Florida Shellfish

Overview of Recent and Ongoing Applied Research Projects

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UF IFAS Extension UNIVERSITY of FLORIDA

SFRC

Sea Grant Florida

Applied Industry-driven Research and Extension Projects

- With faculty from UF IFAS and other institutions developing and implementing applied research and extension projects
- Over past seven years, federal and state funds have been invested in industry-driven projects
- These projects are focused on
    1) Genetic improvement of stocks
    2) Advancement of farming practices
    3) Species diversification

UF Project Partners

- Chuck Adams, *Food and Resource Economics*
- Jim Austin, Shirley Baker, Ed Phlips, Ruth Francis-Floyd, Denise Petty, *SFRC Fisheries and Aquatic Sciences*
- Bill Pine, Peter Frederick, *Wildlife Ecology and Conservation*
- Todd Osborne, Mark Clark, Rex Ellis, *Soil and Water Science*
- Steve Otwell, Anita Wright, *Food Science and Human Nutrition*

Genetic Improvement of Stocks

- **Evaluation of Clam Stock Hybridization, 2007-9**
- **Assessment of F1 Hybrids Backcrossed with Hard Clams, 2009-11**
- **Evaluation of Thermally Selected Multi-Parental Crosses with Hard Clams, 2010-12**

Funded by USDA CSREES Special Research Grants

Supported by the Cedar Key Aquaculture Association
Former Congresswoman Ginny Brown-Waite
Former Senator Mel Martinez

Project Team, 2007-13

HARBOR BRANCH
FLORIDA ATLANTIC UNIVERSITY

UF UNIVERSITY of FLORIDA
IFAS

Dr. John Scarpa - HBOI
Shellfish breeder
- Production of experimental stocks

Dr. Shirley Baker - UF
Invertebrate physiologist
- Laboratory challenges

Leslie Sturmer - UF
Shellfish extension agent
- Experimental field trials
- Industry liaison

- Both institutions involved in job retraining programs in the 1990s and in the development of sustainable aquatic organism production

Improvement of Cultured Clam Stocks through Hybridization

- Hybridization is a common breeding technique
- Hybrids have superior traits to either parent species
- The use of clam hybridization for “mariculture” potential was examined in the 1960-70s by Winston Menzel at Florida State University
  - Showed hybrids had improved growth, shelf life
  - Little data reported on merit of hybrids for improved survival
- A rigorous examination of clam hybridization was conducted in 2007-9*
  - To improve production
  - To assure product quality

* Scarpa, J., Sturmer, L.N., Arnold, W., Geiger, S. and Baker, S.M. 2009. Culture of hard clam hybrids (*Mercenaria mercenaria*, *M. campechiensis*): Hatchery to field-nursery. Journal of Shellfish Research 28(3): 727-728.

Clam Species

- Northern hard clam
  - Gulf of St. Lawrence to Florida
  - Supports aquaculture and fishing industries
- Southern quahog
  - North Carolina to Caribbean
  - Supports recreational fishery
  - Traits for resisting environmental stressors
  - Gapes in refrigerated storage
- *Mercenaria* species normally separated by environmental tolerances
  - Hybridize where they do co-occur and under hatchery conditions

Northern hard clam
Mercenaria mercenaria notata

Southern quahog
Mercenaria campechiensis

Single parent crosses utilized
Oct-Dec, 2007

Produced and tested 3 families (A,B,C)

- Parental stocks - ♀x♂:MxM, CxC
- Reciprocal hybrids - ♀x♂: MxC, CxM

Summary*

- Hybridization may offer improved clam production performance
  - **MxC**, ↑ SW and DryMtWt
- Genetic background played a significant role in responses
  - Family A, **MxC** ↑ SW,TW, DMtWt, Yield
  - Family C, **CxM** ↑ SW,TW, DMtWt, Yield
- Shelf life acceptable up to 8 days
  - At 10 days **MxC** (88%), **CxM** (70%), versus **MxM** (98%)
- Gaping in storage problematic
  - By day 8 for **MxC** (47%)
  - By day 4 for **CxM** (63%)

* Sturmer, L.N., Scarpa, J. and Baker, S.M. 2010. Culture of hard clam hybrids (*Mercenaria mercenaria*, *M. campechiensis*): Results of growout production trials. Page 966, Book of Abstracts, Aquaculture 2010, San Diego, CA.

Backcrossing F1 Hybrids with Hard Clams

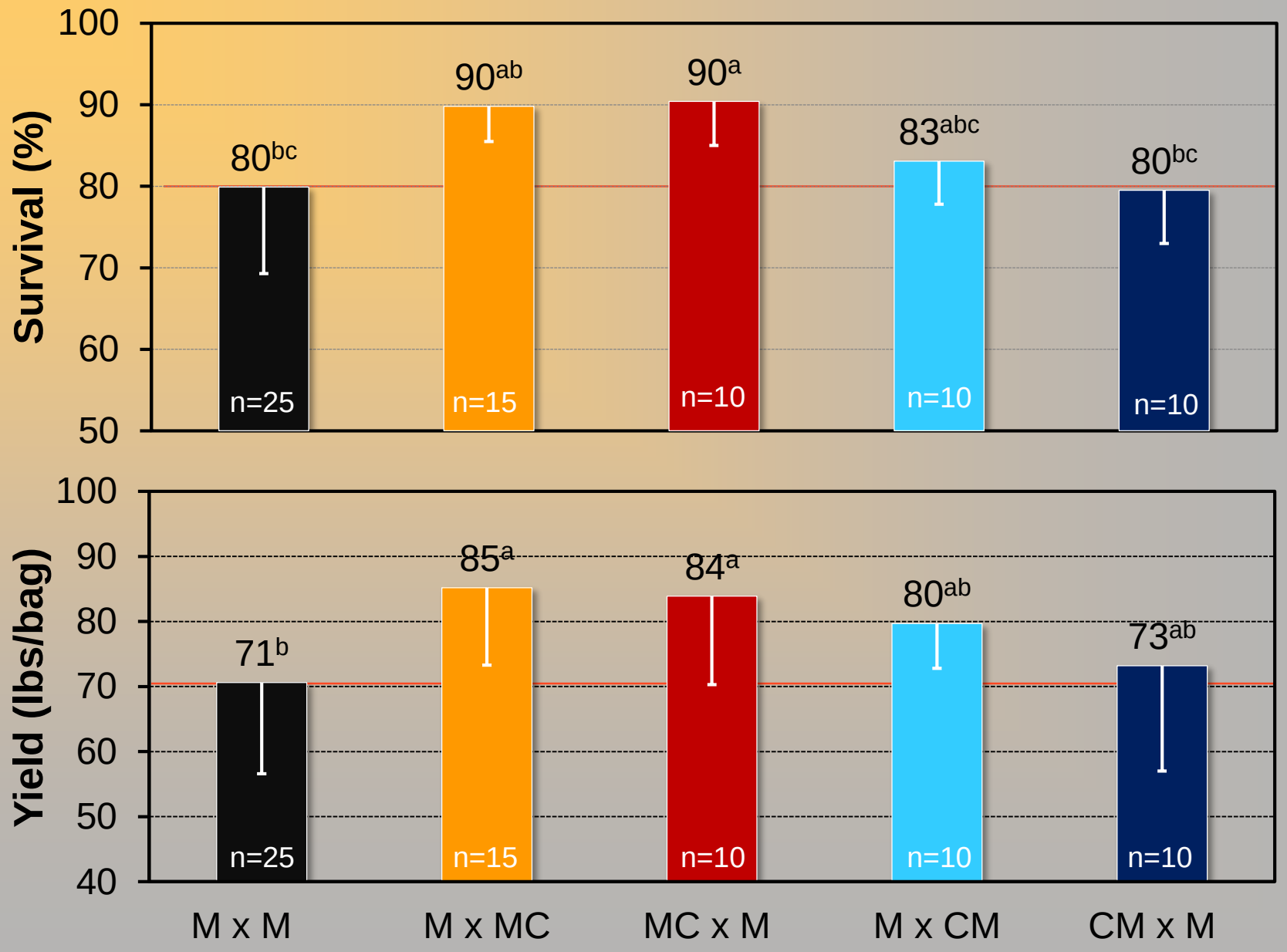
- Mating of a hybrid with its parental species
- F1 Hybrids (**MxC** and **CxM**) backcrossed to hard clams (**MxM**) as female or male
- Objectives:
  - Improve product quality
  - Maintain improved production

Backcross Parents

Backcross Families	Female ♀	Hybrid Family	x	Male ♂	Hybrid Family	=	Stock
F	M			M			M x M
G*	M			MxC	A		M x MC
H	M			CxM	C		M x CM
D	M			M			M x M
E	MxC	A		M			MC x M
	CxM	C		M			CM x M

* M x CM replicate stock in Family G spawn was not viable

Production Results (13 months)



Note: ANOVA were performed using the PROC GLM procedure of SAS. Treatment means were considered significantly different when $p \leq 0.05$.

Summary

- Backcrossing F1 hybrids to hard clams offered improved survival and yield
  - MxMC and MCxM had ↑ survival, ↑ yield
- Genetic background (families) played a significant role in responses
  - For Family F, M x MC had ↑ survival, ↑ production
  - For Family D, MC x M had ↑ survival, ↑ production
- Shelf life commercially acceptable
  - At 10 days, 98-100% for all stocks
  - At 12 days, 92-96% for backcrosses vs 99% for hard clams
- Gaping in refrigerated storage acceptable
  - At 10 days, 3-11% for backcrosses vs 2% for hard clams
  - At 12 days, 7-14% for backcross stocks vs 3% for hard clams
- This breeding approach can increase summer survival and productivity, while maintaining product quality standards

Broodstock Made Available to Industry

- High performing broodstock lines provided to 90% of Florida hatcheries
  - Group 32, Family D: MC-A x M
  - Group 40, Family F: M x MC-A
  - Group 44, Family G: M x MC-A

"We spawn millions!"

Development of Clam Broodstock for Seed Production Workshop
Harbor Branch Oceanographic Institute at FAU
December 2011

Improvement by Thermal Selection and Addition of Wild Stocks, 2011-12

- Common breeding approach is selection of survivors of adverse environmental events
- In plant breeding programs, thermal challenges are artificially induced with progeny from surviving stocks produced
- Another common breeding approach is to out-cross domestic stocks with wild stocks
- FL cultured clams selected for “notata” strain
- Shell coloration not preferred in some markets and associated with inbreeding depression

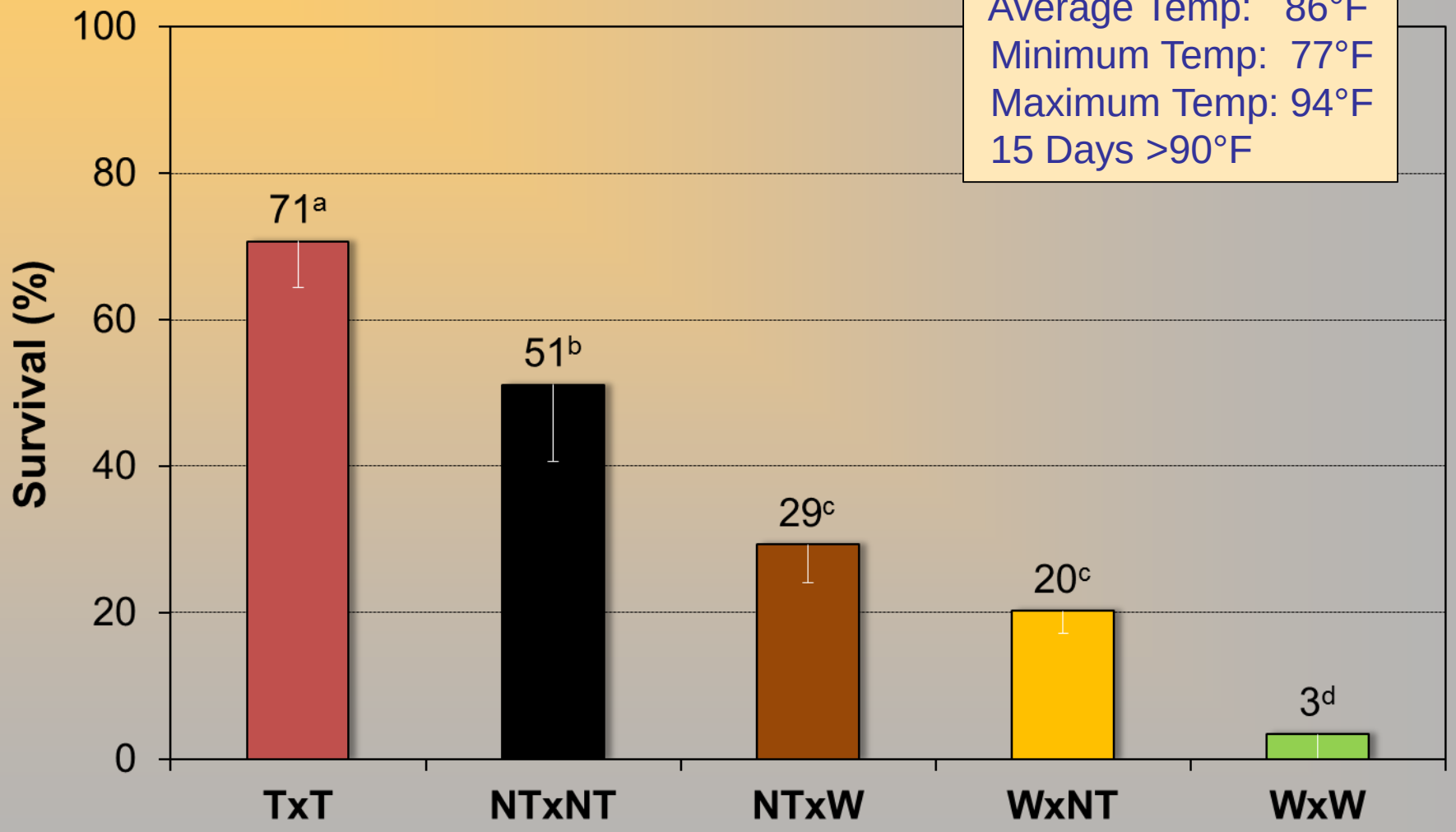
- Objectives:
  - Improve growth, survival, and genetic diversity
  - Reduce color variant – “notata”

Breeding Scheme

- Thermally challenged hard clams
  - 2250 subjected to 95ºF for 48 hours
  - Spawned 45 survivors, or 2%
  - Compared with non-thermally challenged hard clams (control)
- Incorporation of “wild” stocks
  - “Wild” clams obtained from natural populations near St. Augustine
  - Spawned with cultured clam stocks
  - Created reciprocals and controls

Female ♀	X	Male ♂	=	Stock
T		T		T x T
NT		NT		NT x NT
NT		W		NT x W
W		NT		W x NT
W		W		W x W

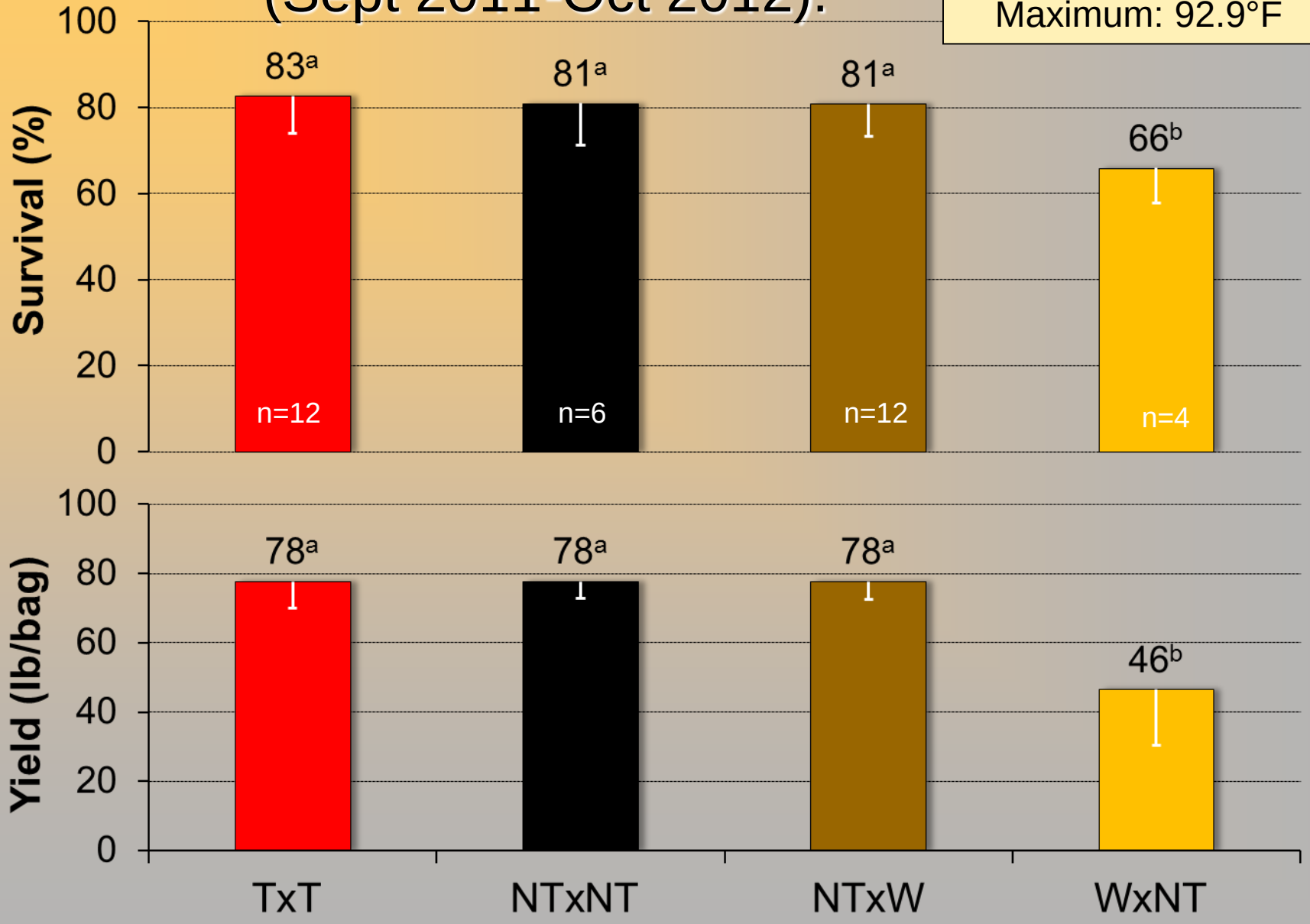
Field Nursery Results (July-Sept 2011): Survival



Note: ANOVA were performed using the PROC GLM procedure of SAS. Treatment means were considered significantly different when $p \leq 0.05$.

Growout Results (Sept 2011-Oct 2012):

Water Temperatures:
8 days > 90°F (32°C)
Maximum: 92.9°F



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Shell Coloration of Clam Stocks, % Notata

- Rated on a scale of 1 to 5, where
  - 1 = 0%
  - 2 = 25%
  - 3 = 50%
  - 4 = 75%
  - 5 = 100%
- Rated 150 clams per group

Improvement of Cultured Clams by Marker Assisted Selection in Stocks

- Select stocks based on markers associated with trait of interest
- Potential marker: Heat shock proteins
  - Induced – In response to stressors, Hsp
  - Cognate – Cellular housekeeping, **Hsc70**
- In previous studies:
  - Hsc70 levels associated with clam survival in temperature challenges (El-Wazen 2008)
  - Hsc70 levels may be heritable

Funded by:
USDA
NOAA
Sea Grant Florida

Florida Broodstock Survey

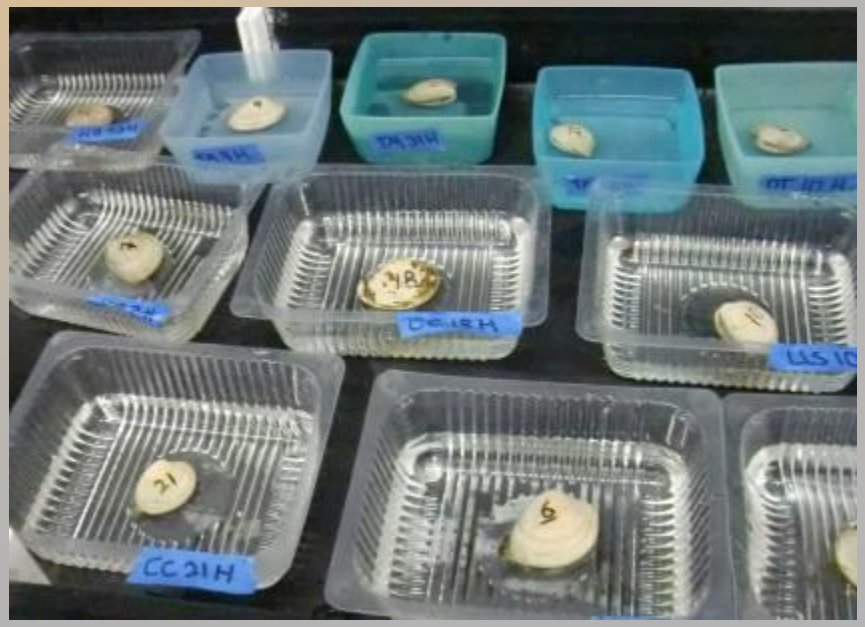
- Collected hard clams from 10 sources
  - Commercial stocks (C)
  - Natural populations (W)
- Extracted hemolymph from ~500 clams

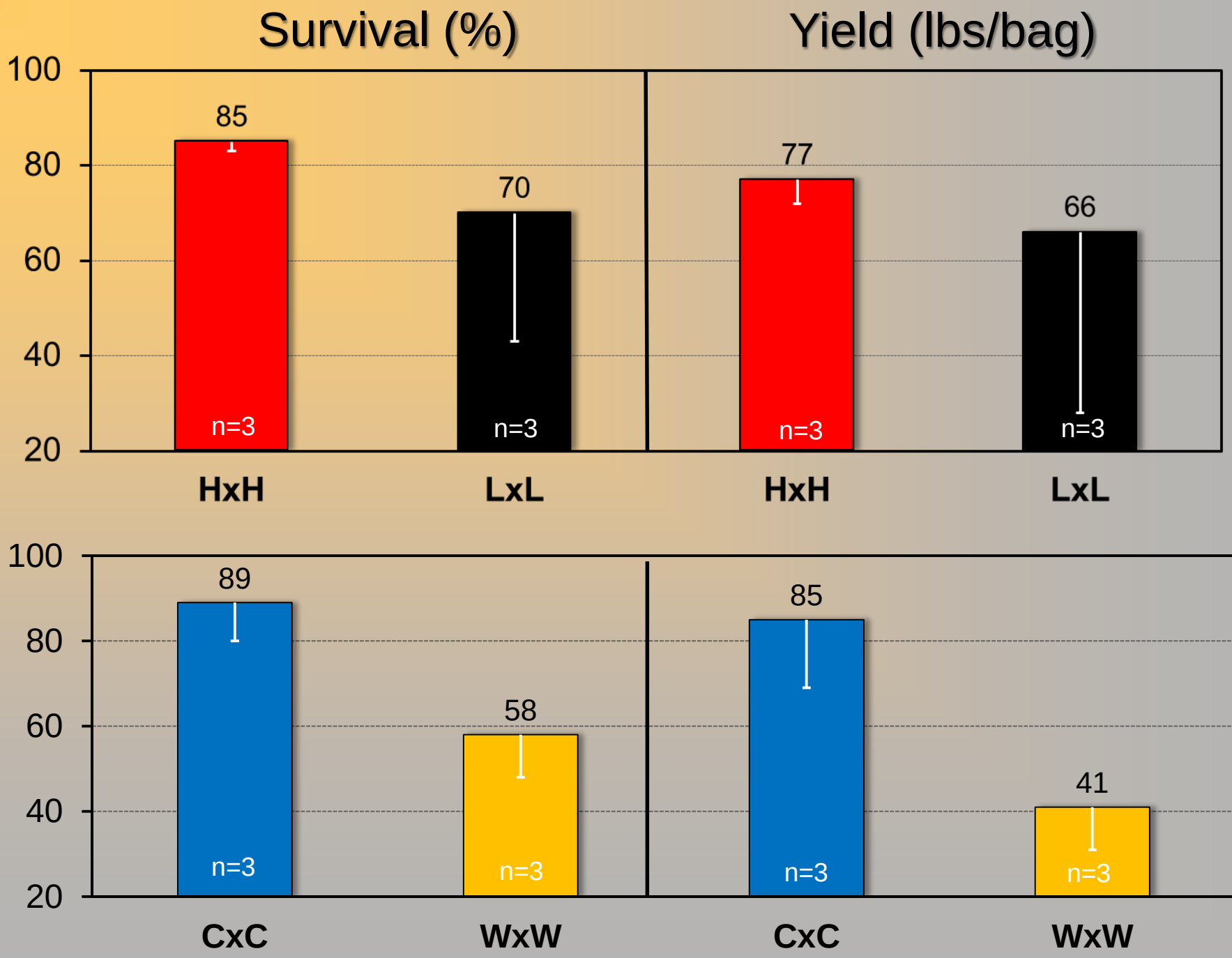
- Analyzed for levels of Hsc70
- Three expression levels of Hsc70

Hatchery Production*

- Hatchery techniques modified for single parent crosses
- Produced six distinct families
  - High-expressing Hsc stocks (**HxH**)
  - Low-expressing Hsc stocks (**LxL**)
- Jan – Apr 2012

* Scarpa, J., Baker, S.M., Sturmer, L.N., and Krebs, W. 2013. Preparing for climate change: Increasing hard clam survival in Florida using biomarkers of thermal tolerance. Aquaculture 2013 Conference Proceedings: 185.



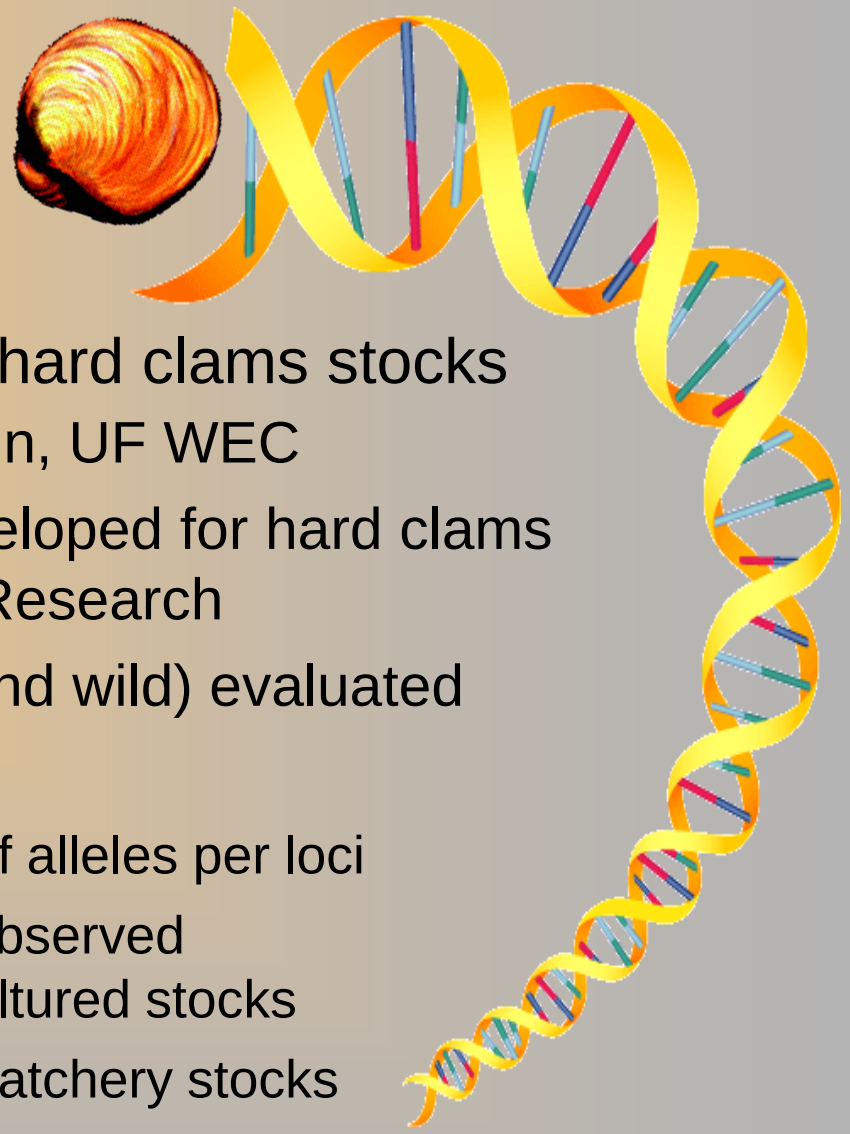


*PROC TTEST, SAS 9.4, treatment means significantly different when p≤ 0.05

Summary

- Broodstock selection methods may be useful in increasing hard clam survival and improving shell characteristics
  - ↑ Survival in **T**x**T** versus **NT**x**NT**
  - ↓ Notata coloration in **NT**x**W** versus **NT**x**NT**
- Hatcheries must ensure good record keeping for separate lines as reciprocal parental crosses played a role in responses
  - ↑ Survival and yield in **NT**x**W** versus **W**x**NT**
- Differing parental Hsc levels did not affect hard clam production
  - Survival and yield = in **H**x**H** versus **L**x**L**
- Wild stocks did not perform well
  - ↓ Survival and yield in **W**x**W** versus **C**x**C**
- Commercial hard clam stocks are being selected for Florida conditions and some improvement can be gained from basic breeding practices

What's New ?



- Determined **genetic diversity** of hard clams stocks
  - Study conducted by Dr. Jim Austin, UF WEC
  - Using microsatellite markers developed for hard clams by UF Center for Biotechnology Research
  - Eleven Florida stocks (cultured and wild) evaluated
  - Preliminary results
    - Wild stocks had higher number of alleles per loci
    - Wild stocks had equal levels of observed heterozygosity (heritability) as cultured stocks
    - Differentiation highest between hatchery stocks
    - Drift has occurred between wild and cultured stocks

Shellfish Farm Environment, Management and Other Projects

- Assessment of Farming Activities on Aqueous Soils
- Evaluation of Mechanical Harvesting
- Net Coatings for Biofouling Control
- Valuation of Ecosystem Services
- Sensory Profiling of Clams
- Industry Economic Impact

Fresh from Florida

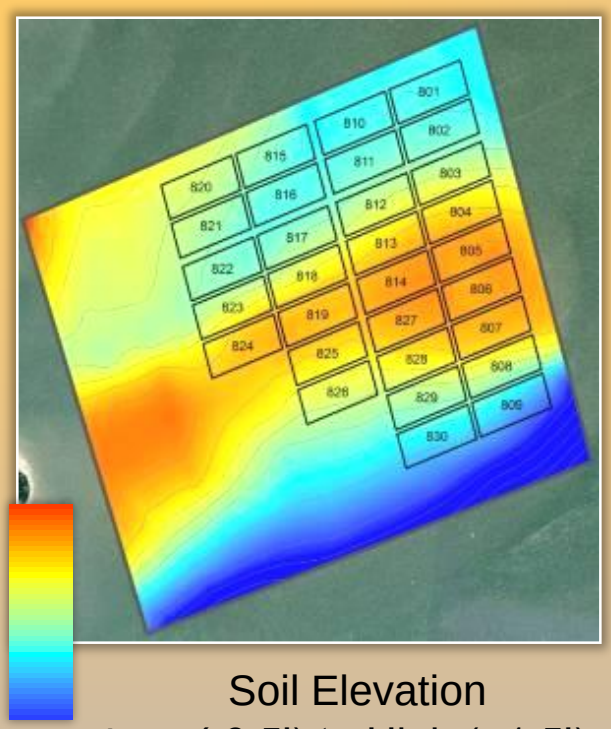
Assessment of Soil Landscapes in Clam Lease Areas*

- Clams are infaunal bivalves and spend majority of their lives buried
- Sediment characteristics affect clam production, but is a short coming in many studies
- Subaqueus soils at one high-density lease area were investigated using a soils-based approach, 2007-9

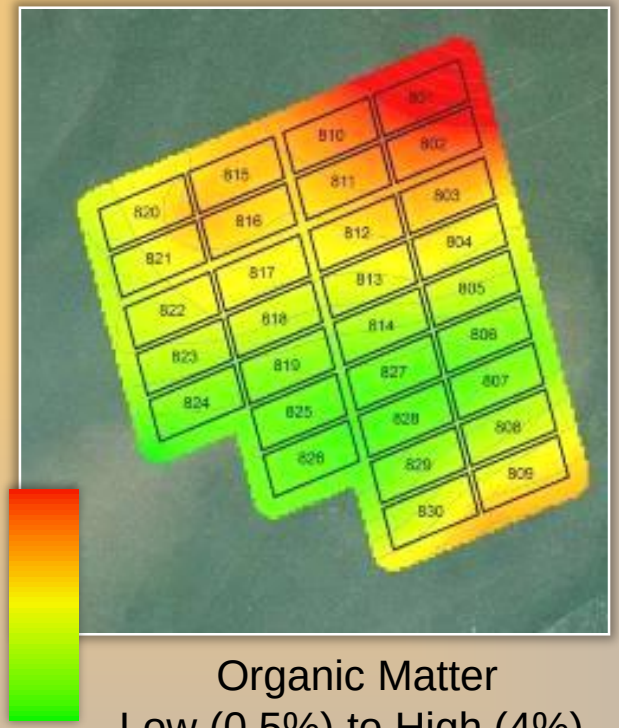
Dog Island High-density Lease Area

Investigators:
Rex Ellis, Todd Osborne, and Mark Clark
University of Florida, Soil and Water Science Department

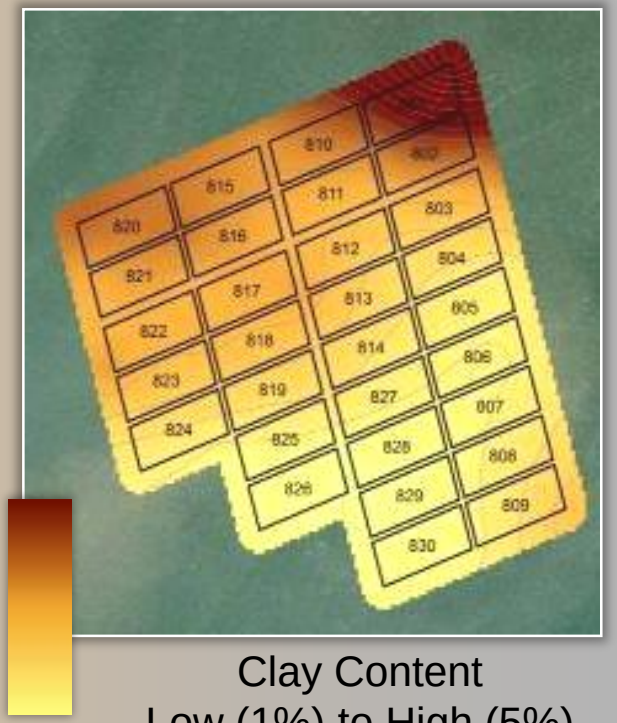
Dog Island HDLA Soil Characterization Study, 2009-10



Soil Elevation
Low (-6.5') to High (+1.5')



Organic Matter
Low (0.5%) to High (4%)



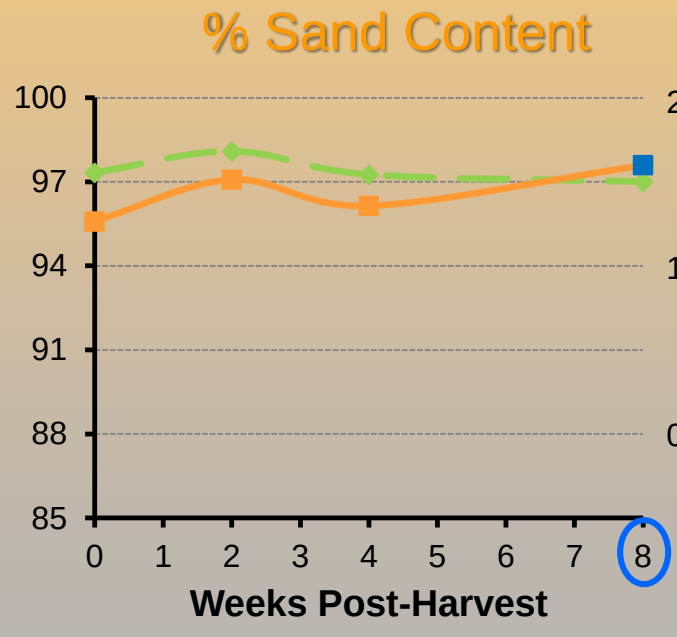
Clay Content
Low (1%) to High (5%)

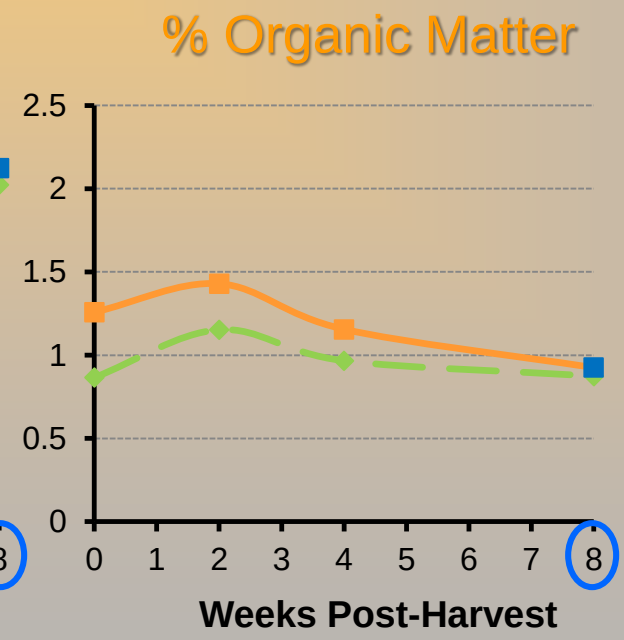
- Spatial relationships between soil properties and lease trends evident
  - OM and Clay are lowest in the shallowest areas (ie. sand bar)
  - Gulf side of the sand bar has depressed clay and OM
  - The protected side of the bar has elevated clay and OM
- Patterns likely drive critical biogeochemical reactions that affect clam production throughout the lease area

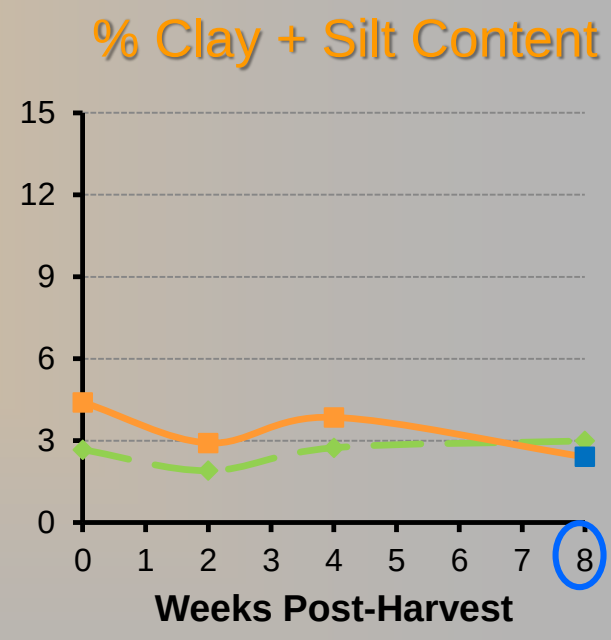
Soils-based Approach to Clam Farming

Is there an effect on soil properties due to clam harvesting methods?

If so, what is recovery time of soils?



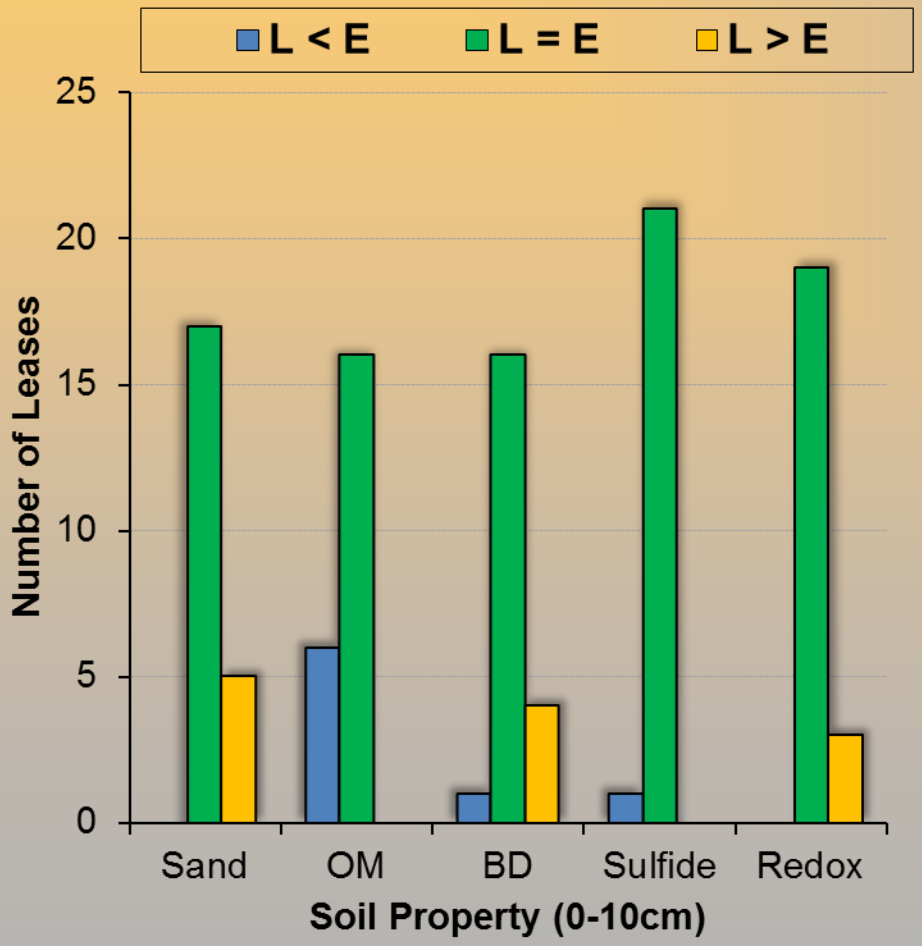




- Recovery of soil properties after harvest in relation to reference site
- Recommend a 2-month fallow time before replanting bags

Soils-based Approach to Clam Farming

Lease (L) versus Easements (E)



Do soil properties differ in areas of intensively farmed leases versus adjacent unfarmed areas (e.g., easements, corridors)?

Soil Property	L < E	L = E	L > E
	(%)		
Sand	0	77	23
OM	27	73	0
BD	5	76	19
Sulfide	5	95	0
Redox	0	86	14

Note: T-tests were performed using SAS software. Treatment means were considered significantly different when $p \leq 0.10$.

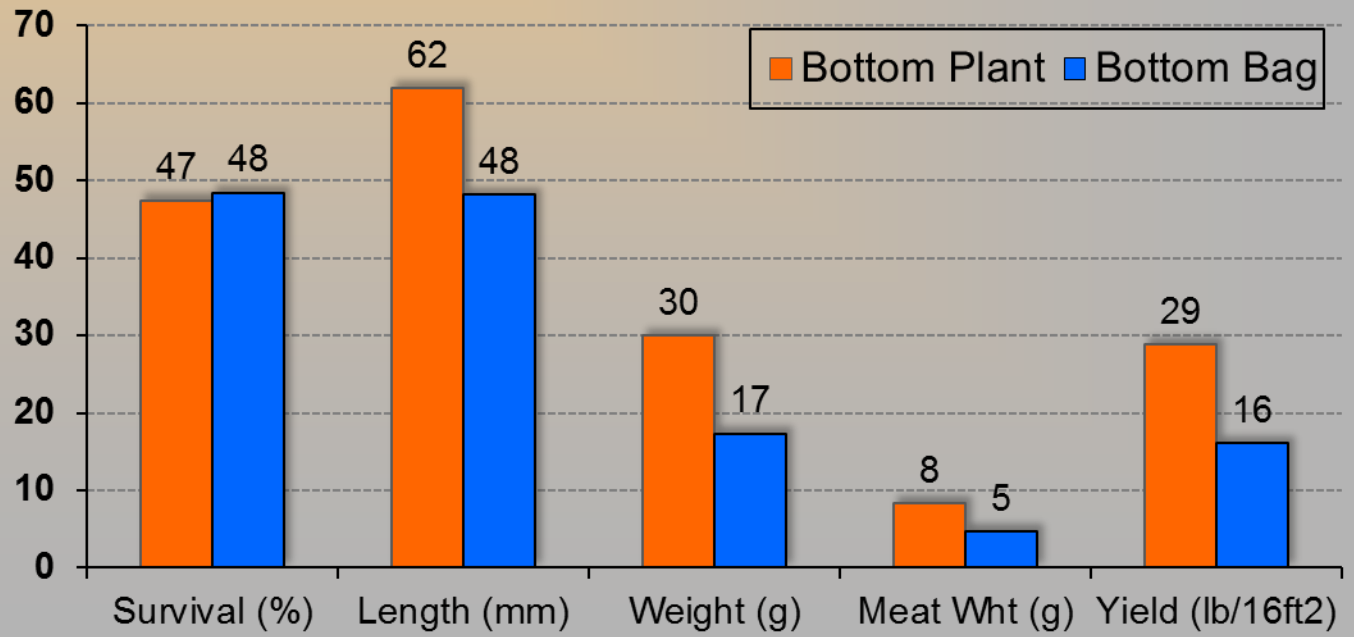
Alternative Culture and Harvest Methods

- Interest in bottom planting
- Lease provisions limit use of mechanical harvesting
- Evaluated effects of a pump-driven harvester on water and soil physiochemical properties
  - Clams, FSG PD, 2013
  - Sunray Venus, DACS ARC, 2013-4
  - With Todd Osborne, UF SWS

- Tested Virginia "box" harvester
  - No tines, angle of box digs into substrate
  - 5 Hp pump delivers pressurized water via 18 nozzles along spray bar

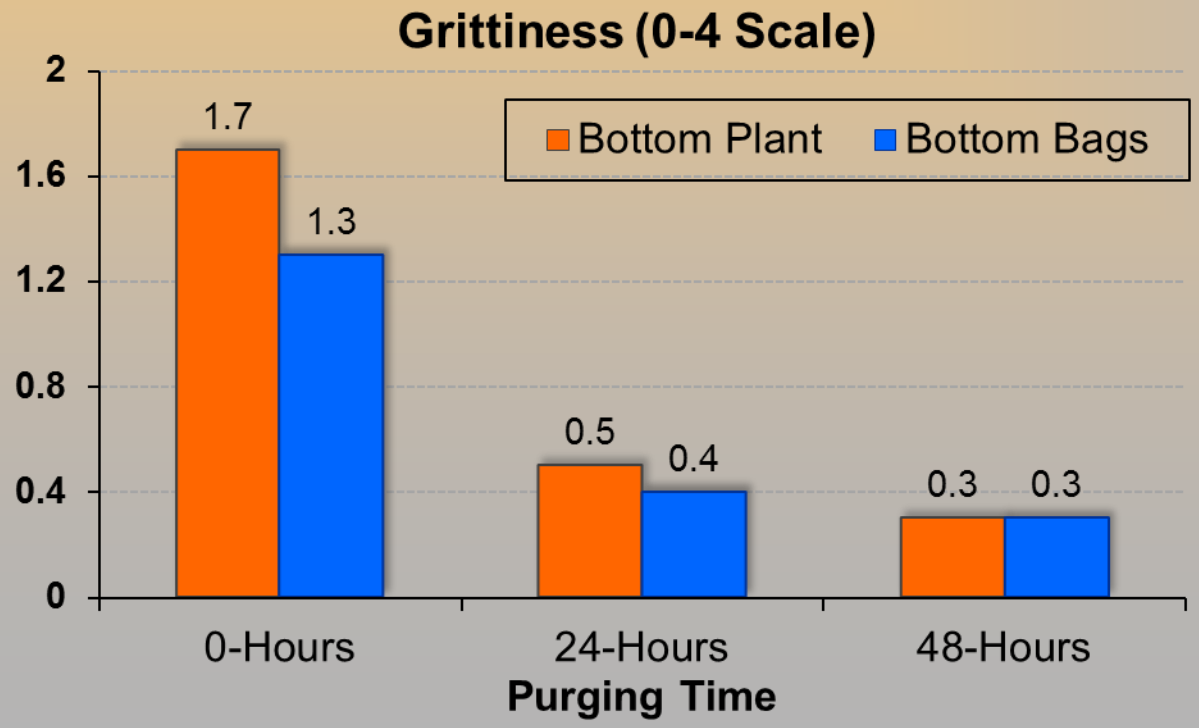
Bags versus Bottom-planted Sunray Venus

- Bottom plants, ½" mesh HDPE and polyester 9mm mesh cover netting, 8' x 10', 80 ft^2
- Bottom bags, belt of 5 bags, 80 ft^2 per row
  - Four replications, 12 month growout
  - Stocking density, 56/ft^2; Seed size, 15 mm SL
- Bottom-planted sunray venus were
  - 29% larger in shell length
  - 76% heavier / 60% more meat weight (wet)
  - 80% increase in yield (lb/16ft^2)
  - Crop time could be reduced by 2-3 months



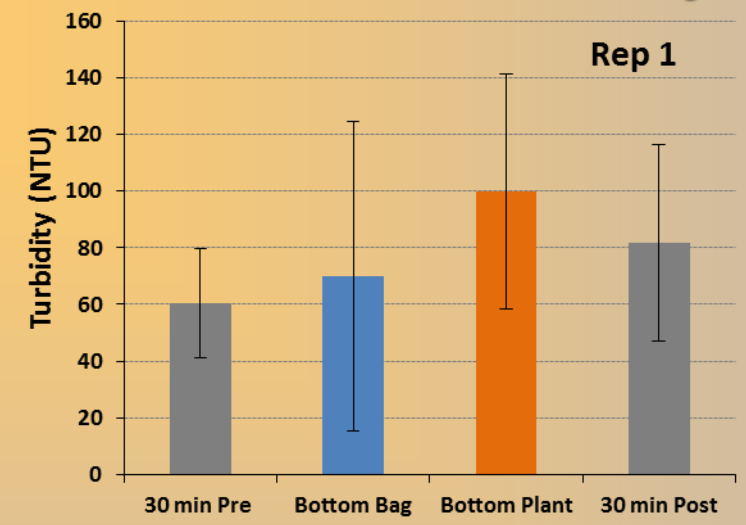
Product Quality of Sunray Venus

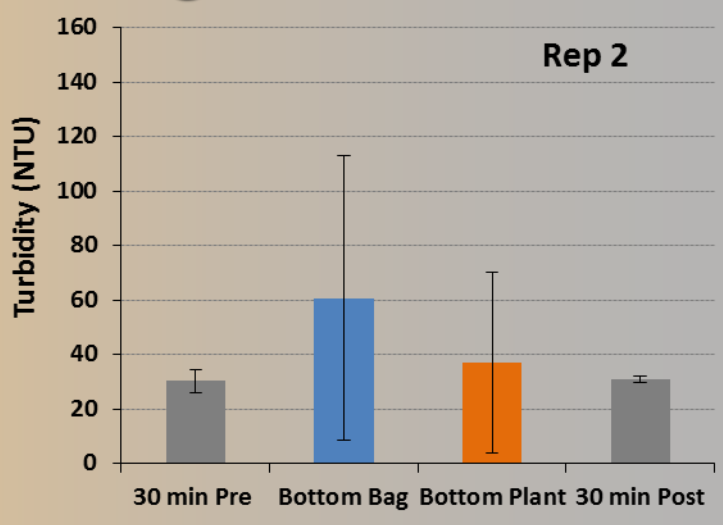
- Grittiness evaluation, 5-point scale where 0=no grit and 4=extremely gritty
  - Sunray venus harvested from both methods were rated as “slightly to moderately” gritty
  - After 24 hours, 70% reduction in grittiness values for clams harvested by both methods
  - After 48 hours, values same for both methods

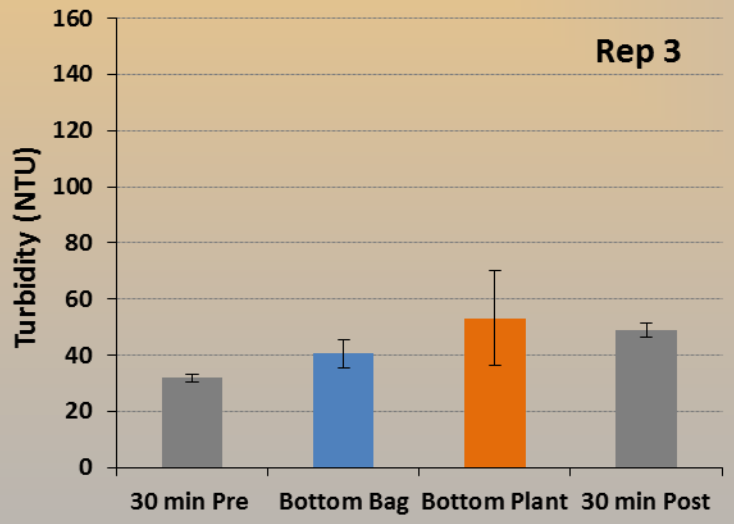


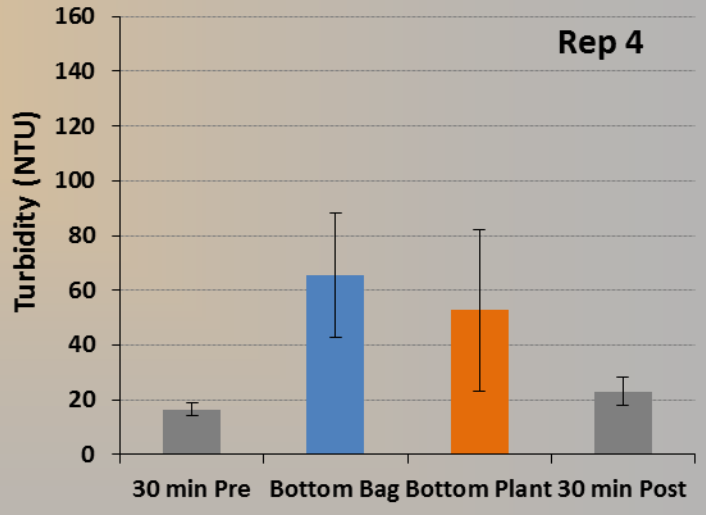
- Shell deformities
  - 0.5% for bottom plant
  - 3.1% for bottom bags
- Shell breakage
  - 2.9% for bottom plant
  - 0.5% for bottom bags
- Shell life, 10 days
  - 100% for both culture methods

Effects on Water Quality using Harvester





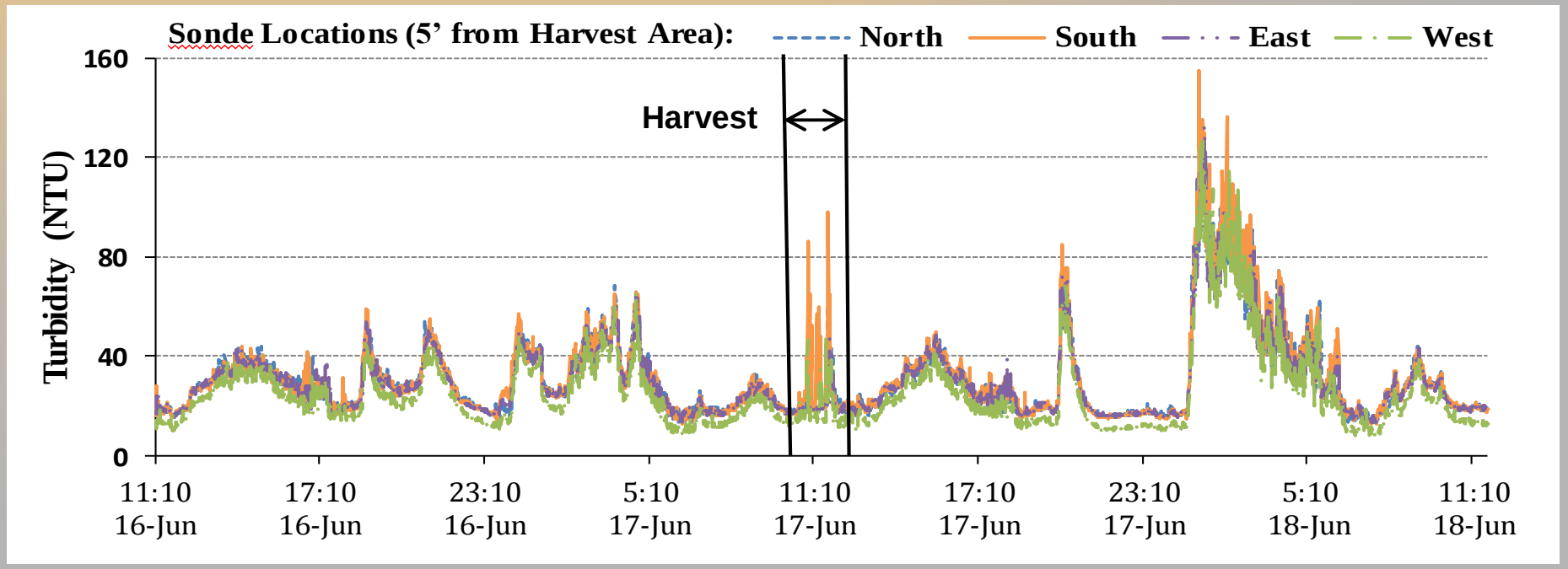




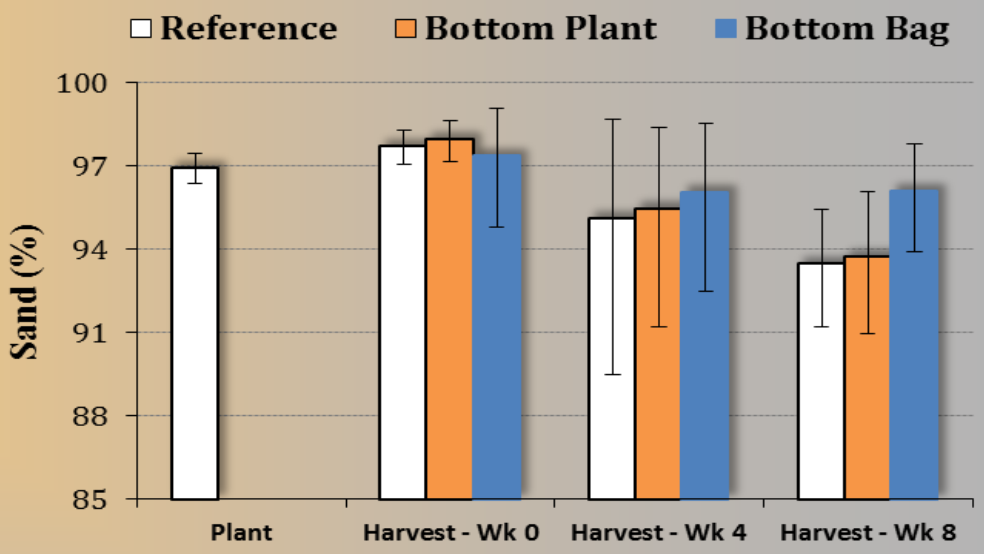
- **Turbidity (NTU)** measured continuously 48 hours hours pre-and post-harvest
- No significant difference observed in any replicate between mean turbidity values observed during the use of the pump-driven harvester or bag harvest

Effects on Water Quality using Harvester

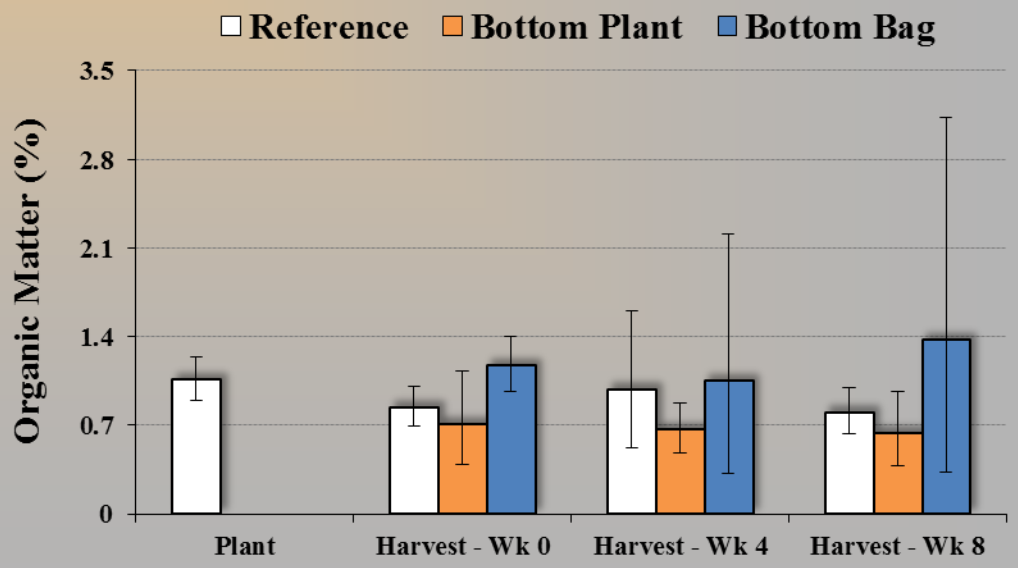
- Short-lived, variable pulse events
- Weather events can produce effects comparable to or greater than those associated with harvesting



Effects on Soil Properties using Harvester



- Soils measured at plant, harvest, and post-harvest (4 and 8 wks)
- Little effect observed in harvest-induced changes to soils PSD
- Science-based information provided to DACS to support proposed statute change in 2015 legislative session



Evaluating Biocide-free Net Coatings in Reducing Biofouling on Clam Culture Gear

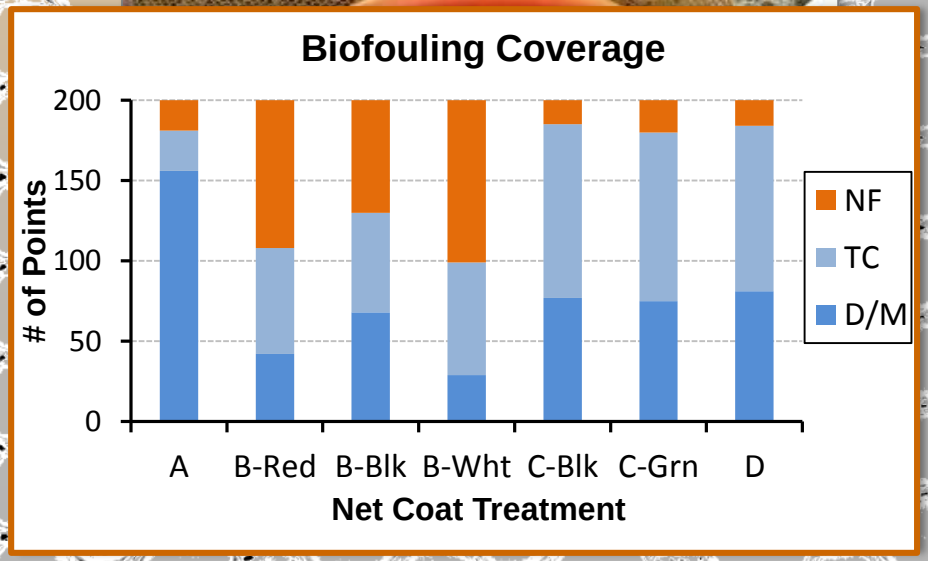
- In preliminary study, two foul-release, biocide-free coatings were tested on clam bag material in Cedar Key, FL*
  - A. Photoactive release coating
  - B. Silicone-based release coating
  - C. Alkyd-based coating
  - D. Uncoated (control)
- After 3 months, Trts A and B had significantly less coverage and wet weight of biofouling than Trts C and D

*Reference: *Cassiano, E., A.Croteau, G. Smith, L.Sturmer, and S.Baker. 2012. Addressing biofouling in Florida's hard clam aquaculture industry: performance of two net coatings. Journal of Shellfish Research 31(1):268A.*

Evaluating Biocide-free Net Coatings in Reducing Biofouling on Clam Culture Gear

- Field trials being conducted in 2014-15
- Biocide-free (non-toxic) antifouling coatings
  - Commercially available
  - Experimental formula
- Treated and untreated bags tested at 3 growing sites on Florida's west coast
- Assess biofouling coverage and weight, clam production, post-harvest maintenance of bags, and cost-benefit analysis

Funded by DACS Florida Aquaculture Program, 2014-15



"Green" Clams

Assessing and Quantifying the Value of Ecosystem Services Provided by Florida Clam Aquaculture

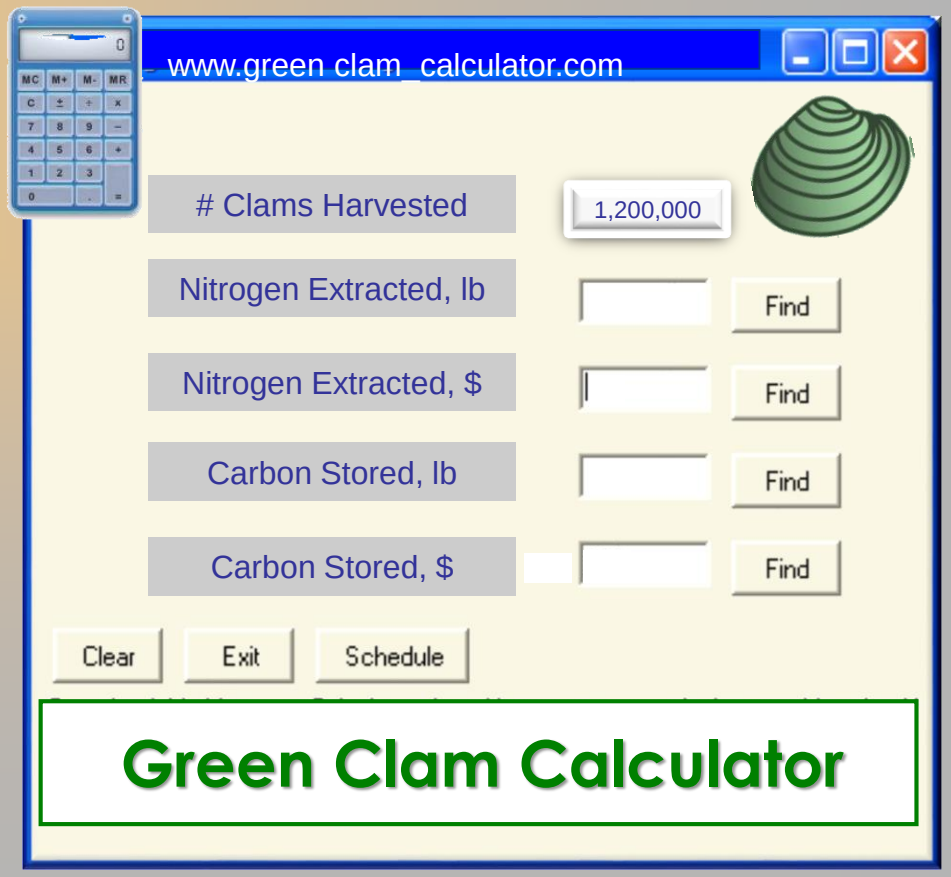
- Determine net removal and storage of nitrogen and carbon by harvest-size clams in Florida waters
  - Shirley Baker, UF SFRC
- Calculate range of valuation of ecosystem services (ES) provided by industry using replacement cost method
  - Sherry Larkin, Kelly Grogan UF FRED

Funded by DACS Florida Aquaculture Program, 2014-15

"Green" Clams

Promoting the Value of Ecosystem Services Provided by the Hard Clam Aquaculture Industry in Florida

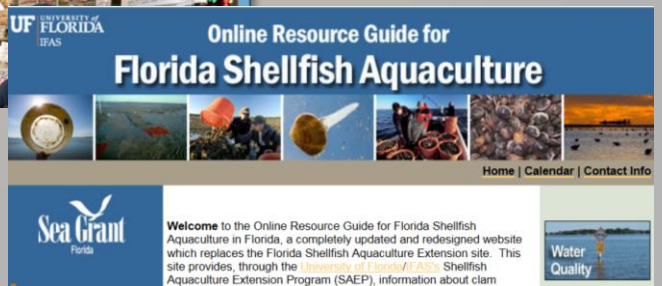
- Information used to produce interactive, web-based tools
- On-line ES calculator
  - Growers enter annual production to determine ES values for their farms
- Industry could potentially seek certification of carbon and nutrient credits/offsets



www.FlaClams.com

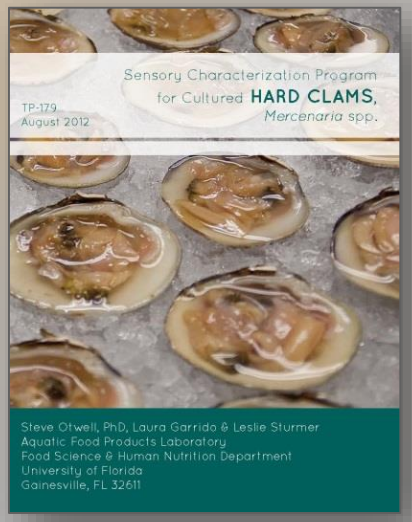
Promoting the Value of Ecosystem Services Provided by the Hard Clam Aquaculture Industry in Florida

- Website designed to showcase Florida industry
  - Informative resource tool and working platform to promote cultured clams as environmentally friendly and benign
  - Developing outline and need industry input from each growing area
  - Featuring: News Blog, Calendar, About our Industry, About our Farms and Farmers, About our Clams, Try Florida Clams, Where to Buy



Sensory Profile of Hard Clams

- A science-based, non-biased tool developed
  - Describe and rate sensory attributes for hard clams
    - Appearance, Aroma, Taste, Texture, Flavor, Aftertaste
  - Lead to local product distinctions or “appellations”



Cultured hard clams from MA to FL evaluated in 2009-10 at the UF Aquatic Food Products Lab

Florida Sea Grant Technical Publication, TP-179

Economic Impact of Florida Clam Culture Industry

- Survey of certified shellfish wholesalers conducted by UF economists* to determine number and value of clams handled in 1999 and 2007… and now 2012
- Input-output methodology used to estimated direct, indirect and induced impacts
- IMPLAN PRO™ software

*Chuck Adams and Alan Hodges
UF Food and Resource Economics Department

http://Edis.ifas.ufl.edu
EDIS Publication # FE961, Oct 2014

Economic Impact Assessment Findings … 1999, 2007 & 2012

Wholesale Dealer Sales	1999	2007	2012
$ of sales by dealers*	$21.8 mill	$26.7 mill	$19.5 mill
Ave. price rec'd by dealer*	$0.16	$0.15	$0.14
Disposition of sales (% by #) / ave price rec'd* (by *region* and *type of buyer*)			
In-State	49% / $0.23	41% / $0.13	50% / $0.12
Out-of-State	51% / $0.22	59% / $0.15	50% / $0.15
Wholesale buyer	77% / $0.17	61% / $0.12	64% / $0.13
Restaurant	14% / $0.15	6% / $0.18	15% / $0.14
Retail	7% / $0.14	32% / $0.18	20% / $0.16
Consumer	1% / $0.23	1% / $0.19	1% / $0.19

* Dollar values are nominal, not adjusted for inflation

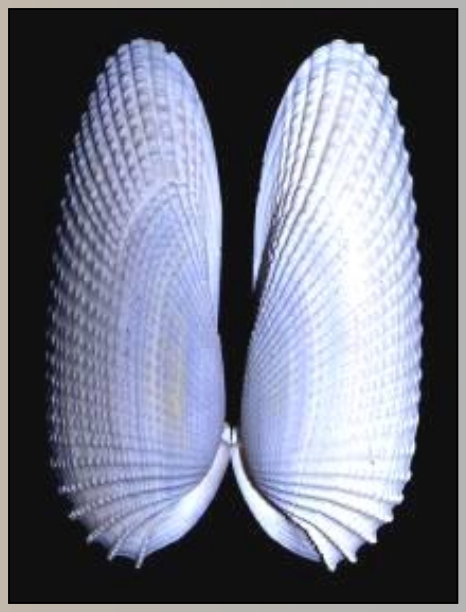
Economic Impact Assessment Findings … 1999, 2007 & 2012

Economic Impact ($ million) *	1999	2007	2012
Region 1			
Economic Output	24.0	44.9	
Incomes	6.5	23.0	N/A
Value-Added	8.8	28.8	
Regions 2 & 3 (combined)			
Economic Output	9.9	8.1	
Incomes	3.5	2.3	N/A
Value-Added	3.3	2.7	
Total for Florida			
Economic Output	33.9	53.0	38.7
Incomes	9.0	25.3	14.7
Value-Added	12.1	31.5	21.9

* Dollar values are nominal, not adjusted for inflation

Species Diversification

- Alternative species for aquaculture
  - Native molluscan species
  - Cultured and marketed similar to hard clam *Mercenaria mercenaria*
- FL Sea Grant-funded research has explored culture potential of a variety of marine mollusks
  - Angel wing, 1992-1994
  - Bay scallop, 1996-2000
  - Ark clams, 2002-2004
  - Sunray venus, 2006-12



Investigation of Ark Clam Culture and Marketability

PROJECT TEAM INVESTIGATORS:

Leslie Sturmer, Jose Nunez, LeRoy Creswell, Shirley Baker
University of Florida, Institute of Food & Agricultural Sciences

Robert Degner, Kimberly Morgan
University of Florida, Agricultural Market Research Center

Alan Power, Randal Walker
University of Georgia, Marine Extension Service

John Baldwin, Larry Nissmen
Florida Atlantic University, Dept. Biological Sciences

FUNDED BY:

USDA CSREES and Florida Sea Grant, 2002-6

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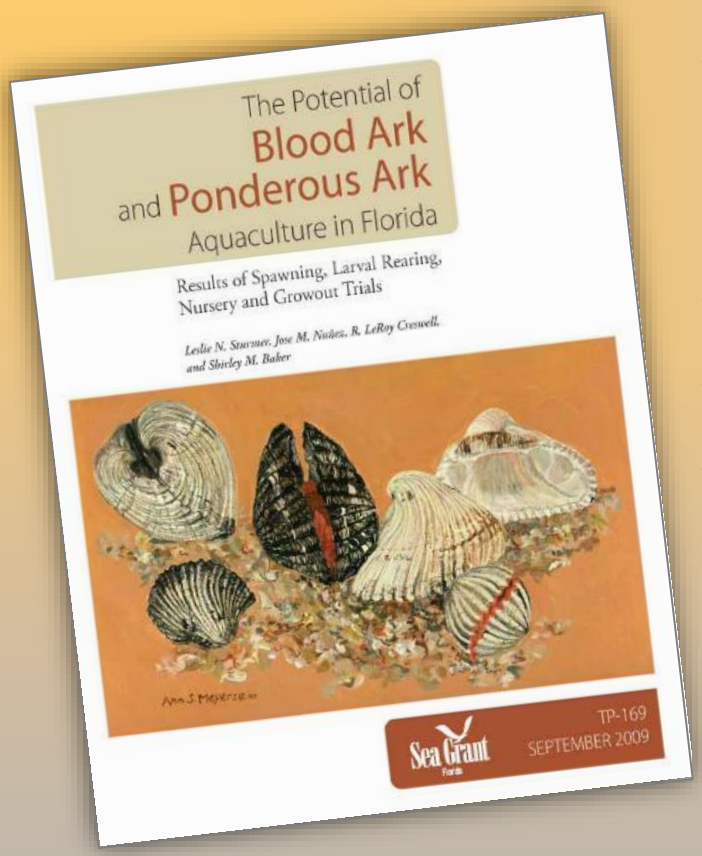
USDA

Sea Grant Florida

Species Diversification: Ark Clams



- Nursing and growout can be conducted using gear and methods similar for hard clams
- Survival and growth documented
- Ethnic markets identified
- Unreliable setting and seed production

- Spawning protocols and cues for setting pediveligers developed
  - John Scarpa, HBOI-FAU
  - USDA NIFA, 2012-3

Renewed Interest in Oyster Culture

Commissioner Putnam, Cabinet Approve New Aquaculture Leases

Expansion of Water Column Leases Brings Opportunity to Apalachicola Bay, Other Areas of the State

Oct 10, 2013

Tallahassee, FL – Commissioner of Agriculture Adam H. Putnam and the Florida Cabinet today voted unanimously to approve additional aquaculture leases in several parts of the state, primarily in Apalachicola Bay.

The wild oyster industry in the Apalachicola Bay has declined substantially in recent years. Spring Creek Oyster Company recently began cultivating oysters in cages in the full water column. part of the water, which reduce improves survival rates.

Florida Department of Agri

Benefiting commercial aquaculture,
Conserving natural resources

Divisio aculture

Navigational Marking of Off-Bottom Oyster Culture Leases

Kal Knickerbocke
1203 Governor's Squ
Tallahassee, Florida 32301-27

Tallahassee Office: 850-488-5471
Winter Haven Office: 863-297-3985
Email: Kal.Knickerbocker@FreshfromFlorida.com
Website: www.FreshfromFlorida.com

Off-bottom oyster culture that involve surface or subsurface oyster culture equipment may present a navigation hazard to boaters and a significant liability risk to leaseholders. This liability can be reduced if the leaseholder applies for and receives approval from the U.S. Coast Guard to appropriately mark lease boundaries as a navigation hazard. The U.S. Coast Guard communicates the potential hazard to the boating public via a notice to mariners and coastal navigation charts are amended to depict the hazard

density, types of vessels, or marine life considerations. These issues are just some of the many variables which the U.S. Coast Guard will consider and/or which may affect a Private Aids to Navigation marking determination.

U.S. Coast Guard

Florida is split into two U.S. Coast Guard districts. The Eighth District is headquartered in New Orleans and their eastern boundary ends at the Econfina River in Taylor County.

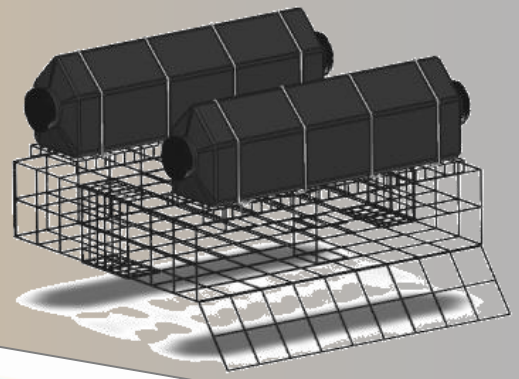
Application

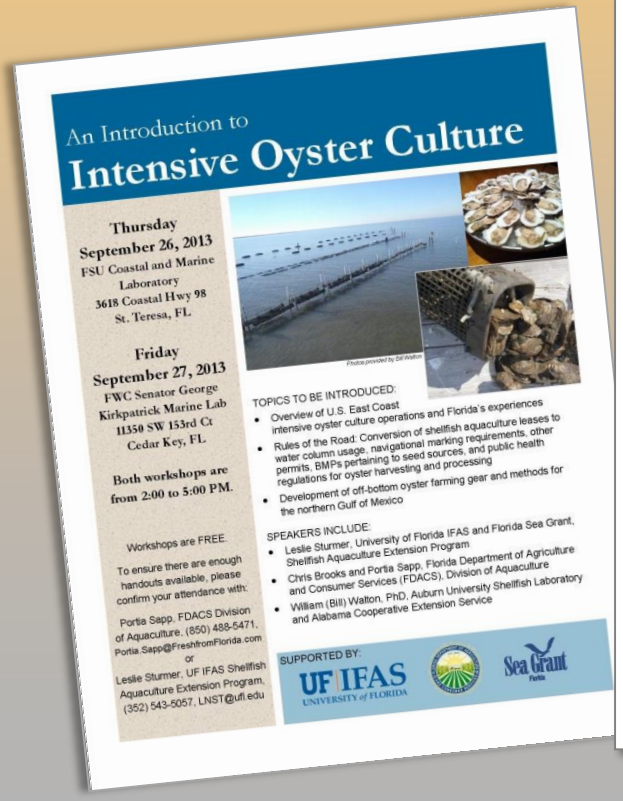
The U.S. Coast Guard offers a Private Aids to Navigation Application form (CG-2554). Information required for the form includes the contact information for the responsible party, the U.S. Army Corps of Engineer permit that approves structures in navigable waters of the United States, location in latitude and longitude for each proposed marker, and

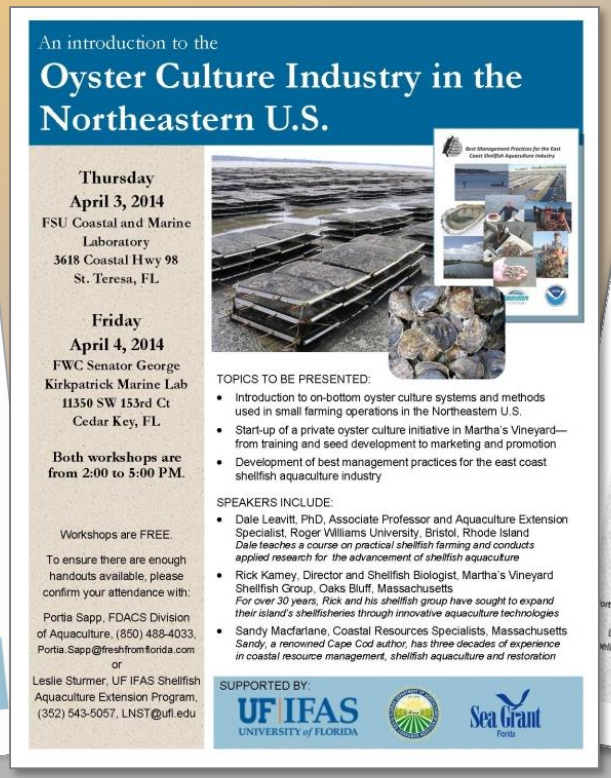
- In past 12 months, over 35 clam leases modified for water column usage (Franklin, Levy, Manatee)
- New oyster aquaculture leases in Wakulla County
- Several clam hatcheries now producing oyster seed

Oyster Culture Workshops

- A series of workshops co-organized by UF and FDACS to inform interested clam growers and others about advancements in oyster culture gear and methods



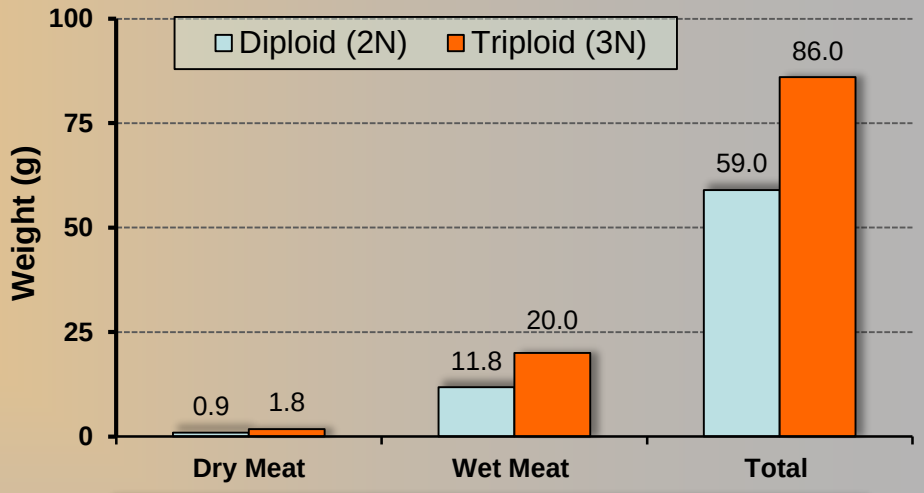




DVDs are available

Development of Triploid Oysters*

- Private-public partnership
  - 4Cs Breeding Technologies Inc.
  - Auburn University
  - University of Florida
- Develop naturally occurring triploids through tetraploid technology using west coast Florida oyster stocks
- Comply with FDACS rules pertaining to oyster genetic protection and disease prevention



*Sturmer, L., Vaughan, D., and Allen, S. 1993. The potential of triploidy in enhancing American oyster *Crassostrea virginica* cultivation in Florida. Book of Abstracts, 1993 annual meeting of the World Aquaculture Society, U.S. Chapter, Hilton Head, South Carolina.

Evaluation of the Sunray Venus Clam *Macrocallista nimbosa*

- Integrated project
  - Brood stock handling
    - UF Florida Sea Grant
  - Embryonic development
    - UF The Whitney Lab
  - Hatchery protocols
    - Harbor Branch at FAU
  - Nursery and growout culture
    - UF Florida Sea Grant
  - Market perception
    - UF Food & Resource Economics
- FL Sea Grant funding, 2006-10

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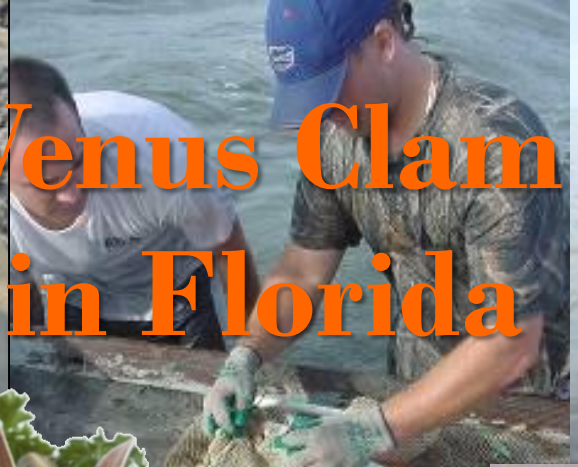
Sea Grant Florida

Eliminate Barriers to Commercial Production of Sunray Venus

- Funded by FSG, 2010-12
- Objectives:
  - Created initial brood stock lines for seed suppliers
  - Determined production performance at existing lease areas
  - Established relationship between soils and productivity at lease areas
  - Defined salinity and soil preferences for selection of future lease sites
  - Determined sensory, microbial, and nutritional profiles
  - Examined product attributes with respect to wholesale market and product distribution standards

Sunray Venus Clam Culture in Florida









Eight Years of Research and Development

Sea Grant Florida

Project VENUS

- An integrated technology transfer project to assist the commercial development of sunray venus clam culture
- Brings together the following resources:
  - University of Florida IFAS
  - Harbor Branch Oceanographic Institute at FAU
  - FDACS Bureau of Seafood and Aquaculture Marketing
  - Cedar Key Aquaculture Association
- Funded through NOAA National Sea Grant Program

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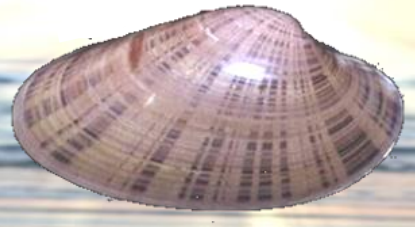
Fresh from Florida

Sea Grant Florida



Project Objectives:

- Ensure **adequate sunray venus seed** availability for Florida growers by working with shellfish hatchery operators
- Educate current clam growers about **culture and handling methods** suitable for sunray venus clam production
- **Characterize bottom sediments** to determine compatibility of existing leases and siting new leases for sunray venus culture
- Evaluate protocols used by **shellfish processors for freezing** sunray venus clams to assess product quality
- **Educate consumers and seafood buyers** about the availability and attributes of a new Florida aquaculture product

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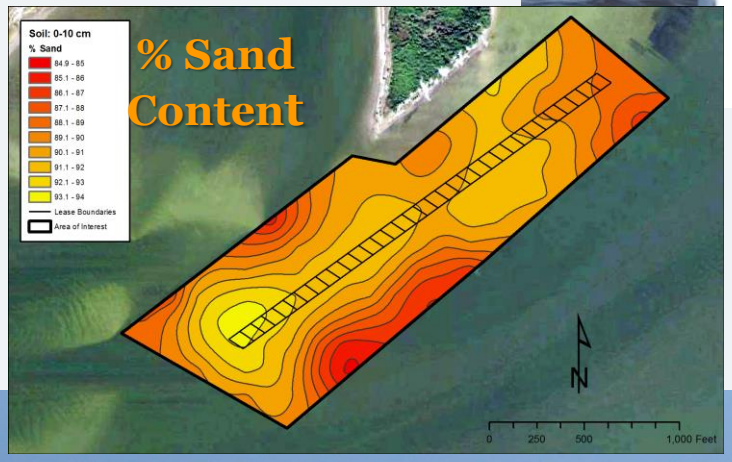
Fresh from Florida

Sea Grant Florida

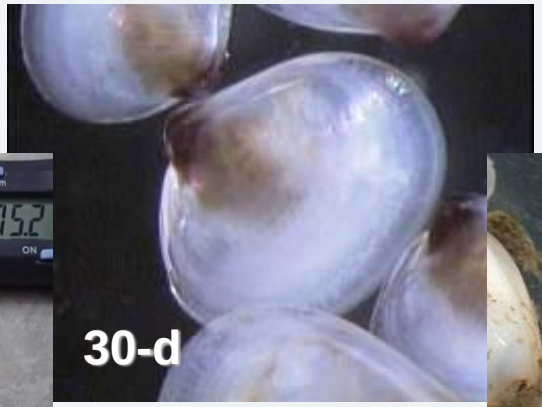
Dog Island Demonstration Site
Cedar Key



- 5-acre site established for education by FDACS and UF
- Allows growers to grow a crop without investment and commitment of a lease
- Site suitable for sunray venus culture
- 38 growers participating

Addressing Sunray Venus Seed Production

- Examining **nutritional status** (fatty acids) of cultured and wild adults
  - HBOI-FAU and UF, Specialty License Plate funding, 2014-15
- Determining **reproductive patterns** of wild and cultured adults
  - HBOI-FAU and UF, DACS ARC proposed funding, 2015-16
- Evaluating **maturation protocols** for spawning wild adults
  - Bay Shellfish and Eckerd College, DACS ARC proposed funding, 2015-16



Clam Industry Meetings

- Present information on recent and ongoing projects
- Meet Dr. Huiping Yang and learn about her research experiences
- Provide direction in addressing research efforts to meet the needs of shellfish aquaculture industry

Questions?