

A scenic sunset over a body of water, likely an estuary. The sun is low on the horizon, casting a bright orange and yellow glow across the sky and reflecting on the water. A palm tree is visible on the right side of the frame. The overall atmosphere is calm and serene.

Pine Island's Estuaries – A Big Picture: Ideas for Safe-Guarding Our Special Waterways

ROAR Meeting – July 16, 2022

Ms. Judy Ott, Estuary Escapes LLC

Dr. Coty Keller, Local Ecologist

What are We Talking About?

Purposes:

- Learn – About PI's Estuaries
- Understand – Estuaries' Value
- Act – Restore Estuaries Now

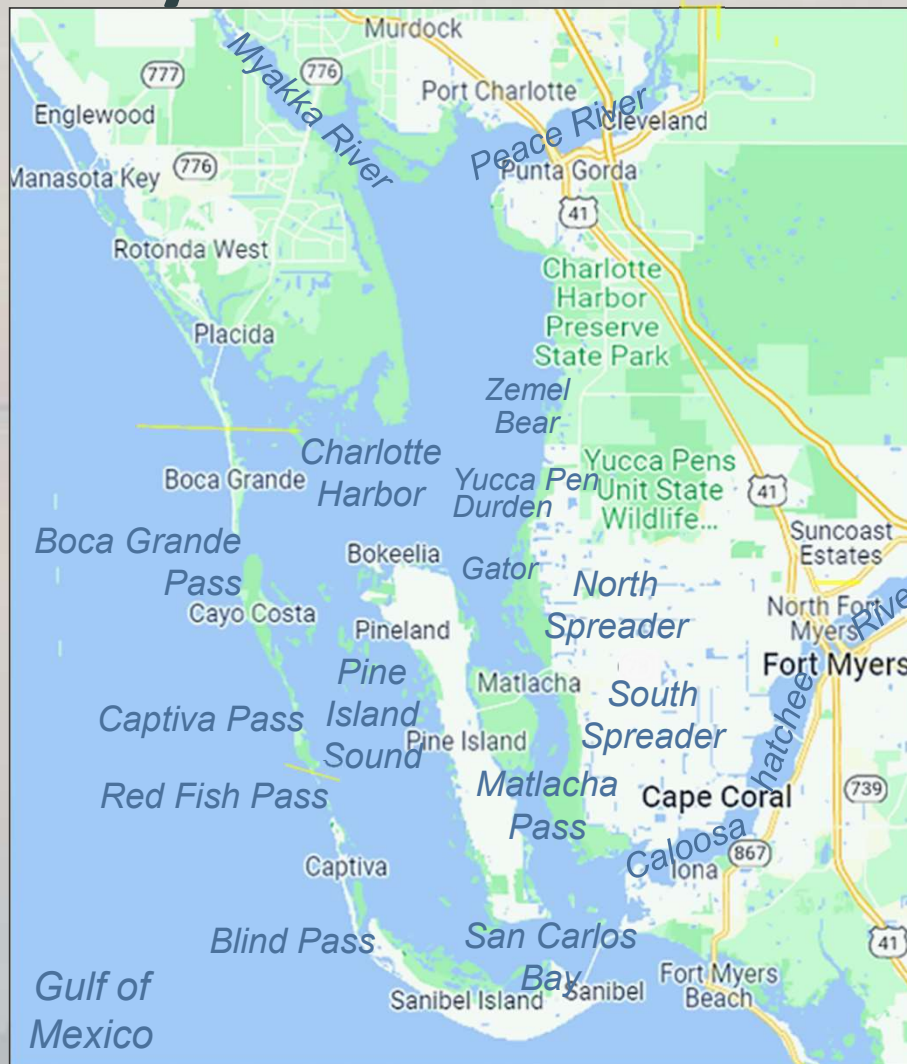
Topics:

- Why Our Estuaries are Essential
- How We Monitor Our Estuaries
- Why Our Estuaries are Threatened
- What the Causes & Solutions Are
- What Actions are Needed Now
- Take Home Messages
- *Where to Find More Information*



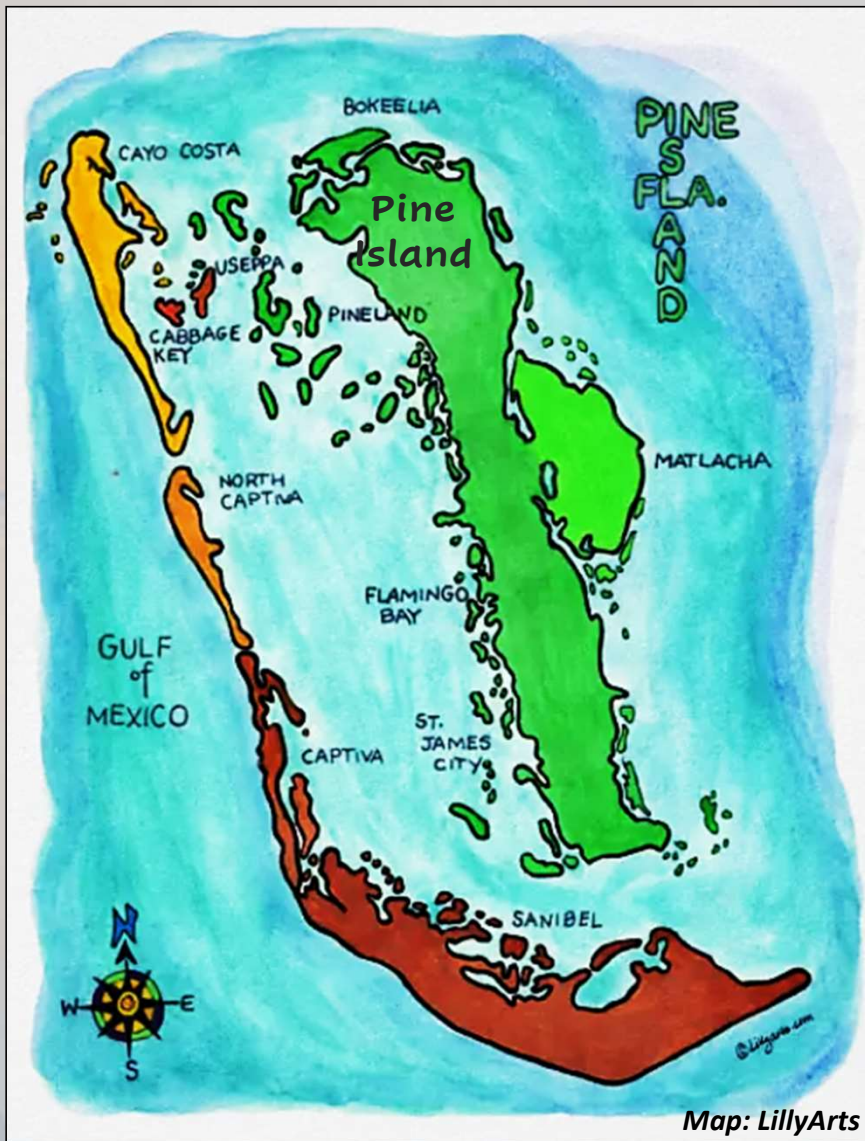
Photo: FCF Flats

Why are Pine Island's Estuaries Special & Essential?



Many Waters Converge Here:

- 4 Estuaries
- Estuaries = Salt & Fresh Water Meet
- Gulf of Mexico & 4 Passes
- 3 Rivers & 2 Spreaders & 4 Creeks
- Estuaries Vary in Size & Depth
- Tides Change Daily, Monthly, Seasonally, Annually & with Climate
- Salt & Fresh Water Mixing Drives Everything



Map: LillyArts

Many Barrier Islands Protect Us:

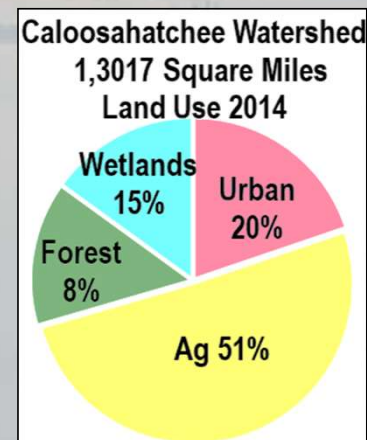
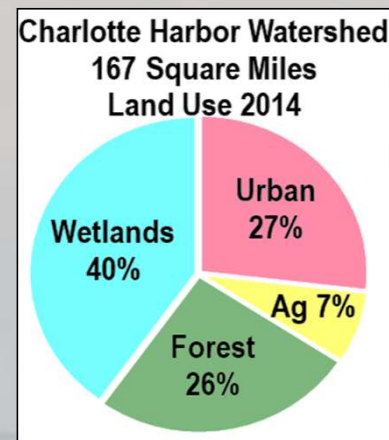
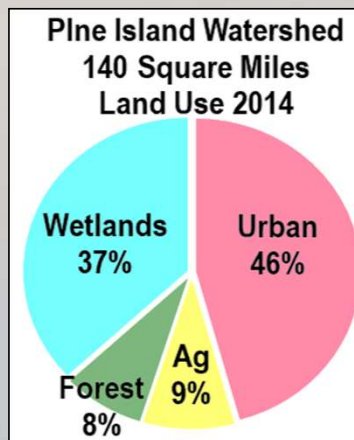
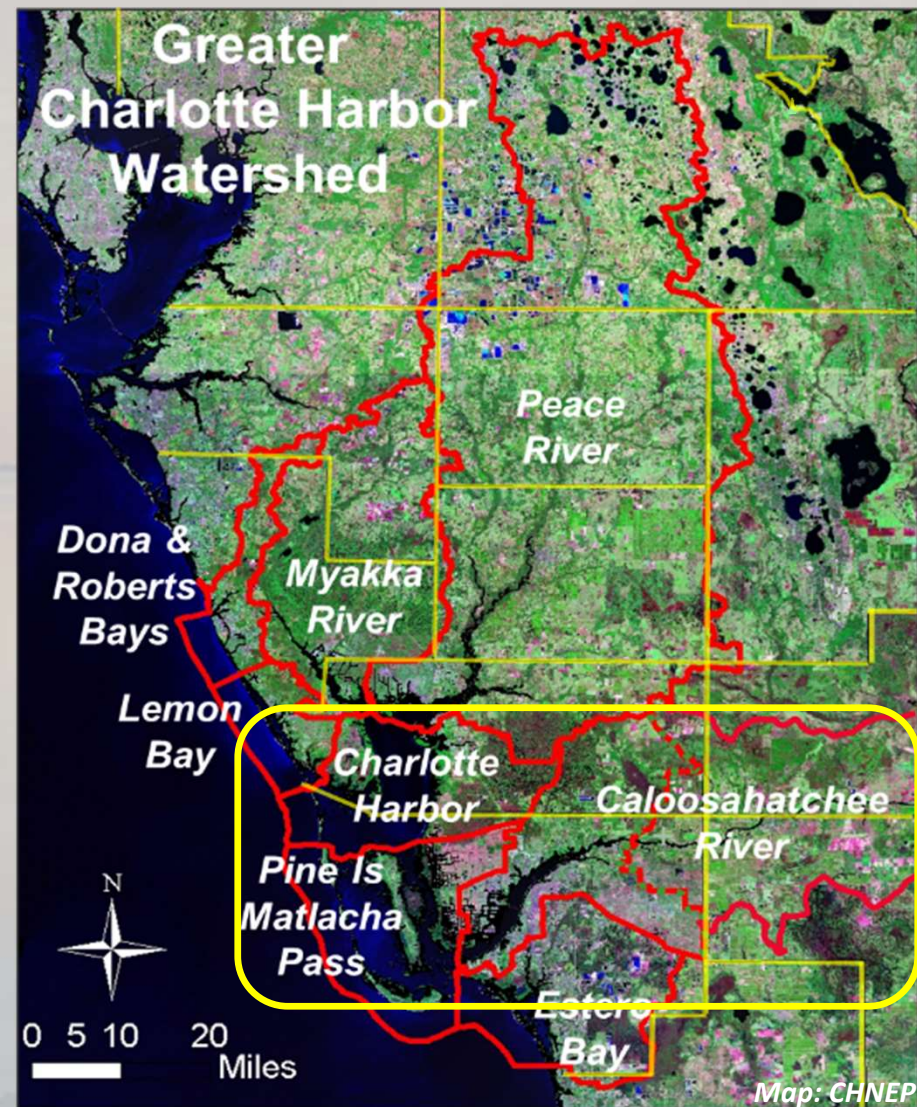
- Cayo Costa, North Captiva, Captiva & Sanibel
- Protect from Us Hurricanes
- Reduce Waves, Storm Surge & Wind
- Less Beaches & More Mangroves
- Less Tourists & More Biodiversity



Photo: FDEP

Many Watersheds Converge Here:

- Watershed = Land that Sheds Rainwater Downstream to Waterways
- 3 Adjacent Watersheds
- Vary by Size, Distance & Counties
- Activities in Watershed Greatly Affect Water Quality in Our Estuaries
- Key to Good Water is Slowing Runoff



Many Cities, Counties & Agencies Affect Us:

- 3 Cities & 4 Counties & 1 State
- 2 Water Mgmt Dist & 1 FDEP Dist & 1 US Army Corps Dist



Red Mangroves



Photo: Wikipedia

Black Mangroves

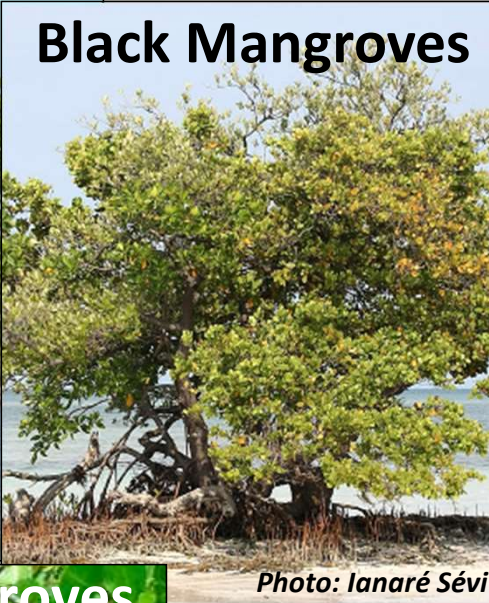


Photo: Ianaré Sévi

White Mangroves



Photo: David Sedore

Many Plants & Animals Thrive Here:

- Everything has its Own Niche
- Everything has its Optimal & Tolerable Conditions
- Timing is Everything
- Tides Drive Biodiversity

Needle Rush



Photo: Ann Murray/UF

Cord Grass

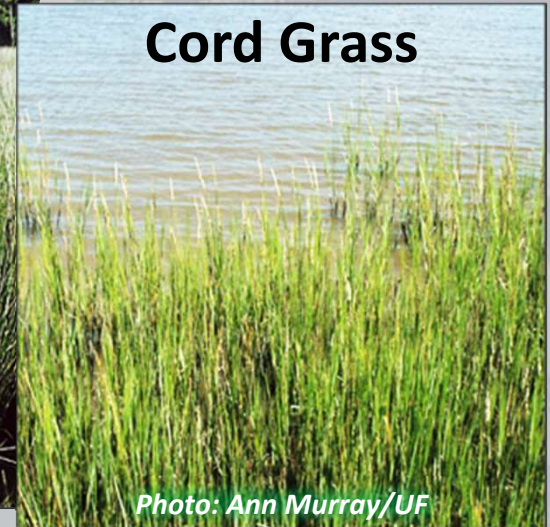
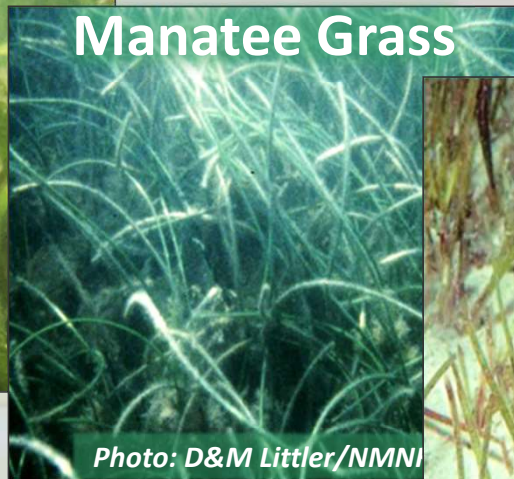
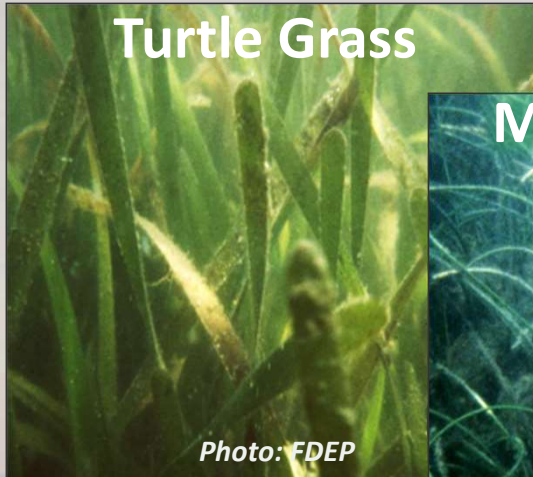


Photo: Ann Murray/UF

4 Species of Mangroves & 3 Species of Marsh Grass

- Underwater – Sea Grasses are Base
- Provide Inverts Places to Hide

*5 Species of Seagrass &
>375 Species of Inverts*

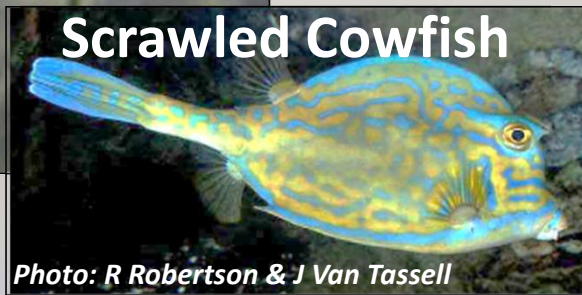


- Shellfish & Crustaceans Clean Up Turbidity & Detritus



28 Species of Mollusks & 22 Species of Crustaceans

- Fishery Populations are Inter-Dependent



250 Species of Fish

- **Sharks are Fish, Too!**



- **But Dolphins & Manatees are Mammals**



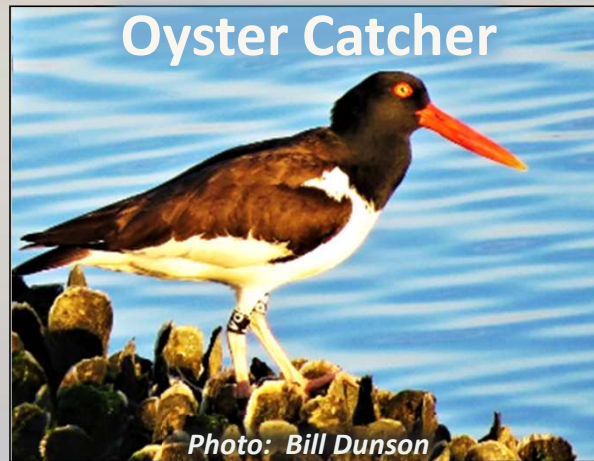
- And Otters & Raccoons are Mammals, too



- But Reptiles are Cold Blooded

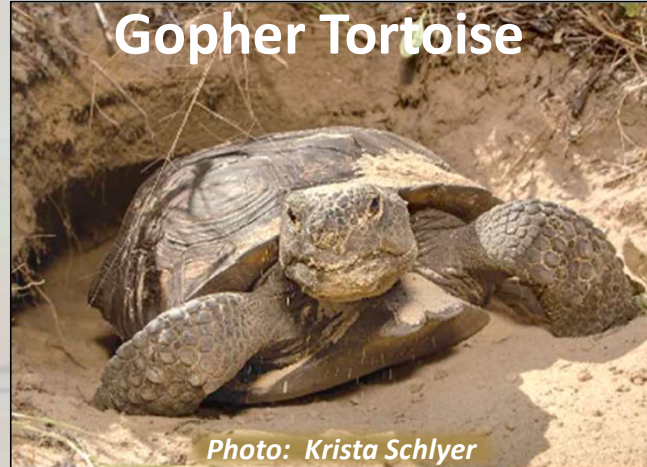


• **And Our Fine Feathered Friends Fill Many Niches**



250 Species of Birds

- Many State & Federal Protected Species Live Here



**20
Protected
Species**

Many People Depend on Healthy Estuaries for Livelihood:

Some Values of Natural Resources to the Annual Economy of the Pine Island Matlacha Watershed*

***from 2020 CHNEP Economic Valuation Report**

Activity	Goods & Services Value	Jobs
Recreation	\$1,341,190,000	
Commercial Fishing	\$10,087,000	
Agriculture	\$1,611,000	
TOTAL	\$1,353,019,000	13,160

- Recreation & Tourism
- Fishing & Boating
- Property Values
- Aesthetic Enjoyment

2015 FL Relators Study in Lee Co:

- ↑ Water Clarity 1 ft =
- ↑ Property Value 15%

2020 Punta Gorda VCB: Visitors Save Households >\$700 Taxes/Year

Aesthetics = \$??

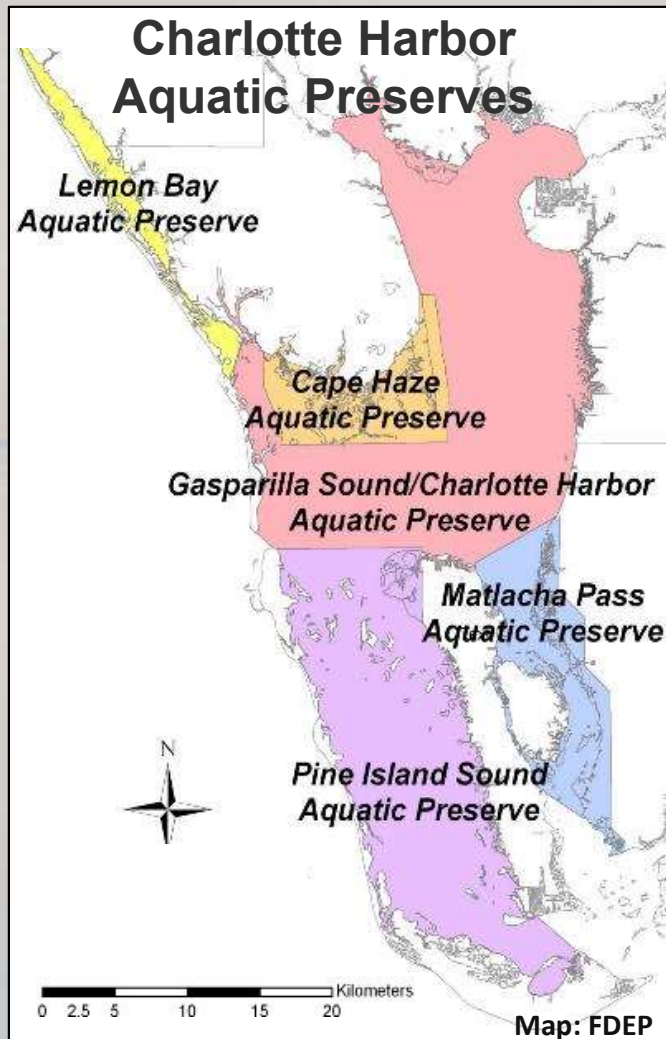
Many People Care About Our Estuaries:

Endangered Smalltooth Sawfish Critical Habitat Charlotte Harbor Unit



*USFWS Review of Activities in:
<3 feet water, unvegetated &
adjacent to mangroves

- 1920 & 1945: National Wildlife Refuges
- 1956: Greater Pine Island Civic Association
- 1967: Sanibel Captiva Conservation Fndtn
- **1970s: Charlotte Harbor Aquatic Preserves**
- 1975: Cayo Costa State Park
- 1975: Pine Island Garden Club
- 1976: Calusa Land Trust
- **1987: Pine Island Plan (see GPICA website)**
- 1988: Responsible Growth Mgmt Coalition
- 1995: Charlotte Harbor National Estuary
- **2009: Endangered Sawfish Critical Habitat**
- 2010: Matlacha Civic Association
- 2015: Calusa WaterKeeper
- 2017: Pine Island ROAR

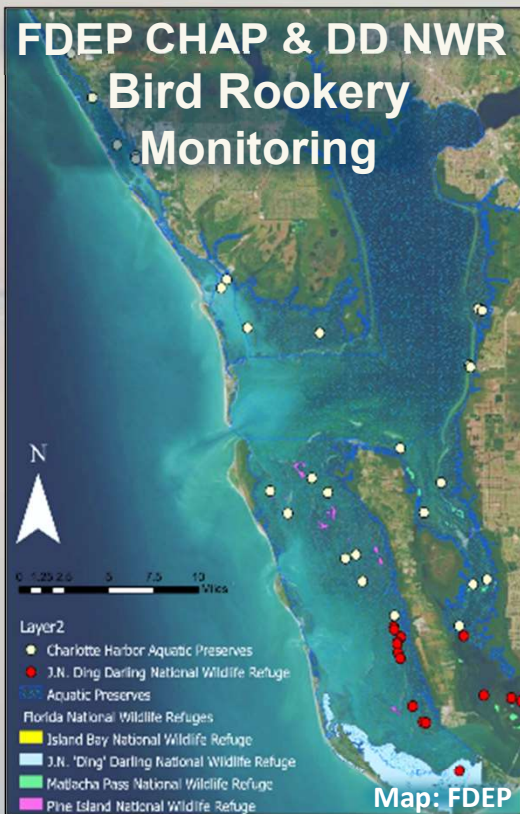


Charlotte Harbor Aquatic Preserves:

- FL Law (258 FS) & Adm Code (18-20 FAC)
- To be preserved in natural conditions for future generations to enjoy
- Outstanding FL Waters – can't degrade past ambient (natural) conditions
- Activities must have positive public benefit
- Boundaries up to mean high water line
- 1970 – Pine Island Sound Aquatic Pres
- 1972 – Matlacha Pass Aquatic Preserve
- 1975 – Gasparilla Snd/Charlotte Harbor
- Office in Punta Gorda (941) 575-5861

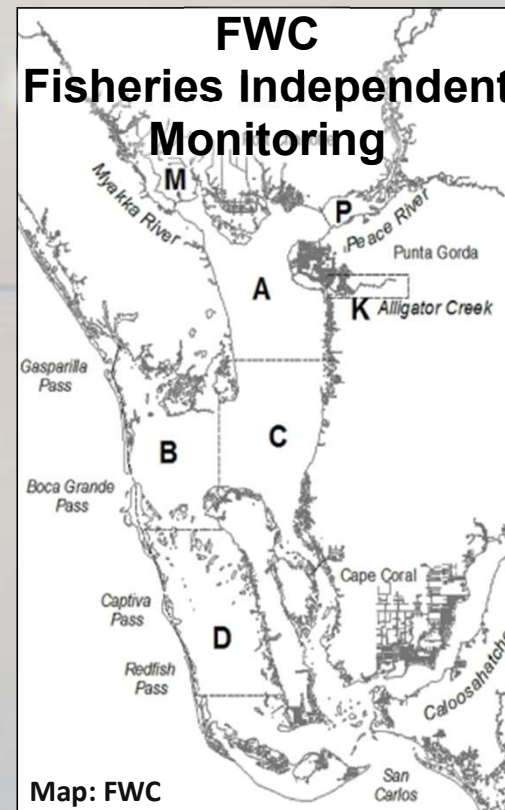
Who's Monitoring Our Estuaries?

Birds:



- Charlotte Harbor Aquatic Pres & Ding Darling NWR
- Wading & Diving Bird Nesting
- Species, Nests, Chicks, Humans
- 30 Sites X PI
- Monthly X 14 yrs
- Critical Wildlife Areas

Fish:



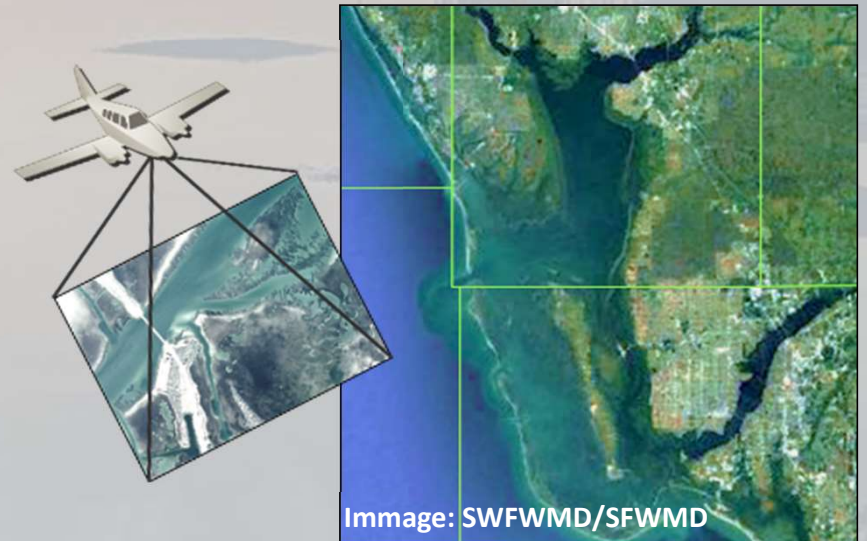
- Fisheries Independent Monitoring
- Fishery Community
- Species, Sizes, Numbers
- 50 Sites by PI
- Monthly X 33 yrs
- Also Smalltooth Sawfish

Seagrass:

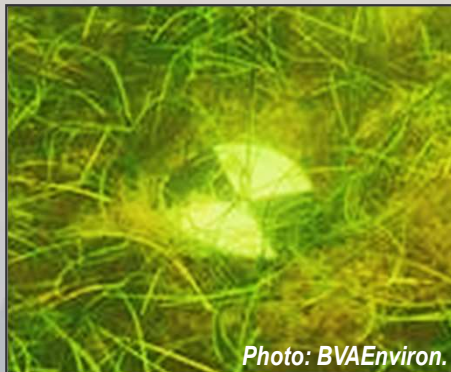
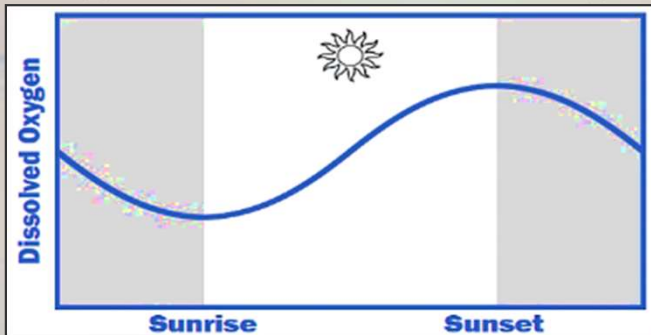
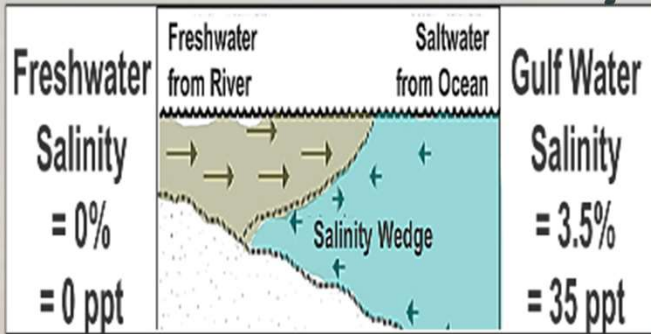


- Charlotte Harbor Aquatic Preserves
- Seagrass Transect Monitoring
- Species, Density, Length, Deep & Shallow Edge
- Also Algae
- 17 Sites X PI
- Yearly X 23 yrs

- SWFWMD & SFWMD
- Seagrass Aerial Mapping
- Presence, Acres, % Cover
- Complete Photos X PI
- Every 2-6 yrs X 33 yrs



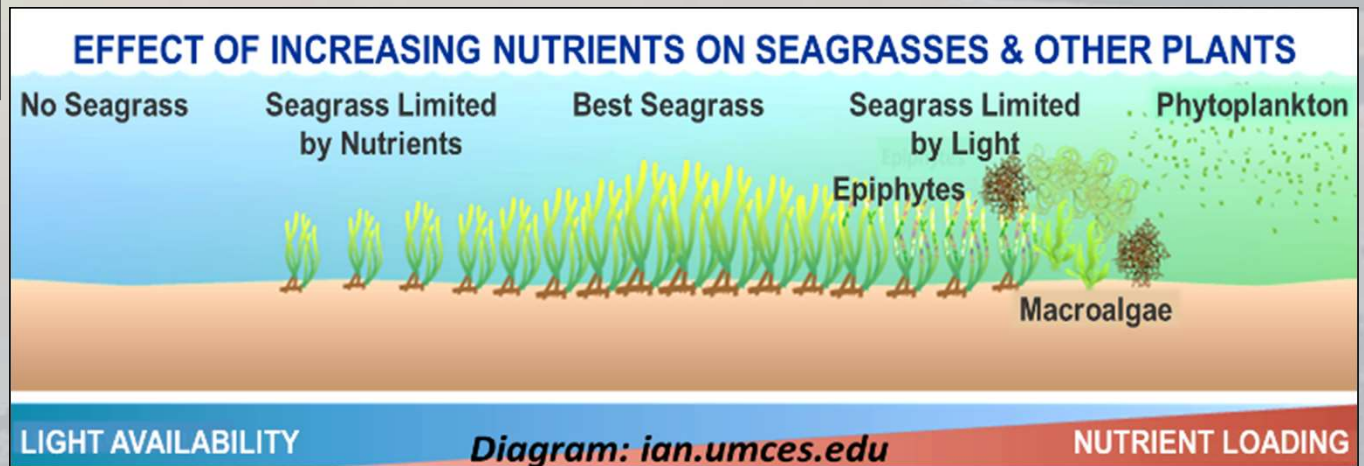
Water Quality – Essential Factors for Estuary Health:



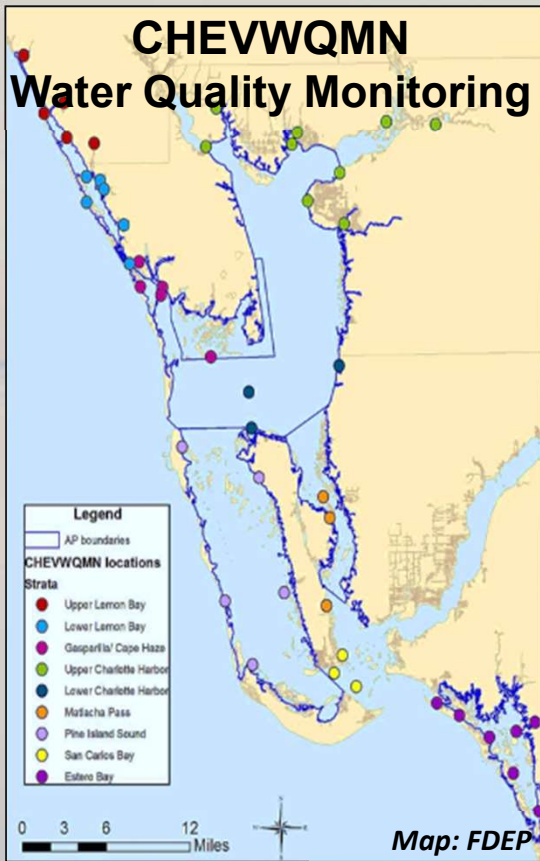
Animal	Min DO Needs (mg/L)
Seatrout	6
Red Drum	5
Blue Crab	4
Ladyfish	3
Pinfish	2
Scallop	2

Diagram: SCCF

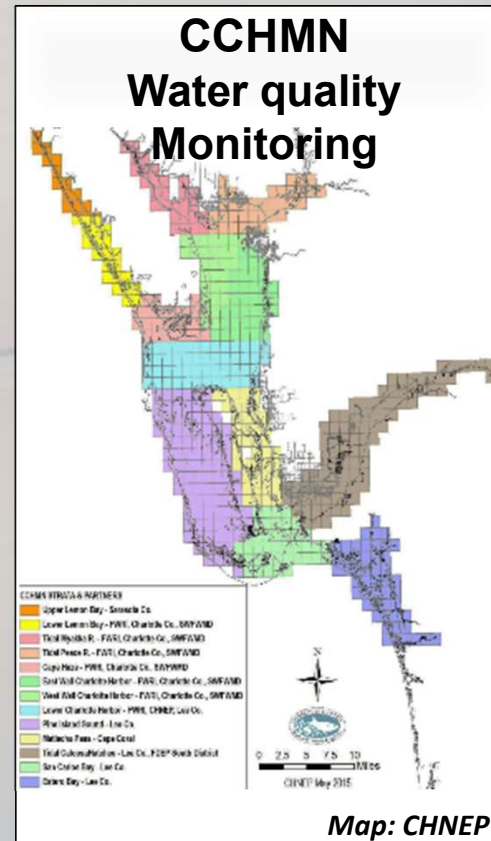
- Salinity & Temp – Drive Everything
- Oxygen – for Fish
- Depth & Clarity – for Seagrass
- Chlorophyll (chl) – for Clarity
- Nitrogen & Phosphorus – for Chl
- Bacteria & Harmful Algae – Humans



Water Quality – Monthly:

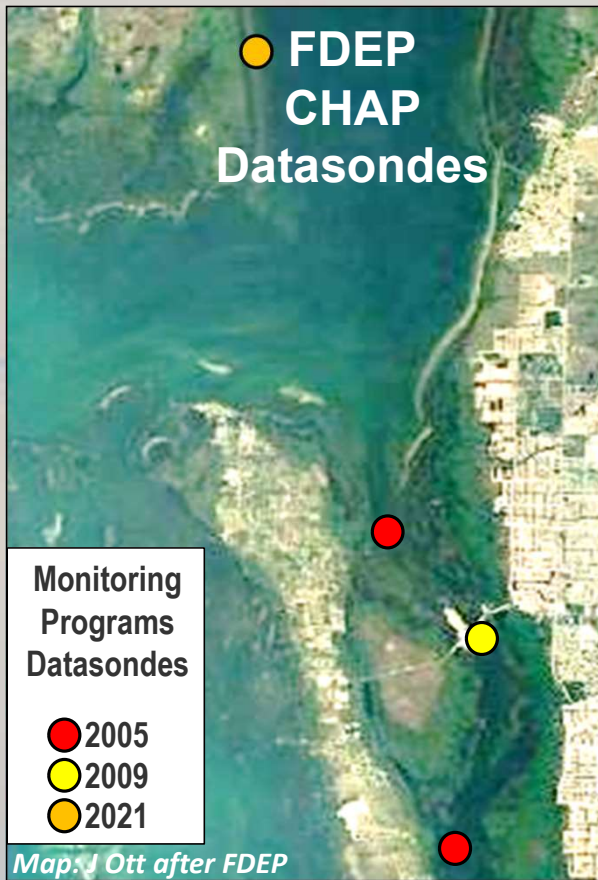


- Charlotte Harbor Aquatic Preserve
- Volunteer Water Quality Monitoring
- 19 Factors
- 13 Sites X PI
- Monthly X 24 yrs



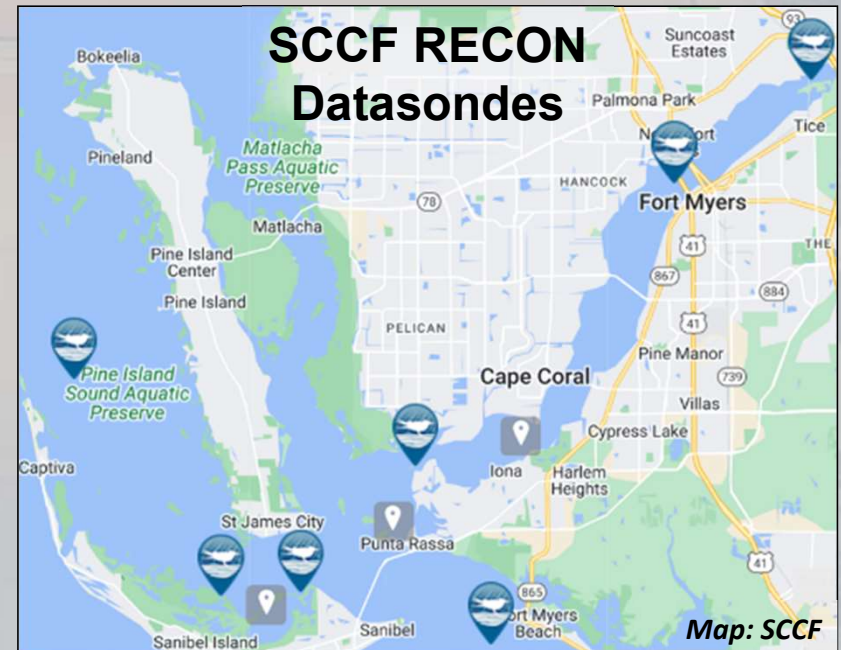
- Multi-Agency
- Random Water Quality Monitoring
- 21 Factors
- 20 Sites X PI
- Monthly X 18 yrs

Water Quality – Continuous Data Loggers:

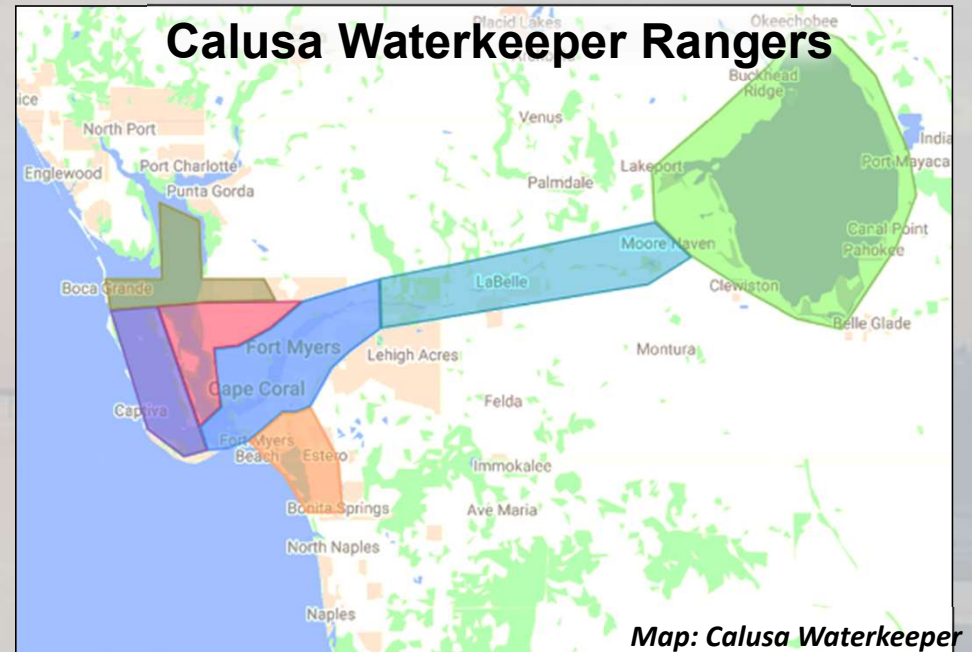
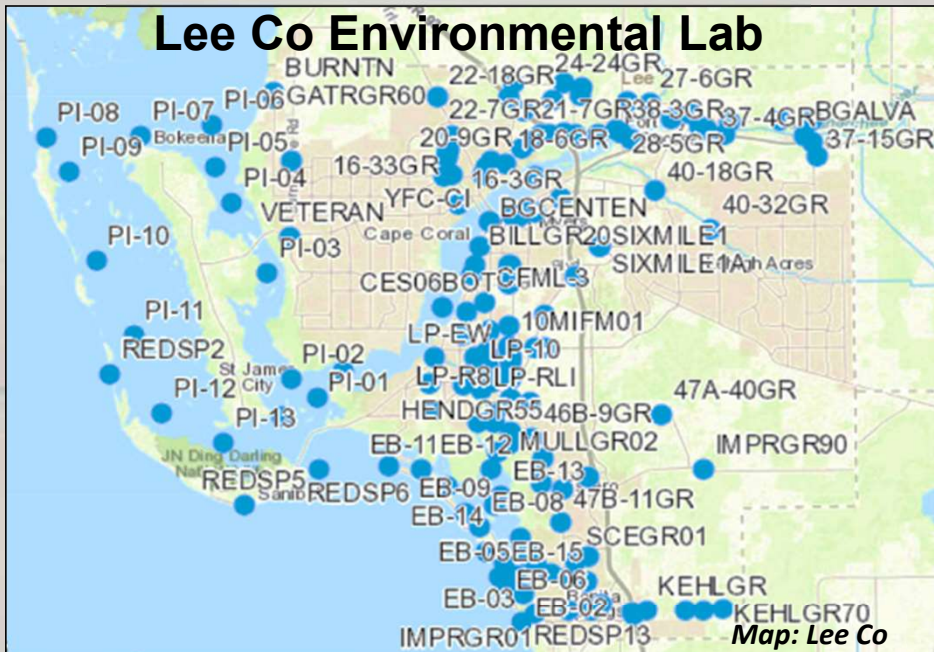


- Charlotte Harbor Aquatic Preserves Datasondes
- 8 Factors X 15 min
- 4 Sites X PI
- Continuously X 17, 13 & 1 yrs

- SCCF RECON Datasondes
- 8 Factors (& Flow) X 15 min
- 4 Sites X PI
- Continuously X 12 yrs

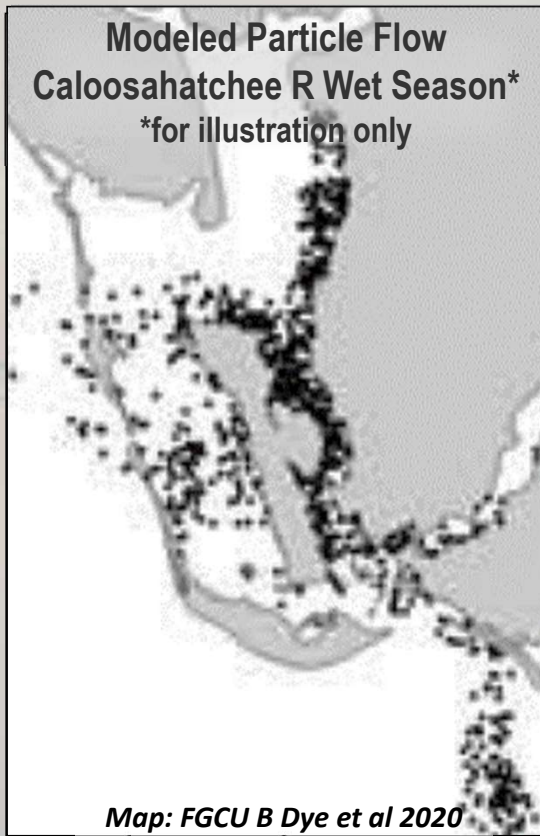


Water Quality – Other:



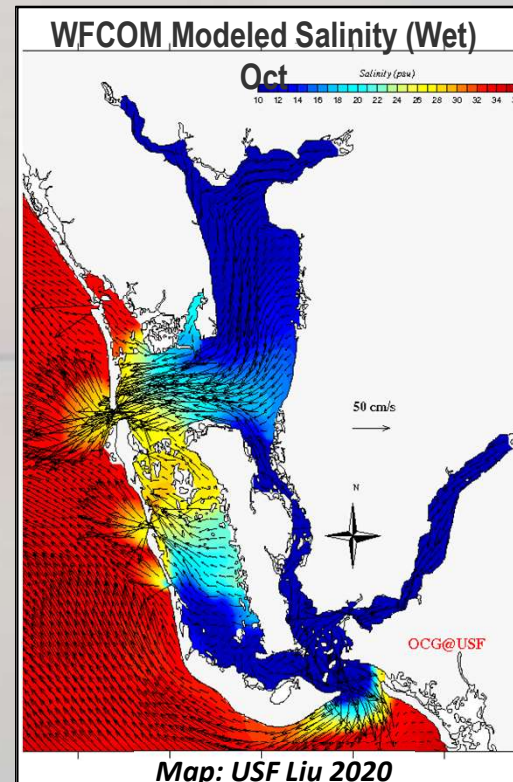
- Other Special Purpose:**
- FDEP Watershed Monitoring
 - CC Canal Watch & HOA WETPLAN
 - Red Tide, Cyanobacteria & Cyanotoxins
 - Fecal Indicator Bacteria
 - Pharmaceuticals, Hydrocarbons & Metals

Water Quality – More Considerations:



Pollutant Load:

- Quantity of Pollutant an Estuary Must Break Down
- Concentration X Volume = Total Load
- FGCU Particle Flow Model



Flow:

- Affects Salinity, Inverts & Fish
- Changes with Tide & Rain & River Flow
- Moves Tidal Node
- USF Salinity & Flow Model

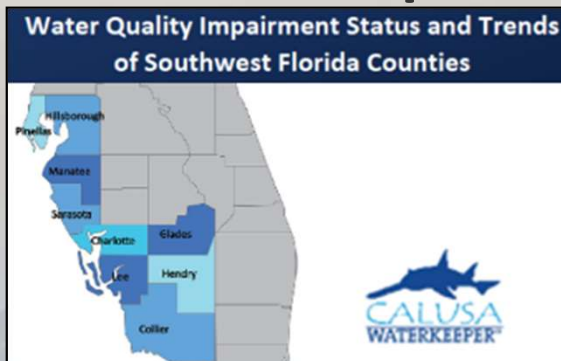
***Remember – Data Access is Essential:**

USF Water Atlas, CHNEP, Lee Co Lab Environmental, SCCF, Calusa WaterKeeper

How Do We Know Our Estuaries are Threatened?

Estuary Report Findings:

- Show Water Quality Impairments Increasing Faster
- 2017 Conservancy of SW FL Estuary Report Card
- 2018 CHNEP Water Quality Status Reports
- 2021 Calusa Waterkeeper Water Quality



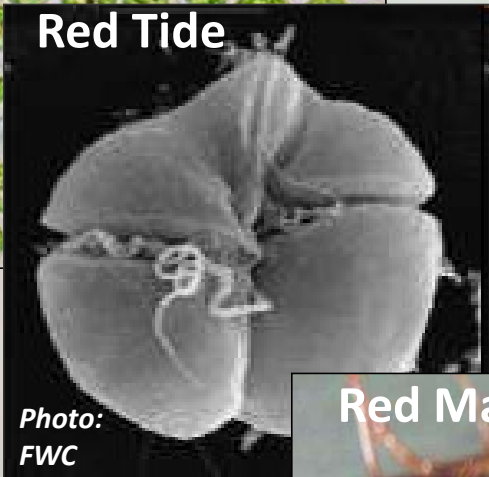
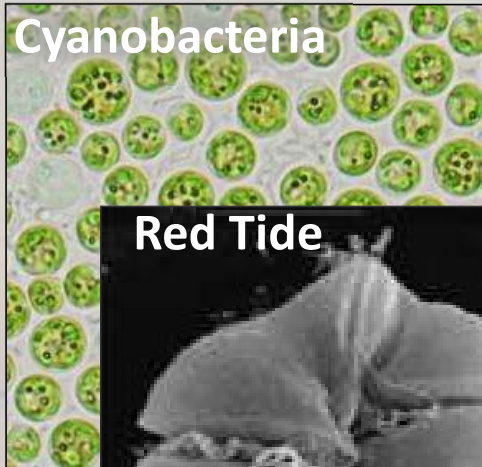
Climate Report Findings:

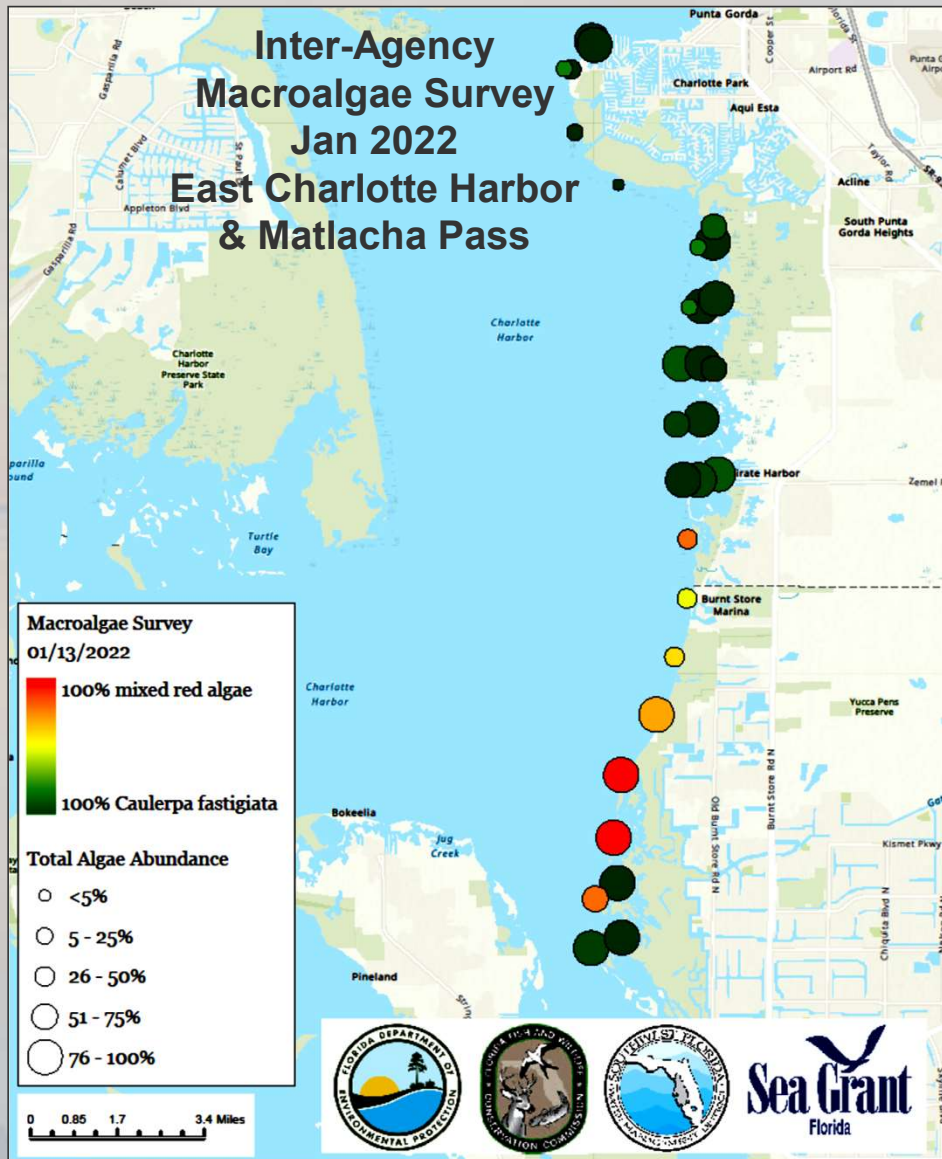
- Show Climate Impacts Increasing Faster
- 2019 IPCC Special Report Ocean in a Changing Climate
- 2019 UN Emissions Gap Report
- 2022 IPCC Climate Change Impacts, Adaptation & Vulnerability



We're Having a "Boom in Blooms" – of Algae:

- Block Sunlight for Seagrass
- "Blue Greens" in Fresh Water
- Red Tide in Salt Water
- Macro Algae in Estuaries
- From High Nutrients & Temps



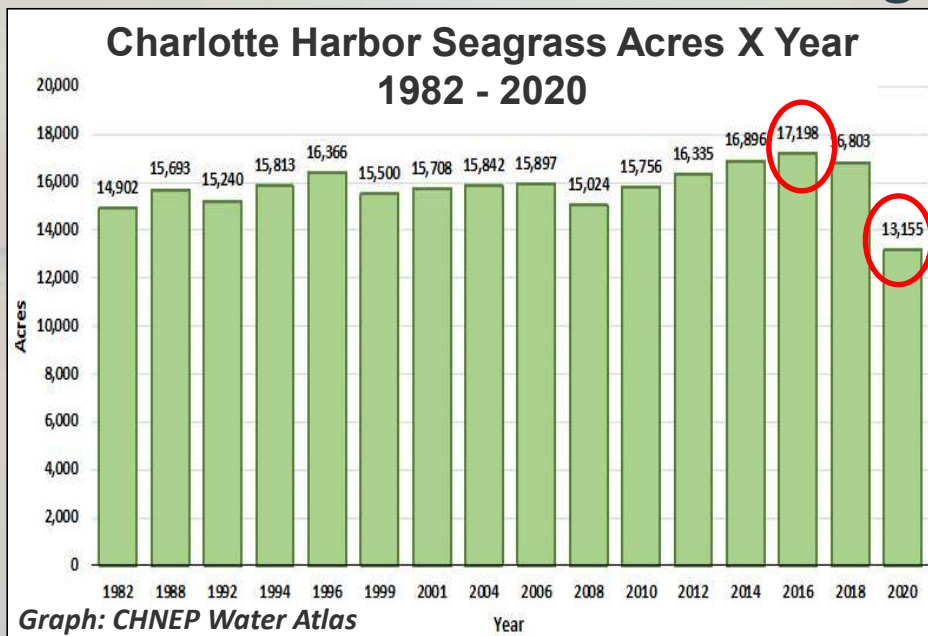


Macroalgae Blooms are Increasing:

- Blooms Started 10 years ago
- Species Vary X Estuary
- Charlotte Harbor & Tarpon Bay – Invasive Green Caulerpa
- Pine Is Sound – Red Macroalgae
- Matlacha Pass – Caulerpa & Sargassum
- Shade Out Seagrasses
- Monitored Since 2020

Seagrasses are Declining:

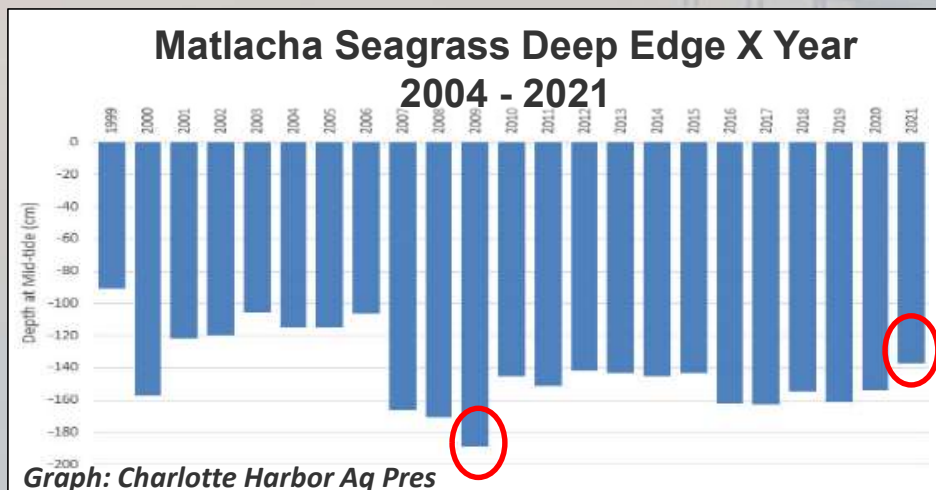
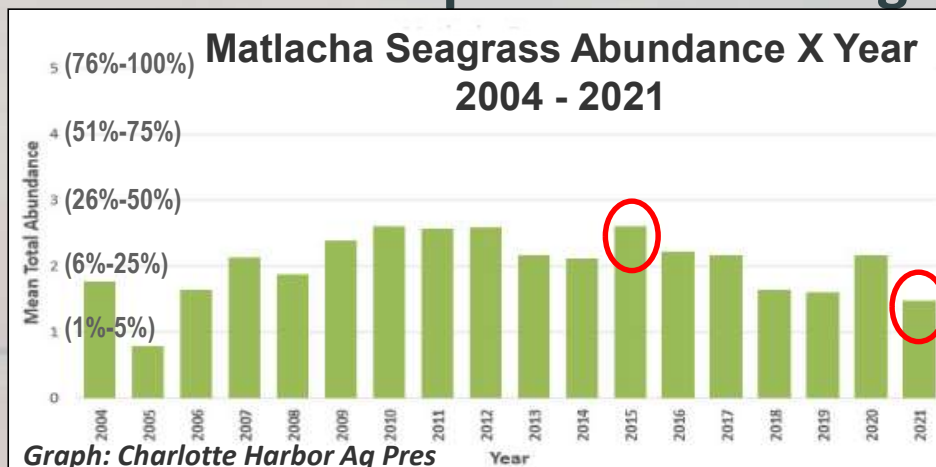
- Losses Vary X Estuary & X Year
- ## Charlotte Harbor Acres Declining



4,000 ac Less since 2106
13% Less Cover since 2015
20 Inches Shallower since 2009

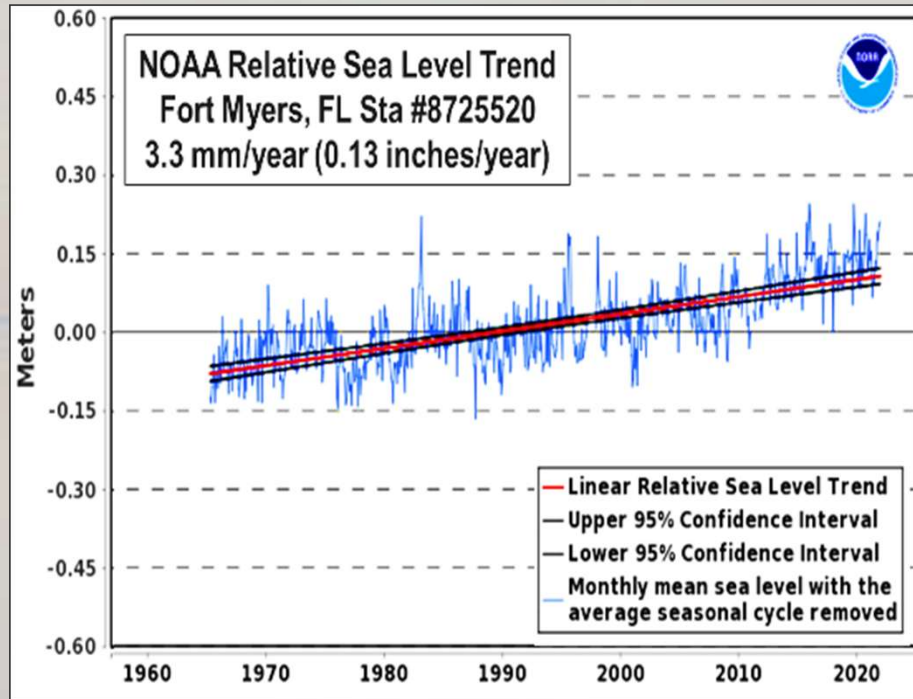
Matlacha Pass

% Cover & Depth are Declining



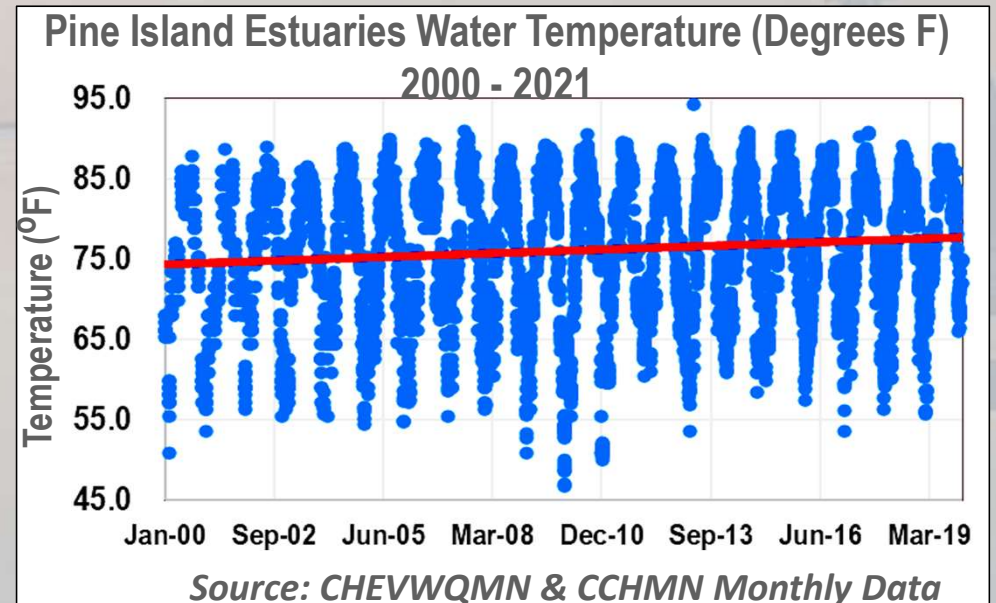
Water Level is Rising:

- +5 Inches in 40 Years Locally



Water Temperature is Rising:

- Fastest Increasing Parameter
- Significantly in PI Estuaries
- +3 Deg F in 20 Years Locally



See: Drivers of Seagrass & Algae Changes in SW FL Aquatic Preserves by Janicki, 2022

Nutrients are Higher than Required by State Standards:

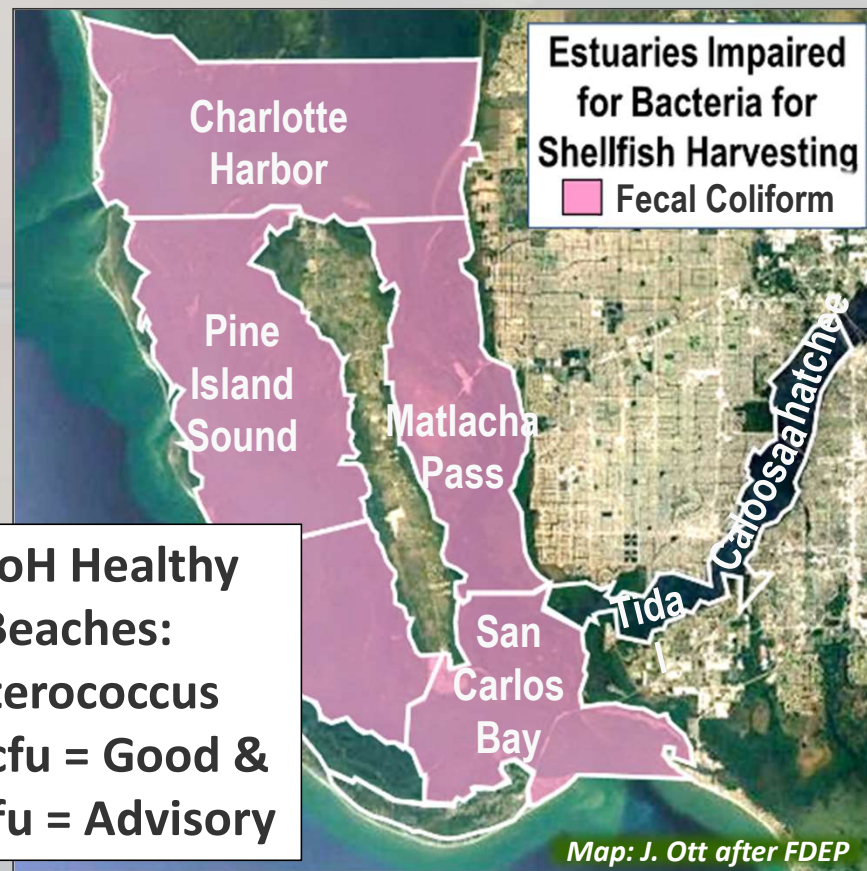
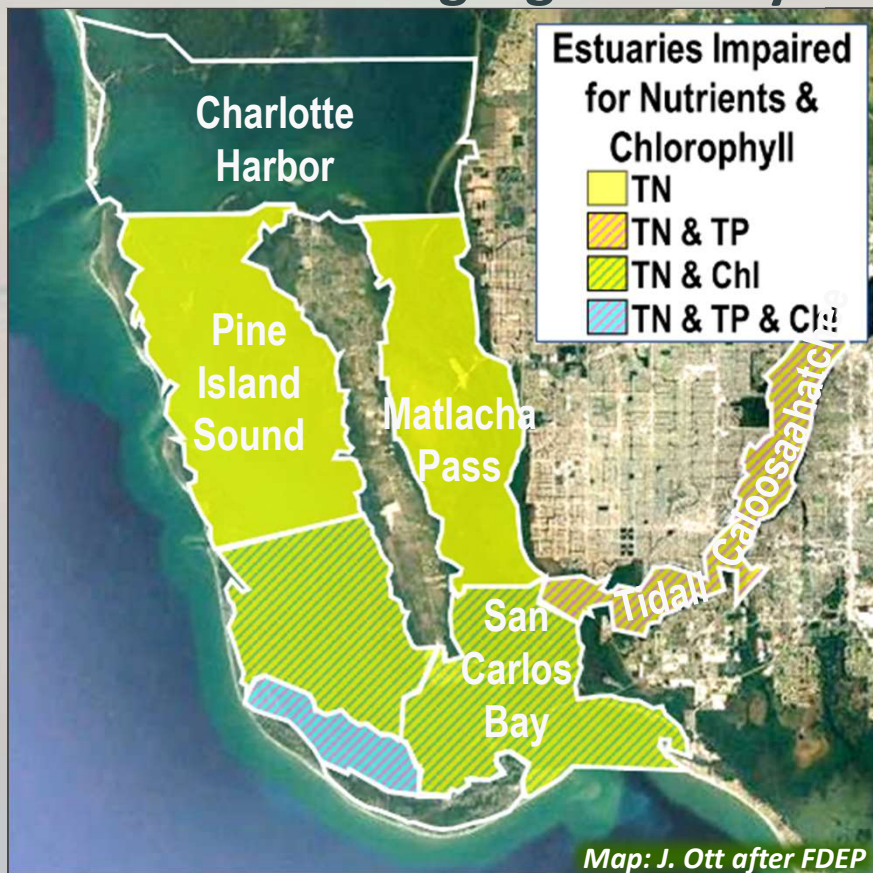
- Water Quality Standards – How We Want to Use Our Waterbodies
- Purpose – Identify Waters that Need Restoring
- Defined – in State Regulations (62.302 FAC), with Federal Authority
- Set Maximum Pollutant Discharges – from Public & Private Facilities
- Waterbodies Worse than Standards are “Impaired”
- So State & County Must Take Actions in Watershed to Reduce Pollutants
- Calculate Pollutant Loads (*TMDLs*)
- Prepare Management Plans (*BMAPs*)
- Nutrient Standards for Estuaries (2012)

Water Quality Standards for Pine Island Estuaries (62-302 FAC)				
Basin	TP (mg/L)	TN (mg/L)	Chl (ug/L)	Bacteria Fecal Indicator
Charlotte Harbor	0.19	0.67	6.1	See FAC
Pine Island Snd	0.06	0.57	6.5	See FAC
Matlacha Pass	0.08	0.58	6.1	See FAC
San Carlos Bay	0.05	0.55	3.7	See FAC

Our Estuaries are Impaired for Nutrients & Bacteria:

- Impaired for Nitrogen & Still Increasing Significantly

- Impaired for Fecal Coliform for Shellfish



***FDoH Healthy Beaches:**
 Enterococcus
 < 35 cfu = Good &
 >70 cfu = Advisory

Remember: These are Outstanding FL & Shellfish Harvest Waters

What are the Causes & Solutions to these Threats?

We Know the Basic Causes:

- 50 Years of Estuary & Watershed Science – Research (1970s), CHAP & SWFWMD (1980s), CHNEP (1990s)
- Too Many Extra Nutrients from Human Activities – Worsened by Hydrologic & Climate Changes
- Extra Nutrients Come from Wastewater (Septics & WWTPs) & Stormwater (Urban, Ag & Fertilizer)
- Extra Nutrients Vary X Landuse X Watershed
- Site Specific “Hot Spots” – Locations & Parameters & Land Uses & Ages
- Rapidly Changing Conditions – Development, Storms, Temps & Sea Level



Hydrologic Changes Deliver More Pollutants:

Faster Storm Runoff:

- Carries More Sediment & Nutrients
- Storms are Increasing
- Roads & Roofs are Increasing
- Runoff is Faster & Flashier
- Stormwater Designs, Codes & Monitoring are Out of Date



More Altered Flows:

- Changes Salinity, Sediment, Nutrients & Biology
- Cumulative Flow Changes
- Spreader Waterways, Boat locks, Wiers, Calooshatchee R & Lake O Discharges



Climate Changes Estuaries:

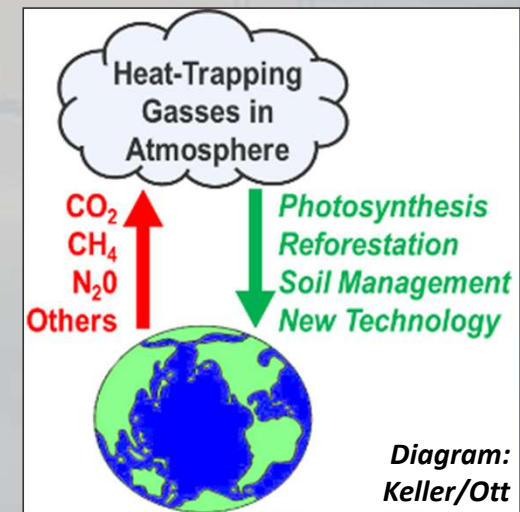
- Storms & Droughts More Intense
- Habitats in Different Salinities & Times & Depths
- Water Temperatures Higher
- Water Chemistry & Biology Change
- Species Struggle for New Niches & Dominance

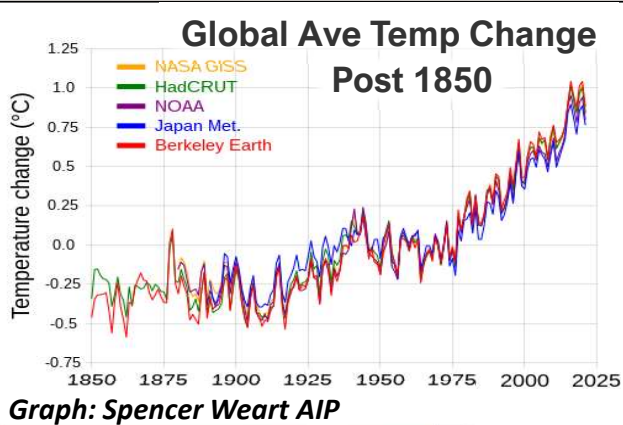


Photo: Sean Rayford, Getty Images

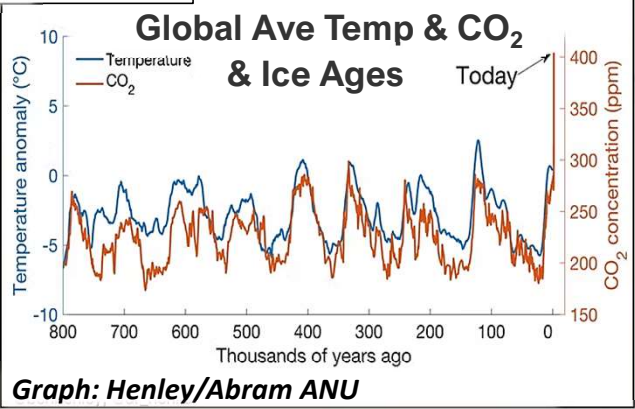
We Know the Basic Solutions:

- Decrease Nutrients Delivered to Waterways
- Update Stormwater Infrastructure
- Update Wastewater Treatment
- Restore Natural Water Flows
- Reduce Climate Change Now





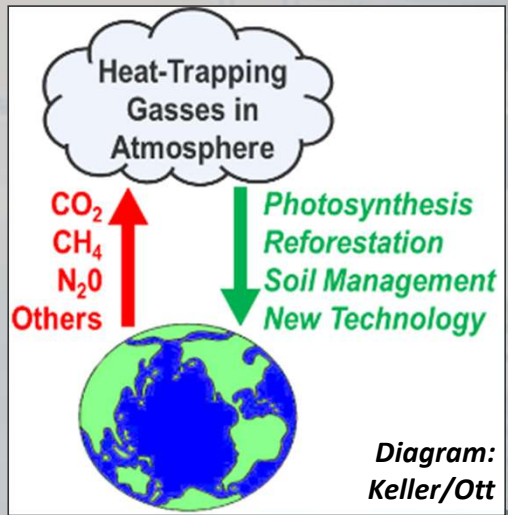
Understanding Climate Change is Complicated



We Know the Basic Solutions:

- Decrease Nutrients Delivered to Waterways
- Update Stormwater Infrastructure
- Update Wastewater Treatment
- Restore Natural Water Flows
- Reduce Climate Change Now

- Tipping Point = 1.5° C (35° F) Higher than Pre-Industry
- Goal = Net Zero Emissions X 2050
- Must Reduce Emissions $\geq 10\%$ Each Year



What are Actions are Needed?

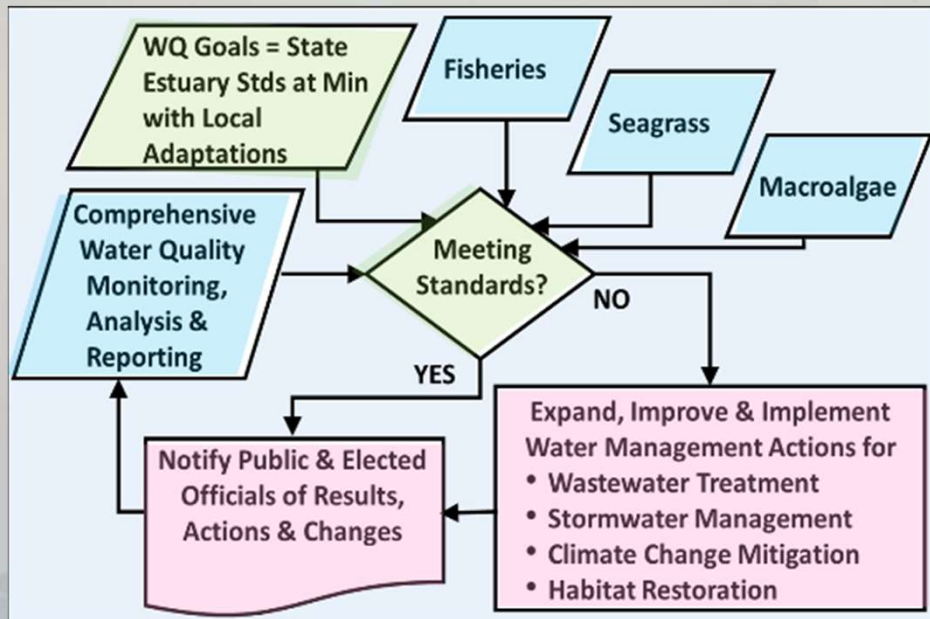
Critical Actions Include:

- 1) Create a *County* Comprehensive Water Resource Mgmt Approach
- 2) Declare a *County* Water Resource Vision
- 3) Monitor & Report Water Quality – Understandably in All Waterways
- 4) Identify “Hot Spots” – from Monitoring
- 5) Reduce Nutrients to Standards & Goals – Focus on “Hot Spots”
- 6) Improve Wastewater & Stormwater Mgmt – Including Funding & Scheduling
- 7) Institute Complementary Programs – For Climate & Water Quality



Use a Science-Based Decision-Making Process:

- Work Together Efficiently
- Set Water Quality Goals Using State Stds & OFWs
- Use Science to Drive Restoration



Create "K to Gray" Education Campaign:

- Audiences = *Elected Officials, New Residents, Staff, Schools, College Students & Adults*
- Topics = Estuaries & You, Water Quality Basics, Climate Actions, Economic Values, etc
- See: *Community Playbook for Healthy Waters – Gulf Coast Community Fndn*



County Must Lead Estuary Restoration Actions – Now:

- *County Must Hire a Water Resource Manager*
- **County Must Create a Healthy Waterways Vision – for Our Economy**
- **Can Coordinate Restoration – Between Departments & Staff, Cities & Counties, Agencies, Elected Officials & Citizens**
- **Responsible for Key Solutions –**
Local Knowledge, Zoning, Infrastructure, Education & Funding
- **Responsible for Wastewater & Storm Water Infrastructure –**
Location, Design, Funding & Scheduling
- **Is Closest to Impacts & Solutions –**
Water & Climate Adaptation & Mitigation
- *Citizens Must Participate in Local Decisions*



We Must Participate in Estuary Restoration Actions – Now:

- **Urge Global Climate Action & Reduce Our Climate Footprint – Now!**
- **Urge County to Hire Water Resource Manager & Develop Vision**
- **Urge County to Update Stormwater & Wastewater Systems**
- **Urge County to Adopt Protective Tree Ordinances**
- **Urge Army Corps to Set More Natural Lake Okeechobee Discharges**
- **Urge SFWMD &/or FDEP to Evaluate Water Quality Impacts of Cape Coral Reuse Water & Weir Removal**

*1 Acre of Trees Sequesters >5 Tons
of CO₂ Each Year*

*25 Acre Cleared Construction Site
Loses Ability to Sequester >125 Tons
of CO₂ Each Year*



We Must Participate in Estuary Restoration Actions – Now:

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- **Urge SFWMD &/or FDEP to Evaluate Water Quality Impacts of Cape Coral Reuse Water & Weir Removal**
- **Become Citizen Scientist, Nature Steward & Plant Lots of Trees**
- **Create *Community Playbook for Healthy Waterways***
- **Pump & Care for Our Septic Systems**
- **Vote Smart & Help Get Out the Vote**
- **Join ROAR, Calusa WaterKeeper & CLT**



What are the Take Home Messages?

- PI's Estuaries are Essential & Complicated & in Crisis
- Healthy Estuaries are Essential for Our Economy
- County *Must* Take Lead in Restoring Our Estuaries Now
- Good Water Quality & Flows & Climate are Vital for Estuaries
- Focus on Fixing Nitrogen & Flows & Climate Impacts
- We *Must* Help with Solutions
- Pick 2 Actions & Start – *Now!*



Photo: Brian Cotterill

Where Can We Find More Information?

- Community Playbook for Healthy Waterways: waterqualityplaybook.org
- USF CHNEP Water Atlas: chnep.wateratlas.usf.edu
- Calusa WaterKeeper: calusawaterkeeper.org
- SCCF: sccf.org
- Calusa Land Trust: calusalandtrust.org
- William Coty Keller's Web Page: ecopapak.org
- Greater Pine Island Civic Association: gpica.org
- Charlotte Harbor Aquatic Preserves: floridadep.gov/rcp/aquatic-preserve

Special Thanks to Charlotte Harbor Aquatic Preserves Staff!

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