HARMFUL ALGAL BLOOMS IN SOUTH FLORIDA AND THE INDIAN RIVER LAGOON

Jim Sullivan, Ph.D., Executive Director
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HARMFUL ALGAL BLOOMS (HABs)

Occurrences of phytoplankton (algae) that cause negative ecosystem (or human) impacts
WHAT ARE PHYTOPLANKTON?

MICROSCOPIC PLANTS, COMMONLY CALLED ALGAE
MANY SPECIALIZED ADAPTATIONS
Harmful phytoplankton (like all plants) typically need three main conditions to bloom (grow):

Optimal light

Higher light promotes faster growth

Optimal temperature

Warmer temperatures promote faster growth

Optimal nutrients

More nutrients = more biomass

Which one of these can we realistically control?
HOW ARE ALGAL BLOOMS HARMFUL?

TOXINS (SAXITOXIN, MICROCYSTINS, BREVETOXIN, DOMOIC ACID...)
HIGH BIOMASS (HYPOXIA/ANOXIA, SHADING)
MECHANICAL DAMAGE (MUCOUS, SURFACTANTS, SERRATIONS)
ECONOMICS (TOURISM, RECREATION, PROPERTY VALUES, FISHERIES...)
FL HABs: an Ecological & Economic Crisis

These are not the headlines we want to see, but this problem is not going away any time soon...

Florida Tourism Not Seeing Green as Toxic Algae Chokes Business

Water releases, algae threatening home values

A toxic algae bloom in Florida is slaughtering marine life by the masses

Supercharged by Pollution, Florida’s Toxic Algae Crisis Continues Unabated

By Julie Dermansky • Thursday, August 16, 2018 - 15:57

Florida’s algae crisis: How is it affecting tourism and other businesses?

Are the toxic algae blooms along Florida's coasts making people sick?

USA TODAY NETWORK  Amy Bennett Williams, Fort Myers News-Press
Worldwide, HABs are increasing not only in geographical locations, but also in type, frequency, duration and severity.

Reported HAB occurrences:

~1972

NOW

Florida is one of the most impacted states in the US.
Why are HAB events increasing?

1. Eutrophication (nutrient pollution)
   More nutrients — more algae biomass

2. Global warming & Climate change
   Warming - increasing HAB ranges and growth rates
   Changing precipitation - drought/runoff, extreme events

3. Human ecosystem modifications
   Land use practices, increased runoff, dredging, transport of species, food chain effects...
IT IS FORECAST TO GET EVEN WORSE...

Fourth National Climate Assessment

Government Report On Climate Change Says Red Tide Will Become More Common In Florida

November 23, 2018 at 4:50 pm  Filed Under: Climate change, Florida, Government Report, Red Tide, Sea Life

Volume II
Impacts, Risks, and Adaptation in the United States
Report-in-Brief
Current HAB threats in South Florida

- *Aureoumbra* (non-toxic?)
- *Pyrodinium* (saxitoxin)
- *Psuedonitzchia* (domoic acid)
- *Microcystis* (microcystin)
- *Karenia* (brevetoxin)
- *Cyanobacteria/PicoPlankton* (non-toxic?)
- *Gambierdiscus* (ciguatera)
Acute impacts: immediate and typically severe response to toxins

Chronic impacts: response to toxin only realized over longer times and/or exposure

This needs much more research!
Aureoumbra “brown tide”
(hypoxia and anoxia, fish kills, seagrass loss)

Pyrodinium “red tide”
(saxitoxin – dangerous neurotoxin, Paralytic Poisoning)

Psuedonitzchia
(domoic acid – dangerous neurotoxin, Amnesic Poisoning)

cyanobacteria and other picoplankton
(“superbloom”, hypoxia and anoxia, fish kills, seagrass loss)

Microcystis “green tide”
(microcystins – dangerous hepatotoxins, liver & neurological damage, hypoxia and anoxia, fish kills, seagrass loss)

Karenia “red tide”
(brevetoxin - neurotoxin, Neurotoxic Poisoning, fish kills)

RECENT AND ONGOING HABs AND EFFECTS IN THE IRL

Lake Okeechobee
*Microcystis* (blue-green algae) HABs are transported from Lake discharges to the East coast of FL through C-44 and into the St. Lucie Estuary and Indian River Lagoon.

St. Lucie & Martin County declared a state of emergency in 2016 & 2018 as a result of *Microcystis* in their waters.
Not only are the cyanobacteria blooms causing economic and environmental damage (tourism, recreation, wildlife kills, etc.), it appears that there may be a direct human cost:

**Report: 4 Counties Part Of Liver Disease, Algae Bloom Cluster**

By THE ASSOCIATED PRESS • MAY 30, 2017

Four counties along Florida's Treasure Coast make up a cluster with high rates of both deaths from liver disease and algae blooms.

TCPalm reported Sunday that the cluster in Indian River, Martin, St. Lucie and Okeechobee counties is the only one of its kind in the state.

**Toxic algae suspected in acute liver failure that nearly killed two dogs in Martin County**

Tyler Troadway, Treasure Coast Newspapers • Published 2:41 p.m. ET Sept. 4, 2018 | Updated 6:25 p.m. ET Sept. 4, 2018
WHAT ARE WE DOING?

FLORIDA CENTER FOR COASTAL & HUMAN HEALTH

Est. August 2018 at FAU Harbor Branch

FAU/HBOI & Partner Expertise

Florida HAB Crisis

Population Health Impacts

Healthy Environment & Population
Florida Center for Coastal & Human Health

Recruiting Public Stakeholders

Recruiting Strategic Research Partners

Harbor Branch Oceanographic Institute

ORCA

Smithsonian

University of Florida

CDC

One Lagoon

Ocean

NASA

IRSC

FAU Brain Institute
Rich Chemical Fingerprints from the Southern Estuary during the *Microcystis* bloom

The toxin
*Microcystin LR*

Unknown Compounds

Trophic Transfer of Algal Toxins

Piscivory

Crustacivory

FAU Harbor Branch tests people for levels of toxin released from blue-green algae

**monitoring**

**toxin screening**

microcystin

saxitoxin

**FLORIDA CENTER FOR COASTAL & HUMAN HEALTH**

**CONDUCTING CRITICAL RESEARCH**
INTEGRATING SCIENCE FOR BETTER MANAGEMENT

Florida Center for Coastal & Human Health

classical observations of blooms
new technologies and methods
remote sensing
real-time water quality monitoring
new technologies and methods

biological indicators
modeling/prediction risk assessment stakeholders
policy
human health ecosystem health
new technologies and methods
Ron DeSantis names Florida blue-green algae task force

“The toxic algae has been a massive problem. It’s been a problem on the southwest coast of Florida and may very well have been a contributor to why the red tide was so bad,” DeSantis said.

The task force includes the following experts:

Dr. James Sullivan
Dr. Sullivan, executive director of FAU’s Harbor Branch, is an expert on marine ecosystem health. He earned his master’s and doctorate degrees in biological oceanography with specializations in phytoplankton physiology and ecology, as well as bio-optics and biophysics, from the University of Rhode Island Graduate School of Oceanography.

Dr. Wendy Graham
Dr. Graham is the Carl S. Swisher Eminent Scholar in Water Resources in the Department of Agricultural and Biological Engineering and Director of the Water Institute at the University of Florida. Dr. Graham holds a B.S. in environmental engineering from the University of Florida, and a Ph.D. from the Massachusetts Institute of Technology.

Dr. Evelyn Gaiser
Dr. Gaiser holds a bachelor’s degree in biology from Kent State University, a master’s in animal ecology from Iowa State University and a doctorate in ecology from the University of Georgia. Research in Dr. Gaiser's lab has informed the progress of Everglades restoration and is integrated into the Florida Coastal Everglades Long-Term Ecological Research program, which she has led since 2007.

Dr. Michael Parsons
Dr. Parsons is a professor of marine science at Florida Gulf Coast University and director of the Coastal Watershed Institute and Vester Field Station. He was a State of Louisiana Board of Regents Fellow and received his doctorate from Louisiana State University in biological oceanography.

Dr. Valerie Paul
Dr. Paul has served as director of the Smithsonian Marine Station at Fort Pierce, Florida, since 2002. She received her B.A. from the University of California San Diego with majors in Biology and in Chemical Ecology and her Ph.D. in Marine Biology from the Scripps Institution of Oceanography at UC San Diego.
THANKS

QUESTIONS?