

ASSESSMENT OF OFF-BOTTOM OYSTER (*CRASSOSTREA VIRGINICA*) AQUACULTURE TECHNIQUES ON BIOFOULING IN THE NORTHERN GULF OF MEXICO

Ellis L. Chapman Jr. (Chappie)

LSU, Louisiana SeaGrant, LSU School of Renewable Natural Resources



Introduction

- Current oyster production in the GoM
 - Mostly on-bottom based
- Off-bottom production
 - Gaining favor
 - Growing hatchery seed above the bottom
- Biofouling
 - Cost
 - Increased biofouling in GoM
 - Current Management



Comeau, 2010



Materials

- Aerial Drying of Floating Cages
 - OysterGro
 - 6-slot
 - Feeding v. Drying Position
- Antifouling coatings
 - Netminder™
 - “Bio-friendly” antifouling coating
 - Creates a “slippery” layer

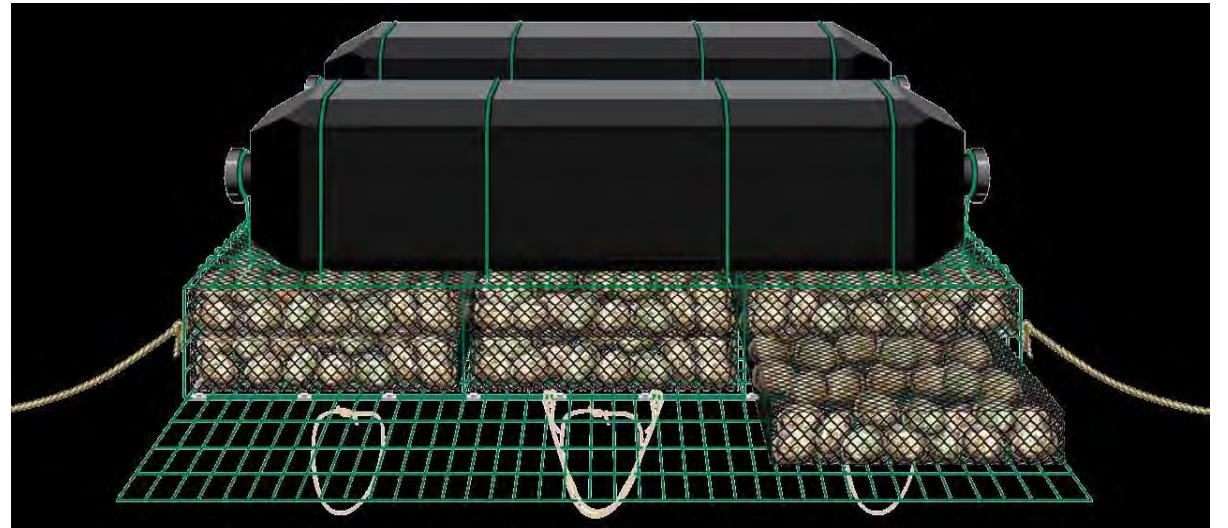


Figure 6. The OysterGro™ floating cage. Each cage consists of an outer housing made of 12-gauge vinyl-coated wire mesh which houses six Velar® bags. Each cage measures 1.524 m (60" in) long, 0.914 m (36" in) wide, and 0.152 m (6" in) deep.
Source: www.oystergro.com



www.seamar.com

Oyster Biofouling Test Locations

Site Specificity

- Critical to oyster farming
- 4 sites in the GoM over 4 states
 - LA
 - MS
 - AL
 - FL



Figure 1. Gulf of Mexico testing sites. Source: ESRI Online®.

Methods

- 12 cages at each site (48 altogether)
 - 4 Weekly, 4 Biweekly & 4 Triweekly flipped
 - 72 bags at each site
 - 150 oysters/bag
- Harvest
 - 25 oysters collected from all bag replicates
 - Immediately put into coolers then chest freezers for long term sampling
 - H, L, W & WWW for all 25 oysters
 - Live/dead counts from all bags
 - Wet bag weights on bags
 - Percent fouling on all bags
 - CI for 10 of the 25 sampled oysters from each replicate



Results (Louisiana)

	Flip Regime		
	Weekly	Biweekly	Triweekly
Shell Length (mm)	97.54 ± 0.429, B	104.35 ± 0.446, A	105.38 ± 0.45, A
Whole Wet Weight (g)	139.78 ± 1.162, B	150.67 ± 1.246, A	151.05 ± 1.248, A
Fan Ratio	0.79 ± 0.004, A	0.74 ± 0.004, A	0.73 ± 0.003, A
Cup Ratio	0.34 ± 0.002, A	0.33 ± 0.002, B	0.32 ± 0.002, B
Percent Fouling (%)	0.21 ± 0.023, B	0.31 ± 0.022, A	0.18 ± 0.022, B
Defouled Weight (g)	2.88 ± 0.322, A	3.11 ± 0.339, A	3.79 ± 0.411, A
Wet Bag Weight (kg)	3.04 ± 0.058, A	3.04 ± 0.058, A	2.86 ± 0.058, A
Quality Index	1.06 ± 0.082, A	1.27 ± 0.093, A	1.35 ± 0.099, A
Condition Index	8.48 ± 0.188, A	8.72 ± 0.191, A	8.80 ± 0.192, A
Survival (ratio)	0.95 ± 0.004, A	0.96 ± 0.004, A	0.97 ± 0.004, A

Results (Louisiana)

	Antifouling Coatings On Bags	
	1 (With Coatings)	0 (Without)
Shell Length (mm)	102.09 ± 0.359, A	102.75 ± 0.361, A
Whole Wet Weight (g)	148.02 ± 1.000, A	146.32 ± 0.990, A
Fan Ratio	0.76 ± 0.003, A	0.75 ± 0.003, A
Cup Ratio	0.33 ± 0.002, A	0.33 ± 0.002, A
Percent Fouling (%)	0.24 ± 0.020, A	0.23 ± 0.019, A
Defouled Weight (g)	3.54 ± 0.317, A	2.97 ± 0.267, A
Wet Bag Weight (kg)	3.01 ± 0.047, A	2.95 ± 0.047, A
Quality Index	1.16 ± 0.072, A	1.30 ± 0.077, A
Condition Index	8.85 ± 0.157, A	8.48 ± 0.154, A
Survival (ratio)	0.96 ± 0.003, A	0.96 ± 0.000, A

Results (Louisiana)

	Antifouling Coatings On pontoons	
	1 (With Coatings)	0 (Without)
Shell Length (mm)	102.15 ± 0.360, A	102.69 ± 0.360, A
Whole Wet Weight (g)	147.79 ± 1.000, A	146.54 ± 0.991, A
Fan Ratio	0.76 ± 0.003, A	0.75 ± 0.003, A
Cup Ratio	0.33 ± 0.002, A	0.33 ± 0.002, A
Percent Fouling (%)	0.23 ± 0.020, A	0.23 ± 0.019, A
Defouled Weight (g)	3.26 ± 0.294, A	3.25 ± 0.293, A
Wet Bag Weight (kg)	2.96 ± 0.047, A	3.00 ± 0.047, A
Quality Index	1.11 ± 0.069, B	1.35 ± 0.080, A
Condition Index	8.77 ± 0.157, A	8.56 ± 0.154, A
Survival (ratio)	0.96 ± 0.003, A	0.96 ± 0.004, A

Results (Mississippi)

	Flip Regime		
	Weekly	Biweekly	Triweekly
Shell Length (mm)	70.66 ± 0.407, B	81.39 ± 0.431, A	81.65 ± 0.435, A
Whole Wet Weight (g)	65.81 ± 0.782, C	93.29 ± 1.043, B	98.27 ± 1.102, A
Fan Ratio	0.83 ± 0.038, A	0.80 ± 0.004, A	0.81 ± 0.004, A
Cup Ratio	0.42 ± 0.003, A	0.38 ± 0.002, B	0.38 ± 0.002, B
Percent Fouling (%)	0.78 ± 0.023, A	0.75 ± 0.024, A	0.71 ± 0.026, A
Defouled Weight (g)	1.70 ± 0.174, B	1.27 ± 0.134, B	3.62 ± 0.233, A
Wet Bag Weight (kg)	3.93 ± 0.115, A	4.09 ± 0.115, A	4.11 ± 0.115, A
Quality Index	0.03 ± 0.013, A	0.03 ± 0.035, A	0.05 ± 0.029, A
Condition Index	18.90 ± 0.722, A	12.29 ± 0.411, B	12.67 ± 0.430, B
Survival (ratio)	0.88 ± 0.013, B	0.90 ± 0.012, B	0.95 ± 0.009, A

Results (Mississippi)

	Antifouling Coatings On Bags	
	1 (With Coatings)	0 (Without)
Shell Length (mm)	78.04 ± 0.344, A	77.76 ± 0.349, A
Whole Wet Weight (g)	85.98 ± 0.800, A	85.60 ± 0.809, A
Fan Ratio	0.81 ± 0.030, A	0.81 ± 0.031, A
Cup Ratio	0.39 ± 0.002, B	0.40 ± 0.002, A
Percent Fouling (%)	0.76 ± 0.021, A	0.73 ± 0.019, A
Defouled Weight (g)	1.64 ± 0.133, A	1.97 ± 0.167, A
Wet Bag Weight (kg)	4.00 ± 0.094, A	4.09 ± 0.094, A
Quality Index	0.05 ± 0.017, A	0.03 ± 0.030, A
Condition Index	16.00 ± 0.502, A	13.24 ± 0.370, B
Survival (ratio)	0.91 ± 0.010, A	0.91 ± 0.009, A

Results (Mississippi)

	Antifouling Coatings On Pontoons	
	1 (With Coatings)	0 (Without)
Shell Length (mm)	77.84 ± 0.349, A	77.96 ± 0.780, A
Whole Wet Weight (g)	86.70 ± 0.817, A	84.89 ± 0.792, A
Fan Ratio	0.81 ± 0.003, A	0.81 ± 0.030, A
Cup Ratio	0.39 ± 0.002, B	0.40 ± 0.002, A
Percent Fouling (%)	0.74 ± 0.020, A	0.76 ± 0.020, A
Defouled Weight (g)	1.83 ± 0.156, A	1.78 ± 0.146, A
Wet Bag Weight (kg)	3.95 ± 0.094, A	4.13 ± 0.094, A
Quality Index	0.06 ± 0.014, A	0.01 ± 0.034, A
Condition Index	12.91 ± 0.360, B	16.32 ± 0.509, A
Survival (ratio)	0.91 ± 0.010, A	0.91 ± 0.009, A

Results (Alabama)

	Flip Regime		
	Weekly	Biweekly	Triweekly
Shell Length (mm)	71.73 ± 0.42, B	78.26 ± 0.445, A	77.79 ± 0.443, A
Whole Wet Weight (g)	71.69 ± 0.896, B	86.46 ± 1.068, A	87.73 ± 1.083, A
Fan Ratio	0.85 ± 0.003, A	0.84 ± 0.003, A	0.82 ± 0.003, B
Cup Ratio	0.45 ± 0.037, A	0.38 ± 0.037, A	0.39 ± 0.037, A
Percent Fouling (%)	0.0083 ± 0.024 *	0.14 ± 0.014 *	0.11 ± 0.0125 *
Defouled Weight (g)	3.79 ± 0.694, A	4.42 ± 0.366, A	5.08 ± 0.461, A
Wet Bag Weight (kg)	1.24 ± 0.127, B	2.49 ± 0.127, A	2.25 ± 0.127, A
Quality Index	0.20 ± 0.030, C	0.48 ± 0.046, B	0.704 ± 0.057, A
Condition Index	11.15 ± 0.216, A	9.60 ± 0.201, B	10.47 ± 0.209, A
Survival (ratio)	0.72 ± 0.027, B	0.61 ± 0.029, C	0.81 ± 0.023, A

Results (Alabama)

	Antifouling Coatings On Bags	
	1 (With Coatings)	0 (Without)
Shell Length (mm)	75.48 ± 0.354, A	76.39 ± 0.357, A
Whole Wet Weight (g)	81.19 ± 0.824, A	82.74 ± 0.840, A
Fan Ratio	0.84 ± 0.003, A	0.84 ± 0.003, A
Cup Ratio	0.43 ± 0.030, A	0.38 ± 0.003, A
Percent Fouling (%)	0.11 ± 0.014 *	0.077 ± 0.091 *
Defouled Weight (g)	4.22 ± 0.364, A	4.64 ± 0.485, A
Wet Bag Weight (kg)	1.91 ± 0.103, A	2.08 ± 0.103, A
Quality Index	0.48 ± 0.038, A	0.45 ± 0.036, A
Condition Index	10.11 ± 0.168, B	10.71 ± 0.173, A
Survival (ratio)	0.70 ± 0.022, A	0.73 ± 0.021, A

Results (Alabama)

	Antifouling Coatings On pontoons	
	1 (With Coatings)	0 (Without)
Shell Length (mm)	75.46 ± 0.354, A	76.41 ± 0.357, A
Whole Wet Weight (g)	81.12 ± 0.824, A	82.80 ± 0.840, A
Fan Ratio	0.84 ± 0.003, A	0.83 ± 0.003, B
Cup Ratio	0.39 ± 0.003, A	0.43 ± 0.030, A
Percent Fouling (%)	0.065 ± 0.074 *	0.12 ± 0.016 *
Defouled Weight (g)	3.80 ± 0.311, B	5.06 ± 0.520, A
Wet Bag Weight (kg)	2.12 ± 0.103, A	1.86 ± 0.103, A
Quality Index	0.49 ± 0.0382, A	0.43 ± 0.036, A
Condition Index	10.60 ± 0.172, A	10.21 ± 0.168, A
Survival (ratio)	0.74 ± 0.021, A	0.69 ± 0.022, A

Results (Florida)

	Flip Regime		
	Weekly	Biweekly	Triweekly
Shell Length (mm)	85.18 ± 0.379, B	91.46 ± 0.397, A	91.47 ± 0.393, A
Whole Wet Weight (g)	111.40 ± 1.073, C	126.60 ± 1.218, A	121.94 ± 1.169, B
Fan Ratio	0.78 ± 0.036, A	0.74 ± 0.035, A	0.74 ± 0.035, A
Cup Ratio	0.38 ± 0.002, A	0.37 ± 0.002, B	0.36 ± 0.002, B
Percent Fouling (%)	0.21 ± 0.037, B	0.38 ± 0.040, A	0.47 ± 0.041, A
Defouled Weight (g)	6.53 ± 0.341, B	15.51 ± 0.754, A	15.73 ± 0.771, A
Wet Bag Weight (kg)	2.03 ± 0.091, B	2.62 ± 0.091, A	2.69 ± 0.091, A
Quality Index	0.97 ± 0.079, B	2.56 ± 0.162, A	2.70 ± 0.170, A
Condition Index	11.36 ± 0.168, A	9.45 ± 0.169, B	7.53 ± 0.168, C
Survival (ratio)	0.89 ± 0.013, A	0.88 ± 0.013, A	0.90 ± 0.011, A

Results (Florida)

	Antifouling Coatings On Bags	
	1 (With Coatings)	0 (Without)
Shell Length (mm)	88.80 ± 0.318, B	89.94 ± 0.318, A
Whole Wet Weight (g)	118.72 ± 0.937, A	121.24 ± 0.950, A
Fan Ratio	0.76 ± 0.029, A	0.75 ± 0.029, A
Cup Ratio	0.37 ± 0.002, A	0.37 ± 0.002, A
Percent Fouling (%)	0.31 ± 0.033, A	0.40 ± 0.031, A
Defouled Weight (g)	11.63 ± 0.496, B	13.55 ± 0.568, A
Wet Bag Weight (kg)	2.20 ± 0.075, B	2.69 ± 0.074, A
Quality Index	1.86 ± 0.109, B	2.30 ± 0.124, A
Condition Index	9.55 ± 0.138, A	9.34 ± 0.137, A
Survival (ratio)	0.88 ± 0.010, A	0.90 ± 0.010, A

Results (Florida)

	Antifouling Coatings On Pontoons	
	1 (With Coatings)	0 (Without)
Shell Length (mm)	89.36 ± 0.323, A	89.38 ± 0.313, A
Whole Wet Weight (g)	117.85 ± 0.943, B	122.11 ± 0.943, A
Fan Ratio	0.75 ± 0.029, A	0.76 ± 0.029, A
Cup Ratio	0.37 ± 0.002, B	0.37 ± 0.002, A
Percent Fouling (%)	0.34 ± 0.031, A	0.37 ± 0.032, A
Defouled Weight (g)	12.73 ± 0.531, A	12.46 ± 0.535, A
Wet Bag Weight (kg)	2.46 ± 0.075, A	2.43 ± 0.073, A
Quality Index	2.46 ± 0.134, A	1.69 ± 0.097, B
Condition Index	9.46 ± 0.140, A	9.43 ± 0.136, A
Survival (ratio)	0.87 ± 0.011, A	0.91 ± 0.009, A

Discussion

- Everything is site specific
- Flip Regime effects fouling, oysters and bag weights
 - Weekly flips:
 - Decrease growth
 - Decrease biofouling accumulation (bags and oysters)
 - Yield better conditioned oysters
 - Biweekly & Triweekly oysters react similarly
- Coating has minimal effects
 - Not necessarily positive either, if at all
- Triweekly had best survival



Source: Ellis Cha



Conclusions

- Proper continuous management are required for biofouling management
- Weekly flipping reduces growth and could increase mortality but...
 - Quality?
 - Meat Yield?
 - Market?
- Antifouling coatings do not seem to have much effect



Source: Ellis Cha



Thank you to our industry partners

- OysterGro
- LA SeaGrant
- MS/AL SeaGrant
- FL SeaGrant
- Dauphin Island Shellfish Lab.
- Cedar Key Marine Research Station
- Navy Cove Oyster Company
- MDMR



Source: UF IFAS online

