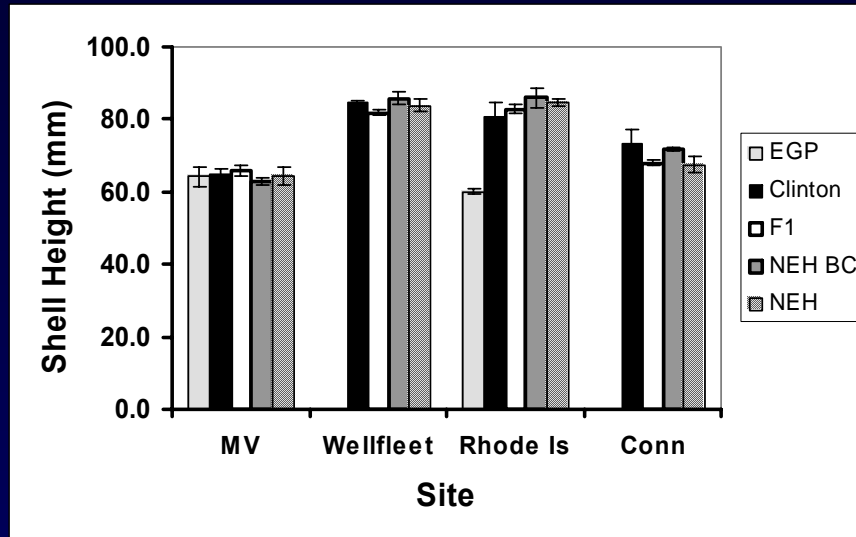
Deployed at 4 sites: Westerley, RI, Clinton, CT, Wellfleet and Martha's Vineyard, MA in June of 2007 (Dermo, MSX and some ROD).

Test whether “local” lines developed using survivors after disease outbreaks demonstrate better disease resistant than other commercial lines.

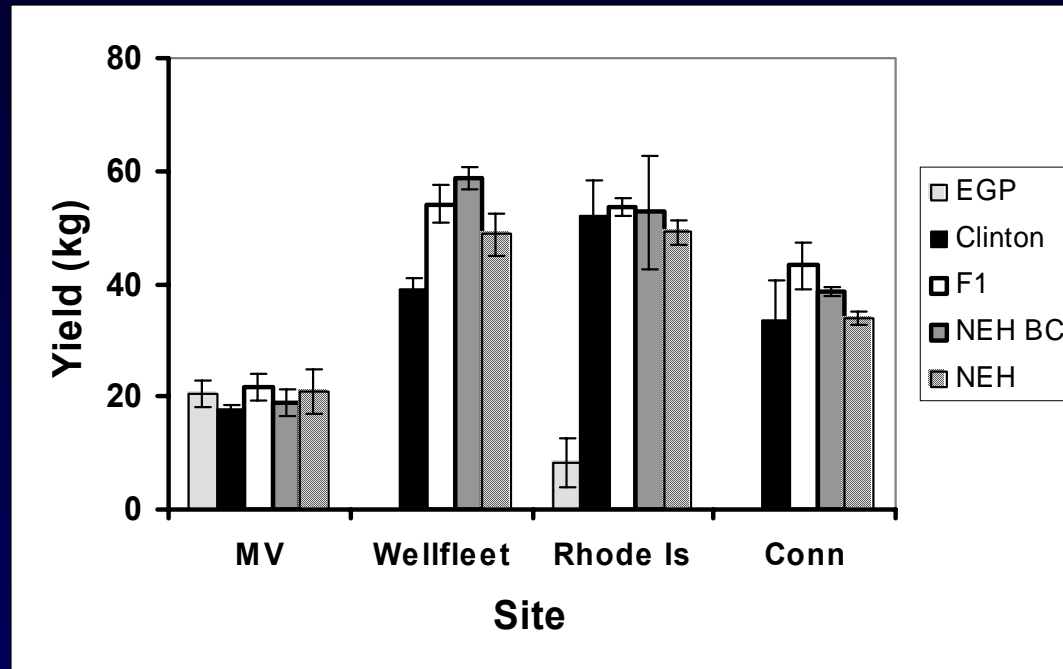
Growth and Survival monitored till December 2008.

Results (as of December 2008)

Local Lines & NEH Hybrids Connecticut to Massachusetts



- Site to site variation in growth but little no variation in growth among lines except EGP which was deployed late.
- Poor survival for EGP
- Greatest difference in survival among lines at Westerly, Rhode Island site.



Marginal Yield (across all four sites)

F1 ≈ NEH BC > NEH ≈ Clinton >>> EGP

Summary of Cross-Breeding Work

Little interline variation in shell height.

Variation in yield primarily driven by differences in survival, although there is some line-specific variation in wet weight (not shown).

Hybrid lines (F1, UMFS BC, & NEH BC) provided highest marginal yield. However, UMFS BC line had poor survival at Cape Shore Site.

Overall, performance of local “Clinton” stock equivalent to the industry standard NEH line at three of four sites.

Results are only preliminary (and we still have a lot of disease testing to perform), however using hybrid or backcross lines for enhanced resistance to multiple diseases shows promise.