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
Crop Insurance Systems, Inc.

Ocean State Aquaculture Association
Ward Oyster Company
Orchard Point Oyster Co
Rural Community Insurance Services

October 28, 2021
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.
### Causes of Loss the Insurance Covers

<table>
<thead>
<tr>
<th>Covered Causes</th>
<th>Excluded Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adverse weather</td>
<td>Mysterious disappearance</td>
</tr>
<tr>
<td>Freeze</td>
<td>Pollution</td>
</tr>
<tr>
<td>Excessive Precipitation</td>
<td>Oil spills</td>
</tr>
<tr>
<td>Drought</td>
<td>Quarantine</td>
</tr>
<tr>
<td>Disease</td>
<td>Boycott</td>
</tr>
<tr>
<td>Low salinity</td>
<td>Loss of value</td>
</tr>
<tr>
<td>High Salinity</td>
<td></td>
</tr>
<tr>
<td>Hurricane</td>
<td></td>
</tr>
<tr>
<td>Ice floe</td>
<td></td>
</tr>
<tr>
<td>Storm surge</td>
<td></td>
</tr>
<tr>
<td>Algae bloom</td>
<td></td>
</tr>
</tbody>
</table>
Income from Operations Without Crop Insurance

“Mother nature is your partner; she is not your friend”
Bob Rheault
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

Total Premium

2011-2020
Premiums Average $10.5 B
Indemnities Average $9.2 B

 Millions

0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000


Premium Indemnity
10 Years of Grower Premium vs Indemnity

Grower Premiums Average: $3.9 B
Indemnities Average: $9.2 B
The Insurance Developers Problem

Devise an accurate system to:

– Set an insurance amount.
– Identify when a loss occurs.
– Determine the amount of loss.
– Estimate insurance cost.

• Pure Premium

Pre loss: What Value?

Post Loss: What’s left?
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.
Seed Purchase

Seed Placed in Upweller

Grow out Location

Harvest

Retail Market (Higher Value)

Wholesale Market

Size Test

Yes

No

Yes

No

Yes

No
## Inventory Model

### Estimating the Oyster Inventory

<table>
<thead>
<tr>
<th>Oyster Size</th>
<th>Oyster Count</th>
<th>Maximum Stocking Density</th>
<th>Oyster Bag Inventory</th>
<th>Survival Rate</th>
<th>Oysters</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ inch</td>
<td>50,000</td>
<td>18,000</td>
<td>3</td>
<td>85%</td>
<td>42,500</td>
</tr>
<tr>
<td>1 inch</td>
<td>42,500</td>
<td>3,200</td>
<td>14</td>
<td>90%</td>
<td>38,250</td>
</tr>
<tr>
<td>2 inch</td>
<td>38,250</td>
<td>550</td>
<td>70</td>
<td>95%</td>
<td>36,338</td>
</tr>
<tr>
<td>3 inch</td>
<td>36,338</td>
<td>190</td>
<td>191</td>
<td>95%</td>
<td>34,521</td>
</tr>
</tbody>
</table>

### Estimating the Oyster Inventory Value

<table>
<thead>
<tr>
<th>Oyster Size</th>
<th>Oyster Count</th>
<th>Survival Rate</th>
<th>Oysters</th>
<th>Value</th>
<th>Inventory Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ inch</td>
<td>50,000</td>
<td>85%</td>
<td>42,500</td>
<td>$0.10</td>
<td>$4,250</td>
</tr>
<tr>
<td>1 inch</td>
<td>42,500</td>
<td>90%</td>
<td>38,250</td>
<td>$0.35</td>
<td>$13,388</td>
</tr>
<tr>
<td>2 inch</td>
<td>38,250</td>
<td>95%</td>
<td>36,338</td>
<td>$0.65</td>
<td>$23,620</td>
</tr>
<tr>
<td>3 inch</td>
<td>36,338</td>
<td>95%</td>
<td>34,521</td>
<td>$0.95</td>
<td>$32,795</td>
</tr>
</tbody>
</table>

Total $74,053
## Likely formulas: Indemnity

### Production to Count

<table>
<thead>
<tr>
<th>Oyster Size</th>
<th>Inventory after Loss (PTC)</th>
<th>Loss from Uninsured Causes</th>
<th>Ending Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ inch</td>
<td>8,500</td>
<td>+ 6000</td>
<td>14,500</td>
</tr>
<tr>
<td>1 Inch</td>
<td>15,300</td>
<td>+ 0</td>
<td>15,300</td>
</tr>
<tr>
<td>2 Inch</td>
<td>16,352</td>
<td>+ 2000</td>
<td>18,352</td>
</tr>
<tr>
<td>3 Inch</td>
<td>17,261</td>
<td>+ 0</td>
<td>17,261</td>
</tr>
</tbody>
</table>

### Post Loss Inventory Value

<table>
<thead>
<tr>
<th>Oyster Size</th>
<th>Ending Inventory</th>
<th>Value per Piece</th>
<th>Ending Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ inch</td>
<td>14,500 x $0.10</td>
<td>= $1,450</td>
<td></td>
</tr>
<tr>
<td>1 Inch</td>
<td>15,300 x $0.35</td>
<td>= $5,355</td>
<td></td>
</tr>
<tr>
<td>2 Inch</td>
<td>18,352 x $0.65</td>
<td>= $11,929</td>
<td></td>
</tr>
<tr>
<td>3 Inch</td>
<td>17,261 x $0.95</td>
<td>= $16,398</td>
<td></td>
</tr>
</tbody>
</table>

### Indemnity Amount

- Insurance Guarantee: $51,837
- Post Loss Inventory Value: $35,132
- Indemnity Amount: $16,705
Expected Liability

Good agreement between program and industry
70% of crop insured at or above 65%

<table>
<thead>
<tr>
<th>Percent of Crop Value Covered</th>
<th>Coverage Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8</td>
<td>0.10 0.05 0.15 0.35 0.25 0.10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>State</th>
<th>Farm Gate Value (000)</th>
<th>50%</th>
<th>55%</th>
<th>60%</th>
<th>65%</th>
<th>70%</th>
<th>75%</th>
<th>Liability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine</td>
<td>$9,670</td>
<td>$271</td>
<td>$213</td>
<td>$696</td>
<td>$1,760</td>
<td>$1,354</td>
<td>$580</td>
<td>$4,874</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>$419</td>
<td>$12</td>
<td>$9</td>
<td>$30</td>
<td>$76</td>
<td>$59</td>
<td>$25</td>
<td>$211</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>$28,385</td>
<td>$795</td>
<td>$624</td>
<td>$2,044</td>
<td>$5,166</td>
<td>$3,974</td>
<td>$1,703</td>
<td>$14,306</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>$5,745</td>
<td>$161</td>
<td>$126</td>
<td>$414</td>
<td>$1,046</td>
<td>$804</td>
<td>$345</td>
<td>$2,895</td>
</tr>
<tr>
<td>Connecticut</td>
<td>$15,000</td>
<td>$420</td>
<td>$330</td>
<td>$1,080</td>
<td>$2,730</td>
<td>$2,100</td>
<td>$900</td>
<td>$7,560</td>
</tr>
<tr>
<td>New Jersey</td>
<td>$1,370</td>
<td>$38</td>
<td>$30</td>
<td>$99</td>
<td>$249</td>
<td>$192</td>
<td>$82</td>
<td>$690</td>
</tr>
<tr>
<td>Maryland</td>
<td>$3,651</td>
<td>$102</td>
<td>$80</td>
<td>$263</td>
<td>$664</td>
<td>$511</td>
<td>$219</td>
<td>$1,840</td>
</tr>
<tr>
<td>Virginia</td>
<td>$13,100</td>
<td>$367</td>
<td>$288</td>
<td>$943</td>
<td>$2,384</td>
<td>$1,834</td>
<td>$786</td>
<td>$6,602</td>
</tr>
<tr>
<td>North Carolina</td>
<td>$2,400</td>
<td>$67</td>
<td>$53</td>
<td>$173</td>
<td>$437</td>
<td>$336</td>
<td>$144</td>
<td>$1,210</td>
</tr>
<tr>
<td>South Carolina</td>
<td>$649</td>
<td>$18</td>
<td>$14</td>
<td>$47</td>
<td>$118</td>
<td>$91</td>
<td>$39</td>
<td>$327</td>
</tr>
<tr>
<td>$80,389</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total $40,516</td>
</tr>
</tbody>
</table>
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. Egna, M. Maldonado, F. Conway
Enhancing community resilience and seafood sustainability through a diverse seafood processing workforce

LORI A. CRAMER, FLAXEN D.L. CONWAY, MARTA MALDONADO, HILLARY EGNA, JENNIFER BEAULLIEU
The Oregon Seafood Processing Story

- 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

- 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

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

- 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

- 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

- 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

- **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

- 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

- 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

“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

- 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?

Conclusions to date

- 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 Luca¹, Lucas Marxen², Jeanne Herb³, Lisa Calvo⁴, David Bushek⁴, Russ Babb⁵, Jeff Normant⁵, Michelle Stuart², Zack Greenberg⁶ and Megan Kelly⁵

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 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](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)
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?

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

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?

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?

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

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?

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?

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?

_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
Phase 1: Q – Concourse and Q Sample

What is the structure of values associated with aquaculture production?

Qualitative Data

Q Methodology
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)
Phase 1: Q – Analysis

Factor Analysis

Perspectives (Factors)

Watts and Stenner, 2012

Schmolck, 2014 (PQMethod)
### Perspectives

1. The aquaculture preservationist
2. The ecological aquaculturist
3. The aquacultural pessimist
4. The aquacultural minimalist

### Summary Points

1. Seafood production prominent; Aquaculture for communities
2. Aquaculture prominent; Science; Enviro benefits; Fishing problematic
3. Fishing prominent; Fishing subject to outside forces; Aquaculture problematic
4. Fishing prominent; Aquaculture can fit in; Local rights to access and produce

**Total Variance Explained = 50%**
Sample Q Results (NC Example)

<table>
<thead>
<tr>
<th>Table 2. Synopsis of Results</th>
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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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28 When we’re talking about our waters, stewardship is more important than seafood production. We have to protect our resources first. 

-5 = least like the way I think
5 = most like the way I think
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

<table>
<thead>
<tr>
<th>Quality</th>
<th>More associated with wild-caught</th>
<th>Associated equally with wild-caught and farmed</th>
<th>More associated with farmed</th>
<th>Associated with neither wild-caught nor farmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to access</td>
<td>19.3</td>
<td>23.3</td>
<td>34.1</td>
<td>5.3</td>
</tr>
<tr>
<td>Affordable</td>
<td>20.9</td>
<td>18.3</td>
<td>36.7</td>
<td>6.8</td>
</tr>
<tr>
<td>Sustainable</td>
<td>25.6</td>
<td>21.4</td>
<td>26.7</td>
<td>4.8</td>
</tr>
<tr>
<td>Good for local environments</td>
<td>32.2</td>
<td>20.6</td>
<td>19.6</td>
<td>4.9</td>
</tr>
<tr>
<td>Good for local economies</td>
<td>32.8</td>
<td>24.6</td>
<td>19.5</td>
<td>5.1</td>
</tr>
<tr>
<td>Safe</td>
<td>32.9</td>
<td>27.0</td>
<td>18.4</td>
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<tr>
<td>Good for local culture</td>
<td>36.6</td>
<td>21.2</td>
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<td>4.8</td>
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<tr>
<td>Local</td>
<td>40.8</td>
<td>19.7</td>
<td>16.7</td>
<td>6.0</td>
</tr>
<tr>
<td>Tasty</td>
<td>43.6</td>
<td>30.5</td>
<td>6.7</td>
<td>5.0</td>
</tr>
<tr>
<td>Healthy</td>
<td>45.3</td>
<td>23.1</td>
<td>11.2</td>
<td>4.3</td>
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<tr>
<td>Fresh</td>
<td>50.7</td>
<td>22.4</td>
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Percentage of respondents
Phase 2: Sample Survey Results (NC Example)

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<th>3=Third most important</th>
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<td>Protecting small and family businesses</td>
<td>213</td>
<td>182</td>
<td>152</td>
</tr>
<tr>
<td>Environmental sustainability</td>
<td>254</td>
<td>133</td>
<td>137</td>
</tr>
<tr>
<td>Fair wages for seafood producers</td>
<td>105</td>
<td>174</td>
<td>115</td>
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### Top 3 Considerations When Managing Mariculture

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<tr>
<td>Addressing food security</td>
<td>120</td>
<td>109</td>
<td>111</td>
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<tr>
<td>Maintenance of coastal culture and heritage</td>
<td>76</td>
<td>98</td>
<td>133</td>
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<tr>
<td>Statewide economic development</td>
<td>62</td>
<td>98</td>
<td>125</td>
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<tr>
<td>Coastal community development</td>
<td>68</td>
<td>92</td>
<td>117</td>
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<tr>
<td>Emphasizing wild-caught seafood harvest</td>
<td>76</td>
<td>72</td>
<td>56</td>
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<tr>
<td>Addressing the U.S. seafood trade deficit</td>
<td>33</td>
<td>53</td>
<td>51</td>
</tr>
<tr>
<td>Emphasizing farmed seafood production</td>
<td>31</td>
<td>27</td>
<td>41</td>
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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  |  luke.fairbanks@usm.edu
Thank You!

Luke Fairbanks: lukefairbanks.com | luke.fairbanks@usm.edu
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
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
Asst. Prof. Halley Froehlich  
EEMB/ES University of California, Santa Barbara

Assoc. Prof. Sarah Lester  
Geography  
Florida State University

Dr. Luke Gardner  
California Sea Grant  
University of California San Diego

Kim Thompson  
Aquarium of the Pacific  
Seafood for the Future

Prof. Gretchen Hoffman  
EEMB University of California, Santa Barbara

Mae Rennick  
EEMB University of California, Santa Barbara

Dr. Rebecca Gentry  
Geography  
Florida State University

Hayley Lemoine  
Geography  
Florida State University

Sebastian Tapia  
Bren School University of California, Santa Barbara
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
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
Source: directly from
farms/operations

State-level not public
Regional/National,
semi-annual
reports/highlights
(marine focus)
Source: agencies & other orgs

Mixed availability
Individual state
agencies &
organizations

State solicited
1.5 yrs, 50+ experts
Comparing data, marine aquaculture numbers don’t quite match

Value\textsubscript{2018} = $525 million
Value\textsubscript{corrected} = $572 million

\[\Delta$ = $47 million\]

Volume = ???
Spp/group = 23

\[\begin{array}{ll}
\text{NOAA} & 37,347 \text{ tonnes} \\
\text{USDA} & 65 \text{ spp/group} \\
\text{NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION} & 39,200 \text{ tonnes} \\
\text{U.S. DEPARTMENT OF COMMERCE} & (30)??? \text{ spp/group}
\end{array}\]
A closer look at USDA and state solicited data reveals data access/quality vary per state

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

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

From farms/operations on NASS ‘List Frame’

Option #1
National Agricultural Statistics Service (NASS) & Economic Research Service (ERS)

Expand Survey to Marine
- Value and volume
- Size/life-stage
- Sources of loss to production

Option #2
The National Marine Fisheries Service (NMFS) & Office of Science and Technology (OST)

Adopt Fisheries Information Networks
- Value & volume (landings)
- Species

From state agencies & other organizations
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
<table>
<thead>
<tr>
<th>Enabling factors</th>
<th>Policy attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aquaculture development act or comprehensive legislation</td>
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<table>
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<tr>
<td>Illegal aquaculture or aquaculture moratoriums</td>
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<tr>
<td>Same agency for freshwater and marine aquaculture</td>
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<td>Same agency for marine fisheries and aquaculture</td>
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<td>Aquaculture and climate change policy</td>
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<td>Enabling factors</td>
<td>Policy attributes</td>
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<tr>
<td>Aquaculture and climate change policy</td>
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</table>
Enabling policy score
Predicting mariculture output?

- Number of Species vs. Enabling Policy Score
- Number of Farms vs. Enabling Policy Score
- Number of Acres (in Thousands) vs. Enabling Policy Score
- Sales Value (Million USD) vs. Enabling Policy Score

Statistical significance:
- P = 0.017
- $R^2 = 0.27$
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<tr>
<th>State</th>
<th>Development act or comprehensive legislation</th>
<th>Freshwater aquaculture provisions</th>
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<th>Aquaculture BMPs</th>
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<th>If yes, comprehensive multi-use RFG</th>
<th>Government contact</th>
<th>Regulatory Guidance</th>
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</table>
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

WORKSHOPS

POLICY BRIEF

MAGAZINE

Adequate Data?

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

<table>
<thead>
<tr>
<th>Uncertainty Type</th>
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<tbody>
<tr>
<td>1. Confidentiality</td>
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<td>2. Uncertain zeros</td>
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<td>3. Differing submissions types &amp; forms</td>
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<td>4. Non-standardized units</td>
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<td>5. Non-standardized conversion factors</td>
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<td>6. Fisheries and aquaculture data pooled</td>
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<td>7. Freshwater or marine</td>
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<td>8. Pilot species</td>
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<td>9. Infrequent reporting</td>
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<td>10. Data entry format</td>
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<td>11. Taxonomic resolution</td>
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<td>12. Definition of aquaculture</td>
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<td>13. Reclassification</td>
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<td>14. Change in staff or agency responsible for data</td>
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<tr>
<td>15. Lack of participation</td>
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SBE-Fisheries Interactions & Carbon Offsets: Assessing Existing and Potential Seaweed Aquaculture

S. Gaines, C. Lester, R. Geyer, S. Augyte
Fisheries Interactions & Carbon Offsets: Assessing existing & potential seaweed aquaculture
Seaweed’s Carbon Sequestration Potential

Aquaculture Fisheries Interactions
How do we capture the co-benefits of seaweed aquaculture?
Seaweed’s carbon sequestration potential

Key Issues:

- How is the seaweed used?
- What are the costs? (emissions & $$)
- What is the potential scale?

High Growth Potential, Limited Resources
Seaweed’s carbon sequestration potential
Seaweed’s Carbon Sequestration Costs
Seaweed’s Carbon Sequestration Scalability

Deep Ocean Sinking Scaling:
19,000 fold increase in global production
18 million km²
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

![Bar chart showing cost of mitigation for different methods. Seaweed Nutrient Removal has the lowest cost, followed by Wetland, Buffers, Cover Crops w/Erosion Controls, Cover Crops, Nutrient Management w/Erosion Controls, Drainage Water Management w/Erosion Controls, Erosion Controls, Drainage Water Management, and Nutrient Management.](chart.png)
Seaweed aquaculture could represent a cost effective -- potentially revenue generating -- intervention for remediating global nutrient pollution.
Key need: Better pollution markets
Aquaculture Fisheries Interactions
Altered Carrying Capacity

**Limited access to fishing**

Added structure from a farm limits access to wild fish harboring at a farm. Some regulations add to this protection by limiting fishing around ocean farms as well.

**Aggregation**

Wild species are attracted to the novel structure of the farm or food subsidies from excess feed or waste where farms can support higher densities than elsewhere.

**Direct impacts**

- **Positive impacts**
  - Wild organisms can receive benefit from food subsidies or protection from natural predation that the structure of a farm might provide.

- **Negative impacts**
  - Farm outputs can cause stress or damage to wild populations through eutrophication, parasites from overstocked cages and other consequences from an unhealthy farm.
Opposing Effects

FAD

MPA

Opposing Effects

Deviation from status quo

years

Catc

Bioma

ss

years
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
Georgia’s New Oyster Farming Program
Changes to the Oyster Mariculture Industry

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.

New demand for single oysters sold by the half shell.

Creation of subtidal water bottom leases allowing for oyster farming in floating cages.
Fight over floating oyster farms erupts anew as SC bill could pause summer harvest

Oyster Growers and Boaters at Odds Over Bay Lease Locations

Homeowners File Land Ownership Lawsuit Over Oyster Farm Plan

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

*For illustration only, not an actual lease location.*
AERIAL SITE RELATION TO MARSH
Sketch for Rendering
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.
Oyster Lease Site

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

Motor boating: 91%
Fishing: 90%
Walking or hiking: 52%
Sunbathing: 42%
Kayaking, canoeing, or paddleboarding: 42%
Bike riding: 38%
Birdwatching: 26%
Harvesting wild oysters: 20%
Sailing: 10%
Other: 8%

Several times a week: 50%
Once a week: 10%
Several times a month: 24%
Once a month: 6%
Several times a year: 9%
Once a year: 0.5%
Less than once a year: 0.4%
None in the past two years: 0.3%
Coastal Recreational Priorities

- Having clean/unpolluted water: 73%
- Having access to fishing: 63%
- Viewing natural scenery: 38%
- Viewing marine wildlife: 37%
- Being in a quiet, peaceful place: 30%
- Seeing undeveloped shoreline: 28%
- Recreating with other boaters: 26%
- Avoiding boat traffic: 13%
- Other: 8%

PRELIMINARY RESULTS
Oyster Farming Familiarity

How familiar are you with oyster farming?

- Not at all familiar: 34%
- Slightly familiar: 40%
- Moderately familiar: 17%
- Familiar: 6%
- Very familiar: 3%

Have you ever seen an oyster farm in person?

- Yes: 30%
- No: 62%
- I don't know: 8%
Oyster Farming Support

1. I support oyster farming in general
   - 13% Strongly Disagree
   - 5% Disagree
   - 7% Neither同意不同意
   - 52% Agree
   - 24% Strongly Agree

2. I support oyster farming in Georgia's coastal waters
   - 12% Strongly Disagree
   - 7% Disagree
   - 10% Neither同意不同意
   - 47% Agree
   - 24% Strongly Agree

3. I support more oyster farming in Georgia
   - 14% Strongly Disagree
   - 8% Disagree
   - 10% Neither同意不同意
   - 47% Agree
   - 24% Strongly Agree

4. I support oyster farming in Georgia's coastal waters near my home
   - 12% Strongly Disagree
   - 14% Disagree
   - 13% Neither同意不同意
   - 40% Agree
   - 20% Strongly Agree

5. I support oyster farming in Georgia's coastal waters that I use the most
   - 12% Strongly Disagree
   - 15% Disagree
   - 16% Neither同意不同意
   - 40% Agree
   - 18% Strongly Agree

I don't know

Preliminary Results
### Oyster Farming Benefits

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<th>Harmful</th>
<th>Neither harmful nor beneficial</th>
<th>Beneficial</th>
<th>Extremely beneficial</th>
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<td>10%</td>
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<td>Water quality</td>
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<td>6%</td>
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<td>Wild shellfish harvesting</td>
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<td>3%</td>
<td>27%</td>
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<td>Commercial use of coastal waters</td>
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<td>Recreational use of coastal waters</td>
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<td>Georgia's coastal scenery</td>
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*PRELIMINARY RESULTS*
## Oyster Farming Perceived Recreational Impact

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<th>Extremely harmful</th>
<th>Harmful</th>
<th>Neither harmful nor beneficial</th>
<th>Beneficial</th>
<th>Extremely beneficial</th>
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<tbody>
<tr>
<td>Recreational boating</td>
<td>22%</td>
<td>42%</td>
<td>28%</td>
<td>5%</td>
<td>4%</td>
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<tr>
<td>Enjoying natural beauty</td>
<td>21%</td>
<td>35%</td>
<td>40%</td>
<td>2%</td>
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<tr>
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<td>28%</td>
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<tr>
<td>Commercial fishing</td>
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<td>Beach activities</td>
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<tr>
<td>Birdwatching</td>
<td>8%</td>
<td>9%</td>
<td>69%</td>
<td>11%</td>
<td>4%</td>
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<tr>
<td>Other uses</td>
<td>19%</td>
<td>8%</td>
<td>63%</td>
<td>3%</td>
<td>7%</td>
</tr>
</tbody>
</table>

**PRELIMINARY RESULTS**
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
Kelsey Broich – kbroich@uga.edu
Brian Simmons – brian.simmons@uga.edu
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

HTTPS://KAPSAR.SITES.UCSC.EDU
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

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

Crop ingredients

EPA

DHA

- Project overview
- Progress to date
- Next steps
Sustainability: Alternative ingredients

- Project overview
- Progress to date
- Next steps
Open-source aquafeed decision support tool

- Open source aquafeed software
- Aquafeed life-cycle assessment database
- Techno-economic assessment database
- Performance metrics database

Sustainable?

Project overview
Progress to date
Next steps
Project objectives

Objectives:
1. Environment: Life cycle analysis
2. Economics: Techno-economic analysis
3. Nutrition: Feed conversion ratio, Protein & amino acids
4. Software: Open-access decision-support tool for rainbow trout feeds

Legend:
- Low levels of completion
- High levels of completion

Steps:
- Meta-model database
- Literature search
- Inventory: material & energy inputs
- Process model development

Next steps:
- Project overview
- Progress to date
Communication with industry advisors

- Project overview
- Progress to date
- Next steps

Logos of Sea Grant, Anthropocene Institute, Zeigler, Calysta, Cellana, Veramaris, and Corbion.
Meta-model database: Life cycle assessment

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: Methyllococcus capsulatus
- Soldier fly larvae meal
- Macroalgae: Ulva meal
Meta-model database: Life cycle assessment

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

Alternative ingredients included in our analysis

- **Nannochloropsis oculata meal**
- Whole cell **Schizochytrium**
- **Schizochytrium oil**
- **Mealworm meal**
- Single cell protein: **Methylococcus capsulatus**
### Meta-model database: Economic assessment

**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

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

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**Executable file:**

- OperationalADST_Full_V12_a
Software development

F3 Mixr

Aquafeed decision-support tool
Kapuscinski-Sarker Lab
University of California, Santa Cruz

Select salmonid species
### Software development

#### Input feed ingredients

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish meal</td>
<td>0.2</td>
</tr>
<tr>
<td>Corn gluten meal</td>
<td>0.85</td>
</tr>
<tr>
<td>Wheat Flour</td>
<td></td>
</tr>
<tr>
<td>Soybean meal</td>
<td></td>
</tr>
<tr>
<td>Fish oil</td>
<td></td>
</tr>
<tr>
<td>Soy protein concentrate</td>
<td>0.2</td>
</tr>
<tr>
<td>Wheat gluten meal</td>
<td>0.65</td>
</tr>
<tr>
<td>Soy oil</td>
<td></td>
</tr>
<tr>
<td>Corn oil</td>
<td></td>
</tr>
<tr>
<td>Canola oil</td>
<td>0.12</td>
</tr>
<tr>
<td>Poultry byproduct meal</td>
<td>0.2</td>
</tr>
<tr>
<td>Blood meal</td>
<td>0.67</td>
</tr>
<tr>
<td>Nanochloropsis meal</td>
<td>0.67</td>
</tr>
<tr>
<td>Marine microalgae (Schizochytrium) oil</td>
<td></td>
</tr>
<tr>
<td>Marine microalgae (Schizochytrium) whole cells</td>
<td>0.023</td>
</tr>
<tr>
<td>Single cell protein (Methylococcus capsulatus) meal</td>
<td></td>
</tr>
<tr>
<td>Black soldier fly larvae (Hemietta illucis) meal</td>
<td></td>
</tr>
<tr>
<td>Mealworm larvae (Tenebrio molitor) meal</td>
<td></td>
</tr>
<tr>
<td>Yeast (Saccharomyces cerevisiae)</td>
<td></td>
</tr>
<tr>
<td>Fish meal from byproducts</td>
<td></td>
</tr>
<tr>
<td>Fish oil from byproducts</td>
<td></td>
</tr>
<tr>
<td>Macroleauge (Ulva)</td>
<td></td>
</tr>
</tbody>
</table>

This table shows the ingredients and their respective amounts in grams per kilogram of feed.
Software development

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.
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

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. Wi


Meta-model database

- 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

- Add optional open source optimization tool
- Produce software user’s manual and video demonstration
Disseminate results

• 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

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

1. Qualitatively Measure Shellfish Mariculture Tourism Supply (Objective 1)
2. Compare Shellfish Mariculture Tourism Supply and Demand (Objective 4)
3. Quantitatively Measure Demand for Shellfish Mariculture Tourism Experiences (Objectives 2 and 3)
4. Identify, Promote, and Evaluate Preliminary Shellfish Mariculture Tourism Experiences Based on Supply/Demand Comparison (Objectives 5 and 6)
5. Refine Strategies for Shellfish Mariculture Tourism Experience Development Using Additional Demand Data and Evaluation of Preliminary Experiences (Objectives 7 and 8)
6. Establish Resources to Support Recommended Shellfish Mariculture Tourism Experience Development Strategies (Objective 9)
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.

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

**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

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

**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.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective 4</strong>: Compare potential shellfish mariculture tourists’ experience preferences with current NC shellfish mariculture tourism assets</td>
<td><strong>Ongoing comparison</strong> of shellfish mariculture asset inventory with survey results</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Peer-Reviewed Conference Presentations</th>
<th>Invited Presentations</th>
<th>Media Coverage</th>
<th>Educational Experiences</th>
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<tbody>
<tr>
<td>3 international conferences</td>
<td>1 regional conference</td>
<td>2 national news stories</td>
<td>7 workshops</td>
</tr>
<tr>
<td>3 national conferences</td>
<td>2 local conferences</td>
<td>8 local news stories</td>
<td>1 internship experience</td>
</tr>
<tr>
<td>6 outreach presentations</td>
<td></td>
<td></td>
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</tbody>
</table>

### Travel and Tourism Research Association Annual Conference (virtual, June 2021).
- Aquaculture America Conference. (Honolulu, HI; Feb. 2020).

### Invited Presentations
- NC Catch Summit (Raleigh, NC; Mar. 2020).
- Oysters South Conference (Wilmington, NC; Feb. 2020).

### Media Coverage
- How America’s oyster farms are drawing more visitors than ever. (Conde Nast Traveler; Aug. 2021)
- North Carolina Oyster Trail highlights Outer Banks-farmed mollusks in effort to restore crucial species. (The Virginian Pilot; Apr. 2021).

### Educational Experiences
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
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

IT'S NATIONAL OYSTER WEEKEND

Why not "taste the rainbow" of N.C. oysters?

Sweet
Salty
Bitter
Umami
Sour
Buttery
Next Steps

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

<table>
<thead>
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<th>Actions</th>
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<tbody>
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<td><strong>Objective 8:</strong> Create strategies for the continued development of shellfish mariculture tourism experiences</td>
<td>Establish recommendations for mariculture tourism development based on:</td>
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<tr>
<td></td>
<td>• Asset inventory (focus on gaps)</td>
</tr>
<tr>
<td></td>
<td>• Tourist demand data</td>
</tr>
<tr>
<td></td>
<td>• Experience evaluations</td>
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<tr>
<td><strong>Objective 9:</strong> Establish best practices for shellfish mariculture tourism entrepreneurs</td>
<td>Craft and publish resources to share recommendations through:</td>
</tr>
<tr>
<td></td>
<td>• 1 - 2 page technical reports</td>
</tr>
<tr>
<td></td>
<td>• Workshops</td>
</tr>
<tr>
<td></td>
<td>• Extension FactSheets</td>
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</tbody>
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Questions

Whitney Knollenberg
Whitney_Knollenberg@ncsu.edu
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).
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
INITIAL SURVEY

Aquaculture Education
(Classroom, Farm Visits, Social Events)

Impact Evaluation

Follow-up Survey
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 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 chenylee@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.

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.
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
**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.

| School name and location: | Waimea High School  
|--------------------------|-----------------------------|
| Participating teacher(s): | Tyson, Asante Marine Biology  
|                          | Kate, Konadin English  
| Work phone:              | T/M call cell for best results  
| Cell phone:              | T/M: 808-330-9742  
| Preferred email:         | t.asante@seaanders.k12.hi.us  
| Number of classes participating in project (i.e., 2 classes, 16 students each): | 2 classes  
|                         | Period 1: 22 students  
|                         | Period 2: 13 students  
| Title / subject of class(es): | Period 1: Environmental Resources Management  
|                         | Period 2: Natural Resource Product 1  
| Total amount of student participants (anticipated): | 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:

| Lesson 1: Seafood & Human Health | USDA guidelines pertaining to seafood. 5  
|---------------------------------|------------------------------------------
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
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".

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<thead>
<tr>
<th>I prefer to eat seafood caught in the ocean (wild-caught seafood) because:</th>
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<td>17.2 Wild-caught seafood is better for the environment than farm-raised seafood (aquaculture)</td>
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<td>(a) I disagree</td>
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<td>17.3 Wild-caught seafood is healthier than farm-raised seafood (aquaculture)</td>
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<td>(a) I disagree</td>
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<td>17.4 I prefer wild-caught seafood more than farm-raised seafood (aquaculture) because that is what I eat at home</td>
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<td>(a) I disagree</td>
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<table>
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<tr>
<th>I prefer to eat farm-raised (aquaculture) seafood because:</th>
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<td>17.5 Farm-raised seafood (aquaculture) seafood tastes better than wild-caught seafood</td>
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<td>(a) I disagree</td>
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<td>17.6 Farm-raised seafood (aquaculture) is better for my health than wild-caught seafood</td>
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<td>(a) I disagree</td>
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<td>17.7 Farm-raised seafood (aquaculture) seafood is better for the environment than wild-caught seafood</td>
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<td>(a) I disagree</td>
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<tr>
<td>17.8 I prefer farm-raised seafood (aquaculture) seafood than wild-caught seafood because that is what I eat at home</td>
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<td>(a) I disagree</td>
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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
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
Navigating the Kelp Forest: Current and Legal Issues Surrounding Seaweed Wild Harvest and Aquaculture

Catherine Janisse 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 building demand for 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 $15 million annually, making it one of the state’s most valuable communities. Seaweed and kelp aquaculture in other areas could help replace traditional habits that are being negatively impacted by changing ocean conditions.

In addition to those economic benefits, a commercial seaweed and kelp industry could also have significant ecological impacts—seaweed takes up carbon dioxide, downregulates levels of nitrogen and phosphorus, and gives 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, allowing potential public use complications. Further, there are issues regarding the Food and Drug Administration’s (FDA) and the U.S. Department of Agriculture’s (USDA) respective regulations of seaweed and kelp producers. 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 algal market—valued at approximately $5 billion—has been historically focused in East Asian countries, with seaweed and kelp frequently used in regional cuisine. Donald J. McFadyen, A Guide to the Seaweed Industry (2003). Production for human consumption contributes to around $5 billion of this market, while substances extracted from seaweed, known as polysaccharides and mucilages, have many uses as the remaining raw material.

Seaweed and kelp can be either wild harvested or commercially cultivated, but harvesting produces more than 90 percent of the world demand. Microalgae are typically cultivated either offshore in large floating macro aquaculture systems or onshore in large flow systems. In off-bottom line farming, seaweed and kelp are grown in large flow systems.

Ms. Janisse is a senior research analyst 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 cj@alumni.uchicago.edu. Ms. Nichols is the executive legal fellow of the National Sea Grant Law Center, located at the University of Mississippi School of Law. She may be reached at amnichols@uga.edu.

Statutory and Regulatory Framework:

At the federal level, a lack of current, clear, and applicable statutory and regulatory structures for commercial seaweed and kelp aquaculture complicates matters. The 1991娛862 and 2004מרי1181 regulate commercial seaweed and kelp aquaculture. Current FDA and USDA regulations for handling, storing, processing, and organic certification also do not clearly apply to all aspects of commercial seaweed and kelp aquaculture. The current treatment of red algae in commercial seaweed and kelp aquaculture in Alaska, California, and Maine provide insight into how the industry may further develop in other parts of the country.

Section 10 of the act requires that activities conducted below the high water line of our various ocean waters be approved and permitted by the U.S. Army Corps of Engineers (COPs). Section 12 of the act requires that activities conducted below the high water line of our various ocean waters be approved and permitted by the U.S. Army Corps of Engineers (COPs). Section 10 of the act requires that activities conducted below the high water line of our various ocean waters be approved and permitted by the U.S. Army Corps of Engineers (COPs). Section 12 of the act requires that activities conducted below the high water line of our various ocean waters be approved and permitted by the U.S. Army Corps of Engineers (COPs). Section 10 of the act requires that activities conducted below the high water line of our various ocean waters be approved and permitted by the U.S. Army Corps of Engineers (COPs). Section 12 of the act requires that activities conducted below the high water line of our various ocean waters be approved and permitted by the U.S. Army Corps of Engineers (COPs). Section 10 of the act requires that activities conducted below the high water line of our various ocean waters be approved and permitted by the U.S. Army Corps of Engineers (COPs).
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)
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.
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)?
Project Inspiration: Building Consensus in the West

Resource Managers

Law Enforcement

State Attorneys General
Project Overview


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

<table>
<thead>
<tr>
<th>Federal Considerations</th>
<th>State Efforts</th>
<th>Industry Barriers and Challenges</th>
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<tbody>
<tr>
<td>August 27</td>
<td>September 23</td>
<td>October 22</td>
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</table>
| • Nancy Balcom, Guidance for the U.S. Seaweed Industry: Why is it Needed? | • Kristin Derosia-Banick, Connecticut  
• Peter Oshiro, Hawaii  
• Kimberly Stryker, Alaska  
• California Department of Health | • Sebastian Belle, Maine Aquaculture Association  
• Markos Scheer, Sea Grove Kelp  
• Michael Graham, Monterey Bay Seaweeds  
• Suzie Flores, Stonington Kelp Company |
| • Emanuel Hignutt, Jr., FSMA Preventive Controls for Human Foods with Emphasis on Seaweed | | |
| • Catherine Janasie, USDA Regulation of Seaweed | | |

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
# March 2021 Workshop - Week 2

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## Day 5: What Guidance?

## Day 6: State Regulators Workday

## Day 7: Narrowing In

## Day 8: Moving Forward & Reflecting Back
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.
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?

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

Stephanie Otts
sshowalt@olemiss.edu

Catherine Janasie
cjanasie@olemiss.edu
SBE-An Assessment of Mariculture Feasibility in American Samoa

S. Pautzke, T. Spence
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
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

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)?
Why study land-based RAS?

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 Bute.
Project Overview

**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?

**Macro Level (U.S.)**

- Compare across sites to:
  - Examine similarities and differences in how perceptions explain support for RAS
  - Examine change in public discourse over time

**Meso Level (RAS Site)**

- Examine public discourse within each site via:
  - Public meetings & comments
  - News media content
- Examine community-level perceptions via:
  - Aggregate survey responses

**Micro Level (Individual)**

- Examine individuals’ perceptions in each site via:
  - In-depth interviews
  - Representative mail survey
RAS Facility Sites

- Samoa Peninsula, CA
- Bucksport, ME
- Belfast, ME
- 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

(Rickard et al., under review)
“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

(Rickard et al., under review)
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

(Rickard et al., under review)
RAS as relative restoration

“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

(Rickard et al., under review)
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

(Johnson et al., in prep)
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

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

Trust & Confidence

Cooperation

(Earle & Siegrist, 2008; Johnson et al., in prep)
Trust in Corporation

Confidence in Corporation

RAS Project

Benefits > Risks

Cooperation

Trust in Government

χ² = 3.68, df = 2, p > .05, χ²/df = 1.84, RMSEA = .046 (90% confidence interval [CI] = .00, .12); CFI = .99, TLI = .99

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

(Johnson et al., in prep)
Next steps

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

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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\textsuperscript{1,2} and Adriane Michaelis\textsuperscript{1,3}

\textsuperscript{1}Auburn University Shellfish Lab
\textsuperscript{2}Virginia Institute of Marine Science
\textsuperscript{3}NOAA NMFS Southeast Fisheries Science Center

Sea Grant Aquaculture Research Symposia: October 28, 2021
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?
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)
Research Questions

• 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

All aspects of research approved by Auburn University Institutional Review Board.
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

---

**Research approach**
- COVID-19 Impacts

**Business closures**
- Participant access
- Participant interest

**Participant interest**
- Wholesaler 13%
- Purchaser 29%
- FOH 13%
- Chef 45%
Phase 1: Results to Inform Survey

- INFORMATION ACCESS & TRANSFER
- FACTORS INFLUENCING PURCHASE
- COVID IMPACTS ON PURCHASING
- VARIABLE FRAMEWORKS OF UNDERSTANDING
Phase 2: Survey

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)

**REGION**
- West Coast: 29%
- Mid Atlantic: 21%
- Midwest: 8%
- New England: 16%
- Southeast & Gulf: 26%

**ROLE 1**
- Chef: 26%
- Wholesale: 19%
- Server/FOH: 11%
- Retail: 5%
- Restaurant Purchaser: 34%
- Owner: 5%
- Direct Customer Interactions: 13%

**ROLE 2**
- Purchaser: 87%

**GENDER**
- Female: 45%
- Male: 52%
- Prefer not to say: 3%

**ETHNICITY**
- Hispanic/Latino: 18%
- Non-Hispanic/Non-Latino: 82%
Phase 2: Survey Participants

- RESTAURANT
  - Independently owned, single-location operation: 57%
  - Part of a local or regional chain or restaurant group: 43%

- AVE. ENTREE
  - $15-25: 39%
  - $26-50: 61%

- DISTRIBUTION
  - Globally - throughout and outside of the US: 14%
  - Nationally - throughout the US: 29%
  - Regionally - within a subset of US states: 43%
  - No response: 14%
  - No geographic area I will not purchase from: 69%

WHERE DO YOU PURCHASE SEAFOOD FROM?
- Globally - throughout and outside of the US: 33%
- Nationally - throughout the US: 24%
- Regionally - within a subset of US states: 37%
- Outside of my region: 9%
- No geographic area I will not purchase from: 69%

I WILL NOT PURCHASE SEAFOOD FROM:
- Outside of the US: 22%
Phase 2 Results: Seafood Information (N = 38)

Where do you get seafood related information?

- Seafood Sellers: 82%
- Seafood Producers: 82%
- Internet: 74%
- Chefs: 68%
- Books/Mags: 66%
- Resource Management: 66%
- Industry Events: 63%
- Non-Profit Orgs: 55%
- News: 50%
- Restaurant Staff/Servers: 45%
- Formal Ed.: 34%
- Scientists: 29%
- Other: 11%
Phase 2 Results: Seafood Information (N = 38)

What is your preferred information format?

- Websites, online videos: 68%
- Face-to-face convos: 61%
- Email: 58%
- In-person events: 42%
- Print media: 32%
- Virtual events: 32%
- Books: 26%
- Telephone: 26%
- Mobile apps: 5%

Preliminary findings
Phase 2 Results: Seafood Information (N = 38)

What type of info do you seek?

- **Availability/supply**: 82%
- **Harvest methods**: 82%
- **Local species**: 76%
- **Harvest location**: 74%
- **Price**: 71%
- **Climate/environmental impacts**: 71%
- **Producer story**: 66%
- **New seafood legislation**: 55%
- **Certifications**: 53%
- **Flavor profile**: 53%
- **Species biology/ecology**: 47%
- **Taste**: 42%
- **How to prepare/cook**: 42%
- **Underutilized species**: 39%
- **Truth-in-labeling**: 39%
- **Texture**: 37%

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?

<table>
<thead>
<tr>
<th>Program</th>
<th>Familiar - Don't Use</th>
<th>Familiar - Use</th>
<th>Unfamiliar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquaculture Stewardship Council</td>
<td>37%, 10</td>
<td>63%, 17</td>
<td></td>
</tr>
<tr>
<td>Global Aquaculture Alliance</td>
<td>36%, 8</td>
<td>64%, 14</td>
<td></td>
</tr>
<tr>
<td>Global GAP</td>
<td>13%, 2</td>
<td>88%, 14</td>
<td></td>
</tr>
<tr>
<td>Canada Organic Aquaculture Standards</td>
<td>7%, 1</td>
<td>93%, 13</td>
<td></td>
</tr>
<tr>
<td>Friends of the Sea</td>
<td>12%, 2</td>
<td>88%, 15</td>
<td></td>
</tr>
<tr>
<td>Marine Stewardship Council</td>
<td>50%, 10</td>
<td>50%, 10</td>
<td></td>
</tr>
<tr>
<td>Monterey Bay Seafood Watch</td>
<td>46%, 12</td>
<td>54%, 14</td>
<td></td>
</tr>
<tr>
<td>Naturland</td>
<td>8%, 1</td>
<td>92%, 11</td>
<td></td>
</tr>
</tbody>
</table>
Phase 2 Results: Wild and Farmed Characteristics

Characteristic more associated with ________ seafood

- Availability
  - Wild: 16%
  - Farmed: 42%
  - Both: 42%

- Affordability
  - Wild: 11%
  - Farmed: 45%
  - Both: 39%

- Consistency
  - Wild: 8%
  - Farmed: 39%
  - Both: 47%

- Customer preference
  - Wild: 74%
  - Farmed: 18%
  - Both: 8%

- Diversity/variety
  - Wild: 63%
  - Farmed: 24%
  - Both: 11%

- Good flavor
  - Wild: 58%
  - Farmed: 32%
  - Both: 11%

- High quality
  - Wild: 47%
  - Farmed: 42%
  - Both: 11%

- Sustainability
  - Wild: 13%
  - Farmed: 45%
  - Both: 34%

- Safety
  - Wild: 39%
  - Farmed: 32%
  - Both: 16%

- Type I purchase/recommend
  - Wild: 32%
  - Farmed: 61%
  - Both: 8%

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*

- Quality
- Freshness
- Price
- Customer pref.
- Consistency
- Enviro. responsibility
- Relationship w/ chef, wholesaler
- Seasonality
- Relationship w/ producer
- Harvest location
- Harvest methods
- Social responsibility
- Variety/novelty
- Under-utilized species
- Personal pref.

Preliminary findings
Phase 2 Results: Seafood Characteristics (N = 33)

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

- Quality
- Fresh not frozen
- Shelf-life
- Price
- Customer Preferences
- Customer Requests
- Consistency
- Environmental responsibility or sustainability
- Relationships with Chefs/Wholesalers
- Seasonality based on harvest methods or population abundance
- Social/cultural seasonality (e.g., holidays)
- Relationships with Producers
- Harvest Location
- Local product
- Harvest methods
- Social responsibility
- Variety/Novelty
- Underutilized species
- Personal Preferences
- Fits within theme of menu/business
- Transport methods
- Wild-caught (preference for)

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: 5%
- Somewhat disagree: 5%
- Neither agree nor disagree: 12%
- Somewhat agree: 32%
- Strongly agree: 46%

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

- Strongly disagree: 2%
- Somewhat disagree: 5%
- Neither agree nor disagree: 10%
- Somewhat agree: 44%
- Strongly agree: 39%

Preliminary findings
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?**
- Reduced quantity: 34%
- Fewer high-priced items: 25%
- More familiar/comfort foods or species: 23%
- More local species: 6%
- More frozen: 12%

**HOW HAS COVID AFFECTED YOUR SEAFOOD PURCHASING?**
- Reduced menu/list: 42%
- Less expensive items: 24%
- More local species: 14%
- More frozen items: 20%
- Unsure at this time: 46%
- NA - Did not change: 6%

**WILL YOU RETURN TO YOUR PRE-COVID MENU?**
- Yes: 39%
- No: 9%
- Unsure at this time: 46%
- NA - Did not change: 6%

Preliminary findings
## Preliminary Conclusions: Seafood Information

<table>
<thead>
<tr>
<th>Important sources</th>
<th>Preferred format</th>
<th>Info sought</th>
<th>Info lacking</th>
<th>Certification programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sellers</td>
<td>• Websites</td>
<td>• Availability/supply</td>
<td>• Availability/supply</td>
<td>• &lt; 50% use</td>
</tr>
<tr>
<td>• Producers</td>
<td>• Face-to-face</td>
<td>• Harvest methods</td>
<td>• Environmental impacts on spp.</td>
<td>• Seafood Watch most common but</td>
</tr>
<tr>
<td>• Internet</td>
<td>• Email</td>
<td>• Harvest location</td>
<td>• Regulations</td>
<td>…local relevance?</td>
</tr>
<tr>
<td>• Chefs</td>
<td></td>
<td>• Local species</td>
<td>• Legislation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Price</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Regulations</td>
<td></td>
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</tr>
</tbody>
</table>

- 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

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.

- 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

<table>
<thead>
<tr>
<th>Agreement statements</th>
<th>COVID impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>US seafood is safe</td>
<td>Decreased quantity</td>
</tr>
<tr>
<td>US seafood is sustainable</td>
<td>Decreased high priced items</td>
</tr>
<tr>
<td>Consumers drive demand</td>
<td>Reduced menu</td>
</tr>
<tr>
<td><em>Maybe</em> I drive demand, too?</td>
<td>Increased local purchasing</td>
</tr>
</tbody>
</table>

Preliminary findings
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

- **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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