What's Our 1st Local Step to Protect Our Estuaries & Economy?

Meeting with Charlotte Co. Staff – March 11, 2019
David Blewett, Fisheries Ecologist, FWC
William Coty Keller, Local Ecologist, CC B&SAC
Judy Ott, Estuary Scientist, Estuary Escapes LLC

Photo: Tess

What Are We Talking about Today?

Why We Need Adequate Water Quality Monitoring to Guide Estuary Protection & Restoration.

- Why Our Estuaries are Important
- Threats to Our Estuaries
  - Fisheries
  - Seagrass
  - Water Quality
- Components of an Effective Water Quality Monitoring Program
- Questions & Discussion

Where Are Our Estuaries?

Estuary: Where freshwater from the land meets saltwater from the sea.

Charlotte Co. includes:

- **Lemon Bay & Charlotte Harbor**
- **Tidal Myakka and Peace Rivers**
- **Plus >14 Tidal Creeks**

Why Are Our Estuaries Important?

- Economic & lifestyle values includes: recreational fishing, commercial fishing & seafood, boating & kayaking, birding & aesthetics.
- Valuable habitat for nursery fisheries.
- Value recognized through designation as FL Aquatic Preserves, Outstanding FL Waters & Charlotte Harbor National Estuary Program.

Some Economic Values of Estuaries to Charlotte Co.*
***Source: FL Sea Grant**

		Licenses	Est. Total Benefit
Commercial Fishing	2010	154	$1,100,000
Recreational Fishing	2010	22,485	$8,000,000
Boating	2010	21,000	$1,900,000
Marine Related Businesses	2010	4,700	$4,900,000

What Are General Threats to Water Quality?

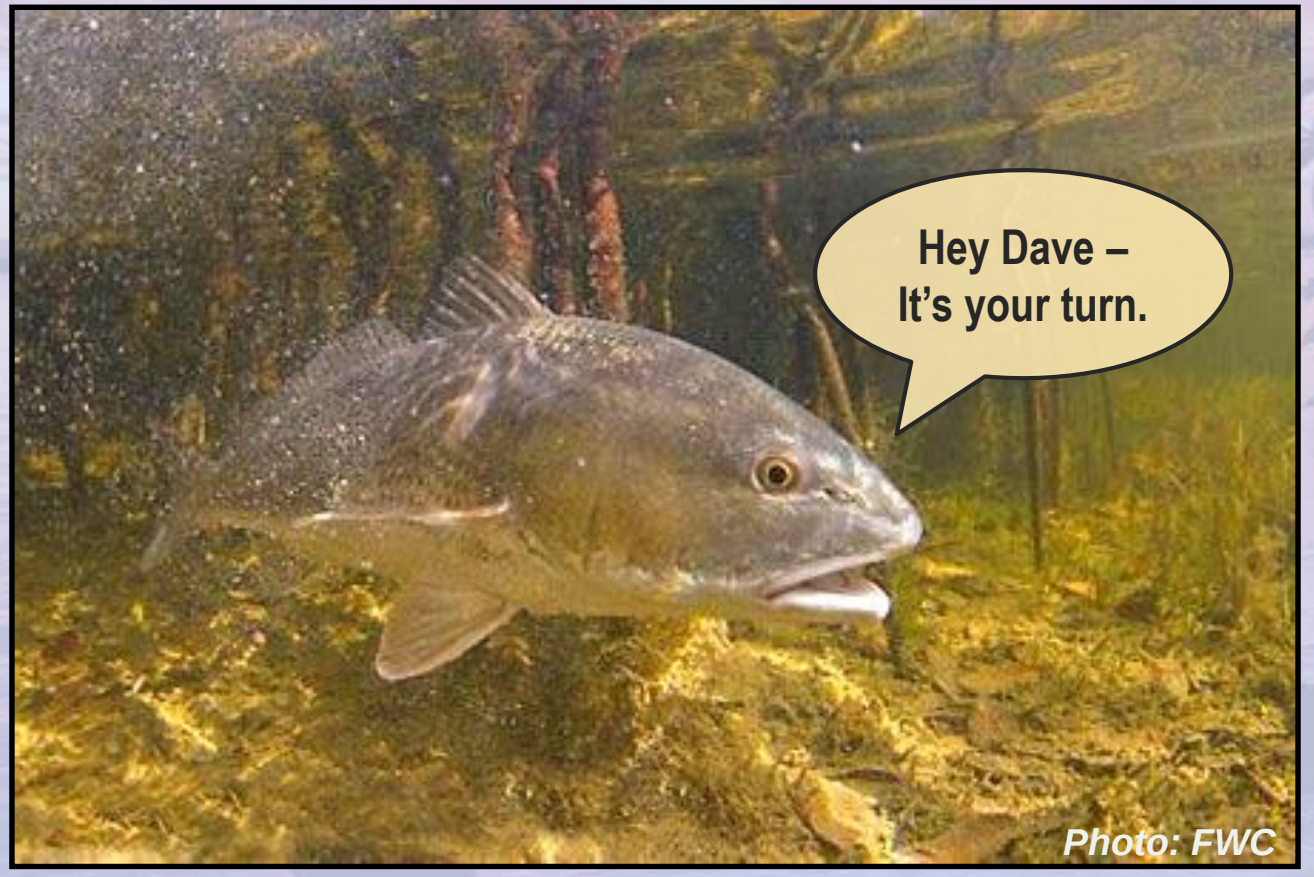
Threats:

- High nutrients can cause algae blooms.
- Algae blooms can shade & reduce seagrasses.
- Decomposing algae can reduced dissolved oxygen for organisms.
- Lack of dissolved oxygen can cause dead zones (North Gulf, Indian River Lagoon, Sunshine Lake).

Sources:

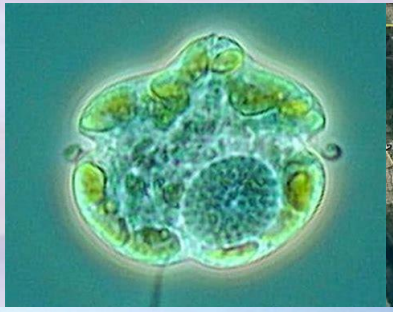
- Septic systems impact many FL waters.
- Residential & agricultural runoff contributes nutrients to surface & ground waters.
- Algae blooms are worsened by warming waters & intensifying rains – expect "Boom in Blooms".
- Red tide & blue-green algae are worsened by excess nutrients.

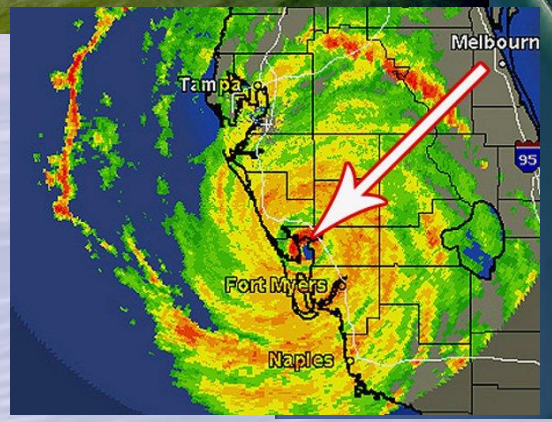
What Are Our Fisheries Telling Us?

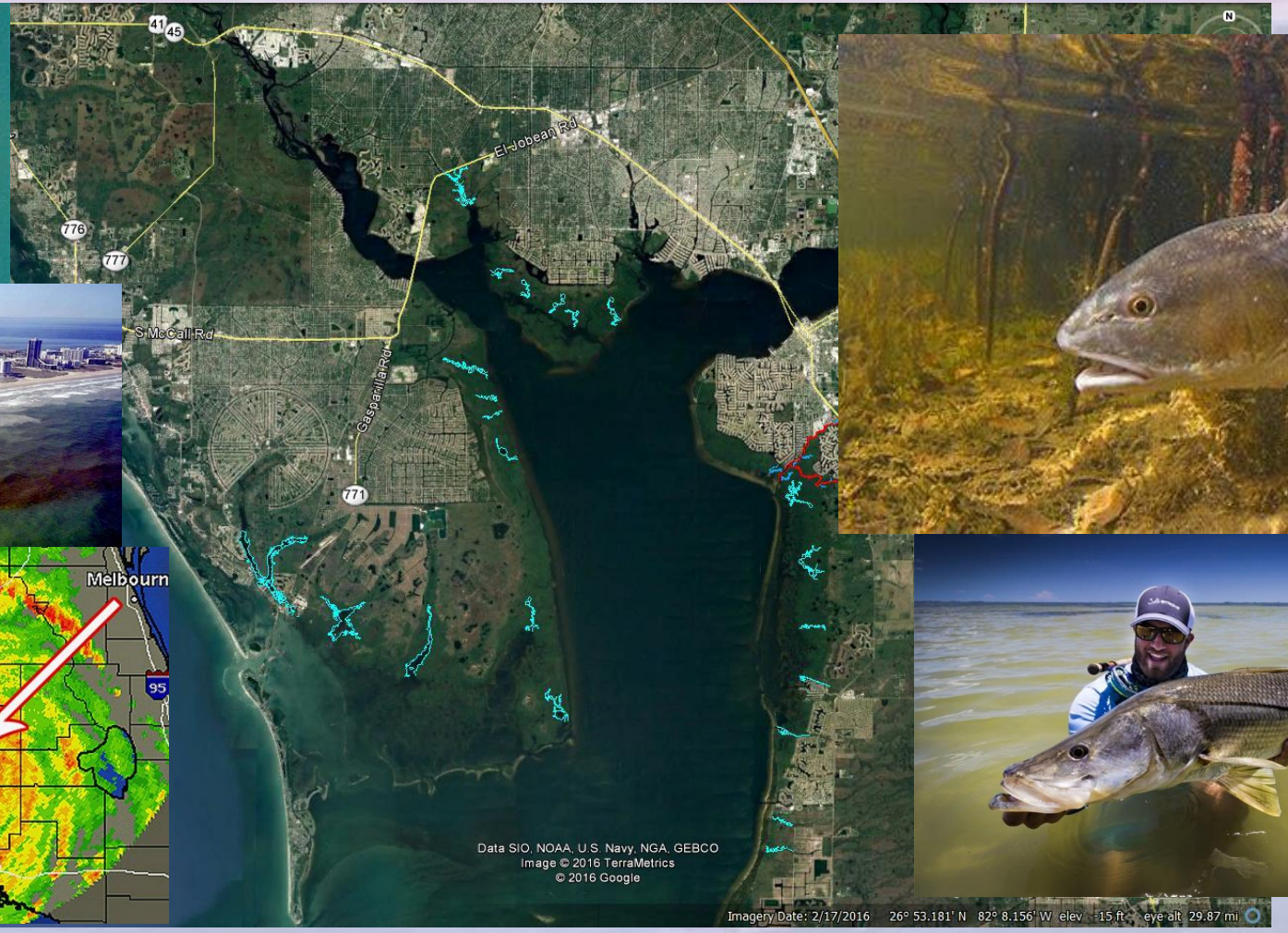


Resiliency in Fish Populations

David Blewett, Philip Stevens, and Courtney Saari
Fish and Wildlife Conservation Commission (FWC)
Fish and Wildlife Research Institute (FWRI)







Background

- Charlotte County resident and fisheries ecologist with the FWC for over twenty five years (sport fish populations and habitat)

- Charlotte Harbor is a unique and special estuary and it's rooted deeply in our culture (there is so much interest about the fish and wildlife in our area)

- Number one question - "How's the health of the harbor?"

Second most asked question:

What’s the engine doing in the middle of the boat?

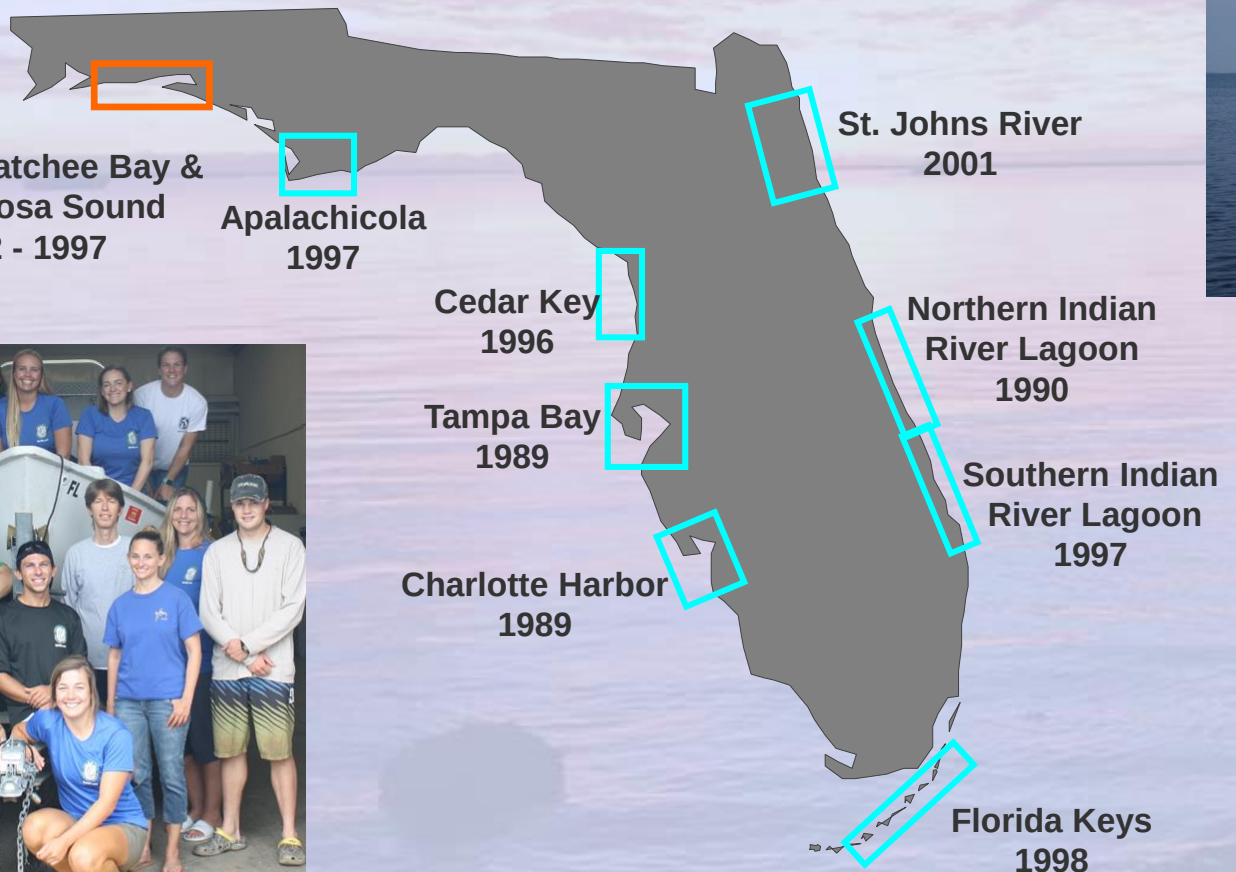
Basic overview

- Fish populations can rebound quickly after disturbances, but only to a certain point
- Share observations and cursory data showing an increase in the amount of macroalgae in Charlotte Harbor
- Briefly point out some benefits of having a consistent long-term water quality monitoring program in place that provides good spatial coverage throughout our interior urban waterways

Thank you for your efforts and commitment to convert septic systems to sewer in sensitive areas

This is powerful step to help assure better water quality in Charlotte Harbor

FWC Fisheries-Independent Monitoring (FIM) Field Labs



Long-term Fisheries Monitoring

Long-term monitoring is a type of sampling where the same measurements are made over time, preferably using the same equipment and the same sampling design.

Three types of sampling gears are used to collect small and large fish, and some large invertebrates like shrimp and crabs (1996-present).

Small fish sampling

Small Seine

Shallow bay and river (flats and shorelines)

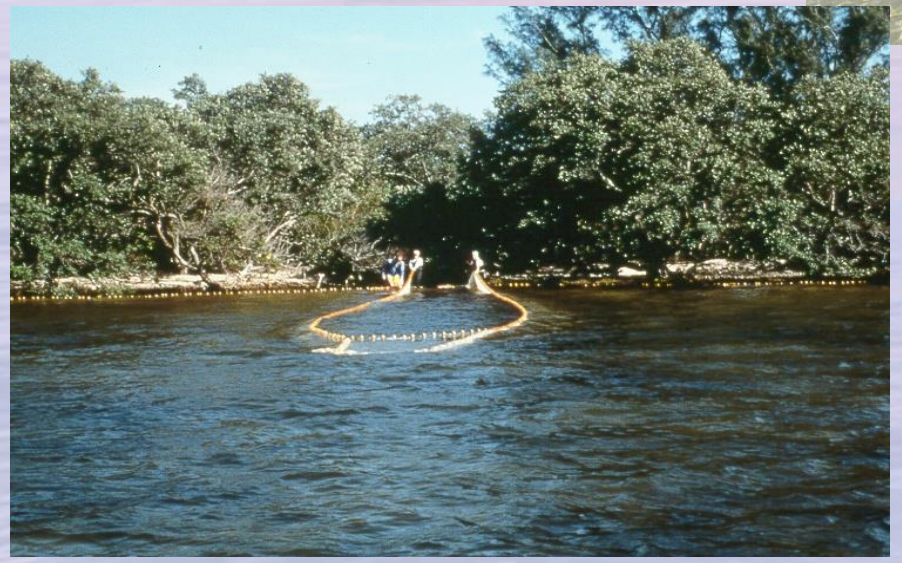
Trawl

Deep bay and river (>1.7 m)

Example of small fish sample

Large fish sampling along shorelines

Large Haul Seine (2 football fields long)



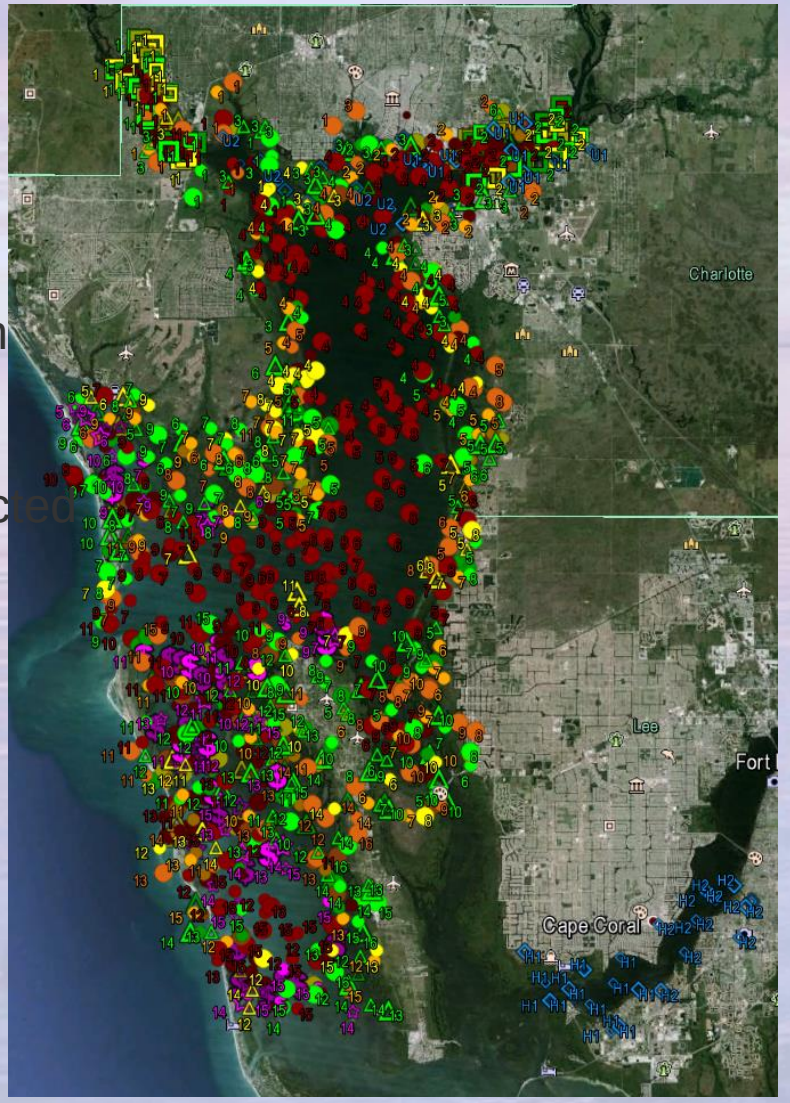
Typical annual fish sampling distribution

Random sampling design

Over 100 sampling sites per month (over 1000 samples per year)

Record data on all fishes and selected invertebrates, habitat, and water conditions (salinity, temp., DO)

*Over 50 published studies in the last 10 years



Program directives:

Track abundance of fish in Florida’s estuaries
Determine the effects of regulations
Pinpoint essential fish habitat
Investigate effects of variable freshwater inflow

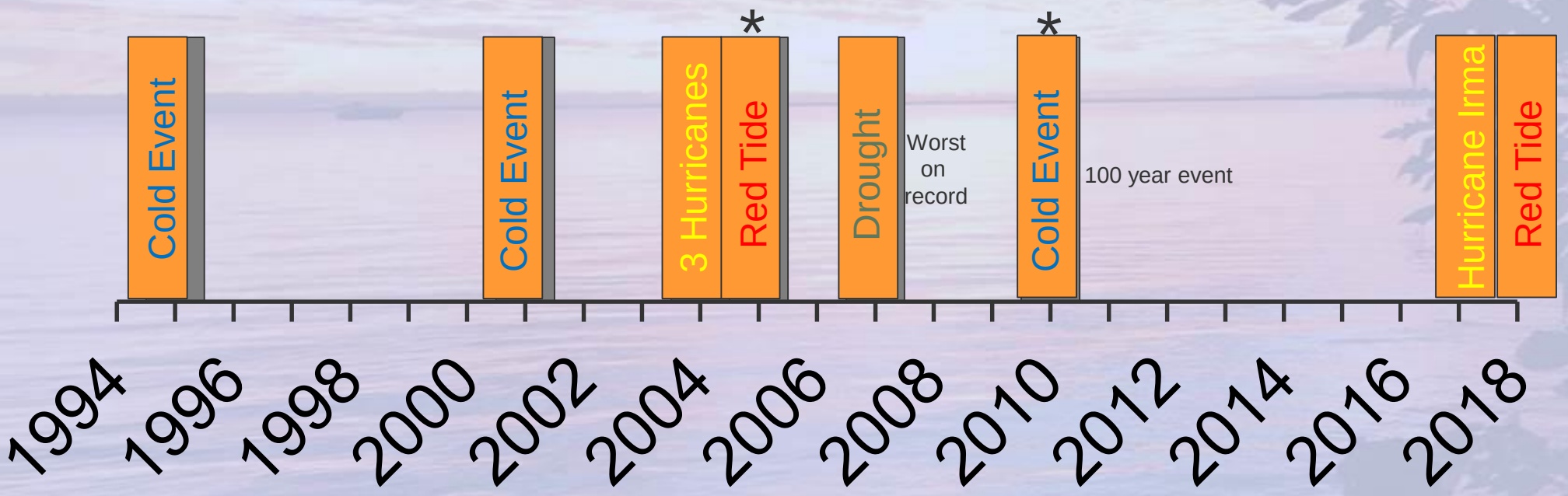
Though in reality much of our research time goes into studying environmental disturbances

An environmental disturbance is a temporary change in environmental conditions that may affect an ecosystem.

Some marine examples include:

- Harmful algal blooms (HAB)
- Extreme low oxygen events
- Extreme temperatures
- Oil spills
- Droughts
- Hurricanes

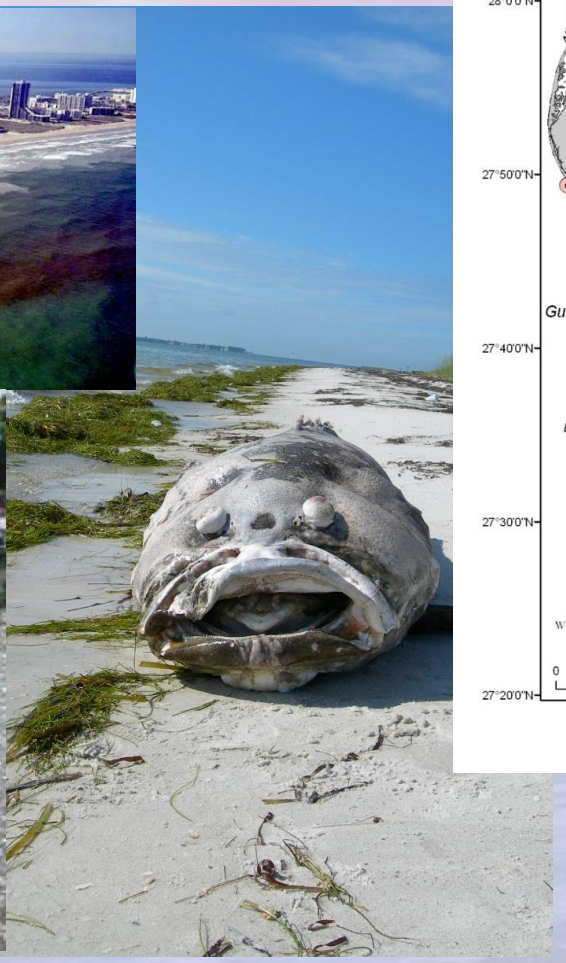
A series of disturbances that impacted Charlotte Harbor



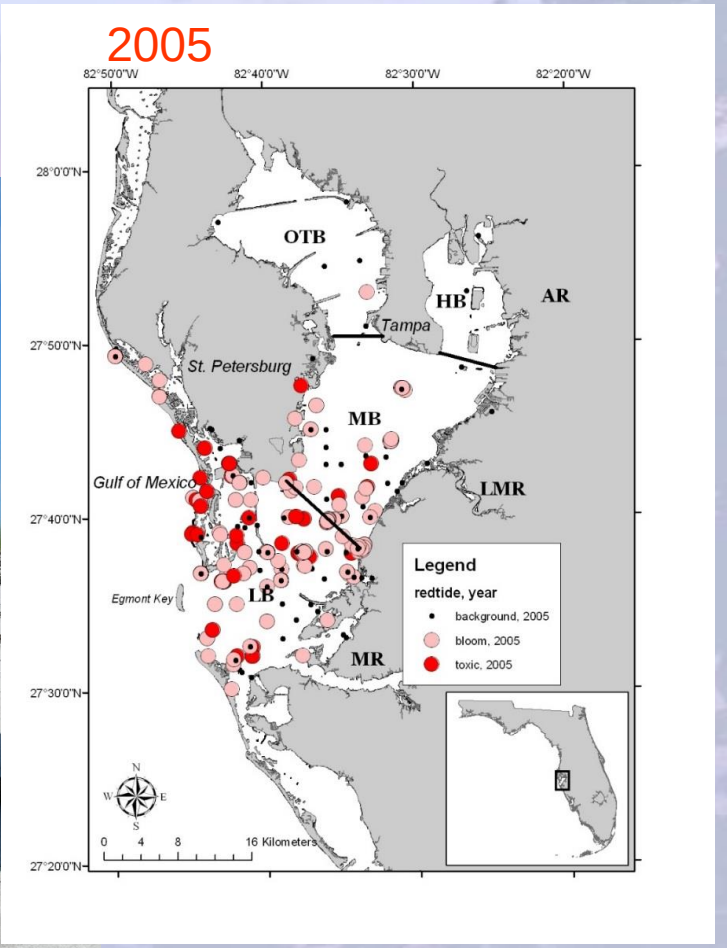
Also, blue-green algae outbreaks in 2006, 2016, 2018 in the Caloosahatchee River

Results from Fisheries-Independent Monitoring – 2005 Red Tide Event

2005 Red Tide Event – Tampa Bay

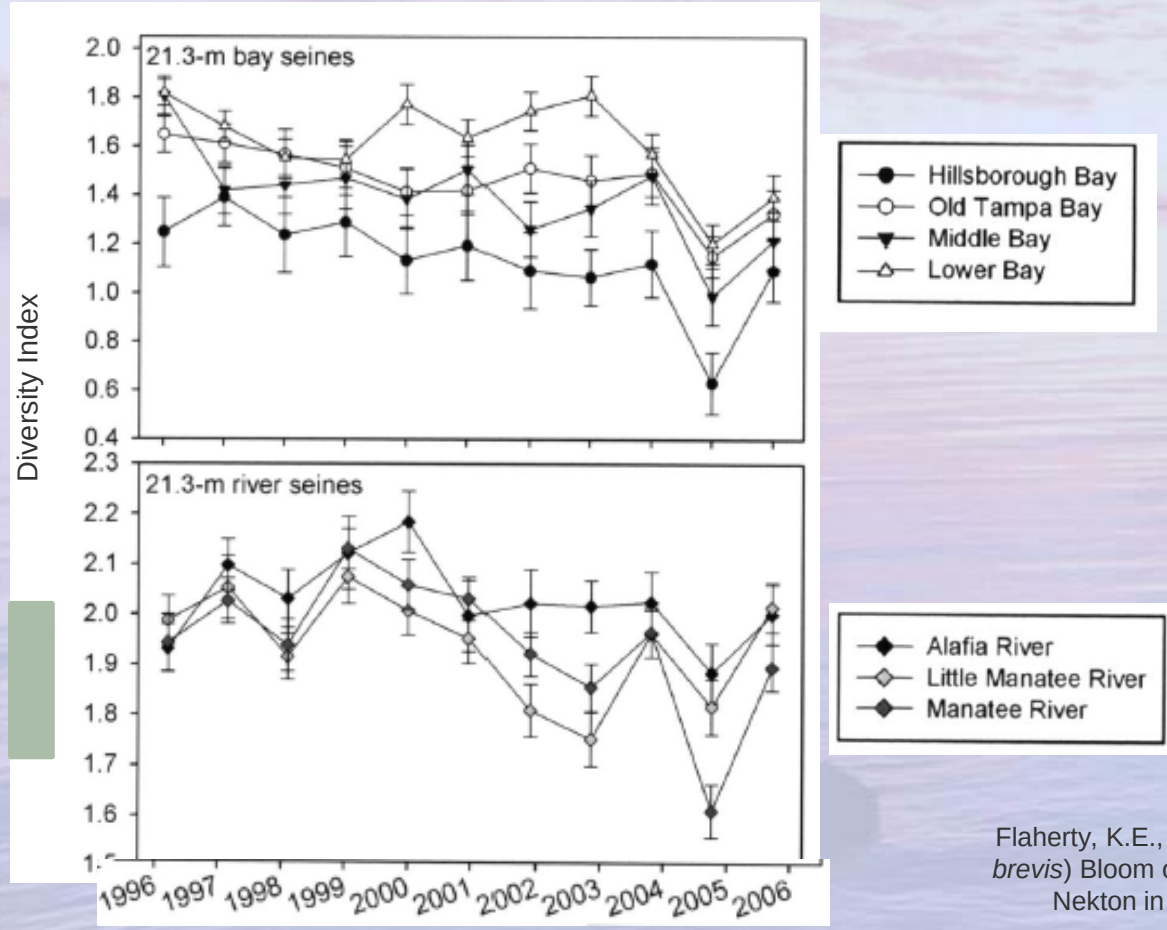


2005



Effects of red tide on small fishes

Noted differences in the overall community of small fishes in 2005 but there was a quick rebound in 2006



Flaherty, K.E., and J.H. Landsberg. 2011. Effects of a Persistent Red Tide (*Karenia brevis*) Bloom on Community Structure and Species-specific Relative Abundance of Nekton in a Gulf of Mexico estuary. *Estuaries and Coasts* 34(2): 417-439.

Small juvenile sport fish abundance

Snook – no effect

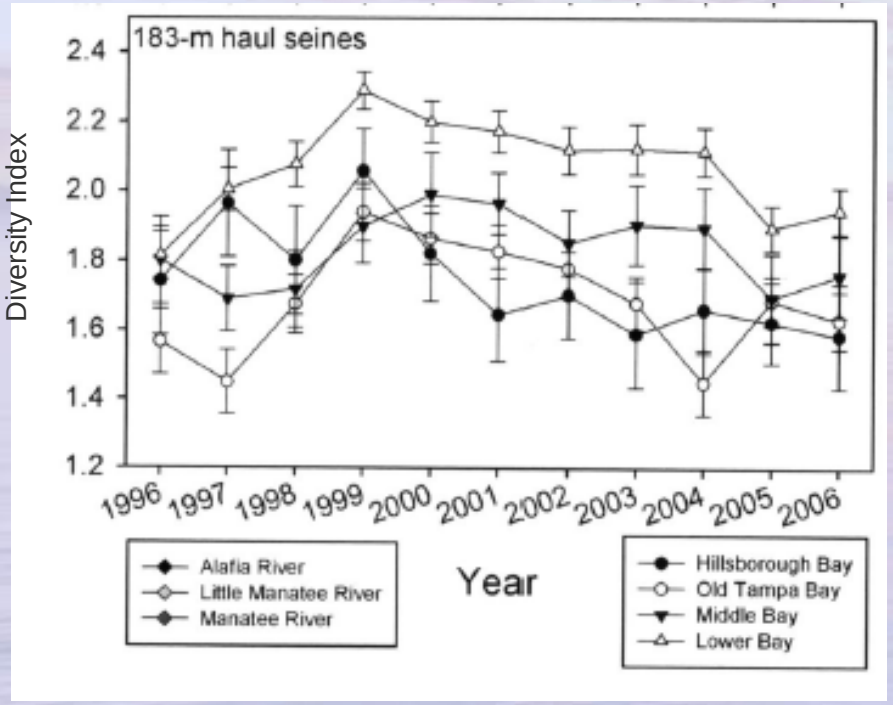
Spotted Seatrout – low juvenile recruitment in 2005, but rebounded within two to three years

Redfish – low juvenile recruitment in 2005, but also rebounded within two to three years

Sheepshead – no effect

Effects of red tide on large juvenile and adult fishes

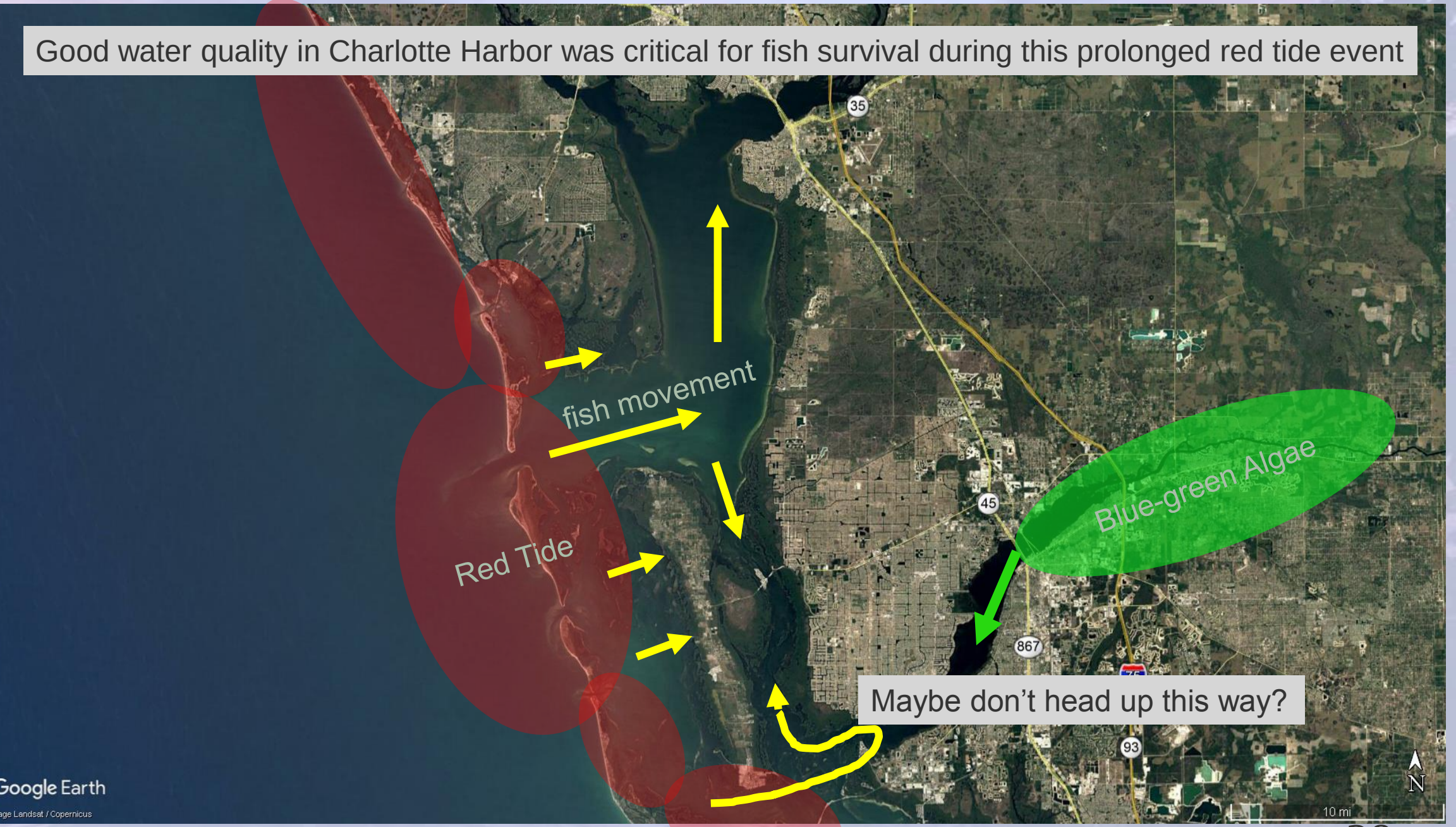
Diversity of large juvenile and adult fishes were consistent with those of previous years and no noticeable drop in abundance



****Red tide has less of an impact on larger fishes that have the ability to move away from red tide


Statewide *Karenia brevis* concentrations
09/04/2018 - 09/11/2018
Okaloosa
Santa Rosa
Escambia
Walton
Bay
Jefferson
Wakulla
Taylor
Gulf
Franklin
Dixie
Levy
Nassau
Duval
St. Johns
Flagler
Volusia
Citrus
Hernando
Pasco
Pinellas
Manatee
Sarasota
Charlotte
Lee
Collier
Brevard
Indian River
St. Lucie
Martin
Palm Beach
Broward
Monroe
Dade
Karenia brevis (cells/liter)
not present/background (0-1,000)
very low (>1,000-10,000)
low (>10,000-100,000)
medium (>100,000-1,000,000)
high (>1,000,000)
120 mi
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Google earth

Good water quality in Charlotte Harbor was critical for fish survival during this prolonged red tide event



There are ways to promote natural resiliency, which is inherent in fish populations

1) Identification, conservation, and restoration of fish habitat

An abundance of good habitat = An abundance of fish

2) Set high bench marks for fisheries regulations that allow for quicker recoveries

Stakeholder input helped FWC to set a high bench mark for Snook conservation - 40% Spawning Potential Ratio (SPR)

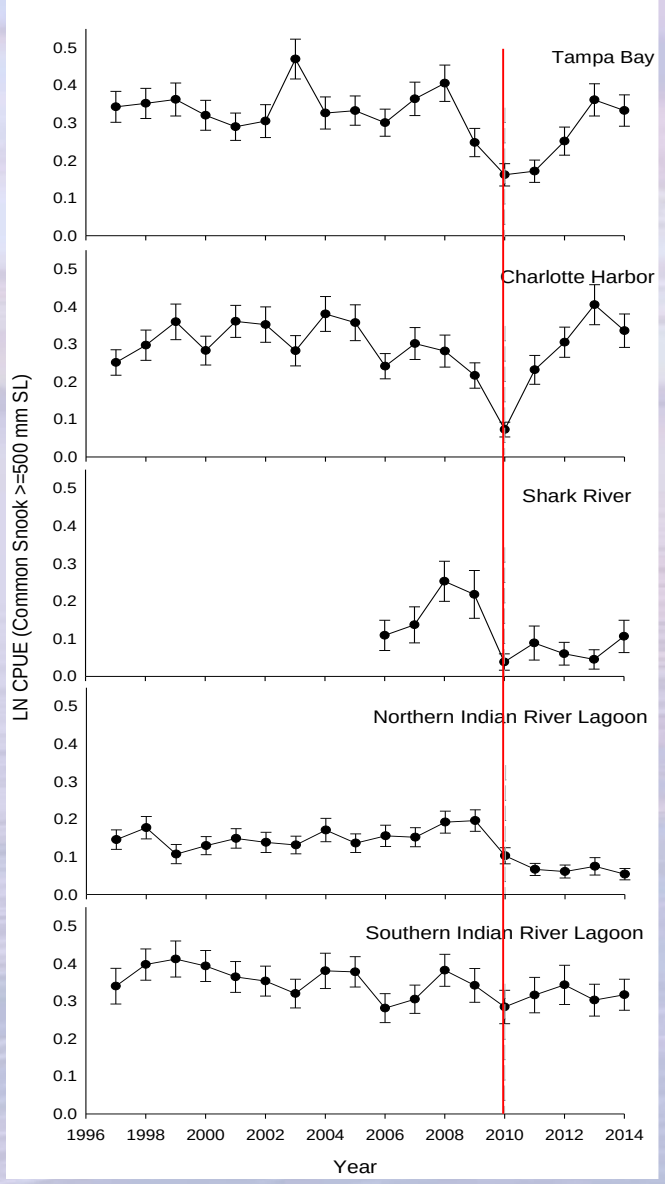
Emergency closures due to disturbances (cold kill, red tide)

3) Provide for support for good water quality

To help prevent or shorten the duration of some disturbances

Results from Fisheries-Independent Monitoring – 2010 Snook Cold Kill Event

Snook catch rates over time (1997-2014) – 50-70% decline in 2010

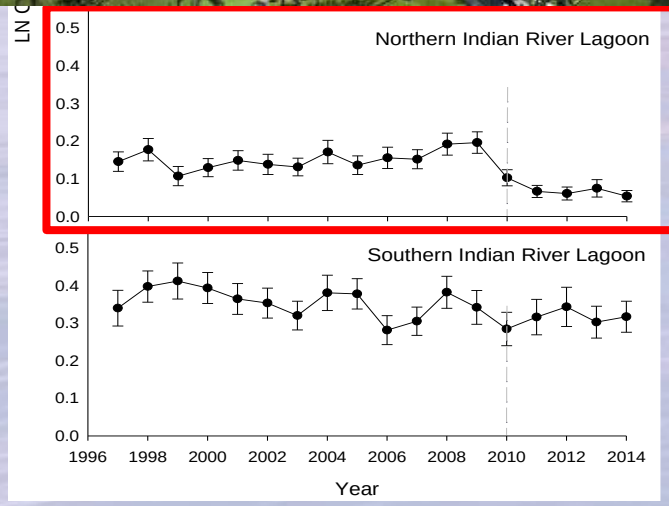


Tampa Bay fully recovered within 3 years

Charlotte Harbor fully recovered within 3 years

Shark River area recovered by 2016 (six years later)

Northern IRL has not recovered because of water quality issues – they've experienced constant microalgae blooms, starting in 2011



That's over eight years and still no recovery for snook!

The green algae “superbloom” of 2011 killed over half the lagoon’s seagrasses

2012 Brown Tide
(brown microalgae)

2018 Blood Tide
(red microalgae)

Since FWC fisheries sampling started in 1989 we have documented incredibly large volumes of macroalgae in this estuary

A high volume of macroalgae indicates a high amount of nutrients within a system, and can be seen as a WARNING SIGN

Macroalgae

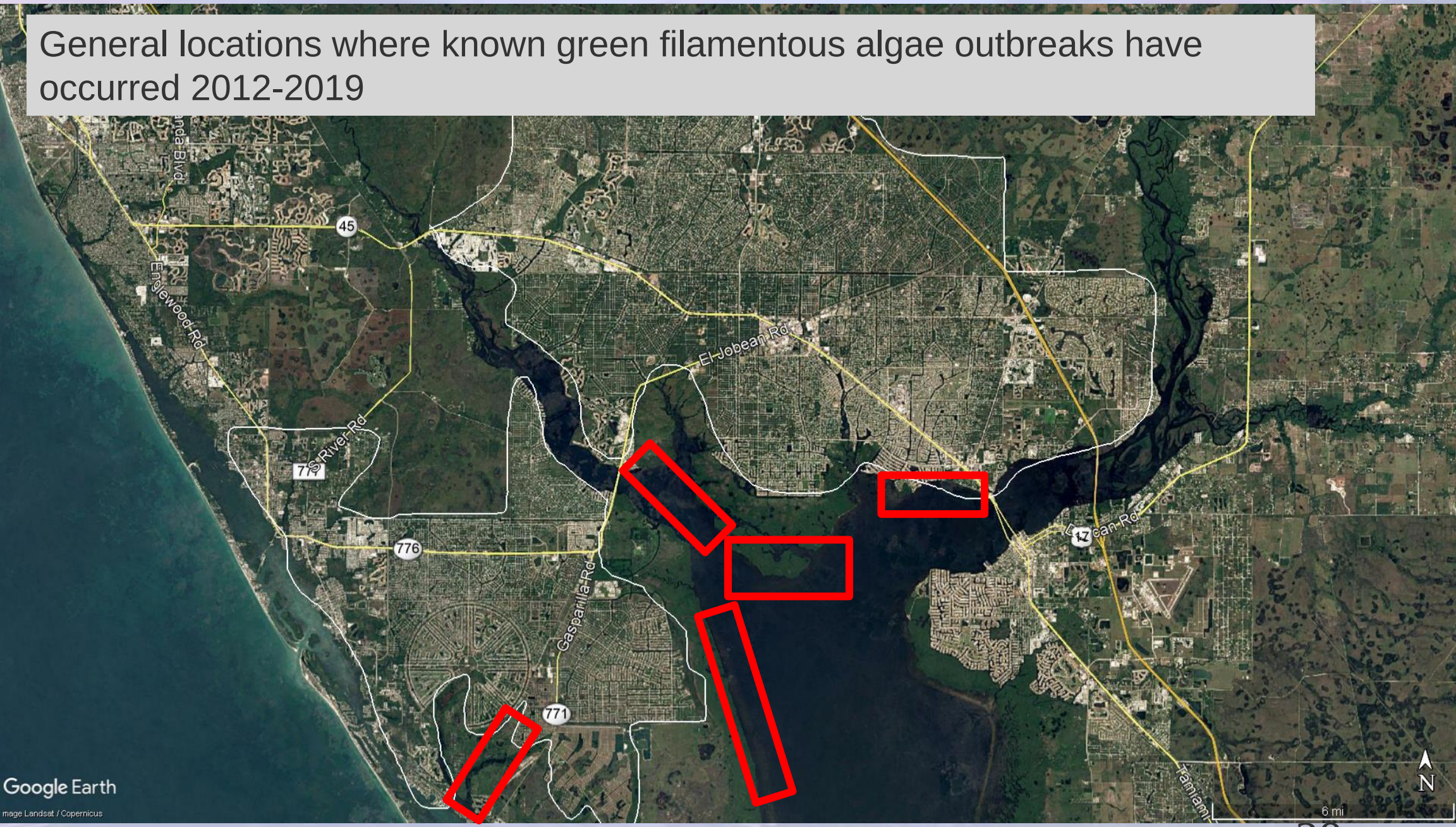
Within the last eight years FWC fisheries scientists have noticed a significant increase in macroalgae in Charlotte Harbor

Recently there have been 3 massive outbreaks (2012, 2015, 2019) of green filamentous algae

1) Tippecanoe Bay and Hog Island
2) Tippecanoe Bay, Hog Island, Grassy Point, and along the western shoreline
3) Coral Creek

Historically these algae have rarely been observed in Charlotte Harbor

General locations where known green filamentous algae outbreaks have occurred 2012-2019



Large areas of green filamentous algae just offshore of Hog Island in Charlotte Harbor - something that's never been observed by FWC biologist since the beginning of the FIM program (1989)

2012/15 events off Tippecanoe and Hog Island

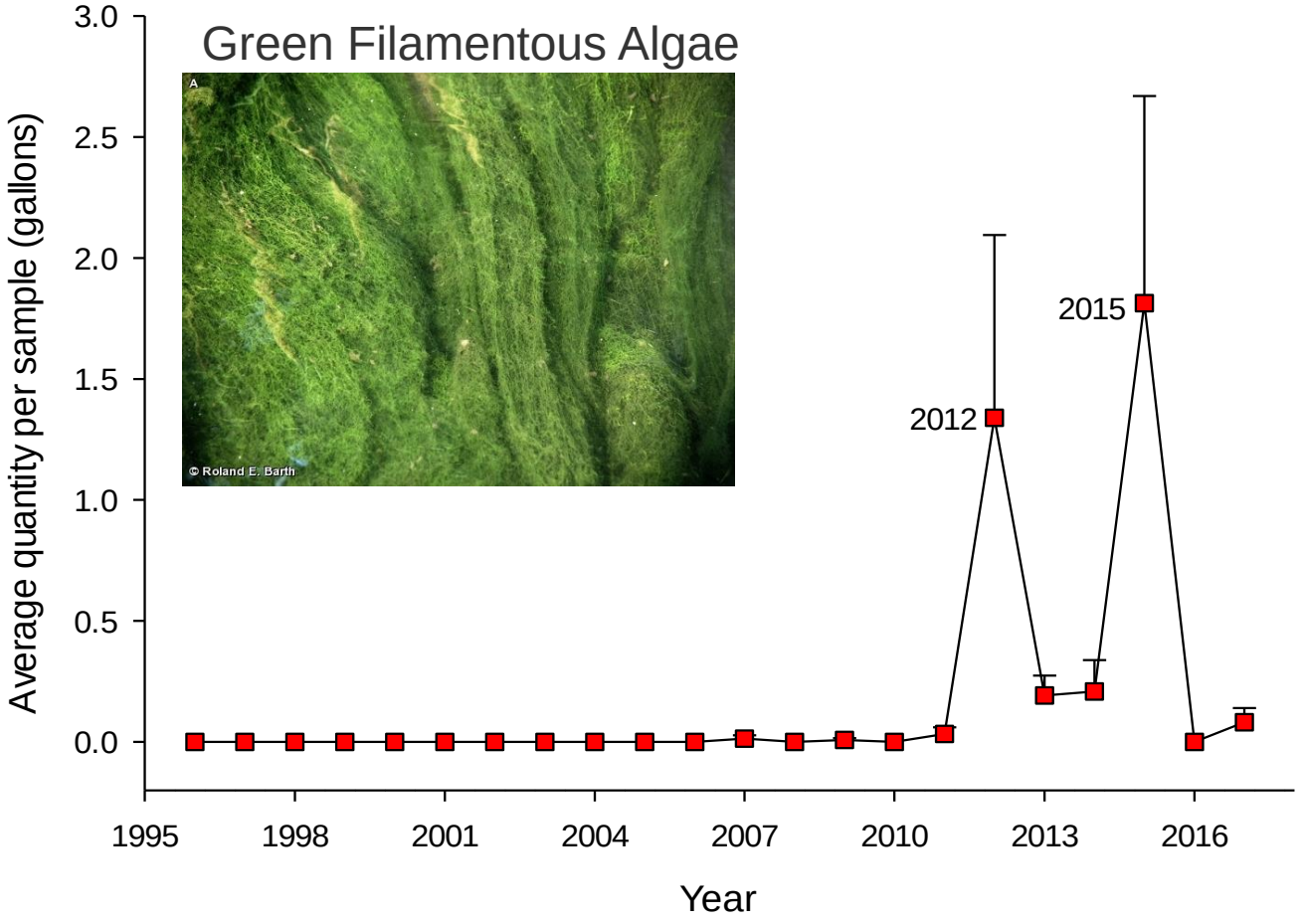
Large areas of decaying green filamentous algae along the shores of Hog Island in Charlotte Harbor

Hog Island – Charlotte Harbor
green filamentous algae covered approx. 2 miles of shoreline

shoreline photo

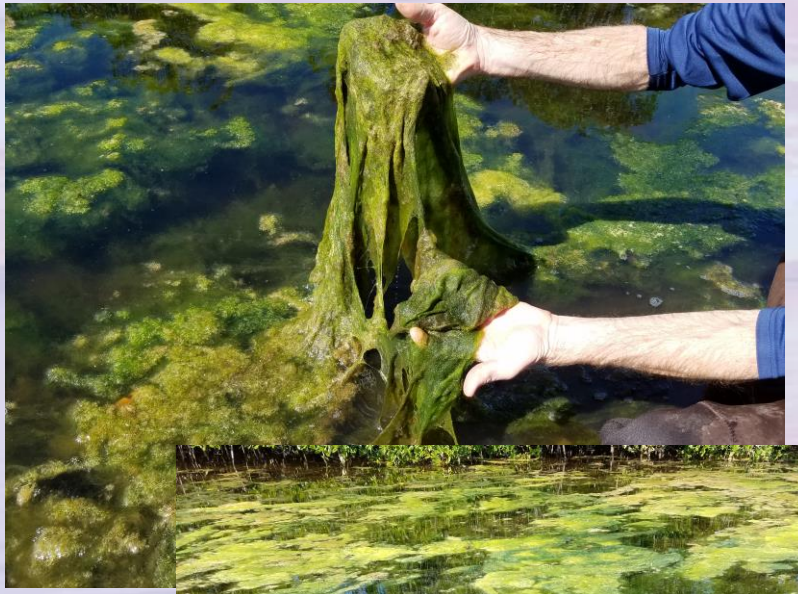
offshore photo

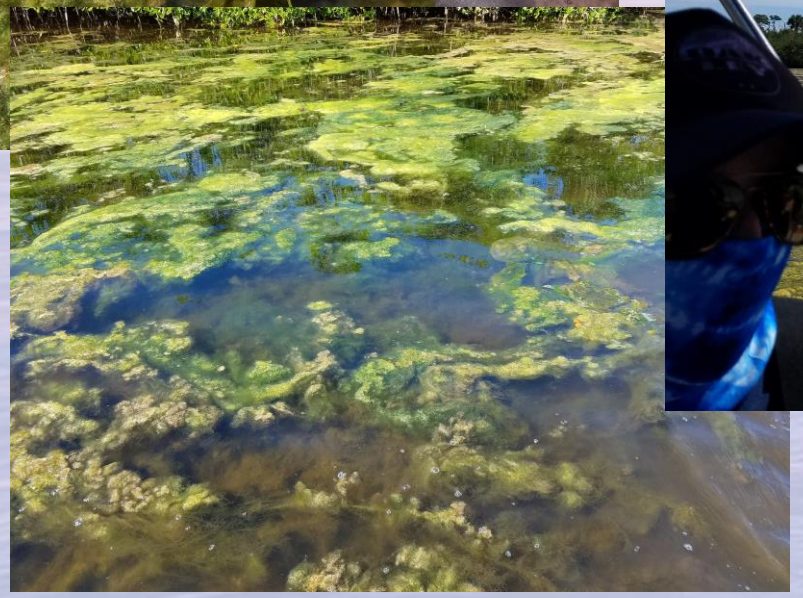
FWC Fisheries-Independent Monitoring program - green filamentous algae bycatch in small seine catches from Tippecanoe Bay, Hog Island, and Grassy Point 1996-2017



February 15, 2019 – just three weeks ago in Coral Creek

Currently, this outbreak covers almost the entire 1.5 miles of the eastern branch





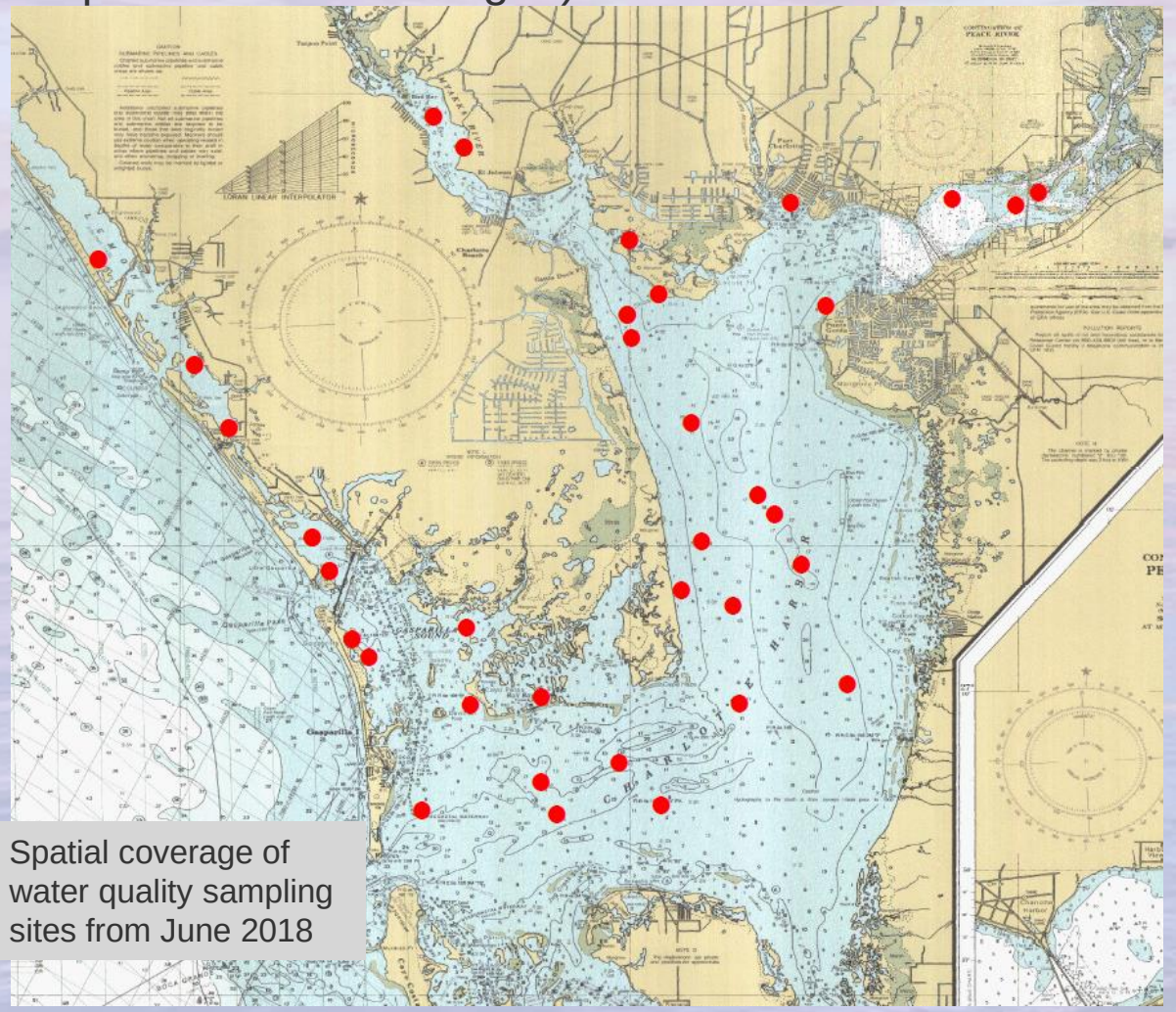
I can share this video through Dropbox if you are interested in seeing the extent of this recent outbreak

Is it possible that high concentrations of nutrients (particularly nitrogen) are coming from various canals and small tributaries and then those nutrients are being taken up quickly by macroalgae once they enter larger tributaries and the harbor?

**This would result in a greater number of algae blooms while only observing minimal increases in the overall nitrogen levels in the open waters of the harbor

Coastal Charlotte Harbor Monitoring Network (CCHMN)

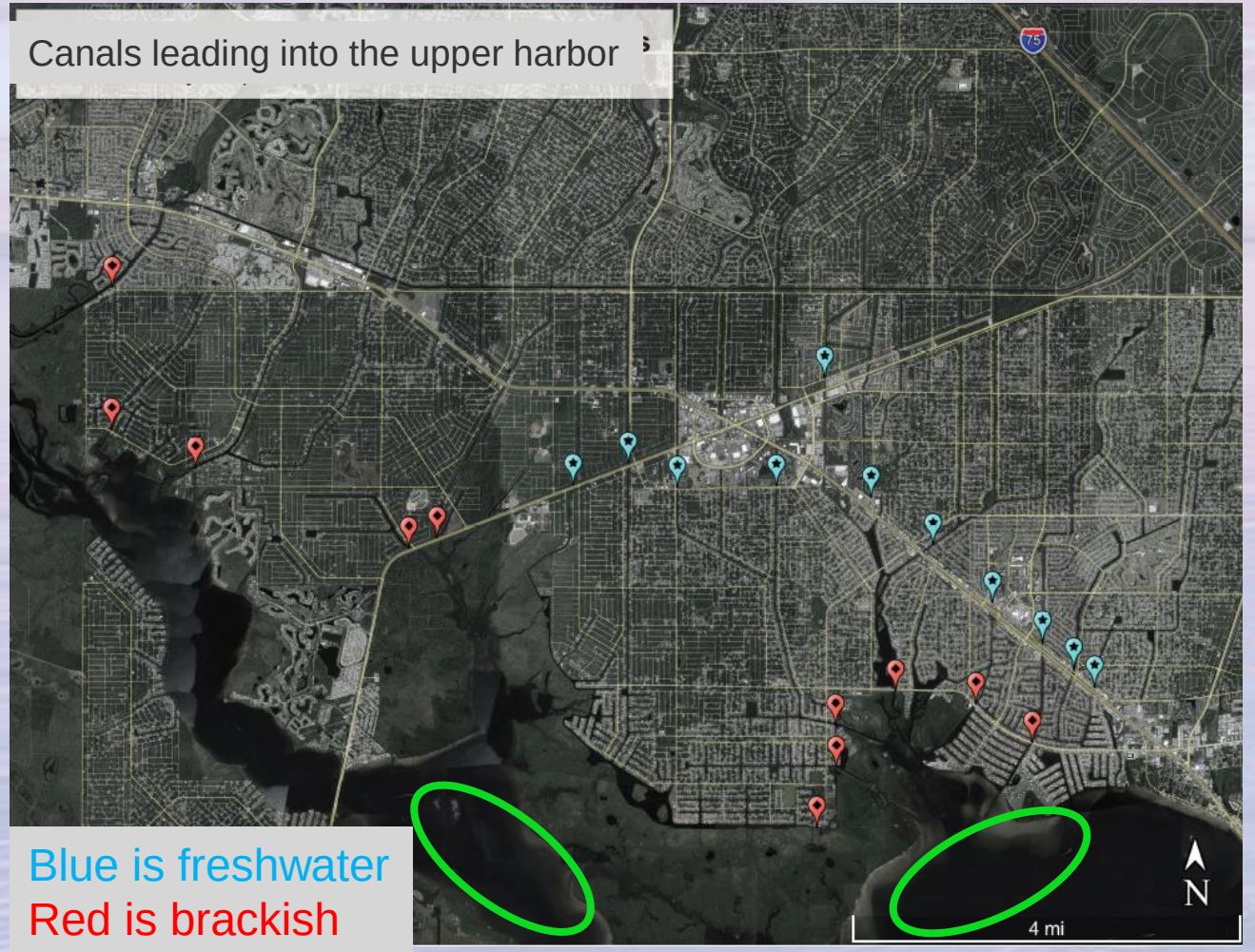
Sampling water quality consistently in the open estuary since 2001– long-term monitoring in the open bay is critical but it only provides part of the story (due to nutrient uptake from macroalgae)



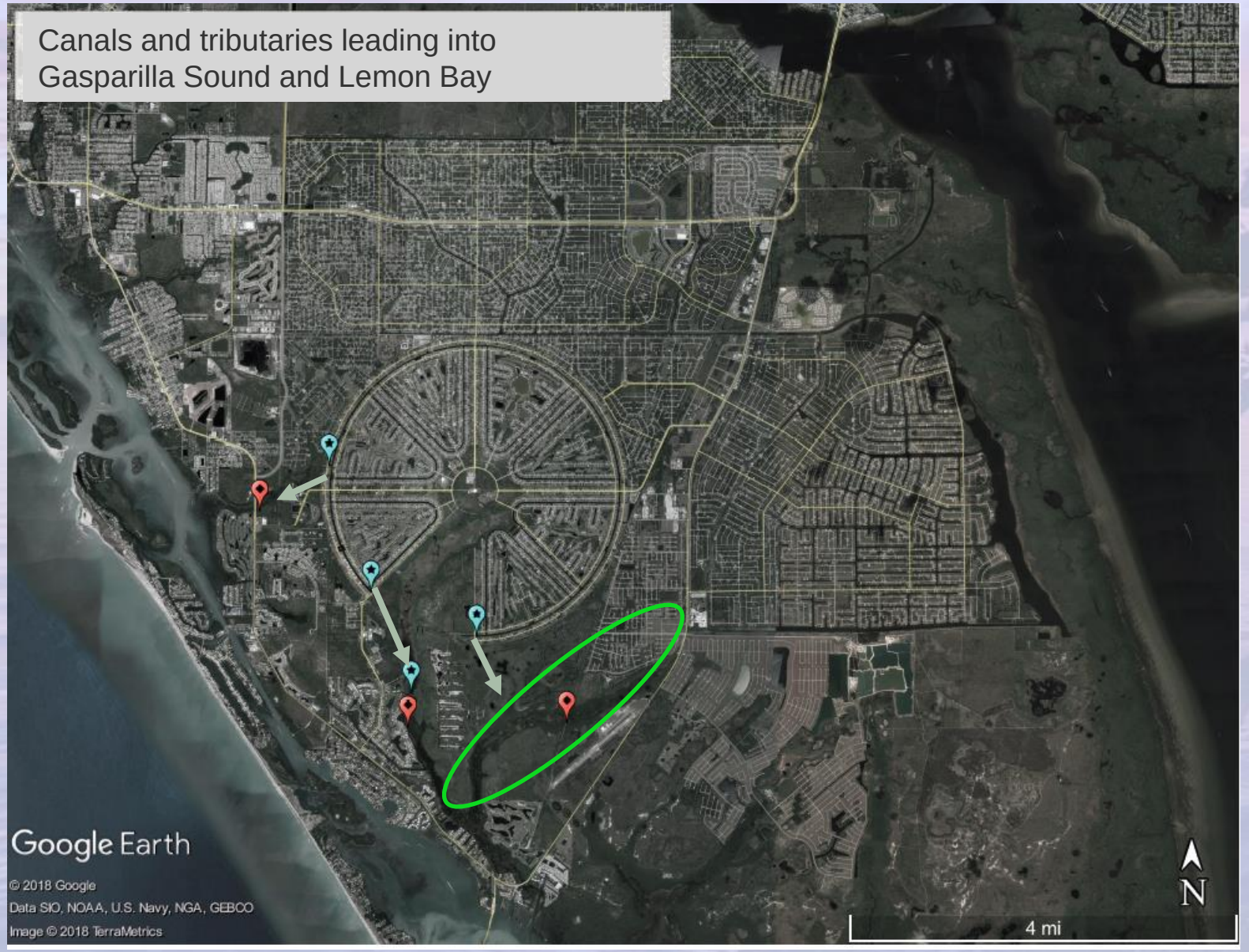
Spatial coverage of water quality sampling sites from June 2018

Joint project:
Charlotte County
SWFWMD
DEP
CHNEP
FWC

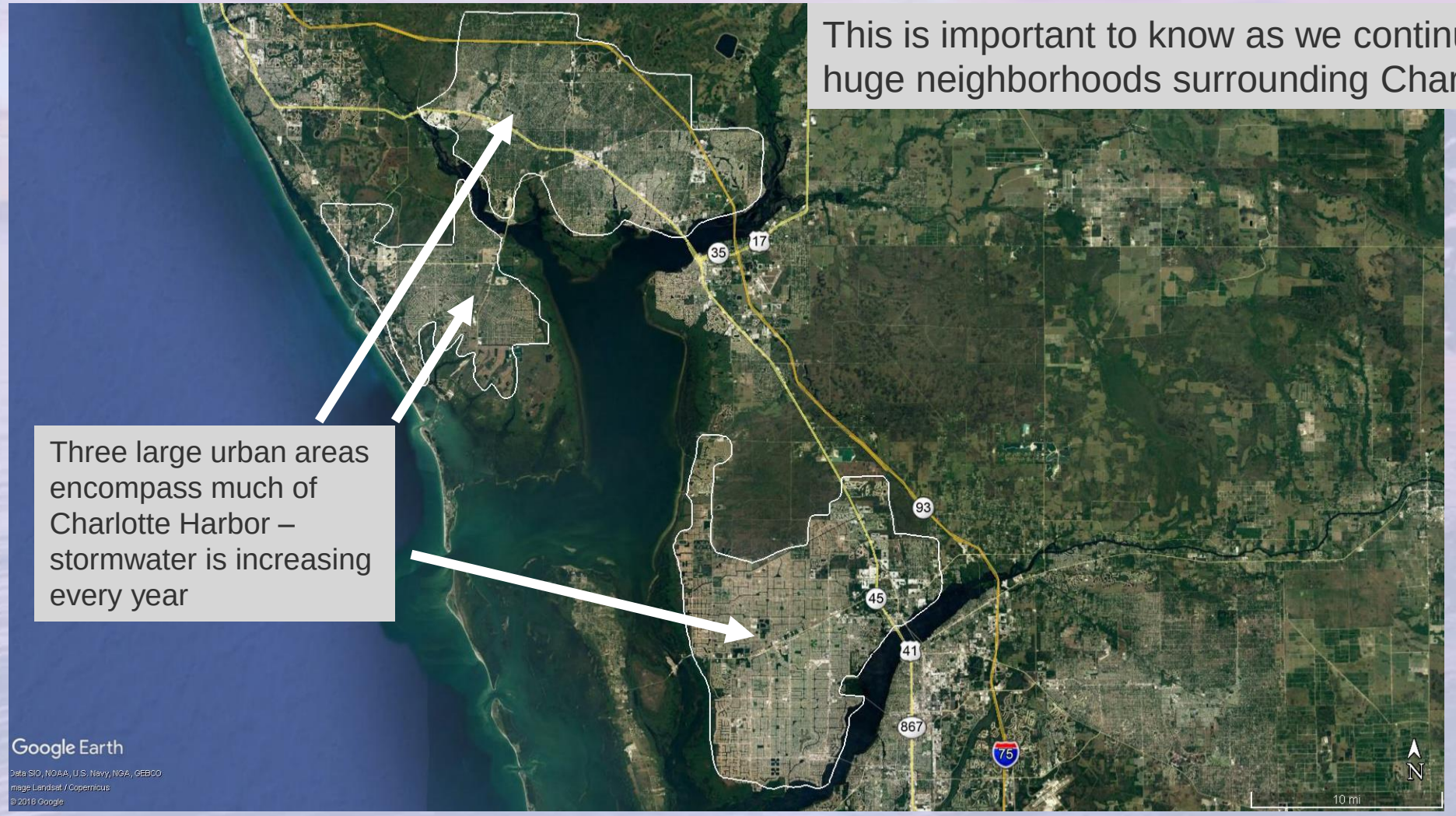
Long-term and widespread WQ monitoring in urban waterways that drain into Charlotte Harbor – will help to identify localized WQ problems and **document improvements**



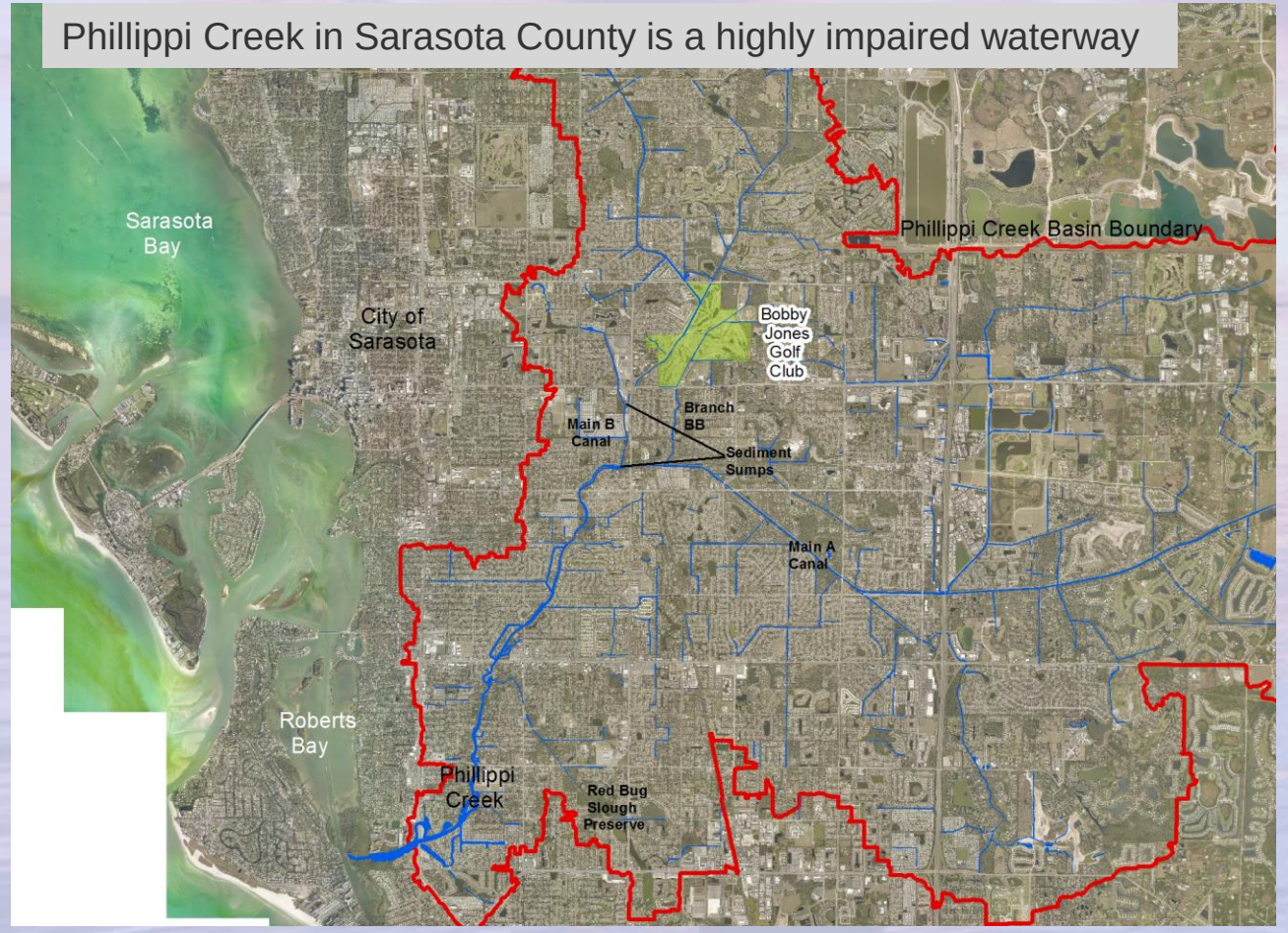
Water sampling further upstream of Lemon Bay and Gasparilla Sound

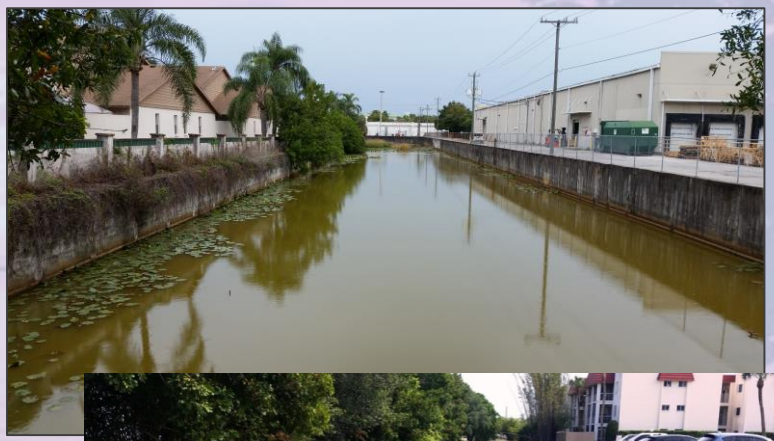


Getting upstream fine-scale water quality data would provide a heads up on smaller watershed issues, such as impacts from increased stormwater (could also document improvements)



There is very little room for stormwater improvements once a watershed is build out





It's watershed is almost completely built out, which leaves little hope of making significant water quality improvements.

But in Charlotte County we have the opportunity to partner now with local, state, and federally agencies to find solutions to smaller problems before they become a big problem

Southwest Florida Water Management District
Charlotte Harbor Surface Water Improvement and Management Plan
aka SWIM Plan

Urban Stormwater

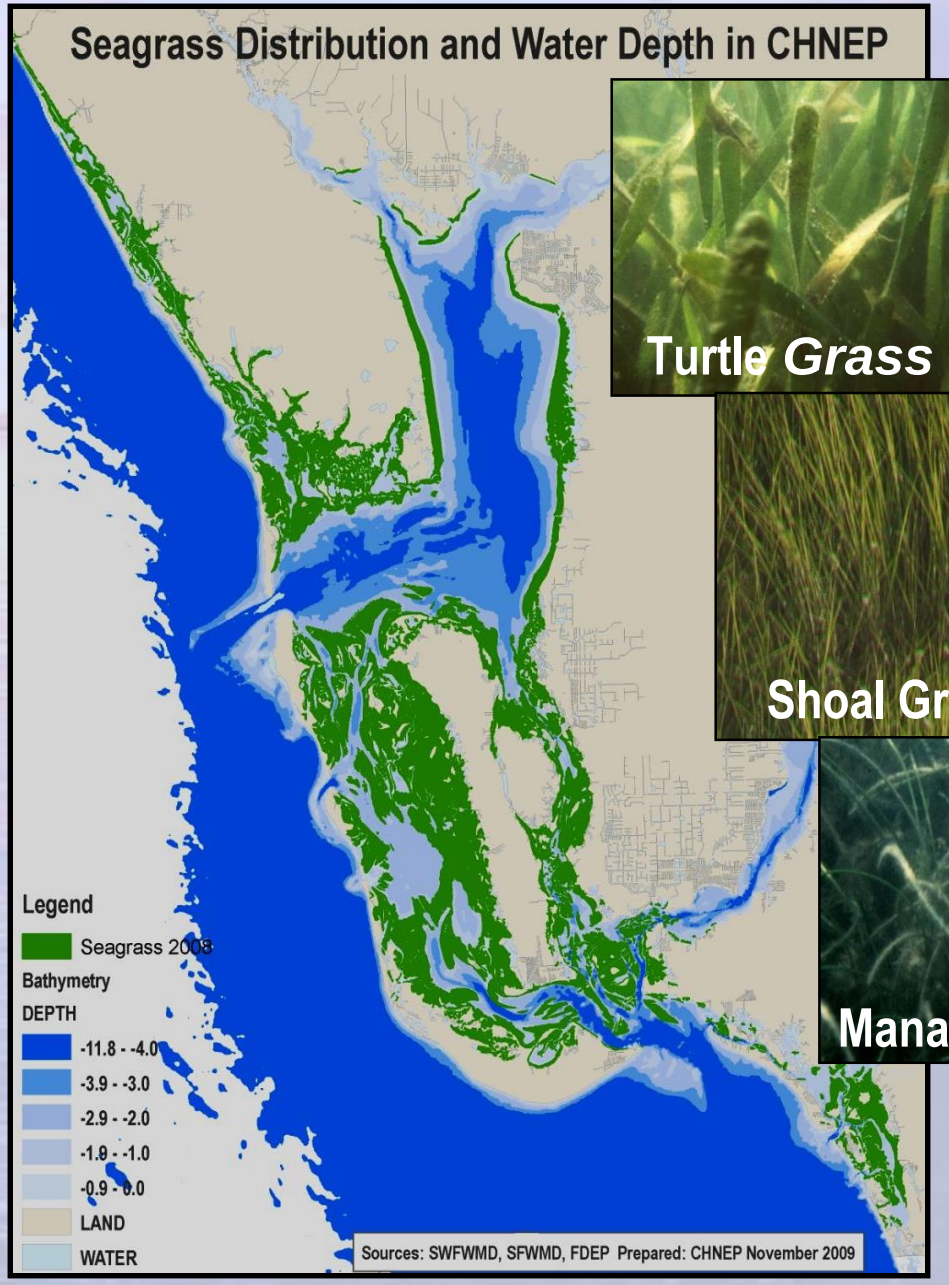
- Develop regional and local stormwater master plans, as needed
- Implement cost-effective stormwater treatment systems in priority sub-basins

Bottom line - we don’t want to wait until we have a harbor-wide WQ problem

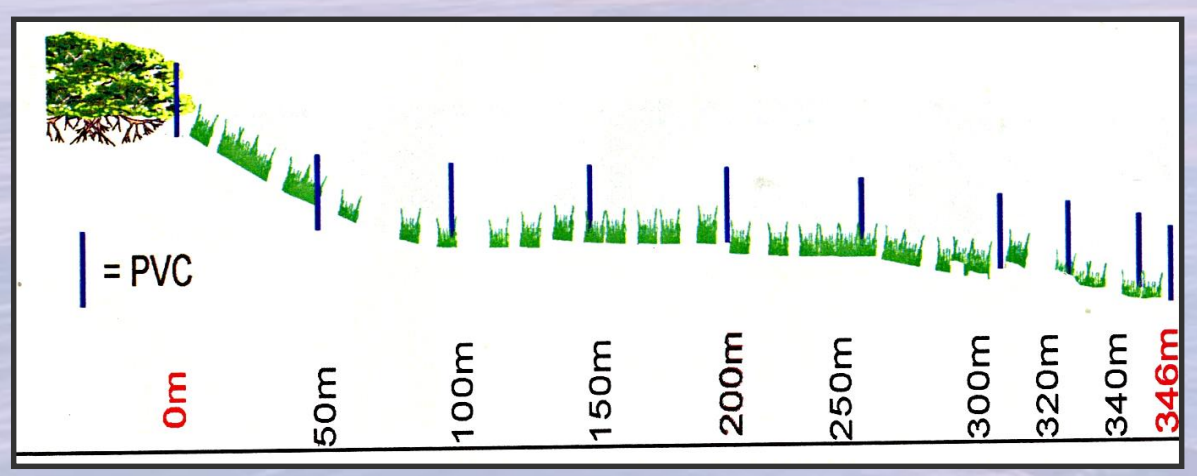
1) It may take 20-50 years to try and fix, and there are no guarantees
2) The problems may be so multifaceted that consensus on solutions are hard to find and millions of dollars of investments may not find the appropriate solutions (ex. Indian River Lagoon)
3) Right now Charlotte County’s large urban areas have space for buffering stormwater impacts, but once fully developed there are few options and they become more costly and less effective (ex. Sarasota County-Phillippi Creek)

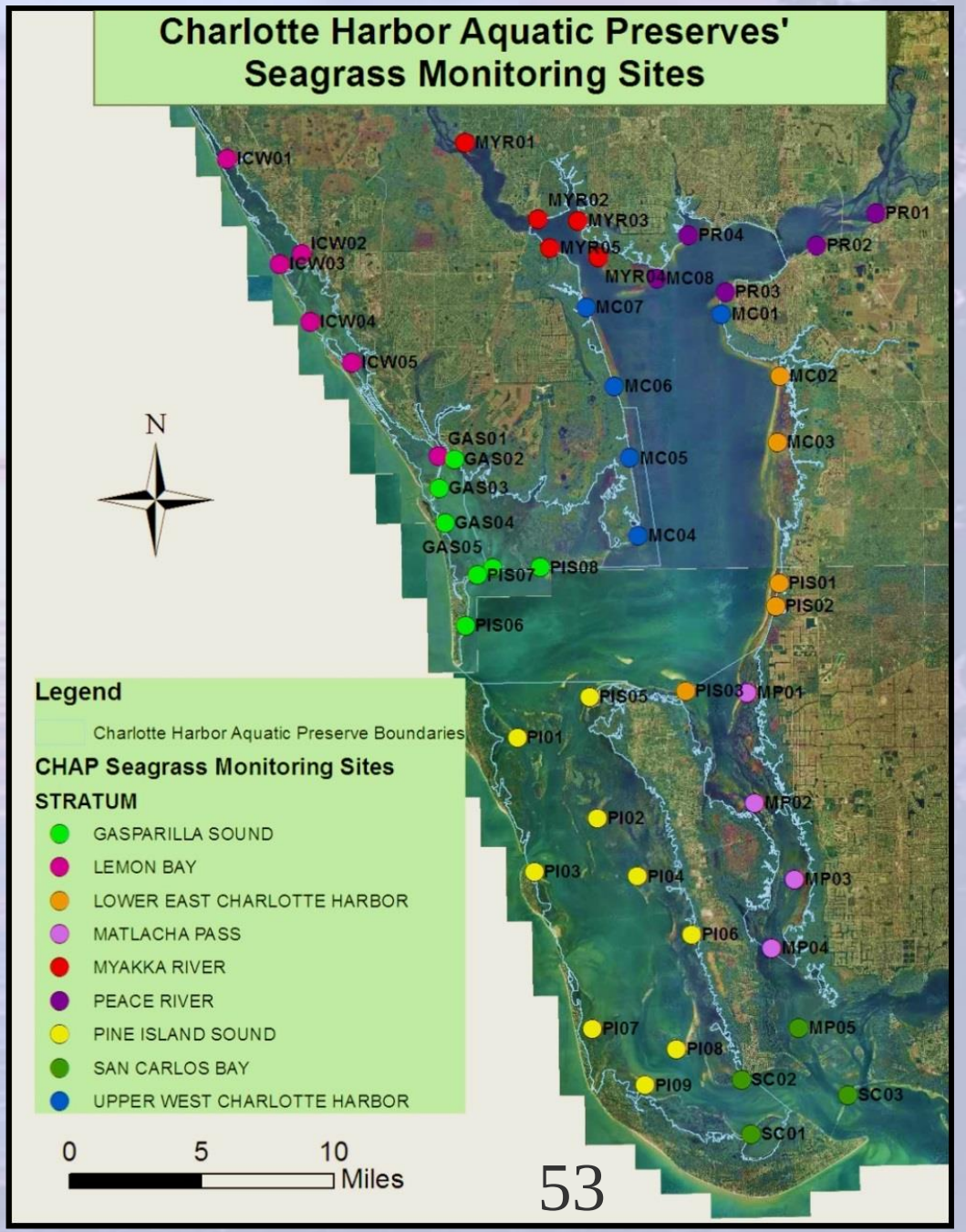
What Are Our Seagrasses Telling Us?

- Seagrasses are critical for estuary health.
- They provide habitat & food for fisheries, crustaceans, shellfish & marine mammals.
- They depend on adequate sunlight & are the base of the estuarine food web.
- They link biology with water chemistry – oxygen, chlorophyll, nutrients, turbidity & water color.

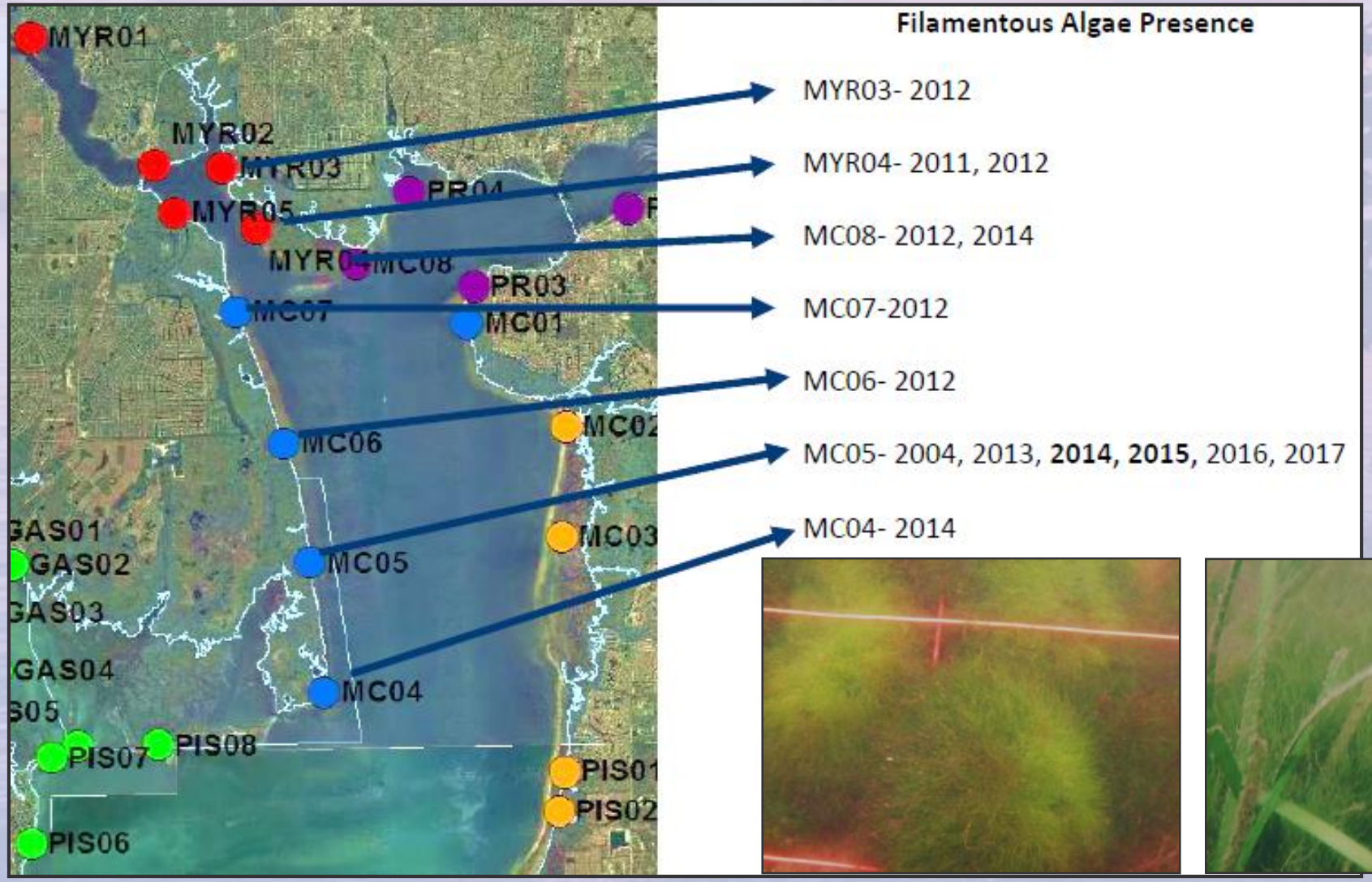


- **Seagrasses are mapped by SWFWMD every 2 – 3 years.**
- **They are monitored by FDEP Charlotte Harbor Aquatic Preserves every fall since 1998.**
- **Monitoring includes: depth, species type, percent cover, sediment & algae presence.**



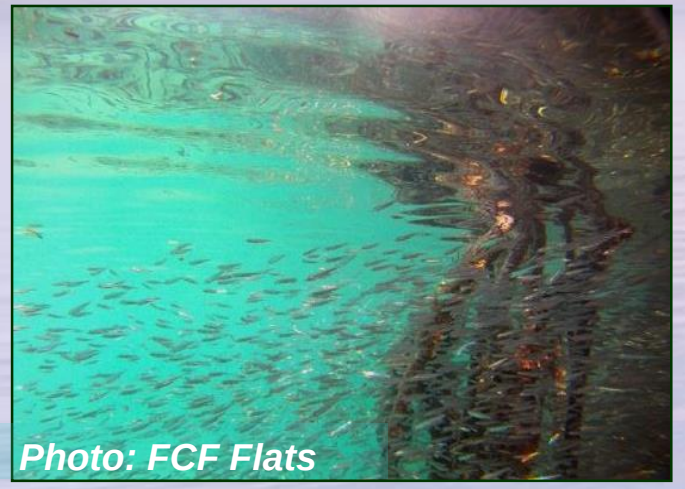


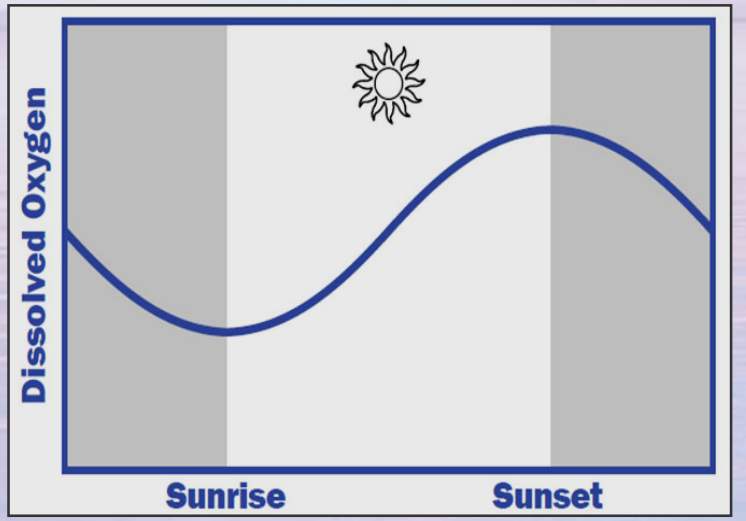
- **Seagrass monitoring results show increasing blooms in green filamentous algae since 2012, which indicates increasing nutrients.**

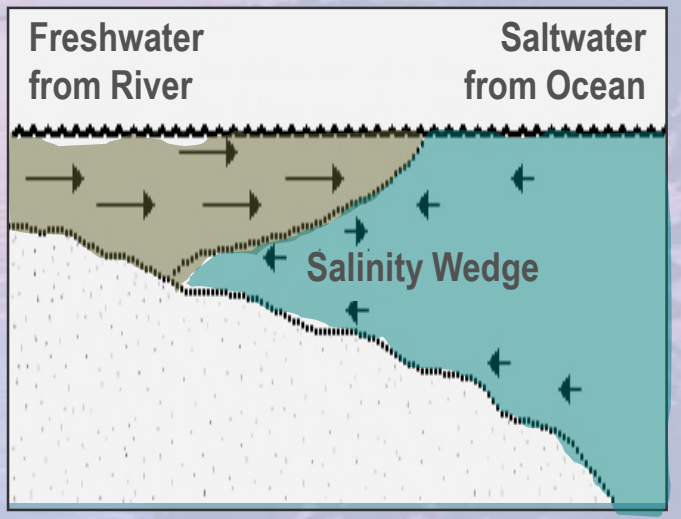


What Is Our Water Quality Telling Us?

- Focus on parameters critical for estuary & human health.
- Dissolved Oxygen
  ~ important for fish & inverts – each has best range
  ~ changes with time, depth, tide & temperature

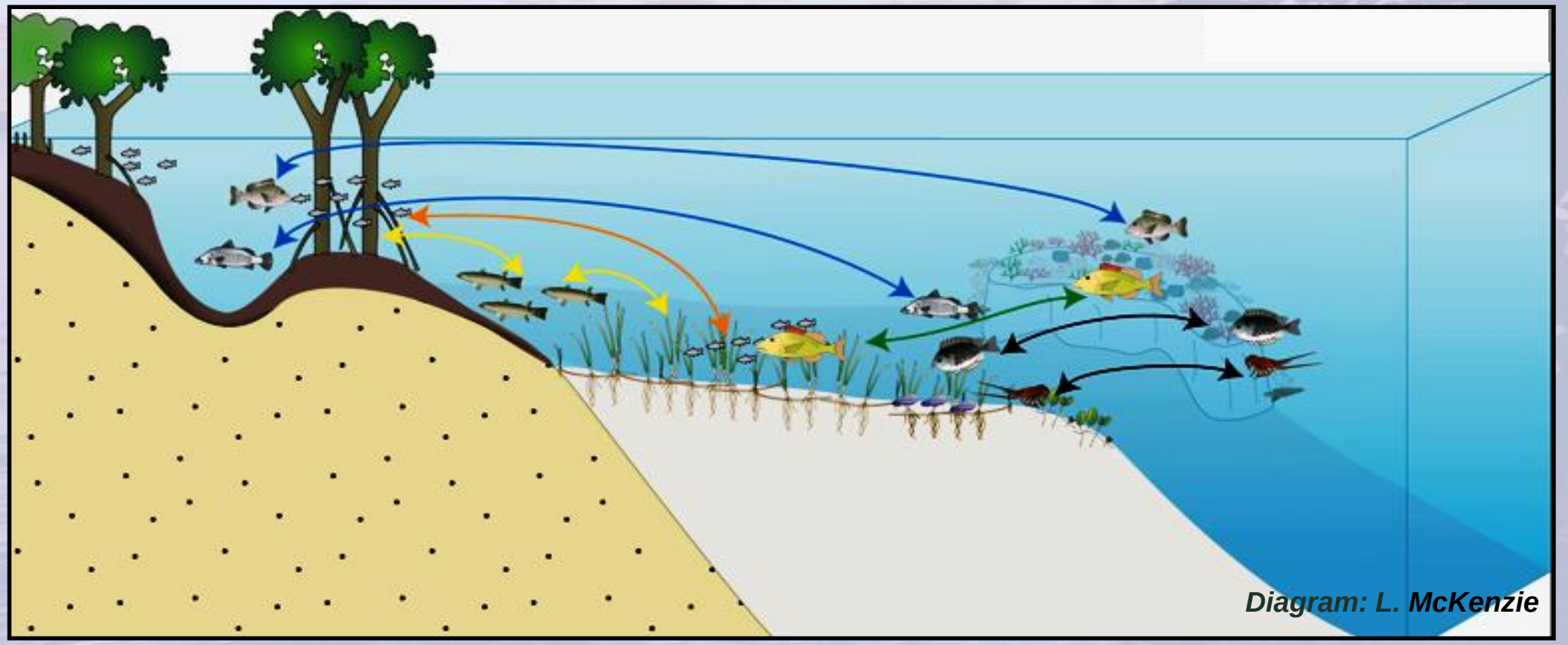




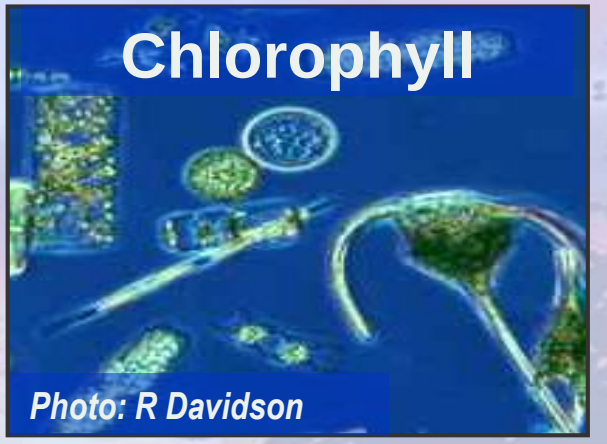


- Bacteria
  ~ important as human health (& shellfish) indicator
  ~ different species tested for different locations, time & cost

- **Water Clarity**
  ~ important for submerged plants & habitats
  ~ changes with chlorophyll, turbidity & water color



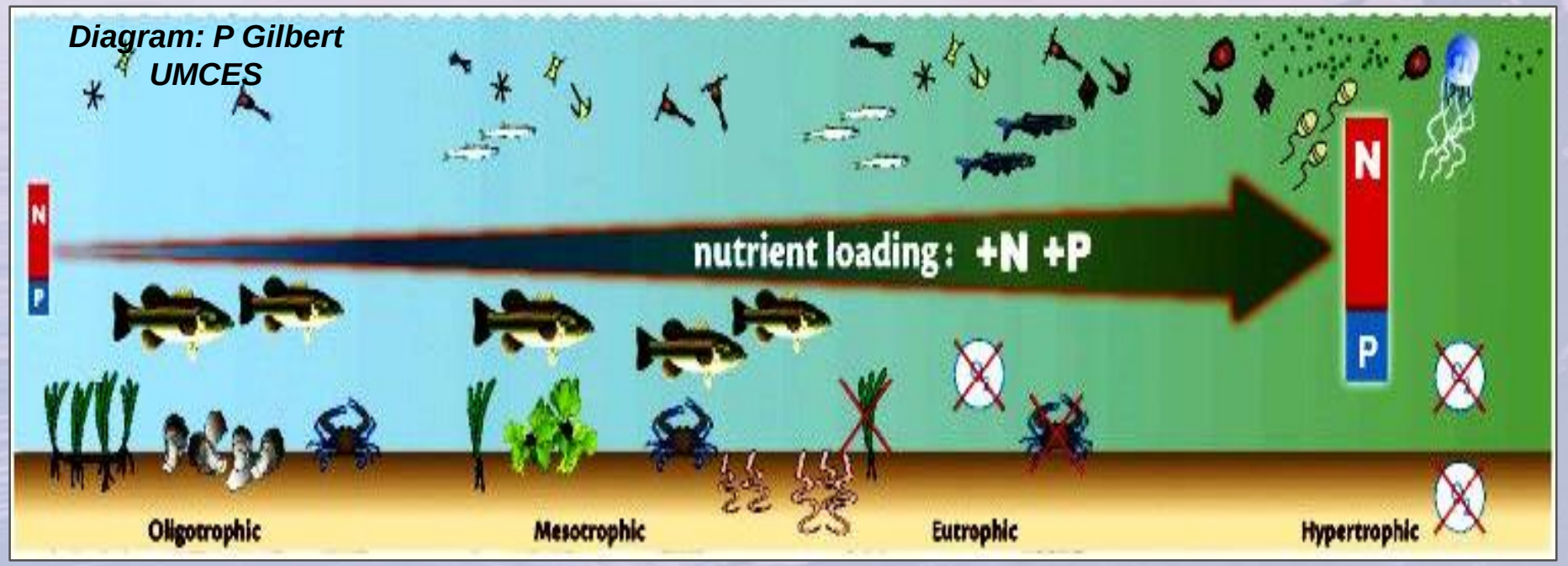
- **Chlorophyll**
  - **~ measure of algae concentrations**
  - **~ changes with nutrients**



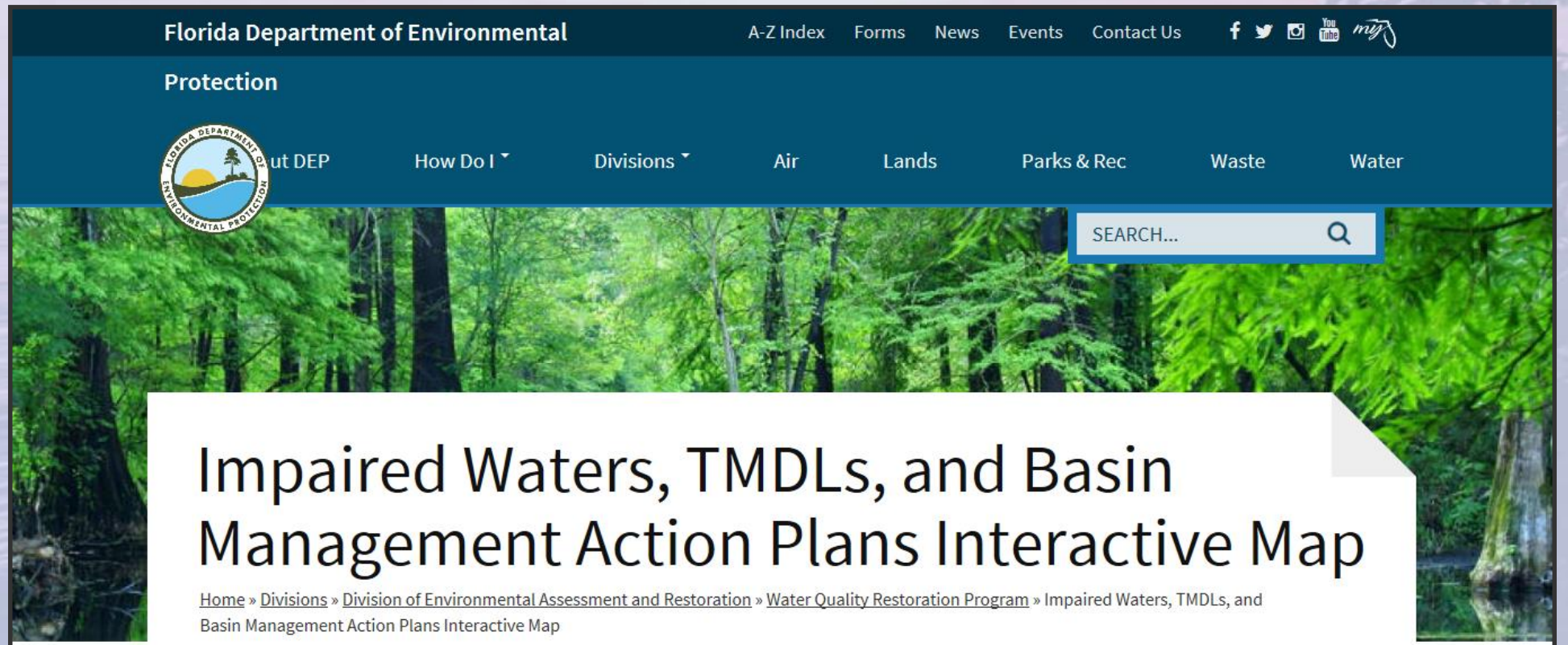
- **Turbidity**
  - **~ from sediment in water**
  - **~ changes with flow & waves**

- **Color**
  - **~ color from tannins**
  - **~ changes with rainfall & tide**

- **Phosphorus & Nitrogen**
  - **~ important for healthy ecosystems**
  - **~ change with natural & human processes**
  - **~ effect algae growth & chlorophyll**
  - **~ cyanobacteria & algae limited are by TP in freshwater**
  - **~ red tide & algae are limited by TN in estuary & ocean**



- **Regulatory standards exist for some water quality parameters.**
  - **~ Some standards are values & some are descriptive.**
  - **~ Different waterbodies ("WBIDs") have different standards.**
  - **~ Measuring for & interpreting the standards is complicated.**
  - **~ Waterbodies not meeting standards are impaired & need corrective actions.**
  - **~ Lists are in 62-302 FAC & maps are on web.**



- **EXAMPLE Water Quality Standards from 62-302 FAC for Class III "Fishable Swimmable" Waters.**
  ~ Please contact FDEP for actual standards & impairments for each waterbody (WBID) & parameter.

Some Water Quality Standards from 62-302 FAC for Class III "Fishable Swimmable" Waters.								
	DO (% sat)*		Chl (ug/L)**		TP (mg/L)**		TN (mg/L)**	
Basin	Fresh	Marine	Lake	Marine	Stream	Marine	Stream	Marine
Upper Lemon Bay	>38%	>42%	20	8.9	0.12	0.26	1.54	0.56
Lower Lemon Bay	>38%	>42%	20	6.1	0.12	0.17	1.54	0.62
Tidal Myakka	>38%	>42%	20	11.7	0.12	0.31	1.54	1.02
Tidal Peace	>38%	>42%	20	12.6	0.12	0.5	1.54	1.08
Charlotte Harbor	>38%	>42%	20	6.1	0.12	0.19	1.54	0.67

*DO % varies with temperature & salininity. For example: Freshwater with 0 ppt salinity at 72° & 38% sat = 3.3 mg/L DO. Saltwater with 35 ppt salinity & 72° & 42% sat = 3.0 mg/L DO.

**Chl, TP & TN standards are different for lakes & streams & depend on water color & biological assessments.

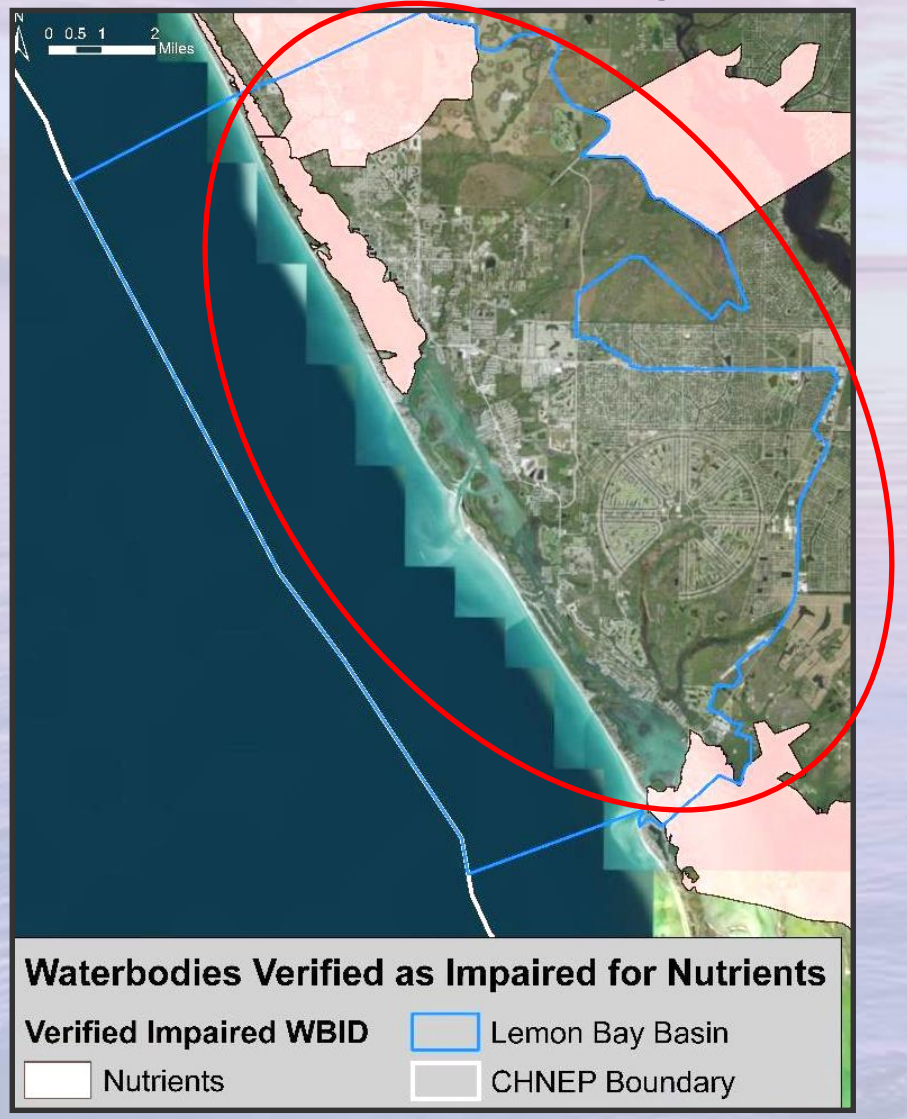
• Water clarity for seagrasses is declining.*

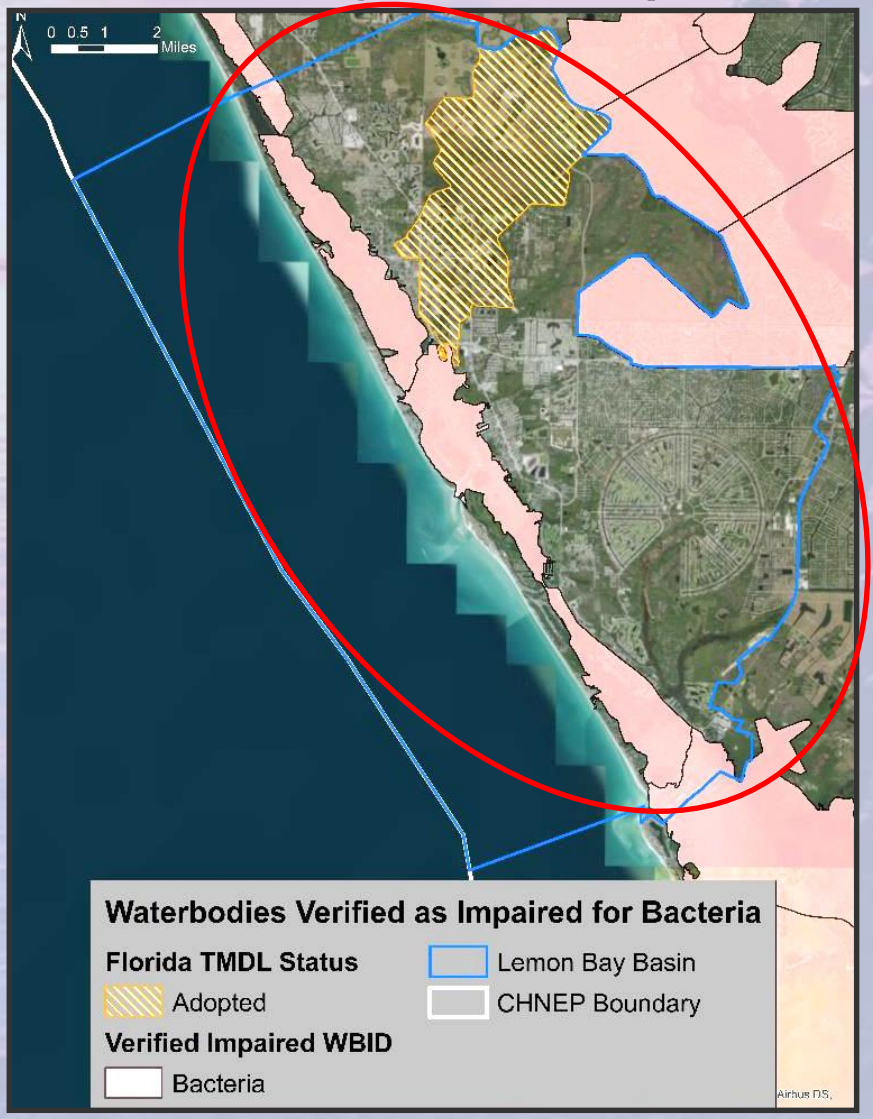
***Source: CHNEP Water Clarity Reporting Tool on CHNEP Water Atlas.**

	CHNEP Strata with Seagrass RESTORATION Targets								Strata with Seagrass PROTECTION Targets					
Year	Dona and Roberts Bay	Lower Lemon Bay	Tidal Peace River	West Wall	East Wall	Matlacha Pass	Tidal Caloosahatchee	Estero Bay	Upper Lemon Bay	Tidal Myakka River	Bokeelia	Cape Haze	Pine Island Sound	San Carlos Bay
1998									-2					
1999									-2					
2000									-1					
2001		-2	-2	-2	-2				0	-2		-2		
2002		-1	-1	-1	-2		-2		0	0	-2	-2		2
2003	-2	-1	-2	-2	-2		-2		-1	-2	-2	-2		1
2004	0	0	0	0	1	1	0	-1	0	0	0	0	0	2
2005	0	0	-1	-2	-2	-2	-2	0	0	-1	-1	0	-1	-1
2006	0	0	0	0	0	0	2	1	1	1	0	0	-1	-2
2007	2	1	2	2	2	2	2	2	1	2	2	1	2	2
2008	1	-1	0	1	1	0	1	-1	0	0	2	-1	2	0
2009	0	-2	-1	-1	-1	0	0	0	1	0	1	-1	0	-1
2010	-2	-2	0	-1	0	-2	1	-1	-1	0	0	-1	0	-1
2011	-1	-1	0	-1	0	-2	1	-1	-1	-1	1	-2	0	-1
2012	0		-2	-2	-2	-2	1	0	-1	-2	0	-2	2	-2
2013	-1	-1	-2	-2	-2	-2	0	0	-1	-2	0	-2	1	-2
2014	0	-2	-2	-2	-2	-1	1	0	0	-2	1	-2	2	-1
2015	-2		-2	-2		0	0	-2	-2	-2	0		0	-2
2016	-2		-2	-1		-2	-2	-2	-1	-2	-2		0	-2

- **Some local waters are impaired for DO, chl, TN, TP or bacteria.**
- **Lemon Bay nutrient & bacteria impairment maps:**

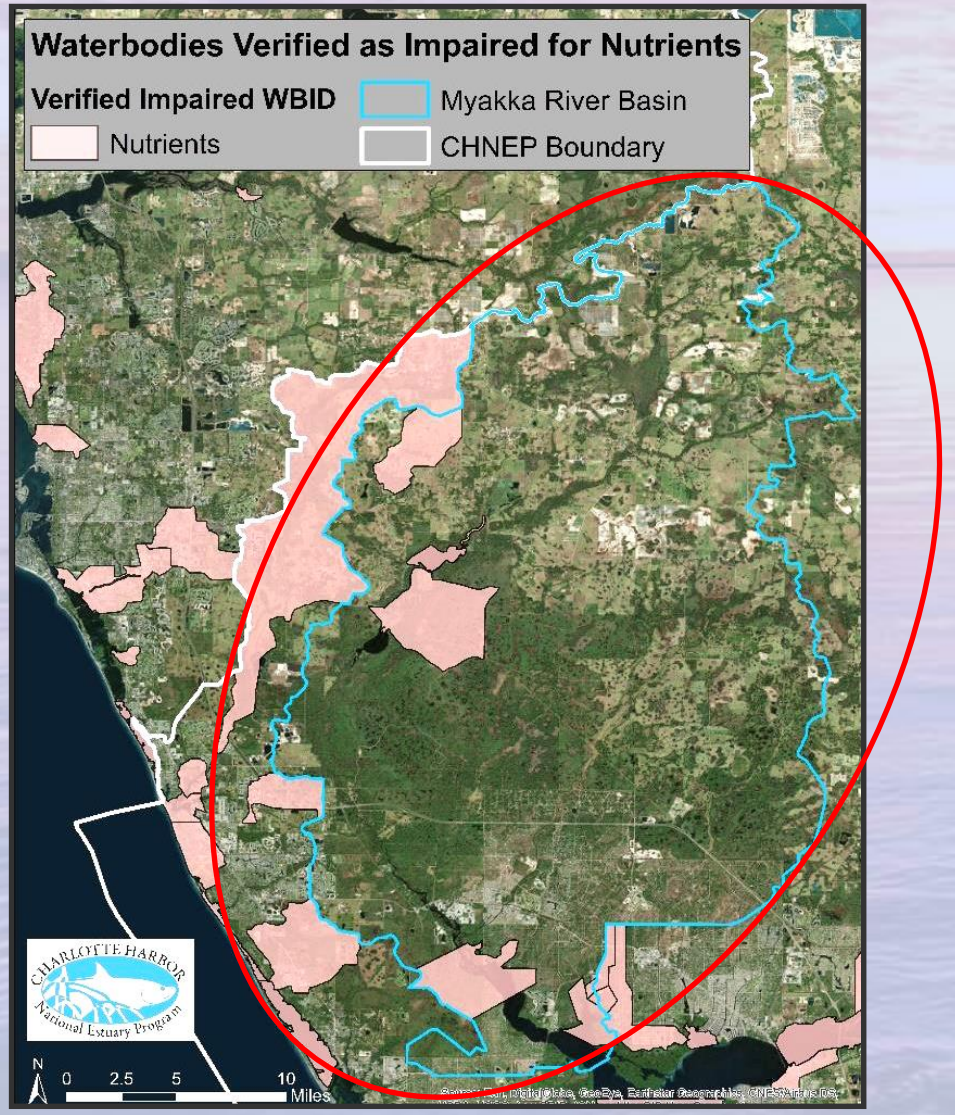
***Source: CHNEP Lemon Bay Basin Surface Water Quality Status Report 2019.**

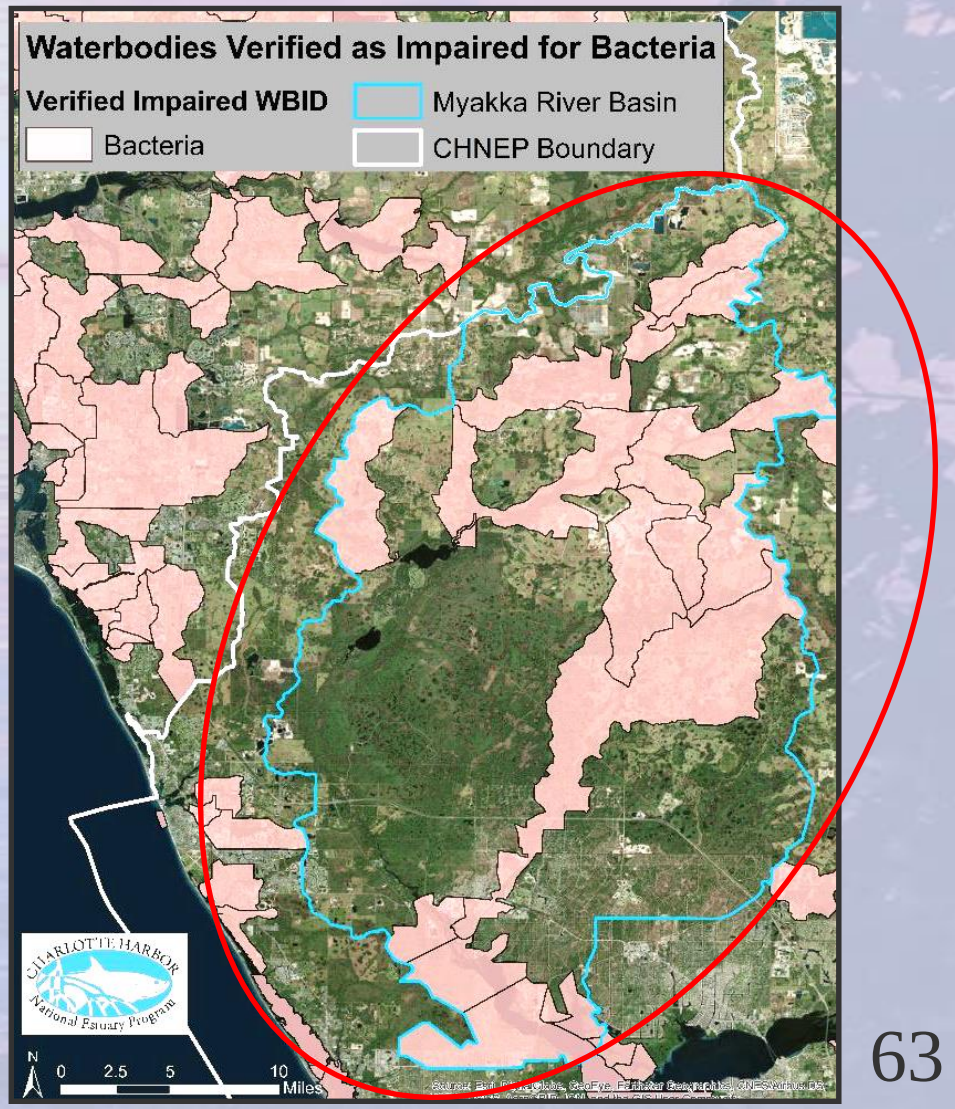




- **Myakka R. watershed nutrient & bacteria impairment maps:***

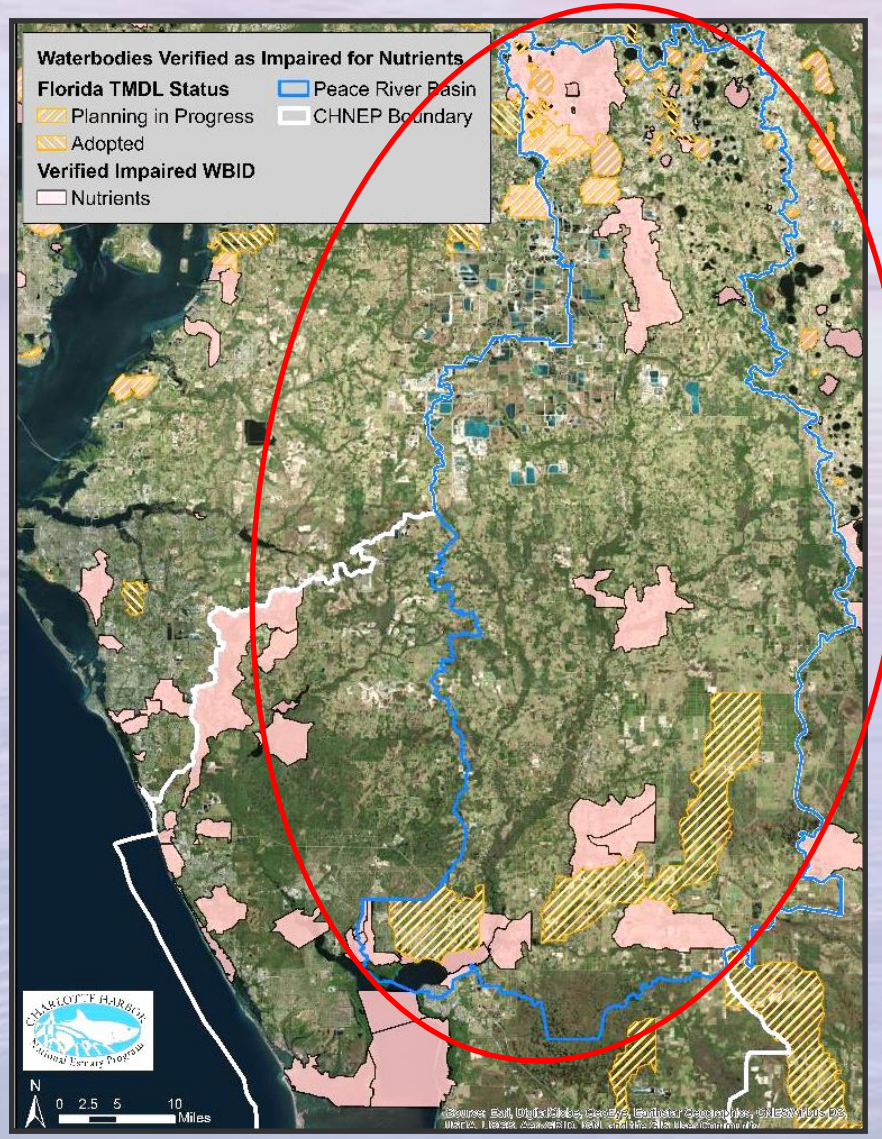
***Source: CHNEP Myakka River Basin Surface Water Quality Status Report 2019.**

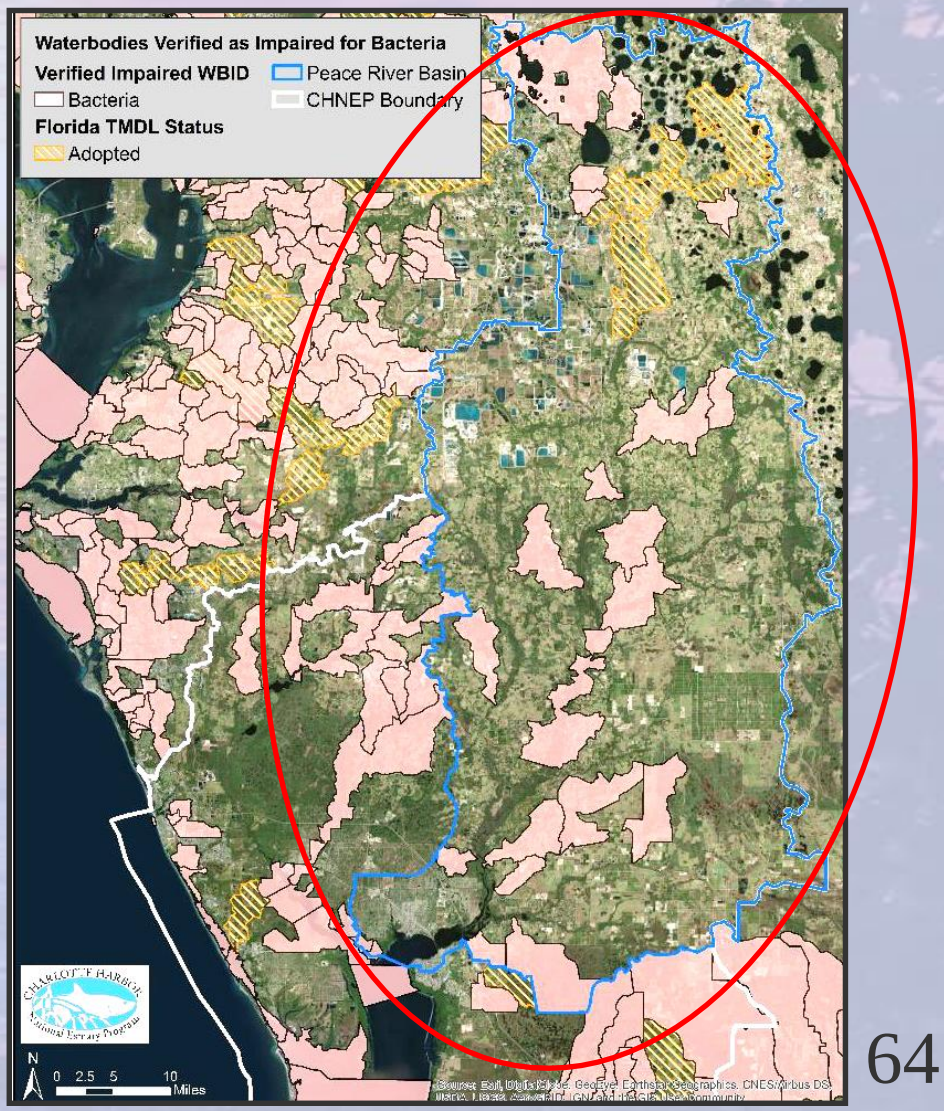




- **Peace R. watershed nutrient & bacteria impairment maps:***

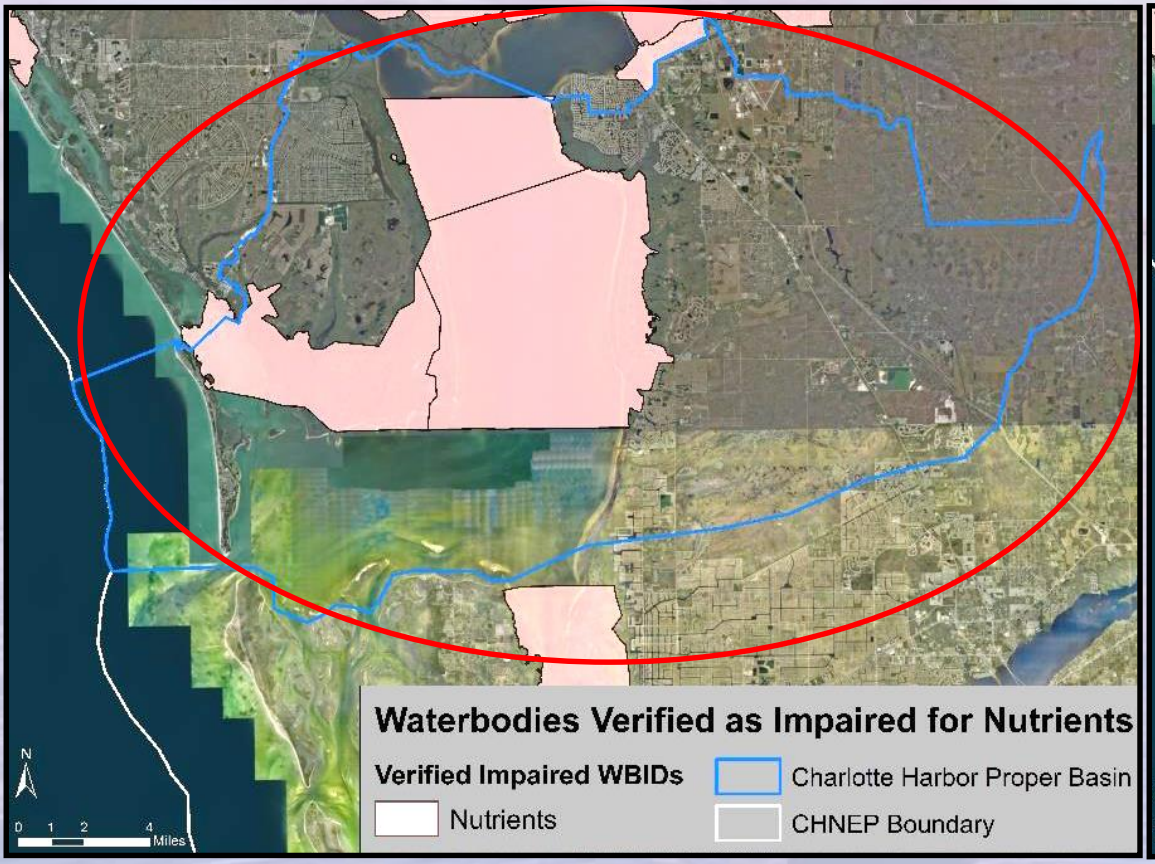
***Source: CHNEP Peace River Basin Surface Water Quality Status Report 2019.**

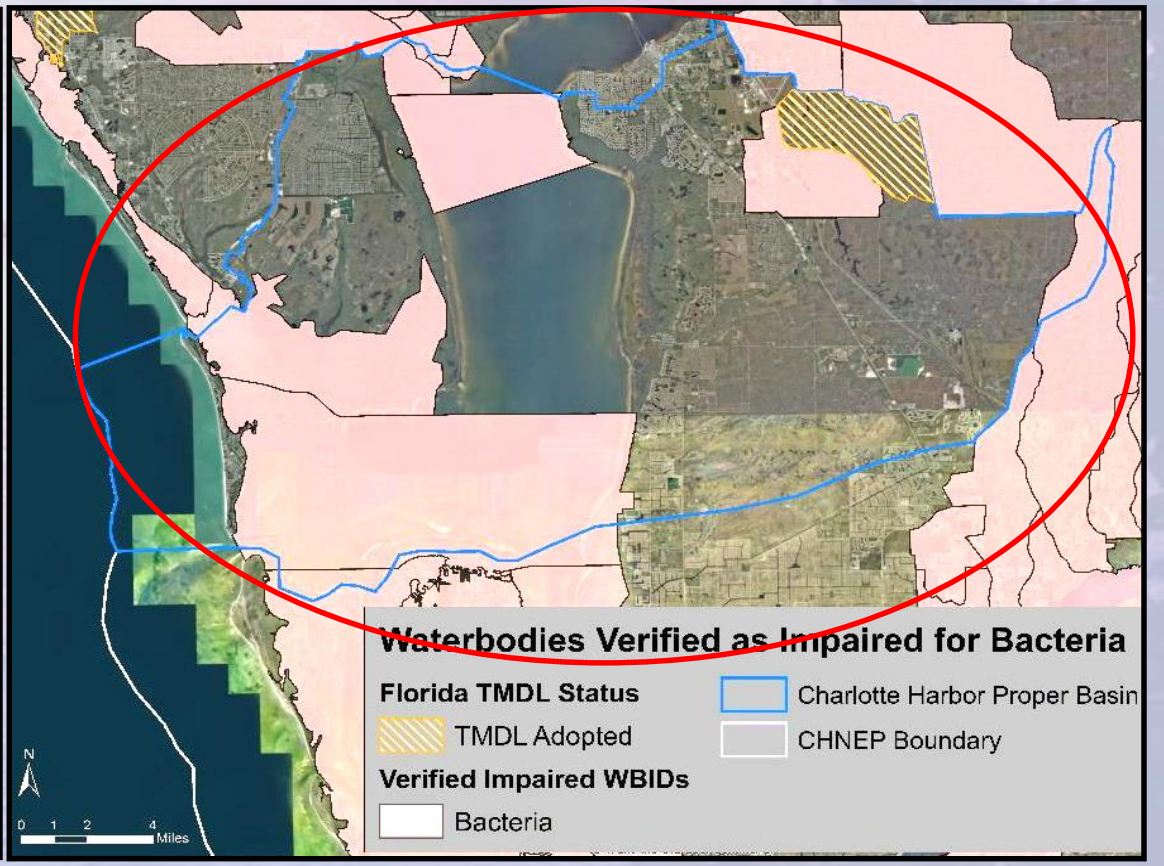




- **Charlotte H. watershed has nutrient & bacteria impairments.***

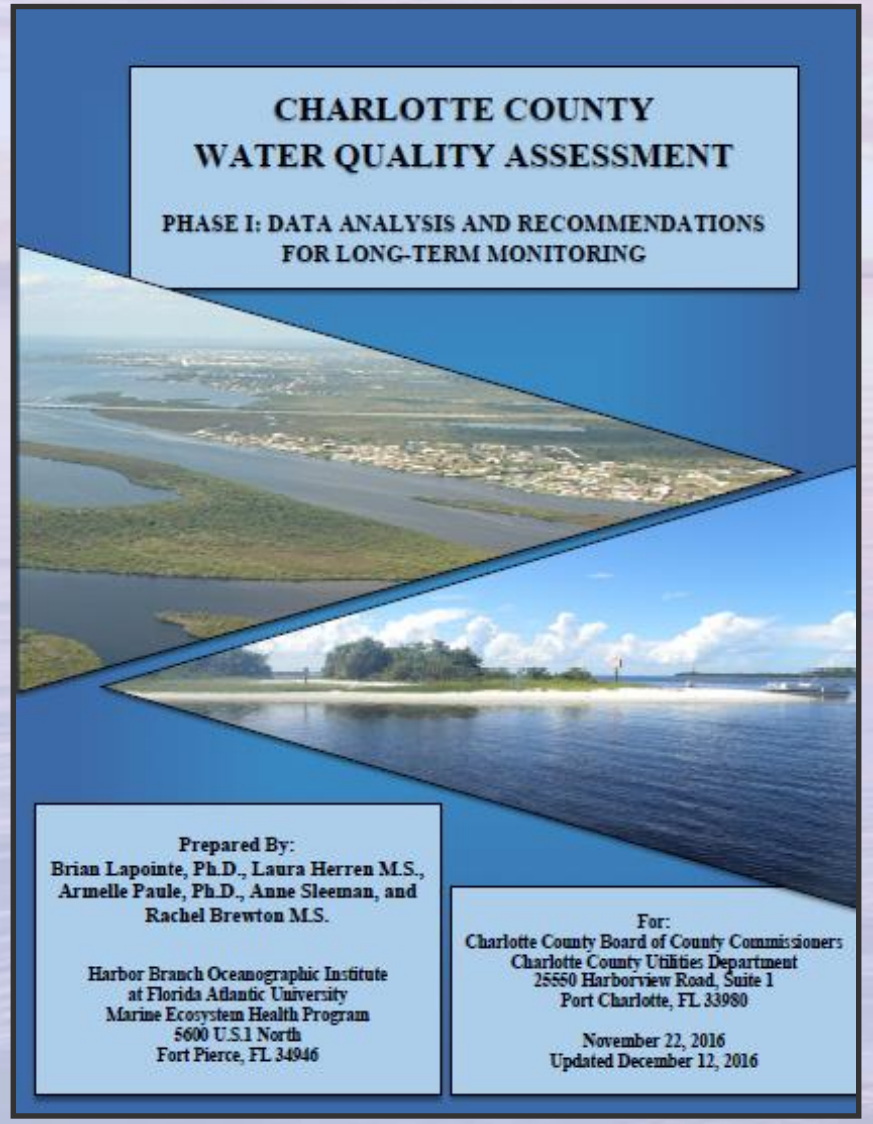
***Source: CHNEP Charlotte Harbor Basin Surface Water Quality Status Report 2019.**





- **Septic systems may be contributing to nutrient & bacteria loads to surface & ground waters.***

***Source: Charlotte Co. Water Quality Assessment Report 2016.**



Report evaluated:

- **Historic water quality data**
- **Current water quality data**
- **Nitrogen isotopes in algae**
- **Sucralose in water samples**

What Steps Can We Take Locally to Protect & Restore Our Estuaries?

- **First: Implement Comprehensive Water Quality Monitoring & Reporting Program**
- **Improve wastewater treatment & reduce problem septic systems.**
- **Improve stormwater management & reduce nutrient runoff.**
- **Increase native vegetation & reduce fertilizer use.**
- **Monitor reclaimed water & only use for irrigation away from surface & groundwater.**
- **Participate in regional habitat restoration projects, including wetlands & bivalves.**
- **Reduce climate change and plan for higher storms, temperatures & sea level**

Step 1: Implement Comprehensive Water Quality Monitoring & Reporting Program

Purpose: To have representative water quality data analyzed, evaluated & provided to decisions makers & the public to direct actions needed to assure the health of our estuaries.

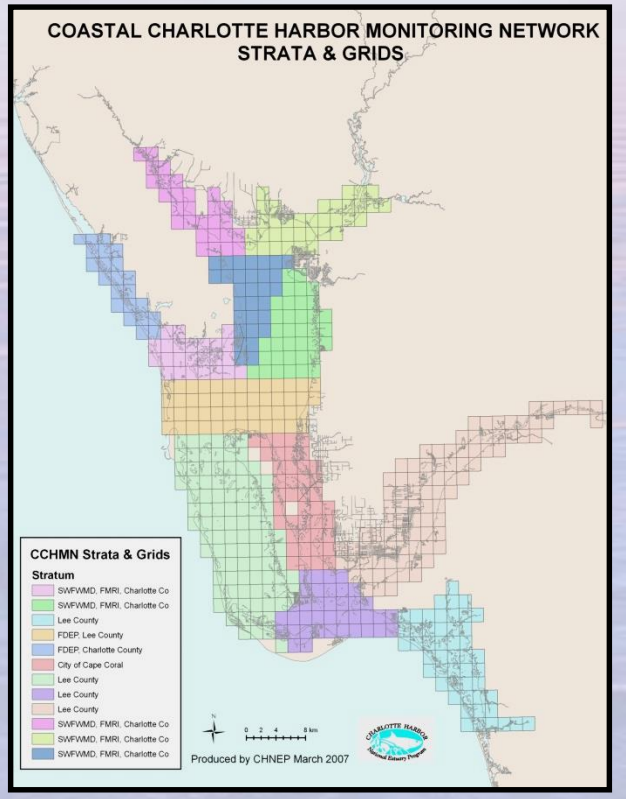
Criteria:

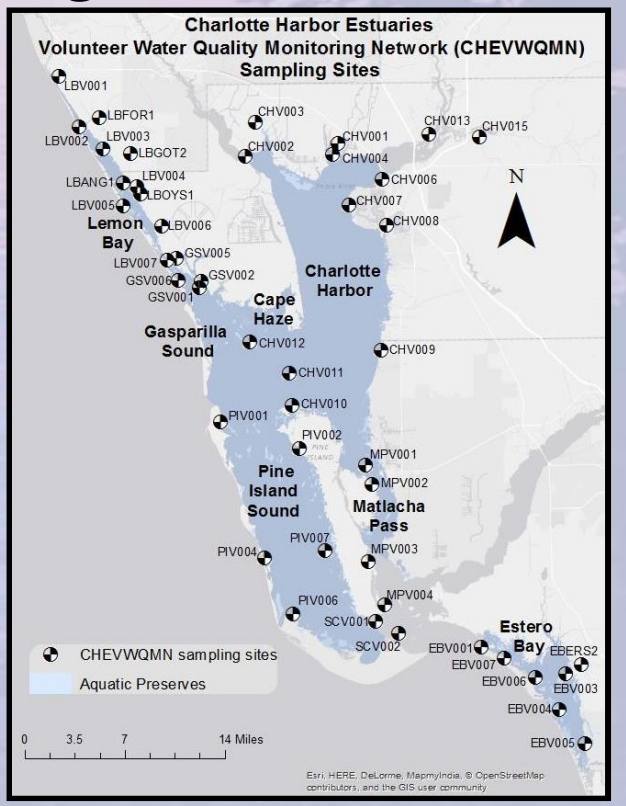
1) **Adequate sampling of waterways in & adjoining the estuary.**
2) **Routine reporting of laboratory analyses results to agencies responsible for interpreting, evaluating & presenting results.**
3) **Routine review of water quality reports by person/people with adequate authority to take actions based on results.**
4) **Readily available access to understandable reports are provided to the public & elected officials.**

Steps toward comprehensive water monitoring program:

- **Build on existing Co. experience & work, including:**
  ~ 2015 meeting with Co. & CHNEP to coordinate monitoring
  ~ 2016 report "Charlotte Co Water Quality Assessment
- **Review locations currently being sampled by Charlotte Co., FDEP & CHNEP & identify gaps in sampling locations.**

Charlotte Co. Utilities
Surface & Ground Water
Monitoring Sites
near Spring Lakes





- Identify sites, timing, parameters & methods needed.
- include key physical, biological & chemical parameters.


Photo: BenchMark

~ depth
~ secchi
~ temperature
~ salinity
~ dissolved oxygen
~ chlorophyll
~ nitrogen
~ phosphorus
~ bacteria

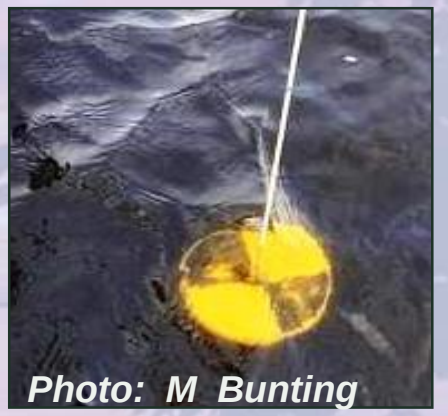


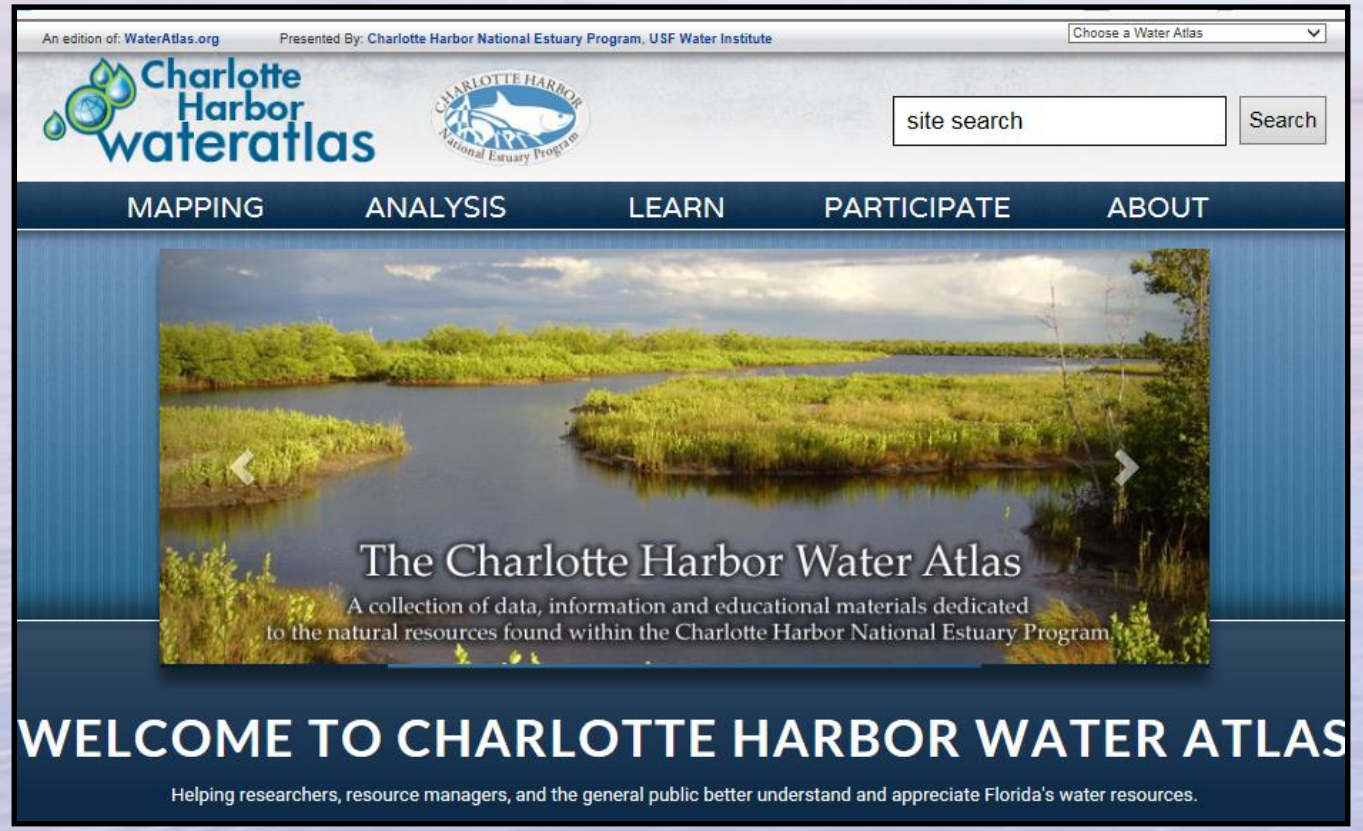
Photo: M Bunting

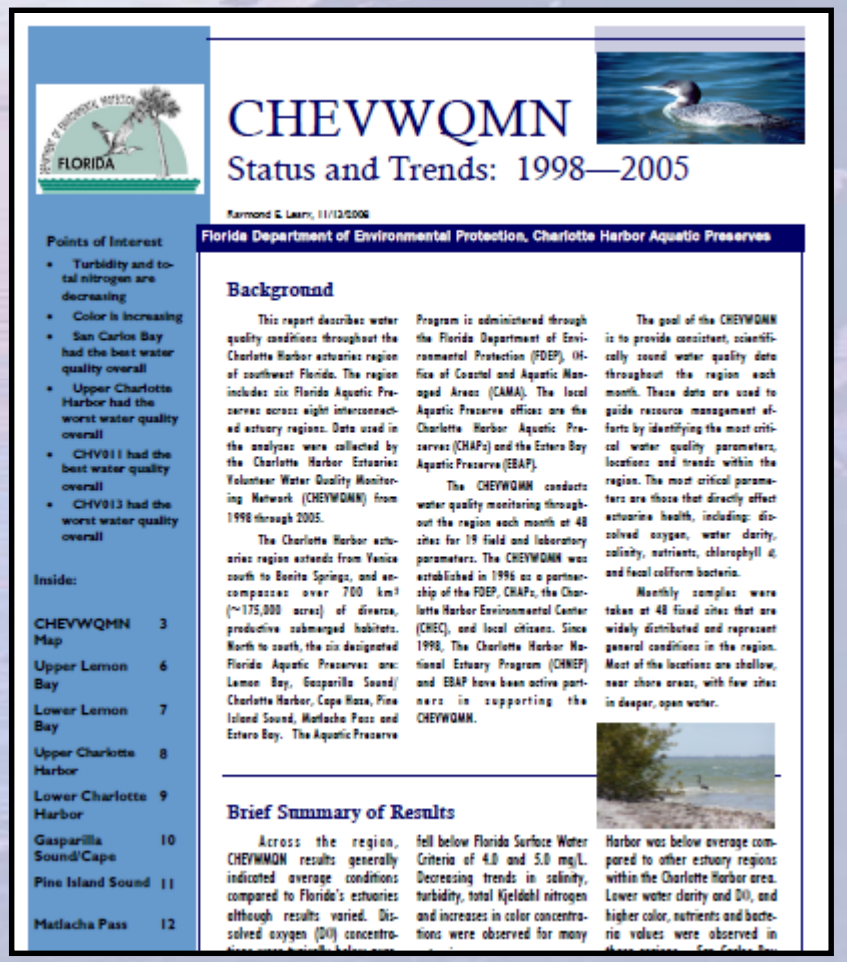
Photo: M Bunting


Photo: M Bunting

- Prepare written field & lab procedures & SOPs.

- **Analyze data & compare to state standards.**
- **Prepare & present results understandably.**
- **Ensure results are presented to decision makers responsible for implementing corrective actions.**





What Are The Conclusions?

- We have a water quality crisis in the making – many of our waters are already impaired.
- If we delay action, our valuable estuaries will be at risk – prevention is more effective & less expensive than restoration.
- The first step is to establish a comprehensive local water quality monitoring & reporting program.
- The water quality program needs to include adequate sampling, understandable interpretation & routine reporting of results to people with authority to implement corrective actions.
- Water quality results also need to be made readily available in an understandable way to the public & elected official.
- We encourage the County to invest in the staff & partnerships needed to accomplish this critical step towards protecting our invaluable estuaries.

Any Questions & Discussion?

Need More Information?

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