Florida Bay Seagrass Die-off Summary

David Rudnick, Ph.D.
South Florida Natural Resources Center
Everglades National Park

South Florida Ecosystem Restoration
Joint Working Group and
Science Coordination Group Meeting
March 21, 2016

Acknowledgements

ENP-SFNRC: Christopher Kavanagh
Erik Stabenau
Vicki Absten
Zach Fratto

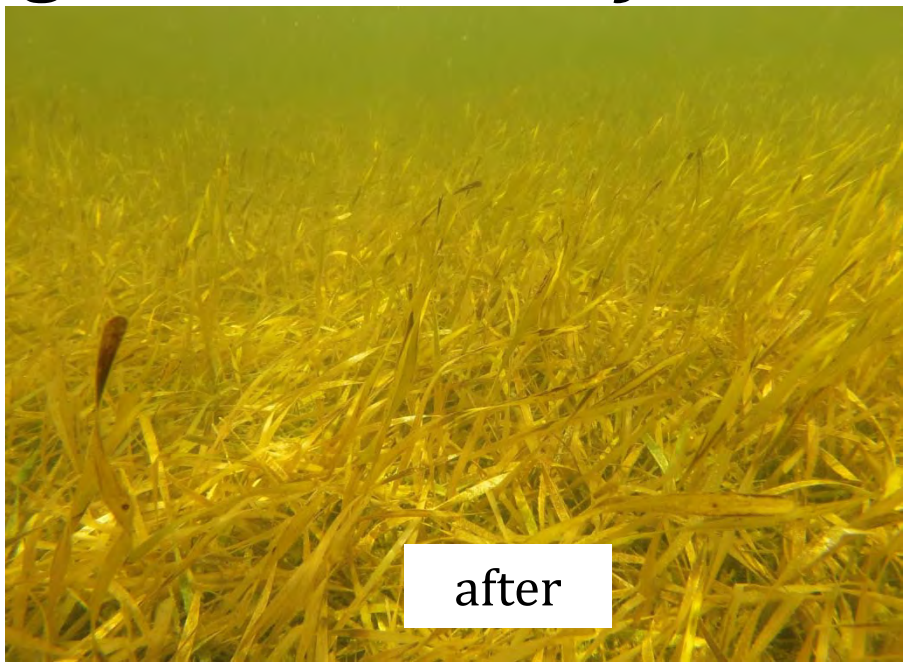
FWRI-FFWCC: Penny Hall
Paul Carlson
Manuel Merello

SFWMD: Christopher Madden
Steve Kelly
Joseph Stachelek

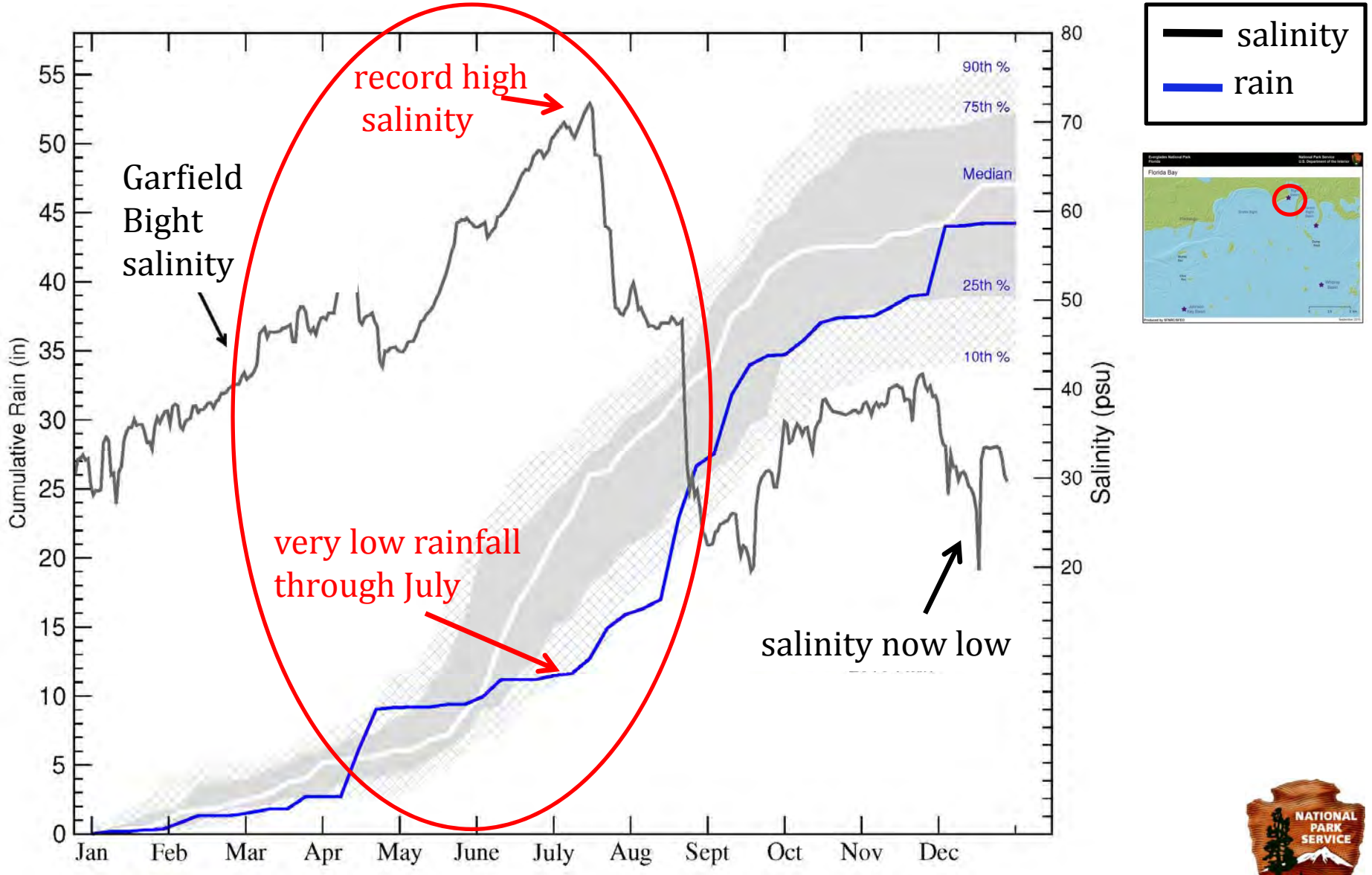
RECOVER Amanda McDonald
April Patterson

…..and many more

Turtle Grass Die-off During the Summer of 2015



Garfield Bight Salinity and Cumulative Rainfall in 2015



Turtle Grass Detritus Produced with Die-off

seagrass detritus decay

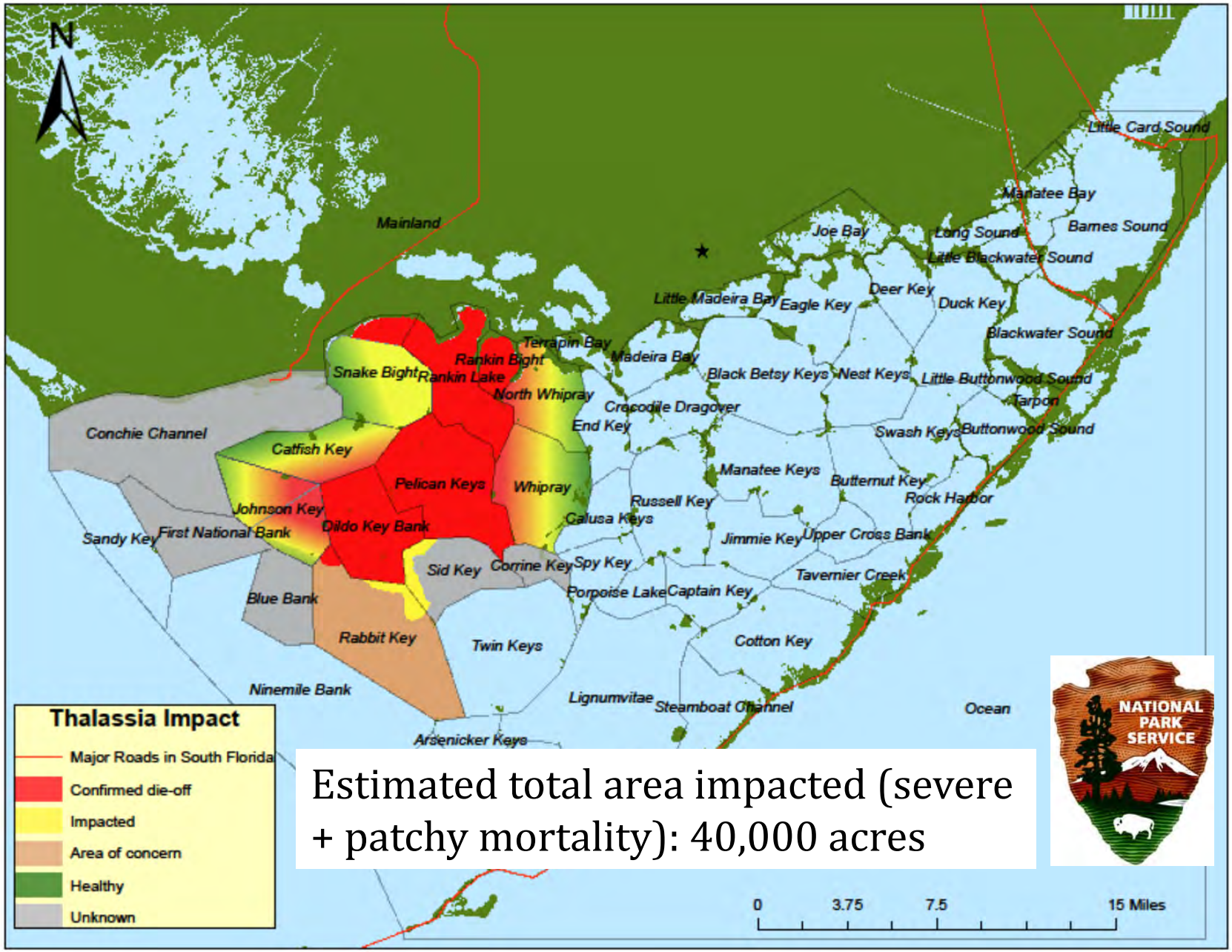
consumes oxygen
produces toxic sulfide

→

releases nutrients

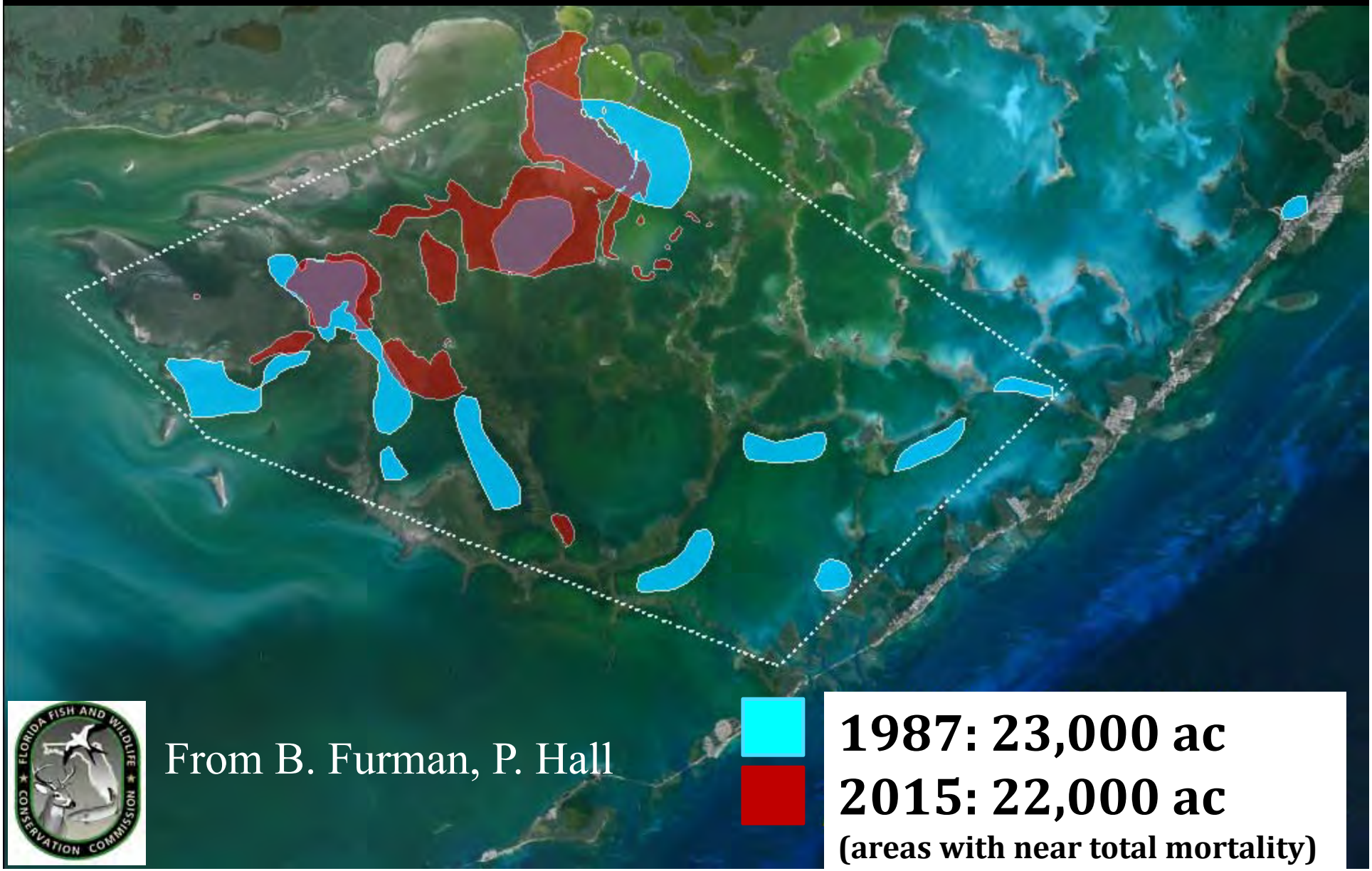
cycle with algal blooms and more seagrass die-off?

Seagrass Die-off Area (Jan. 2015)

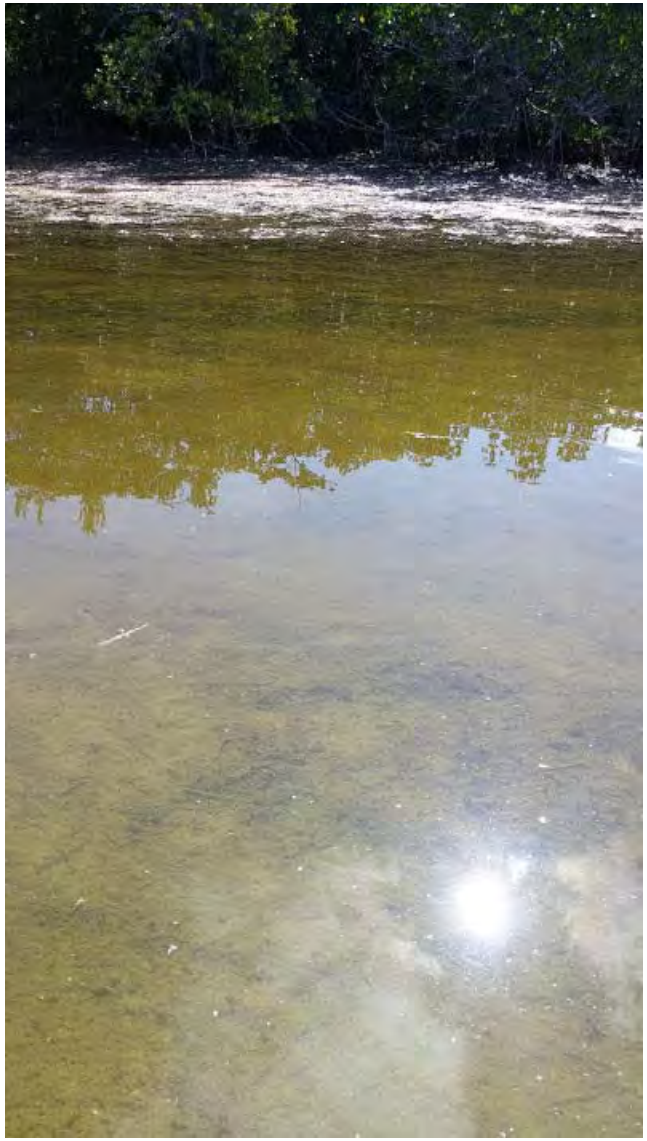


Estimated total area impacted (severe + patchy mortality): 40,000 acres

Florida Bay Seagrass Die-off Areas: Comparison of 1987 to 2015

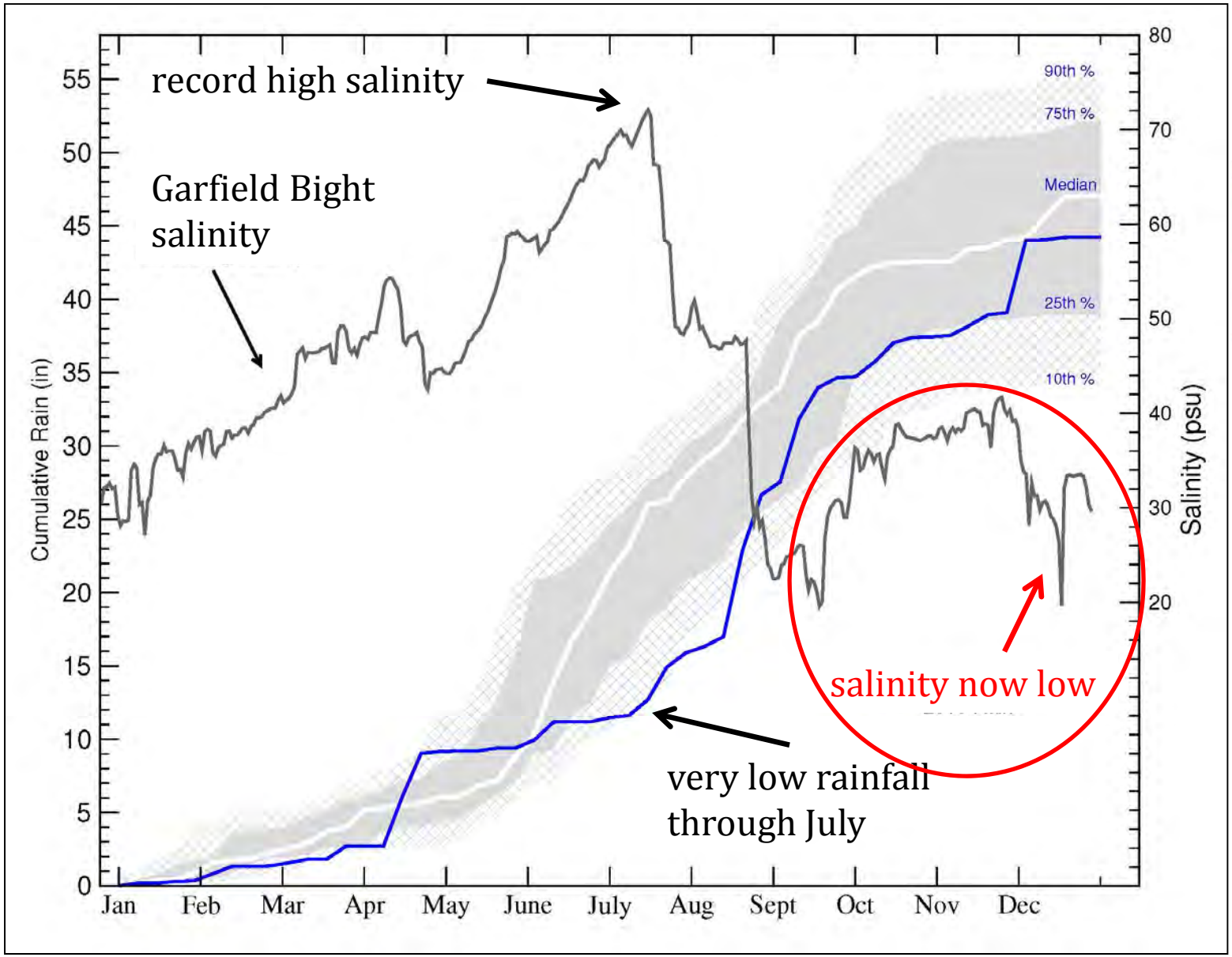


Former Buoy Key Seagrass Meadow: Habitat Lost



photos taken
March 2016

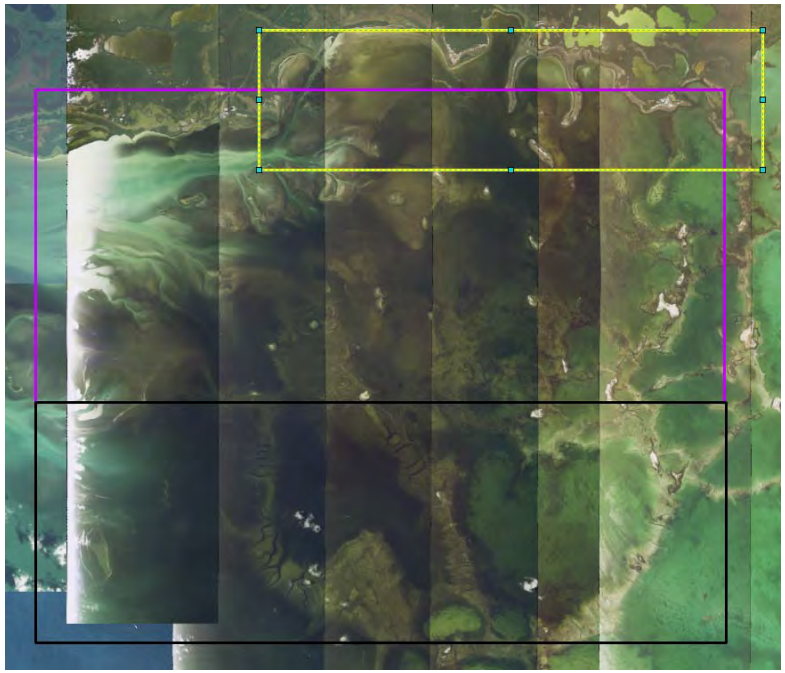
Garfield Bight Salinity and Cumulative Rainfall in 2015



Plans to Assess Changing Florida Bay Conditions

Assessment Goal	Approach	Participants
Die-off spatial extent change?	**Aerial photography** (airplane, drone), in-water measurements	FWRI, NPS, RECOVER (USACE, SFWMD)
Water quality, algal bloom change?	**WQ monitoring** (grab samples, sonde network, Dataflow), **sediment sulfide**	SFWMD, NPS, FWRI
Fish community change?	Juvenile sportfish sampling, recreational surveys	NOAA, RECOVER, NPS
Understanding and minimizing risks	**Research and modeling** seagrass and algal responses; detritus decay and nutrients	NPS, to be determined

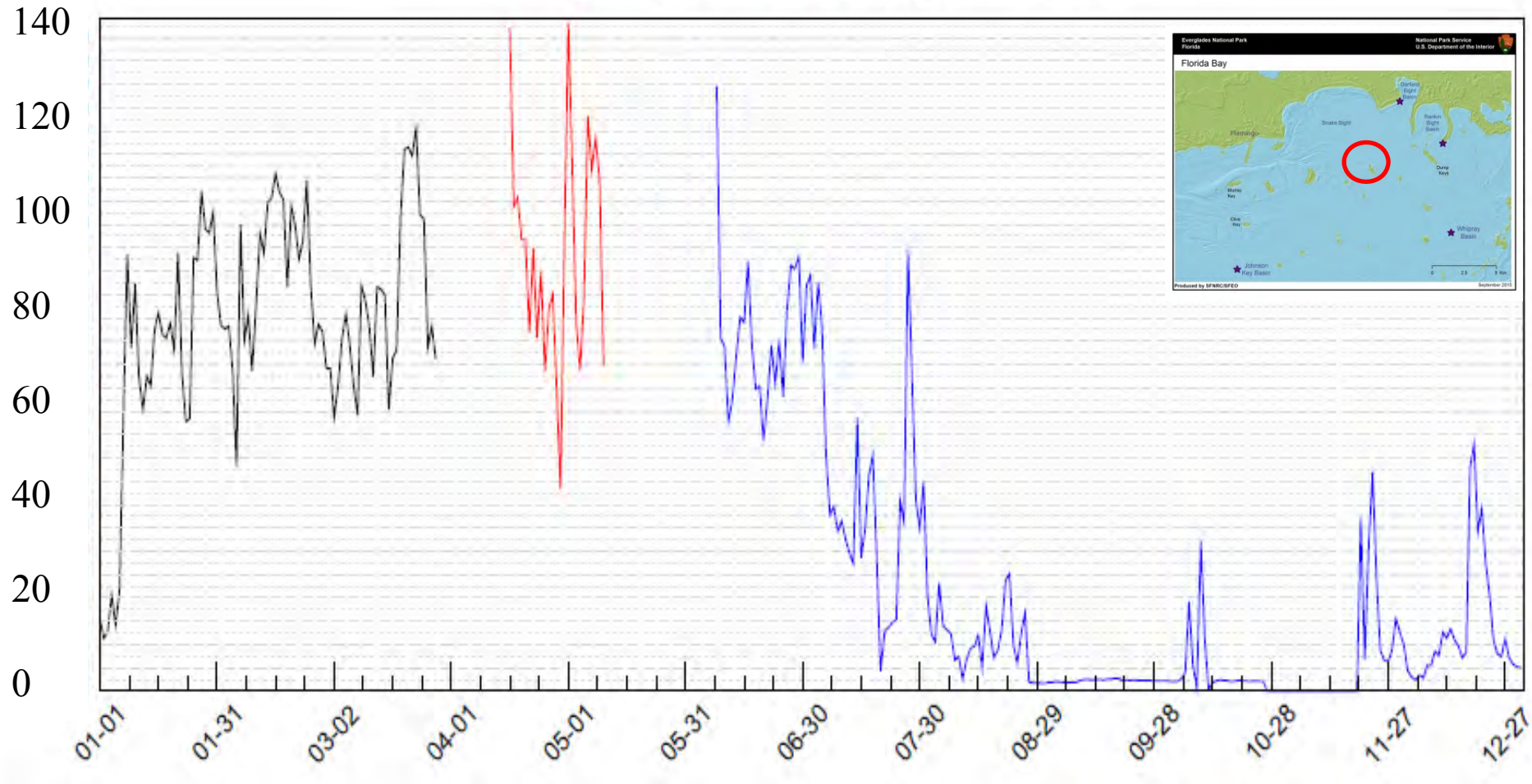
Areas targeted for April 2016 aerial photography
(FWRI, NPS, SFWMD, USACE)

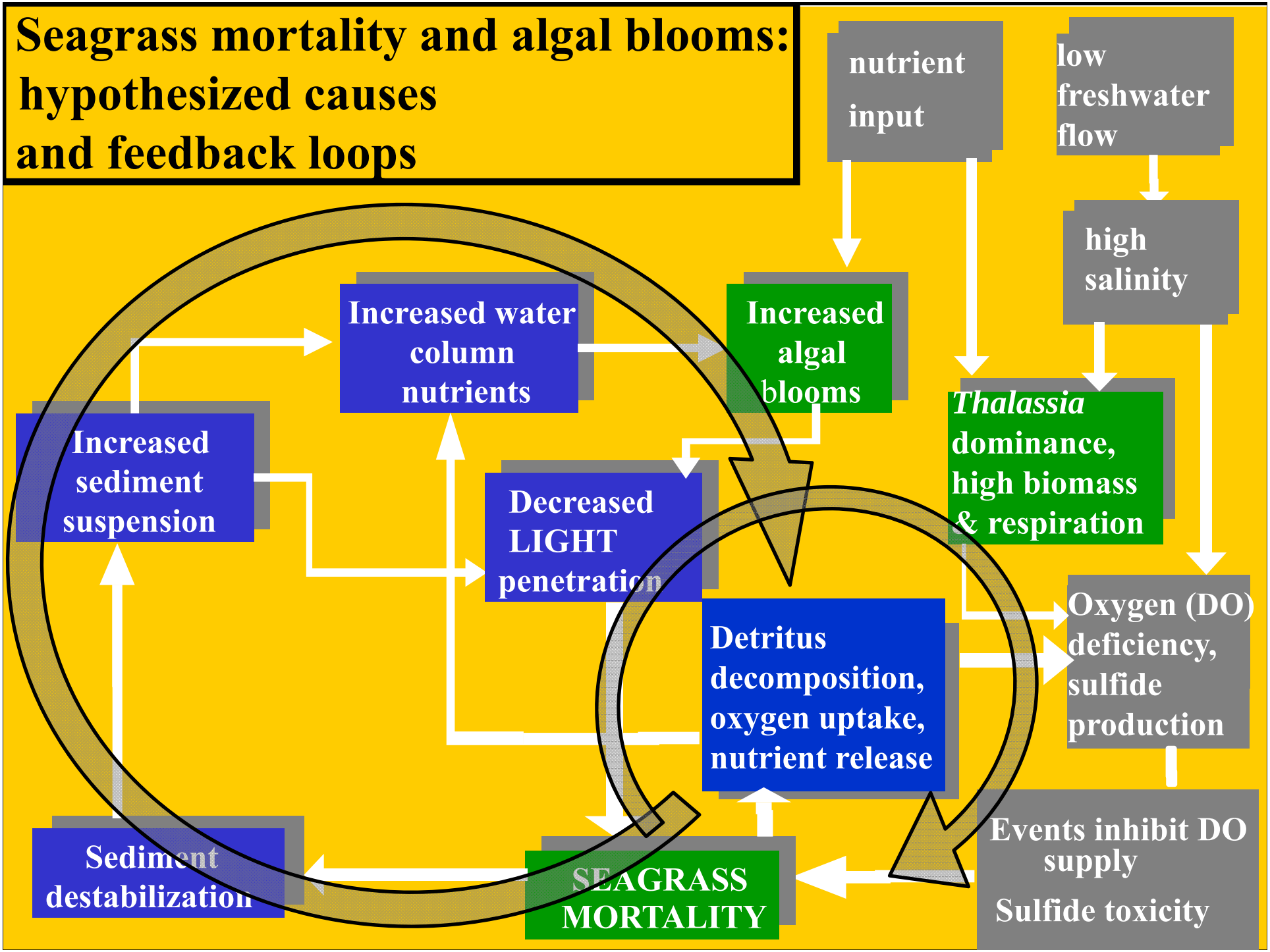


Conclusions

- Large scale, rapid seagrass die-off occurred in Florida Bay in 2015; at least 20,000 acres of habitat is gone
- By January 2015, the location and spatial extent of this die-off was similar to that of the 1987-1990 die-off
- The lethal agents, proximately causing die-off, are anoxia and sulfide toxicity
- High salinity decreases dissolved oxygen supply and increases die-off risk
- With nutrient release from decaying seagrass detritus, Florida Bay now has risk of large-scale algal blooms, which can propagate more seagrass die-off.

Percent Saturation Dissolved Oxygen at Buoy Key (2015)



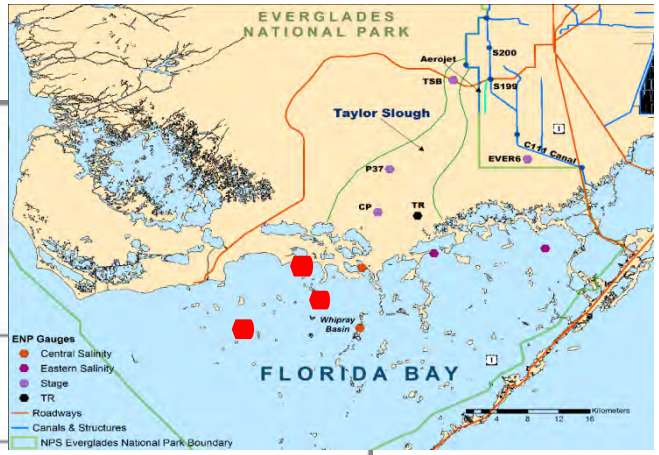

Seagrass mortality and algal blooms: hypothesized causes and feedback loops
nutrient input
low freshwater flow
high salinity
Increased water column nutrients
Increased algal blooms
Increased sediment suspension
Decreased LIGHT penetration
Thalassia dominance, high biomass & respiration
Detritus decomposition, oxygen uptake, nutrient release
Oxygen (DO) deficiency, sulfide production
Sediment destabilization
SEAGRASS MORTALITY
Events inhibit DO supply
Sulfide toxicity

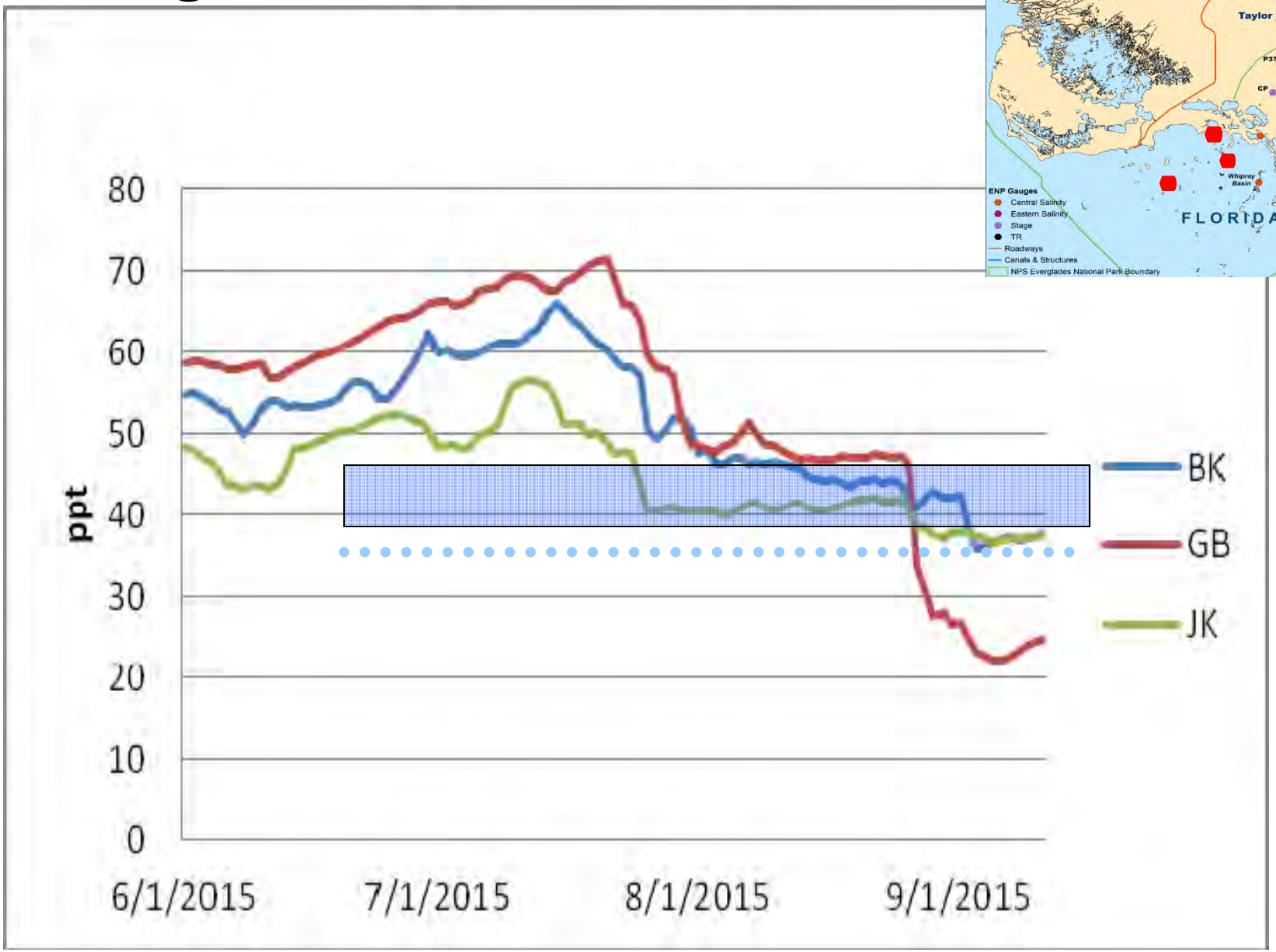
Sediment Porewater Sulfide Concentrations (mM) in Die-off Areas.
Values > 2 mM are toxic to *Thalassia testudinum*.

	Florida Bay Basins			
DieOff Event/Sample	Johnson Key Basin	Rabbit Key Basin	Rankin Lake	Whipray Basin
1987-1991 Event				
Summer 1989	0.50	0.40	0.60	1.52
Fall 1989	2.85	2.55	1.45	1.23
Summer 1990	1.15	0.85	0.60	1.51
Fall 1990	3.70	3.15	4.78	
2015 Event				
Summer 2015	3.40		4.95	5.72
Fall 2015	4.23	1.71	6.53	

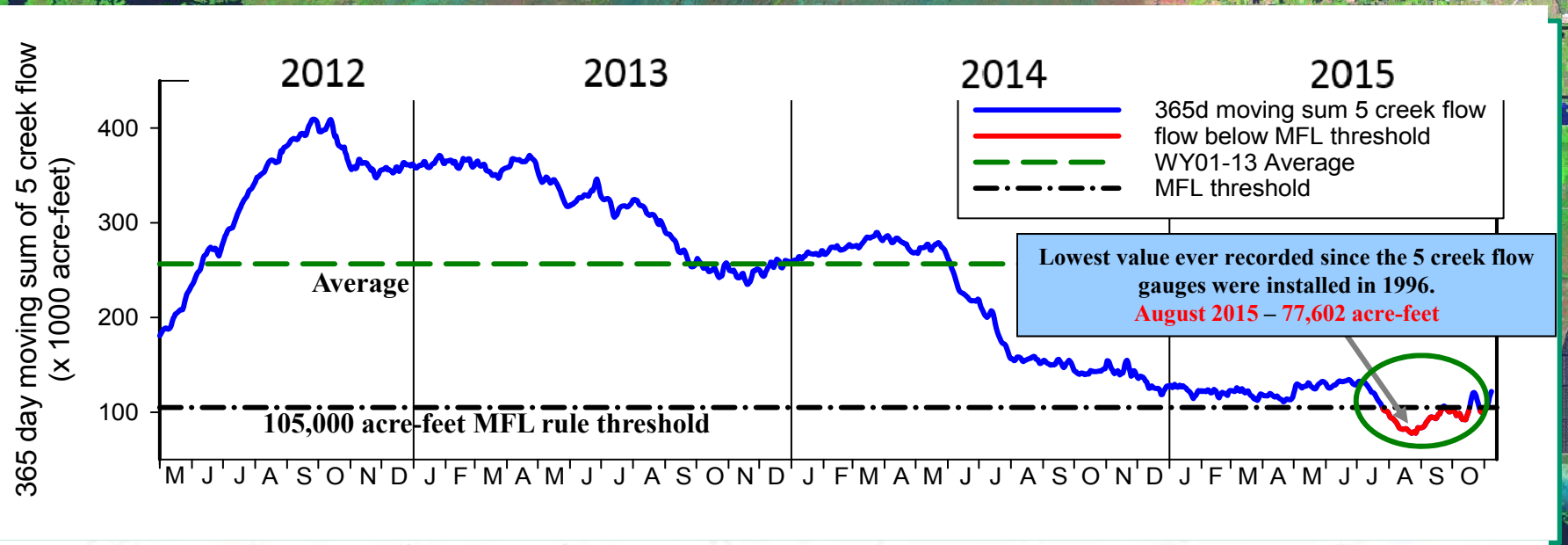
From P. Carlson, V. Absten

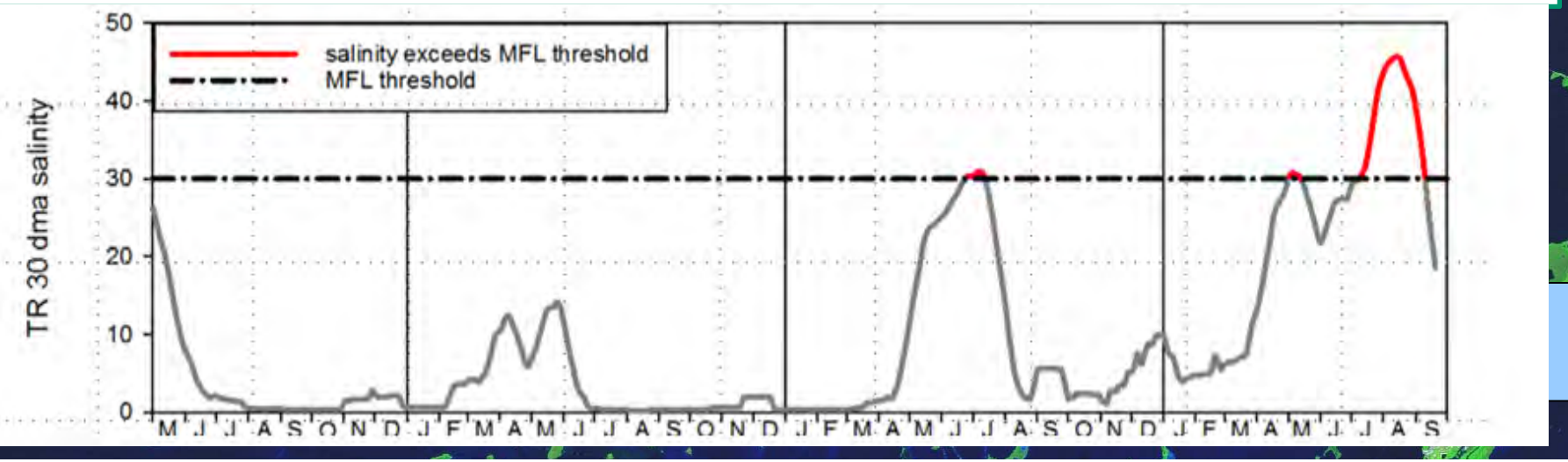
Record High Salinity in North-Central Florida Bay During the Summer of 2015

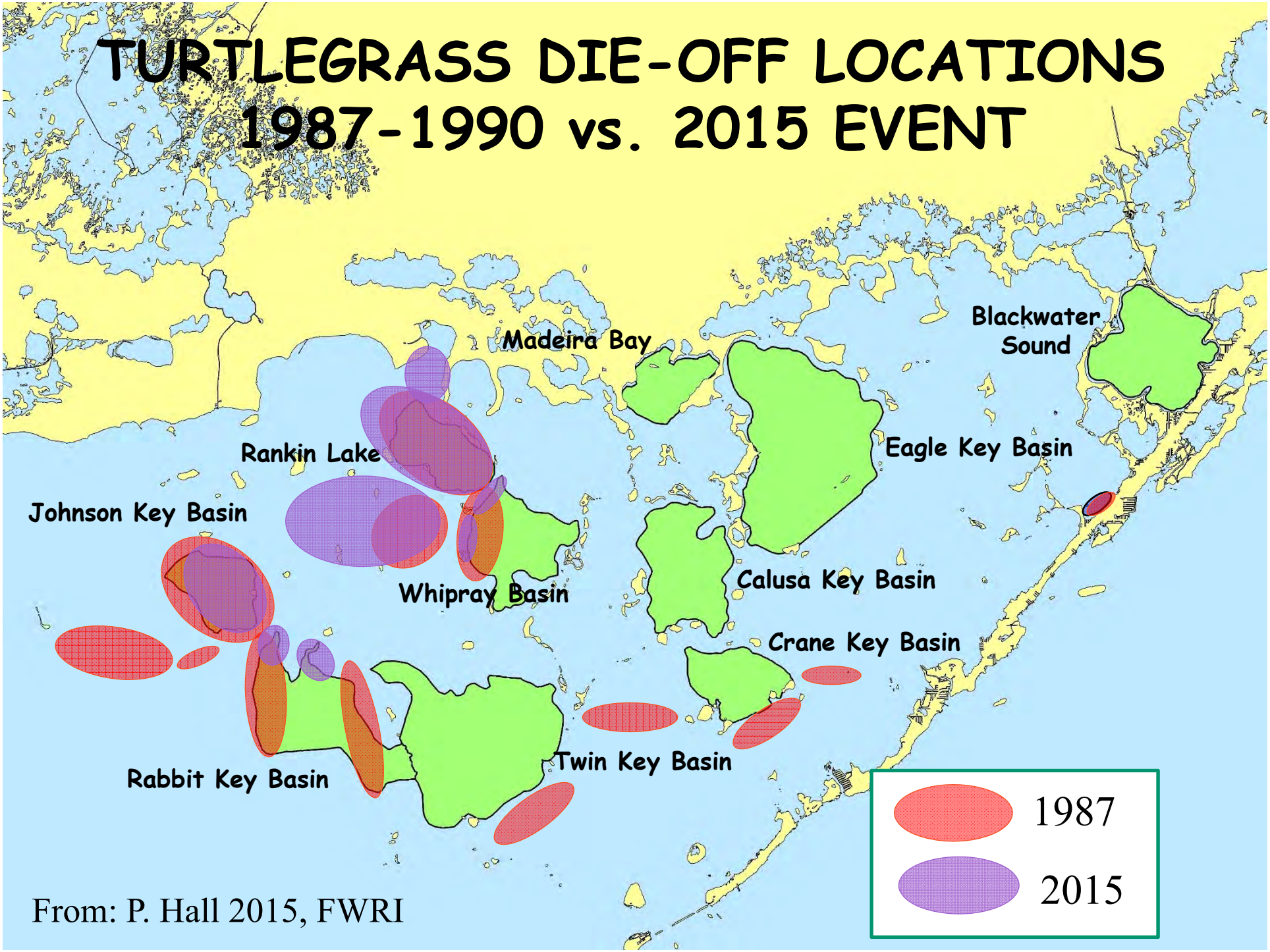




2012-2015 Conditions - Florida Bay Taylor River Salinity & MFL Flow






TURTLEGRASS DIE-OFF LOCATIONS
1987-1990 vs. 2015 EVENT
Madeira Bay
Blackwater Sound
Rankin Lake
Eagle Key Basin
Johnson Key Basin
Whipray Basin
Calusa Key Basin
Crane Key Basin
Twin Key Basin
Rabbit Key Basin
1987
2015
From: P. Hall 2015, FWRI