

# SBE-Oyster Crop Insurance Basic Research

R. Cerda, C. Parker, D. Clauser, L. Jansonius

## Funding Opportunity:

### Social, Behavioral, and Economic Research Needs in Aquaculture - 2019

- Crop Insurance Systems (CIS) requested funding to develop a crop insurance Concept Paper to submit to USDA.
- The USDA evaluates Concept Papers to determine whether the concept is likely to result in a viable crop insurance product.
- If USDA determines the proposal is likely to be a viable crop insurance product, funding for research and development is provided.
- CIS received funding to develop an Oyster Crop Insurance program in October 2021.

# Oyster Crop Insurance Concept Proposal

Proposed by:

**East Coast Shellfish Growers Association**

**Maine Aquaculture Association**

**North Carolina Shellfish Growers Association**

**Massachusetts Aquaculture Association**

**Ocean State Aquaculture Association**

**Ward Oyster Company**

**Orchard Point Oyster Co**

**Rural Community Insurance Services**

**Crop Insurance Systems, Inc.**

**October 28, 2021**

A photograph of two men on a boat, likely an oyster boat, handling oysters. The man on the left is wearing a blue long-sleeved shirt and a grey cap. The man on the right is wearing a light-colored plaid shirt, a brown cap with a logo, and blue gloves with yellow accents. They are surrounded by oysters on a wooden surface. In the background, there are more oyster racks in the water and a cloudy sky. The text "What we will talk about." is overlaid in white on the top half of the image.

# What we will talk about.

- A little bit of the history of Crop Insurance.
- The benefits of having crop insurance.
- What oyster crop insurance will protect against.
- Crop insurance models and the insurance model CIS is pursuing.
- The challenges CIS must address.
- The insurance program development process.



# A brief history of Crop Insurance

1939: Crop insurance begins as a pilot program covering wheat and a year later, cotton.  
**Central Question:** Can crop losses be predicted and can crop insurance help farmers manage the financial consequences of crop losses?  
1979: Congress answers the question affirmatively



1981: Crop insurance becomes a national program and begins expanding to cover many more crops. Private sector insurers are brought into the program to increase farmer participation in the insurance program.



2000: The private sector becomes the exclusive developer of crop insurance products.

2005: Crop Insurance Systems is formed to help farmers find solutions to their crop insurance problems.

# Primary Purpose of Crop Insurance

## Budgeting tool

- Allows the government to predict expenditures for crop disasters.
  - Congress wanted to end the need for ad-hoc disaster assistance payments that traditionally caused a search for unbudgeted money to pay for crop disasters.
- Provides farmers with a counter measure against production and or revenue losses.
  - Participatory Disaster Assistance





# What we know about Farmers who use crop insurance

- Farmers use crop insurance to protect their operating results.
- Farmers that use crop insurance finish their careers wealthier than farmers who don't use crop insurance.
- With crop insurance as a backstop, farmers take prudent risks to grow their business.
- With crop insurance, financing farming operations is easier because growers have repayment capacity.

*Crop Insurance Protects Farm Equity*



## Causes of Loss the Insurance Covers

### Covered Causes

Adverse weather  
Freeze  
Excessive Precipitation  
Drought  
Disease  
Low salinity  
High Salinity  
Hurricane  
Ice floe  
Storm surge  
Algae bloom

### Excluded Causes

Mysterious disappearance  
Pollution  
Oil spills  
Quarantine  
Boycott  
Loss of value

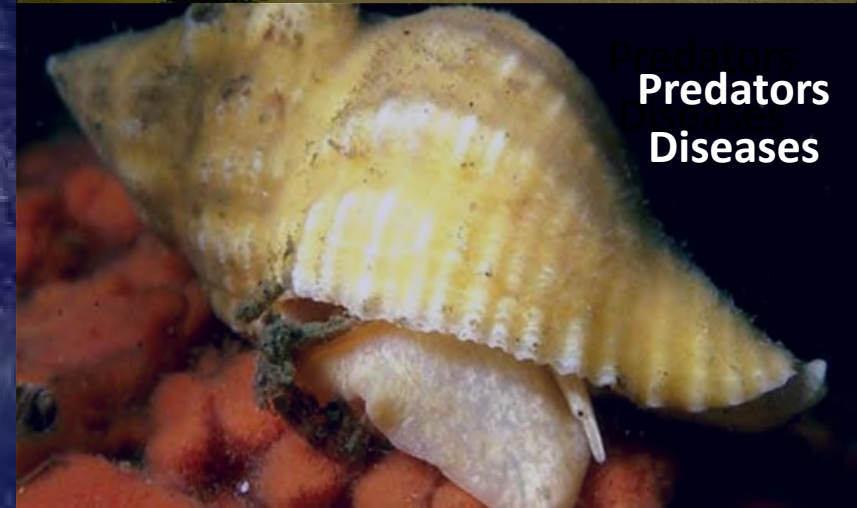
Increased  
Salinity



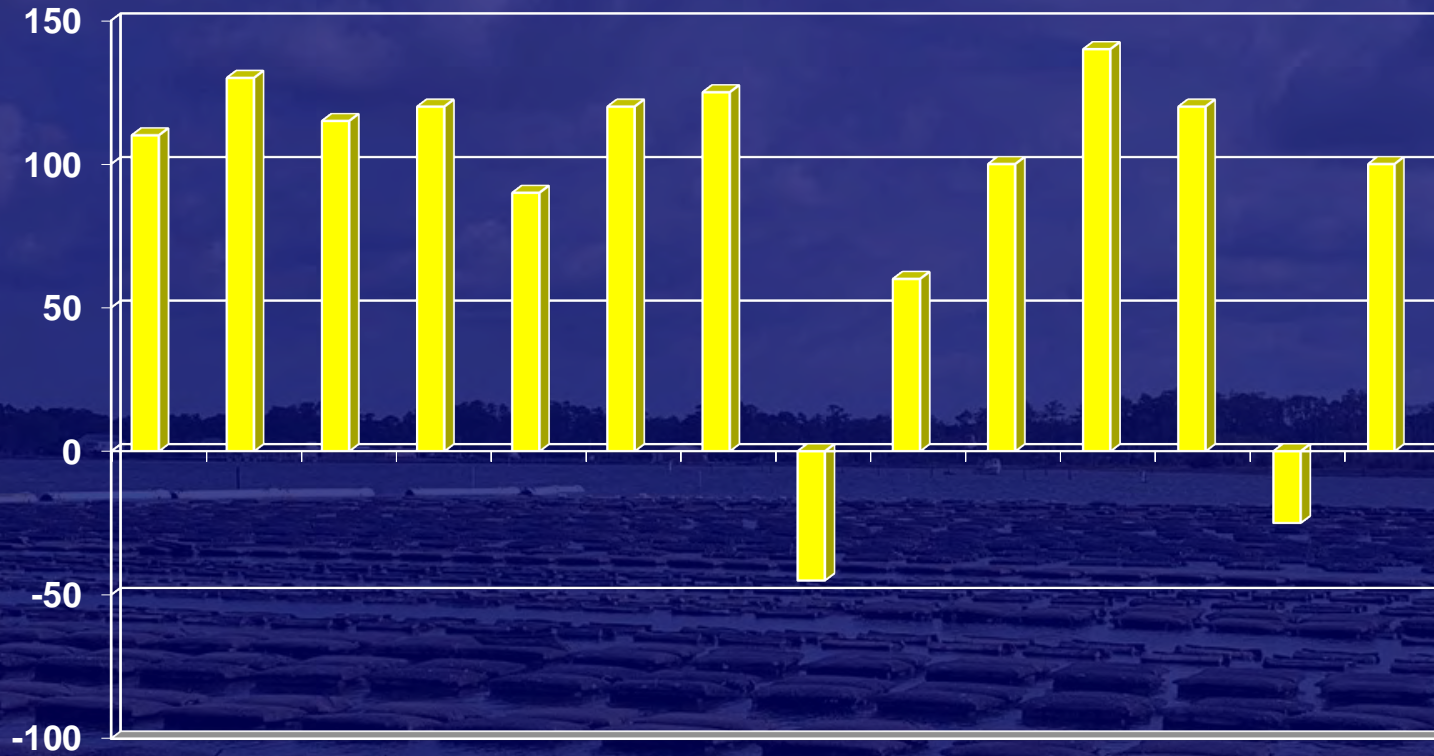
Decreased  
Salinity



Predators  
Diseases

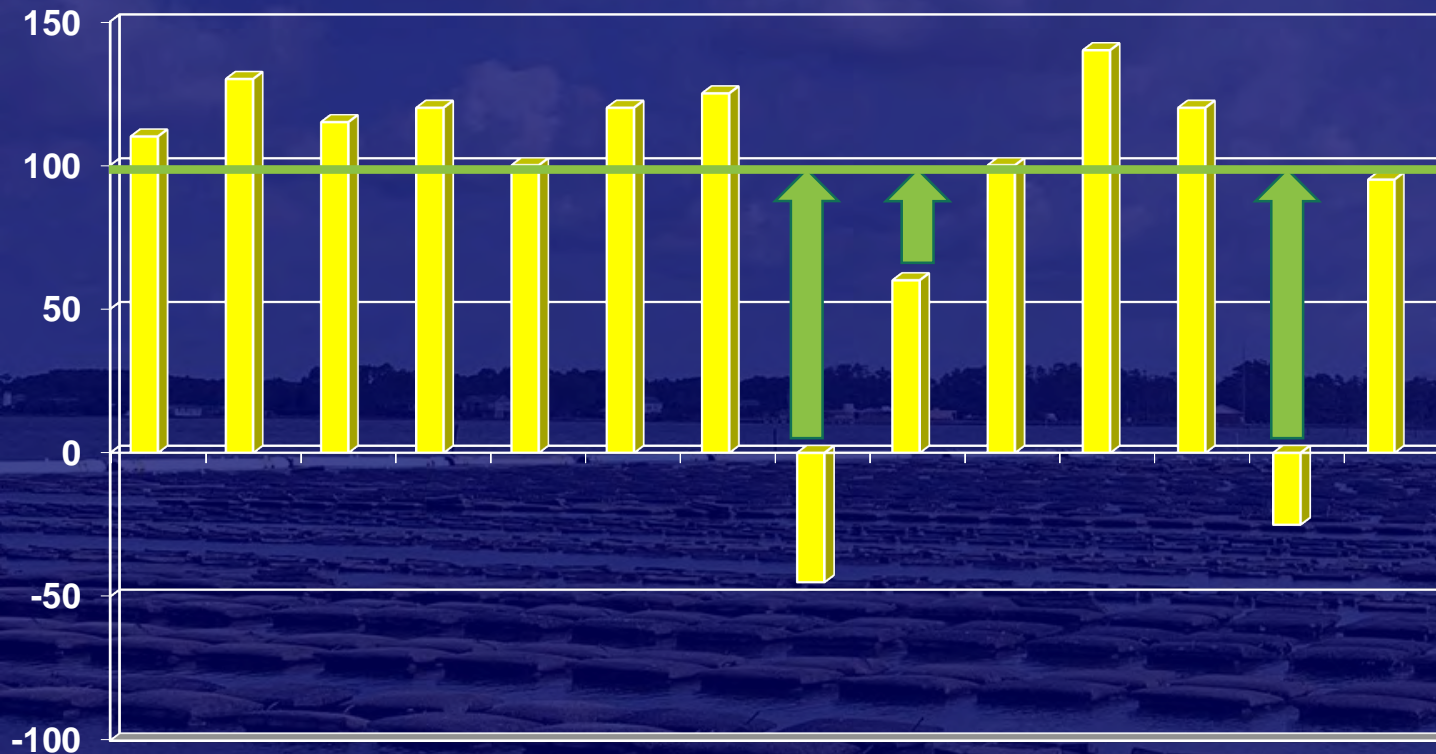


# Income from Operations Without Crop Insurance



*"Mother nature is your partner; she is not your friend"*  
Bob Rheault

# Income from Operations With Crop Insurance



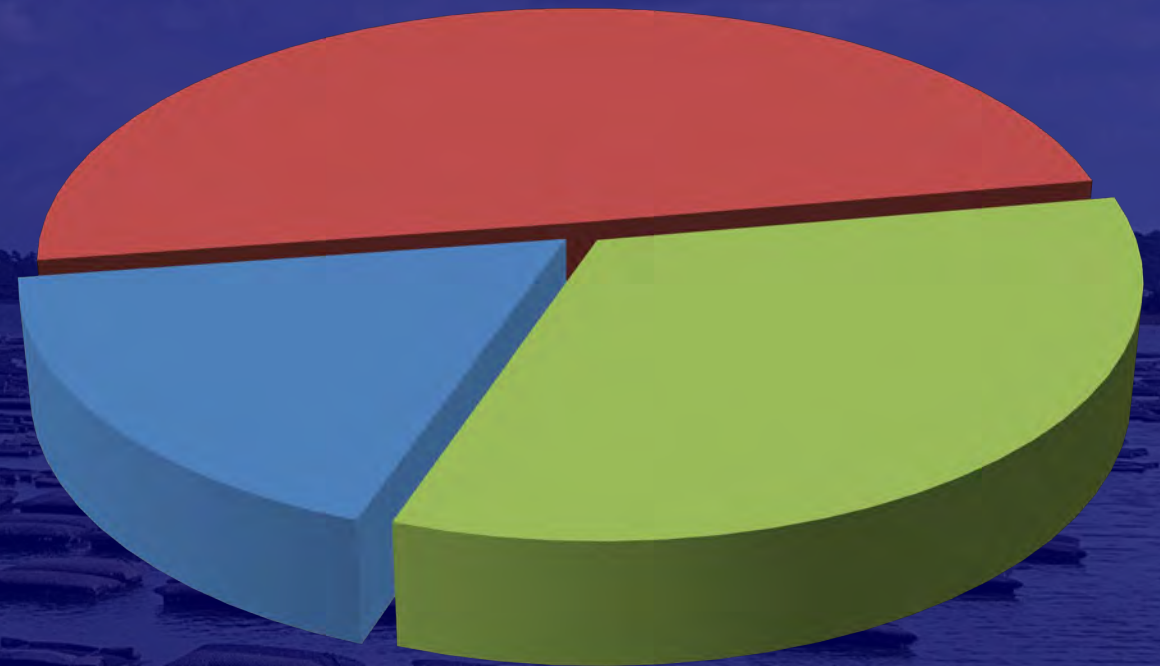
## Benefits

1. Provides a minimum income that helps growers meet their financial obligations when crop yields are troubled.
2. Makes an oyster business a better credit risk.
3. Increases grower opportunities to expand operations because the grower can transfer the risk of loss to the insurance company.
4. Likely to increase farmer wealth over time because the insurance absorbs the yield shocks.
5. Peace of mind.

# What About Crop Insurance Premiums?

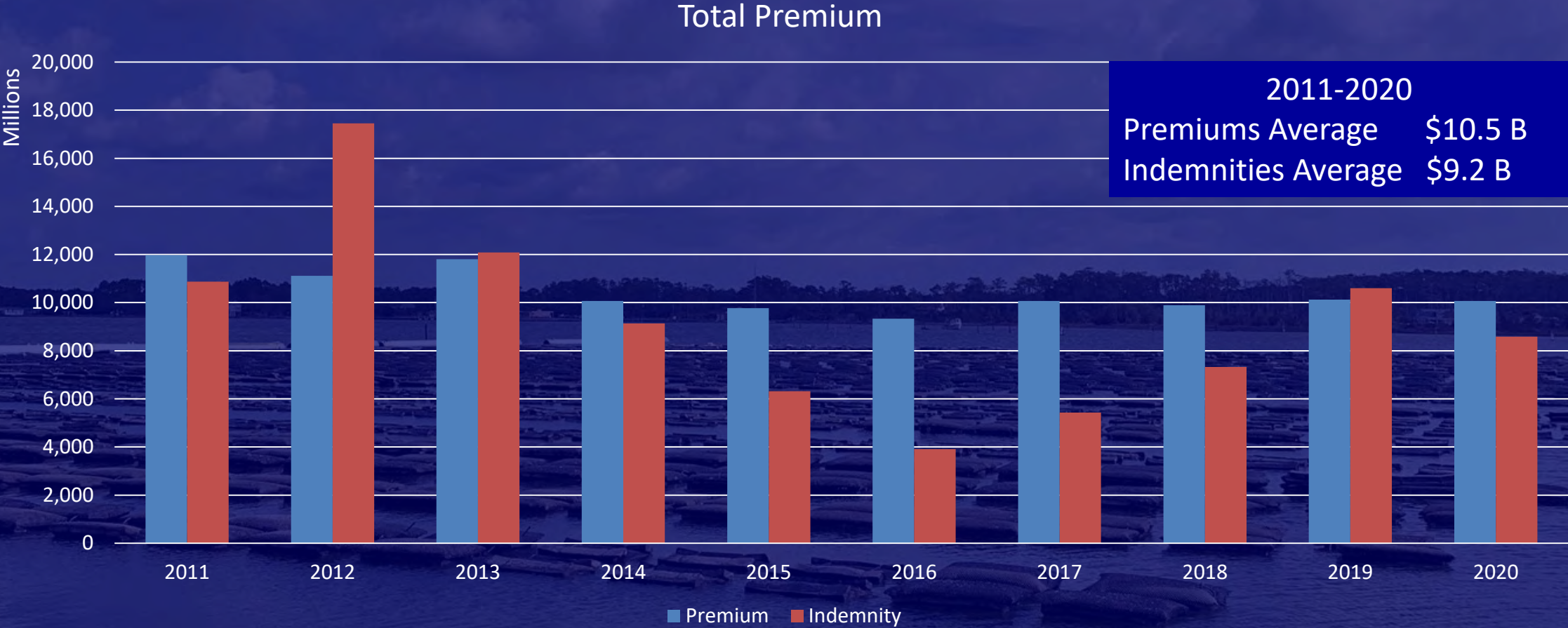
- What is in an insurance premium?
  - Pure Premium: the amount needed to pay for expected insurance losses.
  - Administrative Costs:
    - Research and Development
    - Administration
    - Agent commissions
    - Loss adjustment expenses
    - Profit

Federal Crop Insurance Premiums



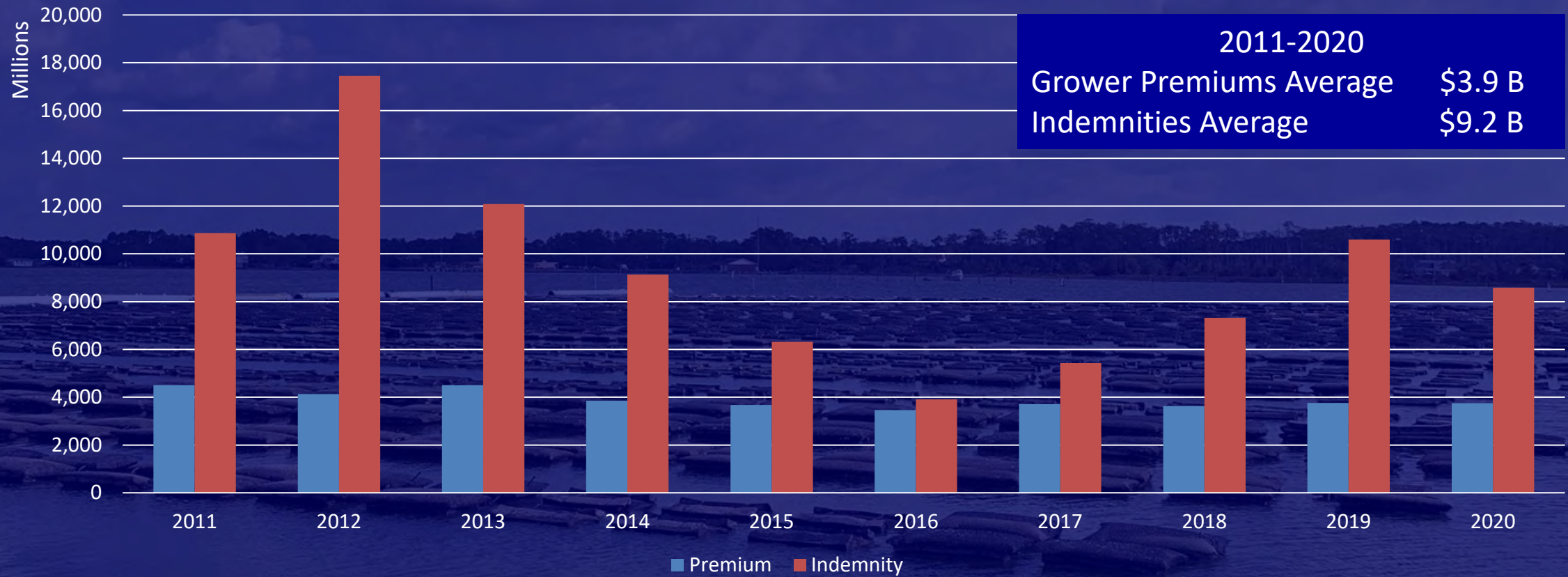
■ Admin. ■ Subsidy ■ Grower Premium

# Ten Years of Total Premium vs Indemnity



# 10 Years of Grower Premium vs Indemnity

## Subsidized Premium



# The Insurance Developers Problem



Pre loss: What Value?



Post Loss: What's left?

- Devise an accurate system to:
- Set an insurance amount.
  - Identify when a loss occurs.
  - Determine the amount of loss.
  - Estimate insurance cost.
- Pure Premium



# Insurance Models

Area wide Insurance

Individual Insurance

Area Yield/acre

Area Revenue/acre

Yield /acre

Revenue/acre

Vegetative Cover

Rainfall Index

Inventory Based

Production Based

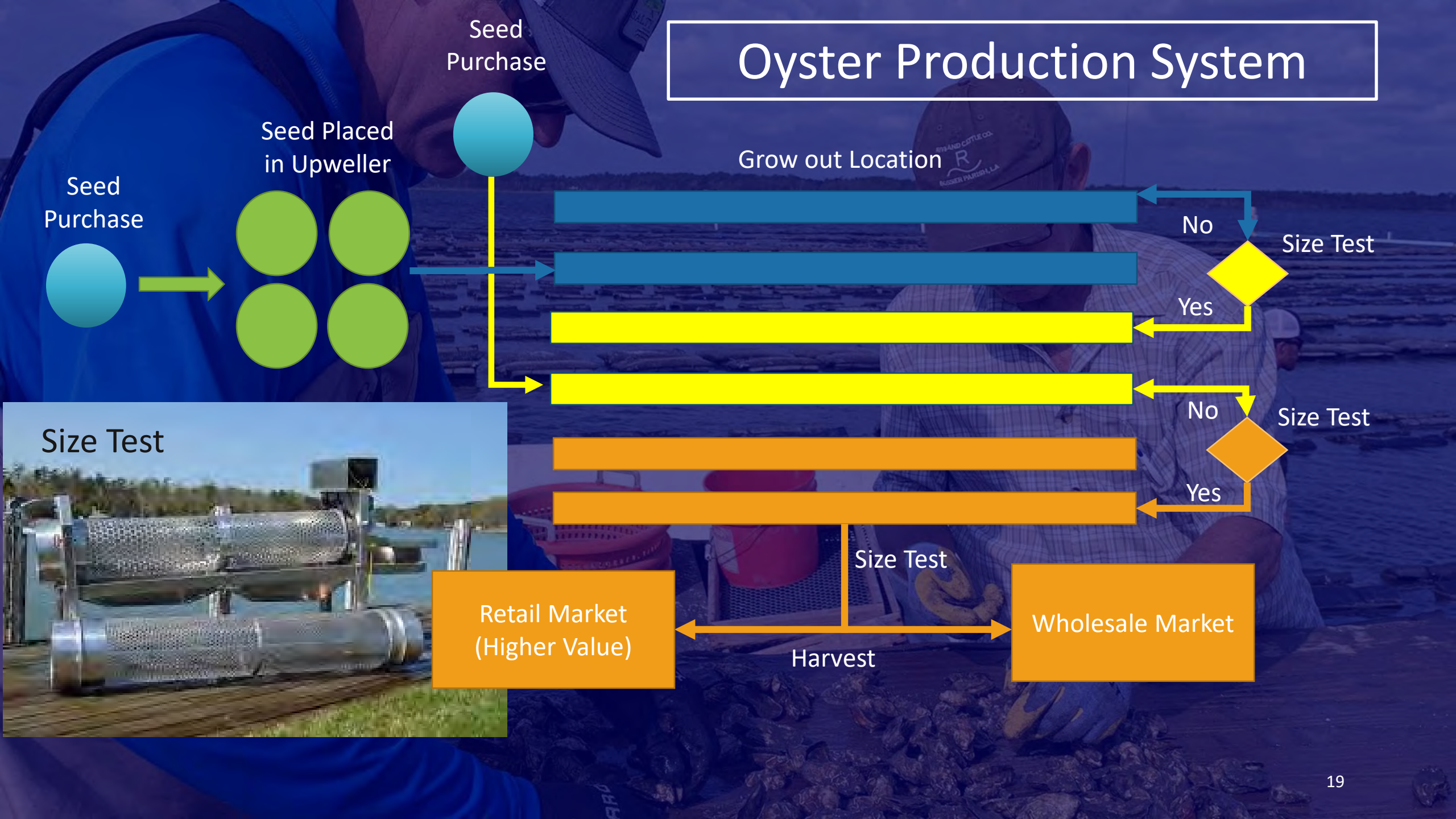
# What we know so far about Oyster Insurance.

- The program that seems most appropriate for the oyster industry is an inventory insurance model.
- The inventory model insures the value of oysters held in inventory.
- Oysters will be valued based on their size with some recognition of time lost if the oysters are destroyed.
- Bottom culture will not be insurable, at least initially.
- Finishing on the bottom may be insurable but CIS will need to understand how to determine the inventory on the bottom and how to determine any loss amount.



An Inventory Model sets the amount of insurance through an accounting of the number of oysters in process to be sold times a value of the oysters.

# Oyster Production System



Seed Purchase

Seed Placed in Upweller

Seed Purchase

Grow out Location

Size Test

No

Yes

Size Test

Size Test

No

Yes

Size Test

Retail Market (Higher Value)

Wholesale Market

Harvest

# Inventory Model

## Estimating the Oyster Inventory

Inventory Example					
Oyster Size	Oyster Count	Maximum Stocking Density	Oyster Bag Inventory	Survival Rate	Oysters
½ inch	50,000	18,000	3	85%	42,500
1 inch	42,500	3,200	14	90%	38,250
2 Inch	38,250	550	70	95%	36,338
3 inch	36,338	190	191	95%	34,521

## Estimating the Oyster Inventory Value

Inventory Value Example					
Oyster Size	Oyster Count	Survival Rate	Oysters	Value	Inventory Value
½ inch	50,000	85%	42,500	\$0.10	\$4,250
1 Inch	42,500	90%	38,250	\$0.35	\$13,388
2 Inch	38,250	95%	36,338	\$0.65	\$23,620
3 Inch	36,338	95%	34,521	\$0.95	\$32,795
				Total	\$74,053

# Likely formulas: Indemnity

## Production to Count

Oyster Size	Inventory after Loss (PTC)		Loss from Uninsured Causes	=	Ending Inventory
½ inch	8,500	+	6000	=	14,500
1 Inch	15,300	+	0	=	15,300
2 Inch	16,352	+	2000	=	18,352
3 Inch	17,261	+	0	=	17,261

## Post Loss Inventory Value

Oyster Size	Ending Inventory		Value per Piece	=	Ending Value
½ inch	14,500	x	\$0.10	=	\$1,450
1 Inch	15,300	x	\$0.35	=	\$5,355
2 Inch	18,352	x	\$0.65	=	\$11,929
3 Inch	17,261	x	\$0.95	=	\$16,398
					\$35,132

## Indemnity Amount

Insurance Guarantee		Post Loss Inventory Value	=	Indemnity Amount
\$51,837	-	\$35,132	=	\$16,705

## Expected Liability

**Good agreement between program and industry**

**70% of crop insured at or above 65%**

Percent of Crop Value Covered		0.8						
Crop Covered by Coverage Level		0.10	0.05	0.15	0.35	0.25	0.10	
		Coverage Level						
State	Farm Gate Value (000)	50%	55%	60%	65%	70%	75%	Liability
Maine	\$9,670	\$271	\$213	\$696	\$1,760	\$1,354	\$580	\$4,874
New Hampshire	\$419	\$12	\$9	\$30	\$76	\$59	\$25	\$211
Massachusetts	\$28,385	\$795	\$624	\$2,044	\$5,166	\$3,974	\$1,703	\$14,306
Rhode Island	\$5,745	\$161	\$126	\$414	\$1,046	\$804	\$345	\$2,895
Connecticut	\$15,000	\$420	\$330	\$1,080	\$2,730	\$2,100	\$900	\$7,560
New Jersey	\$1,370	\$38	\$30	\$99	\$249	\$192	\$82	\$690
Maryland	\$3,651	\$102	\$80	\$263	\$664	\$511	\$219	\$1,840
Virginia	\$13,100	\$367	\$288	\$943	\$2,384	\$1,834	\$786	\$6,602
North Carolina	\$2,400	\$67	\$53	\$173	\$437	\$336	\$144	\$1,210
South Carolina	\$649	\$18	\$14	\$47	\$118	\$91	\$39	\$327
	<b>\$80,389</b>						<b>Total</b>	<b>\$40,516</b>

# Funding Phase

We receive funding we must:

1. Demonstrate the ability to develop and design a workable crop insurance model.
2. Demonstrate the interest of growers in the insurance.
3. Demonstrate the product can be efficiently produced.





# Development Phase

To gain approval of the program we must:

1. Demonstrate the proposal will provide benefit to the growing community.
2. Demonstrate the proposed program will be marketable.
3. Demonstrate the proposal will protect the interests of the taxpayer.
4. Demonstrate the program can be administered by the insurance companies participating in the program.





**SBE-Enhancing community  
resilience and seafood sustainability  
through a diverse seafood  
processing workforce**

L. Cramer, H. Eгна, M. Maldonado, F. Conway

***Enhancing community resilience and  
seafood sustainability through a  
diverse seafood processing workforce***

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LORI A. CRAMER, FLAXEN D.L. CONWAY, MARTA  
MALDONADO, HILLARY EGNA, JENNIFER  
BEAULLIEU



Oregon State  
University

# The Oregon Seafood Processing Story

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Crab pots in front of a processor in Tillamook County, OR



Oyster processing in Coos County, OR

- Seafood production now exceeds production rates of every other animal food sector.
- Increased demand results in increased seafood processing activities.
- Seafood is highly perishable and takes a lot of hand labor.
- Cultivated & captured seafood is embedded in the economy and culture of Oregon's coastal communities.
- The processing sector is understudied despite National Standard 8 of the MSA.

# The Oregon Seafood Processing Story

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- Ecological and social change, along with seafood demand, exacerbate the need to investigate the relationship between the seafood processing industry and their host communities.
- In Oregon, what is unclear is an understanding of this industry's role in resilience of coastal communities where these seafood processing activities occur.
- Our study examines potential workforce transitions needed to meet industry demands *and* to improve coastal community resiliency.

# Background/Context

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## *Adaptation/Resilience*

- *A system's ability to modify itself in the face of a changing environment*

## *Communities of Place (COP)*

- *Coastal communities that house seafood processing facilities/industries (aquaculture & wild capture)*

## *Community of Interest (COI)*

- *Seafood industry leaders and support industry representatives*



Oyster shells in baskets along Netarts Bay, (Tillamook County) Oregon.

# The Approach

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- Multiple Oregon Coastal Communities
- 2018-2019 Pilot Project in Coos County
- 2020-2022 Current Project in Tillamook
- Qualitative: Semi-Structured Interviews
  - Community Leaders
  - Industry Leaders
  - Seafood Processing Workforce
- Zoom Interviews
  - Video/Audio recorded, transcribed, inter-rater reliability
  - Code for themes





# COVID-19 Pandemic Impacts

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- Covid-19 was preliminarily found to be a barrier to enhancing seafood processing as it brought uncertainty for the industry and those within it
- The pandemic further highlights preexisting challenges:
  - Policy/management changes
  - Environmental conditions
  - Market fluctuations



# COVID-19 Pandemic Impacts

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- It also impacted our study:
  - Lack ability to do ‘deep engagement’ [to date]
  - Highlights the importance of relationship-building; more difficult when not able to be onsite
  - Shift interview structure from in-person to Zoom (and then Hybrid)
  - Less of an issue with access to community leaders, yet more challenging with industry leaders and workers
- Largest processing plant closed and did not re-open (largest employer of non-English speaking workers)
- Despite setbacks, completed 25 interviews: 14 community leaders, 5 industry leaders, and 6 workers.



# Results From the Pilot

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- **Exposing the work:** identified, explored, and exposed important elements of the work and workforce.
- **Hiddenness:** The industry, work, and workers are in many ways hidden from the broader community.
- **Pervasive blind spots:** The industry and workers have internal blind spots in that they may *undervalue* their contributions or needs, and *overvalue* the broader community's understanding of the industry.
- **Precariousness:** Both the industry and workforce are often “squeezed” by factors beyond their control.



# Results (to date) for Tillamook:

## *Emerging Themes*

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- Characterization of the industry
  - Barriers to recruitment and retention
  - Seasonality
- Characterization of the work and workforce
  - Hard, cold work and low automation
  - Lack of advancement
- Characterization of the community
  - Lack of affordable housing
  - Transportation issues



# Results (to date) for Tillamook: Opportunities & Challenges

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- Community Leaders
  - Believe seafood processing is important
  - Don't understand it
- Industry Leaders
  - High quality product
  - Recruitment & Retention & Bar Conditions
- Workers
  - Provides a job with fulfilling work
  - Others don't understand it



# Importance of Seafood Processing

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Dungeness crabs displayed by an industry leader

“The seafood and this industry are part of the legacy and heritage of this region. It's been a way of life for so many people for centuries; even before the pioneers got here.

The people that live here are connected to it really deeply. They live and breathe it. They live by the tides and that's a real thing. Seafood processing is and always has been that essential part that turns a moment into more...

So processing is the key that unlocks the value of that (product) for the people. Not just that live here, but that visit here, and then all the people that are touched by it, and the consumers in other places too.” (INTCL#015, Pos. 67)

# Next Steps

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- Finish transcribing/analyzing the data
- Use results to refine Qs to take a quick glance with NE and Norway
- What is the complete story community resilience?



Images: Oregon Sea. <https://www.flickr.com/photos/oregonseagrant/albumsGrant>

# Conclusions to date

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- Aquaculture in Tillamook is emerging as important to overall resilience
- Mechanization – not an issue
- Ever-present culture of adaptation that serves as the anchor of resilience in coastal Oregon.





# Thank you!

Lori Cramer

cramerl@oregonstate.edu

Community, Industry, and Worker Participants

Sponsor: NOAA



# SBE-The GIS Based Tool for Spatial Planning and Management of Shellfish Aquaculture in New Jersey

M. DeLuca, L. Marxen, L. Calvo, J. Herb

# A GIS-Based Tool for Spatial Planning and Management of Shellfish Aquaculture in New Jersey

Sea Grant Research Symposium, October 28, 2021

Michael P. De Luca<sup>1</sup>, Lucas Marxen<sup>2</sup>, Jeanne Herb<sup>3</sup>, Lisa Calvo<sup>4</sup>, David Bushek<sup>4</sup>, Russ Babb<sup>5</sup>, Jeff Normant<sup>5</sup>, Michelle Stuart<sup>2</sup>, Zack Greenberg<sup>6</sup> and Megan Kelly<sup>5</sup>

1 Aquaculture Innovation Center, Haskin Shellfish Research Laboratories, Rutgers University

2 Office of Research Analytics, Rutgers University

3 Bloustein School of Planning and Public Policy, Rutgers University

4 Haskin Shellfish Research Laboratories, Rutgers University

5 Bureau of Shellfisheries, New Jersey Department of Environmental Protection

6 Pew Charitable Trusts, Washington, DC



# Key Objectives

- Identify suitable areas for future shellfish aquaculture in NJ
- Identify potential coastal use conflicts
- Collect relevant data layers to support an interactive tool
  - Hydrological characteristics
  - Man-made obstructions
  - Climate and environmental data
  - Current shellfish leased grounds
  - Social information regarding other coastal resource uses
  - Many other data layers
- **Not** a comprehensive spatial plan for shellfish aquaculture, but rather a ***data-informed tool*** that can be used by resource managers and the stakeholder community for aquaculture and coastal management policy, planning and applications for shellfish aquaculture operations.

# Advisory Mechanisms

- Technical Advisory Group
  - Identify relevant scientific data, advise on analytical methods and large data set management
  - Research community (Plant biology, water quality, wind energy, physical oceanography, SAVs, climatology, coastal processes, shoreline change, coastal ecology, GIS)
- Project Workgroup
  - Identify relevant data sets, existing coastal uses, stakeholder outreach
  - The Nature conservancy, American Littoral Society, Jersey Coast Anglers Association, Recreational Fishing Alliance, Shellfish Council, Marine Fisheries Council, Marine Trades Association, NJ Aquaculture Association, Cape May County Planning, Barnegat Bay Partnership, Lunds Fisheries, Bayshore Council, Shellfish aquaculturists

# Communication and Outreach Efforts

- Resource management community (state and federal agencies, NGOs)
- Shellfish Councils
- National meetings

Northeast Aquaculture Conference and Exposition (Jan 2022)

Aquaculture 2022 (Mar 2022)

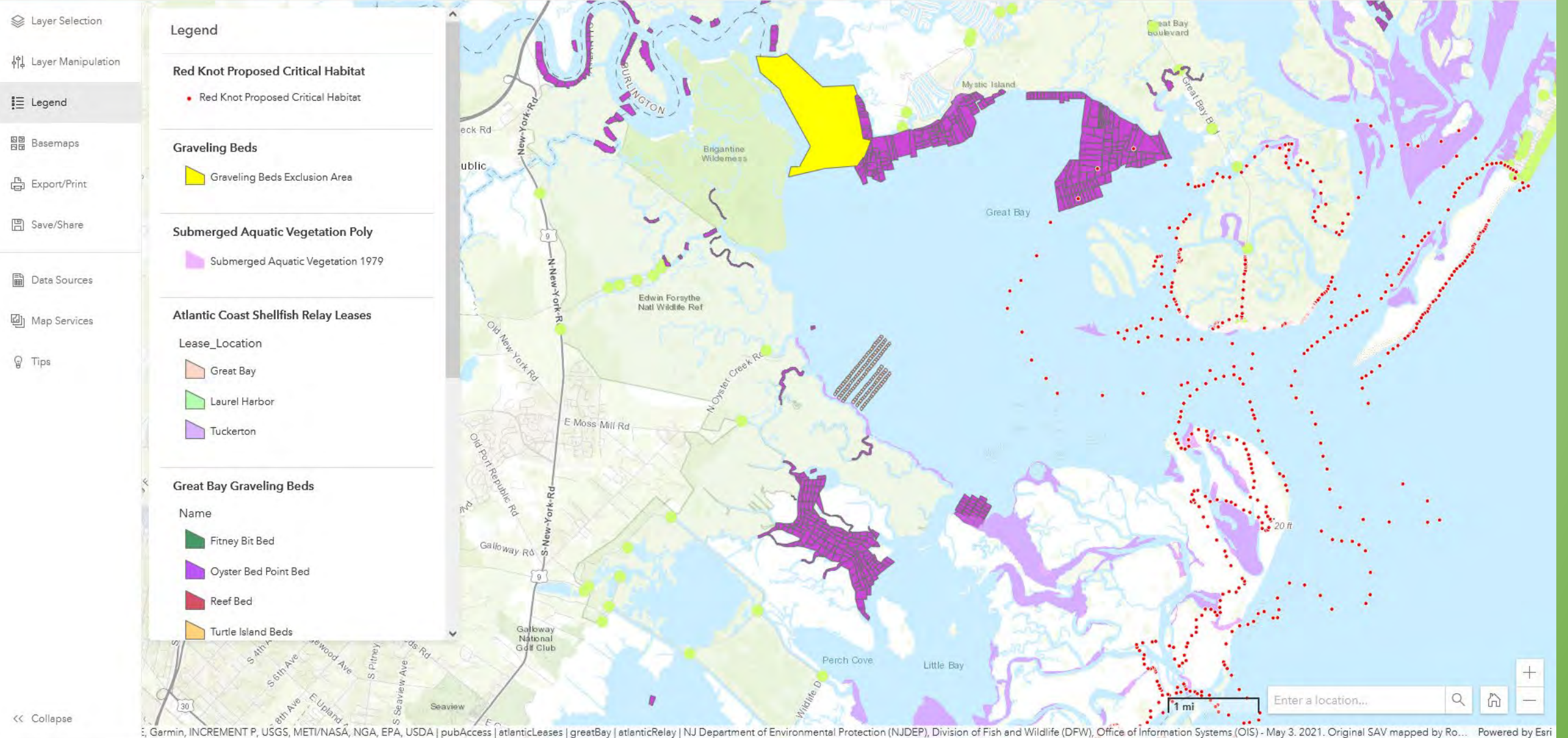
World Aquaculture Society, National Shellfisheries Association,  
National Aquaculture Association, American Fisheries Society (Fish  
Culture Section)

# NJ Aquaculture Suitability Tool

- A GIS-based tool providing informational layers regarding:
  - Alternative-uses
  - Existing aquaculture beds
  - Habitat and environmental factors
  - Navigation waterways and channels
  - Regulatory areas
- Includes features to aid users
  - Export/Print – Users can export maps they create as image files or PDFs and create printable maps.
  - Save/Share – Users can save and share their maps, including all added layers, transparency settings and map extent by generating a url that can be used at anytime to recreate the map working environment

# NJ Aquaculture Suitability Tool

## NJ Aquaculture Suitability Map





# NJ Aquaculture Suitability Tool

- All spatial data and metadata is available through an ArcGIS Online Group for users interested in accessing data for further analysis.
  - <https://arcg.is/05Sfu5>
- Data layers are linked to authoritative sources when available to ensure the most up-to-date data is being utilized in the tool.
- Administrative access to data being coordinated with NJDEP in order to update layers not accessible through other means and to add new datasets as they become available.

# A GIS-Based Tool for Spatial Planning and Management of Shellfish Aquaculture in New Jersey

- Comments and Questions

Thank you to the National Sea Grant College Program for support, and to the many partners engaged in development of the project.

Award # NA19OAR4170325



# SBE-A Mixed-Methods and Comparative Approach to Understanding the Social Dimensions of Aquaculture Production, Consumption, and Siting

L. Fairbanks, G. Murray, L. Campbell, J.  
Stoll, L. D'Anna, N. Boucquey

# A Mixed-Methods and Comparative Approach to Understanding the Social Dimensions of Aquaculture Production, Consumption, and Siting

Luke Fairbanks, The University of Southern Mississippi ([luke.fairbanks@usm.edu](mailto:luke.fairbanks@usm.edu))

Grant Murray, Duke University; Lisa Campbell, Duke University; Joshua Stoll, University of Maine; Linda D'Anna, Coastal Studies Institute; Noëlle Boucquey, Eckerd College

Sea Grant Aquaculture Symposium | October 28, 2021



# Project Rational and Objectives

- Policies and policy goals inconsistent with people's wants and needs
- Lack of attention to social and political context
- Local social issues affect development
- Inequitable development and distribution of benefits

*People–policy gap (Krause et al. 2015)*

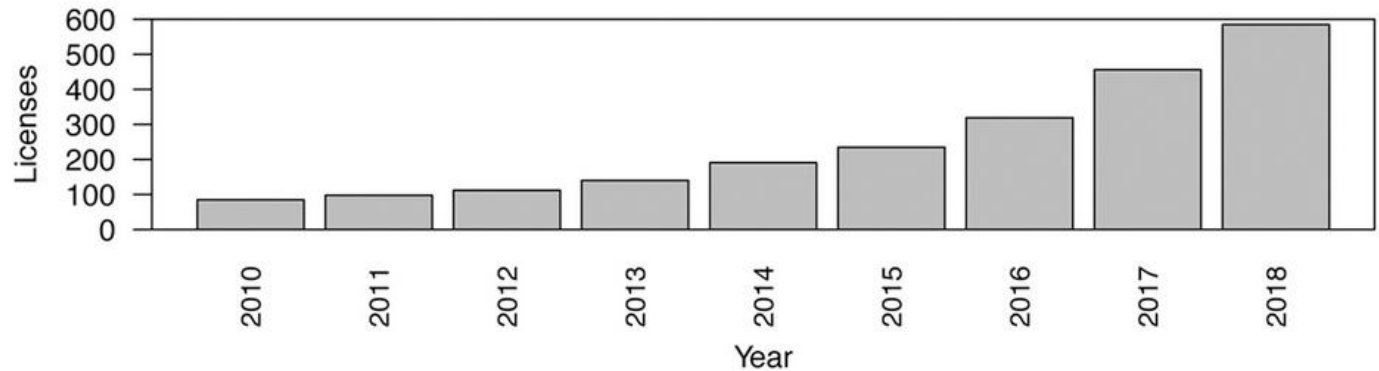
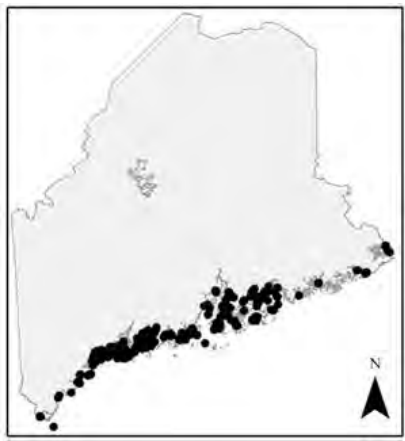
## *Objectives:*

- Identify the range and structure of social values and perceptions associated with aquaculture in three regions (ME, NC, and FL) that can be used to inform aquaculture planning and siting.
- Provide generalized information about the social dimensions of aquaculture through a comparative analysis of the three regions.
- Develop and refine a pair of tools (survey and Q methodology) that can be used in the future to assess the social dimensions of aquaculture across locations and contexts in a standardized way.

# Risks of a People-Policy Gap?

(Krause et al. 2015)

Will industry growth = job and economic growth? For whom?



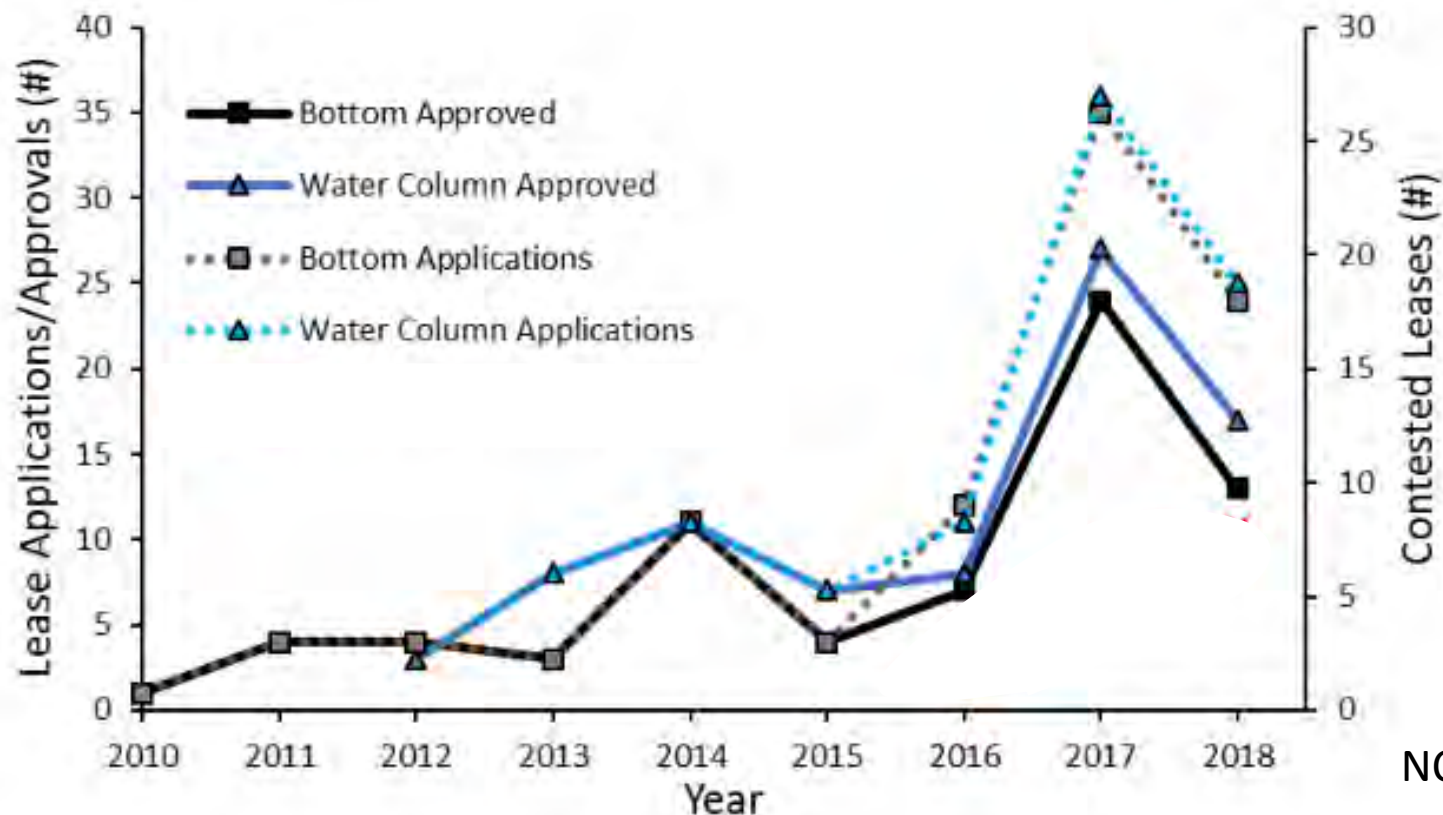
*“Counter to the prevailing narrative, relatively few people in the fishing sector are participating [in marine aquaculture].”*

Stoll et al. 2019

# Risks of a People-Policy Gap?

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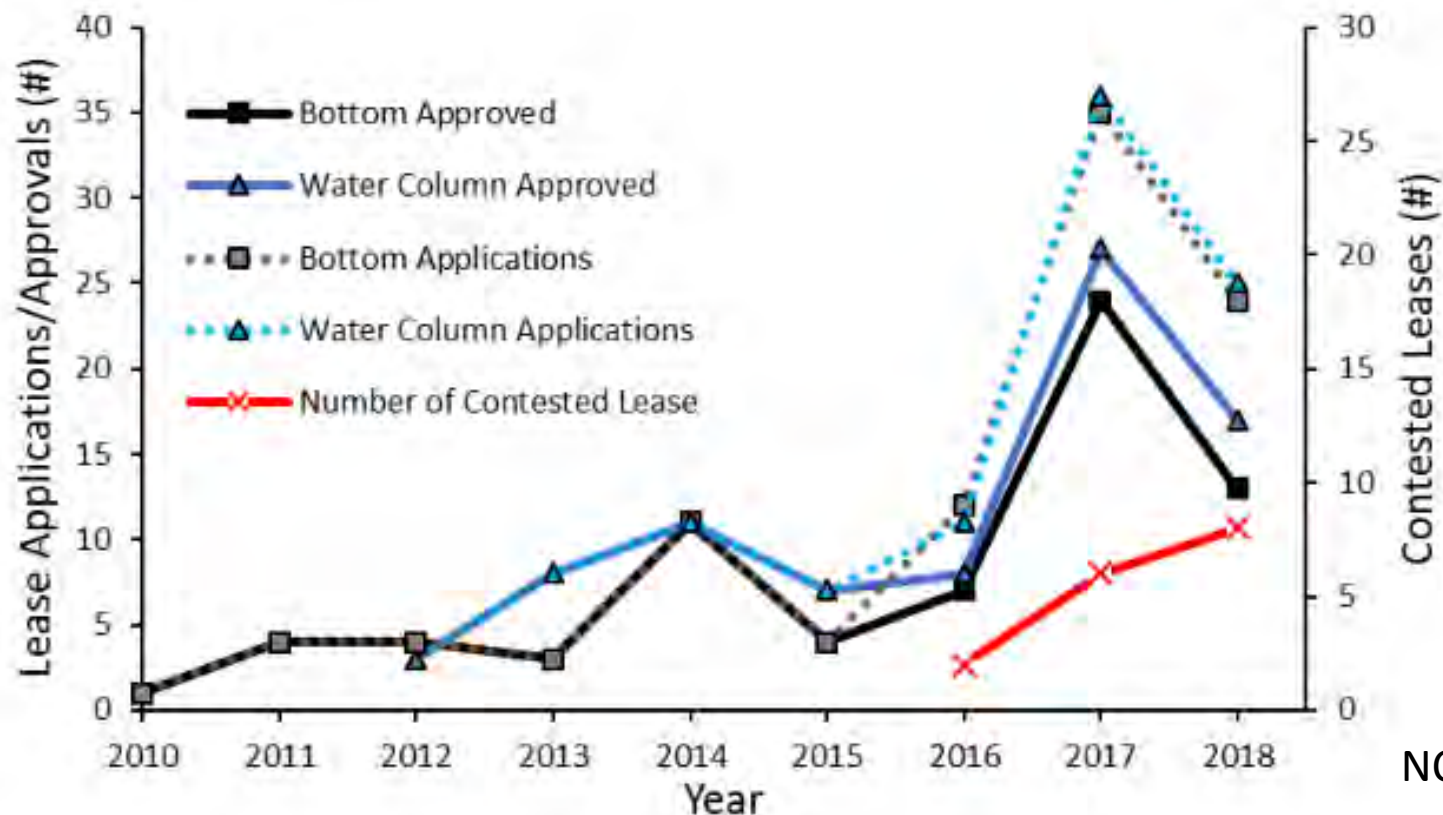
Will we see continued conflicts over development?



# Risks of a People-Policy Gap?

Will industry growth = job and economic growth? For whom?

Will we see continued conflicts over siting and development?





# Risks of a People-Policy Gap?

Will industry growth = job and economic growth? For whom?

Will we see continued conflicts over siting and development?

What are the impacts on the coastal communities where aquaculture happens?

# Risks of a People-Policy Gap?

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What type of industry will we see? What are we enabling and encouraging through policy?

# Risks of a People-Policy Gap?

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What are the impacts on the coastal communities where aquaculture happens?

What type of industry will we see? What are we enabling and encouraging through policy?

Are broad policy goals consistent with local concerns? Is economic development balanced with community wellbeing?

# Risks of a People-Policy Gap?

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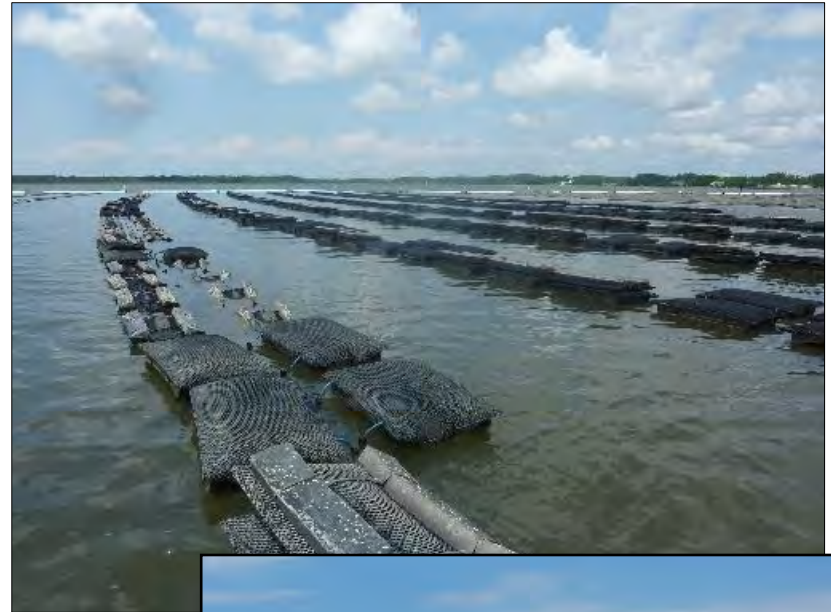
***How might these questions be addressed?***

# Project Methods

*Preliminary: Qualitative Database  
(500+ files)*

*Phase 1: Q Method (~40/region)*

*Phase 2: Survey (N=~2000 across  
regions)*



# Context



## ***Maine***

- Estimates of 3x oyster and 6x mussels by 2030 (Hale Group 2016)

## ***North Carolina***

- New legislation to grow industry
- 10x oyster production by 2030 (\$33m farm-gate / \$100m market) (SMAC 2018)

## ***Florida***

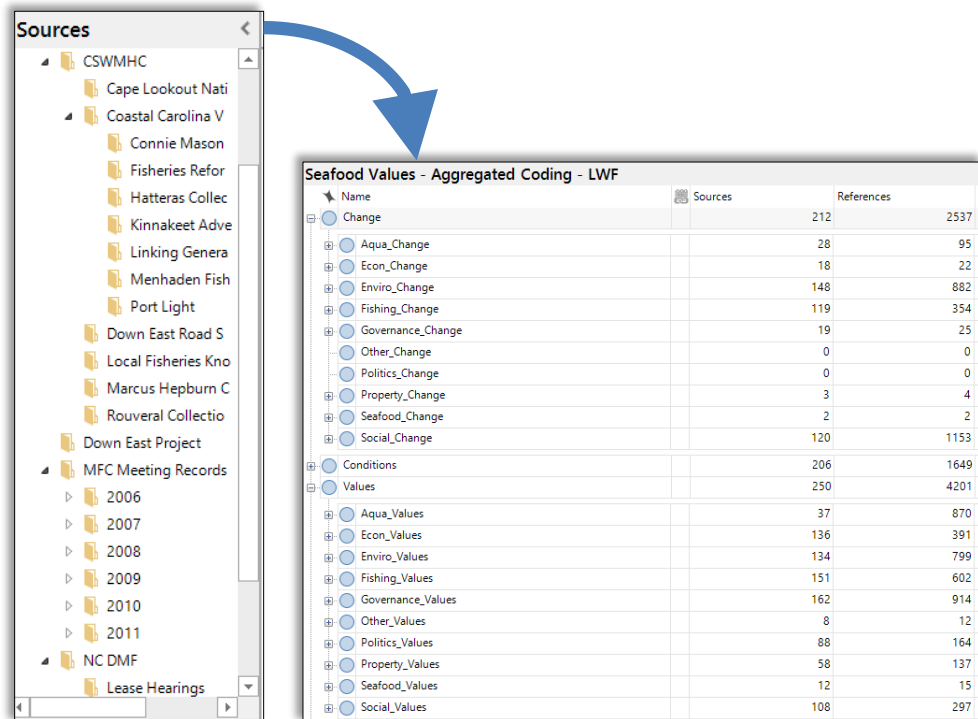
- Substantial clam production; efforts to enable and grow oysters (UF IFAS 2019)



# Preliminary: Qualitative Database

*What is the structure of values associated with aquaculture production?*

*Qualitative Data*



The image shows a file explorer window on the left and a data table on the right. A blue arrow points from the 'Sources' folder in the file explorer to the 'Seafood Values - Aggregated Coding - LWF' table.

**Sources**

- CSWMHC
  - Cape Lookout Nati
  - Coastal Carolina V
    - Connie Mason
    - Fisheries Refor
    - Hatteras Collec
    - Kinnakeet Adve
    - Linking Genera
    - Menhaden Fish
    - Port Light
    - Down East Road S
    - Local Fisheries Kno
    - Marcus Hepburn C
    - Rouveral Collectio
    - Down East Project
  - MFC Meeting Records
    - 2006
    - 2007
    - 2008
    - 2009
    - 2010
    - 2011
  - NC DMF
    - Lease Hearings

**Seafood Values - Aggregated Coding - LWF**

Name	Sources	References
Change	212	2537
Aqua_Change	28	95
Econ_Change	18	22
Enviro_Change	148	882
Fishing_Change	119	354
Governance_Change	19	25
Other_Change	0	0
Politics_Change	0	0
Property_Change	3	4
Seafood_Change	2	2
Social_Change	120	1153
Conditions	206	1649
Values	250	4201
Aqua_Values	37	870
Econ_Values	136	391
Enviro_Values	134	799
Fishing_Values	151	602
Governance_Values	162	914
Other_Values	8	12
Politics_Values	88	164
Property_Values	58	137
Seafood_Values	12	15
Social_Values	108	297

# Phase 1: Q – Concourse and Q Sample

*What is the structure of values associated with aquaculture production?*

*Qualitative Data  
Q Methodology*

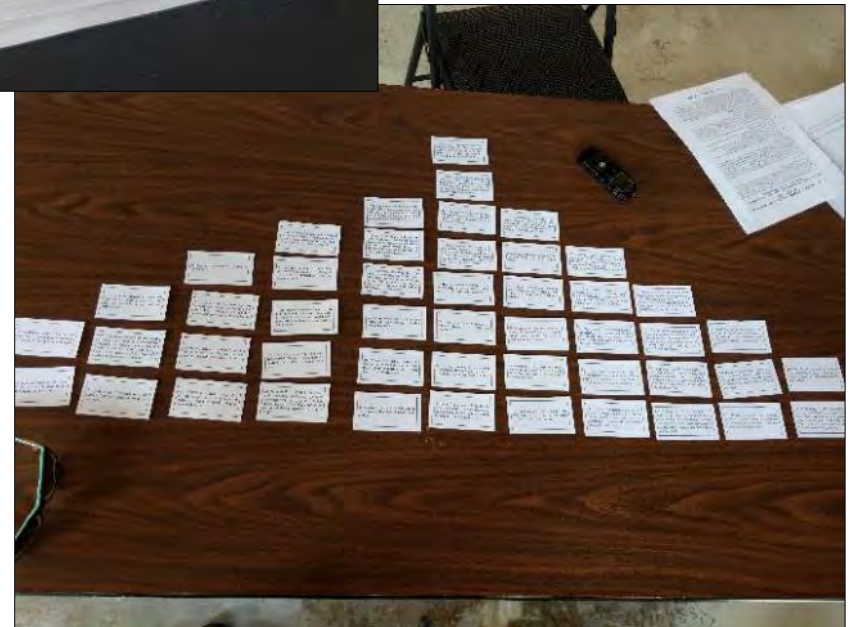
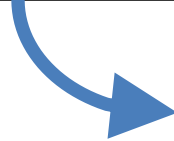
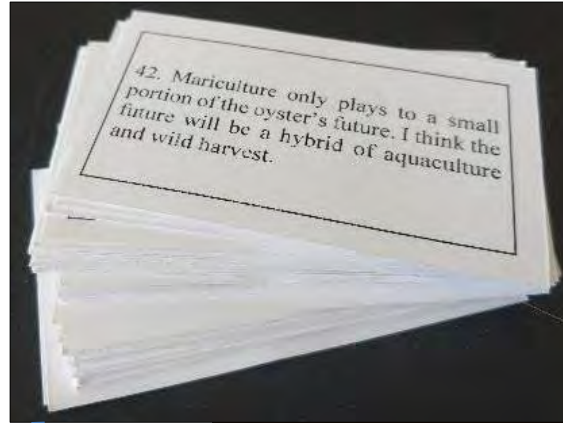
zz Q Concourse Statements v1	85	468	6
● Aquaculture	34	87	
● Change	3	4	
● Economy	18	27	
● Environment	24	56	
● Fishing	35	72	
● Governance	26	31	
● Politics and Power	8	13	
● Property and Space	37	89	
● Seafood	33	69	
● Social		20	





# Phase 1: Q – Implementation

*What is the structure of values associated with aquaculture production?*



*Qualitative Data  
Q Methodology*

# Phase 1: Q – Implementation

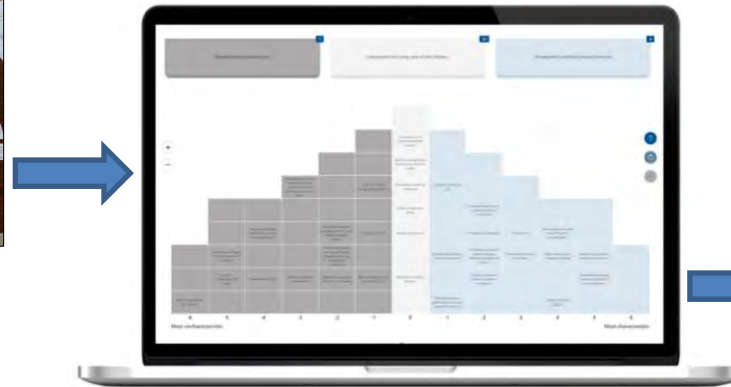
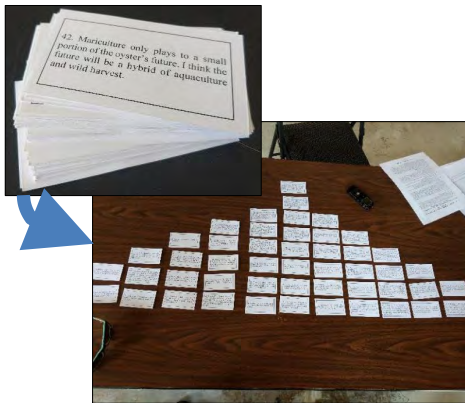


# Phase 1: Q – Implementation

## Transition to Online Q

Generic / modular approach

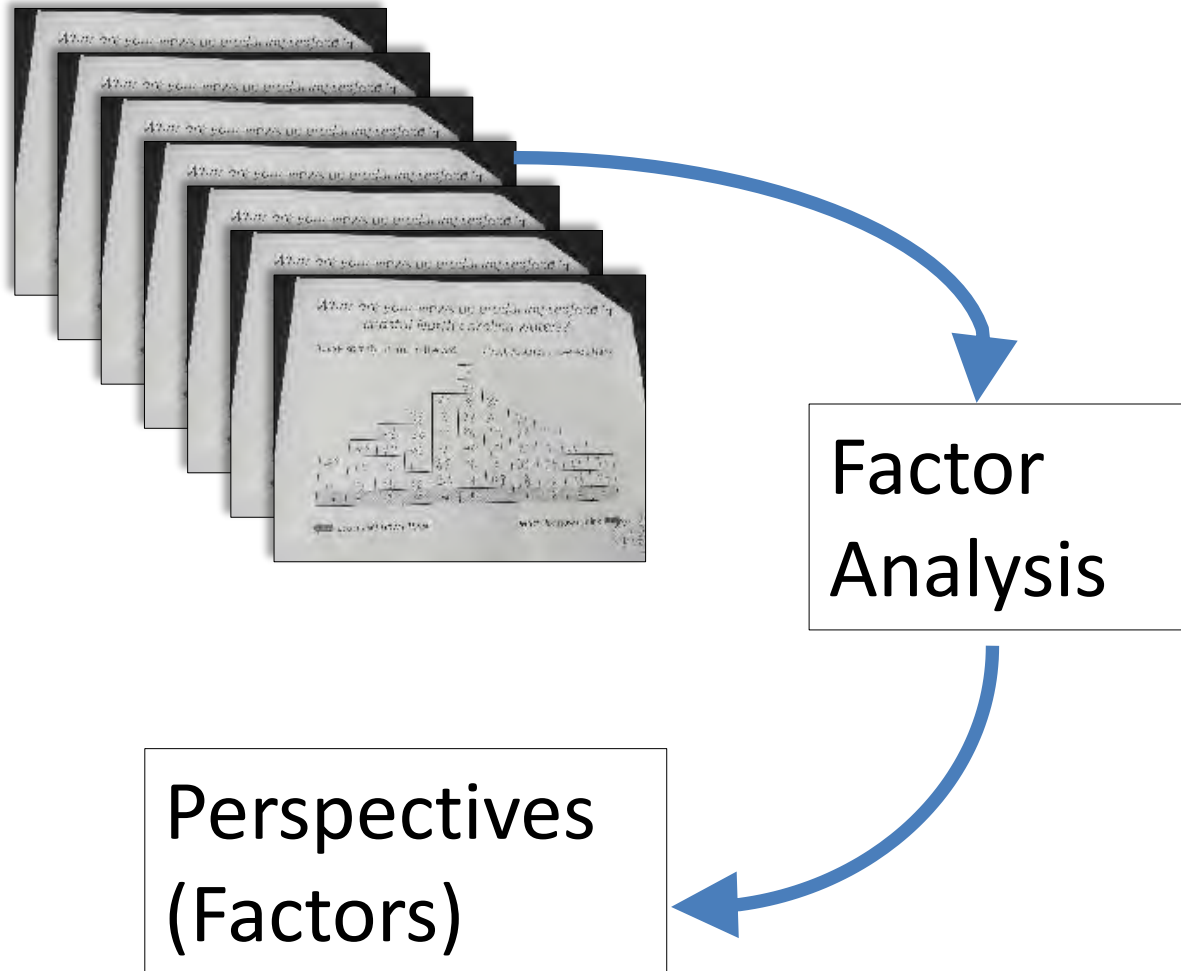
- 30 standard statements
- 10 region-specific statements
- Allows for case-specific and cross-case comparison



Q Method Software (2021)  
([qmethodsoftware.com](http://qmethodsoftware.com))



# Phase 1: Q – Analysis



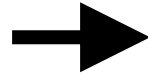
Watts and  
Stenner, 2012

Scholck,  
2014  
(PQMethod)

# Phase 1: Q – Sample Interpretation (NC Example)

## *Perspectives*

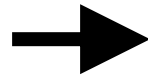
1. The aquaculture preservationist



## *Summary Points*

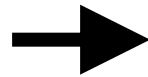
1. Seafood production prominent; Aquaculture for communities

2. The ecological aquaculturist



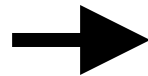
2. Aquaculture prominent; Science; Enviro benefits; Fishing problematic

3. The aquacultural pessimist



3. Fishing prominent; Fishing subject to outside forces; Aquaculture problematic

4. The aquacultural minimalist



4. Fishing prominent; Aquaculture can fit in; Local rights to access and produce

**Total Variance  
Explained = 50%**

# Sample Q Results (NC Example)

<b>Table 2. Synopsis of Results</b>	<b>1. The aquaculture preservationist</b>	<b>2. The ecological aquaculturist</b>	<b>3. The aquaculture pessimist</b>	<b>4. The aquaculture minimalist</b>
Most like the way I think	1†, 20, 24, 31, 32*	6, 10, 34*, 39*, 43†	2†, 11, 16†, 20, 21†	10, 19†, 20, 24, 40*
Least like the way I think	3, 4†, 7, 13, 16	7, 15†, 16, 27, 47†	1*, 5†, 30, 34†, 42*	13, 27, 35†, 36, 38†
Other distinguishing statements	14*, 15*, 18†, 27*, 28†, 29†, 34*, 36*, 42*	1†, 2†, 4*, 11†, 13†, 17*, 20†, 29†, 32*, 36*, 38†, 41*, 47*, 46*	4*, 8†, 13†, 15†, 27*, 32†, 33†, 40†, 43†, 45*	1*, 4*, 5*, 6*, 8*, 15*, 16†, 22*, 32†, 34†, 37†, 47*, 45*, 48†

\* Statistically different than the overall mean for that statement at  $p < 0.05$

† Statistically different than the overall mean for that statement at  $p < 0.01$

(i.e., in both cases, an indication of the degree to which this perspective varies from the overall group on a specific statement)

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1	Shellfish mariculture is really a win-win-win. It's good for the environment, you're able to produce stuff that's good to eat, and it creates good revenue for a grower.	5	3	-4	-2
---	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---	---	----	----

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-5 = least like the way I think

5 = most like the way I think

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28	When we're talking about our waters, stewardship is more important than seafood production. We have to protect our resources first.	-2	3	3	3
----	-------------------------------------------------------------------------------------------------------------------------------------	----	---	---	---

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# Phase 2: Survey

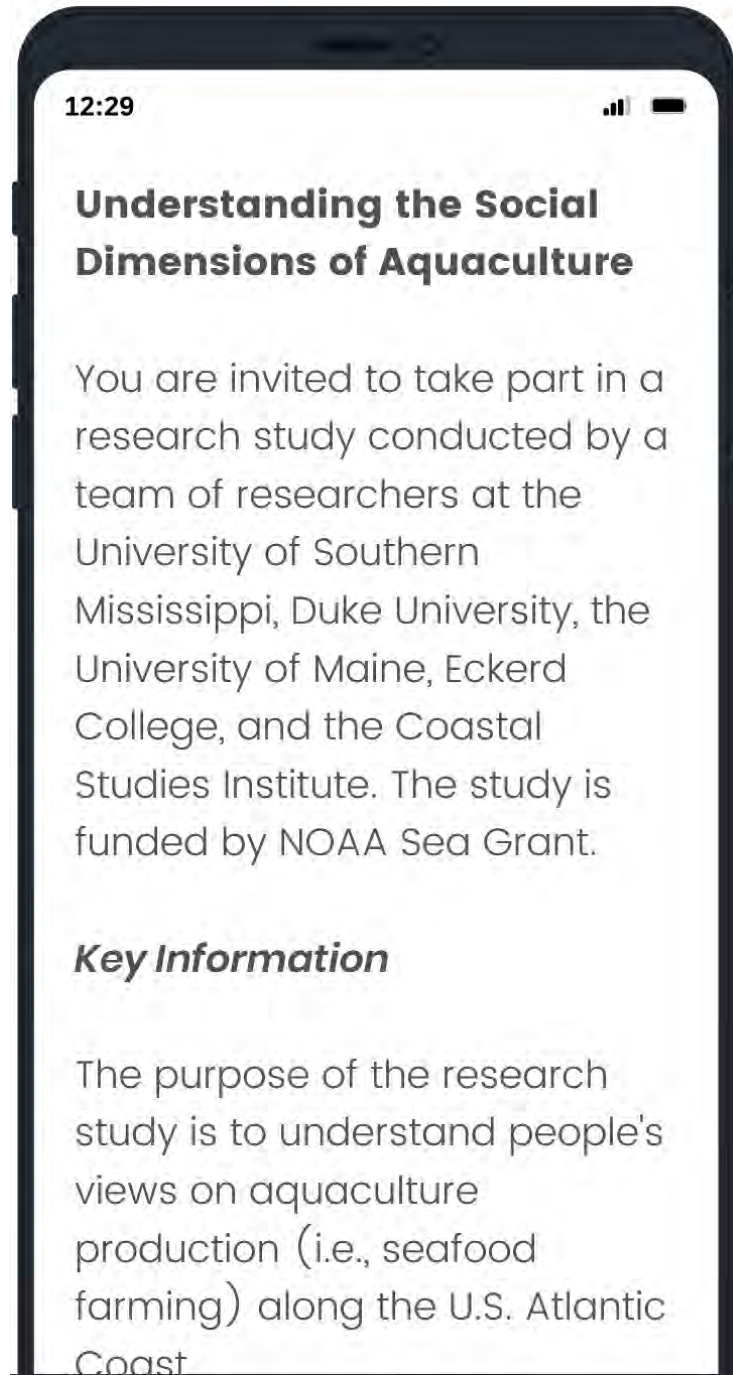
*Consumer Survey*

Internet (Qualtrics)

N = ~2000 across three regions

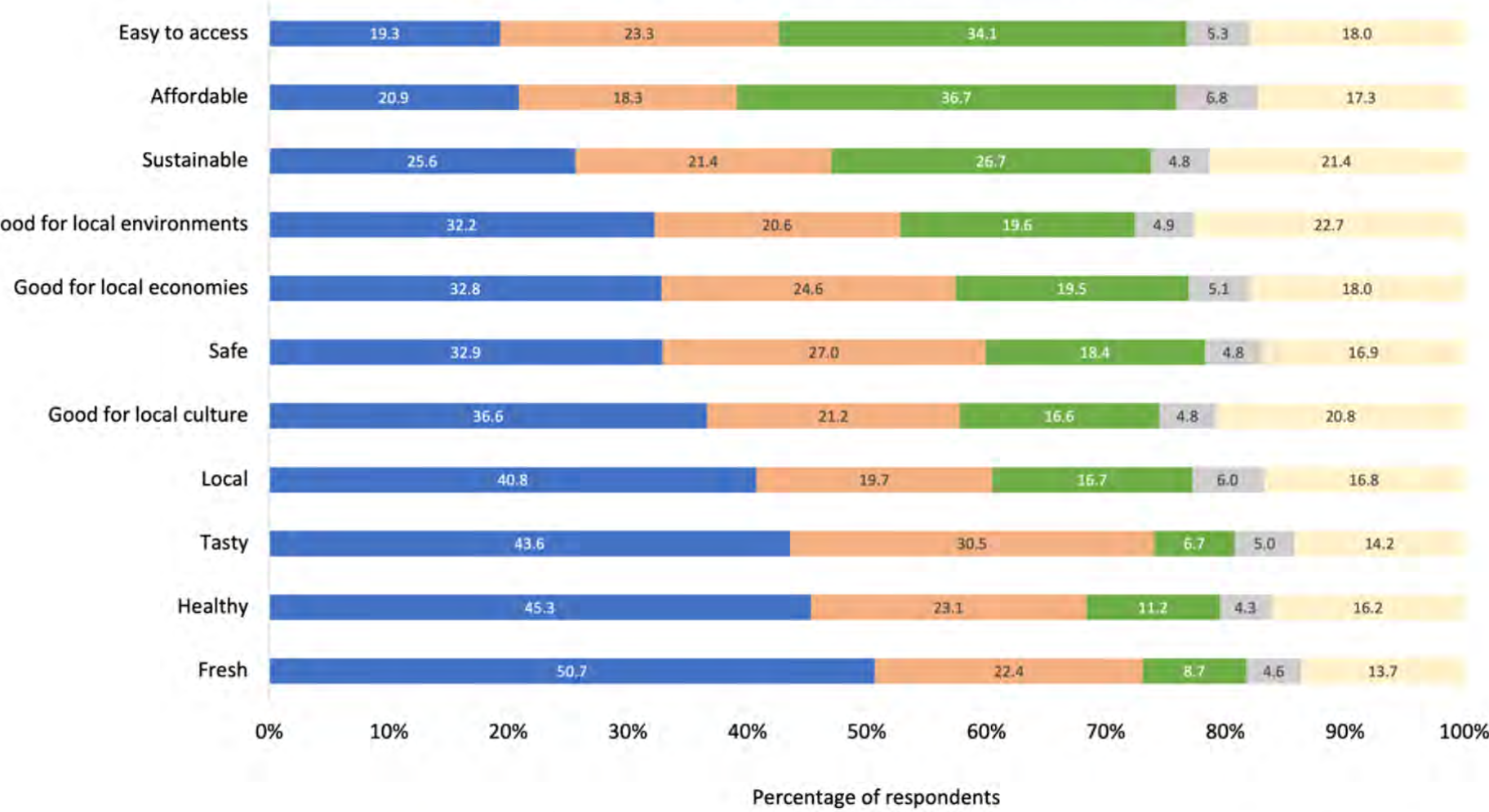
Demographics, behavior,  
preferences, farmed vs. wild,  
knowledge, Q statements

General across regions (not modular)



# Phase 2: Sample Survey Results (NC Example)

Figure 4: Qualities associated with wild-caught vs. farmed seafood

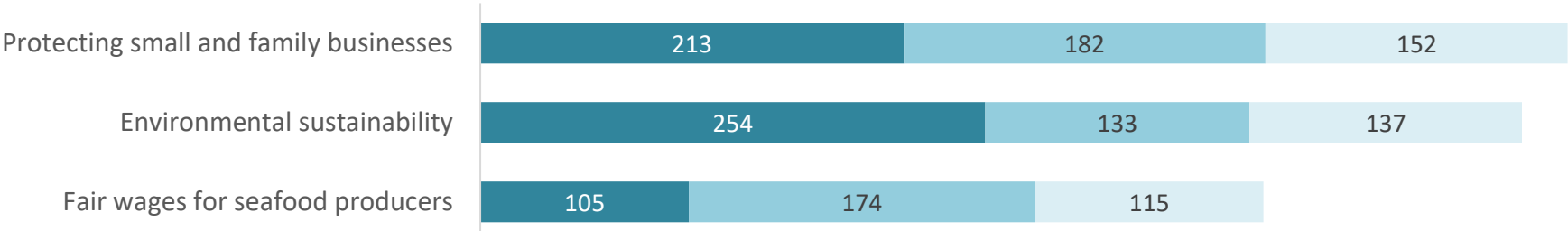


- More associated with wild-caught
- Associated equally with wild-caught and farmed
- More associated with farmed
- Associated with neither wild-caught nor farmed
- I don't know

# Phase 2: Sample Survey Results (NC Example)

**Top 3 Considerations When Managing Mariculture**

■ 1=Most important   ■ 2=Second most important   ■ 3=Third most important

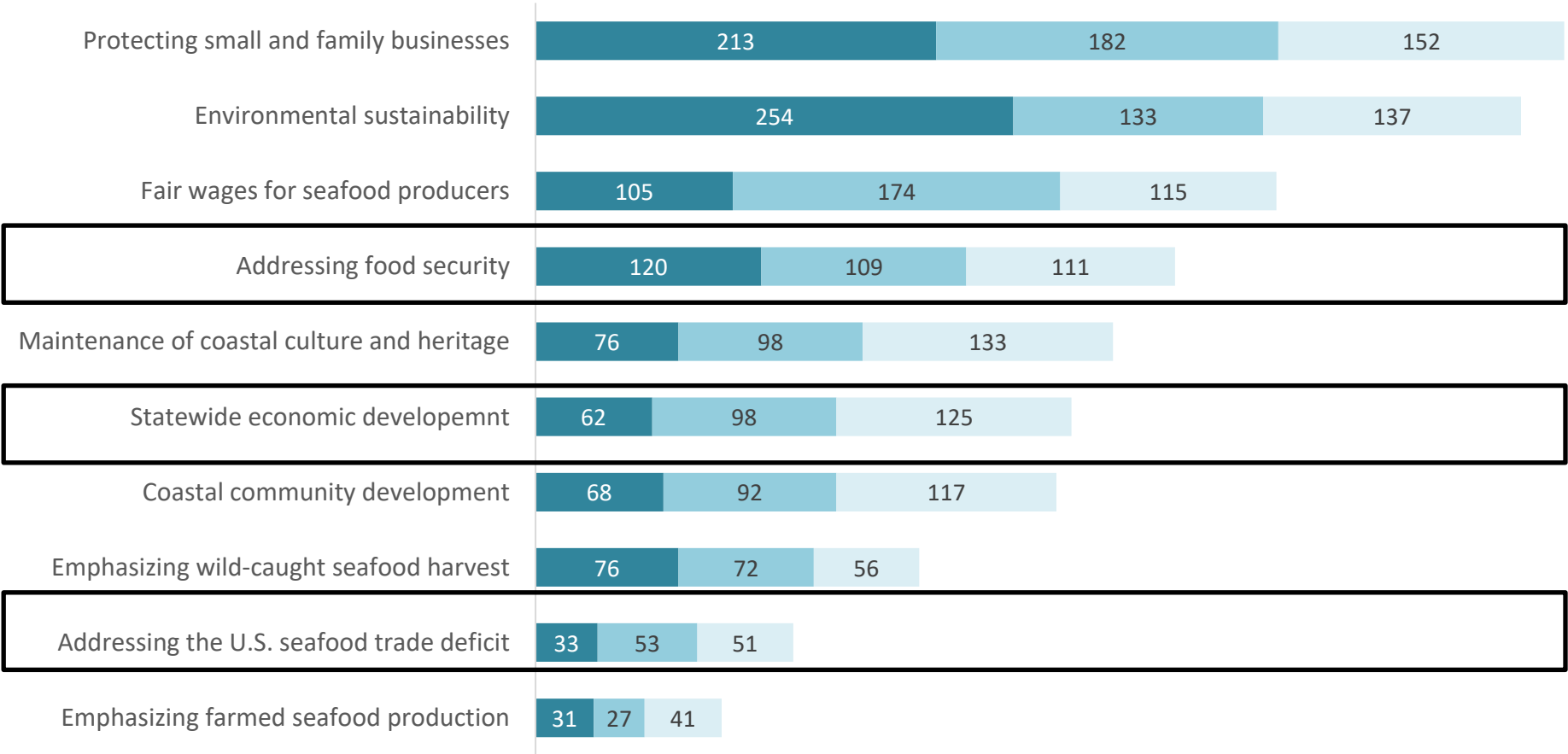




# Phase 2: Sample Survey Results (NC Example)

**Top 3 Considerations When Managing Mariculture**

■ 1=Most important   ■ 2=Second most important   ■ 3=Third most important



# Next Steps

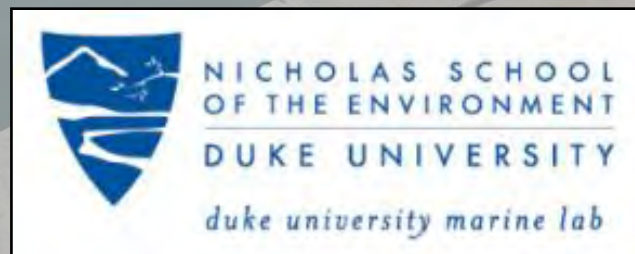
1. NCE to August 2022 (Covid-19 delays)
2. Fully implement online Q and Survey
3. Iteratively refine this approach for relatively rapid and general assessment of social dimensions
  1. Provide a way to “automate Q” – i.e., provide a generic template to start Q method assessments
  2. Provide a general survey to inform consumption, production, and siting
  3. Provide methodology for integration / coupled analysis

## Acknowledgements

Project collaborators: Grant Murray, Lisa Campbell, Josh Stoll, Linda D'Anna, Noëlle Boucquey, Julia Bingham, Robin Fail

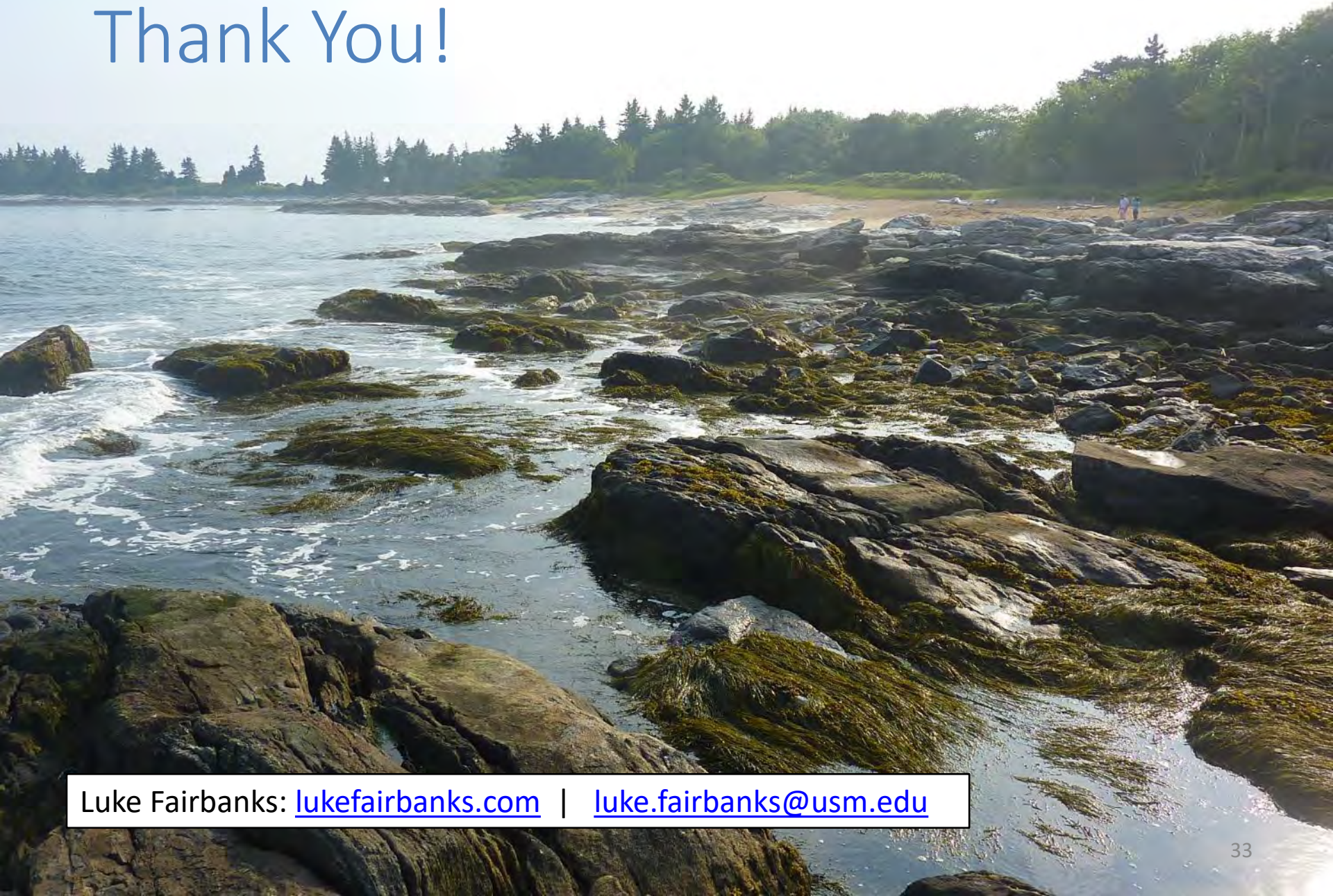
Project partners: Core Sound Waterfowl Museum and Heritage Center, Walking Fish Community-Supported Fishery

Funding support: NOAA Sea Grant



Luke Fairbanks: [lukefairbanks.com](http://lukefairbanks.com) | [luke.fairbanks@usm.edu](mailto:luke.fairbanks@usm.edu)

# Thank You!



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# SBE-Assessing Policy Barriers for Mariculture in the United States while Accounting for Fisheries Context

H. Froehlich, S. Lester, G. Hofmann, J.  
Schubel, L. Gardner, K. Thompson, R. Gentry



Image credit: NOAA Fisheries



Image credit: Aquarium of the Pacific



Image credit: Blue Ocean Mariculture

# Marine Aquaculture Data and Policy to Support Sustainable Development in the U.S.

*SBE-Assessing Policy Barriers for Mariculture in the United States while Accounting for Fisheries Context*

*Speakers: Professor Halley E. Froehlich & Professor Sarah E. Lester*

*October 27, 2021*



*This project was funded by NOAA National Sea Grant*





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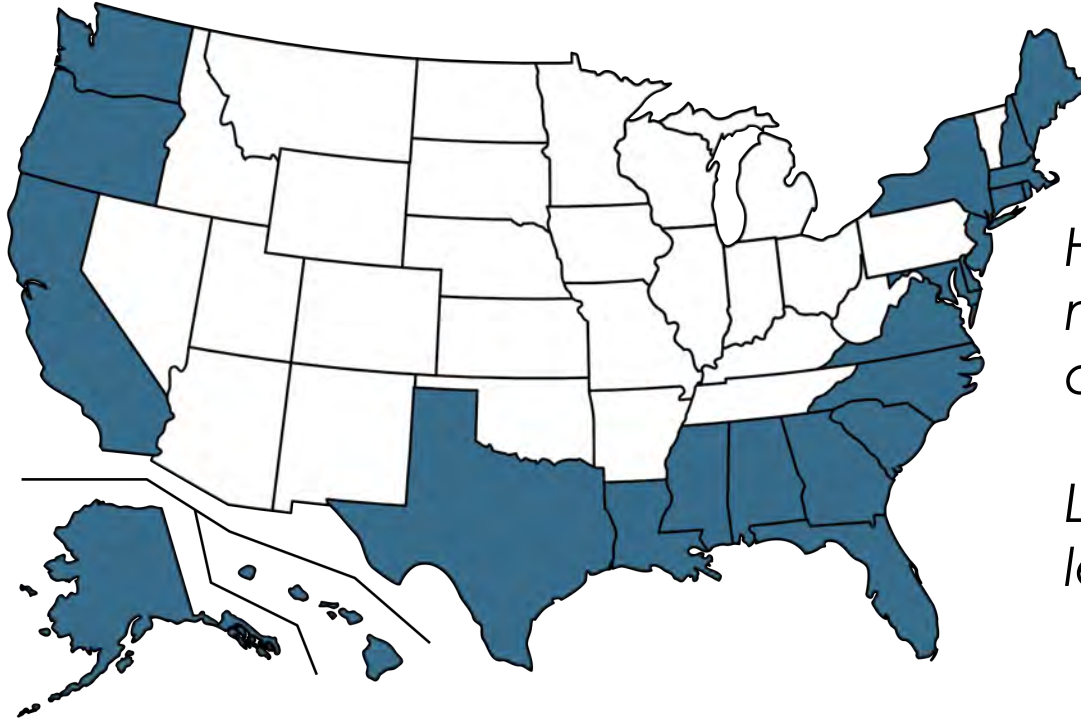


Sebastian Tapia  
Bren School University of  
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# US (marine) aquaculture is small. Why?

*High-level national evaluation & some case-studies report growth is hampered by opaque or cumbersome regulations & policies*



23 coastal  
marine states

How do all  
marine states  
compare?

Lessons to be  
learned?

# US marine aquaculture

1) Data synthesis



2) Case studies



3) Policy synthesis



4) Beyond pubs & next steps



# US marine aquaculture

1) Data synthesis



2) Case studies



3) Policy synthesis



4) Beyond pubs & next steps



# Policy and data are linked



*“Sustainable aquaculture is severely handicapped where there are insufficient data or where the data are unreliable. In fact, **data are essential for informed decision-making in aquaculture**, yet, this aspect is often overlooked.”*



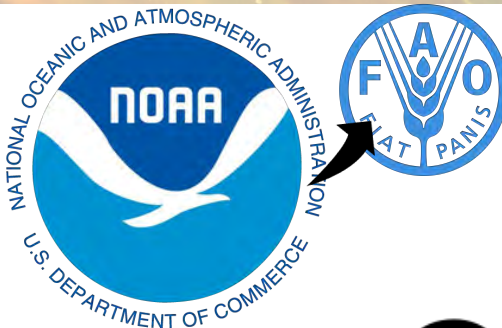
# US aquaculture data seascape



**Publicly available**

Aquaculture census  
freshwater & some marine  
(1998, 2005, 2013, & 2018)

*Source: directly from  
farms/operations*



**NOAA  
FISHERIES**

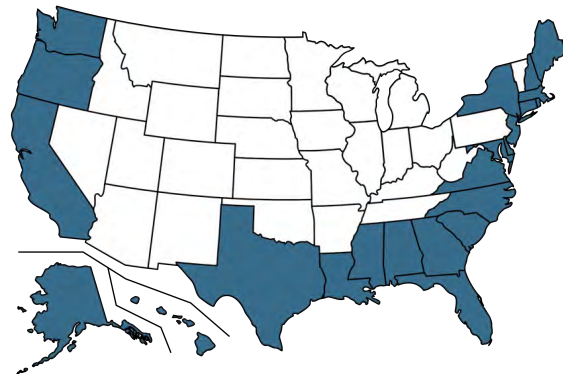
**State-level not public**

Regional/National,  
semi-annual  
reports/highlights  
(marine focus)

*Source: agencies & other orgs*



**State solicited**  
*1.5 yrs, 50+ experts*

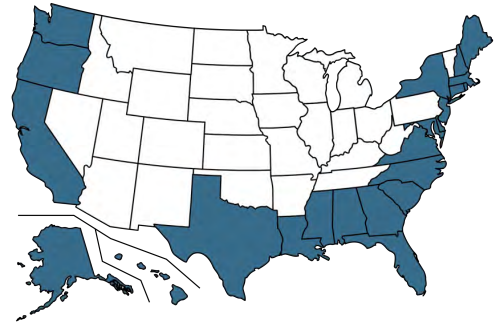


**Mixed availability**

Individual state  
agencies &  
organizations



# Comparing data, marine aquaculture numbers don't quite match



Value<sub>2018</sub> = \$525 million

Value<sub>corrected</sub> = \$572 million

Volume = ???

Spp/group = 23

}  $\Delta\$ = \$47$   
million

\$397 million

37,347 tonnes

(30)??? spp/group

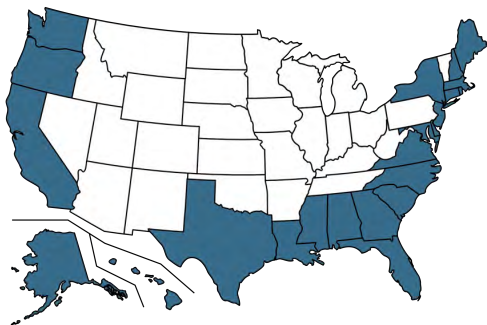
\$220 million

39,200 tonnes

65 spp/group



# A closer look at USDA and state solicited data reveals data access/quality vary per state



Recent data alignment solicited:USDA	% of USDA value (\$USD)	States
<i>Solicited data &lt; USDA</i>	<10%	Alabama, Hawaii, Louisiana, Florida, Virginia
<i>Solicited data &lt; USDA</i>	10-30%	New Jersey, Oregon, California
<i>Solicited data &lt; USDA</i>	40-60%	New Hampshire, Washington, South Carolina
<i>Solicited data ~ USDA</i>	80-120%	Alaska, Texas, <u>Connecticut</u> , Delaware, New York, <u>Massachusetts</u> , Mississippi, <u>Rhode Island</u>
<i>Solicited data &gt; USDA</i>	150-880%	Georgia, Maine, Maryland, North Carolina

*Regional data coordination: Fisheries Information Networks (FINs)*

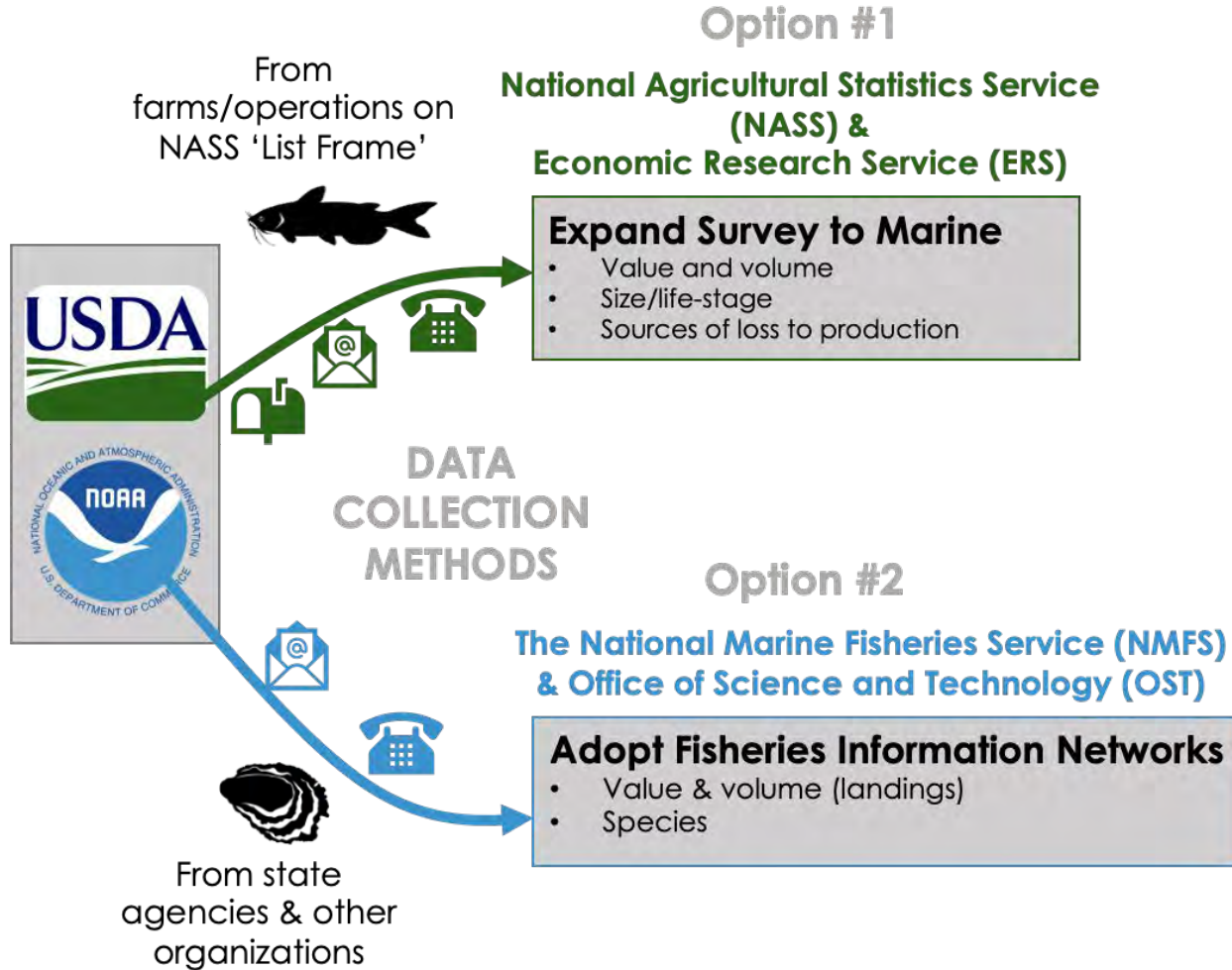


# Summary of US marine aquaculture data

- Marine aquaculture playing an increasingly important role in US
- State-level data are highly uncertain
- Probably much more diverse and valuable
- Feasible first step towards better data: existing regional state-federal cooperative programs



# Paths to Better Data



# US marine aquaculture

1) Data synthesis



2) Case studies



3) Policy synthesis



4) Future needs & next steps





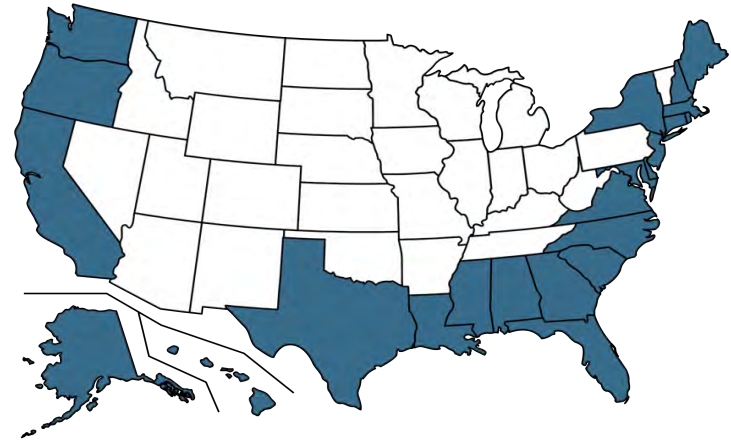
## State-level marine aquaculture policy

- Research from other places highlights the importance of policy and governance
- Most existing production occurs in state waters and is regulated by state policies and regulations
- **How do different state policies and management enable or impede industry development?**



# Synthesis of state-level mariculture policy

- Categorize and document attributes of aquaculture and mariculture policy (legislation, policies, regulatory frameworks, and management) for 23 coastal states
- Focused on “**enabling**” policy attributes





	<b>Policy attributes</b>
<b>Enabling factors</b>	Aquaculture development act or comprehensive legislation
	Marine aquaculture leasing regulations
	Supportive aquaculture initiatives or policies
	Aquaculture best management practices (BMPs)
	Spatial zoning for marine aquaculture
	Marine aquaculture government contact
	Regulatory guidance



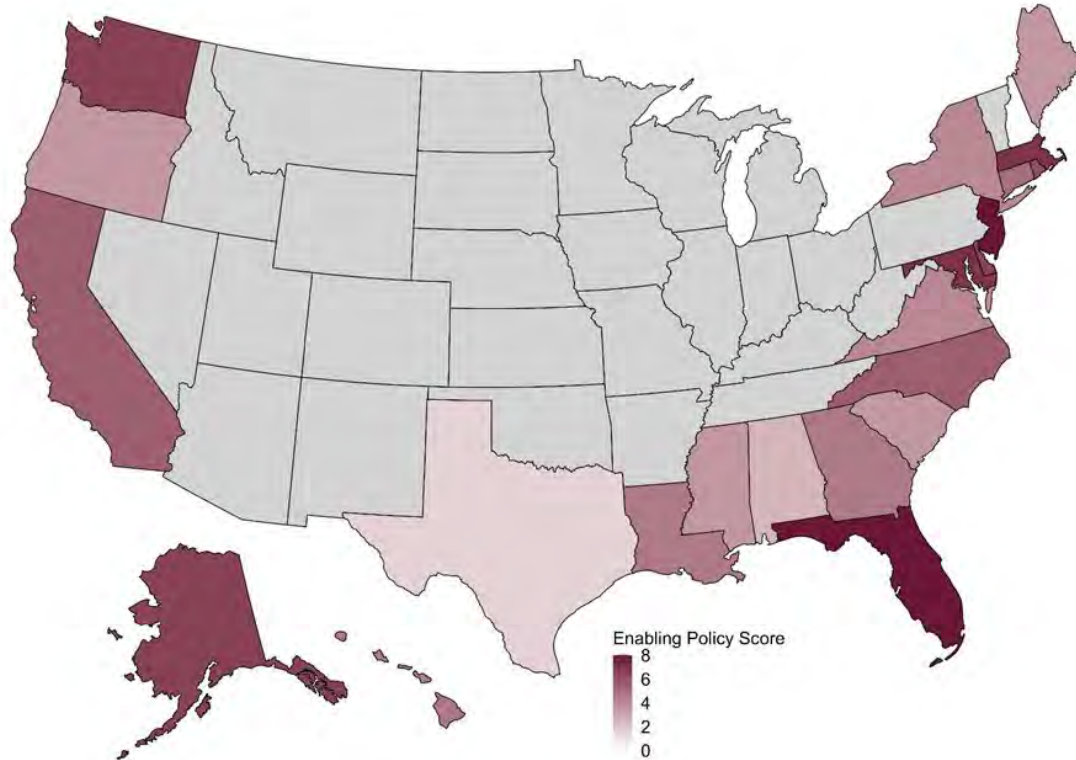
	<b>Policy attributes</b>
<b>Enabling factors</b>	Aquaculture development act or comprehensive legislation
	Marine aquaculture leasing regulations
	Supportive aquaculture initiatives or policies
	Aquaculture best management practices (BMPs)
	Spatial zoning for marine aquaculture
	Marine aquaculture government contact
	Regulatory guidance
<b>Other attributes</b>	Right-to-farm statute includes aquaculture
	Illegal aquaculture or aquaculture moratoriums
	Same agency for freshwater and marine aquaculture
	Same agency for marine fisheries and aquaculture
	Aquaculture and climate change policy



	<b>Policy attributes</b>	<b>%</b>
<b>Enabling factors</b>	Aquaculture development act or comprehensive legislation	<b>48%</b>
	Marine aquaculture leasing regulations	<b>91%</b>
	Supportive aquaculture initiatives or policies	<b>78%</b>
	Aquaculture best management practices (BMPs)	<b>26%</b>
	Spatial zoning for marine aquaculture	<b>35%</b>
	Marine aquaculture government contact	<b>74%</b>
	Regulatory guidance	<b>65%</b>
<b>Other attributes</b>	Right-to-farm statute includes aquaculture	<b>61%</b>
	Illegal aquaculture or aquaculture moratoriums	<b>30%</b>
	Same agency for freshwater and marine aquaculture	<b>77%</b>
	Same agency for marine fisheries and aquaculture	<b>78%</b>
	Aquaculture and climate change policy	<b>13%</b>



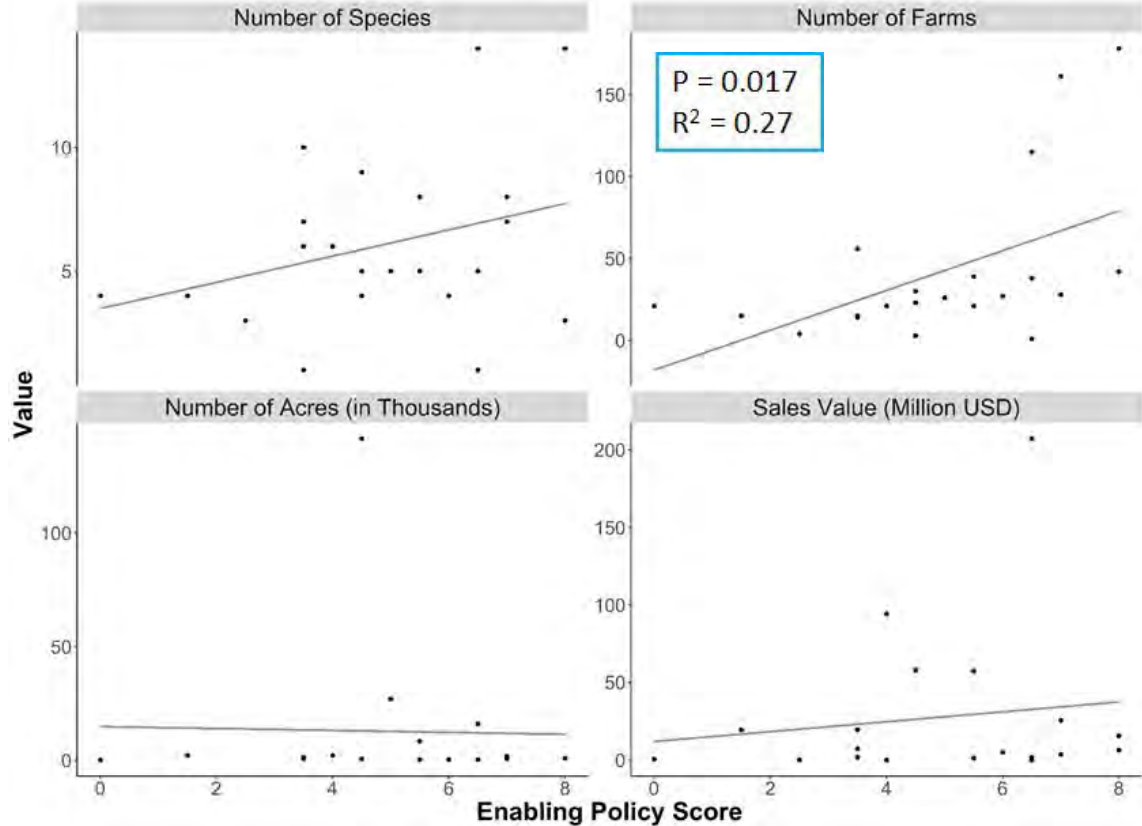
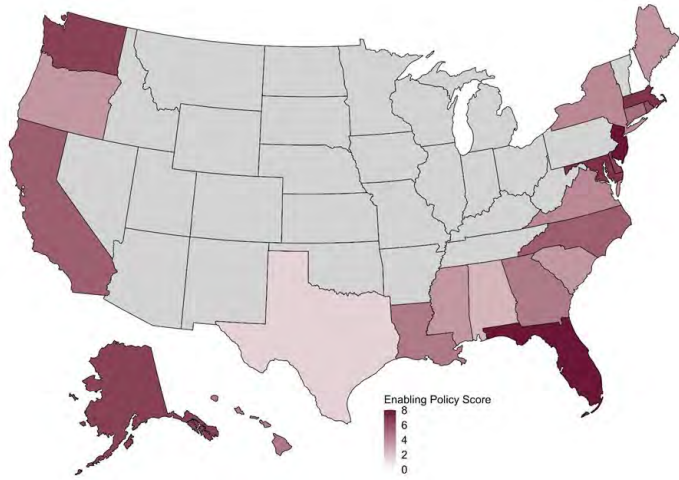
# Enabling policy score





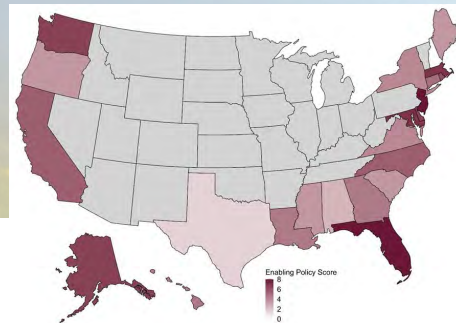


# Predicting mariculture output?





# Policy catalog



## ENABLING POLICY FACTORS

## OTHER POLICY ATTRIBUTES

State	Development act or comprehensive legislation	If yes: marine aquaculture provisions	If no: non-comprehensive legislation	Leasing regulations	Supportive initiatives or policies	Aquaculture BMPs	If yes: marine aquaculture BMPs	Zoning for marine aquaculture	If no: comprehensive multi-use MGP	Government contact	Regulatory guidance	Right to farm statute	Illegal aquaculture or moratoriums	Same agency for freshwater and marine aquaculture	Same agency for marine fisheries and aquaculture	Climate change policy
Alabama	N	-	Alabama Administ	1. Alabama Code	N	N	-	N	N	N	Alabama Seafood	N	N	Alabama Departm	Alabama Departm	N
Alaska	Aquatic Farm Act	Y	-	CSHB 208, An Act	1. Alaska Maricult	N	-	Per CSHB 208 (htt	-	<a href="https://www.adfg">https://www.adfg</a>	Alaska's aquatic fi	Alaska Statutes Se	Alaska Statutes Se	Alaska Departm	Alaska Departm	N
California	California Aquacu	Y	-	California Fish an	1. California Asse	N	-	N	N	<a href="https://wildlife.ca">https://wildlife.ca</a>	Permit Guide to A	California Civil Co	California Senate	California Depart	California Depart	N
Connecticut	N	-	1. An Act Concern	Connecticut Gene	Connecticut Shell	N	-	N	Long Island Sound	<a href="https://portal.ct.g">https://portal.ct.g</a>	A Guide to Marine	N	Prohibitions again	Department of Ag	N	Connecticut Clime
Delaware	Delaware Aquacu	N	Delaware Code, T	Delaware Code, T	Aquaculture techn	N	-	Shellfish Aquacult	-	<a href="https://dnrec.alp">https://dnrec.alp</a>	1. Shellfish aquac	N	Delaware Aquacu	N	Shellfish aquacult	N
Florida	Florida Aquacultu	Y	-	Florida Statutes S	Aquaculture Revid	Aquaculture Best	Y	Aquaculture Use 2	-	<a href="https://www.fdaa">https://www.fdaa</a>	1. Shellfish aquac	Florida Statutes S	N	Florida Departm	N	N
Georgia	HB 501 (2019): ht	Y	-	<a href="https://coastalga">https://coastalga</a>	Georgia Code Sec	N	-	N	N	N	1. Aquaculture req	Georgia Code Sec	N	Georgia Departm	Georgia Departm	N
Hawaii	N	-	Statute 141-2.5 et	Lands Leasing: htt	Hawaii Senate Bill	N	-	N	N	<a href="https://hdoa.haw">https://hdoa.haw</a>	Permits and regul	Hawaii Revised St	N	Hawaii Departm	N	N
Louisiana	N	-	RS 56:431.2 regard	1. Louisiana Admi	Louisiana Oyster I	N	-	N	N	<a href="https://www.wlf">https://www.wlf</a>	Guidance on appl	Louisiana Revised S	N	Louisiana Depart	Louisiana Depart	N
Maine	N	-	<a href="https://www.mai">https://www.mai</a>	Maine Departmen	1. Aquaculture De	N	-	N	N	<a href="https://www.mai">https://www.mai</a>	N	N	N	Maine Departmen	Maine Departmen	N
Maryland	N	-	Maryland Code, T	Code of Maryland	Aquaculture Revid	Best Managemen	Y	Aquaculture Enter	-	<a href="https://dnr.maryl">https://dnr.maryl</a>	Commercial shell	Code of Maryland	N	Maryland Depart	Maryland Depart	N
Massachusetts	N	-	Massachusetts Ge	Licensing and leas	1. Massachusetts	1. Best Managem	Y	Municipal aquacu	-	<a href="https://www.mars">https://www.mars</a>	Massachusetts ad	Massachusetts Ge	N	Massachusetts Dr	Massachusetts Dr	Massachusetts Se
Mississippi	Mississippi Code S	Y	-	1. Mississippi Cod	Mississippi Depart	N	-	N	N	N	N	Mississippi Code	N	N	Mississippi Depart	N
New Hampshire	N	-	N	N	N	N	-	N	N	N	N	N	New Hampshire S	New Hampshire A	1. New Hampshire	New Hampshire F
New Jersey	New Jersey Aquac	Y	-	New Jersey Admin	Aquaculture Deve	1. East Coast Shel	Y	Aquaculture Deve	-	<a href="https://www.nj.g">https://www.nj.g</a>	A Guide to Develo	New Jersey Statut	N	1. New Jersey Dep	New Jersey Depart	N
New York	N	-	N	New York State El	New York State M	N	-	Shellfish Cultivat	-	<a href="https://www.dec">https://www.dec</a>	N	Consolidated Law	N	New York Depart	New York Depart	N
North Carolina	1. Aquaculture De	Y	-	North Carolina Ge	1. North Carolina	N	-	North Carolina Se	-	<a href="http://portal.ncd">http://portal.ncd</a>	N	N	N	N	North Carolina Dr	N
Oregon	N	-	N	Oregon Departme	Oregon Shellfish I	N	-	N	Oregon Territoria	N	Oregon Departme	N	N	Oregon Departme	N	N
Rhode Island	Rhode Island Gen	Y	-	Rhode Island Cod	Rhode Island Shel	N	-	N	Rhode Island Ocea	<a href="http://www.crmc">http://www.crmc</a>	Aquaculture Appli	General Laws of R	Prohibitions again	NA <sup>1</sup>	Rhode Island Dep	N
South Carolina	Aquaculture Enab	N	South Carolina Bil	South Carolina Ge	N	N	-	N	N	<a href="https://www.dnr">https://www.dnr</a>	N	N	N	South Carolina De	South Carolina De	N
Texas	Fish Farming Act,	N	HB1300, Act relat	N	N	N	-	N	N	N	N	N	N	N	Texas Parks and V	N
Virginia	N	-	Virginia Marine Re	Code of Virginia,	N	Best Managemen	Y	N	N	<a href="https://mrc.virgin">https://mrc.virgin</a>	N	N	N	N	Virginia Marine Re	N
Washington	N	-	Revised Code of V	Revised Code of V	Washington Shellf	2007 Best Manag	Y	N	Marine Spatial Pla	<a href="https://ecology.w">https://ecology.w</a>	Products to impr	Code of Washing	Washington Hous	Washington Depa	N	Preparing for a Ch



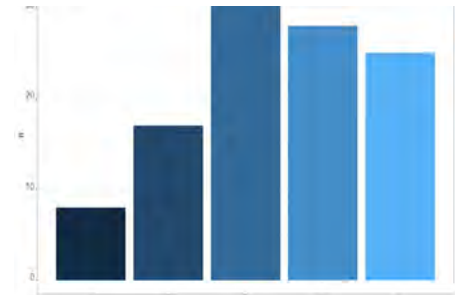
# Policy synthesis: conclusions

- States have diverse policy approaches guiding mariculture development
- Relationship between policy and mariculture output is complex
- Provides useful opportunity for cross-state learning and could inform overarching federal policy

# Beyond Publications

## SURVEY

*Adequate Data?*



## WORKSHOPS



## POLICY BRIEF



## MAGAZINE



Very -----Not at all

# Our Next Steps

- Data and policy papers are in review/accepted
- Case studies finishing up as chapters in Ph.D. student dissertations
- Final study comparing regional variability of US aquaculture and wild capture continues
- Find a long-term home for the state-level aquaculture policy database

# Thank you



*This project was funded by NOAA National Sea Grant*





# Many sources of error, but unclear main one

Uncertainty Type	
1.	<b>Confidentiality</b>
2.	Uncertain zeros
3.	Differing submissions types & forms
4.	Non-standardized units
5.	Non-standardized conversion factors
6.	Fisheries and aquaculture data pooled
7.	Freshwater or marine
8.	Pilot species
9.	Infrequent reporting
10.	Data entry format
11.	Taxonomic resolution
12.	Definition of aquaculture
13.	Reclassification
14.	Change in staff or agency responsible for data
15.	Lack of participation



# SBE-Fisheries Interactions & Carbon Offsets: Assessing Existing and Potential Seaweed Aquaculture

S. Gaines, C. Lester, R. Geyer, S. Augyte



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# **Fisheries Interactions & Carbon Offsets: Assessing existing & potential seaweed aquaculture**

SeaGrant Symposium 2021 | Steven Gaines

---

# Collaborators



Darcy Bradley, UCSB



Charles Lester, UCSB



Simona Augyte, Ocean Era



Halley Froehlich, UCSB



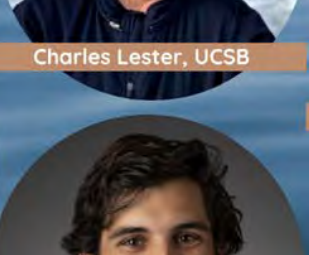
Ben Halpern, NCEAS



Roland Geyer, UCSB



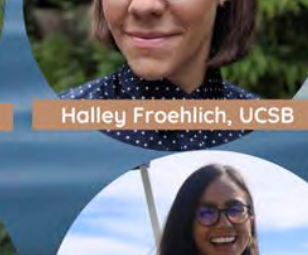
AnnaClaire Marley, UCSB



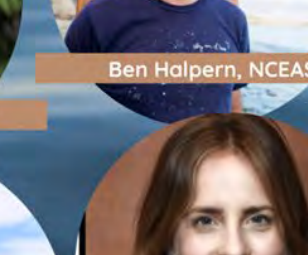
Gabriel de la Rosa, UCSB



Jessica Couture, UCSB



Phoebe Racine, UCSB



Christina Frieder, SCCWRP



Kristen Davis, UCI



Rucha Kolhatkar, UCSB



Allie Caughman, UCSB



Ilan MacAdam Somer, UCSB



Ian Ladner, UCSB



Lisa Wickliff, NOAA

# Seaweed's Carbon Sequestration Potential



?

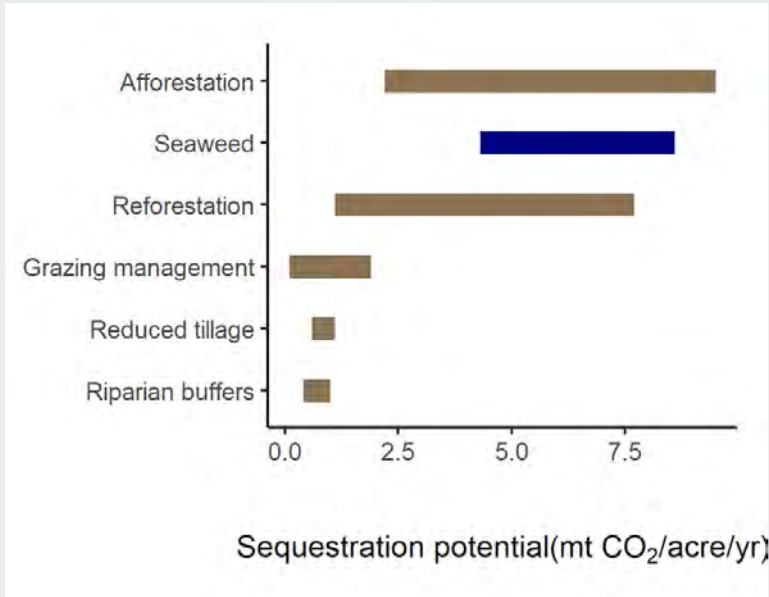
# Aquaculture Fisheries Interactions



**How do we capture the  
co-benefits of seaweed  
aquaculture?**



# Seaweed's carbon sequestration potential



High Growth Potential,  
Limited Resources

Key Issues:

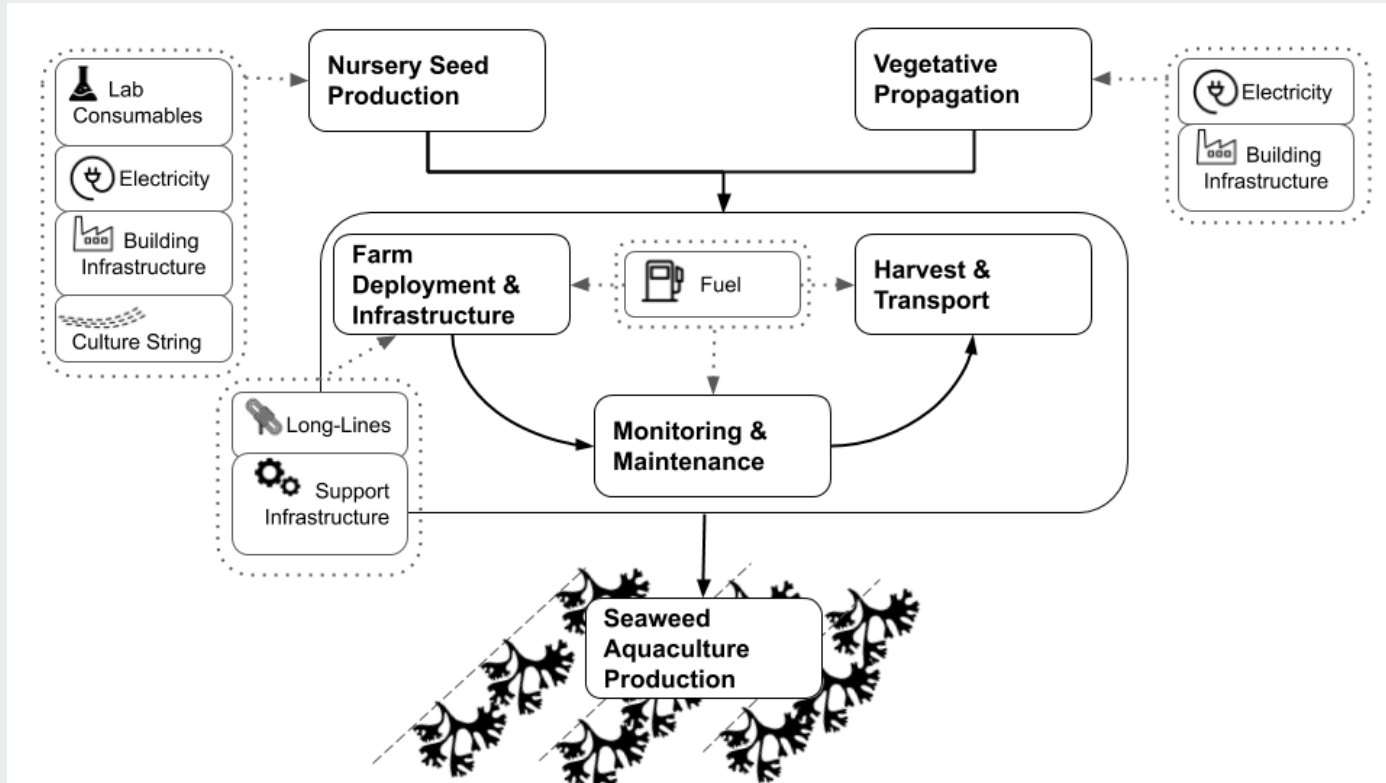
How is the seaweed used?

What are the costs?

(emissions & \$\$)

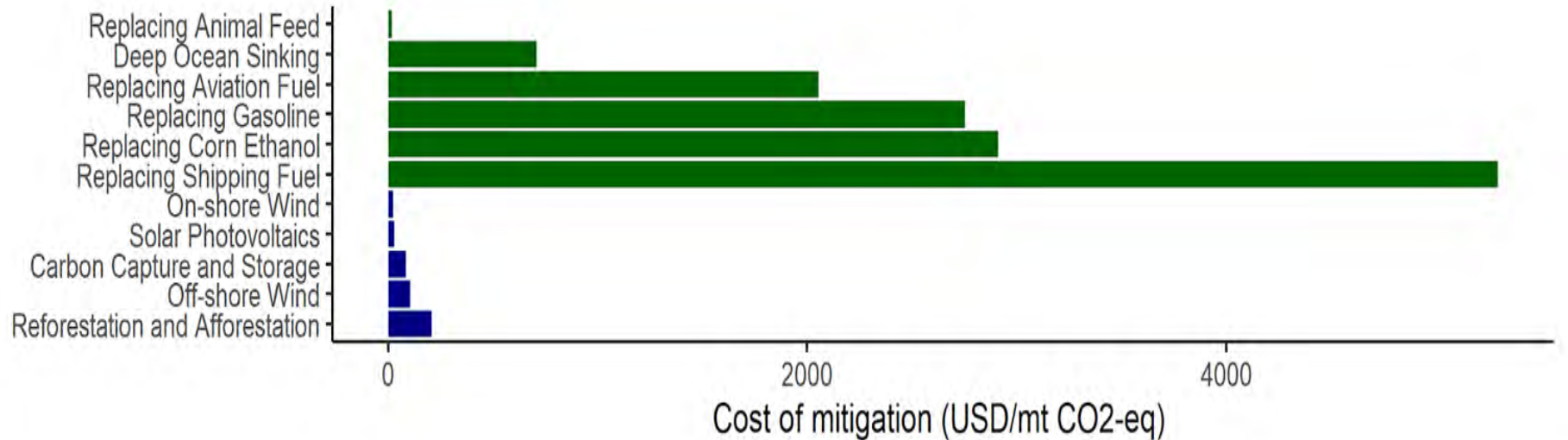
What is the potential  
scale?

# Seaweed's carbon sequestration potential

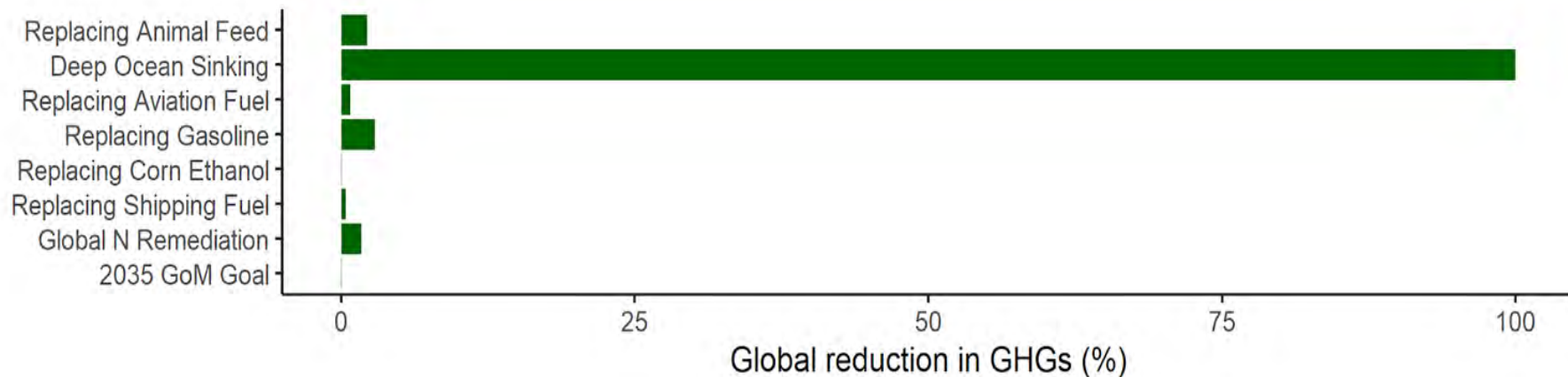


Life Cycle Assessment

# Seaweed's Carbon Sequestration Costs



# Seaweed's Carbon Sequestration Scalability

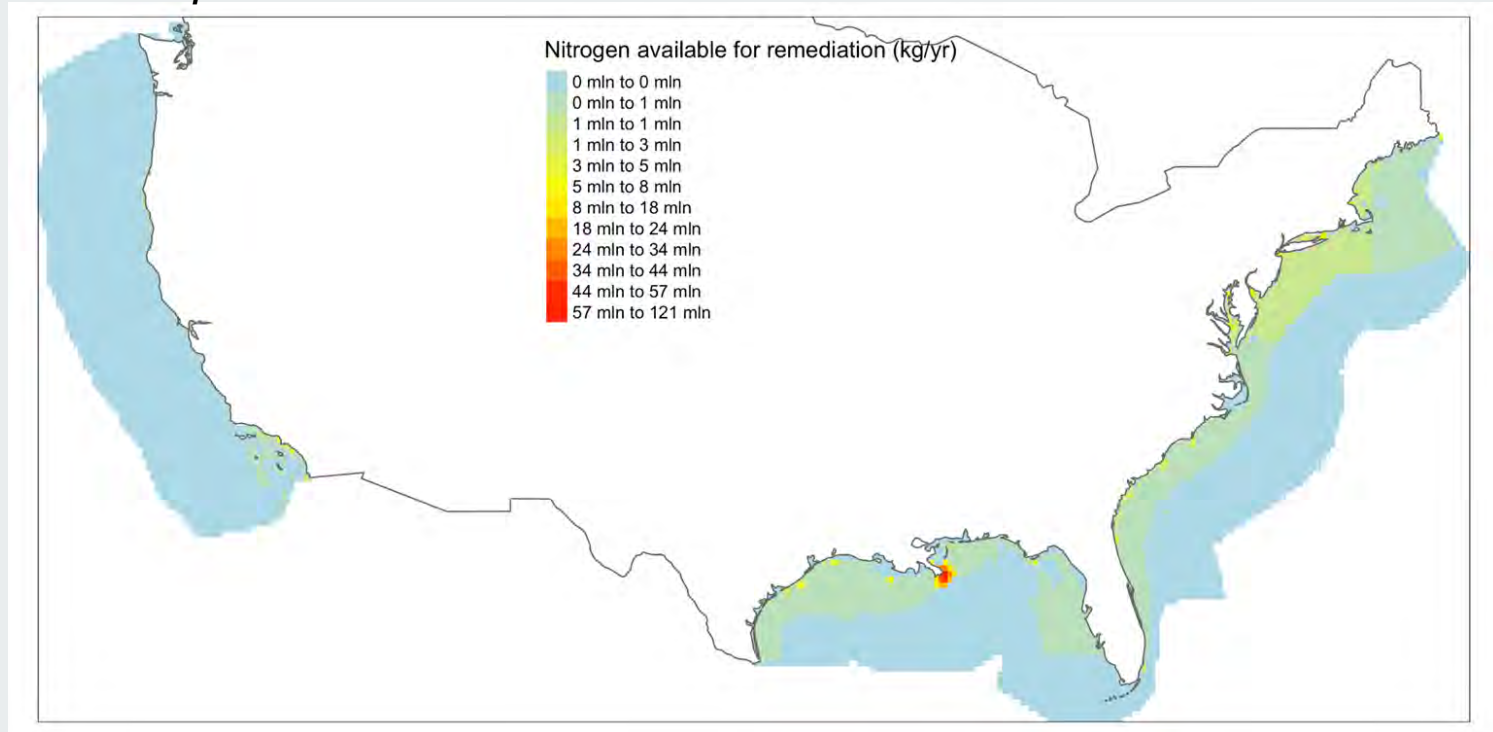


Deep Ocean Sinking Scaling:  
19,000 fold increase in global production  
18 million km<sup>2</sup>  
2.5 X US EEZ



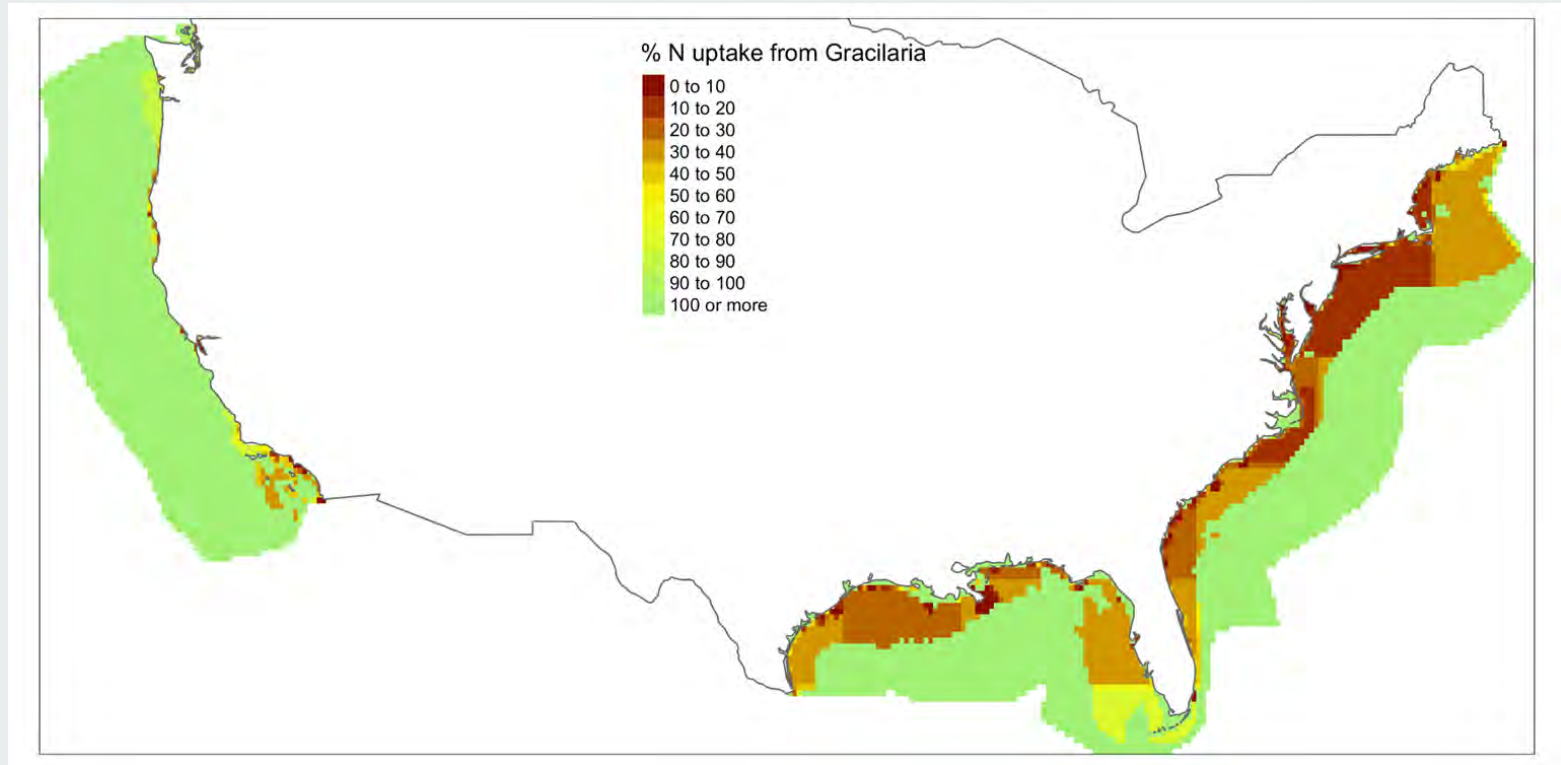
# Relative anthropogenic N in areas potentially available for seaweed aquaculture

*58% of anthropogenic nitrogen & 28% of anthropogenic phosphorus in aquaculture available marine space*

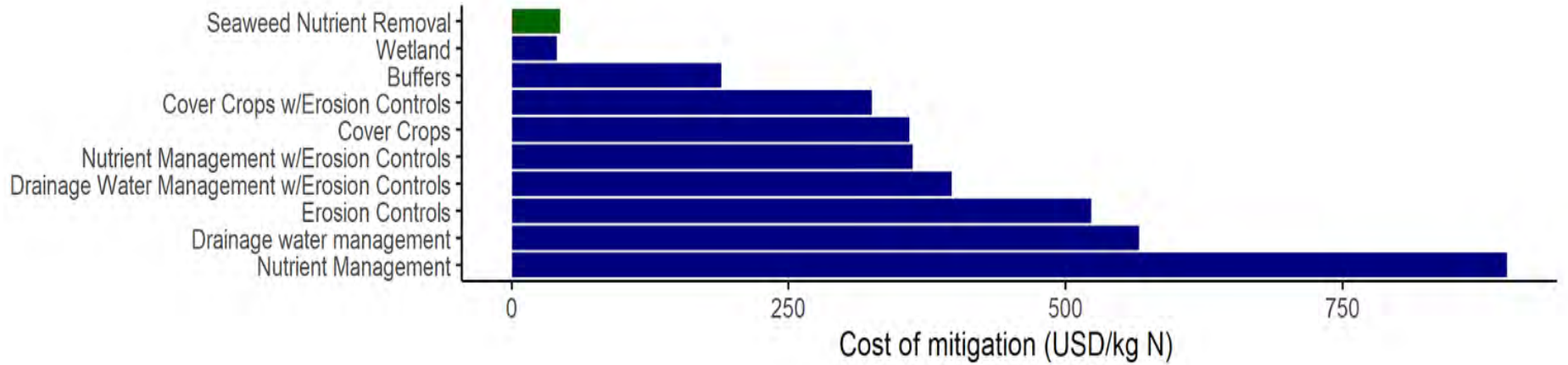


# % anthropogenic N uptake per 0.2x0.2 raster cell by Gracilaria spp.

*\*in areas potentially available for seaweed aquaculture*



# Seaweed's Nutrient Removal Potential



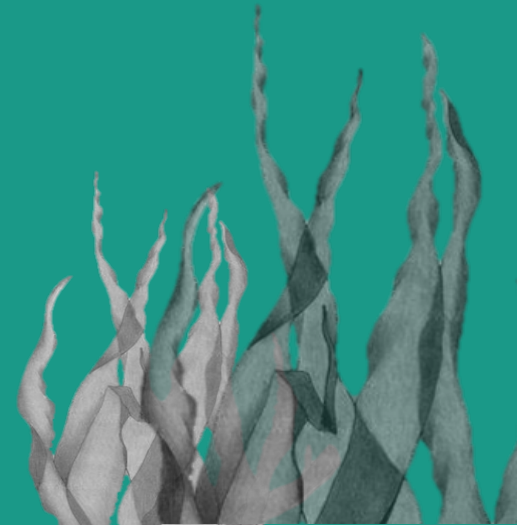
---

Seaweed aquaculture could represent a cost effective -- potentially revenue generating -- intervention for remediating global nutrient pollution



---

Key need: Better pollution markets



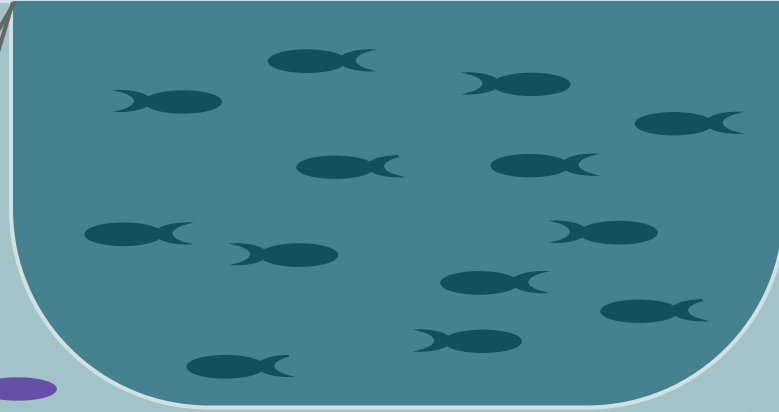
# Aquaculture Fisheries Interactions



# Case studies

## More & larger inside

Akyol & Ertosluk 2009  
Bagdonas et al. 2012  
Ozgul & Angel 2013  
Segvic Bubic et al. 2011



## Unaffected

Archevala-Lopez et al. 2005



## Aggregate under farm

Bagdonas et al. 2012  
Segvic Bubic et al. 2011  
Valle et al. 2009  
Skilbrei & Ottera 2016  
Tanner & Williams 2015  
Sudirman et al. 2009



## Predator attraction

Sanchez-Jerez et al. 2008  
Sobral et al. 2012



## Resident

Skilbrei & Ottera 2016  
Uglem et al. 2009



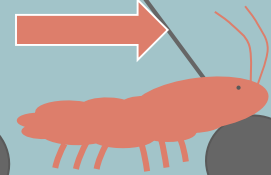
## Attracted to structure

McKindsey et al. 2011

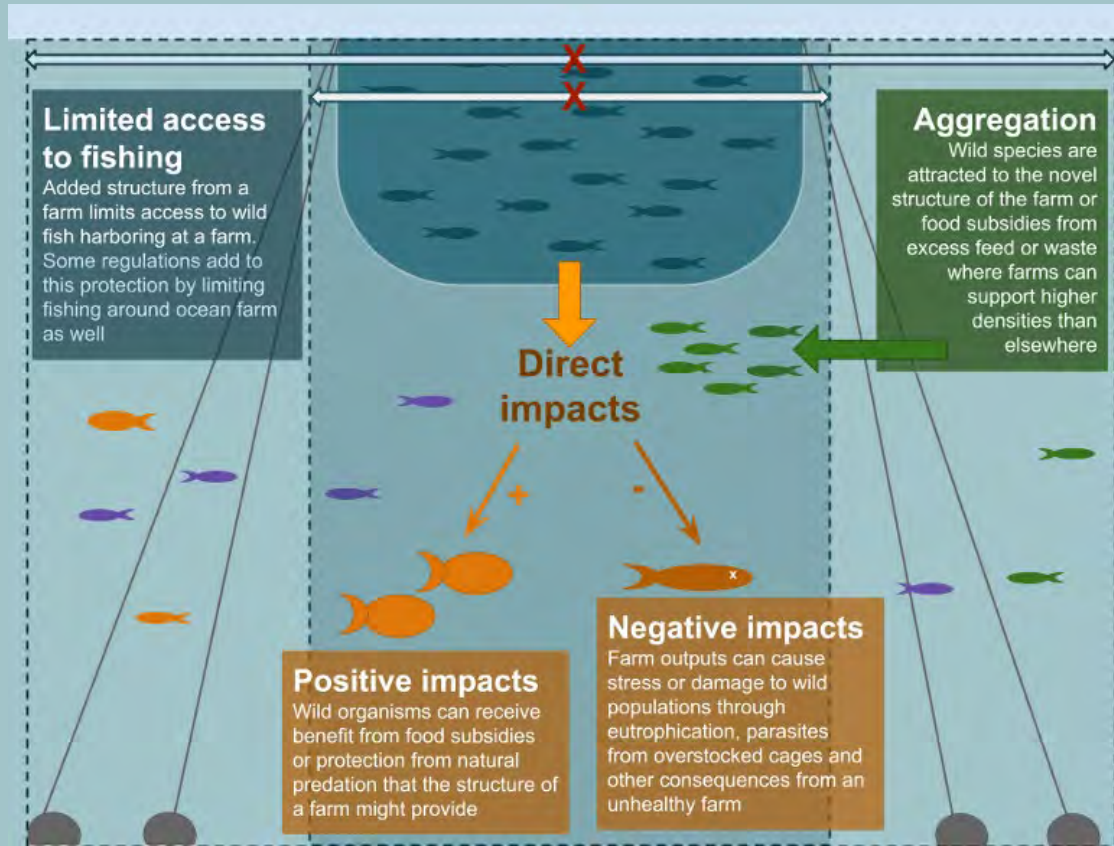


## Deterred

Milewski et al. 2018  
McKindsey et al. 2011



MPA

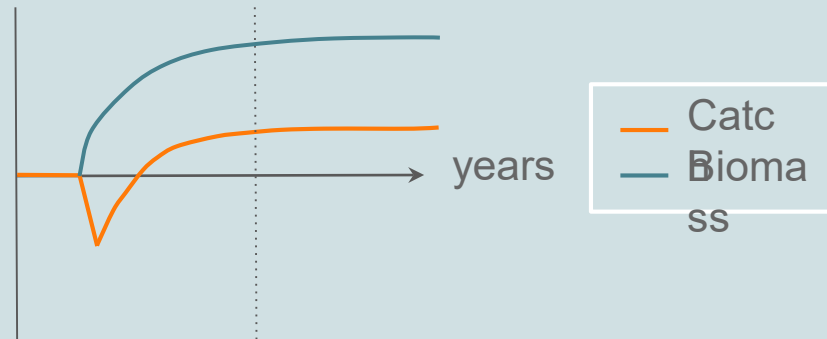
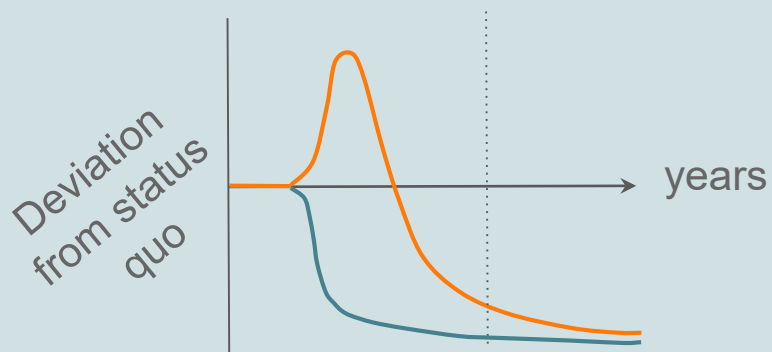
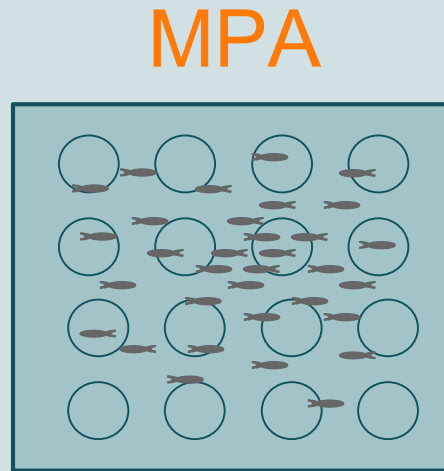
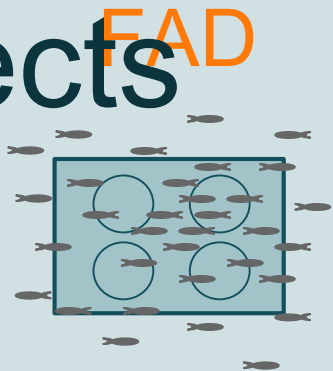


FAD

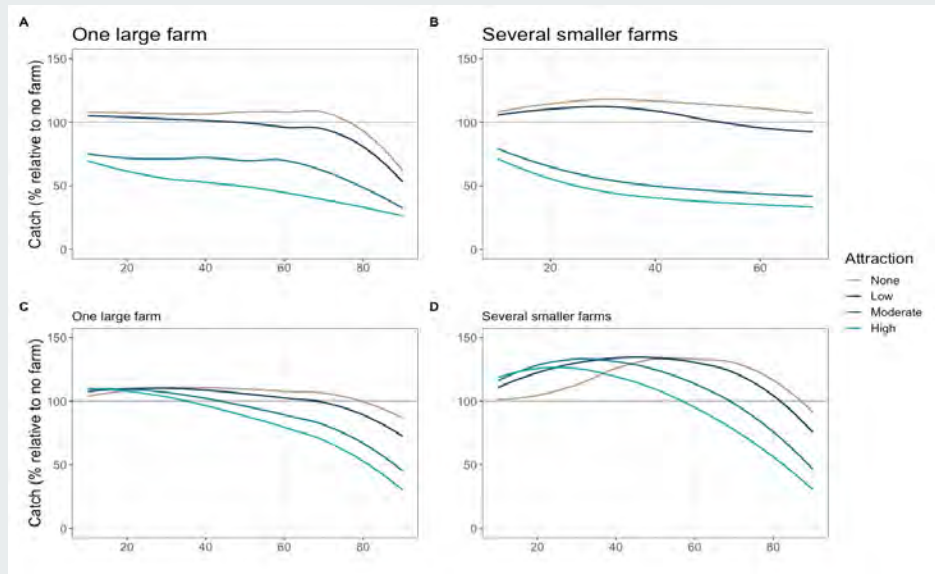
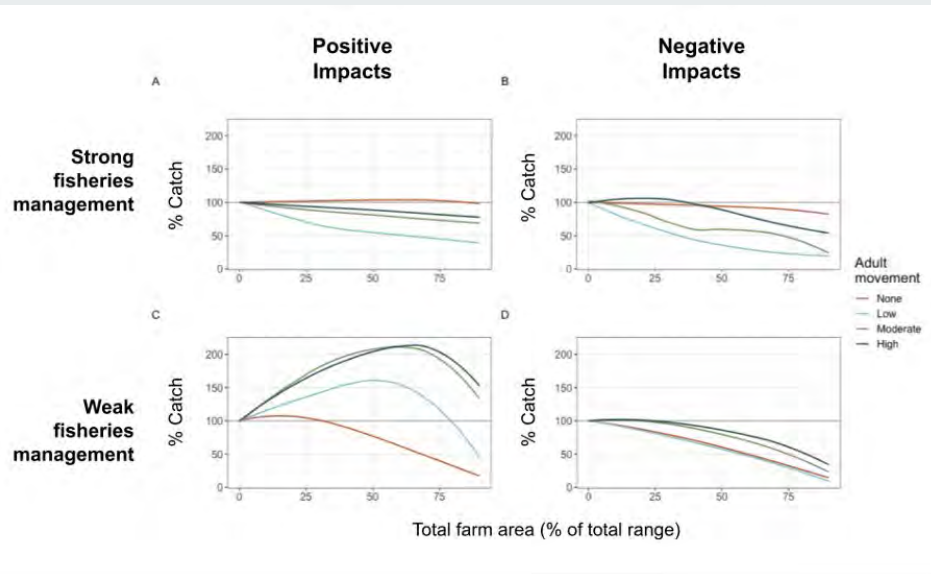
Altered Carrying Capacity



# Opposing Effects

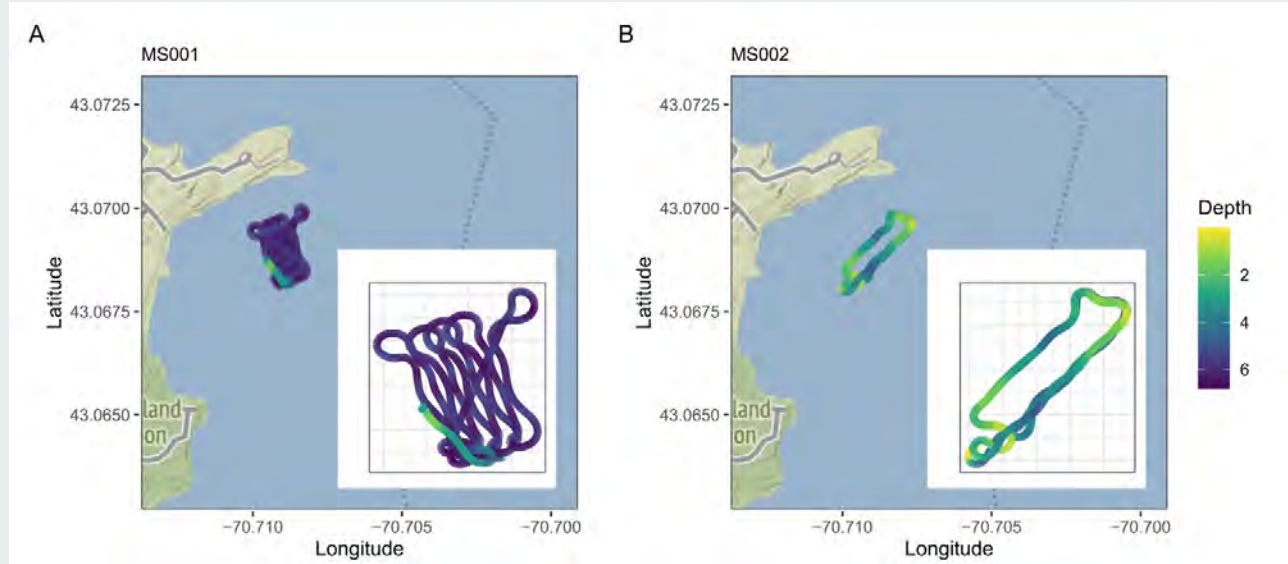


# Optimizing for Fisheries Benefits



# Next step: empirical estimates from farms

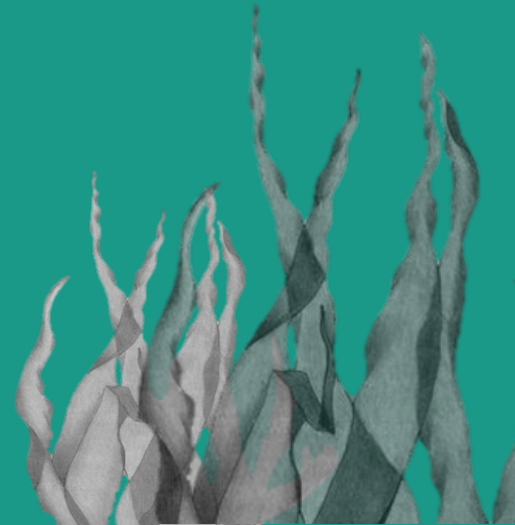
- Sonar maps of fish distributions
- Estimating fish attraction to and retention in farms



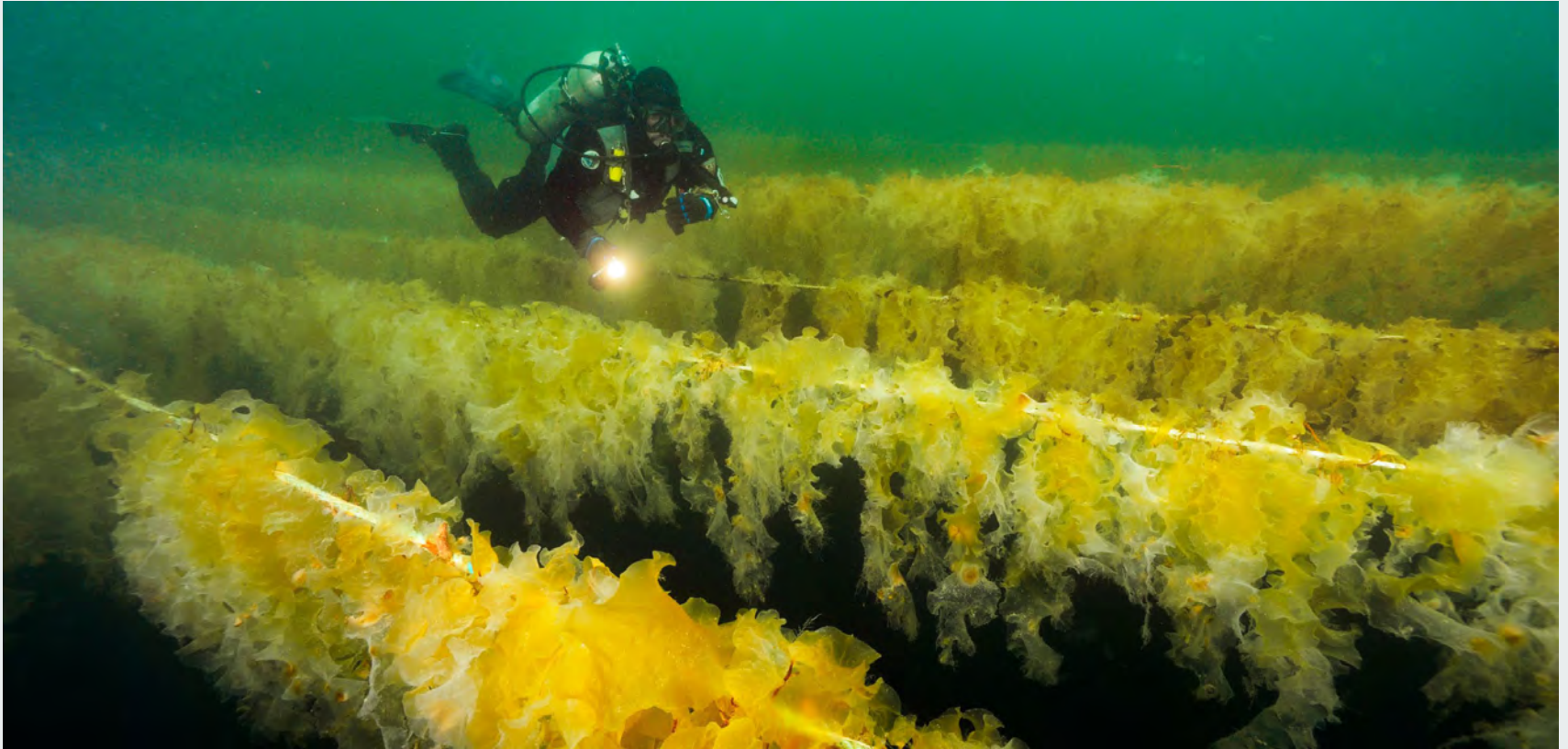
---

Farms can generate diverse co-benefits

Strategic designs matter

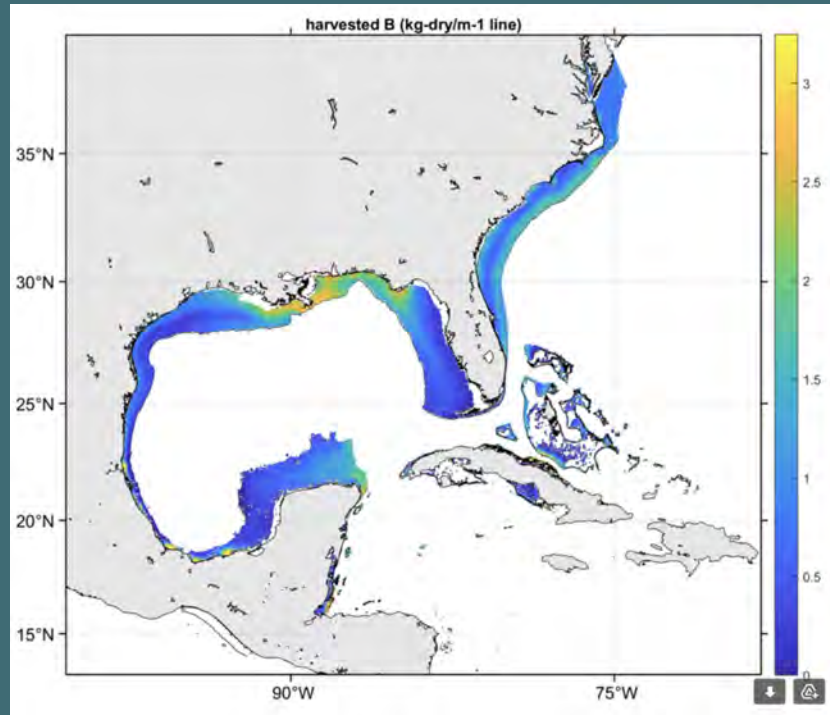


# Questions?



# Potential Harvest Projections - MACMOD

Annual harvest of *Eucheuma* estimated by the macroalgal growth model with forcing data from SABGOM. Farm suitability restricted to 10 - 100 m seafloor depth.



# Using Water Quality Trading Markets per kg N

- *Eucheuma spp.*: \$8.33–\$69.79
- *Gracilaria tikvahiae*: \$2.05–\$17.17
- *Sargassum spp.*: \$3.20–\$26.80

**Avg Price: \$0.09/kg of pollutant up to \$2,834/kg**

---

# SBE-Growing Oyster Aquaculture in Georgia: Assessing the Legal and Public Perception Landscape to Address Barriers and Promote Success

S. Jones, T. Wright, S. Pippin, T. Bliss, K. Hill



# Growing Oyster Aquaculture in Georgia: Assessing the Legal and Public Perception Landscape

Shana Jones, Katie Hill, Kelsey Broich, Brian Simmons

October 28, 2021



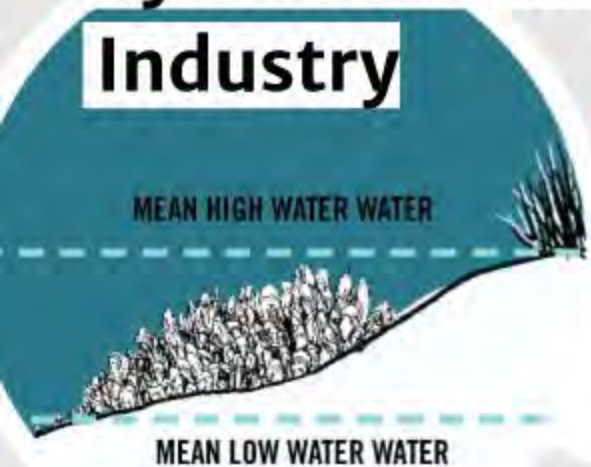
**Carl Vinson**  
**Institute of Government**  
**UNIVERSITY OF GEORGIA**

# Georgia's New Oyster Farming Program



© 100 Miles

# Changes to the Oyster Mariculture Industry



New demand for single oysters sold by the half shell



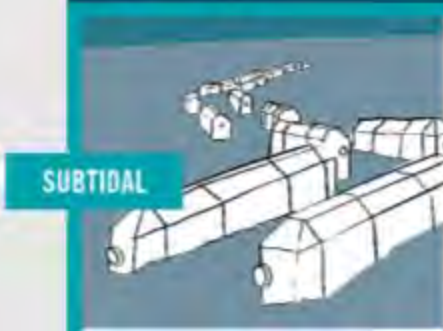
Creation of **SUBTIDAL** water bottom leases allowing for oyster farming in floating cages



In the early 1900s, Georgia led the nation in harvesting wild oysters for canning



Georgia law only provided for lease of state-owned **INTERTIDAL** waters for commercial harvest of wild oysters



SPECIAL REPORT SC water tank wasn't cleaned for years as sludge grew inside. Apparently no one noticed.

## Fight over floating oyster farms erupts anew as SC bill could pause summer harvest

BY CHLOE JOHNSON C.JOHNSON@POSTANDCOURIER.COM  
 MAR 2, 2021 UPDATED APR 3, 2021



Lowcountry Oyster Co. operates one of South Carolina's free-floating cage oyster farms in the region. Growers say it's the most reliable way to farm oysters, but some boaters and waterfront property owners are opposed to them. Photo provided.

## Oyster Growers and Boaters at Odds Over Bay Lease Locations

More East End representation on county board may help avert conflicts



Adam Younes, an oyster grower maintaining floating gear in Gardiner's Bay that has been the subject of friction with its neighbors.  
 David F. Sams

By Christopher Walsh  
 JANUARY 21, 2021

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  - Soccer and Field Hockey Finales Were Riveting  
 Oct 22, 2021 11:30 am
  - Only One Incumbent in Race

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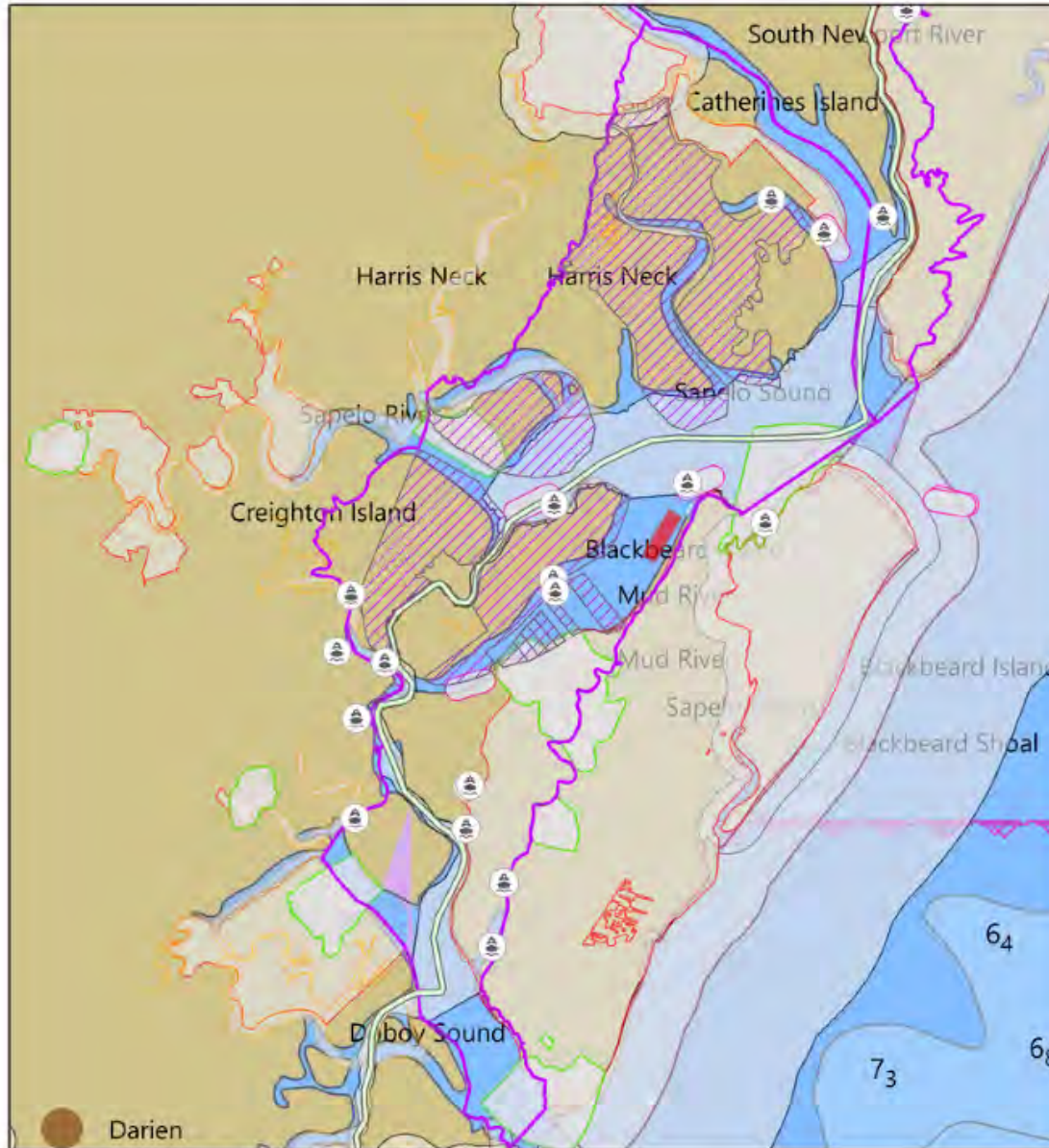
LAWSUITS & LITIGATION

## Homeowners File Land Ownership Lawsuit Over Oyster Farm Plan

SARA F. TELLER — November 6, 2020

Friends of Bassing Beach file a lawsuit asking the court to review land ownership rights.

# McIntosh Exclusionary Areas for Subtidal Leases





- Proposed Mud River Mariculture Zone
- Shellfish Growing Areas
- ▨ Shellfish Leases
- ICW
- Federal Exclusionary Zones
- USFW Critical Habitat
- LTER Boundaries
- Artificial Reefs
- Trawl Research
- Shrimp Bait Zones
- Conservation Lands (Heritage, etc.)
- ⊙ Known Anchorage Sites

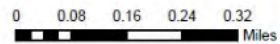
Disclaimer: This map is produced by the Georgia Department of Natural Resources for purpose of providing visual aid and illustrative context. This map is not for determination of any official legal extents, boundaries, or any other legal determinations. Do not use this map for navigational purposes. Although every effort has been made to ensure the accuracy of the information presented herein, the Coastal Resources Division does not guarantee that this map is error-free.

Service Layer Credits: NOAA ENC Online Map Server

# MUD RIVER SUBTIDAL LEASES



-  Mud River Mariculture Zone
-  Mud River Subtidal Leases



PRODUCED BY:  
GA DEPT. OF NATURAL RESOURCES  
COASTAL RESOURCES DIVISION  
SHELLFISH AND WATER QUALITY PROGRAM



# Aquaculture Survey Graphics



*\*For illustration only, not an actual lease location.*





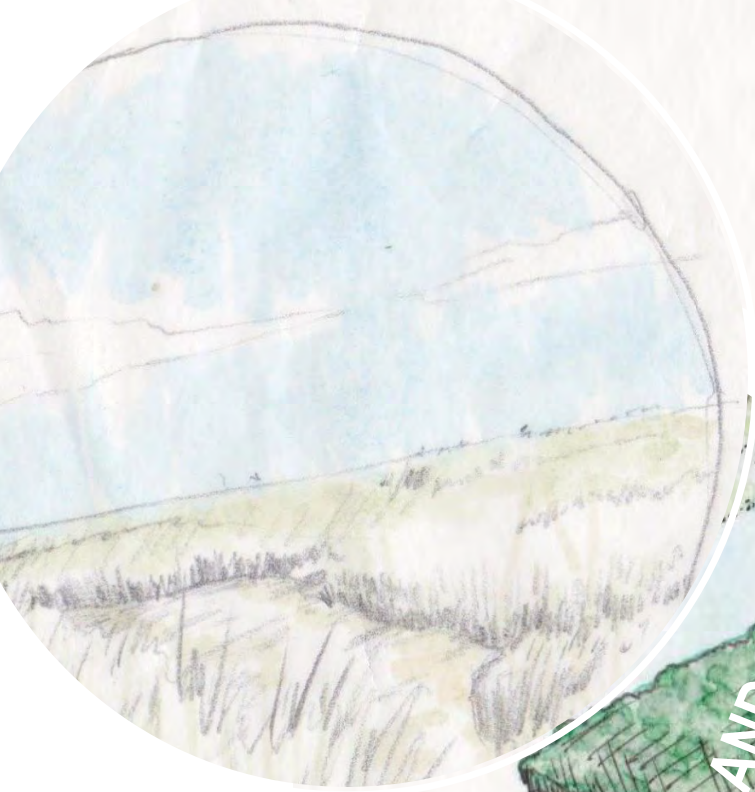




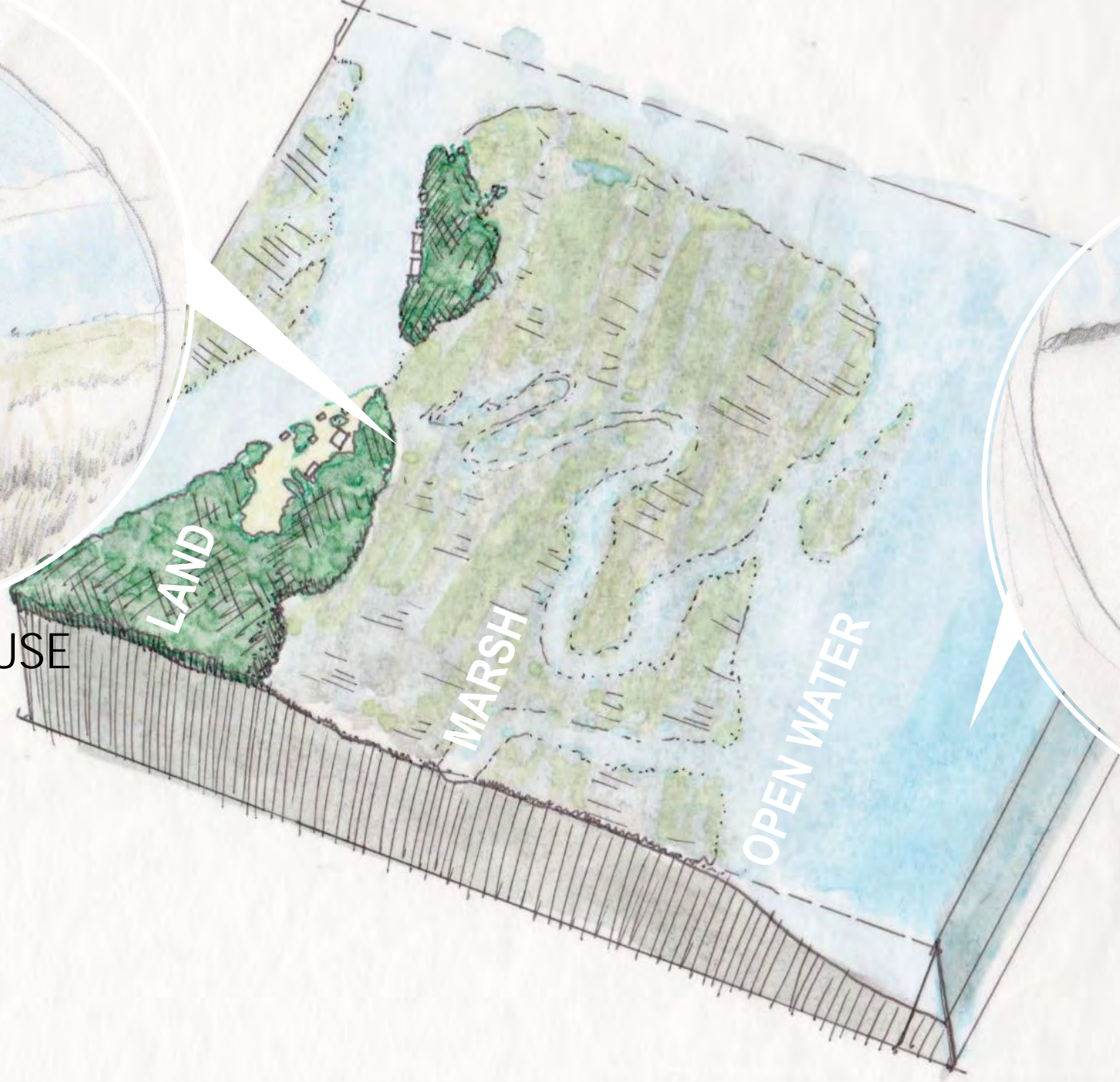
# AERIAL SITE RELATION TO MARSH



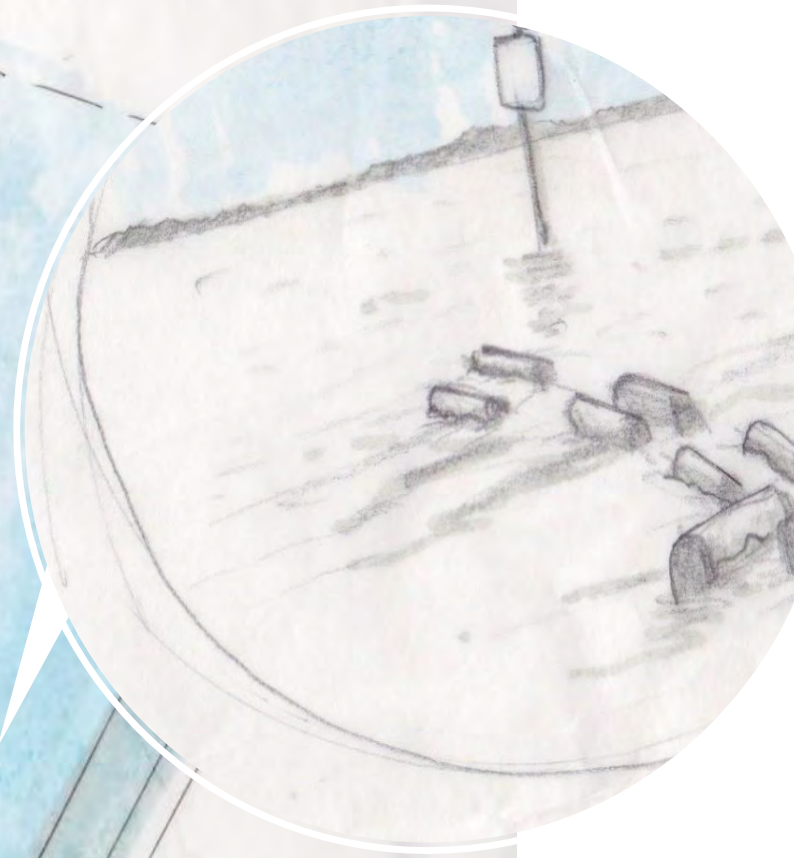
Sketch for Rendering

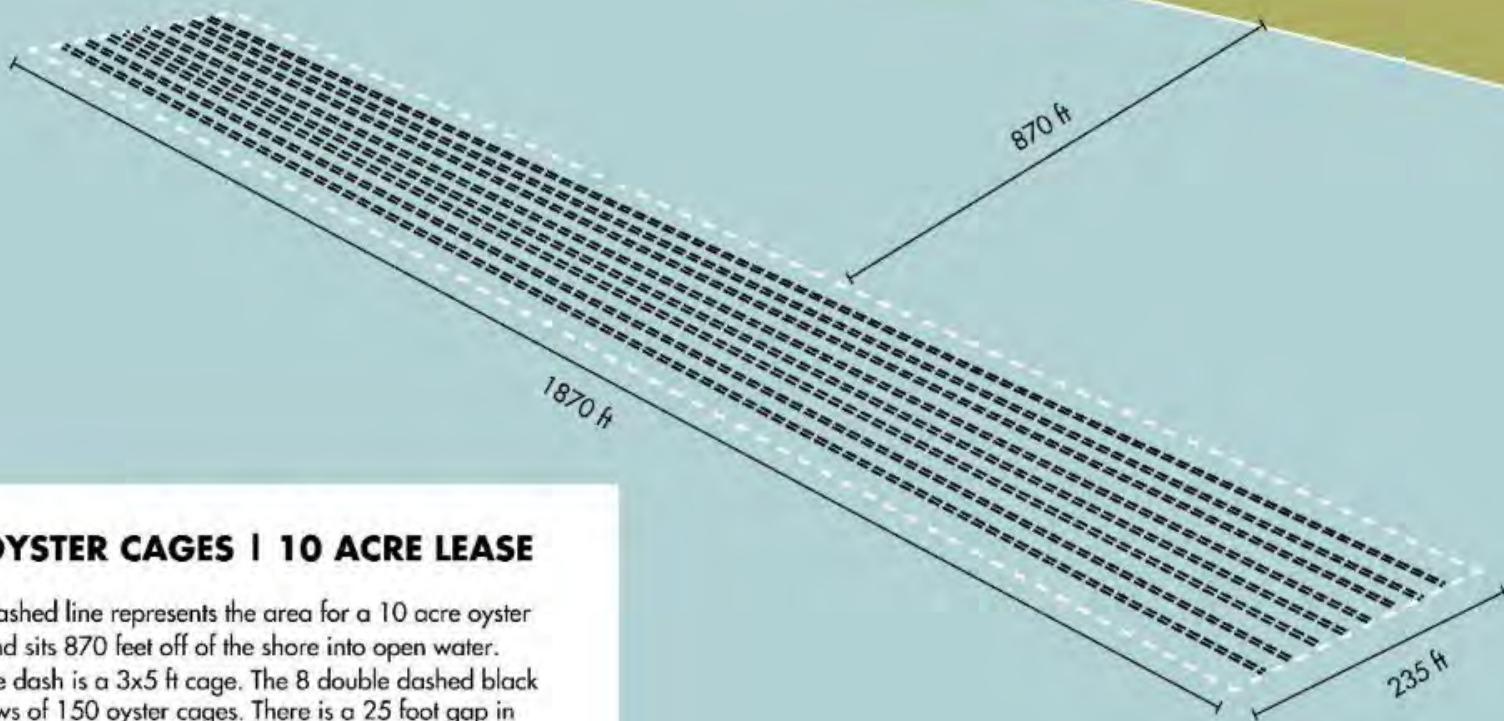


VIEW FROM HOUSE



VIEW FROM BOAT

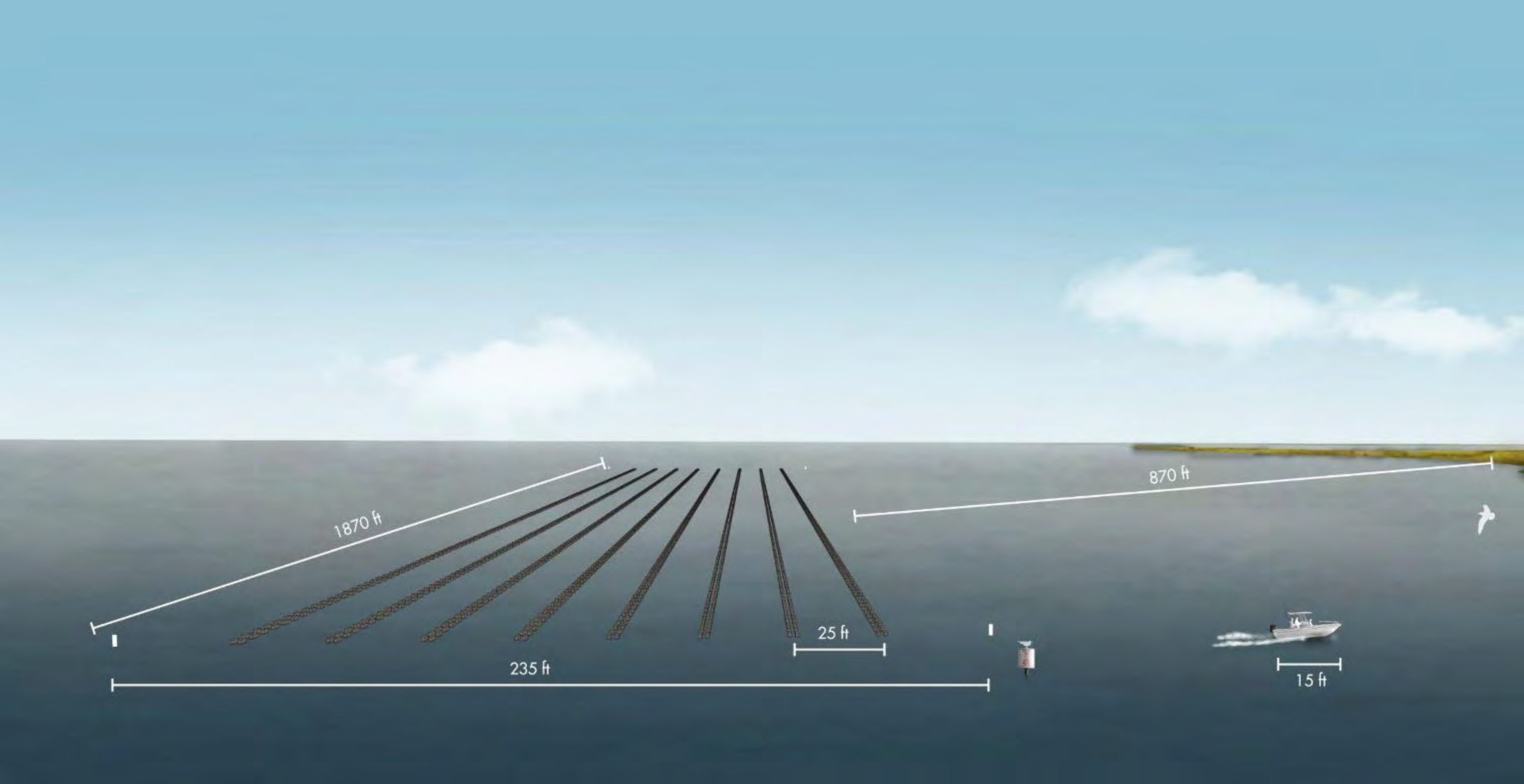




### 1200 OYSTER CAGES | 10 ACRE LEASE

The white dashed line represents the area for a 10 acre oyster lease site and sits 870 feet off of the shore into open water. Each double dash is a 3x5 ft cage. The 8 double dashed black lines are rows of 150 oyster cages. There is a 25 foot gap in between each row.





1870 ft

235 ft

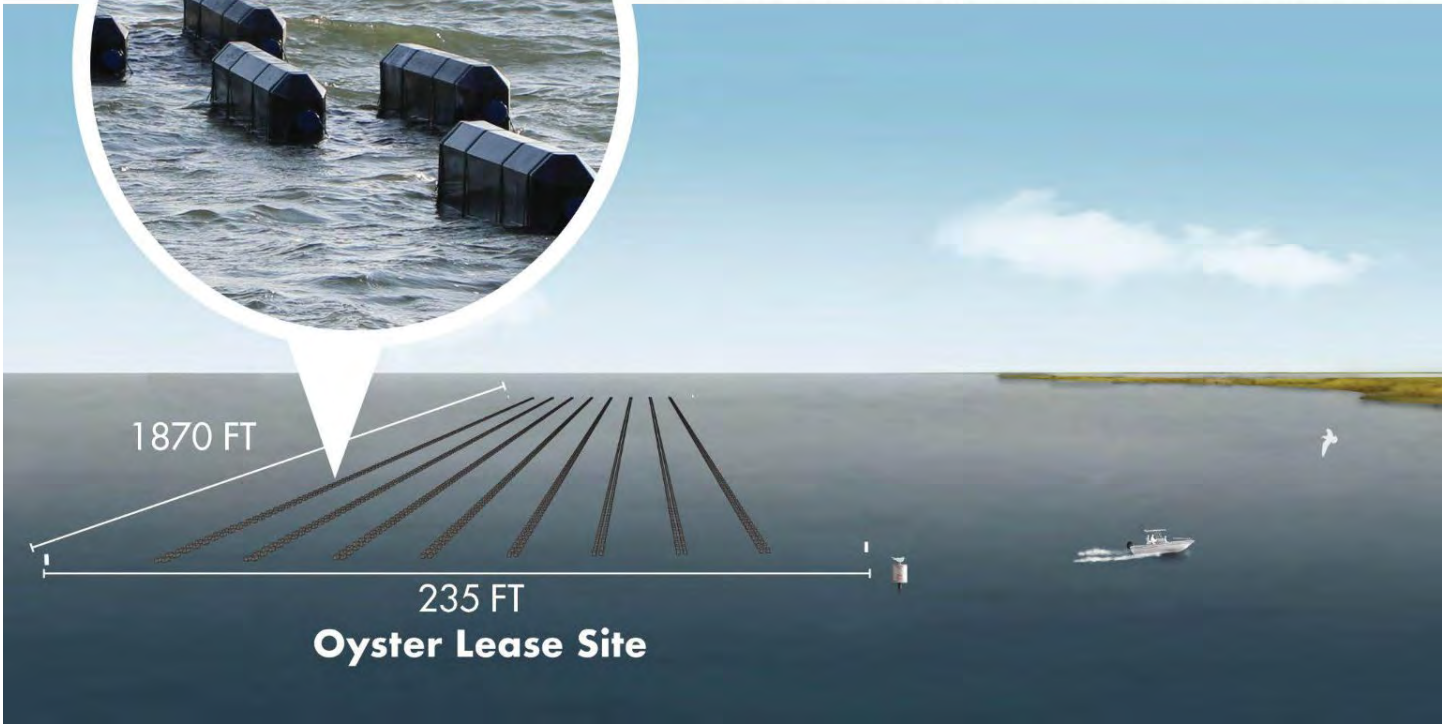
25 ft

870 ft

15 ft



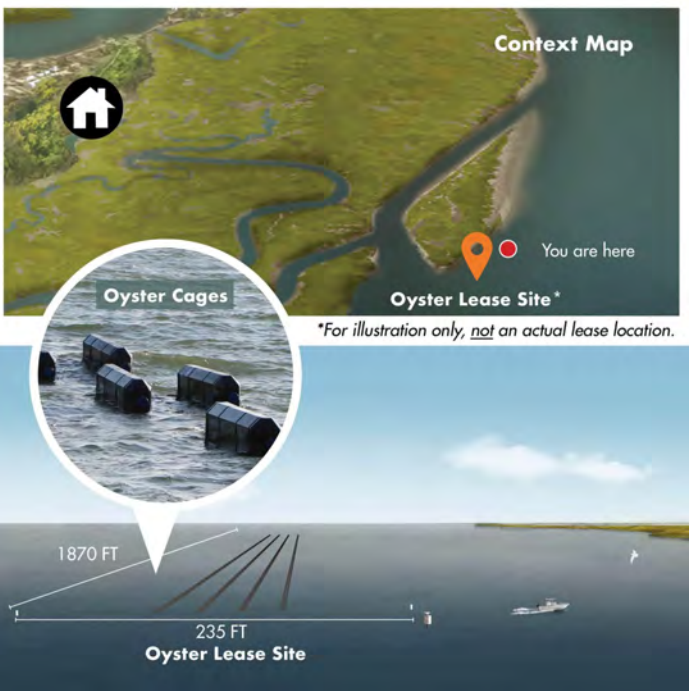
*\*For illustration only, not an actual lease location.*





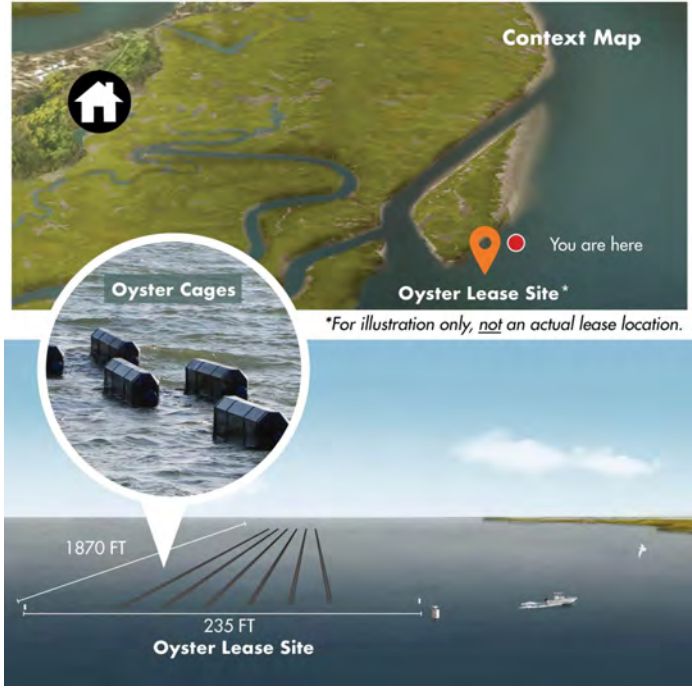
30

0



600

900



120

0

# Survey Content

# Survey Content

- Coastal recreational activities
- Awareness of oyster farming
- Potential areas of conflict
- Support for oyster farming
- Benefits of oyster farming



# Survey Dissemination

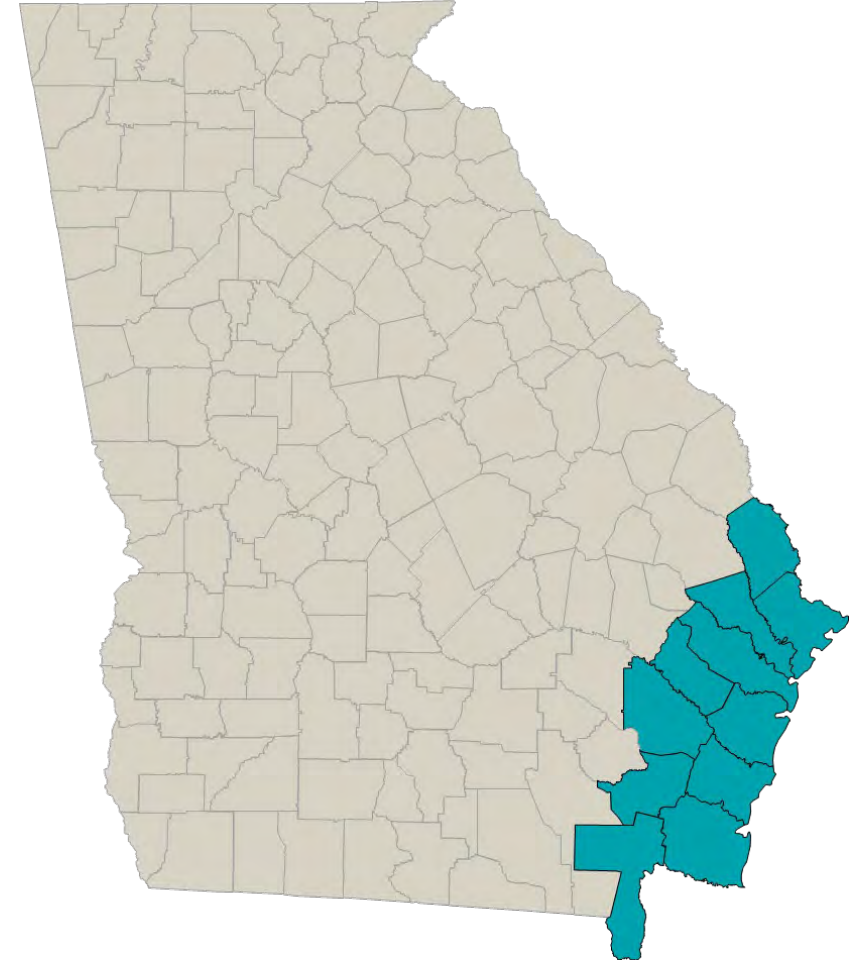
- Emailed to approximately **14,000** registered boater owners

Emails provided by Georgia Department of Natural Resources

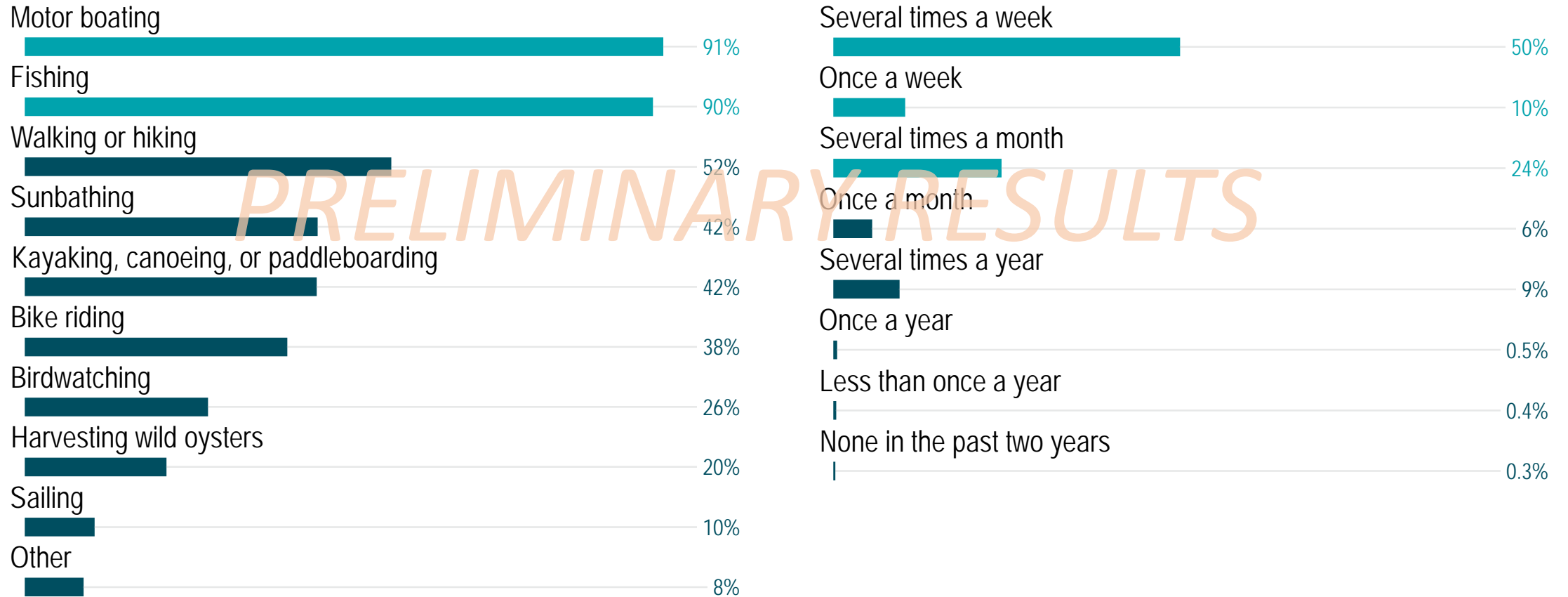
- **11 coastal counties**

Brantley	Chatham	Long
Bryan	Effingham	McIntosh
Camden	Glynn	Wayne
Charlton	Liberty	

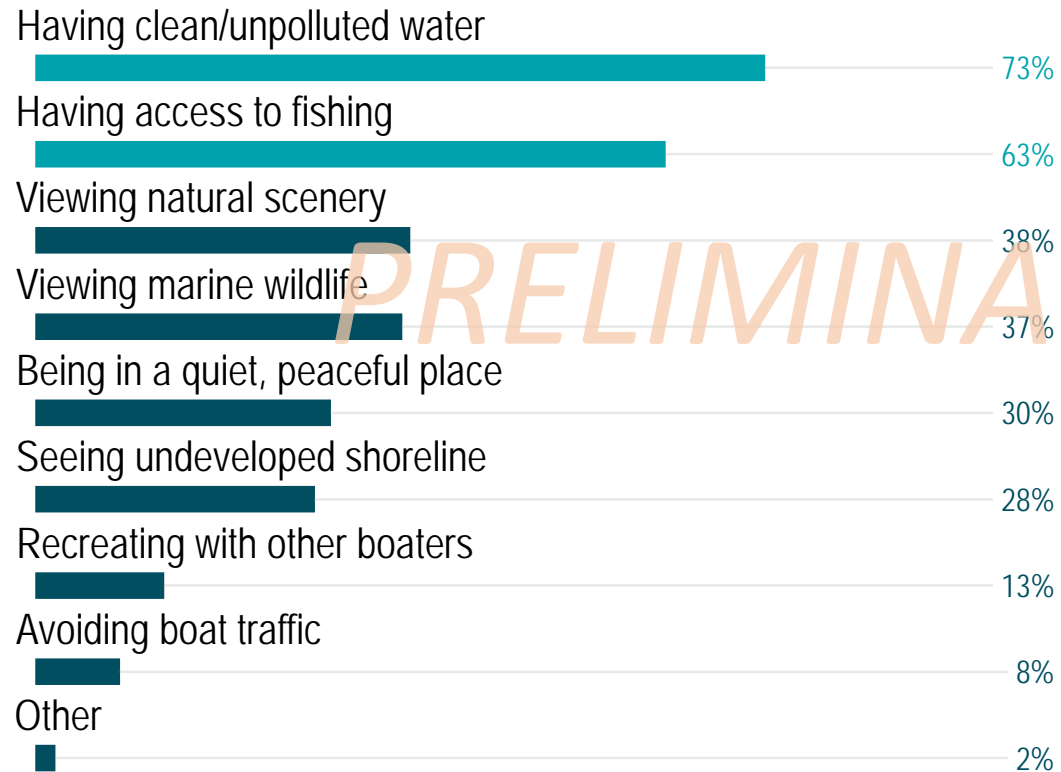
- Data collection started October 7, 2021
- 742 completed responses (as of October 26)



# Coastal Recreational Activities



# Coastal Recreational Priorities

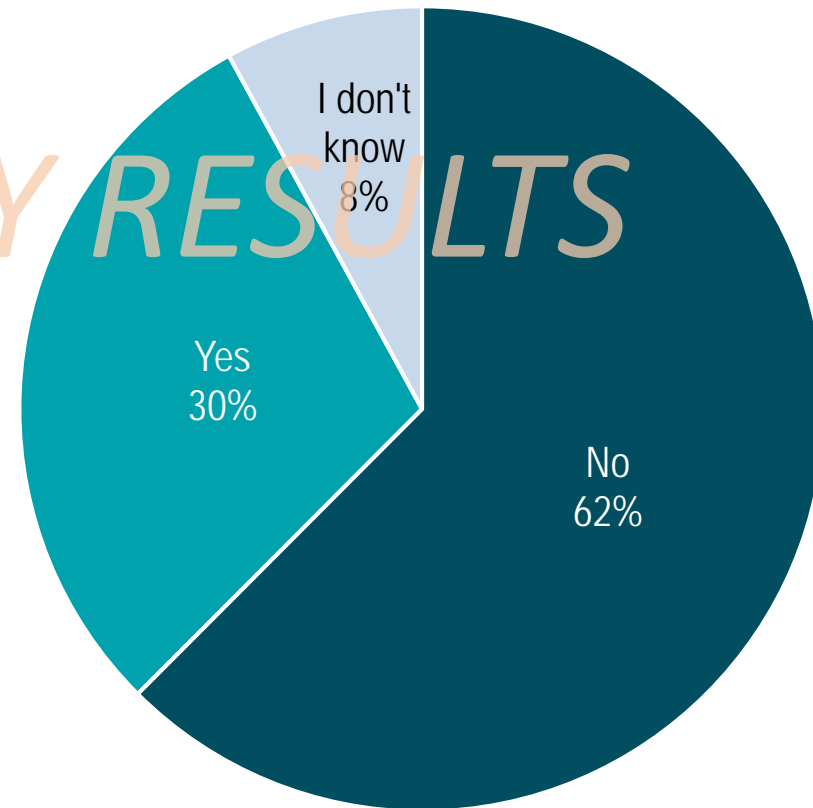


# Oyster Farming Familiarity

How familiar are you with oyster farming?



Have you ever seen an oyster farm in person?



# Oyster Farming Support

I support oyster farming in general



I support oyster farming in Georgia's coastal waters



I support more oyster farming in Georgia



I support oyster farming in Georgia coastal waters near my home



I support oyster farming in Georgia's coastal waters that I use the most





# Oyster Farming Benefits

Georgia's economy



Water quality



Wild shellfish harvesting



Georgia's culture



Commercial use of coastal waters



Recreational use of coastal waters



Georgia's coastal scenery



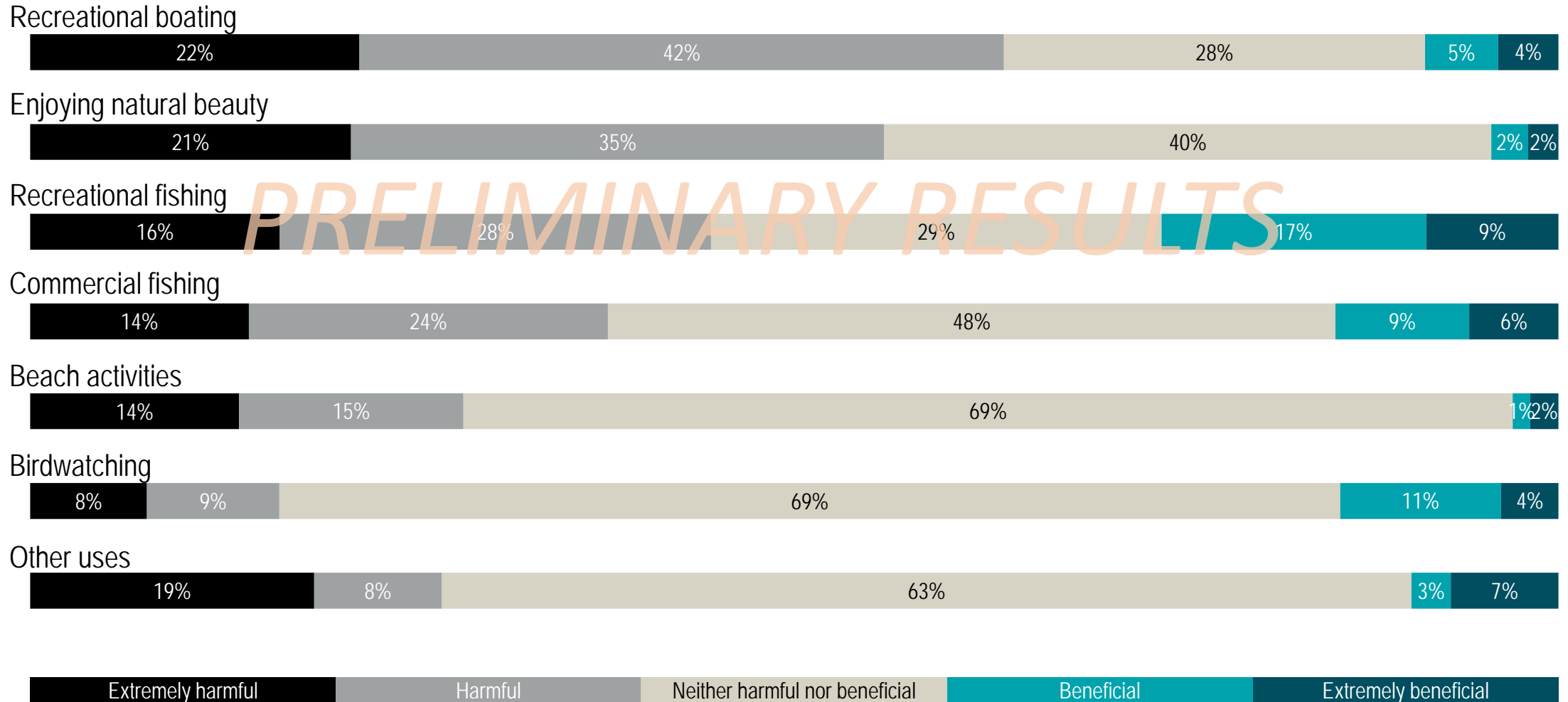
Boater safety



PRELIMINARY RESULTS



# Oyster Farming Perceived Recreational Impact



# Image Comparisons

- Respondents were randomly presented with one of four oyster farm renditions.
  - Images were identical except for the number of cages.
- Conducted an ANOVA to examine the average perceived recreational impact between the four groups.
  - No statistically significant differences exist between the four groups.
- After survey conclusion, additional statistical testing will be done to assess for variations in perceived impact.

# Thank you!

Katie Hill – [katiehill@uga.edu](mailto:katiehill@uga.edu)

Kelsey Broich – [kbroich@uga.edu](mailto:kbroich@uga.edu)

Brian Simmons – [brian.simmons@uga.edu](mailto:brian.simmons@uga.edu)

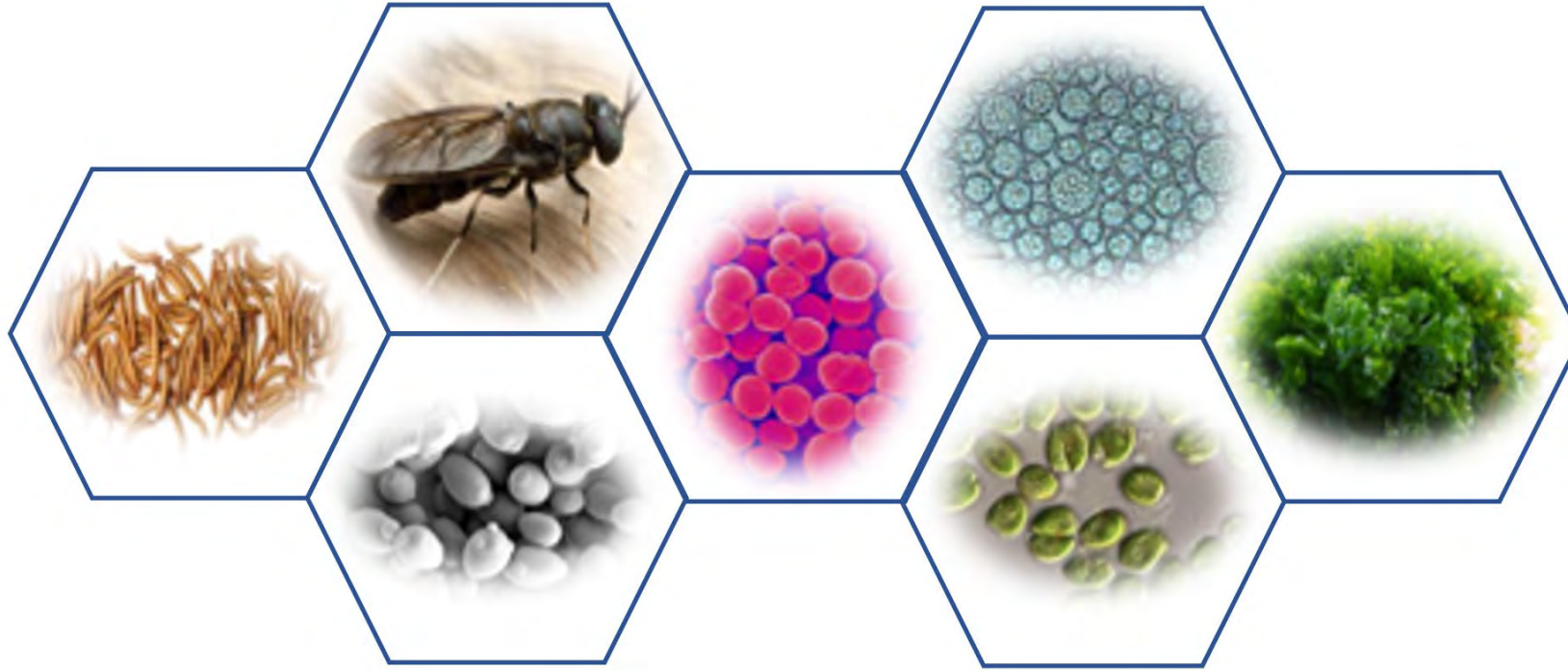


**Carl Vinson**  
**Institute of Government**  
**UNIVERSITY OF GEORGIA**

# SBE-Economic and environmental sustainability decision-support tool for fish-free aquafeed

A. Kapuscinski, B. McKuin, E. Campbell, P. Sarker

# Economic and environmental sustainability decision-support tool for fish-free aquafeed



**PI: Anne Kapuscinski**

**Co-PIs: Pallab Sarker and Elliott Campbell**

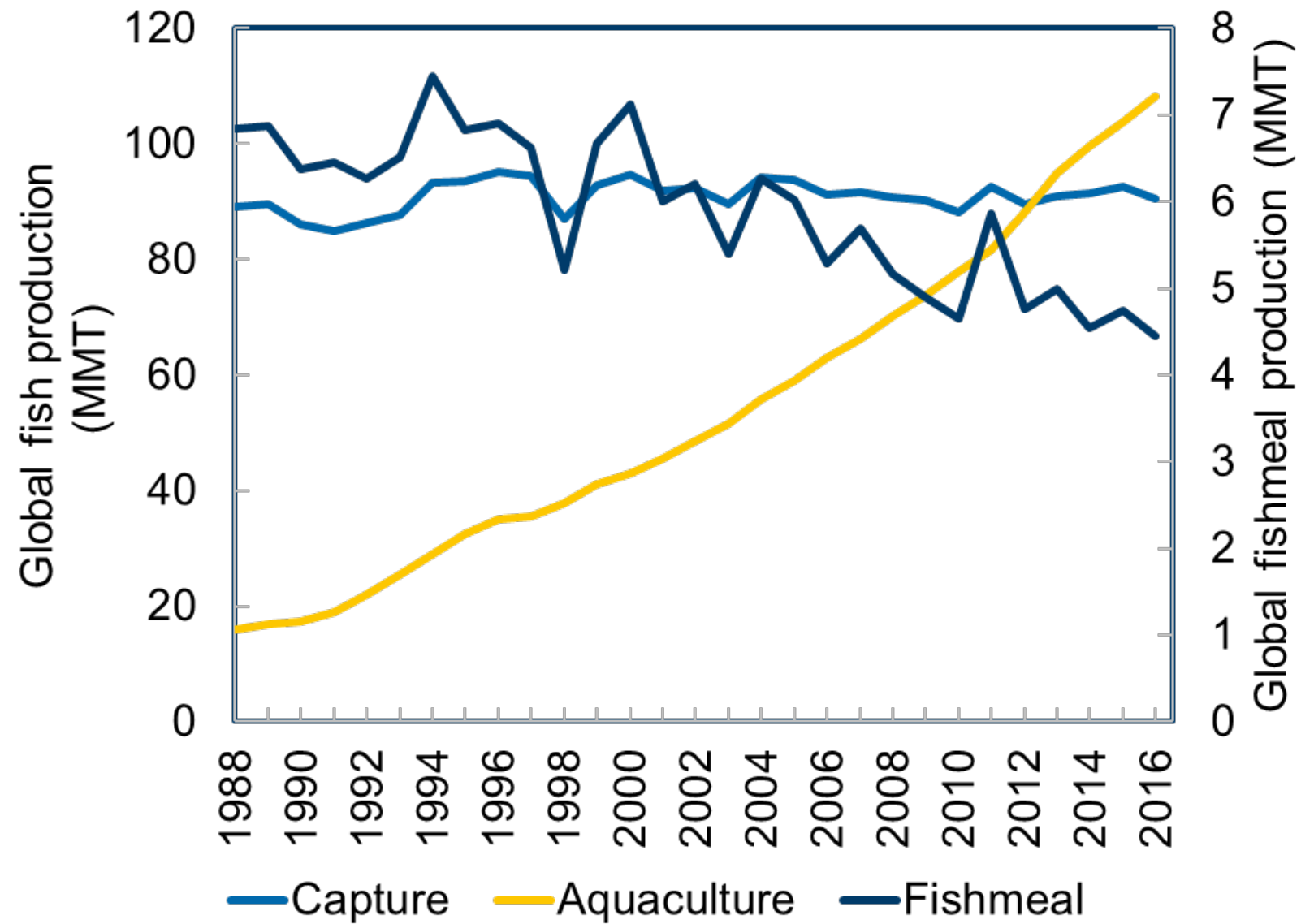
**Technical Lead: Brandi McKuin**

# Roadmap

- Project overview
- Progress to date
- Next steps

# Sustainability: Business as usual

- Project overview
- Progress to date
- Next steps

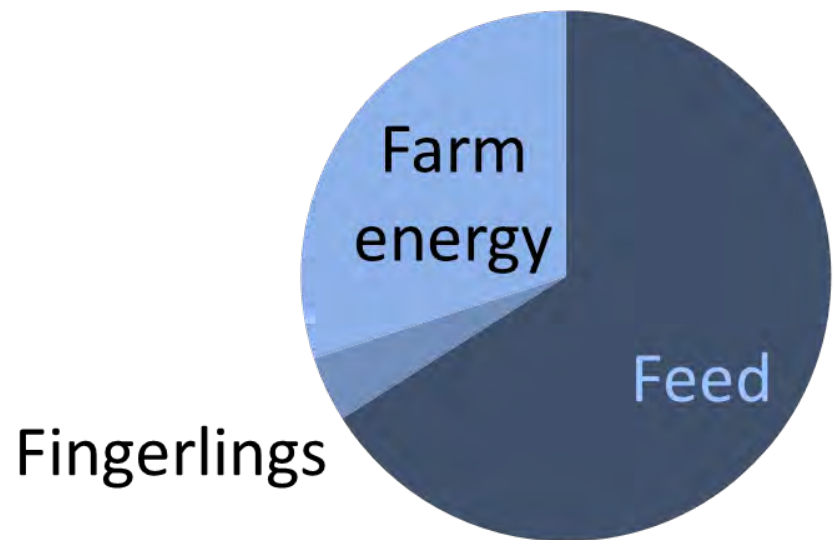




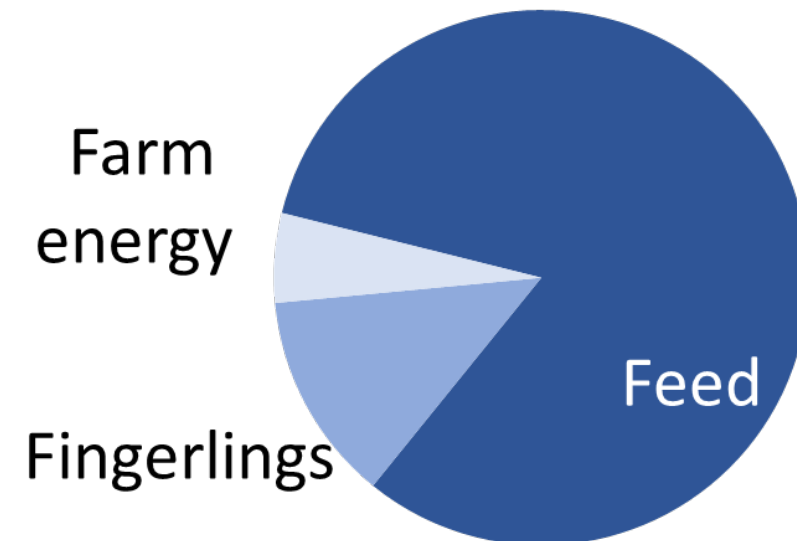
# Sustainability: environmental and economic impacts of aquafeeds

- Project overview
- Progress to date
- Next steps

Life cycle GWP



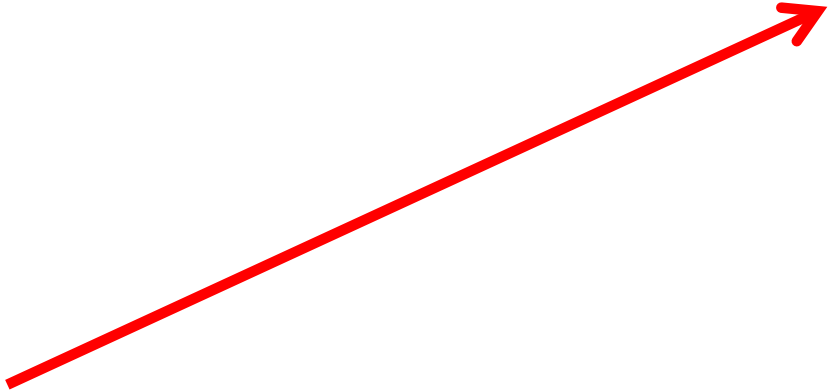
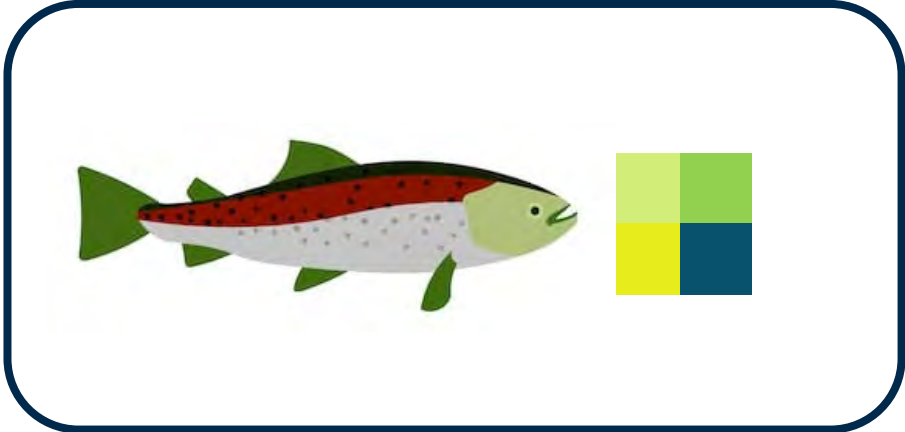
Variable costs



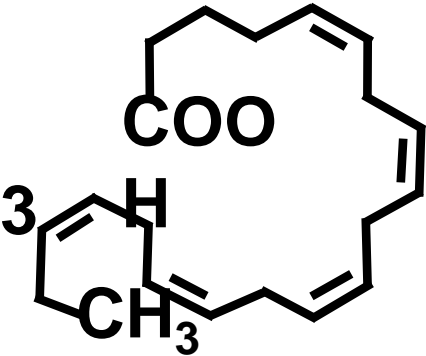
*Life-cycle global warming potential (GWP) and variable costs of cradle-to-farm gate operations. Left panel: life-cycle GWP (Pelletier and Tyedmers, 2010). Right panel: variable costs (Ferreira et al., 2015).*

# Sustainability: Terrestrial ingredients

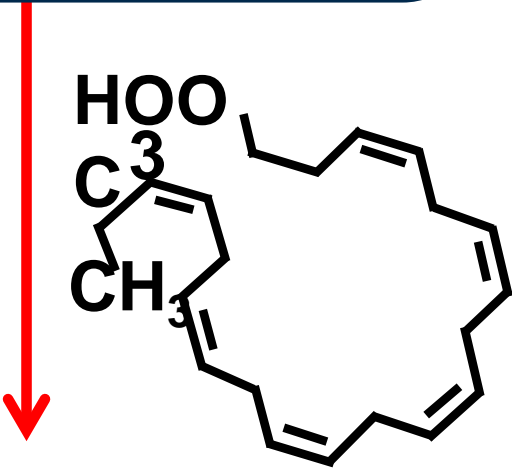
- Project overview
- Progress to date
- Next steps



Crop ingredients



EPA



DHA

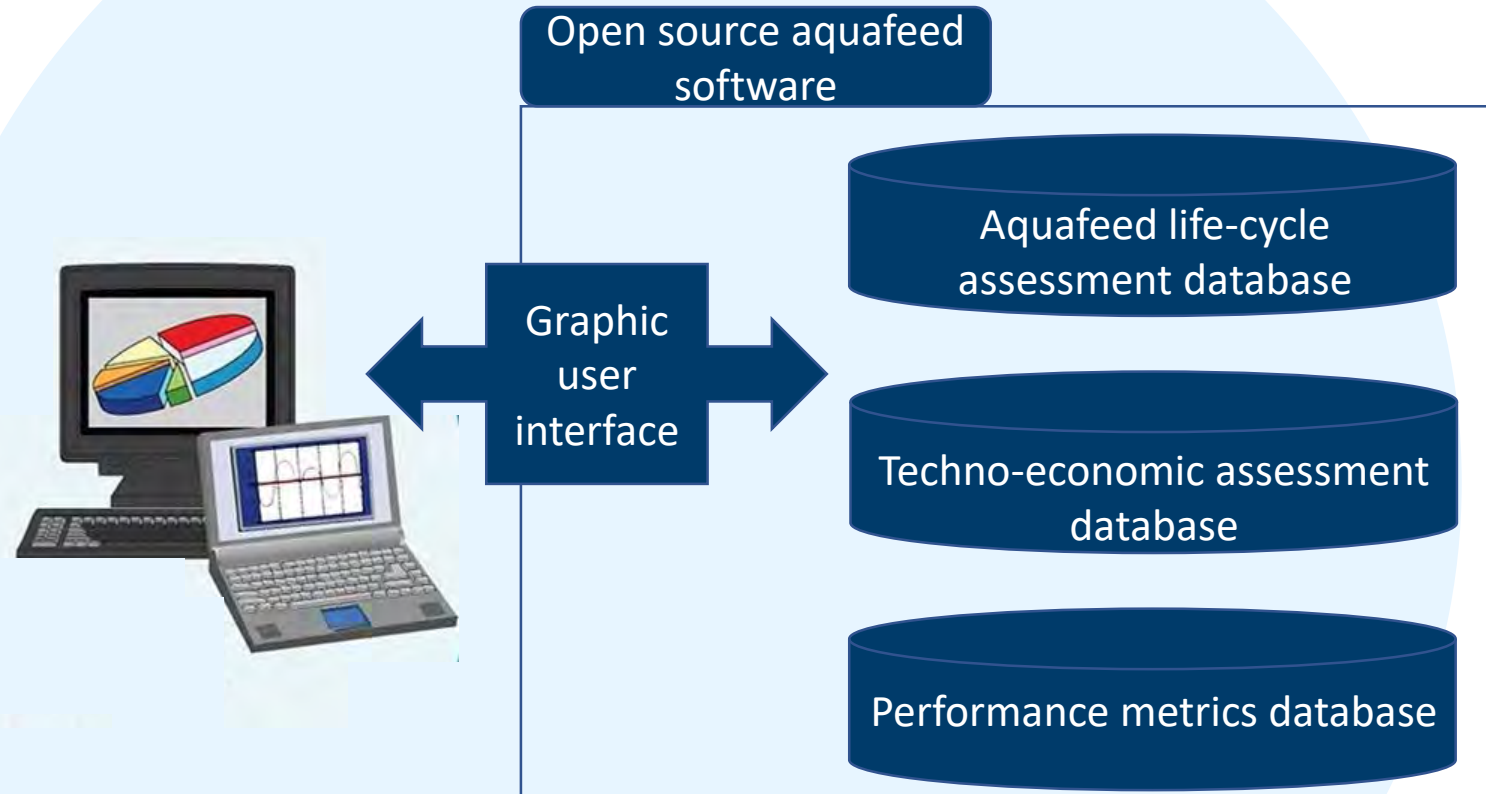
# Sustainability: Alternative ingredients

- Project overview
- Progress to date
- Next steps



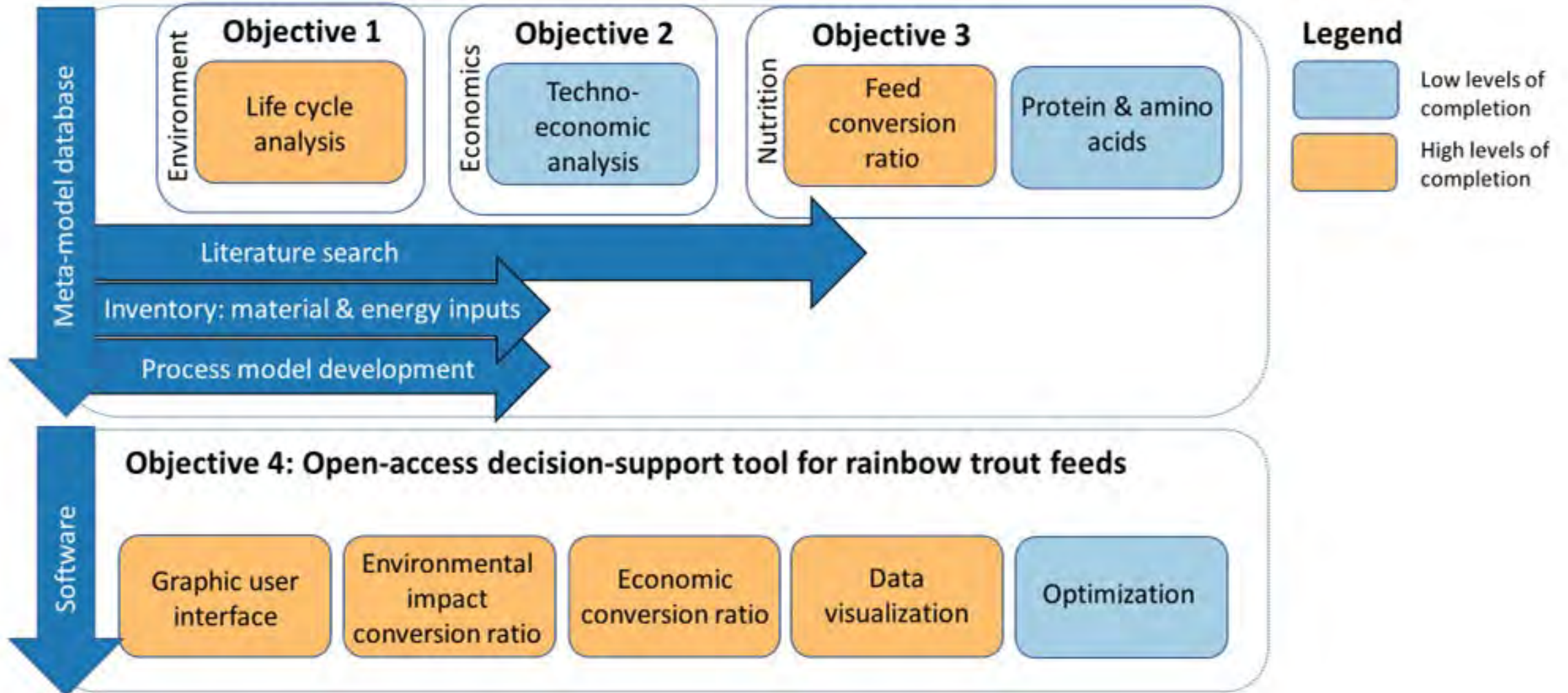
# Open-source aquafeed decision support tool

- Project overview
- Progress to date
- Next steps



# Project objectives

- Project overview
- Progress to date
- Next steps



# Communication with industry advisors

- Project overview
- Progress to date
- Next steps



# Meta-model database: Life cycle assessment

- Project overview
- Progress to date
- Next steps

Alternative ingredients included in our analysis

Fish by-products

Fish meal



Fish oil



Marine microalgae

*Nannochloropsis oculata* meal



Whole cell *Schizochytrium*



*Schizochytrium* oil



Yeast:

*Saccharomyces cerevisiae*



Mealworm meal



Single cell protein: *Methylococcus capsulatus*



Soldier fly larvae meal



Macroalgae: *Ulva* meal



# Meta-model database: Life cycle assessment

- Project overview
- Progress to date
- Next steps

Conventional ingredients included in our analysis

Corn gluten meal



Poultry by-product meal



Fish meal



Blood meal



Soybean meal



Wheat gluten meal



Wheat flour



Soy protein concentrate



Canola oil



Corn oil



Soybean oil



Fish oil










# Meta-model database: Economic assessment

- Project overview
- Progress to date
- Next steps

Alternative ingredients included in our analysis

Marine microalgae

<p><i>Nannochloropsis oculata</i> meal</p> 	<p>Whole cell <i>Schizochytrium</i></p> 	<p><i>Schizochytrium</i> oil</p> 
-------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------

<p>Mealworm meal</p> 	<p>Single cell protein: <i>Methylococcus capsulatus</i></p> 
---------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------

# Meta-model database: Economic assessment

- Project overview
- Progress to date
- Next steps

Conventional ingredients included in our analysis

Corn gluten meal



Poultry by-product meal



Fish meal



Blood meal



Soybean meal



Wheat gluten meal



Wheat flour



Soy protein concentrate



Canola oil



Corn oil



Soybean oil



Fish oil



# Meta-model database: Growth performance

- Project overview
- Progress to date
- Next steps

Alternatives to fish meal included in our analysis

Yeast:  
*Saccharomyces cerevisiae*



*Nannochloropsis oculata* meal



Soy protein concentrate



Soybean meal



Mealworm meal



Single cell protein:  
*Methylococcus capsulatus*



Soldier fly larvae meal



Macroalgae





# Software development

- Project overview
- Progress to date
- Next steps

<input type="checkbox"/>	Name	Date modified	Type	Size
<input type="checkbox"/>	msvc140_1.dll	9/8/2020 3:10 AM	Application extens...	31 KB
<input type="checkbox"/>	msvc140_2.dll	9/8/2020 3:10 AM	Application extens...	190 KB
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<input type="checkbox"/>	opengl32sw.dll	10/12/2021 12:00 PM	Application extens...	20,433 KB
<input type="checkbox"/>	openssl	3/25/2021 8:09 AM	Application	531 KB
<input type="checkbox"/>	openssl.pdb	3/25/2021 8:09 AM	PDB File	2,476 KB
<input checked="" type="checkbox"/>	OperationalADST_Full_V12_a	10/27/2021 4:56 PM	Application	20,701 KB
<input type="checkbox"/>	OperationalADST_Full_V12_a.exe.mani...	10/27/2021 4:56 PM	MANIFEST File	2 KB
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<input type="checkbox"/>	pyexpat.pyd	10/27/2021 2:09 PM	PYD File	178 KB
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<input type="checkbox"/>	pywintypes38.dll	10/12/2021 12:00 PM	Application extens...	139 KB
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<input type="checkbox"/>	sqlite3	4/2/2021 1:55 PM	Application	1,676 KB



Executable file

# Software development

- Project overview
- Progress to date
- Next steps



Select salmonid species

# Software development

- Project overview
- Progress to date
- Next steps

tk

Please enter ammount in grams of ingredient per 1 kilogram of feed:

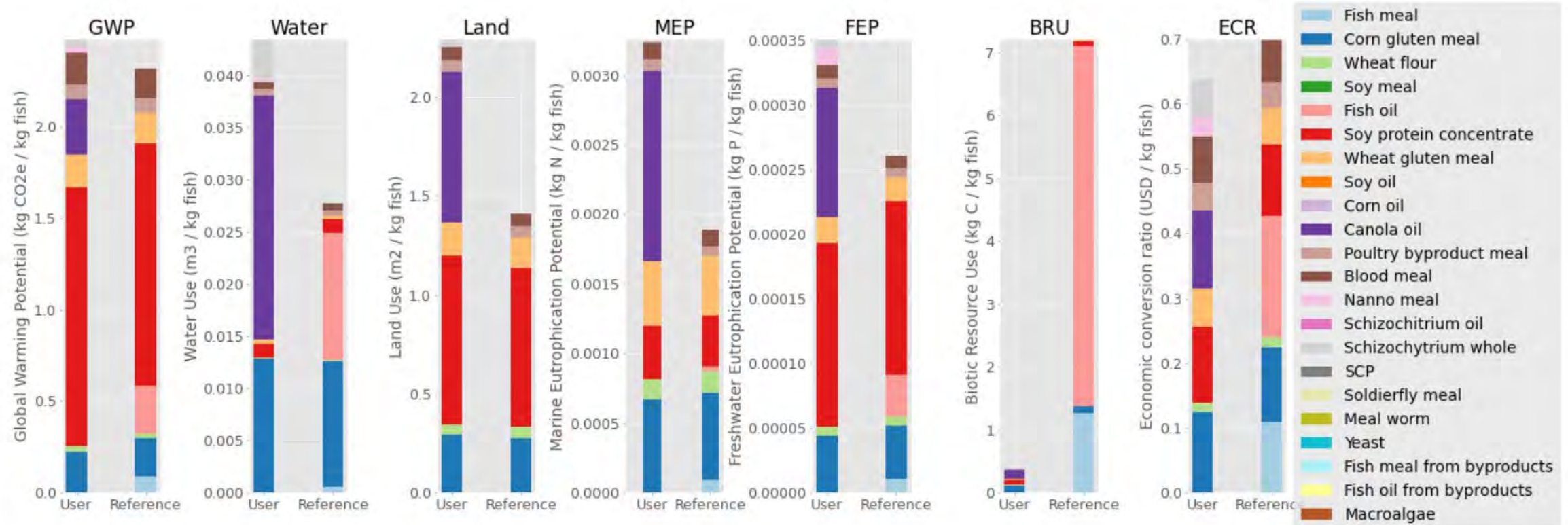
Ingredient:	Amount (kg):
Fish meal	<input type="text"/>
Corn gluten meal	0.2
Wheat Flour	0.03
Soybean meal	<input type="text"/>
Fish oil	<input type="text"/>
Soy protein concentrate	0.2
Wheat gluten meal	0.05
Soy oil	<input type="text"/>
Corn oil	<input type="text"/>
Canola oil	0.12
Poultry byproduct meal	0.2
Blood meal	0.07
Nannochloropsis meal	0.07
Marine microalgae (Schizochitrium) oil	<input type="text"/>
Marine microalgae (Schizochitrium) whole cells	0.025
Single cell protein (Metholoccoccus capsulates) meal	<input type="text"/>
Black soldier fly larvae (Hermetia illuces) meal	<input type="text"/>
Mealworm larvae (Tenebrio molitor) meal	<input type="text"/>
Yeast (Sacchromyces cerevisiae)	<input type="text"/>
Fish meal from byproducts	<input type="text"/>
Fish oil from byproducts	<input type="text"/>
Macroalgae (Ulva)	<input type="text"/>



Input feed ingredients

# Software development

- Project overview
- Progress to date
- Next steps



Data visualization is the environmental impact conversion ratio and economic conversion ratio. Environmental impact conversion ratio metrics include global warming potential (GWP), water use (water), land use (land), marine eutrophication potential (MEP), freshwater eutrophication potential (FEP), and biotic resource use (BRU). Aquafeeds include a reference formulation that include fishmeal and fish oil and the user-input (user) formulation. Reference diet is from Sarker et al. (2020): Elementa Science of the Anthropocene 8: 5. DOI: 10.1525/elementa.404.



# Publications

## scientific reports

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[nature](#) > [scientific reports](#) > [articles](#) > [article](#)

Article | [Open Access](#) | [Published: 12 November 2020](#)

### Microalgae-blend tilapia feed eliminates fishmeal and fish oil, improves growth, and is cost viable

[Pallab K. Sarker](#) , [Anne R. Kapuscinski](#), [Brandi McKuin](#), [Devin S. Fitzgerald](#), [Hannah M. Nash](#) & [Connor Greenwood](#)

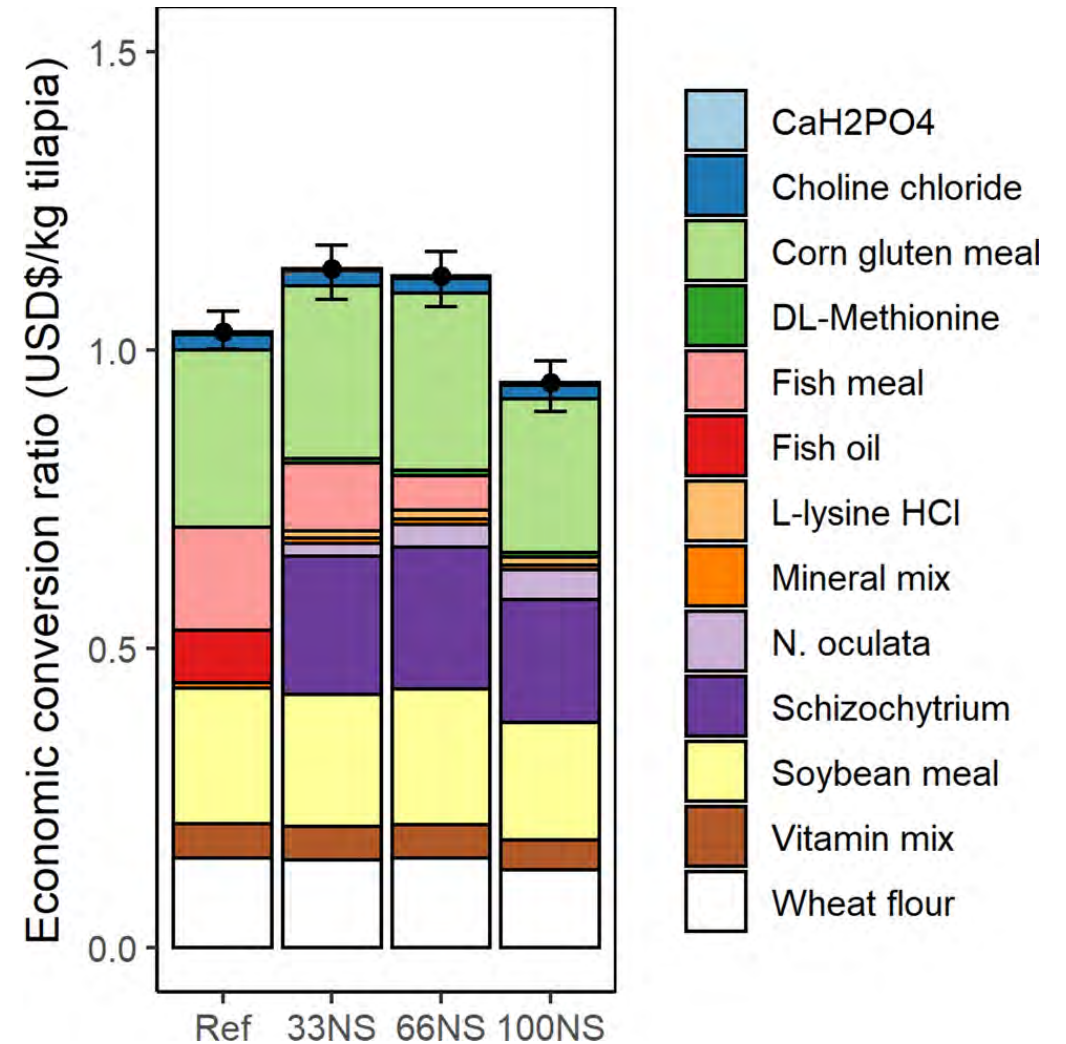
[Scientific Reports](#) **10**, Article number: 19328 (2020) | [Cite this article](#)

6762 Accesses | 9 Citations | 203 Altmetric | [Metrics](#)

#### Abstract

Aquafeed manufacturers have reduced, but not fully eliminated, fishmeal and fish oil and are seeking cost competitive replacements. We combined two commercially available microalgae, to produce a high-performing fish-free feed for Nile tilapia (*Oreochromis niloticus*)—the world's second largest group of farmed fish. We substituted protein-rich defatted biomass of *Nannochloropsis oculata* (leftover after oil extraction for nutraceuticals) for fishmeal and whole cells of docosahexaenoic acid (DHA)-rich *Schizochytrium* sp. as substitute for fish oil. We

- [Project overview](#)
- [Progress to date](#)
- [Next steps](#)



# Publications

- Project overview
- Progress to date
- Next steps

McKuin, B., Kapuscinski, A., Sarker, P., Cheek, N., Colwell, A, Lim, J. 2021. Meta-model database for *F3Mixr*: An economic and environmental sustainability decision-support tool for fish-free aquafeed. DRYAD Repository. DOI: 10.6071/M3809Z (temporary link available on request).

McKuin, B., Kapuscinski, A., Sarker, P., Schoffstall, B., & Lee, M. 2021. Software for *F3Mixr*: An economic and environmental sustainability decision-support tool for fish-free aquafeed. DRYAD Repository. DOI: 10.6071/M3468D (temporary link available on request).

McKuin, B., Kapuscinski, A., Sarker, P., Cheek, N., Colwell, A., Greenwood, C. 2021. Life cycle assessment of the potential of heterotrophic microalgae as sustainable fish oil replacements in aquaculture feeds. *Submitted: Elementa Science of the Anthropocene*.

# Meta-model database

- Project overview
- Progress to date
- Next steps

- Use process models used in life-cycle assessment to conduct techno-economic assessment of alternative ingredients
- Add protein and amino acid data for conventional and alternative ingredients

# Software development

- Project overview
- Progress to date
- Next steps

- Add optional open source optimization tool
- Produce software user's manual and video demonstration

# Disseminate results

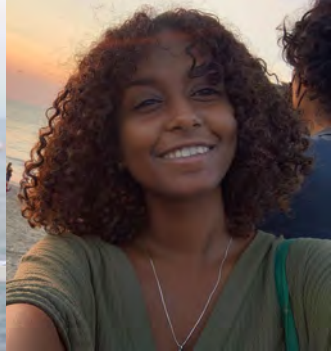
- Project overview
- Progress to date
- Next steps

- Publish life-cycle assessment of a *Nannochloropsis* biorefinery
- Publish techno-economic analysis of *Schizochytrium* biorefinery
- Publish techno-economic analysis of *Nannochloropsis* biorefinery
- Publish article introducing *F3 Mixr*

# Communication with industry advisors

- Project overview
- Progress to date
- Next steps

- Solicit industry feedback on software
- Log feedback for future versions of software



[HTTPS://KAPSAR.SITES.UCSC.EDU](https://kapsar.sites.ucsc.edu)

KAPUSCINSKI-SARKER  
ECOLOGICAL AQUACULTURE LAB

# Acknowledgments





# SBE-Mariculture Tourism: Cultivating Consumer Demand & Coastal Community Supply

W. Knollenberg, C. Barbieri, E. Yeager, J. Harrison, J. Leibach

# Mariculture Tourism: Cultivating Consumer Demand & Coastal Community Supply

Whitney Knollenberg, PhD  
Assistant Professor  
Dept of Parks, Recreation,  
and Tourism Management  
NC State University

Carla Barbieri, PhD  
Professor  
Dept of Parks, Recreation,  
and Tourism Management  
NC State University

Emily Yeager, PhD  
Assistant Professor  
Dept of Recreation  
Sciences  
East Carolina University

Jane Harrison, PhD  
Coastal Economics  
Specialist  
North Carolina Sea Grant

Julie Leibach  
Science Writer/Digital  
Content Specialist  
North Carolina Sea Grant

# Shellfish Mariculture and Tourism Synergies

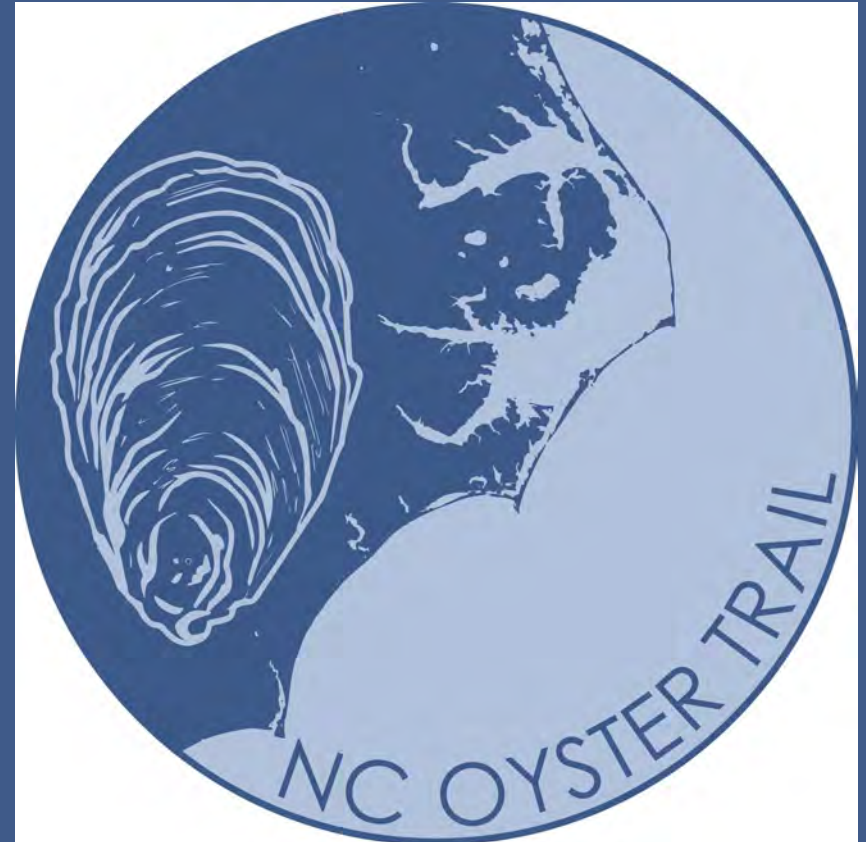
- Growth of shellfish mariculture
- Sustained growth for shellfish mariculture **will require integration with other key sectors of the coastal economy**
- Food/agri tourism as a complementary industry
- Food tourism and agritourism **provide a suite of benefits** to entrepreneurs and the communities they work within



Photo credit: Justin Case

# North Carolina Oyster Trail (NCOT)

- Legislative report for growing NC's mariculture industry
- Grassroots development of NCOT
  - NC Sea Grant, NC Coastal Federation, and NC Shellfish Growers Association
  - 65 members



[NCOysterTrail.org](http://NCOysterTrail.org)

# Potential to Grow Mariculture Tourism

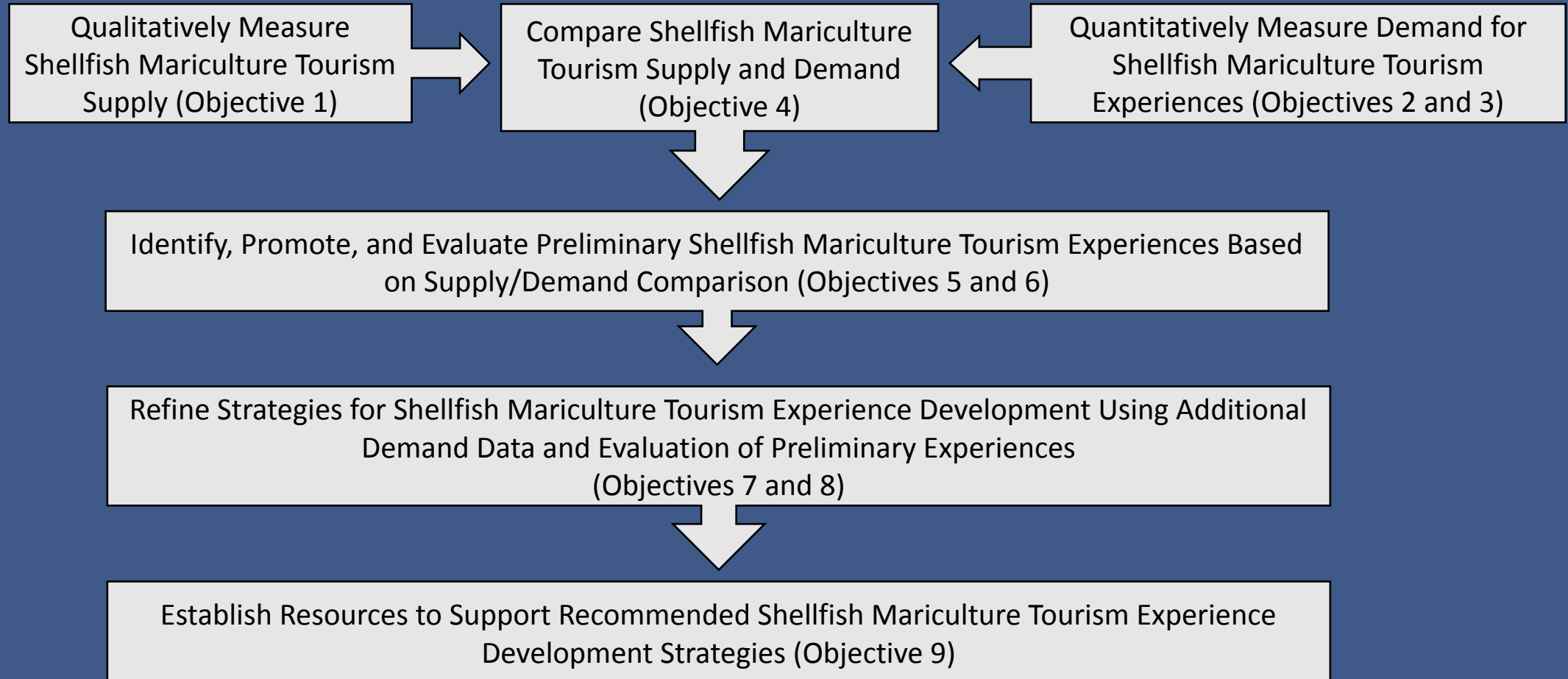
More information is needed to increase the impact of mariculture tourism:

- Who are potential mariculture tourists?
- How do we create, promote, and manage mariculture tourism experiences?



Photo credit: Justin Case

# Mariculture Tourism Development Process



# Modifications Due to COVID-19

- Mariculture tourism demand survey alterations
- Evaluation of tourism experiences paused until travel conditions improved
- NCE through August 2022



Work to Date



*Goal 1: Determine the existing supply of shellfish mariculture tourism assets in NC communities.*

Objectives	Actions
<b>Objective 1:</b> Inventory current shellfish mariculture tourism assets in NC coastal communities.	<b>44 stakeholders</b> (3 workshops; 5 interviews) contributed to asset assessment

### NC shellfish mariculture tourism **assets**:

- Shellfish mariculture operations
- Restaurants
- Seafood retail businesses
- Annual events
- Ecotourism providers
- Educational facilities
- Lodging operators (AirBnB)
- Arts organizations

*Goal 2: Establish demand for shellfish mariculture tourism experiences among coastal community tourists*

*Goal 5: Establish strategies and resources for the sustainable development of shellfish mariculture tourism*

Objectives	Actions
<b>Objective 2/3:</b> Profile potential shellfish mariculture tourists, their preferences for tourism experiences, and perceived risk of cultivated shellfish consumption.	Survey developed to measure: experience preferences, travel behavior, and risk perceptions  <b>746 usable responses</b> from coastal community visitors gathered through Dynata panel
<b>Objective 7:</b> Extend the profile of the potential shellfish mariculture tourist	Same survey instrument used, distributed through local food newsletters, social media channels  <b>326 usable responses</b> gathered from local food consumers

**Five types of potential shellfish mariculture tourists**, distinguishable by:

- Level of interest in the product vs. people behind the product
- Convenience of experience
- Association of shellfish (oysters) with a coastal lifestyle
- Preference for social media, website, or print materials for information
- Acceptable price point for shellfish mariculture tourism experiences
- Levels of perceived risk of cultivated shellfish consumption

*Goal 3: Identify gaps between potential visitor demand for shellfish mariculture tourism products and existing supply of shellfish mariculture tourism assets.*

Objectives	Actions
<b>Objective 4:</b> Compare potential shellfish mariculture tourists' experience preferences with current NC shellfish mariculture tourism assets	<b>Ongoing comparison</b> of shellfish mariculture asset inventory with survey results

### Alignment between shellfish mariculture tourism supply and demand

- Restaurants
- Annual events

### Opportunities to meet shellfish mariculture tourism demand

- Shellfish mariculture operations
- Ecotourism providers
- Educational facilities
- Lodging operators (AirBnB)
- Arts organizations

#### *Goal 4: Develop preliminary mariculture tourism experiences*

Objectives	Actions
<b>Objective 5:</b> Develop and promote 3 to 4 shellfish mariculture tourism experiences	Promoted shellfish mariculture tourism experiences through <b>3 advertisements; 10 organic news stories; 3 videos; 125 social media posts</b>
<b>Objective 6:</b> Evaluate tourists' satisfaction with the experience and the impact the experience has.	Cultivated <b>membership base</b> for NCOT <b>Developing evaluation tool</b> for shellfish mariculture experiences

- Photography and media assets created to **promote shellfish mariculture tourism experiences**
- Recruitment efforts for NCOT have led to **65 members**
- Evaluation tool **will assess:** customer satisfaction; knowledge gained; marketing effectiveness

# Outputs

Peer-Reviewed Conference Presentations	Invited Presentations	Media Coverage	Educational Experiences
<p><b>3</b> international conferences  <b>3</b> national conferences</p>	<p><b>1</b> regional conference  <b>2</b> local conferences  <b>6</b> outreach presentations</p>	<p><b>2</b> national news stories  <b>8</b> local news stories</p>	<p><b>7</b> workshops  <b>1</b> internship experience</p>
<p>Travel and Tourism Research Association Annual Conference (virtual, June 2021).</p> <p>Aquaculture America Conference. (Honolulu, HI; Feb. 2020).</p>	<p>North Carolina State Alumni Association Oyster Showcase (virtual, Feb. 2021).</p> <p>NC Catch Summit (Raleigh, NC; Mar. 2020).</p> <p>Oysters South Conference (Wilmington, NC; Feb. 2020).</p>	<p>How America’s oyster farms are drawing more visitors than ever. (Conde Nast Traveler; Aug. 2021)</p> <p>North Carolina Oyster Trail highlights Outer Banks-farmed mollusks in effort to restore crucial species. (The Virginian Pilot; Apr. 2021).</p>	<p>NC Oyster Week. (virtual workshop; Mar. 2021). Audience: 30 NC Oyster Trail members.</p> <p>NC Oyster Trail Development. (Workshop; Morehead City, NC. Mar. 2020). Audience: 20 shellfish mariculture stakeholders.</p> <p>Erin Kohn, Community Engaged Intern (NOAA program; Jun-Dec. 2021).</p>

# Community Engaged Intern Erin Kohn

- NC State University undergraduate student majoring in environmental sciences, minor in marine sciences, outdoor recreation & PRTM
- Participated in Sea Grant's national undergraduate internship program
- Assisted with communications for the NC Oyster Trail



## How It Started

# 5 BENEFITS OF N.C. OYSTERS



ENVIRONMENTALLY FRIENDLY



SUPPORT WORKING WATERFRONT  
COMMUNITIES



GROWN IN QUALITY WATERS



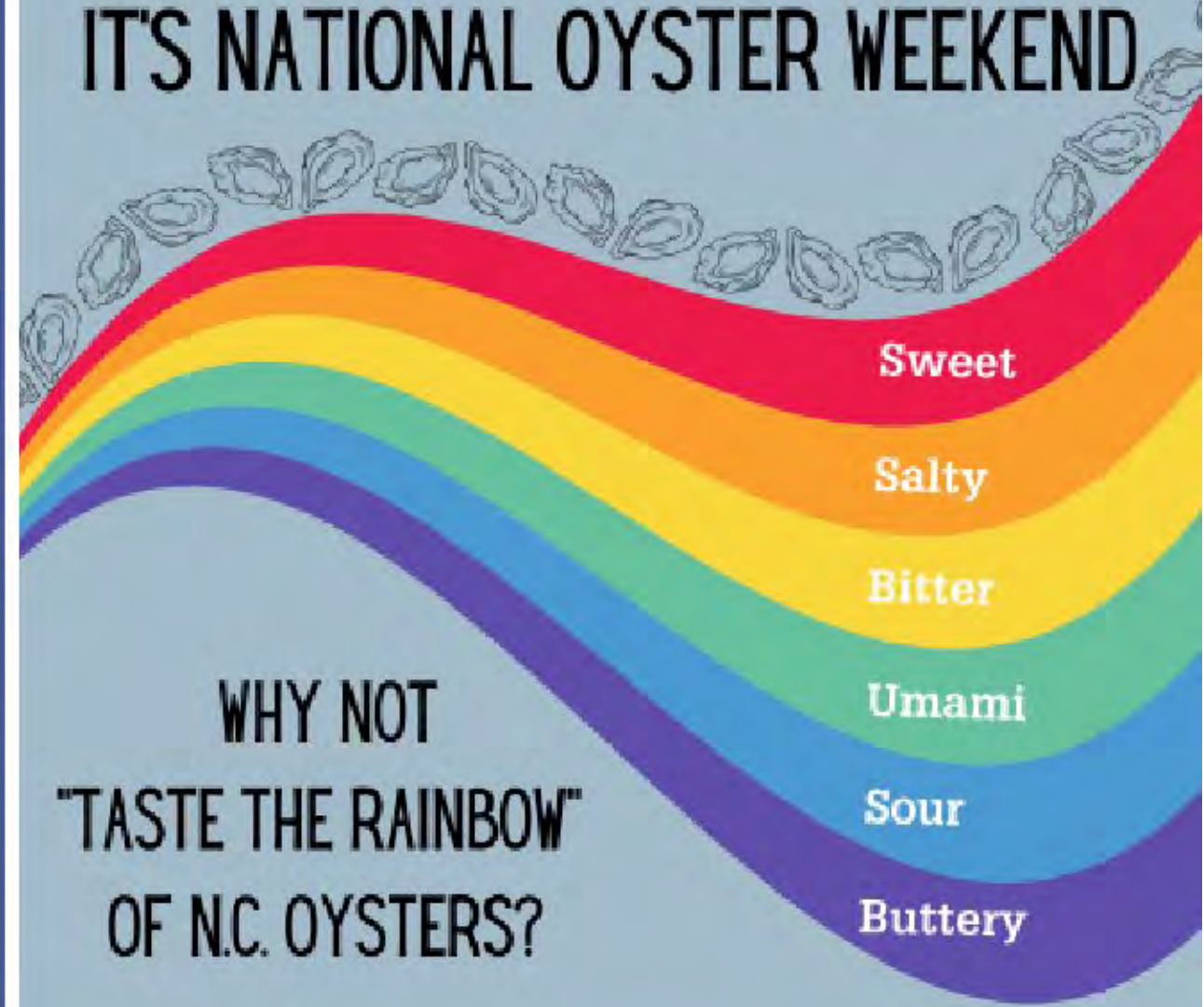
CREATE HABITAT FOR OTHER SPECIES



RICH IN VITAMINS AND MINERALS

## How It's Going

# IT'S NATIONAL OYSTER WEEKEND



WHY NOT  
"TASTE THE RAINBOW"  
OF N.C. OYSTERS?

# Next Steps

*Goal 5: Establish strategies and resources for the sustainable development of shellfish mariculture tourism*

Objectives	Actions
<p><b>Objective 8:</b> Create strategies for the continued development of shellfish mariculture tourism experiences</p> <p><b>Objective 9:</b> Establish best practices for shellfish mariculture tourism entrepreneurs</p>	<p>Establish recommendations for mariculture tourism development based on:</p> <ul style="list-style-type: none"><li>• Asset inventory (focus on gaps)</li><li>• Tourist demand data</li><li>• Experience evaluations</li></ul> <p>Craft and publish resources to share recommendations through:</p> <ul style="list-style-type: none"><li>• 1 - 2 page technical reports</li><li>• Workshops</li><li>• Extension FactSheets</li></ul>



# Questions

Whitney Knollenberg

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# SBE-Assessing public perceptions of aquaculture and the broader impacts of K-12 aquaculture education

C-S. Lee, C. Chan, L. Opunui



# Assessing Public Perceptions of Aquaculture and the Broader Impacts of K-12 Aquaculture Education

**Principal Investigators:** Cheng-Sheng Lee  
Catherine Chan

**Presenters:** Cheng-Sheng Lee  
Leiana Opunui



# Background

- USDA dietary guideline suggests two servings of seafood per week.
- The U.S. imports 70-85% of its seafood, and nearly 50% of this imported seafood is produced via aquaculture (NOAA, 2021).
- The media give risks more prominent coverage than benefits (Olsen and Osmundsen, 2017).
- Respondents (*in Europe*) have less trust in the production and consumption of farmed fish than in their wild counterparts, as the former are perceived as unnatural and unfamiliar (Schlag and Ystgaard, 2013).

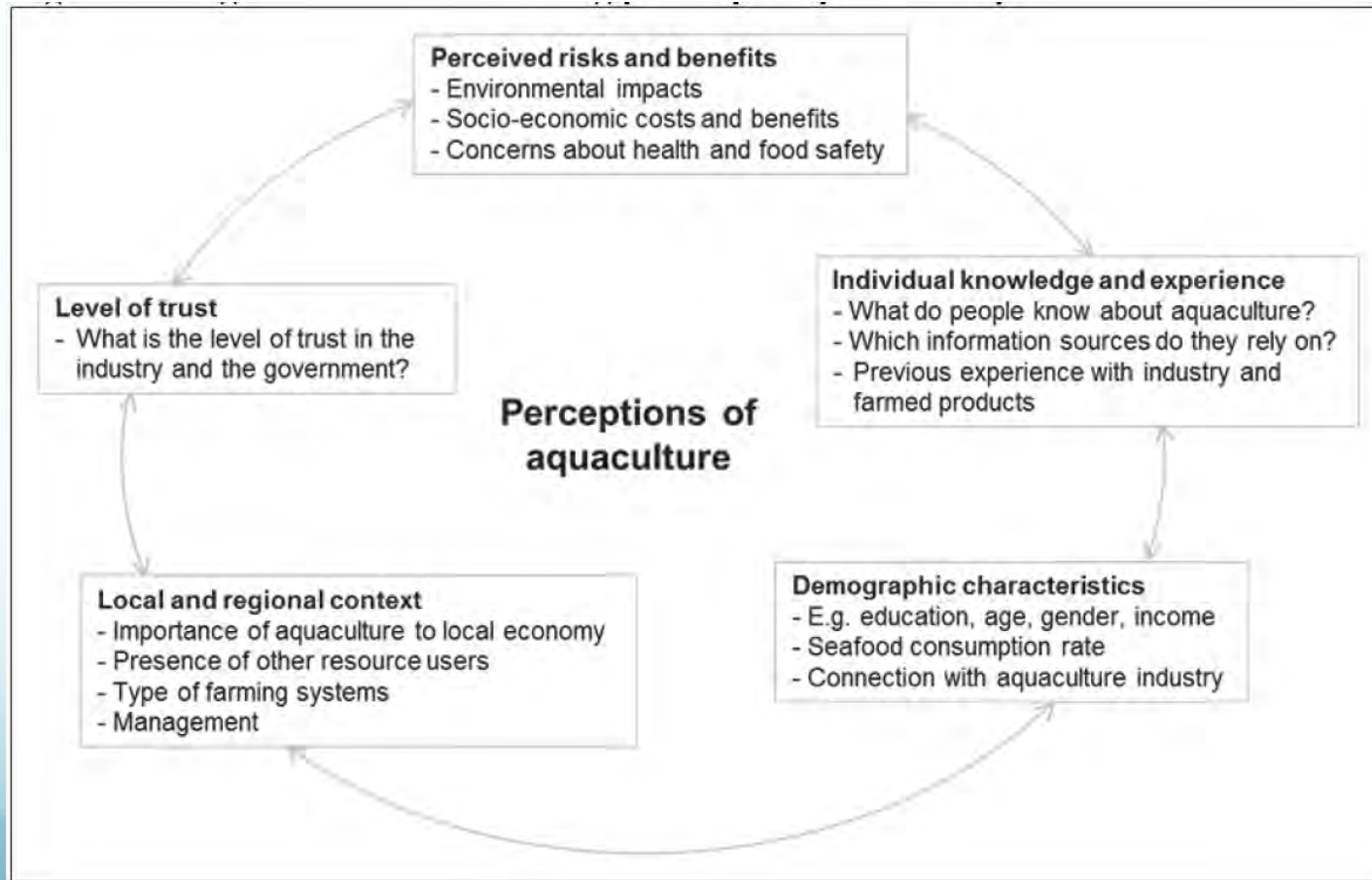


## Background-2

- Overall, the public debate on aquaculture has focused mainly on risks, often lacking a balanced evaluation of costs and benefits (Bacher, 2015, *Perceptions and misconceptions of aquaculture: a global overview*).
- Sufficient and accessible scientific information is key to resolving negative misconceptions surrounding aquaculture and aquaculture products (Carrassón, 2021).
- Providing more information and enhancing consumer knowledge about aquaculture could lead to an increase in the consumption of farmed fish (López-Mas, 2021).



# Perceptions and misconceptions of aquaculture: a global overview (Kathrin Bacher 2015)





## Project Goal

- *The primary **goal** of this project is to **increase seafood consumption and acceptance of aquaculture products.***
- *One key **assumption** for this approach is that students can influence the perception of the whole family.*
- ***Increase knowledge** in seafood production.*



# Approach

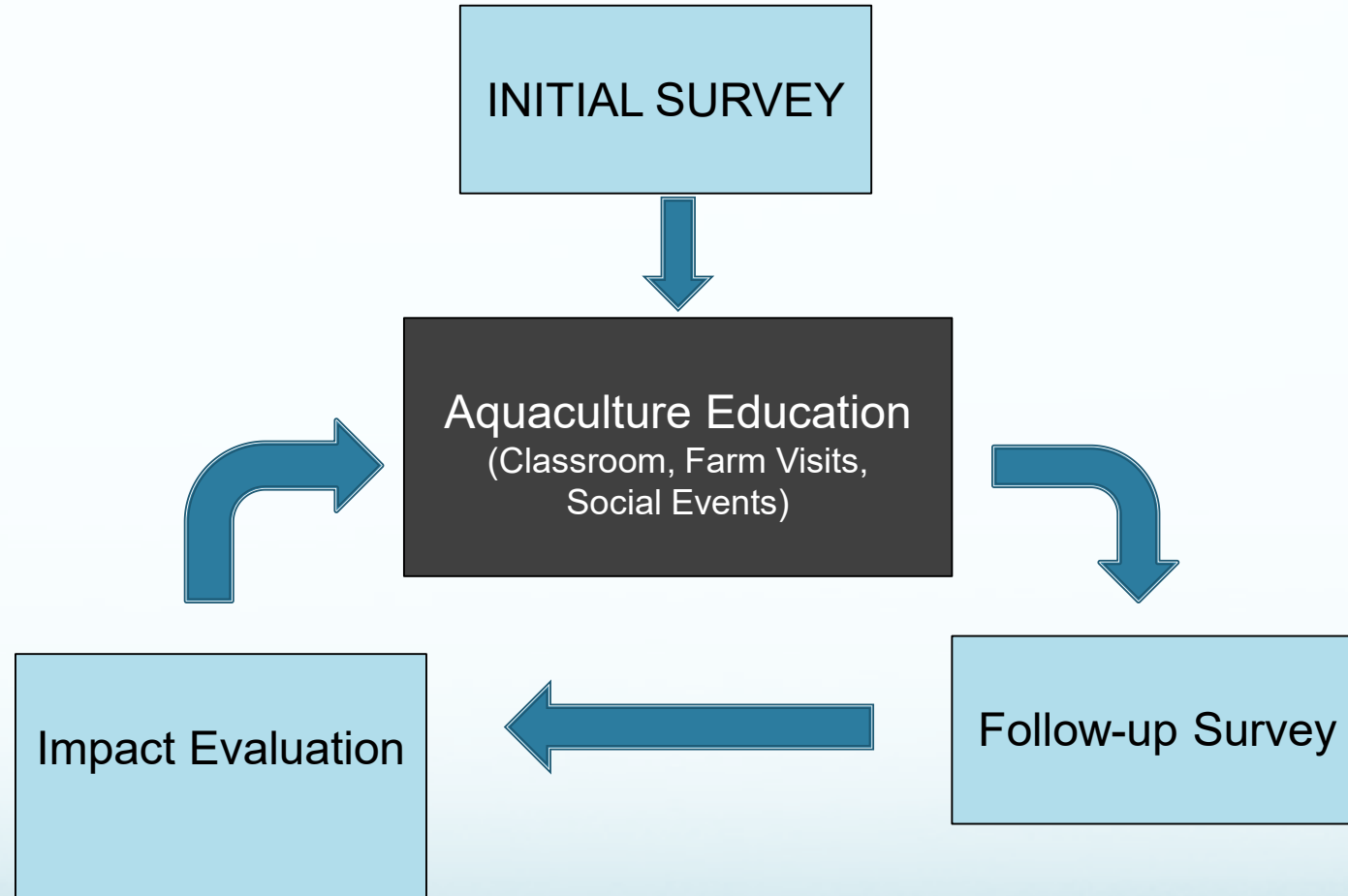
- Assess public (including students and students' family) perceptions of aquaculture and aquaculture products before and after implementing an aquaculture education program.
- Implement an updated multi-faceted education and outreach program titled **A.Q.U.A.** (A Quest to Understand Aquaculture) which provides aquaculture education resources and opportunities (such as special lectures and field trips) to engage teachers, students and their families





## Objectives:

- 1) Conduct an initial survey to document and assess the current perception of the social acceptance of both farmed and wild caught seafood
- 2) Incorporate a seafood and aquaculture education program into K to 12 curricula
- 3) Implement innovative aquaculture outreach to engage student families and the community at large
- 4) Conduct a second survey to document public perception toward farmed and wild caught seafood after the incorporation of a seafood and aquaculture education program
- 5) Utilize the results of the surveys and assessment to further improve the aquaculture education program





## Objective 1: Conduct an initial survey to document and assess the current perception of the social acceptance of both farmed and wild caught seafood

- Employ cognitive mapping that integrates economic, production method and other human dimension components centered around wild caught and aquaculturally produced seafood to understand the initial dynamics of students' and other groups' aggregate **mental models**.
- Survey questionnaires will be developed and conducted at three participating schools.
- Data analysis and revealing education gaps



## Objective 2: Incorporate a seafood and aquaculture education program into K to 12 curricula

- **One-day** teacher **workshop** at UH prior to 2020/2021 school year
- Further develop A.Q.U.A. (A Quest to Understand Aquaculture) curriculum and program
- Aquaculture **classroom lectures**
- **Farm visits**
- “Sustainable Seafood” events in the communities



## Announcement

# Aquaculture for K-12

**What is it?** CTSA is seeking motivated teachers in Hawaii who are interested in participating in a federally funded project titled "Assessing public perceptions of aquaculture and the broader impacts of K-12 aquaculture education."

**Who should join?** Teachers interested in incorporating aquaculture, seafood, and marine resources learning in their classroom.

**Why should I participate?** Aquaculture and natural resources are meaningful tools for educators and students to explore challenging STEM concepts. Through education, students will gain better understanding of aquaculture and its importance to our future food security.

**When is it?** 2020/2021 school year

**What resources will be provided?** We have funds to provide materials and resources necessary to integrate the aquaculture program into curricula of participating schools (such as experimental supplies and school buses for field trips).

**Need more information?** Email the CTSA office at [ctsa@hawaii.edu](mailto:ctsa@hawaii.edu) for a document describing the project, its objectives, and the activities that will take place prior to and during the 2020/2021 school year.

**What is next?** If you are interested, please contact Cheng-Sheng Lee, PhD at [chenglee@hawaii.edu](mailto:chenglee@hawaii.edu) with following information by **November 29, 2019**:

- 1) Grade level of instruction;
- 2) Anticipated/average number of students in class for 2020/2021 school year; and
- 3) A description of any relevant experience you have with aquaculture and/or natural resource education. Before any final commitments are made, we will hold an informational meeting with participating teachers in early December 2019.

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The Center for Tropical and Subtropical Aquaculture (CTSA) is one of five Regional Aquaculture Centers in the United States established by the U.S. Department of Agriculture. Our program mission is to integrate individual and institutional expertise and resources in support of aquaculture development in Hawaii and the U.S. Affiliated Pacific Islands. CTSA has long supported aquaculture education efforts throughout our region. Visit us at [www.ctsa.org](http://www.ctsa.org).



# In-Class Implementation

- Lesson 1: Seafood & Human Health
- Lesson 2: Seafood Source & Availability
- Lesson 3: Seafood security in Hawaii
- Lesson 4: Seafood Farming
- Lesson 5: Careers in Seafood business

Lesson 1: Seafood & Human Health	
LECTURE THEMES	INTERACTIVE ACTIVITY THEMES / QUESTIONS TO ANSWER
<ul style="list-style-type: none"> <li>- Definition of seafood (marine and freshwater? animals and plants?)</li> <li>- Major health benefits of eating seafood</li> <li>- Longevity of countries where seafood is eaten on a regular basis</li> <li>- Connections to local seafood traditions</li> </ul>	<ul style="list-style-type: none"> <li>- What are the USDA nutritional guidelines pertaining to seafood?</li> <li>- How much seafood do students eat and why?</li> <li>- Family or other seafood traditions?</li> </ul>





Lesson 2: Seafood Source & Availability	
LECTURE THEMES	INTERACTIVE ACTIVITY THEMES / QUESTIONS TO ANSWER
<ul style="list-style-type: none"> <li>- Different types of seafood available worldwide</li> <li>- Most consumed marine and freshwater species</li> <li>- Animals: Fish, shrimp, bivalves, etc.</li> <li>- Aquatic plants: seaweeds, etc.</li> <li>- Local market favorites</li> <li>- What is aquaculture?</li> <li>- Natural resource depletion</li> <li>- Stock enhancement (Use scenes on fishing and farming, United fishing agency fresh landing film, fish processing plants.)</li> </ul>	<ul style="list-style-type: none"> <li>- Do students know what types of seafood are available?</li> <li>- Can student name the seafood they eat?</li> <li>- Where does seafood come from?</li> <li>- Fisheries seasonal-catch restrictions</li> <li>- State of Hawaii fishing regulations</li> <li>- Open-Closed areas (FMA-Fishery Management Areas)</li> <li>- Aquaculture species import restrictions/bans (e.g. invasive species, disease carriers, GMOs, etc.)</li> </ul>

Lesson 3: Seafood security in Hawaii	
LECTURE THEMES	INTERACTIVE ACTIVITY THEMES / QUESTIONS TO ANSWER
<ul style="list-style-type: none"> <li>- Securing the seafood supply from fishing and aquaculture</li> <li>- Sustainable fisheries – harvesting from well managed fisheries, subsistence</li> </ul>	<ul style="list-style-type: none"> <li>- Do students know how and where to get quality seafood in Hawaii?</li> <li>- What is the nutritional quality variation between wild-caught and aquaculture</li> </ul>



# In-Class Implementation

- CTSA convened four meetings with multiple teachers to discuss project goals, implementation, and commitment to project
- Participating teachers completed intake forms to individualize learning experiences based on classroom needs
- Classrooms will implement project from October 2021 to May 2022

**CLASS / TEACHER INFORMATION FORM**  
*SEA GRANT AQUACULTURE EDUCATION PROJECT*

<b>School name and location:</b>	Waianae High School 85-251 Farrington Hwy, Waianae, HI 96792
<b>Participating teacher(s):</b>	Tyson Arasato Marine Biology Katie Kealoha English
<b>Work phone:</b>	n/a call cell for best results
<b>Cell phone:</b>	Tyson: 808-330-9742
<b>Preferred email:</b>	t.arasato@seariders.k12.hi.us
<b>Number of classes participating in project (i.e. 2 classes, 20 students each):</b>	two classes Period 1: 22 students Period 2: 15 students
<b>Title / subject of class(es):</b>	Period 1: Environmental Resources Management Period 2: Natural Resource Product 1
<b>Total amount of student participants (anticipated):</b>	37

**Please review the enclosed outline for the five planned lectures / classroom instruction sessions and let us know if you have a preferred focus (or any other comments) for each lesson:**

<b>Lesson 1: Seafood &amp; Human Health</b>	USDA guidelines pertaining to seafood, 5
	Human Fishing Resources and what makes them? Are the



# In-Class Implementation

- Formal Education Implementation
  - Waianae High School
  - Farrington High School
  - Aiea High School
  - Waipahu High School
- Informal Education Implementation
  - Hawaii 4-H Program
  - Hawaii Future Farmers of America (FFA)





# Survey

- Dr. Chan and Patricia worked with an Aquaculture expert to develop the questions
- Approximately 20 questions
- Anonymous
- Initial survey – pre-education to determine current perceptions
- Final survey – post-education to determine a change in perceptions

## Middle/High School Initial Survey

In this activity, we ask you to share your preferences for seafood consumption. We ask you for your opinion, and there are no right or wrong answers. We will not grade your responses. Your participation is what counts. Please take a few minutes to read each item and record your responses using the answer sheet.

School:

Short answer text

1. Please select your current grade:

- 6th grade
- 7th grade
- 8th grade
- 9th grade
- 10th grade
- 11th grade
- 12th grade

2. Please select the option that best describes where you live:

- Urbanized area: relating to a city or a population of at least 50,000 people. Densely populated area consisti...
- Suburban area: mainly consisting of residential areas with a population larger than 2,500 people. Large res...
- Rural community: relating to the countryside or a population fewer than 2,500 people. Least populated are...



## Objectives of Cognitive Mapping: Assess Knowledge Gaps

- Map students' current perceptions
- Identify perception gaps
- Develop more effective educational activities
- Achieve higher rates of aquaculture produced seafood consumption





13. How often do you ask your parents or guardian to buy seafood to eat at your home?

- a. I never ask them to buy
- b. I ask them less than one time per month
- c. I ask them at least one time per month
- d. I ask them at least once a week
- e. I ask them more than once a week

If you answered "b", "c", "d", or "e", continue to question 14. If you answered "a", go to question 15.

14. When you ask your parents to buy seafood, do you define the source of the seafood?

- a. Yes, I ask them to buy wild-caught seafood
- b. Yes, I ask them to buy farm-raised seafood (aquaculture)
- c. No, I don't have a preference

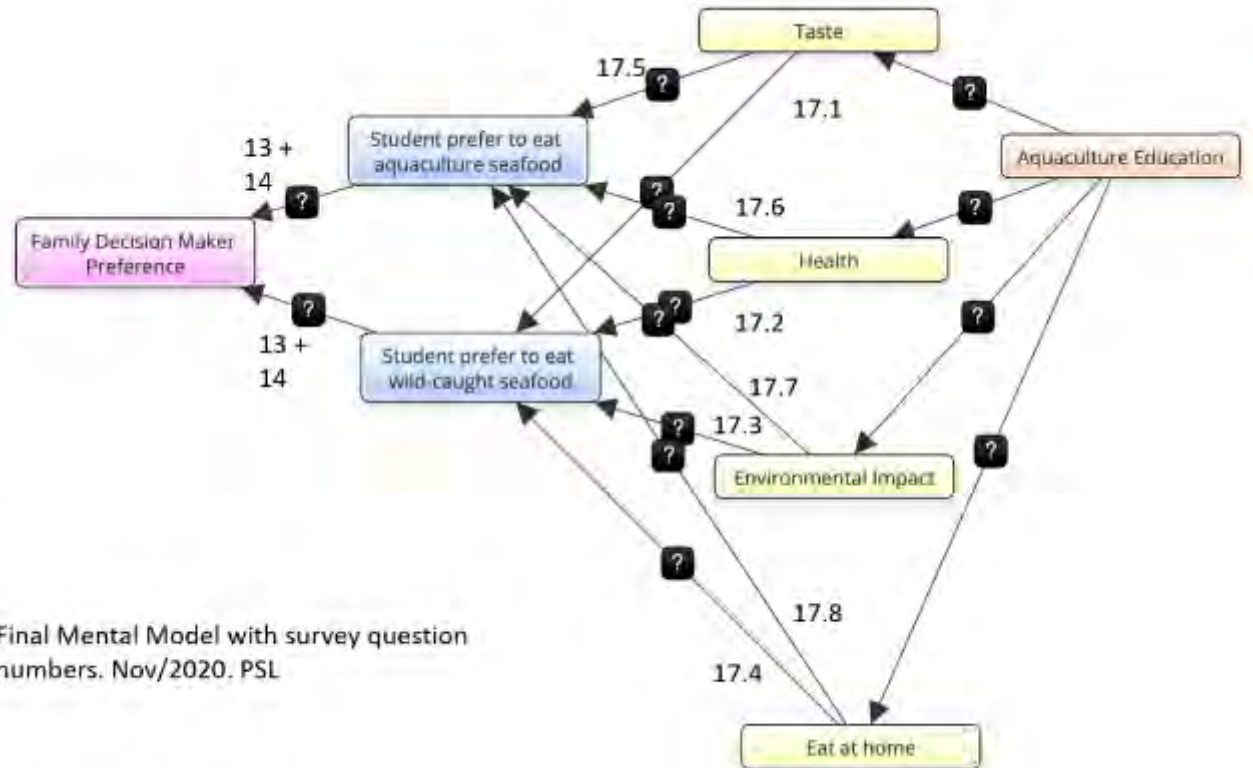
17. Read each statement below and tell us if they are important or not to explain why you prefer to eat wild-caught seafood or farm-raised seafood (aquaculture) products. For each sentence, select the answer that best describes your preference. If you have no preference, please select "I disagree".

	⊘ I disagree	★ I slightly agree	★★ I moderately agree	★★★ I strongly agree
<b>I prefer to eat seafood caught in the ocean (wild-caught seafood) because:</b>				
17.1 Wild-caught seafood tastes better than farm-raised seafood (aquaculture)	(a)	(b)	(c)	(d)
17.2 Wild-caught seafood is better for the environment than farm-raised seafood (aquaculture)	(a)	(b)	(c)	(d)
17.3 Wild-caught seafood is healthier than farm-raised seafood (aquaculture)	(a)	(b)	(c)	(d)
17.4 I prefer wild-caught seafood more than farm-raised seafood (aquaculture) because that is what I eat at home	(a)	(b)	(c)	(d)
<b>I prefer to eat farm-raised (aquaculture) seafood because:</b>				
17.5 Farm-raised seafood (aquaculture) seafood tastes better than wild-caught seafood	(a)	(b)	(c)	(d)
17.6 Farm-raised seafood (aquaculture) is better for my health than wild-caught seafood	(a)	(b)	(c)	(d)
17.7 Farm-raised seafood (aquaculture) seafood is better for the environment than wild-caught seafood	(a)	(b)	(c)	(d)
17.8 I prefer farm-raised seafood (aquaculture) seafood than wild-caught seafood because that is what I eat at home	(a)	(b)	(c)	(d)



# Fuzzy Cognitive Map (FCM)

- FCM translates qualitative mental models into semi-quantitative models using a software called *Mental Modeler*
- Consists of components, relationships between the components, and degree of influence between the components
- Measure the degree of influence aquaculture education has on students' preferences and the impact they have on their parents purchase decisions





# Progress Report

- Coordinating with teachers and youth program leaders to implement the study into their curriculum
- Online consent and survey forms
- Awaiting consent forms from parents and students
- Awaiting survey responses



# Looking Forward

- Overcome the postponement of the project implementation due to Covid-19 pandemic.
- Complete the initial survey before the spring 2022.
- In-class implementation during the spring session of 2021/22 school year
- Assess the education impacts by the end of 2022.
- Depending on Covid-19 situation, we may need to adjust plans accordingly.

# SBE-Developing Policy Consensus to Facilitate State Regulation of Seaweed as Food Product

S. Otts, C. Janasie, A. Concepcion

# Developing Policy Consensus to Facilitate State Regulation of Seaweed as Food Product

Stephanie Otts & Catherine Janasie  
National Sea Grant Law Center  
Sea Grant Aquaculture Research Symposium  
October 27, 2021



THE UNIVERSITY of  
**MISSISSIPPI**  
SCHOOL OF LAW

**Sea Grant**  
Connecticut



**Sea Grant**  
Law Center





Learn about our project

## Best Practices for Regulating Seaweed as Human Food

Enhancing coordination and cooperation among states to build policy consensus

Photo: Kattibelletje Media

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#### Legal Research



Law Center attorneys contribute to the field of ocean and coastal law and policy through the analysis of current issues and the publication of their research results.

#### Education



Center attorneys participate in continuing education programs, conferences, and symposia which serve to educate policy makers, practitioners and laypersons on issues of marine resources policy issues. Attorneys also train law students in the field

#### Outreach



The staff of the National Sea Grant Law Center respond to research requests from the legal community, Sea Grant College Programs, and state and federal agencies located across the country.

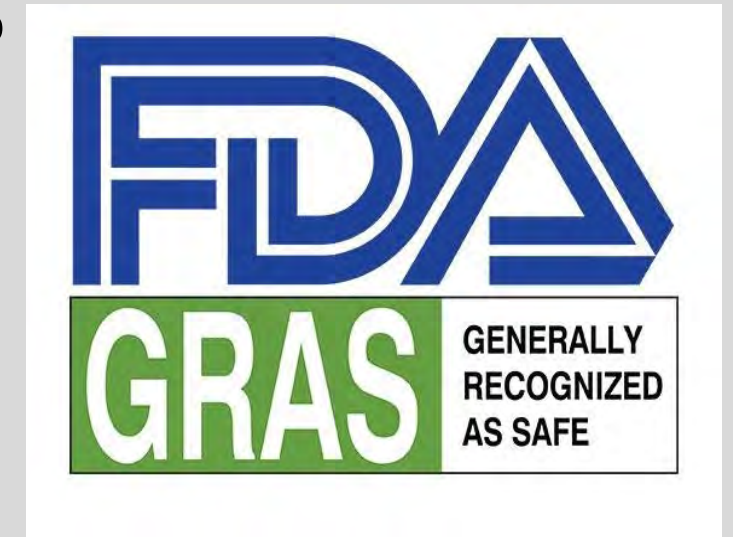
# Who We Are

- One of 34 Sea Grant Programs.
- Based at the University of Mississippi School of Law.
- Established to provide non-advocacy legal research, outreach, and education services to Sea Grant network.
- Follow us on Twitter (@SGLawCenter) and Facebook (@nsglc)!

<http://nsglc.olemiss.edu>

# Project Origins

- 2018 advisory request from Connecticut Sea Grant
  - Asked the NSGLC to research potential models for the state to look to as guidance in its regulation of raw seaweed in its whole form.
- Seaweed in its whole form has not been approved on a federal level as a food product.
  - The FDA considers seaweed “generally recognized as safe” (GRAS), but only when used in other foods as an additive.
- Memo covered:
  - Current federal regulatory framework for seaweed as food.
  - Overview of HACCP and Food Safety Modernization Act (FSMA).
  - Potential models:
    - Seafood HACCP
    - Produce Safety Rule



# NATURAL RESOURCES & ENVIRONMENT

ABA SECTION OF ENVIRONMENT, ENERGY, AND RESOURCES

VOLUME 33, NUMBER 1, SUMMER 2018



- CLIMATE-FRIENDLY AGRICULTURE, SOLUTIONS FOR FOOD WASTE
- BRINE SHRIMP, LAB-TO-TABLE, FOOD LABELING

- FOOD AND BEVERAGE LAW CLINIC, SEAWEED WILD HARVEST AND AQUACULTURE
- GENETICALLY ENGINEERED CROPS, HYDROPONICS



## Navigating the Kelp Forest: Current Legal Issues Surrounding Seaweed Wild Harvest and Aquaculture

Catherine Janasie and Amanda Nichols

Seaweed and kelp have traditionally had many uses, including as both food sources and food additives. Currently, East Asia is the leader in seaweed and kelp production. However, there is a budding seaweed and kelp aquaculture and wild harvest industry in the United States, which presents economic benefits and novel legal considerations. The Maine seaweed and kelp harvest currently generates \$20 million annually, making it one of the state's most valuable commodities. Seaweed and kelp aquaculture in other areas could help replace traditional fisheries that are being negatively impacted by changing ocean conditions. In addition to these economic benefits, a commercial seaweed and kelp industry could also have significant ecological impacts—seaweed takes up carbon dioxide, draws down levels of nitrogen and phosphorus, and gives off oxygen, helping to improve water quality.

The seaweed and kelp industry in the United States is still quite small compared to production in East Asia, and faces several layers of federal and state regulatory uncertainty. Seaweed and kelp aquaculture and harvesting occur offshore, raising potential public trust implications. Further, there are issues regarding the U.S. Food and Drug Administration's (FDA) and U.S. Department of Agriculture's (USDA) respective regulation of seaweed and kelp products. If the United States can successfully address these issues, it could pave the way for a new marine algae industry that could greatly benefit both the economy and the environment.

The global marine algae market—valued at approximately \$6 billion—has been historically focused in East Asian countries, with seaweed and kelp frequently used in regional cuisine. Dennis J. McHugh, *A Guide to the Seaweed Industry* (2003). Products for human consumption contribute to around \$5 billion of this amount, while substances extracted from seaweeds (known as hydrocolloids) and miscellaneous uses make up the remaining sum. *Id.*

Seaweed and kelp can be either wild harvested or commercially cultivated, but farming produces more than 90 percent of the world's demand. Macroalgae are typically cultivated using either off-bottom line farming or floating line aquaculture. In off-bottom line farming, seaweed and kelp are grown

in shallow parts of the ocean on lines stretched between wooden stakes anchored to the sea bed. With floating line aquaculture, seaweed and kelp are grown from lines anchored directly to the sea floor. Most food species are cultivated using the floating line method, which is suitable for deep ocean areas or areas with weak currents. Aquaculture permits under the Rivers and Harbors Act (RHA) and Clean Water Act (CWA) are required in the United States to engage in either method, both on state and federal levels. Additionally, wild harvest often requires a valid state license in the United States (especially when collected for commercial use). This type of harvest is largely important in subsistence use areas like Alaska. However, wild harvest can raise private property concerns in places like Maine when collection requires venturing very close to shore and making use of the beach or rocks at low tide.

If the United States can take advantage of its ample coastline to successfully become a player in the international macroalgae industry, its participation could yield significant economic and environmental benefits. To attain this goal, however, aquaculturists and harvesters will have to contend with regulatory uncertainty, public trust issues, and relevant FDA and USDA rules.

### Statutory and Regulatory Framework

At the federal level, a lack of current, clear, and applicable statutory and regulatory structure for commercial seaweed and kelp aquaculture cultivates uncertainty. RHA section 10 (33 U.S.C. § 403) and CWA section 404 (33 U.S.C. § 1344) pose challenges for permit applicants if applied to commercial seaweed and kelp aquaculture. Current FDA and USDA regulations for handling, storage, processing, and organic certification also do not clearly apply to all aspects of commercial seaweed and kelp aquaculture. The current treatment of and future interest in commercial seaweed and kelp aquaculture in Alaska, California, and Maine provide insight into how the industry might further develop in other parts of the country.

RHA section 10 requires that regulated activities conducted below the high-water line of our nation's navigable waters be approved and permitted by the U.S. Army Corps of Engineers (Corps), 33 U.S.C. § 403. Regulated activities can include such things as the placement or removal of structures, dredging, filling, excavation, or any other disturbance of sediment or modification of a navigable waterway. Under CWA section 404, the Corps is authorized to permit the discharge of dredge and fill material into navigable waters. 33 U.S.C. § 1344. However, because "navigable waters" are defined as three natural

*Ms. Janasie is senior research counsel at the National Sea Grant Law Center at the University of Mississippi School of Law in Oxford, Mississippi, where she is also a member of the law school faculty. She may be reached at [cjanasie@olemiss.edu](mailto:cjanasie@olemiss.edu). Ms. Nichols is the current legal fellow of the National Sea Grant Law Center, located at the University of Mississippi School of Law. She may be reached at [alnichol@olemiss.edu](mailto:alnichol@olemiss.edu).*

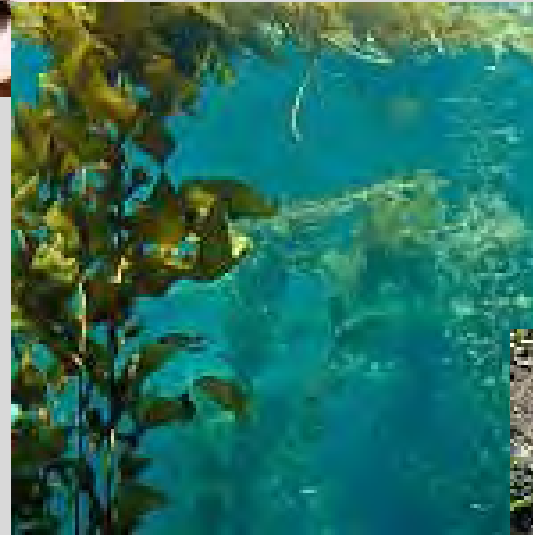
NR&E, Summer 2018

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# Best model?



- With a lack of existing regulations for macroalgae, where should we look for guidance?
  - Seafood?
  - Shellfish?
  - Produce?



**Important Note**

Legal Definitions ≠ Scientific Classifications

Tomato = Vegetable (but it's a fruit)



# Food Safety 101

- Federal Food, Drug, and Cosmetic Act (FDCA) prohibits the introduction into interstate commerce of any food that is “adulterated or misbranded.” (21 U.S.C. 331).
  - Can’t be prepared, packed, held under insanitary conditions
- Basic strategies to protect against adulterated food:
  - HACCP:
    - FDA - Required for: Seafood, Juice
    - FDA - Voluntary for: Dairy Grade A
    - USDA FSIS - Meat and Poultry
  - Food Safety Plan
- “Farms” must comply with general requirements of FDCA.



# FDA Determination - February 2021

Seaweed is a “raw agricultural commodity”

- Seaweed that is harvested and dried still fits within the farm definition.
- Must comply with FDCA adulteration prohibition

Processed seaweed = facility

- Must register and comply with Food Safety Modernization Act (FSMA), including Hazard Analysis/Preventive Controls (PC)
- Ex: cutting, distilling, drying/dehydrating raw agricultural commodities to create a distinct commodity, freezing labeling, packaging, trimming, washing, or waxing.

Hazard Analysis/PC Exemptions - important for the seaweed operations

- Exempt, with modified requirements: Average less than \$1M per year in sales of human food plus the market value of human food manufactured, processed, packed or held without sale.

***Remaining question - how do states step in to regulate seaweed that does not need to comply with FSMA (hazard analysis/PC)?***



Cultivated sugar kelp. Credit:  
Stephen Schreck, PSRF

# PREVENTING THE SPREAD OF AQUATIC INVASIVE SPECIES BY RECREATIONAL BOATS:

MODEL LEGISLATIVE PROVISIONS & GUIDANCE TO PROMOTE RECIPROCITY  
AMONG STATE WATERCRAFT INSPECTION AND DECONTAMINATION PROGRAMS



# Project Inspiration: Building Consensus in the West

Resource  
Managers



Law Enforcement

State Attorneys  
General

# Project Overview

- Funded through NOAA Sea Grant Social, Behavioral, and Economic Research Needs in Aquaculture competition in 2019.
- **Project Partners:** Connecticut Sea Grant and Connecticut Department of Agriculture
- **Project Objective:** Enhance coordination and cooperation among states to build policy consensus as to the preferred approaches for regulating the sale of seaweed in its whole form for food.
  1. Conduct legal research to identify and assess potential models;
  2. Convene a collaborative learning workshop for state program managers and federal regulatory agencies; and
  3. Develop a model law, regulation, or guidance document for the sale of seaweed in its whole form as food.





# Planning Committee

- Jeremy Ayers, Division of Environmental Health, Alaska Department of Environmental Conservation
- Steven Bloodgood, FDA Center for Food Safety and Applied Nutrition
- Jason Bolton, University of Maine Cooperative Extension
- Anoushka Concepcion, Connecticut Sea Grant
- Kristin DeRosia-Banick, Connecticut Department of Agriculture
- Michael Graham, Moss Landing Marine Laboratories
- Emanuel Hignutt, Jr., Office of Food Safety, FDA Center for Food Safety and Applied Nutrition
- Randy Lovell, California Department of Fish and Wildlife
- Jennifer Perry, University of Maine
- Caird Rexroad, Agricultural Research Service, USDA
- Jaclyn Robidoux, Maine Sea Grant
- Mark Tedesco, Long Island Sound Office, U.S. Environmental Protection Agency

# Decision to go Virtual

- Proposal envisioned a 2.5 day in-person workshop in Fall 2020.
  - Approximately 15 hours of content and sessions planned.
  - Very challenging to convert to virtual format.
- Professional facilitator was key to success.
  - Facilitated planning committee discussions.
  - Helped maintain momentum.
  - Introduced us to new tools for virtual engagement:
    - Mural
    - Poll Everywhere



# 2020 Webinar Series

**Objective:** Build foundational base of knowledge and gather input from broad range of stakeholders to inform workshop discussions and development of model.

Federal Considerations	State Efforts	Industry Barriers and Challenges
August 27	September 23	October 22
<ul style="list-style-type: none"><li>● Nancy Balcom, Guidance for the U.S. Seaweed Industry: Why is it Needed?</li><li>● Emanuel Hignutt, Jr., FSMA Preventive Controls for Human Foods with Emphasis on Seaweed</li><li>● Catherine Janasie, USDA Regulation of Seaweed</li></ul>	<ul style="list-style-type: none"><li>● Kristin Derosia-Banick, Connecticut</li><li>● Peter Oshiro, Hawaii</li><li>● Kimberly Stryker, Alaska</li><li>● California Department of Health</li></ul>	<ul style="list-style-type: none"><li>● Sebastian Belle, Maine Aquaculture Association</li><li>● Markos Scheer, Sea Grove Kelp</li><li>● Michael Graham, Monterey Bay Seaweeds</li><li>● Suzie Flores, Stonington Kelp Company</li></ul>

**Audience:**

- Federal and industry webinars were advertised widely, recorded, and posted on the NSGLC project page.
- State webinar was by invitation only and not recorded so state regulators could discuss the issues openly and “off the record.”

# 2021 Coffee Chats

**Problem:** Only some workshop registrants had participated in webinar series. Didn't want to cover the same ground again in workshop.

**Solution:** In the four weeks leading up to the March 2021 workshop, the NSGLC hosted a series of informal video “coffee chats” for participants to drop by and discuss different topics the NSGLC was researching. Draft proceedings chapters were circulated in advance. Sessions covered:

- Federal regulatory framework
- State of the science regarding hazards
- International models
- Catch-up/grab bag.

# March 2021 Workshop - Week 1

**Day 1: Regulations, Technology & Seaweed, Oh My!**

**Day 2: Understanding the Gaps**

**Day 3: Filling the Gap**

**Day 4: Policy, Regulations, & Stakeholders**

Day 1: Regulations, Technology, & Seaweed, Oh My! Mar 8, 2021	Day 2: Understanding the Gaps Mar 9, 2021	Day 3: Filling the Gap Mar 11, 2021	Day 4: Policy, Regulations, & Stakeholders Mar 12, 2021
02:00   Welcome: Why are we here?	02:00   Introduction - Theme - Understanding the Gap	02:00   Welcome & Introduction: Filling the Gap	02:00   Introduction: Theme - Potential Regulatory Models & Stakeholders
02:07   Think: Why are YOU here?	02:10   Presentation: Walking through the Draft Federal Flowchart	02:07   Move into the Mural - Question of the Day	02:05   Daily Mini-Review with Q&A
02:11   Pair discussion: Participation Goals	02:30   Breakout Group & Report Out Instructions	02:14   Daily Mini-Review & Re-Focus - Steph and Cathy	02:15   Entering Mural
02:17   Small group discussion: Participation Goals	02:35   Breakout groups, part 1	02:29   Chat Storm - Zoom	02:20   Large Group Discussion - Linking Hazards to Control
02:27   Small group discussion: Participation Goals	03:00   Break	02:35   International Models: Hand-out to read	02:42   Policy & Stakeholder Considerations
02:37   Highlights in your group	03:10   Gallery Walk	02:40   Plenary: Hazards! - Steph and Zak	02:46   Stakeholder Mapping Brainstorm, part 1
02:52   Introduction to Multi-Day Flow	03:20   Looking Around	02:50   Q&A	02:56   Setting Up Breakouts & Break
03:02   Break	03:25   Breakout groups, part 2	03:00   Break	02:59   Break
03:12   Intro Presentation, National Sea Grant Law Center	03:55   Break	03:10   Breakout Group Instructions	03:09   Welcome back! Individual Brainstorming & Breakout Choices
03:22   Meeting Agreements	04:05   Gallery Walk	03:15   Breakout groups	03:16   Stakeholder Brainstorm, part 2 - Individual Empathy Maps
03:37   Tool overview: Zoom & Mural	04:15   Large Group Discussion	03:35   Breakout Groups	03:51   Return & Intro to Gallery Walk
03:52   Get to know Mural	04:45   The Daily Wrap-up	03:45   Break + Gallery Walk	03:54   Break & Gallery Walk
04:07   Break	04:55   End	04:00   Plenary: Connecticut Seaweed Guide	04:09   The Fish Scale
04:17   Fish Scale		04:15   Q&A	04:16   Large Group Discussion - Bring back to hazards & controls
04:24   Plenary: Workshop Summary Report		04:20   Breakout Groups - Jigsaw	04:45   The Day's Wrap-up
04:29   Q&A on Workshop Summary Report		04:40   Gallery Walk	
04:34   Commercial Seaweed Aquaculture in the United States and Food Safety: Why Size and Type of Farm Operations Matter		04:55   The Day's Wrap-up	
04:48   Q&A		05:00   End	
04:53   The Day's Wrap-up			
04:59   End			

# March 2021 Workshop - Week 2

## Day 5: What Guidance?

## Day 6: State Regulators Workday

## Day 7: Narrowing In

## Day 8: Moving Forward & Reflecting Back

Day 5: What Guidance? Mar 16, 2021	Day 6: State Regulators Workday Mar 17, 2021	Day 7: Narrowing In Mar 18, 2021	Day 8: Moving Forward & Reflecting Back Mar 19, 2021
02:00   Welcome & Agenda	02:00   Optional Day - Theme: Revisiting State Work Flow, Gaps, and Needs	02:00   Welcome & Agenda	02:00   Welcome! Theme: Moving Forward & Reflection
02:05   Presentation: Building Consensus in the West	02:10   Breakout groups by state	02:05   Review: Look How Far We've Come!	02:03   Getting into Mural
02:15   Q&A	04:50   The Day's Wrap-up	02:15   Q&A	02:08   Gallery Walk
02:20   Question of the Day	05:00   End	02:20   Initial Analysis	02:18   Q&A or Reactions
02:25   Introduction to breakouts		02:30   Q&A	02:23   Set up breakouts
02:30   Pair Interview Activity		02:35   Getting into Mural	02:27   Breakouts
03:00   Break		02:40   Large group discussion	02:42   Reactions
03:10   Welcome back!		03:00   Break	02:47   Break
03:13   Round Robin Report-outs		03:10   Welcome back!	02:57   Welcome back & set up breakouts
03:26   Sea Scale!		03:12   Three wishes	03:02   Walk through the Hazards & Controls again
03:31   Large Group Empathy Map for State Regulators		03:27   Setting up the brainstorm	03:07   Breakout groups
03:55   Break		03:32   Tools Discussion	03:22   Reactions
04:05   Our State Compilations		03:42   Clustering	03:27   Next Steps
04:15   Q&A on State Compilations		03:54   Break + self-selection of breakouts	03:36   Q&A
04:20   Your State Workflow & Regulations		04:09   Welcome back!	03:41   Polling
04:30   Q&A on State Flow Charts		04:12   Sea Scale	03:46   Large group discussion
04:35   What We Need from You		04:19   Breakout groups: What type of guidance would help YOU?	04:01   Break + Gif Search
04:40   Large group discussion re work time tomorrow		04:49   The Day's Wrap-up	04:11   Welcome back!
04:55   The Daily Wrap-up		04:55   End	04:13   Chat Storm
05:00   End			04:16   Pluses & Deltas
			04:26   One Word Check-Out
			04:30   End

# Workshop Outcomes

- 32 state regulators representing 11 states participated in at least one session.
- Participants assisted the NSGLC with the development of an FDA work flow and developed their own draft state work flows.
- Brainstormed food safety hazards of concern and possible control methods.

# Next Steps





# Workshop Proceedings

In production. Anticipated to release in December.

Chapters included are:

- Workshop Overview
- State of the Science
- Federal Framework
- Potential Models
  - Seafood HACCP
  - Shellfish Sanitation
  - Produce Safety Rule
  - Foreign Models
- Key findings or takeaways from workshop discussions



# December 2021 Workshop

- 3-hour virtual workshop on Wednesday, December 8.
- NSGLC will be sharing summaries and takeaways from the workshop proceedings
- Facilitated exercise designed to help launch Phase 2 - developing a guidance document - in January 2022.



# Guidance Document

Phase 2 of the project will focus on development of “a model law, regulation, or guidance document for the sale of seaweed in its whole form as food.”

- Unknown at this time what type of guidance document we’ll be producing.
- Decision will be driven by workshop participants and Advisory Committee.

Will involve a peer review process, possibly through an AFDO committee or other organization.



# Questions?

National Sea Grant Law Center  
University of Mississippi School of Law  
Kinard Hall, Wing E - Room 256  
P.O. Box 1848  
University, MS 38677

Stephanie Otts

[sshowalt@olemiss.edu](mailto:sshowalt@olemiss.edu)



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THE UNIVERSITY *of*  
**MISSISSIPPI**  
SCHOOL OF LAW

# SBE-An Assessment of Mariculture Feasibility in American Samoa

S. Pautzke, T. Spence

# American Samoa Aquaculture Feasibility Study



October 2021

Sarah Pautzke  
Project Manager and Scientist, Lynker



# Purpose

- Locally-identified need for an assessment of feasibility of aquaculture in American Samoa
- Comprehensive Economic Strategy and AS Ocean Plan identified aquaculture as a way to increase resilience and food security in the territory, as well as contribute to job creation
- We proposed a project to evaluate optimal species and locations for mariculture
- We will use objective, quantifiable economic, biophysical, social, and cultural attributes to describe what future implementation success might look like

# Anticipated Outcome

The key outcome of this project will be a detailed Final Report that articulates:

- Which areas are amenable to what kinds of mariculture in American Samoa
- Social support in general for mariculture
- Local and regional economic challenges and constraints to developing mariculture in American Samoa
- Existing and potential federal and local permitting requirements to ensure mariculture can be pursued successfully in the Territory from a permitting standpoint



# Project Goals

1. Examine the receptiveness of the social climate in American Samoa with regards to mariculture development,
2. Identify villages that may wish to conduct community-based mariculture based on capacity, receptiveness, and the desire/need to improve local economic activity,
3. Identify species that are most appropriate to rear on small, tropical islands with steep bathymetry and the best geographic areas for those species,
4. Assess economic opportunities, challenges and constraints,
5. Identify individuals, companies, and co-ops that are available to support the industry, and
6. Identify federal and local permitting requirements based on location of mariculture.

# Project Team

Sarah Pautzke – Planning specialist, meeting coordinator

Doug Harper, J.D. – Planning specialist, law expert

Chris Hawkins, PhD – Social scientist

Maria Haws, PhD – Aquaculture specialist

Pingsun Leon, PhD – Aquaculture economist

Keniseli Lafaele – Cultural specialist

AS DOC

AS DMWR

AS EPA

NOAA NMFS PIRO

# Goal 1 Tasks: Examine receptiveness of social climate

- 3-4 large community meetings across Tutuila
- 1-2 meetings on Ofu/Olosega and Ta`u
- Describe different types of aquaculture / mariculture
- Ask for feedback on which types may be appropriate for their villages – get people brainstorming
- Ask if the village is interested in aquaculture, reading room for receptiveness or disinterest

## Goal 2 Tasks: ID villages interested in mariculture

Based on: capacity, receptiveness, and the desire/need to improve local economic activity

- Build on the information from the community meetings
- Conduct a more detailed assessment to develop a list of specific villages receptive to mariculture.
- Conduct site visits to the identified villages to speak with the village chief and other important village residents.
- During site visits, use participatory GIS to ID specific locations the village may want a mariculture venture.
- The data layers obtained from this effort will be included in maps in the grant's final report.

## Goal 3 Tasks: ID species appropriate to rear

Restrictions: small, tropical island, steep bathymetry

- Determine the best geographic areas for those species
- Develop a list of known mariculture species
- Refine the list based on species appropriate for tropical climates
- ID habitats within the interested villages both on land and coastal
- ID areas offshore amenable for offshore aquaculture based on currents, water temperature, etc. using data from PacIOOS and other data such as bathymetry and substrate
- Work with the economist to assess what the economic feasibility and benefits of each type of species and location

# Goals 4 Tasks: Assess economics

## Opportunities, challenges and constraints

- Natural resource economist will assess economic opportunities and identify challenges and constraints.
- Assessment will include costs of shipping product, cost of starting a business, income generated, economic benefits to middle men (e.g. distributors), profitability of venture for the venture and its support industry
- Offer ways of mitigating the challenges and constraints

# Goal 5 Tasks: ID Individuals, companies, co-ops

Who is available to support the industry?

- We develop a comprehensive list of individuals, companies, and co-ops available to support a mariculture industry.
- Includes:
  - ❖ Ice provisioning (for shipping and distribution of product)
  - ❖ Shipping for the product
  - ❖ Construction supplies (e.g. the purse seine industry for net pens)
  - ❖ Feed suppliers
  - ❖ Distributors

# Goal 6 Tasks: Permitting Requirements

Federal and local permitting requirements based on location of mariculture.

- Permitting requirements change based on the location of proposed projects and ventures:
  - ❖ Land-based venture: AS DOC PNRS, ASEPA, as well as a lengthy process within villages and the zoning board
  - ❖ Nearshore area venture: AS DOC PNRS, USACE, NOAA, Coast Guard
  - ❖ Offshore venture: USACE, Coast Guard, NOAA
- Will ID holes in permitting process where steps are unclear for a permit applicant or review agency
- Make suggestions to correct the process



# Progress

- Developed the initial suite of questions for the villages
- Developed one-pager to share with OSA
- Set dates we were traveling to American Samoa to start the project
- Met with colleagues that are working with us

## COVID

- Now stalled

# Good News

## Initial Report

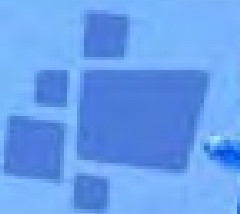
- AS DOC contracted Maria Haws to develop an aquaculture report
- The report laid the groundwork for assessing appropriate species, sites, capacity, and the legal framework upon which we will springboard

## COVID

- The hope is to begin this again in the spring 2022

Thank you!

Sarah Pautzke  
spautzke@lynker.com  
Lynker.com

Lynker 

Lynker 



**SBE-Fish, farms, and shared  
futures: Defining public perceptions  
of land-based aquaculture to  
support sustainable  
decision-making**

L. Rickard, B. McGreavy, B. Johnson

# **Fish, farms, and shared futures:** Defining public perceptions of land- based aquaculture to support sustainable decision-making

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**Dr. Laura N. Rickard, Dr. Bridie McGreavy, Dr. Branden B. Johnson**  
*Graduate students: Gabriella Gurney, Cynthia Houston, Nathan Smith*



**What is land-based recirculating aquaculture (RAS)?**

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# Why study land-based Farming

Business and Economy

## Belfast Residents Express Concerns

About Environmental Impact



# Desert salmon farming becomes reality for Dubai-based company

## Whole Oceans adds processing for an Atlantic salmon farm in Bu



by Nick Sambides Jr.

September 3, 2019 Updated September 4, 2019



# Project Overview

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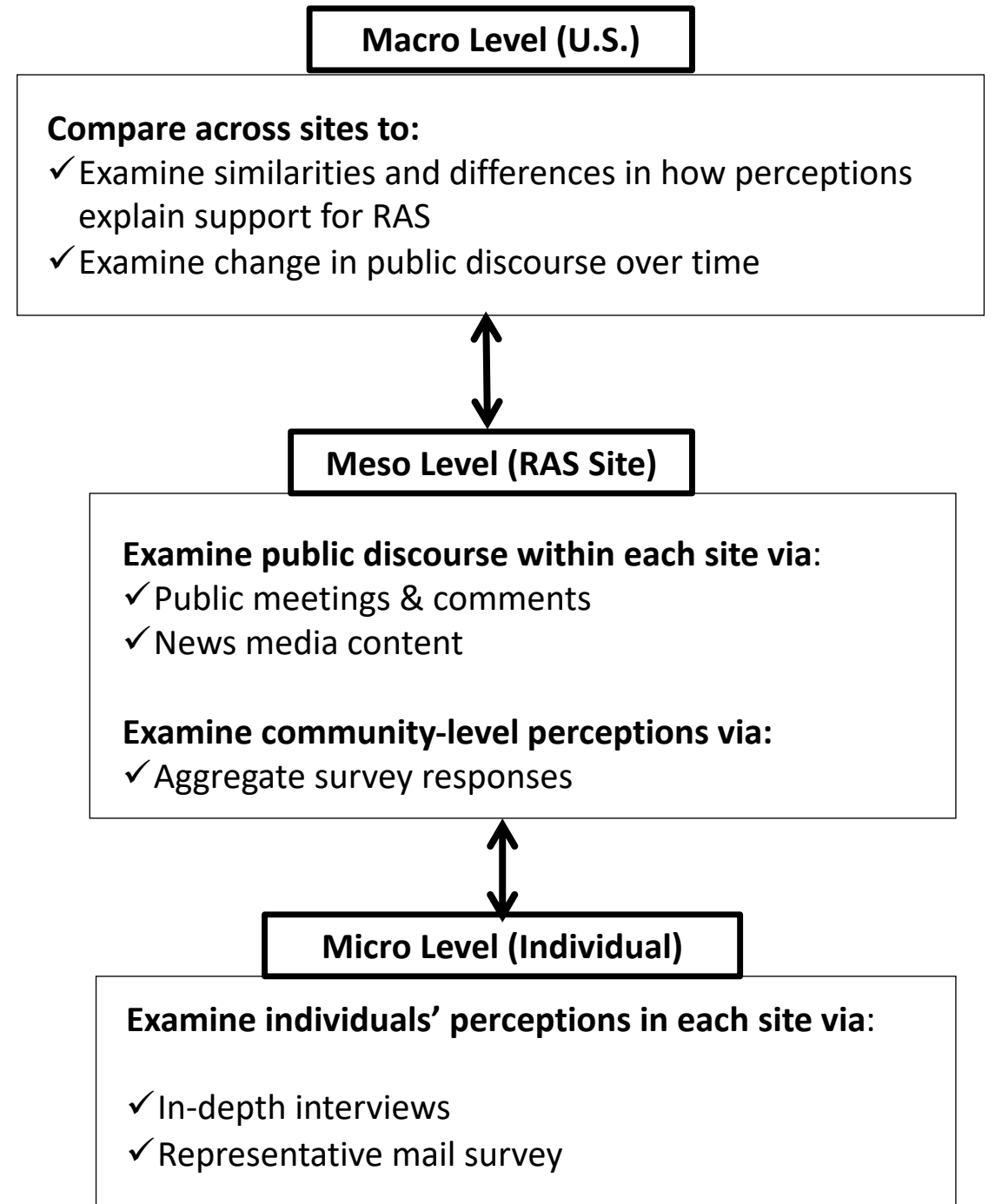
**Objective 1:** Examine RAS in public discourse



**Objective 2:** How do sense of place & perceived naturalness affect support for RAS?



**Objective 3:** How does social trust affect support for RAS?





# RAS Facility Sites



Bucksport, ME



Belfast, ME



Samoa Peninsula, CA



Homestead, FL



# Example #1: Stakeholder interviews

How do key  
stakeholders think  
about the risks and  
benefits related to land-  
based RAS?



$N = 76$  interviews ( $M = 56$  min.)

Government, corporate, journalist, pro/anti-RAS  
advocate, university affiliates



# RAS as complementing or threatening local industry



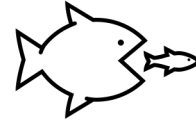
“This is a strong marine resources state and aquaculture is a hybrid between the two... Maine wants to be the major, major U.S. food producer it used to be and this is a **totally natural fit** in my opinion.”

-RAS advocate, Belfast, ME

“...By having an **artificial system**, it makes it even harder and harder and harder to push politicians and other groups that have no interest in preserving those natural systems into doing any of that stuff.”

-Fisherman, Samoa, CA

# RAS as unsafe/harmful or safe/beneficial



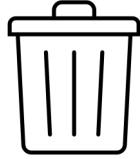
“No wild fish should be put in a tank and his whole life is swimming in circles, with no other lifeforms in the tank. That’s torture. **So I think they’re torturing the salmon,** and I don’t want to eat torture.”

-Anti-RAS advocate, Belfast,  
ME

“Our fish have a nutritionist on staff. Wild fish don’t... But also, because we treat, and disinfect, and clean the water so effectively, so efficiently, we don’t need to use any antibiotics, any medications. **It’s a cleaner, healthier product.**”

-Corporate representative, Belfast,  
ME

# RAS as "natural" extraction or unprecedented risk



“[Nordic Aquafarms is] yanking out...1.7 million gallons a day of freshwater, six million gallons a day of saltwater and they're spewing out 7.7 million gallons a day of wastewater. That sounds like a flow through system to me... **So they're damaging the salinity that impacts the fishery.**”

-Environmental advocate, Belfast, ME

“It's a **well-established regulation** for the wastewater disposal.”

-Corporate representative,  
Homestead, FL

# RAS as relative restoration

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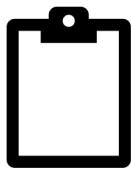
“So when you talk about clean and renewable and better for the property, it’s gone from a tannery, which is probably one of the worst things to have; to a paper mill, which was better; to land-based – **it’s gotten better.**”

-Local official, Bucksport, ME



## Example #2: Resident survey

What are the effects of trust and confidence on judgment that project benefits will exceed its risks, and overall project support?



- Belfast, ME, Samoa, CA, Homestead, FL
- Mail + online; Oct 2020-Mar 2021; non-respondent May 2021
- $n = 523$  (56% ME, 34% CA, 11% FL); 11.9% response rate
- Sense of place; community change; expected project impacts; information seeking; ratings of project sponsor; cooperative intentions with project; demographics



Cornell University  
Survey Research Institute

**Q17.** People who work for this corporation are \_\_\_\_\_ me.

- Very different from
- Somewhat different from
- Equally different from and similar to
- Somewhat similar to
- Very similar to

**Q18.** Historically, this corporation has done its job very well.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

## Trust & Confidence



## Cooperation



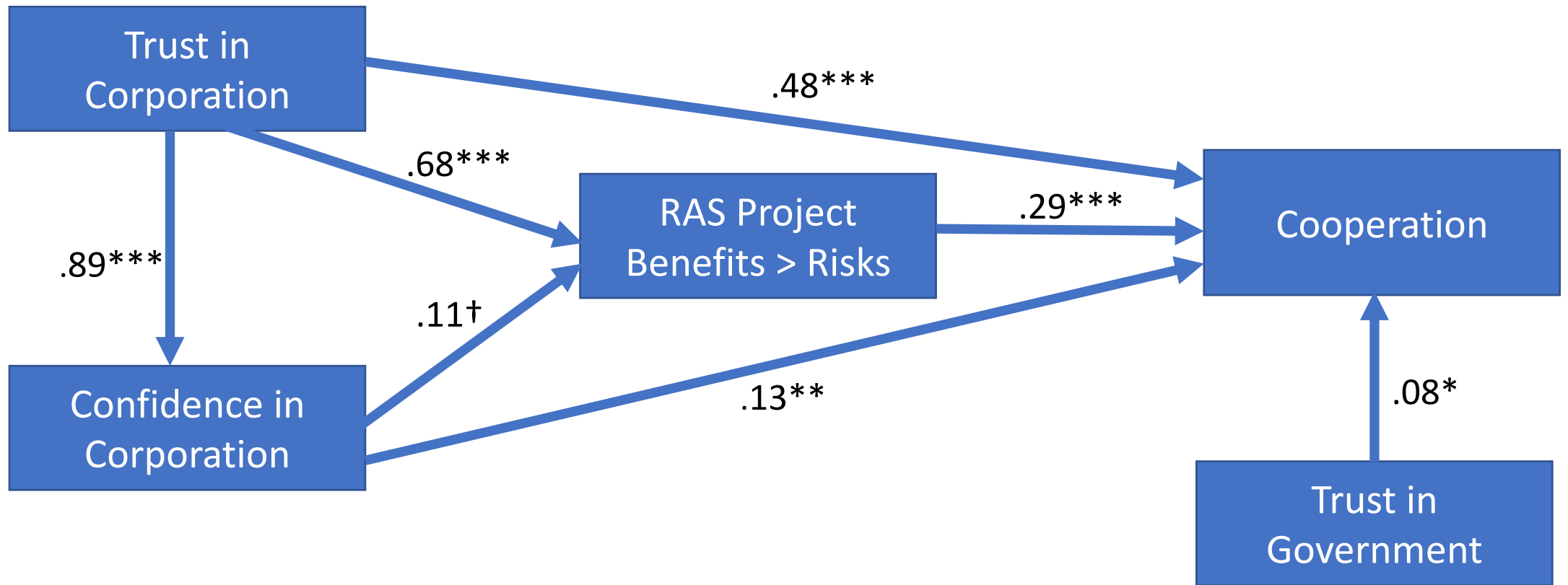
**Q25.** If an election were held tomorrow on the future of this land-based aquaculture project, I would

- Vote against having the project in or near my community
- Vote for having the project in or near my community
- Not vote

**Q26.** If this land-based aquaculture project built in or near my community sells fish locally, I would

- Buy or eat fish from the project
- Not buy or eat fish from the project





$\chi^2 = 3.68, df = 2, p > .05, \chi^2/df = 1.84, RMSEA = .046$  (90% confidence interval [CI] = .00, .12); **CFI = .99, TLI = .99**

†  $p < .10$  \*  $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$



## Next steps

- Data analysis: sense of place, information-seeking
- Public-facing website & presentation
- Follow-on funding

# Acknowledgements



Cornell University  
Survey Research Institute



**Aquaculture**  
Research Institute



RECIRCULATING  
AQUACULTURE  
SALMON  
NETWORK



# Thank you!

---

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@LNRickard



**SBE-Assessment of perceptions of  
marine aquaculture by the US food  
service industry:**

**Finding challenges and opportunities for  
expanding the US aquaculture industry**

B. Walton, A. Michaelis

# Seafood Perceptions in the Food Service Sector

Bill Walton<sup>1,2</sup> and Adriane Michaelis<sup>1,3</sup>

<sup>1</sup>Auburn University Shellfish Lab

<sup>2</sup>Virginia Institute of Marine Science

<sup>3</sup>NOAA NMFS Southeast Fisheries Science Center

*Sea Grant Aquaculture Research Symposia: October 28, 2021*



# Rationale



**Public perception of aquaculture = a barrier to industry expansion**  
(e.g., Knapp & Rubino 2016)



**Consumer-focused research typical**  
(Atlantic Corporation, 2019; Brayden et al. 2018; Hall & Amberg 2013; Risius et al. 2017)



**Intention-behavior gap re: seafood values and consumption**  
(Carlucci et al., 2015)



**Who can (and does) inform and shape that gap?**

# The food service sector as seafood influencers



**Chefs, servers, and wholesalers are influential actors, key informants, opinion-leaders, and knowledge brokers.**

(Alonso & O'Neill 2010; Fabinyi & Liu 2016; Murphy & Smith 2009; Nieto Enrigue 2018)



**Limited work to understand chef/distributor purchasing decisions**

(Lawley & Howieson 2015; Fabinyi et al. 2017; Roy 2016).



**Chefs and servers influence, for example, by assigning value to local ingredients**

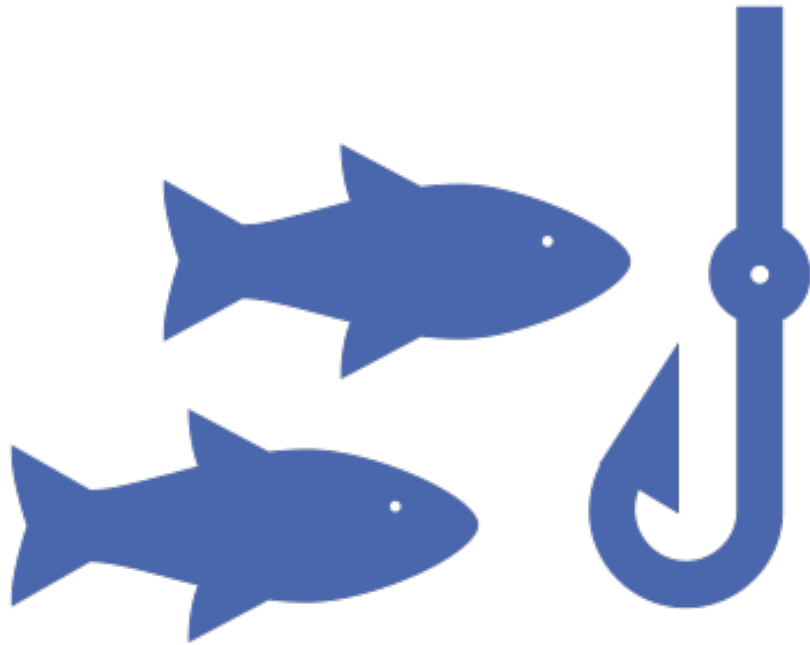
(Deale 2008; Inwood et al. 2009; Ortiz 2010; Roy 2016)



**Can we assume similarly for seafood?**

(Chen et al. 2017)





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# Research Questions

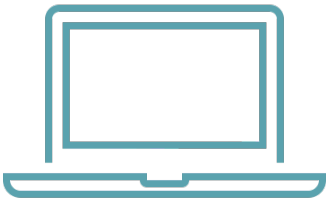
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- What perceptions and factors guide seafood purchasing by wholesalers/distributors and chefs?
- Within the food service sector, how is seafood information gathered and used?
- How are consumers influenced, guided, or advised by these food service professionals?

# Experimental Design



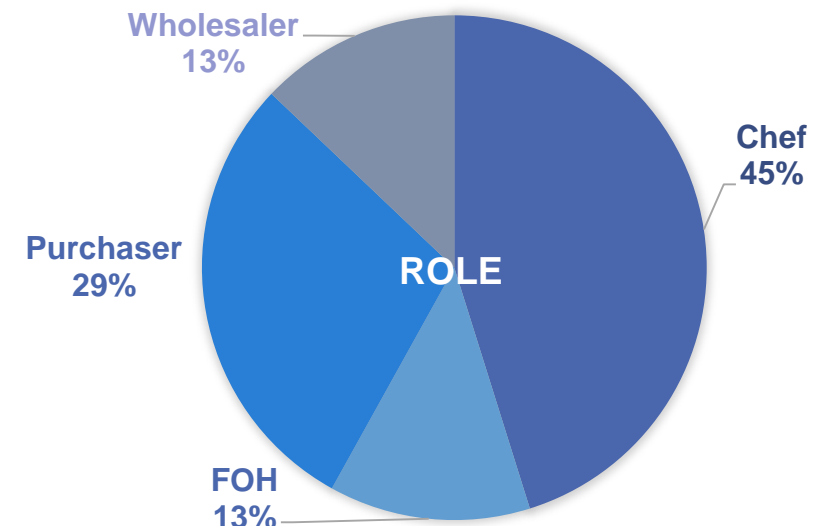
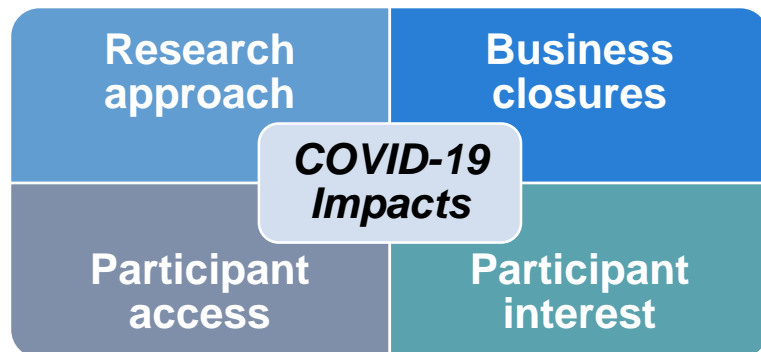
- **Phase 1: Semi-structured interviews** (Sep 2020-Mar 2021)
  - 12 “seafood” and “foodie” US cities (systematically selected)
  - Top-ranked seafood restaurants, wholesalers, and retailers
  - Chefs, wholesalers, purchasers, servers, customers



- **Phase 2: Structured online survey** (Apr-May 2021)
  - 12+(12\*3) cities targeted, open to participants across US
  - Seafood restaurants, wholesalers, and retailers
  - Chefs, wholesalers, purchasers, servers

# Phase 1: Semi-structured Interviews

- 31 phone interviews (190 invitations \* 3)
- 11 cities (+ Birmingham, AL; NR: Miami, San Diego)
  - Austin, TX
  - Baltimore, MD
  - Boston, MA
  - Charleston, SC
  - Chicago, IL
  - Nashville, TN
  - New Orleans, LA
  - New York City, NY
  - San Francisco, CA
  - Seattle, WA



# Phase 1: Results to Inform Survey



INFORMATION  
ACCESS &  
TRANSFER



FACTORS  
INFLUENCING  
PURCHASE



COVID IMPACTS  
ON PURCHASING



VARIABLE  
FRAMEWORKS OF  
UNDERSTANDING

---

# Phase 2: Survey

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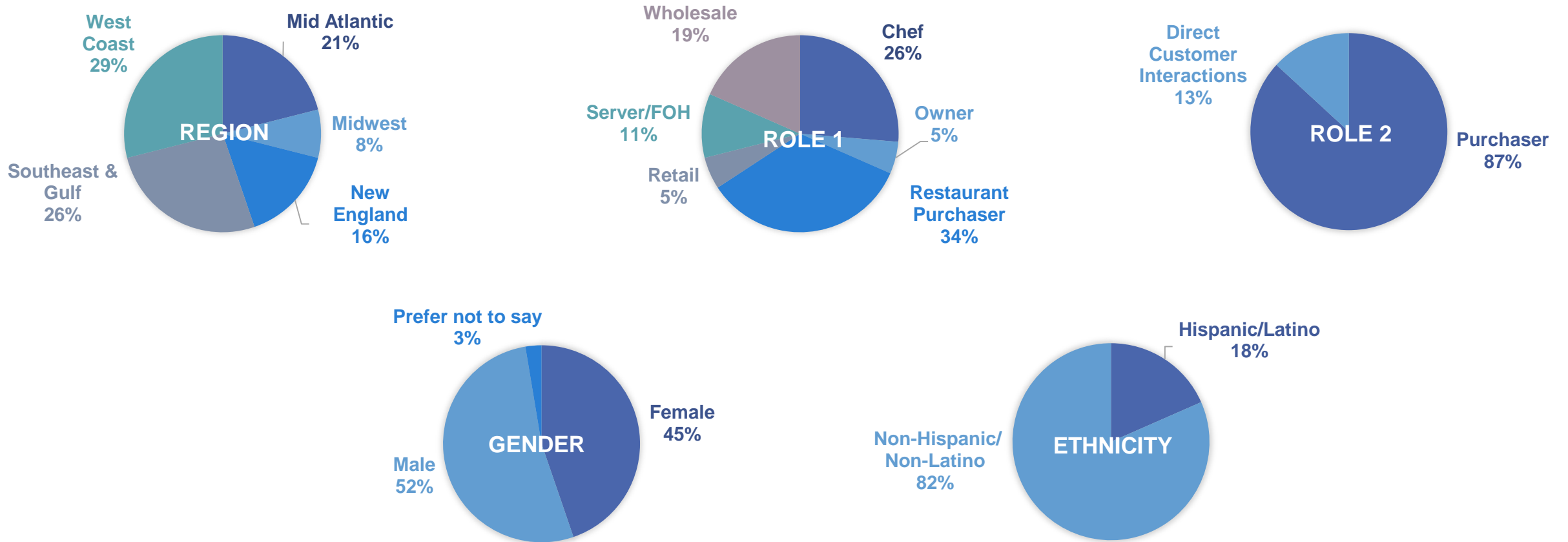
## Approach

- Online survey, via Qualtrics
- Anonymous
- Participant incentive - \$25 gift card lottery

## Participants

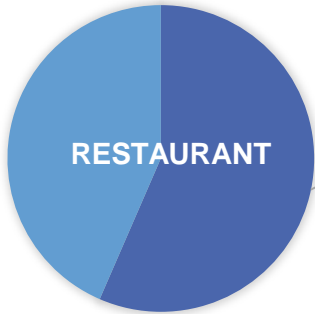
- >500 emailed invitations + social media shares
- Emphasis on intended 48 cities
- 132 completed surveys -> 38 unique, *valid* participants
  - Culled based on open-ended responses
  - Total included in analysis corresponds to # of valid emails (not linked to data)

# Phase 2: Survey Participants (N = 38)



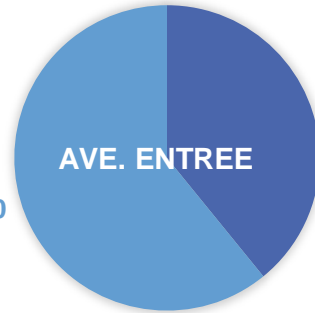
# Phase 2: Survey Participants

Part of a local or regional chain or restaurant group  
43%



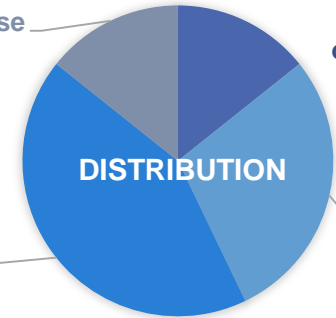
Independently owned, single-location operation  
57%

\$26-50  
61%



\$15-25  
39%

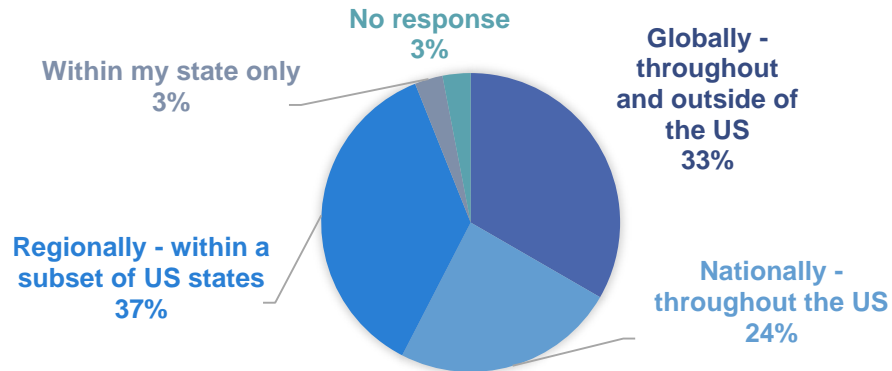
Regionally - within a subset of US states  
43%



Globally - throughout and outside of the US  
14%

Nationally - throughout the US  
29%

## WHERE DO YOU PURCHASE SEAFOOD FROM?



No response  
3%

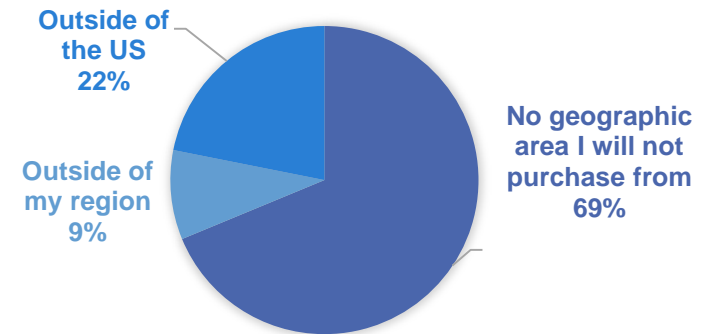
Within my state only  
3%

Globally - throughout and outside of the US  
33%

Nationally - throughout the US  
24%

Regionally - within a subset of US states  
37%

## I WILL NOT PURCHASE SEAFOOD FROM:



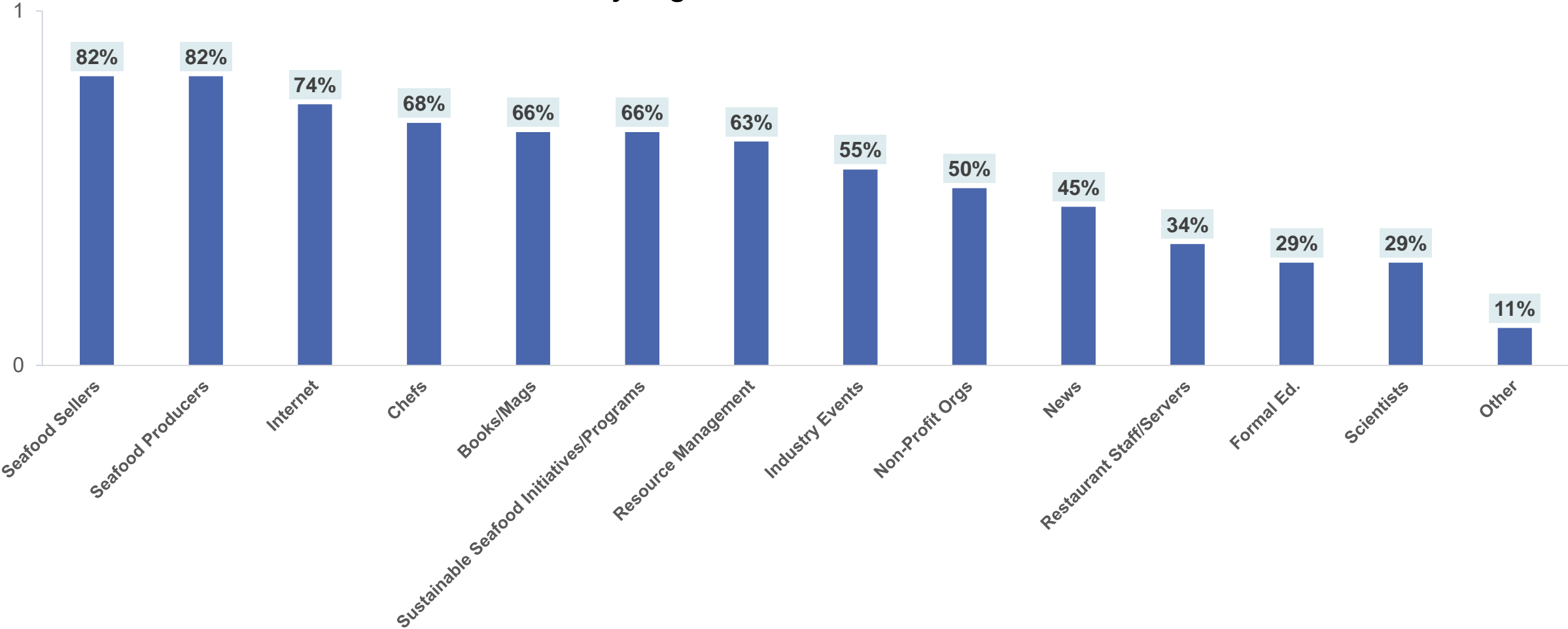
No geographic area I will not purchase from  
69%

Outside of the US  
22%

Outside of my region  
9%

# Phase 2 Results: Seafood Information (N = 38)

*Where do you get seafood related information?*

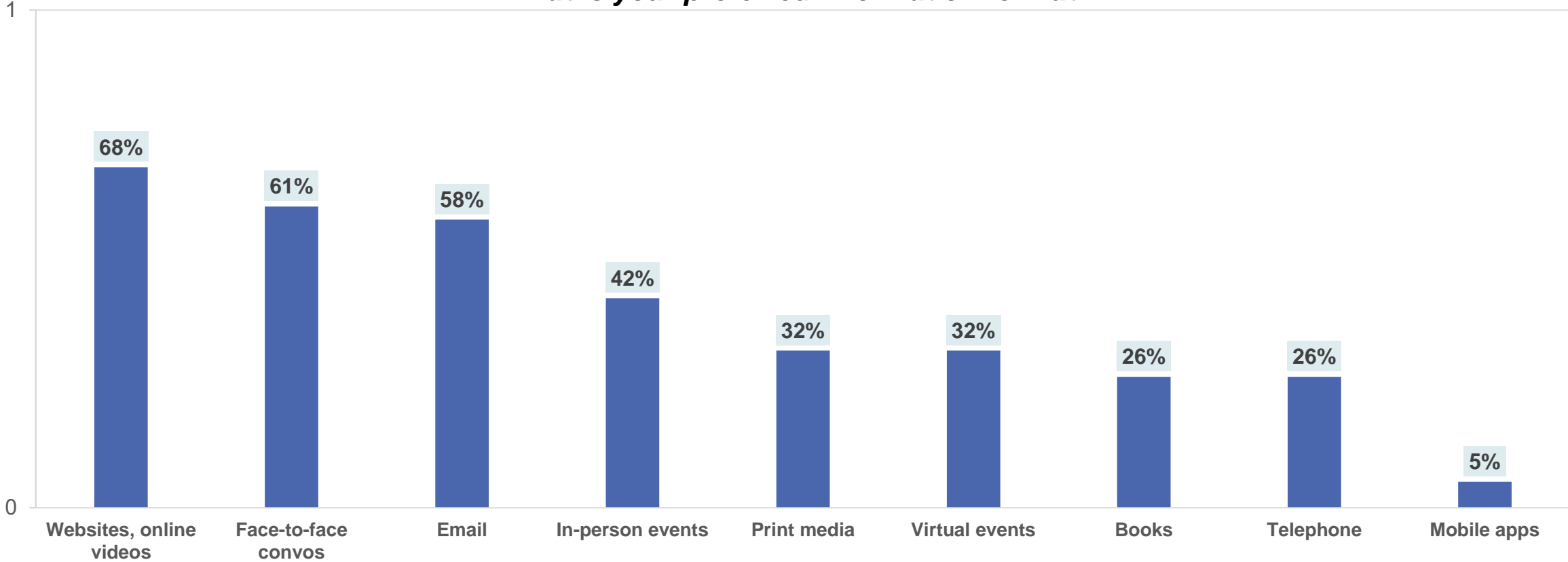


*Preliminary findings*



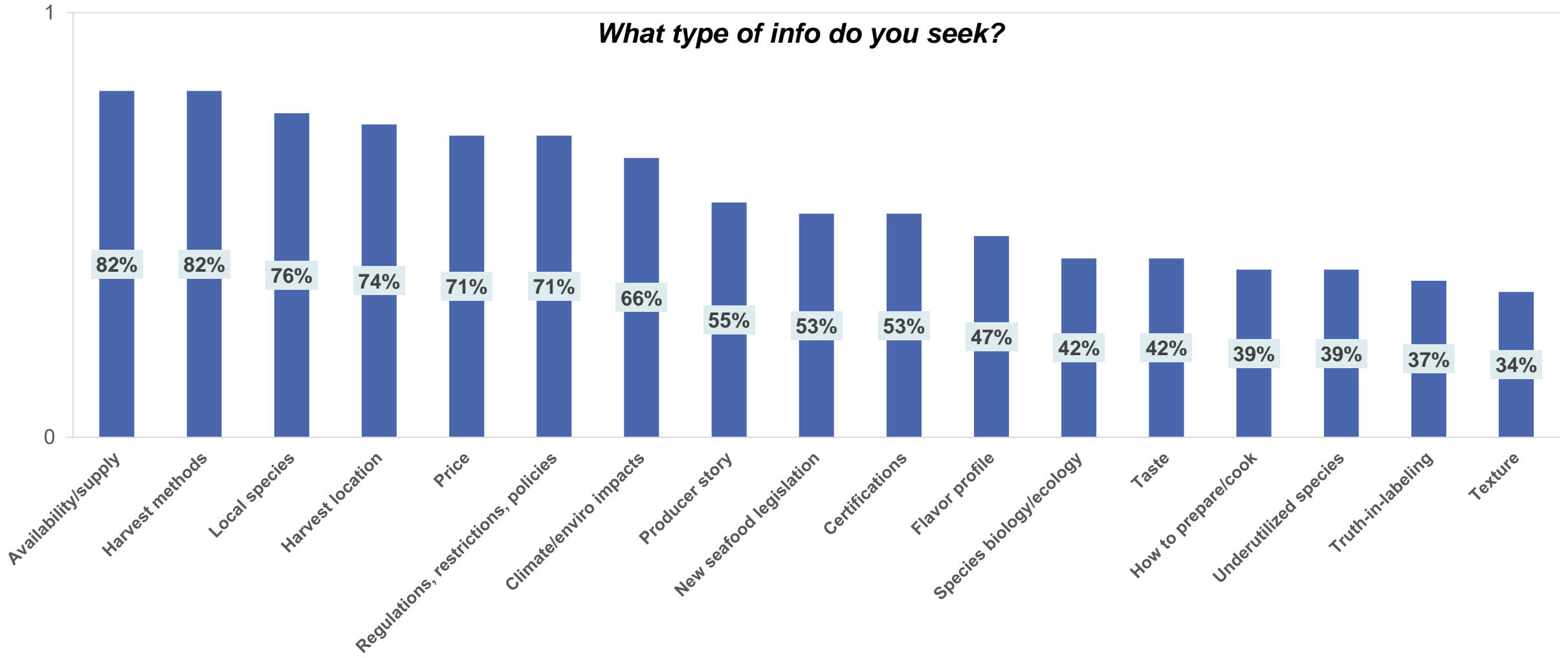
# Phase 2 Results: Seafood Information (N = 38)

*What is your preferred information format?*



*Preliminary findings*

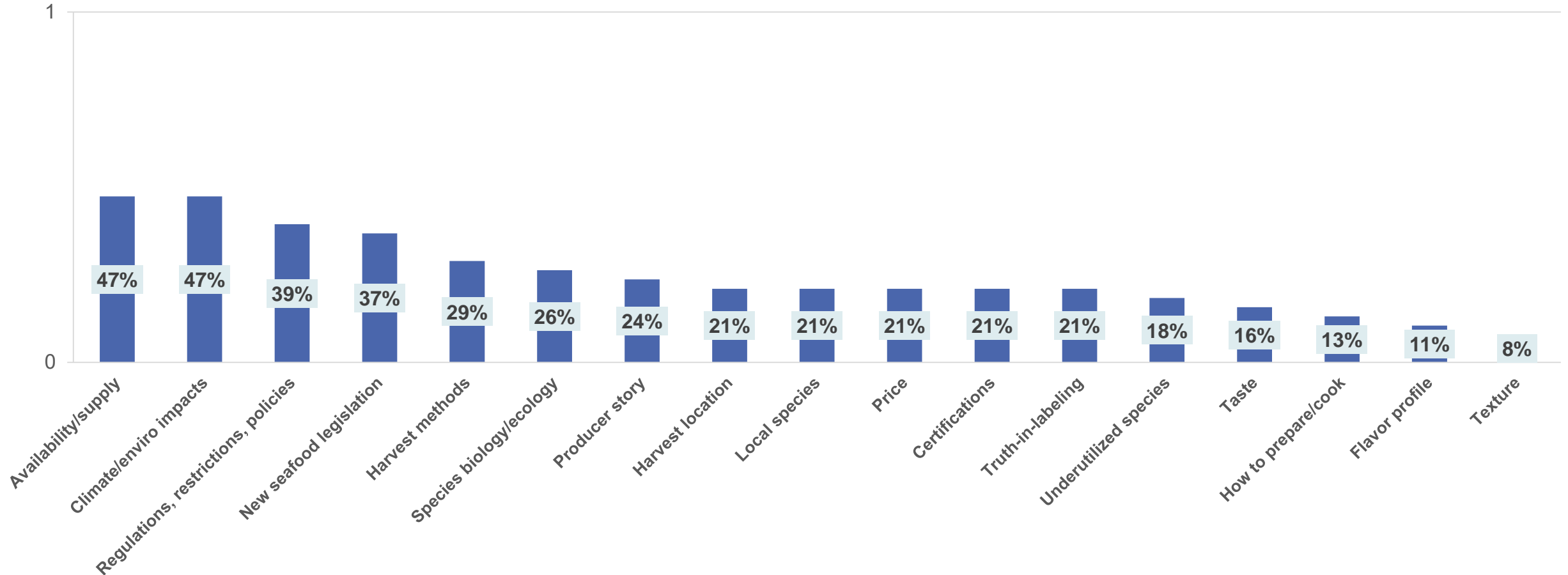
# Phase 2 Results: Seafood Information (N = 38)



*Preliminary findings*

# Phase 2 Results: Seafood Information (N = 38)

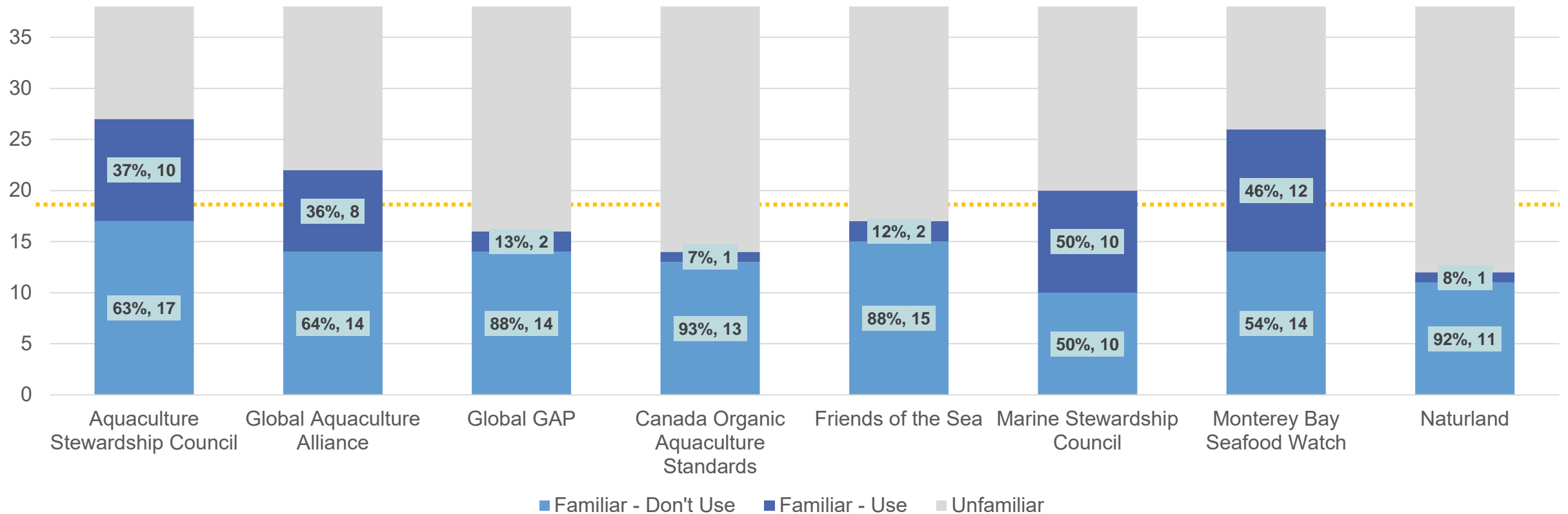
*What type of info are you lacking?*



*Preliminary findings*

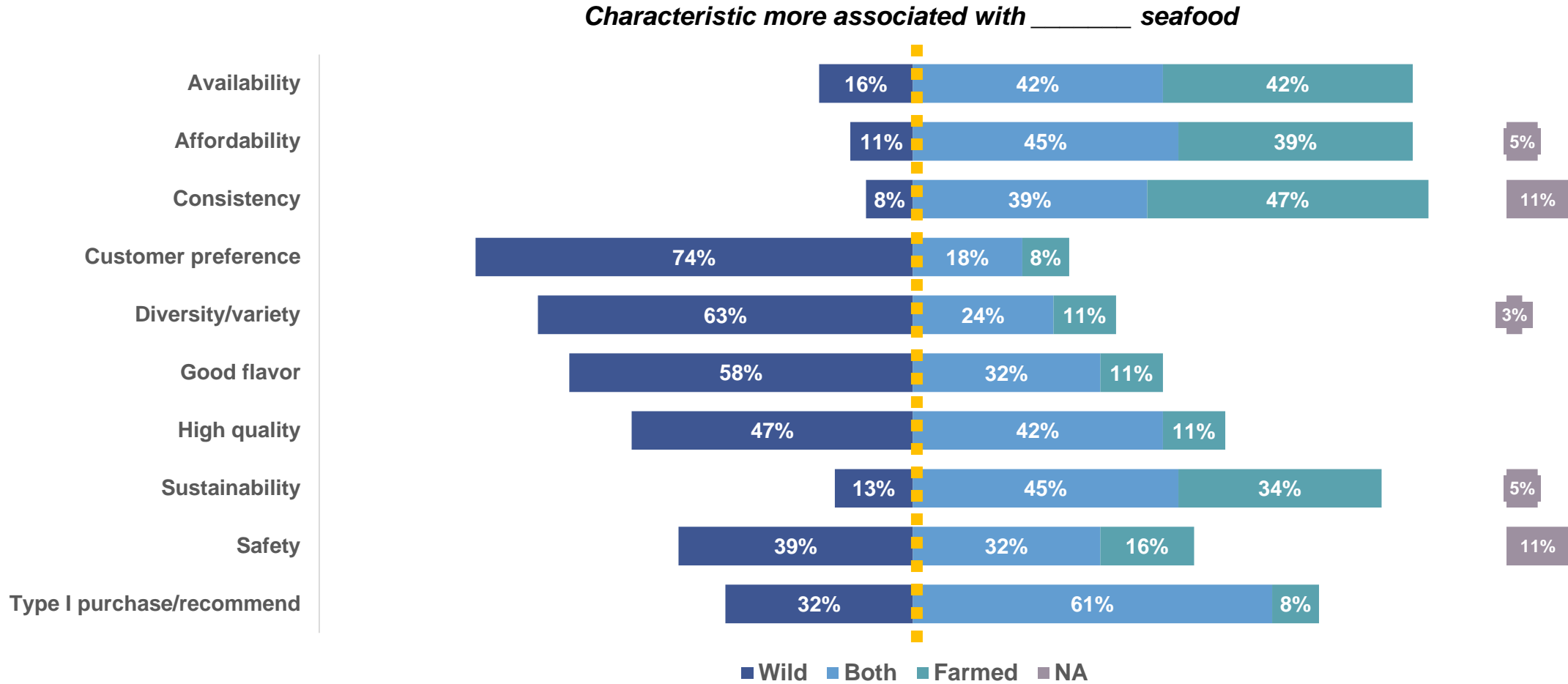
# Phase 2 Results: Seafood Certifications (N = 38)

*What seafood certification programs are you familiar with?  
Do you use them to guide purchasing?*



*Preliminary findings*

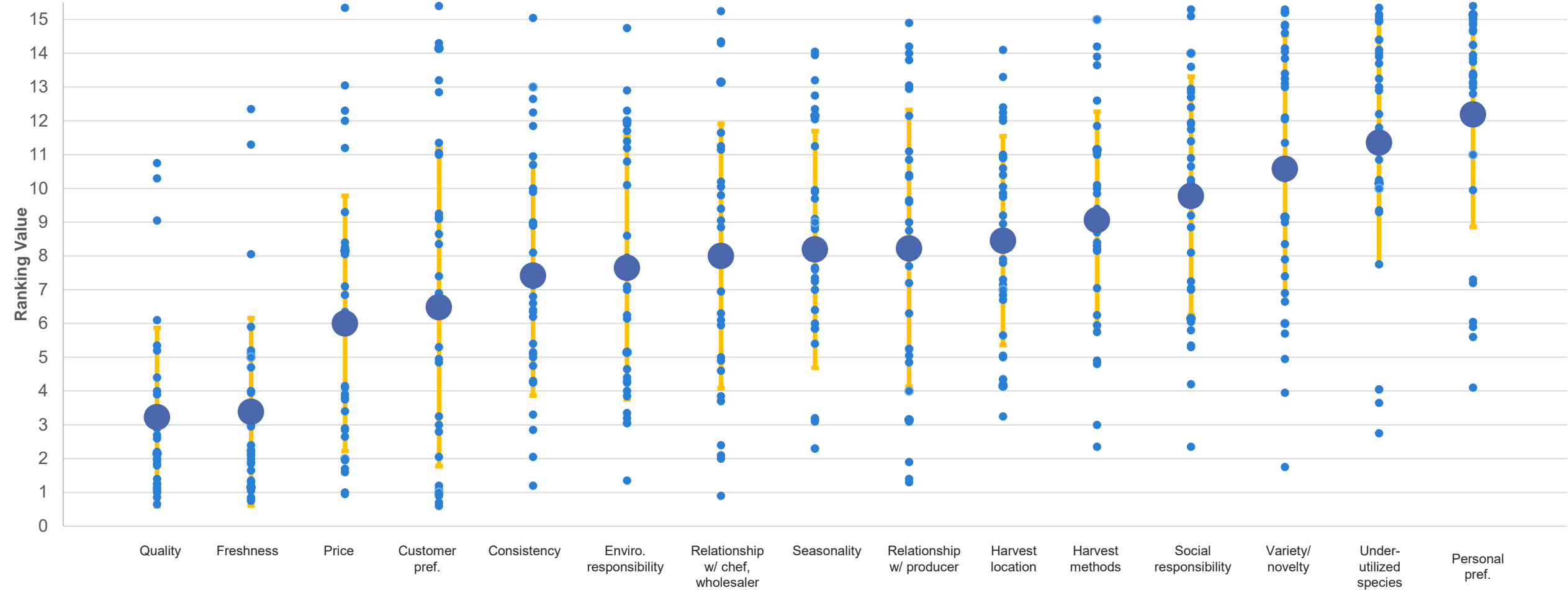
# Phase 2 Results: Wild and Farmed Characteristics



*Preliminary findings*

# Phase 2 Results: Seafood Characteristics (N = 33)

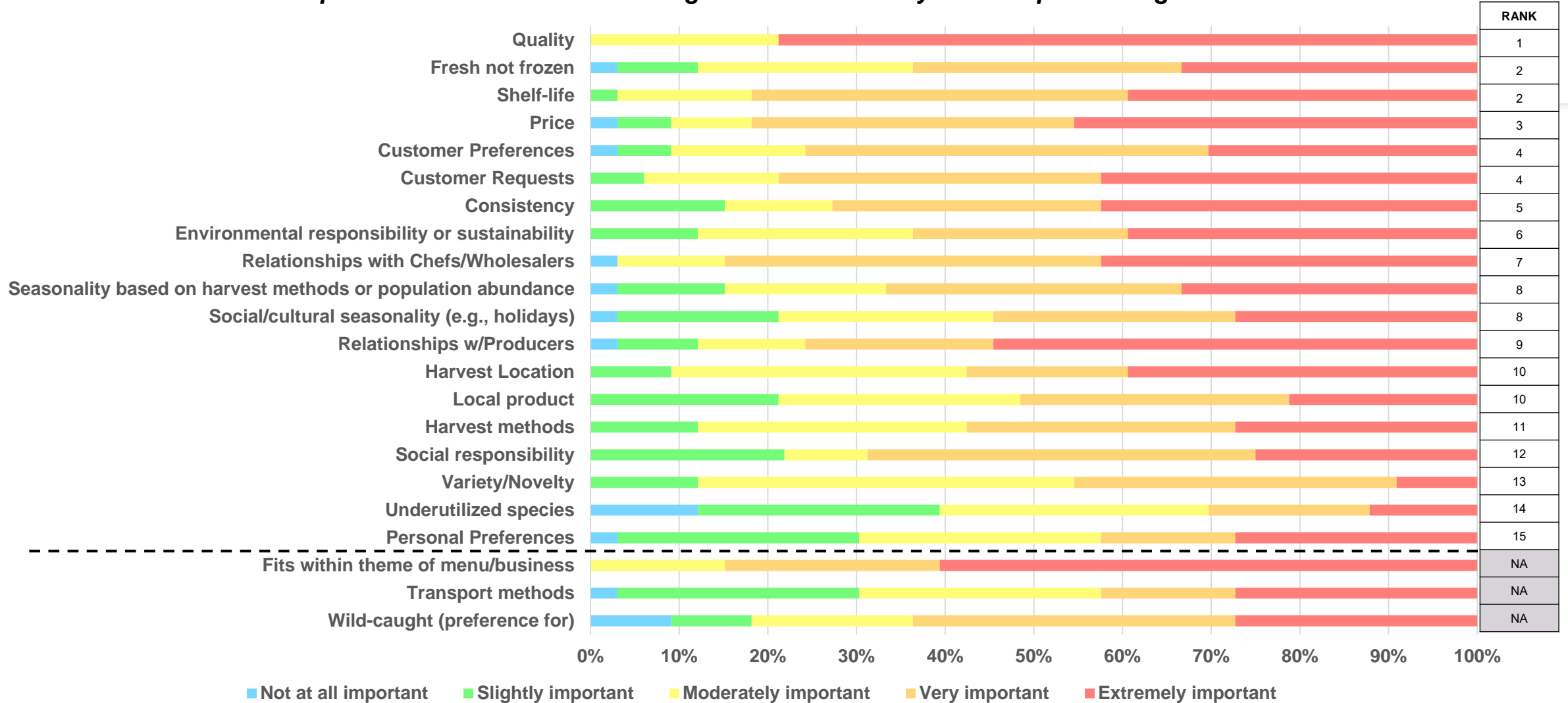
Rank the following characteristics from most important (1) to least important (15) when it comes to influencing your seafood purchasing



*Preliminary findings*

# Phase 2 Results: Seafood Characteristics (N = 33)

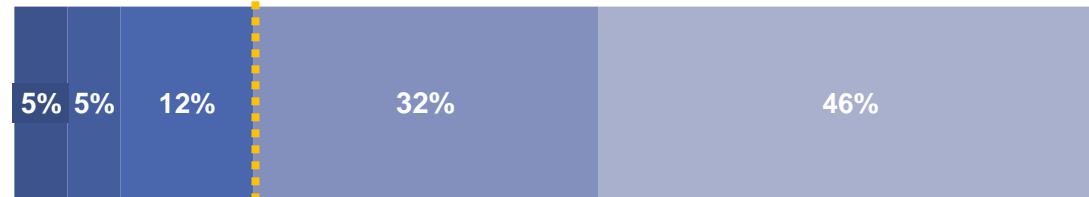
*How important are each of the following characteristics to you when purchasing seafood?*



*Preliminary findings*

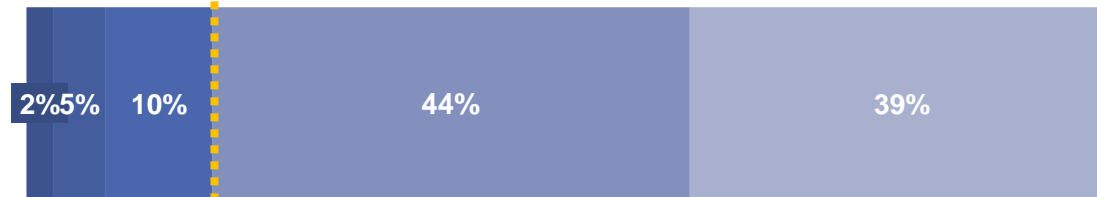
## Phase 2 Results: Trust in US Seafood Management (N = 38)

I trust that seafood harvested or farmed per US regulations is **sustainable**.



- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

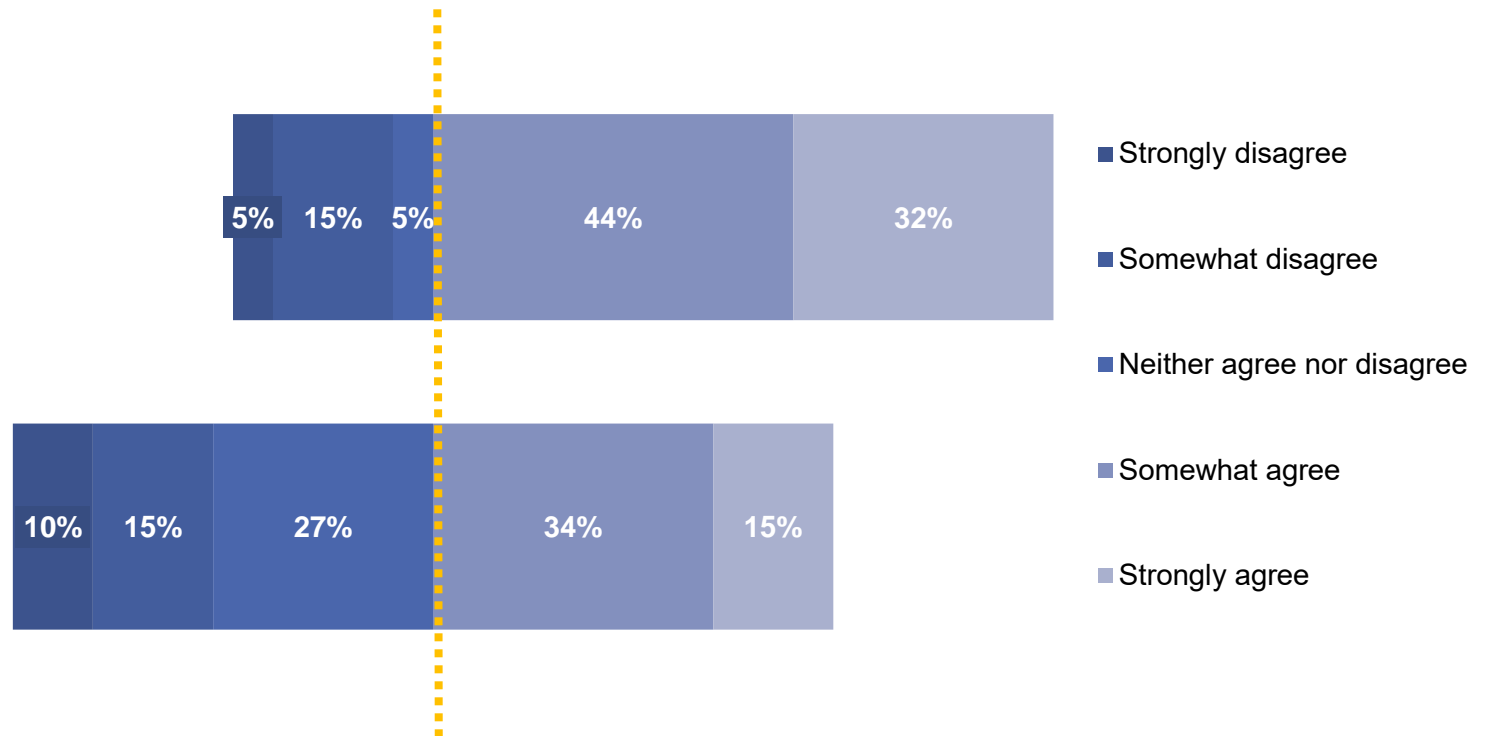
I trust that seafood harvested or farmed per US regulations is **safe**.



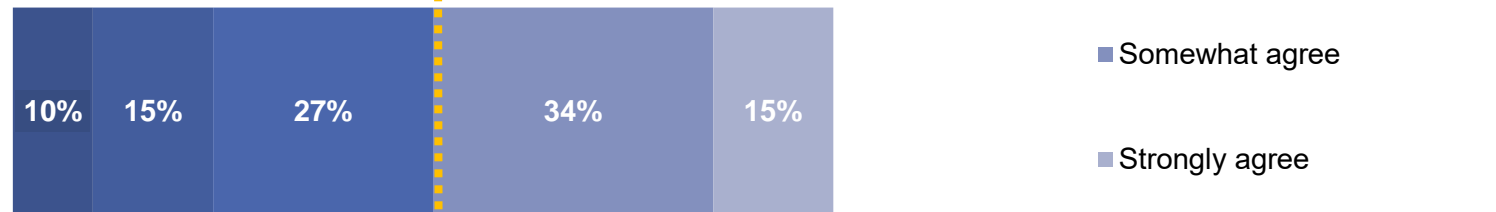


## Phase 2 Results: Do participants think they're influencers? (N = 38)

When it comes to seafood, the **consumer** shapes the market and demand.

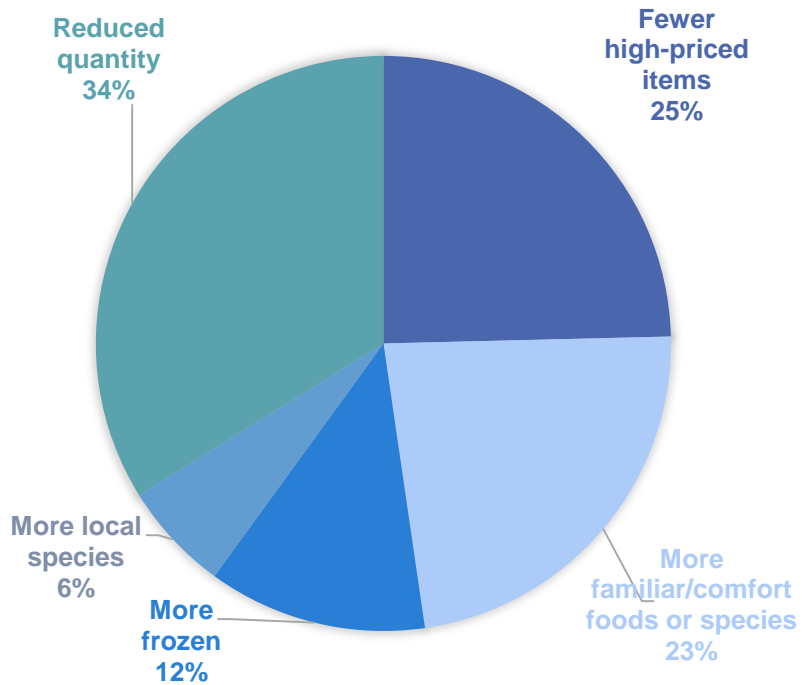


When it comes to seafood, **I** influence the market by creating demand.

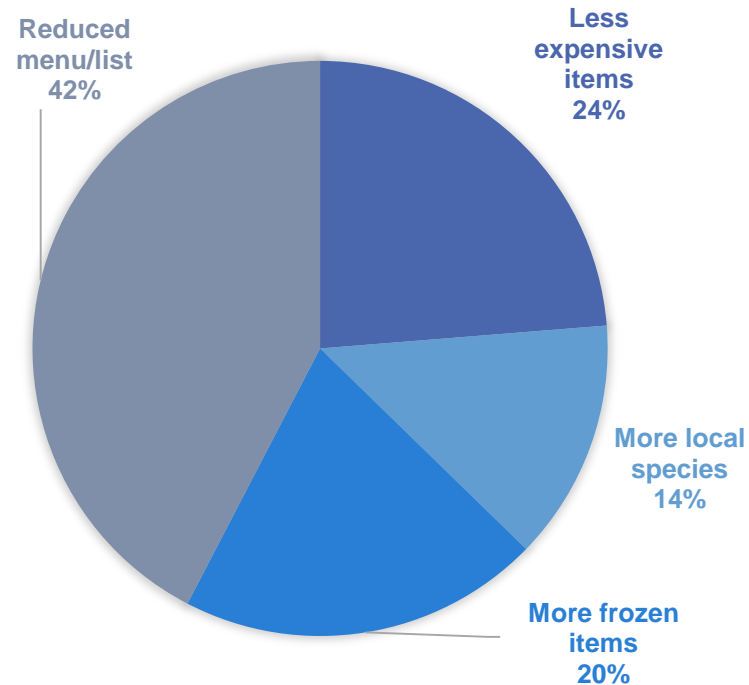


# Phase 2 Results: COVID Impacts (N = 33)

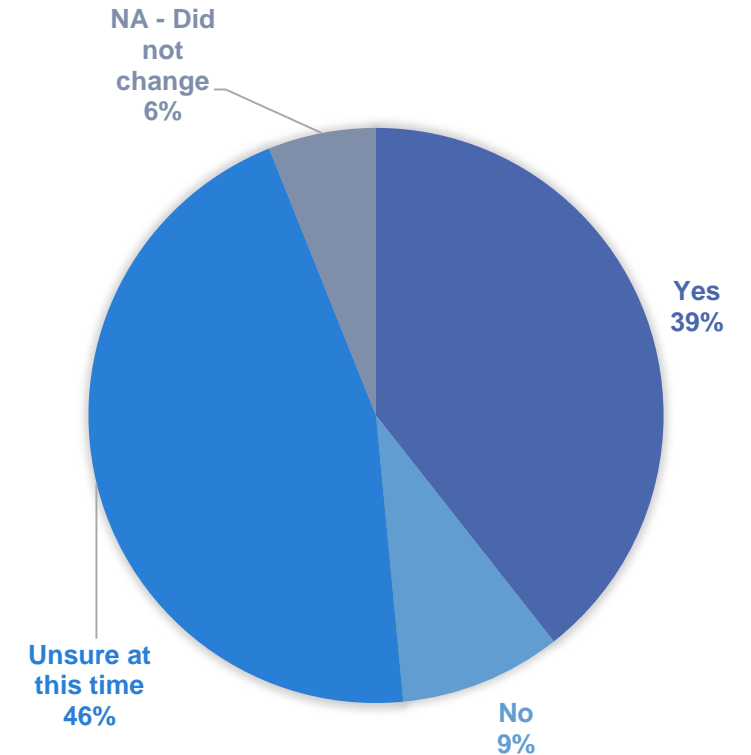
### HOW HAS COVID AFFECTED YOUR SALES?



### HOW HAS COVID AFFECTED YOUR SEAFOOD PURCHASING?



### WILL YOU RETURN TO YOUR PRE-COVID MENU?



*Preliminary findings*

# Preliminary Conclusions: Seafood Information

Important sources	Preferred format	Info sought	Info lacking	Certification programs
<ul style="list-style-type: none"><li>• Sellers</li><li>• Producers</li><li>• Internet</li><li>• Chefs</li></ul>	<ul style="list-style-type: none"><li>• Websites</li><li>• Face-to-face</li><li>• Email</li></ul>	<ul style="list-style-type: none"><li>• Availability/supply</li><li>• Harvest methods</li><li>• Harvest location</li><li>• Local species</li><li>• Price</li><li>• Regulations</li></ul>	<ul style="list-style-type: none"><li>• Availability/supply</li><li>• Environmental impacts on spp.</li><li>• Regulations</li><li>• Legislation</li></ul>	<ul style="list-style-type: none"><li>• &lt; 50% use</li><li>• Seafood Watch most common but...local relevance?</li></ul>

- Sellers, producers, and chefs as sources of knowledge
- Online and face-to-face = preferred media
- Potential for resource managers and scientists to address knowledge gaps
- Desire for info related to local systems and species (abundance, status, threats, etc.)

# Preliminary Conclusions: Wild and Farmed Perceptions

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## Wild Seafood

- Customer preference
  - Diversity/variety
  - Good flavor
  - ~Quality

## Farmed Seafood

- Availability
- Affordability
- Consistency
- ~Sustainability

- Participants largely purchase/recommend both wild and farmed
- Perceptions as areas for future work – outreach/education (misconceptions) as well as research (data gaps)
- Potential to strengthen associations for both wild and farmed?
- Continued analysis: individual conceptions of “farmed seafood”

# Preliminary Conclusions: Factors that Influence Purchasing

*Everything was important, but...*

## Most important

- Quality
- Freshness
- Price
- Customer preferences
- Fits within theme/brand

## Moderate to high importance

- Consistency
- Environmental responsibility
- Relationship w/chefs & wholesalers
- Relationship w/producers

## Least important

- Personal preference
- Underutilized species
- Variety/novelty

## Greatest variability

- Customer preferences
- Relationship w/producers

- Basic factors rank high.
- Moderate factors include some more associated with farmed seafood: consistency, environmental responsibility/sustainability
- Counter to local/sustainable/slow food initiatives re: underutilized species?

# Preliminary Conclusions: Misc.

## Agreement statements

- US seafood is safe
- US seafood is sustainable
- Consumers drive demand
- *Maybe I drive demand, too?*

## COVID impacts

- Decreased quantity
- Decreased high priced items
- Reduced menu
- Increased local purchasing
- Increased frozen items
- Menu uncertainty

- Overall confidence in US seafood management and regulations re: safety and sustainability
- Variable self-perception as influencers of market
- COVID impacts on purchasing present, “pivoting” by necessity

# Next Steps: Within this Project



## Complete data analysis and prepare written end-products

- Extended analyses as appropriate
- Support survey results with interview detail



## Share results and integrate feedback

- Panel-Workshop at Aquaculture America 2022
- Panel-Workshop at Oyster South Symposium



## Extension material(s)

- How to more effectively engage/share seafood-related info



## Peer-reviewed publication(s)



## Integration of findings into server training programs

# Next Steps: Beyond this Project

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## Target server-customer knowledge transfer

- Leverage opportunities with server training programs



## Social network analyses focused on chefs

- Role of subset of industry as influencers/brokers of seafood knowledge



## Template for local/regional seafood guides

- Share with regional partners



# Acknowledgements

## Project Participants



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