

# A Holistic Assessment of Using Shellfish Aquaculture for Water Quality Improvement Initiatives in Florida

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The Nature  
Conservancy





# What is nutrient pollution?

- Nutrient pollution is when too many nutrients, mainly nitrogen in coastal systems, are added to bodies of water and cause excessive algae growth.
- Algal blooms → low dissolved oxygen, turbidity kills seagrass, reduces habitat.
- 65% of US and many global estuaries have moderate to high impacts due to excess nutrients.

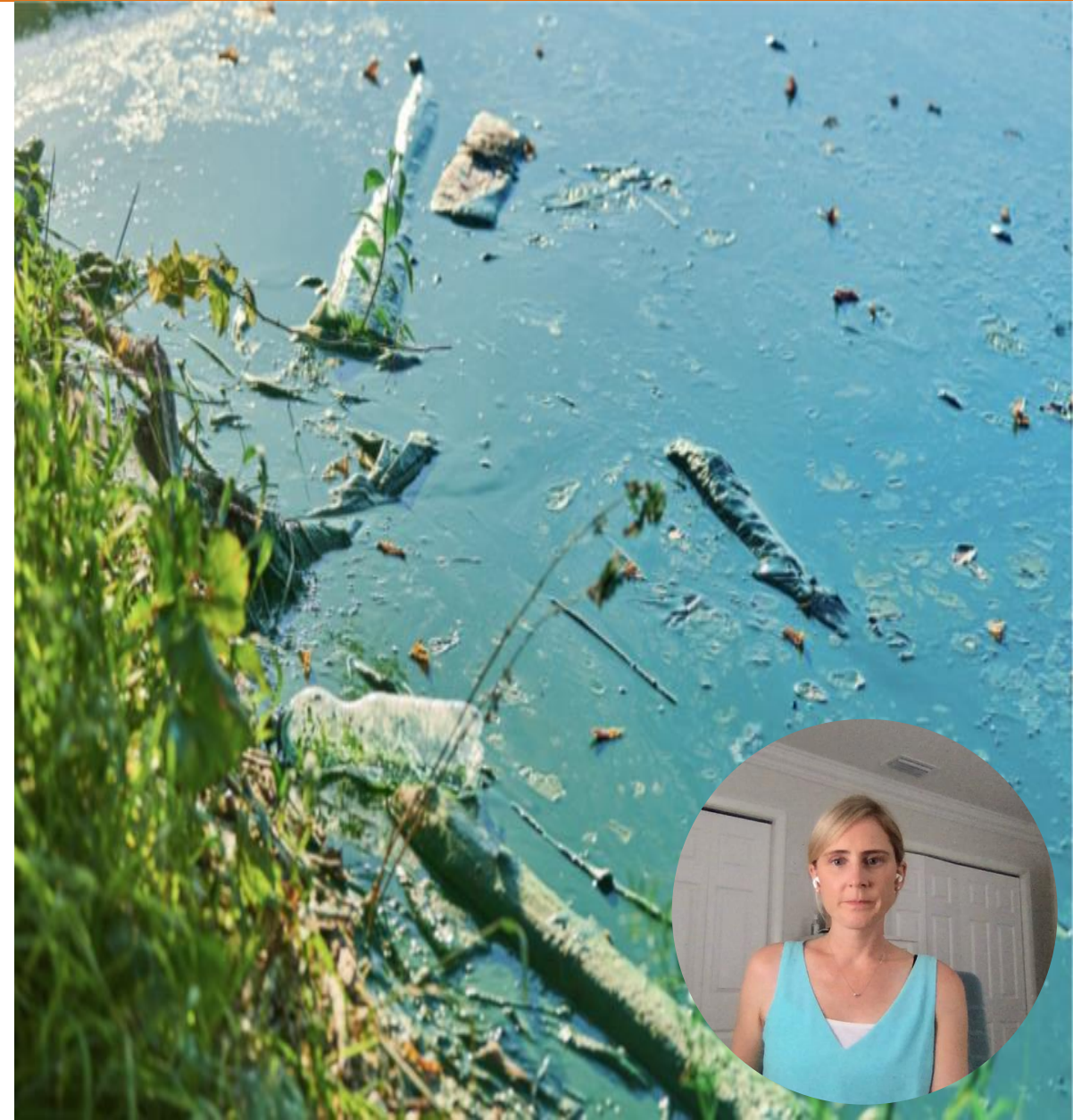




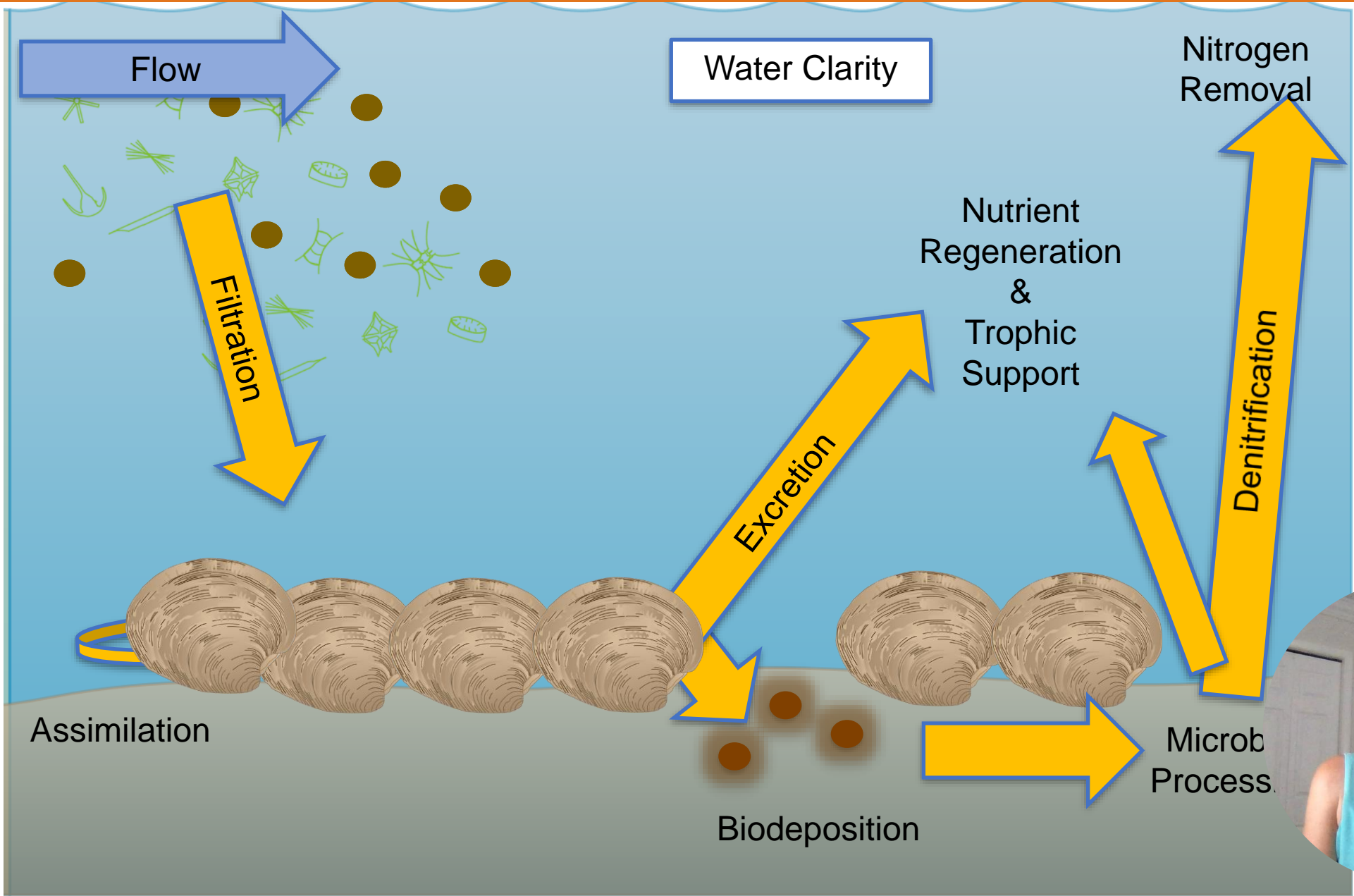
# Can shellfish help improve water quality?

What do we know:

- Land-based nutrient reductions alone are not enough.
- Wastewater treatment plant upgrades are costly.
- Difficult to control and manage non-point source pollution.
- **Shellfish filter water and remove nitrogen.**



# Relationship with shellfish and water quality



# Water Quality Restoration & Shellfish Aquaculture

## Biogeochemical Studies: Nitrogen Removal

- What is the net nitrogen removal from shellfish aquaculture in Florida?
- What impact does aquaculture have on nitrogen removal in Florida's waterways?

## Economic Experiments: Value of Nitrogen Removal

- How much are point source polluters and other buyers willing to pay for credits?
- How much do we need to pay growers to grow shellfish for nitrogen removal?

## Legal and Policy Analysis: Payments for Ecosystem Services

- What is Florida's current policy on nutrient trading?
- What are the legal opportunities for a payment for services from shellfish farmers?





# Nitrogen Removal: Site Selection

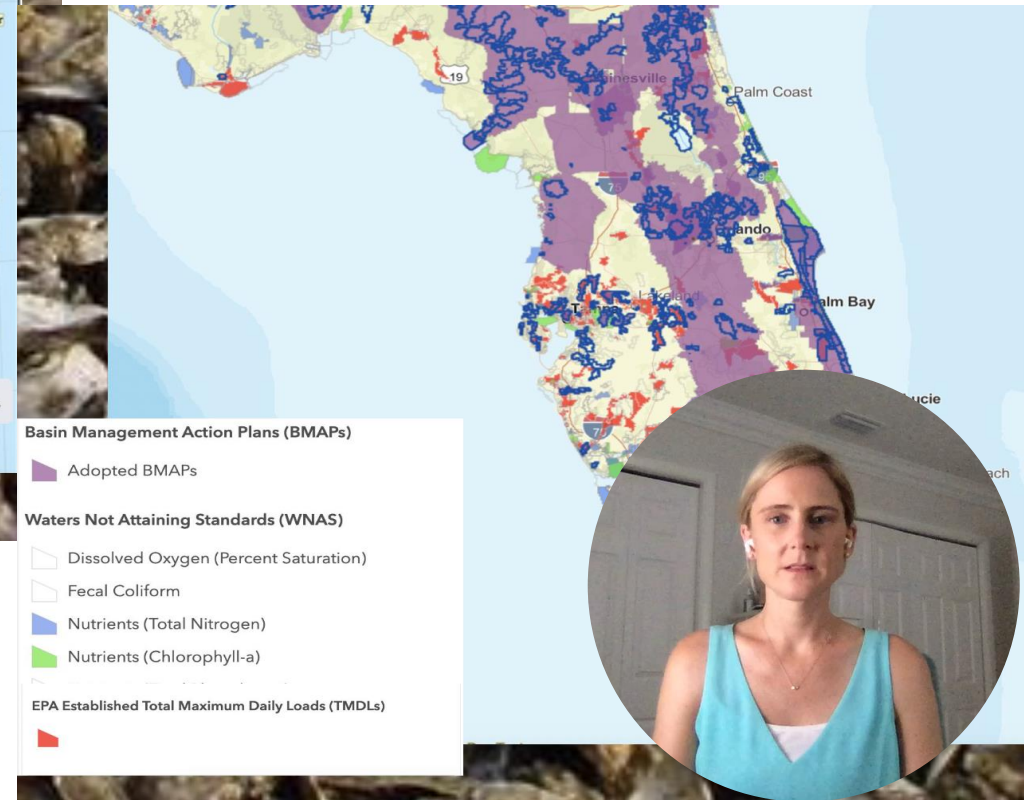
## Site Selection

- Active leases (oysters and clams)
- Watershed nitrogen problem
- Within 6-hours of Homestead, FL

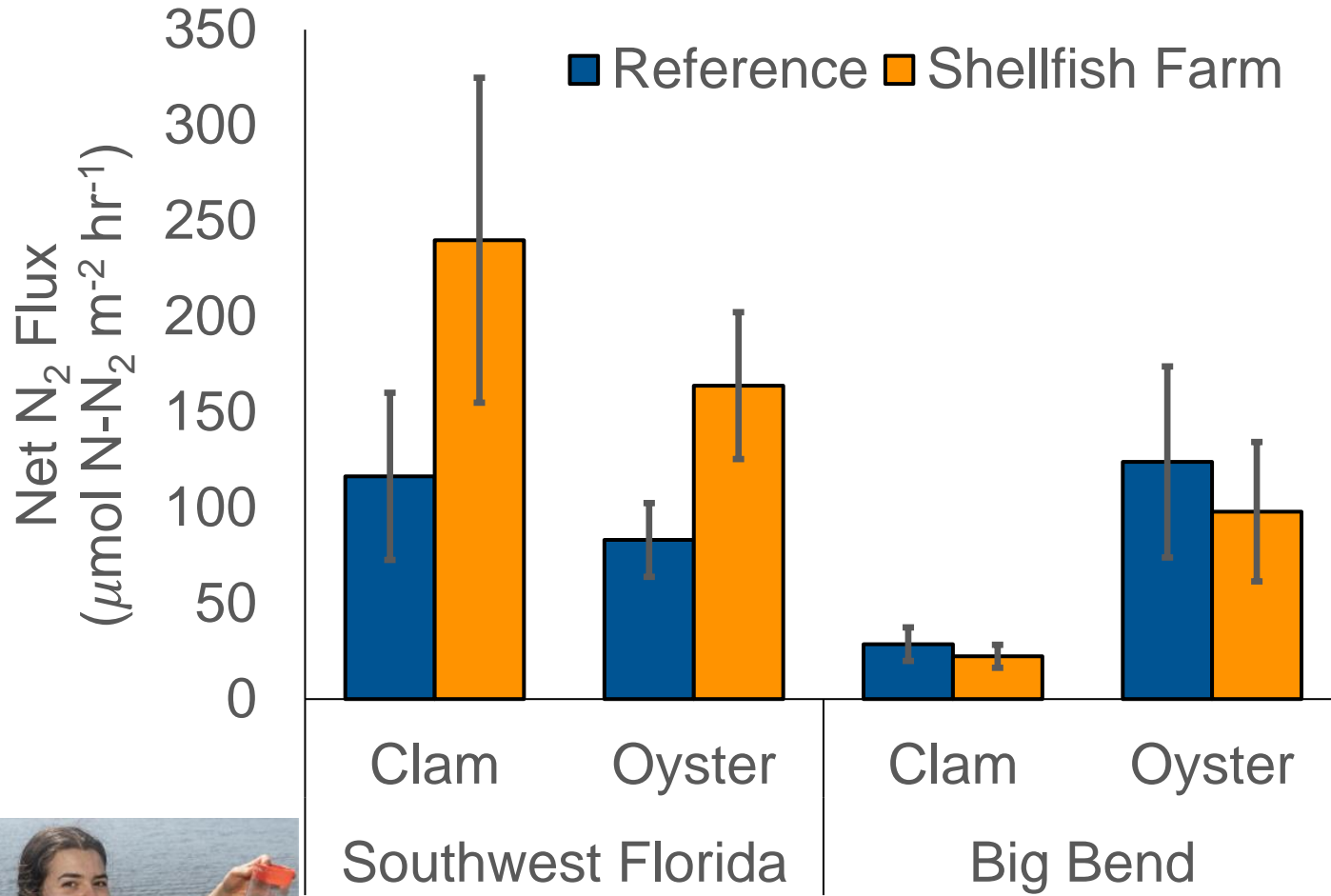
## Shellfish Leases



## Nutrient Issues



# Nitrogen Removal Through Denitrification



## Need for site-specific data

- Variation in local hydrology, sediment type, number of farms may affect denitrification enhancement
- Importance of shellfish biomass and fate of biodeposits





# Nitrogen Removal Through Harvest

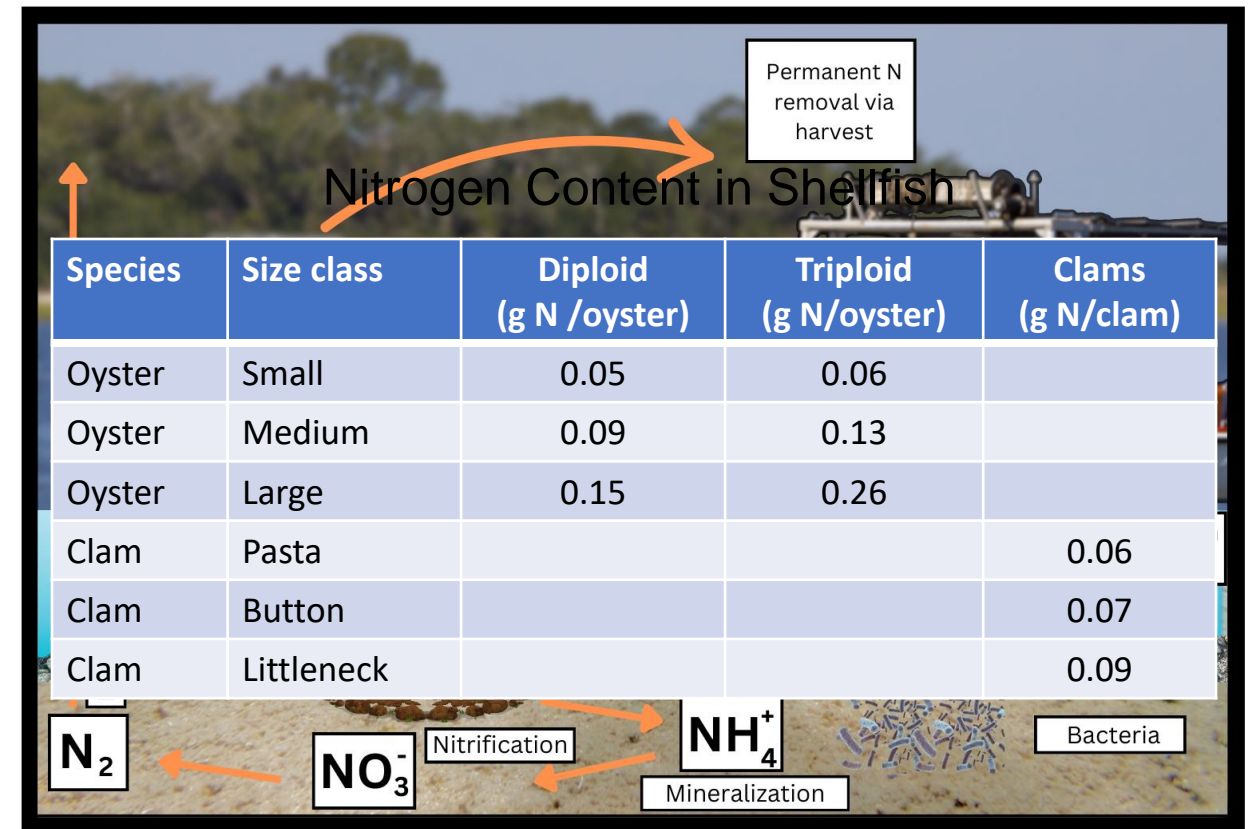
Nitrogen assimilated in shell and tissue is removed at harvest.

## Measuring shellfish



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\*Preliminary Data

# How much nitrogen is removed by shellfish farms?

To determine total annual nitrogen removal from a shellfish farm, we can upscale field measurements\*

Denitrification  
Enhancement



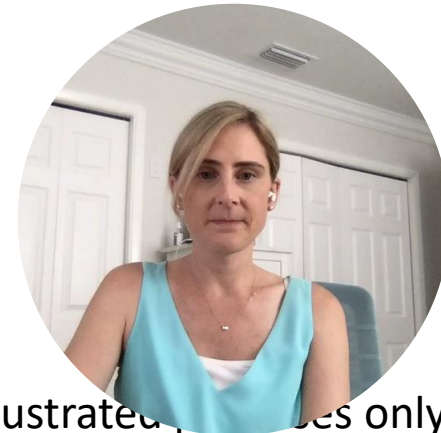
Harvest  
Assimilation



Total Annual  
Nitrogen  
Removal

- 1) Yearly enhancement based on daily light
- 2) Scaled on footprint (area) of lease

- 1) Nitrogen content per individual
- 2) Scaled based on annual harvest sales



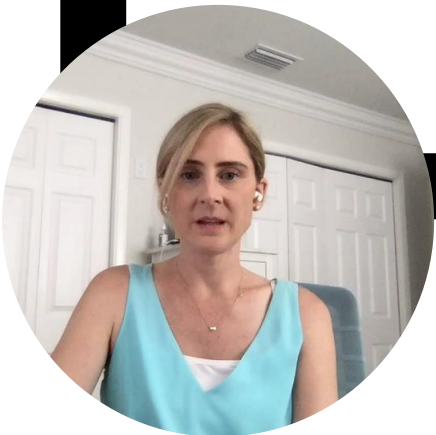
\*Many, many assumptions, for illustrative purposes only



# Determining the Value of Nitrogen Removal Services

## Cost of credits

- **Supply Side:** Survey to determine the price per credit to enter a market or grow shellfish for water quality restoration
- **Demand Side:** Survey to assess current nutrient abatement costs and estimates for additional abatements to determine willingness to pay for credits



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# Credit Supply- Florida Shellfish Producers

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- The survey was sent to 359 clam and oyster producers
- 59 responses (Thank you to all who responded!)





# Growing shellfish for nitrogen removal benefits

- What price would you need to be paid to grow shellfish just for nitrogen removal benefits?
  - Determines at what price the grower is willing to sell their credits

	Current Price	Sale Never Allowed	Sale Sometimes Allowed	Sale Always Allowed	# of responses
Oysters	\$0.60	\$0.78	\$0.70	\$0.64	14
Pasta Clams	\$1.00	\$1.15	\$1.00	\$1.00	8
7/8" Clams	\$0.10	\$0.13	\$0.13	\$0.13	10
Littleneck Clams	\$0.14	\$0.17	\$0.17	\$0.16	



# Demand for Credits- Wastewater Treatment Plants

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- 50 wastewater treatment plants surveyed
- 20 out of 55 facilities represented located in Basin Management Action Plan areas
- 30 out of 55 operate under a National Pollution Discharge Elimination System (NPDES) Permit





# Willingness to pay for nitrogen credits

- Most common legislative concern: Requiring Advanced Water Treatment across the state of Florida
- Asked those plants their anticipated costs to meet state-mandated nitrogen reduction criteria.

What are credit buyers willing to pay for nitrogen credits?



	Mean	Median	Min	Max
\$/kg	\$4.16	\$2.87	\$0.91	\$10.19



# How much is nitrogen removal worth?

## Clam Lease Example

Extraction – based on assimilation and harvest numbers (250,000 ind.)

Denitrification – based on enhancement and lease area (2 acres)



This shellfish farm could remove about 110 lbs of nitrogen from the coastal environment per year

Potential payment for services to this shellfish farmer: \$199.00



Give it a try!





# Nutrient Trading in Aquaculture

- Demonstrated that we can calculate the nitrogen storage and removal benefits of shellfish aquaculture and assign it a monetary value

## Florida Water Quality Trading Program appears to work for bivalves, but...

- Locational and uncertainty factors loom large
- Monitoring and reporting may be burdensome relative to revenue gained
- Rule reform to clarify some requirements might be warranted



# Nutrient Trading in Aquaculture



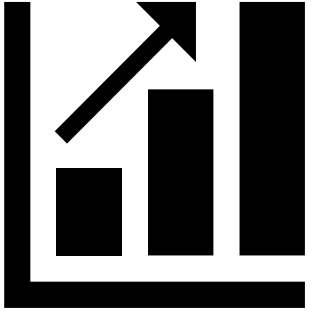
## Other opportunities exist!

- Stormwater utility fee payments
- Fertilizer fees
- Local option sales tax initiatives are not a likely source of payments for services, but could potentially fund construction of restoration aquaculture projects
- Long term subsidies and grant programs such as the Water Revolving Fund



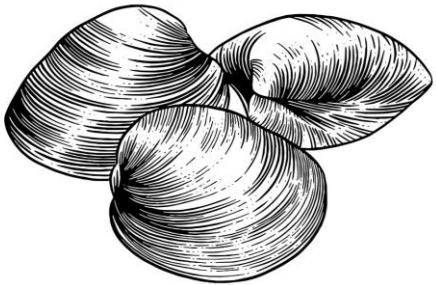


# Payments for Services: Moving Forward



- **Demand for credits likely to increase**

- Wastewater treatment plants are concerned about their ability to meet regulatory requirements.
- Other potential buyers exist but were missed in our survey



- **Aquaculture as a Best Management Practice**

- Shellfish aquaculture removes nitrogen and provides other benefits
- Uncertainties remain about mechanisms for payment



- **Paving the way for payment**

- Test Florida's water quality trading program
- Consider fee-based payments for services funding
- Look for long term payments for services strategy



# Shellfish are a tool in our toolbox, but ongoing questions about mechanisms for payment for services



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