Conflicting Indicators of Estuarine Health in a Southwest Florida Estuary Susceptible to Harmful Algal Blooms

Presentation to the National Water Quality Monitoring Council

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SARASOTA BAY ESTUARY PROGRAM
Restoring Our Bays

The Sarasota Bay Estuary includes a 50 mile long coastal lagoon with four inlets

The Sarasota Bay Estuary Program was established in 1989

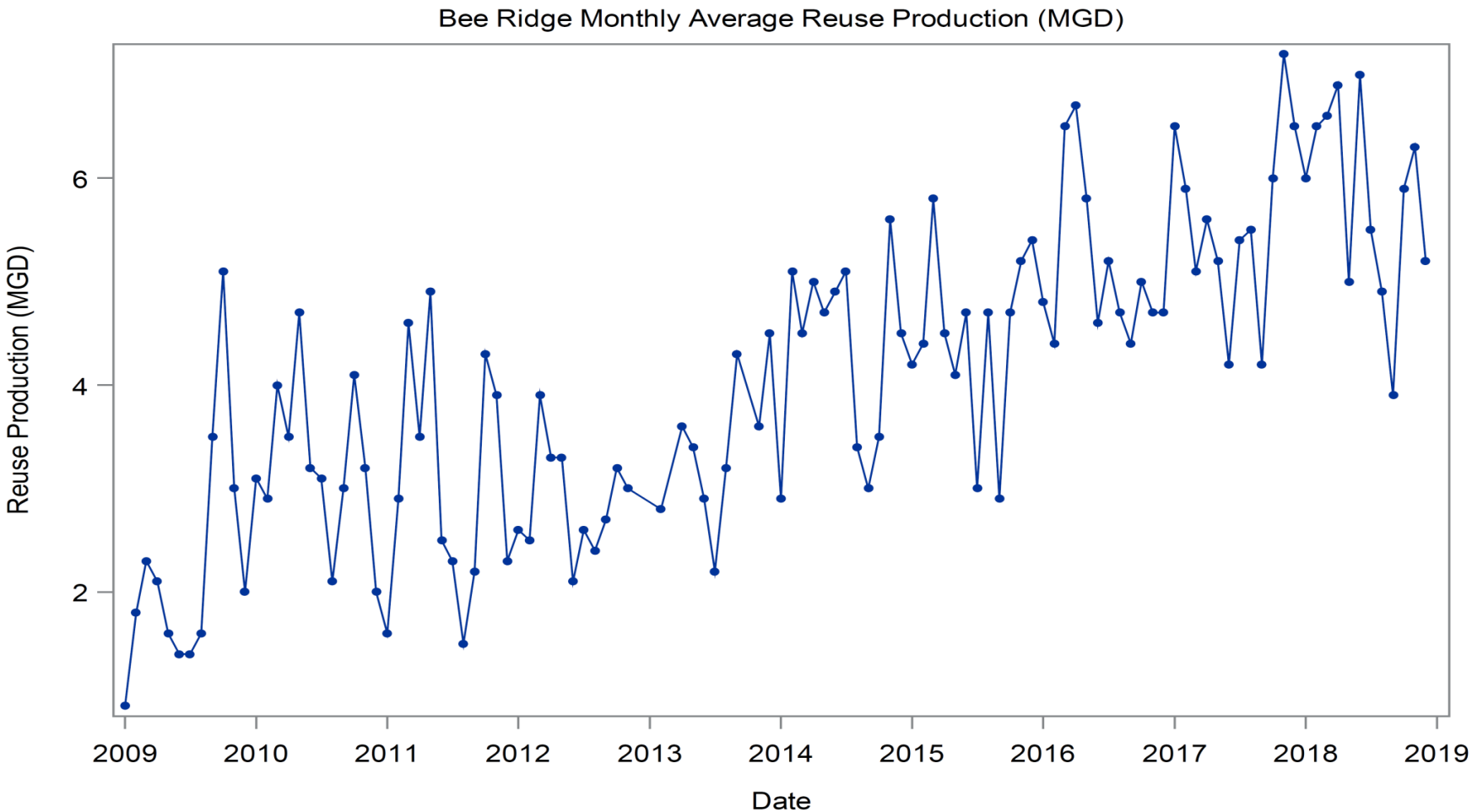
Between 1980's and 2010:

- Nitrogen pollution was reduced by an estimated 64%
- Seagrasses rebounded by 46% and have recently been above historical acreages
- Water quality achieved state standards

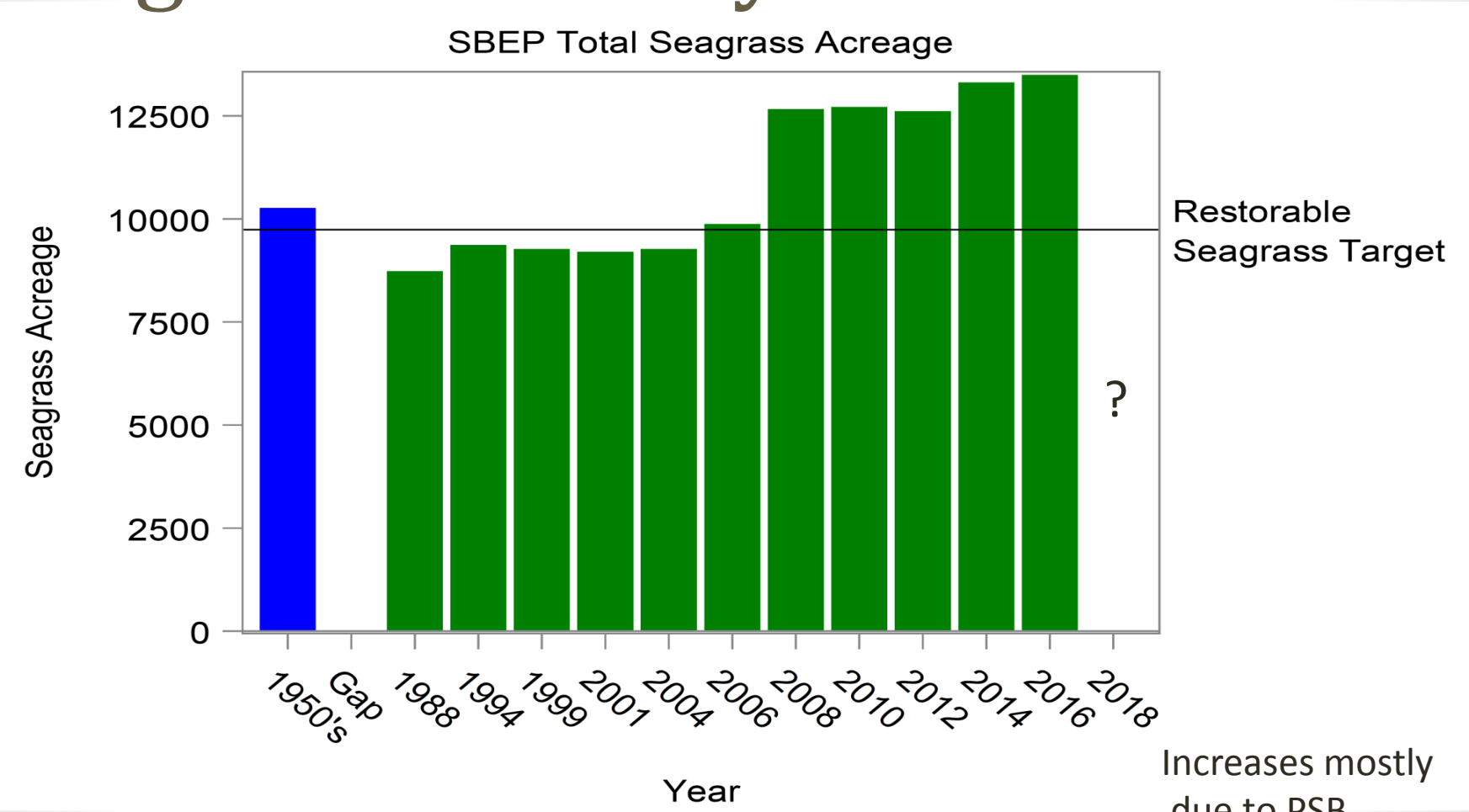
Factors Affecting Improvements

- Grizzle Figg Act – required wastewater discharges to SW Florida estuaries be treated to Advanced Wastewater Treatment (AWT) standards
- Improved stormwater treatment
- Septic to Sewer conversions in priority watersheds
- Eliminating small package plants and increasing production for reclaimed water supply

Increased Volume of Reclaimed Water Production



Seagrass – Our Keystone Indicator



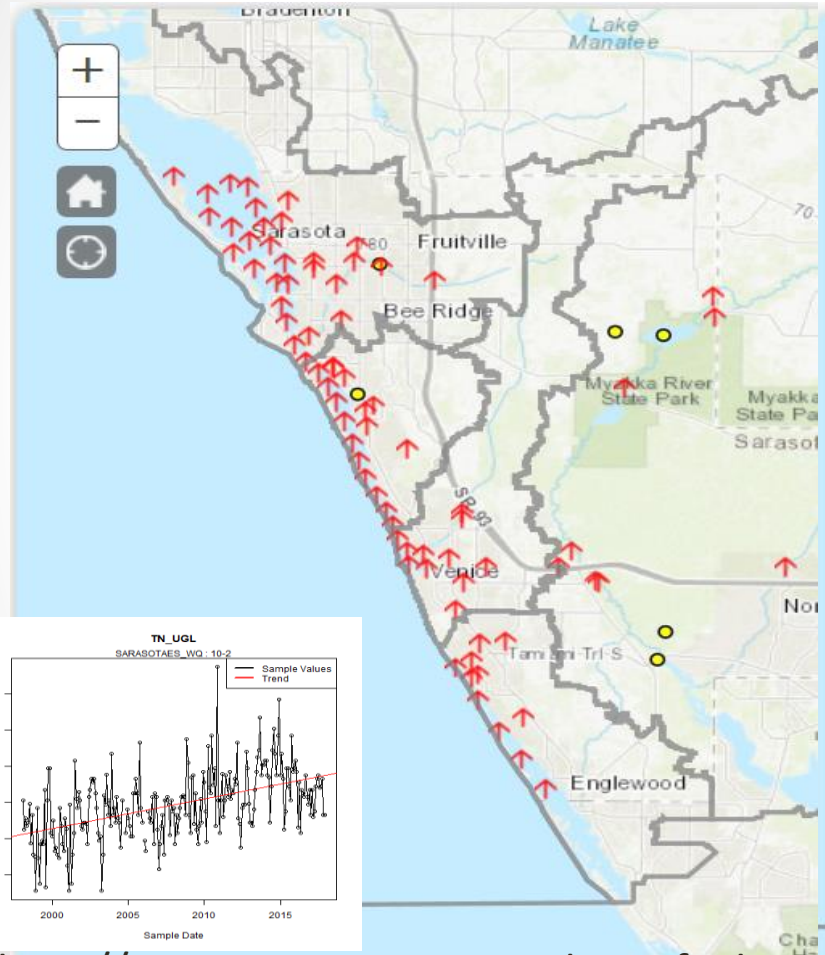
Increases mostly due to PSB, SB, and LSB

However:

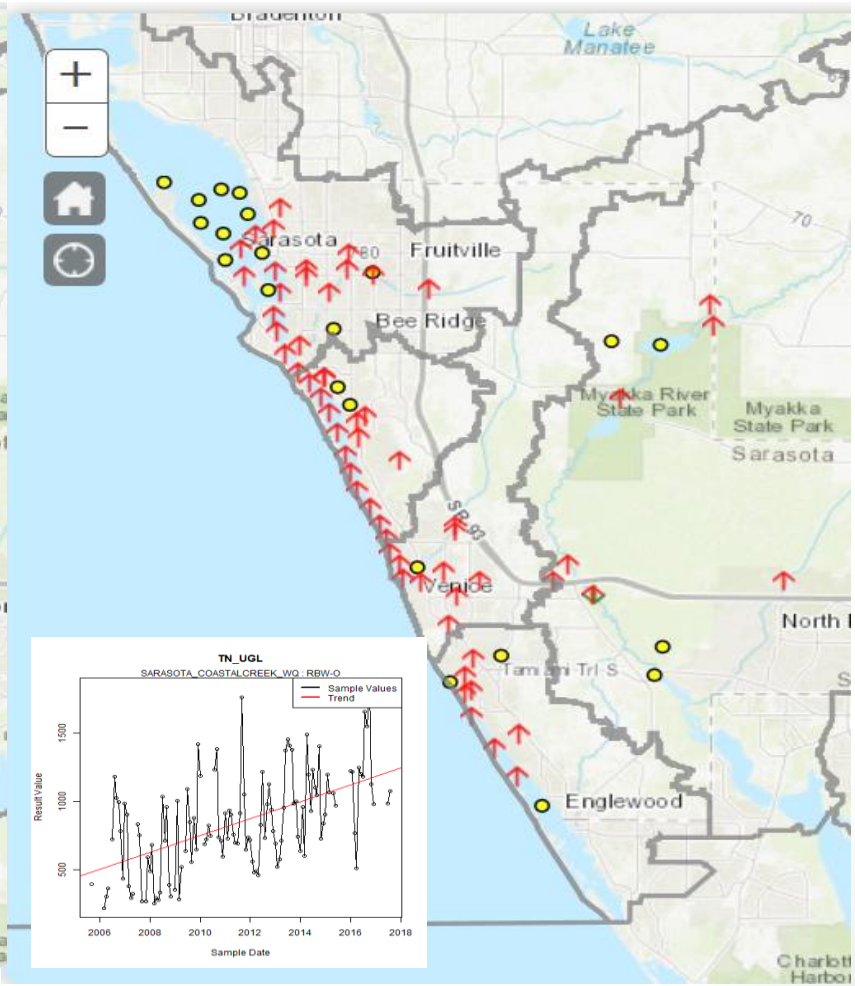
- Trends in nitrogen concentrations have recently been increasing throughout the watersheds and estuaries
- Water quality standards for chlorophyll are now being exceeded in most segments
- Coincident episodes of harmful algal blooms have heightened concerns regarding nutrient pollution and its effects on estuarine health

Timeseries Trends in TN

1998-2017



2008-2017



http://www.sarasota.wateratlas.usf.edu

“Red Tide”
Karenia brevis

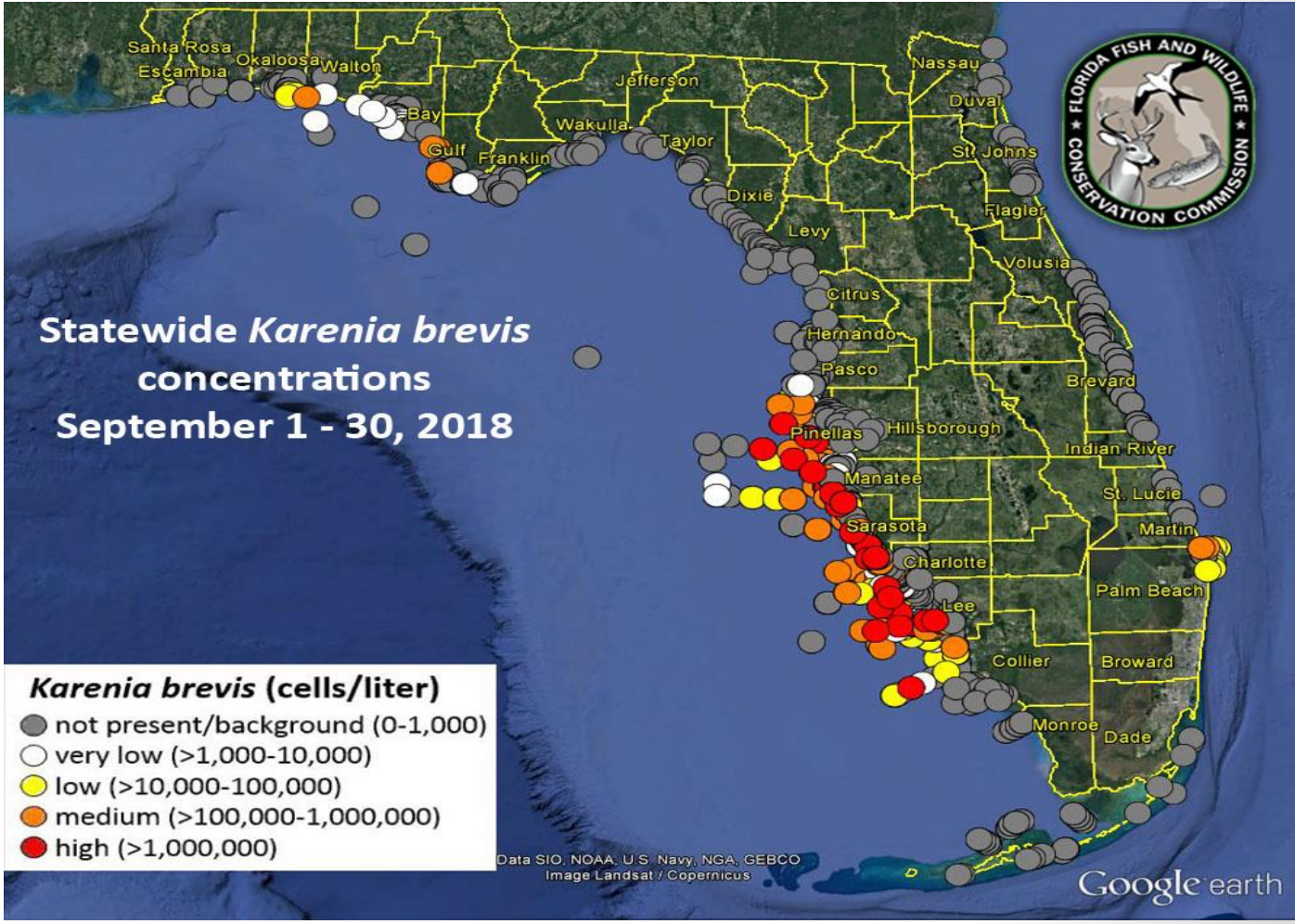
Naturally occurring

Historical records back to 1500’s

Blooms initiated offshore

Evidence that intensity And duration is increasing

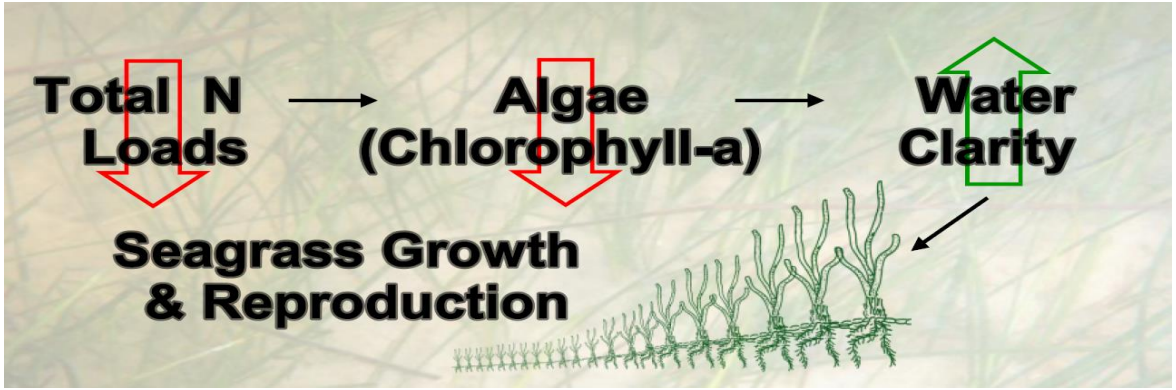
High P makes area Susceptible to nitrogen



Relevance to Water Quality Standards

- Sarasota Bay Estuary Program established targets and thresholds for chlorophyll and nitrogen

- Based on a reference period when seagrasses (key ecological indicator) were stable



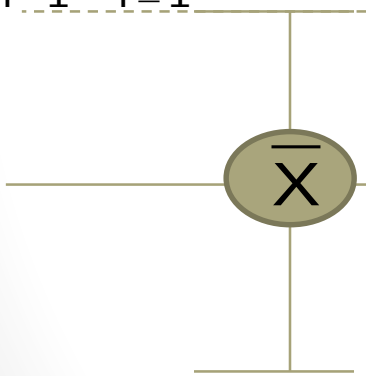
Water Quality Indicators

Reference Period Approach

Chlorophyll a

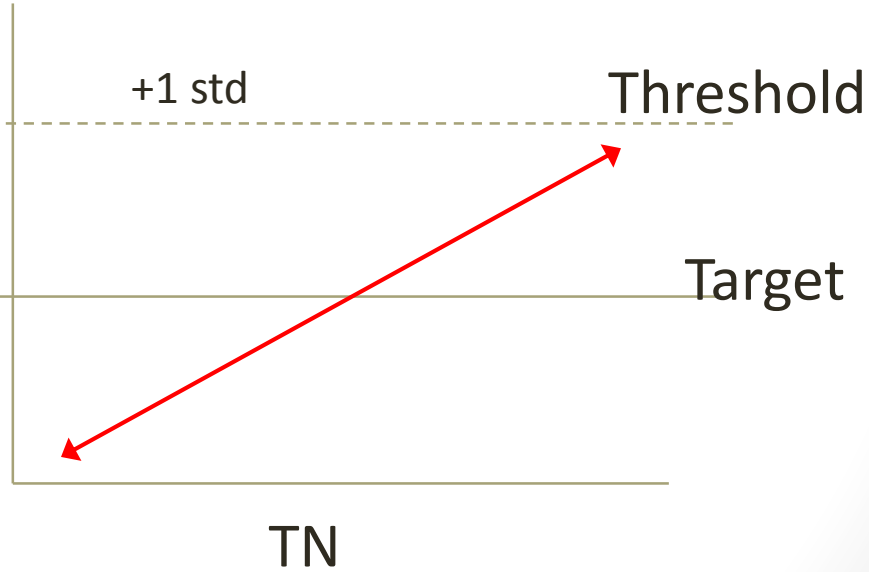
Reference Period

$$\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x-\overline{x})^2}$$

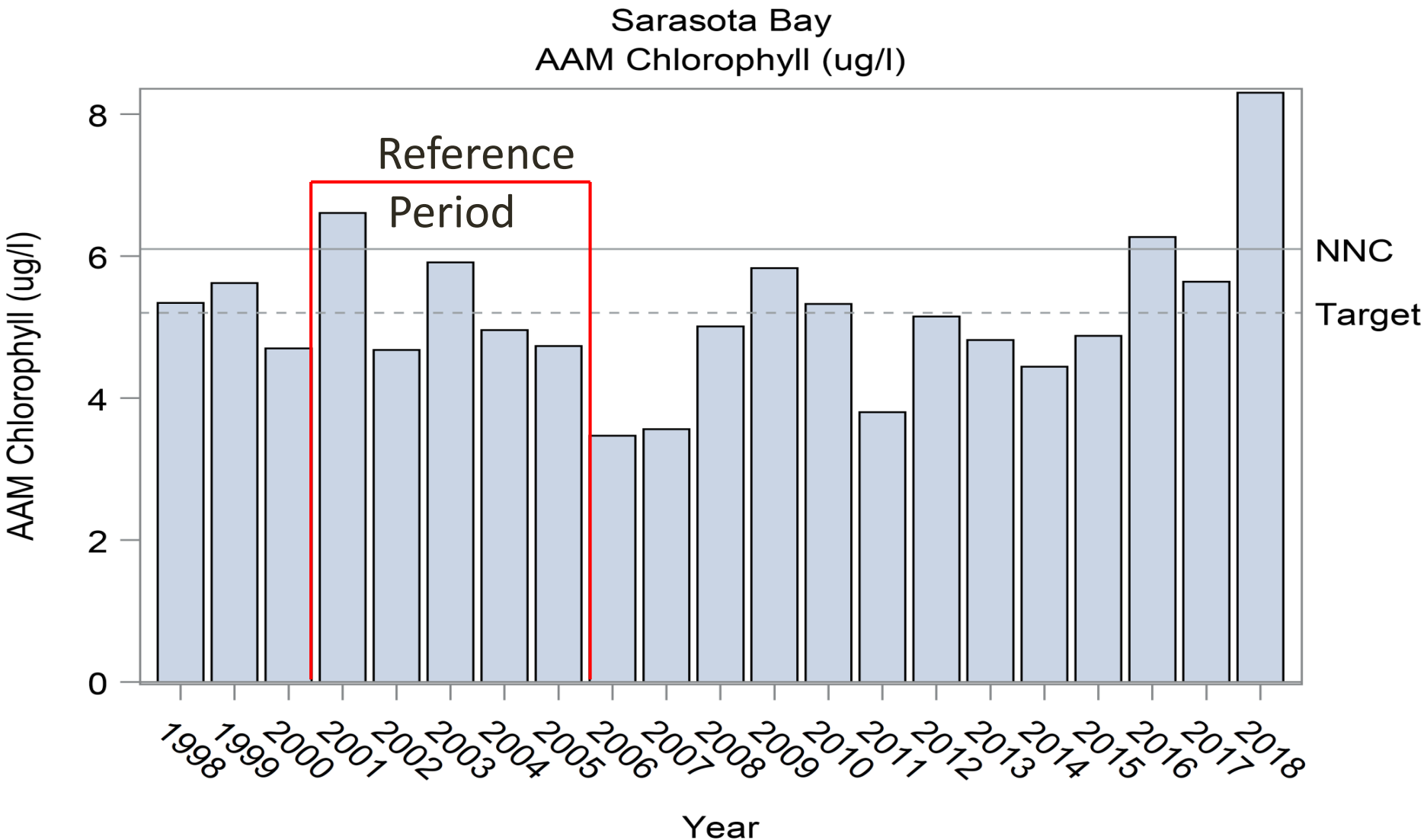


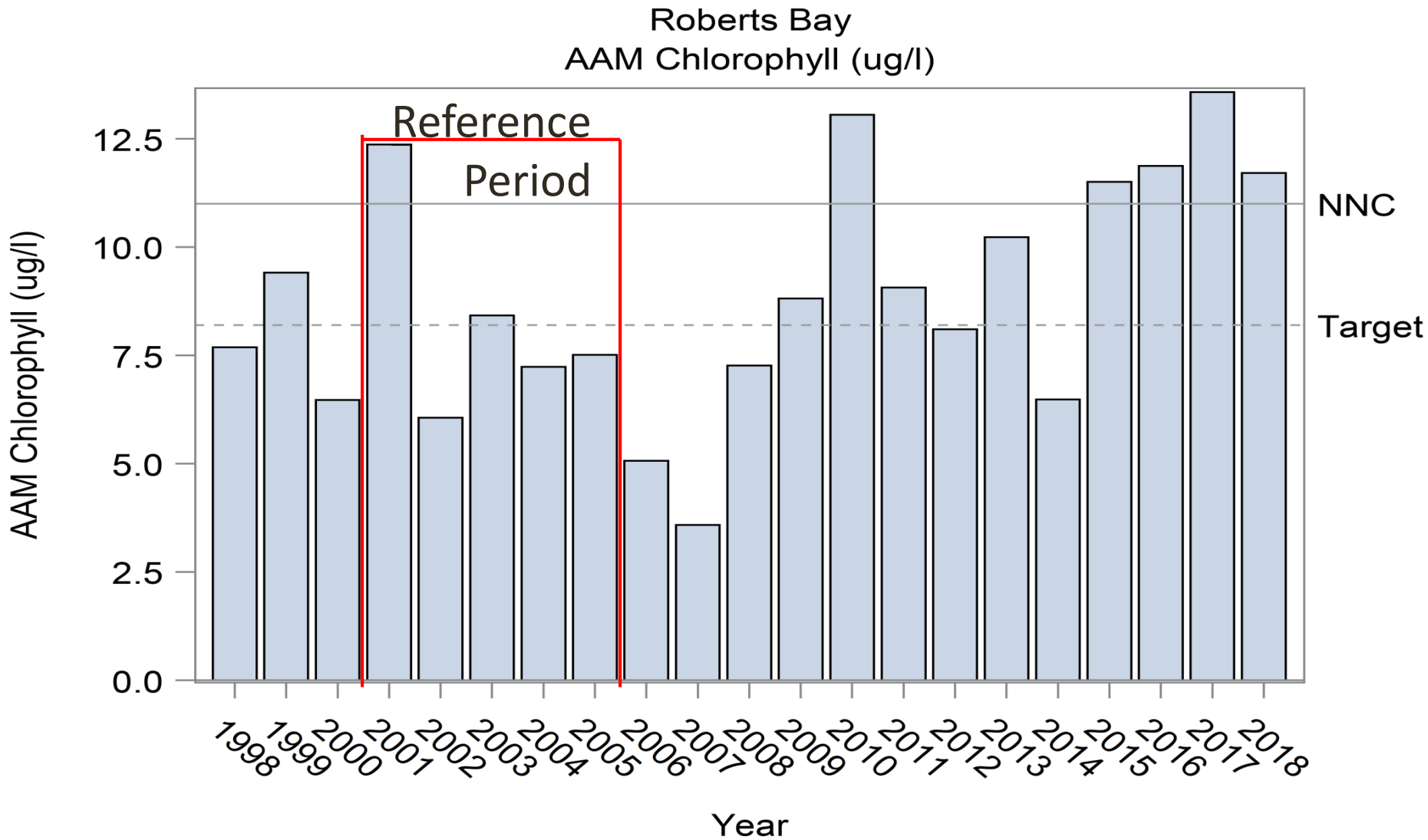
Total Nitrogen

Linear Regression



Accepted By FDEP as NNC


Sarasota Bay
AAM Chlorophyll (ug/l)
Reference
Period
NNC
Target
AAM Chlorophyll (ug/l)
0
2
4
6
8
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year


Roberts Bay
AAM Chlorophyll (ug/l)
Reference
Period
NNC
Target
AAM Chlorophyll (ug/l)
12.5
10.0
7.5
5.0
2.5
0.0
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year

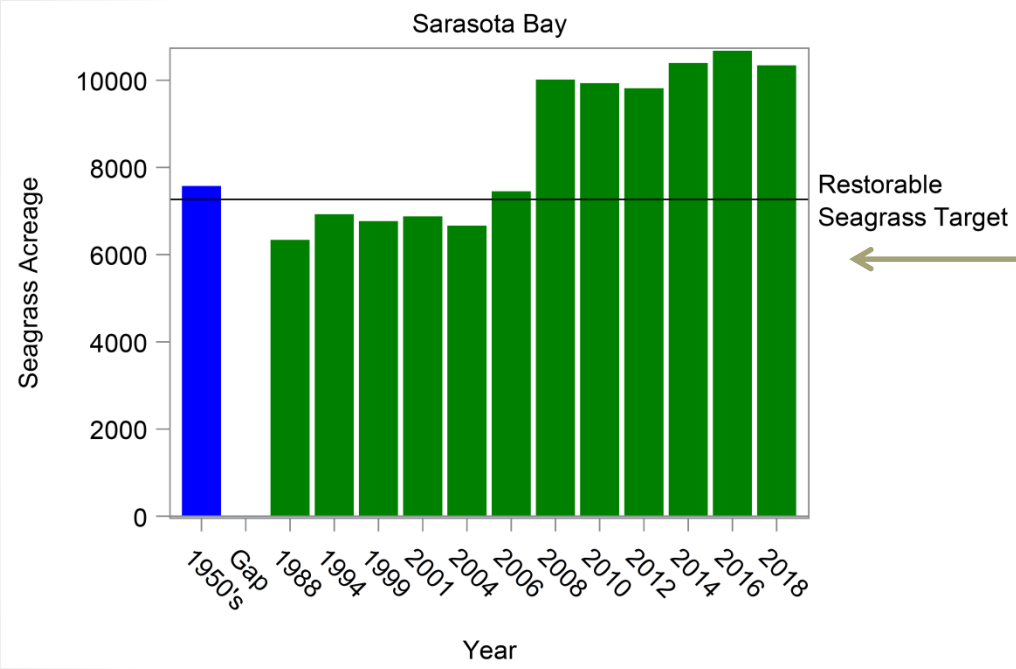
Likely Outcome of Next FDEP Assessment

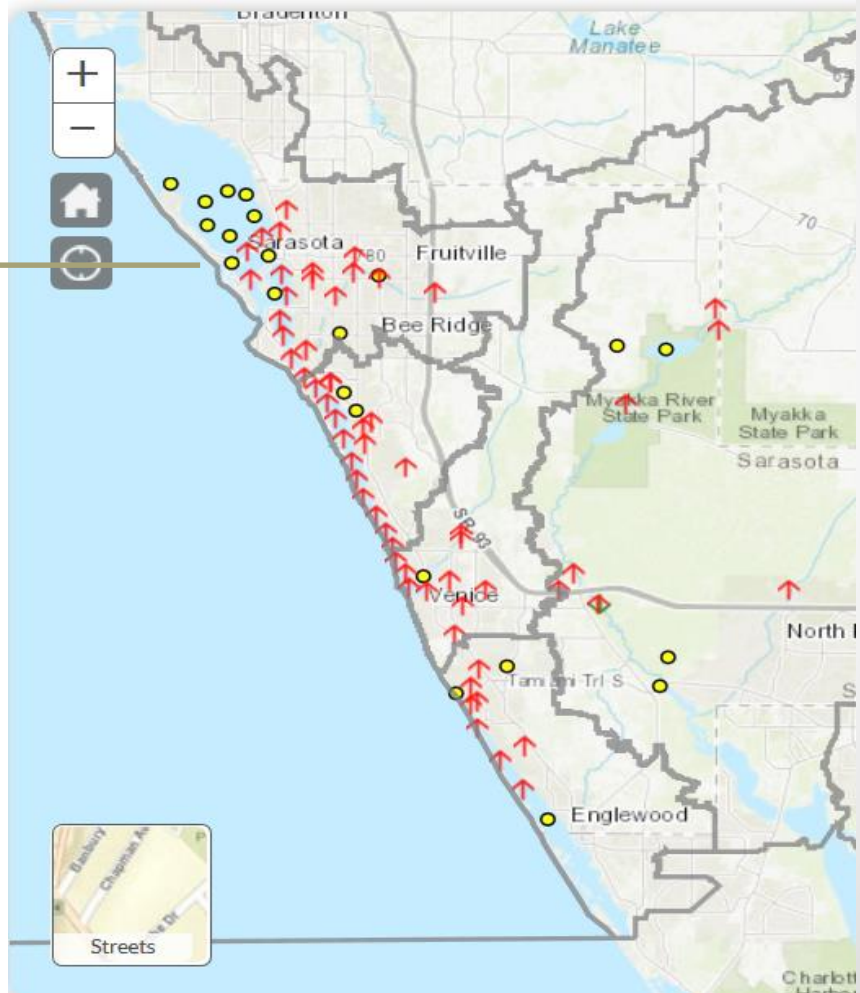
Segment	WBID	Chlorophyll *a*	TN	TP
Sarasota Bay	1968C	Impaired	Not Impaired	Not Impaired
Roberts Bay	1968D	Impaired	Not Impaired	Not Impaired
Little Sarasota Bay	1968E	Impaired	Not Impaired	Not Impaired
Blackburn Bay	1968F	Impaired	Impaired	Not Impaired

FDEP Evaluation Due in 2020

Sarasota Bay

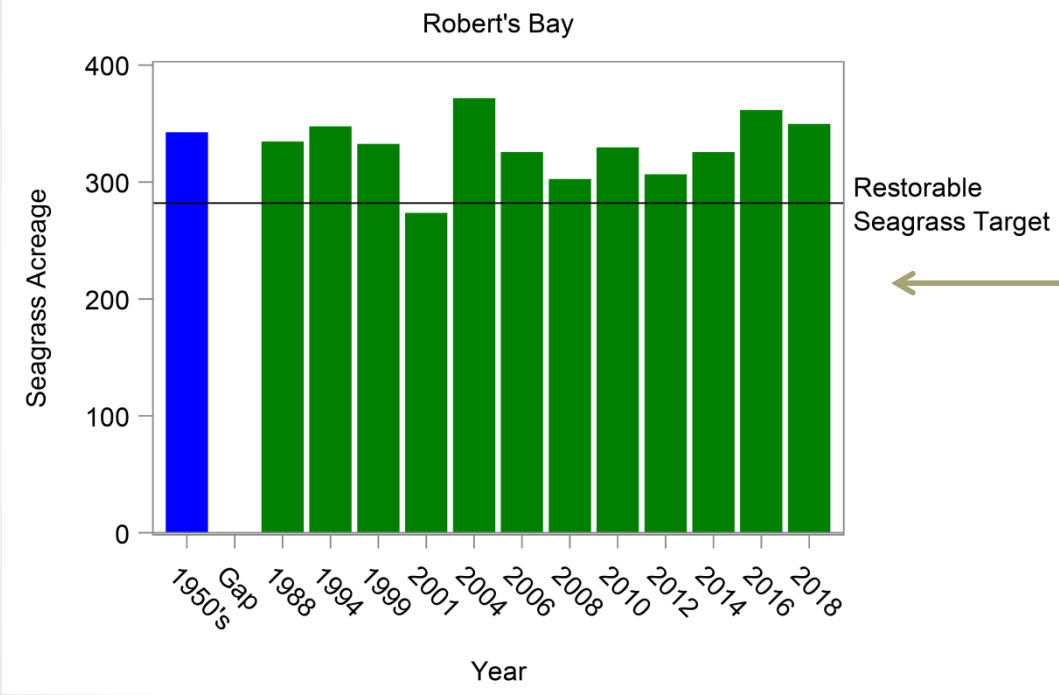
2008-2017



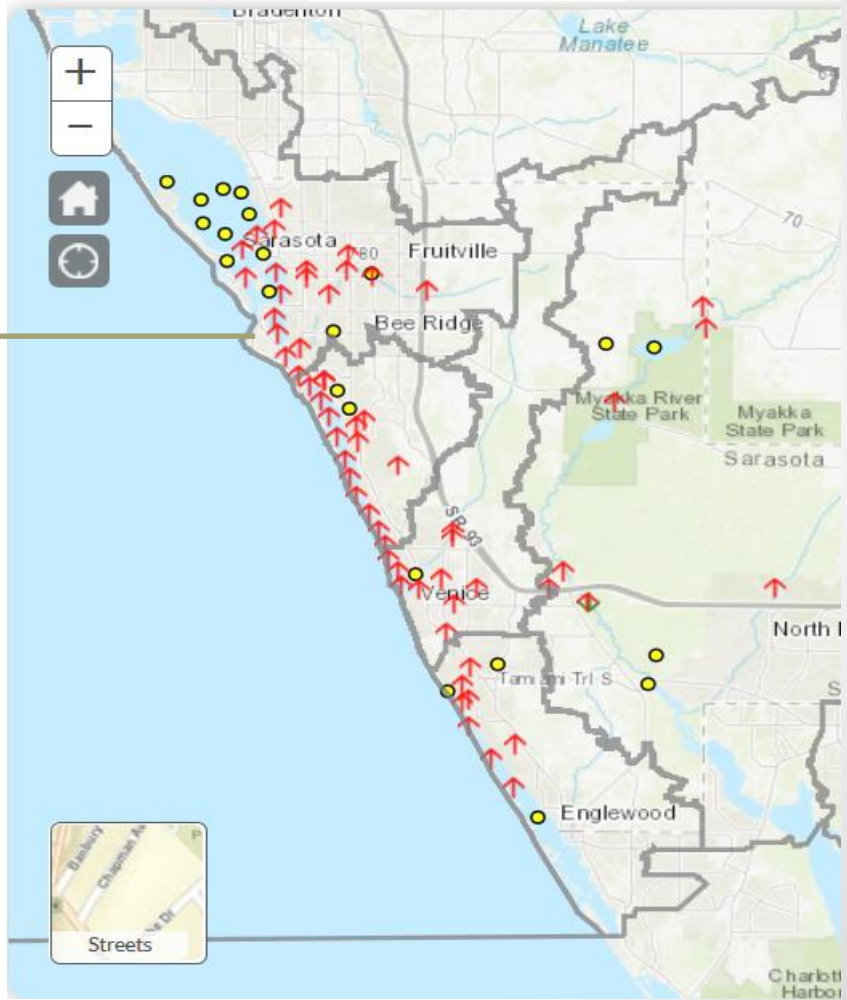


Good exchange with Gulf

Robert's Bay



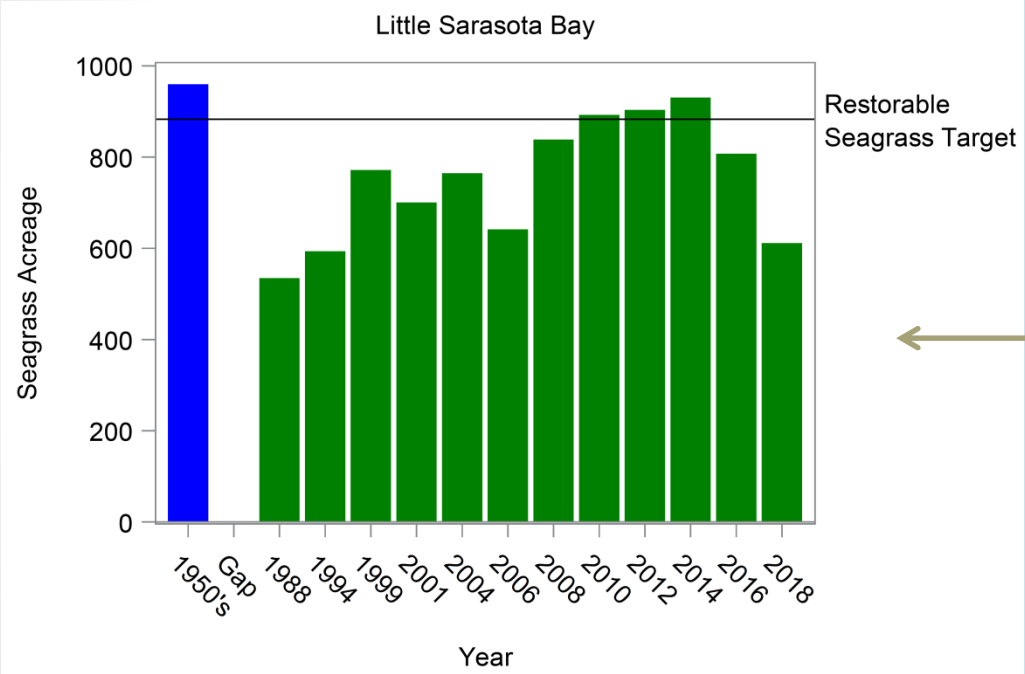
2008-2017

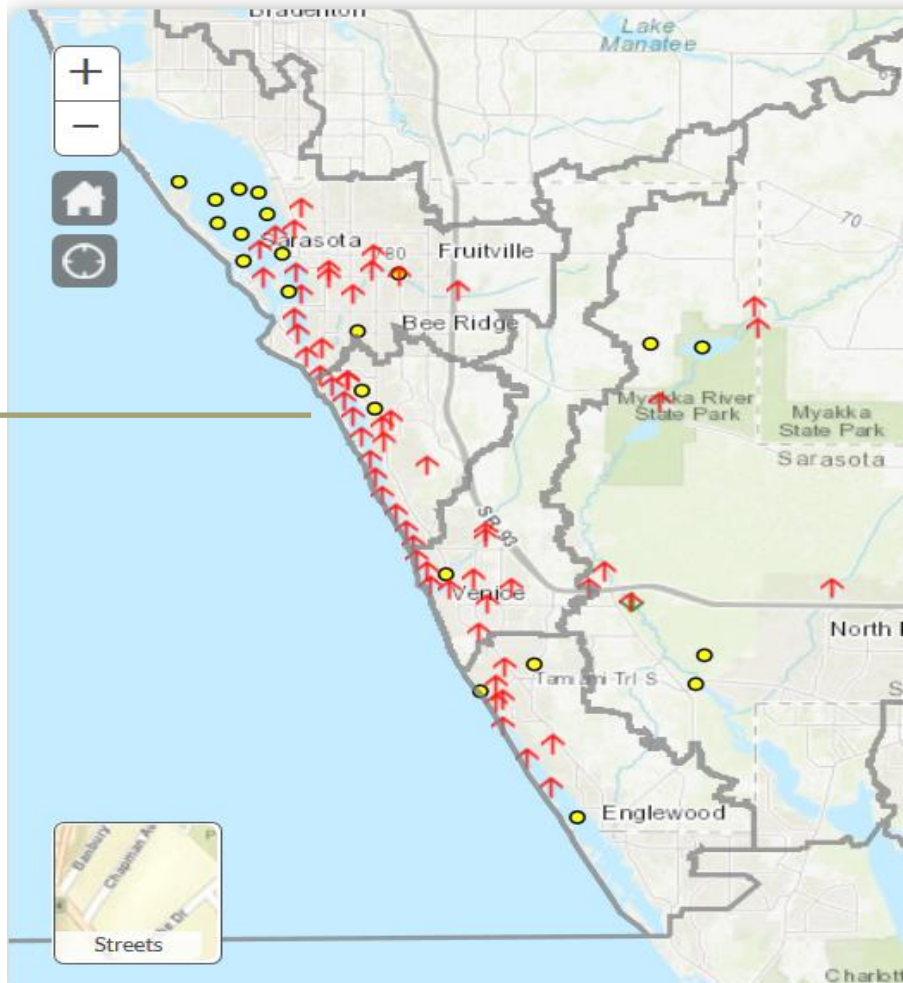


Large creek discharge
Limited exchange with Gulf

Little Sarasota Bay

2008-2017

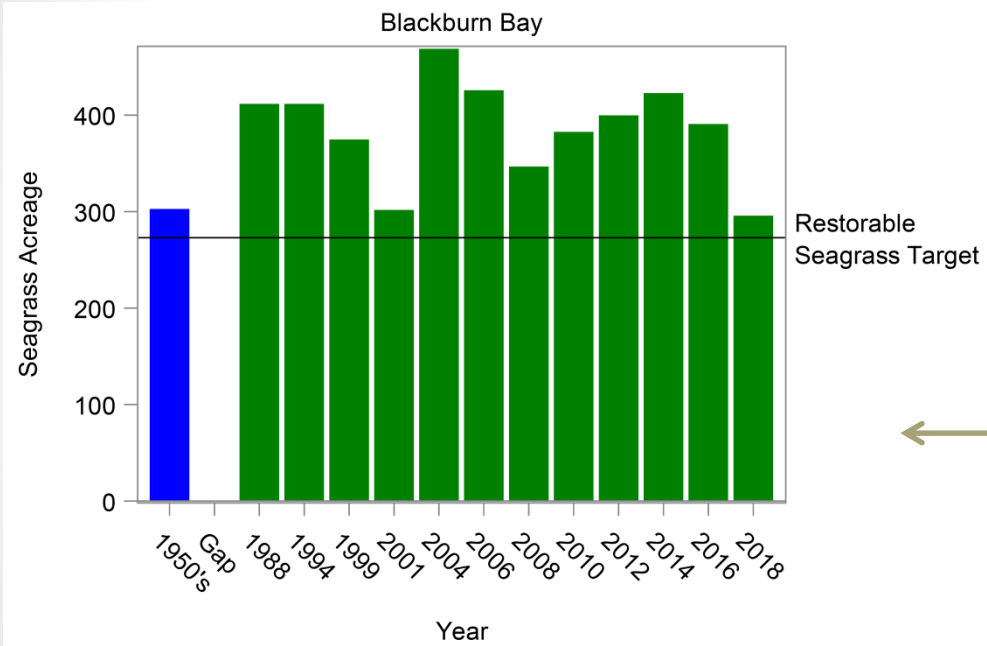


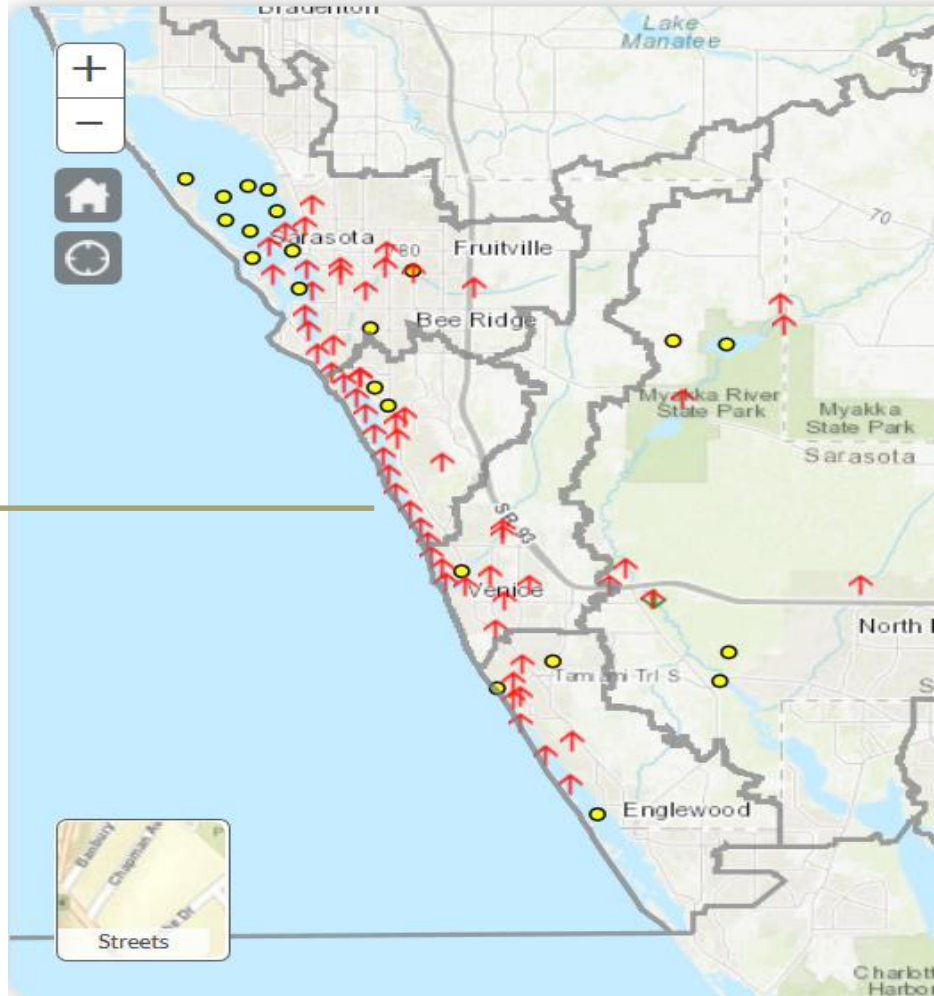


Least exchange with Gulf

Blackburn Bay

2008-2017





Mixing of freshwater inputs and exchange with Gulf

Summary

- Chlorophyll now exceeding state standards

- Nitrogen concentrations increasing

+ Nitrogen not yet exceeding state standards in most Bays

+ Seagrasses remain above historic levels for most Bays

- Downward seagrass trends in Bays less exchange with Gulf

What's With These TN Trends?

- **Lots of Ideas**
  - Laboratory results systematically biased? No
  - Rainfall /Atmospheric deposition changing?
  - Groundwater concentrations increasing?
  - Background conditions increasing?
  - Has increased volume of reuse affected nitrogen trends?
- **Need for a systematic approach**

Proposed Restoration and Protection Strategy (RA Plan)

SBEP serve as honest broker - existing inter-local agreements and WQ consortium and management structure in place

- Reevaluate Water Quality Targets
- Update/Reevaluate Loading Model
- Update Evaluation of Estuarine Responses
- Identify Nutrient Loading Limits
- Identify Nutrient Load Reduction Projects that Achieve Loading Limits

Many of the tools and data sources are in place

Benefits of FDEP Approved RA Plan

- Eligibility for funding and cost sharing
- Stresses proactive efforts to reduce nutrients in the watershed
- Maintains local control - Provides opportunity to demonstrate local efforts and provide local expertise
- ***Cleaner water faster***

Lessons Learned

- A lot of benefits of having multiple indicators but it can lead to confusion / inaction
- Seagrasses may have threshold responses that have not been exceeded in Bays with better exchange
- Power of a strong monitoring program to pick up changes in water quality
- Having targets and thresholds works even if they aren’t perfect