Application of Triploidy to an Emergent Oyster Culture Industry on Florida's West Coast: Results of UF Growout Trials

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Sea Grant
Florida

Application of Triploidy to an Emergent Oyster Culture Industry on Florida's West Coast

Project demonstrates and evaluates an oyster breeding technique under local conditions

OBJECTIVES are two fold:

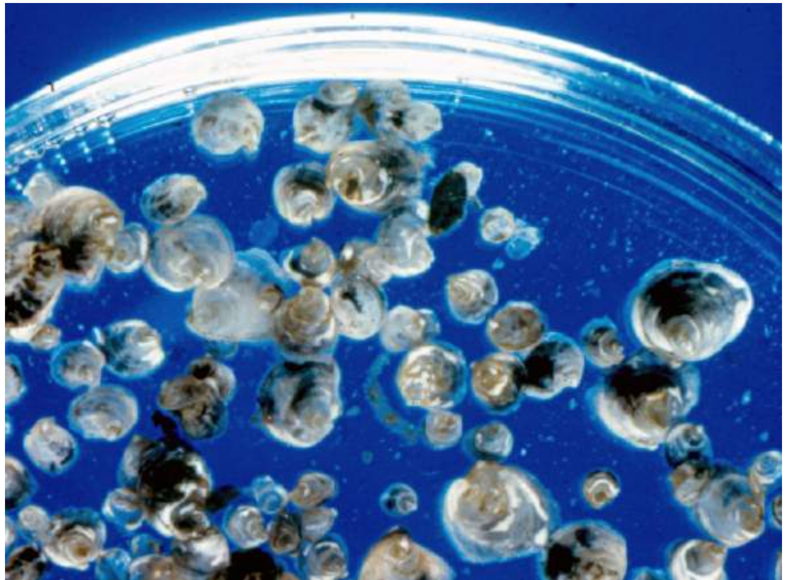
1) Document production performance, and evaluate quality of diploid (2N) and triploid (3N) oysters
2) Examine effects of management practices in replicated field trials

Funded by: NOAA Sea Grant Florida *2015-18*

Seed Production

SPAWNS

- Trial 1: April 2016
  - 3N: FL west coast 2N♀ X LSU 4N ♂
  - 2N: FL west coast stocks, half siblings
- Trial 2: September/October 2016
  - 3N: LSU and AU hatcheries
  - 2N: FL west coast hatchery



LAND-BASED NURSERY

- Trials 1&2
  - 3N & 2N: Nurse in wellers at commercial facility in Cedar Key

UF Field Trials

FIELD-BASED NURSERY

	Trial 1	Trial 2
Seed Size (avg)	26 mm	29 – 34 mm
Time	2.5 months	1.5 months
Stocking Density	625-5000/bag	700/bag
Juvenile Size (avg)	51 – 54 mm	40 – 47 mm

GROWOUT TRIAL 1: Oct 2016—Apr 2017

TREATMENTS:

Ploidy:

- 2N (n=18)
- 3N (n=18)

Density:

- 2N: Low (125) n=6; Medium (150) n=6; High (175) n=6
- 3N: Low (125) n=6; Medium (150) n=6; High (175) n=6

Timeframe:

April	May	June	July	August	September	October	November	December	January	February	March	April

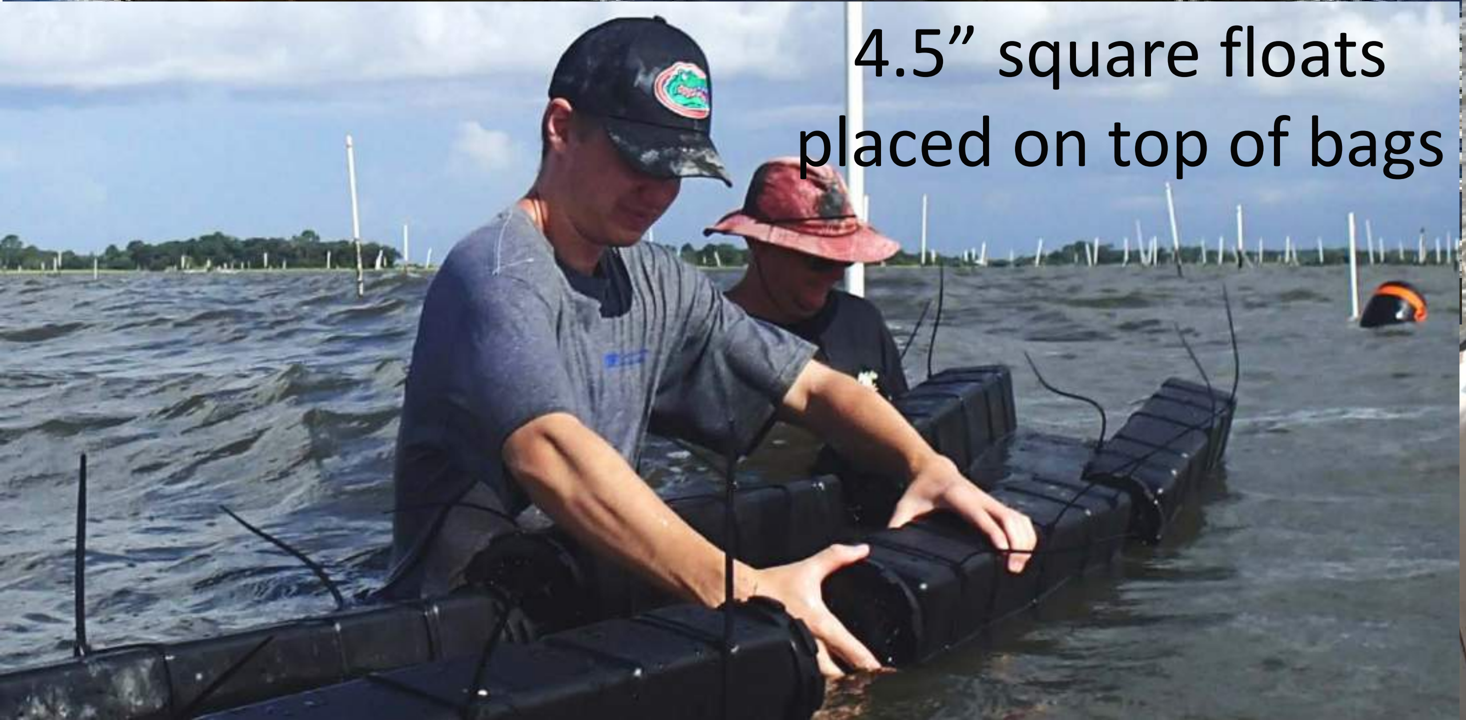
Spawn (April)

Land based Nursery: 3.5 months

Field based Nursery: 2.5 months

Growout - WINTER: 6 months

GROWOUT TRIAL 1

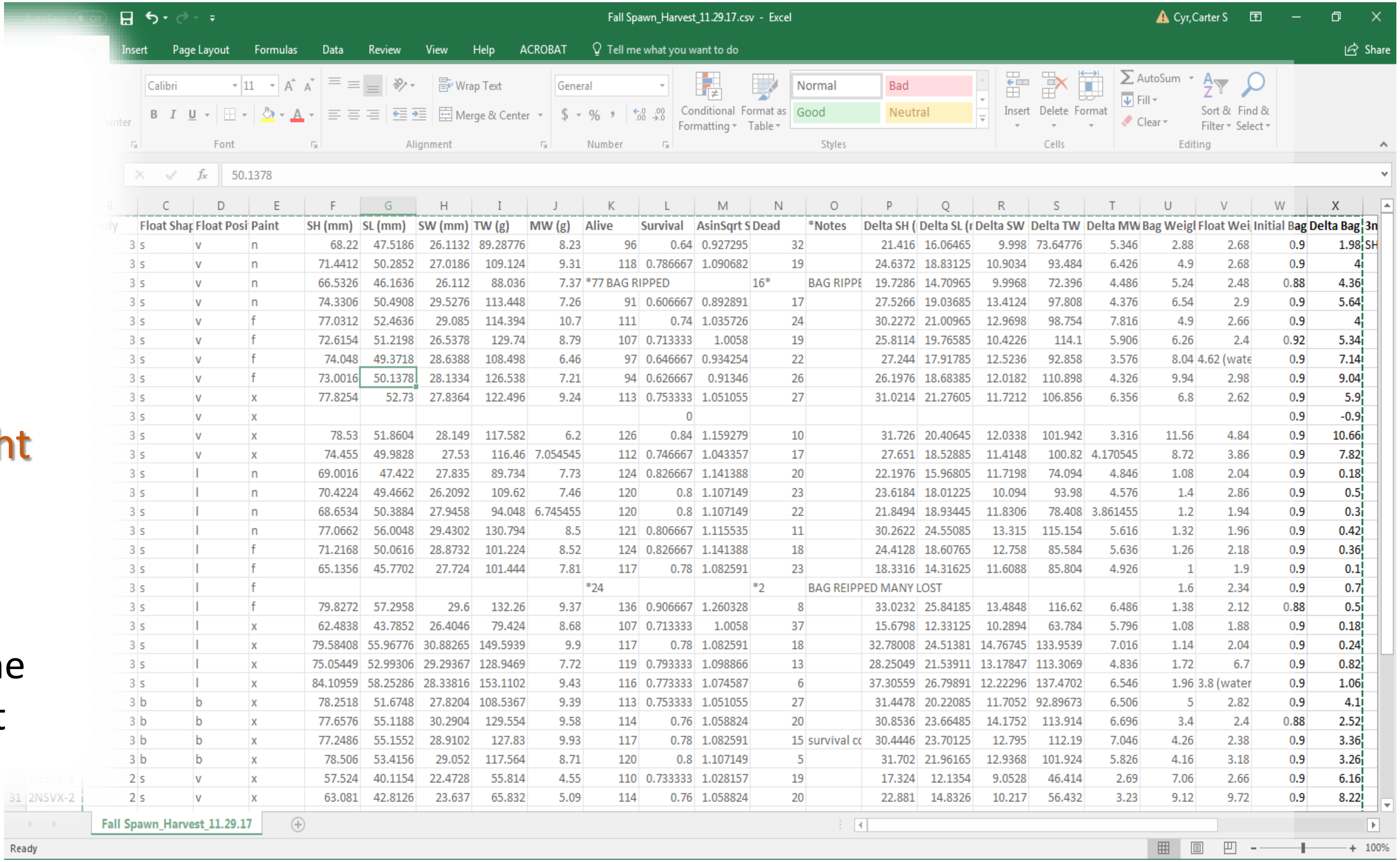


4.5” square floats placed on top of bags

14 mm mesh bags

VARIABLES MEASURED: Variables Reporting

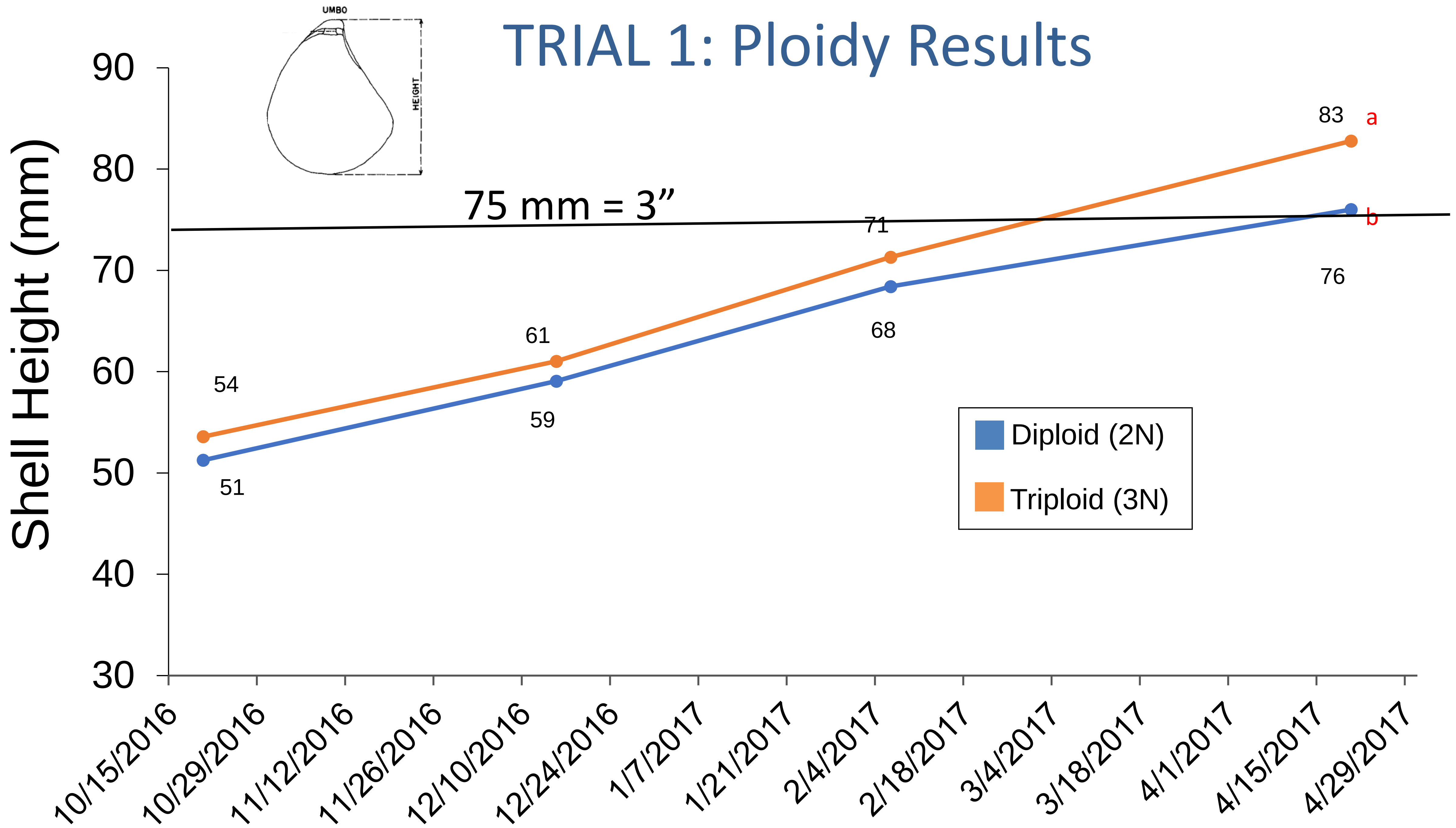
- Shell Metrics
  - Shell height
  - Shell length
  - Shell width
- Weight Metrics
  - Total
  - Meat (wet)
  - Meat (dry)
- Condition Index
- Survival
- Biofouling Weight
  - On bags
  - On oysters
- Bag Metrics
  - Oyster volume
  - Oyster height
  - Bag height
- Labor Hours



dy	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	

Fall Spawn_Harvest_11.29.17

TRIAL 1: Ploidy Results



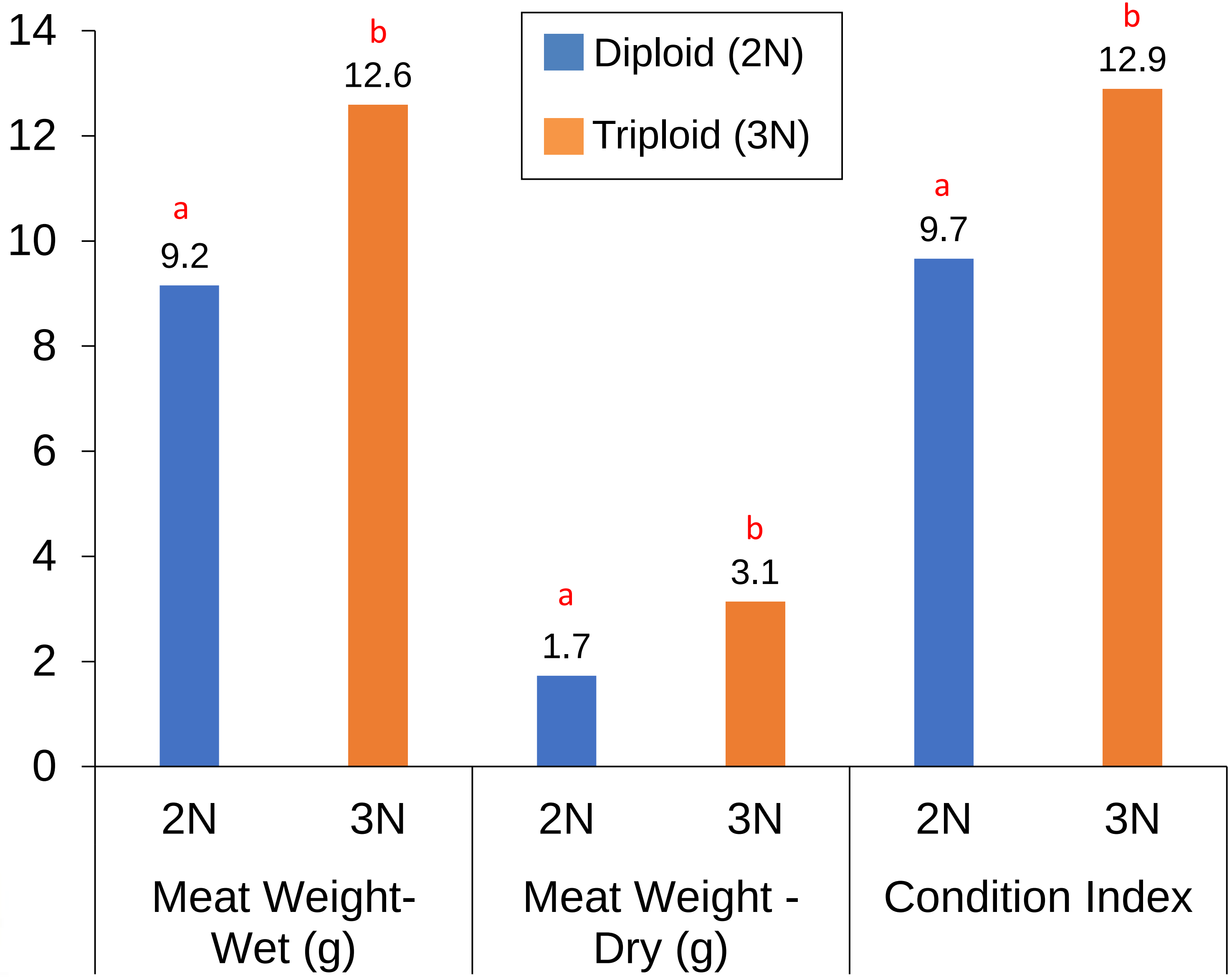
Statistical analyses performed on growth of each metric (α=0.05)

TRIAL 1: Ploidy Results

2N

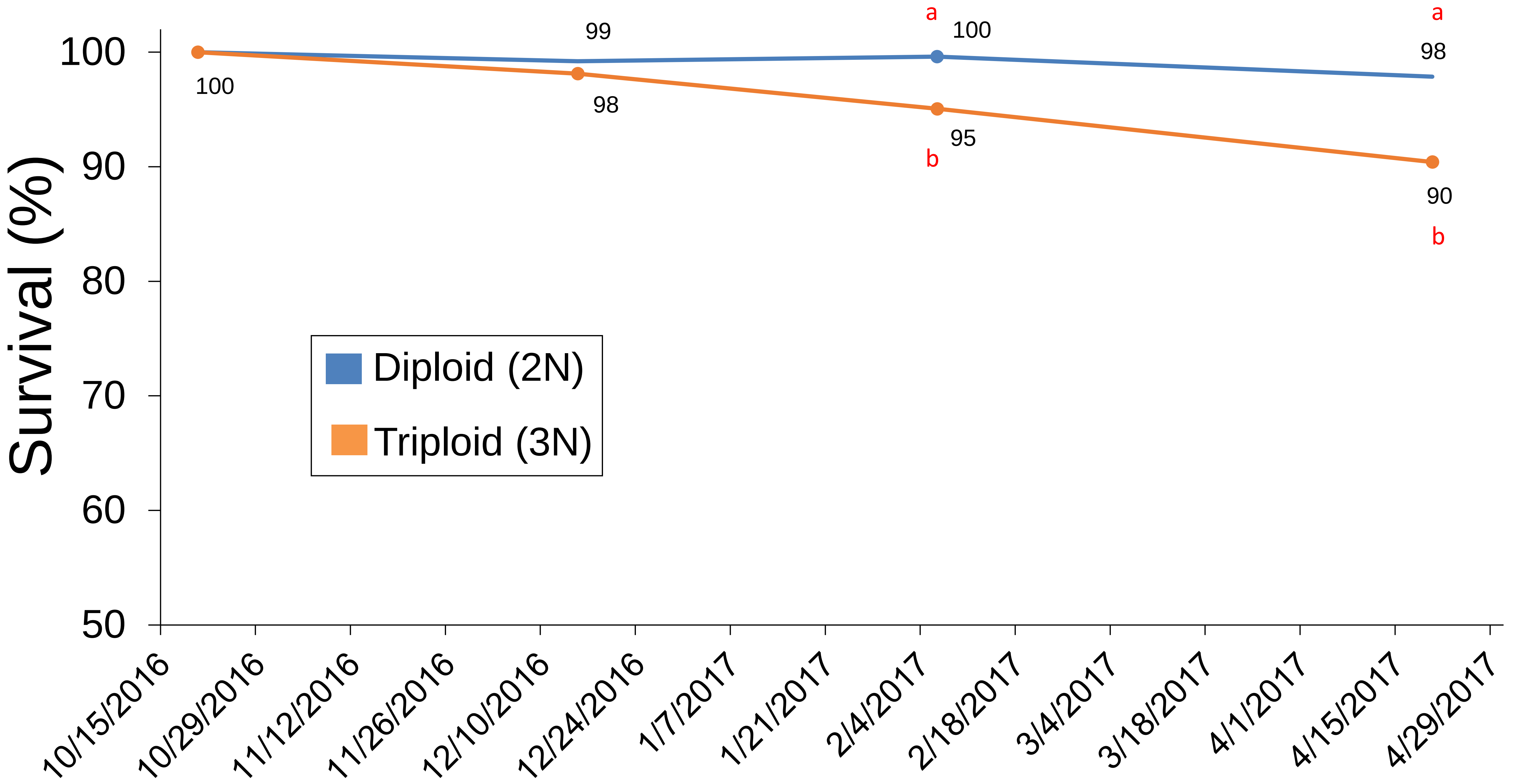
1 cm

3N

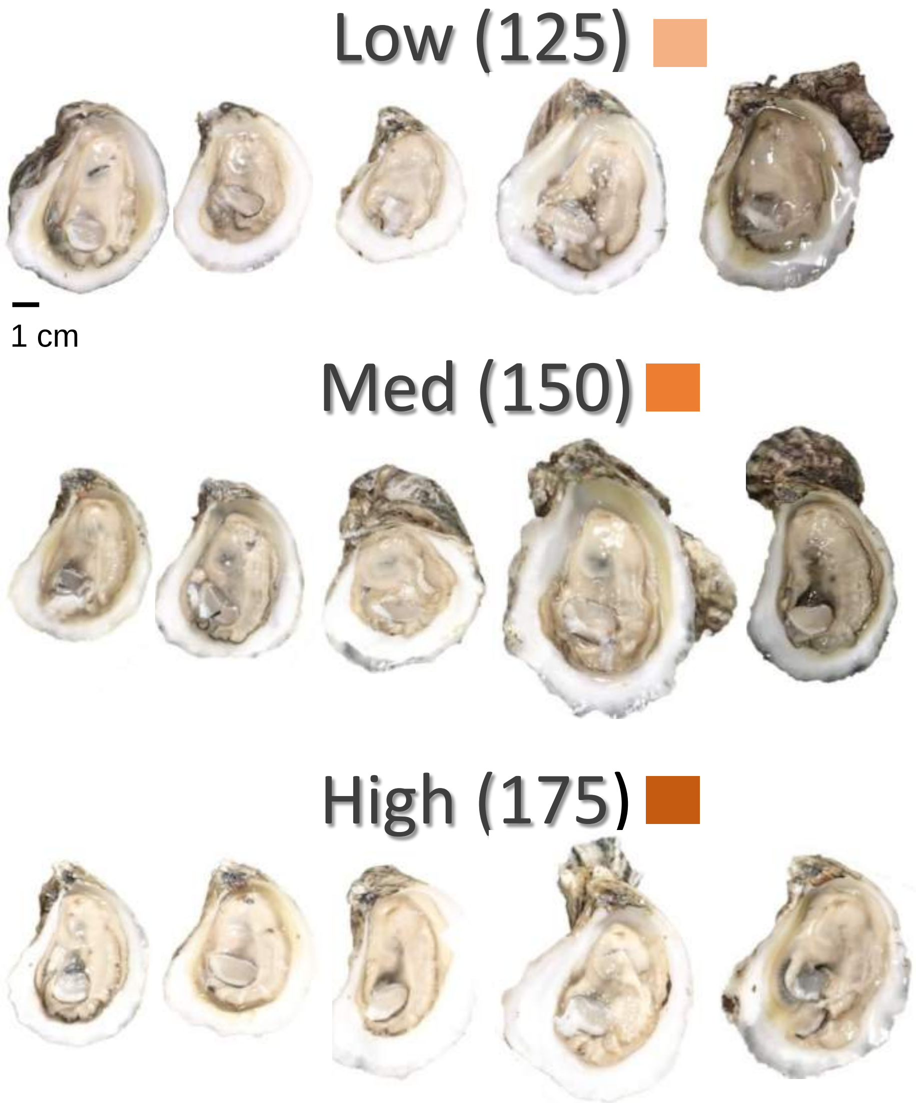


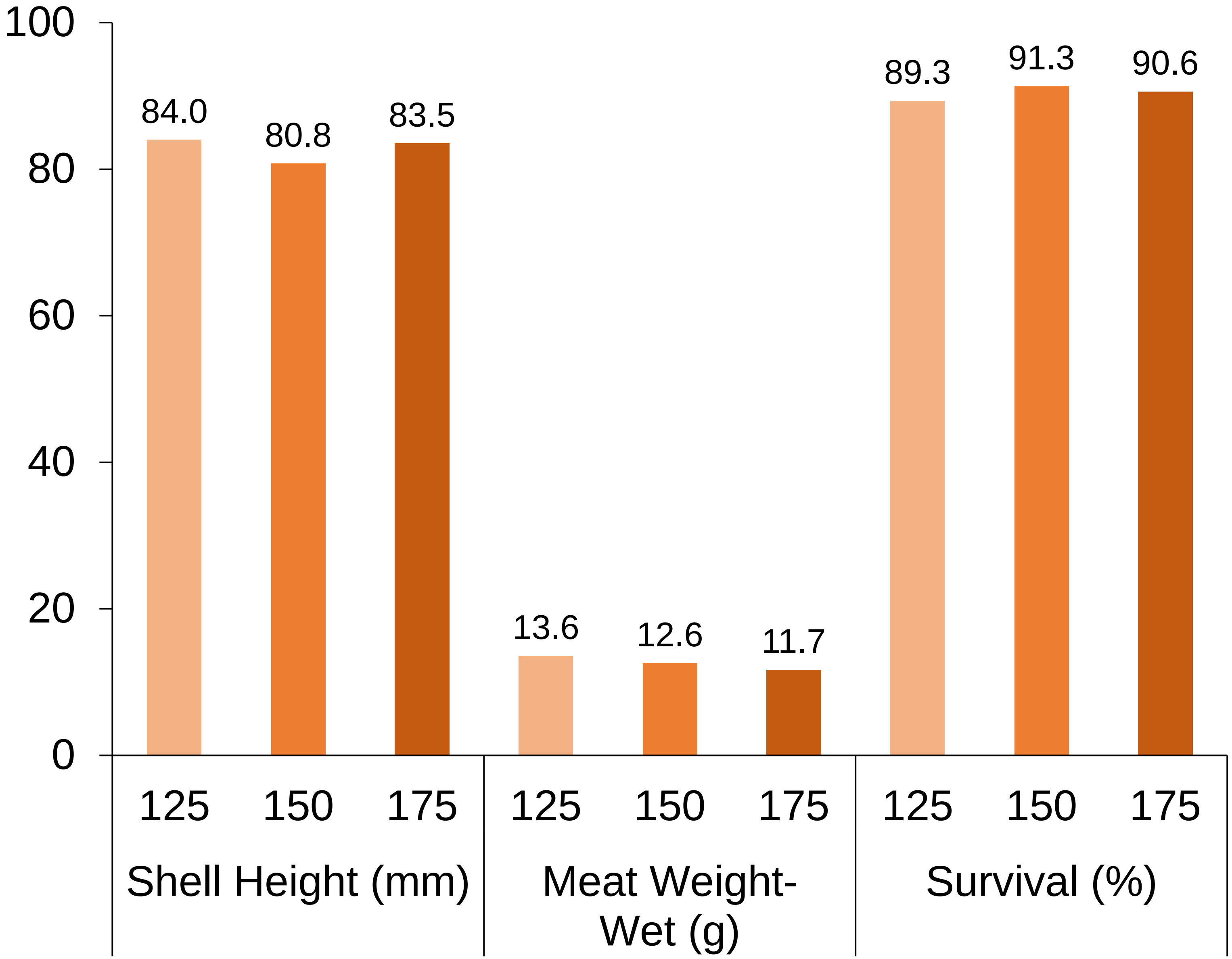
Statistical analyses performed on growth of each metric (α=0.05)

TRIAL 1: Ploidy Results

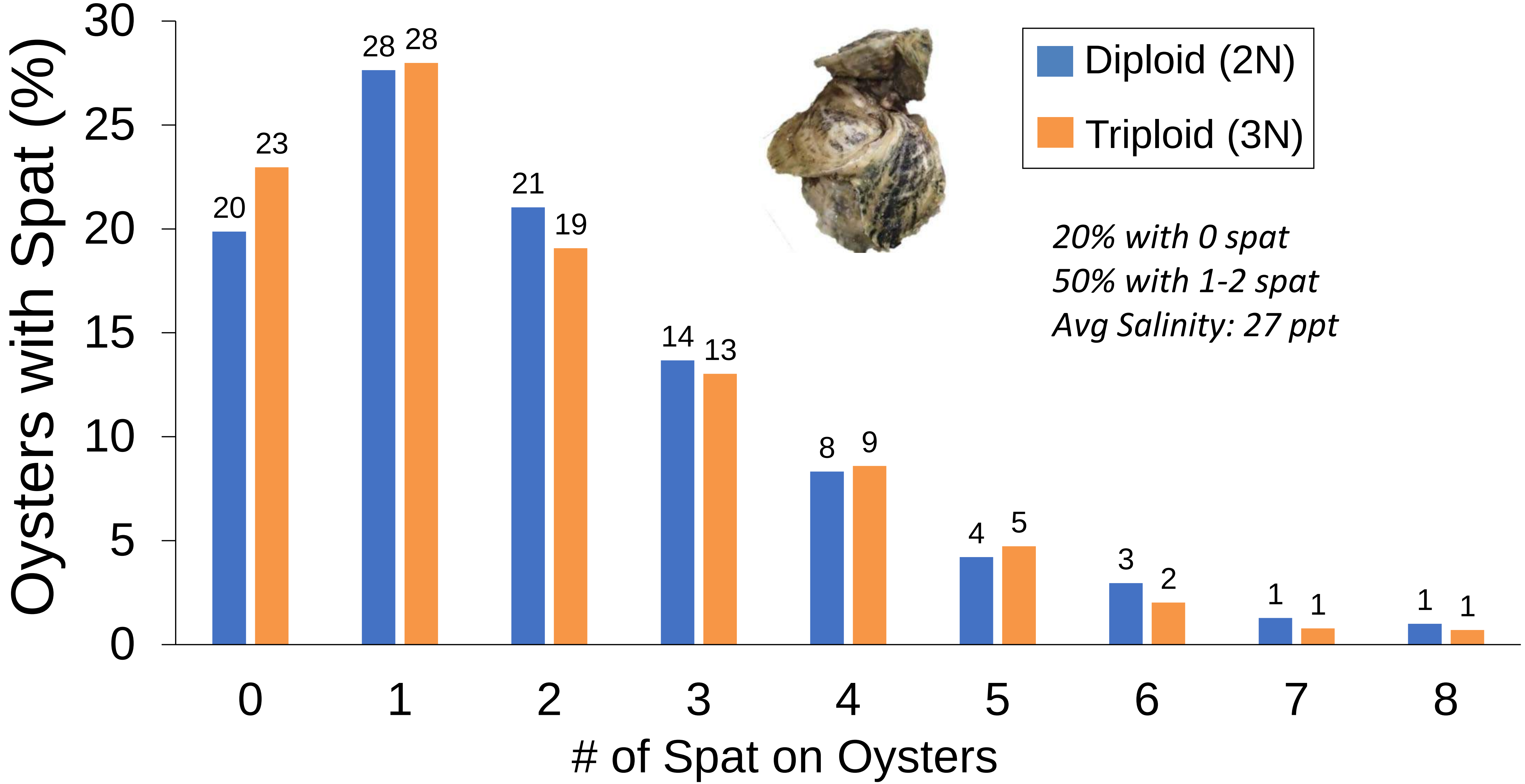


TRIAL 1: Stocking Density Results





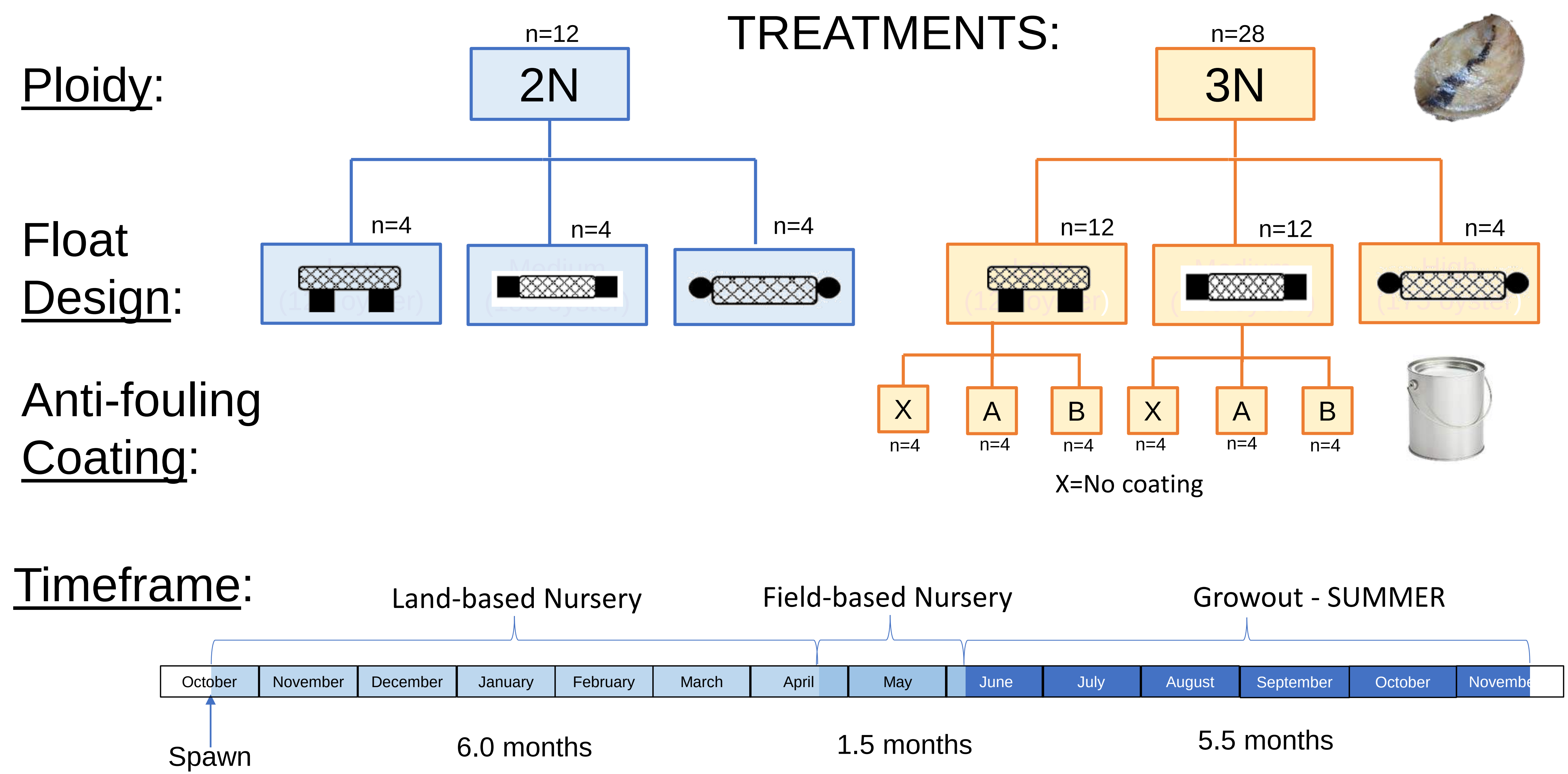
TRIAL 1: Biofouling at Harvest



TRIAL 1: Biofouling at Harvest

98% of oysters were saleable after culling

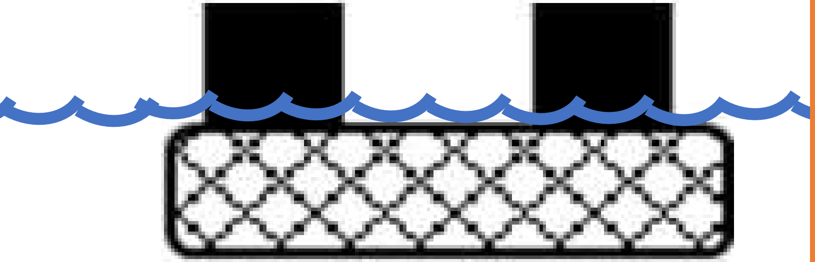
GROWOUT TRIAL 2: Jun 2017—Nov 2017



TRIAL 2: Jun 2017—Nov 2017

Float Type and Placement

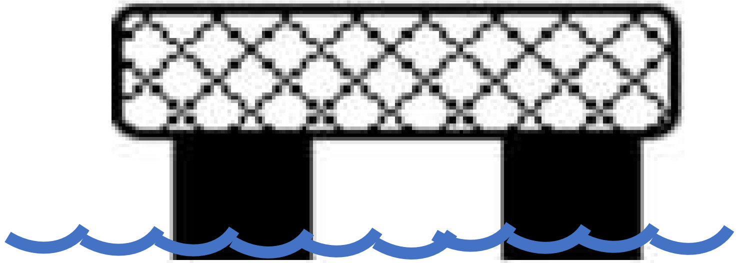
Square - Top



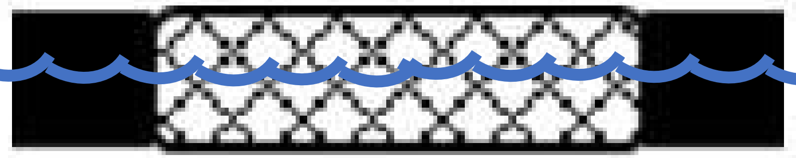
Requires "UNflipping"

Allows air drying

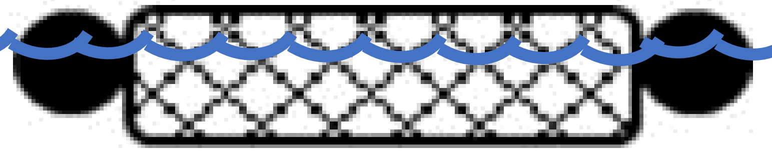
Less fouling?



Square - Side



Bullet - Side

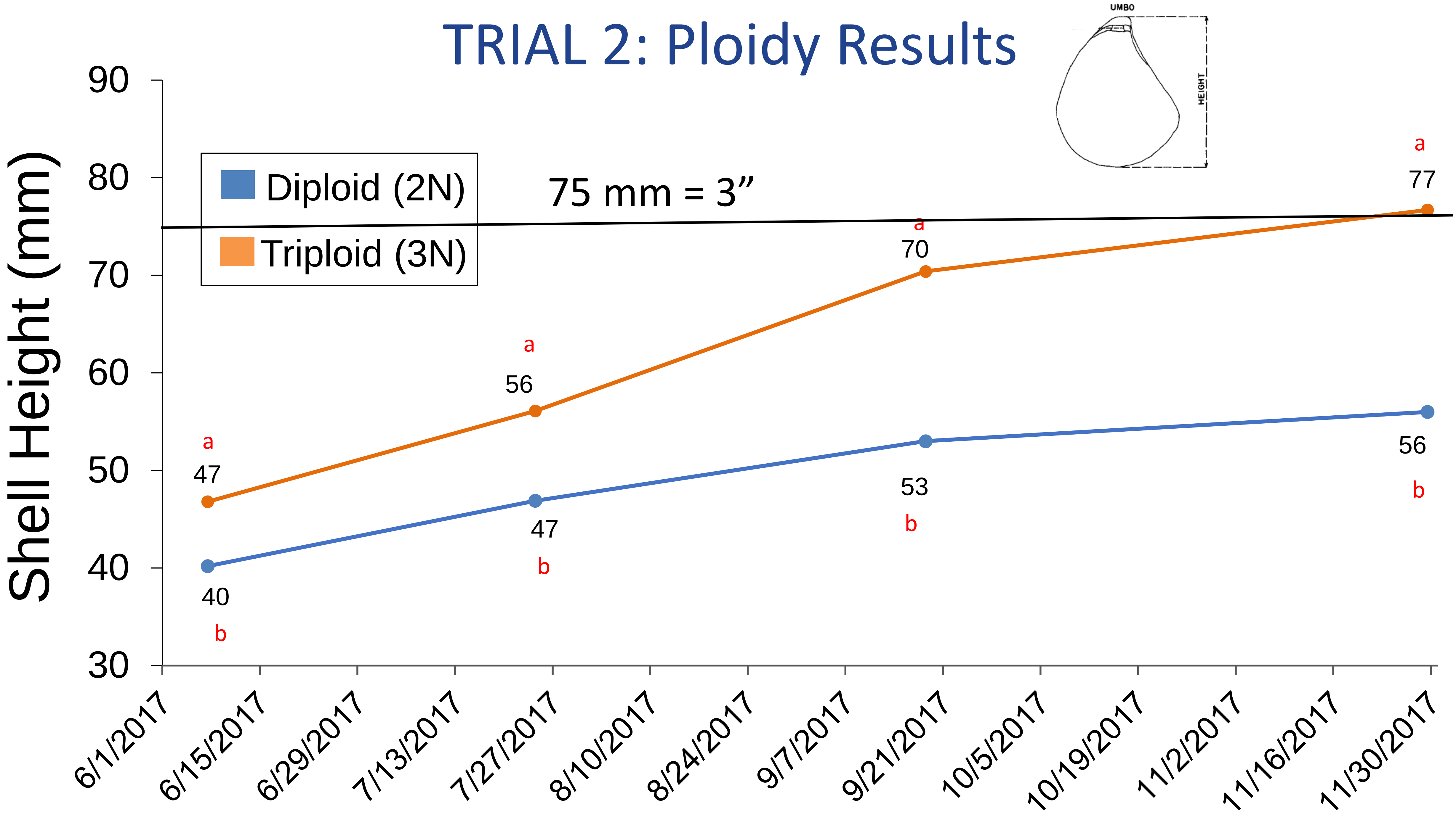


Does NOT require "UNflipping"

Less labor

Less $

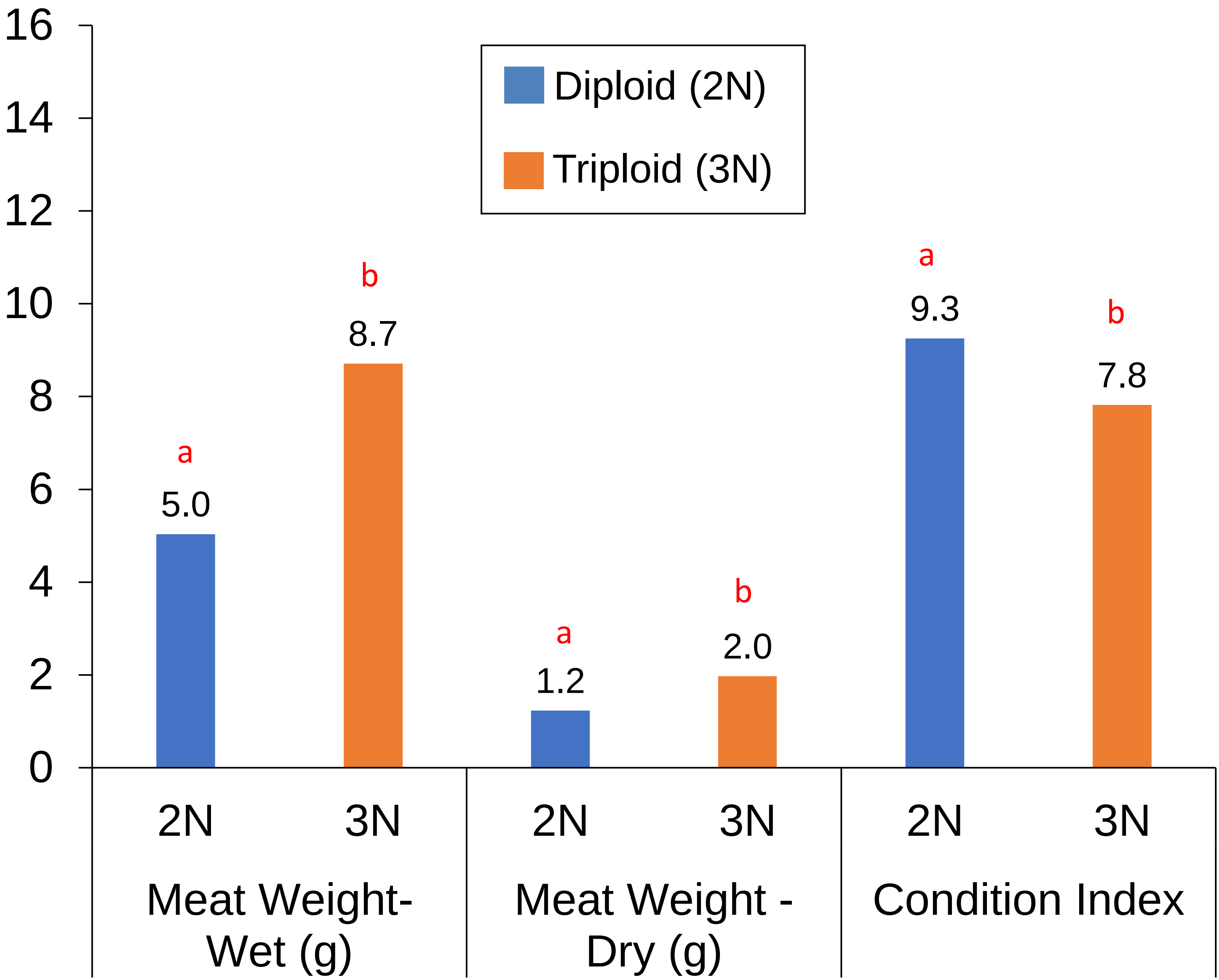
TRIAL 2: Ploidy Results



Statistical analyses performed on growth of each metric (α=0.05)

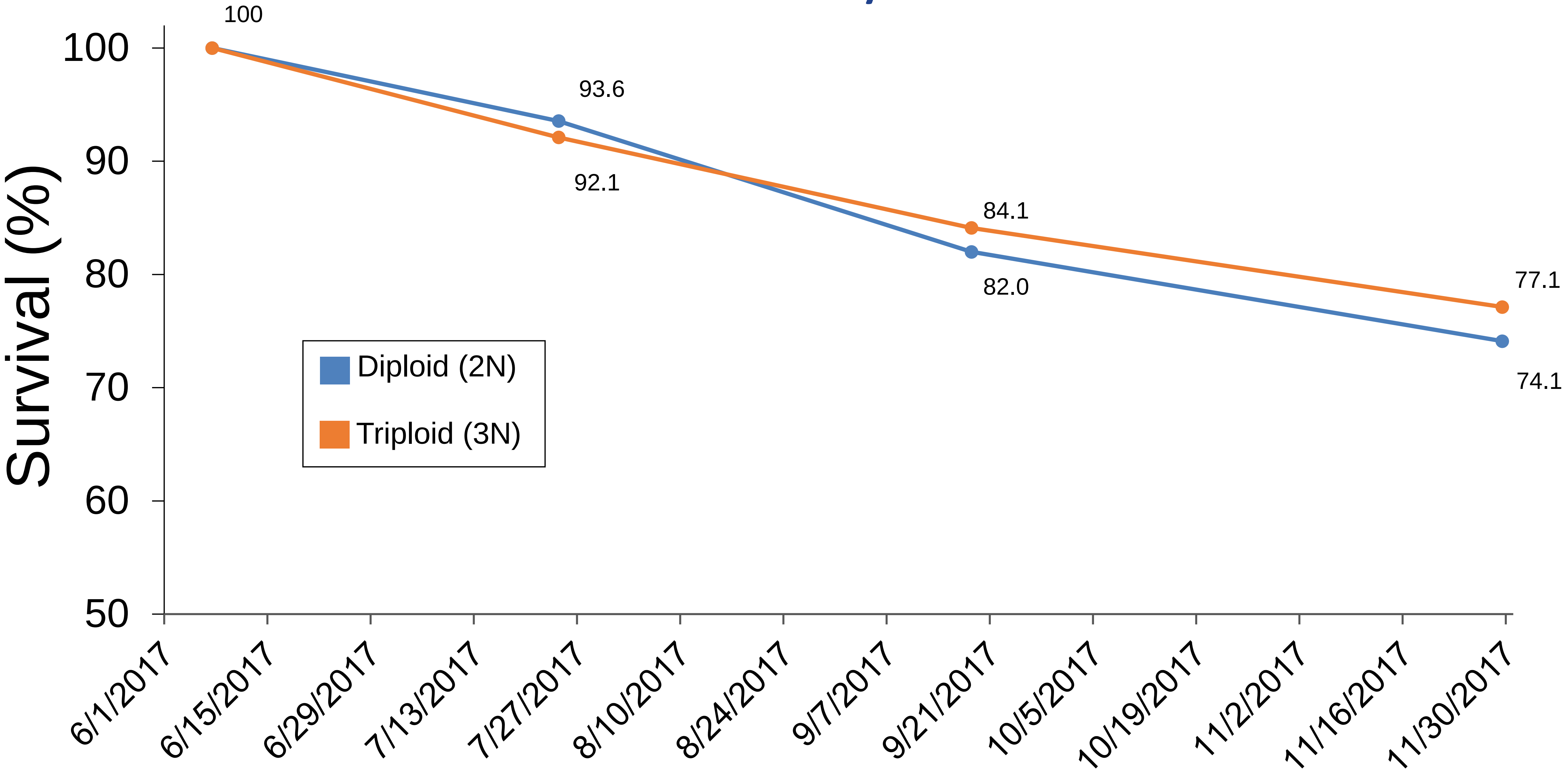
TRIAL 2: Ploidy Results

2N 3N

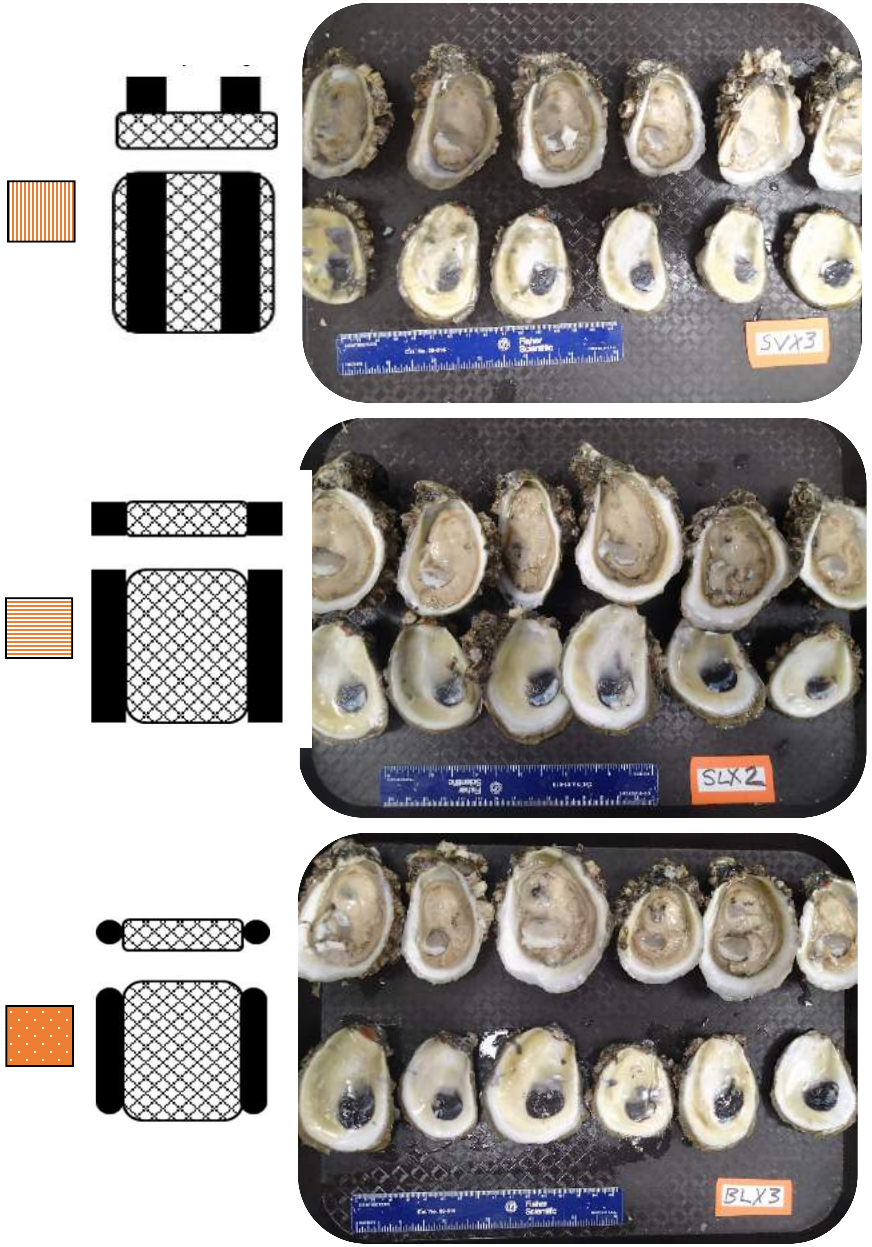


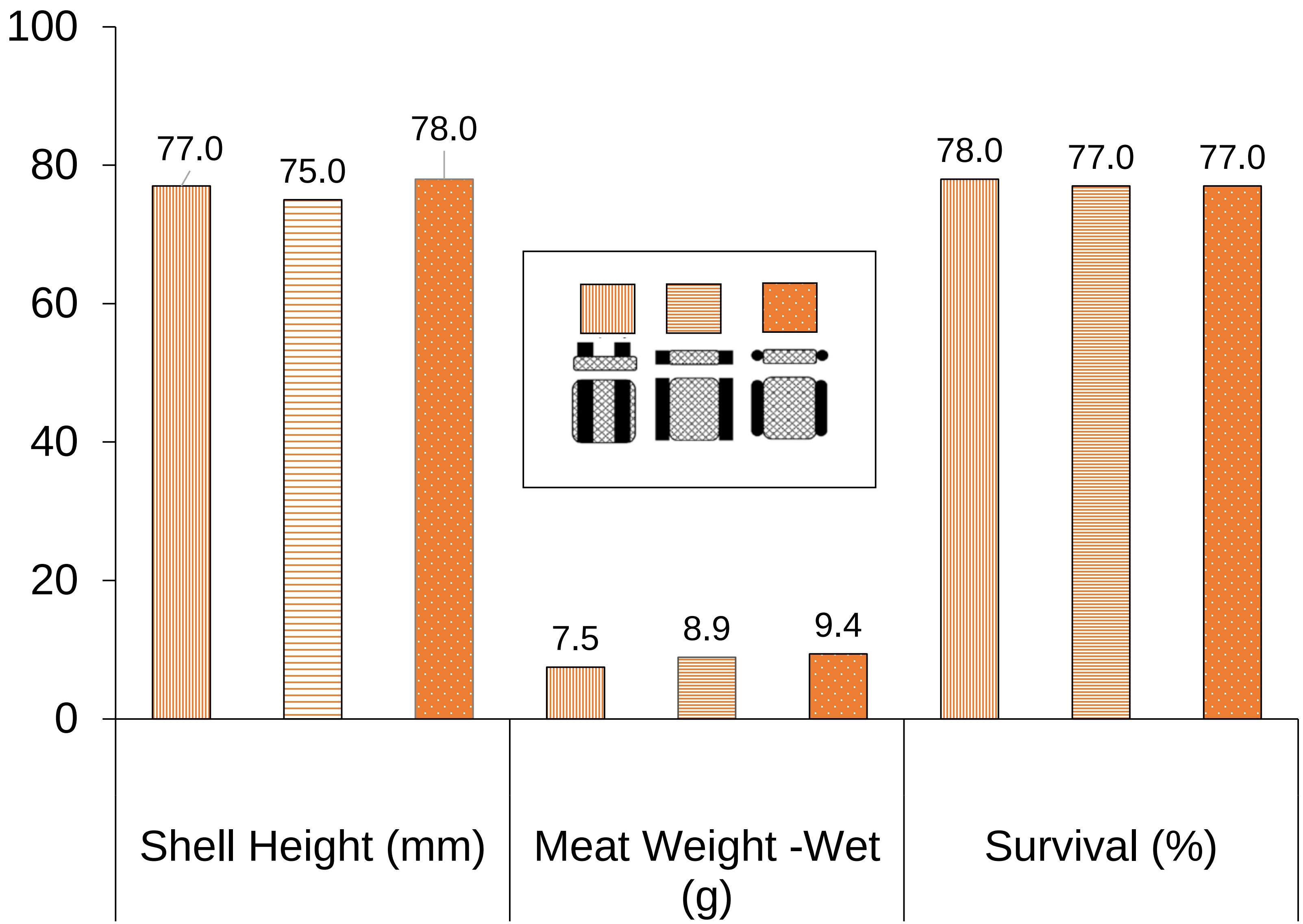
Statistical analyses performed on growth of each metric (α=0.05)

TRIAL 2: Ploidy Results

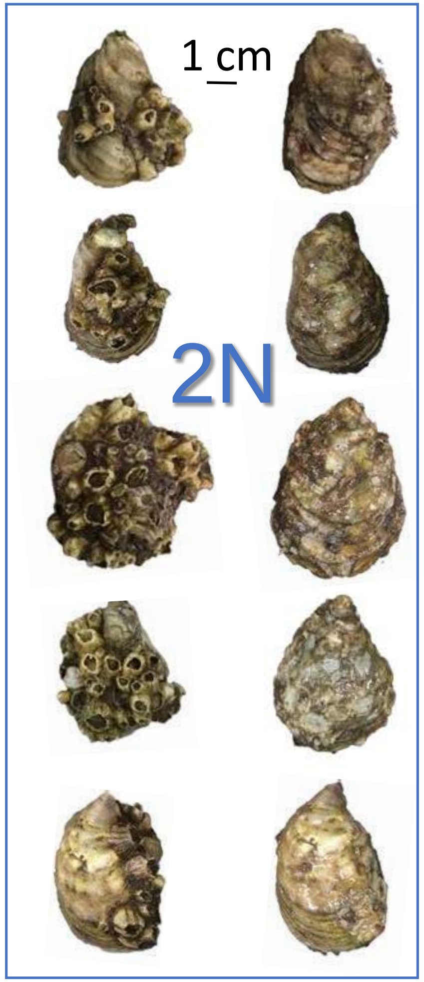


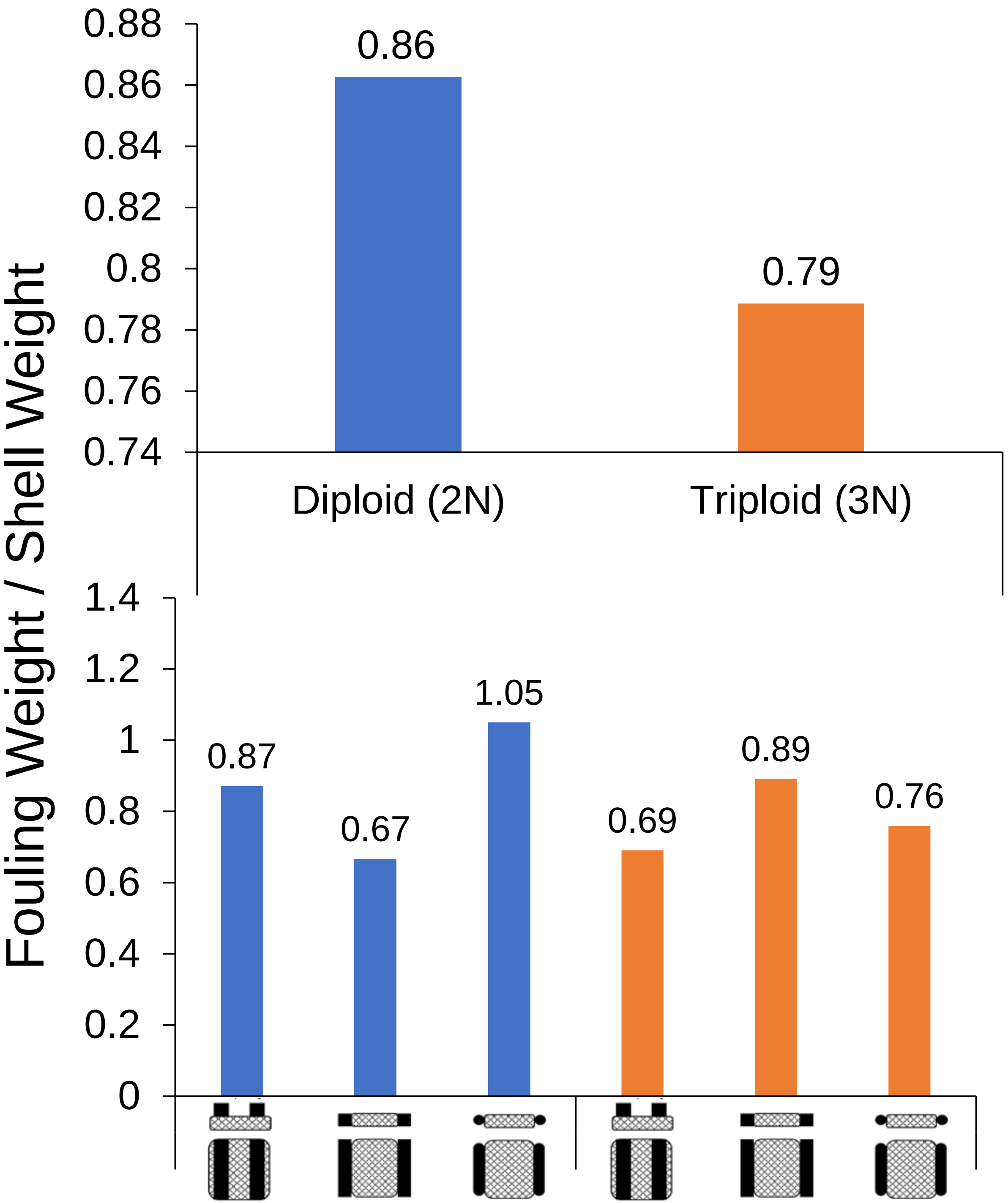
TRIAL 2: Float Design Results

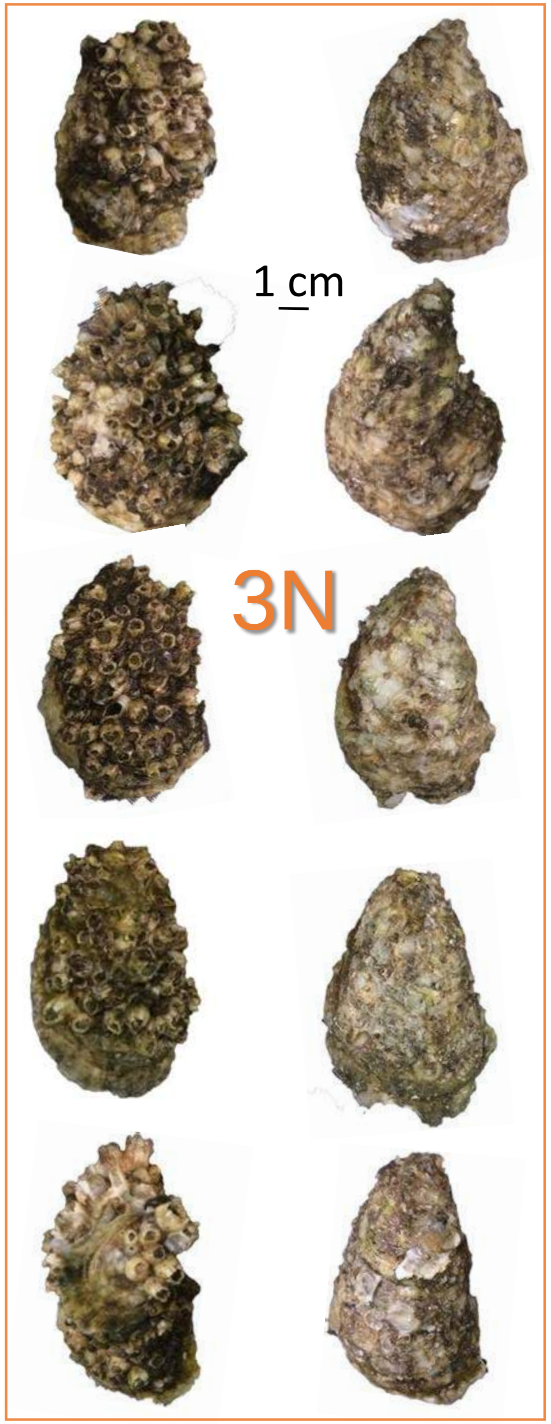




TRIAL 2: Biofouling

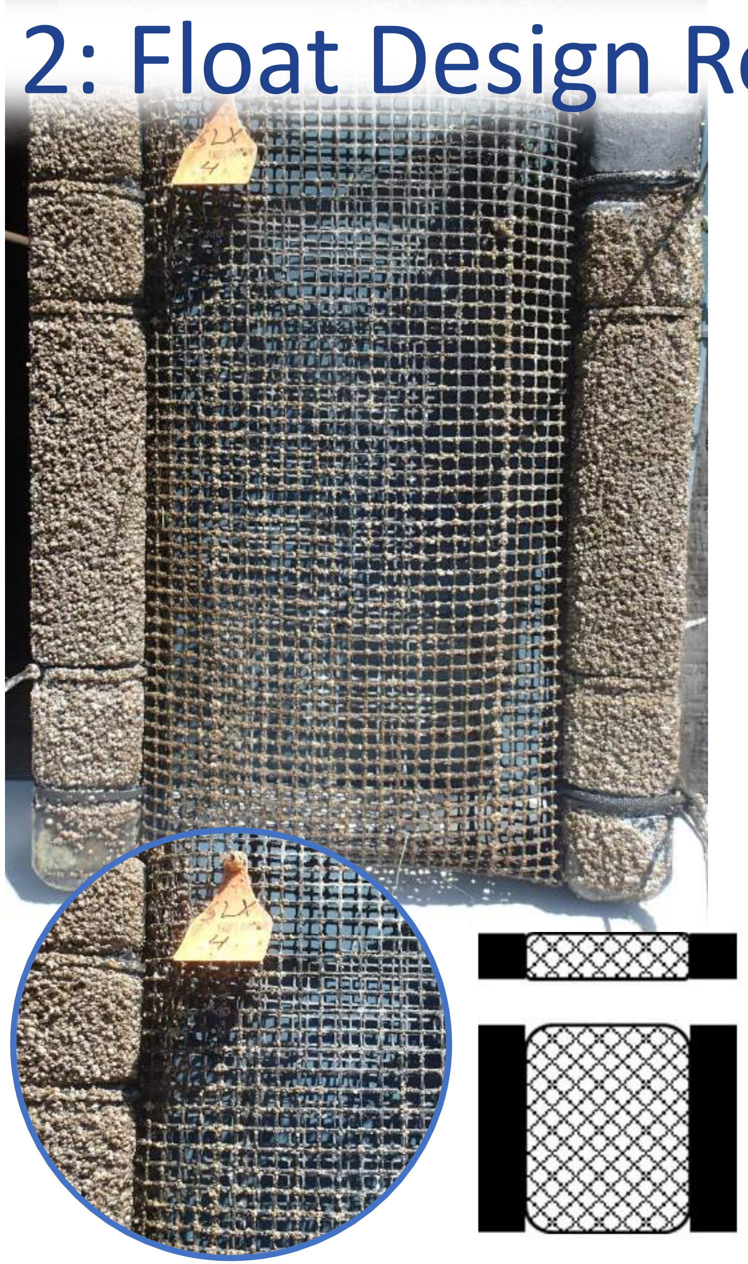




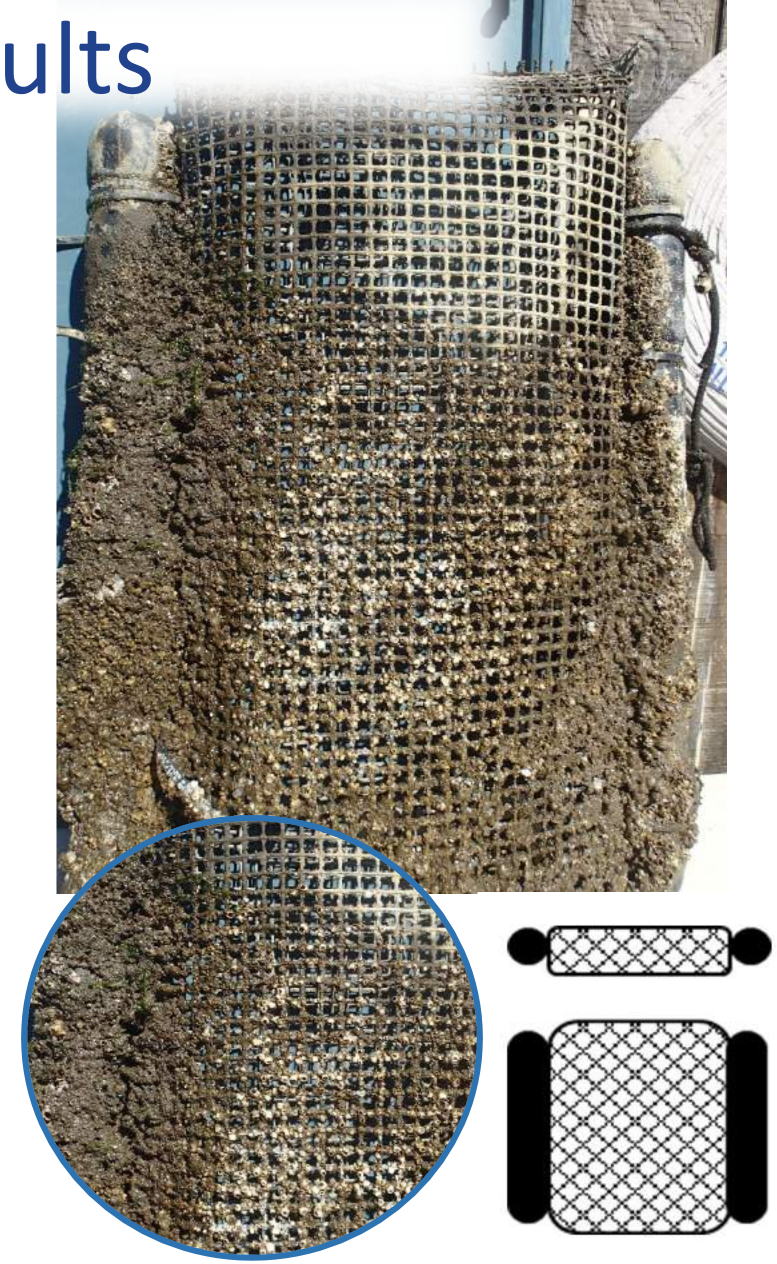


TRIAL 2: Float Design Results

Square-Top



Square-Side



Bullet

Avg Biofouling Weight on Bag:	Square-Top	Square-Side	Bullet
	17.9 ± 5.3 lbs [a]	1.3 ± 0.9 lbs [b]	7.3 ± 1.3 lbs [c]

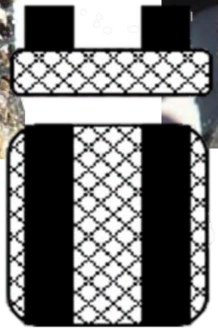
TRIAL 2: Float Design Results

TRIAL 2: Anti-fouling Coating Results

No Coating

Coating A

Coating B



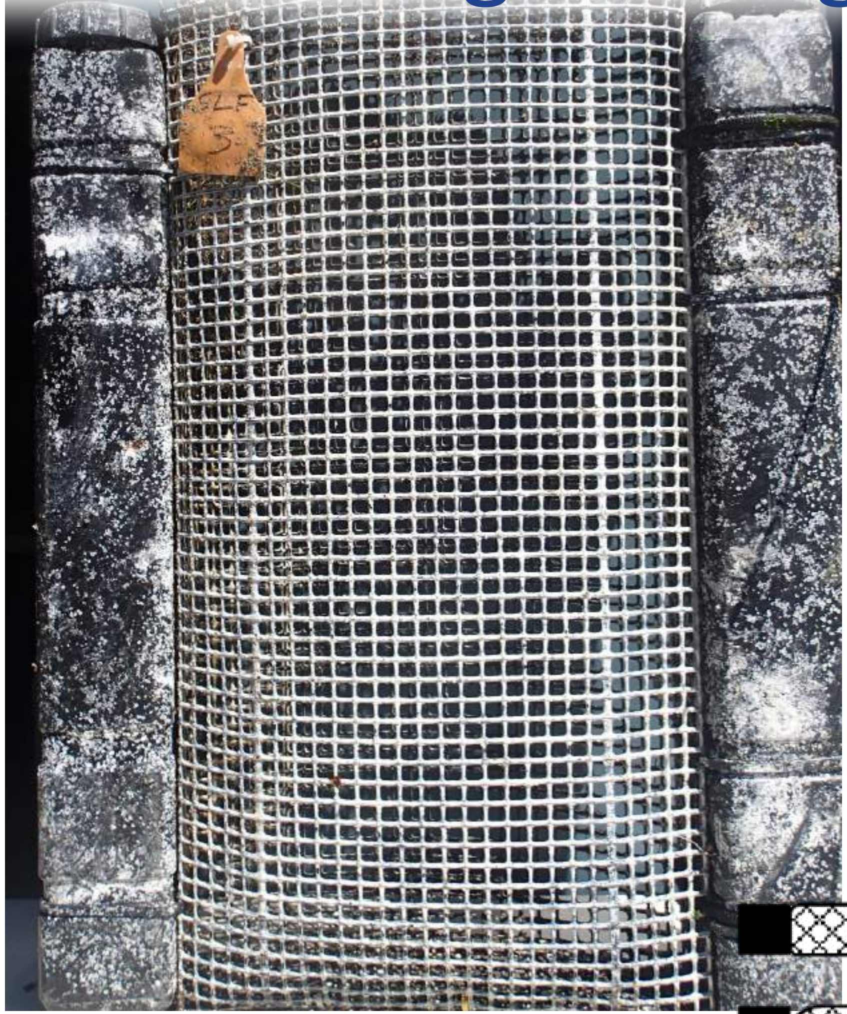
Square-Top

Avg Biofouling Weight on Bag : 17.9 ± 5.3 lbs | 14.1 ± 4.9 lbs | 8.6 ± 4.0 lbs

TRIAL 2: Anti-fouling Coating Results

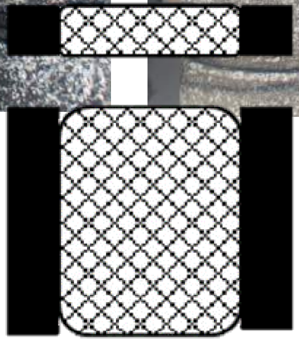
No Coating

Avg Biofouling Weight on Bag: 1.3 ± 0.9 lbs



Coating A

0.7 ± 0.4 lbs

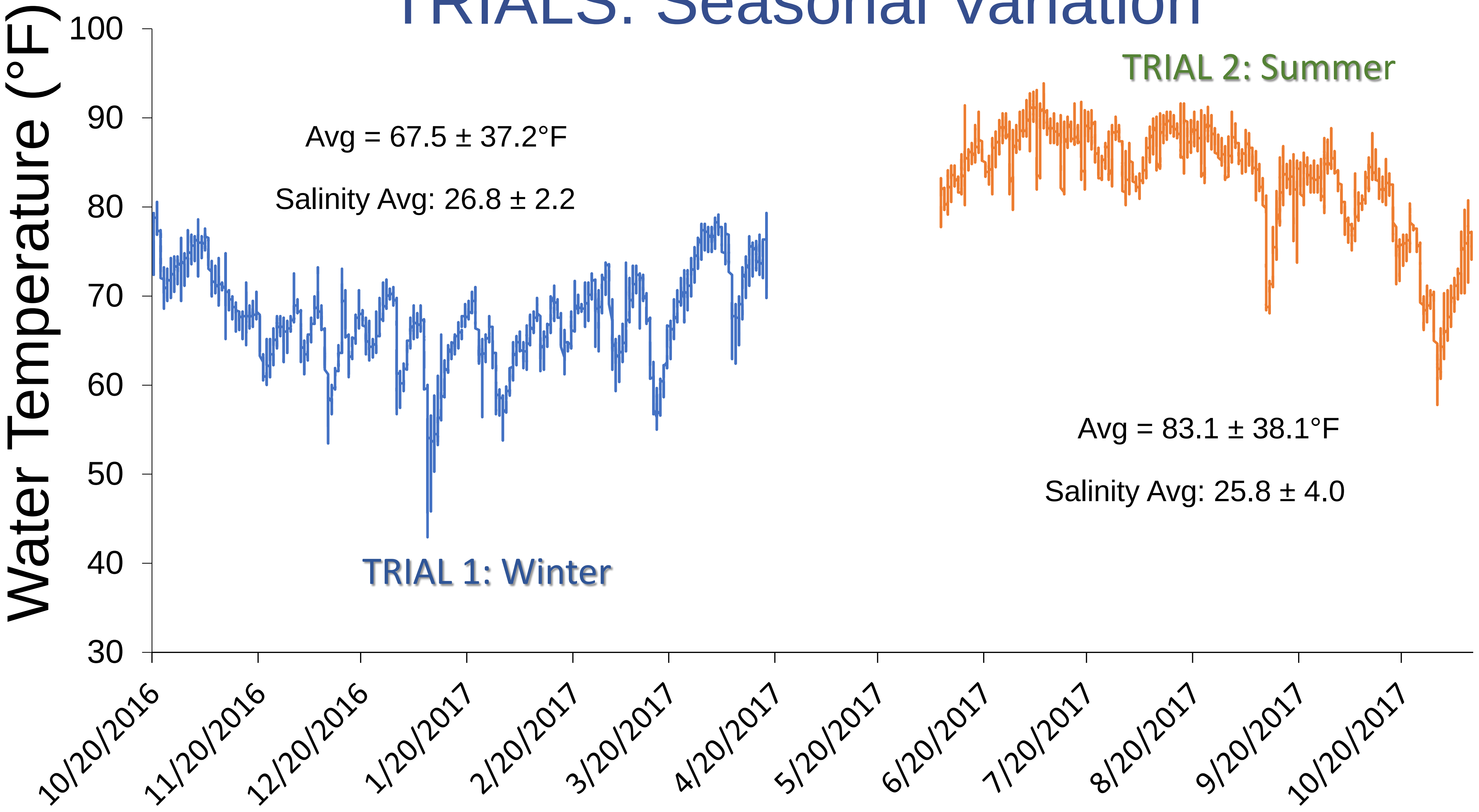


Square-Side

Coating B

0.8 ± 0.3 lbs

TRIALS: Seasonal Variation



TRIALS: Seasonal Variation

	Diploid (2N)		Triploid (3N)	
	Trial 1	Trial 2	Trial 1	Trial 2
Shell Height (mm)	76	56	83	77
Meat Weight (g)	9	5	13	9
Survival (%)	98	74	90	77

Trial 1: August-April (over winter)
Trial 2: April-November (over summer)

SENSORY EVALUATION

- Conducted by Dr. Charles Sims,
  UF Aquatic Foods Pilot Plant
- Panelists (n=75) received raw oysters to evaluate sensory attributes and consumer acceptance (blind test)
- Two Trials: May 2017 and February 2018

SENSORY EVALUATION

- Panelists rated attributes on a 9-point scale: 1=dislike extremely, 5=neither like nor dislike, 9=like extremely
- Data subjected to statistical analysis

Attribute	Trial 1-May 2017		Trial 2-Feb 2018	
	Diploid	Triploid	Diploid	Triploid
Meat Appearance	6.1	6.8	6.3	6.7
Texture	6.5	6.9	6.8	7.0
Flavor	6.4	6.8	7.0	6.8
Acceptability	6.3	6.8	6.8	7.0

SENSORY EVALUATION

- Results of Both Trials:
  - —3N rated higher in appearance and overall acceptability than 2N
  - —No differences in flavor, texture, or preference
  - —Trend that 3N was favored over 2N as almost all attribute averages were higher than 2N
  - —Winter ratings slightly higher than summer values

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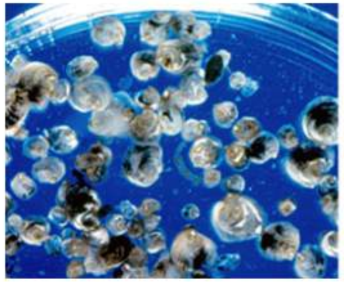


Oyster Farming Demonstration Project

Application of Triploidy to the Emergent Florida West Coast Industry

This project allows for large-scale demonstration and evaluation of an oyster breeding process to local conditions on Florida's west coast by oyster growers. The objectives are two-fold:

1. Document production performance, assess health, and evaluate the quality (sensory characteristics) of diploid (2N) and triploid (3N) oysters under commercial conditions, and
2. Quantify the effects of different culture methods, salinity regimes, and seasonal harvests.

SCOPE OF WORK: Oysters from two ploidy types (triploids – 3N and diploids – 2N) and two seasonal spawns (spring and fall) are being provided to certified growers, who have obtained approval from DACS to culture oysters on their shellfish aquaculture leases. Eleven growers in four west coast counties (Charlotte, Franklin, Levy, and Wakulla) are using a variety of culture systems (floating bags, bottom cages, and adjustable lone lines), which allows for evaluation of site and gear interaction on ploidy type. University of Florida (UF) faculty are also culturing oysters at their research lease off Cedar Key to document growth and survival and evaluate gear types, stocking densities, and antifouling coatings.

Follow this project by viewing the news blog posted at http://shellfish.ifas.ufl.edu

Seed Provided to Growers in July

July 27, 2016

Single-set triploid oyster seed were produced by crossing Cedar Key stocks with sperm from tetraploid stocks maintained at Louisiana Sea Grant's oyster hatchery. Read more

UF Plants Seed in August

September 14, 2016

Triploid and diploid oyster stocks were also planted by UF at their experimental lease located within the Dog Island Lease Area off Cedar Key on August 4. Read more

Hurricanes Impact Oyster Trials

October 7, 2016

After meandering around the Gulf of Mexico as a tropical depression, Hurricane Hermine gathered steam and headed straight for the Big Bend coast on September 2. Read more

UF Oyster Growout Study Initiated

November 1, 2016

This article summarizes the growth of diploid (2N) and triploid (3N) oysters cultured at the UF experimental lease within the Dog Island Lease Area near Cedar Key. Read more

Financial Characteristics and Risks

January 2017

Another component of the Oyster Culture Demonstration Project is to document economic costs and benefits associated with diploid versus triploid oyster production along the west coast of Florida. Read more

Sampling UF Field Trials

February 2017

A similar number of oysters provided to project participants were also cultured at the UF experimental lease off Cedar Key so that growth and survival could be documented bimonthly during growout. Read more

Harvesting Growers' Field Trials

March 2017

Ten growers in four west coast counties participating in this project received oyster seed (2500 of each ploidy type, 20-22 mm in shell height) during July 2016 to grow on their leases. Read more

Harvesting UF Field Trials

April 2017

Six months after seed oysters (average 25 mm in shell height) were stocked into 14 mm mesh Vexar bags (October 2016), they were harvested in April 2017 (12 months from spawn). Read more

Next Crop of Seed Distributed

April 2017

To quantify the effects of seasonal harvests on ploidy type, several spawns using tetraploid oysters held from the spring 2016 spawn were attempted in the fall. Read more

Consumer Evaluation of Oysters

May 2017

Oysters typically acquire their flavor from their growing environment and are frequently named after their harvest location. Read more

New UF Growout Study Initiated

June 2017

The second phase of the demonstration project evaluates the performance of diploid and triploid oysters planted in early spring. Read more

Sampling UF Field Trials

September 2017

As in the first phase of the demonstration project, oysters were also cultured at the UF experimental lease off Cedar Key in the second phase. Read more

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