Geographic area
Variety of different systems

- **Watershed to open water ratios**
  - High - Charlotte Harbor
  - Low - Clearwater Harbor, Sarasota Bay
  - Intermediate - St. Joseph Sound, Tampa Bay, Lemon Bay

- **Degree of urbanization of watershed**
  - High - Clearwater Harbor, Tampa Bay, Sarasota Bay, Lemon Bay
  - Low - St. Joseph Sound, Charlotte Harbor

- **Historical seagrass loss**
  - Substantial - Clearwater Harbor, Tampa Bay, Sarasota Bay
  - Minor - St. Joseph Sound, Lemon Bay, Charlotte Harbor
Basis for seagrass loss

• Direct impacts
  – Shoreline modification
  – Intracoastal waterway
  – Shipping channels

• Indirect impacts
  – Eutrophication
    • Excessive phytoplankton
    • Macroalgae
    • Epiphytic algae
Signs of eutrophication – Tampa Bay in the 1980s

Photos from Roger Johansson
Nutrient paradigm in Tampa Bay

From Greening (2012)
Nutrient paradigm in Sarasota Bay

From Tomasko et al. (1996)
Problem ready for a solution…

Bardenpho process: linked nitrification/denitrification
Implementing the solution

- 1972 Wilson-Grizzle Act
  - Mandated effluent quality of 5,5,3,1
    - TSS, CBOD, TN, TP
  - Basis for upgrade to City of Tampa’s WWTP

- Repealed in 1981

- 1987 Grizzle-Figg Act
  - Replaced 5,5,3,1
  - Geographically restricted
  - Basis for upgrade to City of Sarasota’s WWTP

- Stormwater regulations implemented in mid-1980s
Management actions implemented

Data from Tomasko et al. (2018)
Tampa Bay response (example)

Data from Johansson (2002)
Sarasota Bay response (example)

From Tomasko et al. (2009)
Seagrass response
Increases in all systems (compared to 1999) but at different rates and with different timelines.
Tampa Bay more dominant, but not because of losses elsewhere, just higher rate of recovery
Recovery is obvious to most residents
Lessons learned

• Initial management proceeded without “perfect knowledge”
  – Cause and effect and solutions identified

• System responses not fully known or anticipated
  – After restoration kicked-in, management paradigms became more detailed

• Multiple stressors acted upon
  – Direct impacts, wastewater, stormwater

• Public support key
  – Good legislation can go away

• Need for patience
  – Several years between load reductions and signs of improvement
So, nothing to worry about?
Not hardly…
Population expected to double

2005

Population: 3.8M
Developed land: 0.9 M acres

2050

Population: 7M
Developed land: 1.6 M acres

Source: One Bay 2010
Impacts from 2018 Red Tide event?
SLR expectations

- Consensus on NOAA (2015) values for intermediate low and intermediate high
- Between 2 to ca. 4 feet of SLR over next 80 years
- Hang on!
Questions?