1st Aquaculture Training for Municipal Leaders

*Tues. Nov.19th, 2019 * 1:00PM – 3:30PM * URI Bay Campus, Narragansett RI*

Hosted by: The Ocean State Aquaculture Association and the Coastal Resources Center & Rhode Island Sea Grant, Graduate School of Oceanography, University of Rhode Island

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MEETING SUMMARY

- Five presentations given (see PDF of presentations)

- Break out discussions, by table (towns), addressing five guiding questions: *1) What types of inquiries (questions, issues, concerns, etc.) are your receiving in your town regarding aquaculture? 2) How often do you field an inquiry about aquaculture? Is this changing? 3) What role do you play in addressing these inquiries? 4) What support and resources can help you better address these inquires? 5) From your perspective, what are the positive aspects of aquaculture in your town? What are the challenging aspects?*

<u>Key topics raised (many concerns were echoed by multiple towns):</u>

1) *What types of inquiries (questions, issues, concerns, etc.) are your receiving in your town regarding aquaculture?*
    - Increasing conflict between recreational users and aquaculture
    - General curiosity from public about aquaculture; asking if/how to interact with leases; direct interaction with public and leases by transiting through.
    - Concerns over interactions between public users of space and surface gear from aquaculture
    - Sentiment from seasonal residents that permitting is "pushed through" in off-season to avoid objections from seasonal residents.
    - Unclear as to if/how/where public can traverse through leases.
    - Concern over lack of adequate monitoring as leases "creep" out of their permitted areas

- Concerns over why CRMC/state doesn't formally consider aesthetics (visual) impacts from leases when permitting. Ex. Jerry Brown Farm area
- General concern over increases in marine debris from aquaculture farms (stray gear, etc.)
- Lack of adequate enforcement over lease areas, lease boundary "creep"

2) *How often do you field an inquiry about aquaculture? Is this changing?*
   - Routine, weekly
   - Concerns over how much more aquaculture is planned/will be permitted; appearance of the full farm
   - Questions daily about aquaculture during the high season (summer months); this is when competing usage concerns surface most.
   - What's changing is now towns are fielding more "formal" inquiries and interactions, i.e. from attorneys vs. individual residents; More written, formal complaints now

3) *What role do you play in addressing these inquiries?*
   - The full range of tending to questions/concerns, BUT serve in advisory role, as the state (CRMC) has the formal role.

4) *What support and resources can help you better address these inquires?*
   - Better way to inform town residents about aquaculture-related news, meetings, events, issues.
   - Need better enforcement – Can examine increasing lease fees to support more enforcement; noted that RI has highest lease fees on east coast
   - Better communication between municipalities that share waters
   - Can and should be more cross-learning between municipalities – i.e. what worked in SK might serve NK for example.
   - Need a better way to show trade-offs between proposed aquaculture, i.e. in different areas, using different gear configurations, etc.
   - Need a better way for towns/public to voice concerns related to multi-use areas; clarify and expand the public input process
   - Mapping
     - Enhance utility of existing aquaculture maps; need for common format (Note: current RI DEM maps can be viewed in different format options).
     - Share with public better, once more; list on town websites
     - Add features to maps and make sure they are updated regularly

    - Fix the current RI DEM-maintained aquaculture lease maps, as there are some glitches
    - Maybe training to towns on how to use the maps and the various features (there was a comment to have more features like NOAA chart options, which are in fact there now).
    - Make the maps more user-friendly
    - Wickford Kayak Center distributes maps on general features in the kayaking area (do they include leases?) – Might be a good template, as these are designed for public audiences.
- Need for lease applicants to provide a standardized lease application – i.e. NOAA charts used for map, use common decimal or lat/long system.
- Mediation services in RI specific to farmers and adjacent land-owners – Center for Mediation & Collaboration Rhode Island - http://www.cmcri.org/
- Need for public brochures/education around:
    - "Aquaculture 101"
    - How to navigate around/through leases
    - Basic boater education and awareness around aquaculture; maybe even add aquaculture lease navigation to state boater education
- Standardized statewide system for how leases are marked to aid in navigation and public interactions; high-visibility vs. low visibility

5) *From your perspective, what are the positive aspects of aquaculture in your town? What are the challenging aspects?*
    - Floating gear
        - Floating gear guidelines for the state – discussion around modifying aspects of this; like the idea of these being guidelines vs. enforced/regulatory. Re-visit the max height above water, as the lower the height, the less optimal growing and the more acreage the farmer would need
        - Interest around a study/analysis to determine acceptable height above water for floating gear in relation to acceptability to public/visual impacts; production potential in different height/horizontal farm layouts – Maybe RWU/Matt Griffin to conduct?
        - Recognition/discussion that floating gear is preferred to growers, but affords the most visual impact
    - NK: Concerns over Rome Point being "full"; where wil aquaculture go next? Visual will become increasingly important

- NK: Transmission cable for wind farms likely to come to Quonset. Impacts related to and peripheral to aquaculture and future siting?

Contact Info for Attendees:

First Name	***Last Name***	***Town,city or business name***	***Email***
Azure	Cygler	CRC/URI	acygler@uri.edu
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Alexie	Rydman	EPA	N/A
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Andrew	Sheerer	South Kingstown	N/A
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Bill	Silkes	American Mussel Harvesters	bill@americanmussel.com

Adam	Silkes	American Mussel Harvesters	Adam@americanmussel.com
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Ernest	Wilcox	North Kingstown	ernie6334@gmail.com

Shellfish Aquaculture Trends and Opportunities

Bob Rheault

Executive Director

East Coast Shellfish Growers Association

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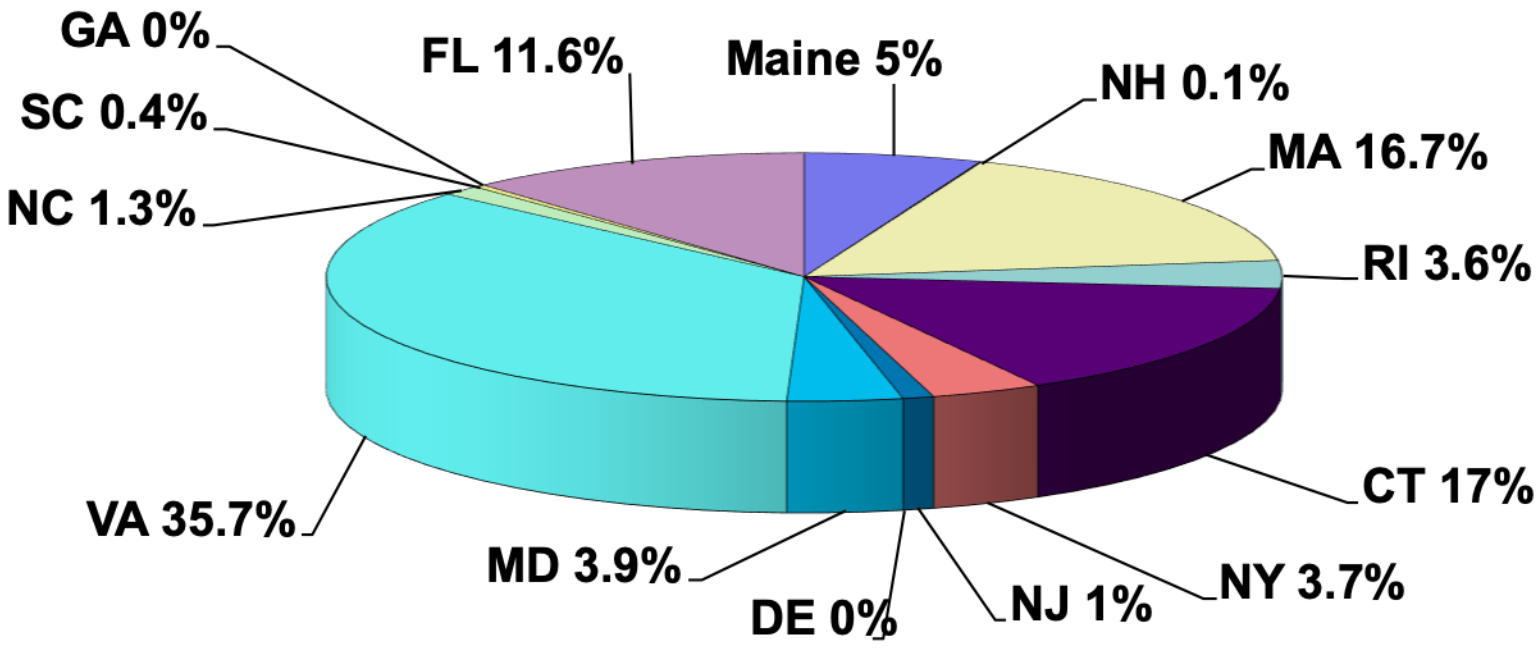
Shellfish Aquaculture by State

percent of total East Coast

$168 million farm gate



Industry Snapshot

- ~1300 farms from Maine to Florida
- Primarily small farmers with less than 10 employees
- Collectively harvest $170M

  45% clams, 55% oysters

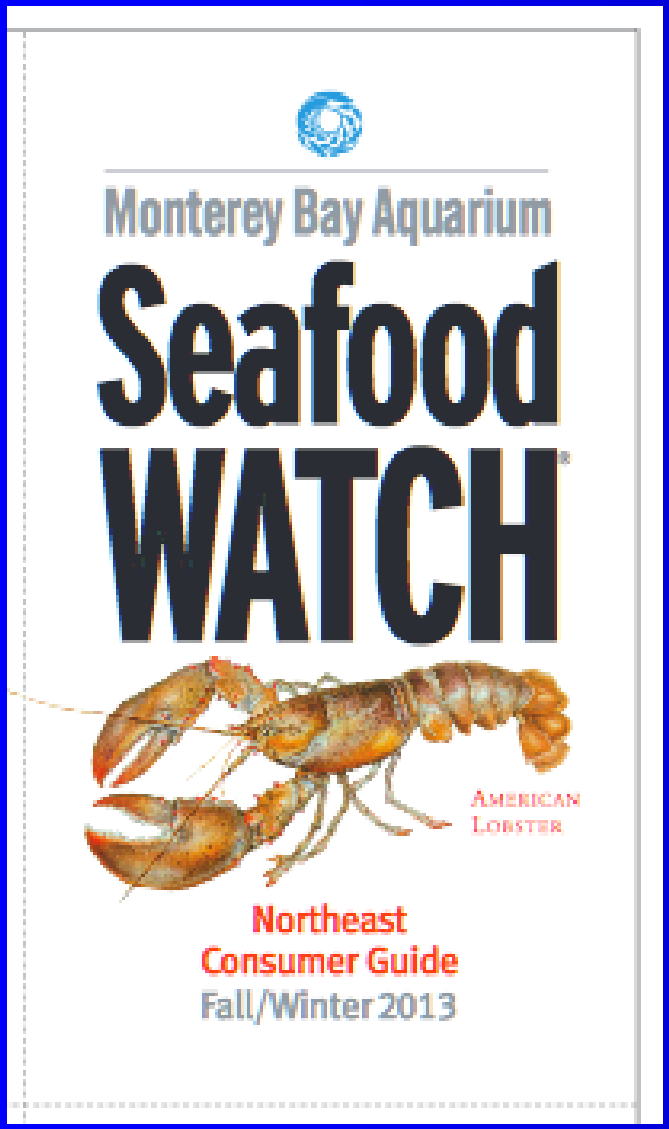
  production growing 5-10% / yr

  oyster production doubled in 5 yrs

Celebrate Shellfish

Shellfish feeding

The Ultimate in Sustainable Seafood



Well managed.

Caught or farmed responsibly.

No feeds or antibiotics.

No fertilizers

BEST CHOICES

Arctic Char (farmed)
Bass: Striped (US hook & line, farmed)
Catfish (US)
Clams, Mussels, Oysters
Cod: Atlantic (imported, hook & line)
Crab: Dungeness & Stone
Croaker: Atlantic (non-trawl)
Haddock (US hook & line)
Halibut: Pacific (US)
Lobster: Spiny (CA, FL & Mexico)
Salmon (AK)
Scallops (farmed)
Squid: Longfin (US)
Swordfish (Canada & US harpoon, troll, pole)
Tilapia (Ecuador & US)
Trout: Rainbow (US farmed)
Tuna: Albacore/White canned (Canada & US troll, pole)
Tuna: Skipjack/Light canned (US troll, pole)
Tuna: Yellowfin (US troll, pole)

Good food – Good for you too

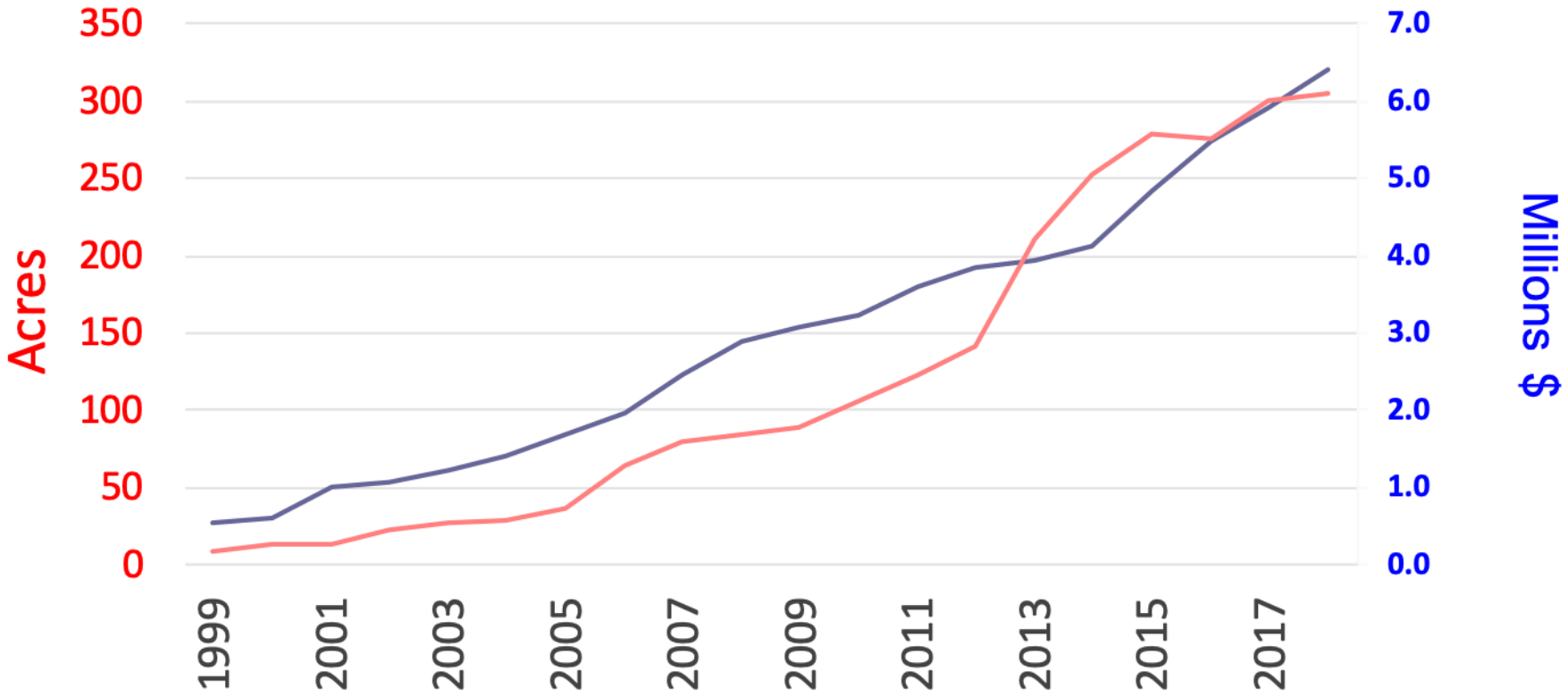
- High in protein
- Low in fat
- High in heart-healthy omega-3 fatty acids
- Good source of vitamin B_{12} & minerals (Iron, Zinc)

Ecosystem Services

- Nitrogen removal at harvest
  - Each oyster and clam contains about 0.3-0.5g N
  - Harvest 5 million oysters – remove ~1.5 tons N
  - Essential fish habitat
  - Vertical structure
    – nooks and crannies
  - Enhances survival
    of juvenile fish

Graphic by Kent Forrest

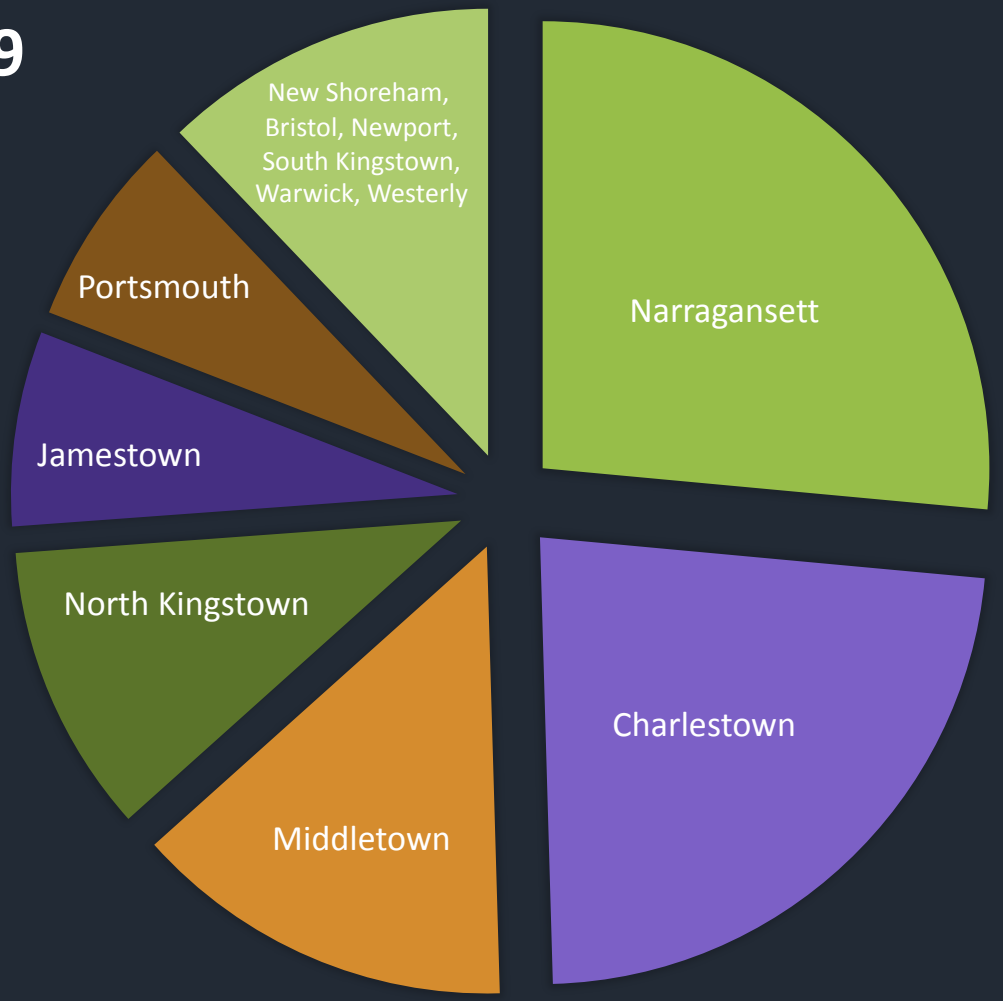
2018 Rhode Island Aquaculture Production



In 2014 cultured oysters surpassed quahogs as the number one value seafood product landed from RI state waters

Aquaculture by Town: 2019

Town	Acres
Narragansett	89.74
Charlestown	78.24
Middletown	46.9
North Kingstown	35.5
Jamestown	23.91
Portsmouth	23.65

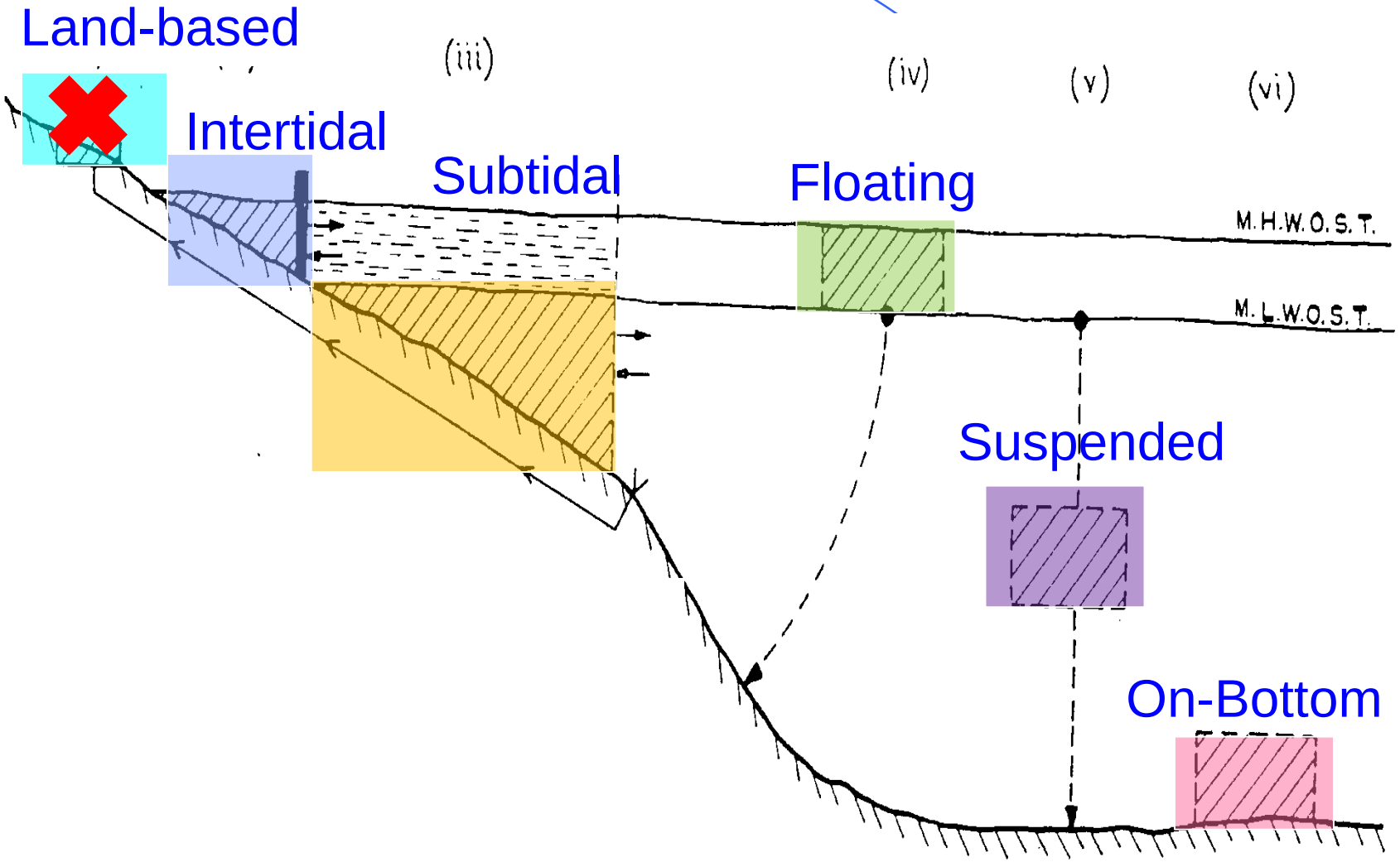


Ponds provide storm protection and rich food supplies.
Ponds also have most intensive recreational use demands.
Challenge is to find a balance that works for everyone.

Bivalves with Benefits

- Sustainable seafood
- Green jobs
- Nutritious & delicious
- Cultural icon
- Ecosystem services to boot!
  - Remove nutrients - Stabilize sediments
  - Provide habitat - Reduce turbidity

Oyster Grow-out Options

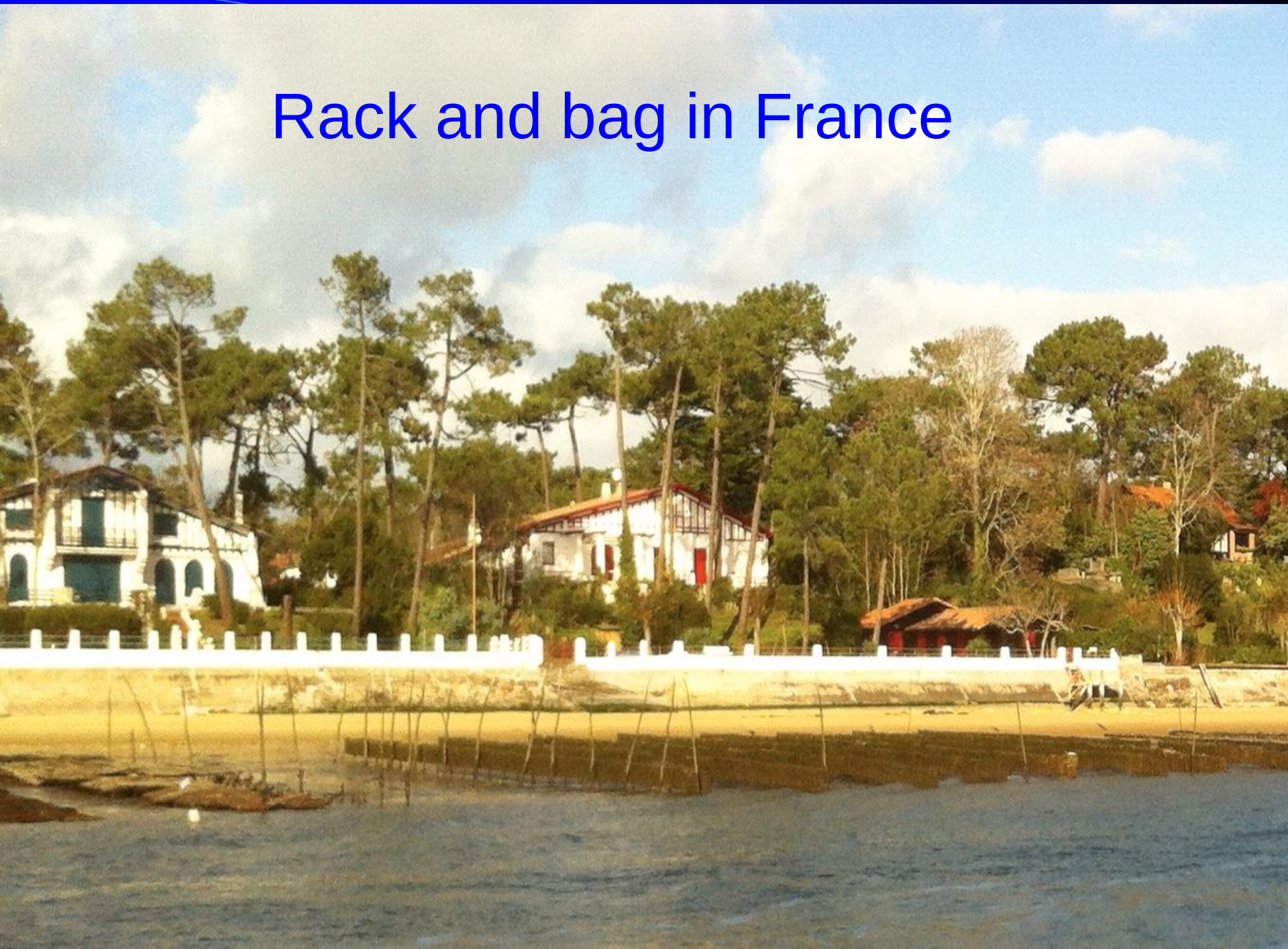


On bottom – free planted


GAGE

Intertidal off bottom

Rack and bag in France



Bottom cages - intertidal

Bottom cages sub-tidal

Suspended culture

Suspended gear

Floating gear

Floating Bags

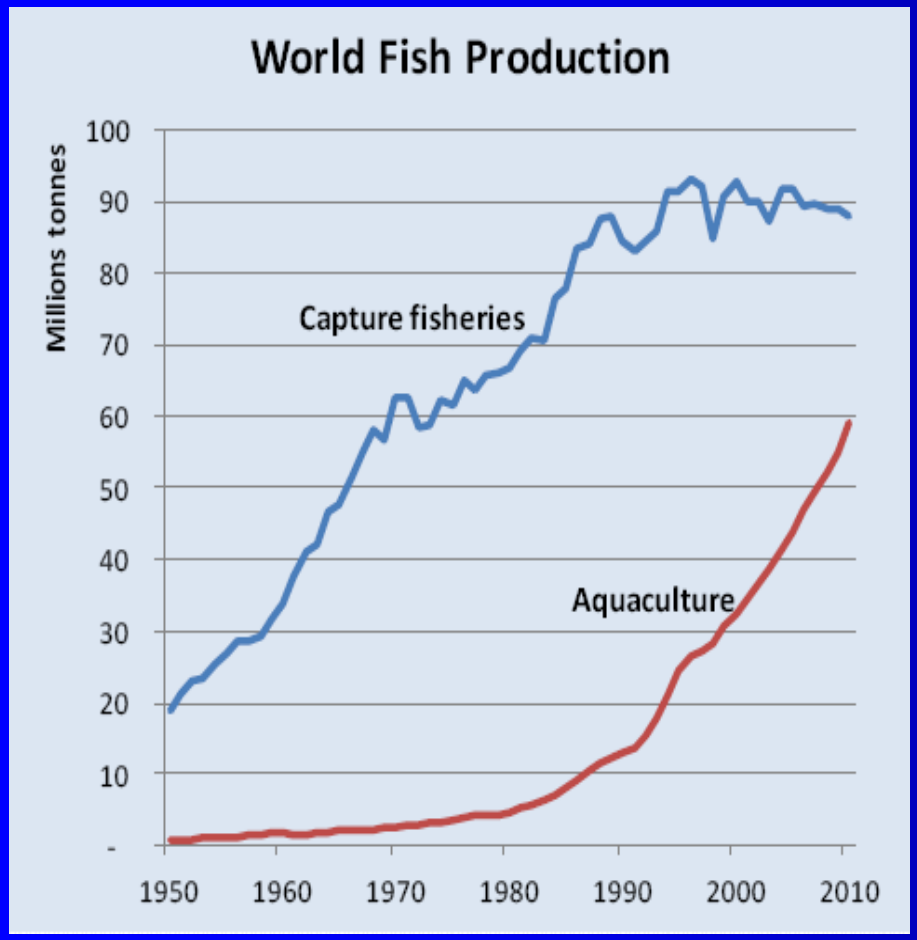
Challenges

- Water quality
- Predators
- Storms
- Disease / parasites
- Sea level rise
- Ocean acidification
- Labor intensive
- Access to commercial dock space
- Regulations
- Cheap imports
- Customers can’t open our products

Opportunities

- Nutrition trends
- Locavore movement
- Omega-3 fatty acids
- Sustainable seafood movement
- Nutrient credit markets
- Global markets
- Demand projections
- Eco-Tourism

World Fish Supply



Fish supply (mt)	2010 (baseline)	2030 (projection)
Aquaculture	59	123
Capture fisheries	88	88
Total supply	**147**	**211**
% of aquaculture:	40	58

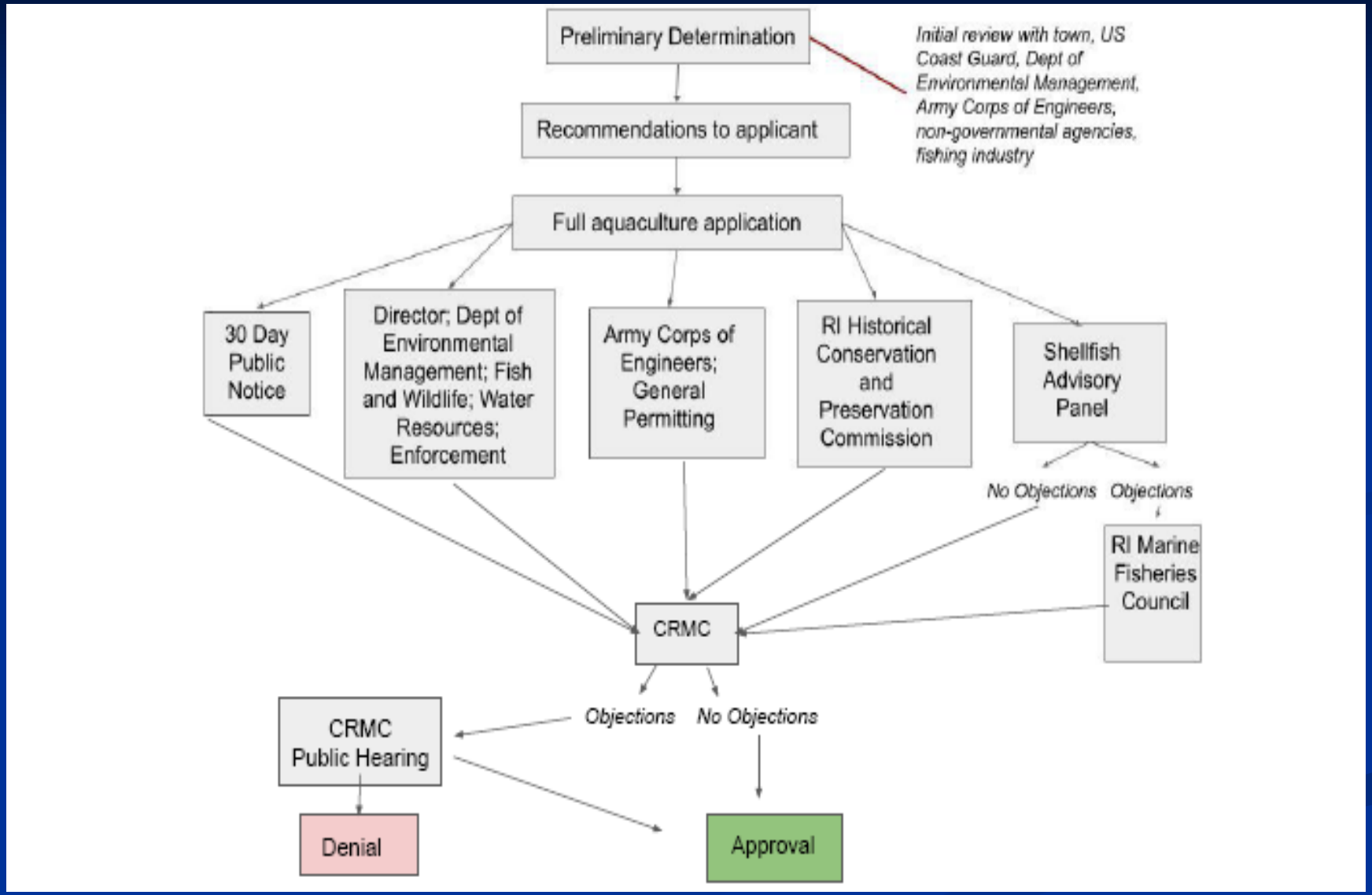
- Predicts a global shortfall of seafood supply on the order of 50 million metric tons in 10 years
- We import 91% of the seafood we consume in the US.
- This is a food security and job security issue. Prices will go up.

Source: FAO FISHSTAT

Despite Challenges Optimism Prevails

Fishermen and farmers are optimists by nature

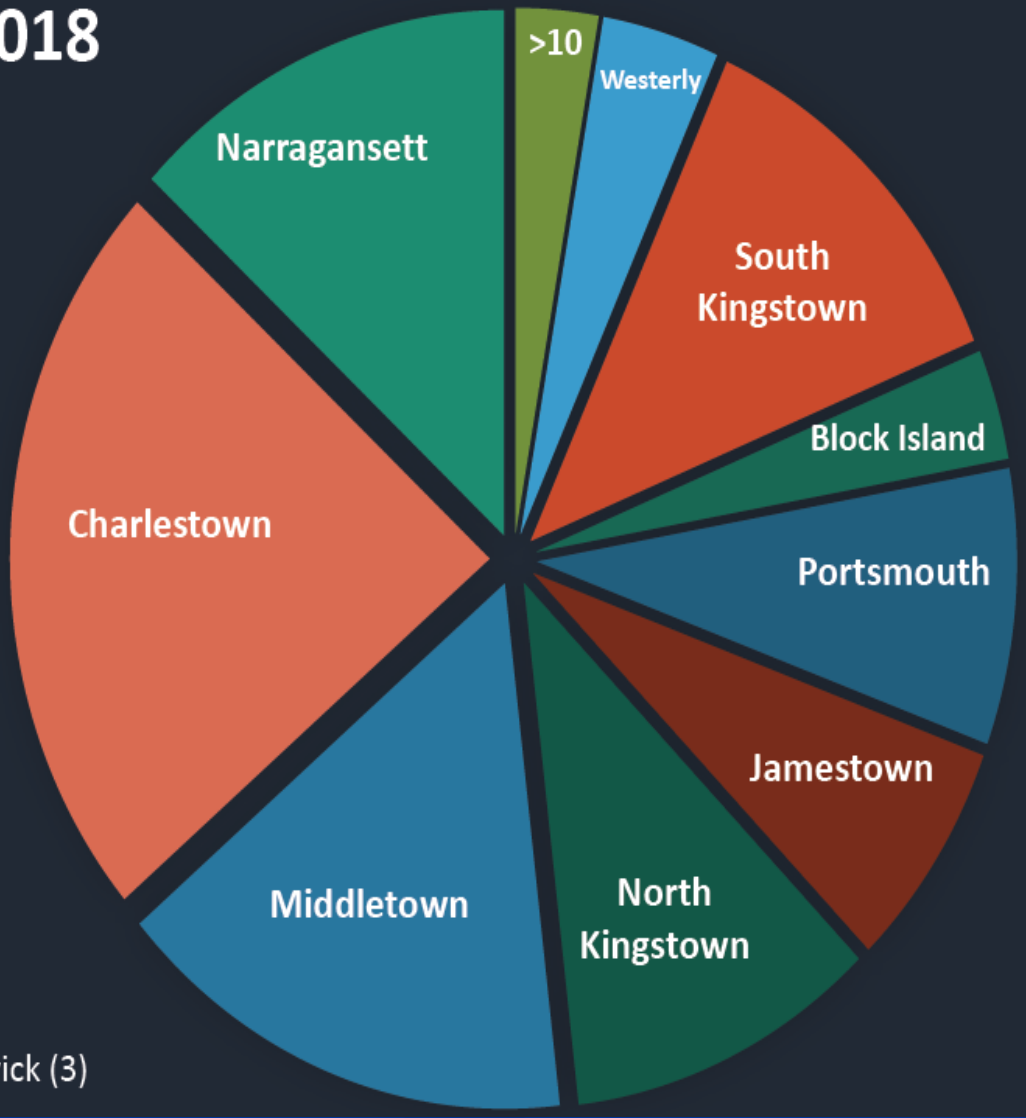
- Opportunities for growth
- Opportunity for innovation
- Opportunity to work on the water, make a living off sustainable, delicious, nutritious shellfish


Preliminary Determination
Initial review with town, US Coast Guard, Dept of Environmental Management, Army Corps of Engineers, non-governmental agencies, fishing industry
Recommendations to applicant
Full aquaculture application
30 Day Public Notice
Director; Dept of Environmental Management; Fish and Wildlife; Water Resources; Enforcement
Army Corps of Engineers; General Permitting
RI Historical Conservation and Preservation Commission
Shellfish Advisory Panel
No Objections
Objections
RI Marine Fisheries Council
CRMC
Objections
No Objections
CRMC Public Hearing
Denial
Approval

RI Aquaculture by Town 2018

Town	Acres
Charlestown	78
Middletown	53
Narragansett	45
South Kingstown	41
North Kingstown	36
Portsmouth	29
Jamestown	24
Westerly	13
Block Island	11

Towns with Less than 10 acres:
Tiverton (3), Bristol (.25), Little Compton (3), Warwick (3)



Current RI Aquaculture

- Current Acreage: 339.08 acres
- Number of farms: 81
- 2018 product value: $6.09 M
- Point Judith Pond 75.89 acres 4.9%
- Potter Pond: 6.9 acres 1.9%
- Ninigret Pond: 64.37 acres 3.9%
- Winnapaug Pond: 13.35 acres 3.0%
- Quonochontaug: 13.87 acres 1.9%

SHELLFISH AQUACULTURE AND THE MARINE ENVIRONMENT

Matthew Griffin

Roger Williams University

Saltbox Sea Farm

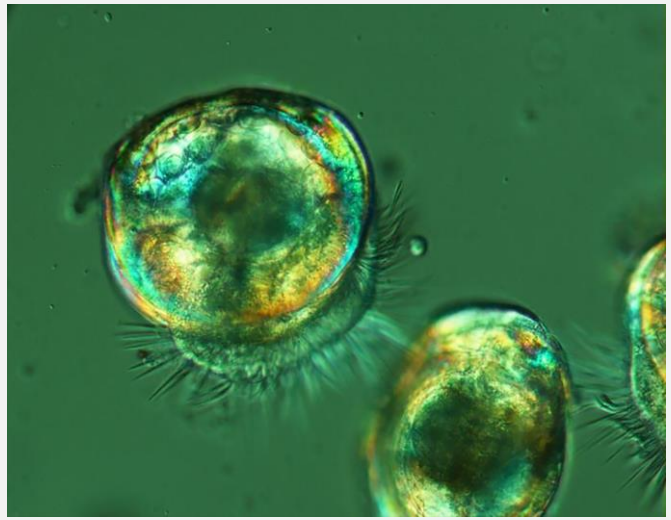
ROGER WILLIAMS UNIVERSITY

SALTBOX SEA FARM

OYSTERS & SEA VEGETABLES - NARRAGANSETT BAY & SAKONNET RIVER, RI

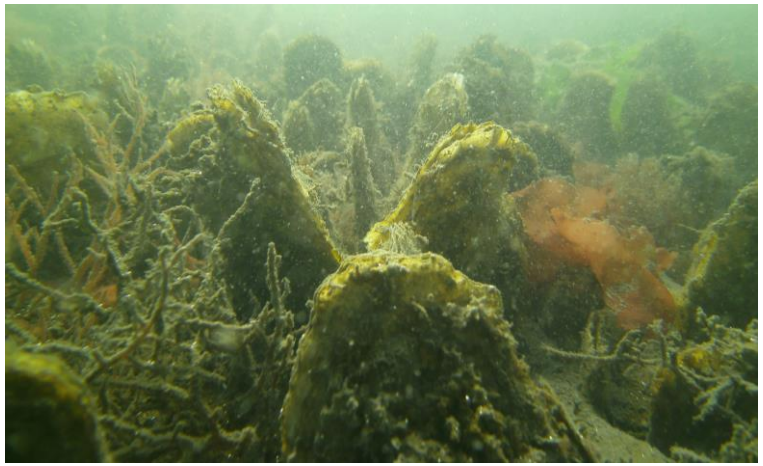
ROUGH WATERS PORTSMOUTH SALTS

OYSTER SETTING



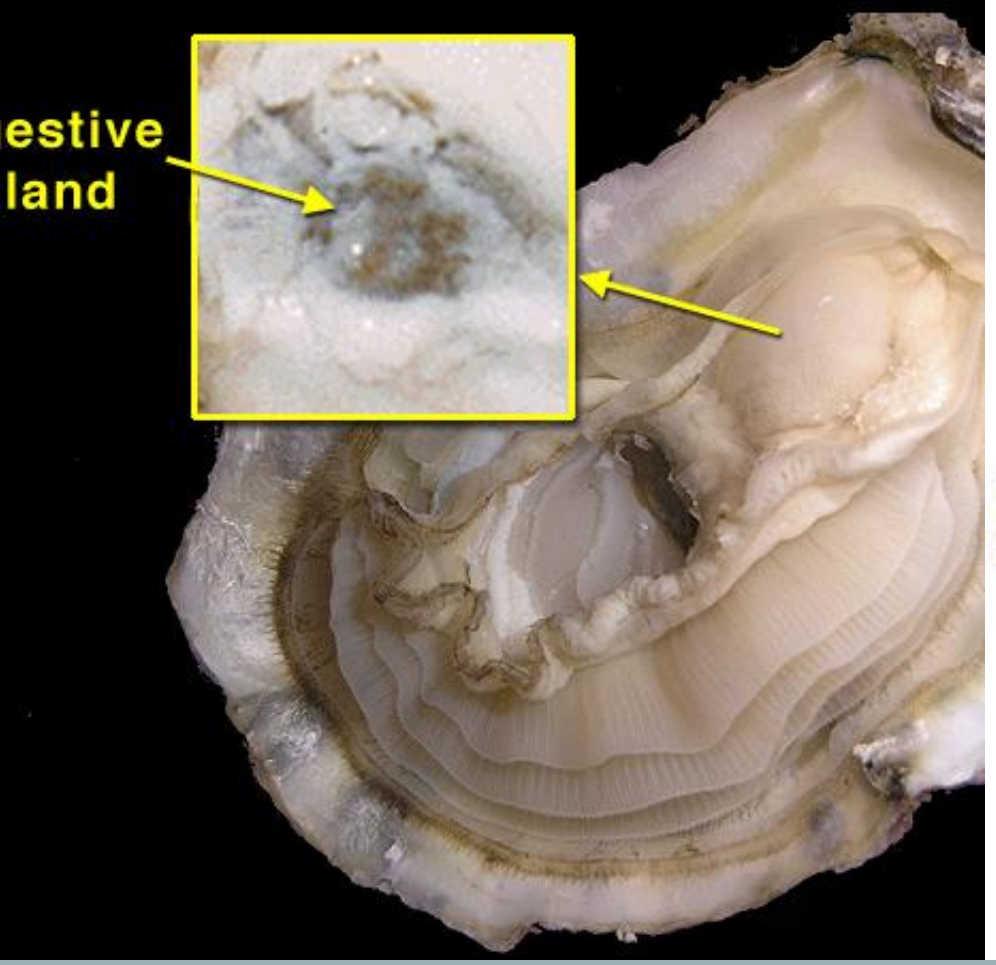
Micro-cultch

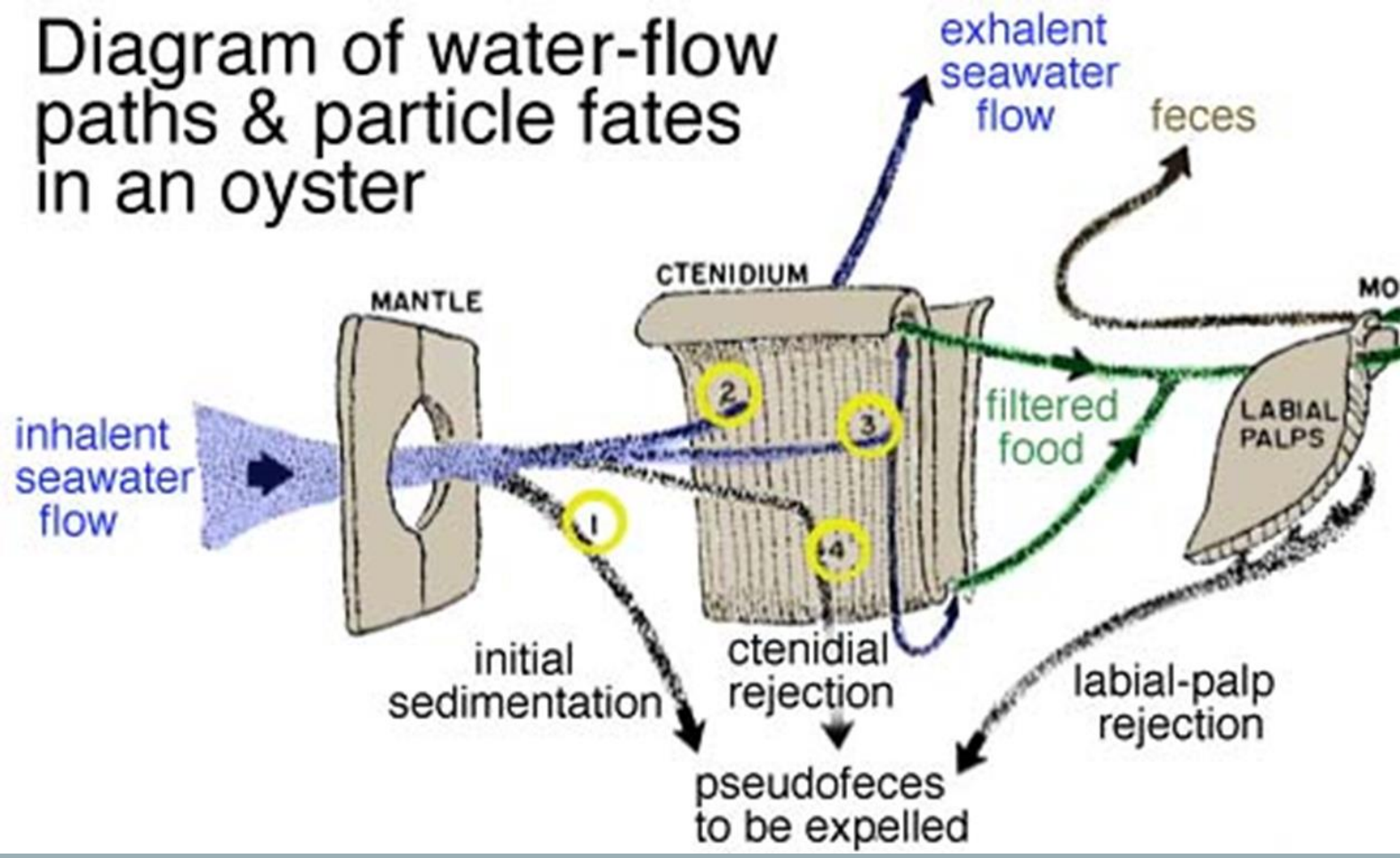
Natural set



SINGLE SET OYSTERS

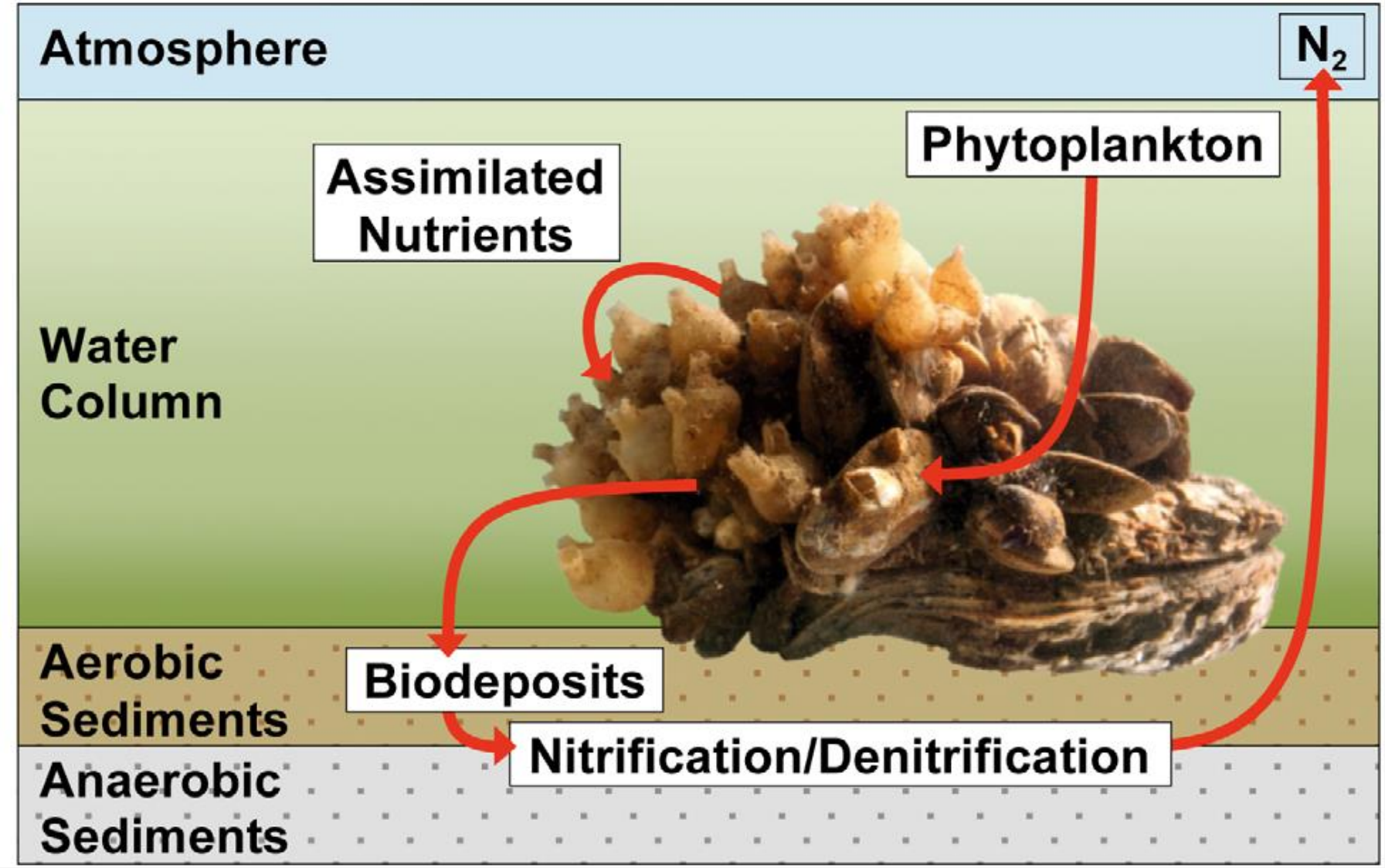
NATURAL SET OYSTERS



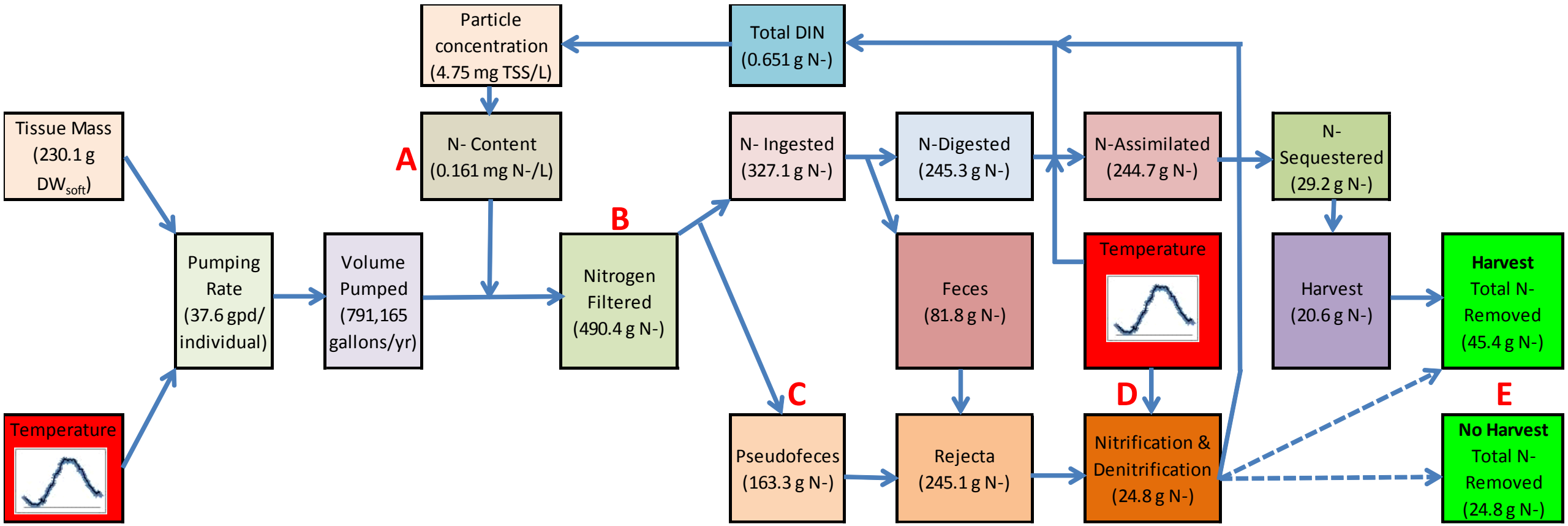


FILTER FEEDING

NUTRIENT CYCLING AND REMOVAL



N - BUDGET FOR AN OYSTER BED IN TOWN POND (1 M^2/YR)



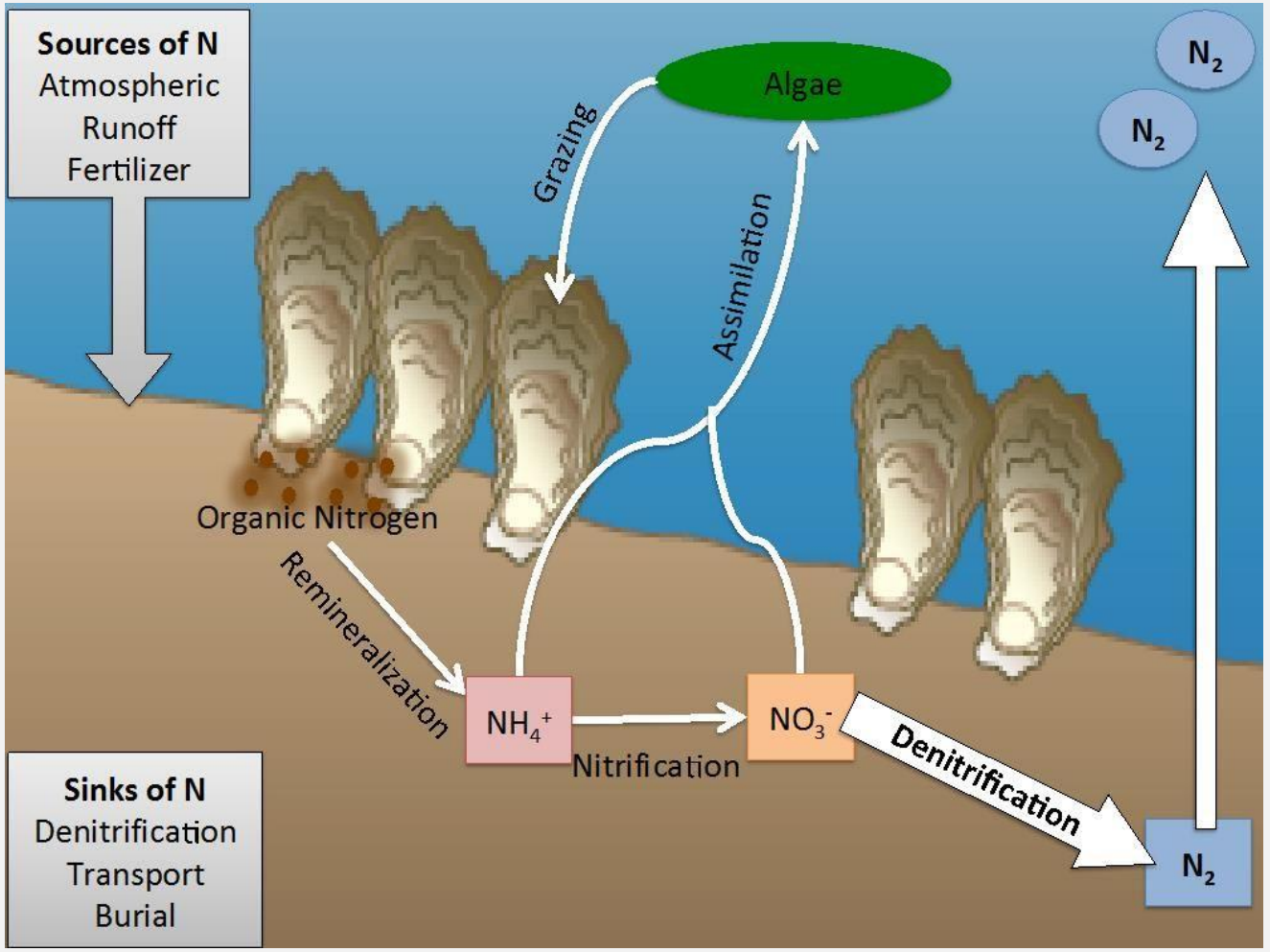
N - removal by a single oyster = 0.77 g N/yr. (if harvested)

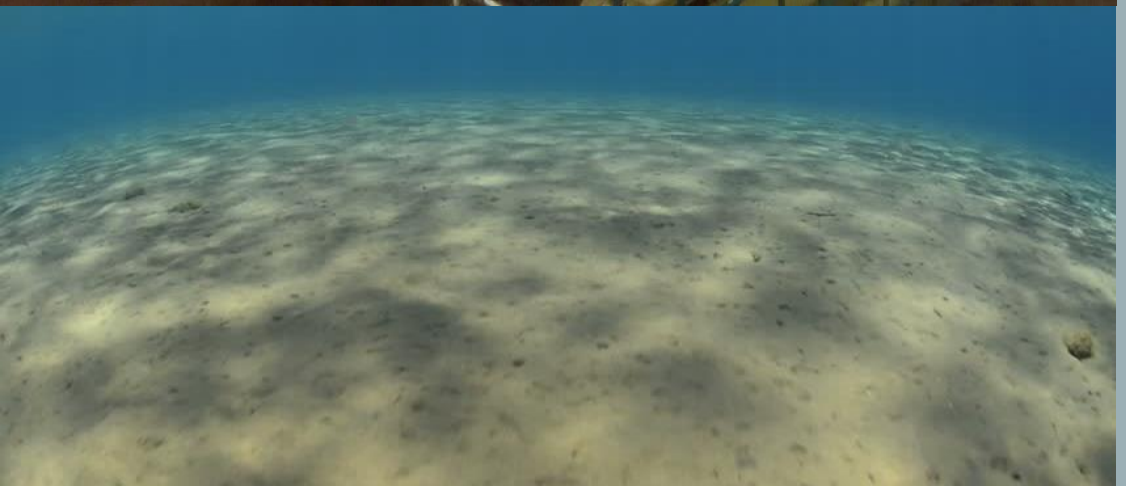
N - removal of 1-acre farm = 231 kg N/yr. = 509 lbs.

N - removal from oyster sales in 2018 = 14,500 lbs.

HOW DOES THIS STACK UP TO OUR NEEDS?

- 9000 tons excess N into Narragansett Bay (2014)
- 0.1% of excess N removed from 2018 Harvest

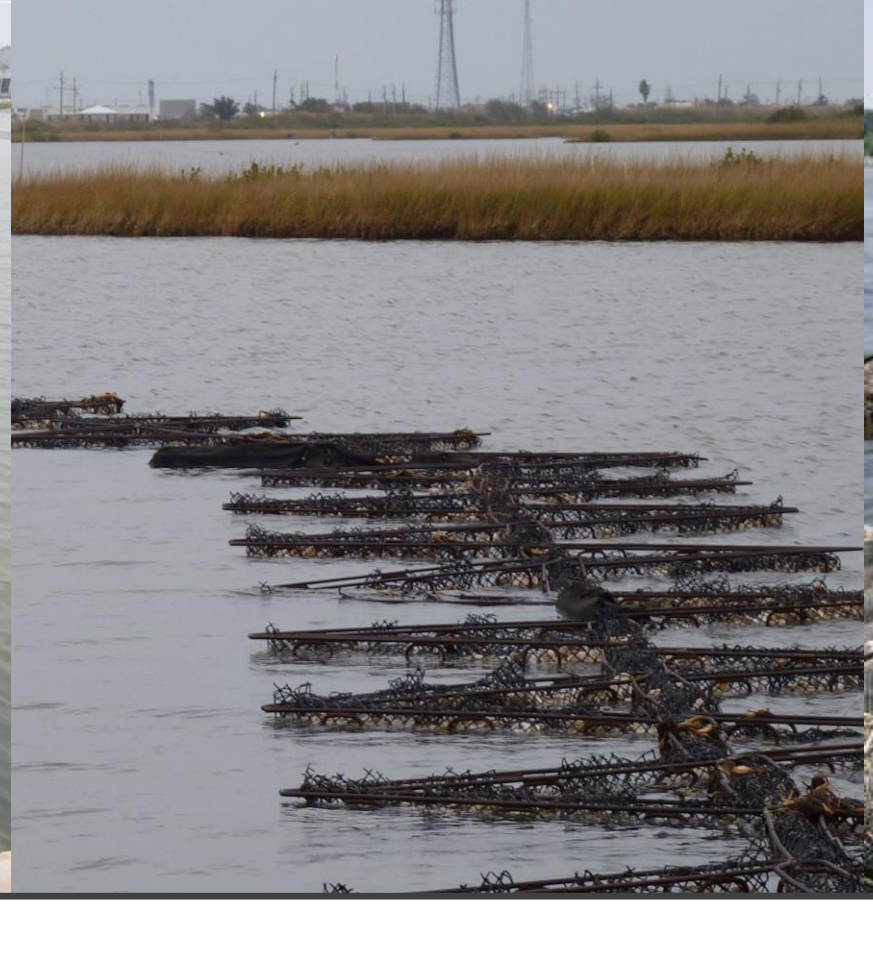




SHELLFISH FARMS AS HABITAT

One acre of oyster reef produces/supports 2,320 lbs. fish and mobile crustaceans

Great Salt Pond, BI

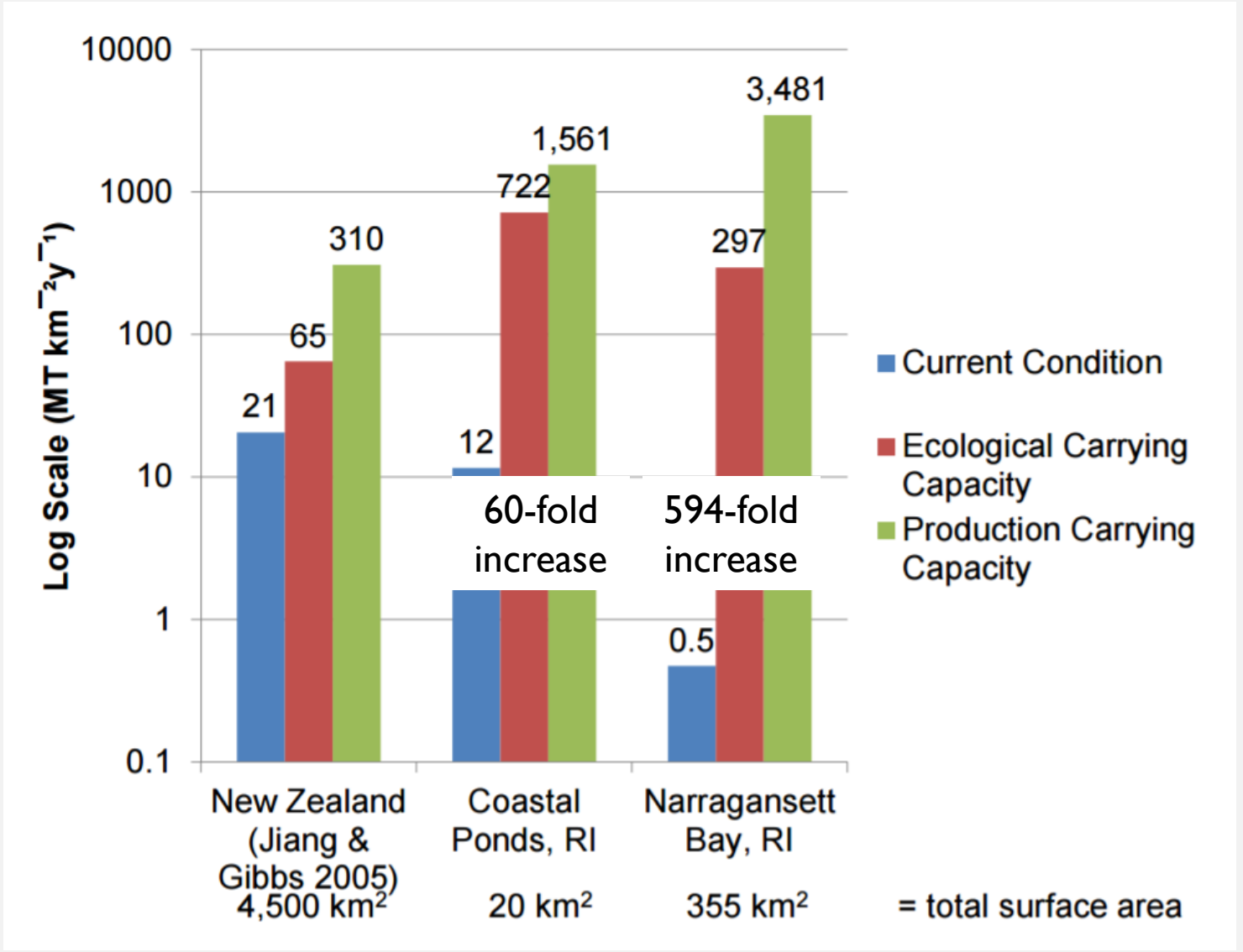


SHORELINE PROTECTION

ECOLOGICAL CARRYING CAPACITY

- Ability of the natural environment to support farm production without impacting other ecological systems in the waterbody
  - Primarily addresses food availability (primary production)
- Recent study completed by Carrie Byron at URI
  - Used a model to represent the ecosystem and scaled it different levels of shellfish production

CARRIE BYRON'S RESULTS



AQUACULTURE MUNICIPAL WORKSHOP

ECONOMIC IMPACT ANALYSIS OF AQUACULTURE IN RHODE ISLAND

A COMMON SENSE APPROACH

Cameron Ennis, Esq.

Executive Director, Education Exchange

FIRST OFF…I AM NOT AN ECONOMIST.

- I am an attorney which means a few things:
- I like to read.
- I am inherently skeptical,
- I know that for the right price, an expert will write any report the way I want it written.

- But I wanted to present you with the most accurate data I could find.

Appendix 1. Glossary of Input-Output Terms

Direct effects/impacts: Direct impacts represent the revenues, value-added, income, or jobs that result directly fi economic activity within the study area or a regional economy.

Employment or Jobs: Represents the total numbers of wage and salaried employees as well as self-employed jo includes full-time, part-time and seasonal workers measured in annual average jobs.

Indirect Business Taxes: Include sales, excise, and property taxes as well as fees and licenses paid by businesses normal operations. It does not include taxes on profits or income.

Indirect effects/impacts: Indirect effects occur when businesses use revenues originating from outside the regio study area, to purchase inputs (goods and services) from local suppliers. This secondary, or indirect business, gen additional revenues, income, jobs and taxes for the area economy.

Induced effects/impacts: Induced effects or impacts occur when new dollars, originating from outside the study introduced into the local economy. Induced economic impacts occur as the households of business owners and em spend their earnings from these enterprises to purchase consumer goods and services from other businesses withi region. This induced effect generates additional revenues, income, jobs and taxes for the area economy.

Input-Output Analysis: The use of input-output models to estimate how revenues or employment for one or mo ular industries, businesses or activities in a regional economy impact other businesses and institutions in that regi the regional as a whole.

Input-Output Models: A mathematical representation of economic activity within a defined region using inter-in transaction tables or matrices where the outputs of various industries are used as inputs by those same industries industries as well.

Labor Income: All forms of employment compensation, including employee wages and salaries, and proprietor or profits.

Local/ Resident revenues/expenditures: Local revenues or spending represent simple transfers between individ businesses within a regional economy. These transactions do not generate economic spin-off or multiplier (indire induced) effects.

Economic Impact Analysis

Types -
1) Output - revenue → goods/services output of industry
2) Value Added - gross regional product (GRP)
3) Labor Income Impact - wages + taxes
4) Employment - jobs
5) Property Value Impact

Sources
1) Direct Effect - $ spent on supplies, salaries, spending by
2) Indirect - business transactions initially caused by business activity
3) Induced Effects - results of increased income caused by direct/indirect
4) More jobs → higher wages → more household spending

Methodology
1) Input/Output Model (I/O)
a) IMPLAN, RIMS-II, EMSI
b) Environmental Impact + Social Impact Assessment (Quality of life - pollution)

D: Indirect/Spillover → if one sector grows
business owners + employees in sector has $ extra money throughout economy

Direct	Indirect
Oyster Sales - Sales tax 7%	Tourism
Seed Sales - Sales tax 7%	Hospitality (F&B) Employment
Employment	Beach Passes → Down waters
Salaries / Payroll Tax 10%	House rentals
Permit/Licences/Testing	Slip Rentals
Gas 5%	Boat sales, rentals + maintenance
Insurance 3%	1% Hotel Tax
Seed 35%	
Lease Application + Associated Costs	
Seed Testing	

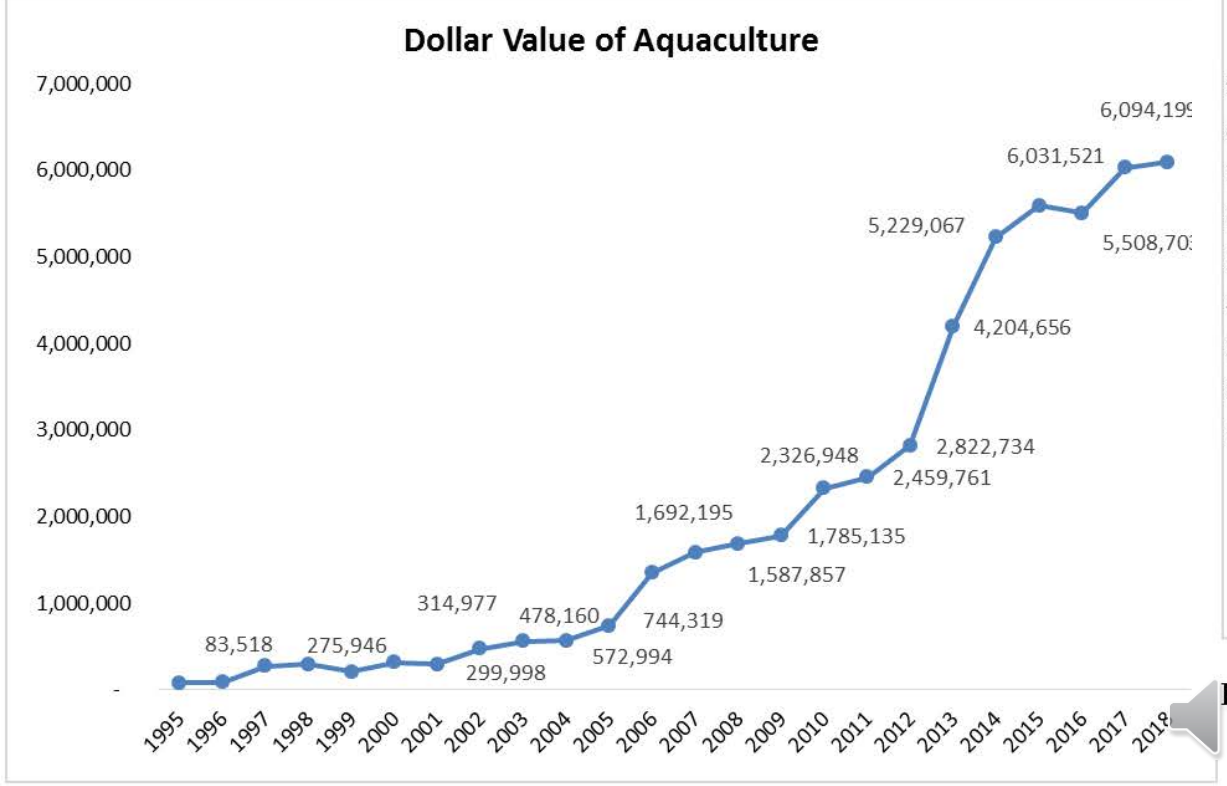


Figure 5. Total dollar value of aquaculture

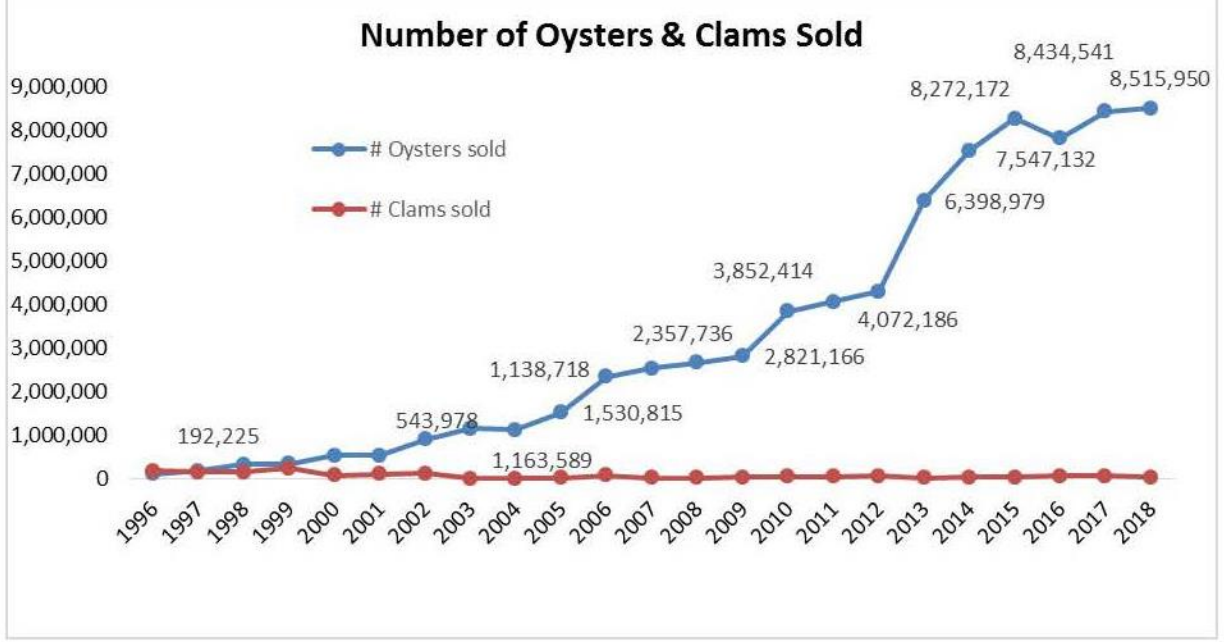


Figure 7. The American oyster remains Rhode Island's dominant aquaculture product.

How much aquaculture was there in 2018?

CRMC
COASTAL RESOURCES MANAGEMENT COUNCIL

Aquaculture in Rhode Island 2018

Photograph: Ayla Fox

Prepared by:
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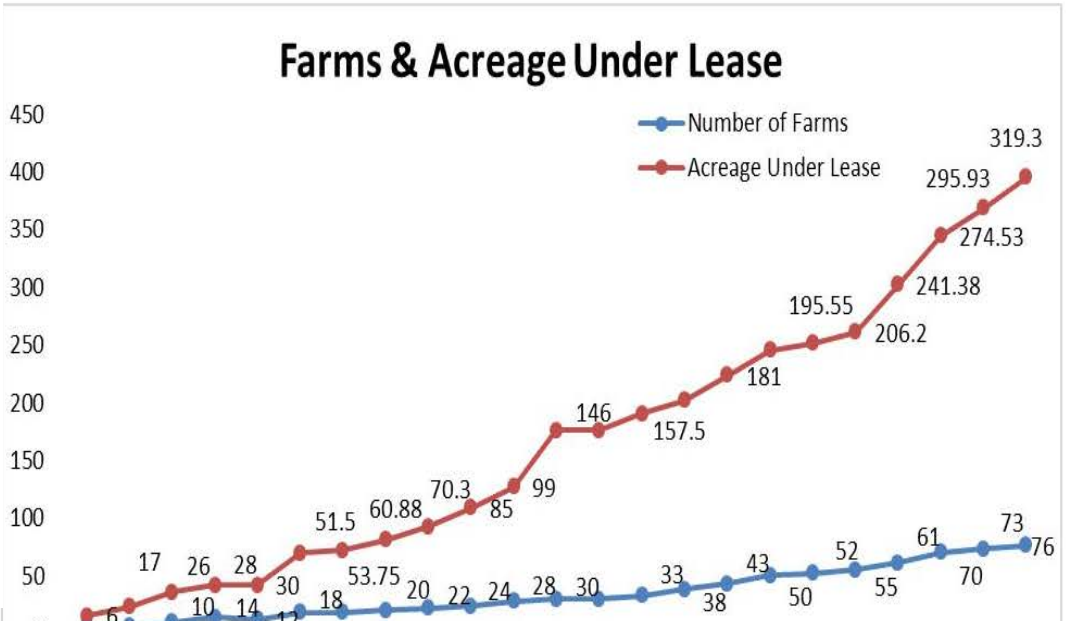
Aquaculture Coordinator
Coastal Resources Management Council
4808 Tower Hill Rd.
Wakefield, RI 02879-1900

Rhode Island Aquaculture Industry - 2018
At a Glance

- The number of farms in Rhode Island increased from 73 to 76
- The total area now under cultivation increased 23.2 acres for a total of 319.3 acres
- Oysters remained the number one aquaculture product with 8,515,950 sold for consumption
- The farm gate value of aquaculture products for consumption was $5,850,749
- Oyster seed sales from RI aquaculturists was valued at $243,250
- Combined value of aquaculture products for consumption and seed sales was $6.09 million
- The number of aquaculture farm workers increased to 200



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Aquaculture in Rhode Island 2018

Photograph: Ayla Fox

Prepared by:
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The Economic Impact of Tourism in Rhode Island

2017 Analysis

TOURISM ECONOMICS
AN OXFORD ECONOMICS COMPANY

Economic Activity Associated with Commercial Fisheries and Shellfish Aquaculture in Northampton County, Virginia

October 2014

Thomas J. Murray
Virginia Institute of Marine Science
Virginia Sea Grant-Affiliated Extension

VIMS | WILLIAM & MARY
VIRGINIA INSTITUTE OF MARINE SCIENCE
MARINE ADVISORY SERVICES

Virginia Coastal Zone MANAGEMENT PROGRAM

Sea Grant Virginia

An Approach to Determining Economic Impacts of U.S. Aquaculture

Doug Lipton, Matt Parker, John DuBerg, and Michael Rubino

Pg 16, 15, 19 23

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

NOAA Technical Memorandum NMFS-F/SPO-197
September 2019

EAST COAST SHELLFISH GROWERS ASSOCIATION

Ecosystem Services Associated with Shellfish Aquaculture

Bob Rheault
Executive Director
East Coast Shellfish Growers Association
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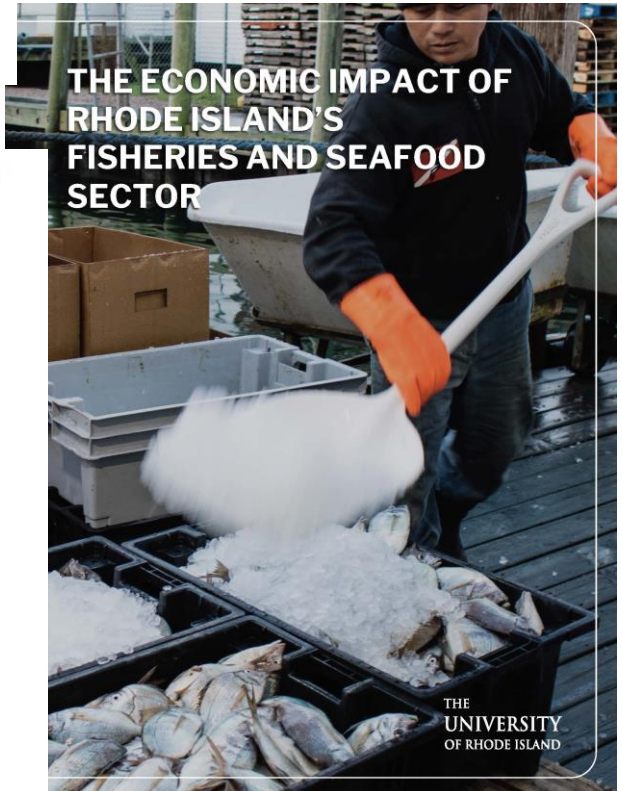
Rhode Island Intensive Oyster Aquaculture Economic Impact Analysis

Draft

Prepared for
National Oceanic and Atmospheric Administration,
National Centers for Coastal Ocean Science

February 2014

February 1, 2015



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American Institute of Biological Sciences

Economic Valuation of Ecosystem Services Provided by Oyster Reefs
Author(s): Jonathan H. Grabowski, Robert D. Brumbaugh, Robert F. Conrad, Andrew G. Keeler, James J. Opaluch, Charles H. Peterson, Michael F. Piehler, Sean P. Powers and Ashley R. Smyth
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Source: *BioScience*, Vol. 62, No. 10 (October 2012), pp. 900-909
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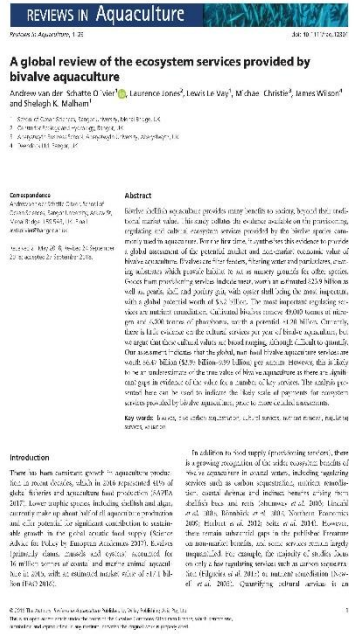
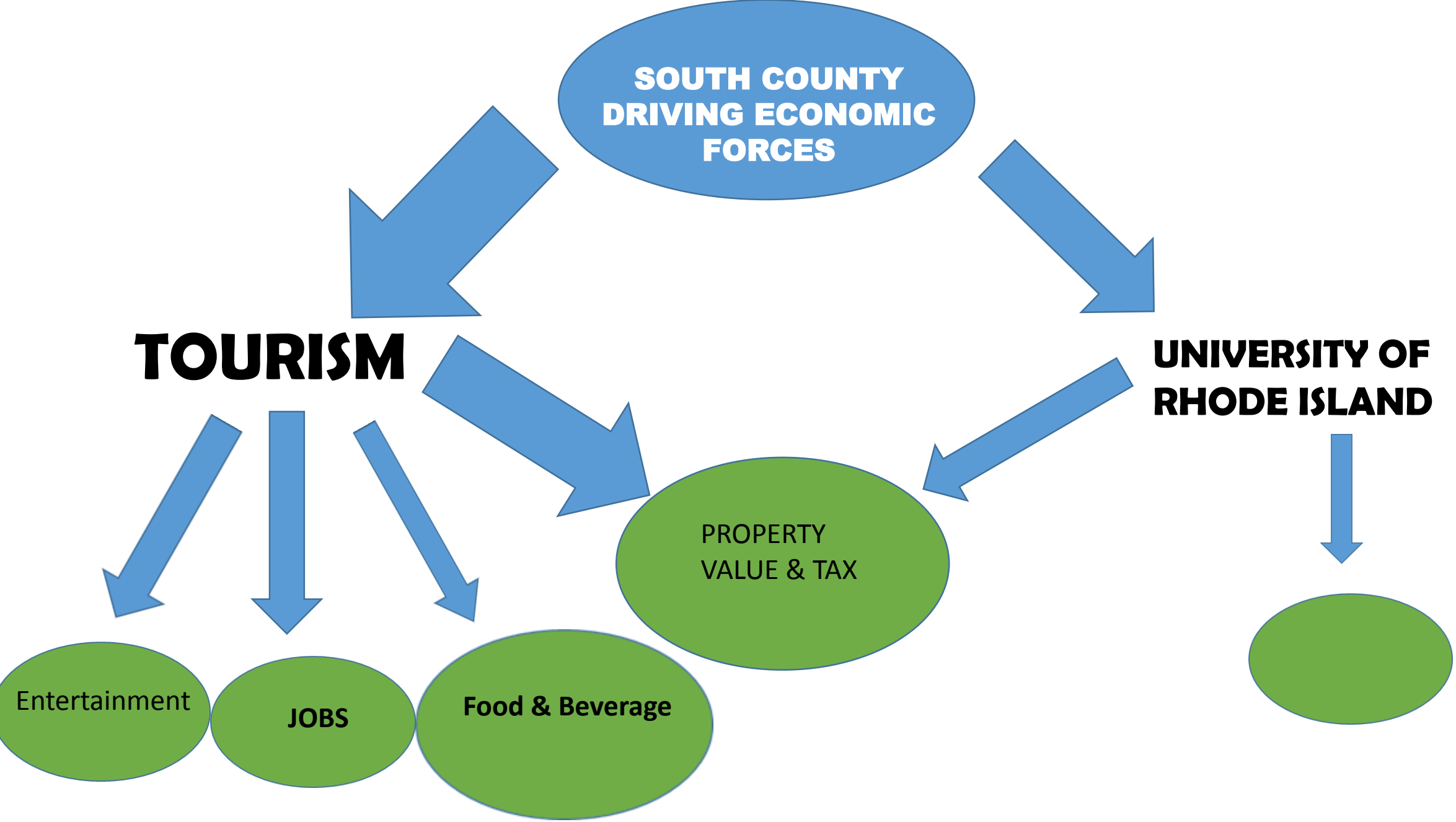
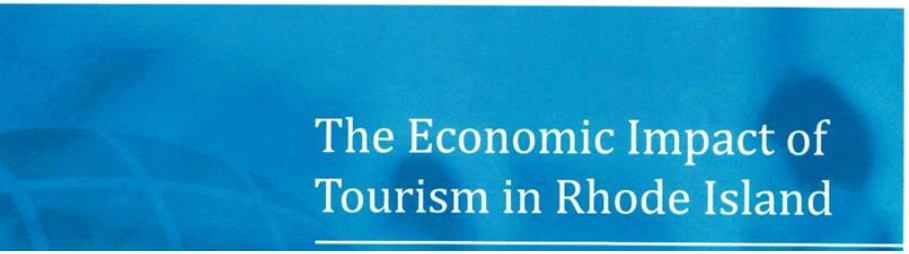
Accessed: 19/10/2012 20:30




SOUTH COUNTY DRIVING ECONOMIC FORCES
TOURISM
UNIVERSITY OF RHODE ISLAND
PROPERTY VALUE & TAX
Entertainment
JOBS
Food & Beverage

OVERLAPPING INDUSTRIES



Why is this a challenge?

- Most economic sectors such as financial services, insurance, or construction are easily defined within a country's national accounts statistics.
- Tourism is not so easily measured because it is not a single industry. It is a demand-side activity which affects multiple sectors to various degrees.
- Tourism spans nearly a dozen sectors including lodging, retail, real estate, air passenger transport, food & beverage, car rental, taxi services, travel agents, and recreation (including museums, theme parks, sports events and others).

of the increase, we estimate the total economic impact would range from $10.7 - $12.8 billion and the number of jobs from 109,500 - 133,400.

The above estimates should be used cautiously given the lack of reliability in the statistics about the current level of aquaculture production, and the production budgets on which the estimates are based. We make several findings and recommendations as to actions needed to produce reliable annual economic impact estimates that are summarized here:

1) *Fisheries Economics of the United States* currently provides useful information to stakeholders and the general public about the economic impact of the fishing and seafood industries, and

should include domestic aquaculture impact estimates, particularly as domestic aquaculture increases in importance as a component of U.S. seafood supply.

An Approach to Determining Economic Impacts of U.S. Aquaculture

Doug Lipton, Matt Parker, John DuBerg, and Michael Rubino

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2) There is insufficient extant cost information and only greatly outdated information on production costs for several major species to develop a reasonable national estimate of economic impacts.

3) A systematic way of collecting annual aquaculture production data from states, industry associations, or directly from producers is essential to ensuring the quality of the estimates that rely on these numbers.

   a. A clear definition of what constitutes aquaculture production, particularly for shellfish, is necessary and will help avoid some double counting in commercial landings that occurs now.
   b. Since there is interest in reporting on marine versus freshwater aquaculture production, classification of what constitutes each will have to be agreed upon.
   c. Protecting confidentiality of firm level data will be an issue when there are a small

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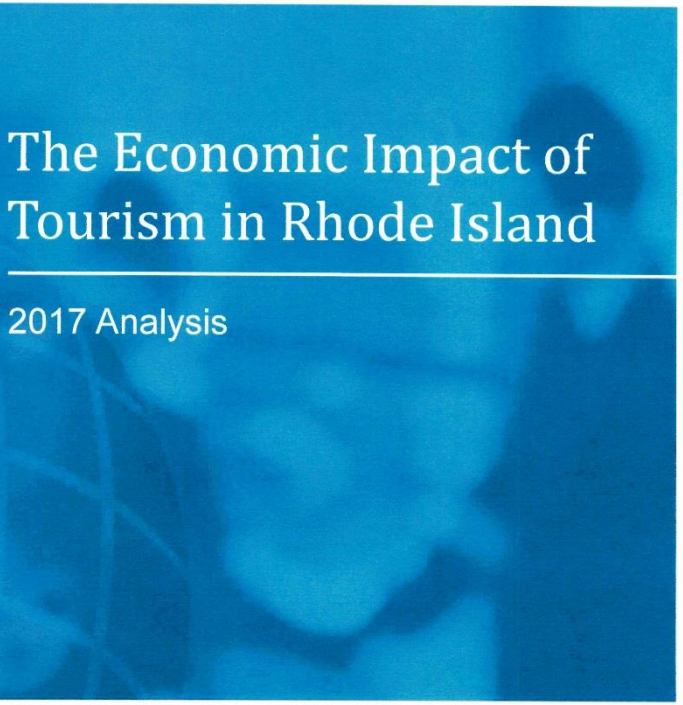
National Marine Fisheries Service

NOAA Technical Memorandum NMFS-F/SPO-197
September 2019



Headline results

- Rhode Island hosted 24.8 million visitors in 2017, including 7.8 million overnight visitors
- The total traveler economy reached $6.5 billion in 2017, including visitor spending, tourism-related construction, and supporting industries.
- This represents growth of 5.4% in 2017 and cumulative growth of 23% over the past five years.
- This supported 83,913 jobs, including direct, indirect and induced impacts. This equates to one job for every 293 visitors.
- 13.1% of all jobs in the state (1-in-7.6) are sustained by the travel economy.
- Total traveler economy employment increased 4.3% from 2015 to 2017. The compares to just 1.9% employment growth for the total Rhode Island economy.
- Tourism in Rhode Island generated $775 million in state and local taxes in 2017. Each household in Rhode Island would need to pay $1,890 in additional taxes in the absence of the visitor economy.

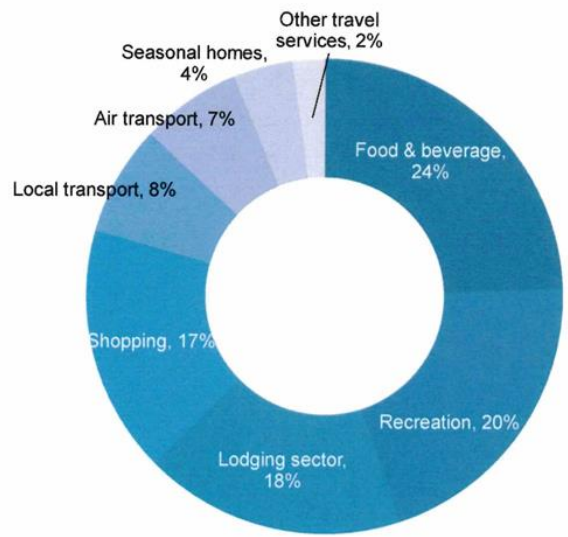
ourism is the 5th largest employer in RI

Rhode Island Employment Ranking		
1	Health care and social assistance	89,271
2	Retail trade	57,650
3	Manufacturing	42,912
4	Professional, scientific, and technical services	42,046
5	**Tourism (direct)**	**37,403**
6	Administrative and support and waste management and remediation services	35,714
7	Finance and insurance	35,537
8	Other services (except public administration)	35,020
9	Local government	32,494
10	Educational services	31,260
11	Construction	30,269
12	Accommodation and food services**	29,694
13	Real estate and rental and leasing	
14	State government	
15	Wholesale trade	
16	Arts, entertainment, and recreation	
17	Transportation and warehousing	
18	Management of companies and enterprises	
19	Federal, civilian	
20	Information	

Source: Bureau of Economic Analysis, Tourism Economics
BEA data as available for 2016. Latest tourism employment data is shown for 201
** net of tourism-generated employment

Visitor spending by sector

RI Visitor Spending
2017



- 24% of each visitor dollar is spent on food and beverages.
- The recreation sector, including casino gaming, is the second largest recipient of visitor spending at 20%.
- The lodging sector accounts for 18% of all visitor spending.

Summary of impacts

- $4.4 billion in visitor spending sustained direct employment of 37,403 within the narrow "visitor industry", representing 5.9% of all employment in 2017. This compares to 5.7% of employment in 2015 as the visitor economy expanded at a faster rate than the rest of the Rhode Island economy.

- The $6.5 billion travel economy sustained employment of 83,913 including direct, indirect, and induced impacts. This represented 13.1% of all employment in 2017.

RI Tourism Impact Summary, 2017		
	Visitor industry	**Traveler economy**
Expenditures (millions)	$ 4,364	$ 6,500
	Direct impacts	**Total Impacts****
GDP (millions)	$ 2,120	$ 5,491
Employment	37,403	83,913
Share of total employment	*5.9%*	*13.1%*
Personal income (millions)	$ 1,171	$ 3,131
State taxes (millions)	$ 280	$ 387
Local taxes (millions)	$ 283	$ 389

** includes direct, indirect, and induced impacts

Travel economy impacts by sector

- Travel economy expenditures of $6.5 billion generated a total of $5.5 billion in state-wide GDP in 2017 (after netting out imports). This includes indirect and induced impacts and represents 9.2% of the state economy.
- The visitor industry also directly supported 83,913 jobs (13.1% of all RI employment) with income of $3.1 billion in 2017.

Travel Economy Impacts, 2017 (Total)					
	GDP (mns)		Employment	Personal Income (mns)	
Agriculture, Fishing, Mining	$	2	63	$	1
Construction and Utilities	$	183	1,796	$	107
Manufacturing	$	20	224	$	14
Wholesale Trade	$	118	707	$	60
Air Transport	$	274	1,047	$	66
Other Transport	$	120	2,076	$	94
Retail Trade	$	370	7,575	$	230
Gasoline Stations	$	24	255	$	23
Communications	$	181	526	$	104
Finance, Insurance and Real Estate	$	870	4,116	$	216
Business Services	$	558	7,217	$	430
Education and Health Care	$	259	3,983	$	232
Recreation and Entertainment	$	708	16,162	$	412
Lodging	$	616	6,900	$	301
Food & Beverage	$	1,071	28,985	$	725
Personal Services	$	87	1,920	$	82
Government	$	31	364	$	34
TOTAL	$	5,491	83,913	$	3,131
Share of RI Economy		9.2%	13.1%		5.7%

BUBBLES & PEARLS

I’m not going to tell you that all Champagne sales in RI are an indirect economic benefit of the RI Aquaculture industry simply because oysters pair well with sparkling wine…or wine or beer in general. I will tell you that there is an undeniable positive correlation between shellfish sales and alcohol sales in every restaurant.

Post-Secondary Education

The University of Rhode Island:
12 Aquaculture undergraduate students per year, half in state, half out of state (Dr. Michael Rice, URI Aquaculture, 2019)
$525 per credit instate students (URI website: tuition 2019)
$1,238 per credit out of state students (URI website: tuition 2019)

6ppl instate x $525 per credit x 30 Aquaculture specific credits= $94,500 direct
6ppl out of state x $1238 per credit x 30 Aquaculture specific credits= $222,840 direct
6ppl instate x $525 per credit x 90 General Education Credits= $283,500 indirect
6ppl out of state x $1238 per credit x 90 General Education Credits= $668,520 indirect

Roger Williams University:
10-20 Aquaculture undergraduate students per year (Dr. Dale Leavitt, RWU Aquaculture, 2019)
$1,527 per credit (RWU website; tuition 2019)

15ppl x $1,527 per credit x 45 Aquaculture specific credits= $1,030,725 direct
15ppl x 1,527 per credit x 75 General Education Credits= $1,717,875 indirect

***As well as the uncalculated expenses including student's cost of housing, textbooks, food, gas, etc. directly spent in the local economy.**

Total Direct: $1,348,065.00

Total Indirect: $2,669,895.00

Farm Production

The 2018 farm gate value of Rhode Island grown products was $6,094,199 which is an increase of 4.7 percent from the 2017 farm gate value. Seed sales for 2018 dropped to $243,250 while kelp sales climbed by 230% to $17,008.

The number of farms active in Rhode Island aquaculture at the end of 2018 was 76, with cultivation of 319.3 acres.

CRMC

COASTAL RESOURCES MANAGEMENT COUNCIL

Aquaculture in Rhode Island 2018

Photograph: Ayla Fox

Prepared by:
David Beutel
Aquaculture Coordinator
Coastal Resources Management Council
4808 Tower Hill Rd.
Wakefield, RI 02879-1900

Rathskeller	$2.25
Matunuck Oyster Bar	$2.00
210 Oyster Bar	$2.00
The Bridge	$2.50
Benjamin's	$2.25
Captain Jacks	$2.50
Chop House	$2.75
The Mooring	$3.00
22 Bowens	$3.00
Red Parrot	$3.00
White Horse	$3.00
Providence Oyster Bar	$2.95
Circe	$3.00
Celestial Café	$2.17
Georges	$2.50
Ella's	$3.00
Greenwich Bay Oyster Bar	$1.95
Wharf Kitchen	$2.33
Lobster Bar	$3.00
Coast Guard	$2.75
Pineapple Club	$3.00
Ocean House	$3.50
Average Price	**$2.65**

Rhode Island Restaurant Oyster Sales

(end consumer purchase from restaurant)

8,434,541 oysters x $2.65*per oyster= $22,351,533.65

$22,351,533.65 x $.07 RI sales tax = $1,564,607.36 in RI sales tax

*See figure 1 "Average Rhode Island Restaurant Sales Price" for how average price was derived
* Local 1% Hotel Tax not included for hotels with restaurants that sell oysters (i.e. Ocean House, The Break, etc…).

- Oyster Sales in Rhode Island (from distributor and/or from farm directly)

- 8,434,541 Oysters sold for consumption (Beutel, pg. 3)
- $500,000 USDA RI Oyster Farm Grant (PBN Staff, pg. 3)

- 8,434,541 oysters x $.70 per piece = $5,904,178
- $5,904,178 + $500,000= $6,404,178

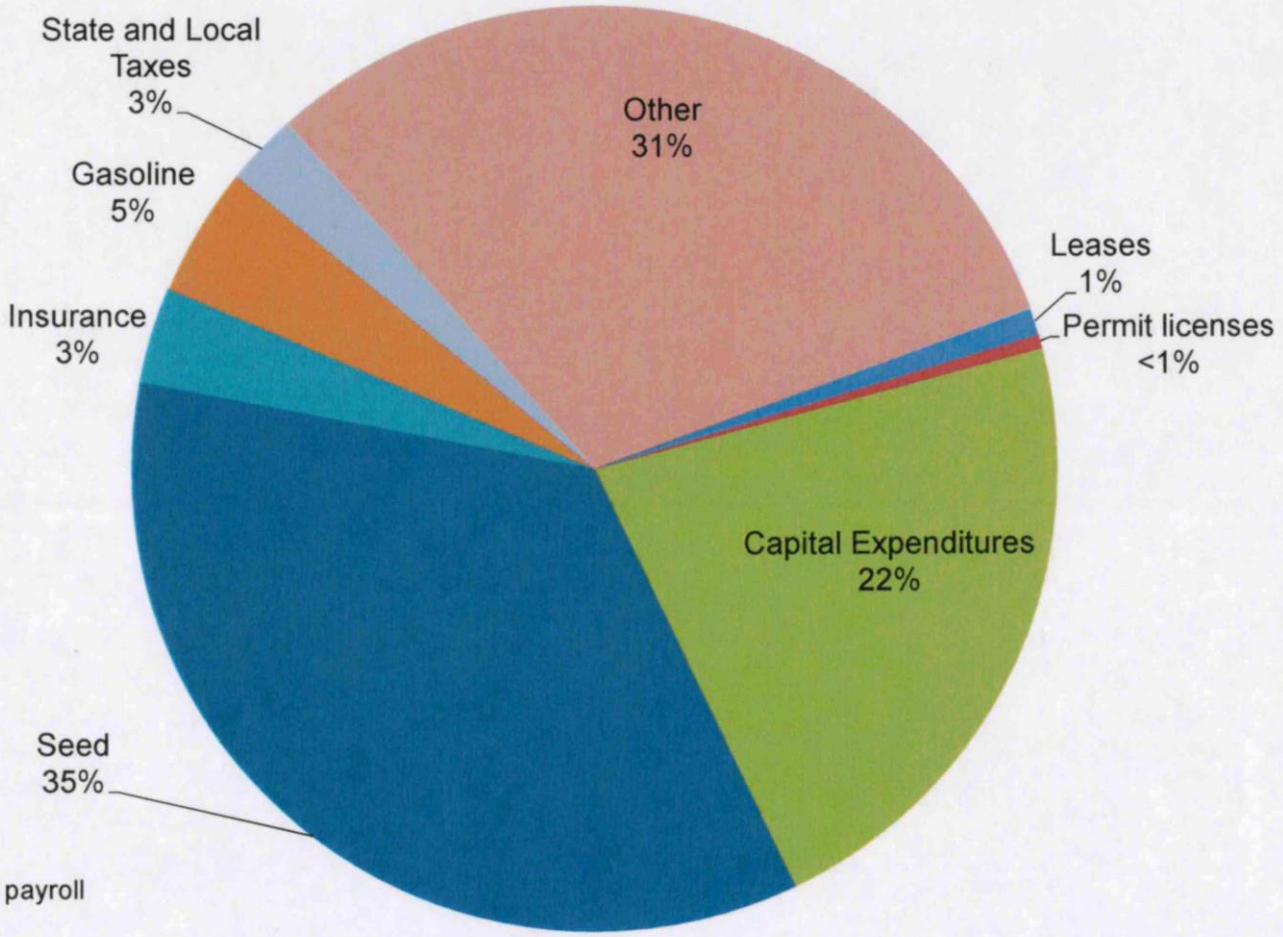
- *this equation assumes out of state sales vs. purchases made from out of state dealers are equivalent, thus canceling out.
- **$.70= average between direct to restaurant sales and estimated direct to distributor sales

Table 5 - Total Economic Impact of Shellfish Aquaculture and Commercial Fishing in Northampton County, Virginia - 2013

	Aquaculture	Commercial Fishing	Total
Output ($ millions)	$90.8	$6.6	$97.4
Employment (fte)	817	170	987
Income ($ millions)	$25.6	$1.5	$27.1

Table 6 - Summary Economic Impacts in Northampton County from Northampton County Aquaculture & Commercial Fisheries Landings - 2014 ($ Millions)

		Aquaculture	Commercial fishing	Total
Labor Income Impacts	Direct Impacts	$9.6	$1.3	$10.9
	Indirect Impacts	$10.0	$0.1	$10.1
	Induced Impacts	$6.0	$0.2	$6.2
	Total	$25.6	$1.5	$27.1
Indirect Business Tax Impacts	Direct Impacts	$0.7	$0.0	$0.8
	Indirect Impacts	$1.1	$0.0	$1.1
	Induced Impacts	$1.4	$0.0	$1.5
	Total	$3.3	$0.1	$3.4
Other Property Income Impacts	Direct Impacts	$2.5	$0.0	$2.5
	Indirect Impacts	$3.4	$0.0	$3.4
	Induced Impacts	$4.1	$0.1	$4.3
	Total	$10.0	$0.2	$10.2
Total Value Added Impacts	Direct Impacts	$12.9	$1.3	$14.2
	Indirect Impacts	$14.5	$0.1	$14.6
	Induced Impacts	$11.6	$0.3	$11.9
	Total	$38.9	$1.8	$40.7
Output Impacts	Direct Impacts	$36.8	$5.8	$42.6
	Indirect Impacts	$35.3	$0.2	$35.6
	Induced Impacts	$18.7	$0.6	$19.2
	Total	$90.8	$6.6	$97.4
Employment Impacts (FTE)	Direct Impacts	313	163	476
	Indirect Impacts	343	2	345
	Induced Impacts	161	6	166
	Total	817	170	987



*Other than payroll

Note: Other includes miscellaneous purchases of clothing and equipment, repair services and transportation
Source: Northern Economics, Inc. using Rheault, 2013

5. Oyster Production and Revenue (2012)

ster Production (count)	Oyster Revenue ($)
3,691,339	1,604,745
461,417	229,249

penditure Data

their spending in 2012. The survey listed the spending categories pondents supplied responses by category. Total reported spending pods and services shown below (Table 6 and Figure 2).

al and Average Expenses by Category, 2012 ($)

Expenditure	Leases	Permit licenses	Capital expenditures	Seed	Insurance	Gasoline	State and local taxes*	Other	Total
Total	9,250	5,083	222,000	354,730	34,044	45,491	25,466	312,636	1,008,700
Average	1,321	726	37,000	50,676	4,863	7,582	4,244	52,106	158,519

Note: The calculated totals above were adjusted to meet reported totals; where reported totals were greater than calculated totals (the sum of categories) and no 'other' expenditures were reported, study team increased other expenditure totals to maintain consistency.

AQUACULTURE VS FISHERIES

Figure 2. Schematic of the domestic aquaculture seafood market for estimating economic impacts.

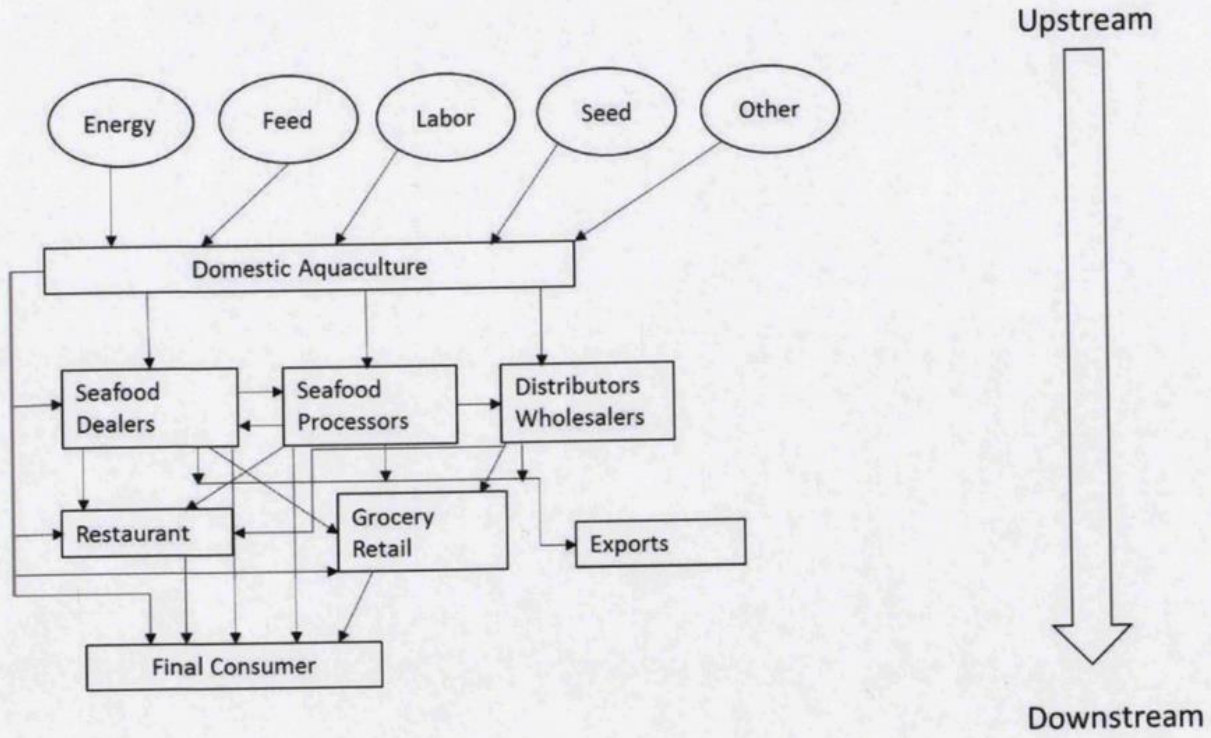
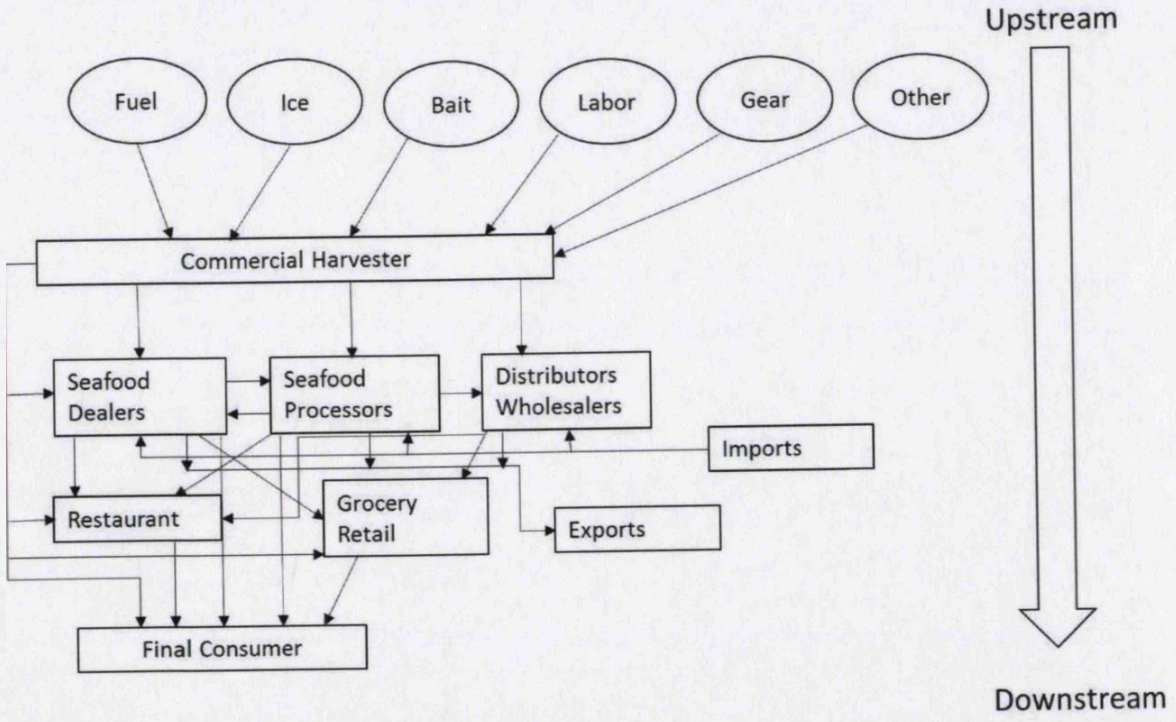


Figure 1. Schematic of the seafood market underlying calculations of economic impacts for Fisheries Economics of the U.S.



EXECUTIVE SUMMARY

+ 428 firms
+ 3,147 jobs
+ $538.3 million gross sales

RESULTS

The Rhode Island Fisheries and Seafood Sector includes 428 firms, generating $538.3 (+/- 11.6%) million in annual gross sales and employing 3,147 people (+/- 9.4%). The largest subsector, in terms of the number of firms and jobs, is Commercial Fishing, including finfish, shellfish and squid.

Gross Sales and Jobs by Subsector

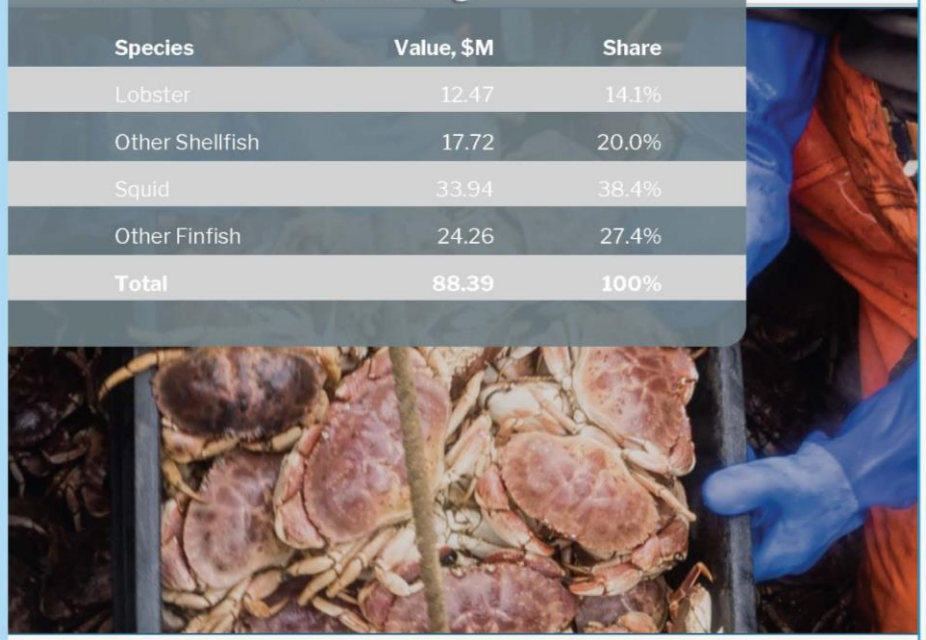
Category	Firms	Sales, $M	Jobs
Commercial Fishing	150	88.39	1,711
Charters	75	19.99	182
Processors	11	67.05	215
Professional Services	18	5.76	73
Retail Dealers	26	11.57	136
Service and Supply	27	84.61	152
Tackle Shops	25	14.71	62
Wholesalers	96	246.26	617
All Fisheries and Seafood	**428**	**538.33**	**3,147**

74% of RI Fisheries and Seafood employment is found in the largest two

values of landings (NOAA) and the resulting jobs estimate from the IMPLAN input-output model. The Technical Appendix to this report contains more discussion about these data. Because the business data do not admit a breakdown of commercial fishing by species, we present the NOAA data for values of landings below. Besides lobster, top shellfish species are Scallops ($8.49M), Quahogs/Clams ($5.59M) and Jonah Crab ($3.32M). Top finfish species are Fluke ($5.47M) and Scup ($4.04M).

X-Vessel Value of Landings

Species	Value, $M	Share
Lobster	12.47	14.1%
Other Shellfish	17.72	20.0%
Squid	33.94	38.4%
Other Finfish	24.26	27.4%
Total	**88.39**	**100%**



The data suggest that fishing license holders are generally specialized, with 42% landing 5% shellfish or less by value, and 55% landing 95% shellfish or more by value. Thus, shellfishing operations are generally of a smaller economic scale: the majority of licenses are for shellfish, though they comprise only 34.1% of the total value of landings.

February 1, 2015

RESULTS

GREEN-RELATED SECTOR SUMMARY

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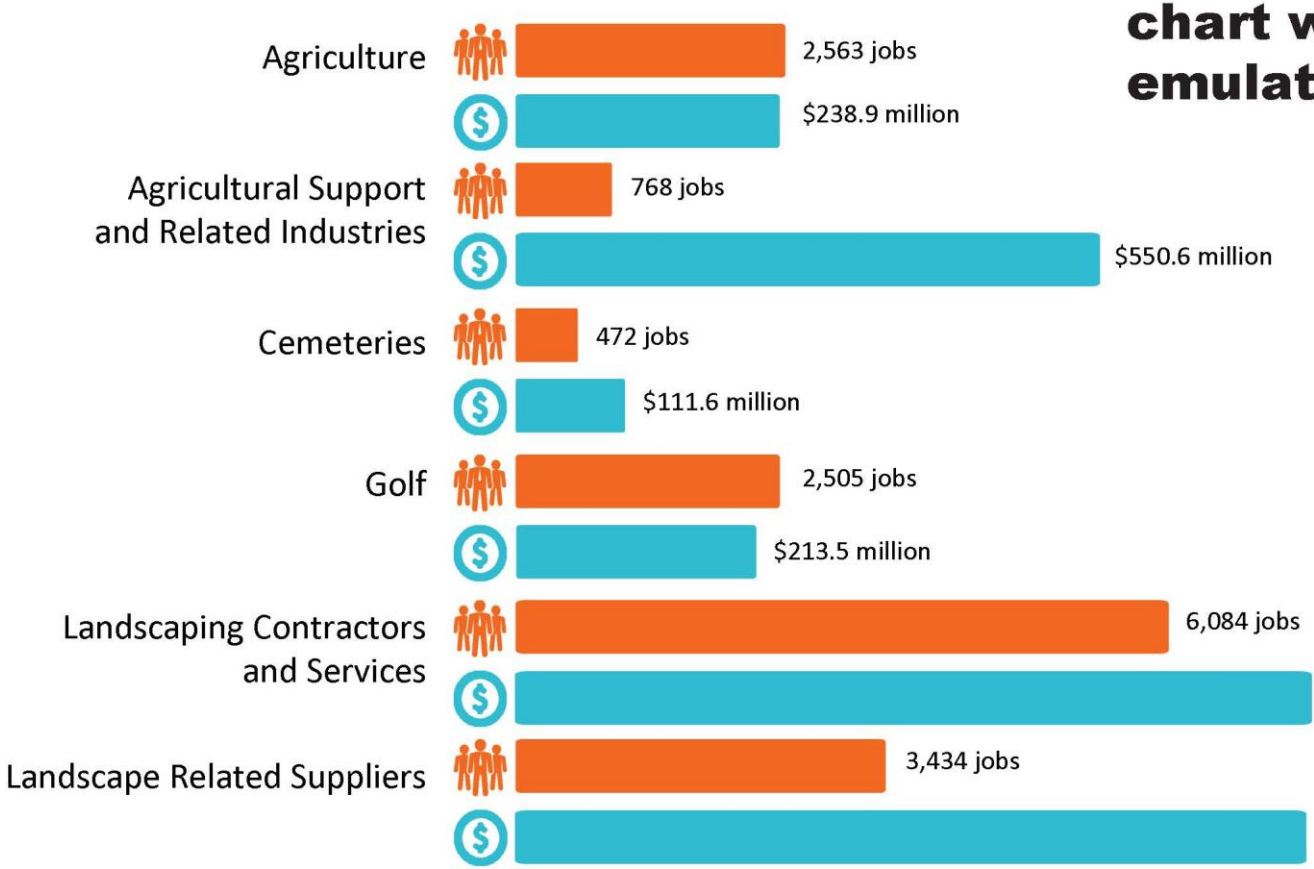


February 1, 2015

AGRICULTURE

Subsectors in Agriculture

The following subsector definitions are included in our estimates for agriculture. The details of NAICS classifications for these subsectors can be found in the Technical Appendix to this report.

Animal Production
We estimate all animal agriculture together except for aquaculture. This category includes dairy, ranching and farming of cattle, pigs, sheep or goats, and poultry and egg production. Also included are apiculture (beekeeping), rabbit farming, and breeding operations for horses and pets.

Aquaculture
Includes farming of shellfish, finfish, and hatcheries of both types. Oyster farming operations are the most common type of aquaculture in Rhode Island.

Crop Production
We include all crop farming except for nursery and vineyards, which are estimated separately. This category includes growers of grains, vegetables, melons, fruits, tree nuts and other crops.

Did you know?

Agricultural output (4x) and jobs (1.4x) are dramatically larger than the 2012 Agricultural Census figures.

We estimate gross sales of $238.9 million and 2,563 jobs, excluding more than 2,000 jobs of farm operators and family members.

Economic Input-Output Model Application

Most regional input-output studies attempt to characterize either, the economic impacts of specified changes in final demand for a given set of products, services, and industries, or the economic significance of specific industries in a regional and national economy. The research described herein accomplishes the latter task, assessing the economic significance of the shellfish farming upon related industries located in Northampton County and the Commonwealth of Virginia.

Because of the interrelationships among the many sectors of an economy, any new basic economic activity, such as increasing clam and oyster sales to out-of-county buyers, will generate additional waves of economic impact. By stimulating the expenditures by out-of-region customers for the export sale of marine products, the seafood production sectors initiate such expanding rounds of economic impact. These impacts first occur within Northampton communities and then throughout the state.

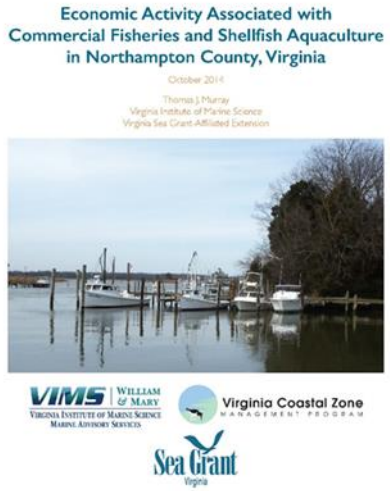
For example, the export marketing of seafood products from the County and Virginia calls forth additional activity among the suppliers of necessary inputs as well as among distributors of seafood related products, warehouses, and retailers. The impact of the sale of a dollar of aquaculture and fishery related goods and services, generates activity not only for the retail sector, but also indirectly generates economic activity for suppliers, accountants, and programmers whose employment supports the operation of the retail enterprise. In an analogous way, the activities of seafood-related marketers and consumers will generate multiple rounds of economic activity.

As mentioned above, economic impact analysis is an attempt to provide an estimate of the total impact of any economic activity in any region, including, not only the primary economic impact, but also secondary and tertiary impacts.

The IMPLAN Model

Many economic impact studies use information from the Regional Inter-industry Impact Model – (IMPLAN 2008). This model was developed using a combination of direct survey data obtained through national surveys of inter-industry interaction, and then shares down the inter-industry relationships to the local or regional level, based upon the structure or employment structure of industries in the state or region. The IMPLAN model used herein includes industry linkages specific to Northampton County and the Commonwealth of Virginia.

From these government derived regional inter-industry relationships, output, income, and employment multipliers are



3.2.2 Oyster Economic Impacts

The preliminary estimates of impacts of aquaculture oysters are presented in Table 6. The 2015 first sale oyster production value was estimated to be $173 million, $26 million less (13%) than crawfish value. Interestingly, the indirect effect of this oyster production was significantly less (60%) than the impact from crawfish, while the induced effect is higher by 23% for oysters. This is due to the fact that labor costs make up a much higher percentage of oyster production compared to crawfish production. The greater labor reliance in oyster production can be seen in the direct employment estimates which equate to 23 jobs per $1 million of production compared to less than 7 jobs per $1 million for crawfish.

Table 6. Summary of All Impacts for Aquaculture: Oysters

Industry Sector	Direct	Indirect	Induced	Total
Growers				
Employment impacts (jobs)	3,936	553	1,103	5,593
Income Impacts (000 of dollars)	99,748	33,823	55,704	189,274
Output Impacts (000 of dollars)	172,778	98,400	178,358	449,536
Primary dealers/processors				
Employment impacts (jobs)	748	553	815	2,116
Income Impacts (000 of dollars)	37,507	31,238	41,129	109,874
Output Impacts (000 of dollars)	110,435	93,162	131,768	335,366
Secondary wholesalers/distributors				
Employment impacts (jobs)	958	551	608	2,117
Income Impacts (000 of dollars)	68,020	32,667	30,686	131,373
Output Impacts (000 of dollars)	90,936	95,169	98,425	284,530
Grocers				
Employment impacts (jobs)	1,331	142	293	1,766
Income Impacts (000 of dollars)	34,300	9,239	14,798	58,338
Output Impacts (000 of dollars)	39,081	24,976	47,385	111,442
Restaurants				
Employment impacts (jobs)	9,253	1,299	2,830	13,382
Income Impacts (000 of dollars)	194,194	78,972	142,871	416,037
Output Impacts (000 of dollars)	346,775	233,753	457,375	1,037,902
Harvesters and seafood industry				
Employment impacts (jobs)	16,269	3,104	5,661	25,033
Income Impacts (000 of dollars)	433,768	185,940	285,189	904,896
Output Impacts (000 of dollars)	760,005	545,460	913,311	2,218,777

ENVIRONMENTAL ECONOMIC

Nutrient Removal; Denitrification & Sequestration

Denitrification – NH_3 – NO_x – N_2(gas) -

Could exceed harvest values (Newell et al. 2005, Stevenson & Brown 2006, Piehler & Smythe 2011, and Kellog 2011)

Could be insignificant (Stephenson 2011, Golen 2007)

Piehler and Smythe 2011 valued nitrogen removal services of oyster reefs at ~ $12,000/acre·yr

Grabowski et al. 2012 ~ $2,600 - $13,400/acre·yr

Nutrient Removal at Harvest

Each oyster contains 0.2-0.5 grams N in tissue and shell protein
(Newell 2004 , Grizzle 2011, Stephenson & Shabman 2011)

@ $13/kg = 2.3% of harvest value
(Piehler and Smythe 2011)

@ $28/kg = 5% of harvest value
(NC Nutrient Offset Credit Program)

@ $330/kg = 59% of harvest value
(Stephenson et al. 2010)

EAST COAST SHELLFISH GROWERS ASSOCIATION

Ecosystem Services Associated with Shellfish Aquaculture

Bob Rheault
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East Coast Shellfish Growers Association
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FISHING INDUSTRIES

Habitat Valuation

Commercial fisheries harvest value is enhanced by oyster reefs, but only if the niche-type is limited.

Periodic harvest and maintenance activities can disturb resident populations

Enhanced commercial harvest value estimated at:
$4,123/ha·yr (Grabowski & Peterson 2007)
>$35,000/ha·yr (Kroeger & Guannel in prep.)

Recreational fisheries "willingness to pay" valuation is likely to be much higher

CHARTERS

We identified 75 businesses operating as fishing charters, many of whom are included in our study of the Marine Trades (Sproul and Michaud, 2018). While similarly regulated to commercial fishing in Rhode Island, these businesses are treated as recreational fishing for the purpose of economic impact analysis. As with Tackle Shops, the impacts from Charters can be considered to measure a small share of the economic impact of recreational fishing.

Fishing charters are the smallest firms in our study, generating an average of 2.43 jobs and gross sales of $267,000. The business has a heavy seasonal component with many firms operating part-time, so the larger firms bring up the average. The median charter operation generates $147,000 per year in gross sales.

Quick Facts for Charters

Number of Firms in RI	75
Jobs	182
Gross Sales, $M	19.99
Jobs per Firm	2.43
Gross Sales per Firm, $M	0.27
Gross Sales per Employee, $K	109.84

Figure 2: Direct vs. Indirect

		Aquaculture post-secondary
	direct	$ 1,348,065.00
	indirect	$ 2,669,895.00
	induced	housing rentals, food, clothing, books, recreation
		Oyster Sales Tax
	direct	$1,564,607.36
	indirect	$98,963,000 food & bev tax + bed tax
	induced	$ put back into community by wait staff, restaurant owners, hotel owners/employees
		Payroll State Tax
	direct	$501,182.19
	indirect	hospitality payroll tax
	induced	?

Total Indirect: $77,640,323.00
Total Direct: $4,798,699.71

		Lease Licensure Fees
	direct	?
	indirect	?
	induced	?
		Operating Costs
	direct	$2538796.54 including insurance, gas, capital expenditures
	indirect	boat reg. fee, gas tax ($41,329.25)
	induced	farm gear, equipment upgrades, boaters license
		Environmental/Social
	direct	?
	indirect	?
	induced	increased property value, improved water quality
		Aquaculture Jobs
	direct	farm employees 194 in 2017 (Beutel, pg. 3)
	indirect	raw bar employees, distributors, captain's for eco tours, farm to table chefs/catering
	induced	Money employees spend in community; housing, food, recreation, work clothes

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Presentation by Jules Opton-Himmel, owner of Walrus & Carpenter Oyster Farm

"Aquaculture as a Business: Portrait of a RI Oyster Farm"

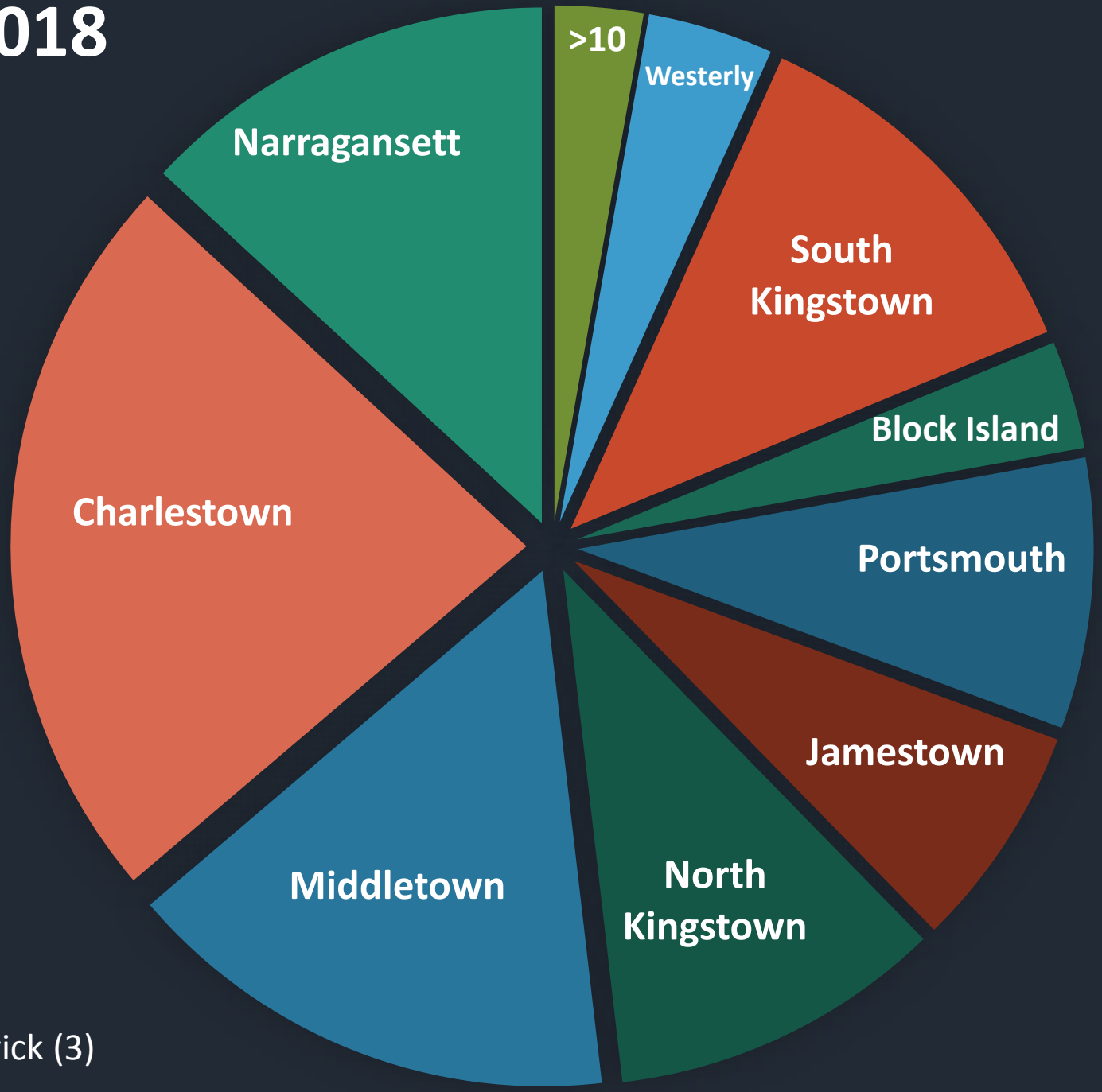
Presentation contained proprietary information so will not be circulated.

Questions: jules@walrusandcarpenteroysters.com

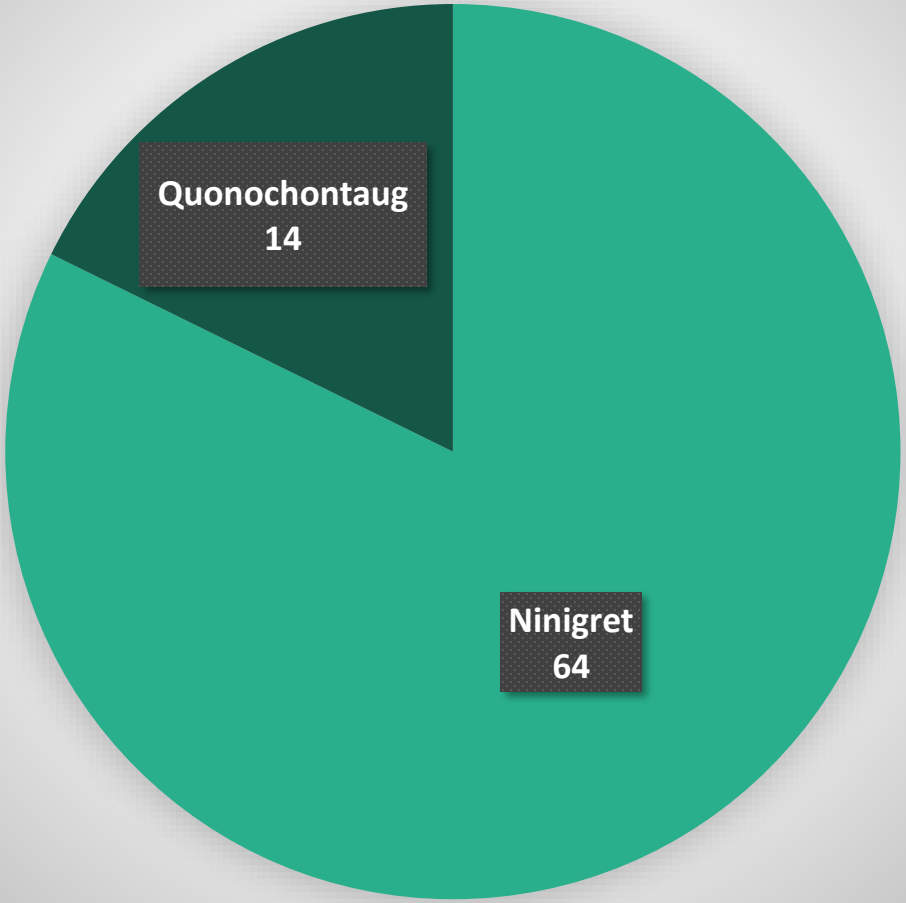
RI Aquaculture by Town 2018

Town	Acres
Charlestown	78
Middletown	53
Narragansett	45
South Kingstown	41
North Kingstown	36
Portsmouth	29
Jamestown	24
Westerly	13
Block Island	11

Towns with Less than 10 acres:
Tiverton (3), Bristol (.25), Little Compton (3), Warwick (3)

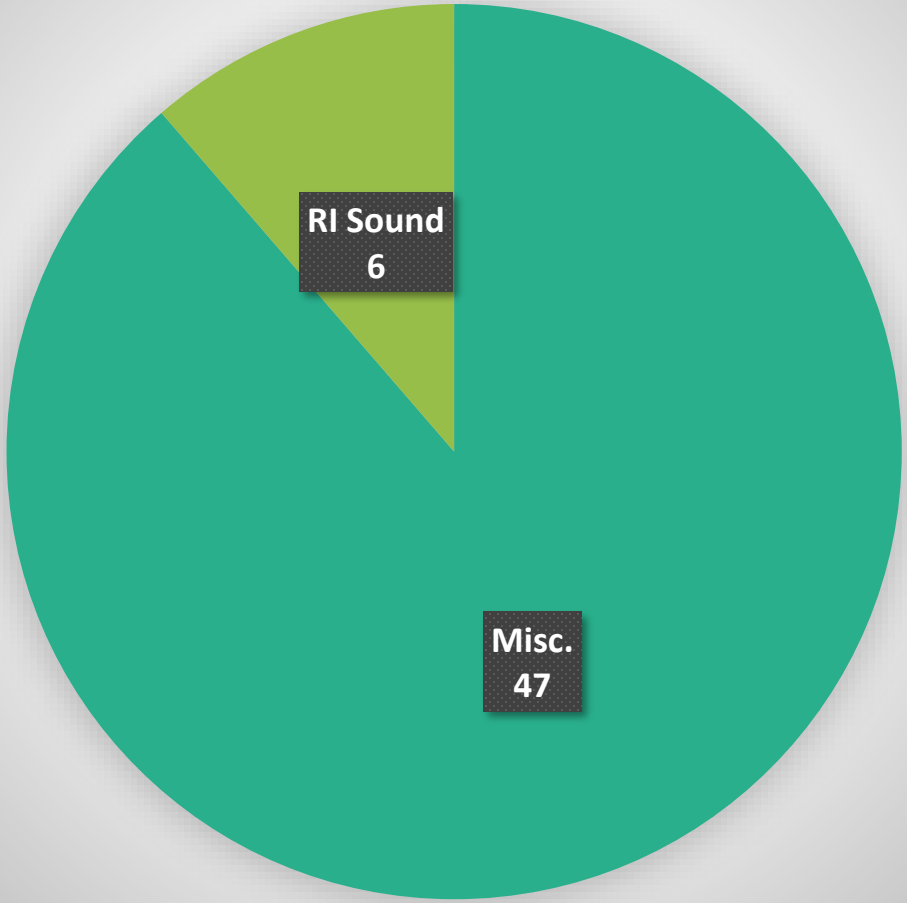


Charlestown: 78 acres



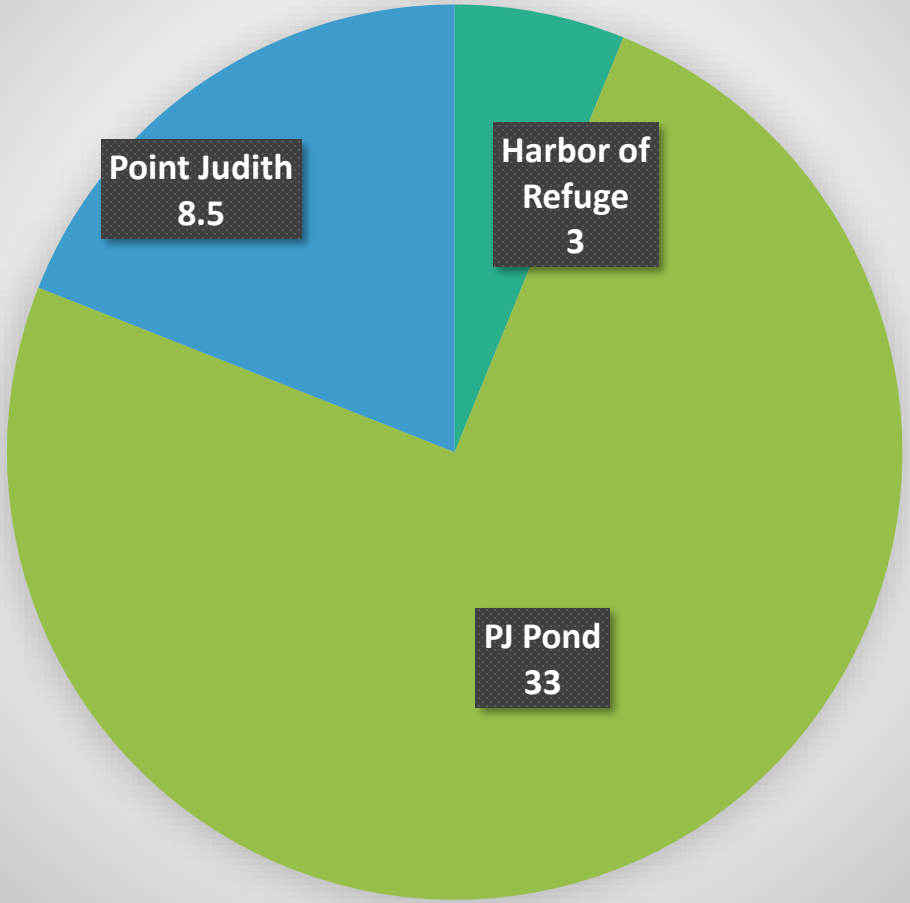
Oyster, Clam, Hard Clam

Middletown: 53 acres



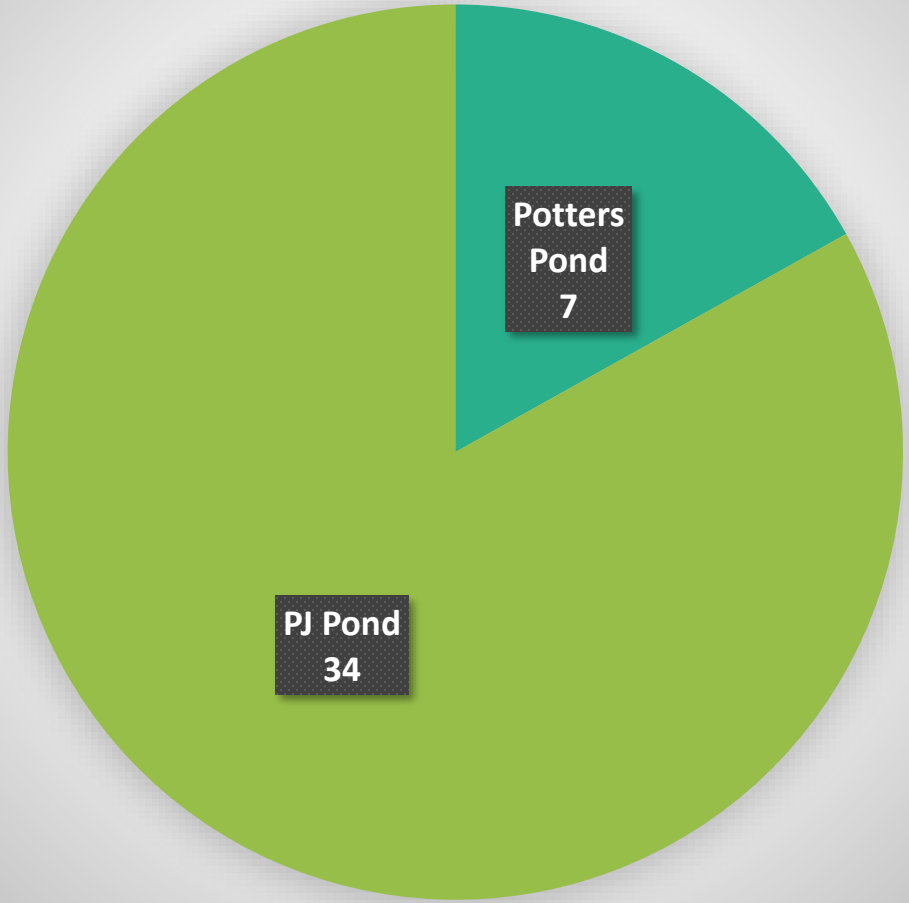
Oyster, Blue mussel, Bay scallop

Narragansett: 44.5 acres

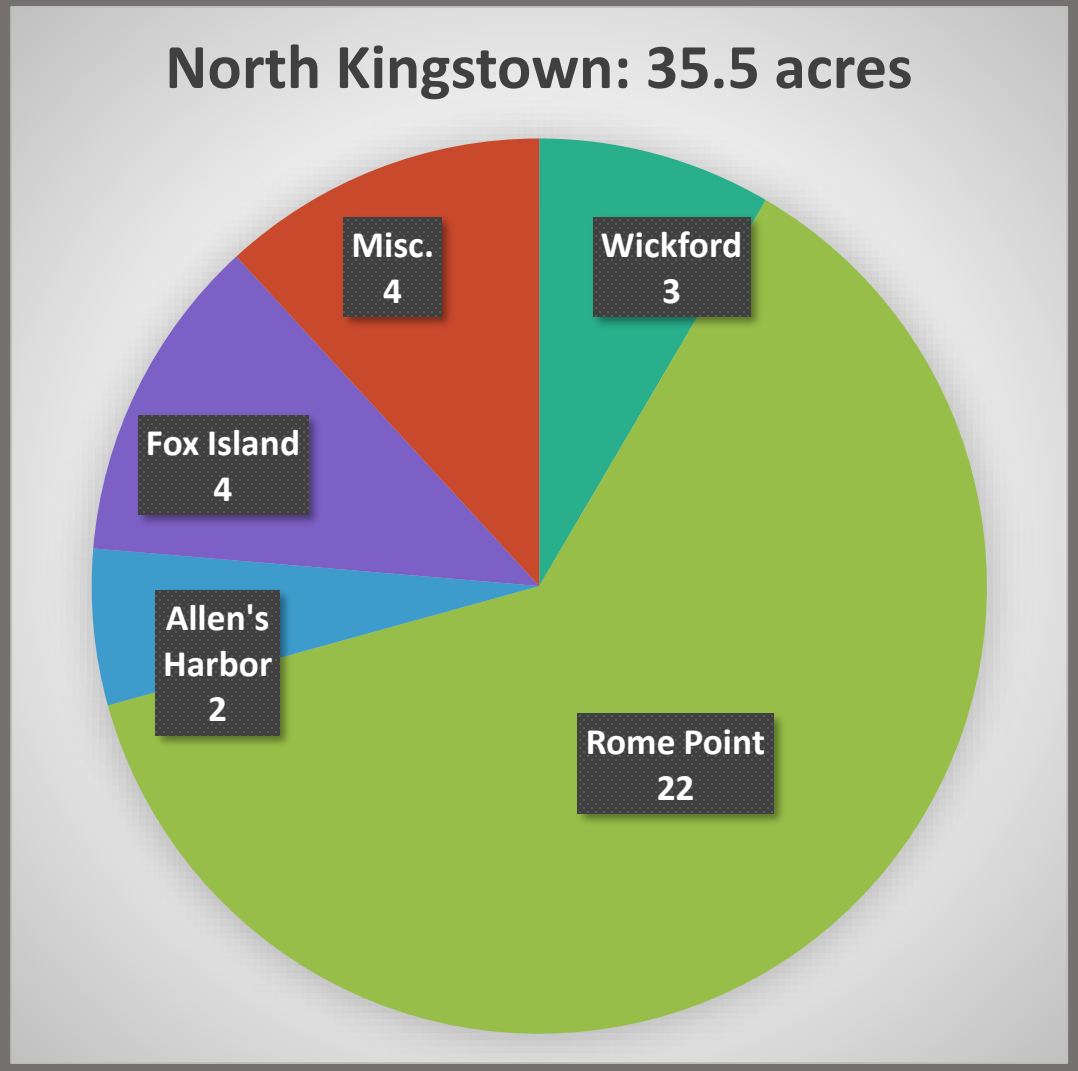


Kelp, Oyster, Steamer, Bay Scallop, Surf Clam

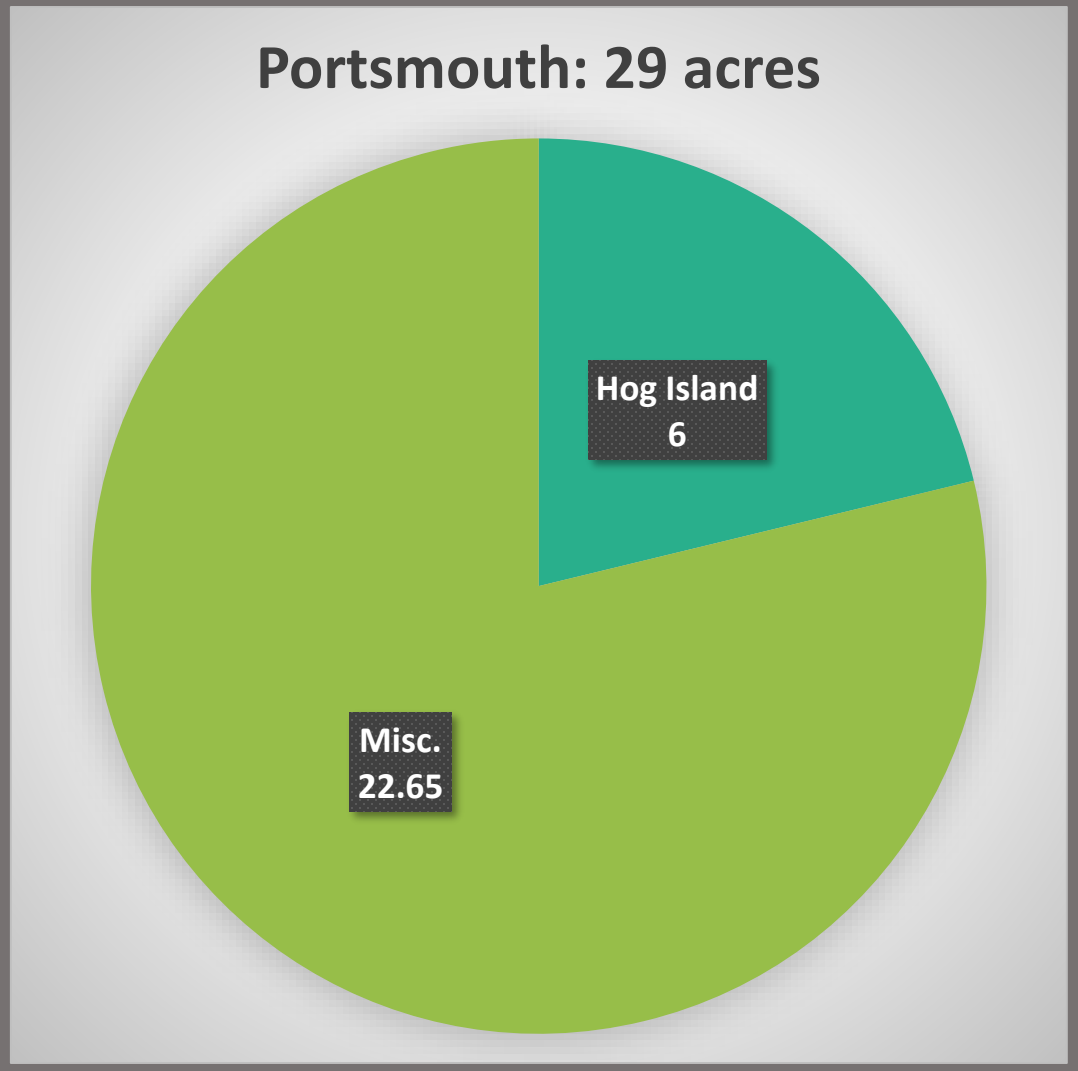
South Kingstown: 41 acres



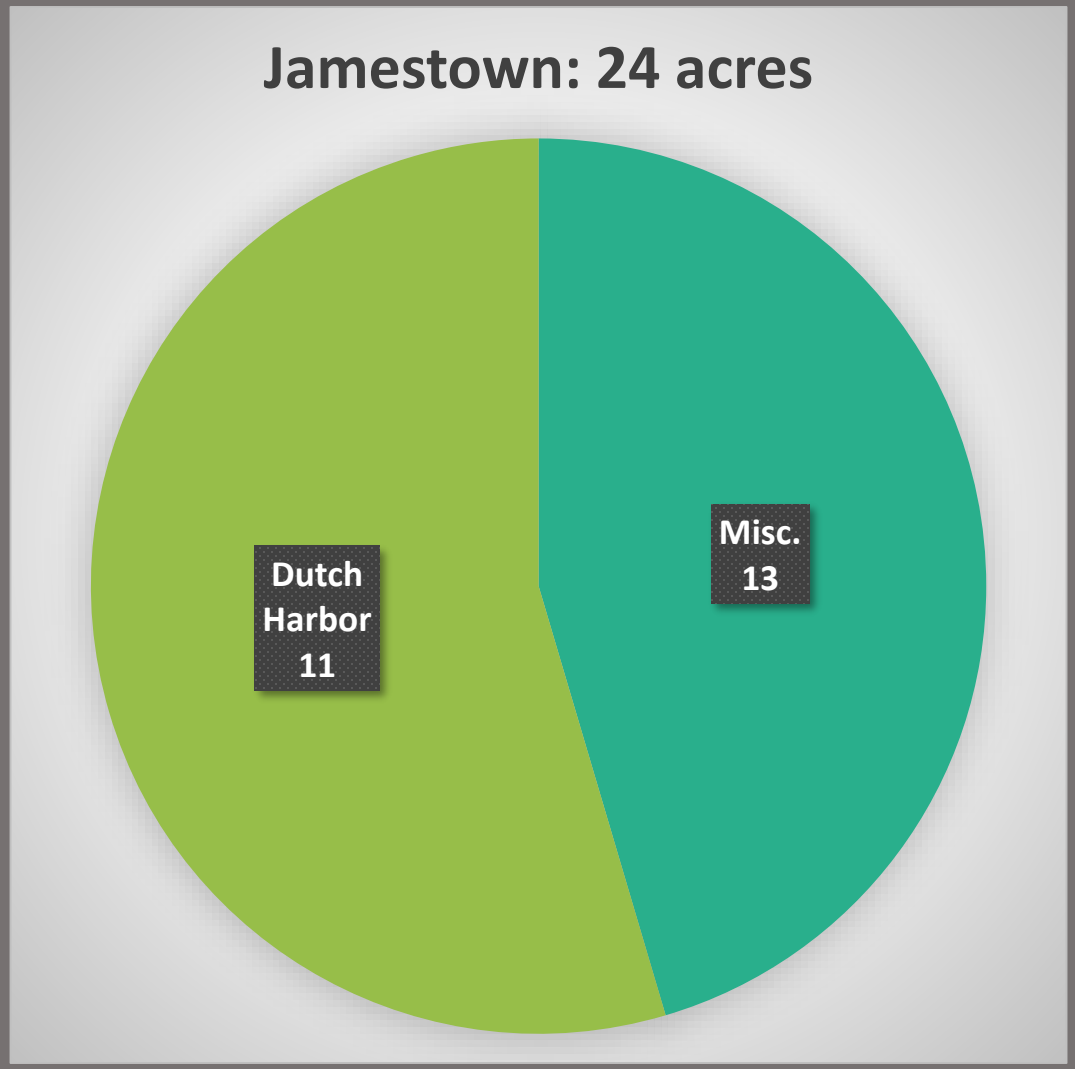
Oyster, Clam, Bay Scallop



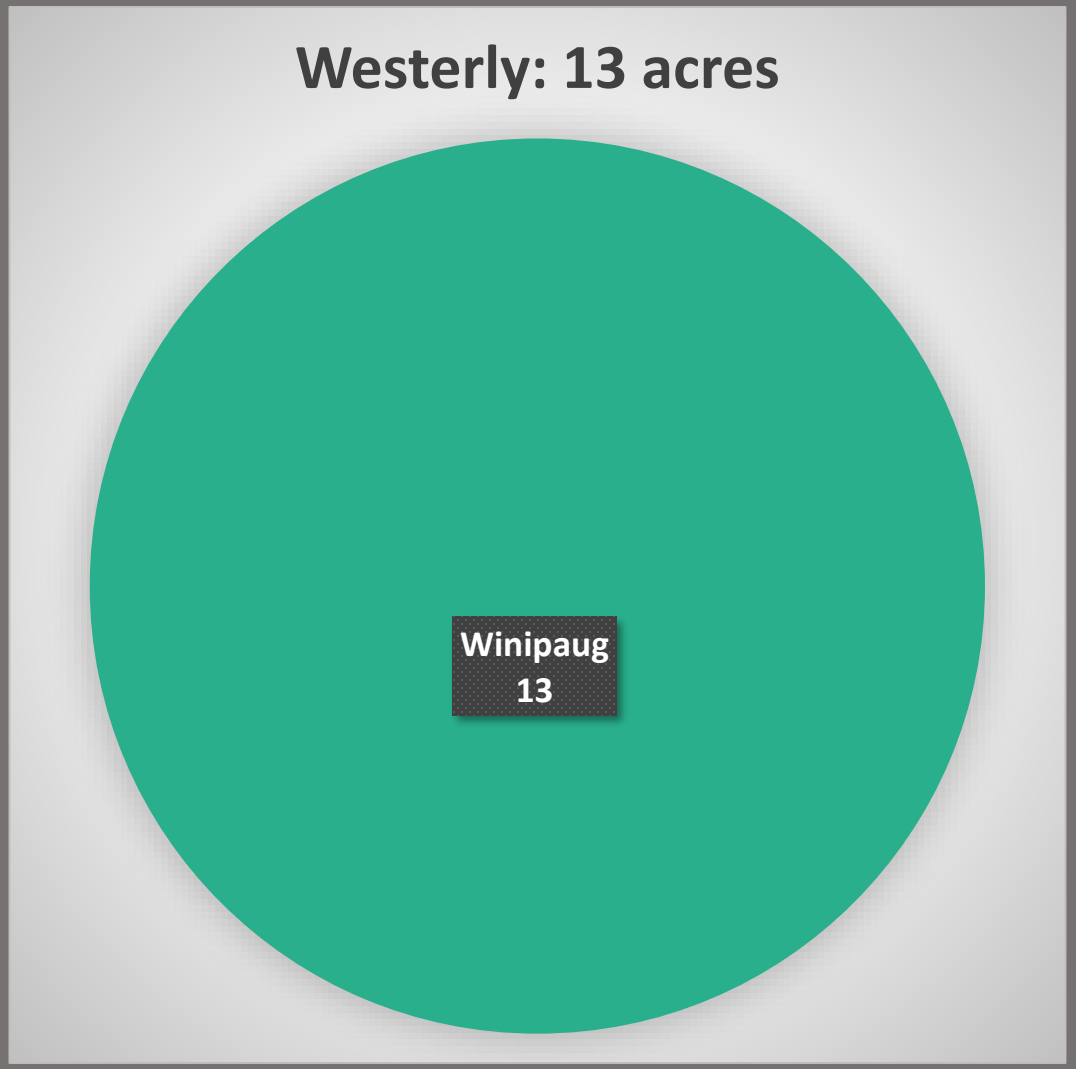
Oyster, Kelp, Bay scallop



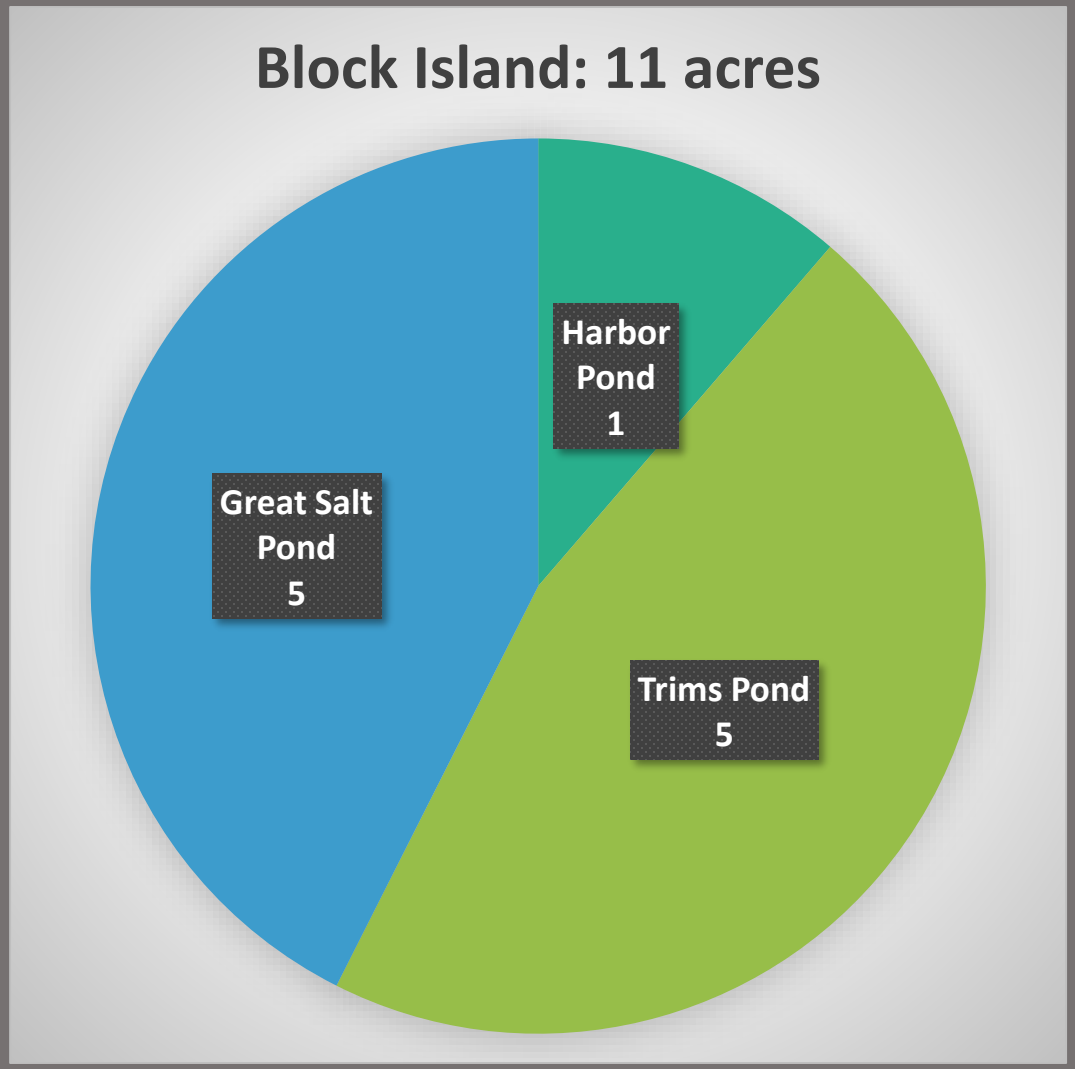
Oyster, Clam, Steamer



Oyster, Kelp, Bay scallop



Oyster, Clam, Bay scallop



Oyster, Kelp, Clam

Towns with Less Than 10 acres		
Tiverton	3.2	Sakonnet River
Bristol	0.25	Misc.
Little Compton	3.2	Sakonnet River
Warwick	2.75	Misc.