Oyster Bay EFFECTS OF CO-CULTURE OF URCHINS, LYTECHINUS VARIEGATUS, WITH FACTEDN OVSTEDS, CDASSOCTDEA, VIDGINICA WITH EASTERN OYSTERS, CRASSOSTREA VIRGINICA William C. Walton*1, Caitlin Robitaille¹, Jackie Wilson^{1,2}, Sophie Chehade³, Becky Wasden¹, Adriane Michaelis¹, and Stephen A. Watts³ OSS 2020

CO-CULTURE OF OYSTERS AND URCHINS: PILOT STUDY, 2019-20

- Wild-collected adult green sea urchins, stocked at 0, 4, 8 with 40 subadult oysters (2" SH)
- Gear: 9 mm bags in floating cages
- FL oyster farms: Alligator Harbor and Oyster Bay
- Overwintered and harvested after 5 months
- Biofouling reduced on oysters as oyster cleaning time decreased with increasing urchins



NEXT STEPS, 2022-23: REEVALUATING CO-CULTURE OF EASTERN OYSTERS WITH URCHINS USING HATCHERY-PRODUCED JUVENILES





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POTENTIAL FOR COMMERCIAL DEVELOPMENT OF CULTURING HATCHERY-PRODUCED URCHINS WITH OYSTERS

Document hatchery production of green sea urchin juveniles

Determine performance of oysters with and without urchins

- Field nursery (2-3 months, 4 mm bags)
- Intermediate growout (3-4 months, 9 mm bags)
- Final growout (3-4 months, 14 mm bags)

Evaluate at commercial farm sites on FL Gulf of Mexico coast

- Alligator Harbor, Franklin County (high salinity site)
- Oyster Bay and Skipper Bay, Wakulla County (variable salinity sites)
- Cedar Key, Levy County (medium salinity site)

Assess biofouling on oysters and bags with and without urchins

HATCHERY PRODUCTION OF GREEN SEA URCHINS

- Closed-system hatchery at University
 of Alabama-Birmingham
- Broodstock collected from St. Joseph Bay, Florida
- Produce juveniles (7-9 mm test diameter)
- Problems with water quality, bacteria, amphipods, food production





FIELD NURSERY CO-CULTURE

- Wild-collected sub-adult urchins: 29 mm
- 3n oysters: 16 mm shell height (R6 seed)
- 4 mm bags, cylindrical floats on sides
- Stock July 20-21, 2022
- Experimental design:
 3 treatments, 3 replicates (bags), 3 sites

Treatment	Oysters (n)	Urchins (n)	Fouling Control
A	1200	12	None
В	1200	0	Flipping bags
С	0	12	None









NOAA/NOS/Center for Operational Oceanographic Products and Services

CEDAR KEY

- Located in open waters
- Winds gusts \geq 30mph
- August 9, 2022 (20 days)
- Urchin survival: 0%





OYSTER BAY

- Salinities ≤20ppt
- August 11, 2022 (22 days)
- Urchin survival: 0%



FIELD NURSERY: ALLIGATOR HARBOR AFTER 2.5 MONTHS

- Urchin survival after 19 days: 100%-with oysters, 68%-without oysters
- Harvested October 5, 2022, delayed due to Hurricane Ian
- Blue crabs observed in bags resulting in predation on urchins

Trastmont	Oysters	Urchins	Fouling	Urchin	Oyster	Oyster
medument	(n)	(n)	Control	Survival (%)	SH (mm)	Survival (%)
А	1200	12	None	36	59 (2.4")	99
В	1200	0	Flipping bags		56 (2.2")	99
C	0	12	None	0		





No differences in oyster growth (SH, SL, SW, TWW) or survival

INTERMEDIATE GROWOUT CO-CULTURE: ALLIGATOR HARBOR

- Wild-collected sub-adult urchins, 29 mm
- 3N oysters, ave 56-59 mm SH, 400/bag
- 9 mm mesh bags with cylindrical floats
- Stock October 5, 2022
- Experimental design: 4 trts, 3 reps
 O Urchin density -- 0, 10, 15, 20/bag
 - \circ Float placement top vs sides
 - Oysters (51 mm, 2") with barnacle set from Cedar Key used in Trt E*





Treatment	Oysters (n)	Urchins (n)	Float Placement	Fouling Control	SH (mm)
А	400	10	Тор	None	59
В	400	0	Side	Flipping bags	56
D	400	20	Side	None	59
E*	400	15	Тор	None	51

UDCUINC	Experimental Design						
UKUTINJ	Treatment	Oysters (n)	Urchins (n)	Float Placement	Fouling Control		0000
AFTER 3.5 MONTHS	А	400	10	Тор	None		
	В	400	0	Side	Flipping bags	-	
Harvested January 10, 2023	D	400	20	Side	None		
, · · ·	E	400	15	Тор	None		





No differences in length, but E>A,D in wet weight

No staititcally differences in survival





Experimental Design

Treatment	Oysters (n)	Urchins (n)	Float Placement	Fouling Control
А	400	10	Тор	None
В	400	0	Side	Flipping bags
D	400	20	Side	None
E	400	15	Тор	None

GROWTH





No differences in height or in SL, SW, TWW

BIOFOULING AFTER 3.5 MONTHS



- Treatment B (no urchins): Matrix of gammarid tube-building amphipods with sediment/detritus
- Treatment E (15 urchins): 64% reduction in barnacles, No amphipods

	Expe	erimenta	Bag Fouling	g Results		
Treatment	Oysters	Urchins	Float	Fouling	Weight (lbs)	Weight (%)
	(n)	(n)	Placement	Control		
А	400	10	Тор	None	4.1	62
В	400	0	Side	Bag flipping	1.5	41
D	400	20	Side	None	1.4	38
E	400	15	Тор	None	2.5	54



- Fouling weight quantified by weighing bags without floats and subtracting pre-deployment weight
- Weights higher in bags with floats on top (Trts A and E) versus bags with floats on sides (Trts B and D)
- No differences in weights with and without urchins (Trts B&D)

FINAL GROWOUT CO-CULTURE: ALLIGATOR HARBOR

- Oysters, ave 73-84 mm (≥3") SH, 150/bag
- 14 mm mesh bags with cylindrical floats
- Adult urchins (2" test) compared with subadults urchins (1.3" test) from previous trial
- Stock January 10, 2023
- Experimental design: 4 treatments, 3 reps

Experimental Design								
Treatment	Oysters (n)	Urchins (n)	Float Placement	Fouling Control				
В	150	0	Side	Bag Flipping				
D	150	17 sub	Side	None				
E	150	17 sub	Тор	None				
F	150	20 adult	Side	None				





GROWTH AND SURVIVAL AFTER 3.5 MONTHS - ALLIGATOR HARBOR

• Harvested April 25, 2023



	Ex	kperimenta	I Design		Urchir	าร	Oyst	ers
Treatment	Oysters (n)	Urchins (n)	Float Placement	Fouling Control	Test Diameter (mm)	Survival (%)	Shell Height (mm)	Survival (%)
В	150	0	Side	Bag Flipping			100 (4.0")	93
D	150	17 sub	Side	None	36	53	96 (3.8")	89
E	150	17 sub	Тор	None	40	96	91 (3.6")	86
F	150	20 adult	Side	None	51	50	96 (3.8")	98

- Nominal growth subadults urchins (Trts D, E) and adult urchins (Trt F)
- Survival higher for urchins in bags with floats placed on top (Trt E) versus bags with floats on sides (Trts D, E)
- No differences in oyster growth rates for SH, SL, TWW, WMW and survival

BIOFOULING

AFTER 3.5 MONTHS - ALLIGATOR HARBOR

- Decrease (59%) in barnacles on oysters in Trt E
- Bags with floats on top (Trt E) had highest fouling weight (6.3 lbs)
- Fouling on bags with side floats did not vary between bags with urchins (Trts D,F) and without urchins (Trt B)
- Fouling on bags lower with adult urchins (Trt F) than with subadult urchins (Trt D)



	Expe	Bag Fouling Results			
Treatment	reatment Oysters Urchins Flo (n) (n) Placer			Fouling Control	Fouling Weight (lbs)
В	150	0	Side	Bag Flipping	3.9
D	150	17	Side	None	5.9
E	150	17	Тор	None	6.3
F	150	20	Side	None	2.6



Oysters cultured with no urchins at harvest (Trt B)



Oysters cultured with urchins at harvest (Trt E)

SUMMARY CO-CULTURE OF URCHINS AND OYSTERS

- Reliance on wild urchins is not realistic, reliable hatchery production of urchins would be necessary for commercial development
- Use of urchins as a biofouling control method limited to lease areas with high, steady salinities (>25 ppt)
- Site conditions may also restrict use of urchins to areas which provide protection from prevailing winds
- Gear type may be restricted to floating cages allowing urchins to sit deeper in the water than floating bags



SUMMARY CO-CULTURE OF URCHINS AND OYSTERS

- Co-culturing organisms require conditions must be favorable to support production of both species
- Results of field trials were not favorable for urchins
- Potential for biofouling control of oysters not clearly demonstrated
- Other practicalities of stocking urchins in oyster culture bags not addressed, such as tumbling
- Findings limit potential for urchin and oyster co-culture on Florida's Gulf coast

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