

OPEN SCIENCE IN TAMPA BAY: BRINGING WATER QUALITY (AND OTHER DATA) TO THE MASSES

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PARTNERS!



https://twitter.com/allison_horst

Janicki Environmental

- Mike Wessel
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Ben Best

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Mike McManus

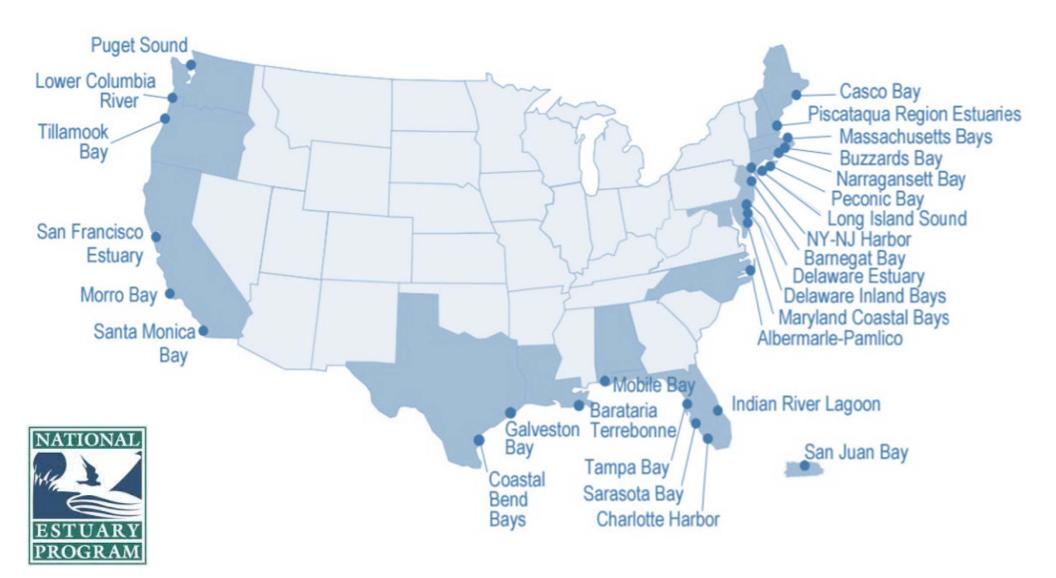
Tampa Bay Estuary Program

- Ed Sherwood
- Marcus Beck
- Maya Burke

OVERVIEW



- Tampa Bay Estuary Program
- Open Science Philosophy
- Seagrass-Water Quality Paradigm
- Water Quality Tool
- Workshop
- Future Steps













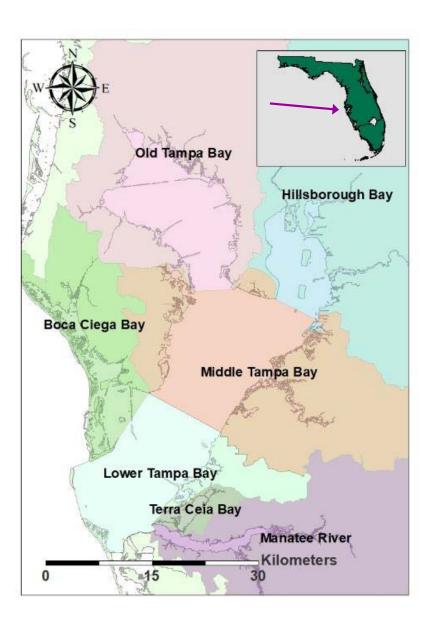


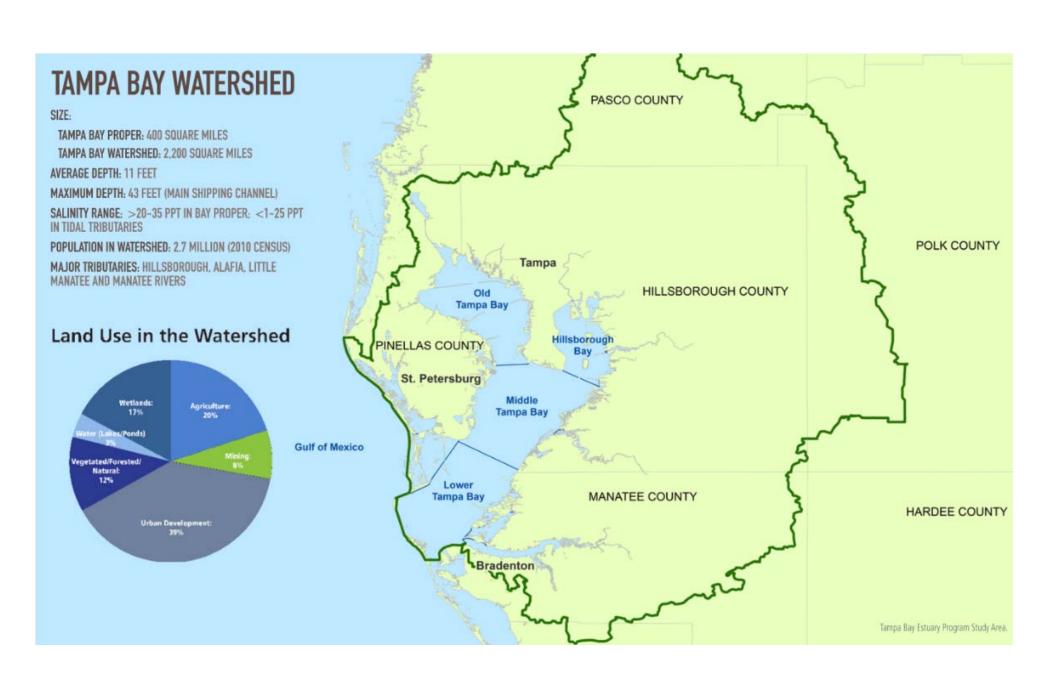














OF TAMPA BAY, 1950-2016.

A HISTORY KEY MILESTONES IN THE RESTORATION OF TAMPA



1950s Population less than 1/4 of today.

Commission of Hillsborough County

• 1970s

Save Our

Bays and

action to

pollution

discharges

reduce

Environmental

Protection established 1974

EPCHC initiates baywide water quality monitoring program.



1982

Statewide Stormwater Rule is enacted. requiring nutrient management from municipal stormwater systems.

1985

The Tampa Bay Regional Planning Council convenes the region to develop the Future of Tampa Bay report, including specific actions to reduce pollution and recover habitats in Tampa Bay. The Agency on Bay Management is established to support the report's recommendations.



1991

Tampa Bay is recognized by EPA as an "estuary of national significance," and the Tampa Bay National Estuary Program is approved. TBNEP's primary mission is to develop a Comprehensive Conservation and Management Plan.

1996 TBNEP's CCMP is approved by local partners, the Governor, and the EPA Administrator. Numeric goals for habitat restoration and water quality improvement are adopted.



develops an Action Plan (Partnership for Progress) to meet nutrient management targets.

The TBNMC



First year that all bay segments TBEP water

2006

achieve quality targets.



2014

Tampa Bay surpasses seagrass recovery goal of 38,000 acres.



1960s •

Bay degradation is recognized.



Image credit JOR Johansson

• 1972

1972

EPA Clean

Water Act

approved.

Florida legislation-Wilson-Grizzle Act requires wastewater plants discharging other citizen to Tampa Bay to groups call upgrade to Advanced for legislative Wastewater Treatment standards. or enact 100% reclaimed.



City of Tampa's Howard F. Curren WWTP achieves AWT standard, reduces nitrogen loadings by 90%. City of St Petersburg implements 100% reclaimed water from their direct discharge, with similar reductions. Other WWTPs in the region implement nutrient reductions.

• 1979

1982

The first Bay Area Science Information Symposium (BASIS) is conducted by the Tampa Bay Regional Planning Council.

1987

The State's Water Management Districts establish Surface Water Implementation and Management (SWIM) programs to restore and protect priority water bodies within each District. Tampa Bay is identified as the Southwest Florida Water Management District's priority water body.

1996

The public/ private Tampa Bay Nitrogen Management Consortium (TBNMC) is formed to assist in meeting nitrogen management targets needed to meet seagrass goals.

1998

An Interlocal Agreement between the TBNEP partners forms a new Independent Special District of the State of Florida, the Tampa Bay Estuary Program, TBEP partners commit to implementing projects to assist in meeting numeric goals, and to support a funding schedule.

2009

TBNMC develops voluntary nutrient loading limits for all sources, to continue to meet water quality targets. Federal and state regulatory agencies adopt limits to meet regulatory requirements

2016

Surveys show continued seagrass increases, to 41,655 acres.



















Why Open Science?



Scientist: My 500 page report will answer all your questions!



Manager: This 500 page report does not answer any of my questions!

OPEN SCIENCE OVERVIEW









Open Knowledge International, http://opendefinition.org/, https://creativecommons.org

MY AHA MOMENT!



Share data and analytical tools



EXISTING BARRIERS







Communication barriers
Irreproducible results
Information loss
Inaccessible data
Opaque workflows

Image courtesy M. Beck, TBEP

BRIDGING THE DIFFERENCES



Open Science can bridge the research-management divide!

Image courtesy M. Beck, TBEP

TBEP and its partners can:

- Automated reporting of CCMP indicators
- Made available through TBEP website – keeping entire workflow transparent and accessible
- Lower barriers to inclusion to make better science in less time

The open science cake

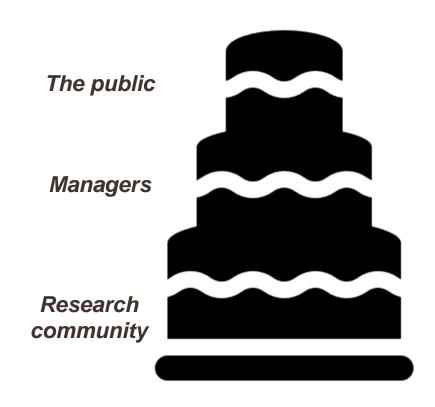


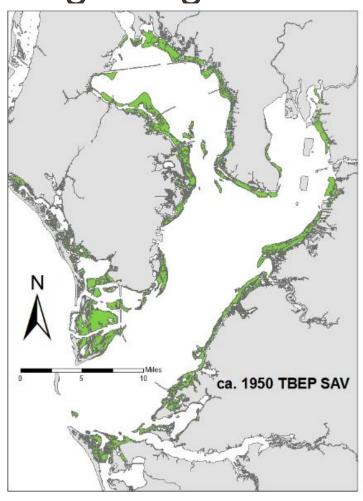
Image courtesy M. Beck, TBEP

KEY INDICATOR - SEAGRASS



- Habitat and economic value
- Straightforward indicator for public, managers, and researchers
- Science-based numeric goals & targets
- Long-term monitoring
- Adaptive management Ongoing assessment & adjustment

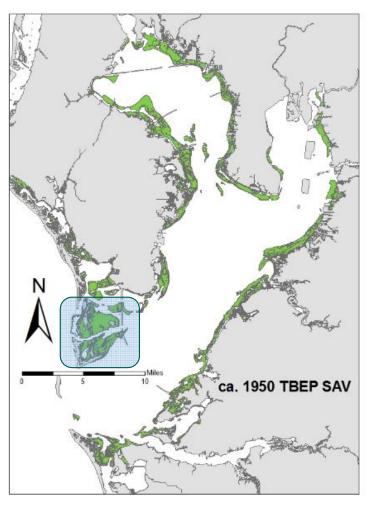
Setting Seagrass Restoration Goals – ca. 1950



Approximately 40,400 acres, however...



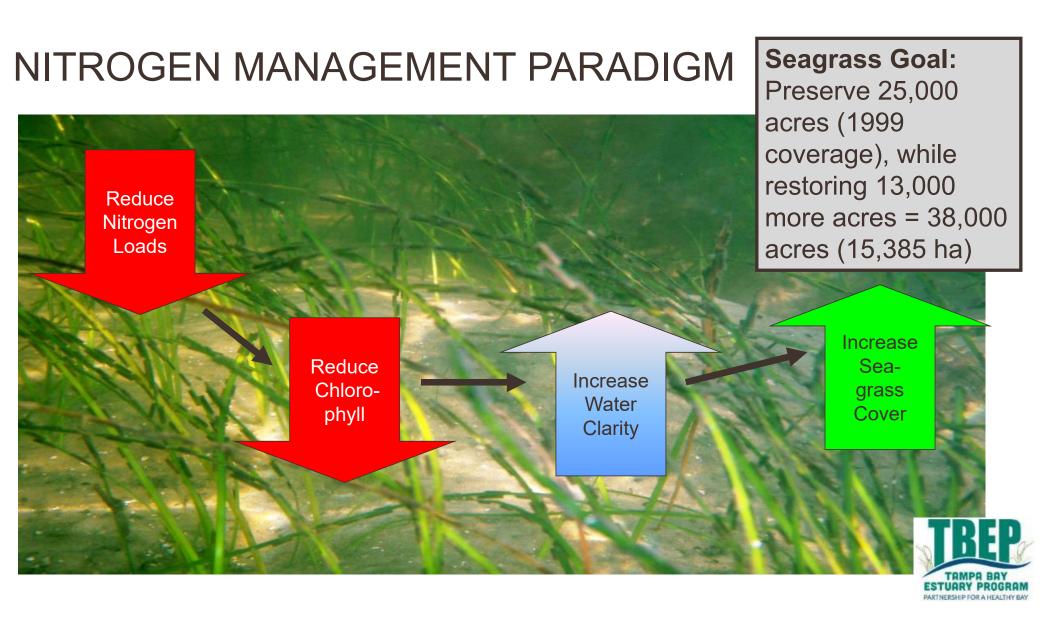
Setting Seagrass Goals – Dredge and Fill





Adjusted From 40,400 to 38,000 acres





Tampa Bay National Estuary Program Technical Publication #06-96

What can TBEP do with open science?



Tampa Bay Estuary Program Technical Report #04-00

DEVELOPING AND ESTABLISHING A
PROCESS TO TRACK THE STATUS OF
CHLOROPHYLL-a CONCENTRATIONS
AND LIGHT ATTENUATION TO SUPPORT
SEAGRASS GOALS IN TAMPA BAY

FINAL REPORTS

December 1999 and October 2000

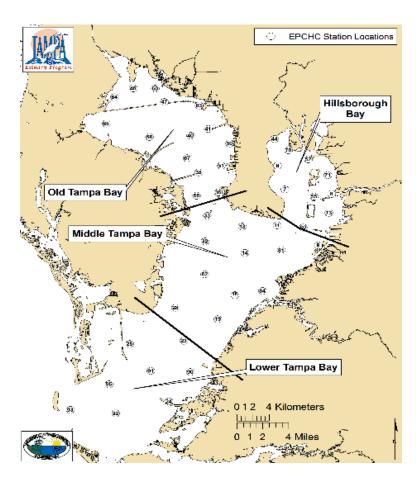


ESTIMATING CRITICAL EXTERNAL
NITROGEN LOADS FOR
THE TAMPA BAY ESTUARY:
AN EMPIRICALLY BASED APPROACH
TO SETTING MANAGEMENT TARGETS

FINAL REPORT

NOVEMBER 1996

WATER QUALITY ASSESSMENT



- Rely on long-term ambient water quality stations sampled by EPCHC
- 45 fixed stations have been monitored since 1974
- Annual averages developed from chlorophyll-a & secchi disk depth measurements



Tampa Bay Nitrogen Management Consortium

- Formed in 1998, now includes 40+ public/private partners
- Members include TBEP government and regulatory agency participants, local phosphate companies, agricultural interests and electric utilities
- Mid-1990s, collectively accepted responsibility for meeting nitrogen load reduction goals
- Consortium members may choose to implement any combination of projects to maintain loads to Tampa Bay at 1992-1994 levels

Public Partners:

- Hillsborough County
- Manatee County
- Pinellas County
- Pasco County
- Polk County
- Sarasota County
- City of Tampa
- · City of St. Petersburg · City of Clearwater
- City of Palmetto
- · City of Bradenton
- City of Largo
- · City of Lakeland
- · City of Oldsmar
- · City of Gulfport
- · City of Mulberry
- · City of Plant City
- City of Safety Harbor
- SWFWMD
- US EPA
- FDEP
- FDACS
- FDOH
- FDOT
- MacDill AFB
- TBRPC
- Tampa Bay Water
- · Tampa Port Authority
- EPC of Hillsborough County
- · AEDC of Hills. County

Private Partners:

- · Eastern Terminals
- Mosaic
- CSX Transportation
- · Florida Power & Light

- · CF Industries
- · Tampa Electric Co.
- · Kinder Morgan Bulk T., Inc.
- Progress Energy
- Tropicana Products, Inc.
- · Kerry I&F
- Trademark Nitrogen
- Yara N.A.
- · Alafiia Preserve, LLC
- Eagle Ridge, LLC
- LDC Donaldson Knoll Investments, LLC

Site Specific Thresholds for Chlorophyll-a

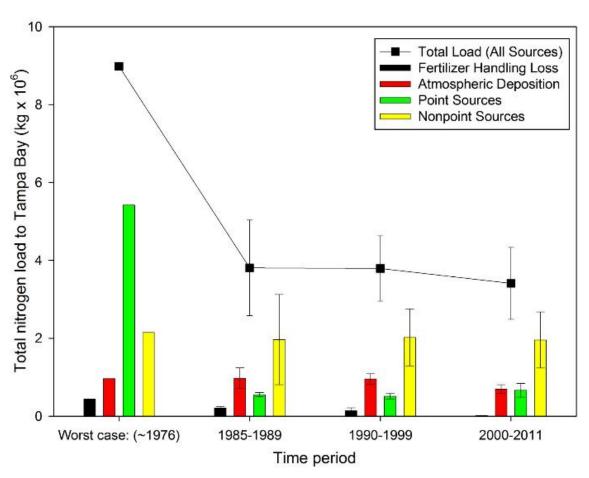
- Hillsborough Bay: 15.0 ug/L
- Old Tampa Bay: 9.3 ug/L
- Middle Tampa Bay: 8.5 ug/L
- Lower Tampa Bay: 5.1 ug/L

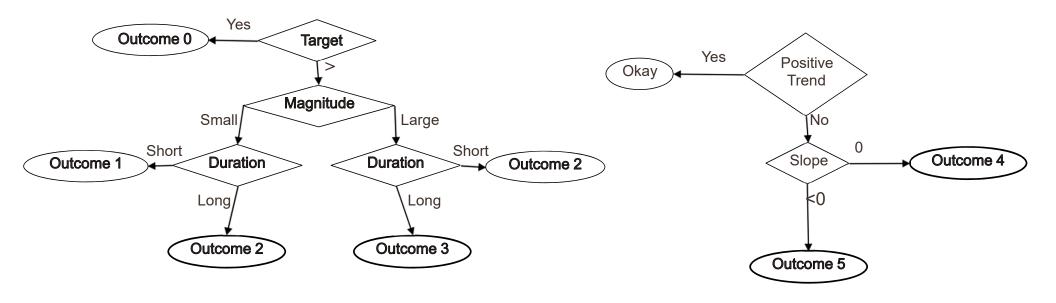


Nitrogen Management Goal:

"Hold the line" on nitrogen loading at 1992-1994 average level. To compensate for expected increase in load with population growth, reduce or preclude an additional 17 tons per year.

Reducing TN Loads to Tampa Bay





CHLOROPHYLL CONCENTRATION DECISION TREE

SEAGRASS ACREAGE DECISION TREE

MANAGEMENT ACTION CATEGORIES

Decision matrix identifying appropriate categories of management actions in response to various outcomes of the monitoring and assessment of chlorophyll-a and light attenuation data.

CHLOROPHYLL	LIGHT ATTENUATION				
30	Outcome 0	Outcome 1	Outcome 2	Outcome 3	
Outcome 0	GREEN	YELLOW	YELLOW	YELLOW	
Outcome 1	YELLOW	YELLOW	YELLOW	RED	
Outcome 2	YELLOW	YELLOW	RED	RED	
Outcome 3	YELLOW	RED	RED	RED	

"Stay the course"; partners continue with planned projects to implement the CCMP. Data summary and reporting via the Baywide Environmental Monitoring Report and annual assessment and progress reports.

TAC and Management Board on caution alert; review monitoring data and loading estimates; attempt to identify causes of target exceedences; TAC report to Management Board on findings and recommended responses if needed.

TAC, Management and Policy Boards on alert; review and report by TAC to Management Board on recommended types of responses. Management and Policy Boards take appropriate actions to get the program back on track.

Water Quality Has Improved

	Chlorophyll-a (ug/L)			
Bay Segment	2016 Average	FDEP RA Thresholds	R	
Old Tampa Bay	9.0	9.3	200 All Se	
Hillsborough Bay	11.4	15.0 TI	BEP Wa	
Middle Tampa Bay	5.7 8.		TBEP Action	
Lower Tampa Bay	3.0	5.1		

AWT & Reuse Standards Implemented

Stormwater Regulations Enacted

85/86

2006: First-time
All Segments Meet
EP Water Quality Targets

TBEP Partner & NMC Actions Implemented

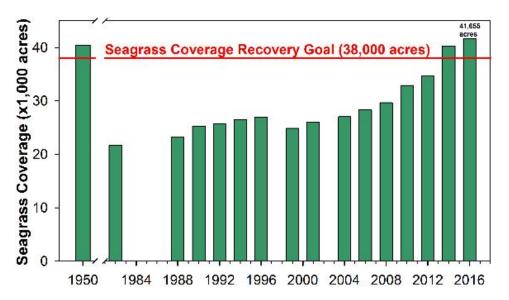
1992

	Year	Old Tampa Bay	Hillsbor- ough Bay	Middle Tampa Bay	Lower Tampa Bay
	1975	Red	Red	Red	Green
	1976	Red	Red	Red	Yellow
	1977	Red	Red	Red	Red
	1978	Red	Red	Red	Yellow
	1979	Red	Red	Red	Red
	1980	Red	Red	Red	Red
	1981	Red	Red	Red	Red
	1982	Red	Red	Red	Red
	1983	Red	Yellow	Red	Red
	1984	Red	Green	Red	Yellow
	1985	Red	Red	Red	Yellow
	1986	Red	Yellow	Red	Green
	1987	Red	Yellow	Red	Green
	1988	Yellow	Green	Yollow	Green
	1989	Red	Yellow	Red	Yellow
	1990	Red	Green	Red	Yellow
	1991	Green	Yellow	Yallow	Yallow
	1992	Yellow	Green	Yellow	Yellow
l	1993	Yellow	Green	Yellow	Yellow
	1994	Yellow	Yellow	Red	Red
	1995	Red	Yellow	Red	Yellow
	1996	Yelow	Green	Yellow	Green
	1997	Yellow	Green	Red	Yellow
	1998	Red	Red	Red	Red
	1999	Yellow	Green	Yellow	Yellow
	2000	Green	Green	Yallow	Yallow
	2001	Yellow	Green	Yellow	Yellow
	2002	Yellow	Green	Green	Green
	2003	Red	Yellow	Creen	Yellow
	2004	Red	Green	Green	Yellow
	2005	Green	Green	Yellow	Yellow
•	2006	Green	Green	Creen	Green
	2007	Green	Green	Green	Green
	2008	Yellow	Green	Green	Yellow
	2009	Yellow	Yellow	Green	Green
	2010	Green	Green	Green	Green
	2011	Red	Grean	Yallow	Green
	2012	Green	Green	Creen	Green
	2013	Green	Green	Green	Green
	2014	Green	Green	Green	Green
	2015	Yellow	Green	Yellow	Green
	2016	Yellow	Green	Genen	Green

Results? Seagrass Coverage Expansion!



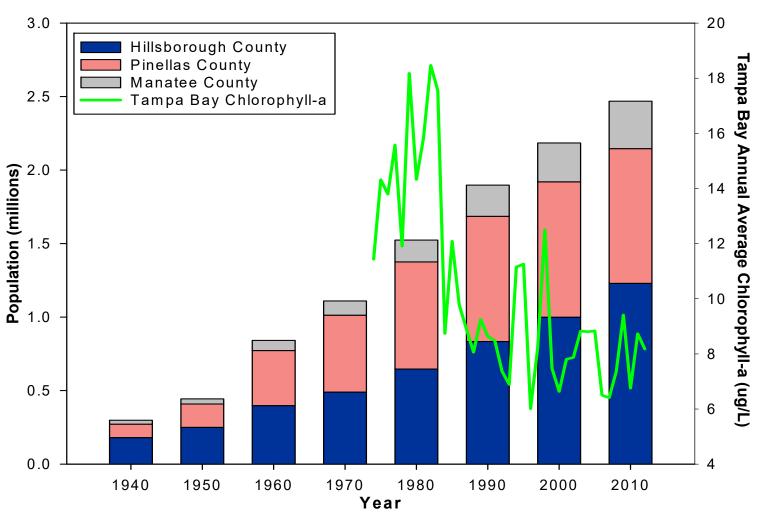
Data from SWFWMD

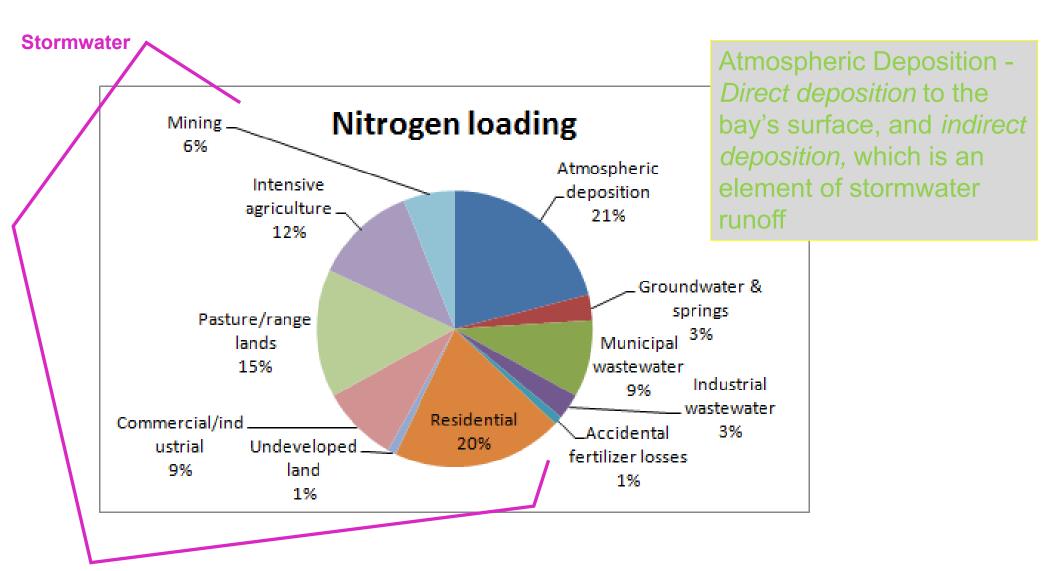


Exceeded 1950s estimate of 40,400 acres!

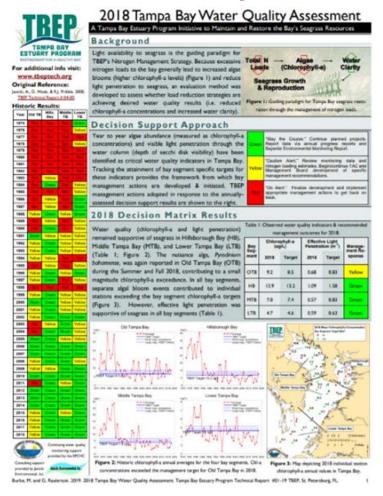
Sustaining Success

- Can recovery be maintained w/ increasing population?
- Expected to double (again) by 2050
- New Actions / Offsets will be Needed

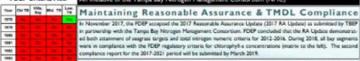




TBEP and Open Science?

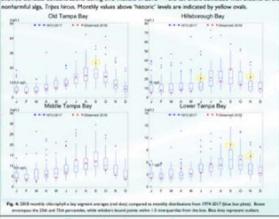


Progress Towards Meeting Regulatory Goals

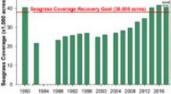


2018 Chl-a Monthly Variation Compared to 1974-2017

Chlorophyli-a concentrations were evaluated within the bay on a monthly basis during 2018 and compared to prior years' levels (figure 4). Bievated concentrations in Old Tampa Bay: and Lower Tampa Bay were primarily due to Pyriodismin betinemers and Karraio briens' blooms, respectively. Hilliborraugh Bay also showed elevated concentrations during two months in 2018 — the fall event coincided with blooms of the nonharmful alla, Figus kinox. Monthly values above "historic" levels are indicated by wellow over



Tampa Bay Seagrass Recovery



FDEP Criteria Met:

(81) (81)

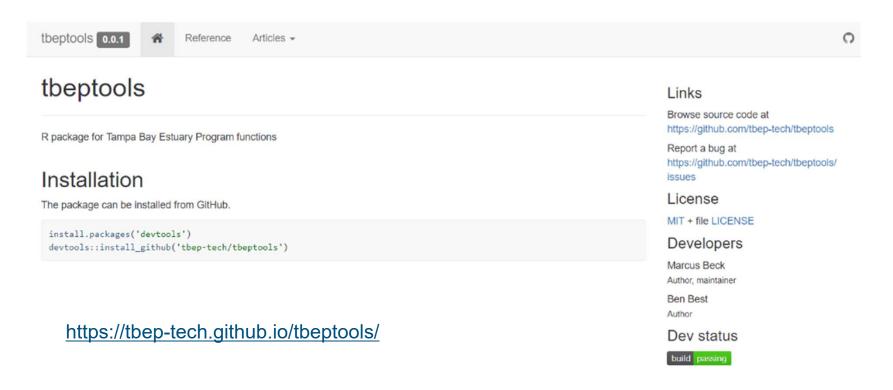
2814 2818 2819

> 1960 1984 1988 1992 1996 2000 2004 2008 2012 2014 Figure & Hossic sugmest acrees solutions for Turque Ray from 1990 2018

Tamps Buy's total sengrass coverage continues to remain above the recovery goad, though a thight decrease in acreage was observed from 2014 to 2018. The beyonds coverage was estimated to be 40,48 acres as of 2018 (Tiguer S). As in 2016, total seagrass coverage remains above between the beyonds copyed (2010) acres as serial estimated historic seagrass coverage of the 1950s (40,400 acres). The next SVFVVMD seagrass coverage estimates will be developed from serial photographs acquired over the wister 2019-20 period, following the extensive red told event that plagued the region throughout 2018 (note the 2018 coverage estimate for Timps Bay was developed prior to the red tills effecting the Bay). More information on the Buy's seagrass recovery utilizing transact moreotomic flats can also be found in TEBP Tacknools Multimour 1801.6.

What is TBEP doing with open science?

Open source software to retrieve, organize, and analyze Tampa Bay data



What is TBEP doing with open science?

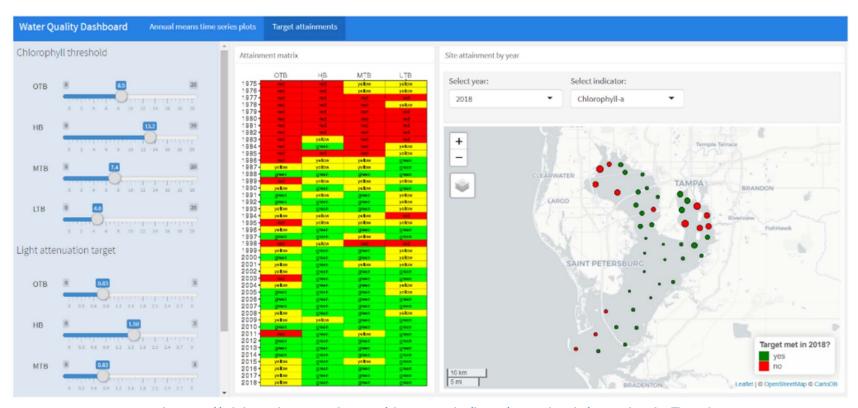
Interactive dashboards update in real time



https://shiny.tbeptech.org/tbeptools/inst/wq-dash/wq-dash.Rmd

What is TBEP doing with open science?

Interactive dashboards update in real time



https://shiny.tbeptech.org/tbeptools/inst/wq-dash/wq-dash.Rmd

MAKING SPACE FOR OPEN SCIENCE

Assess current level of open science knowledge

Communicate importance of open science to stakeholders

Develop interest and motivation for continued learning



#TAMPABAYOPENSCI

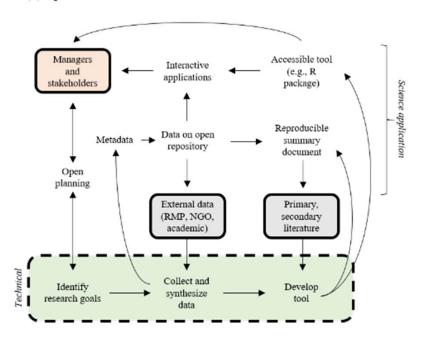
https://docs.google.com/document/d/1kSY9eSn4le4vWusCmlQMRH6YcYOq3zEn2veNrOGRy_Y/edit?usp=sharing

OPEN SCIENCE WORKSHOP





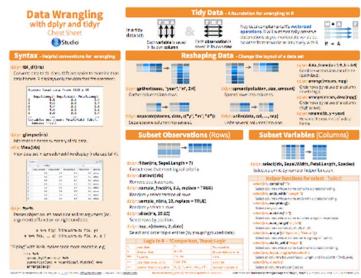
(b) Open bioassessment



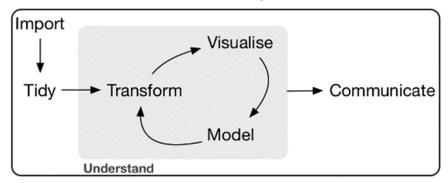
Beck: What is Open Science?



Best: What is Open Science?

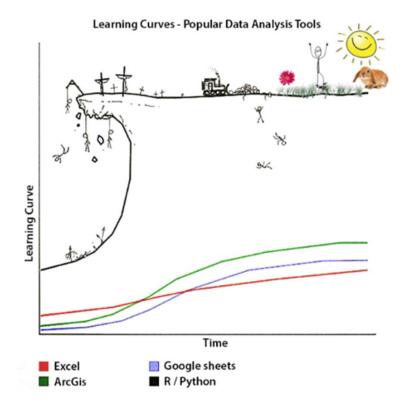


RStudio: Help > <u>Cheatsheets</u> > Data Transformation with dplyr



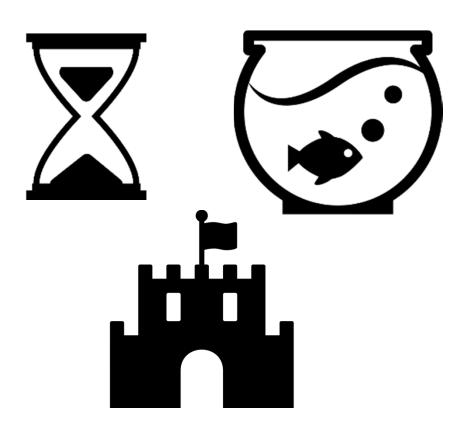
Grolemund & Wickham: https://r4ds.had.co.nz/

CHALLENGES

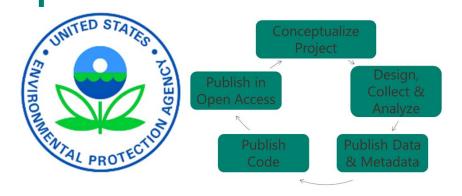


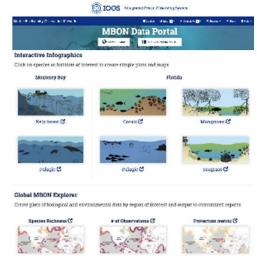
Beck: Open Science Challenges

Time, Visibility, Security



LIGHTNING ROUNDS

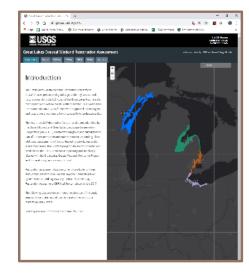




https://mbon.ioos.us

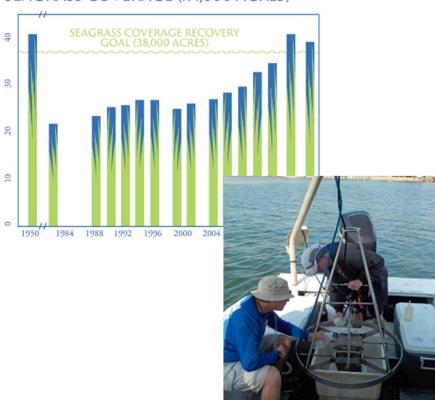


https://www.glsc.usgs.gov/MALMR/application.html



Indicators dive

SEAGRASS COVERAGE (x 1,000 ACRES)



Monitoring group	Action Plans (Bool gross)*	Montaining Question Number(i)	Indicators and Moscows.	Das Colleged	Collection Supposery. Incative, and carried year (if houses) and Sedanum Quality ()	Responsible Entity Santies	Programmy of Reporting (and names dates)	Sharing Reporting	Gops and Founding Newlo
			- T	Chemical and obstacal	nen tedensen Quality ()	no nino Lume 2)			
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Telhalay kulo gadiy (kew)	WQL 5W1, 5W8, Cacs, BD9, FH (13)	(3	Changes in concentrations and fire (training and yolung)	Chronisl and physical parameters such dainy N.D. Chlorophyll a, salamy, DO, clarky, imperation, plf, tomisericity, TNA, DOM	Questinity societies trabutaness, 2006	Manage and Proclas Country 1969 MANE	(soonda (prost funded projects)	Technical opera	Battaneous of tuburary gameter critica, estinguishes of tailed earth flats (wase quality, hybridings), labitary, long-tubura flatiding Attentiobarts (stressing entropy
National Londing	WQL 8W1, 5WK 5W1C, AUC. WW1, WW1, III (3)	7.5	Lunding more proportions, demonstric Automaco opported by Pipept	Nitrogen loading	Monthly, hip wide, 198	Newsgate Management 5 Consolidary	Beery Sycam (sension)	Reasonable Assumace Reasonable recey 5 years	Amogure inputate most, close processos to Yanga Say, influentica inputate impacto imma ISAPs and green unfastracture, continue causes program Rading
Tecal continuismen	WW2, WW5, PH2, PH4, (No.) (13)	10,11	Number of advances, number of pump-our numbers	Critinos hacteria	Monthly in quarterly, wasterward transmal plean, bettern, and ambient, 1974 (EIPCHC ambient)	Hadis Departments, FDEP, EPCSC	Mentily or quartely in FDEP (segular)	Super: epition estimates into 2022 Securiable Assumes Decraries FIREP OCULUS wobes	Selection of water trailing, contact controls
Sepis volenu	WW2, WW5, P612, P614 (1)	10	Loading estimates (autoent	National coldina historia	Occasional, tablictop	Holth Depresents	Actual Casegolas	Reposit sortem estimates, ano 2022 llaurandala Assensed Document, FDEF OCULUS rednik	Leading estimates; continue
Solvens and breaking	CoC1, CoC4(1)	7,9	Charges in beather a rectal and populations and physical or classical characteristics of technical	Softment chemistry and grain sate, benthic processorate desertion	Annual, hay scale up appropriate, 1961	EPCHC lead. Penche and Manage County suggest	Occasional special studies (prognite)	Technical reports. Tampa Bay Beathar Index	Cedater and sector doing
Manpletin (sex)	C#C4(I):	- 11	Concentration of microplanico to mater colonia	Types and sizes of microplanics	Sidentify the due year, boy wide, 2019	Ecked College (2016- 2017 goar)	Technical reports (prepular)	Technical reports	Tecoperation of emerging analytical techniques, long-teter flooring
More lid algol Waters	WQ1.8W9 (1,7)		Programmy and severity of HABIA	HAD species. concentration, timing	Weekly to morethy, buyers in and hoterets, 1990	FWKI	Weekly or m seeded	Weekly + blarts, website, technical reports	Educagement Indiages to earlier created aspecticable, continue current program familing
Senggrass личи	(0.01, ння (1.2)	12,14	Асмари	Area of NAV (area) photography integratation	Ni amend, bay solder 1982	swrwam	Th-canical (regular)		Frances and explanations for parties and communic a lamife offers, received analysis, communications program funding
Scogram transcore	WQL, BH5 (1,7)	12.14	Lingth of transect, species stells, denoty of SAV	liqueias, pecinet carres, shoot crueds, height, depth, epiphories	Annual, bay-wide on sharehoos, 1945	HUEP, ROAD FUEP, ROAD FREE FRANCE	Every 5 years (propile)	Technical reports, Hishest Master Plan Update	Coatanae carrier program. Noeling
Stydeology	WQ1, BH3, FII (1.2)	2.5	Changes on first taxing and constant	Fire characteristics	Monthly, inhunana, 1945	SVFVMD kat, USGS suggest	leterneousti every cymn (brejslar)	Minimum Tiews and Levels decisions	Potent heshay recentals



WHY ARE WE DOING THIS?

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		r		Khenind and phosini		T		B 0.07-04-0	1
Acabases vienas opinies	90g 800 504 0.004 (I)	1,4,5,6,15,20,22	Companion wilder, langer to airoger and chlorophyth s. KA approval		Monthly, buy-main, 1974	Philipprough Manuse, and Andrea Country, THEP, SAME	Award (wyolu)	Water Action for the adventure may be used report and, materiable assurance durant materials (species)	content contant curest program facing
Inhalay water quary Yang	WQL SW1. 894.0-04. 008,711 (13)		Change in constantions on the disting on tribung	Chemical and physical parameters including N, P, Chimophylin, culture, DO, chimby, imagendum, 141, restrictively, 175, DOM:	Quartery various solutions, 20%	Till descript. Memics and Parellan Granties, 1987. DAMP	Stoppie (gran- faulte menso	Indepolyman	Tell easest of talkgars named a critical marginature of small excita land power public lightness, land to be the first trans-
resident to the						-		100000000000000000000000000000000000000	the delices his mini-
Stancer Loading	WQL 5W1. 597(5W12. ADL 7W1. WWS FILID	22	Lossing most projection. Emerget: Accounts opening by PDIP	Nangea Instance	Morthly, bay-wate, 1905	Nisy tone belianment of Occasional	Does Seems (regular)	Remorable Assurance contribution to 2 years	clear premary to Tampe Sey, influentian reparties in gards from INDs and green influentians, continue arrest program furthers
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Comprehensive Conservation & Management Plan

Evaluate listed actions

Progress toward meeting goals and objectives

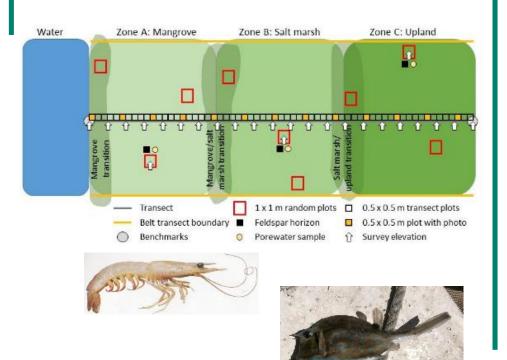
WHY ARE WE DOING THIS?

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Monitoring & Indicators
Plan

CCMP Actions
What is measured
Parameters
Frequency, location
Partners
Reporting
Funding Needs

INDICATORS



Identifying roadblocks, needs, and solutions

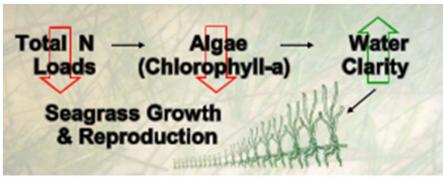


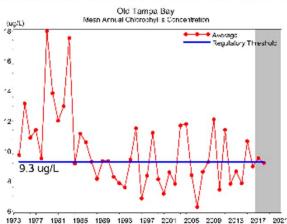




https://docs.google.com/document/d/1W3ub8RqCWoZbI2haQc1ya-v7u3iJTn3iVyixW5N1kw4/edit?usp=sharing

ICREATING INDICATORS FOR TAMPA BAY





Identify the problem

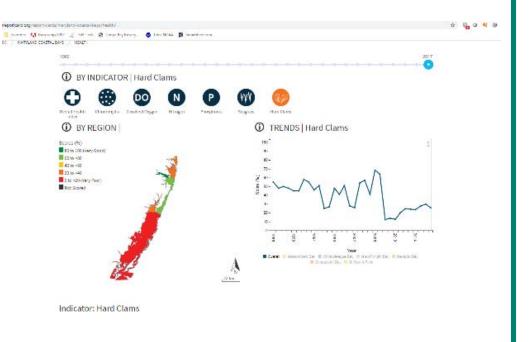
Data collection (including historical and gap)

Data Analysis

Identify management actions

Iterate!

USING INDICATORS



https://ecoreportcard.org/reportcards/maryland-coastal-bays/health/

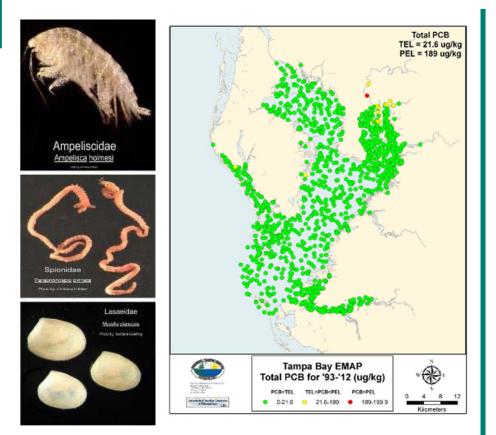
Determine useful ways to present data to interested communities

Create the roll-out plan



https://vitalsigns.pugetsoundinfo.wa.gov/

BENTHIC INDEX



Identify hotspots of sediment contamination

Assess health of benthic habitats

Bioaccumulation

Health risks to fish, other wildlife, & humans

BENTHIC

Dredge Hole	PEL Quotient	TBBI Fall 2016	TBBI Spring 2017	Silt Clay Fall 2016	Silt Clay Spring 2017	DO Mean Score	Benthic Rank
Skyway							
Causeway South	0.02	94.8	95.0	4.0	4.0	5.5	1
Venetian Isles	0.02	91.9	89.4	3.6	4.4	2.5	2
Skyway							
Causeway North	0.01	87.5	89.1	6.0	4.5	7.0	3
Georgetown	0.04	85.8	84.4	11.9	18.4	1.5	4
Culbreath Bayou							
North	0.06	85.5	85.5	12.3	10.2	4.0	5
Culbreath Bayou							
South	0.10	58.4	78.0	51.5	58.2	1.0	6
Ft. De Soto	0.01	47.2	68.3	7.4	13.2	9.0	6
MacDill Beach	0.06	49.1	84.9	21.0	30.4	7.0	8
MacDill Docks	0.17	80.1	67.4	54.5	30.5	2.5	9
Bay Point	0.10	69.3	52.7	53.9	60.2	10.0	10

Tampa Bay Benthic Index

Sediment Toxicity

Silt/clay

Dissolved oxygen

NEKTON INDEX















Fish used as indicators in

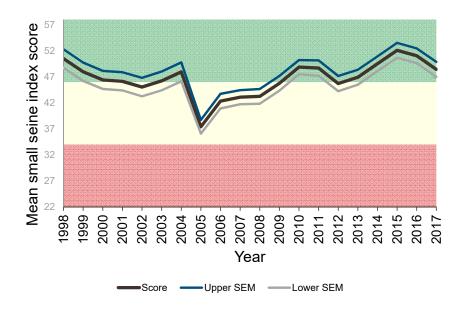
Streams, Lakes, Estuaries

Valuable for:
Monitoring

Identifying research needs

Provides simple way to communicate bay health

NEKTON INDEX



FWRI 2018. Tampa Bay Nekton Index

FWRI

Abundance, Diversity, Focal/Selected, Forage, Habitat, Estuary use

Stressor events seen with rebounds

FIM Database

HABITAT CHANGE

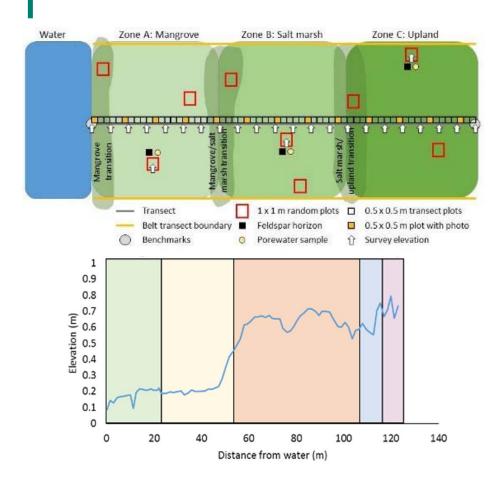


Progress in restoring and protecting key coastal habitats in Tampa Bay.

Decadal Habitat
Master Plan

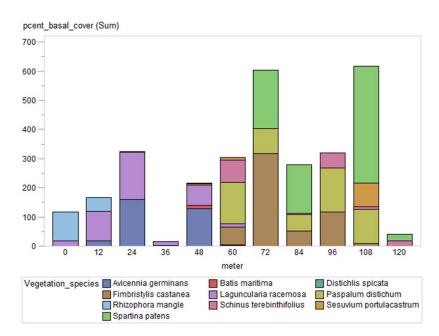
Restoration and Protection Targets

HABITAT CHANGE



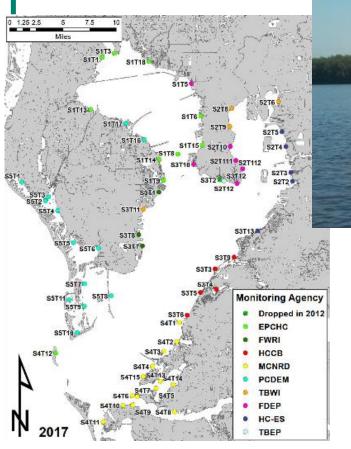
Critical Coastal Habitat Assessment

Monitor climate change impacts



FWRI 2017. Phase 2: Critical Coastal Habitat Assessment Final Report.

SEAGRASS





Seagrasses are a keystone species for TBEP

Integrator of water quality

Fisheries habitat

Extrapolate species coverage by Bay segment

SEAGRASS

302 SHERWOOD, GREENING, JOHANSSON, KAUFMAN, AND RAULERSON

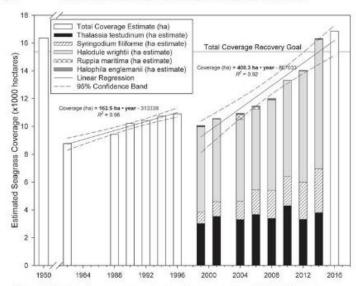


Figure 2. Historic and contemporary estimates of seagrass coverage (1950–2016). Contemporary estimates (1999–2014) of individual seagrass species cover were derived from mean baywide estimates of a particular species' frequency of occurrence, as determined from available, annually monitored transect sites (see Table 1). Linear regressions with 95% confidence intervals describing the total coverage recovery trajectories over two distinct time periods (1982–1996 vs. 1999–2016) are also included and suggest a more rapid recovery over recent periods. Data source: TBEP and SWFWMD.

Sherwood et al. 2017. SE Geographer

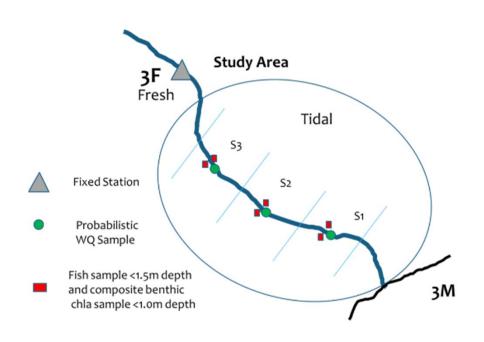
Species

Frequency of Occurrence

Deep edge

New Field Tool

TIDAL TRIBUTARIES



Janicki Environmental and Mote Marine Laboratory, 2016

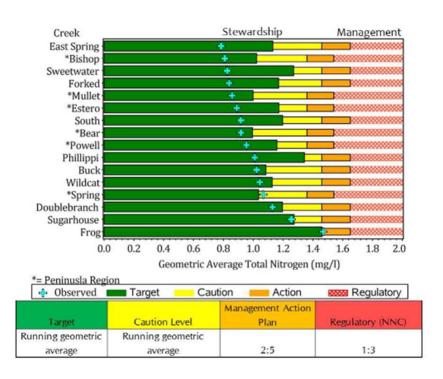
Water quality

Sediments

Fish (not current study)

SBEP, CHNEP, TBEP, Janicki, Mote

TIDAL TRIBUTARIES



Janicki Environmental and Mote Marine Laboratory, 2016

Data not regularly collected

Made some progress in water quality data, but need to create metrics for flashiness, ungaged systems

WORKSHOP FEEDBACK "Great exposure to a range tools, together

"Great exposure to a range tools, together with a solid intro of the philosophical underpinnings of Open Science"

"I was unaware of some of the data reporting capabilities that now exist. *It's exciting!*"

"I have a much *better understanding* of open science, and absolutely know where to look for resources."

WORKSHOP
FEEDBACK "I really liked the interactive nature of presentations. However, as a beginner." presentations. However, as a beginner in coding and open science at times I felt it moved at a very fast pace."

"I liked the group discussion at the end of the workshop. I would have liked to have *more hands-on* with Rstudio and Github."

> "This was a good introduction, but I think a *hands-on follow-up* is needed."

TBEP and its General and partners can: actionable Educational materials Fact sheets Web resources The public Interactive dashboards Automated report cards Managers Prioritization tools Research Technical documents community Analysis/source code Specific and Open data foundational

Image courtesy M. Beck,

TRFP

NEXT STEPS?



How do we continue the conversation?

Additional workshops?

Digging in?

Indicators and update?

http://clipart-library.com/



THANK YOU



graulerson@tbep.org



www.tbep.org

