

HYBRID CLAMS (*Mercenaria mercenaria*, *M. campechiensis*) FOR FLORIDA, AQUACULTURE: Laboratory Evaluation

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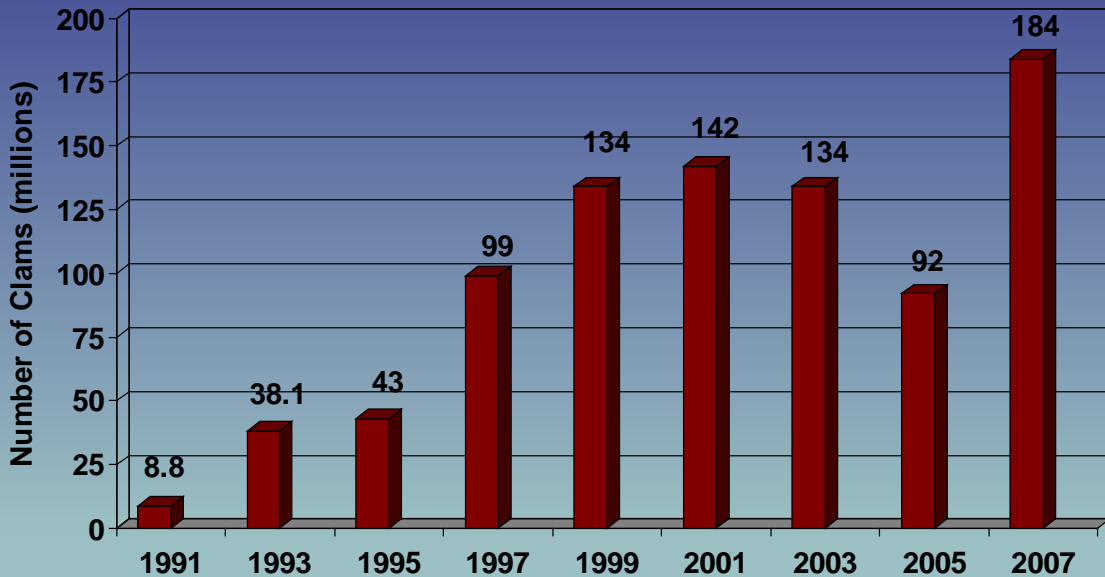


Florida Clam Aquaculture

- Industry initiated and developed rapidly during 1990s
 - Successful job retraining programs
 - > 350 former fishermen
 - 2-4 acre leases, 1100 acres
 - Annual net profit potential \$30-35K



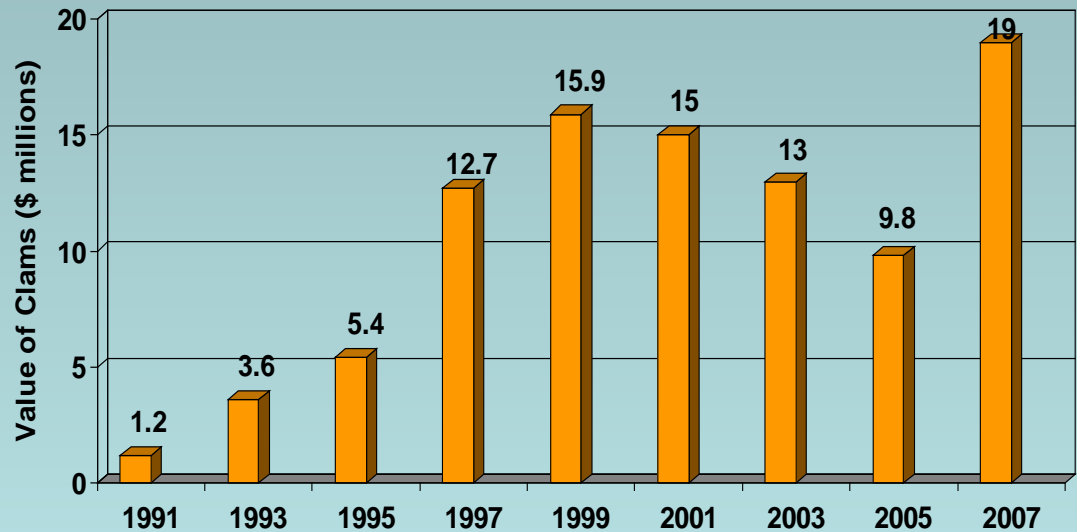
Florida Clam Industry Growth, 1991-2007



Production



Sales value



1987-2005 Compiled from Florida Agricultural Statistics Service's survey of aquaculturists

2007 Compiled from University of Florida survey of shellfish wholesalers

Florida Clams Grow Fast

- 15-18 month growout from seed (6mm) to littleneck (2" SL)
- Third to half of other state's crop times
 - Year-round growing conditions
 - Subtropical water temperatures
 - High natural productivity levels



Why improve upon a good thing?

- Increasing summer mortalities (> 50%)
- High water temperatures and other environmental stressors during prolonged summer months



Photo Courtesy: Carlton Ward, Jr., LINC Foundation

Improvement of Cultured Clam Stocks through Hybridization

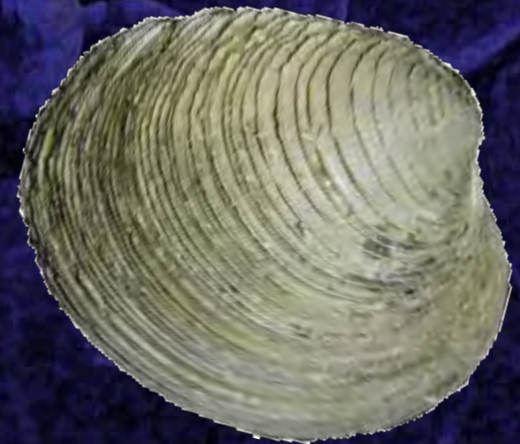
- Hybridization is a breeding technique
 - Used in commercial agriculture and finfish aquaculture
- Hybrids have superior traits to either parent species
 - For example, improved growth or environmental stress resistance
- Clam hybridization for “mariculture” potential was examined by Winston Menzel, Florida State University, in the 1960-70s
 - Hybrids had superior commercial traits to either parent species, ie. growth, shelf life
 - But little data on merit of hybrids for improved survival

Clam Species

- Northern hard clam - Fisheries and aquaculture MA to FL
- Southern quahog - Recreationally fished NC to Caribbean
 - Not cultured - tendency to gape in refrigerated storage
 - May have production traits for resisting environmental stressors
- Normally separated by environmental tolerances, readily hybridize where they co-occur or under hatchery conditions



Northern hard clam
Mercenaria mercenaria



Southern quahog
Mercenaria campechiensis

Hybrid project objectives

- Culture of Hard Clam Hybrids: Results of Growout Production Trials. Leslie Sturmer. Tuesday 1:30.
 - Create replicate hybrid families
 - Compare production characteristics in grow-out
 - Document product quality
- **This presentation**
 - Compare stress resistance in laboratory challenges





Stress resistance challenges

- Crosses:
 - Parental species (MxM, CxC)
 - Hybrids (MxC, CxM)
- Families:
 - Family A and B (Sept 2008)
 - Family A and C (May 2009)
- Treatments: 2 x 2 factorial, 4 randomized blocks
 - Salinity: 15 or 25 ppt
 - Oxygen: Normoxia (>5 mg/L) or hypoxia (~2 mg/L)
 - Temperature: 32°C
- Repeated 2x:
 - 19 mm SL (Sept 2008)
 - 35 mm SL (May 2009)



Stress resistance challenges

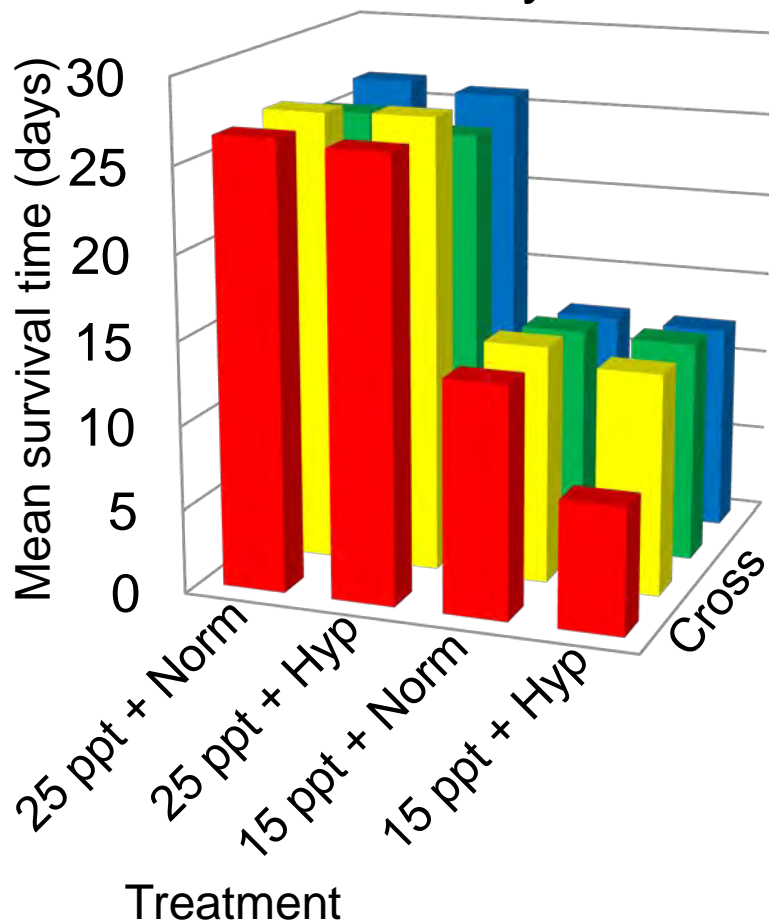
- Survival (alive/dead) observed every 24 hrs for 27 or 22 days
- Kaplan-Meier survival analysis to calculate mean survival time (MST)
- 3-factor ANOVA
 - H_0 : No effect of cross, family, or treatment on MST



Results – 19 mm SL

■ M x M ■ M x C ■ C x M ■ C x C

Family A

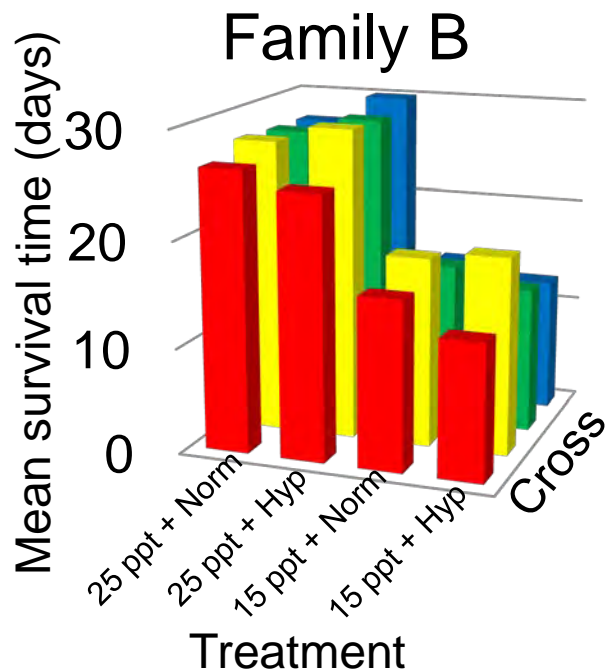
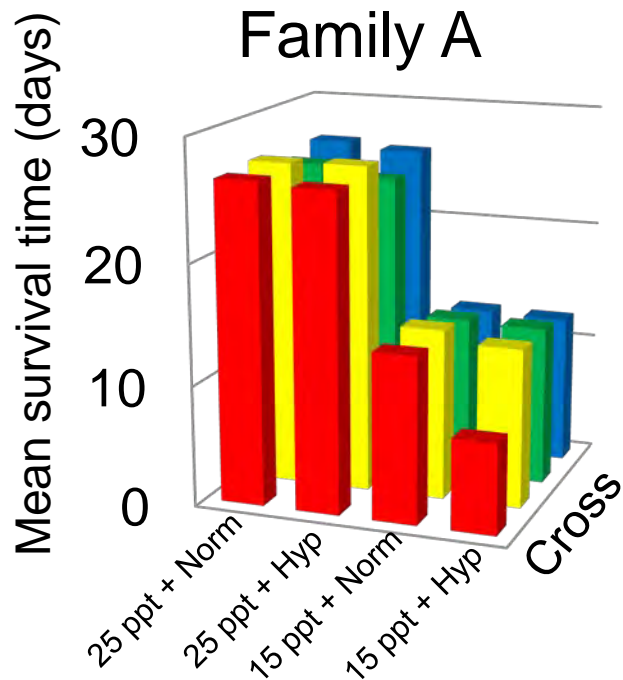


- **Cross, Family, and Treatment** had significant effects on MST
- Significant effect of **Cross** on MST
 - Example:
 - Challenged with 15ppt + Hyp treatment
 - MxC least sensitive (MST = 13.2 days)
 - MxM most sensitive (MST = 7.5 days)
 - MxC MST 5.7 days greater than MxM MST

Results – 19 mm SL

■ M x M ■ M x C ■ C x M ■ C x C

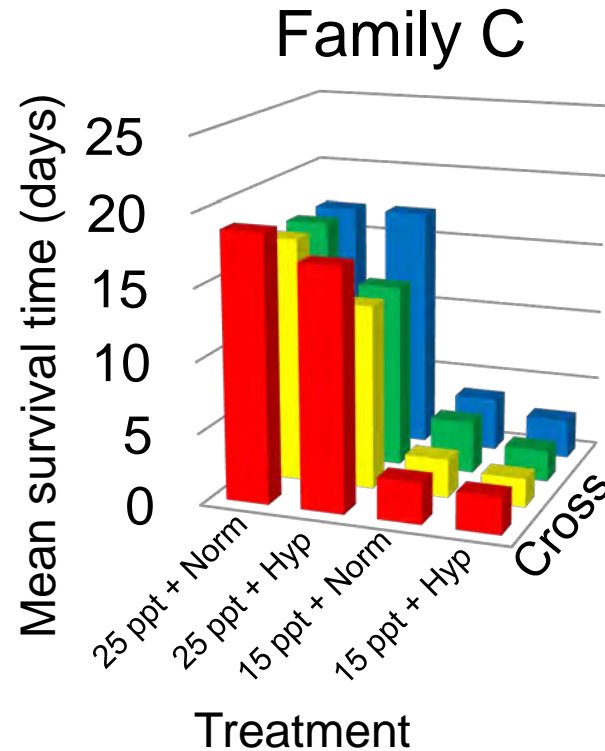
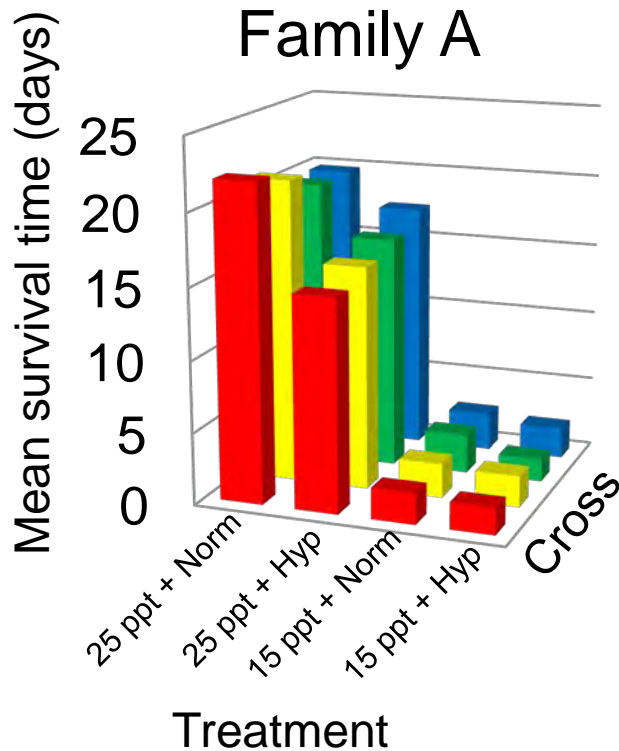
- **Cross, Family, and Treatment** had significant effects on MST
- Significant effect of **Family** on MST
 - Example:
 - Challenged with 15 ppt + Hyp treatment
 - Family B least sensitive (MST = 14.5 days)
 - Family A most sensitive (MST = 11.6 days)
 - Family B MST 2.9 days greater than Family A MST



Results – 35 mm SL

■ M x M ■ M x C ■ C x M ■ C x C

- Only **Treatment** had significant effect on MST
- No significant effects of **Cross** or **Family** on MST



Conclusion – Laboratory evaluation of hybrids

- Hybridization may offer improved stress resistance in early growout
- Genetic background (family) may play a significant role in response to stressors



Hybrid project summary **M X C**

- Hybridization may offer improved clam production performance
 - **MxC** ↑ SW, and DryMtWt
 - **MxC** ↑ **MST** when challenged by **stressors**
- Genetic background played a significant role in responses
 - Family A, **MxC** ↑ SW, TW, DMtWt, Prod
 - **Family B** ↑ **MST** when **challenged by stressors**
- Shelf life acceptable
 - 10 days for **MxC**, 8 days for **CxM**
- Gaping in refrigerated storage problematic
 - By day 8 for **MxC**, day 4 for **CxM**



Acknowledgements

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Looking forward to seeing you next year!

- Initial report on backcrossing F1 hybrids with hard clams, 2009-10
 - **Laboratory challenges**
 - Spawning
 - Land-based nursing
 - Field nursing