Gear Type Comparison for Off-bottom Oyster Aquaculture in Florida, USA

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Sea Grant Florida

Biofouling is a major concern for the production of off-bottom cultured oysters

Objectives

1. Document performance of triploid Eastern Oysters *Crassostrea virginica* using different off-bottom culture methods
2. Evaluate effects of biofouling control methods in Southern growing conditions

Comparing Off-Bottom Oyster (*Crassostrea virginica*) Aquaculture Production in the Northern Gulf of Mexico on Biofouling

Ellis Chapman

Oyster South: Oyster Aquaculture In the Southern USA

Friday, March 8

3:15pm

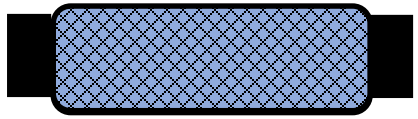
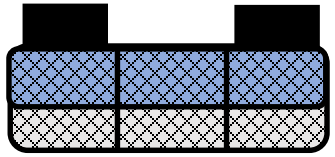
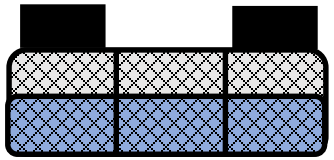

Cedar Key, FL

Growout: Experimental Design

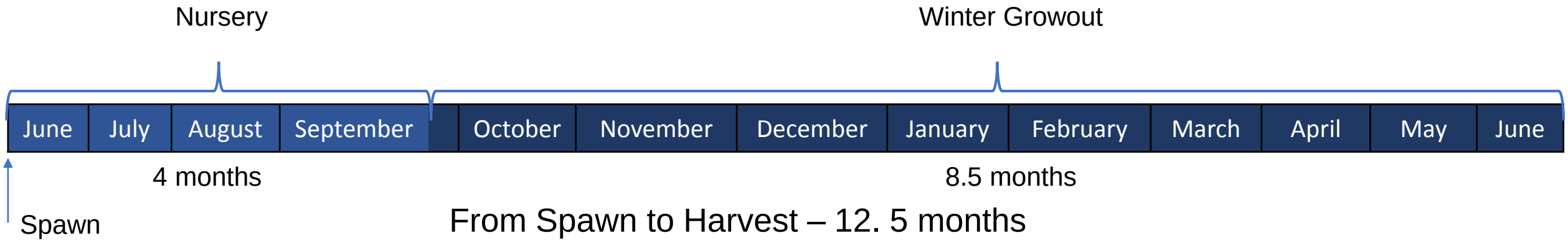
Ploidy:

3N

Gear Type:

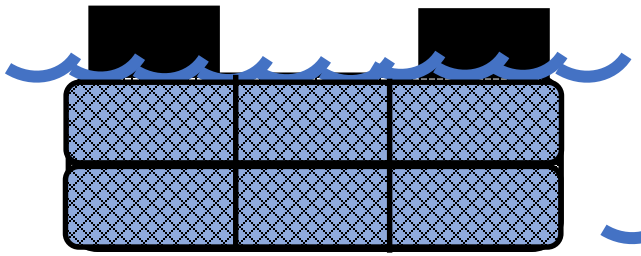
Floating Bag	Floating Cage Top	Floating Cage Bottom
		
n=9	n=7	n=5

Timeframe:

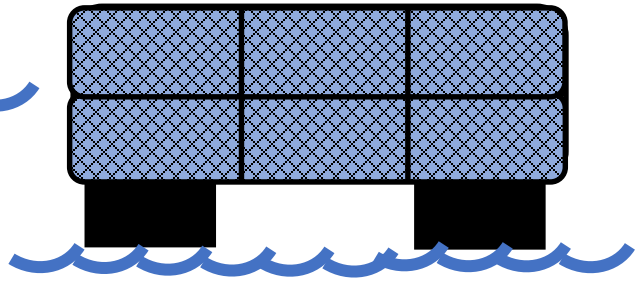


From Spawn to Harvest – 12. 5 months

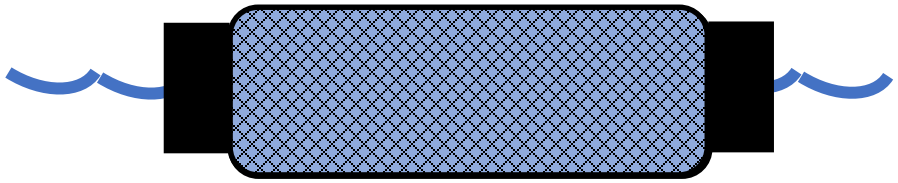
Gear Type and Float Placement



Growing Position



Drying Position

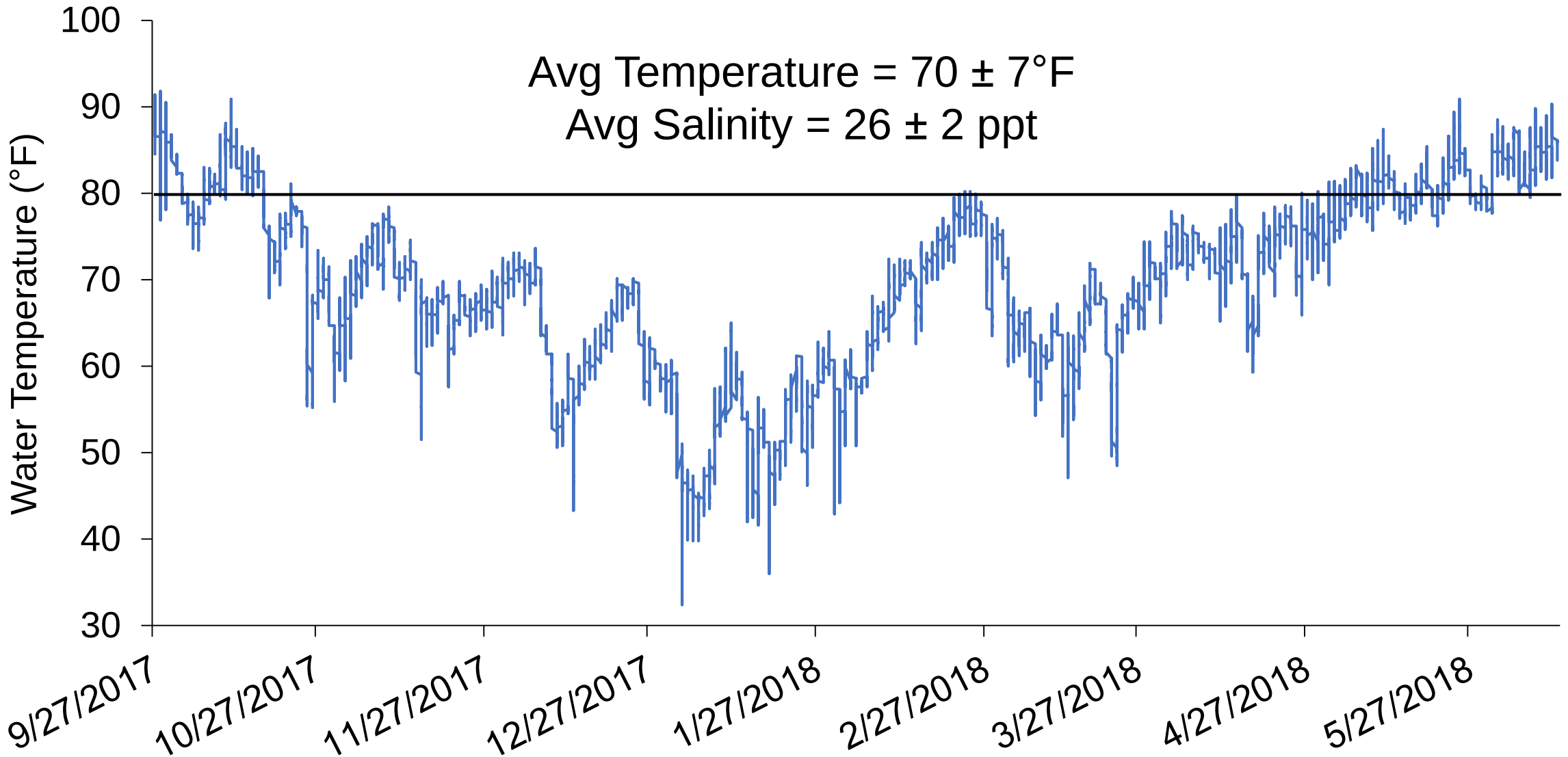


Square – Side Float

Stocking and Biofouling Control

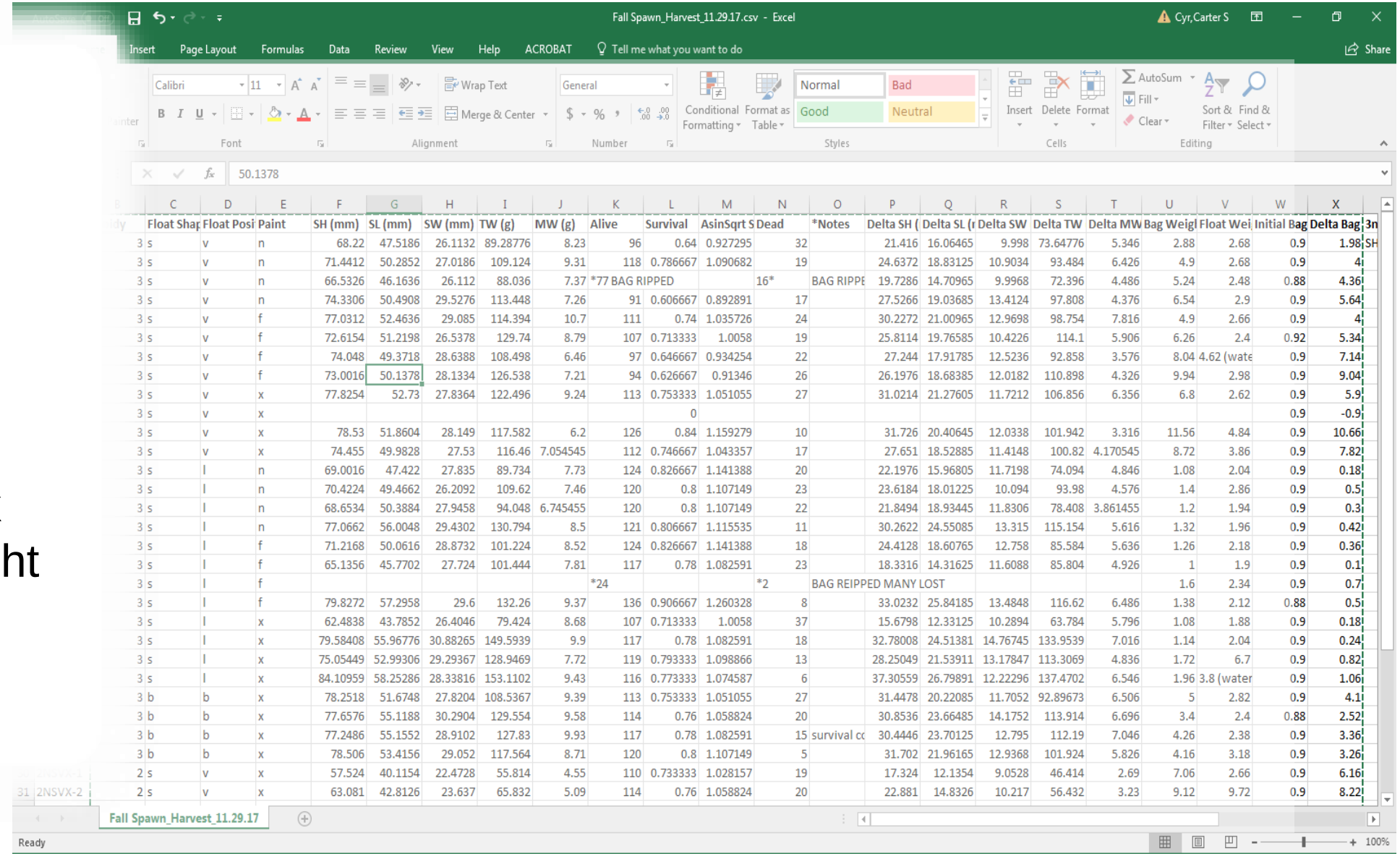
- Deployment size: SH 52mm, SL 39mm, SW 27 mm
- Stocking density: 150 oysters / bag
- 14 mm uncoated Vexar bags
- Weekly Flipping
  - Floating Cage: Air dried exposure for 24 hrs, flipped back
  - Floating Bag: Does not require “Unflipping”

Growing Temperatures, Sept 2017- June 2018



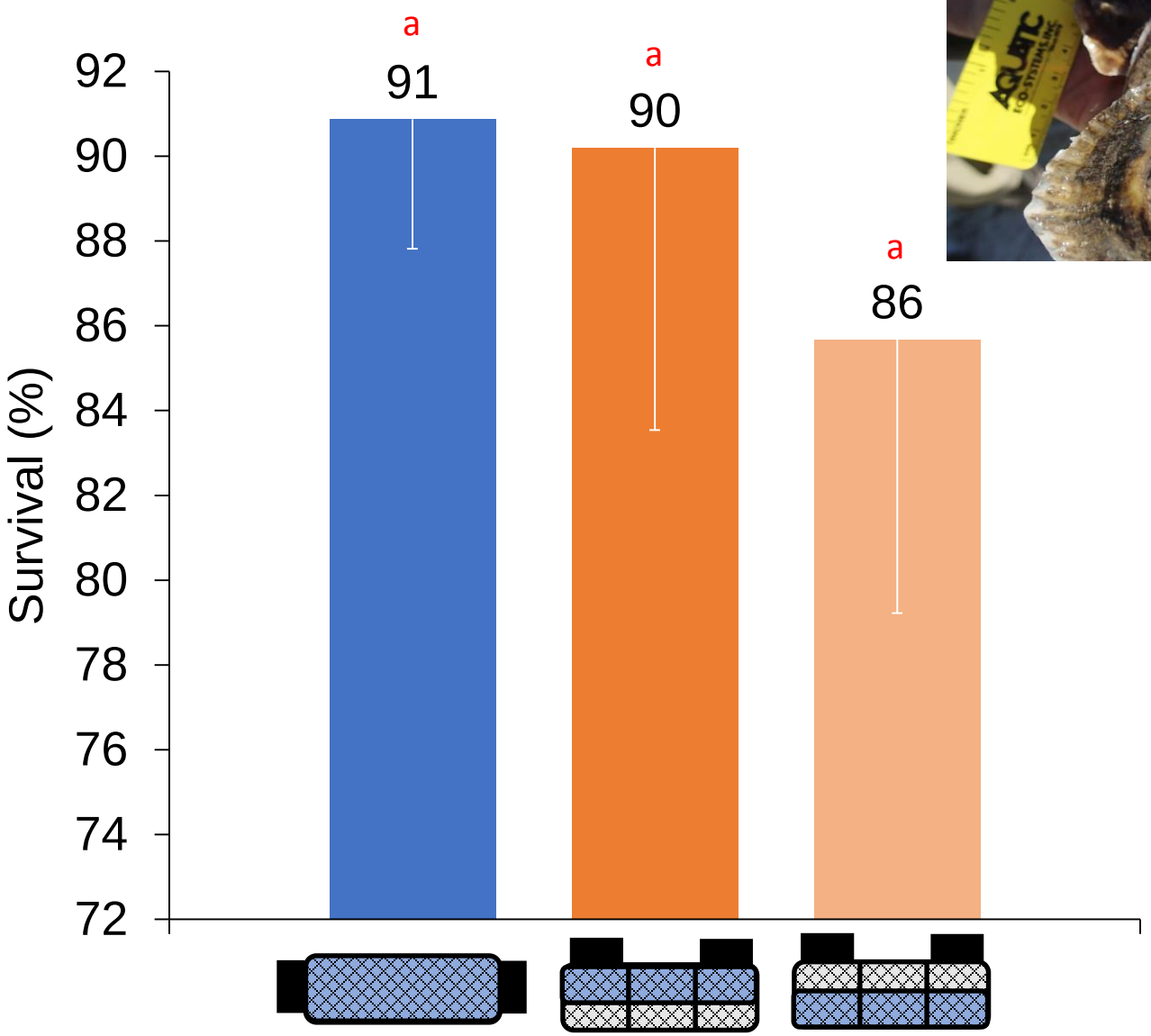
Variables Measured

- Survival
- Shell Metrics
  - Shell height
  - Shell length
  - Shell width
- Weight Metrics
  - Meat (wet)
  - Meat (dry)
- Condition Index
- Biofouling Weight
  - Bags
  - Oysters



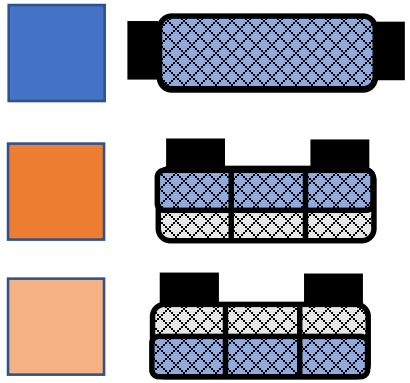
	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
	Float Shap	Float Posi	Paint	SH (mm)	SL (mm)	SW (mm)	TW (g)	MW (g)	Alive	Survival	AsinSqrt S	Dead	*Notes	Delta SH (	Delta SL (r	Delta SW	Delta TW	Delta MW	Bag Weigl	Float Wei	Initial Bag	Delta Bag	3n
3	s	v	n	68.22	47.5186	26.1132	89.28776	8.23	96	0.64	0.927295	32		21.416	16.06465	9.998	73.64776	5.346	2.88	2.68	0.9	1.98	SH
3	s	v	n	71.4412	50.2852	27.0186	109.124	9.31	118	0.786667	1.090682	19		24.6372	18.83125	10.9034	93.484	6.426	4.9	2.68	0.9	4	
3	s	v	n	66.5326	46.1636	26.112	88.036	7.37	*77 BAG RIPPED			16*	BAG RIPPE	19.7286	14.70965	9.9968	72.396	4.486	5.24	2.48	0.88	4.36	
3	s	v	n	74.3306	50.4908	29.5276	113.448	7.26	91	0.606667	0.892891	17		27.5266	19.03685	13.4124	97.808	4.376	6.54	2.9	0.9	5.64	
3	s	v	f	77.0312	52.4636	29.085	114.394	10.7	111	0.74	1.035726	24		30.2272	21.00965	12.9698	98.754	7.816	4.9	2.66	0.9	4	
3	s	v	f	72.6154	51.2198	26.5378	129.74	8.79	107	0.713333	1.0058	19		25.8114	19.76585	10.4226	114.1	5.906	6.26	2.4	0.92	5.34	
3	s	v	f	74.048	49.3718	28.6388	108.498	6.46	97	0.646667	0.934254	22		27.244	17.91785	12.5236	92.858	3.576	8.04	4.62 (wate	0.9	7.14	
3	s	v	f	73.0016	50.1378	28.1334	126.538	7.21	94	0.626667	0.91346	26		26.1976	18.68385	12.0182	110.898	4.326	9.94	2.98	0.9	9.04	
3	s	v	x	77.8254	52.73	27.8364	122.496	9.24	113	0.753333	1.051055	27		31.0214	21.27605	11.7212	106.856	6.356	6.8	2.62	0.9	5.9	
3	s	v	x							0											0.9	-0.9	
3	s	v	x	78.53	51.8604	28.149	117.582	6.2	126	0.84	1.159279	10		31.726	20.40645	12.0338	101.942	3.316	11.56	4.84	0.9	10.66	
3	s	v	x	74.455	49.9828	27.53	116.46	7.054545	112	0.746667	1.043357	17		27.651	18.52885	11.4148	100.82	4.170545	8.72	3.86	0.9	7.82	
3	s	l	n	69.0016	47.422	27.835	89.734	7.73	124	0.826667	1.141388	20		22.1976	15.96805	11.7198	74.094	4.846	1.08	2.04	0.9	0.18	
3	s	l	n	70.4224	49.4662	26.2092	109.62	7.46	120	0.8	1.107149	23		23.6184	18.01225	10.094	93.98	4.576	1.4	2.86	0.9	0.5	
3	s	l	n	68.6534	50.3884	27.9458	94.048	6.745455	120	0.8	1.107149	22		21.8494	18.93445	11.8306	78.408	3.861455	1.2	1.94	0.9	0.3	
3	s	l	n	77.0662	56.0048	29.4302	130.794	8.5	121	0.806667	1.115535	11		30.2622	24.55085	13.315	115.154	5.616	1.32	1.96	0.9	0.42	
3	s	l	f	71.2168	50.0616	28.8732	101.224	8.52	124	0.826667	1.141388	18		24.4128	18.60765	12.758	85.584	5.636	1.26	2.18	0.9	0.36	
3	s	l	f	65.1356	45.7702	27.724	101.444	7.81	117	0.78	1.082591	23		18.3316	14.31625	11.6088	85.804	4.926	1	1.9	0.9	0.1	
3	s	l	f						*24			*2	BAG REIPPED MANY LOST						1.6	2.34	0.9	0.7	
3	s	l	f	79.8272	57.2958	29.6	132.26	9.37	136	0.906667	1.260328	8		33.0232	25.84185	13.4848	116.62	6.486	1.38	2.12	0.88	0.5	
3	s	l	x	62.4838	43.7852	26.4046	79.424	8.68	107	0.713333	1.0058	37		15.6798	12.33125	10.2894	63.784	5.796	1.08	1.88	0.9	0.18	
3	s	l	x	79.58408	55.96776	30.88265	149.5939	9.9	117	0.78	1.082591	18		32.78008	24.51381	14.76745	133.9539	7.016	1.14	2.04	0.9	0.24	
3	s	l	x	75.05449	52.99306	29.29367	128.9469	7.72	119	0.793333	1.098866	13		28.25049	21.53911	13.17847	113.3069	4.836	1.72	6.7	0.9	0.82	
3	s	l	x	84.10959	58.25286	28.33816	153.1102	9.43	116	0.773333	1.074587	6		37.30559	26.79891	12.22296	137.4702	6.546	1.96	3.8 (water	0.9	1.06	
3	b	b	x	78.2518	51.6748	27.8204	108.5367	9.39	113	0.753333	1.051055	27		31.4478	20.22085	11.7052	92.89673	6.506	5	2.82	0.9	4.1	
3	b	b	x	77.6576	55.1188	30.2904	129.554	9.58	114	0.76	1.058824	20		30.8536	23.66485	14.1752	113.914	6.696	3.4	2.4	0.88	2.52	
3	b	b	x	77.2486	55.1552	28.9102	127.83	9.93	117	0.78	1.082591	15	survival cc	30.4446	23.70125	12.795	112.19	7.046	4.26	2.38	0.9	3.36	
3	b	b	x	78.506	53.4156	29.052	117.564	8.71	120	0.8	1.107149	5		31.702	21.96165	12.9368	101.924	5.826	4.16	3.18	0.9	3.26	
2	s	v	x	57.524	40.1154	22.4728	55.814	4.55	110	0.733333	1.028157	19		17.324	12.1354	9.0528	46.414	2.69	7.06	2.66	0.9	6.16	
2	s	v	x	63.081	42.8126	23.637	65.832	5.09	114	0.76	1.058824	20		22.881	14.8326	10.217	56.432	3.23	9.12	9.72	0.9	8.22	

Survival



Note: Kruskal-Wallis nonparametric tests were performed using R. Treatments were considered significantly different when $p \leq 0.05$. Dunn's test were performed Post-hoc.

Shell Metrics



Shell Shape

Shell Height (SH) : Shell Length (SL) : Shell Width (SW)

Preferred Ratio: **3** : **2** : **1**

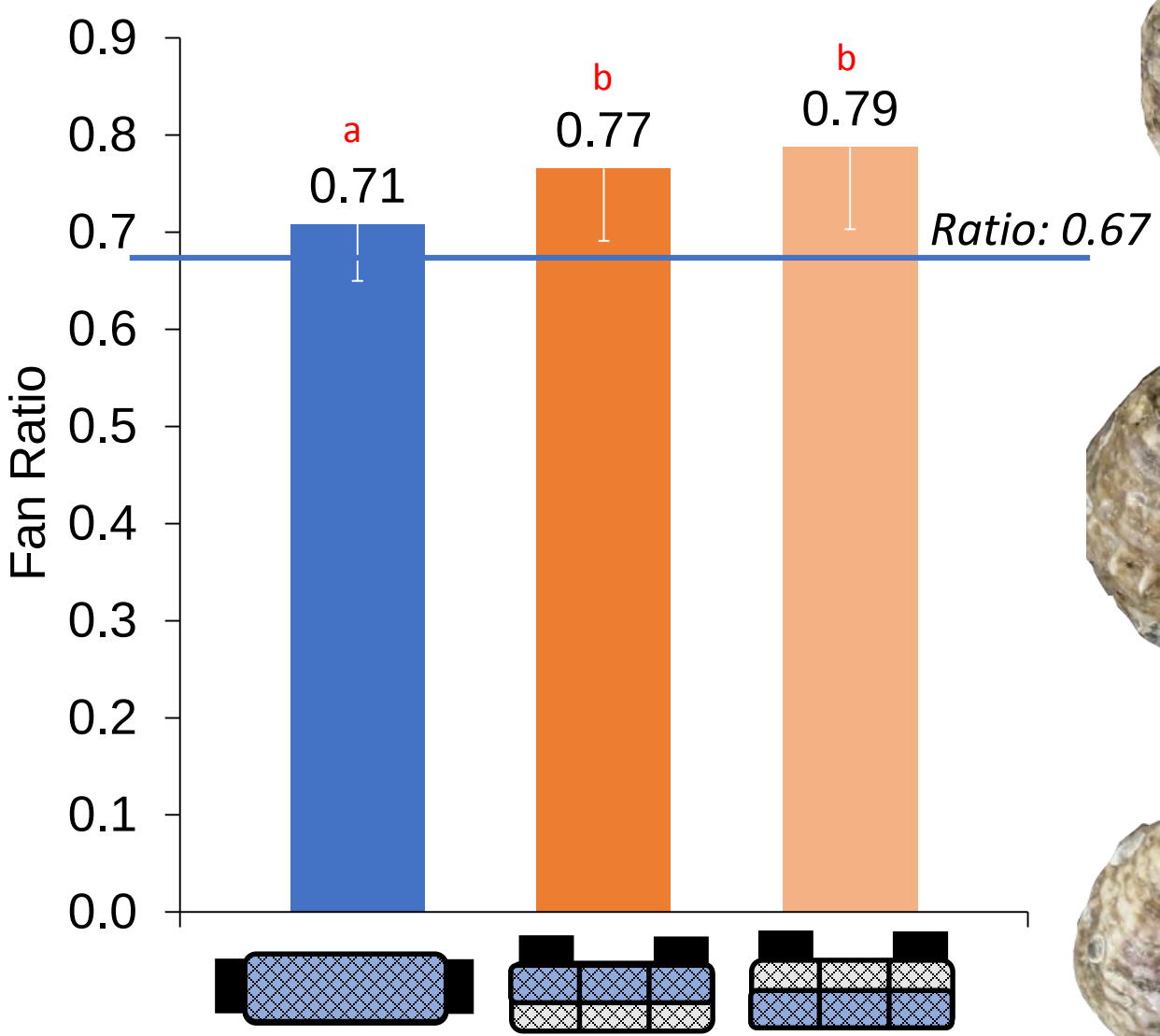
Fan Ratio

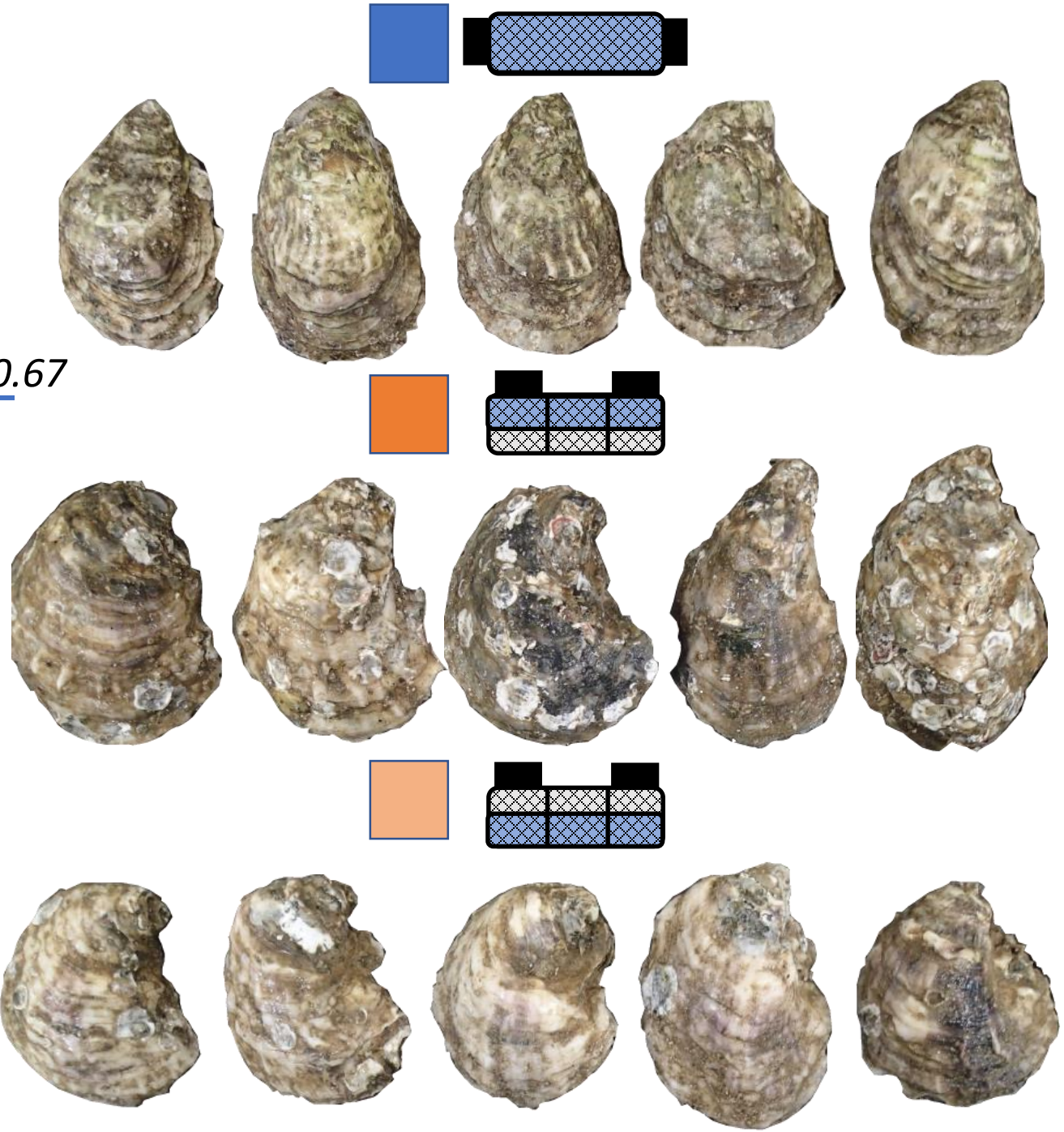
SL/SH = 2/3 = 0.67

Cup Ratio

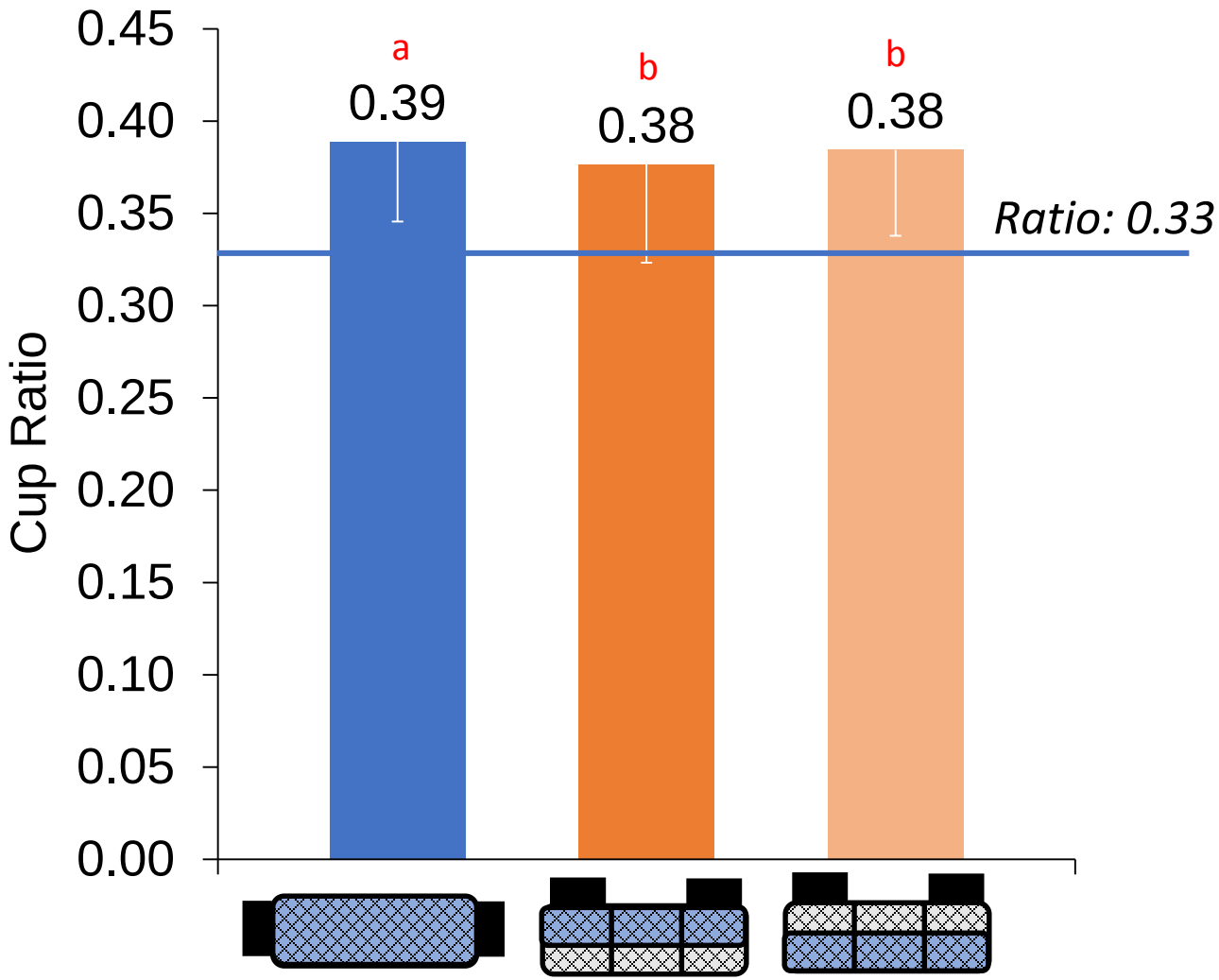
SW/SH = 1/3 = 0.33

Shape: Fan Ratio

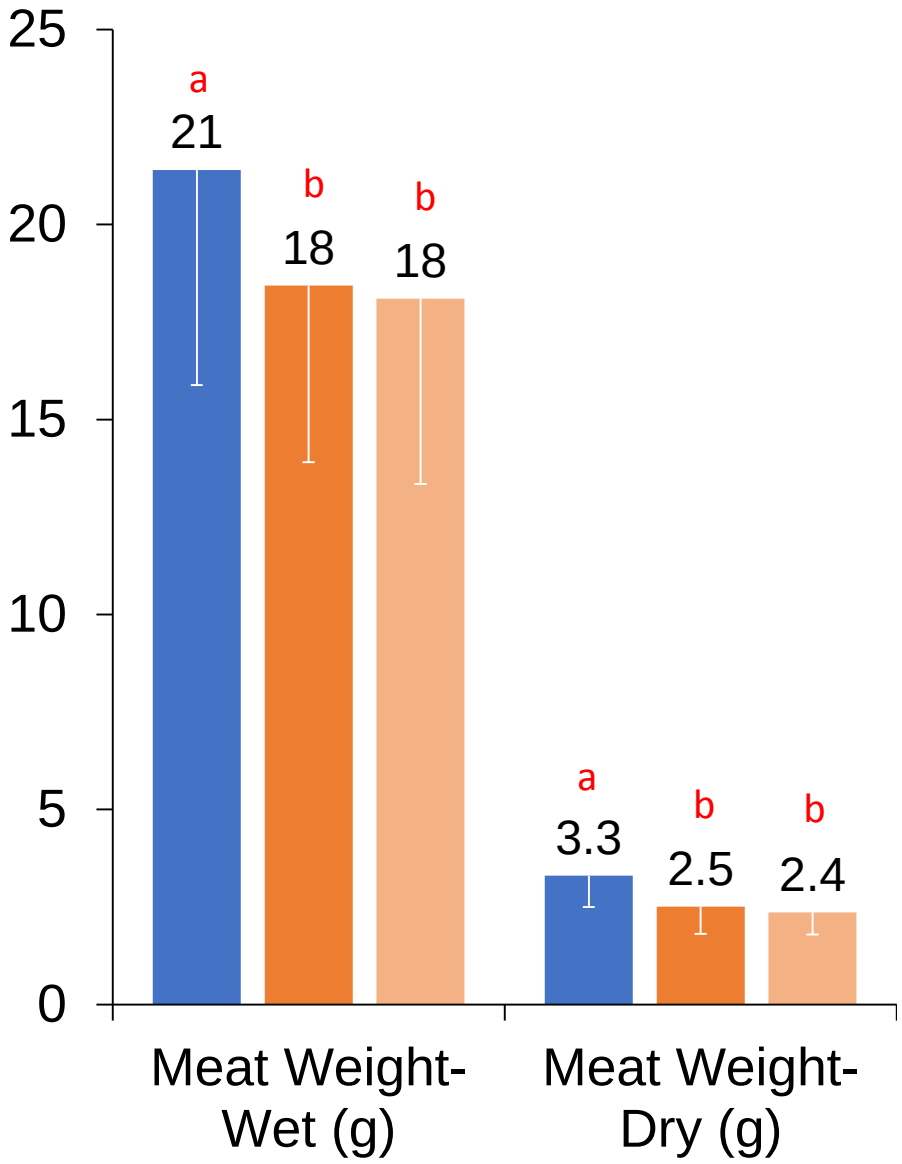


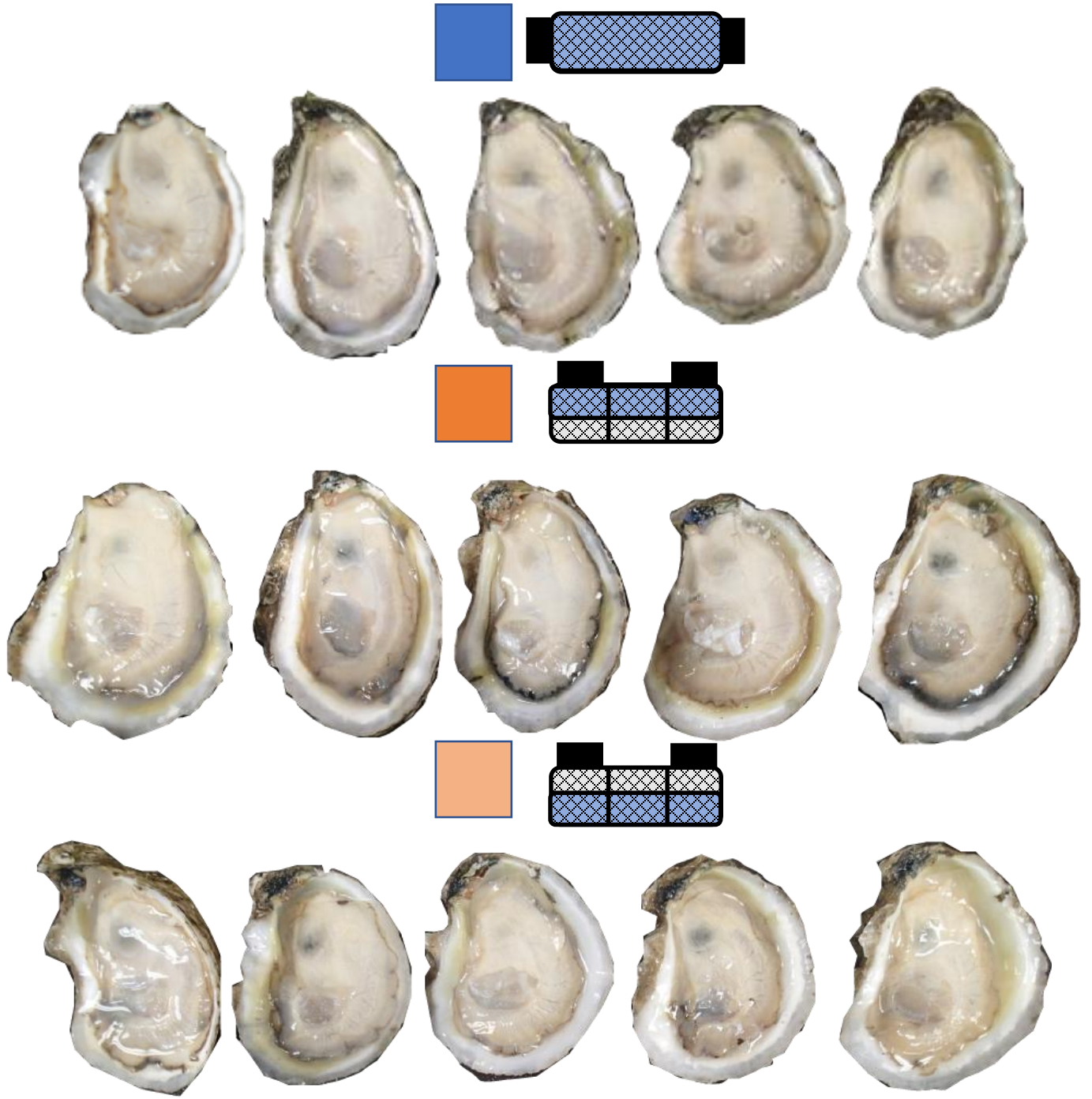


Shape: Cup Ratio



Weight Metrics

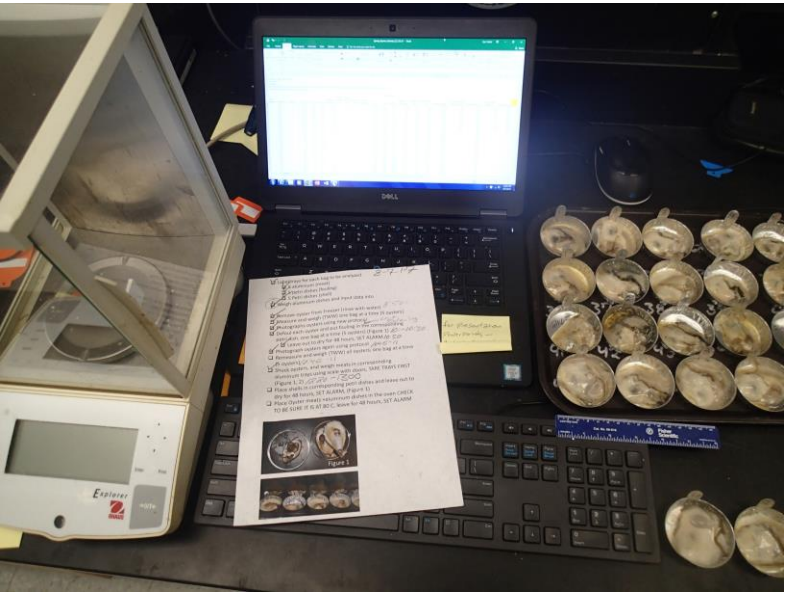


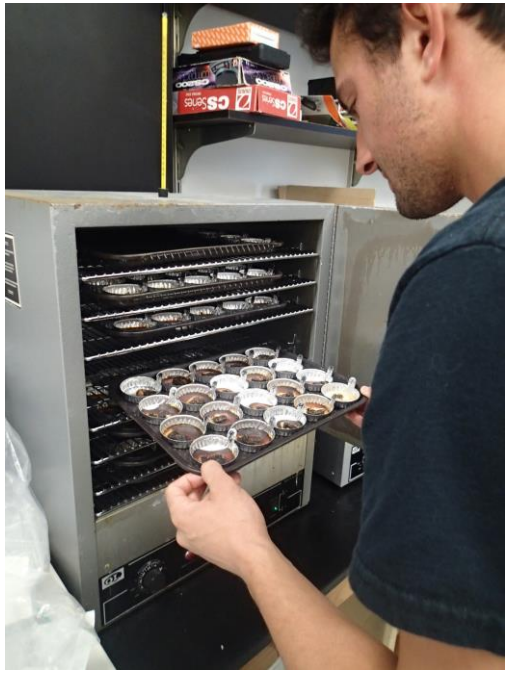


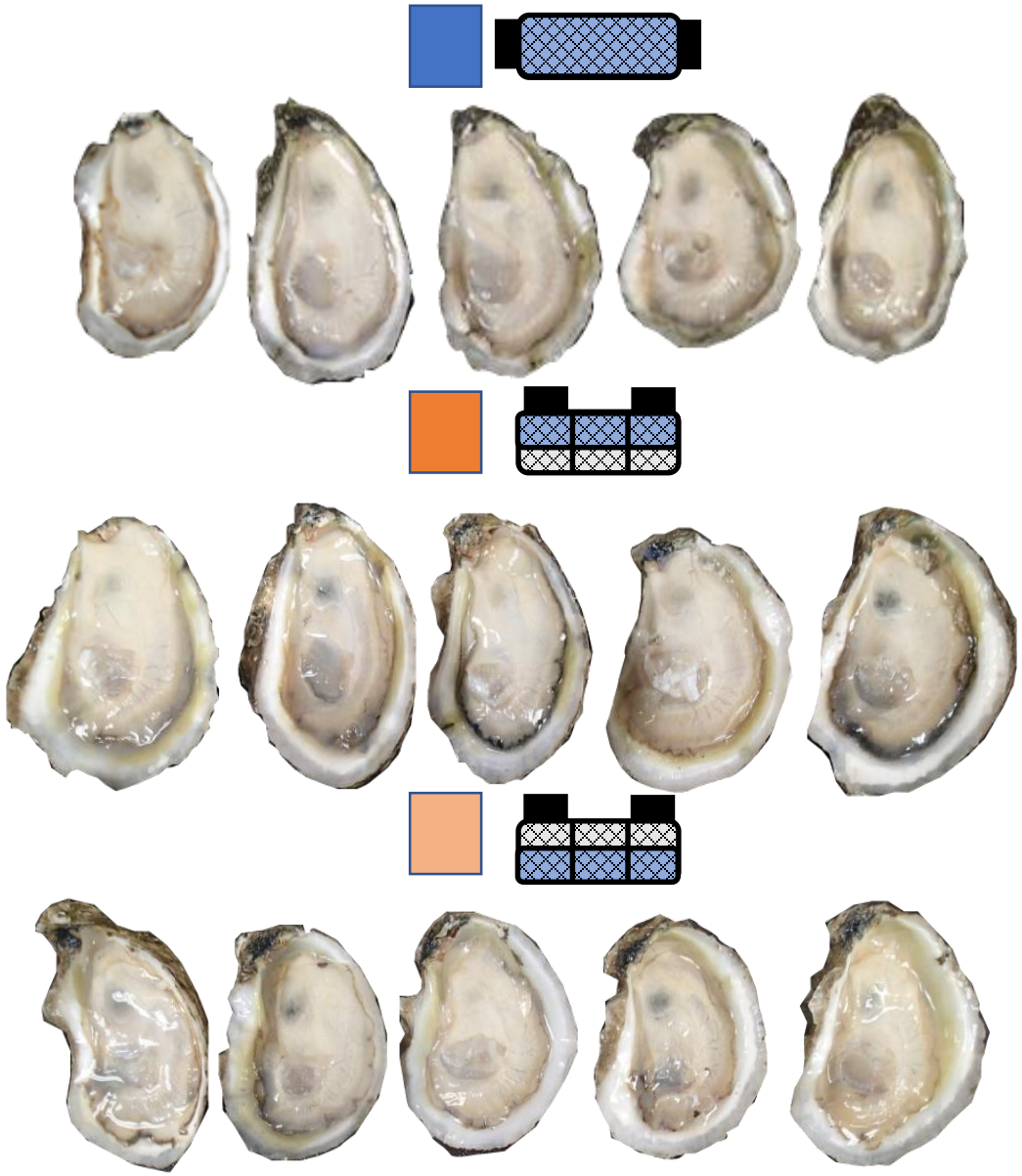
Condition Index

- Weight ratio that describes quality of meat or yield (“fatness”)
- Relative value, no ‘ideal’ condition index range

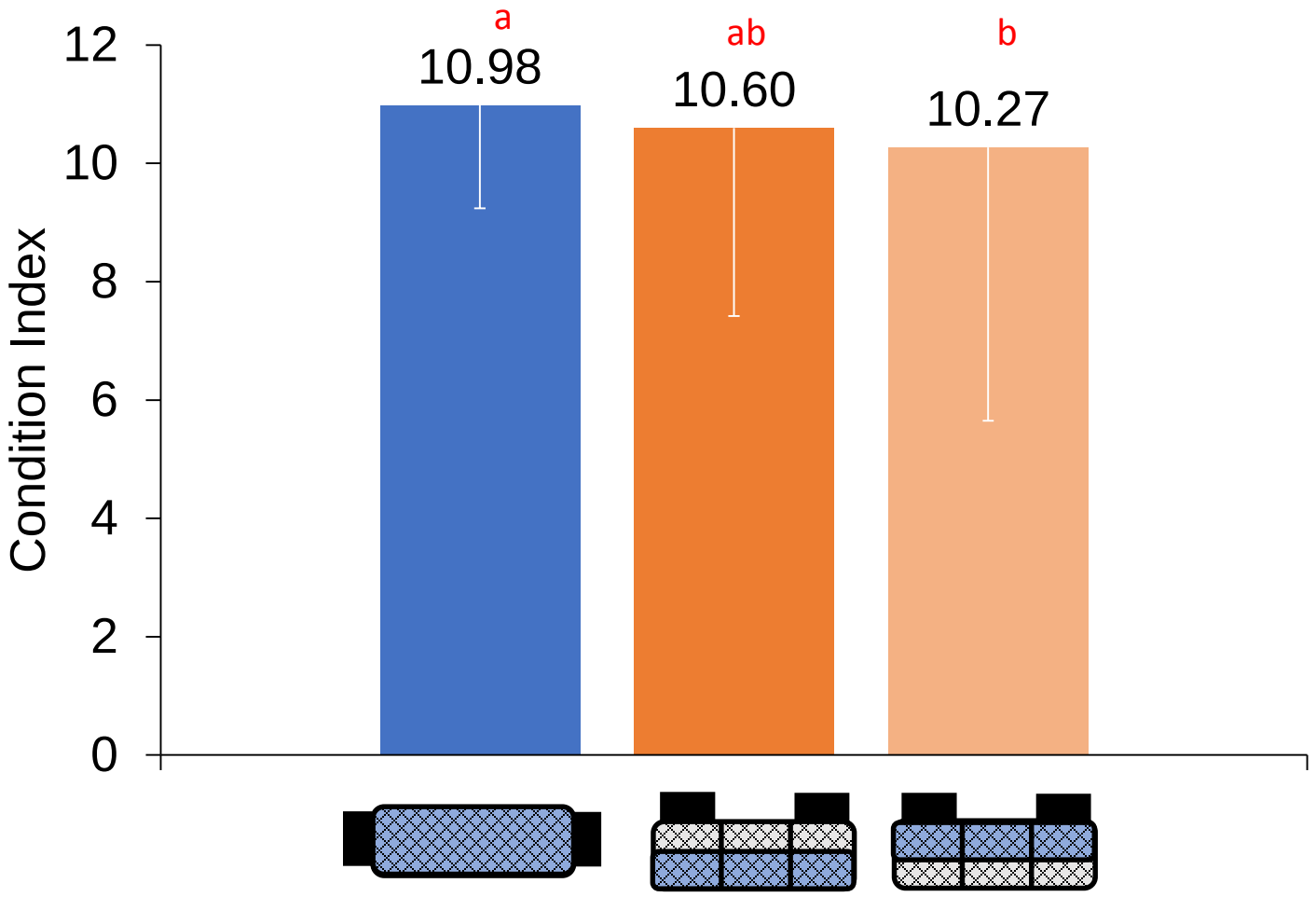
$$\mathrm{CI} = \left[\frac{Dry\ Meat\ Weight\ (g)}{Total\ Wet\ Weight\ (g) - Dry\ Shell\ Weight\ (g)}\right] \times 100$$



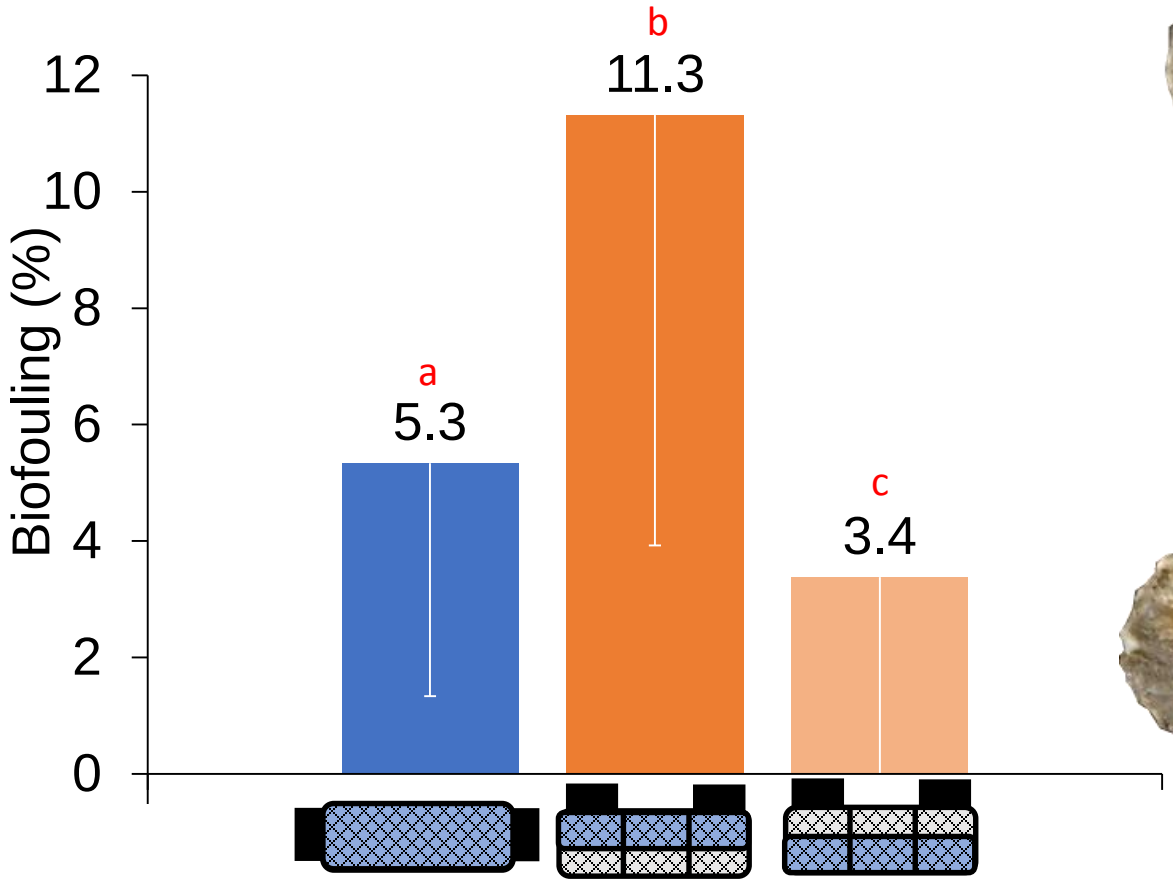


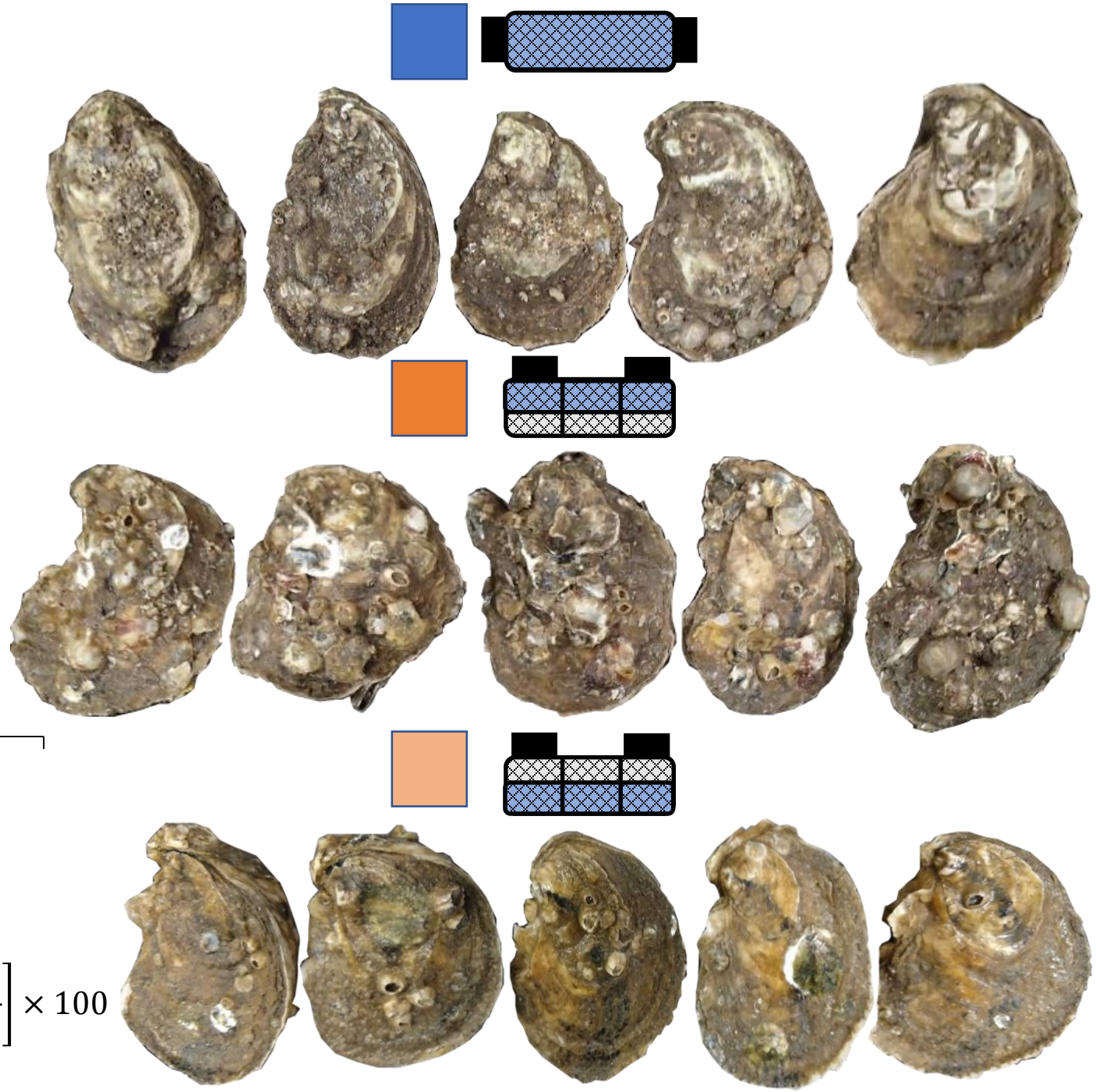


Condition Index



Biofouling on Oysters

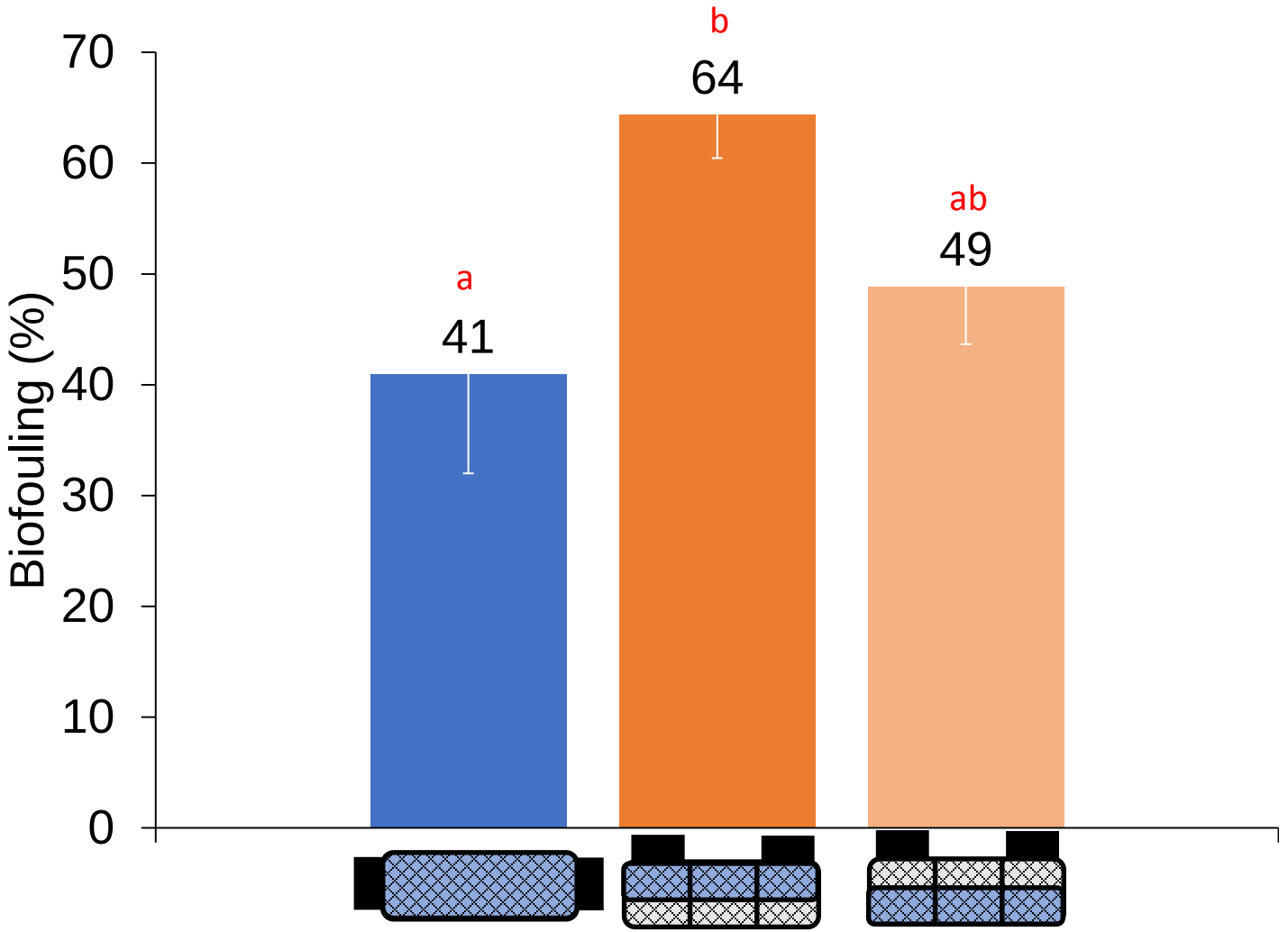




$$\% \; Biofouling \; Equation$$

$$= \left[\frac{Fouling\ Weight\ (g)}{Total\ Weight\ Fouled\ Oyster\ (g) - Wet\ Meat\ Weight\ (g)}\right] \times 100$$

Biofouling on Bags



$$\% \, Biofouling = \left[\frac{Fouling \; Weight \; (lbs)}{Total \; Weight \; of \; Fouled \; Bag \; (lbs)}\right] \times 100$$

Biofouling Weights on Bags

1.5 ± 0.5 lbs

a

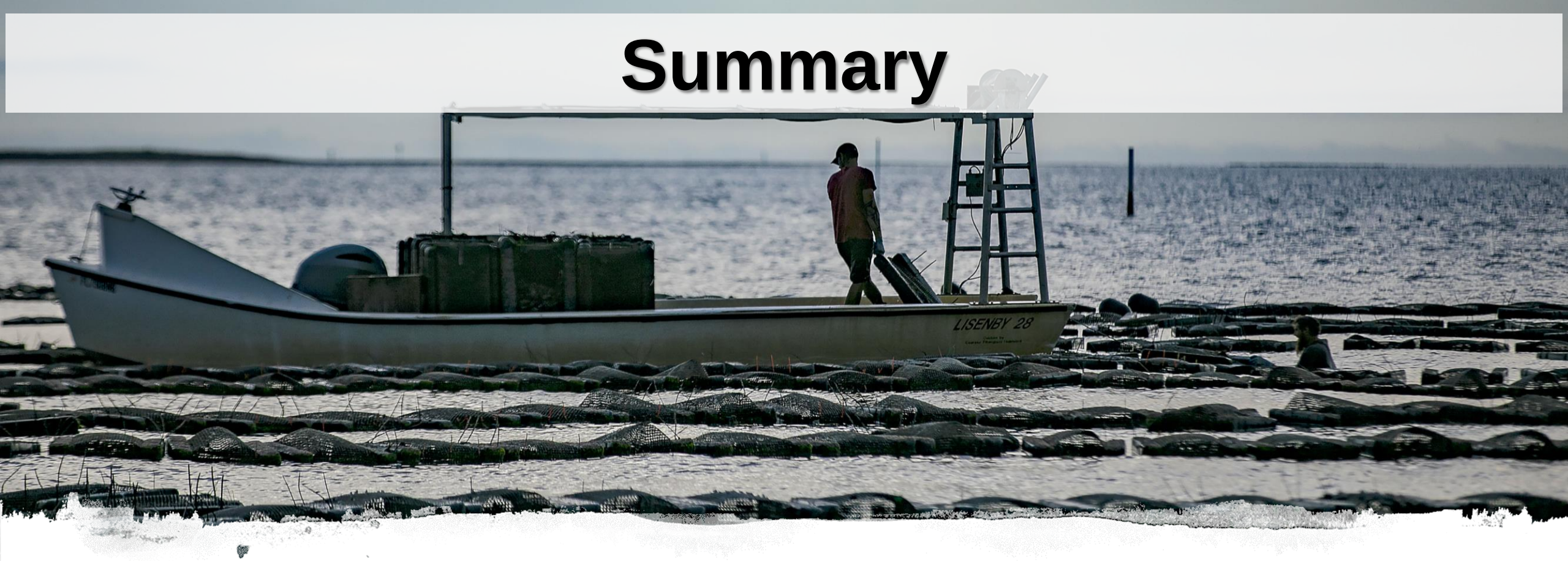
3.7 ± 0.6 lbs

b

1.9 ± 0.4 lbs

ab

Summary



- Oyster culture in floating bags and cages had similar:
  - Survival (91 vs 86%)
  - Shell height (84 vs 87 mm)
  - Fan (0.71 vs 0.79) and cup (0.39 vs 0.38) ratios
  - Wet (21 vs 18 g) and dry (3.3 vs 2.4 g) meat weight
  - Condition index (10.98 vs 10.27)

Summary

Biofouling on oysters and gear was less on floating bags and cage bottom bags.

- Oysters: 3 and 5% versus 11%
- Bag: 41 and 49% versus 64%

Summary

- Commercially acceptable survival and growth
- Floating bags do not need to be flipped back reducing labor and cost by 50%
- Biofouling management practices effective over a winter growout in Florida

ACKNOWLEDGEMENTS

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- Photo Credit: Alan Youngblood, Gainesville Sun