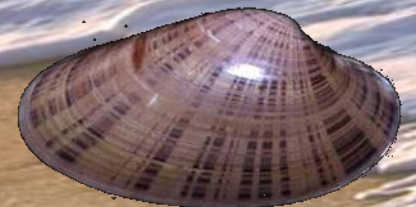


Eliminating Barriers to Commercial Production of Sunray Venus Clams in Florida:

Production Evaluation at Growout Sites and Soil Relationships

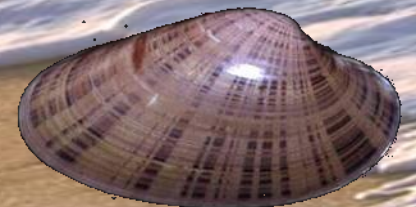
Leslie Sturmer

Cooperative Extension Service



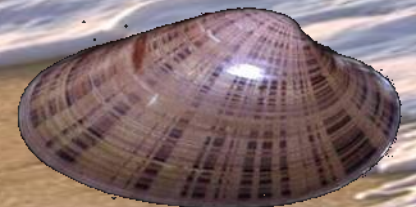
Eliminating Barriers to Commercial Production of Sunray Venus Clams in Florida

- Funded by Florida Sea Grant, L/LR-A-46, **2010-12**
 - John Scarpa, Harbor Branch Oceanographic Institute at FAU
 - **Leslie Sturmer, UF IFAS Cooperative Extension Service**
 - Chuck Adams, UF IFAS Food and Resource Economics
 - Steve Otwell, UF IFAS Food Science and Human Nutrition
 - **Rex Ellis, UF IFAS Soil and Water Science**
 - **Todd Osborne, UF IFAS Soil and Water Science**
 - **Mark Clark, UF IFAS Soil and Water Science**



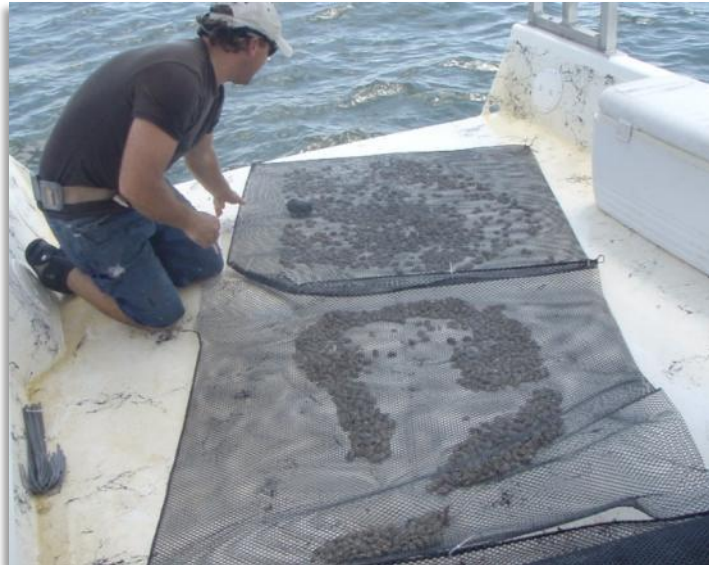
Rational and Objectives

- Determine compatibility of shellfish culture leases and potential future lease sites for sunray venus clam culture.
 - Measure production performance (growth and survival) of sunray venus clams for growout culture at multiple existing commercial lease areas and at test sites.
 - Examine relationship between aqueous soils (substrate) and sunray venus clam productivity at leases using a soils-based approach



Determining Production Performance of Sunray Venus Clams at Commercial Lease Areas

- Provided 210,000 growout seed to 18 growers
- Evaluated 20 leases and 4 potential lease sites in 4 counties during 2010-12
- Growers allowed to “experiment” with seed
- Standardized 3 bottom bags
- Stocking densities (50/ft²)
- Duration – about 12 months



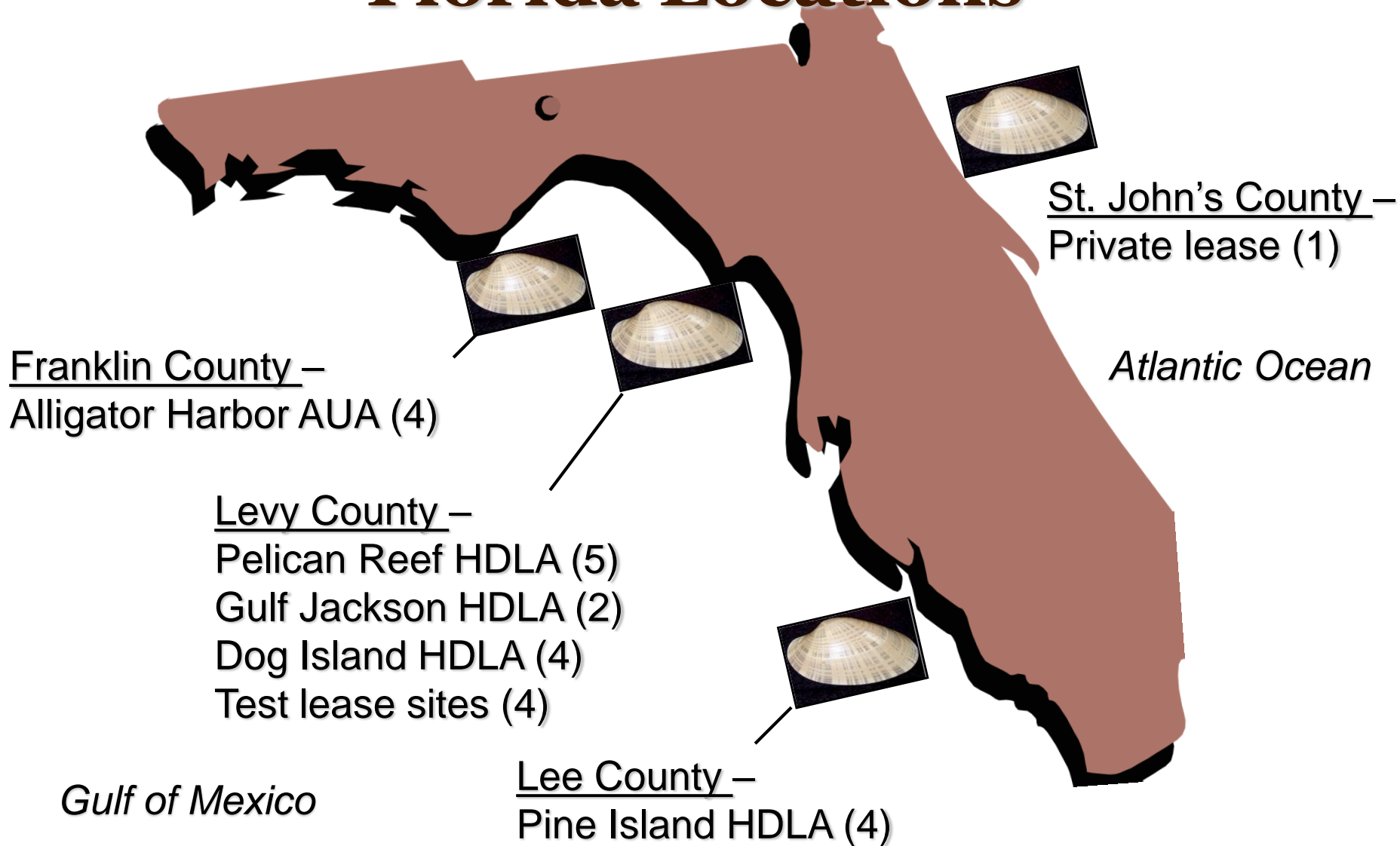
Johnnie Sheridan of Carrabelle stocking bags



Barry Hurt of Placida harvesting sunray venus clams

Growout Trials, 2010-12

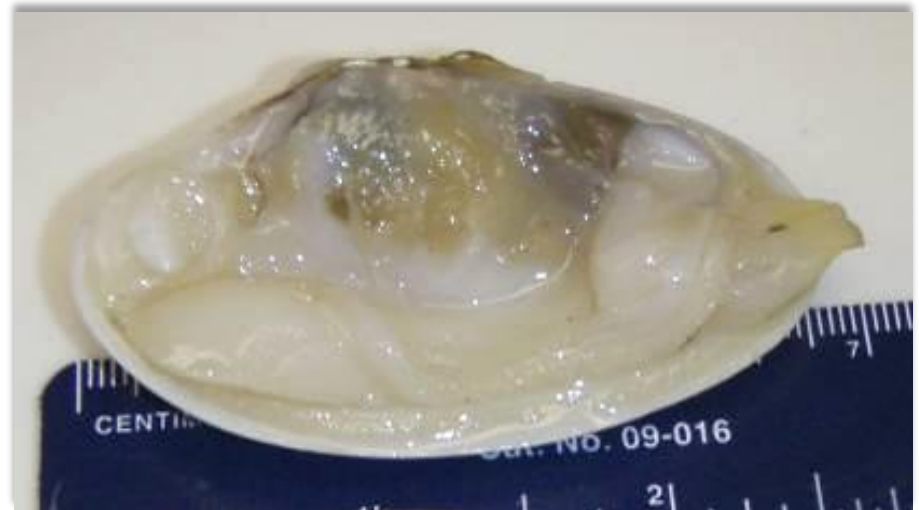
Florida Locations



Sampling and Measurements

Production characteristics measured

- Survival
- Growth – length, width, height
- Weight – total, meat (wet, dry)
- Condition index



Sampling and Measurements

Production characteristics measured

- Shell deformities or irregularities
 - Limited to bottom margin of shell with one shell having excessive curvature resulting in a depression
 - Ranged from 8 to 48% per bag in 2008-10 field trials



Sampling and Measurements

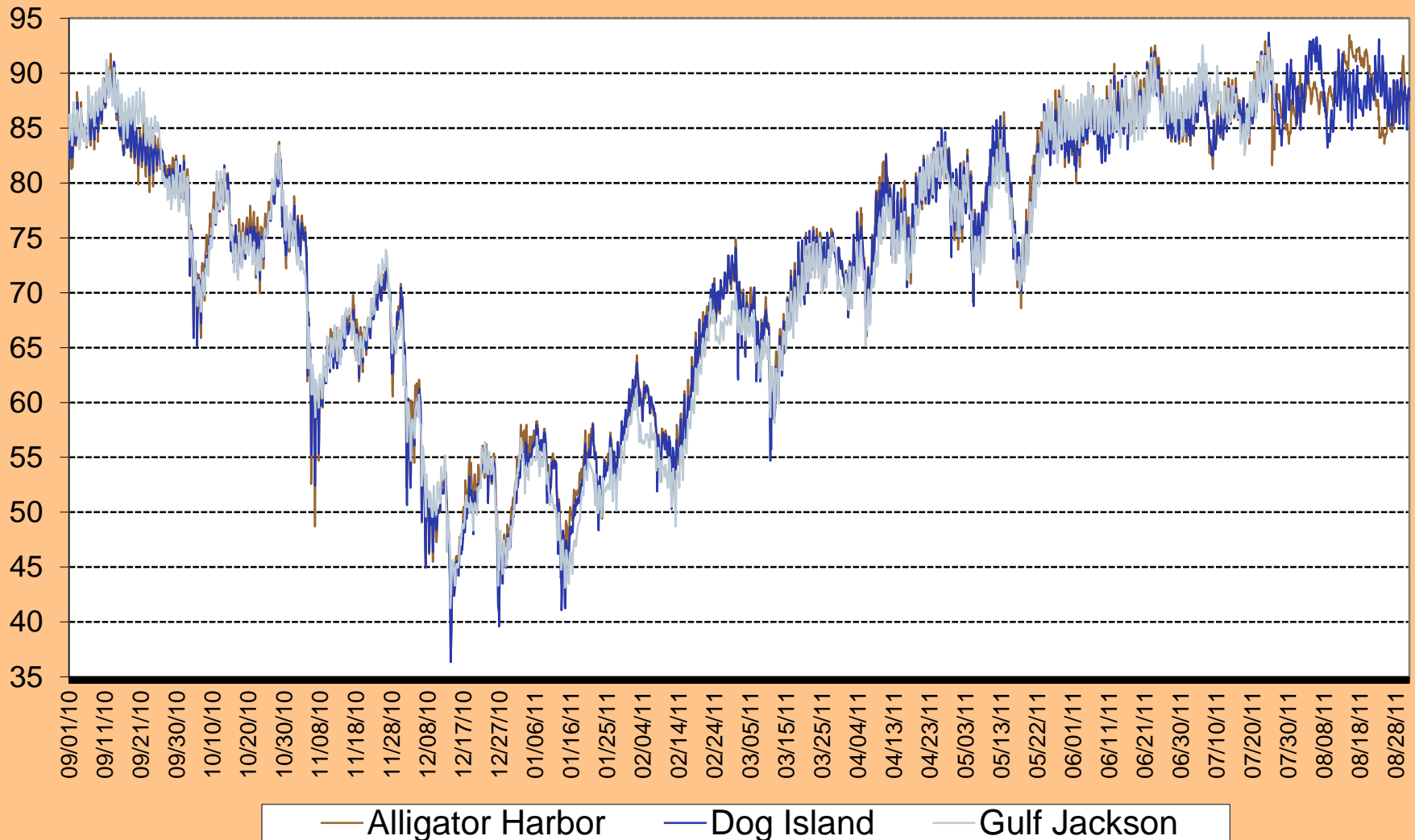


Soils properties and chemistry measured at plant and harvest:

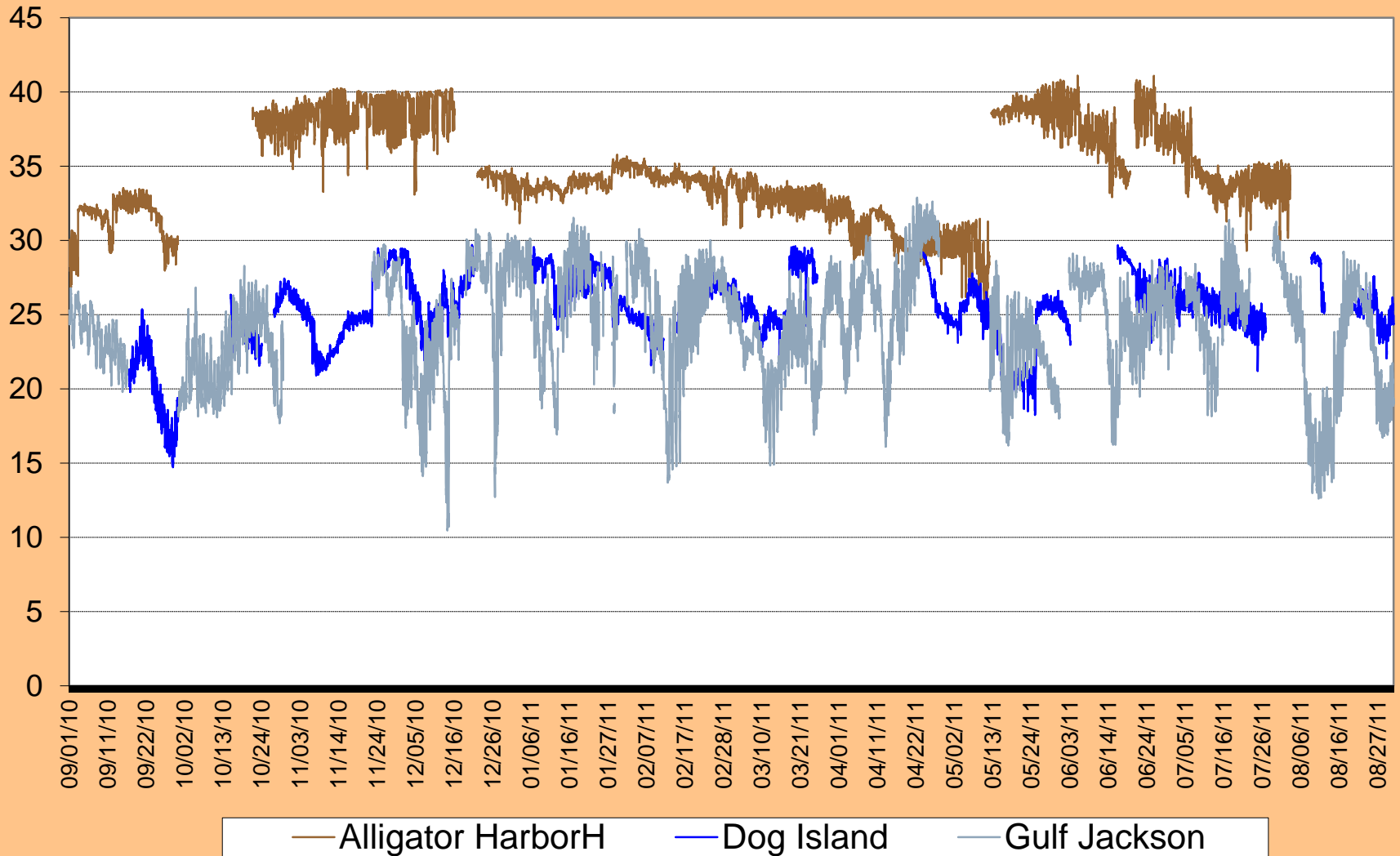
- Triplicate core samples
 - Sand, silt, clay
 - Organic matter
- Hydrogen sulfide



Water Temperature (°F), 2010-11 Growers' Sites



Salinity (ppt), 2010-11 Growers' Sites



2010-11 Growout Results – Alligator Harbor

Lease #	Width in (\pm SD)	Length in (\pm SD)	Total Weight g (\pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
F1	0.7 (0.1)	1.7 (0.04)	12.3 (1.1)	0.6 (0.1)	63.3 (21.9)
F23	0.6 (0.1)	1.6 (0.1)	10.3 (2.5)	0.6 (0.2)	54.6 (10.9)
F37	0.7 (0.1)	1.7 (0.2)	12.5 (2.9)	0.6 (0.1)	71.2 (1.4)

Comments: Slowest growth (>5/8"SW), related to high salinities; Highest overall survival; Low shell deformities



Shell Deformities:
 F01 – 4.0 \pm 5.3%
 F23 – 4.0 \pm 0%
 F37 – 9.3 \pm 3.1%

Lease Site Study – Alligator Harbor AUA, F-23 - Bag 3

2010-11 Growout Results – Alligator Harbor

Production Characteristics at Harvest:

Lease #	Width in (\pm SD)	Length in (\pm SD)	Total Weight g (\pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
F1	0.7 (0.1)	1.7 (0.2)	12.3 (3.6)	0.6 (0.1)	63.3 (21.9)
F23	0.6 (0.1)	1.6 (0.1)	10.3 (2.9)	0.6 (0.2)	54.6 (10.9)
F37	0.7 (0.1)	1.7 (0.1)	12.5 (2.9)	0.6 (0.1)	71.2 (1.4)

Soil Properties at Planting:

Lease #	Sand % (\pm SD)	Clay % (\pm SD)	Silt % (\pm SD)	Organic Matter % (\pm SD)	H ₂ S mol (\pm SD)
F1	97.2 (0.2)	2.7 (0.1)	0.30 (0.20)	0.45 (0.03)	0.97 (0.40)
F23	93.0 (4.2)	3.9 (0.5)	3.3 (4.4)	0.48 (0.03)	1.30 (0.50)
F37	88.0 (5.3)	3.4 (0.7)	8.6 (5.2)	0.49 (0.06)	0.54 (0.21)

Comments: Largest range in Sand % (87-97); F1&F23 similar in Soil Content; F37 lower Sand, higher Silt & OM

2010-11 Growout Results – Pelican Reef

Lease #	Width in (\pm SD)	Length in (\pm SD)	Total Weight g (\pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
905	0.8	2.0	18.7	0.6	4.4 (7.6)
906	0.8 (0.1)	2.1 (0.1)	21.0 (2.2)	1.2 (0.02)	15.5 (11.7)
998	0.8 (0.1)	1.9 (0.1)	17.2 (2.7)	0.8 (0.08)	35.5 (10.8)

Comments: Better growth (7/8"SW); Lowest overall survival; Range of shell deformities, from low to highest



Shell Deformities:
 905 – 4.0
 906 – 6.7 \pm 4%
 998 – 1.3 \pm 1%

Lease Site Study – Pelican Reef HDLA, L-906 - Bag 2

2010-11 Growout Results – Pelican Reef

Production Characteristics at Harvest:

Lease #	Width in (\pm SD)	Length in (\pm SD)	Total Weight g (\pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
905	0.8	2.0	18.7	0.6	4.4 (7.6)
906	0.8 (0.1)	2.1 (0.1)	21.0 (2.2)	1.2 (0.02)	15.5 (11.7)
998	0.8 (0.1)	1.9 (0.1)	17.2 (2.7)	0.8 (0.08)	35.5 (10.8)

Soil Properties at Planting:

Lease #	Sand % (\pm SD)	Clay % (\pm SD)	Silt % (\pm SD)	Organic Matter % (\pm SD)	H ₂ S mol (\pm SD)
905	90.8 (0.5)	7.0 (0.6)	2.7 (0.5)	2.1 (0.5)	0.35 (0.07)
906	89.8 (5.3)	3.1 (0.4)	7.2 (5.0)	0.9 (0.4)	0.25 (0.15)
998	95.9 (5.4)	4.8 (1.3)	0.8 (0.7)	1.9 (1.2)	0.22 (0.07)

Comments: Sand % similar, Highest range of Clay%, Wide range in Silt%, Higher OM% than AH

2010-11 Growout Results – Gulf Jackson

Lease #	Width in (\pm SD)	Length in (\pm SD)	Total Weight (g \pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
631	0.83 (0.03)	2.1 (0.11)	21.6 (2.9)	1.0 (0.1)	48.4 (10.3)
6022	0.81 (0.04)	2.1 (0.14)	21.9 (3.3)	1.0 (0.3)	25.0 (13.1)

Comments: Similar growth as PR (7/8"SW); Better survival than PR; Low shell deformities



Shell Deformities:
 631 – 1.3 \pm 1.2%
 6022 – 2.0 \pm 2.0%

Lease Site Study – Gulf Jackson HDLA, L-631 - Bag 2

2010-11 Growout Results – Gulf Jackson

Production Characteristics at Harvest:

Lease #	Width in (\pm SD)	Length in (\pm SD)	Total Weight (g \pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
631	0.83 (0.03)	2.1 (0.11)	21.6 (2.9)	1.0 (0.1)	48.4 (10.3)
6022	0.81 (0.04)	2.1 (0.14)	21.9 (3.3)	1.0 (0.3)	25.0 (13.1)

Soil Properties at Planting:

Lease #	Sand % (\pm SD)	Clay % (\pm SD)	Silt % (\pm SD)	Organic Matter % (\pm SD)	H ₂ S mol (\pm SD)
631	88.6 (7.2)	3.9 (0.7)	7.4 (6.7)	1.3 (0.6)	0.16 (0.05)
6022	87.5 (5.0)	4.7 (1.5)	7.7 (5.9)	1.8 (0.2)	0.05 (0.02)

Comments: Lowest Sand%(82) observed ; Same Clay and OM%, Differences in Silt, highest Silt % (12) observed

2010-11 Growout Results – Dog Island

Lease #	Width in (\pm SD)	Length in (\pm SD)	Total Weight g (\pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
818	0.84 (0.03)	2.1 (0.1)	21.6 (2.9)	1.0 (0.04)	62.1 (13.0)
820	0.70 (0.04)	1.9 (0.1)	13.9 (1.9)	0.6 (0.12)	11.0 (3.8)

Comments: Similar growth as other Levy County sites (7/8"SW); Highest survival in Levy County, also low value



Shell Deformities:
 818 – 4.7 \pm 3.1%
 820 – 1.3 \pm 2.3%

Lease Site Study – Dog Island HDLA, L-818 - Bag 2

2010-11 Growout Results – Dog Island

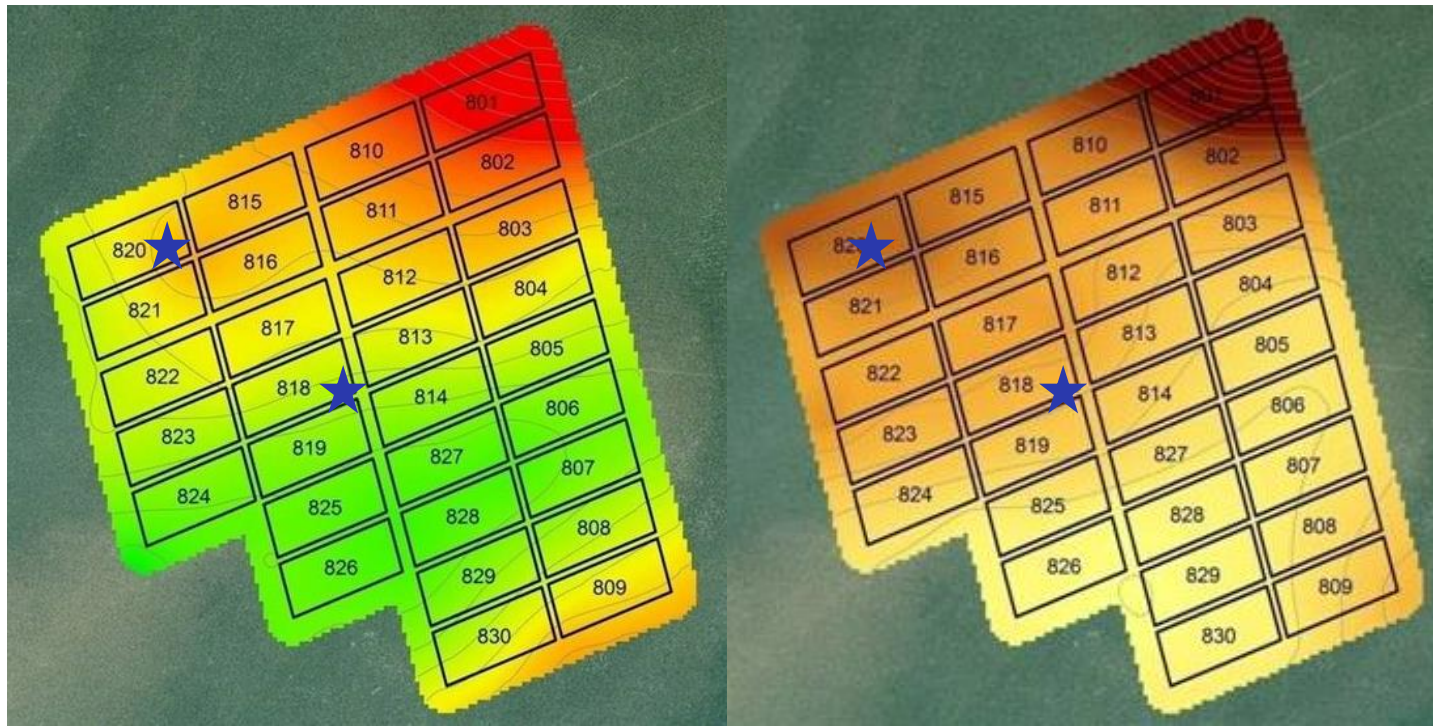
Lease #	Width in (\pm SD)	Length in (\pm SD)	Total Weight g (\pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
818	0.84 (0.03)	2.1 (0.1)	21.6 (2.9)	1.0 (0.04)	62.1 (13.0)
820	0.70 (0.04)	1.9 (0.1)	13.9 (1.9)	0.6 (0.12)	11.0 (3.8)

Organic Matter

High
(4%)



Low
(0.5%)



Clay Content

High
(5%)



Low
(1%)

2010-11 Growout Results – Dog Island

Production Characteristics at Harvest:

Lease #	Width in (± SD)	Length in (± SD)	Total Weight g (± SD)	Dry Meat Weight g (± SD)	Survival % (± SD)
818	0.84 (0.03)	2.1 (0.1)	21.6 (2.9)	1.0 (0.04)	62.1 (13.0)
820	0.70 (0.04)	1.9 (0.1)	13.9 (1.9)	0.6 (0.12)	11.0 (3.8)

Soil Properties at Planting:

Lease #	Sand % (± SD)	Clay % (± SD)	Silt % (± SD)	Organic Matter % (± SD)	H ₂ S mol (± SD)
818	93.3 (2.8)	5.0 (0.8)	2.4 (2.9)	1.2 (0.6)	0.41 (0.01)
820	88.8 (4.8)	8.0 (2.9)	3.3 (2.1)	2.5 (1.5)	0.19 (0.10)

Comments: Range of Sand% same as PR; Parcel 818 had higher Sand %, lower Silt and OM% than 820

Examining Relationship between Sunray Venus Clam Productivity and Aqueous Soil Properties

Acceptable Production and Soils Relationships:

Values	Survival (%)	Sand (%)	Clay (%)	Silt (%)	Organic Matter (%)
Average	62.8	92.9	3.76	3.64	0.66
Range	55 - 71	88.0 - 97.2	2.8 - 5.0	0.3 - 8.6	0.48 - 1.2

Soil Content: Higher Sand, Lower Silt, Lower Organic Matter

Unacceptable Production and Soils Relationships:

Values	Survival (%)	Sand (%)	Clay (%)	Silt (%)	Organic Matter (%)
Average	24.9	90.1	5.08	5.09	1.62
Range	4 - 48	87.5 - 95.9	3.1 - 8.0	0.8 - 7.7	0.9 - 2.5

2011-12 Growout Results – Pine Island

Lease #	Width in (\pm SD)	Length in (\pm SD)	Total Weight g (\pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
100	0.73 (0.04)	1.9 (0.1)	16.9 (2.2)	0.9 (0.1)	60.5 (10.1)
103	0.73 (0.05)	1.9 (0.1)	16.0 (3.1)	0.9 (0.1)	50.8 (8.4)
2002	0.83 (0.03)	2.2 (0.1)	24.0 (2.1)	1.5 (0.1)	53.2 (27.0)

Comments: Good growth and survival at all parcels (11 months), some evidence of predation



Shell Deformities:
100 – 0
103 – $4.7 \pm 3.1\%$
2002 – $2.0 \pm 2.0\%$

2011-12 Growout Results – Pine Island

Production Characteristics at Harvest:

Lease #	Width in (\pm SD)	Length in (\pm SD)	Total Weight g (\pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
100	0.73 (0.04)	1.9 (0.1)	16.9 (2.2)	0.9 (0.1)	60.5 (10.1)
103	0.73 (0.05)	1.9 (0.1)	16.0 (3.1)	0.9 (0.1)	50.8 (8.4)
2002	0.83 (0.03)	2.2 (0.1)	24.0 (2.1)	1.5 (0.1)	53.2 (27.0)

Soil Properties at Planting:

Lease #	Sand % (\pm SD)	Clay % (\pm SD)	Silt % (\pm SD)	Organic Matter % (\pm SD)	H ₂ S mol (\pm SD)
100	97.1 (0.6)	1.0 (0.9)	2.0 (1.2)	0.26 (0.09)	0.04 (0.02)
103	97.1 (0.9)	3.3 (0.4)	0.05 (0.9)	0.46 (0.14)	0.08 (0.05)
2002	97.5 (0.8)	1.6 (0.4)	1.2 (0.8)	0.40 (0.04)	0.08 (0.05)

Comments: High Sand% (same as AH); Range in Clay, Silt, and OM% similar to AH and preferred ranges

2011-11 Growout Results – Levy County Test Sites

Test Site	Width in (\pm SD)	Length in (\pm SD)	Total Weight g (\pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
DI-E	0.74 (0.01)	2.15 (0.06)	20.9 (1.3)	-	56.9 (8.7)
DI-W	0.74 (0.02)	2.19 (0.02)	21.2 (1.1)	-	48.8 (4.9)
AO	0.63 (0.01)	1.88 (0.06)	13.7 (0.4)	-	52.3 (8.4)

Comments: Good growth and survival at all parcels; large shells, evidence of conch predation; no deformities



Shell Deformities:

DI-E – 0%
DI-W – 0%
AO – 0%

2011-11 Growout Results – Levy County Test Sites

Production Characteristics at Harvest:

Test Site	Width in (\pm SD)	Length in (\pm SD)	Total Weight g (\pm SD)	Dry Meat Weight g (\pm SD)	Survival % (\pm SD)
DI-E	0.74 (0.01)	2.15 (0.06)	20.9 (1.3)	-	56.9 (8.7)
DI-W	0.74 (0.02)	2.19 (0.02)	21.2 (1.1)	-	48.8 (4.9)
AO	0.63 (0.01)	1.88 (0.06)	13.7 (0.4)	-	52.3 (8.4)

Soil Properties at Planting:

Test Site	Sand % (\pm SD)	Clay % (\pm SD)	Silt % (\pm SD)	Organic Matter % (\pm SD)	H ₂ S mol (\pm SD)
DI-E	94.3 (0.5)	2.9 (0.2)	2.8 (0.7)	0.63 (0.02)	0.07 (0.04)
DI-W	95.4 (0.5)	2.1 (0.9)	2.5 (1.4)	0.52 (0.03)	0.08 (0.02)
AO	94.0	2.3	3.7	0.44	0.04 (0.01)

Comments: Similar Soil% among test sites; % content fall within acceptable ranges for Sand, Clay, Silt, & OM

What's Next?

- Evaluate alternative culture (bottom plants) and harvesting methods
 - Hard clams, Florida Sea Grant, 2012-3
 - Sunray venus, FDACS ARC, 2013-4



- Determine effects on soil physiochemical properties resulting from the use of a modified hydraulic rake ("box" harvester)



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- UF-Bill White, Reggie Markham, Matt
- HBOI-John Scarpa and staff
- Industry Partners

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