#### THE UNIVERSITY OF RHODE ISLAND

COLLEGE OF THE ENVIRONMENT AND LIFE SCIENCES



# Non-Linear AIDS for Shellfish in Rhode Island: A Market Study

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## Introduction

#### Seafood Industry

- Major contributor to State economy
- 2.7% of total seafood production constitute shellfish
- Quahog and Scallop- 40% of total commercially harvested shellfish
- Oysters- Leading cultured shellfish with 7 millions (CRMC 2014)



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### Background

#### Shellfish Management in Rhode Island

- By RI Department of Environment and Management
- Designated as shellfish harvest areas
- A steady flow of shellfish supply in the market
- Management Strategy
  - Closing of some of fishing areas
  - To control human consumption-safe shellfish in market
- Reality often disrupt by recurring water quality issues.
  - Inconsistencies in product flow in market IINK BIG WE DO-





# Background

- Inconsistency in product flow
  - Create price volatility
  - Affect fishermen in two ways
    - Lost revenue
    - Future competition from other states
- Critically important to understand economic aspect of shellfish resources
- Study- first step interaction of price and quantity within shellfish market.





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# Objective

- Understand ex-vessel market of shellfish in Rhode Island.
- Specifically,
  - Relationship between price of shellfish and its quantity landed
  - Relationship between price of shellfish and quantity of related products landed.



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**Theoretical Model** 

# • General form of IAIDS $w_i = \alpha_i + \sum_j \gamma_{ij} \ln q_j + \beta_i \ln Q$

Value Share of good i

Quantity of good j

Quantity Index

• Quantity Index defined as  $\ln Q = \alpha_0 + \sum \alpha_j \ln q_j + 0.5 \sum \sum \gamma_{ij} \ln q_i \ln q_j$ 





### **Theoretical Model**

- Quantity index is non-linear
- Linearizing by using approximations
- Stone's Quantity Index- Widely used  $\ln Q = \sum w_i \ln q_i$
- Thus, Widely used IAIDS equation is  $w_{it} = \alpha_{it} + \sum \gamma_{ij} \ln q_{jt} + \beta_i \sum w_j \ln q_j$





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### **Theoretical Model**

- Our interest- measure relationship between price and quantity
  - Price flexibility was calculated

$$\begin{split} \varphi_{i} &= -1 + \frac{\gamma_{ij} + \beta_{i}(w_{i} - \beta_{i} \ln Q)}{w_{i}} & \text{Own-price flexibility} \\ \varphi_{ij} &= \frac{\gamma_{ij} + \beta_{i}(w_{j} - \beta_{j} \ln Q)}{w_{i}} & \text{Cross-price flexibility} \\ f_{i} &= -1 + \frac{\beta_{i}}{w_{i}} & \text{Scale flexibility} \\ \end{split}$$

### **Empirical Model**

- Contribution to the literature
  - Compare the models- check approximation bias
    - With approximated Quantity Index
    - With original non-linear Quantity Index
  - Inclusion of any dynamic factors
    - Season and lagged quantity





### **Empirical Model**

 Our model for analysis  $w_{it} = \alpha_{it} + \sum_{i=1}^{3} \gamma_{ij} \ln q_{jt} + \beta_i \ln Q + \sum_{i=1}^{12} Month_m + \sum_{i=1}^{xmas} \upsilon_{i\pi} Event_{\pi} + \sum_{i=1}^{xmas} (1 - \alpha_{it}) + \sum_{i=1}^{3} (1 - \alpha_{it}) + \sum_{i=1}^{$  $\sum_{i=1}^{m} \rho_{is} \ln p_{s} + \sum_{i=1}^{s} \nu_{ij} \ln q_{jt-1} + \varepsilon_{it}$ s = MA $\ln Q = \alpha_0 + \sum \alpha_j \ln q_j + 0.5 \sum \sum \gamma_{ij} \ln q_i \ln q_j$ or  $\ln Q = \sum w_i \ln q_i$ THINK BIG WE DO"





#### Data

- Shellfish landings from SAFIS
  - RI, MA, and VA
    - Trip-level landing report from dealers
    - Info about quantity, value from 2007 to 2012
- Species Considered...





### Introduction-Species in RI



**Bay Scallop** 



Sea Scallop

Eastern Oyster



#### Soft Shell Clams



**Blue Mussel** 



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#### Result

NL-IAIDS vs. IAIDS

#### - AIC test to look at goodness of fit

A Carto	NL-IAIDS	IAIDS
AIC	-26,048	-26,023

#### - t-test of difference -estimates and standard

error	Species	Calculated t- value	Critical t-value
	Necks	0.26	
Sim	Cherrystone	0.66	the second site
	Chowders	0.31	1.684
1.	Scallops	0.08	
	Whelk	0.30	





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#### **Result- Share Equation**

- Adjusted R-Sq range from 0.56 to 0.96
- Value Share of good i increase
  - When quantity of good i increase
  - When quantity of good j decrease
- Quahog from other state- no influence on share
- Seasonal variation in share
  Pattern differ with species





### **Result- Price flexibility**

Uncompensated price and scale flexibility of Shellfish in RI									
	Necks	Cherrystone	Chowders	Scallop	Whelk	Income			
Necks	-0.77	-0.59	-0.62	-0.51	-0.07	-1.07			
Cherrystone	-0.02	-0.17	-0.03	-0.01	-0.01	-1.10			
Chowders	-0.08	-0.13	-0.21	-0.07	-0.01	-1.06			
Scallop	-0.10	-0.09	-0.10	-0.44	-0.02	-1.13			
Whelk	-0.09	-0.13	-0.10	-0.11	-0.44	-0.56			



### **Discussion and Conclusion**

- Prices of shellfish are inflexible
  - Price do not respond to moderate quantity change
- Other Shellfish product- substitute with each other
  - Magnitude of the relation differ with species
    - Negligible between cherrystone and scallop
    - Greater impact between necks and cherrystones

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## Caveat of the Study

No oyster, mussel, and soft-shell clams

- Oyster and clams dominant presence
- Oyster-potential competitor for neck quahog
- Clam -compete with cooked quahog
- Did not include info from all other states
  Could only include MA and VA
- Long term effect of price is warranted
  - To ascertain comprehensive knowledge of market.

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