



Working waterfronts, working for you: The role of shellfish aquaculture in water quality restoration

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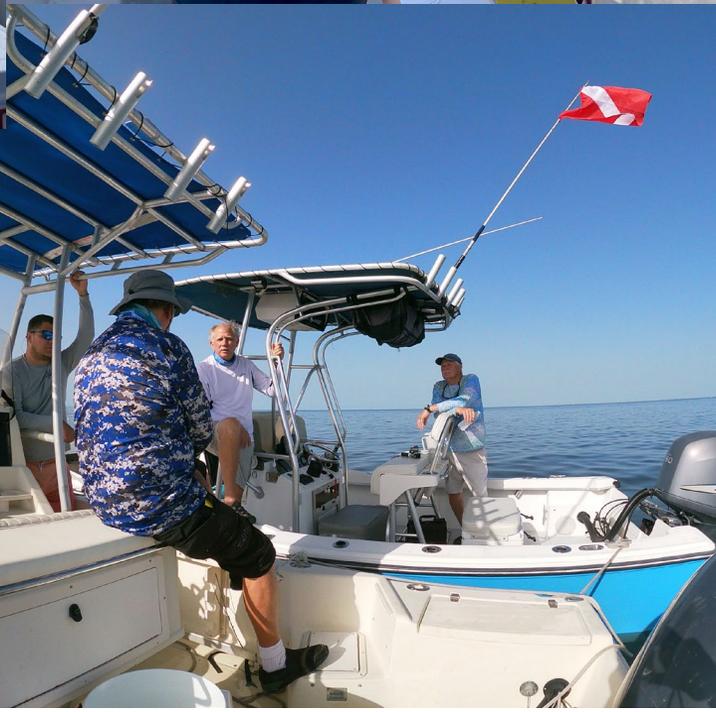
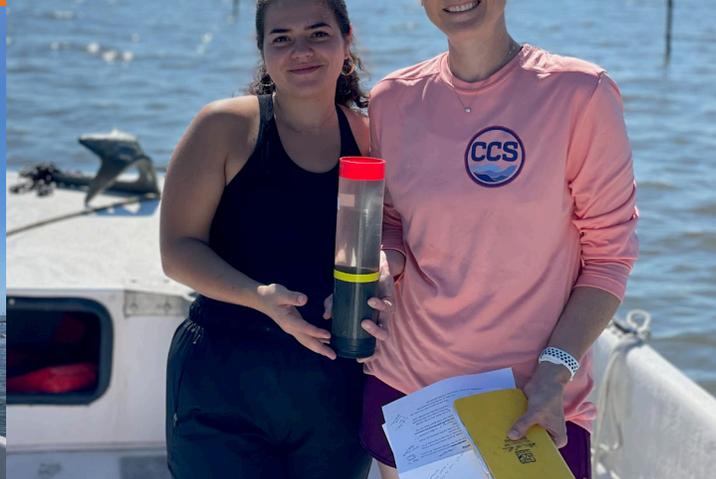


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Thank you!



Shellfish Aquaculture For Water Quality



RABBY'S OYSTER BAR
 seafood Done Right!



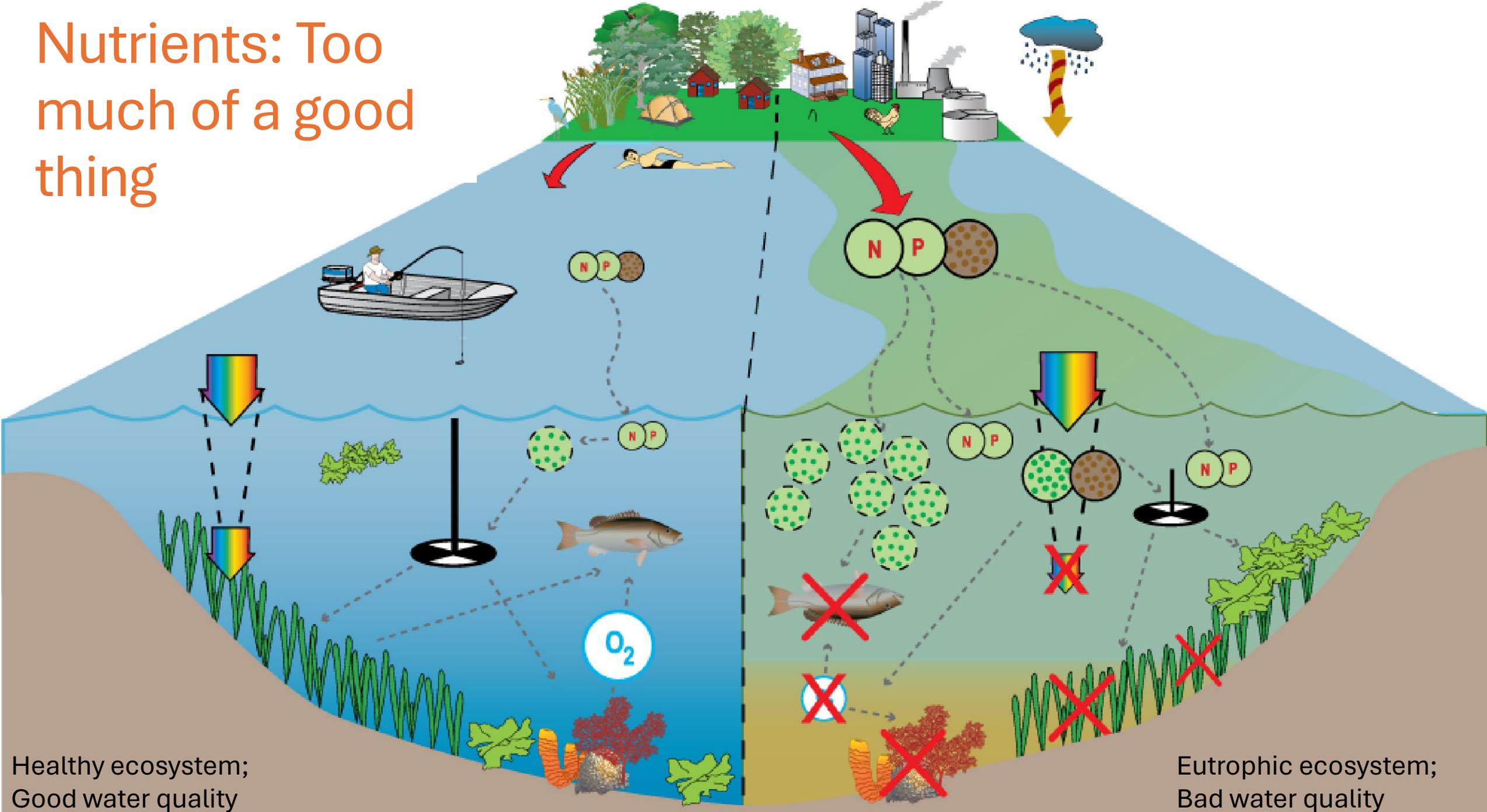
Treasure Coast Shellfish
Grown Land to the Seaside

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.



Nutrients: Too much of a good thing



Healthy ecosystem;
Good water quality

Eutrophic ecosystem;
Bad water quality

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**



Can shellfish help improve water quality?

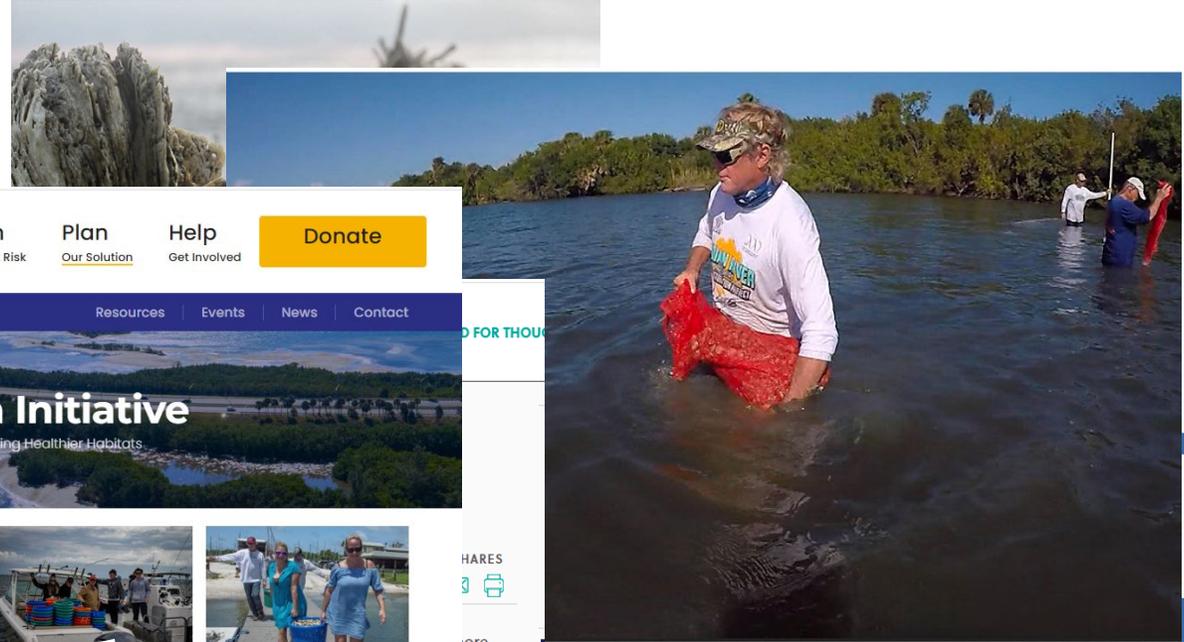
Marine lab initiates two clam studies to guide restoration

-Sanibel Captiva Conservation Foundation

By SCCF - Feb 3, 2021



SCCF Hard clam



Photos courtesy of Rusty Chinnis

Project Objective

The solution

Environmental program seeking \$17.5 million to restore seagrass, clams in 3 Bay Area estuaries

By Jordan Bowen | Published January 15, 2022 | Sarasota County | FOX 13 News



Expected Result

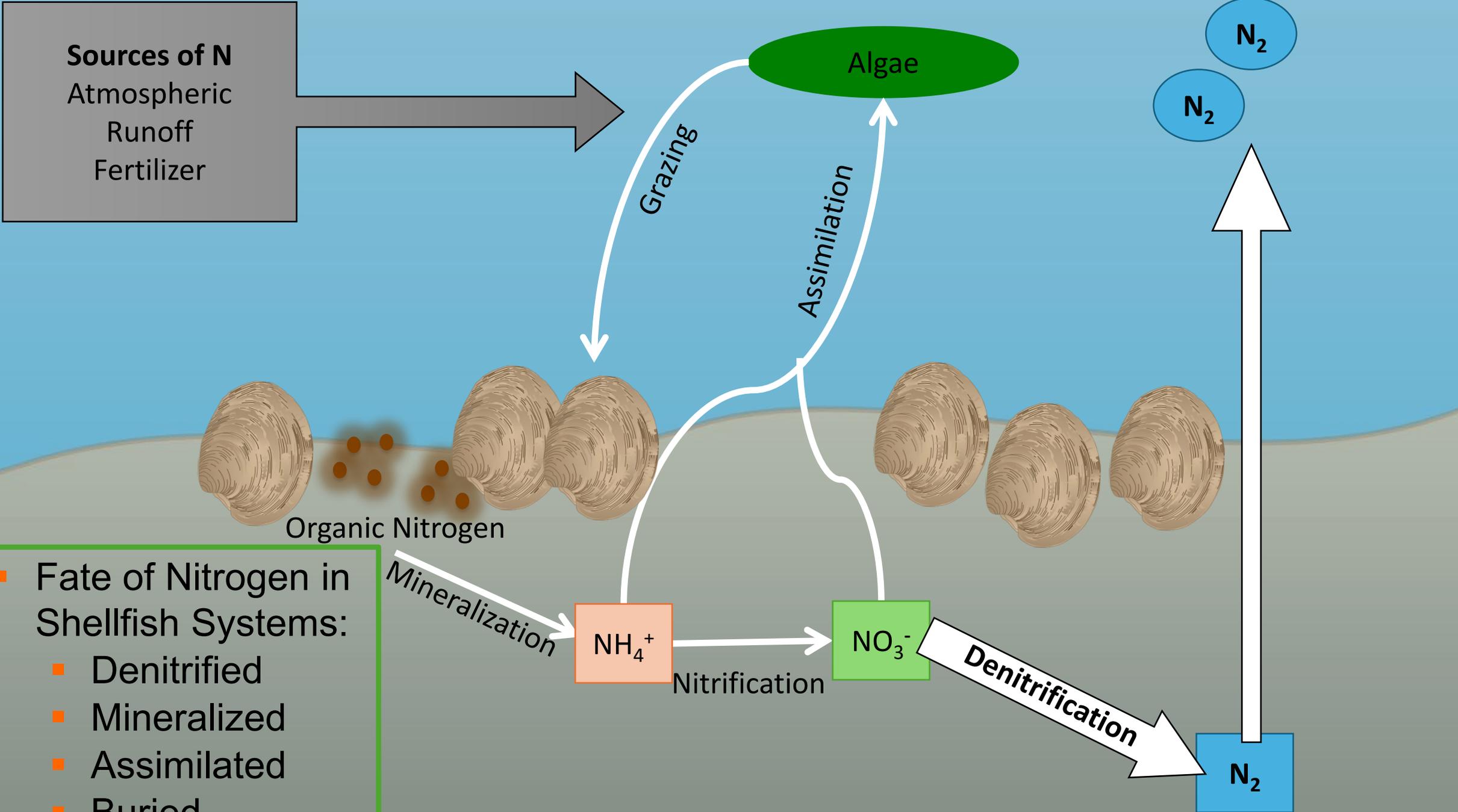
Restoration of seagrass & clam populations in Tampa Bay, Sarasota Bay and Charlotte Harbor

fundraiser, Scallopalooza. They dine inside makers, clarifying opaque, algae-thick water in the eyes of human attendees.

In their mission to improve our bay's water quality and restore marine ecosystems, Sarasota Bay Watch has invested hundreds of volunteer hours and thousands of dollars in their scallop stars, introducing 100 million scallop larvae into local waters to date. However, scallops' star power tends to fade fast. The scallop lifespan is brief (18 months at the outside) and too often shortened further by scallops' susceptibility to predation and red tide.

Perway in Indian River Lagoon



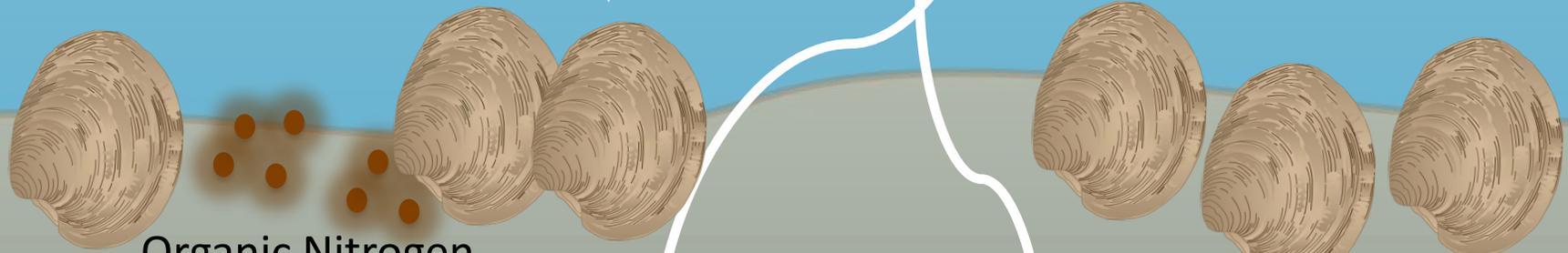


Sources of N
 Atmospheric
 Runoff
 Fertilizer

Algae

Grazing

Assimilation



Organic Nitrogen

- Fate of Nitrogen in Shellfish Systems:
 - Denitrified
 - Mineralized
 - Assimilated
 - Buried

Mineralization

NH_4^+

Nitrification

NO_3^-

Denitrification

N_2

N_2
 N_2

Shellfish-associated nutrient reduction

Does shellfish aquaculture remove nitrogen in Florida's waterways?

How does this compare to other studies?



Bivalve Shellfish in Florida

U.S. shellfish farmers produce ~10 M lbs of clams annually (Florida ranks 4th)

Shellfish growing areas classifications: approved, conditional, restricted, prohibited

FL clam culture supports ~ 550 jobs

Gross revenue impact ~\$40 Million

Submerged land leases >2000 acres

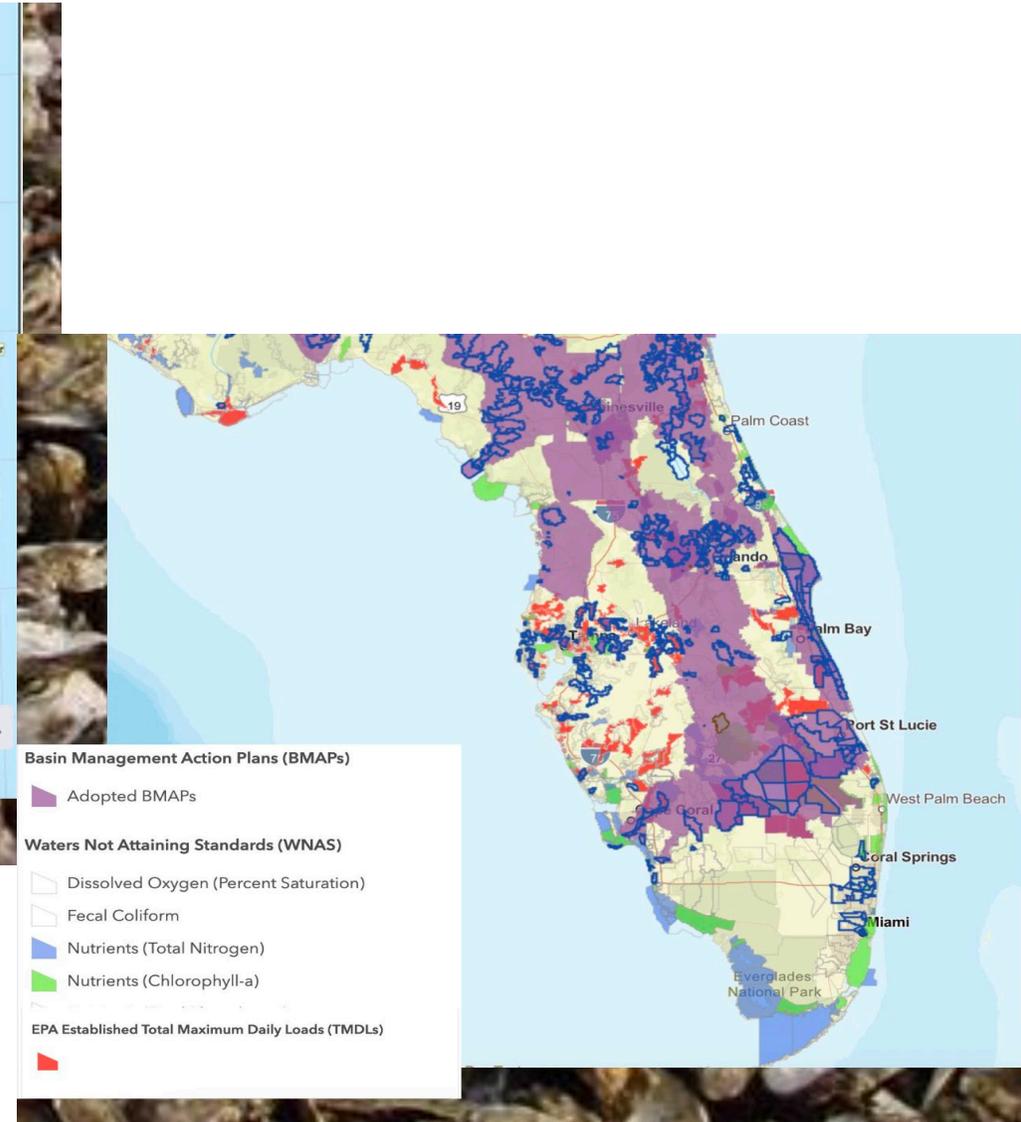
The majority of shellfish farms are in the Big Bend region (Cedar Key)



Nitrogen Removal: Site Selection

Site Selection:

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



Sample Collection

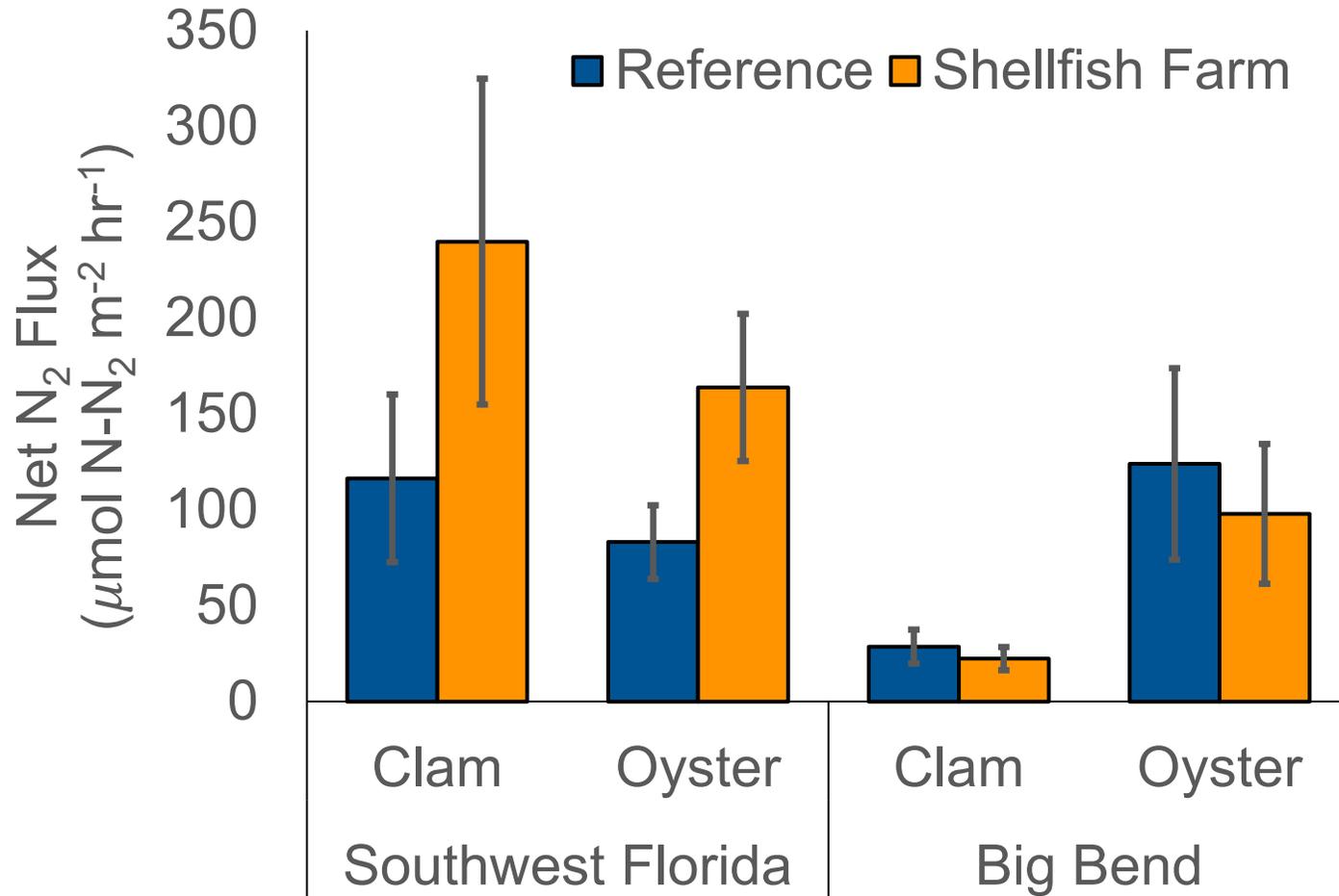
- Collected sediment cores from clam and oyster aquaculture in the wet and dry seasons
- Under floating off-bottom oyster aquaculture
- In, under, and around clam bags



Clam bags covered with sand and macroalgae in SW Florida



Enhanced Denitrification Varies by Site

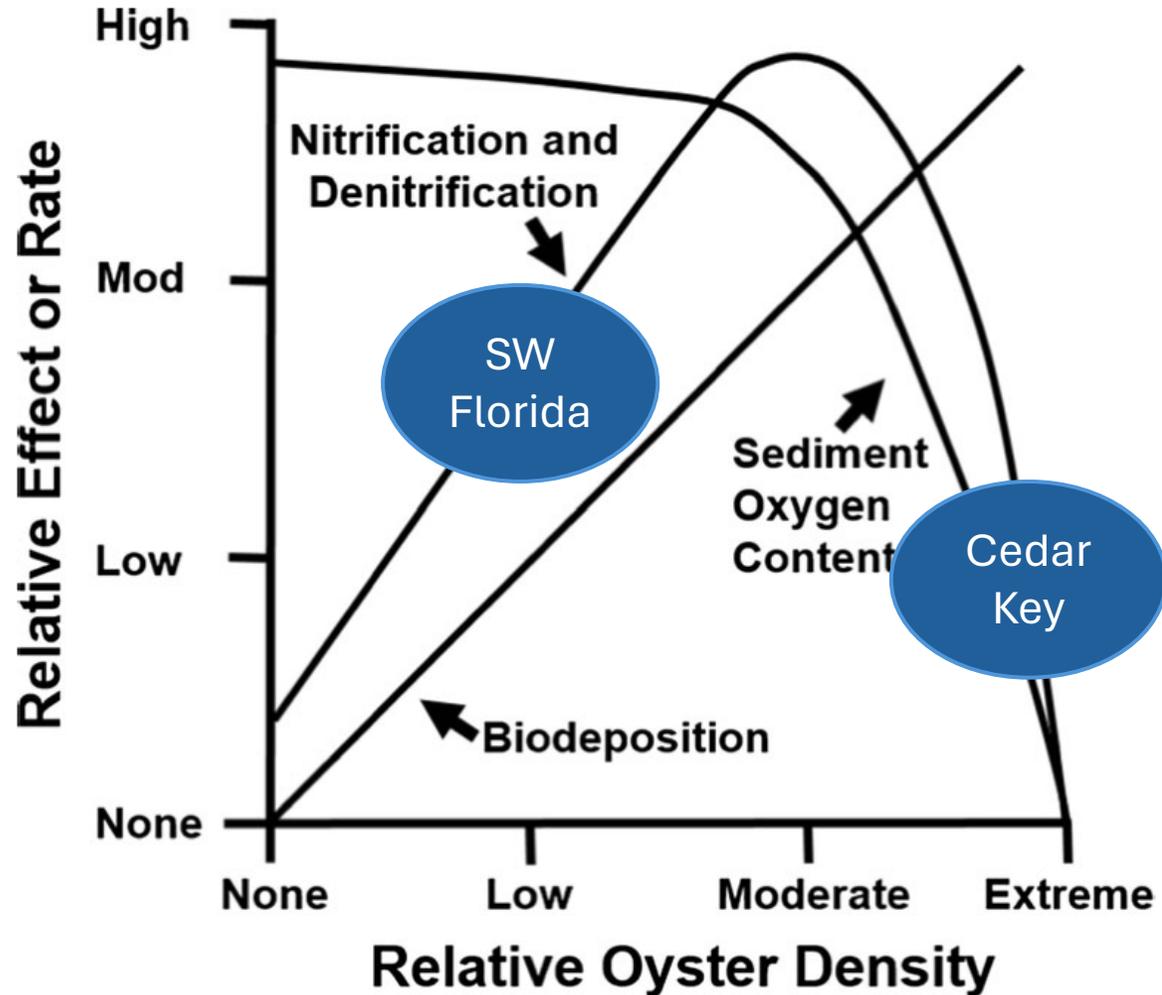


Need for site-specific data

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



Diminishing Marginal Returns



Number of farms could play a role in differences observed between sites

How Does Florida Aquaculture Stack Up?



- Cherrystone (Bayside, Eastern Shore, VA)
 - Enhanced but limited denitrification at oyster aquaculture farm (Lunstrum et al. 2018)
 - Clams do not always enhance denitrification (Murphy et al. 2016)
- Smith Island (Seaside, Eastern Shore, VA)
 - Enhanced denitrification with clam aquaculture, but no seasonal differences (Smyth et al. 2018)



Shellfish Aquaculture & Water Quality Restoration

- How much nitrogen does bivalve aquaculture remove?
- **DEPENDS.** Species, location, type of culture, density and environmental conditions are factors.
- **Additional benefits** to the environment are also important. Increased water clarity, habitat creation, shoreline protection, stock enhancement, buffering against ocean acidification



Thanks!



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