

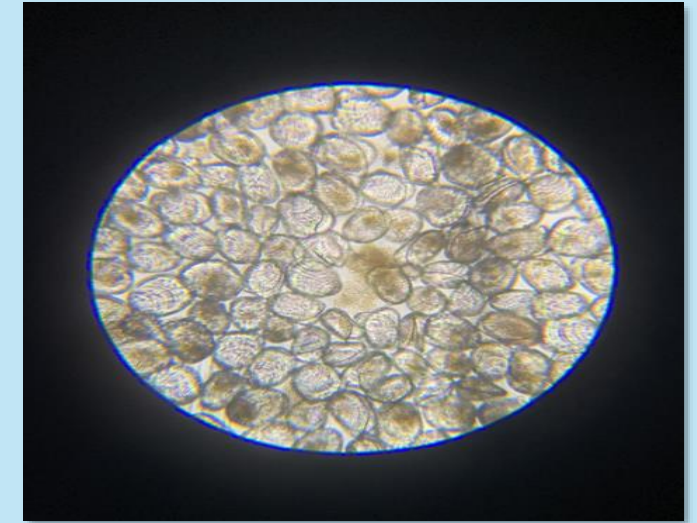
Development of a Breeding Program for Gulf of Mexico Eastern Oyster Using Communal Rearing of Families

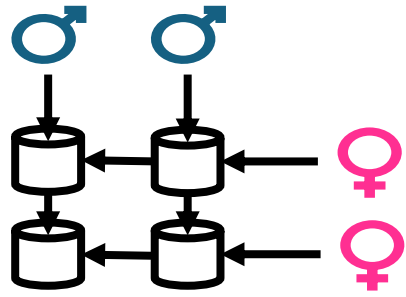
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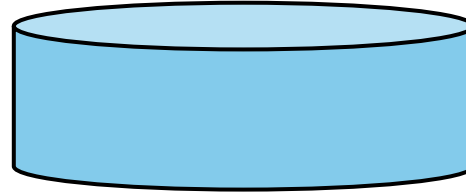
Eastern Oyster (*Crassostrea virginica*)

- Support large markets throughout the United States through wild harvest
- Wild population have suffered population declines due to disease, overharvesting, water quality concerns and other factors
- Declines have prompted interest in aquaculture for supply to the half shell market and reef restoration
- There is currently no structured breeding program in the Gulf of Mexico, so in 2019 the SALT consortium was initiated





Produce progeny according to crossing design



Mix equal numbers of fertilized embryos from each family



Distribute to growout testing sites

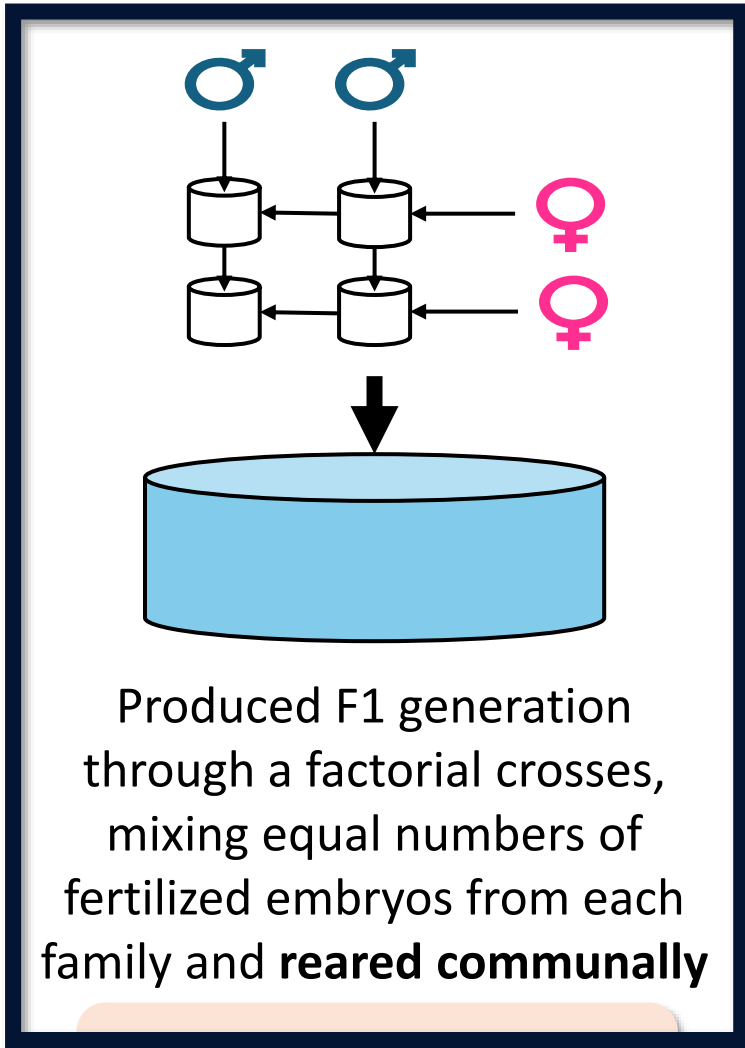


Trait Measurement, genotyping, and pedigree



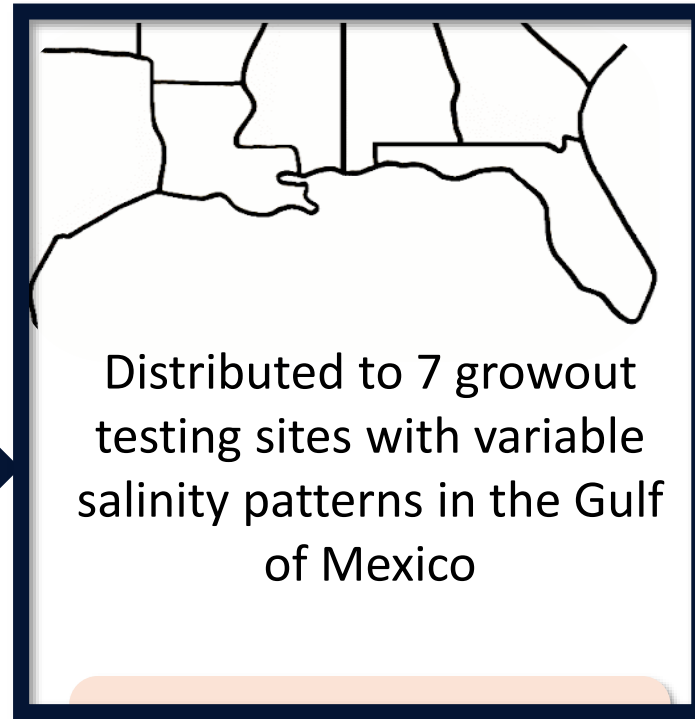
Estimate breeding values and select parents for next generation

Common garden with walk-back selection



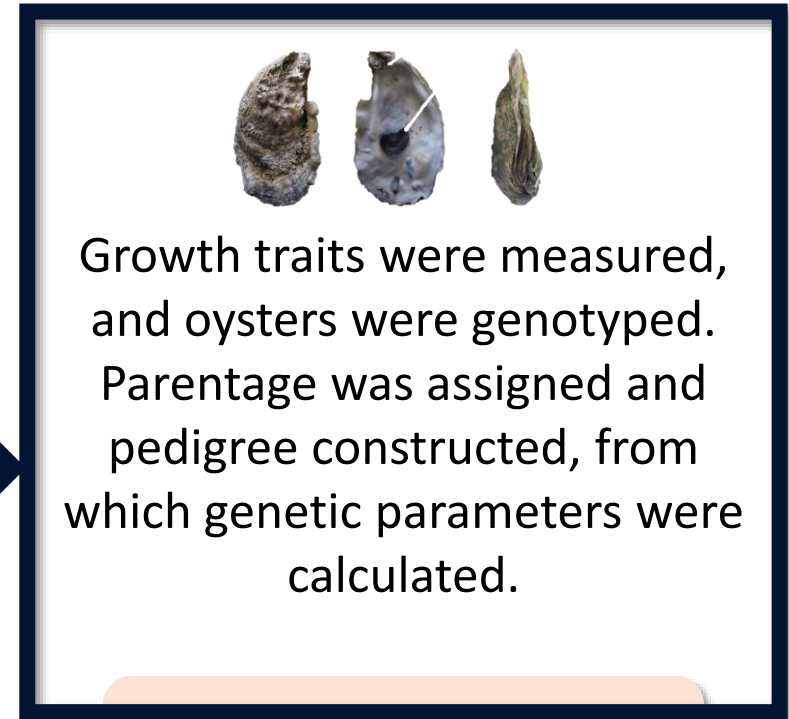
Produced F1 generation through a factorial crosses, mixing equal numbers of fertilized embryos from each family and **reared communally**

Summer 2020



Distributed to 7 growout testing sites with variable salinity patterns in the Gulf of Mexico

Spring 2021



Growth traits were measured, and oysters were genotyped. Parentage was assigned and pedigree constructed, from which genetic parameters were calculated.

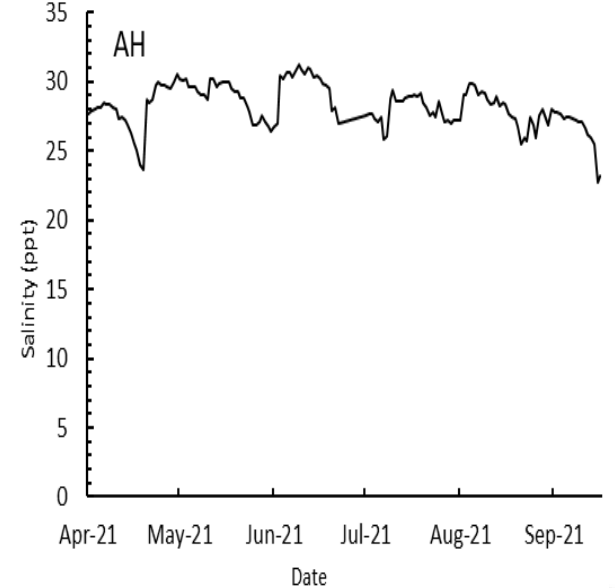
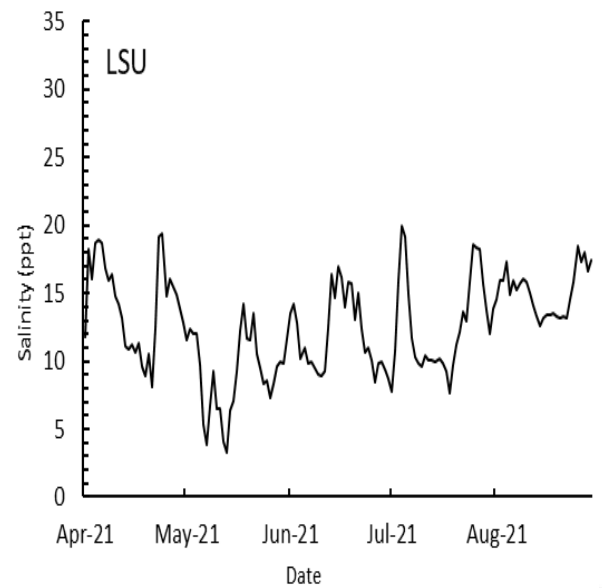
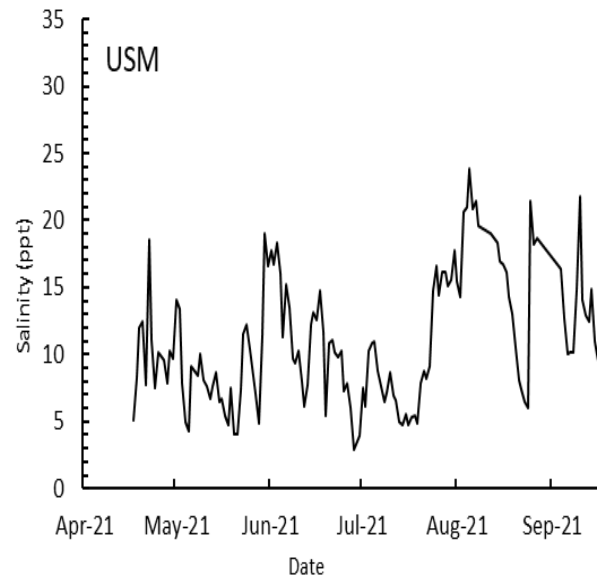
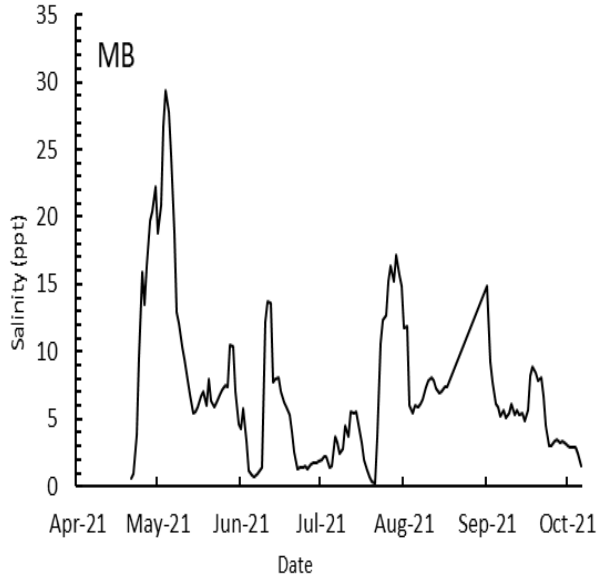
Fall 2021

Calculated breeding values for growth and chose individuals for the next generation

LOW-VARIABLE



HIGH



Mobile Bay, AL

Deer Island, MS

Grand Isle, LA

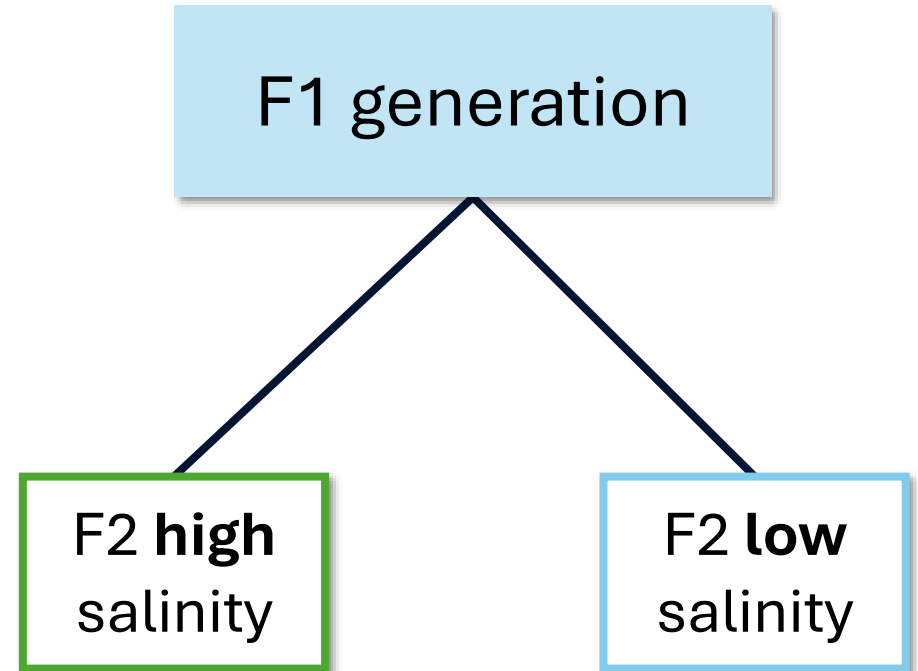
Alligator Harbor, FL



Conclusions from the first generation of breeding

- I. Heritability's were intermediate to high for growth traits.
- II. Genetic correlations between sites were intermediate to high.
- III. 192 parents recovered of 204 indicating common garden is a viable option for management of genetic diversity.

III. Family distributions indicated differential survival between low and high salinity environment



Predicted breeding values

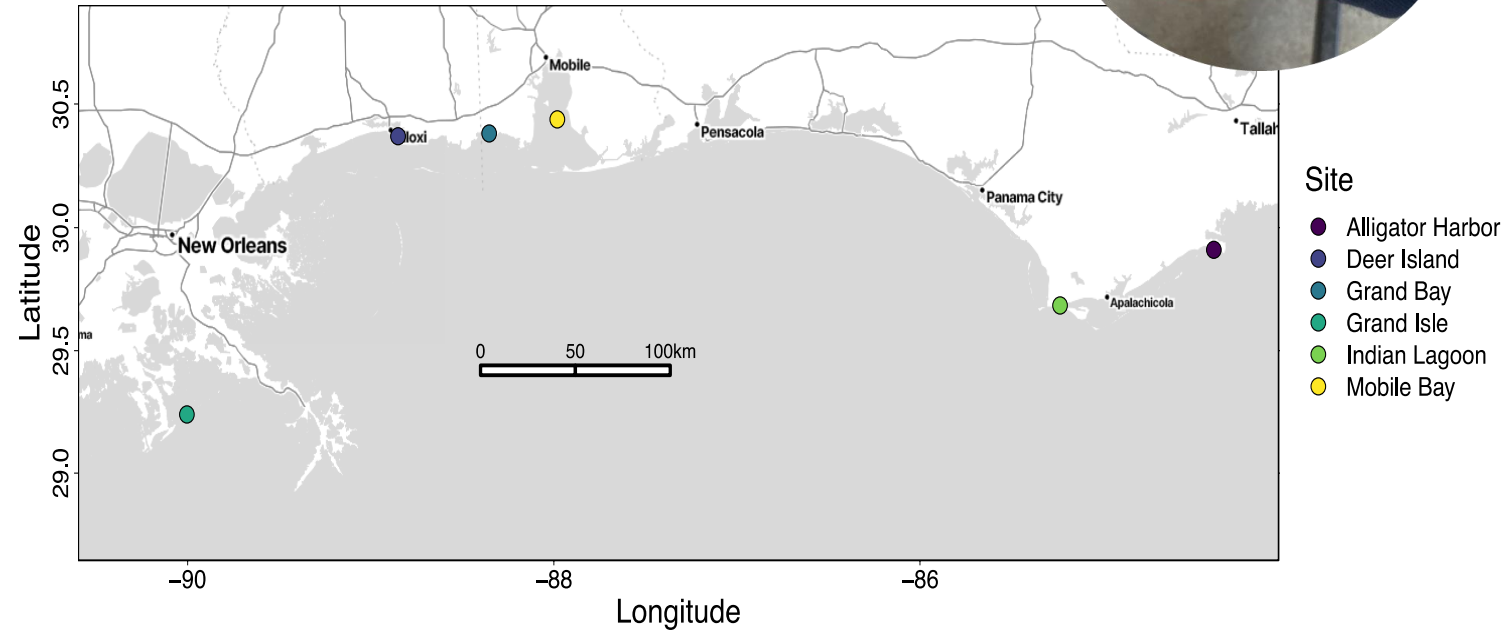


- Breeding values for height were estimated using model accounting for fixed effect of site and a random effect of bag within cage
- Estimation employed REML optimization method
- The selection differential was lower for the high-salinity F2 because of brooders availability

Group	Mean PBV (mm)	Differential (mm)		Differential (%)	
		Low	High	Low	High
<i>Grand Mean Low</i>	54.387	-	-	-	-
<i>F2 Low</i>	57.487	+3.10		+ 5.39	
<i>Grand Mean High</i>	54.513				
<i>F2 High</i>	55.973	+1.46		+ 2.61	
<i>Control</i>	54.466	+0.07 9	-0.047	+ 0.15	-0.086

Field growout sites

- Once oysters reached R6 (retaining on 6-mm mesh) they were deployed to 6 growout sites
- Sites were monitored bi-monthly
 - Survival
 - Growth
 - Salinity
- Bags were split to maintain optimal density and changed out to manage fouling of gear



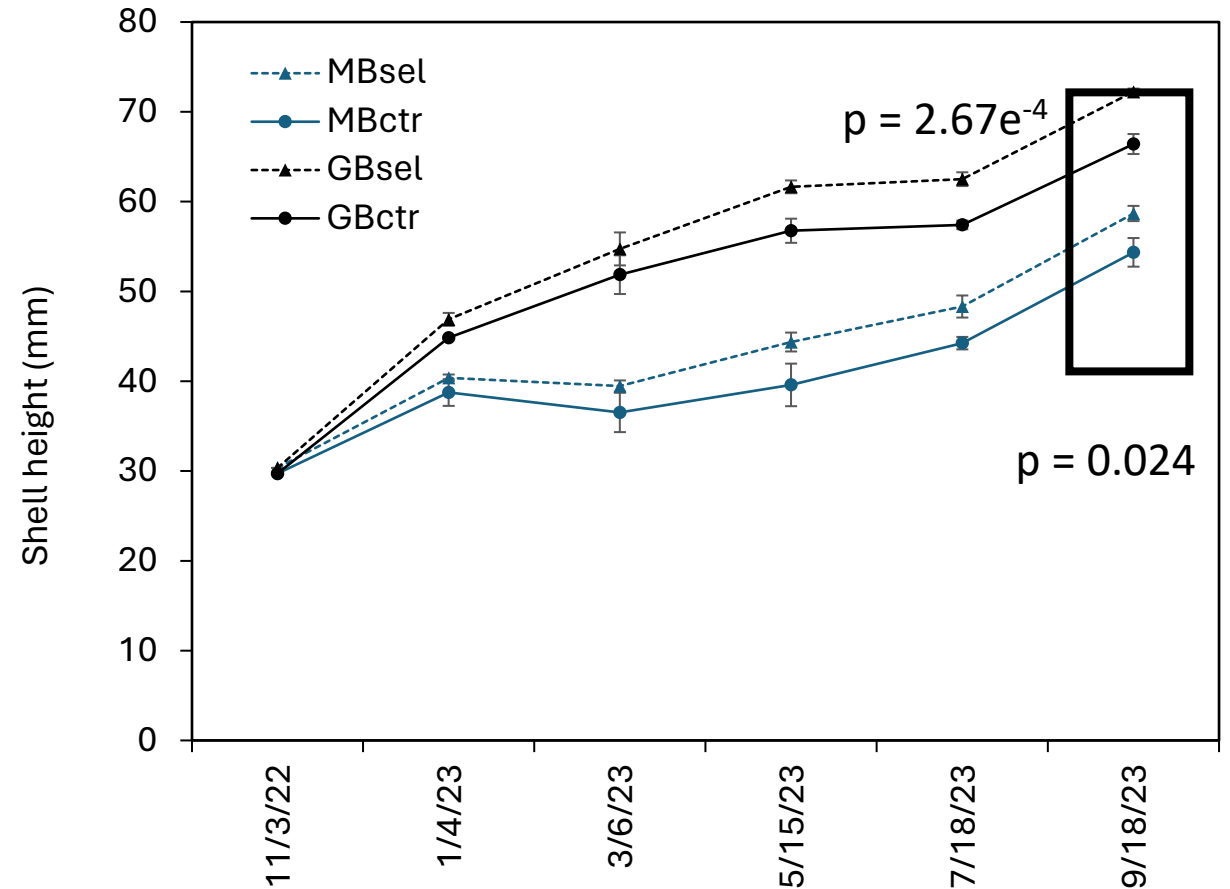
Shell height – F2 Low

- Selected (sel) and control (ctr) oysters were deployed in November 2022

- Shell height of selected line 10-months post deployment was significantly greater at both Mobile Bay (MB) and Grand Bay (GB)

GBOP Selected – Control = 5.82 mm

MB Selected – Control = 4.33 mm



Average shell height of replicate bags at each sampling point. Error bars denote the standard deviation among replicate bags



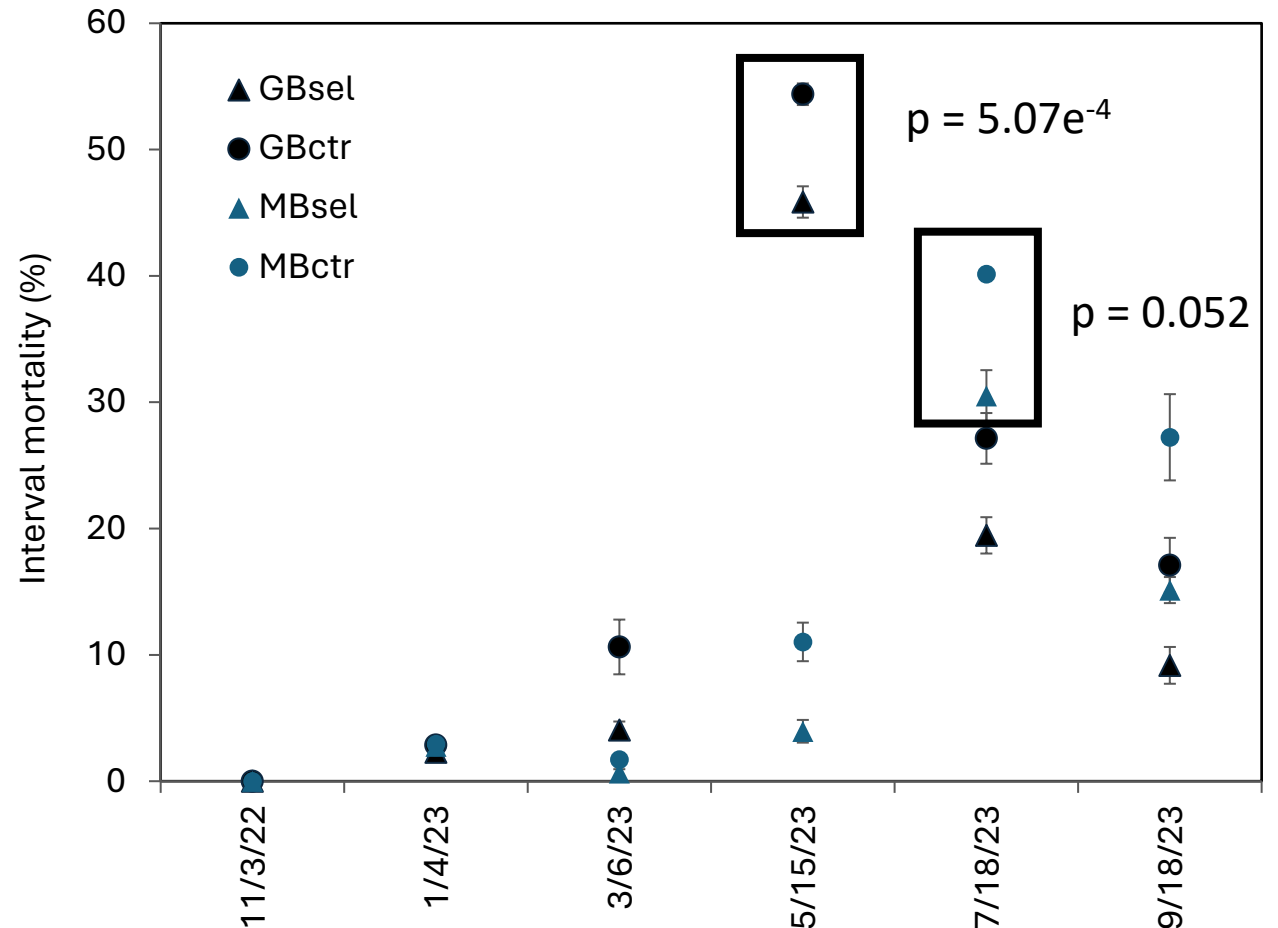
Mortality – F2 Low

- Peak mortality occurred at Grand Bay (GB) in May 2023 and at Mobile Bay in July 2023

- Mortality of control animals at both sites was significantly higher than that of the selected low salinity line

GBOP Control – Selected = 7.96%

MB Control – Selected = 12.92%

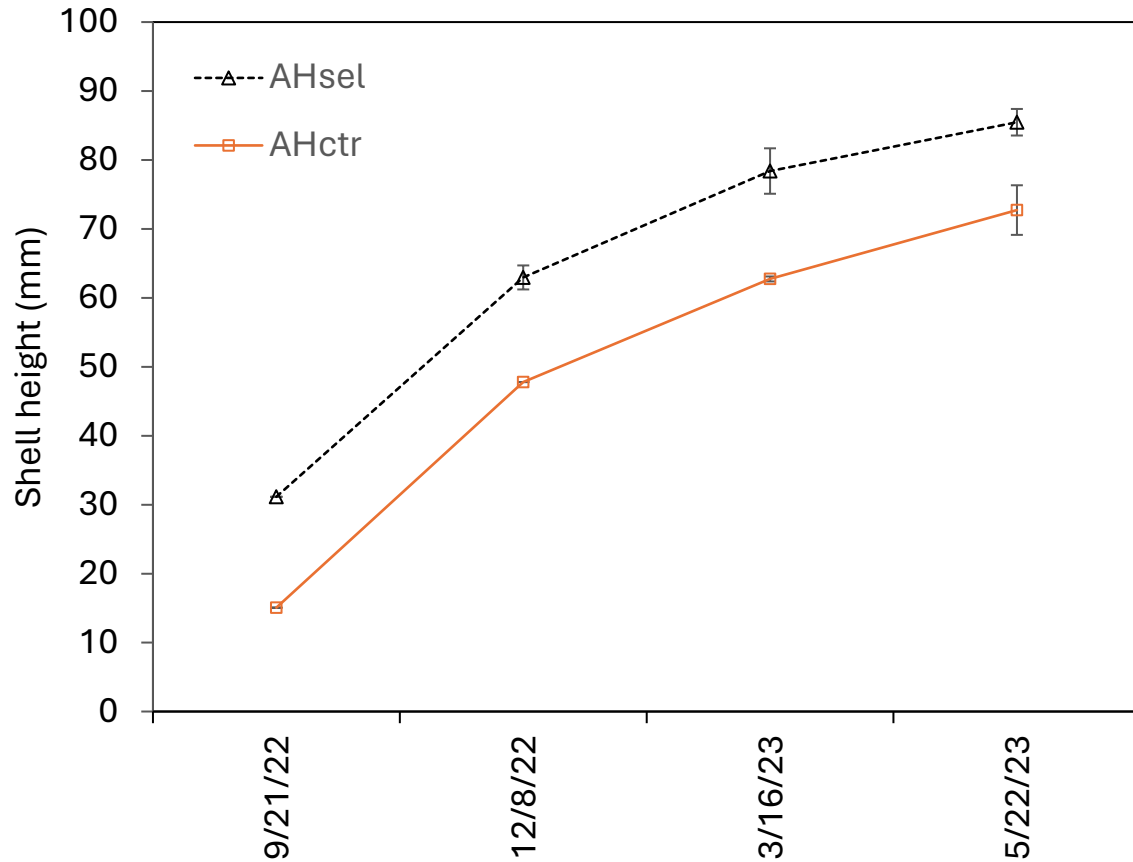


Interval mortality in replicate bags at each sampling point. Error bars denote standard error among replicate bags

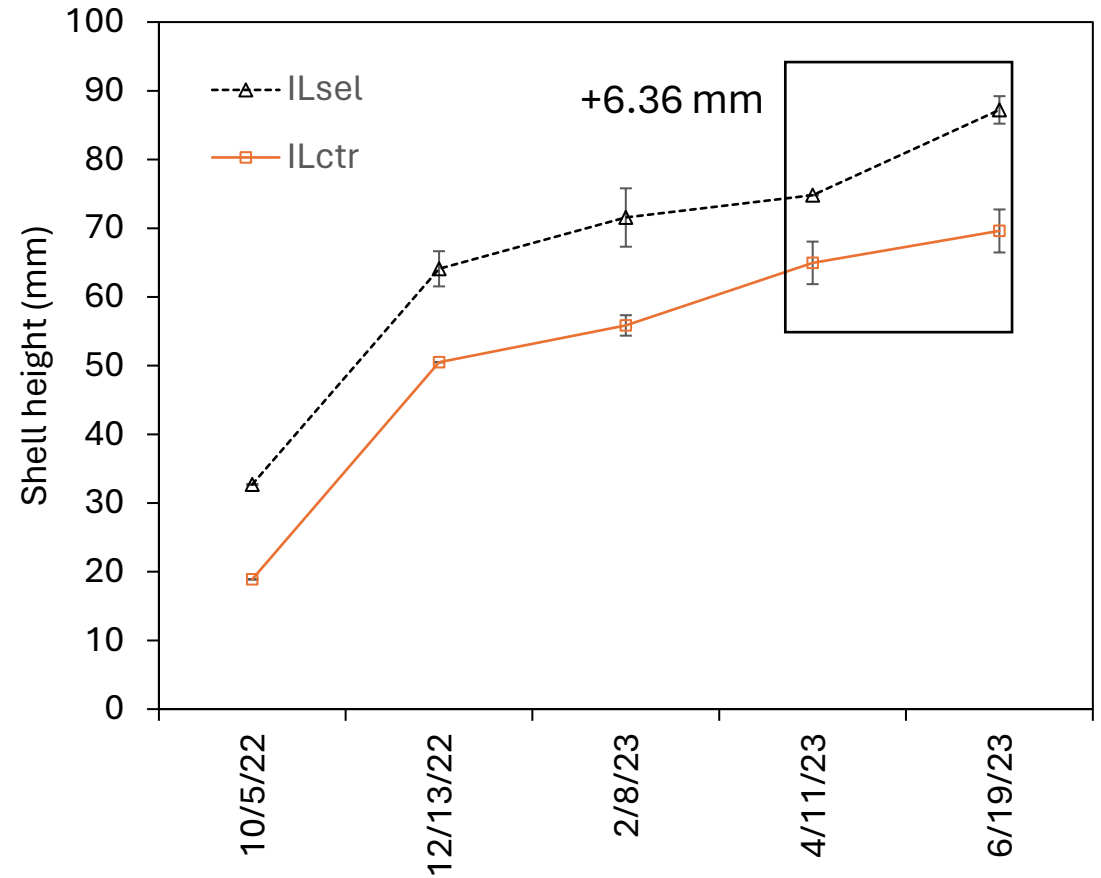


Shell height – F2 High

No significant differences in growth between the selected and control line at either high salinity site



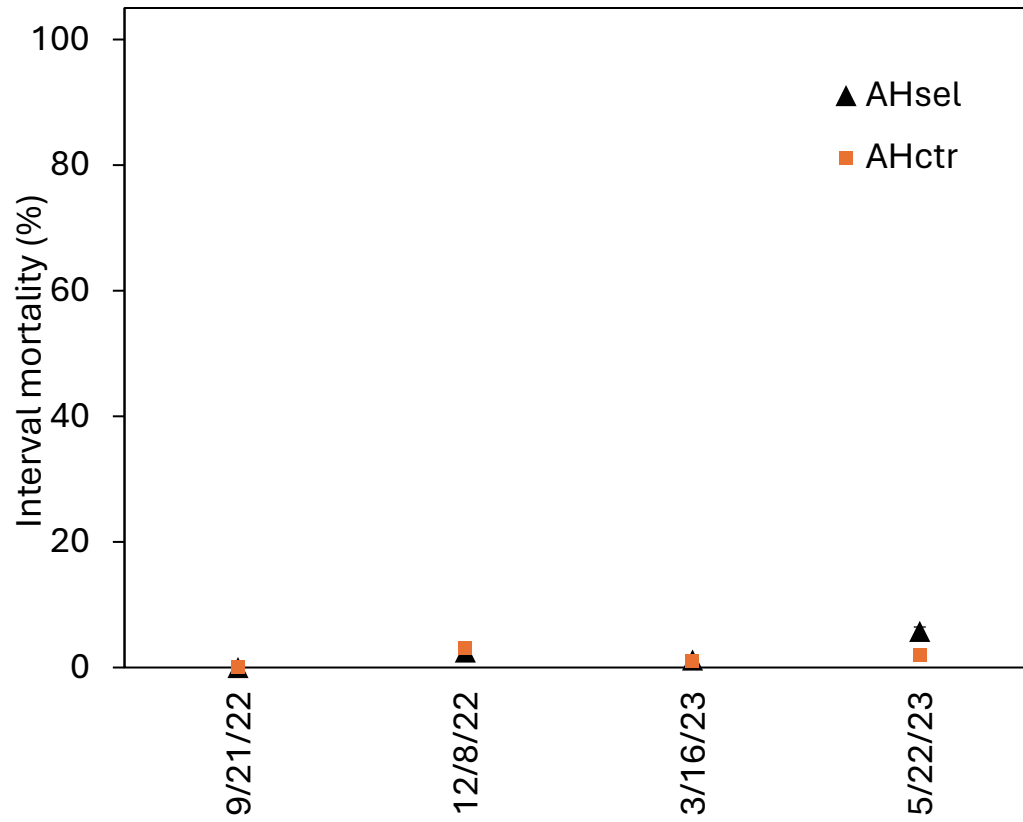
Alligator Harbor



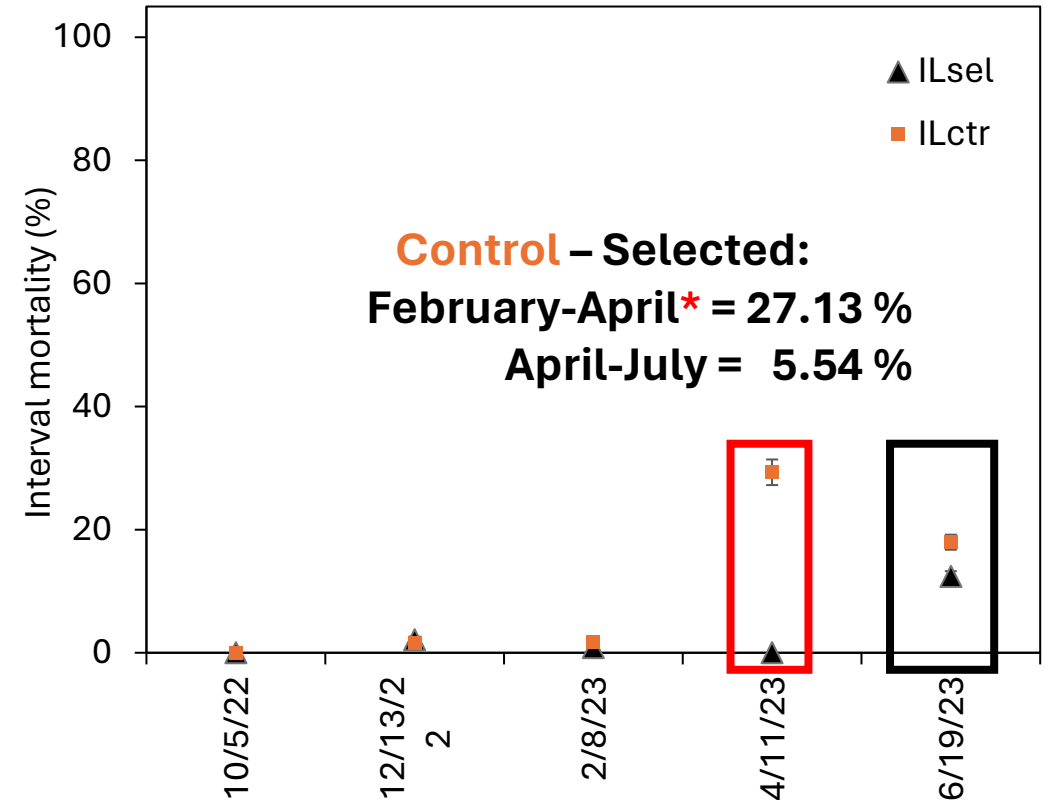
Indian Lagoon

Mortality– F2 High

Survival of selected oysters was significantly greater than controls during April-July at Indian lagoon



Alligator Harbor



Control – Selected:
February-April* = 27.13 %
April-July = 5.54 %

* Only one replicate bag in selected group

Indian Lagoon



Summary and conclusions

F2 Low

- Magnitude of difference between the control line and selected line was greater than the selection differential at both sites
- Control line suffered significantly greater mortality during peak mortality events at each site
- Survival was not directly selected for, indicating selection for growth lead to a correlated response to survival

F2 High

- There selected line tended to grow faster than controls but the difference was not statistically significant
- Survival was significantly lower in controls than in selected at Indian lagoon during the final period when mortality occurred at this site, indicating response selection
- Response to selection in survival was less visible because mortality at both test sites was very low. Response in growth was low likely due to the low selection differential applied.

Ongoing and going forward...

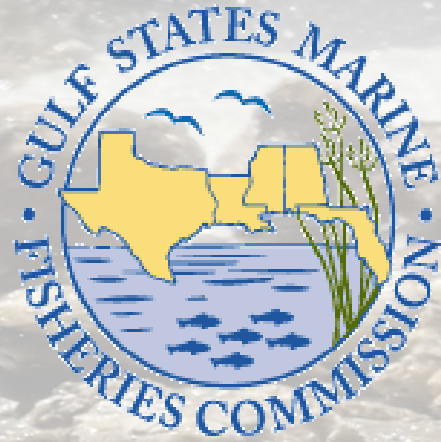
- **The variable results across generations highlight the importance of having multiple test**
- **Evaluation of other traits contributing to survival**
 - Low salinity
 - Heat stress
 - Disease resistance (dermo)
- **Genomic selection (implementation in final project generation)**
- **Assessment of selected lines for performance as triploids**
 - Efforts in collaboration with 4C's



Discussion of how to provide the industry with selectively bred lines ongoing

Acknowledgements

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Questions



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Please email me with any questions or reach out to me at the conference!