2019 Regular Session

The Florida Senate

COMMITTEE MEETING EXPANDED AGENDA

APPROPRIATIONS SUBCOMMITTEE ON AGRICULTURE, ENVIRONMENT AND GENERAL GOVERNMENT Senator Mayfield, Chair Senator Powell, Vice Chair

	MEETING DATE: TIME: PLACE:	Wednesday, January 9, 2019 10:00—11:30 a.m. <i>Toni Jennings Committee Room,</i> 110 Senate Building Senator Mayfield, Chair; Senator Powell, Vice Chair; Senators Albritton, Bean, Berman, Broxson, Hooper, Hutson, Rodriguez, and Stewart		
	MEMBERS:			
TAB	BILL NO. and INTRO	DDUCER	BILL DESCRIPTION and SENATE COMMITTEE ACTIONS	COMMITTEE ACTION

1 Presentation on Nutrient Loads Caused by Septic Systems

Presented

Other Related Meeting Documents

NUTRIENT LOADS FROM SEPTIC SYSTEMS SUPPORT HARMFUL ALGAL BLOOMS IN FLORIDA'S SPRINGS, RIVERS, AND COASTAL WATERS





Brian E. Lapointe, Ph.D.

Appropriations Subcommittee on Agriculture, Environment, and General Government



FLORIDA ATLANTIC UNIVERSITY*

Highlights of Talk

- History, nutrients, HABs
- Early research in the Florida Keys
- Loxahatchee River
- Martin County, St. Lucie Estuary
- Indian River Lagoon
- Hurricane Irma, Caloosahatchee River, Lee County
- Florida Chamber video: The 2018 Algae Crisis and Florida's Wastewater Infrastructure Deficit



2.5 km



U.S. Fish & Wildlife Service

Arthur R. Marshall Loxahatchee National Wildlife Refuge





Art Marshall



Algae bloom



Dr. John Ryther: Seminal Work on Nitrogen Enrichment and Harmful Algal Blooms



Biological Bulletin 106: 198-209 (1954).

THE ECOLOGY OF PHYTOPLANKTON BLOOMS IN MORICHES BAY AND GREAT SOUTH BAY, LONG ISLAND, NEW YORK¹

JOHN H. RYTHER Woods Hole Oceanographic Institution, Woods Hole, Massachusetts



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Nitrogen Acquisition and Utilization by Algae



Source: Glibert et al. 2005

Human Alteration of the Global Nitrogen Cycle



Eutrophication and Harmful Algal Blooms



- Phytoplankton and macroalgae that cause harm by direct toxicity or indirectly by excessive biomass
- Impacts include mass mortalities of wild and farmed fish/shellfish, human illness and death, death of marine mammals, seabird
- Alteration of marine ecosystems, "dead zones"



HABs Expanding Globally in Past Five Decades



We now have:

- more HABs
- more toxins
- more toxic algal species
- more fisheries affected
- more areas affected
- higher economic costs
- more public health impacts

On-Site Treatment and Disposal (OSTDS) Systems: "Septic Systems"

 Permitted by FDOH through Chapter 64E-6
Florida Administrative Code: "Standards for Onsite
Sewage Treatment and
Disposal Systems"

 Septic systems provide primary treatment and are not designed to remove nutrients, bacteria, viruses, pharmaceuticals, or organic wastewater compounds



Septic Systems: A Widespread Nitrogen Source

Wakulla Springs

FDEP, 2015

Failure in Required Distance (24") Between Septic Drainfield and Seasonal High Water Table: Charlotte County

Gracilaria Nutrient Study: Big Pine Key, 1983

HIGH

Phosphorus LOW

HIGH

NITROGEN

LOW

HIGH

PHOSPHORUS LOW

0.06

0

HIGH

Nitrogen MED

LOW

Septic System - Water Quality Study: 1986-1987

5,000-fold DIN enrichment; 400-fold SRP enrichment; N:P ~ 100:1

Lapointe, O'Connell and Garrett. 1990. Nutrient couplings between OSDS, groundwaters, and surface waters of the Florida Keys. Biogeochemistry: 10: 289-307.

Nutrient Monitoring at Looe Key National Marine Sanctuary - 1984 to Present

The Role of Nutrients in Coral-Algal Phase Shifts

Lapointe, B. E., Littler, M. M. and D. S. Littler. 1996. Int. Coral Reef Symp. Panama.

Florida Keys National Marine Sanctuary Act-1990

Marine sanctuary **Panel: Water** quality is top local concern

said.

By Marilyn J. Tarnowski Citizen Staff Writer

MARATHON - A 22-person MARATHON — A 22-person advisory panel has, agreed that water quality is the single most important issue underpinning the management plan being pre-pared for the nascent Florda Keys National Marine Sanctuary. The same panel also found available research and data are scant and inadequate for in-formed decision-making about what affects marine life and ecolwhat affects marine life and ecol-

ogy in the Keys. The group is chartered with advising the National Oceanic and Atmospheric Administration of user-group concerns within the sanctuary. In a two-day ses-sion last week in Marathon, the advisory panel reviewed a near-final report that summarizes existing research and known quantities related to the water-quality of the sanctuary and adjacent waters.

waters. The management-plan writing project now moves into a second phase: A Water Quality Steering committee comprised of NOAA, the federal Environmental Pro-tection Agency: and state and lo-cal agencies, will develop water quality monitoring and research

programs. The advisory panel, said member George Barley of Orlando, cautioned the Water Quality Steering Committee that its first report may give the impression that ample information is available on water-quality impacts. "We don't agree there's ade-

quate data," Barley said. Barley said his committee advocated research and monitoring for water entering the sanctuary and what effect deep sea salty water and freshwater runoff from the Everglades has on sanctuary

ecology. "The "The South Florida Water management district says it is monitoring the situation, but we are skeptical about that," Barley

said. In 1991, Congress funded \$390,000 for Phase I work, the compilation of existing data released earlier this month and released earlier this month and re-viewed by the user groups last week. For 1992, the federal gov-ernment has funded \$625,000 for the development of research and water quality monitoring projects, the heart of Phase II. In addition, a Gulf of Mexico Decised will odd \$620,000 for deer Project will add \$50,000 for dem-onstration water quality pro-jects, EPA Regional Administra-tor Greer Tidwell said.

The user groups also advo-cated a so-called ecosystem ap-proach to research and monitor-ing, which would identify pollu-tion sources in local and adja-cent waters. The water concerns must not stop at sanctuary boundries, Mark Robertson of The Nature Conservatory said. Tidwell said that enlarged scope was already planned. The advisory committee advo

cated active pursuit of new technology appropriate to each of the several sources of water degra-dation.

"This group is the community's link in the development of the management plan." Billy Cau-sey, manager of the sanctuary project, said Thursday after an information session at Buccaneer Lodge. "Now that all of the public

scoping meetings have been held, time is tighter now. The ad-visory council is here to convey the wishes of the constituen cies," he said. The entire man-agement plan must be finished by June 1993.

The Florida Keys National Ma-rine Sanctuary was created by Congress Nov. 16, 1990, to be managed by the NOAA within the Department of Commerce. Legis-lation included a first-time mandate that the program include water quality program administered in conjunction with the EPA.

FKNMS: "Send Us More Water!"

FLORIDA, 5B DEATHS, 4B

The Miami Herald

Taylo Slouat

Keys crisis Chiles views bay's nemesis

By HEATHER DEWAR Herald Staff Writer

Florida Bay is in the midst of an environmental crisis that threatens the Keys' \$600 million fishing and tourism industries, Gov. Lawton Chiles said Friday. He pledged state money for research in the region but warned that there is no quick fix for the bay's problems.

In a one-hour helicopter tour, Chiles surveyed vast tracts of dying sea grasses and the spreading murk of a huge algae bloom that is clouding once-sparkling bay waters all the way from Everglades National Park to Marathon in the Middle Keys.

"What the governor saw today was an environmental collapse unprecedented in Florida history," said Orlando businessman George Barley, who leads a citizens' task force to protect the reef and helped arrange Friday's tour. "It's a national catastrophe.

horizon.

industry.

Just 50 miles south of down-town Miami, Florida Bay is one of the largest sea grass meadows in North America. It makes up one-third of Everglades National

Park. It is the nursery for Flori-Chiles said. Keys tourism income da's largest commercial fishery is conservatively estimated at and an internationally known \$350 million a year. magnet for sports fishermen.

Chiles said there isn't much The bay has been in a mysteristate officiáls can do right now to ous, gradual decline since at least save the bay because scientists 1987. But in the past six months don't know enough about the its waters have taken a dramatic ecosystem when it was healthy. turn for the worse. Sea grass die-He said his administration will off and algae blooms are spreadlobby Congress for research ing faster than ever. And scienmoney and will provide some tists now suspect the bay's troustate money for science within bled waters are reaching the Keys' unique offshore coral reefs. the next few weeks. He did not offer a dollar figure. Chiles, who last visited the bay "We've got to find out what's

three years ago, said he was star-tled by what he saw Friday. "I going on out there, and we've got to find out in a quicker way," he said. "You can't spend forever studying it, but you have to know remember the waters being much clearer," he said. "You can see some major changes out there. what the problem is before we The grass beds are dying, and know where to put our there's an algae bloom that you resources."

can see going all the way to the Scientists say no one theory can explain all of the bay's prob-"It's already having an effect lems. They suspect the main culon the fishing industry. . . . And prit is a critical lack of fresh the way it's going right now, it's water brought on by human tamgoing to go out to the coral reefs. If we kill that, that's our tourist pering with the natural flow from the Everglades, which has been cut to one-tenth of what it was The bay supports a \$250 milbefore drainage and developlion a year fishing industry,

Area with extensive sea grass die-off or algae

SOURCE: Everglades National Park

LEGEND

bloom

CRISIS IN FLORIDA BA Since January, Florida Bay's health has taken a turn for the worse.

Most scientists blame a shortage of fresh water

that once flowed from the Everglades

the open ocean. On Friday, water managers turned on a new portable pump that will increase the flow of fresh water into Taylor Slough,

once the bay's main water source. said But Chiles and South Florida

Water Management District board chairman Alan Milledge both called the pump a "Band-Aid" that won't be enough to solve the bay's problems. Both warned it will probably be

10

GRASSY

I ONG KEY

SABLE

MARATHON KEY

THE 'DEAD ZONE'

Buttonwood Canal

Flamingo visitor center

years before the bay's decline can be reversed. "We don't even know if it's reversible," Chiles

But Dick Ring, the new super-

PATTERSON CLARK / Miami Herald staf intendent of Everglades National Park, said he believes the bay can

Atlantic Ocean

...

be saved "I'm encouraged because now there are a lot of people who understand the problem and are willing to work on it," Ring said. "My concern is that it not be a bunch of different agencies operating on their own and maybe operating at cross purposes

"Most scientists blame a shortage of fresh water that once flowed from the Everglades..."

"The Corps of Engineers drained the Everglades and the National Park is starved for water"

The opposite is true

The flow into the Park has been measured by the USGS every day since Oct. 1st, 1939

"We should send the Lake Discharges to Florida Bay"

Flow from the Central Everglades does not go to Florida Bay and the Park has made it very difficult to put water in Taylor Slough

Florida Bay/Florida Keys Algal Blooms: 1991-1995

Shark River Flow & DIN at Looe Key: 1984 - 2014

Shark River Flow Correlates Significantly With Chlorophyll *a* at Looe Key

Red tide fish kill the worst in years Algae scourge rounds the Keys

By NANCY KLINGENER Herald Stalf Writer 2/22/15

MARATHON - Red tide, a massive rusty algae bloom, has moved from Florida's west coast through the Gulf of Mexico, rounded the Keys and is heading up the Gulf Stream, killing hundreds of thousands of sea creatures in its path.

"It's killing everything from octopus to tarpon," said Marathon fisherman Karl Lessard. "It's the worst red tide I've seen in 25 years in terms of fish being killed."

It's the same red tide that closed Sarasota-area beaches and shellfish beds last September, state biologists said Tuesday.

It's going up the

Gulf Stream.

everything

ravaging

tarpon.'

Over the last several weeks, researchers and commercial fishermen have tracked the tide's progress through the Gulf and into the Atlantic side of the peninsula. Red tide is formed by

naturally occurring algae from octopus to that make water look green to brownish red. The single-celled algae

organisms emit a poison that attacks the nervous system of fish and accumulates in such filter-feeding animals as clams and oysters.

Red tide killing Keys fish By JON STEINMAN Crizen Stall Writer Monroe County fisherman began f t's caused one of the largest fish MARATHON - A red tide has reached the Keys, leaving a trail of dead fish and worried fishermen in

Water Management District and DEE looking for answers.

its wake. "It's caused one of the largest "It's caused one of the arrest (fish kills) I've ever seen," said Karl Lessard, commercial fisher-man and co-founder of the Water Quality Joint Action Group. The Red Tide -- which gets its

name from the reddish hue in the water caused by millions of toxic microscopic organisms known as dinoflagellates - is a relatively common occurrence around the globe, according to state Depart-ment of Environmental Protection

reporting dead fish floating on the surface of Florida Bay, with some reports coming from as far south kills I've ever seen. as 20 miles north of Key West, last - Karl Lessard DEP officials appounced that Water Quality Joint

dinoflagellates carried south from waters off Sarasota are the cause Action Group of the deaths, and they have alerted officials as far north as North Carolina to warn them of the scientists studying the event. red tide's progress. The brand of dinoflagellate that Though estimates of how many ish have perished as a result of the tide are varied, worried fisher-men contacted the South Florida

is periodically washed around the Keys by Gulf of Mexico tides is fa-tal to fish and some sea birds, but not to humans. Humans coming in contact with the substance could

suffer migraine headaches or diarsuper migrane needacres or diar-rhea, among other symptoms. Red tides in other parts of the world, such as New England, Ma-laysia, Japan and California, can be fatal to humans, said Karen Steidinger, a DEP senior research reineritie who has schuling Elonidat scientist who has studied Florida's red tide for 30 years.

KEXWEST

Intrusion of ocean waters into Gulf waters off Florida's West Coast acts as an alarm clock for dinoflagellates there, waking them out of hibernation, she said.

The toxic micro-organisms quickly infect shell fish beds and bottom-feeding fish, and remain in the food chain. The tide that is now

floating off the Keys began in September, she said.

Tuesday February 14, 1995

25 cents

"The main thing you see with red tide is fish kills," Steidinger said. "But red tide doesn't de-oxygenate the water, causing fish to suffocate. It causes respiratory failure in fish."

Steidinger has documented red tides through the area in 1976, 1980, 1983 and 1987. In 1987, the tide caught ocean currents as far north as North Carolina. Eddies off the Gulf Stream, the

owerful East Coast current, bring the dinoflagellates close to shore, disasspreading the organisms' disas trous effects

Bay remedy could be backfiring

y MARC CAPUTO lizen Staff Writer

KEY WEST - Because 215 ianatees suddenly died this par - 152 since March 5 -

ome scientists are blaming the .rge red tide off Southwest Flora, according to the Associated ress. Meanwhile, scientists om around the world say the id tide indicates a deeper probm within Florida's ecosystem, hich will ultimately lead to the

reef.

The algae - a dinoflagellate

death of Florida Bay and the called Gymnodinium breve also produces an aerosol toxin A red, tide, a harmful algae bloom, produces toxins that poiwhich can cause human and animal respiratory illness and person shell fish and cause mass haps even death if inhaled, ECOmarine animal mortalities, says HAB savs. a national research study entitled the Ecology and Oceanogra-phy of Harmful Algal Blooms.

Freshwater flows may be causing red tide

The AP reports some rescued manatees have shown the effects of inhaling the algae's toxic aerosol. The Gulf of Mexico has had

high concentrations of G. breve in the past 18 months and a manatee die-off in 1982 was attributed to a red tide But scientists from the Florida

Marine Research Institute, the U.S. Fish and Wildlife Service and the Center for Discase Control and Prevention have yet to proclaim the red tide the definite

culprit for the manatee deaths the AP says. Dave Tomasko, of the South

west Florida Water Management District, says the current year and a half long red tide has af fected the quality of the waters from Sarasota County to Collier County. He says the manatee deaths may be a result of manatees eating a diet of marine ani-

See BAY, Pace 8A

404% Increase in Coral Disease: 1996-2000

Increased DIN:SRP Reduces Resistance of Corals to High Light and Temperature Stress in the FKNMS

"Chlorophyll a" Composite Dec 3-6, 2013

National Academy of Sciences CROGEE FL Bay Report - 2002

Naples | Naples Daily News

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Report: Everglades restoration may harm Florida Bay

Friday, August 9, 2002

By JENNIFER SERGENT, sergentj@shns.com

The widely held perception that the murky, ailing Florida Bay will recover when the Everglades restoration sends more fresh water there could be wrong, a group of scientists wrote in a report released Thursday.

Cudjoe Regional Advanced WWTP

Jupiter Creek Septic Tank/Water Quality Study in 1995: Loxahatchee River District

Results of Jupiter Creek Study

- Interaction of groundwaters and Jupiter Creek influenced by tidal pumping, elevated groundwater tables in wet season
- "Failing" septic tanks caused ammonium buildup in groundwaters and Jupiter Creek
- δ^{15} N values (o/oo) in shallow groundwaters and Jupiter Creek > + 3 o/oo, characteristic of sewage
- Higher fecal coliforms in wet season compared to dry season in both groundwaters and Jupiter Creek
- High concentrations (> 1,000 ug/kg) of coprostanol, a fecal sterol, present in "black mayonnaise" sediments

St. Lucie Estuary Septic Study: 2005-2006

- Sampled in June & November 2005, March 2006
- Freshwater runoff caused low salinity and DO, high nutrients, turbidity, coliforms
- Highest turbidity, nitrate, and TN in South Fork (C-44); ammonium and phosphate highest in North Fork (C-23, C-24)
- Highest nutrients and coliforms near residential areas with high densities of septic tanks
- Toxic *Microcystis* blooms in Manatee Pocket in 2013 had high δ^{15} N values (+ 8.6 o/oo) in the range of sewage nitrogen

Indian River Lagoon: 2011-2016

20 IRL Sites + 4 Reference Sites

• Objectives: Use multiple lines of evidence (dissolved nutrients, C:N:P and δ^{15} N in macroalgae) to assess spatial/temporal patterns in nutrient pollution, N- vs. P-limitation of algal growth, and N sources fueling eutrophication in the IRL.

• Goal: Improve water quality in the IRL by providing high-quality, userfriendly data to resource managers and policy-makers.

HABs in the Indian River Lagoon & St. Lucie Estuary

Total Dissolved Nitrogen in the IRL Segments

Indian River Lagoon: Population Growth (300,000 septic systems) and Chlorophyll *a*

¹Chl *a* data from SJRWMD; population data from Florida Demographic Estimating Conference, December 2015 and UF, BEBR, Florida Population Studies, Volume 49, Bulletin 174, January 2016.

Macroalgae as Bio-Observatories in the IRL

Stable N Is

9

7

6

3

2

1

0

Roberts

Bay,

Florida

Boston

Harbor,

MA

IRL,

Florida

(%) N518 5 4

Harmful Algae 43 (2015) 82-102

Contents lists available at ScienceDirect Harmful Algae

age N Source

Brian E. Lapointe*, Laura W. Herren, David D. Debortoli, Margaret A. Vogel Harbor Branch Oceanographic Institute at Florida Atlantic University, Harmful Algal Bloom Program, 5600 US 1 North, Fort Pierce, FL 34946, USA ABSTRACT Nutrient pollution is a primary driver of eutrophication and harmful algal blooms (HABs) in estuaries and coastal waters worldwide. In 2011-2012, 20 sites evenly distributed throughout the 251-km long Indian River Lagoon (IRL) were assessed during three sampling events for dissolved nutrients (DIN, SRP, TDN, TDP) and chlorophyll a. Benthic macroalgae were also analyzed for 813C, 815N, and C:N:P contents to identify potential nutrient sources and gauge the type and degree of N and P limitation. The mean DIN and SRP concentrations throughout the IRL were high, averaging 4.24 ± 0.45 and $0.68\pm0.06\,\mu$ M, respectively, explaining the widespread occurrence of HABs during the study. High TDN concentrations (up to 152 µM) and TDN:TDP ratios (>100:1) in the poorly flushed northern IRL, Mosquito Lagoon and Banana River segments reflected the accumulation and cycling of N-rich groundwater inputs that produce Plimitation. These enriched nutrient conditions were associated with unprecedented chlorophyll a concentrations (>100 µg/L), dominated by Resultor sp. Ø. Moestrup in the Banana River in 2011 and Aureoumbra lagunensis D.A. Stockwell, DeYoe, Hargraves and P.W. Johnson in the Mosquito Lagoon and northern IRL in 2012. C:N, C:P, and N:P ratios in macroalgae averaged 15.9, 698.9, and 40.6, throughout the IRL, respectively; significantly higher C:P and N:P ratios in the northern IRL segments suggested strong Plimitation in these N-enriched waters. Macroalgae 815N values were enriched throughout the IRL (+6.3%) and similar to values reported for macroalgae from other sewage-polluted coastal waters. Because pointsource sewage inputs to the IRL were largely eliminated through the IRL Act of 1990, these results suggest that non-point source N enrichment from septic tanks (~300,000) represents a significant and largely ignored N-source to the IRL. The high degree of sewage N contamination of the IRL, combined with recent HABs, including toxic ecotypes of the red macroalga Gracilaria tikvahiae McLachlan, seagrass loss, and wildlife mortality, indicates a critical need for improved sewage collection and treatment, including nutrient removal.

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CrossMark

1. Introduction

Coastal and estuarine ecosystems are among the most productive ecosystems in the world, providing invaluable ecological services to human populations. However, many of these ecosystems are being degraded as a result of expanding human activities such that their ability to sustain future societal needs is now at risk. Humans have greatly increased the concentrations of nitrogen (N) and phosphorus (P) in freshwaters flowing into the coastal zone (Nixon, 1995; Vitousek et al., 1997; MEA, 2005), exacerbating eutrophication and habitat loss (NRC, 2000; Bricker et al., 2007). As a result, nutrient enrichment is now a major agent

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da dei eral10.1016/j.b.d.2016.01.004

of global change in coastal waters, linking an array of problems along coastlines, including eutrophication, biodiversity loss, harmful algal blooms (HABs), "dead zones," emerging marine diseases, fish kills, and loss of seagrass and coral reef ecosystems (NRC, 2000; Howarth and Marino, 2006; Rockström et al., 2009). Located along Florida's east-central coast, the Indian River Lagoon (IRL) is a shallow (mean depth ~0.8 m) and narrow (~3 km wide) bar-built estuary extending 251 km between Jupiter and Ponce inlets (Steward and VanArman, 1987; Fig. 1). Because the IRL comprises a transition zone between temperate and subtropical biomes, the IRL is considered a regional-scale ecotone and one of

the most species-diverse estuaries in North America (Swain et al., 1995). The basin includes the Mosquito Lagoon (ML) and Banana River (BR), which are located in the northern regions of the IRL. The climate of the IRL basin is humid subtropical with distinct dry and wet seasons. Rainfall within the basin averages 140-150 cm/yr,

δ ¹³ N Level
+3 to +5
+5 to +28
+2
0
-3 to +2
-2 to +2
0 to +2

d + 6.3 o/oo

able to other areas contamination

Indian River County Sampling

- October 2013 (wet season)
- March 2014 (dry season)
- Surface water
- Groundwater
- Reference Sites

Dissolved N and P Levels in Natural Vs. Residential Areas

A Human Tracer: Sucralose

Macrophyte $\delta^{15}N$ Reveals Septic System N-Loading to Central IRL

Nitrogen Isotopes in Primary Producers by IRL Segment

Barile Study: Spatial Analysis of Nitrogen Isotopes

Brown Tide in Northern IRL: Winter 2016

El Nino Causes Unusual Rainfall in late 2015/2016: LOBO Data from Sebastian Inlet

Comparing 2012 & 2016 IRL Brown Tides

Microcystis Blooms in the St. Lucie Estuary: 2005, 2013, 2016, 2018

Martin County Watershed to Reef Study: 2015

Sewage Pollution Indicator – $\delta^{15}N$ Macroalgae

*Values > 3 o/oo indicate wastewater contamination Nearshore reefs: increasing abundance of algae, urchins, and boring sponges

Sewage Pollution Indicator – Sucralose

Freshwater Discharges Impact SLE Between January and November 2016

Microcystis Bloom Supported by Sewage Nitrogen in the **St. Lucie Estuary**

to 32.0 μ g/L) and adjacent surface waters (up to 5.5 μ g/L), and 3) δ^{15} N values in surface water (+7.5 °/₀₀), macroalgae (+4.4 $^{\circ}/_{oo}$) and phytoplankton (+5.0 $^{\circ}/_{oo}$) were within the published range (>+3 $^{\circ}/_{oo}$) for sewage N and similar to values in OSTDS-contaminated groundwaters. Measured δ^{15} N values in M. aeruginosa became increasingly enriched during transport from the C-44 canal (~5.8 °/100) into the midestuary (~8.0 °/00), indicating uptake and growth on sewage N sources within the urbanized estuary. Consequently, there is a need to reduce N and P loading, as well as fecal loading, from the SLE watershed via septic-to-sewer conversion projects and to minimize the frequency and intensity of the releases from Lake Okeechobee to the SLE via additional water storage north of the lake. These enhancements would improve water guality in both the SLE and Lake Okeechobee, reduce the occurrence of toxic harmful algal blooms in the linked systems, and improve overall ecosystem health in the SLE and downstream reefs. © 2017 Elsevier B.V. All rights reserved.

Widespread HABs Followed Runoff From Hurricane Irma

Reductions in Florida's Fertilizer Loading

- Farm Sources (80%) FDACS: BMPs for TMDL mandate
- Non-Farm Sources (20%) Turf fertilizer rule (2008) FDEP 2008 Model fertilizer ordinance, "rainy season" blackout FDACS: Comm. fertilizer license UF/IFAS BMP education programs
- Significant reduction in fertilizer loads

Irma & Catastrophic Wastewater Infrastructure Failure

Bloomberg

Cities Swimming in Raw Sewage as Hurricanes Overwhelm Systems

By Jennifer A Dlouhy and Ari Natter September 13, 2017

business

Treatment plants unable to cope with influx from Irma, Harvey

https://www.bloomberg.com/news/articles/2017-09-13/cities-swimming-in-raw-sewage-as-hurricanes-overwhelm-systems

Hurricane Irma gives most of Florida bath of raw sewage

Kevin Spear Orlando Sentinel September 22, 2017

The Washington Post

In Irma's wake, millions of gallons of sewage and wastewater are bubbling up across Florida

by Steven Mufson and Brady Dennis September 15, 2017 https://www.washingtonpost.com/news/energy-environment/wp/2017/09/15/in-irmas-wakemillions-of-gallons-of-sewage-and-wastewater-are-bubbling-up-acrossflorida/2tut term=.2c2105beac67

Florida: \$18.4 billion in wastewater infrastructure upgrades needed

Florida N-Loading: Fertilizers* vs. Septic Systems

*Shaddox and Unruh, 2017, Florida Fertilizer Usage Statistics, IFAS.

Florida Red Tides Supported by Land-Based Nitrogen Runoff

Microcystis Blooms in Lake Okeechobee in 2018: Look to the North

Lake O Flows to Downstream Estuaries: < 30%

Blue-Green Algae in Cape Coral Canals: July 2018

Successful Restoration: Tampa Bay, Sarasota Bay

• Watershed became urbanized between 1950s and 1980, algal blooms developed and seagrasses declined

• Grizzle-Figg Act led to N removal from wastewater

• Algal blooms subsided, seagrasses expanded and have reached 1950s acreage

Resolving Brevard County's Sewage Problem

Brevard County must re-prioritize its Indian River Lagoon Plan

Whereas, the Indian River Lagoon continues to collapse despite considerable efforts by Brevard Co. over the past decade to mitigate nutrient loads through stormwater management and ordinances to reduce fertilizer applications.

Whereas, Severe Harmful Algal Bloom (e.g. Brown Tide) events followed heavy rain events in the winter El Nino 2015-16 and following Hurricane Irma in 2017.

Whereas, Brevard County's centralized sewage infrastructure routinely fails during heavy rain events, where 10's of millions of gallons of untreated sewage are released into the Lagoon. Septic systems malfunction during heavy rain events delivering unmitigated loads. And antiquated municipal wastewater infrastructure suffers breaks, leaks and discharges randomly over time.

Whereas, the Sarasota Bay and Tampa Bay National Estuary Programs (NEPs) made a priority of significant municipal wastewater treatment plant upgrades and septic-to-sewer retrofits in restoration plans. As a result, water quality, seagrass coverage, and shellfish have recovered to 1950's levels in both estuaries.

As such, the Brevard County Commission must review their Indian River Lagoon Plan and reprioritize expenditure of the estimated \$430 million in tax revenue, and alternatively, like the Tampa Bay and Sarasota Bay NEP's, Brevard County must make wastewater infrastructure upgrades to:

- 1) Advanced Wastewater Treatment (AWT maximum nutrient removal)
- Expand Wastewater Treatment Facility (WWTF) Capacity to accommodate future population growth and to septic to sewer retrofits
- Septic-to-Sewer program- retrofit a significant portion of Brevard homes on septic systems to sewer in areas with high water tables and adjacent to surface waters

Meaningful Wastewater Treatment facility upgrades and Septic-to-Sewer retrofits will cost more than the current \$140 million infrastructure plan, estimated closer to \$1 billion

- 1) A Brevard County Wastewater Infrastructure Master Plan (cost= \$1 billion, \$3 billion- all IRL: source: IRL-NEP)
- 2) WWTP upgrades to Advanced Treatment (AWT), infrastructure upgrades (collection system, lift stations, etc.)
- 3) Significant septic-to-sewer-upgrades

Brevard County commissioners approve fivemonth ban on new conventional septic tanks

Dave Berman, FLORIDA TODAY May 22, 2018

THE FLORIDA SENATE
(Deliver BOTH copies of this form to the Senator or Senate Professional Staff conducting the meeting)
Inteeling Date
Topic Septic TANKS AND Algar Blooms Amendment Barcode (if applicable)
Name BRIAN LAPOINTE
Job Title RESEARCH PROFESSOR, FAU
Address 5600 US I NOVETH Phone 772-292-2276
ET PIERCE FL 34946 Email DIApoin1@fm_ech
Speaking: For Against Information Waive Speaking: In Support Against (The Chair will read this information into the record.)
Representing
Appearing at request of Chair: Yes No Lobbyist registered with Legislature: Yes No

While it is a Senate tradition to encourage public testimony, time may not permit all persons wishing to speak to be heard at this meeting. Those who do speak may be asked to limit their remarks so that as many persons as possible can be heard.

This form is part of the public record for this meeting.

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nducting the meeting)
Bill Number (if applicable)
Amendment Barcode (if applicable)
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one 813-504-8340
nail raroover@fouraonsite.com
ting: In Support Against read this information into the record.)
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l with Legislature: Yes No

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APPEARANCE RECO (Deliver BOTH copies of this form to the Senator or Senate Professional S	RD Staff conducting the meeting)
Meeting Date	Bill Number (if applicable)
Topic Sewage infrastructure	Amendment Barcode (if applicable)
Name Myla Pipes	-
Job Title 🎿	<u>_</u>
Address 332 NW Aurora St	Phone 772-233-6182
City Part St. Lucie FL 34983 State Zip	Email <u>nylacone floridation</u>
Speaking: For Against Anformation Waive S	peaking: In Support Against Against in will read this information into the record.)
Representing Ohe Florida Founda	it:o-
Appearing at request of Chair: Yes Kow Lobbyist regist	tered with Legislature: Yes No
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This form is part of the public record for this meeting.

THE FLOR	NIDA SENATE
APPEARAN	ICE RECORD
(Deliver BOTH copies of this form to the Senator	or Senate Professional Staff conducting the meeting)
Meeting Date	Bill Number (if applicable)
Topic Water storage for ev.	Amendment Barcode (if applicable)
Name Julie Wraithmen	
Job Title Executive Director,	Auduban FL
Address 308 N. Monrae St.	Phone 850 - 339 - 500 9
Street City State	32301 Email Wraithmell?
Speaking: For Against Information	Waive Speaking: In Support Against (The Chair will read this information into the record.)
Representing Andubon FV	
Appearing at request of Chair: Yes No	Lobbyist registered with Legislature: Yes No

While it is a Senate tradition to encourage public testimony, time may not permit all persons wishing to speak to be heard at this meeting. Those who do speak may be asked to limit their remarks so that as many persons as possible can be heard.

This form is part of the public record for this meeting.

CourtSmart Tag Report

Room: EL 110Case No.:Type:Caption: Senate Appropriations Subcommittee on Agriculture, Environment, and General GovernmentJudge:

Started: 1/9/2019 10:02:40 AM 1/9/2019 11:29:58 AM Ends: Length: 01:27:19 10:02:42 AM Meeting called to order 10:03:35 AM Chair Mayfield 10:06:01 AM Brian Lapointe, Research Professor, Ph.D., Florida Atlantic University 11:05:19 AM Chair Mayfield Sen. Bean 11:05:24 AM 11:05:46 AM B. Lapointe 11:07:02 AM Sen. Bean B. Lapointe 11:07:48 AM Sen. Broxson 11:08:32 AM 11:09:57 AM B. Lapointe 11:11:48 AM Sen. Broxson 11:12:05 AM B. Lapointe Sen. Albritton 11:13:40 AM 11:15:35 AM B. Lapointe 11:15:40 AM Sen. Albritton 11:16:25 AM B. Lapointe 11:17:34 AM Chair Mayfield 11:17:40 AM Sen. Powell 11:18:52 AM B. Lapointe 11:19:46 AM Sen. Powell Chair Mayfield 11:20:46 AM Sen. Hutson 11:20:48 AM Sen. Rodriguez 11:21:17 AM B. Lapointe 11:24:14 AM Sen. Stewart 11:25:55 AM 11:26:41 AM B. Lapointe 11:27:02 AM Sen. Berman 11:27:21 AM B. Lapointe Sen. Berman 11:27:49 AM 11:28:06 AM B. Lapointe 11:28:35 AM Chair Mayfield