VIRGINIA AQUACULTURE CONFERENCE

VIRGINIA'S PREMIER GATHERING OF AQUACULTURE PROFESSIONALS

PRESENTED BY

VIMS | William & Mary
Virginia Institute of Marine Science

Sea Grant
Virginia

PLATINUM SPONSORS

Farm Bureau Virginia

Cherrystone Aqua-Farms
Premium clams and oysters.

FLIP Farm
FLIPFARM Systems Ltd

Virginia Agricultural Experiment Station
Virginia Seafood Agricultural Research and Extension Center
Virginia Tech

oceanfarmr

Update on OsHV1: C. virginica challenges and seed screening

Kimberly S. Reece, Jessica M. Small, Ryan B. Carnegie, M. Victoria Agnew, Gail P. Scott, Alanna MacIntyre, Shelly Katsuki and Colleen A. Burge

The University of Arizona
Dr. Arun Dhar, OIE Reference Lab for Shrimp Diseases

OsHV-1 Disease (POMS, oyster herpes virus)

- OsHV-1 virus causes mass mortalities of the Pacific oyster, *Crassostrea gigas*, but host range is not restricted to Pacific oysters (bay scallop, green crab and others)
- Disease progresses rapidly and can kill up to 100% of *C. gigas* larvae and juveniles
- Multiple variants including highly virulent microvariants (µvars).
- µvars spread rapidly throughout Europe starting around 2008, into Australia, New Zealand and Asia. Was recently found on the US West Coast (San Diego).
- Is there a risk to the East/Gulf coast shellfish industry?
- Does NOT cause human disease

Reviewed in Pernet et al 2016, Arzul et al 2017, Burge et al 2018

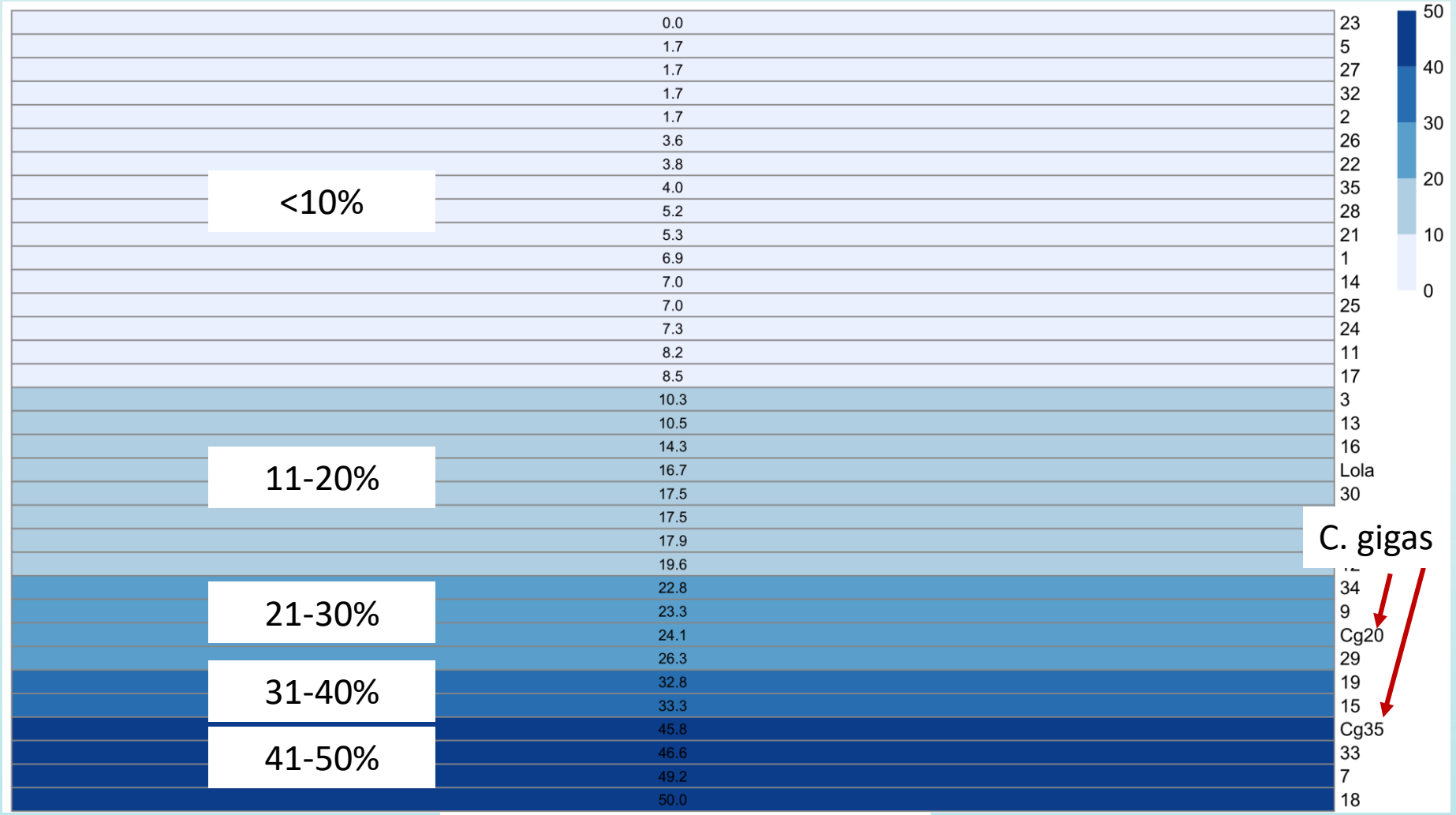
Objectives- Eastern oysters

1. Challenged spat from 30 *Crassostrea virginica* families and two lines with the French µvar: survival and viral loads.

2. Challenged juveniles from 8 families with the French and San Diego µvars: survival and viral loads.

3. Survey spat from research hatcheries on the East and Gulf coasts to determine whether OsHV-1 is currently present.

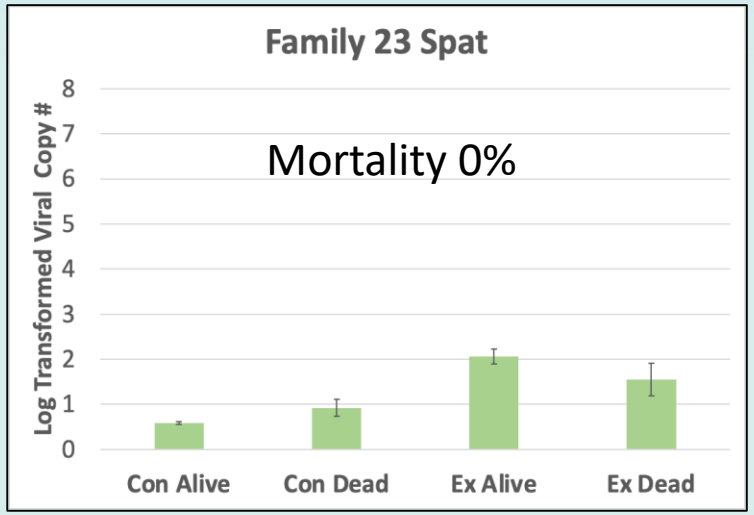
Cumulative mean mortality of Eastern oyster spat

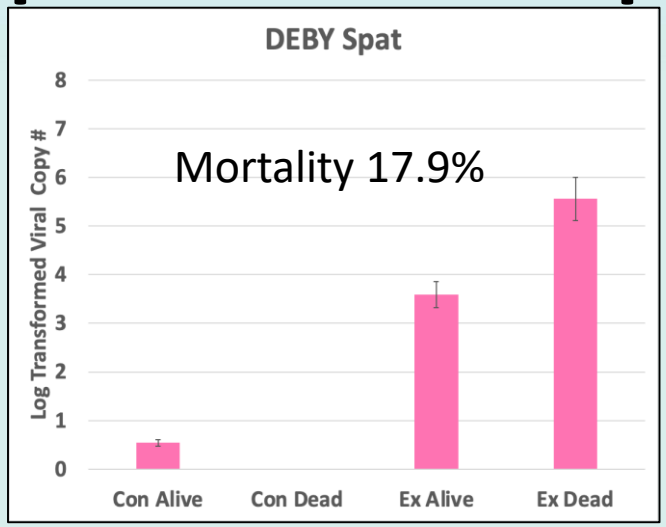


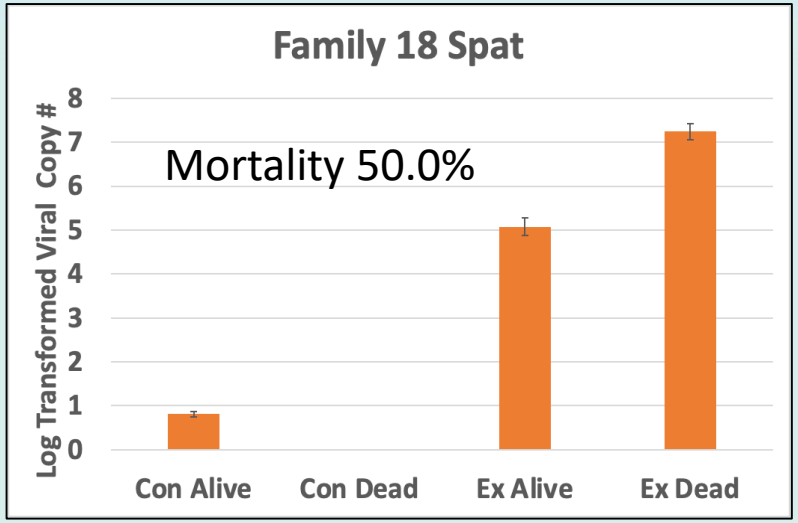
Mean cumulative mortality

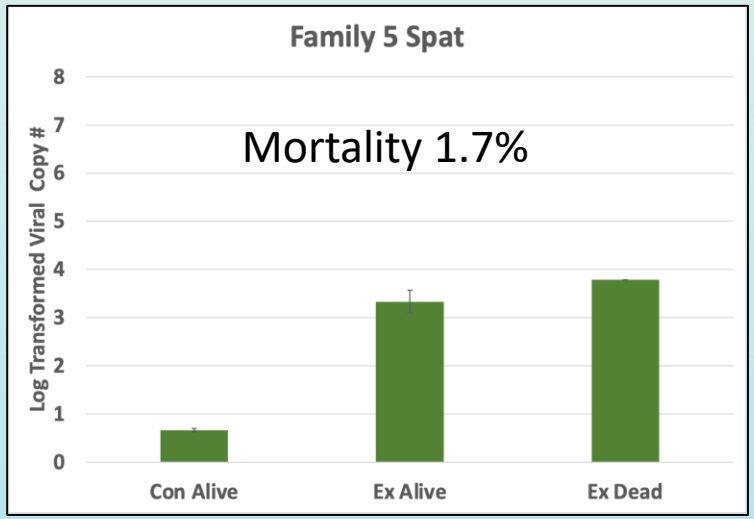
7 day trial by bath exposure

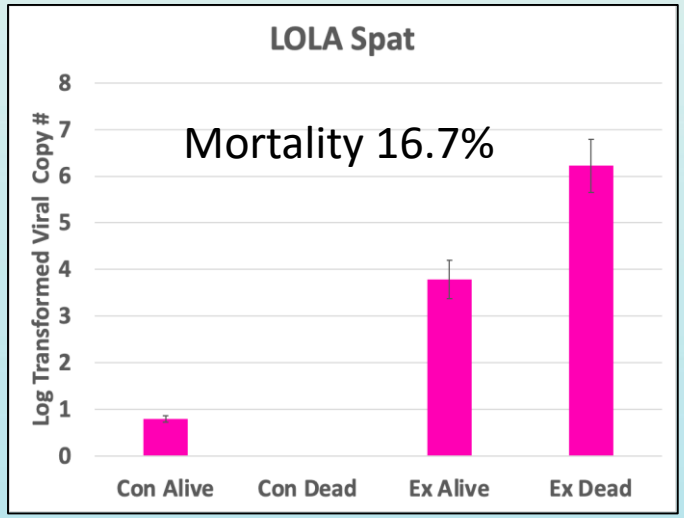
qPCR Results - Spat

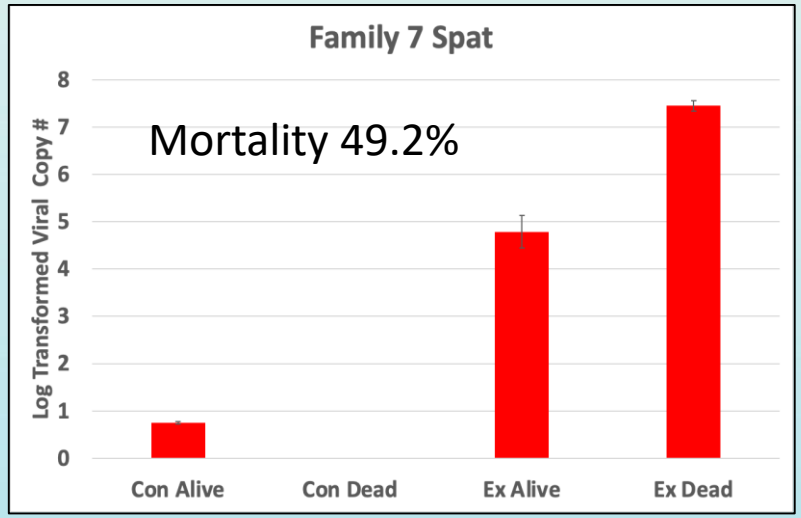




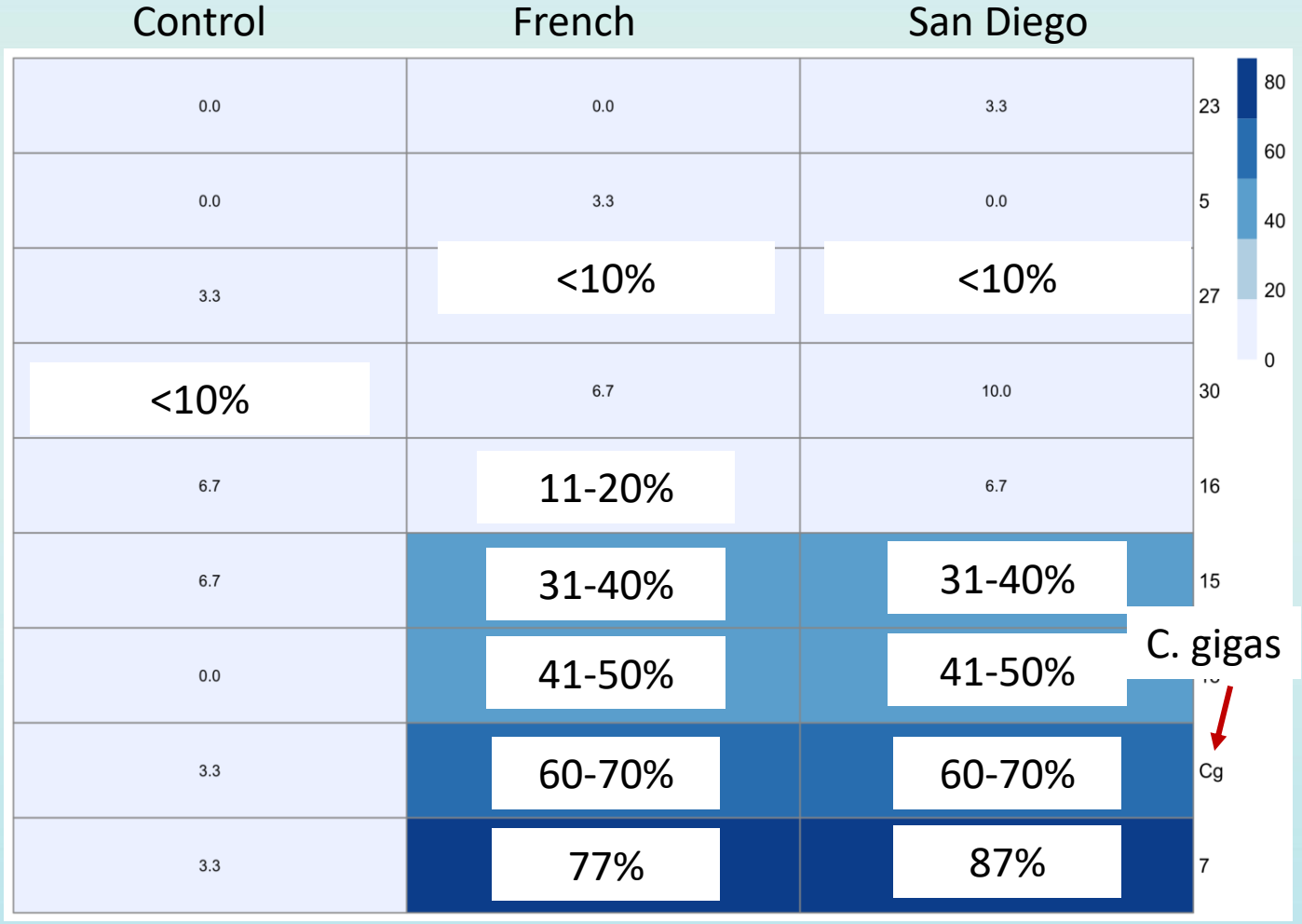








Mortality of juveniles (pattern similar to spat)

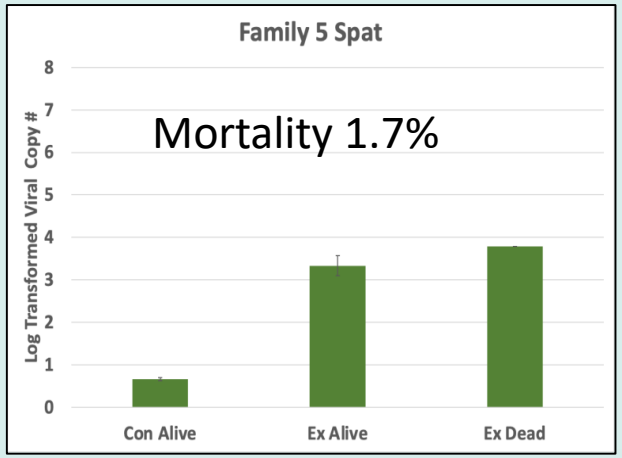


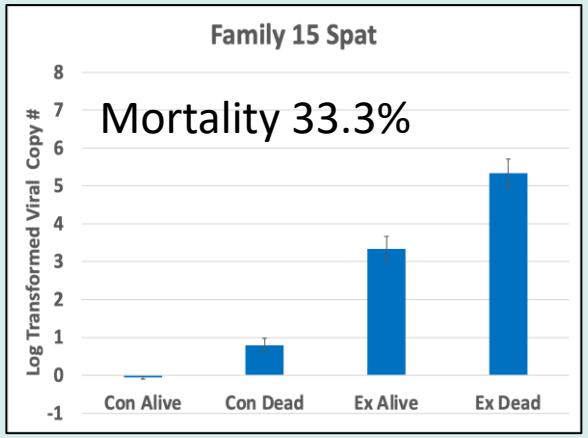
Mean cumulative mortality

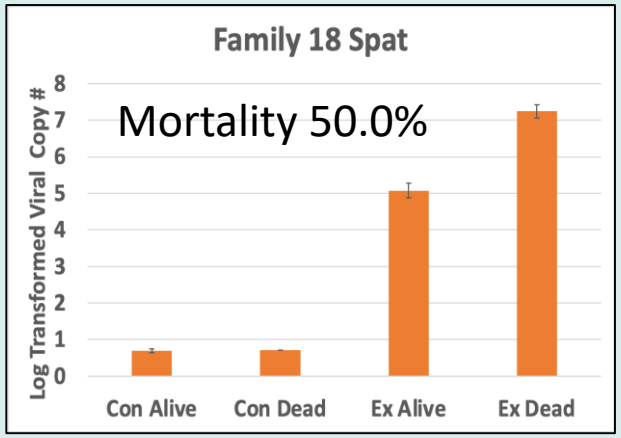
10 day trial by injection

Spat and Juveniles: Viral loads comparable within families

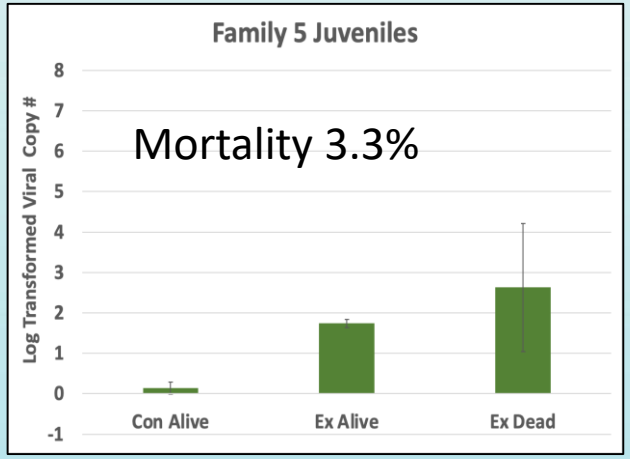
SPAT

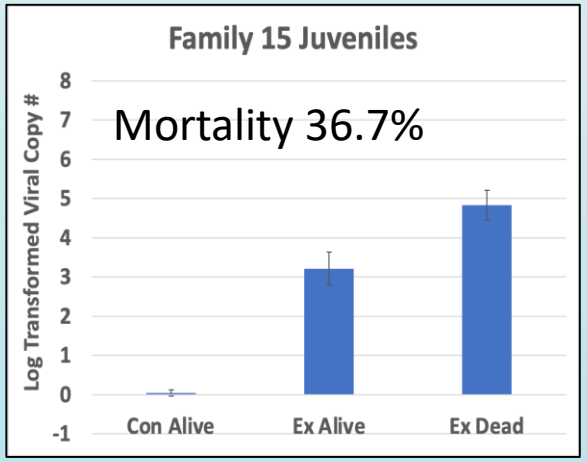


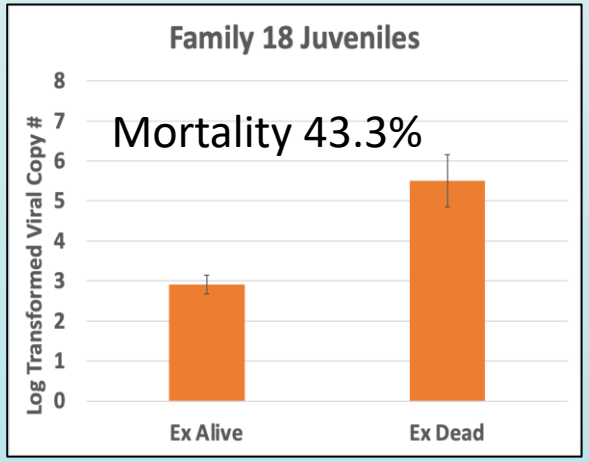




JUVENILES

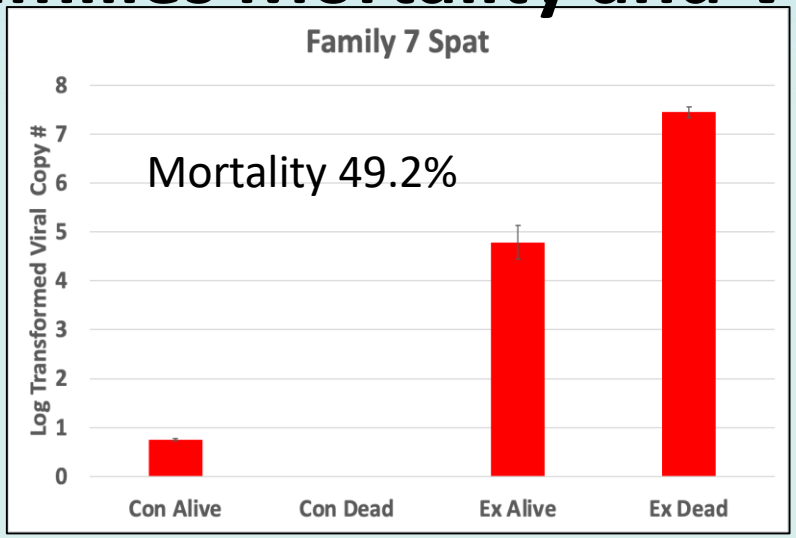


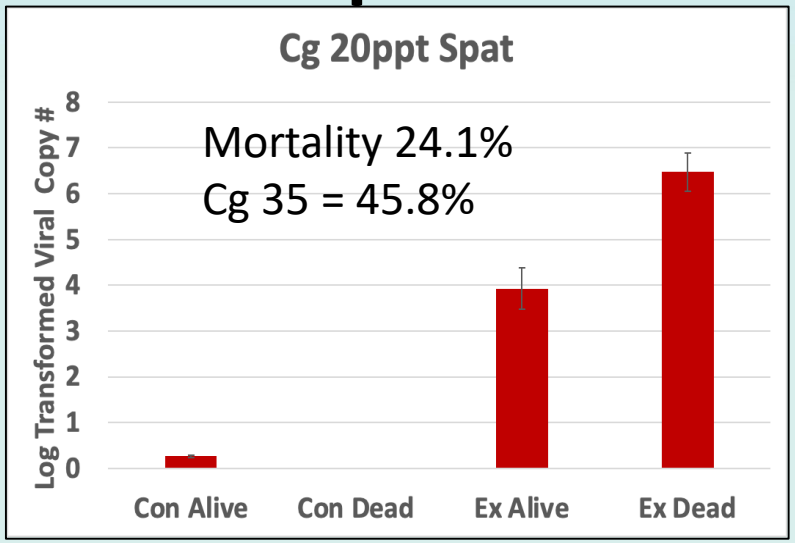




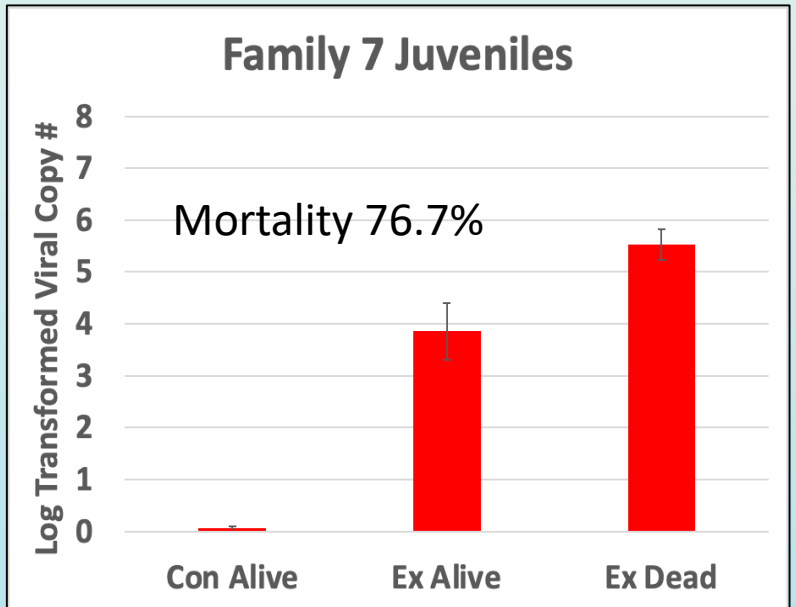
Some Families Mortality and Viral Load Comparable to Pacific oysters

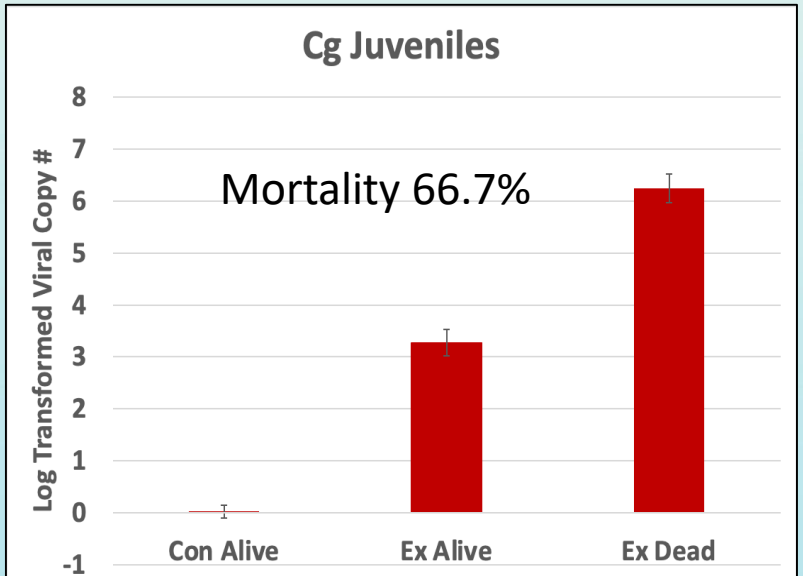
SPAT





JUVENILES





Screening Seed from MD, VA, NC

Research hatchery samples screened to date

- 1 in MD
- 1 in VA
- 2 in NC

All samples negative!!

Still to be tested

- CT
- MS
- FL
- NY
- AL

The Bottom Line

Good News!

- No OsHV-1 virus has been detected on the US East or Gulf coasts
- Eastern oysters demonstrate genetic potential for tolerance to these viruses (breeding for resistance is possible)

Lessons Learned-CAUTION!

- Eastern oysters can be infected and transmit OsHV-1 µvars: some lines/families highly susceptible
- Vigilance is required to prevent introduction
- Additional research is being done on clams and bay scallops

VIMS | William & Mary
Virginia Institute of Marine Science

Sea Grant
Virginia

VIRGINIA AQUACULTURE CONFERENCE

LIGHTNING TALKS

Water Parameters in Oyster Bags Affected by Culture Practices

By: Julianne Grenn and William Walton

VIMS | William & Mary
Virginia Institute of Marine Science

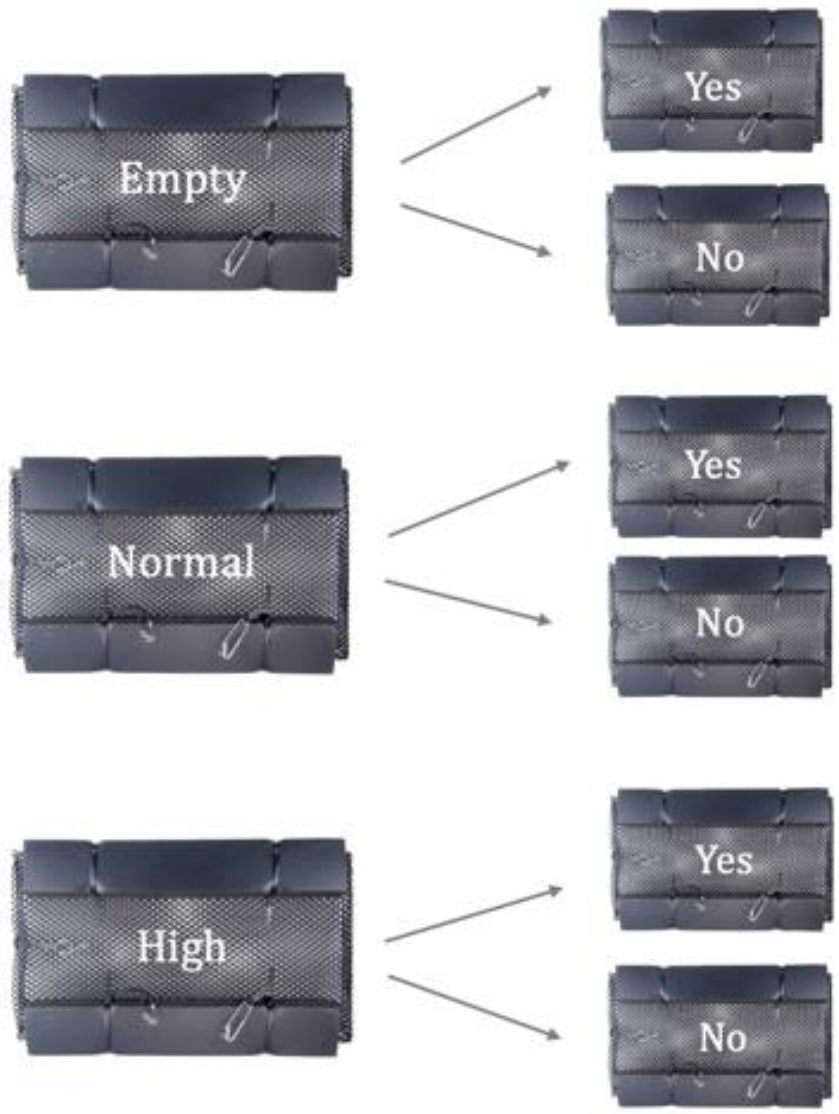
Sea Grant Virginia

Background

- Farmers assess ambient water on farms
  - Handheld devices
  - Local water monitoring station
- Informs everyday decisions
- Is this data representative?

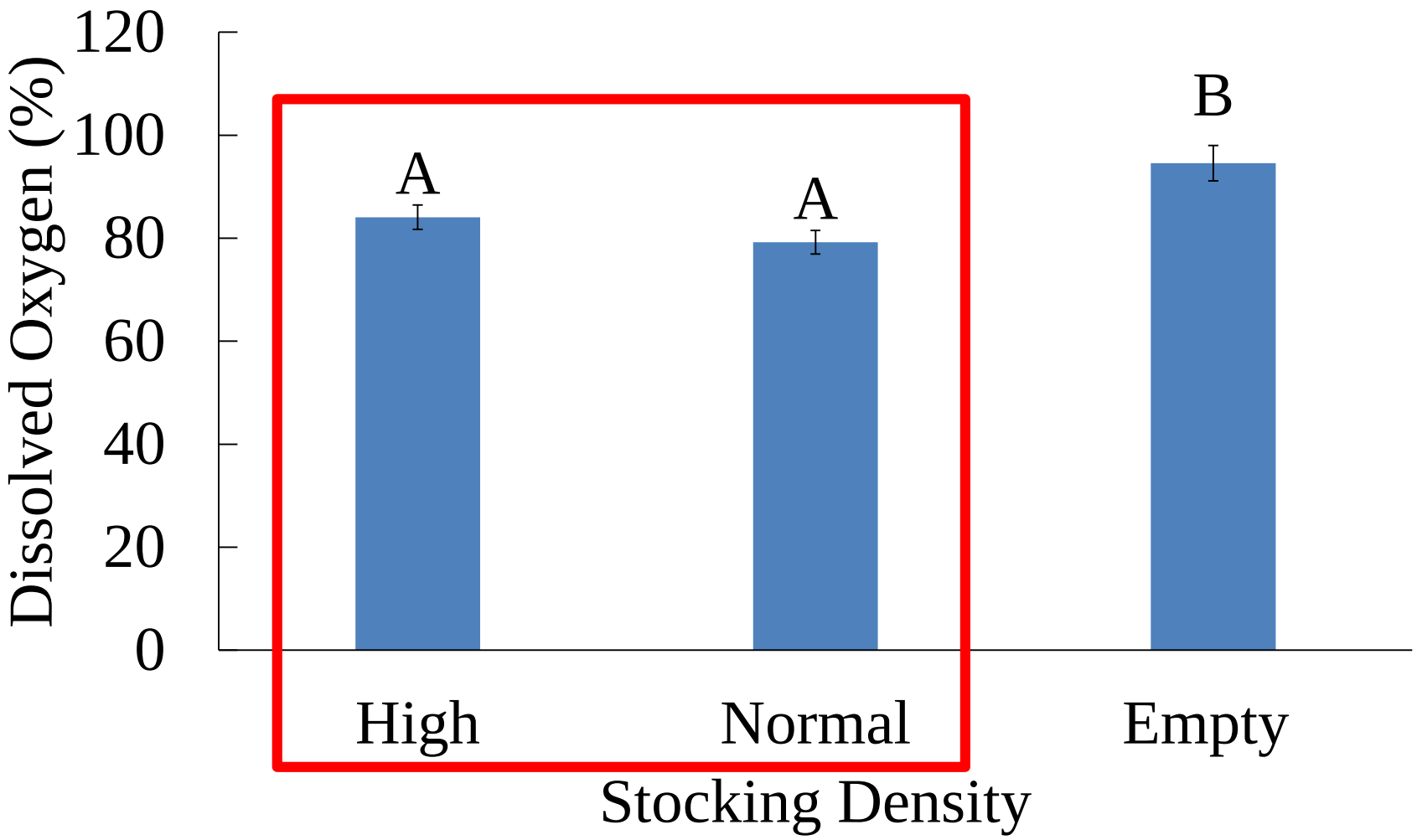
Question

Do biofouling control (air-dried vs. not air-dried) and oyster stocking density (high, normal, and empty) decisions affect the microclimate (water parameters) inside grow-out bags?


Empty
Yes
No
Normal
Yes
No
High
Yes
No

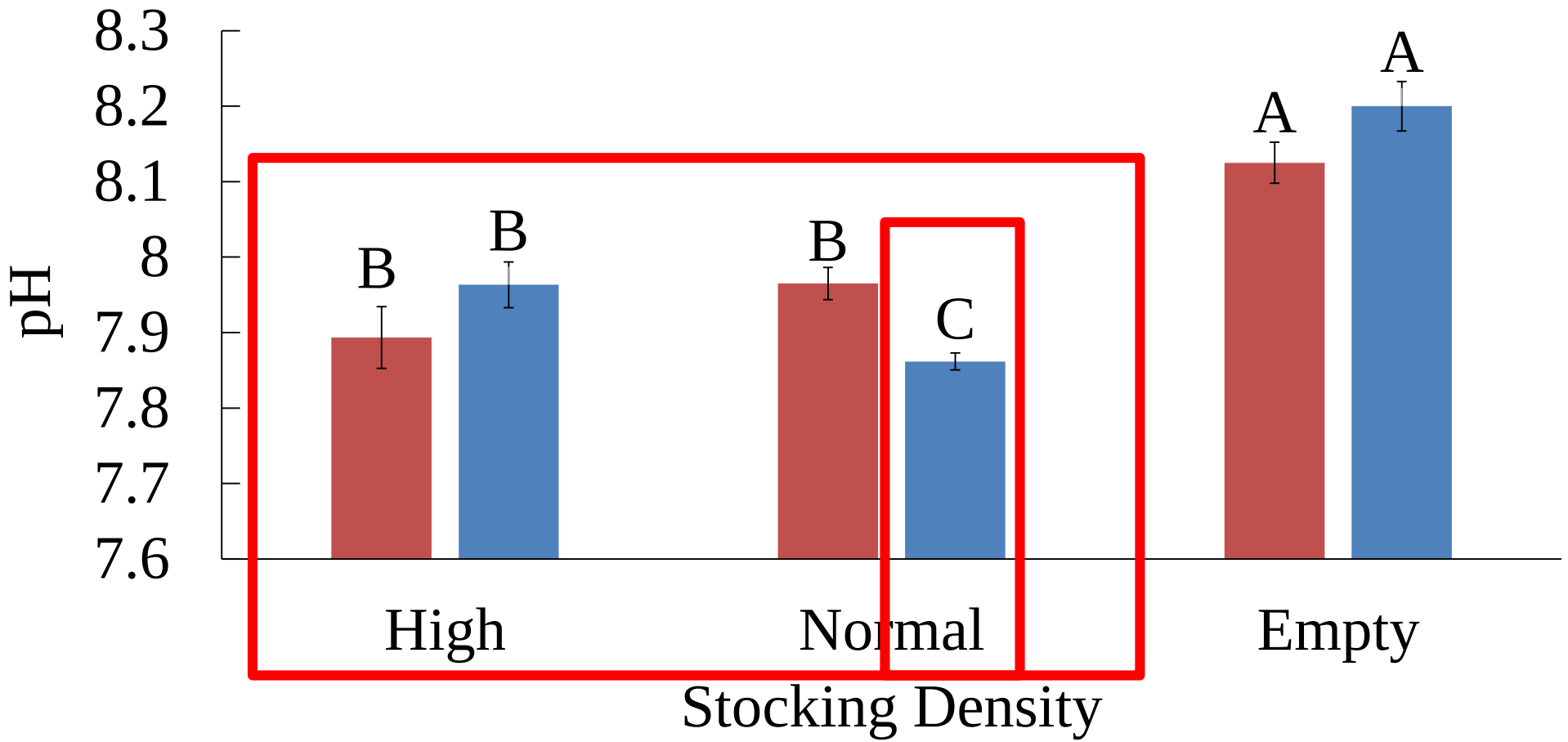
Collect water samples from inside each bag

Dissolved Oxygen and Stocking Density



$p \leq 0.01$

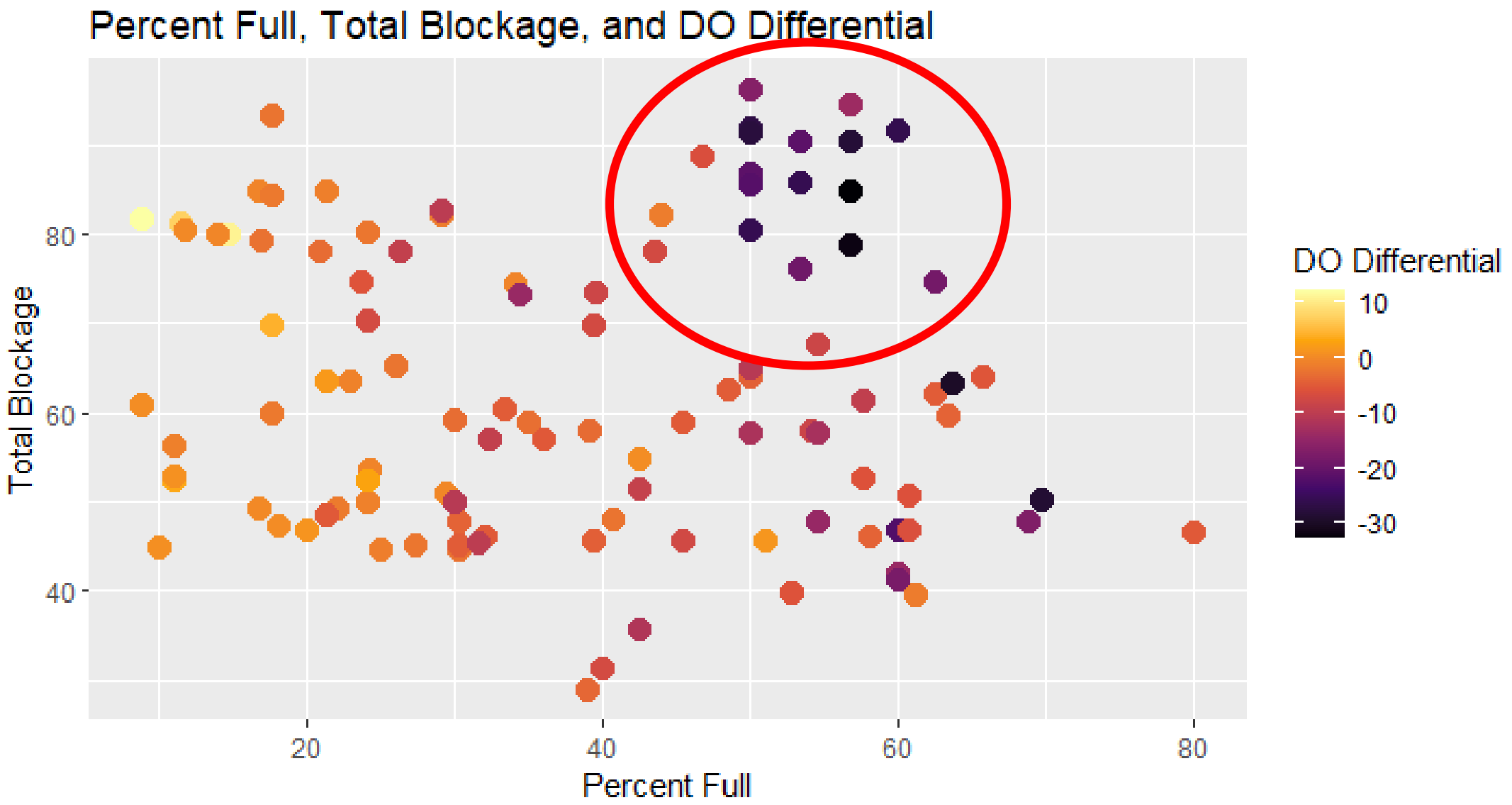
pH and Interaction Effect

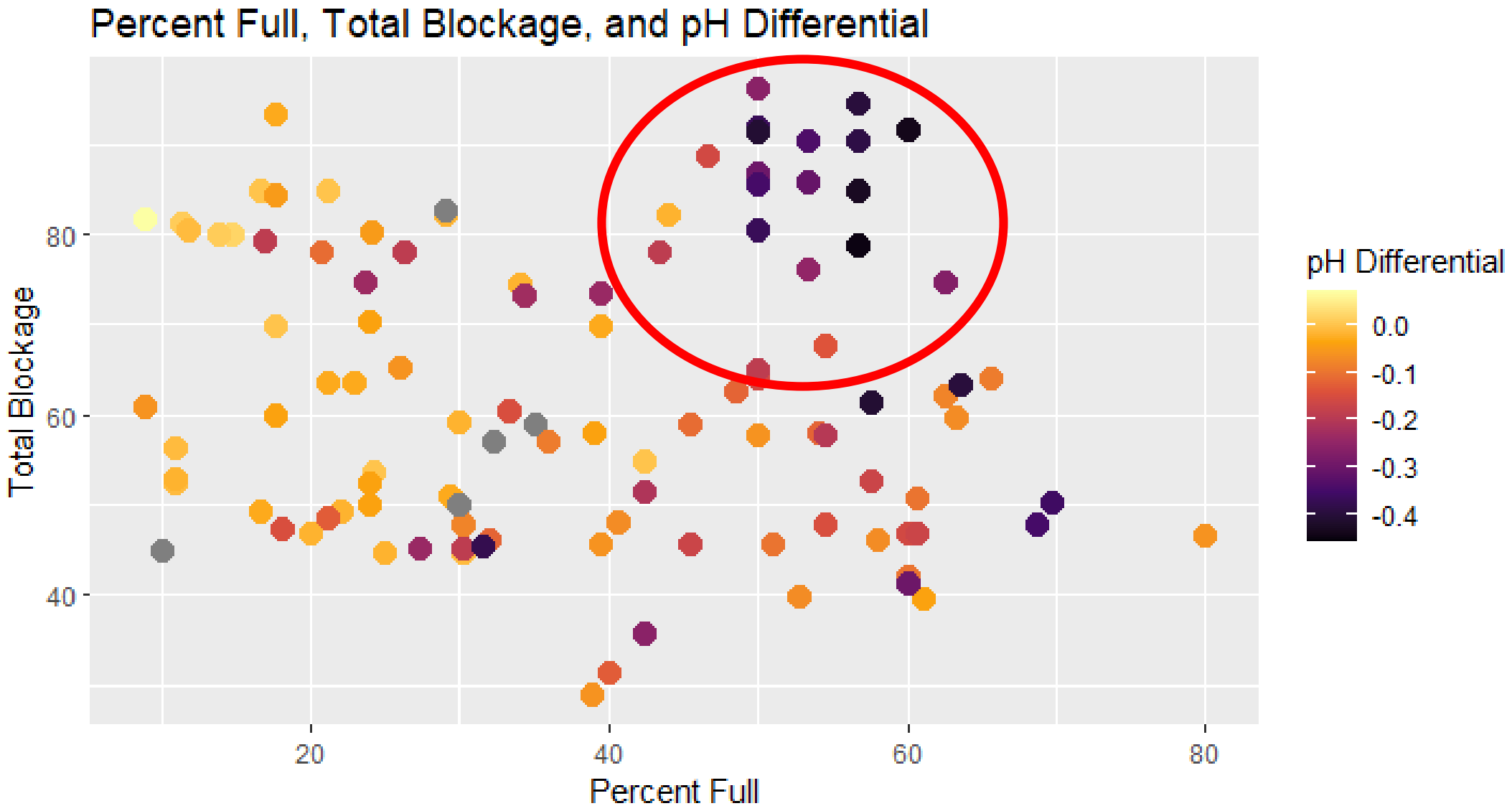


$p \leq 0.01$

Industry Sites

- Sampled at 22 other farms
  - Florida, North Carolina, and Virginia
  - Variety of gear types
  - 124 data points
- Same sampling strategy as used at Big Island Aquaculture


Percent Full, Total Blockage, and DO Differential
Total Blockage
80
60
40
20
40
60
80
Percent Full
DO Differential
10
0
-10
-20
-30


Percent Full, Total Blockage, and pH Differential
Total Blockage
80
60
40
20
40
60
80
Percent Full
pH Differential
0.0
-0.1
-0.2
-0.3
-0.4

What can the data tell us?

1. Ambient conditions > inside the bag conditions
2. Farmers can influence water inside bags through husbandry decisions
3. Future climate change could create more challenges

Acknowledgments

Virginia Sea Grant

Bruce Vogt

C-Salt Lab

Jordan Lynch
Matthew LaGanke
Ima Hosseinzadeh
David Arancibia
Darien Mizuta
Madeline Burgess

Sea Grant Virginia

VIMS | William & Mary
Virginia Institute of Marine Science

Big Island Aquaculture
OYSTERS

Questions?

Julianne Grenn
jmgrenn@vims.edu
(804) 684-7313

VIMS | William & Mary
Virginia Institute of Marine Science

Sea Grant
Virginia

VIMS | William & Mary
Virginia Institute of Marine Science

Sea Grant Virginia

VIRGINIA AQUACULTURE CONFERENCE

LIGHTNING TALKS

Tracey Saxby, Integration and Application Network (ian.umces.edu/media-library).

Inventory Management on Oyster Farms

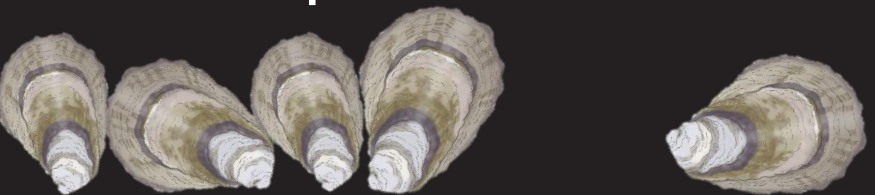
Using Radio Frequency Identification (RFID) Technology to Manage Oyster Farm Inventory

Matthew LaGanke & Cappahosic Oyster Company
Commercial Shellfish Aquaculture Lab & Team (C-SALT)
Virginia Institute of Marine Science

Cappahosic Oyster Company, Gloucester, Virginia
VIMS | William & Mary Virginia Institute of Marine Science
Virginia Fishery Resource Grant Program
CBTRUST Chesapeake Bay Trust

Inventory management is critical for oyster farms

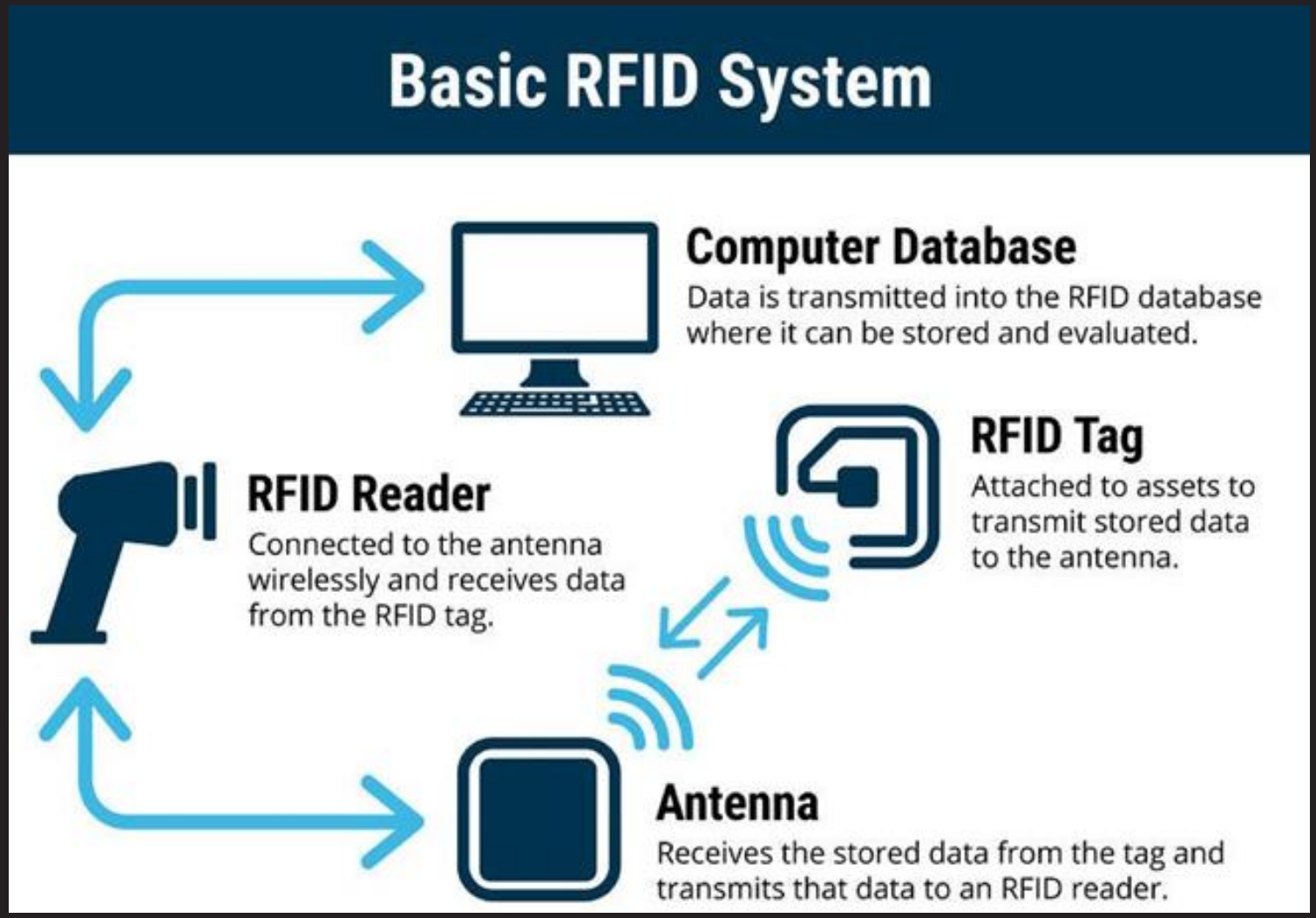
- Supply must meet demand
- The premium half-shell market has grown
- The market emphasizes brand consistency
- Producing oysters of consistent quality requires a watchful eye on the crop



Inventory management in oyster farming can be difficult

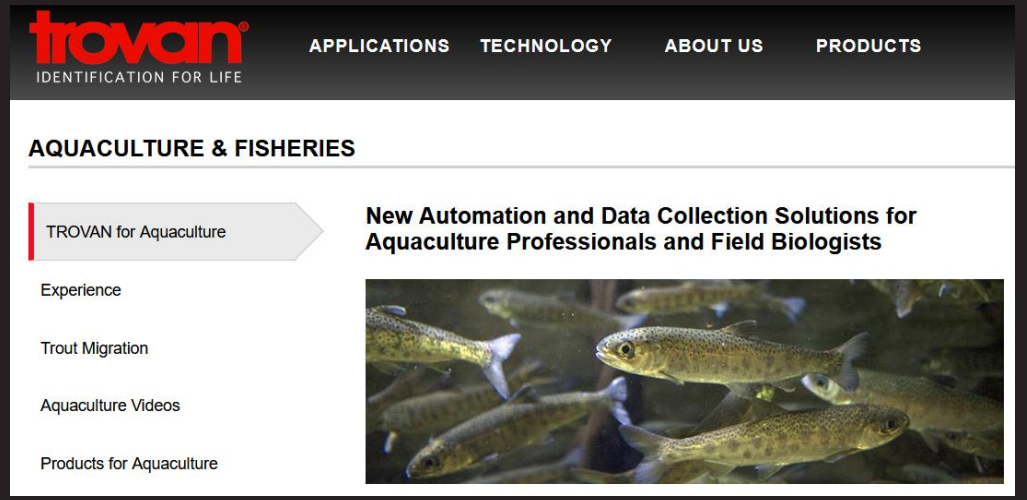
- Farmers want to know how many, what size, where, and when
- Tracking tools include whiteboards, notebooks, color-coded zip ties, excel, and memory
- Smart device apps require interaction with a touchscreen
- Poor inventory management can lead to costly mistakes

What is Radio Frequency Identification (RFID) Technology?



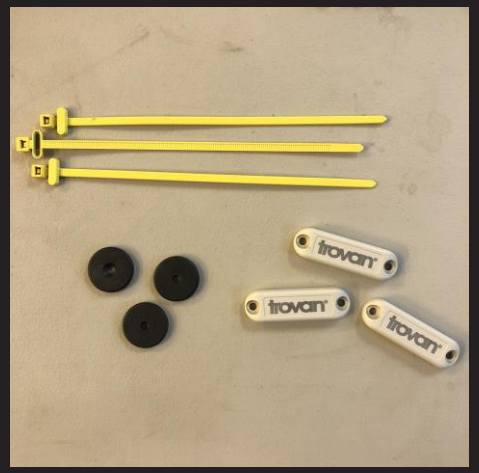
Collaborative integration of off-the-shelf RFID

- Worked with a local oyster farm, Cappahosic Oyster Company
- Trovan was selected as the provider of RFID materials



RFID reader

+

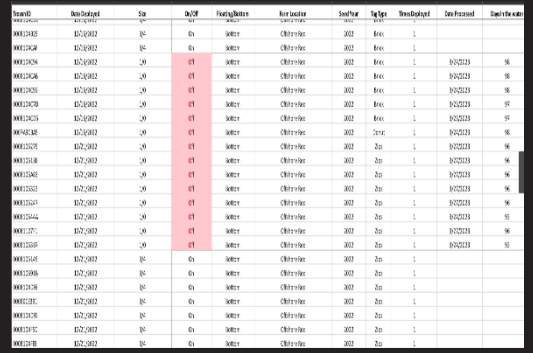


3 RFID tag models

+

RFID information cards

=

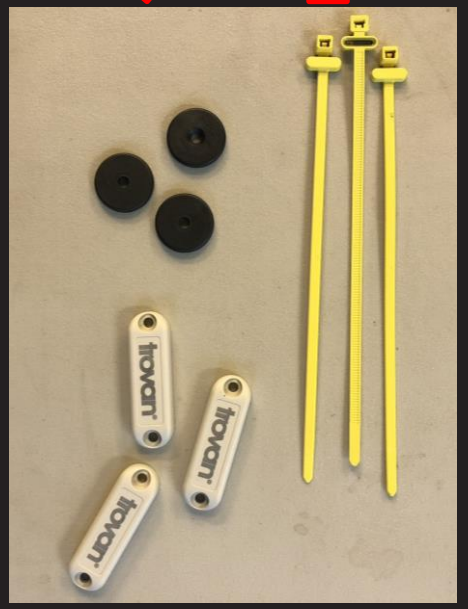


Proprietary database

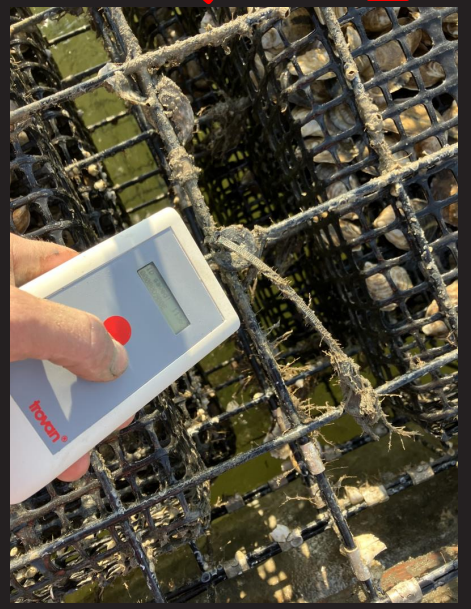
Customized flow of data collection using RFID

Reader with the binder of info cards

Scan info cards



Select one tag model to attach to a cage



Attach and scan a cage tag

Inventory info saved in memory

Data upload and manipulation isn't easy

	A	B
1	Trovan ID	Date
2	00080DBF13	26/04/2023 10:15:12
3	00080DBF04	26/04/2023 10:15:16
4	00080DBF64	26/04/2023 10:15:23
5	0007A9C966	26/04/2023 10:15:27
6	00080DB061	26/04/2023 10:15:31
7	00080DB7A7	26/04/2023 10:15:36
8	00080DBE7A	26/04/2023 10:15:49
9	00080DB16A	26/04/2023 10:15:56
10	00080DB117	26/04/2023 10:16:07
11	00080DACDA	26/04/2023 10:16:34
12	00080D9CFD	26/04/2023 10:16:51
13	00080DB428	26/04/2023 10:16:57
14	00080DBE6C	26/04/2023 10:17:45
15	00080D9F7A	26/04/2023 10:18:17
16	0007A9CAB9	26/04/2023 10:18:37
17	00080D9D3A	26/04/2023 10:31:26
18	00080DC1C6	26/04/2023 10:31:28
19	00080D9878	26/04/2023 10:31:31
20	0007A9C7CE	26/04/2023 10:31:36
21	00080D9E9F	26/04/2023 10:31:38
22	00080D9B34	26/04/2023 10:31:43
23	00080D9EEC	26/04/2023 10:32:03

Sheet3 Sheet4 Example

Download data

	A	B
1	Search for	Convert To
2	000768C946	Starter
3	000768D1AC	On
4	000768D184	Off
5	000768D14B	Offshore Red
6	000768E1BF	Offshore Yellow
7	000768DD52	Orange
8	000768CF91	LL3
9	000768D88D	LL2
10	000768D142	Half Inch line
11	000768D88C	Red Half Inch line
12	000768C80E	Blue
13	000768D679	White
14	000768C817	Little yellow
15	000768E867	Original Bag line
16	000768D538	Three-Quart line
17	000768D50F	Shuck extension
18	000768D538	Three-Quarter
19	000624B122	Last year seed
20	000768E8AB	This year's seed
21	000768C1D3	Neither/Mix
22	000768DEA6	One-Inch
23	000768E081	Three-Quarter
24	000768CCA7	Starter

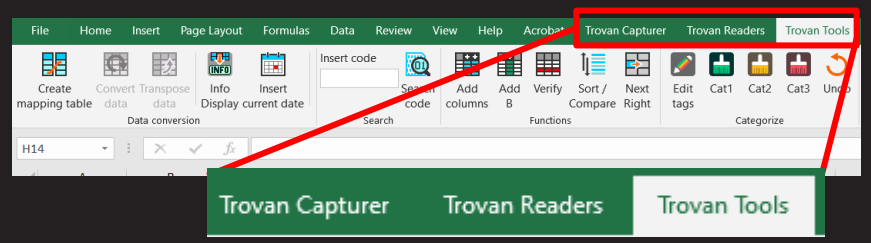
Trovan mapping table Shee

Pre-programmed mapping table

	A	B	C
1	Trovan ID	Date	
2	Starter	26/04/2023 10:15:23	
3	Off	26/04/2023 10:15:27	
4	This year's seed	26/04/2023 10:15:31	
5	Bottom	26/04/2023 10:15:36	
6	Three-Quarter	26/04/2023 10:15:49	
7	4-bag	26/04/2023 10:15:56	
8	Blue	26/04/2023 10:16:07	
9	0008104C43	26/04/2023 10:16:34	
10	0007A9CA8C	26/04/2023 10:16:51	
11	0008104C67	26/04/2023 10:16:57	
12	0007A9CAA2	26/04/2023 10:17:45	
13	0008104C99	26/04/2023 10:18:17	
14	0008104CCB	26/04/2023 10:18:37	
15	Starter	26/04/2023 10:31:26	
16	On	26/04/2023 10:31:28	
17	This year's seed	26/04/2023 10:31:31	
18	Floating	26/04/2023 10:31:36	
19	One-Inch	26/04/2023 10:31:38	
20	6-bag	26/04/2023 10:31:43	
21	00080D9DF4	26/04/2023 10:32:03	
22	00080DB0B6	26/04/2023 10:34:03	
23	00080DC41A	26/04/2023 10:34:06	

Sheet3 Sheet4 Example

Convert data

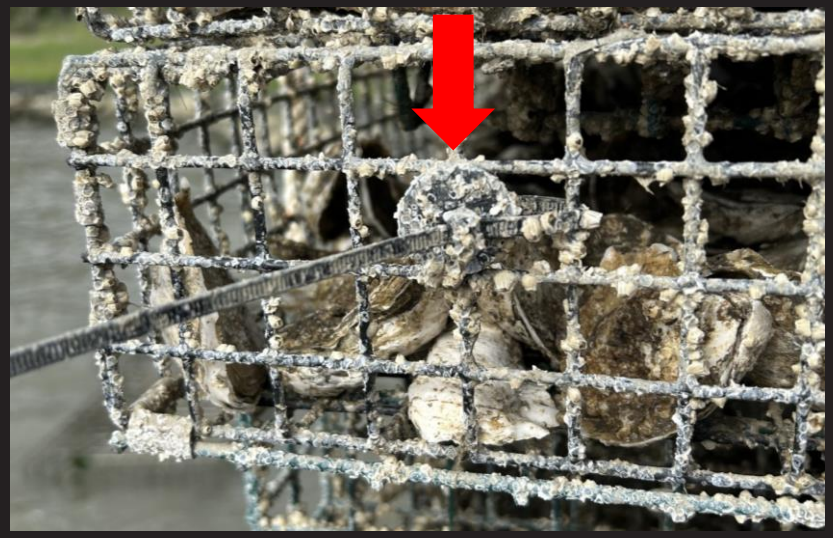


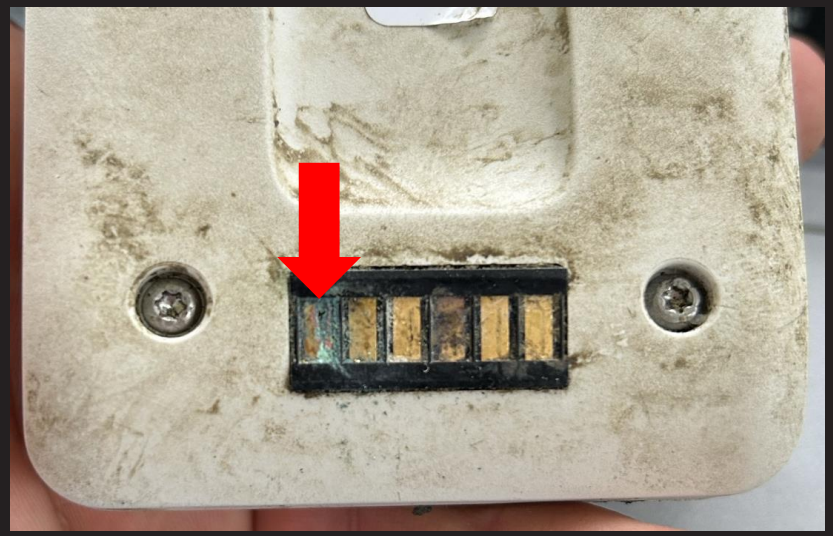
Copy into the master inventory sheet

	A	B	C	D	E	F	G	H
1	Trovan ID	Date Deployed	Size	On/Off	Floating/Bottom	Farm Location	Seed Year	Tag Type
382	00080DB982	3/17/2023	3/4	On	Bottom	Three-Quarter	2022	Donut
383	00080DB420	3/17/2023	3/4	On	Bottom	Three-Quarter	2022	Donut
384	00080DB56F	3/17/2023	3/4	On	Bottom	Three-Quarter	2022	Donut
385	00080DB159	3/17/2023	1/0	On	Bottom	Three-Quarter	2022	Donut
386	0008104967	3/22/2023	1/0	On	Bottom	Offshore Red	2022	Donut
387	0007A9C93D	3/22/2023	1/0	On	Bottom	Offshore Red	2022	Donut
388	0007A9C976	3/22/2023	1/0	On	Bottom	Offshore Red	2022	Donut
389	0008104CCC	3/22/2023	1/0	On	Bottom	Offshore Red	2022	Brick
390	0008104C93	3/22/2023	1/0	On	Bottom	Offshore Red	2022	Brick
391	0007A9CB21	3/22/2023	1/0	On	Bottom	Offshore Red	2022	Donut
392	0008104B8C	3/22/2023	1/0	On	Bottom	Offshore Red	2022	Brick
393	00081052DC	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Zips
394	0008104C7D	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Brick
395	0008104CD5	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Brick
396	0008104963	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Brick
397	0008104C92	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Brick
398	00081054A	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Zips
399	0007A9CBA5	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Donut
400	0008104C94	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Brick
401	00081053B7	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Zips
402	0008104CAB	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Brick
403	00081051B8	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Zips
404	0008105279	3/24/2023	1/0	On	Bottom	Offshore Red	2022	Zips
405	0008105323	3/24/2023	1/0	On	Bottom	Offshore Yellow	2022	Zips
406	0008105247	3/24/2023	1/0	On	Bottom	Offshore Yellow	2022	Zips
407	00081127F1	3/24/2023	1/0	On	Bottom	Offshore Yellow	2022	Zips
408	00080DB08F	3/27/2023	3/4	On	Bottom	Orange	2021	Donut
409	00080DBEB1	3/27/2023	3/4	On	Bottom	Orange	2021	Donut

The RFID hardware is fairly durable

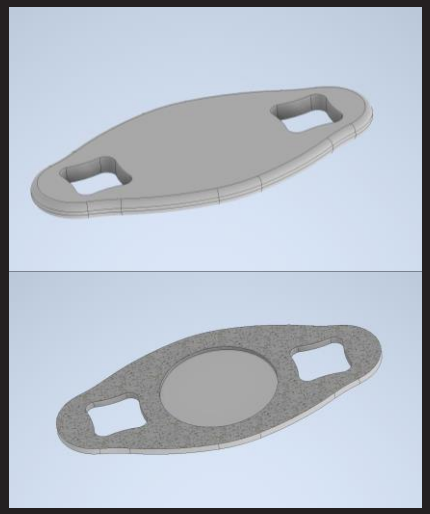
- **We began attaching tags and collecting data in September 2022**
- **The "donut" tag model found to be superior**
  - Retained on cages
  - No saltwater intrusion
  - Easy to attach
- **Moderate success with the reader**
  - Long battery life with extensive memory
  - Usable with gloves on
  - Not corrosion proof

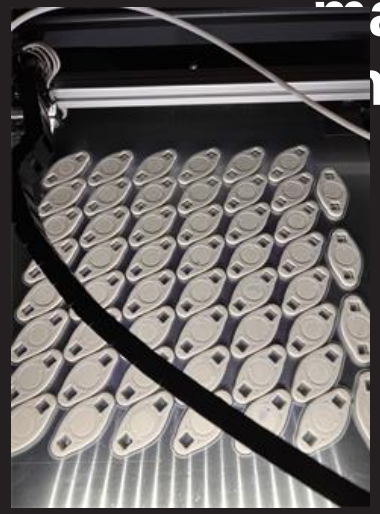


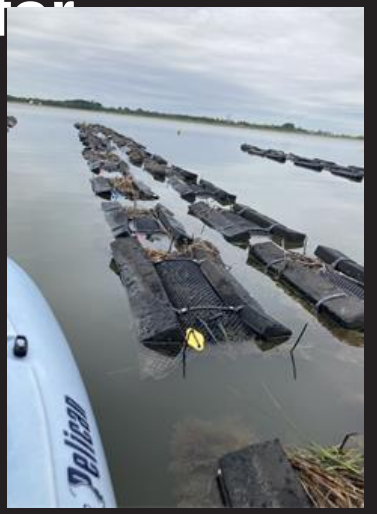


Conclusions

- We collected thousands of data lines through the press of a single button
- The hardware is fairly capable of withstanding the challenging environment
- Processing of data is difficult with Trovan proprietary software
- Future plan: Explore the development of a more complete inventory management system for shellfish culture







Questions?

- For questions regarding the farmer's perspective, Marcia from Cappahosic will present on that next

VIMS | William & Mary
Virginia Institute of Marine Science

Sea Grant Virginia

VIRGINIA AQUACULTURE CONFERENCE

LIGHTNING TALKS

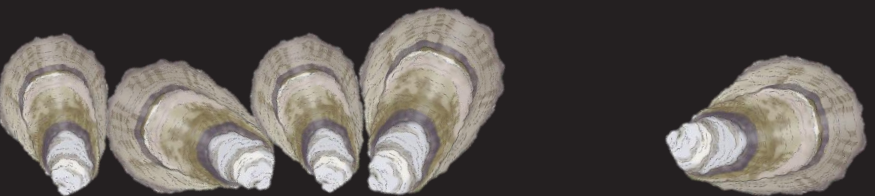
Tracey Saxby, Integration and Application Network (ian.umces.edu/media-library).

A Farmer's Perspective on using RFID to Manage Oyster Farm Production

Marcia Berman, Mark Vann, Hardy Watkins
Cappahosic Oyster Co
&
Matt LaGanke
Commercial Shellfish Aquaculture Lab and Team C-SALT
Virginia Institute of Marine Science

Forever the Skeptic

- Would it be easy to integrate into normal operations?
- Would it hinder daily production?
- Would it be rugged enough and easy to deploy under working conditions?
- Could it yield better inventory management data at a reasonable cost?



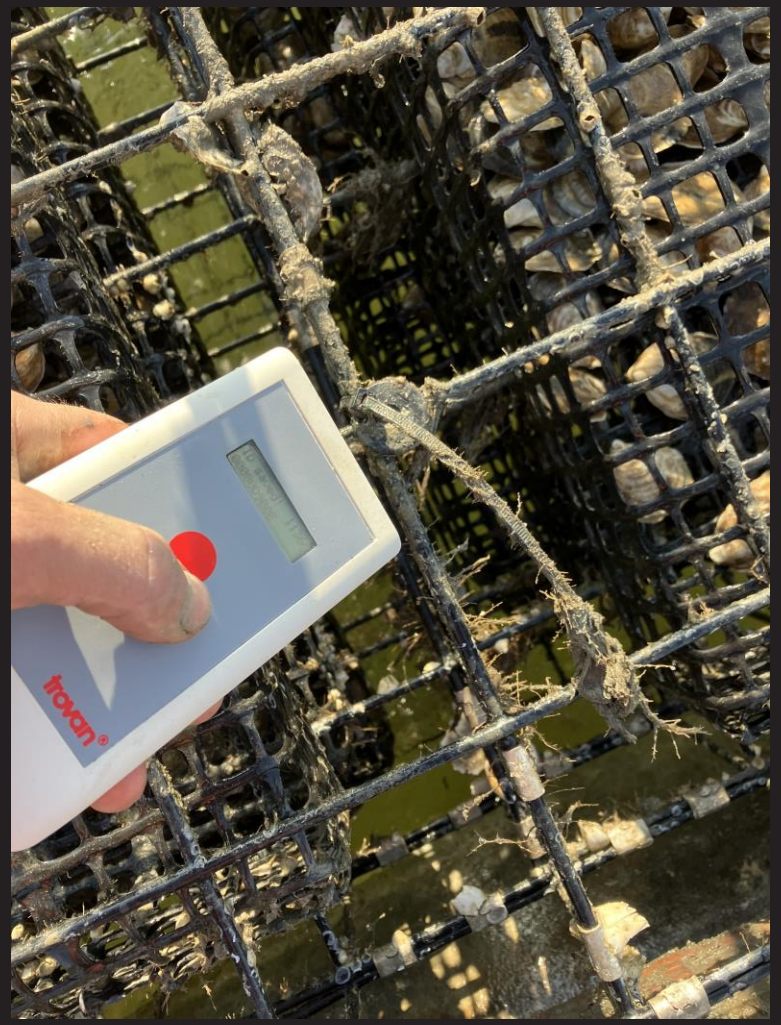
System	Cost
• Aquapocket RFID Reader	$900.00
• RFID IdentifierTags	$3.00
• RFID Data Cards	$2.50
• Database	$300.00/yr

VIMS | William & Mary
Virginia Institute of Marine Science

Sea Grant
Virginia

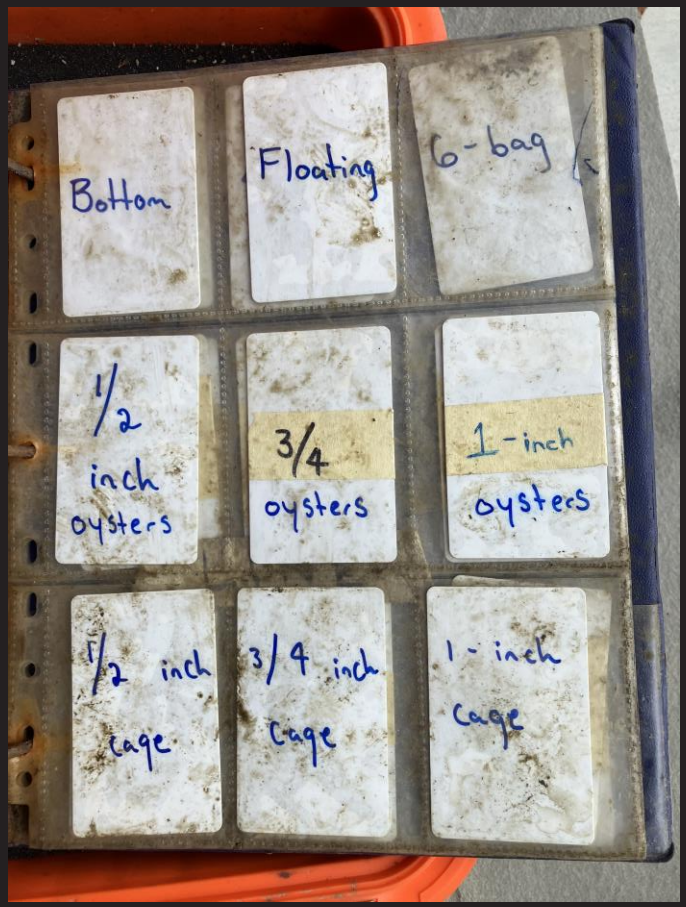
VIRGINIA AQUACULTURE CONFERENCE

LIGHTNING TALKS



Inventory Attributes

- On/off
- Seed year class
- Bottom vs floating
- Oyster size
- Cage mesh size
- Line (color/names)
- Date



Trovan ID	Date Deployed	Size	On/Off	Floating/Bottom	Farm Location	Seed Year	Tag Type	Times Deployed	Date Processed	Days in the water
0008104CD2	12/16/2022	3/4	On	Bottom	Offshore Red	2022	Brick	1		
0008104B29	12/16/2022	3/4	On	Bottom	Offshore Red	2022	Brick	1		
0008104CAF	12/16/2022	3/4	On	Bottom	Offshore Red	2022	Brick	1		
0008104C94	12/16/2022	1/0	Off	Bottom	Offshore Red	2022	Brick	1	3/24/2023	98
0008104CAB	12/16/2022	1/0	Off	Bottom	Offshore Red	2022	Brick	1	3/24/2023	98
0008104C92	12/16/2022	1/0	Off	Bottom	Offshore Red	2022	Brick	1	3/24/2023	98
0008104C7D	12/16/2022	1/0	Off	Bottom	Offshore Red	2022	Brick	1	3/23/2023	97
0008104CD5	12/16/2022	1/0	Off	Bottom	Offshore Red	2022	Brick	1	3/23/2023	97
0007A9CBA5	12/16/2022	1/0	Off	Bottom	Offshore Red	2022	Donut	1	3/24/2023	98
0008105279	12/21/2022	1/0	Off	Bottom	Offshore Red	2022	Zips	1	3/27/2023	96
00081051B8	12/21/2022	1/0	Off	Bottom	Offshore Red	2022	Zips	1	3/27/2023	96
0008105A83	12/21/2022	1/0	Off	Bottom	Offshore Red	2022	Zips	1	3/27/2023	96
0008105323	12/21/2022	1/0	Off	Bottom	Offshore Red	2022	Zips	1	3/27/2023	96
0008105247	12/21/2022	1/0	Off	Bottom	Offshore Red	2022	Zips	1	3/27/2023	96
000810544A	12/21/2022	1/0	Off	Bottom	Offshore Red	2022	Zips	1	3/24/2023	93
00081127F1	12/21/2022	1/0	Off	Bottom	Offshore Red	2022	Zips	1	3/27/2023	96
00081053B7	12/21/2022	1/0	Off	Bottom	Offshore Red	2022	Zips	1	3/24/2023	93
0008105149	12/21/2022	3/4	On	Bottom	Offshore Red	2022	Zips	1		
000810591B	12/21/2022	3/4	On	Bottom	Offshore Red	2022	Zips	1		
0008104DF6	12/21/2022	3/4	On	Bottom	Offshore Red	2022	Zips	1		
00080CE391	12/21/2022	3/4	On	Bottom	Offshore Red	2022	Zips	1		
0008104DF0	12/21/2022	3/4	On	Bottom	Offshore Red	2022	Zips	1		
0008104F5C	12/21/2022	3/4	On	Bottom	Offshore Red	2022	Zips	1		
0008104FE8	12/21/2022	3/4	On	Bottom	Offshore Red	2022	Zips	1		

PROS

- Compact and manageable
- Easy learning curve
- Preserved record
- Cost effective
- Improve production

CONS

- Database Output
- Limited technical support
- Hardware failures ~~$~~ data loss
- Restricted Licensing

FUTURE PLANS

- New and hopefully improved readers will eliminate hardware issues
- Continue adding inventory data to the database
- Work on developing a usable inventory reporting system from the database to inform farm management operations

VIMS | William & Mary
Virginia Institute of Marine Science

Sea Grant Virginia

VIRGINIA AQUACULTURE CONFERENCE

LIGHTNING TALKS

Tracey Saxby, Integration and Application Network (ian.umces.edu/media-library).

VIMS | William & Mary
Virginia Institute of Marine Science
Sea Grant Virginia
VIRGINIA AQUACULTURE CONFERENCE
LIGHTNING TALKS

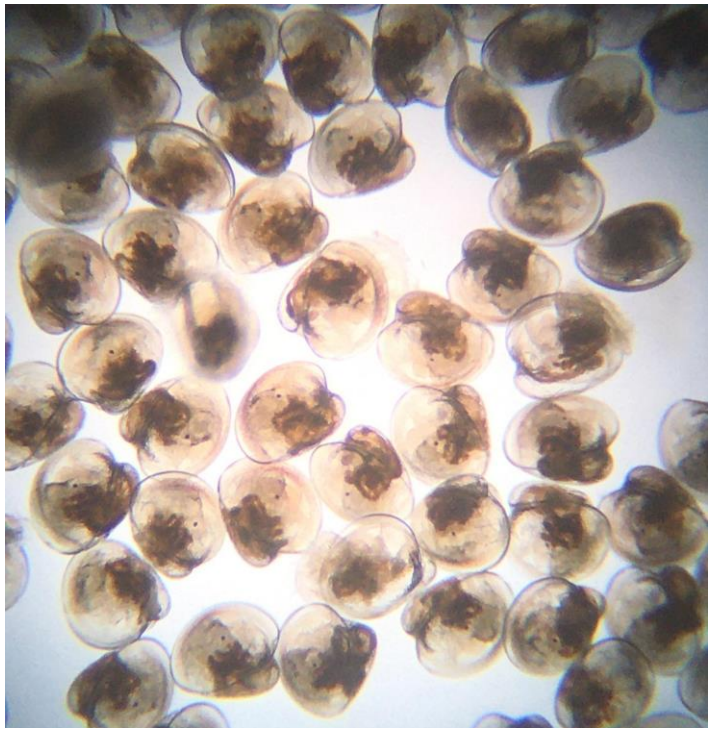
Got the fuzz?: A conversation about the effect of stalked ciliates on oyster nursery culture

Michael Congrove, Samantha Glover*, Standish K. Allen Jr., Richard Snyder

GWYNN'S ISLAND, VIRGINIA
YSTER SEED
HOLDINGS, INC

VIMS | William & Mary
Virginia Institute of Marine Science

Virginia Fishery Resource Grant Program

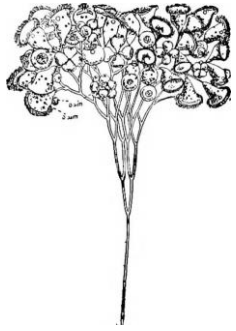


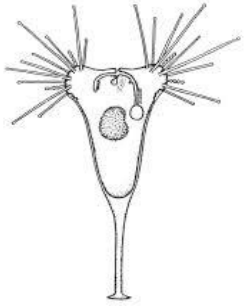
Oyster Seed Holdings, Inc

Gwynn's Island, VA

Stalked ciliate observations: what do we know?

- **Observed increase in stalked ciliate epibiont pests in nursery culture**
- **Thrive in areas of high suspended solids**
- **Disturb the feeding process in small oyster seed and slow their growth**
- **Observed in bottle nursery systems and upwellers at several locations**.



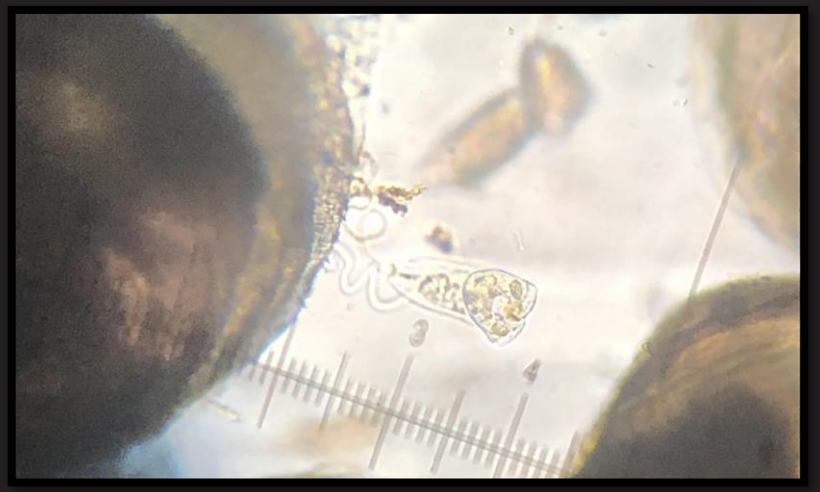


VIMS | William & Mary
Virginia Institute of Marine Science

Sea Grant
Virginia

VIRGINIA AQUACULTURE CONFERENCE

LIGHTNING TALKS



Identification

Peritrich: *Zoothamnium*

Ciliates that form branching colonies that can range in size from several to hundreds of zooids

Stalk contracts in a zig-zag pattern

Detritus and bacteria consumers

Photo: Dr. Richard Snyder

Suctoria: *Acineta*

Contain specialized tentacles with haptocysts that are toxic and used to paralyze prey

Single stalk that coils when retracted

Consume other ciliates

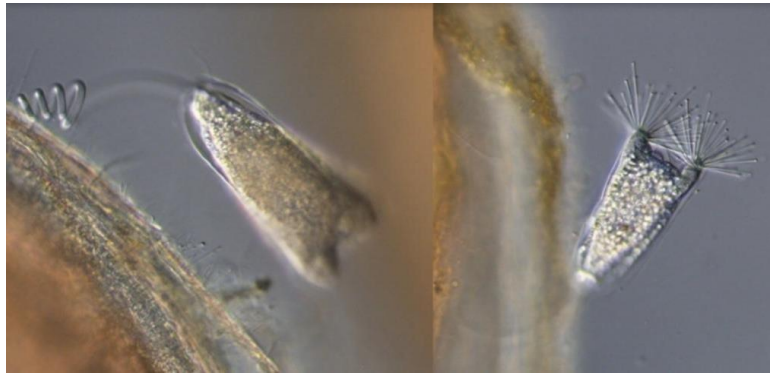


Photo: Dr. Richard Snyder

Peritrich: *Vorticella*

Bell-shaped ciliate

Single stalk that coils when retracted

Consume bacteria and small protozoans

Photo: Protist Information Server, URL: http://protist.i.hosei.ac.jp/

What we want to know:

1. Do you experience infestations?
2. Is there seasonality to these infestations?
3. What seems to be the best control method?
4. Where are you located?

Infestation Survey

Contact Information

- **Michael Congrove**
  - President, Oyster Seed Holdings, Inc.
  - Email: msc@oshoyster.com
- **Samantha Glover**
  - Research and Development Manager, Oyster Seed Holdings, Inc.
  - Email: sam@oshoyster.com
- **Dr. Standish K. Allen Jr.**
  - Research and Development Coordinator, Oyster Seed Holdings, Inc.
  - Email: ska@oshoyster.com
- **Dr. Richard Snyder**
  - Professor and Director, VIMS Eastern Shore Laboratory
  - Email: rsnyder@vims.edu

Acknowledgements

- Funding: Virginia Fishery Resource Grant Program
- Dr. Richard Snyder, Virginia Institute of Marine Science

VIMS William & Mary Virginia Institute of Marine Science

Virginia Fishery Resource Grant Program

VIMS | William & Mary
Virginia Institute of Marine Science

Sea Grant Virginia

VIRGINIA AQUACULTURE CONFERENCE

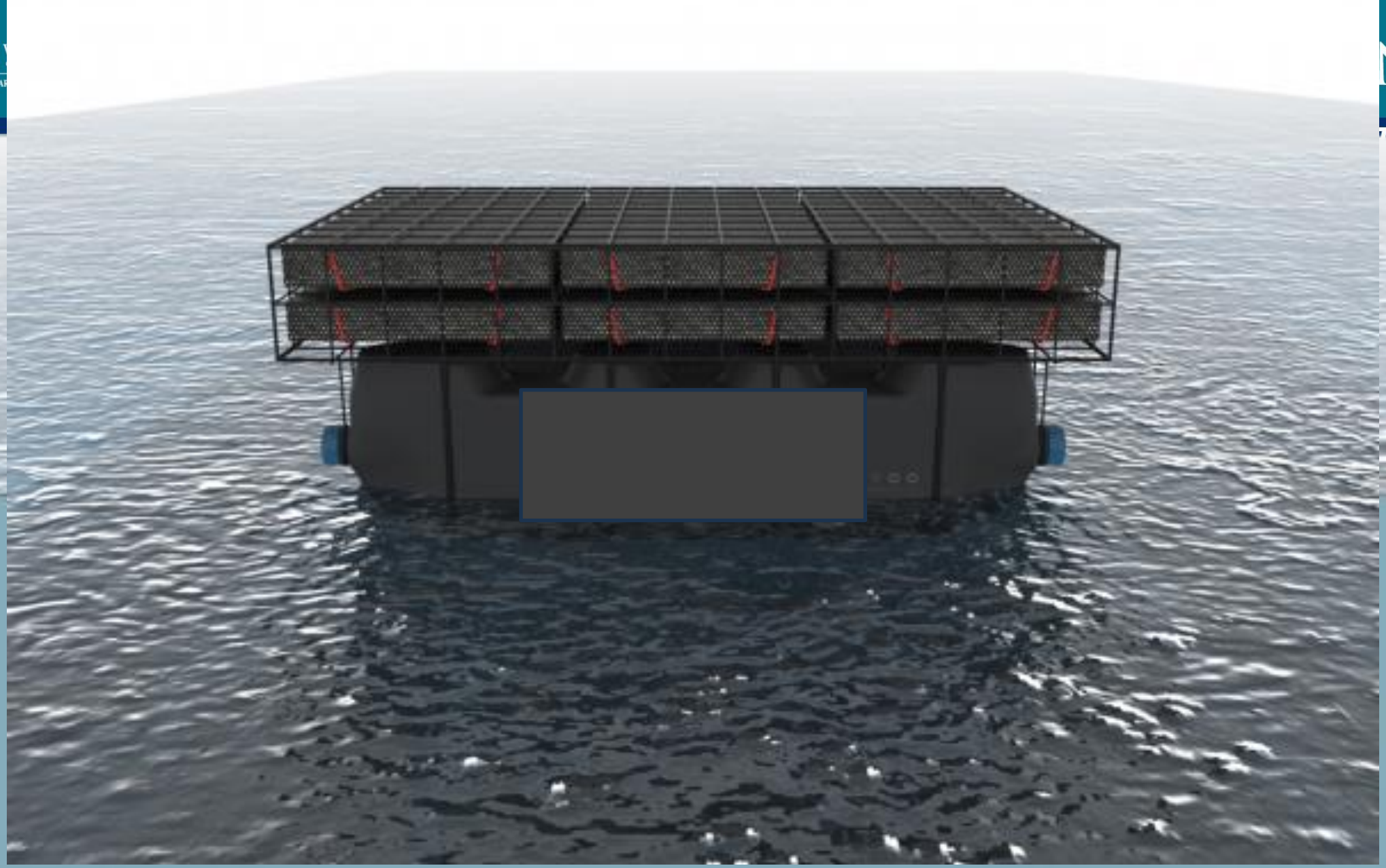
LIGHTNING TALKS

Tracey Saxby, Integration and Application Network (ian.umces.edu/media-library).

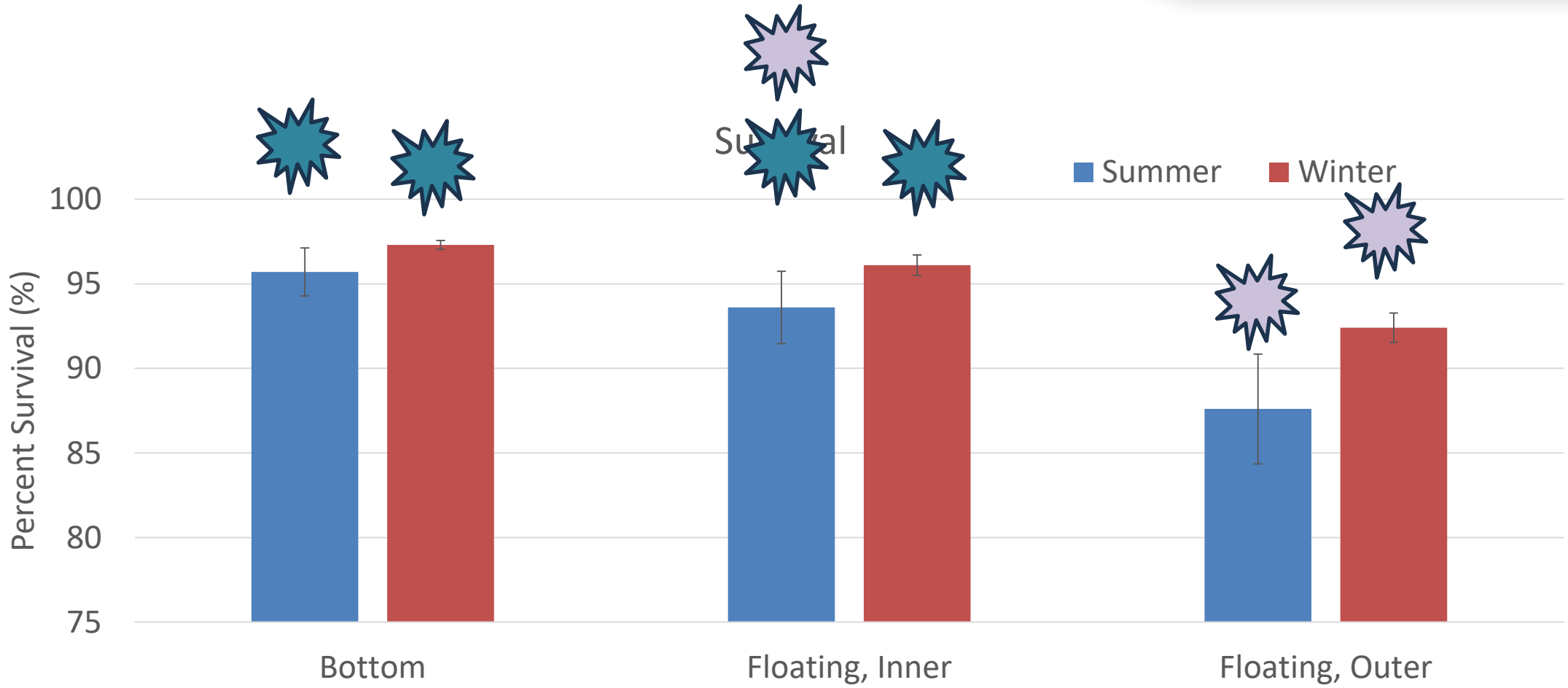
Gear Comparison Trials - Perspective on Floating vs. Bottom Grown Oysters

Presented by Bill Walton
Virginia Institute of Marine Science
On behalf of VIMS Commercial Shellfish Aquaculture Lab Team (C-SALT) and
Cappahosic Oyster Company (FRG 2022-03)

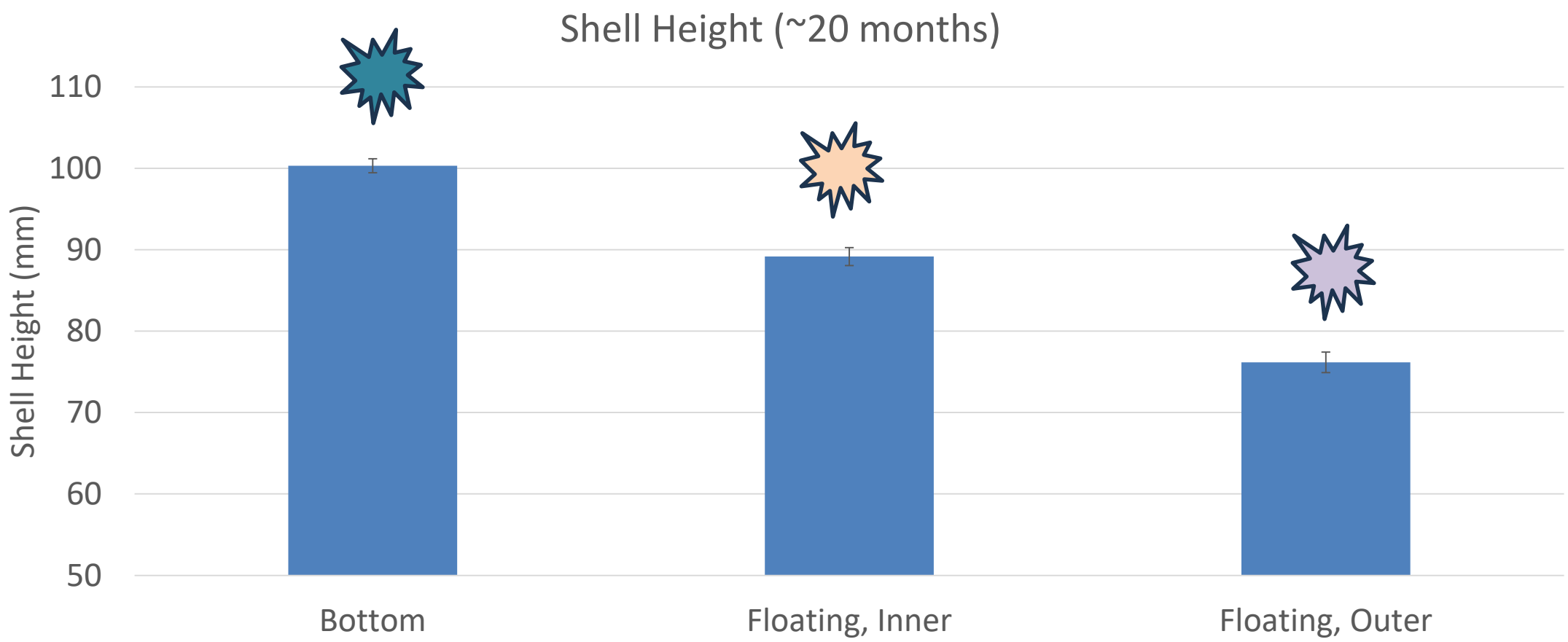
Two methods used by one farm



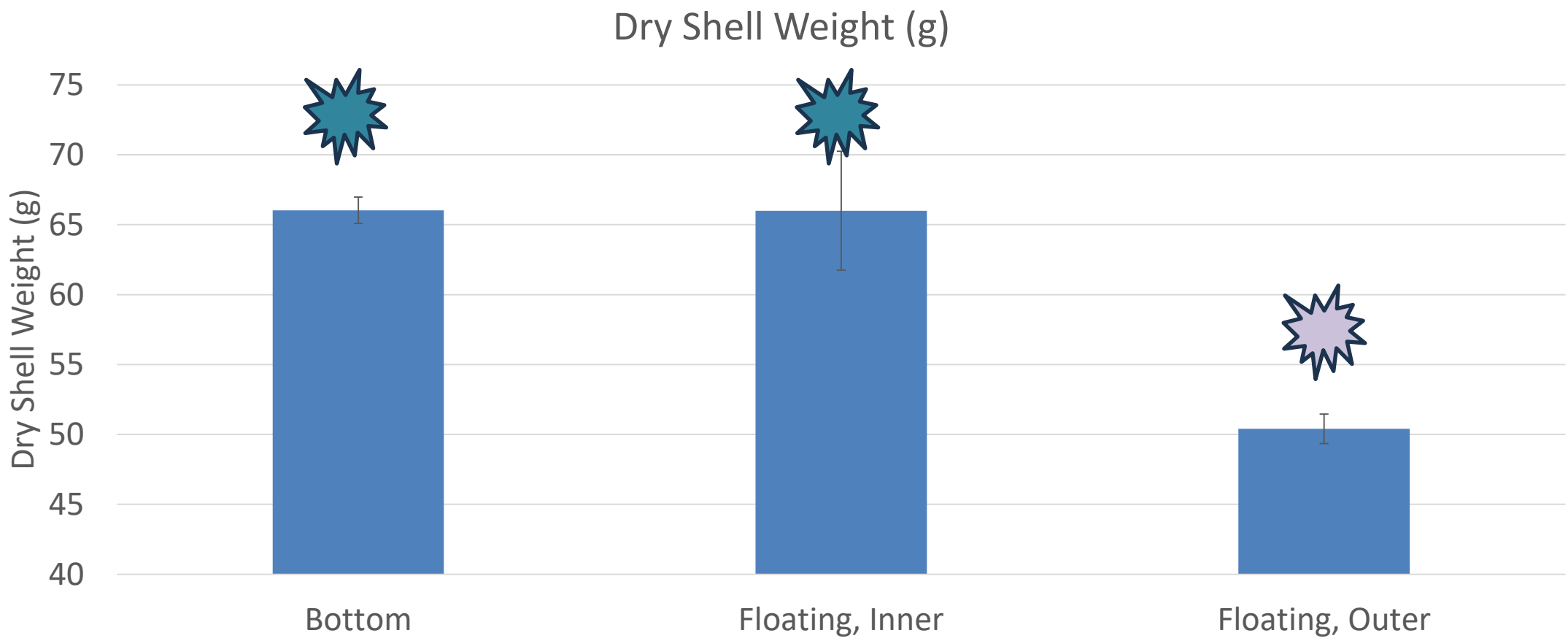
Survival


Summer
Winter
Percent Survival (%)
100
95
90
85
80
75
Bottom
Floating, Inner
Floating, Outer

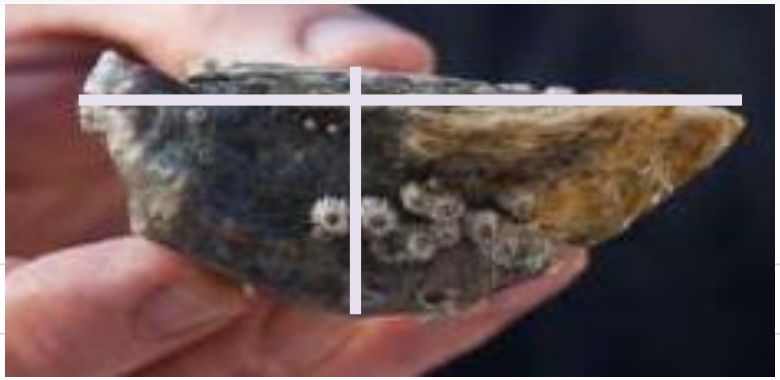
Growth (Average Length)

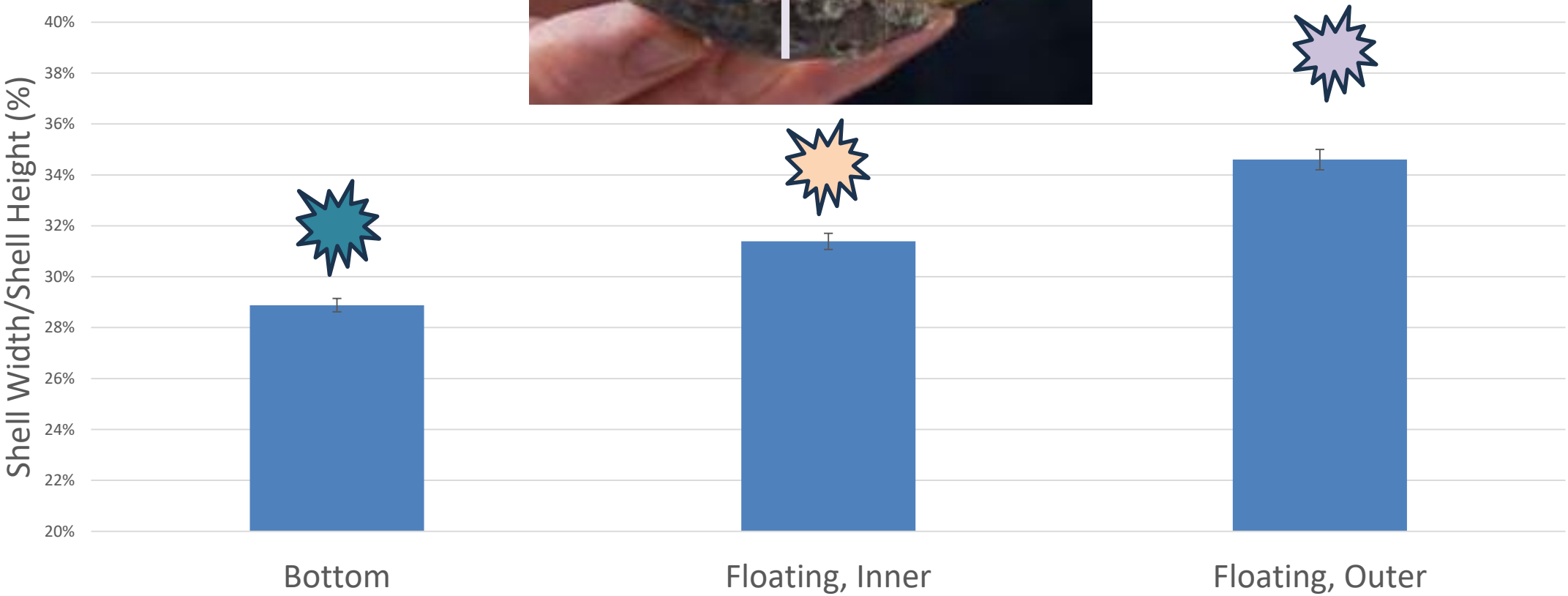


Dry Shell Weight

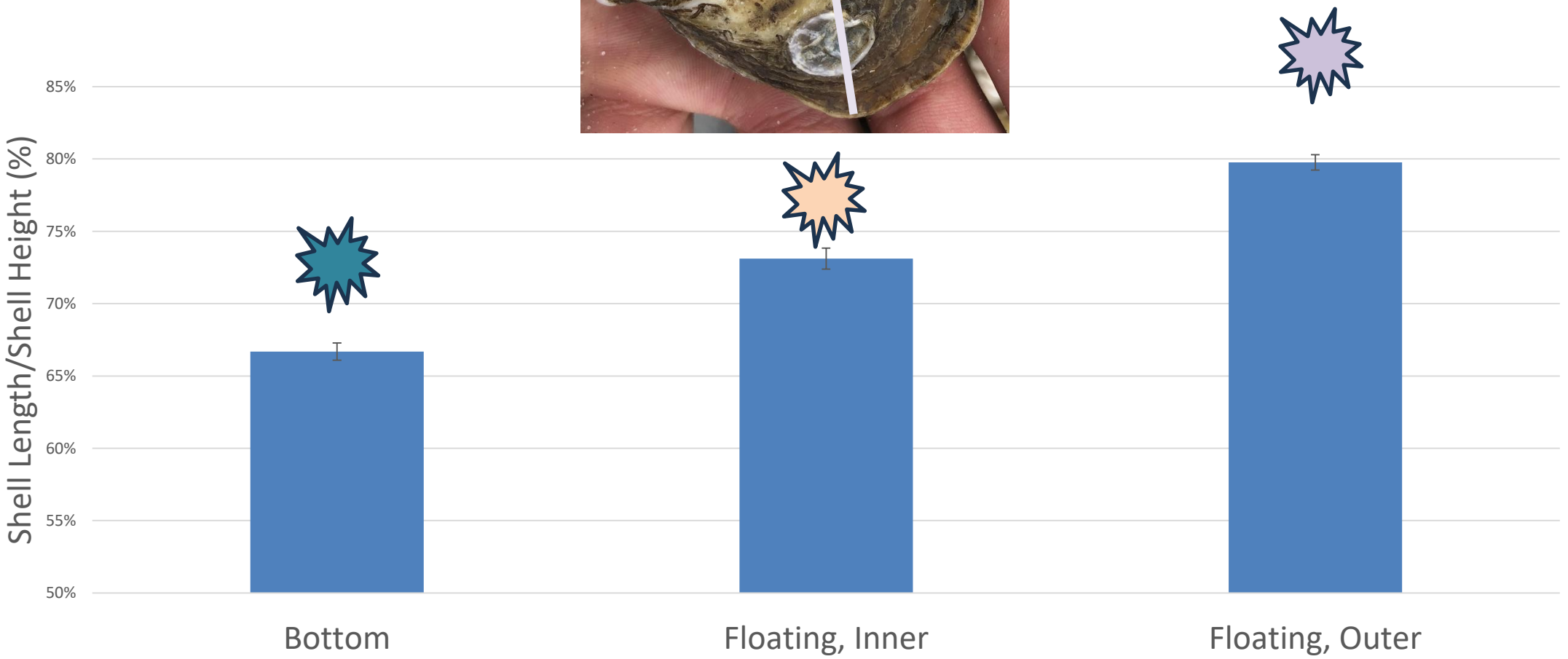


Cup Shape

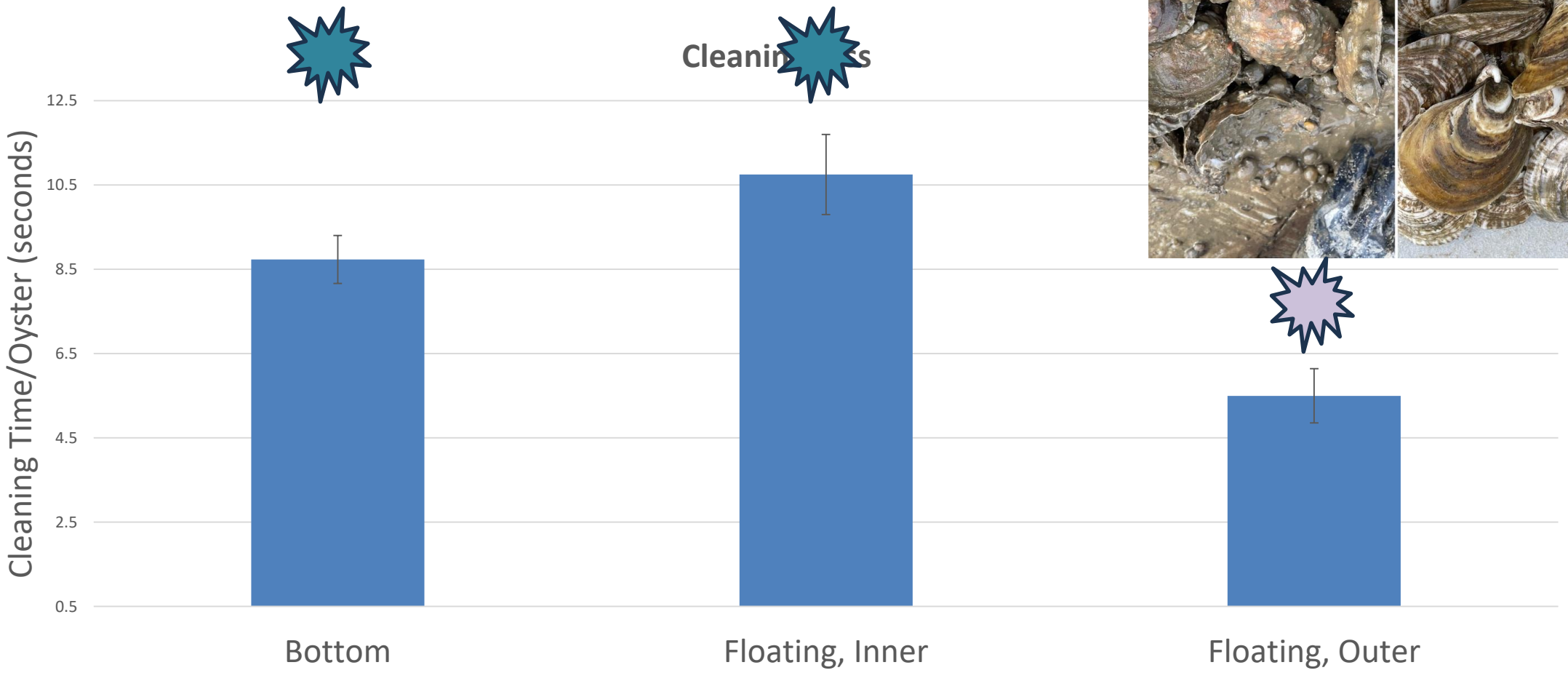



Shell Width/Shell Height (%)
40%
38%
36%
34%
32%
30%
28%
26%
24%
22%
20%
Bottom
Floating, Inner
Floating, Outer

Fan Shape

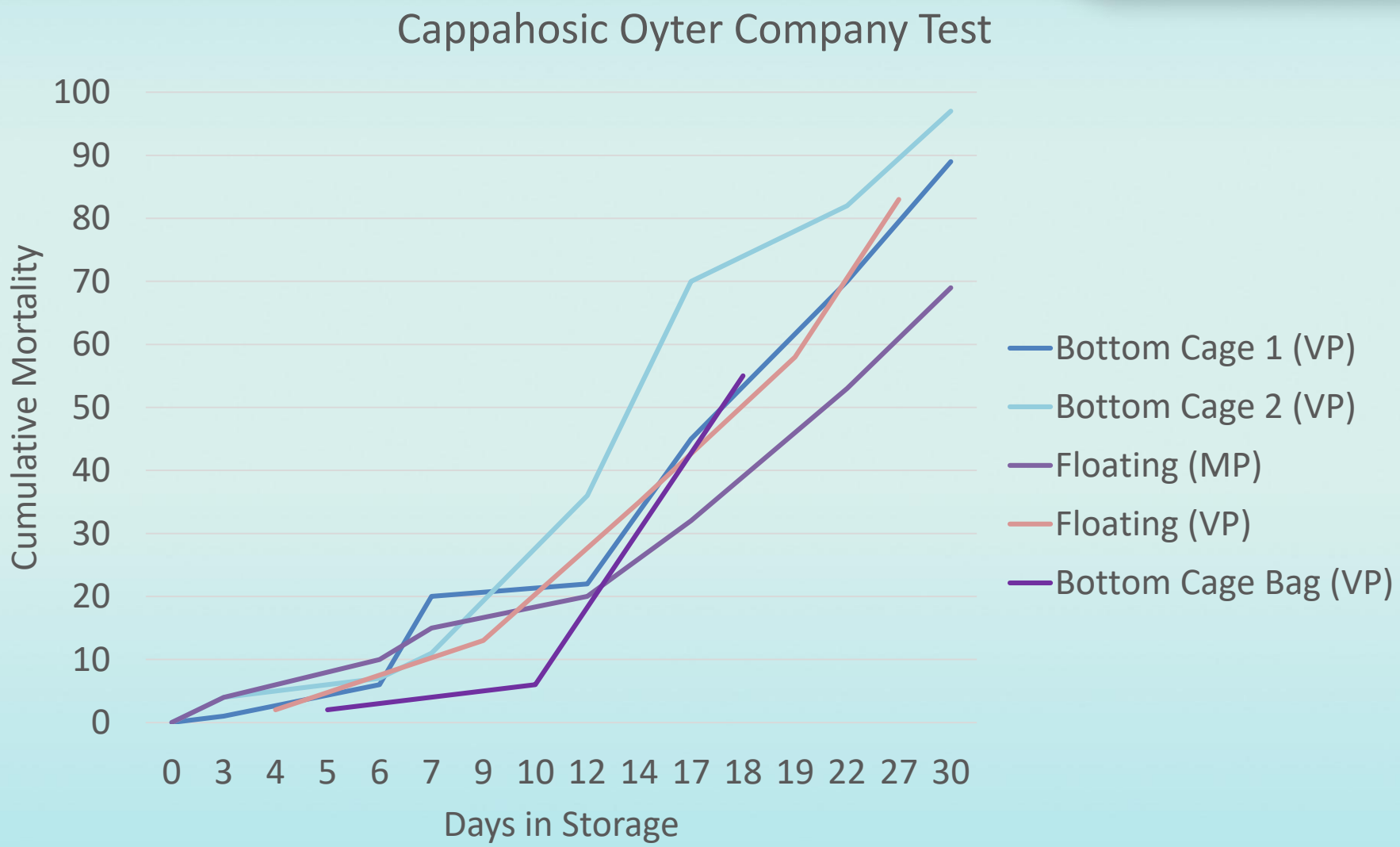

Shell Length/Shell Height (%)
85%
80%
75%
70%
65%
60%
55%
50%
Bottom
Floating, Inner
Floating, Outer

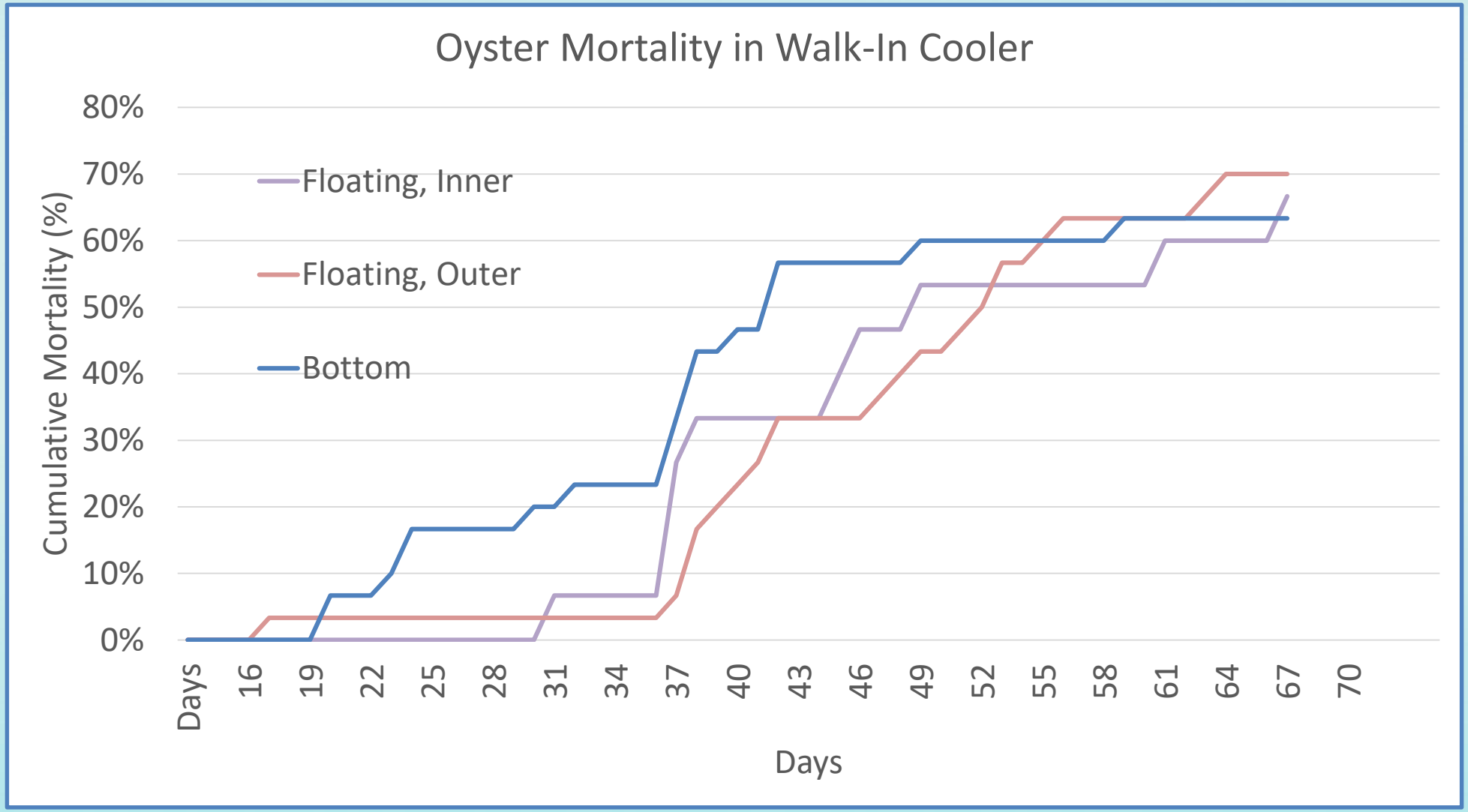
Cleanliness of Oyster



Are there differences after harvest?

- ‘Shuckability’?
  - Working on fair, standard measures of this
- Shelf Life
- Customer Response
- Other?


Cappahosic Oyter Company Test
Cumulative Mortality
100
90
80
70
60
50
40
30
20
10
0
0 3 4 5 6 7 9 10 12 14 17 18 19 22 27 30
Days in Storage
Bottom Cage 1 (VP)
Bottom Cage 2 (VP)
Floating (MP)
Floating (VP)
Bottom Cage Bag (VP)


Oyster Mortality in Walk-In Cooler
Cumulative Mortality (%)
80%
70%
60%
50%
40%
30%
20%
10%
0%
Floating, Inner
Floating, Outer
Bottom
Days
16
19
22
25
28
31
34
37
40
43
46
49
52
55
58
61
64
67
70
Days

Do Customers Notice Differences?

- Casa Pearl, Williamsburg
- September 2023
- 37 Participants (Raw oyster consumers)
- After tasting all three varieties from single farm and asked to order just one variety for the table for next round
  - Oysters raised in bottom cages were chosen nearly twice as often as the two types of oysters raised in floating cages
- After tasting all five varieties offered and asked to order just one of those for last round
  - Bottom cage and oysters from the saltiest site were the top choices
  - Followed by oysters from floating inner
  - Floating outer and oysters from a lower salinity site were the least commonly selected
  - **Note though that there were customers that were adamant that each oyster was the best**

Conclusions

- Clear differences in product attributes during production and post-harvest
- Growers can consider the trade-offs in production costs against the various perceived benefits
- Marketplace seems to embrace some differentiation in varieties

VIMS | William & Mary
Virginia Institute of Marine Science

Sea Grant Virginia

VIRGINIA AQUACULTURE CONFERENCE

LIGHTNING TALKS

Tracey Saxby, Integration and Application Network (ian.umces.edu/media-library).

Economic impact of shellfish closures in Virginia

Fernando Gonçalves
Jonathan van Senten
Katheryn Parraga-Estrada
Michael Schwarz

VIRGINIA AGRICULTURAL EXPERIMENT STATION
VIRGINIA SEAFOOD AGRICULTURAL RESEARCH AND EXTENSION CENTER
VIRGINIA TECH™

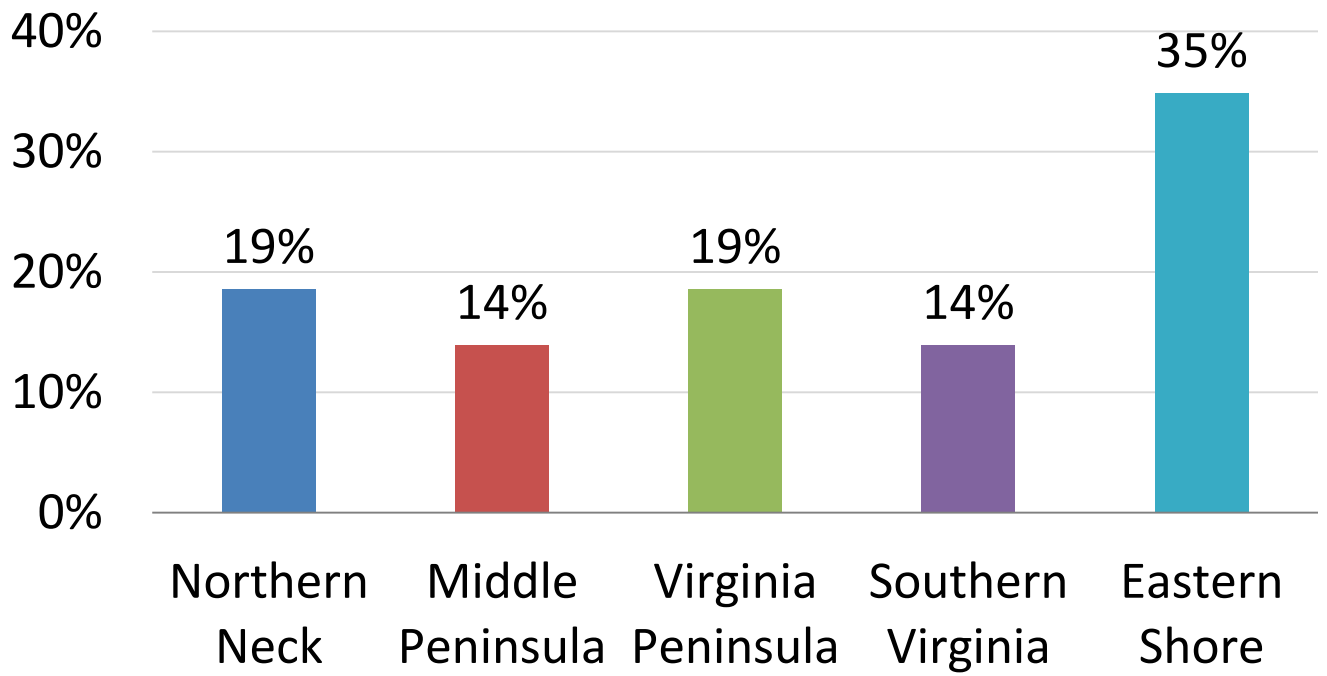
SEAMaR Seafood Economic Analysis & Marketing Research

Sea Grant VIRGINIA

Survey

Response rate	Coverage rate
28%	17%

Geographic distribution of survey respondents



Estimates of economic impacts of shellfish closures on the farm level in Virginia

Indicators	2021	2022
Average acreage of farms	265.27	265.27
Closure days	143.12	112.41
Effects on sales (%)	80%	80%
Effects on employment (%)	40%	40%
Effects on sales ($/acre/day)	**0.47**	**1.35**
Effect on labor income ($/acre/day)	0.64	N/A
Total sale loss in VA	$2,169,801	$4,895,087
Total labor income reduction in VA	$1,477,311	N/A
Total job losses in VA	89	N/A

Total estimated economic impact of closures to Virginia shellfish growers

Category	Jobs	Labor income	Output
Aquaculture*	1,367	$6,441,948	$177,200,126
Direct effects*	1,073	$17,836,629	$119,657,312
Shellfish*	898	$14,933,743	$100,183,254
Impact 2021	-89	-$1,477,311	-$2,169,801
% Δ	-9%	-9%	-2.1%
Impact 2022	-	-	-$4,895,087
%Δ	-	-	-4.7%

Frequency of effects on shellfish farms caused by closures in the past 2 years

	Never	Once in a while	About half the time	Most of the time	Always
Loss of employees	**67%**	**17%**	0%	17%	0%
Reduced sales	13%	13%	0%	**37%**	**37%**
Complete loss of sales	25%	0%	0%	**25%**	**50%**
Permanent loss of customers	33%	33%	0%	17%	17%
Change of customer base	33%	17%	0%	33%	17%
Loss of marketability	29%	0%	14%	29%	29%
Costs with Relay	67%	0%	0%	17%	17%
Penalties/fees	**100%**	**0%**	0%	0%	0%

Ranking of alternatives for reducing the negative economic effects of closures while keeping the product safe for consumers, according to survey responses

Statement	Disapproved	Neutral	Approved
Tracking sources of contaminants	23.52%	5.88%	**70.59%**
Increased access to leasable grounds/waters	23.53%	11.76%	**64.70%**
Closure exemption by private sample testing	23.53%	29.41%	47.05%
Training for water quality testing	25.00%	31.25%	43.75%
Water-based wet storage	18.75%	37.5%	43.75%
Relief programs for closures	**29.41%**	29.41%	41.17%
Onshore wet storage	**31.25%**	31.25%	37.50%
Crop insurance	**35.30%**	29.41%	35.29%

Thank you!

Fernando Goncalves
ocfernando@vt.edu