What is wrong with Florida Bay?

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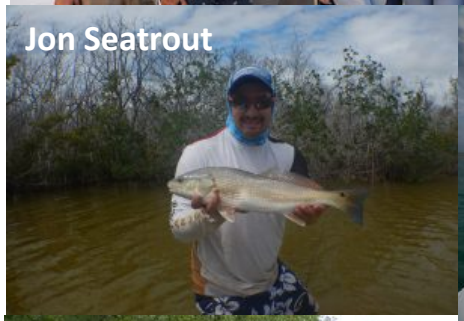
Institute of Environment

Who we are?

Fisheries research group @ FIU




Why fish?
Coastal Fishing: At the core of being a **Floridian**...


"AAHHH, FLORIDA"
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KW Citizen 11/11/96


Florida
FISHING
CAPITAL
of the WORLD℠

A note on **key role of Florida Bay** in Florida's fisheries

1 in 5 Florida anglers fishes the Everglades

Value is **$1.2 billion**/yr
but $ 68 million lost/yr due to lack of water
FL Bay alone $ 500 M/yr

& Florida leads US in:

1. Angler dollars spent

10% of dollars spent, $ 5 billion/yr

2. Numbers of anglers

36% of all US fishing trips

3. Quality of fishing

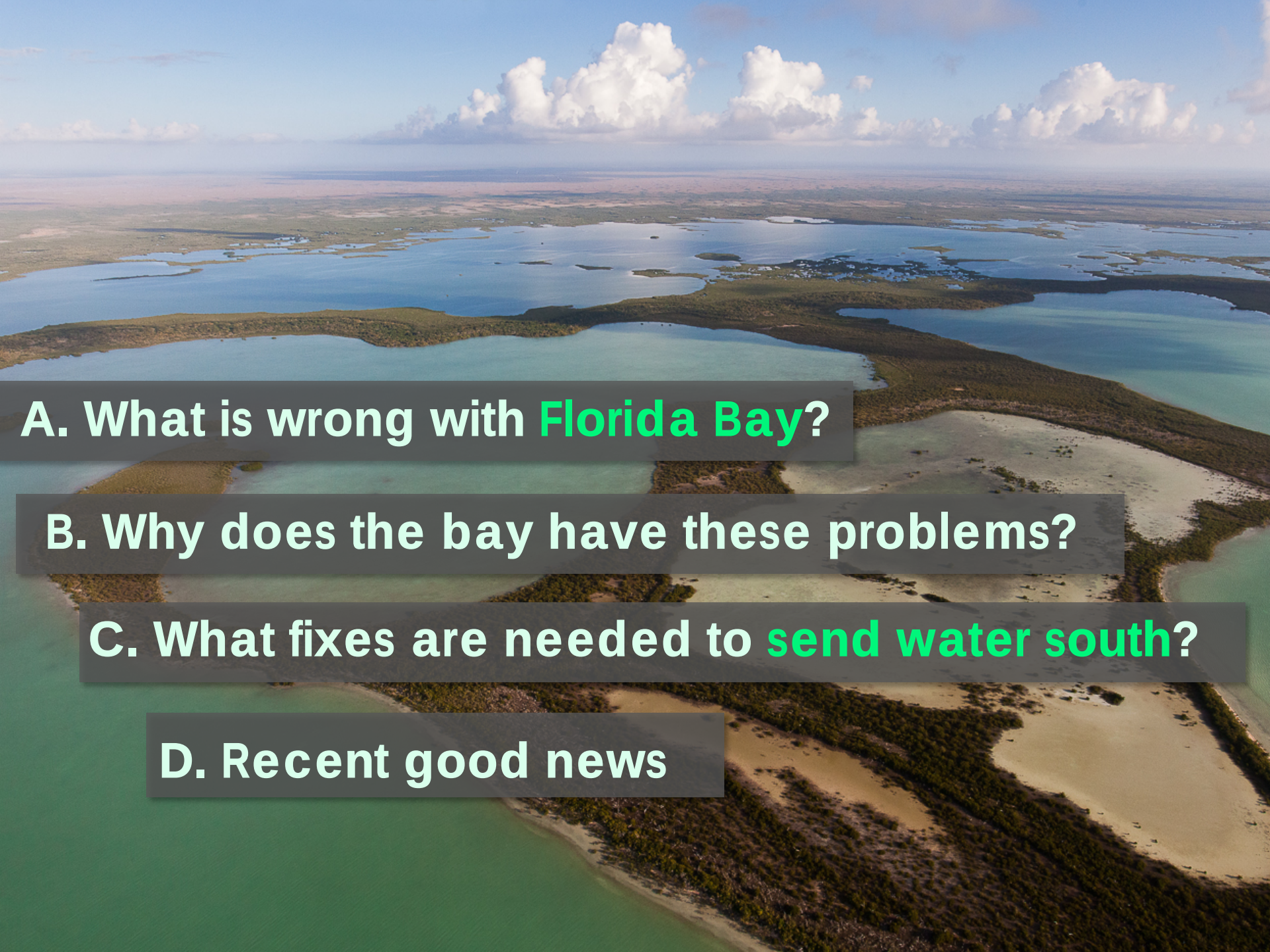
15% of world's fishing records

Fedler 2009, USFWS 2013, NOAA 2015, Brown et al 2018


Keys, Florida, United States | © 2011 DEIMOS IMAGING, Distribution Airbus DS

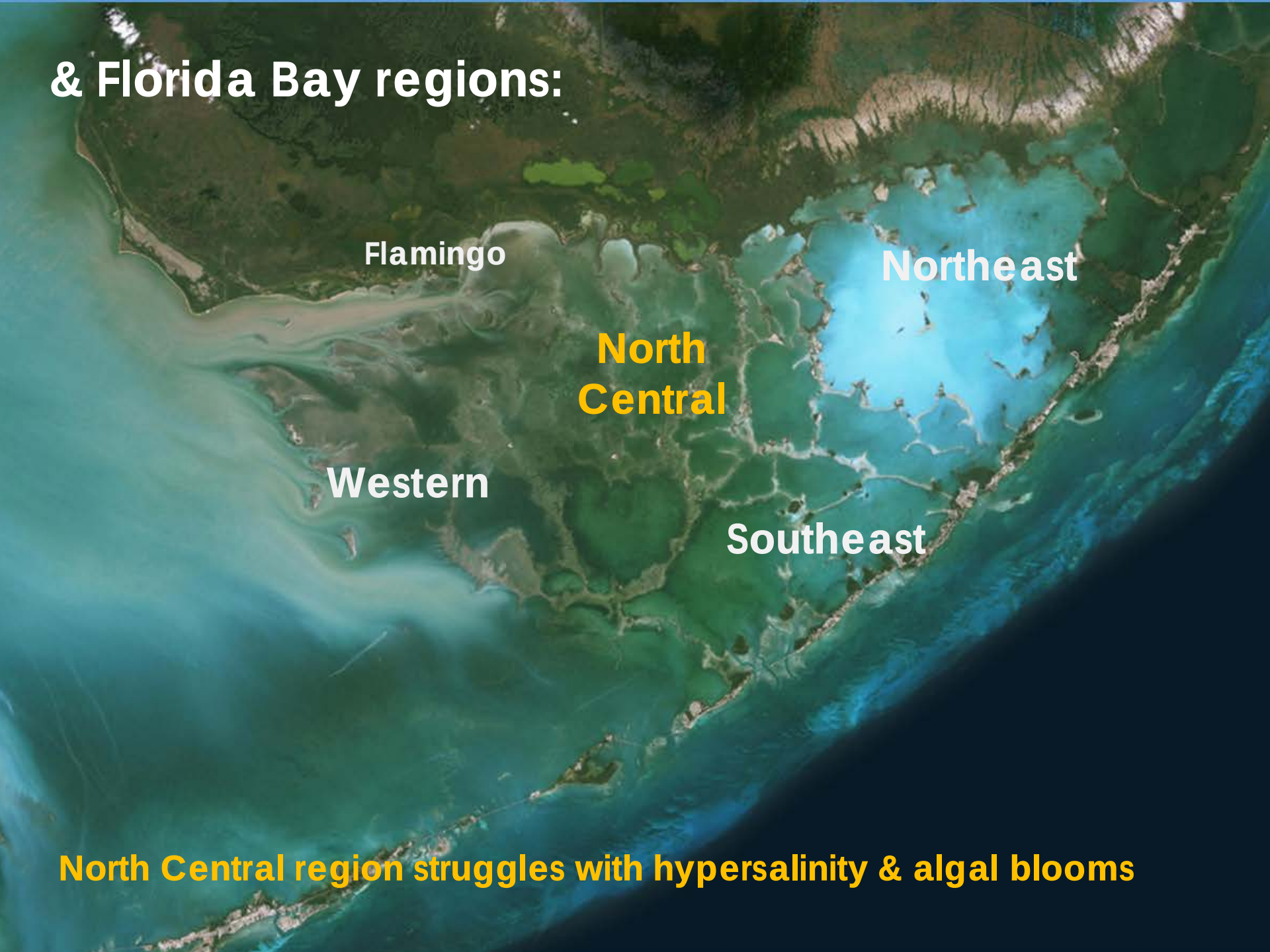

Your water issues are our water issues
DEIMOS-1 Satellite Image - The Keys, Florida, United States | © 2011 DEIMOS IMAGING. Distribution Airbus DS


Your water issues are our water issues
Florida Bay
DEIMOS-1 Satellite Image - The Keys, Florida, United States | © 2011 DEIMOS IMAGING. Distribution Airbus DS


A. What is wrong with Florida Bay?
B. Why does the bay have these problems?
C. What fixes are needed to send water south?
D. Recent good news

First, some Florida Bay Facts:

- **Largest estuary** in Florida
- Bay is a patchwork of **45 basins** connected by mud banks
- Basins are shallow & have lots of light allowing for **seagrass beds** (**10% of world's seagrasses**)
- But over 100 yrs, bay has changed from **an estuary to a marine lagoon**


& Florida Bay regions:
Flamingo
Northeast
North
Central
Western
Southeast
North Central region struggles with hypersalinity & algal blooms


A. What is wrong with Florida Bay?

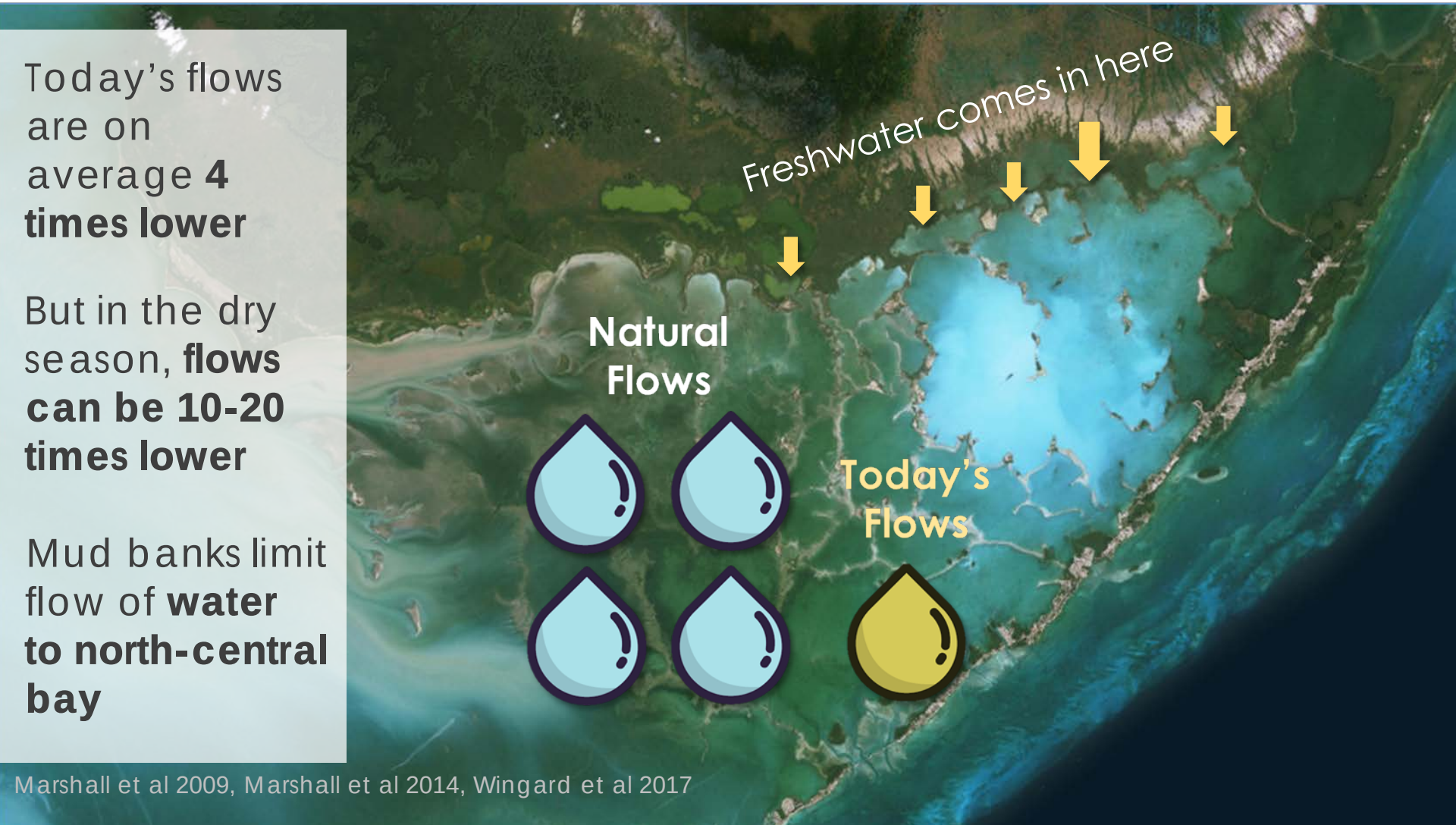

A. What is wrong with Florida Bay?
5 major problems...

1. Bay suffers from **chronic water deficit**

Today's flows are on average **4 times lower**

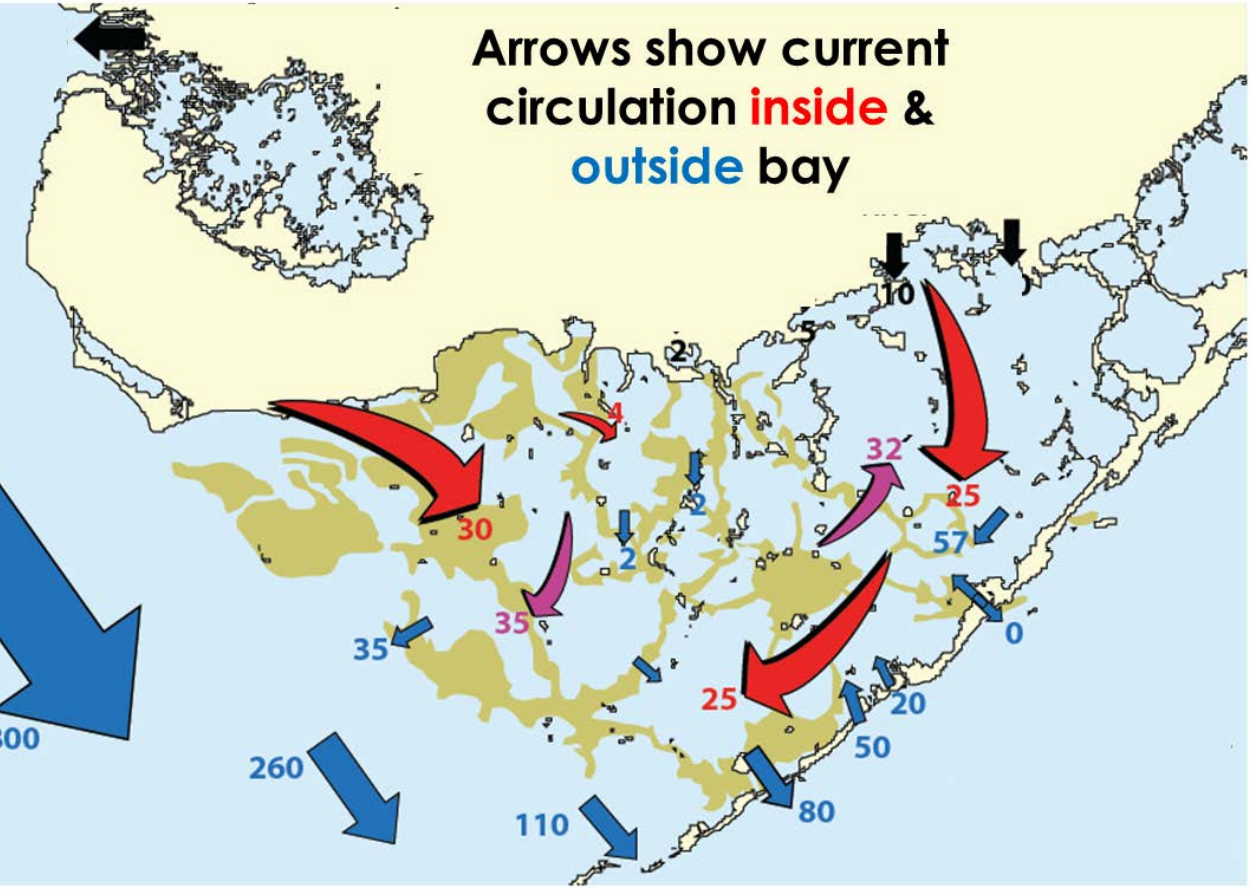
But in the dry season, **flows can be 10-20 times lower**

Mud banks limit flow of **water to north-central bay**



Marshall et al 2009, Marshall et al 2014, Wingard et al 2017

2. Since construction of railroad**, water exchange** with Atlantic is reduced



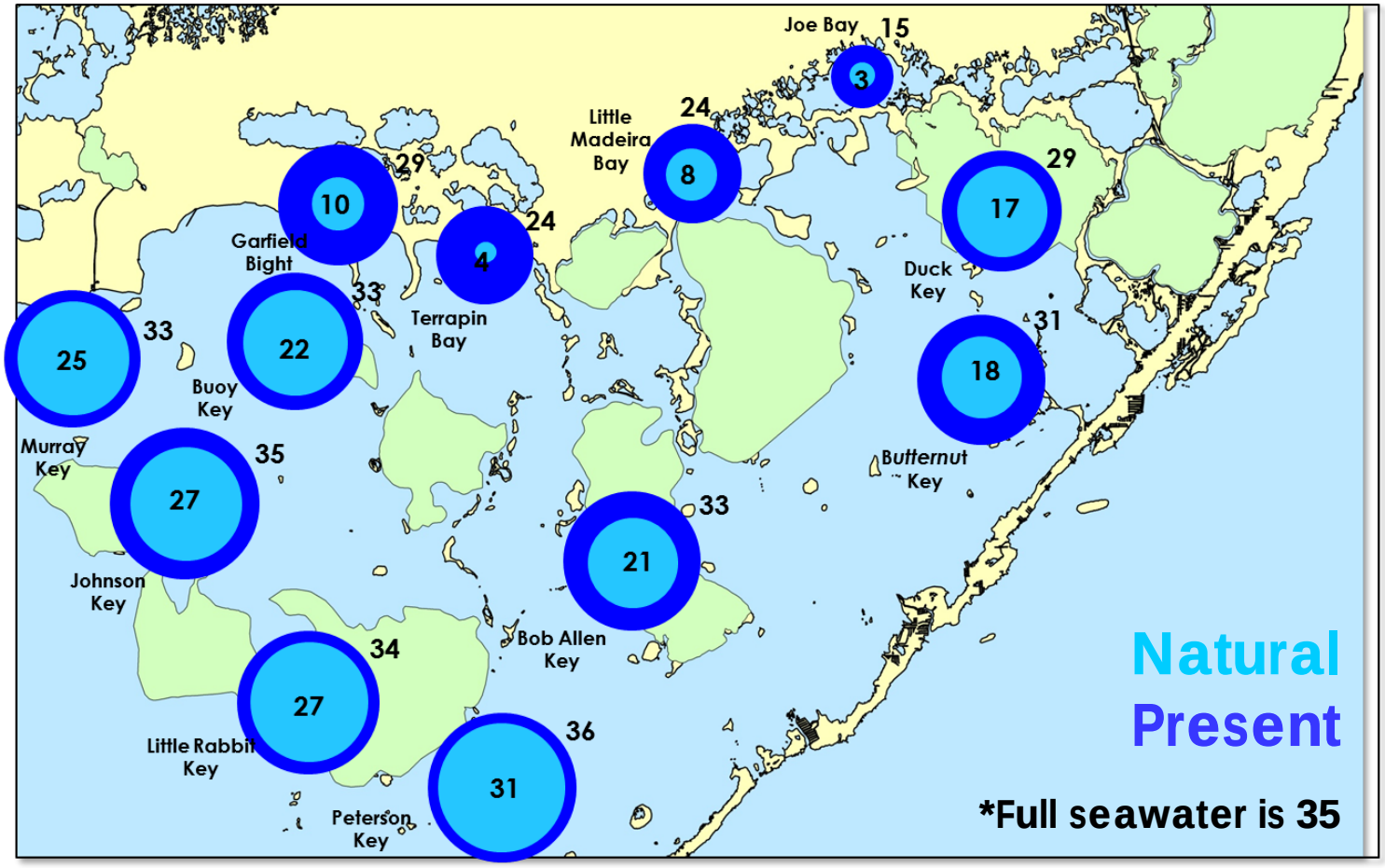
This means that:

- Water **stay longer** in the bay (up to 1 yr)
- Water **circulates differently**

Evaporation is stronger (controls **salinity)**

Bay depends on **wind to flush**

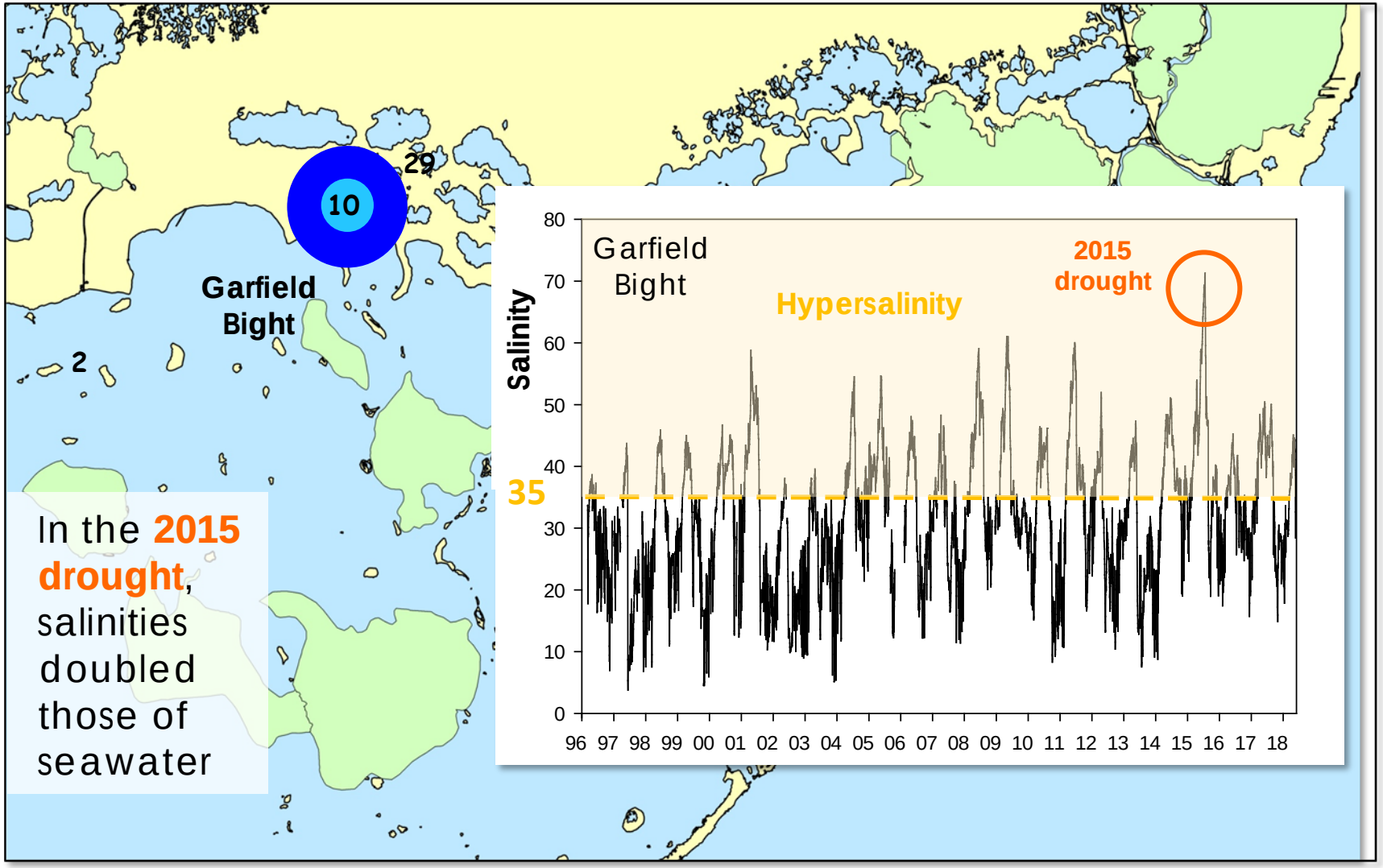
3. Because of **chronic water deficit**, **salinities** are **2-2.5 times higher** inshore



High salinities occur when **more water evaporates** than comes in

High salinities started in **1950s**

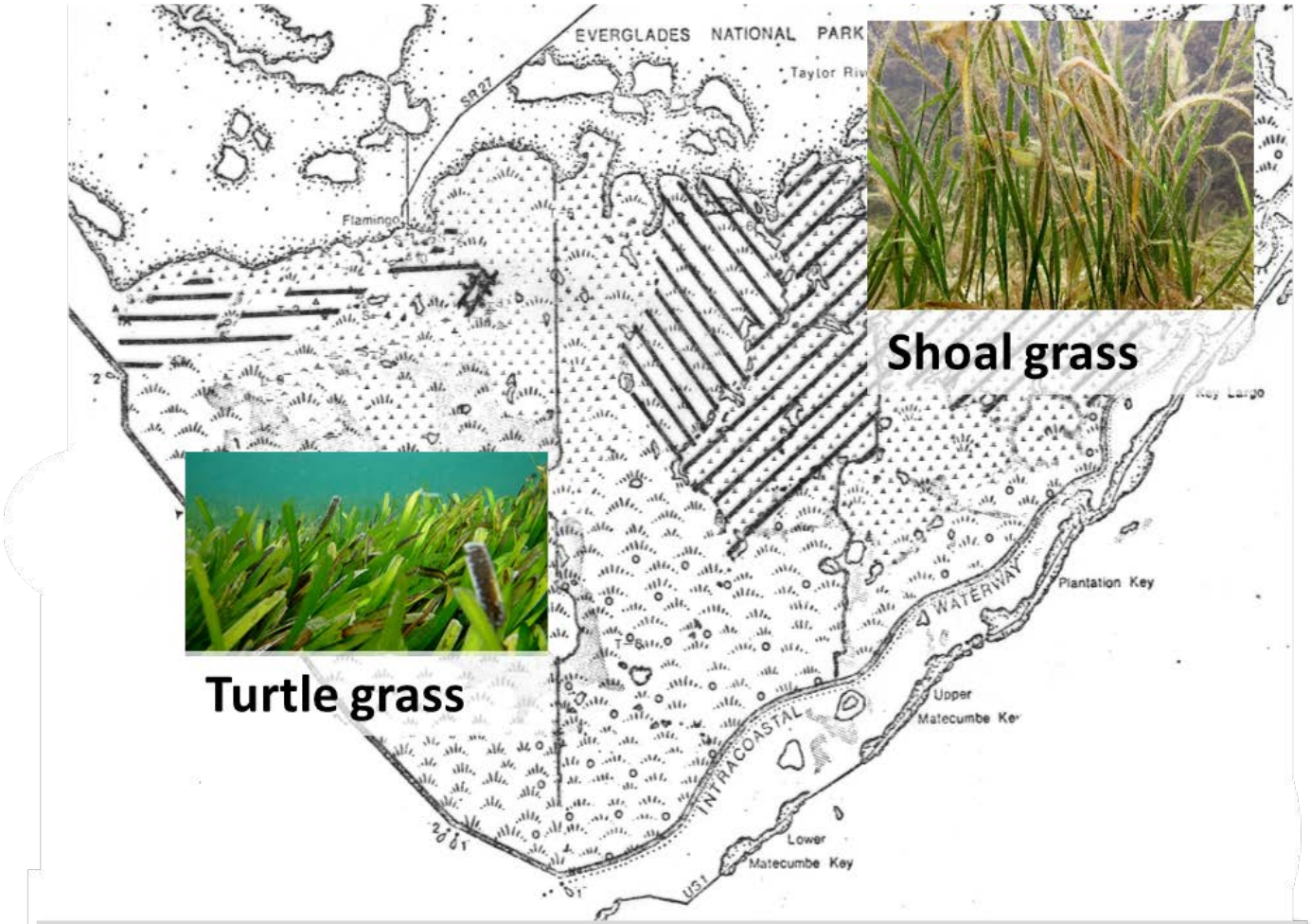
3. North-central bay goes **hypersaline** every yr & when a drought, we get **extreme salinities**



Hypersalinity: higher salinity than ocean water (35 units)

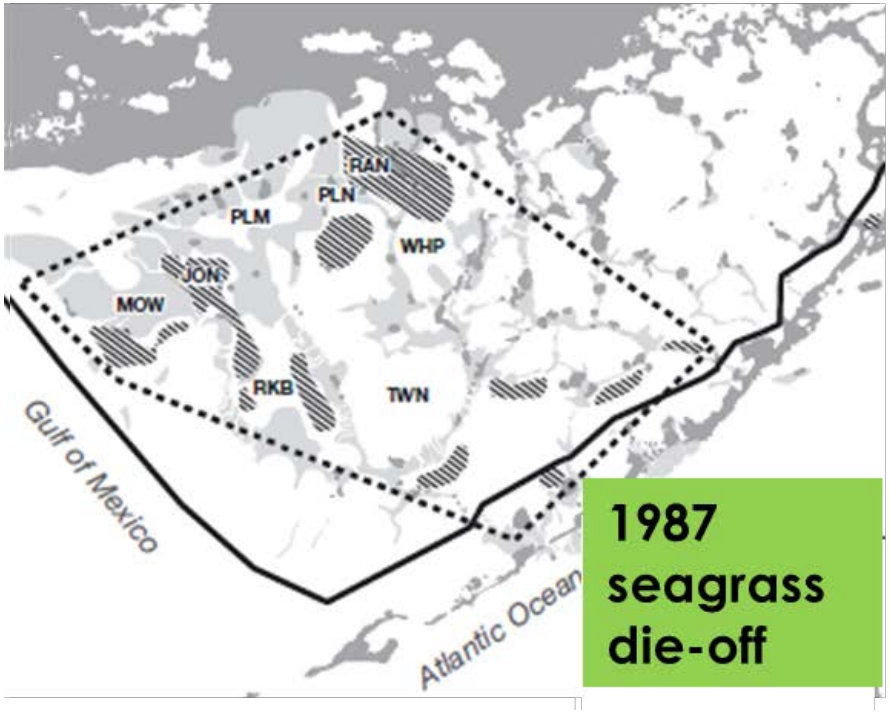
4. Due to **higher salinities**, bay is dominated by only 1 type of grass: **turtle grass**

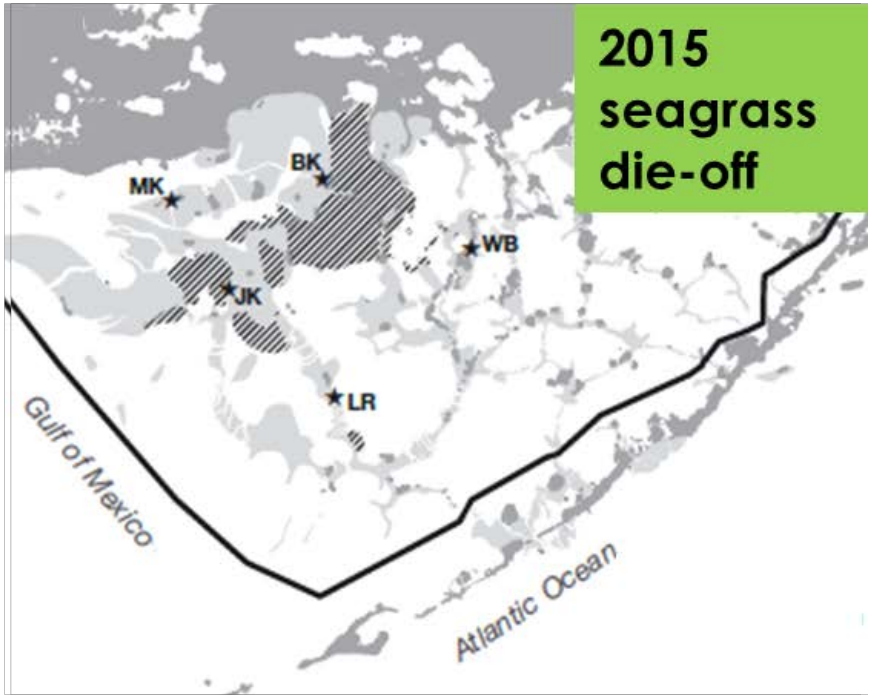
This **decrease in seagrass diversity** means Florida Bay is vulnerable to stressors



Seagrass map from 1970s shows more types of grass

4. Droughts cause extreme salinities & low oxygen that kills turtle grass





= Dead grass

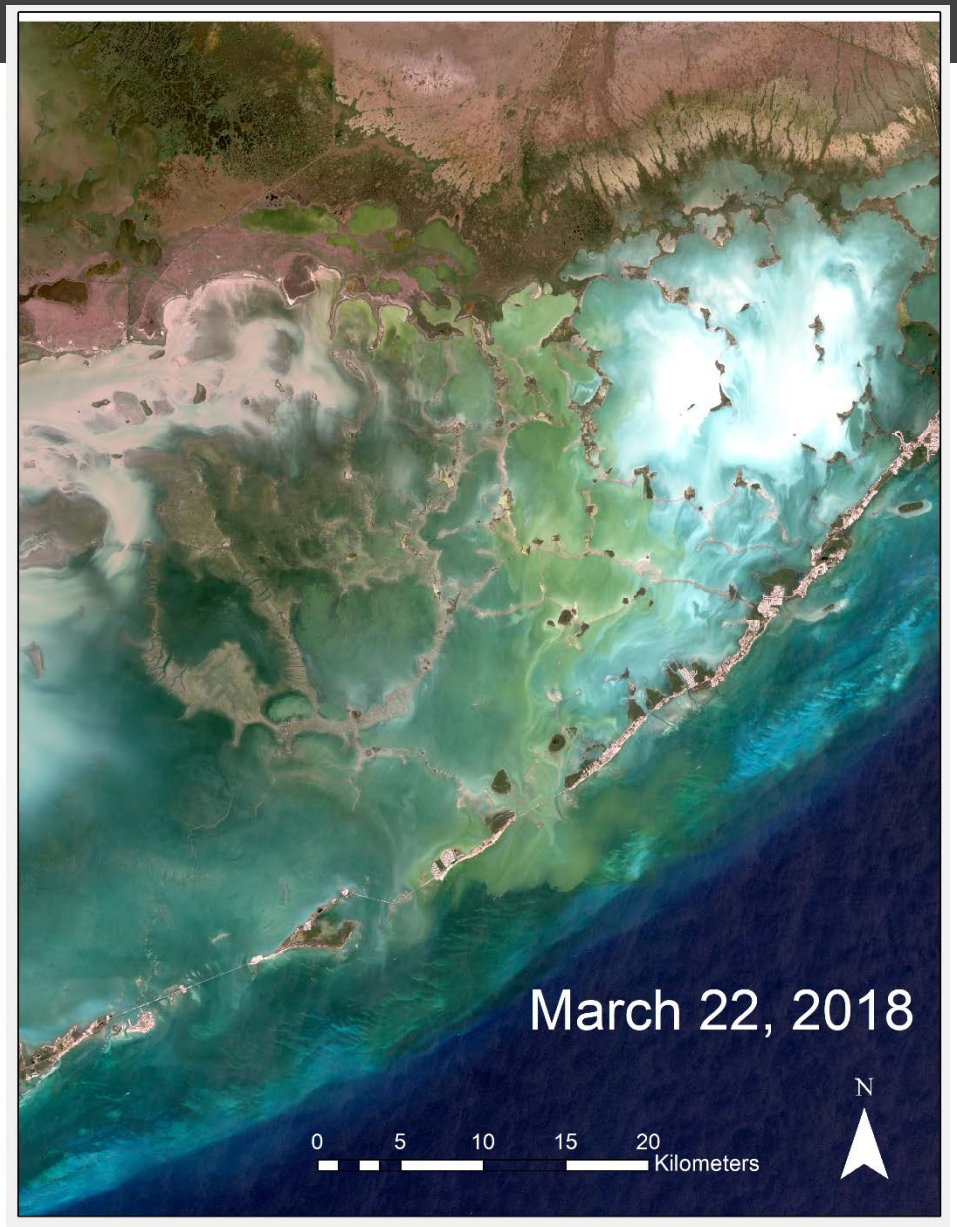
Each die-off covered about **17,000 football fields**

1987 die-off caused **20 yrs of changes** in the bay

5. Seagrass die offs fuel algal blooms

Nutrients released cause blooms

Since 1987die-off, bay is in a new state of **recurrent blooms**



What are effects of these problems on our valuable fisheries?

We haven't studied the effects on fish…but this is key to managing water better

Only fish studied is **juvenile seatrout:**

- They spend **entire life** in the bay
- More babies with **more seagrass**
- Less babies & less healthy with **hypersalinity**

New study starting will look at **effects of 2015 die off** & examine:

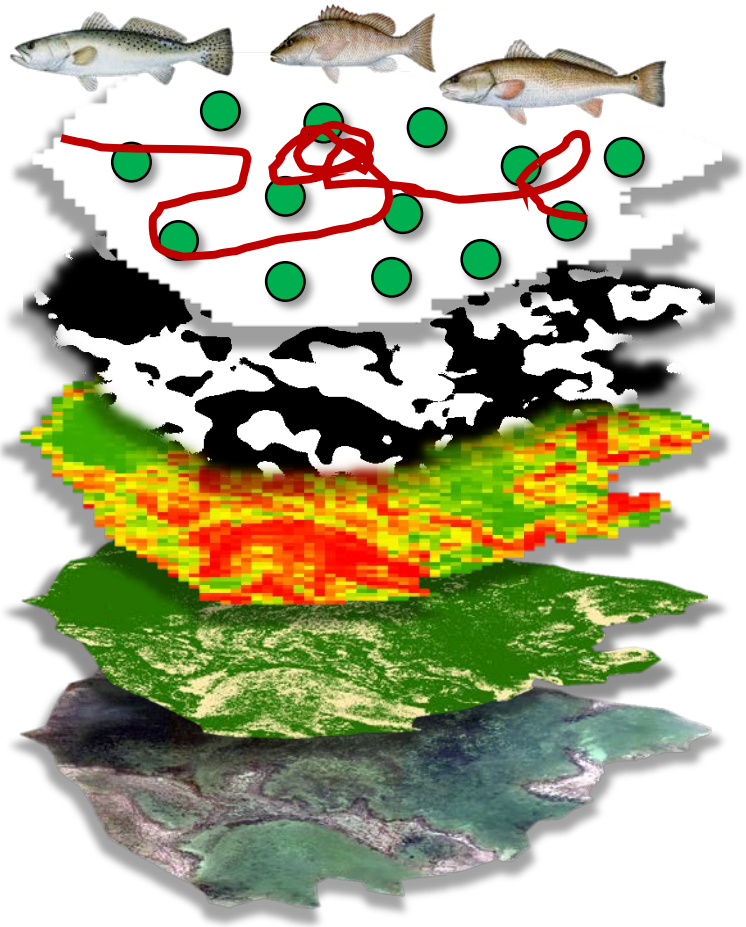
Prey

Redfish, seatrout, snook & snapper

health & movement (tagging) in & out of healthy vs. dead **seagrass**

What are effects of seagrass loss on our fisheries?

Layered approach



Whipray Basin

Hydrophones

Energy landscape

Fragmentation

+ Field data = seagrass map

Satellite image

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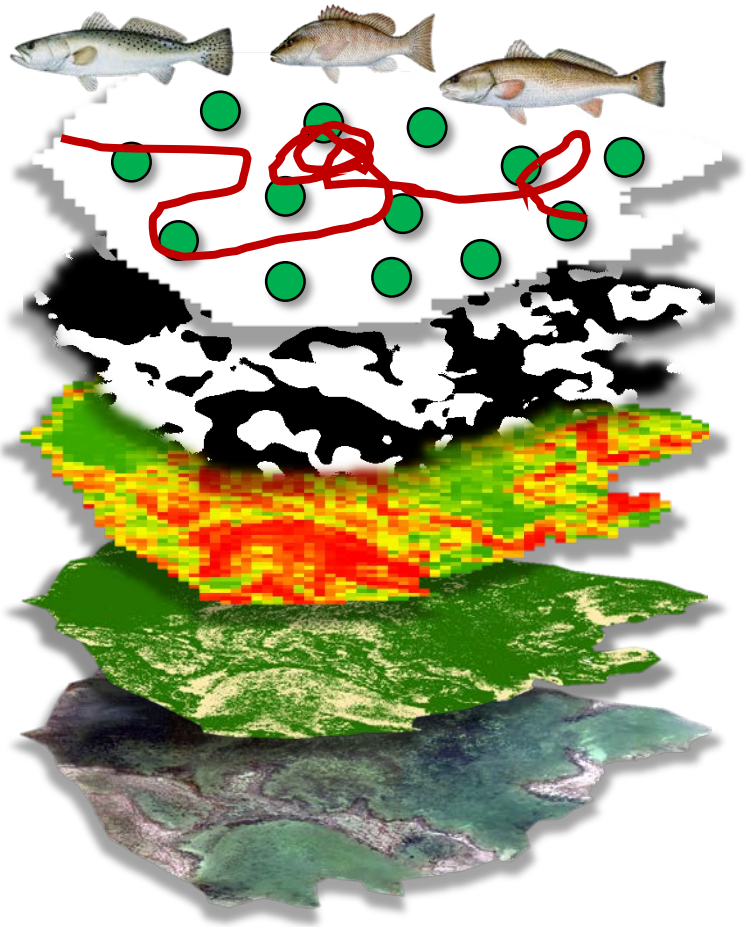

Whipray Basin

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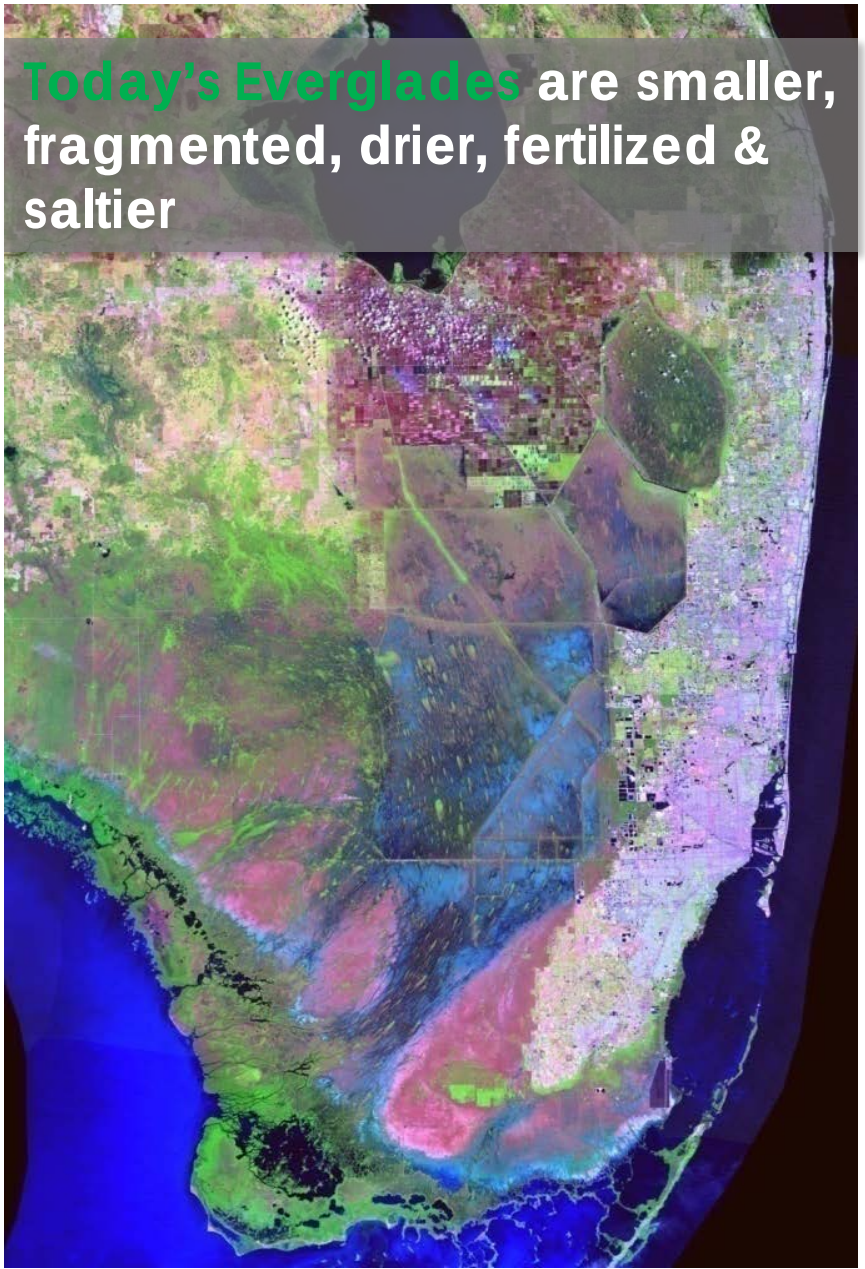
Do areas with seagrass loss offer poor feeding?

Do fish avoid these areas?

B. Why does the bay have these problems?

The Everglades have experienced big changes



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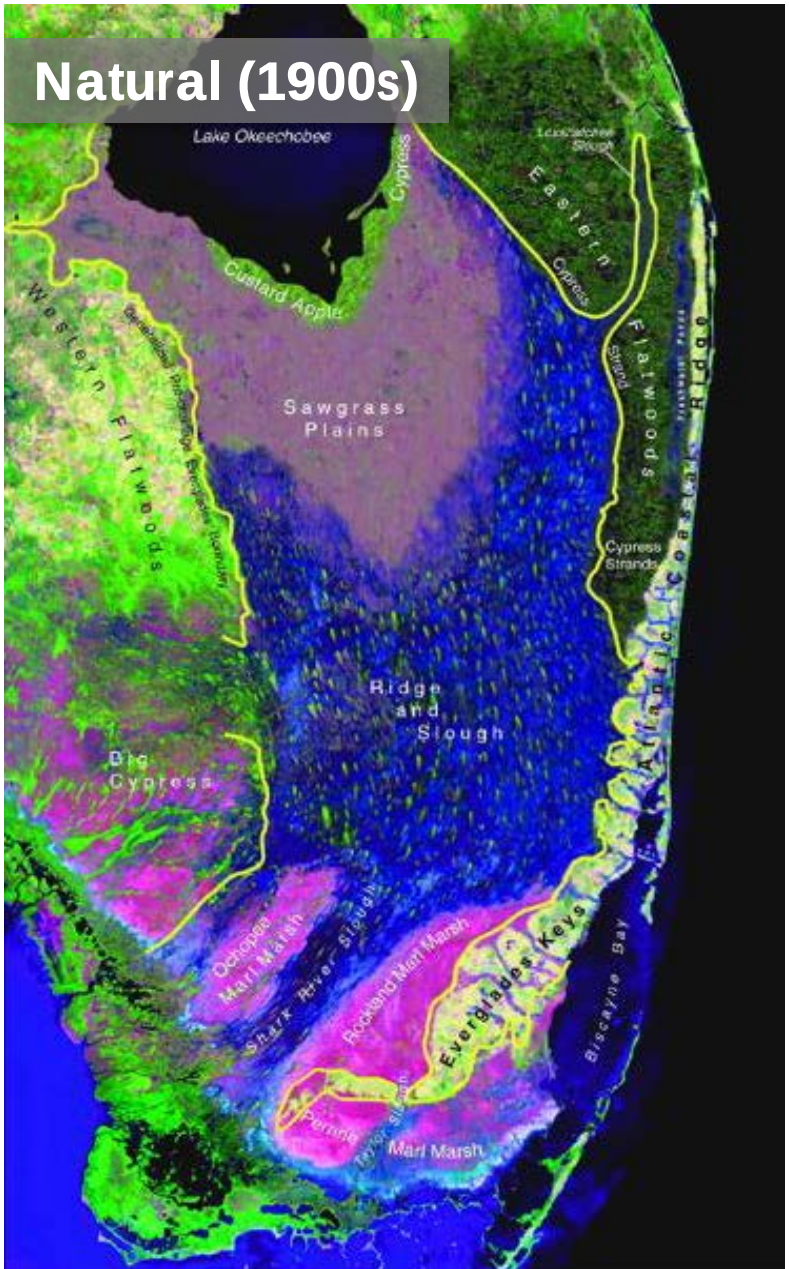
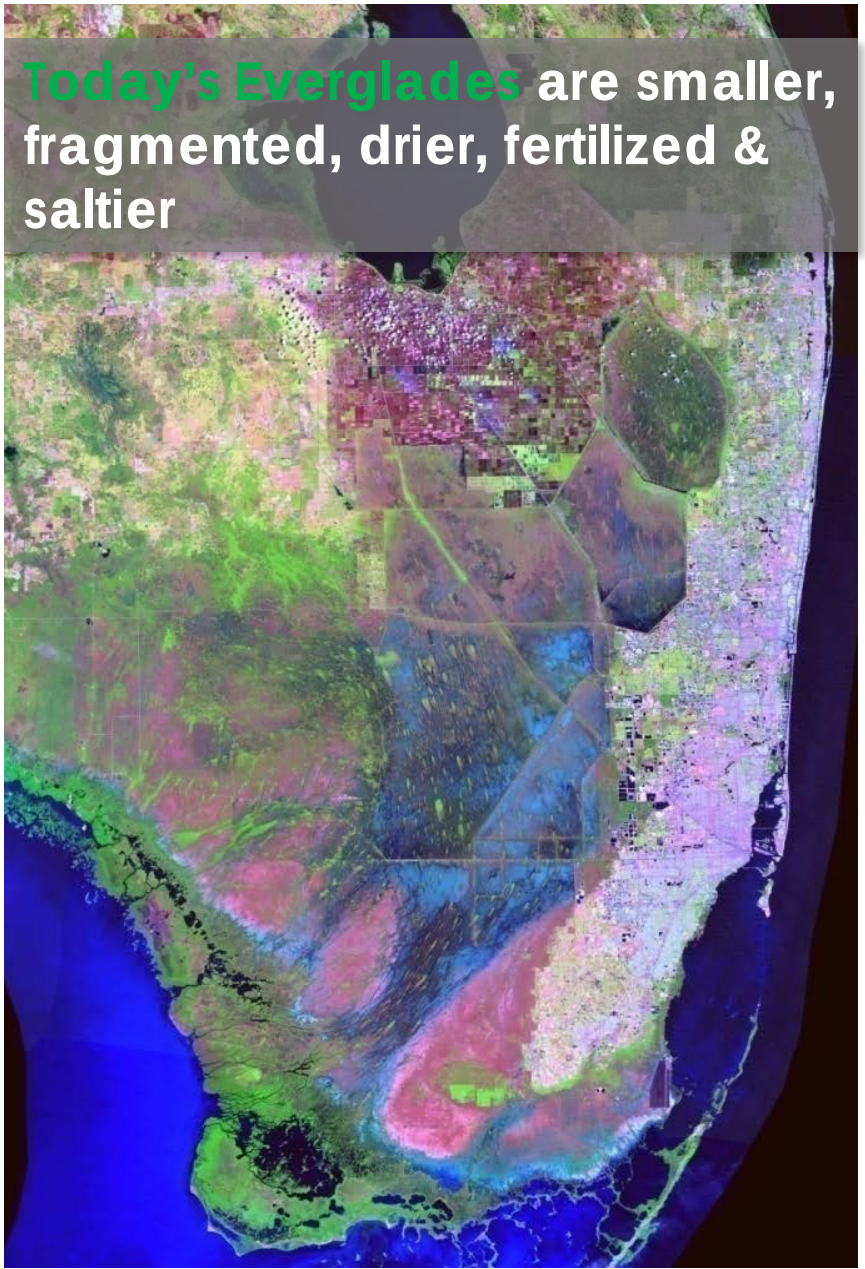
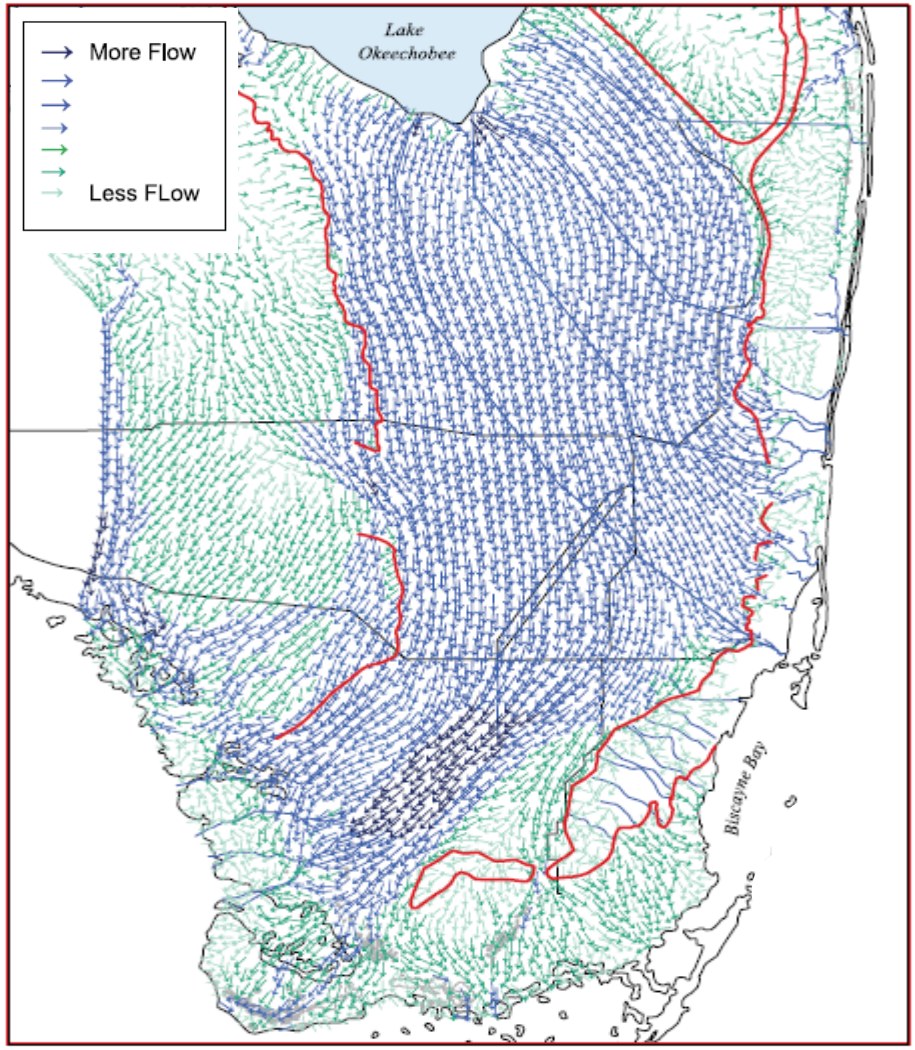
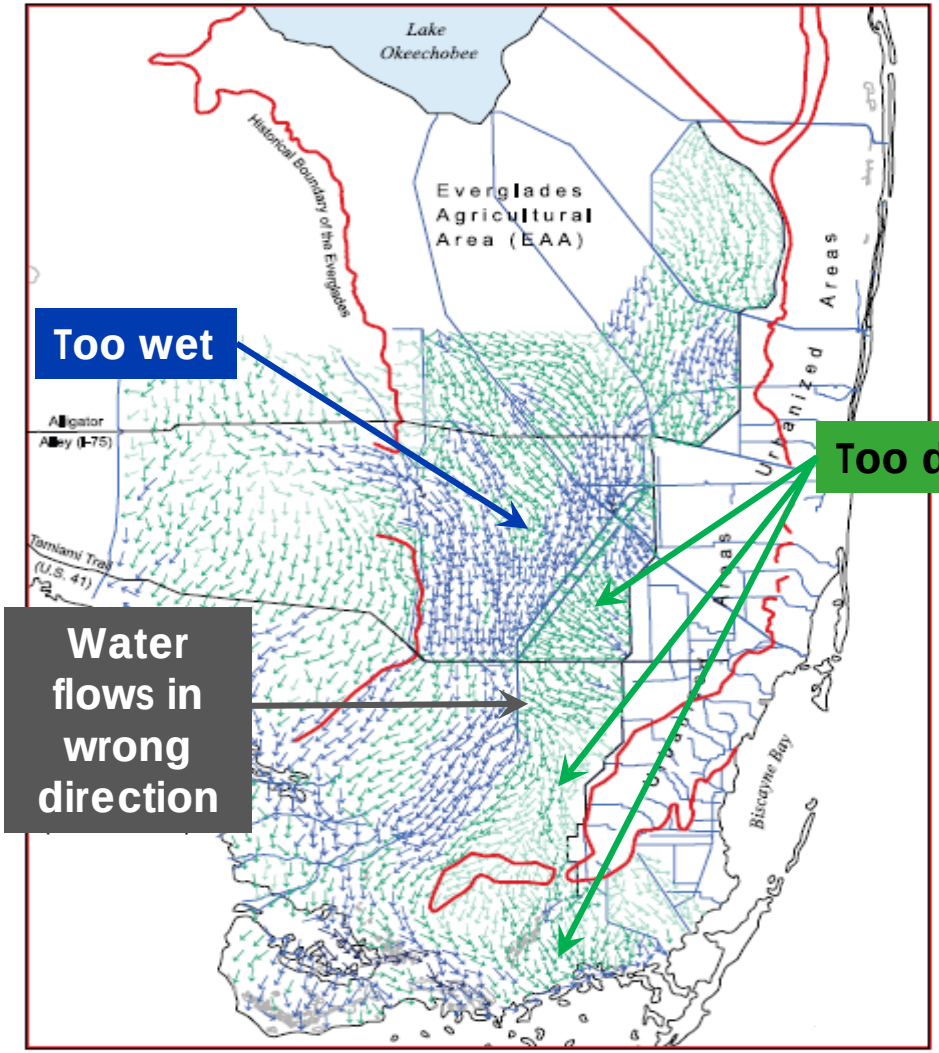


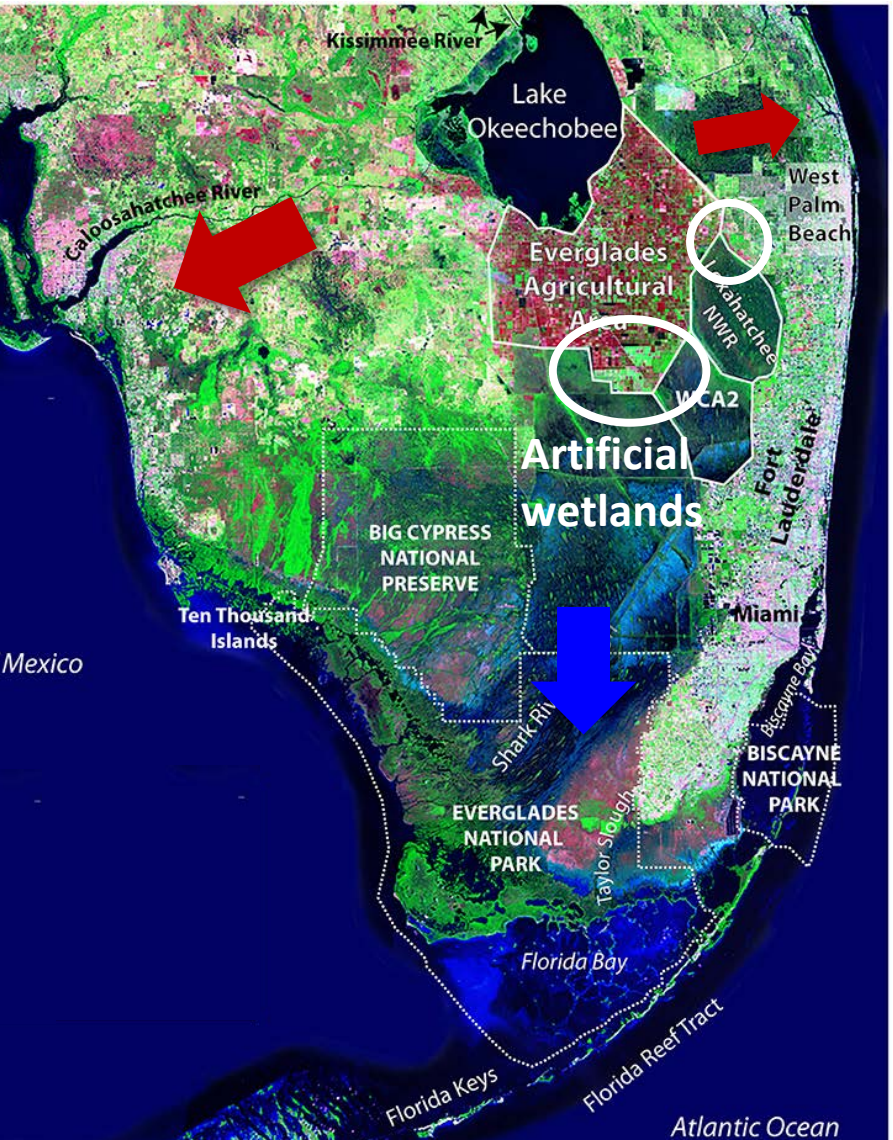


A major change: much less water in ecosystem, hard to manage & hard to get lower volume to the coast





Lake O has too many nutrients & cannot store water as well = releases to coast

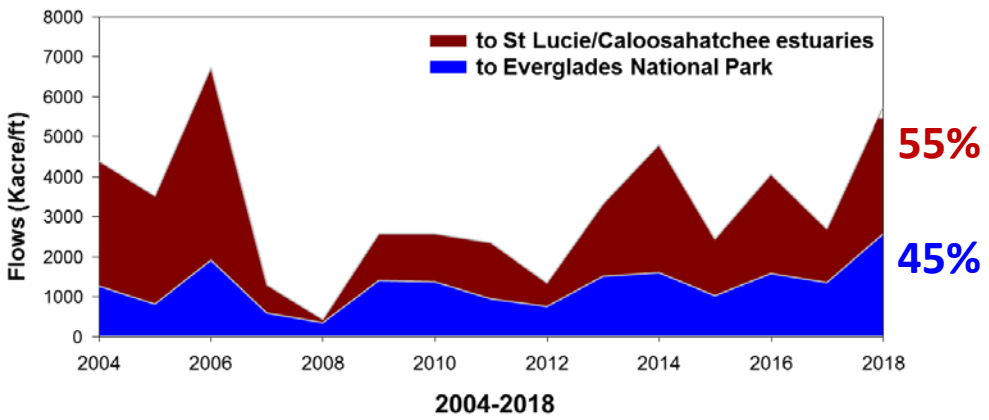


Fertilized water makes **irreversible changes**

World's largest artificial wetlands clean water but they **are too small**

Fertilized water is released to coast:

- **55% released**
- **only 45% to Everglades**



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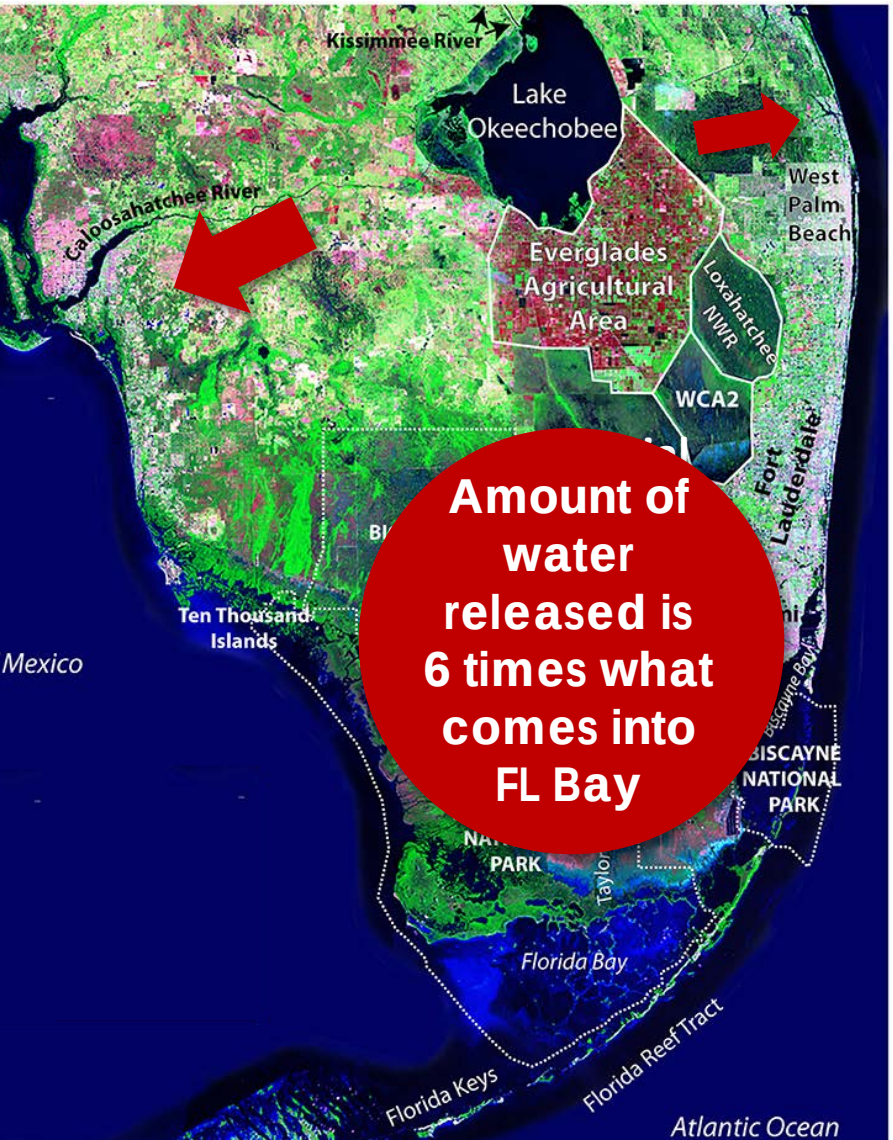

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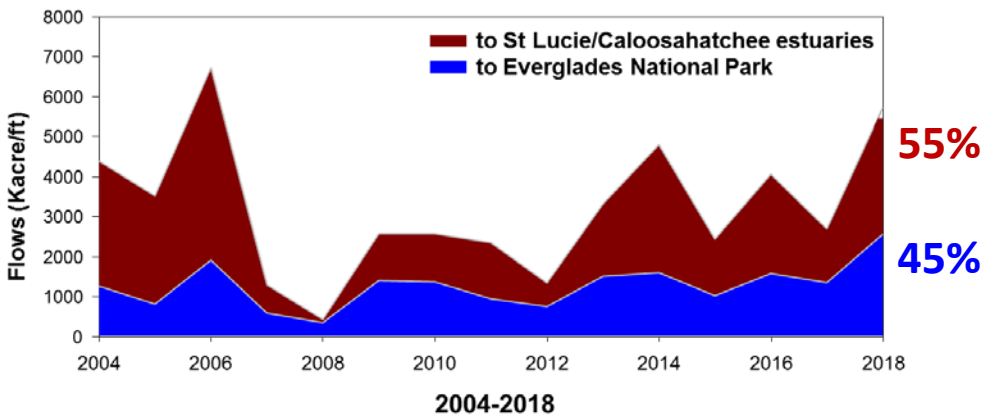
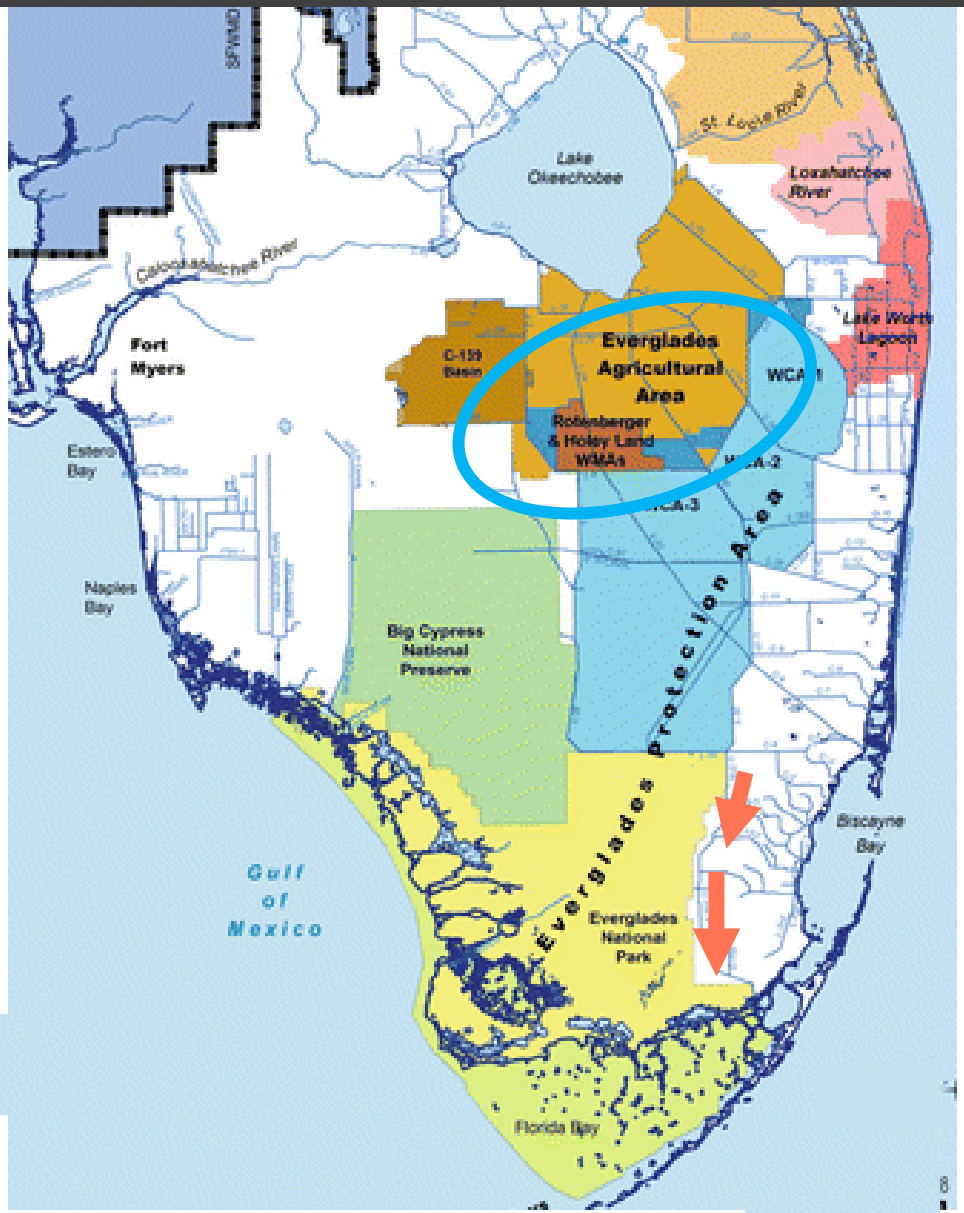


C. What fixes are needed to get water south?

1. What fixes are needed? 2 main ones



1. More **storage & artificial wetlands** to clean up water

NEED 50-70% MORE LAND
EAA Reservoir: 20%

2. Fix **routing of water south**:

- **Water loss** along eastern Everglades is a big problem
- Sending water south is constrained in summer - *need to **keep canals low** for South Dade agriculture*

LOTS OF WATER NEEDED FOR HYPERSALINITY TO STOP

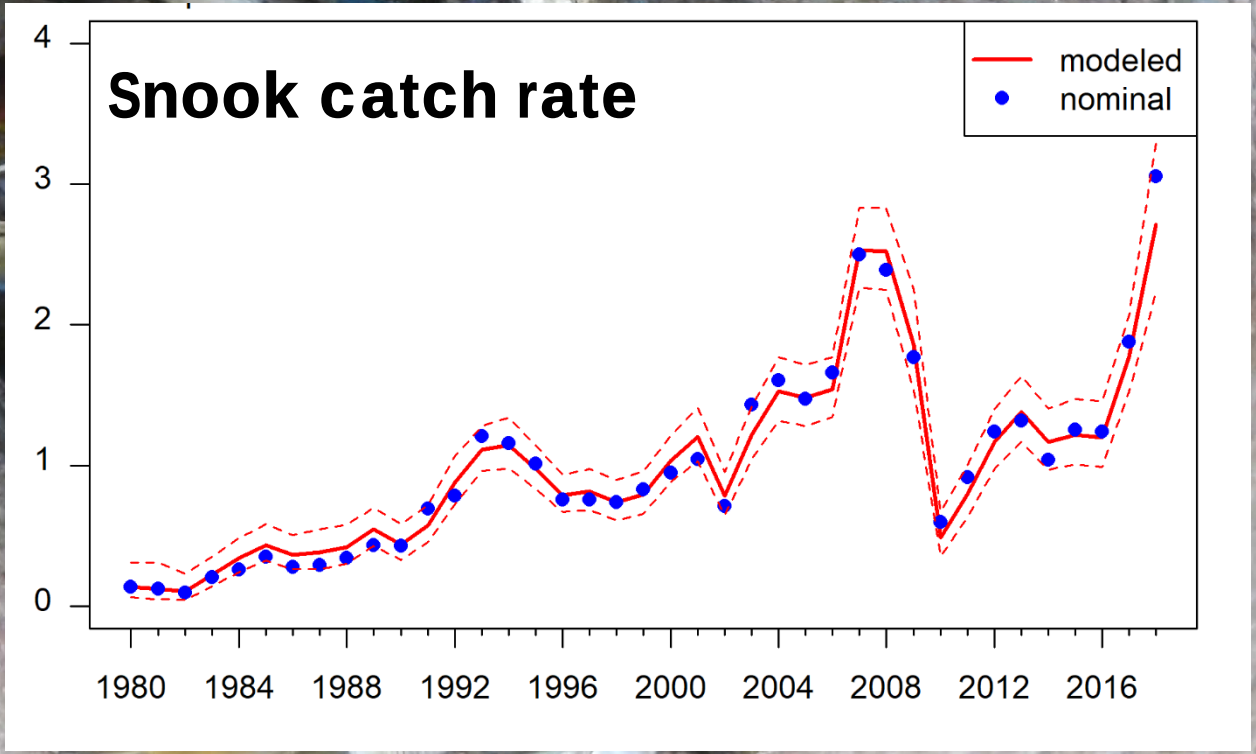
D. Some recent good news for the bay…

Hurricane Irma

- Gave us record amounts of freshwater water (not attainable under current conditions) & low salinities in the bay
- Gave us a glimpse at how ecosystem will do with more water & results were encouraging
- Caused the best wading bird nesting ever documented
- Caused fish to spawn & now juvenile fish are everywhere

IRMA: record spawning for recreational fisheries

- Lots of **juvenile snook, redfish, seatrout** as a result
- Also high numbers of their prey (also spawned)
- Making for **great fishing in upcoming yrs**




HOPE

What is wrong with Florida Bay?

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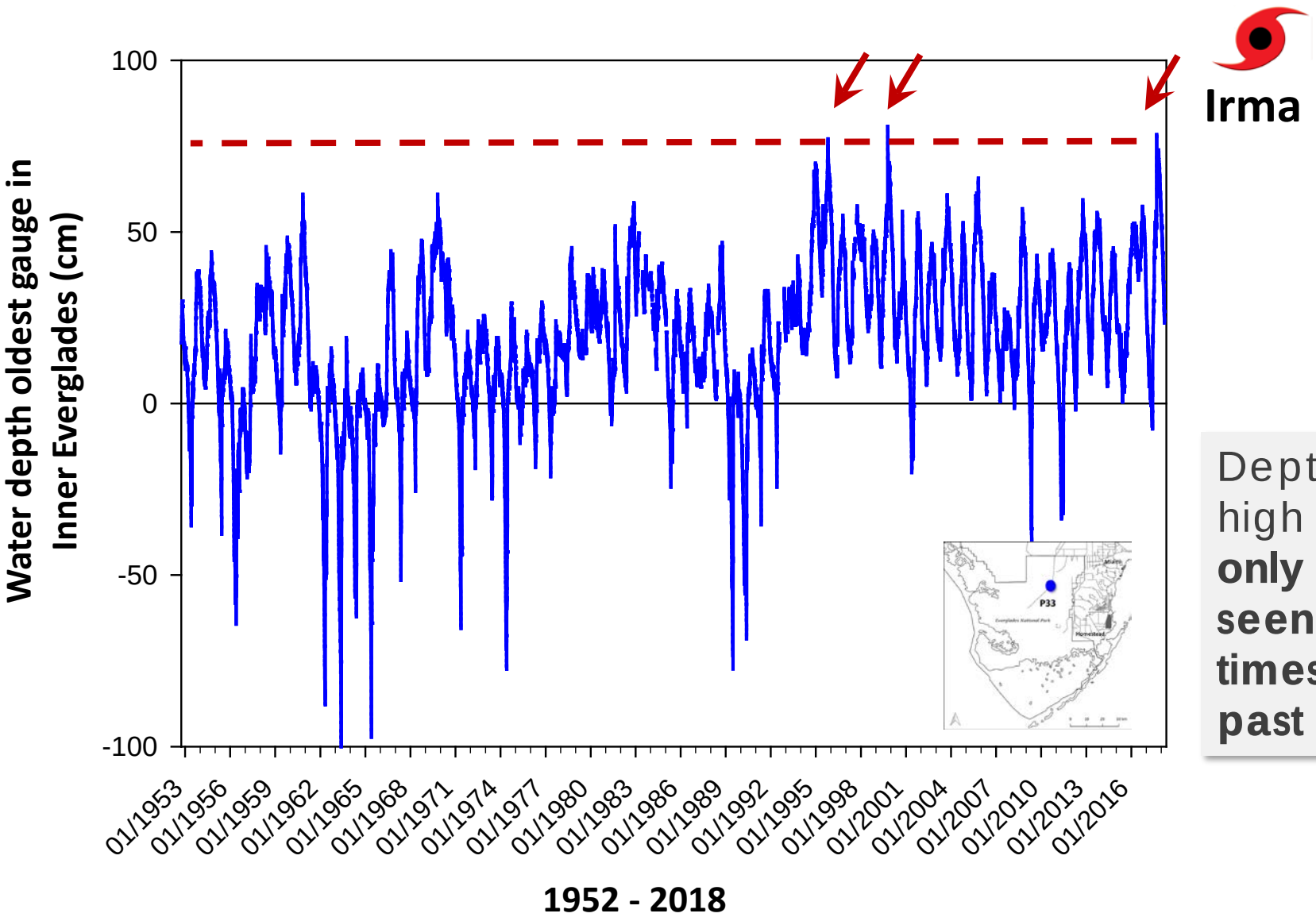
IRMA: record water depths in inner Everglades



Depths this high have **only been seen 3 times in past 64 yrs**

IRMA: record nesting of wading birds in 33 yrs

Data source: P. Frederick, UF; L. Oberhofer, ENP; M. Cook, SFWMD

This is **4-times the recent average**

Largest **nesting at the coast** seen since 1940s

Gives us confidence that with **more water, things can get better!**

IRMA: record low salinities in Florida Bay