Sunray Venus Clam Seed Nursery Culture:

Introduction to Sunray Venus Clam Seed

Results of Land-based Nursery and Field Nursery Trials in Florida

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Presented at Project VENUS Workshops, May 2014, Cedar Key, FL

Sunray Venus Seed Suppliers

- Six Florida seed suppliers are participating in Project VENUS and are planning on providing sunray venus seed to Florida growers this year
- Over 2,400 sunray venus broodstock cultured at the Dog Island UF experimental lease have been distributed to these hatcheries since January 2014

These hatchery and nursery operations are supplying molluscan shellfish seed to Florida growers this year. Contact suppliers for information on species, seed sizes, price, color variation and availability.

Bay Shellfish Co. - H, N
P.O. Box 289
Terra Ceia, FL 34250
Contact: Curt Hemmel
(941) 721-3887 or
(561) 445-3488 (cell)
bayshellfish@tampabay.rr.com
Website: *http://bayshellfish.com*
Species: HC, OY, SRV, BS

Blue Acres - N
1210 Grogan Avenue NE
Palm Bay, FL 32907
Contact: Kevin Reinecke
(321) 243-2526 (cell)
kevin.blueacres@gmail.com
Species: HC

Cedar Creek Shellfish Farm - H, N
701 Downing Street
New Smyrna Beach, FL 32168
Contact: Mike Sullivan
(386) 426-0113 or 847-3202 (cell)
cedarcreekshellfish@gmail.com
Website: *http://ww.cedarcreekshellfish.com*
Species: HC

Clamtastic - H, N
P.O. Box 664
Cedar Key, FL 32625
Contact: Chris Topping or
Anthony Hinkle
(352) 213-5999 or 949-2233
clamtastic2000@yahoo.com
Species: HC, SRV

Cole's Clam Nursery - N
P.O. Box 82
Placida, FL 33946
Contact: Buck Cole (941) 697-3181 or Barry Hurt (863) 604-1891 *bhurt@tampabay.rr.com*
Species: HC

Ewan Leighton - H, N
270 Sea Dunes Drive
Melbourne Beach, FL 32951
Contact: Ewan Leighton (321) 288-8201 *sleighton1@cfl.rr.com*
Species: HC

Florida Shellfish - H, N
P.O. Box 609
Cedar Key, FL 32625
Contact: Will Knight
(352) 949-4724
Species: HC, SRV

Island Fresh Seafood - N
P.O. Box 895
Cedar Key, FL 32625
Contact: Laura Adams, (352) 949-0532 *lauracedarky@gmail.com*
Species: HC

Orchid Island Shellfish Co. - N
633 Old Dixie Highway
Sebastian, FL 32958
Contact: Ed Mangano
(772) 589-1600 or 589-5080 (Fax)
aquagemfarms@aol.com
Species: HC

Research Aquaculture - H, N
72 Azalea Circle
Tequesta, FL 33469
Contact: Tom McCrudden
(561) 702-8159
raiclams@bellsouth.net
Species: HC, OY, SRV

Southern Cross Seafarms - H, N
12170 State Road 24
Cedar Key, FL 32625
Contact: Shawn Stephenson or
Jon Gill
(352) 543-5980 or 543-5982 (Fax)
southerncrossclams@gmail.com
Website: *http://www.clambiz.com*
Species: HC, OY, SRV

Doug Telgen—H, N
16380 Hodges Ave
Cedar Key, FL 32625
Contact Doug Telgen
(352) 543-5388
Species: HC, SRV

This list is provided as a service of the UF/IFAS Shellfish Aquaculture Extension Program. We do not sponsor or endorse any of these suppliers over any others. To obtain a list of East Coast shellfish seed suppliers, contact Gef Flimlin with Rutgers Cooperative Extension, (732) 348-1152, *flimlin@aesop.rutgers.edu,* or go to www.ecsga.org. Shellfish seed obtained from out-of-state suppliers must meet best management practices pertaining to both genetic protection and disease prevention. For more information, contact the FL Department of Agriculture and Consumer Services, Division of Aquaculture at (850) 488-4033, or visit their website http://www.freshfromflorida.com/Divisions-Offices/Aquaculture, click on Laws and Regulations, Chapter 5L-3.

UF UNIVERSITY of FLORIDA
IFAS Extension

April 2014

Sunray Venus Seed Descriptors

- Sieve size used in size grading (mm)
  - Based on bar mesh
  - 1 inch = 25 mm

- Volumetric (number/ml)
  - Used in subsampling to estimate numbers
  - 1000 milliliters (ml) = 1 liter (l)
  - 1 liter = approx. 1 quart

- Shell length (mm), longest distance across shell

Sunray Venus Seed Sizes

Culture Stage	Sieve Mesh Size (mm)	Seed Length (mm)	Seed Count (number/ml)
Land nursery	1.0 – 1.2	3 – 4	275 – 500
Land nursery	2.0 – 2.2	5 – 6	50-100
Field nursery – 3 mm bag	3.0 – 3.3	7 – 8	15-35
Field nursery – 4 mm bag	4.0	8 – 10	10-15
Field nursery – 4 mm bag	5.0	10 – 12	5-10
Growout – 9 mm bag	8.0	12 – 15	1-2
Growout – 11 mm bag	10.0	15 – 20	0.1-1

Sunray Venus Seed Transporting Tips

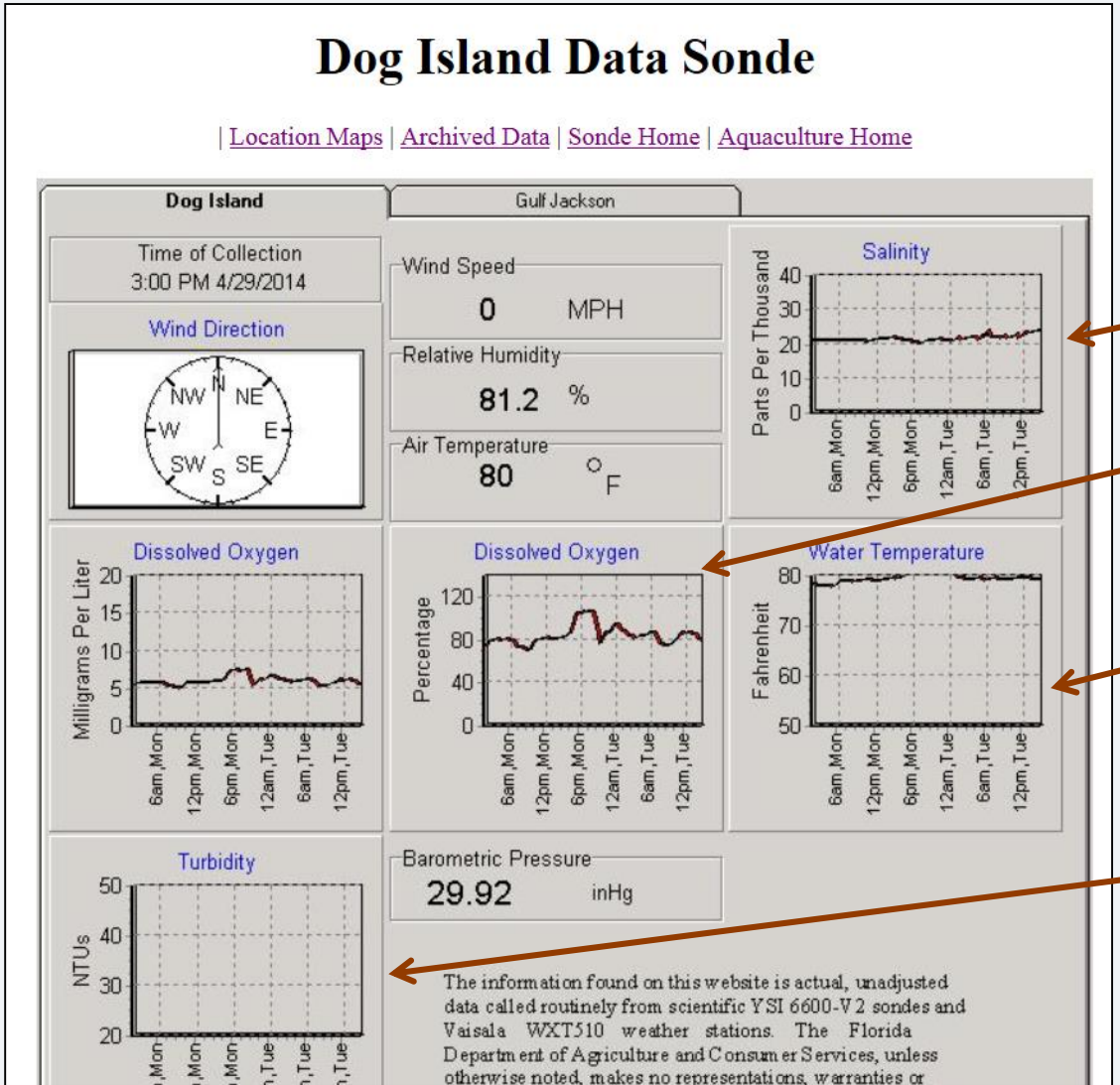
- Transport “out of water” for limited period of 24 to 36 hours
  - Includes time seed is sieved, packed and transported
- Transport cool and moist (not dry)
  - Temperature around 65-70ºF
  - Seed wrapped in an absorptive-type material that maintains moisture but is porous
- Transport in insulated cooler with gel packs or frozen jugs
  - Do not let seed get in direct contact with gel packs, wrap in newspaper
  - Keep seed off bottom of cooler where excess water may collect

Sunray Venus Seed Handling Tips

- ✓ Check weather conditions before accepting seed delivery.
- ✓ Make sure you can get to lease site ASAP to plant seed.
- ✓ Make sure bags and supplies are ready for planting.
- ✓ Get seed information from supplier (e.g., number per ml).
- ✓ Check seed upon arrival to be sure it is alive.
- ✓ Clams that are gaping and do not shut when tapped will eventually die. Seed should not be warm upon arrival.
- ✓ There should be no foul odor.
- ✓ Do not place seed in direct sunlight. Provide shading at all times, but do not use a nonporous material.
- ✓ **Salinity values at lease area should be within <u>5 ppt</u> of the water from which seed was obtained.**

Real-time WATER QUALITY information available at

http://sondes.floridaaquaculture.com/sondes/sonde_di.htm



Salinity

Dissolved Oxygen

Water Temperature

Turbidity

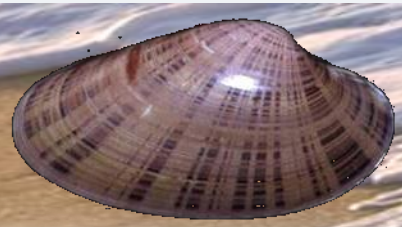
Project Objectives, 2006-12

Utilize current hard clam methods as a starting point to:

1) Examine land-based and field nursery culture
2) Document survival and growth in culture systems
3) Provide seed to growers to evaluate existing lease areas on Florida's west coast

- Funded by Florida Sea Grant R/LR-A-44, 2006-8
- Funded by Florida Sea Grant R/LR-A-45, 2008-10
- Funded by Florida Sea Grant R/LR-A-45, 2010-12

Sea Grant Florida



Land-based Nursery

- Rear in replicated trials at UF Shellfish Culture Facility in Cedar Key
  - Downwellers
  - Raceways
  - Tanks / trays
- Distribute seed to industry partners to nurse in commercial settings
  - Upwellers
  - FLUPSYs
- Examine the following
  - Various systems
  - Stocking densities
  - Seasonal /annual differences

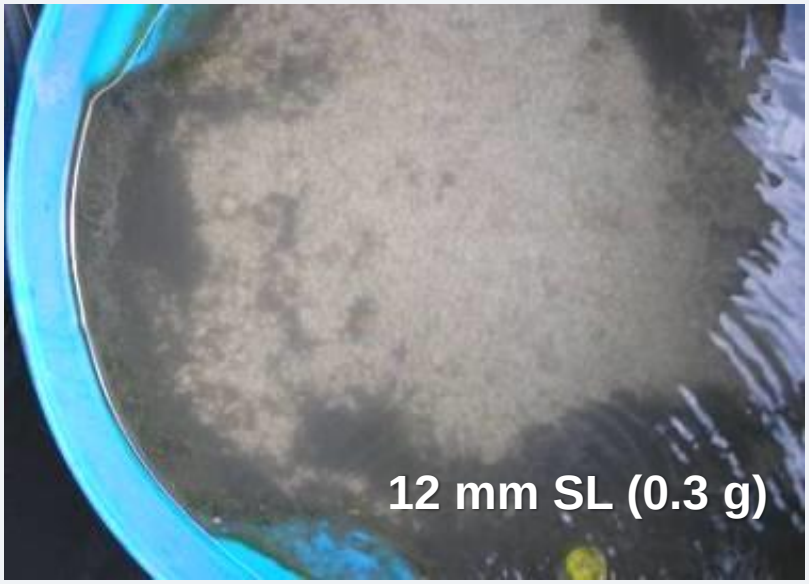
In 2-3 months after setting, depending on feed and temperature, post-set sieved on 1.0-1.2 mm screens

Size: 275-500/mL, 3.3-4.0 mm shell length (SL)

Land-based Nursery Rearing, 2007

Juveniles (>2.0 mm sieved seed, 37/ml, 6.0 mm SL)) moved to land-based nurseries on east coast. Reared in upwellers and FLUPSY at 1,600/ft^2 for 4-5 months.

Upweller without substrate



Bin with substrate (4” sand)

Addition of substrate was advantageous, but could be problematic if allowed to go anaerobic, especially at warm water temperatures.

Land-based Nursery Rearing, 2008

Downweller bins with distributor bar running down length of tank

No substrate added

- July Trial at Cedar Key
  - >3.0 mm sieved seed, 6.5 mm SL
  - Stocking densities
    - 1000, 2000, 3000 per ft^2
  - High mortalities after few weeks
- October Trial at Cedar Key
  - >3.0 mm sieved seed, 6.5 mm SL
  - >2.0 mm sieved seed, 2.5 mm SL
  - Stocking densities
    - 2000, 3000, 4000 per ft^2
  - After 9 weeks
    - Slow growth
    - 5-15% sieved on >4.0 mm screen
    - 66-69% survival

Land-based Nursery Rearing, 2009-11

- September 2009 Trial at Cedar Key
  - >1.2mm sieved seed, 294/ml, 6mm SL
  - Raceway tanks with laminar flow
  - Stocking densities
    - 1000, 2000 per ft^2
  - Trays inside laminar flow raceways
  - Stocking densities
    - 1000, 1500, 2000, 2500 per ft^2
  - Reared for 7-8 weeks (53-55 days)
  - Daily maintenance of rinsing seed
- May 2011 Trial at Cedar Key
  - >1.2mm sieved seed, 234/ml, 6mm SL
  - Trays inside laminar flow raceways
  - Stocking densities
    - 2500, 3000, 3500, 4000 per ft^2
  - Reared for 7.4 weeks (52 days)
  - Daily maintenance of rinsing seed

Land-based Nursery Rearing, 2009

Results ranged from 7-9 mm SL, 85-91% survival

System	Density (# / ft²)	# Reps	Ave SL (mm)	Ave Survival (%)	% Sieve >4.0 mm	% Sieve >3.3 mm
Tank	1000	2	7.4	85	53	26
	2000	2	7.3	89	47	25
Tray	1000	3	8.9	89	79	14
	1500	3	8.4	91	75	15
	2000	3	8.3	88	75	15
	2500	3	8.1	88	70	18

Statistical analyses conducted with SAS using general linear model, statistical differences considered significant if $P<0.05$. No statistical differences were found for system (tank versus tray), or for stocking densities evaluated.

Land-based Nursery Rearing, 2011

Results ranged from 8-9 mm SL, 92-95% survival

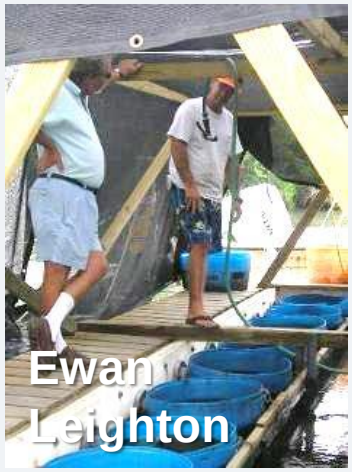
System	Density (# / ft²)	# Reps	Ave SL (mm)	Ave Survival (%)	% Sieve >4.0 mm	% Sieve >3.3 mm
Tray	2500	3	8.9	94	68	17
	3000	3	9.0	94	67	17
	3500	3	8.8	92	63	20
	4000	3	8.4	95	60	20

Statistical analyses conducted with SAS using general linear model, statistical differences considered significant if $P<0.05$. No statistical differences were found for stocking densities evaluated.

Land-based Nursery Rearing, 2013

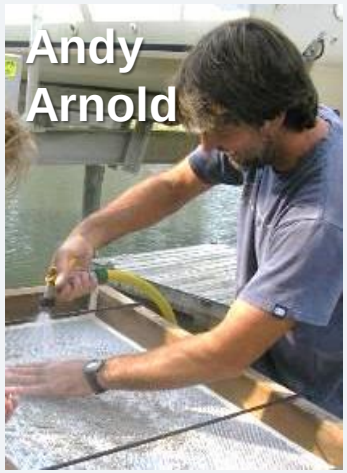
- September Trials at Cedar Key
  - >2.0mm sieved seed, 91/ml
  - Trays inside laminar flow raceways
  - Stocking densities, 1500-2750 per ft^2
  - Daily maintenance of rinsing seed
- Group A
  - After 33 days (4.7 weeks), 74% retained on 4.0 mm sieve, 9.2/ml
  - After 46 days (6.5 weeks), 5.7/ml, 10.5mm SL
- Group B
  - After 42 days (6 weeks), >95% retained on 4.0 mm sieve, 8.2/ml, 10.1mm SL

Land-based Nursery Rearing with Industry Partners, 2007-12



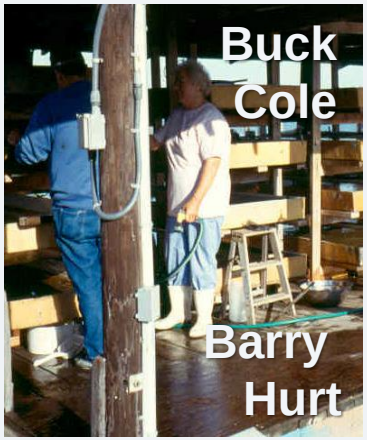
"good survival, slow growth, better growth with substrate added to bins in system"

"grew same or slightly slower than clams in FLUPSY, same survival"

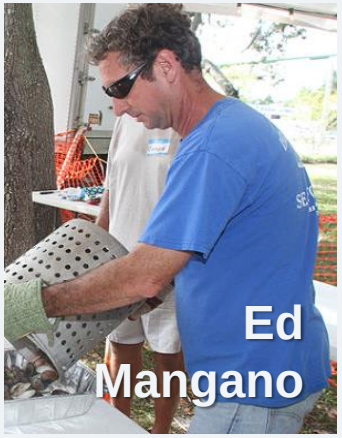


"did not grow as fast as clam seed in FLUPSY"

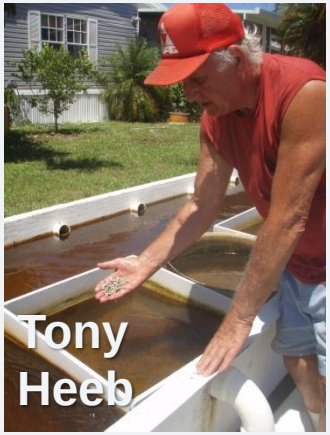
"survival in summer better than clams; at regular temps, slower growth in FLUPSY"



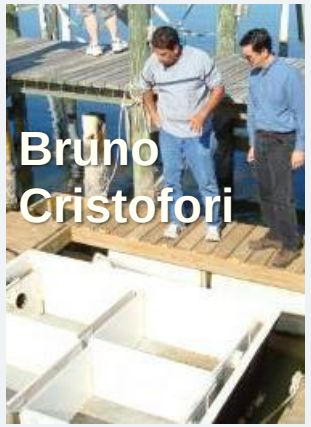
"mixed results with modified upwelling tray system"



"good survival, slower growth than hard clams in fall"

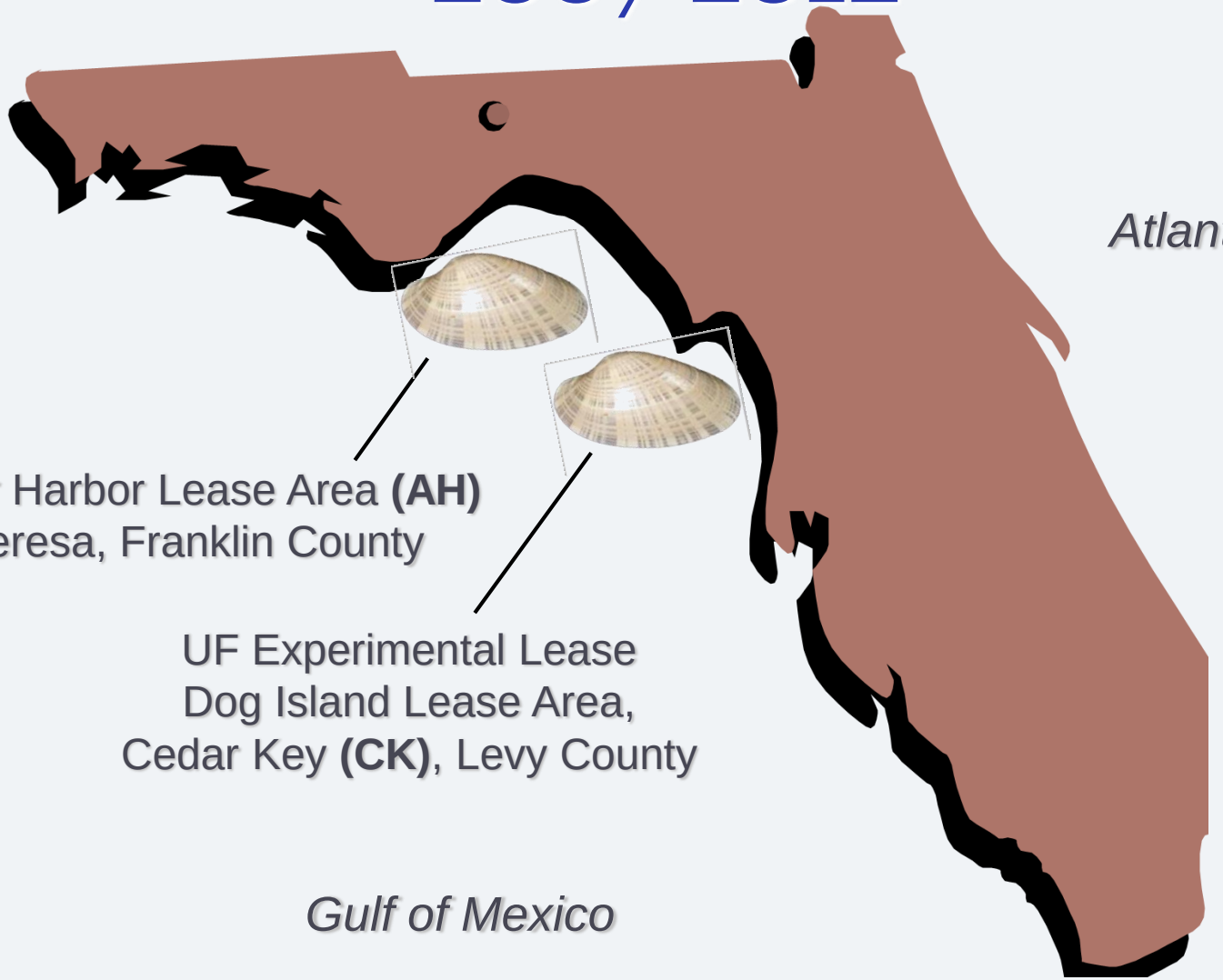


"good survival in FLUPSY over hot summer (90-95^{o}F)"

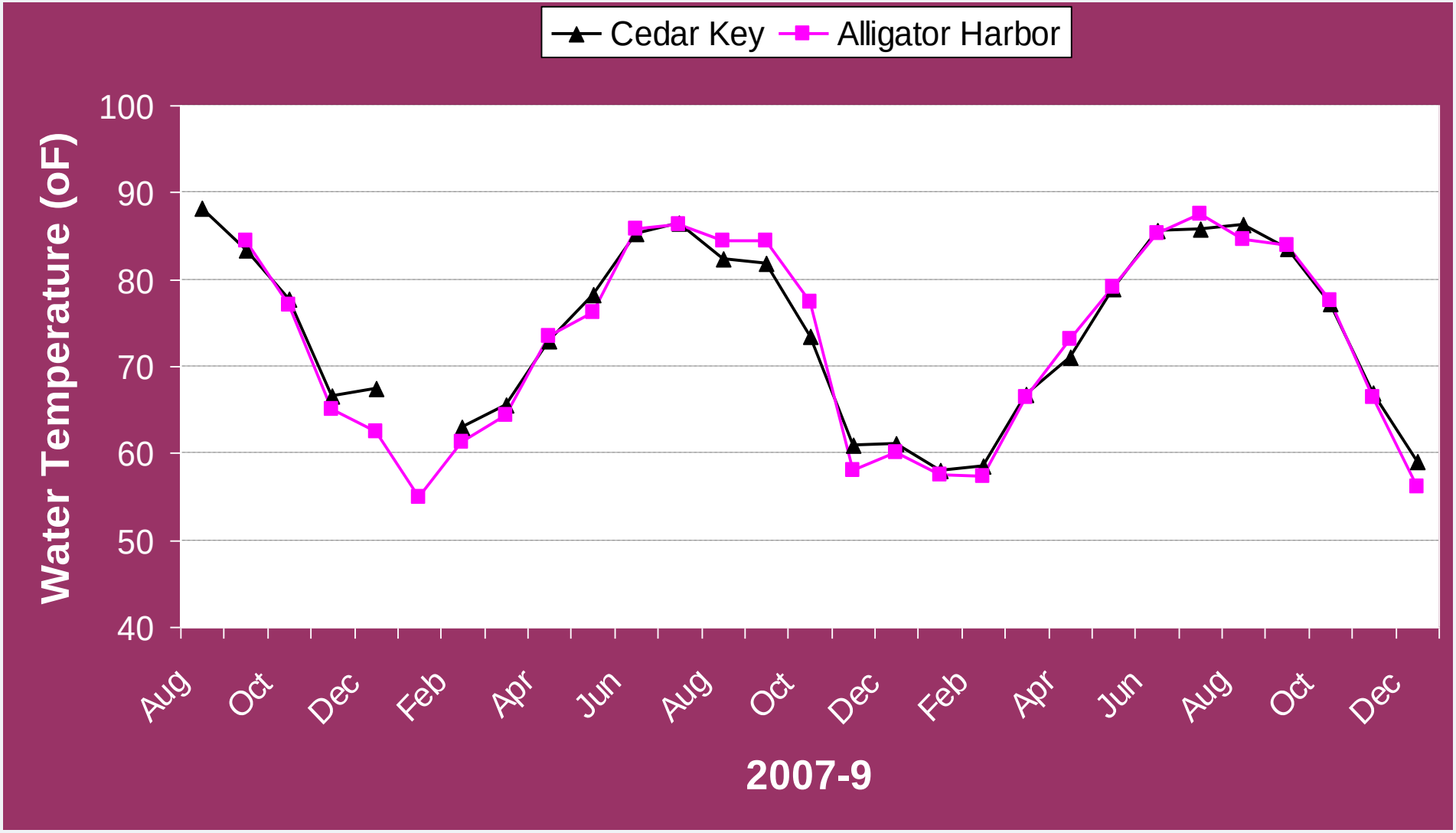


"good survival in FLUPSY, but slower growth than clams"

Field Nursery and Growout Trials, 2007-2012

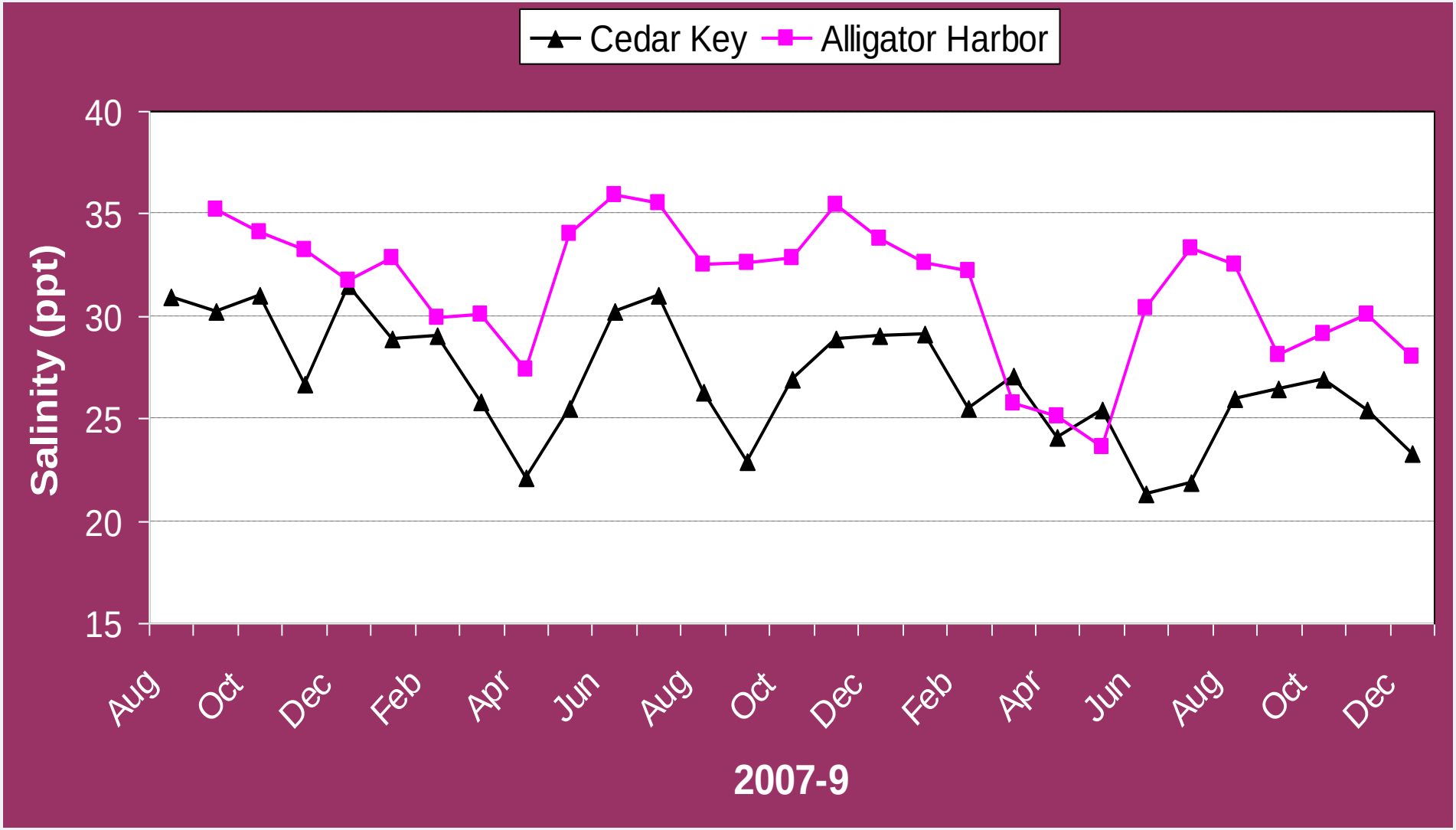


Temperature (ºF), Monthly Averages



Water temperature measured every 30 minutes with YSI 6600 data sonde

Salinity (ppt), Monthly Averages



Salinity measured every 30 minutes with YSI 6600 data sonde

Field Nursery Trials – Bottom Cages

Bottom cages (3' x 1.5' x 6" deep) constructed of wire and lined with 4 mm polyester mesh material

- Stocking densities, 100-375/ft^2 (450-1700/cage)
- Seed sizes, 12-18 mm SL
- Duration, 42-106 days (6-15 weeks)

Field Nursery Results, 2007 Bottom Cages

Site*	Sieve (mm)	Density† (#/ft²)	# Days	Survival (%)	Shell Length (mm)	Growth (mm/day)
AH	>9.0	100	42	69	27	0.20
AH	>9.0	200	42	94	28	0.22
AH	>6.7	222	78	70	28	0.18
CK	>6.0	375	106	82	26	0.14

*AH – Alligator Harbor CK – Cedar Key

† 10,000 hard clam seed planted in a 4’ by 4’ nursery bag results in a density of 625/ft²

Field Nursery Trials – Bottom Bags

Bottom bags (3' by 4' and 4' by 4') made of 4 mm polyester mesh material

- Stocking densities, 300-575/ft^2 (4800-9200 per 4' by 4' bag, or 16/ft^2)
- Seed sizes, 9-14 mm SL
- Duration, 78-113 days (11-16 weeks)

Field Nursery Results, 2007 Bottom Bags

Site*	Sieve (mm)	Density[ł] (#/ft²)	# Days	Survival (%)	Shell Length (mm)	Growth (mm/day)
AH	>6.7	330 (5300/ bag)	78	78	23	0.12
AH	>5.0	555 (8900/bag)	106	32	27	0.17
CK	>4.0	440 (7000/bag)	113	90	24	0.13

*AH – Alligator Harbor CK – Cedar Key

[ł]A density of 625/ft² used for stocking hard clams in a 4' x 4' (16 ft²) nursery bottom bag results in 10,000 seed planted per bag.

Field Nursery Results, 2008-9 Bottom Bags, Cedar Key

Plant Date	Sieve (mm)	Density (#/ft^2)	# Weeks	Survival (%)	Shell Length (mm)	Why?
Aug 2008	>5.0	310-355 (5000-5700/bag)	--	low	--	TS Fay, 10 ppt drop in salinity in 4 days at >88^{o}F temps
Dec 2008	>4.0	335-375 (5400-6000/bag)	32	17	24	Poor seed quality
	>3.3	335-400 (5400-6400/bag)	32	0	--	Poor seed quality
May 2009	>6.0	505-575 (8000-9200/bag)	12	66	20	Good temps and salinity
Oct 2009	>3.3	470 (7500/bag)	32	52	27	
	>4.0	500-675 (8000-11000/bag)	38	56	25	

Field Nursery Results, 2012 Bottom Bags, Cedar Key

Plant Month	# Weeks	# per Bag	Bag Treatment*	Survival (%)	Shell Length (mm)
June	21	6000	Updipped / Chicken wire	84	25-27
			Dipped / Chicken Wire	45	
			Dipped / Tented / No wire	68	
June	22	8500	Updipped / Chicken wire	51	24-25
			Dipped / Chicken wire	62	
July	23	9900	Updipped / Chicken wire	64	22
			Dipped / Plastic netting	44	
Aug	26	9300	Updipped / Chicken wire	63	22-23
			Dipped / Chicken wire	49	

*Typical polyester nursery (4mm mesh) bottom bags used, 4' x 4' (16 ft^2) in size, staked with PVC pipe.

Field Nursery Results, 2012* Bottom Bags, Cedar Key

Plant Month	# Weeks	# Per Bag	Bag Treatment	Survival (%)	Shell Length (mm)
Sept	24	10000	Updipped / Chicken wire	53	22
			Dipped / Chicken Wire	19	
Oct	27	11000	Updipped / Chicken wire	60	23
Nov	22	7400	Dipped / Chicken wire	25	18
Dec	27	10000	Dipped / Chicken wire	39	19

*Monthly salinities and water temperatures in 2012: June—27ppt, 82°F; July—25ppt, 86°F; Aug—24ppt, 85°F; Sept—24ppt, 82°F; Oct—26ppt, 75°F; Nov—27ppt, 64°F; Dec—28ppt, 61°F

Field Nursery Results, 2012
Bottom Bags, Cedar Key

- Nursery bags planted individually or belted
- Cover netting (plastic or chicken wire) placed over bags not tied to bags
- Prior to planting, bottom raked to “fluff” substrate
- After planting bags, water provided by small pump through a distributor bar to assist in covering bags with sediments, only 2-4 passes depending on amount of sand accumulated; did NOT completely bury bags

Observations

- Sunray venus is a very active clam, has a large foot and long siphons
- Sunray venus is oblong in shape as opposed to the round shape of a hard clam; Seed must be larger (longer shell length) than hard clam seed to be retained in similar sized sieves and mesh culture bags used for hard clams.
- Following is a summary of our observations working with sunray venus clams in land-based nursery and field nursery trials over the past six years:
  - Sunray venus seed tend to perform better in the land-based nursery using trays in raceways with laminar flow
  - Sunray venus do not consistently perform well using nursery bottom bags
  - Better survival observed in soft (undipped) nursery bags, using pump-method at planting
  - Bottom bags work better in sandier soils, but not hard-packed sand
  - Sunray venus seem to do better at lower densities than those used for clams
  - Sunray venus require higher and steadier salinities than hard clams

Project VENUS

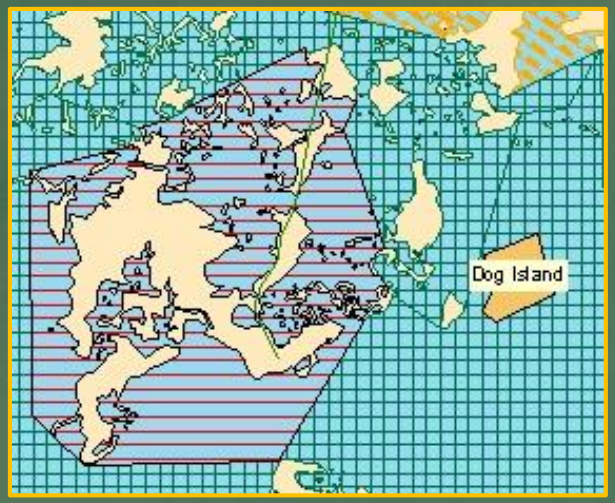
Introduction to the Dog Island Demonstration Site, Cedar Key

- Site established as management agreement (#38-MA-1259) between FDACS Division of Aquaculture and UF IFAS in April 2014 for the purposes of education and demonstration of sunray venus clam culture
- Management agreement will be for three years, 2014-2017

Presented at Project VENUS Workshops, May 2014, Cedar Key, FL

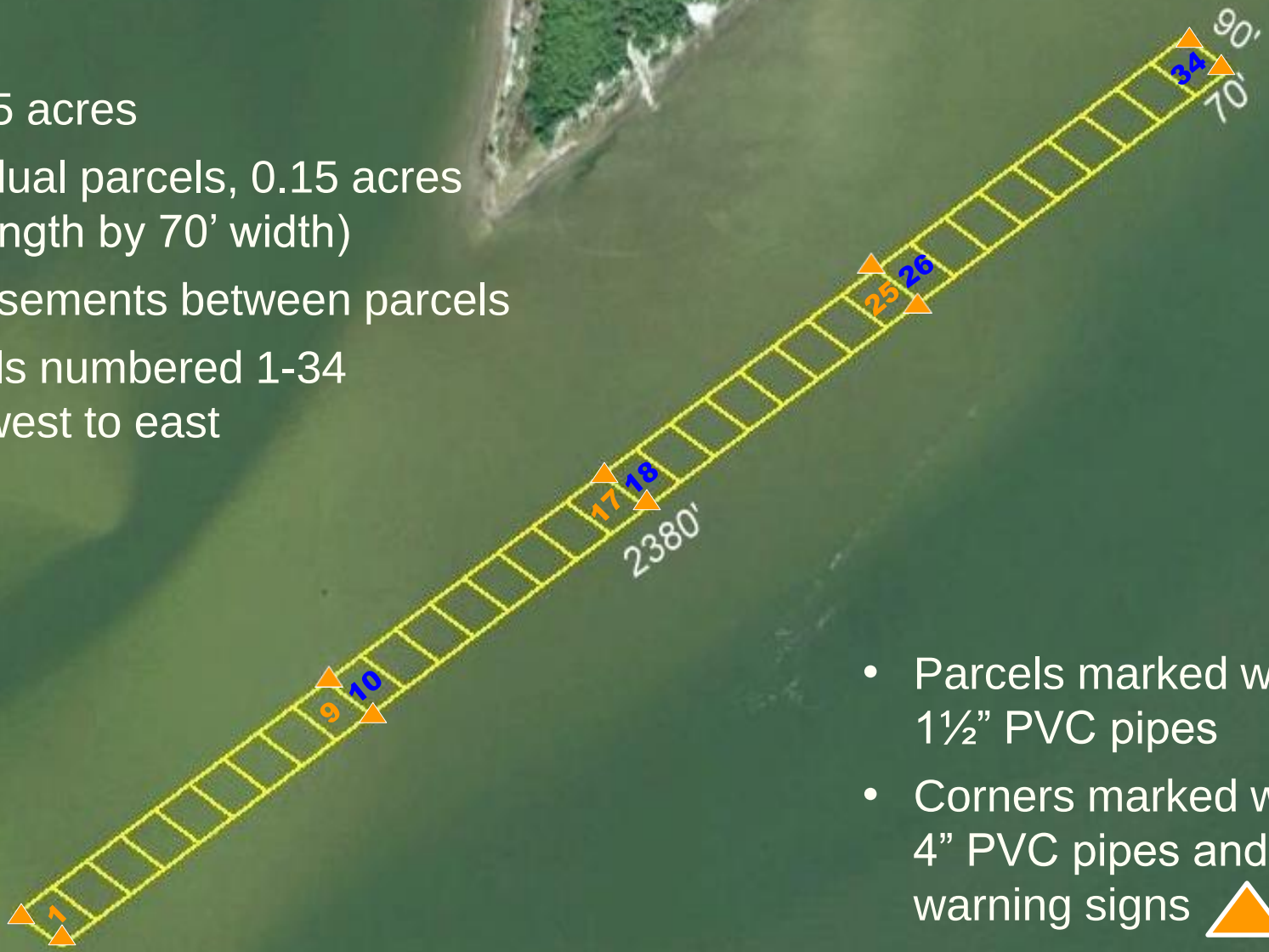
Demonstration Site

- Submerged sand spit located south of Dog Island and west of commercial leases
- Cedar Key SHA Zone A (3012), Conditionally approved
- Test plants (2010-14) resulted in promising production results



Demonstration Site

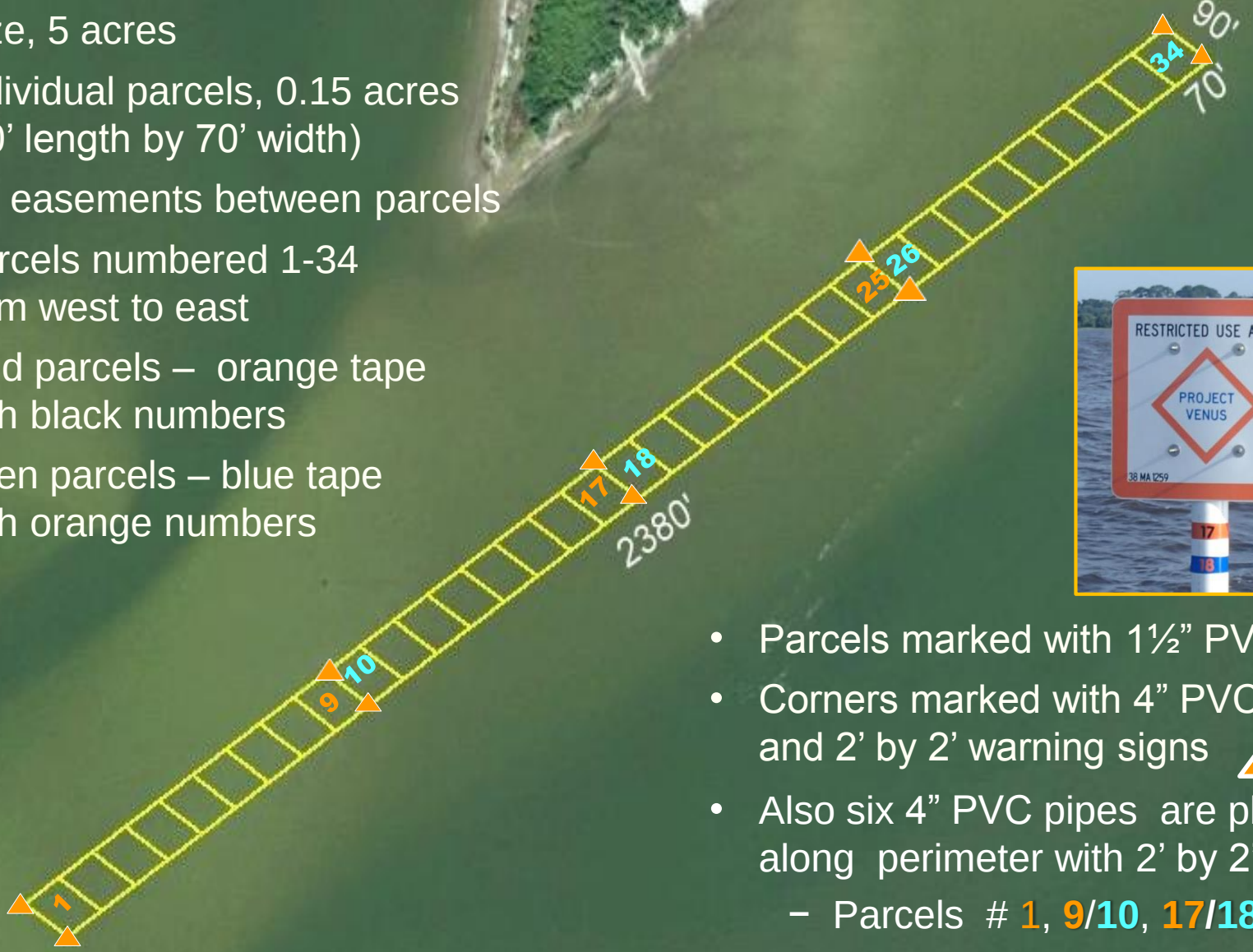
- Size, 5 acres
- Individual parcels, 0.15 acres (90’ length by 70’ width)
- No easements between parcels
- Parcels numbered 1-34 from west to east



- Parcels marked with 1½” PVC pipes
- Corners marked with 4” PVC pipes and warning signs

Demonstration Site

- Size, 5 acres
- Individual parcels, 0.15 acres (90’ length by 70’ width)
- No easements between parcels
- Parcels numbered 1-34 from west to east
- Odd parcels – orange tape with black numbers
- Even parcels – blue tape with orange numbers



- Parcels marked with 1½” PVC pipes
- Corners marked with 4” PVC pipes and 2’ by 2’ warning signs
- Also six 4” PVC pipes are placed along perimeter with 2’ by 2’ signs
  - Parcels # 1, 9/10, 17/18, 25/26, and 34

Demonstration Site Signage and Marking

- Six 4” PVC pipes with 2’ by 2’ signs
  - Parcels # **1**, **17**/**18**, **34**
- Parcels marked with 1½” PVC pipes
  - Common markers between parcels
  - Odd parcels – **orange** tape
  - Even parcels – **blue** tape

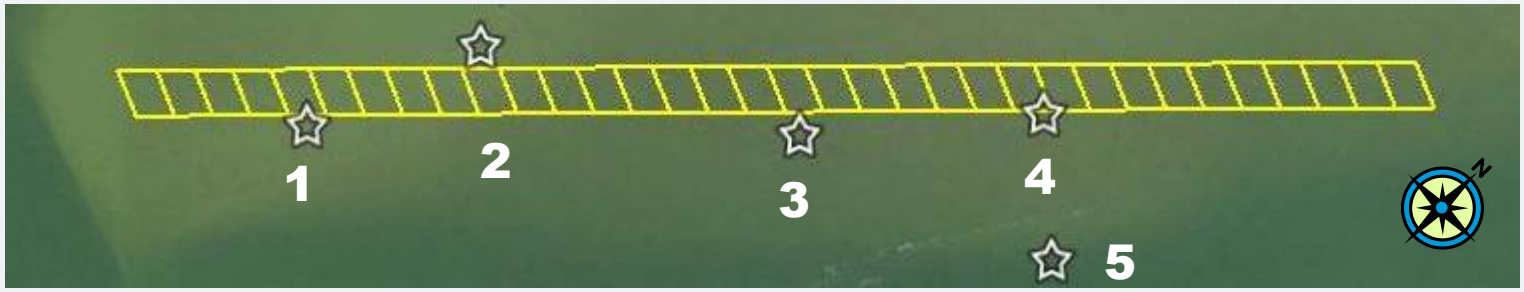
Demonstration site is visible from Cedar Key

Summary of 2013-14 Test Plots Dog Island Demo Site

- Planted two dipped bags each at 5 test plot sites at Dog Island demo site, Feb 2013
- Each bag stocked with 1000 seed (22mm SL)
- Harvested May 2014, 15 months
- Culture period too long
  - Live sunrays large (average = 2.5" SL)
  - 10-35% whole shell of harvest size (>40mm SL)

Test Plot	Survival (%)	Survival including shell >40mm SL (%)	Shell Length (mm)	Growth (mm/mo)
1	39	66	62	2.7
2	26	61	62	2.7
3	44	62	62	2.7
4	57	68	61	2.7
5	50	60	57	2.3

1 inch = 25 mm



Summary of 2013-14 Test Plots
Dog Island Demo Site

#1–10’ south of Parcel #4

#2–50’ north of Parcel #9

#3–40’ south of Parcel #18

#4–southern boundary of Parcel #23

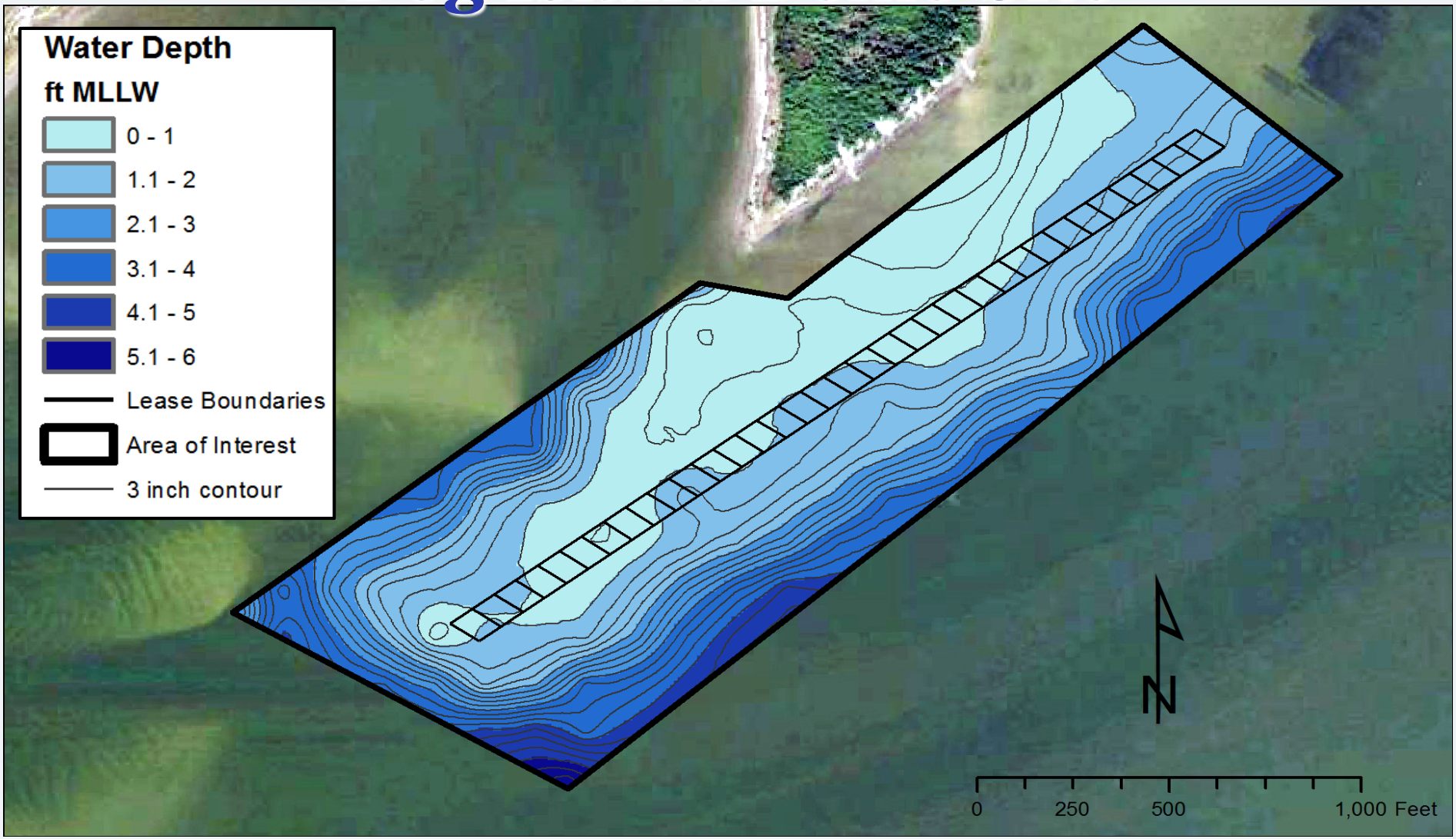
#5–285’ south of Parcel #22

Soil Maps of Demonstration Site

- Relationship between aqueous soils (substrate) and sunray venus clam productivity established using a soils-based approach, 2010-12
  - High sand content (>90%)
  - Low silt content (<5%)
  - Low organic matter content (<1%)
- Soil cores (n=130, 4 inches deep) taken at 40 meter intervals on 35-acre sand spit, January 2014
- Soil samples analyzed for sand, clay, silt and organic matter content
- Bathymetry (water depth) determined, February 2014

Water Depth, feet MLLW

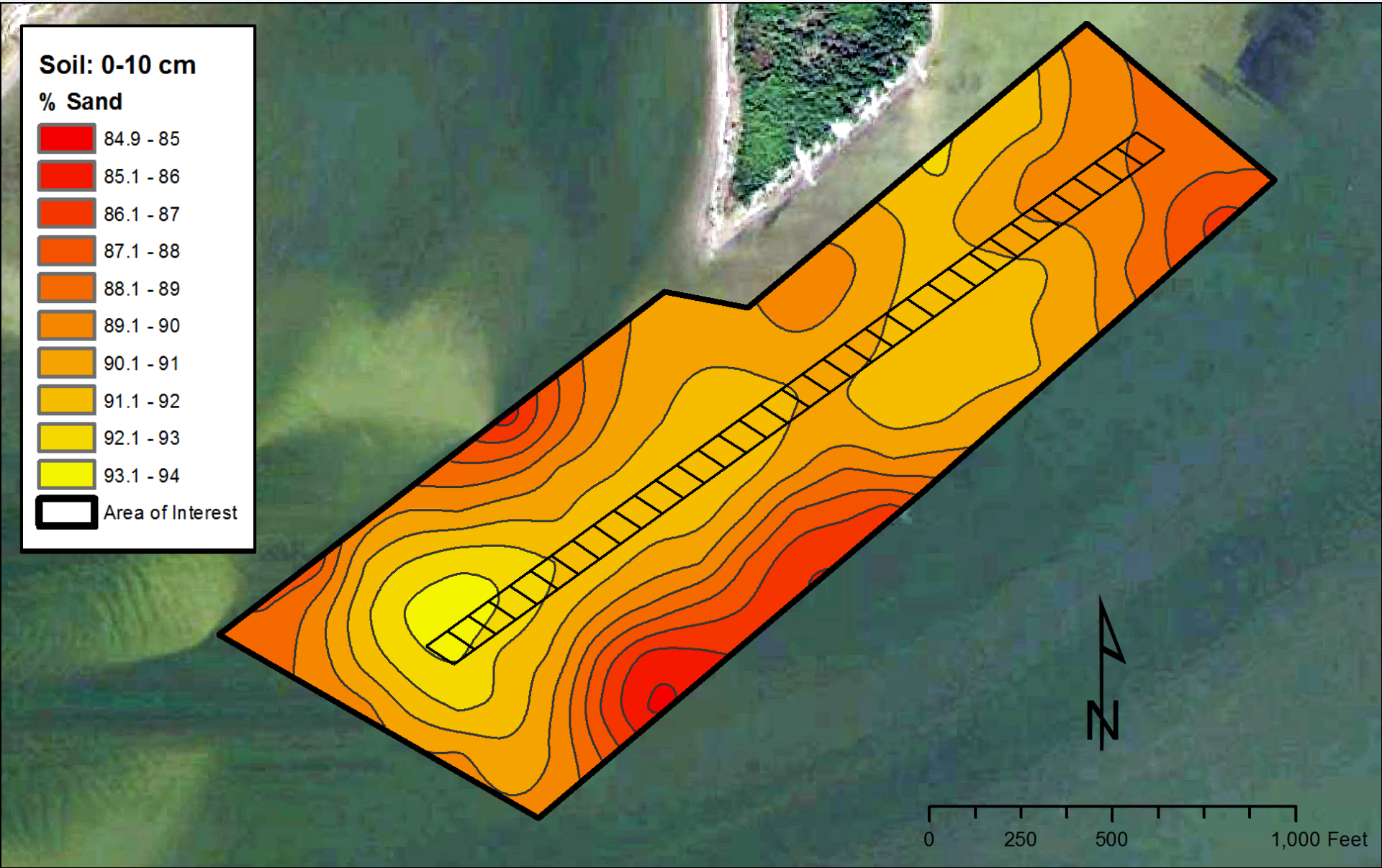
Dog Island Demo Site



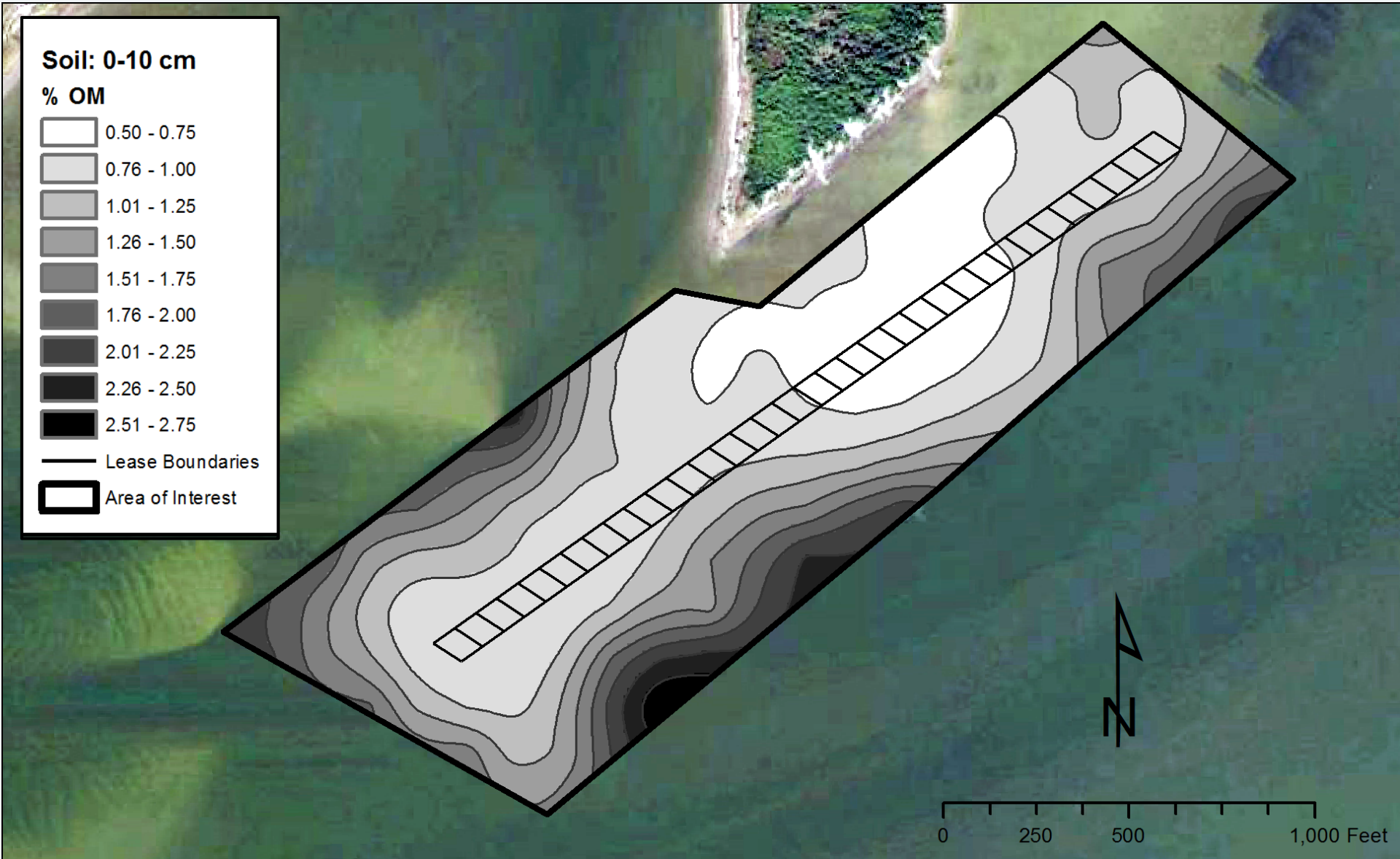
Water depth when tide range is Mean Lower Low Water (MLLW). Solid black lines are 3 inch depth contours. Shades of blue indicate depth in 1 feet ranges from 0-1 feet to 5-6 feet.

% Sand Content

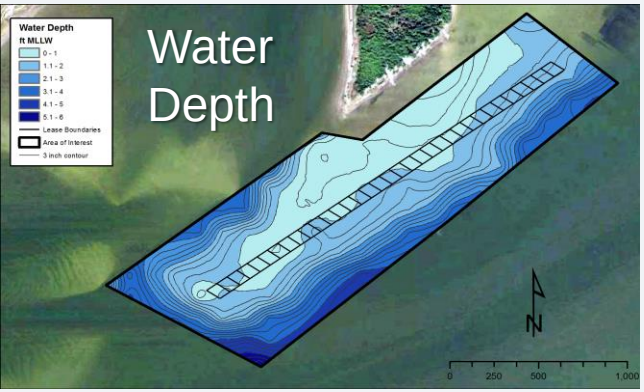
Dog Island Demo Site

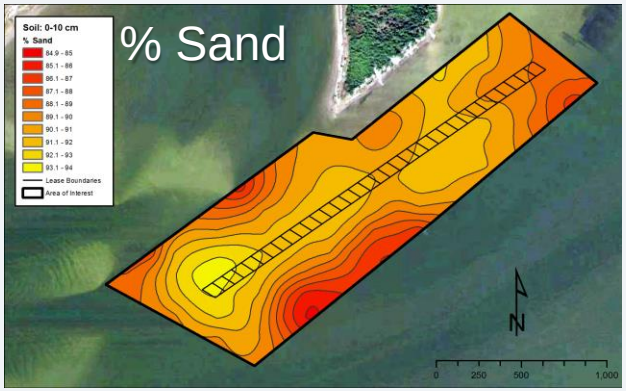


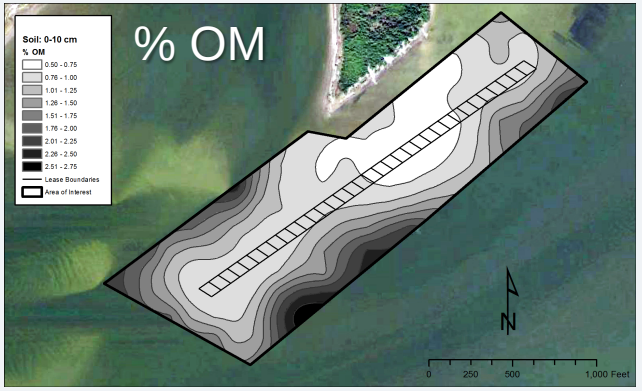
% Organic Matter
Dog Island Demo Site

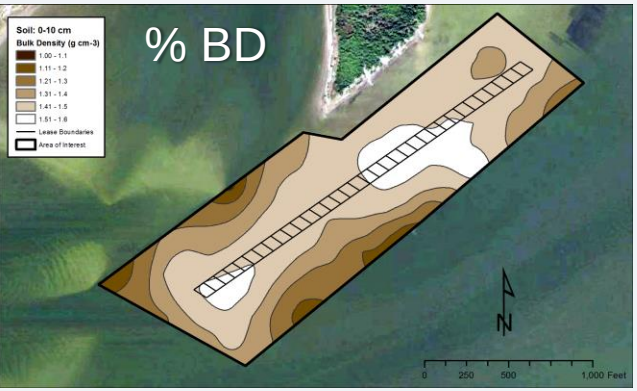


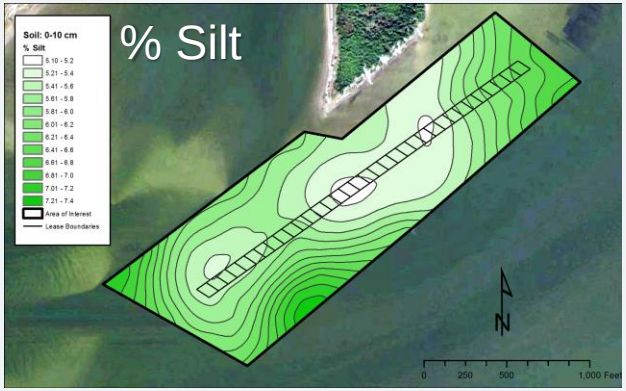
Summary of Soil Characterization Dog Island Demo Site

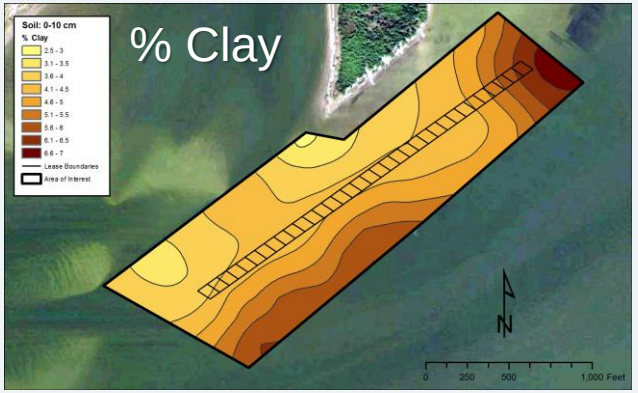












Lighter colored areas are more conducive to sunray venus clam culture. These areas are **shallow**, have **high sand**, **low organic matter** (OM), **high bulk density** (BD, weight per unit volume), **low silt** and **low clay** content, all of which is good for sunray venus growth and health (no shell deformities).