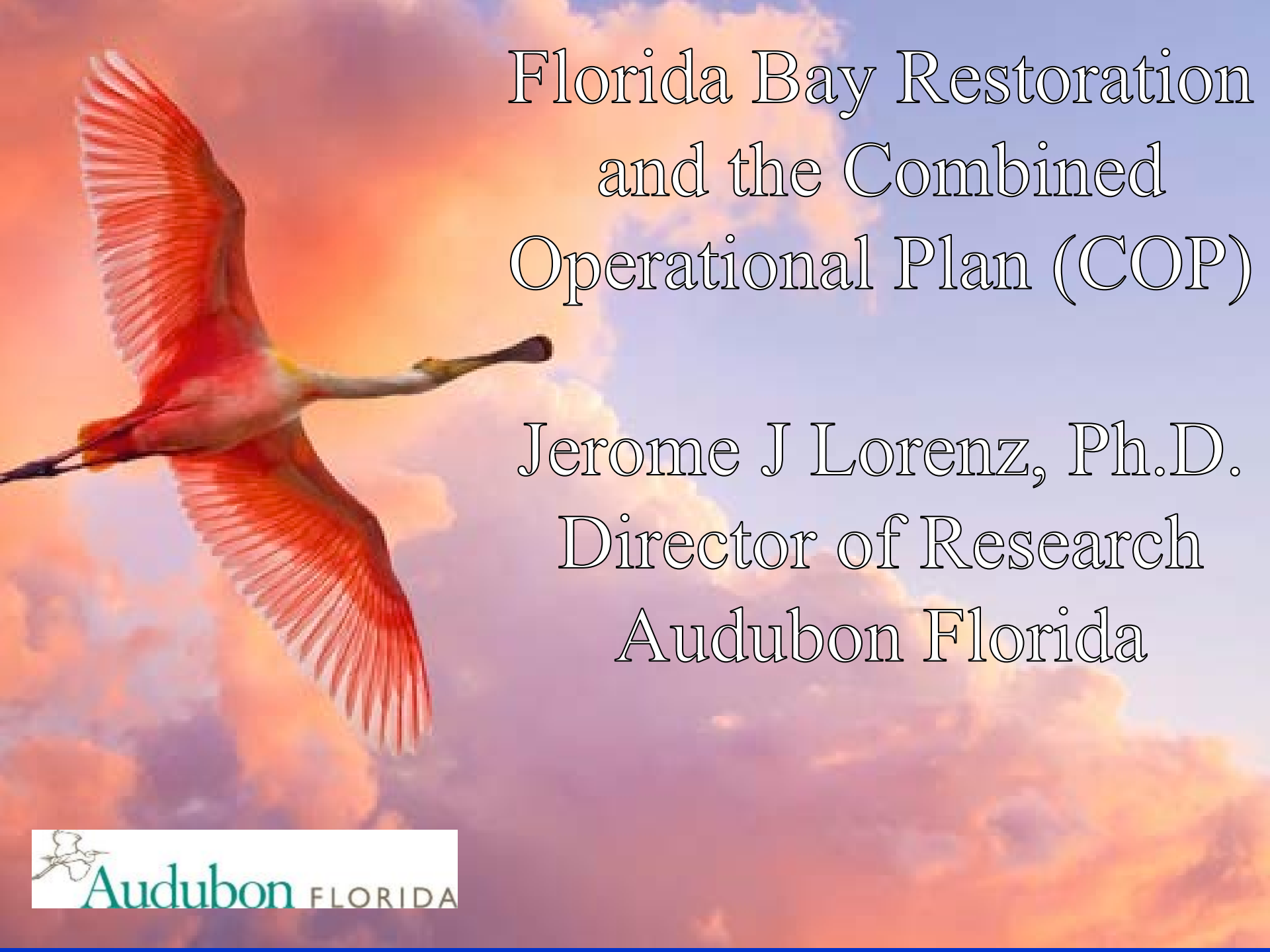
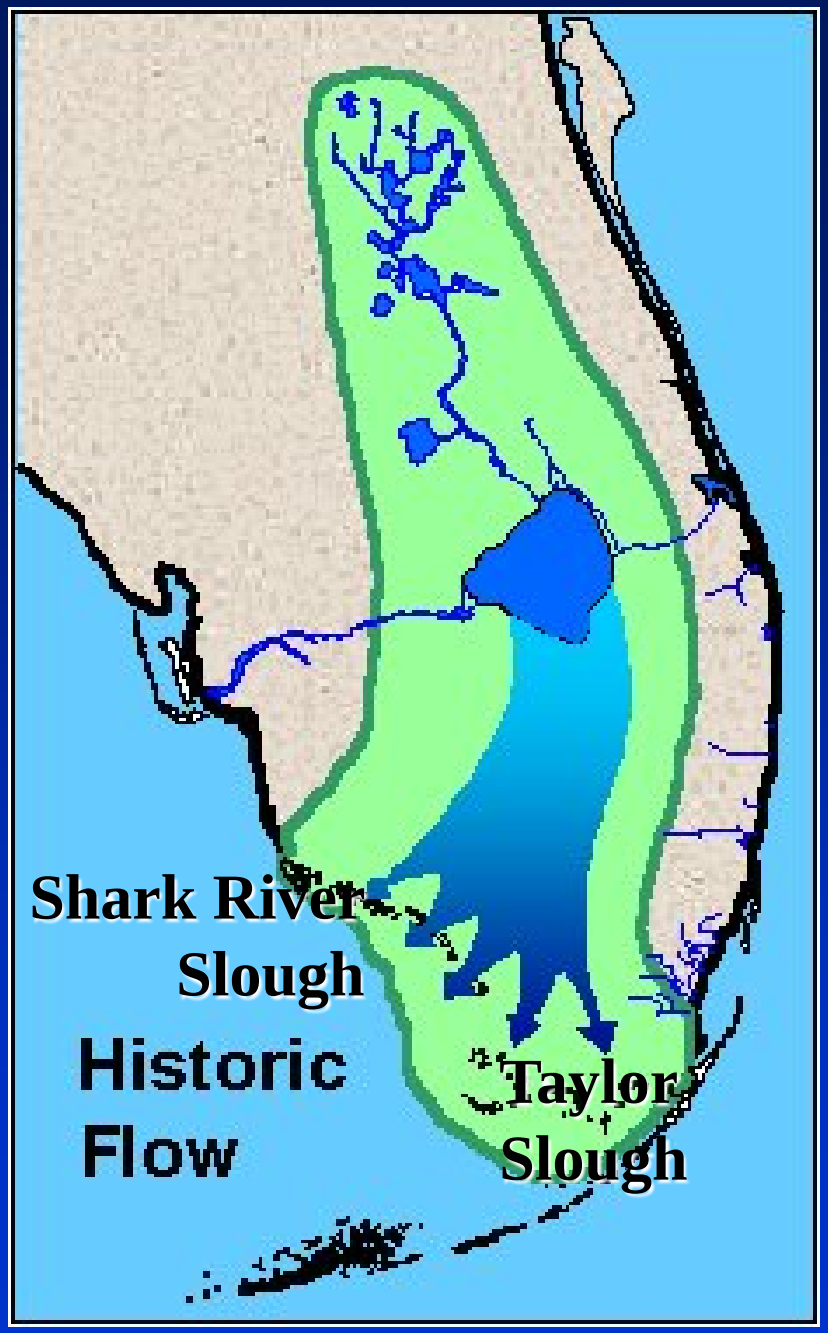
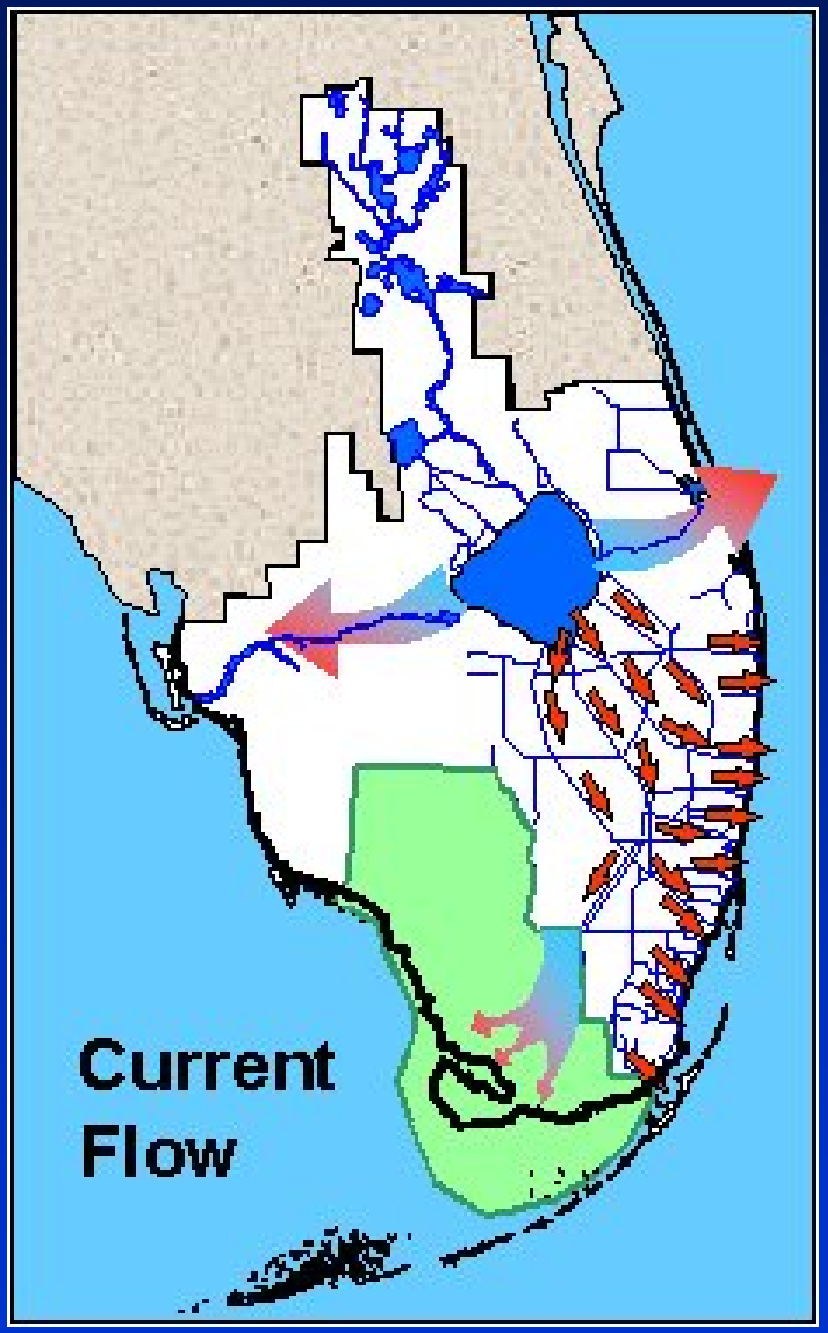


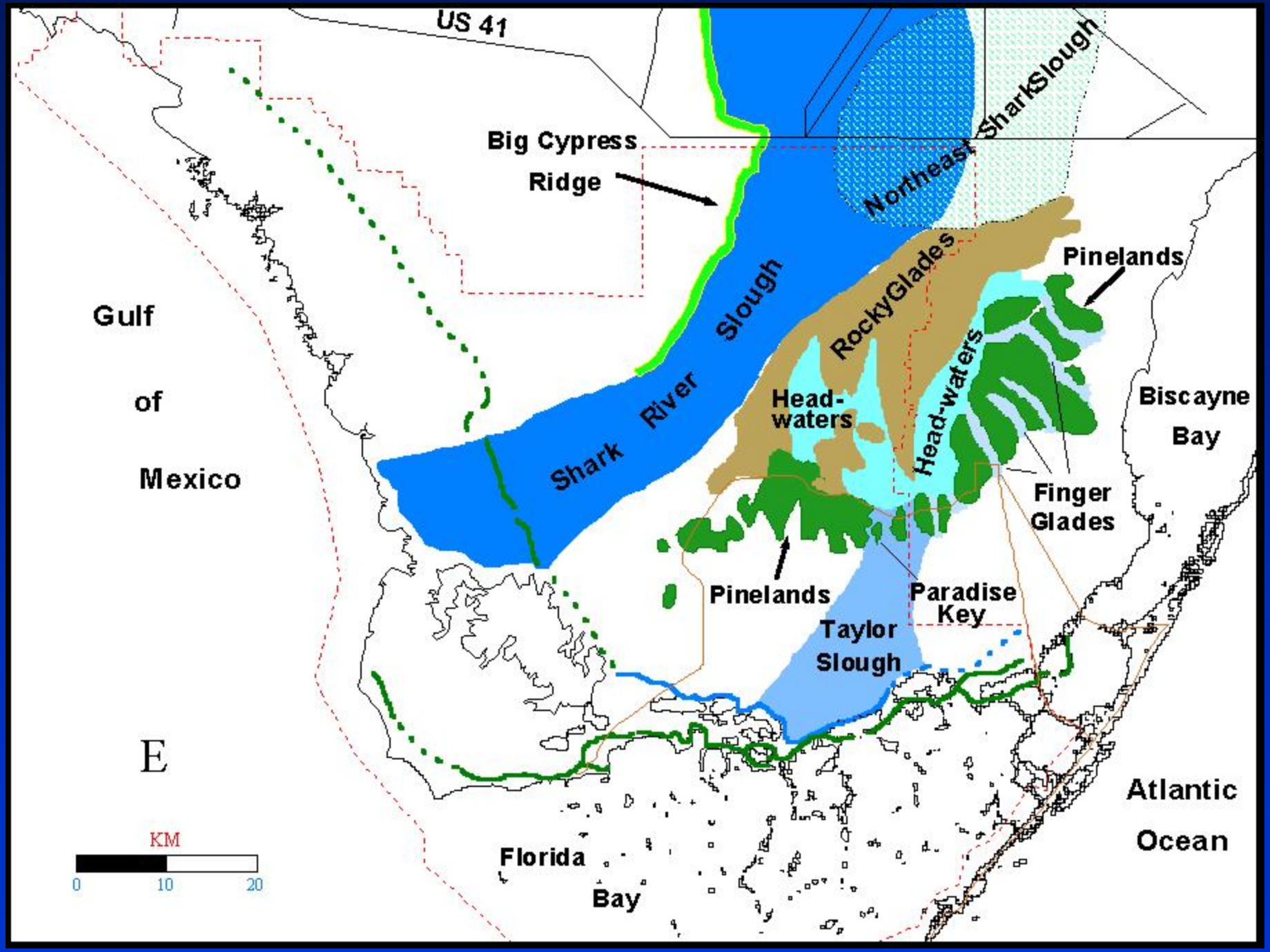
Florida Bay Restoration and the Combined Operational Plan (COP)

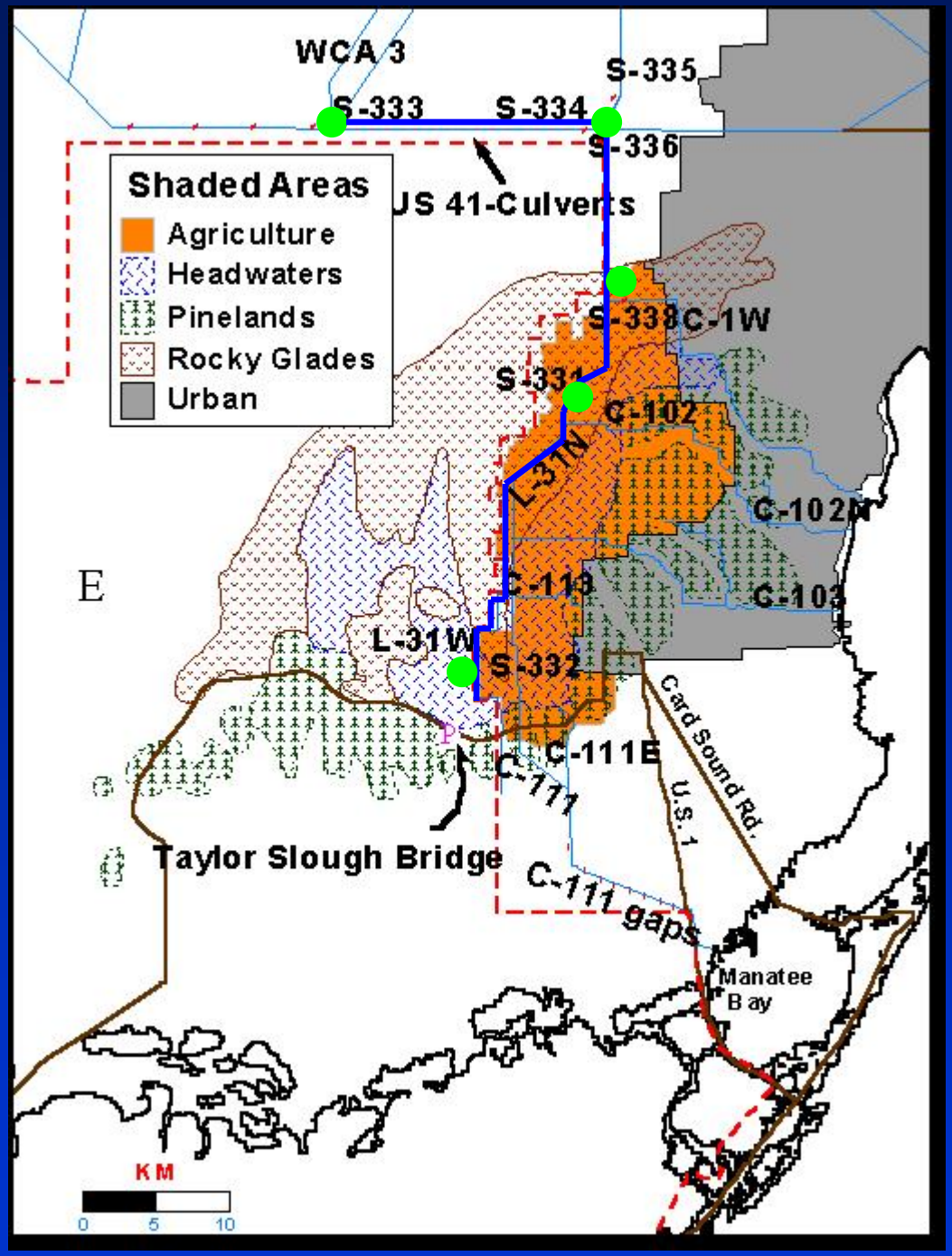
Jerome J Lorenz, Ph.D.
Director of Research
Audubon Florida

Audubon FLORIDA


Shark River
Slough
Historic
Flow
Taylor
Slough


Current
Flow

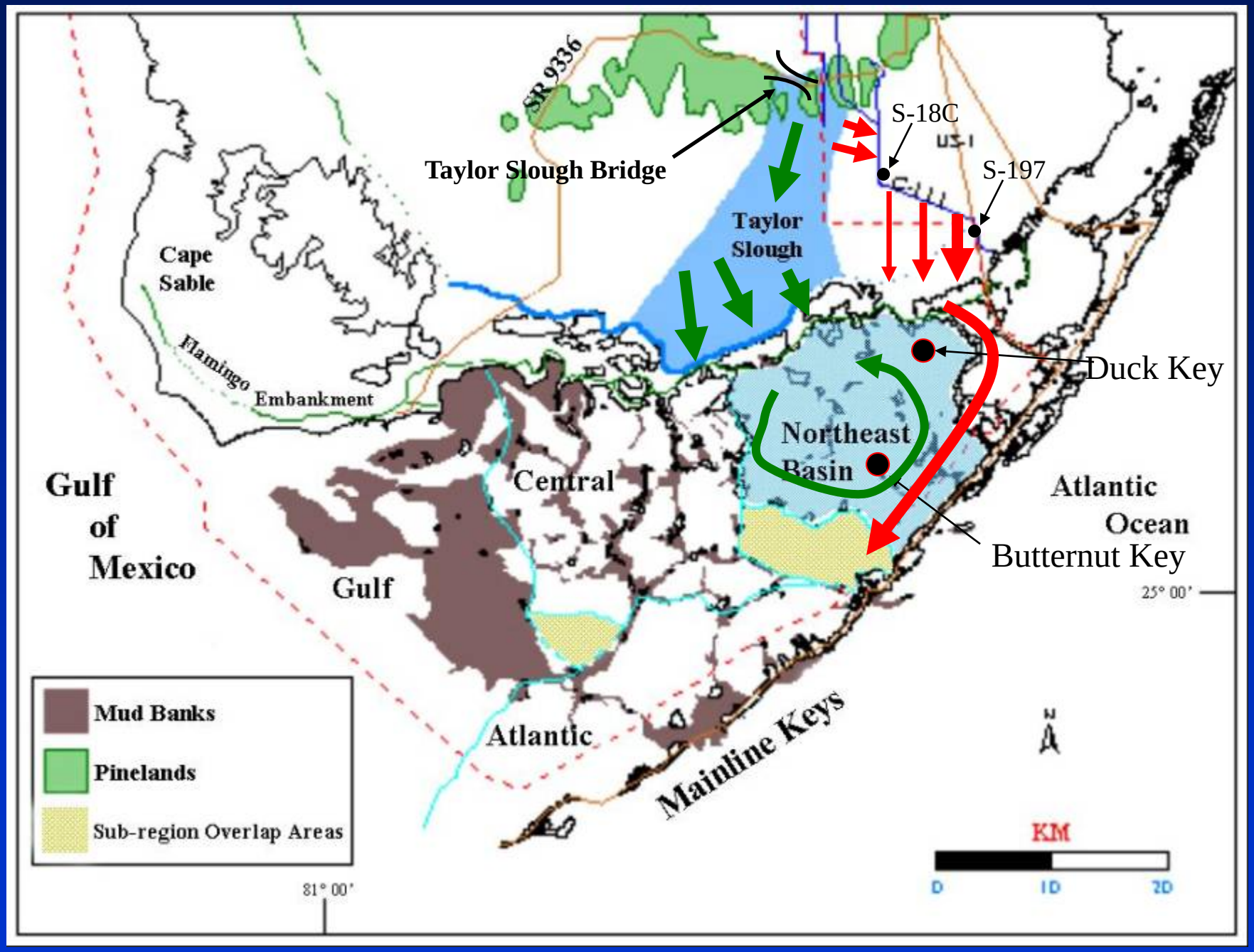

US 41
Big Cypress
Ridge
Northeast Shark Slough
Gulf
of
Mexico
Shark River Slough
Rocky Glades
Head-
waters
Head-waters
Pinelands
Biscayne
Bay
Finger
Glades
Pinelands
Paradise
Key
Taylor
Slough
E
KM
0
10
20
Florida
Bay
Atlantic
Ocean

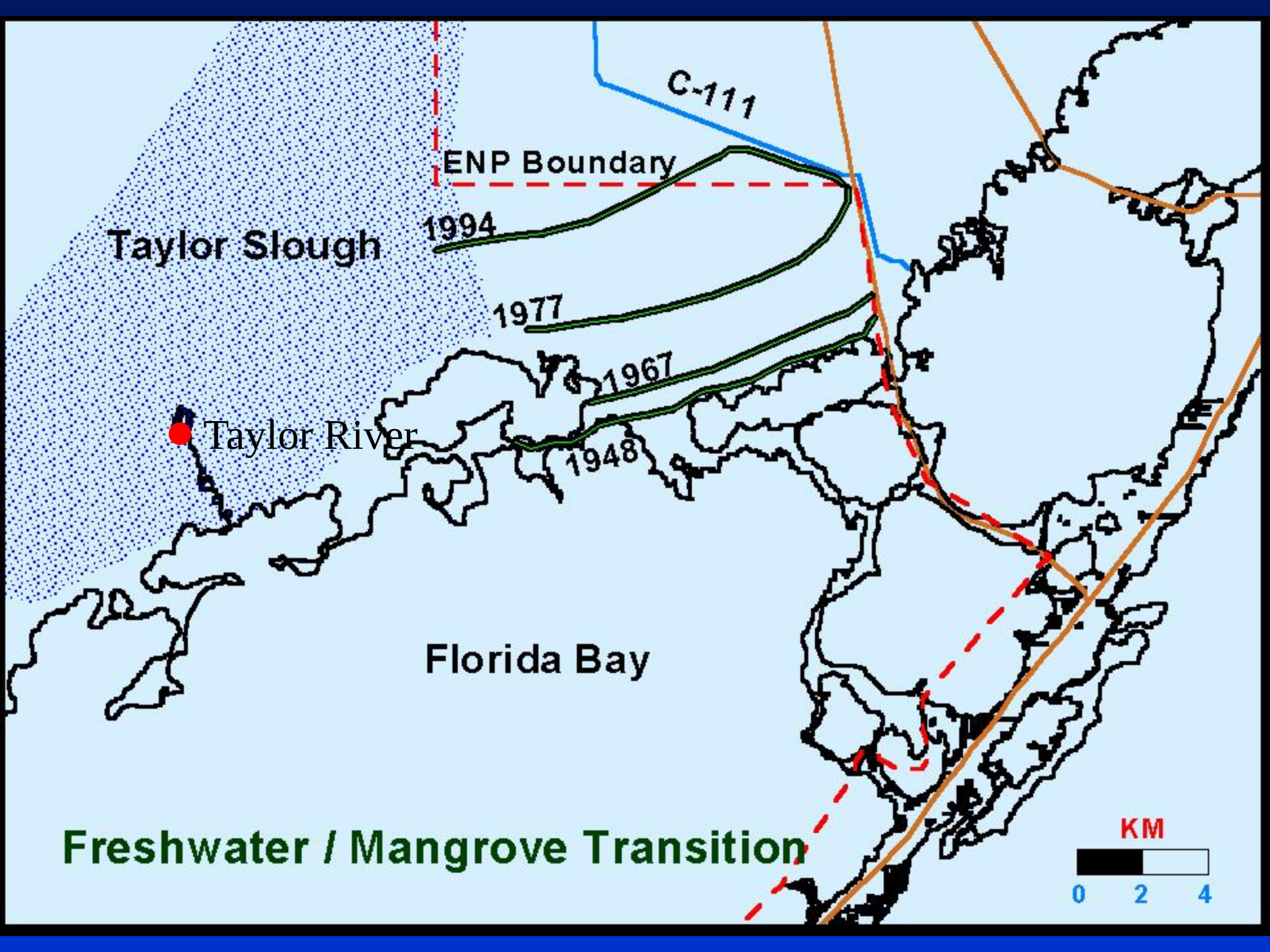

WCA 3
S-335
S-333
S-334
S-336
US 41-Culverts
Shaded Areas
Agriculture
Headwaters
Pinelands
Rocky Glades
Urban
S-338
C-1W
S-331
C-102
L-31N
C-102N
E
C-113
C-103
L-31W
S-332
Card Sound Rd.
C-111E
C-111
U.S. 1
Taylor Slough Bridge
C-111 gaps
Manatee Bay
KM
0
5
10

Marshall et al. 2008 used models coupled with paleoecological to simulate pre-drainage conditions.

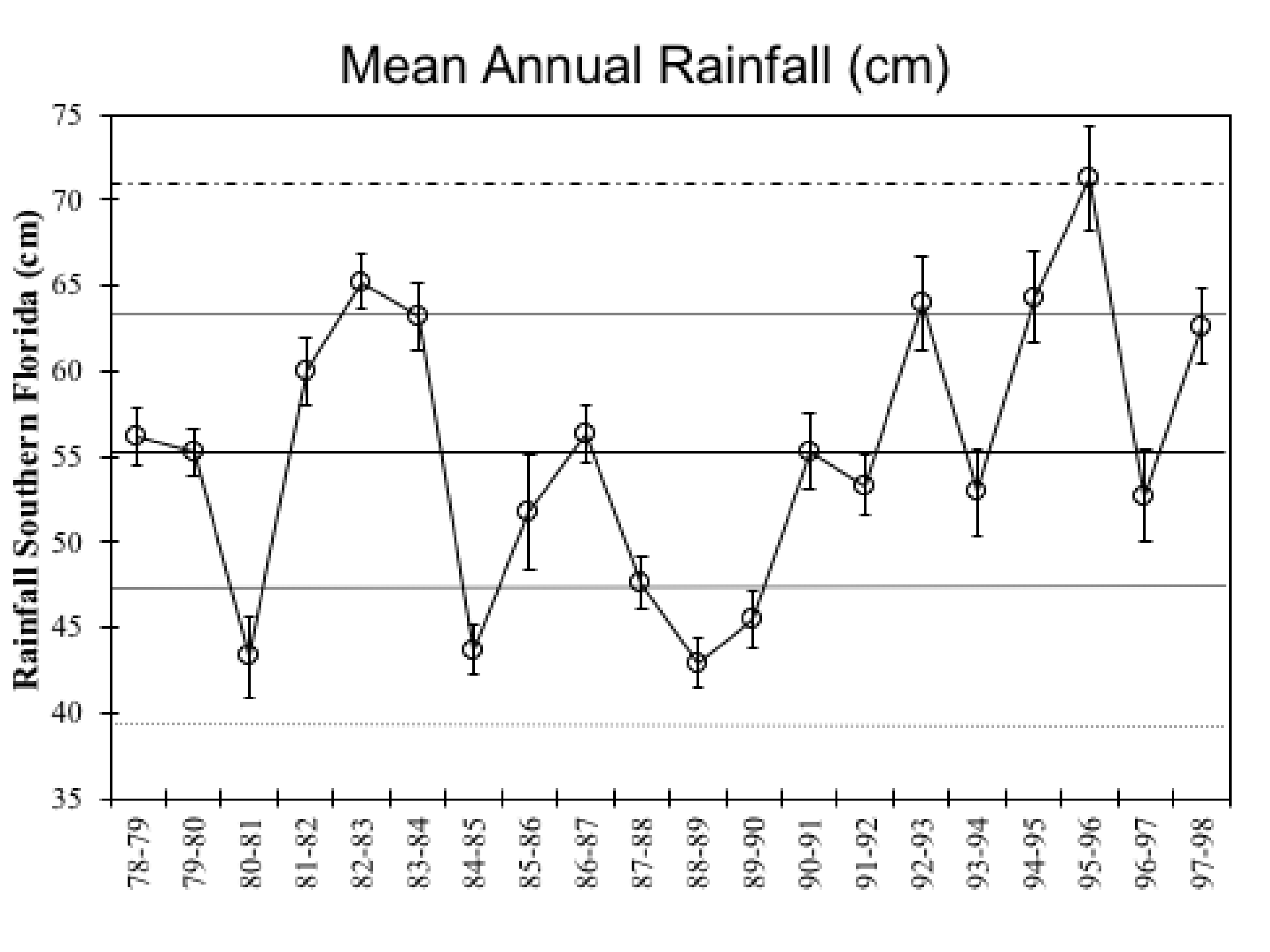
- Conservatively estimated almost 4 times the freshwater flow from Taylor Slough to Florida Bay compared to existing flows

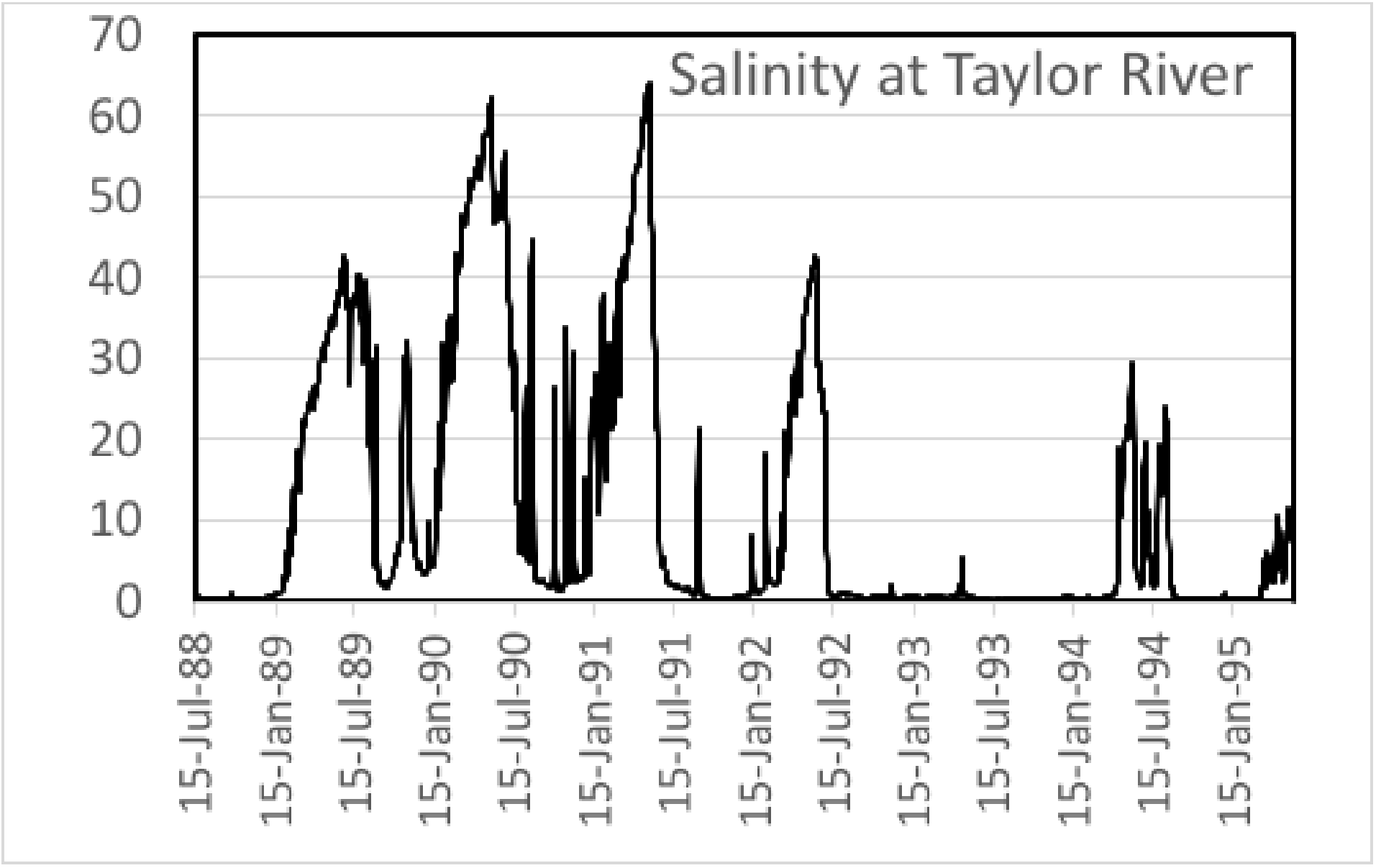
Marshall III, F.E., G.L.Wingard and P. Pitts. 2008. A simulation of historic hydrology and salinity in Everglades National Park: coupling paleoecological assemblage data with regression models. Estuaries and Coasts

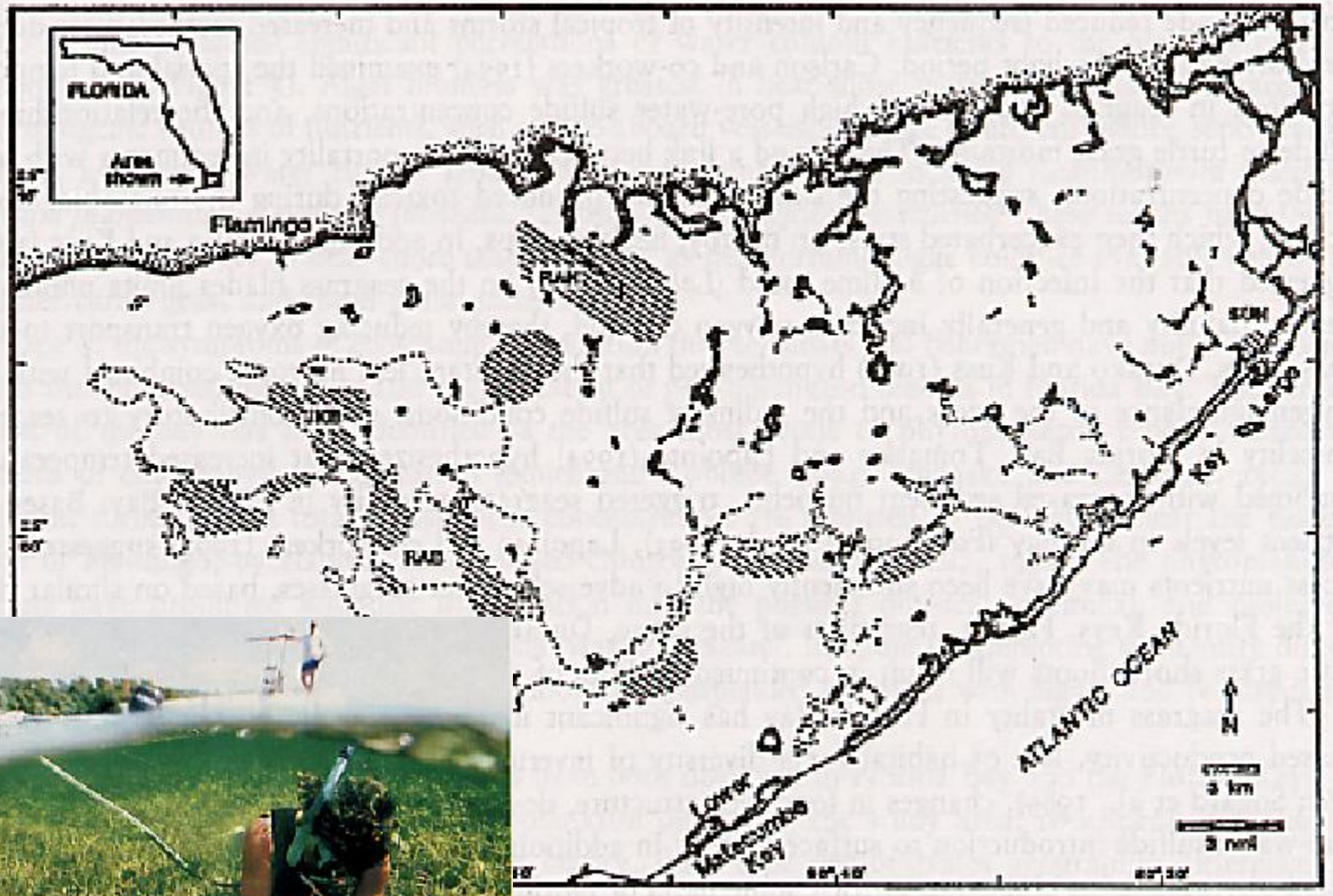

SR 9336
Taylor Slough Bridge
S-18C
US-1
S-197
Taylor Slough
Cape Sable
Flamingo
Embankment
Duck Key
Northeast Basin
Central
Gulf of Mexico
Gulf
Atlantic Ocean
Butternut Key
25° 00'
Mud Banks
Pinelands
Sub-region Overlap Areas
Atlantic
Mainline Keys
N
KM
0
10
20
81° 00'


C-111
ENP Boundary
Taylor Slough
1994
1977
1967
1948
Taylor River
Florida Bay
Freshwater / Mangrove Transition
KM
0
2
4

Ecological Collapse of Florida Bay 1987-1993


Mean Annual Rainfall (cm)
Rainfall Southern Florida (cm)
75
70
65
60
55
50
45
40
35
78-79
79-80
80-81
81-82
82-83
83-84
84-85
85-86
86-87
87-88
88-89
89-90
90-91
91-92
92-93
93-94
94-95
95-96
96-97
97-98


Salinity at Taylor River
70
60
50
40
30
20
10
0
15-Jul-88
15-Jan-89
15-Jul-89
15-Jan-90
15-Jul-90
15-Jan-91
15-Jul-91
15-Jan-92
15-Jul-92
15-Jan-93
15-Jul-93
15-Jan-94
15-Jul-94
15-Jan-95

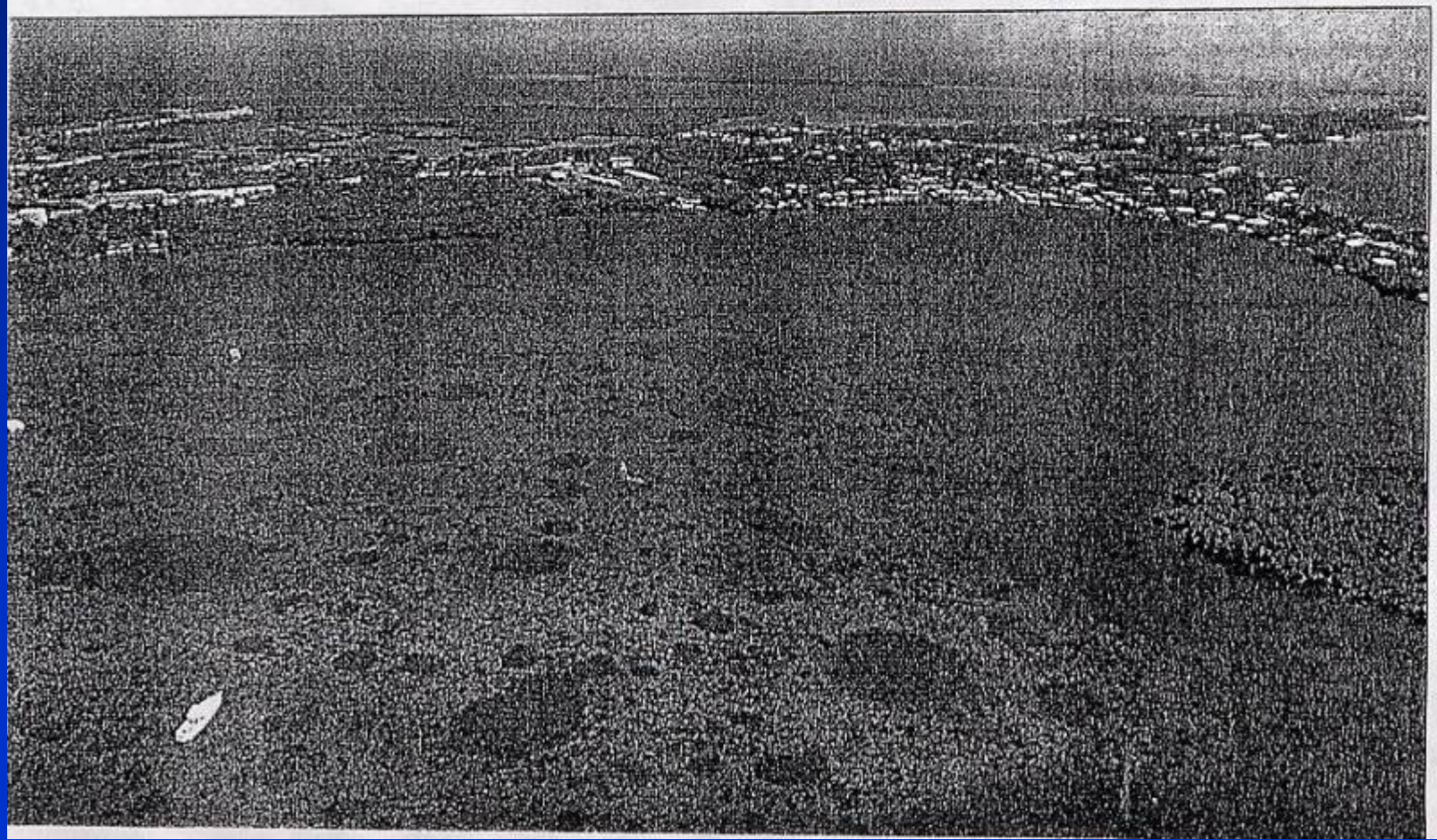

FLORIDA
Area shown
Flamingo
RAH
RAB
ATLANTIC OCEAN
Lower Matecumbe Key
N
3 km
3 nmi

The Miami Hera

TUESDAY, AUGUST 11, 1992

'Florida Bay is falling apart like a rotting piece of cloth.'

— JAY ZIEMAN, marine scientist



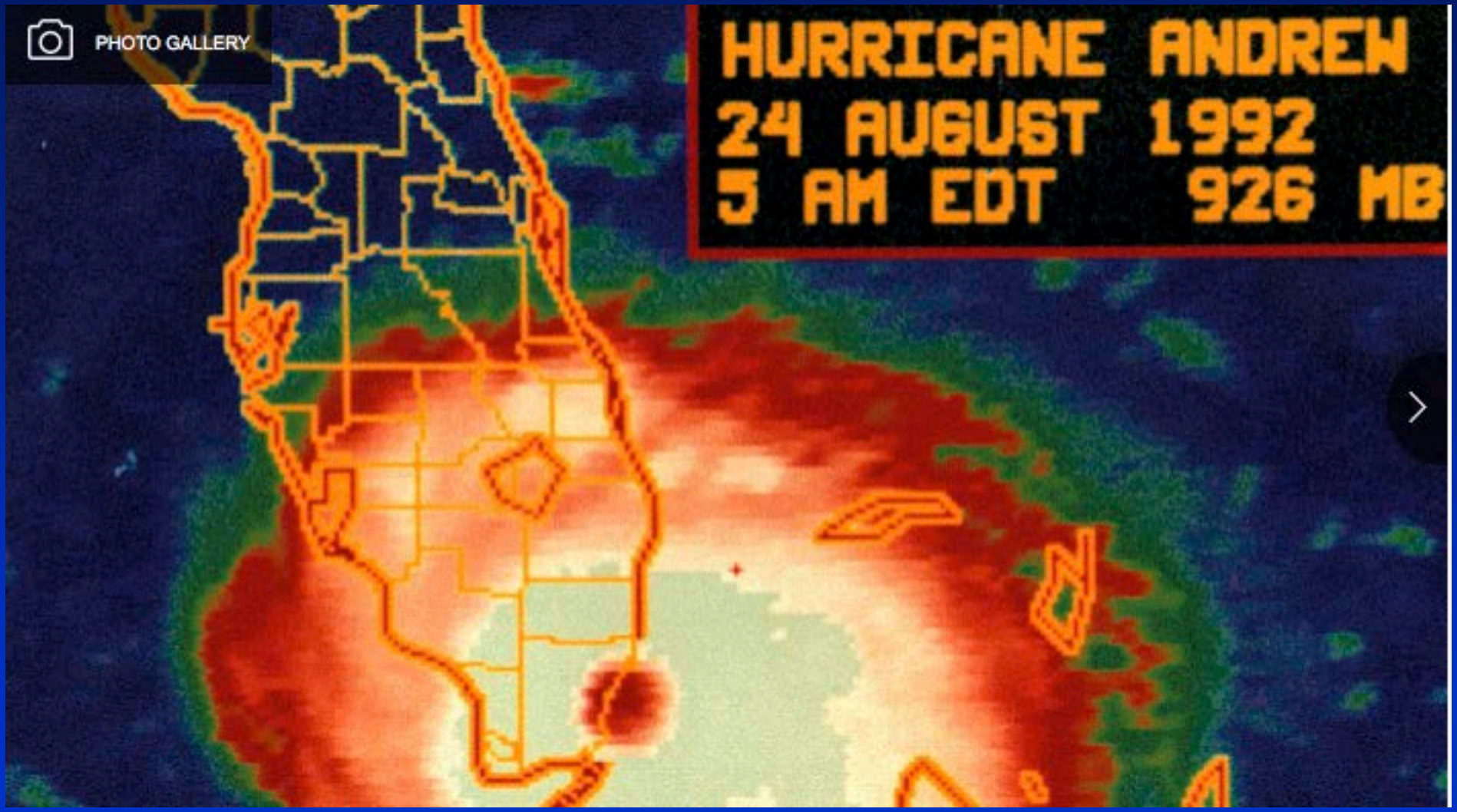
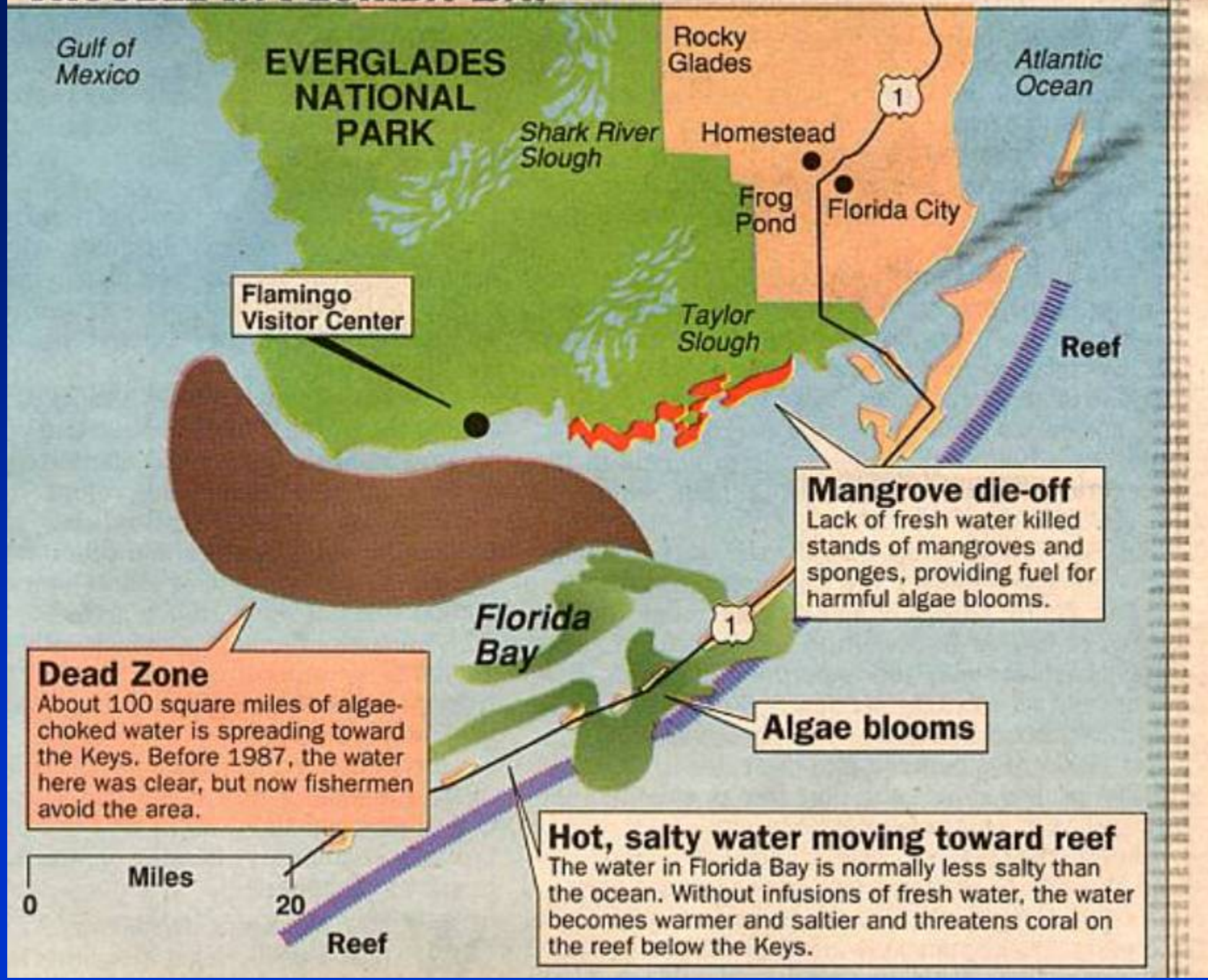


PHOTO GALLERY
HURRICANE ANDREW
24 AUGUST 1992
5 AM EDT
926 MB

TROUBLE IN FLORIDA BAY



EVERGLADES NATIONAL PARK

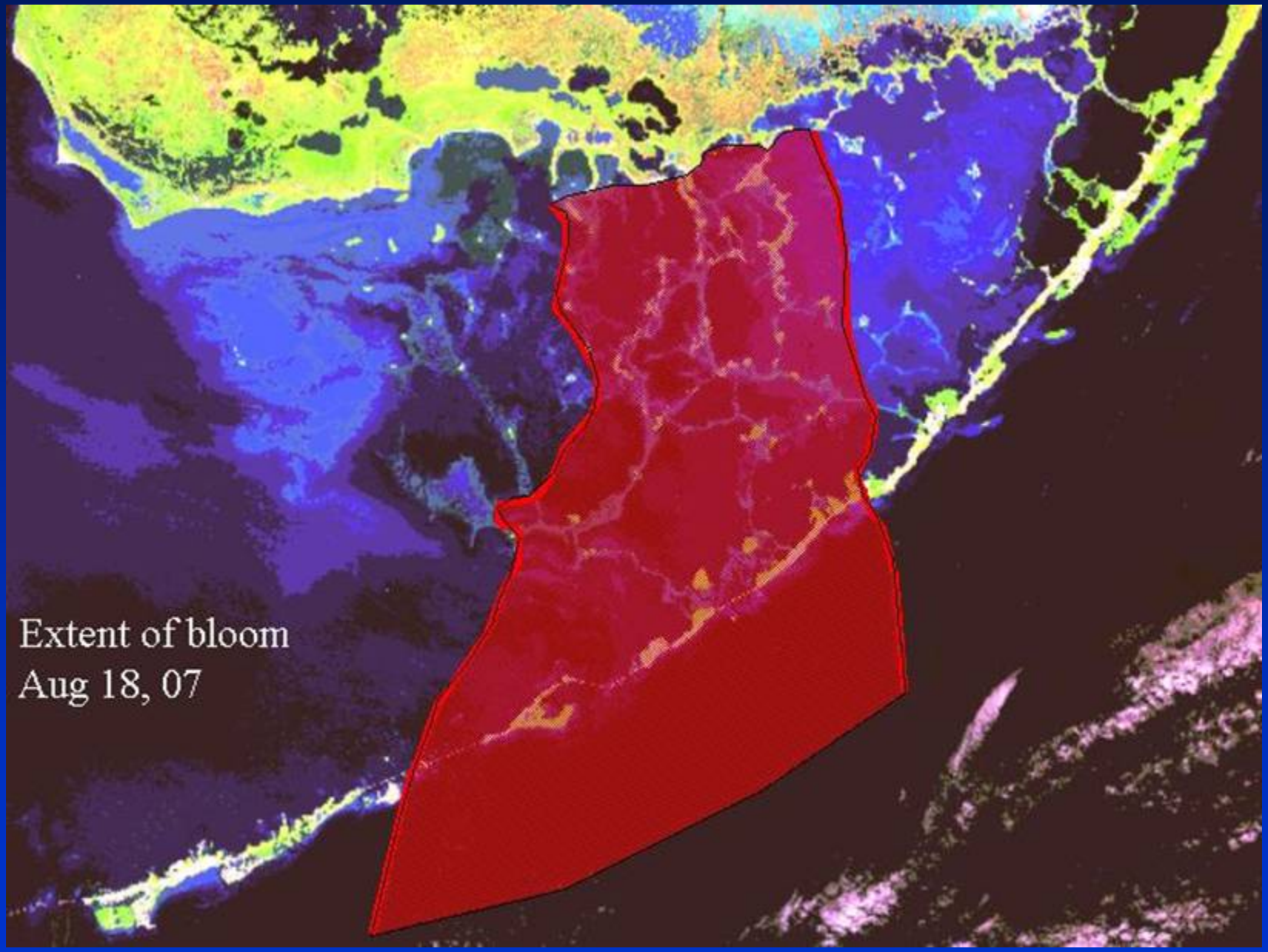
Fish suffocate in Florida Bay

Hundreds of fish have died in an area of Florida Bay that has seen previous fish kills, which may be a sign of a deteriorating bay.

The fish, which included redfish, sea trout and sea catfish, were found dead in a shallow area east of Flamingo.

They died from suffocation; oxygen levels in the bay drop off as the water heats up, Everglades National Park spokeswoman Pat Tolle said Thursday.

During August, September and October, the shallow waters heat up and the water circulation deteriorates, Tolle said. Kills are most likely to occur during the late summer and early fall, she said.


Extent of bloom
Aug 18, 07

Tennessee Reef: August 16th 2007

1960

1989

Sponge Mortality

Photo courtesy Miami-Dade DERM

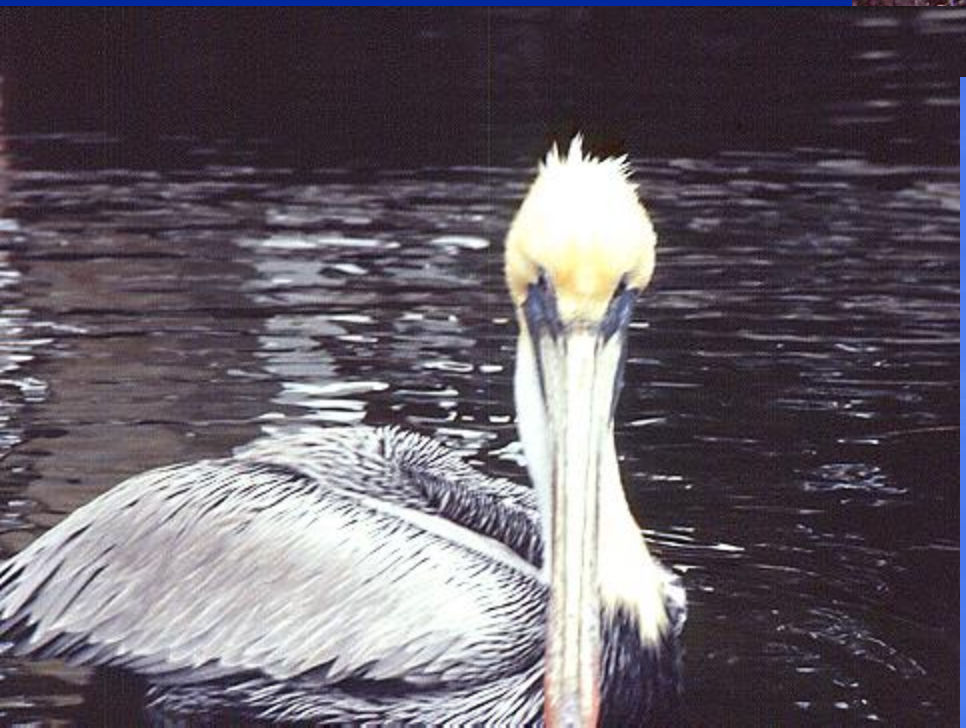
Photo courtesy Miami-Dade DERM

Stress to the entire Benthic Community

A Review of the Effects of Altered Hydrology and Salinity on Vertebrate Fauna and Their Habitats in Northeastern Florida Bay

Jerome J. Lorenz

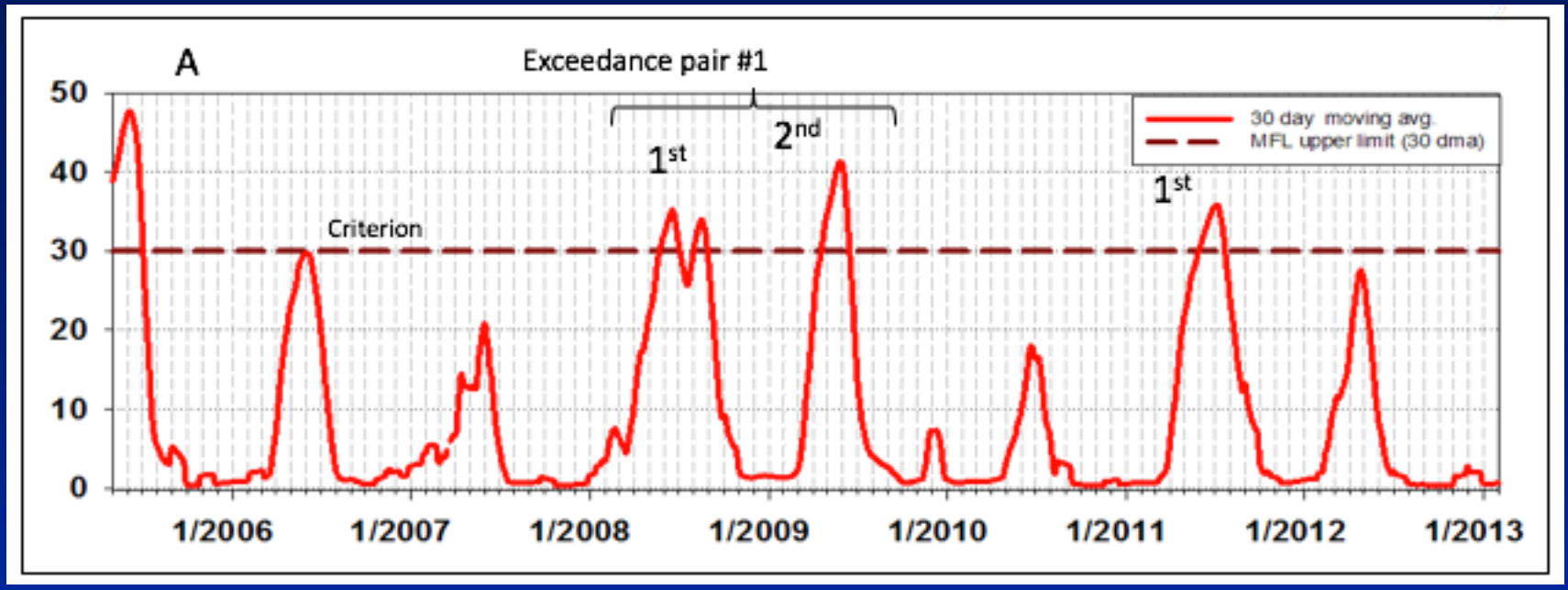
Species/Group	References	Type of evidence	Inferred change from historical	Documented change through time
Prey base fishes	Lorenz 1999, Lorenz 2000, Lorenz and Serafy 2006, Lorenz 2012	Inferred from field studies	Much lower productivity due to salinity stress, habitat change and reduced hydroperiod	Freshwater periods are more productive than periods with saline influence
Spotted seatrout	Rutherford et al. 1989	Inferred from field studies	Perhaps increased in number due to a more compatible higher salinity	Increased catch rates from 1972 to 1984
Red drum	Tilmont et al 1989a, Rutherford et al. 1989	Inferred from field studies	Decreased due to less freshwater runoff	
Common snook	Tilmont 1989b, Rutherford et al. 1989	Inferred from field studies	Decreased due to less freshwater runoff	Declined catch rates from 1972 to 1984
Mud bank fish community structure	Sogard et al 1989, Matheson et al. 1999	Qualitative		Changed from benthic to pelagic dominated spp from 1984-86 to 1994-96
Seagrass fish community structure	Thayer and Chester 1989, Thayer et al. 1999	Qualitative		Changed from benthic to pelagic dominated spp from 1984-85 to 1994-96
Mangrove shoreline fish productivity	Ley 1992, Montegue and Ley 1993, Ley et al. 1994	Inferred from field studies	Lowered productivity compared to historic condition	
American crocodile range	Ogden 1978, Mazzotti 1999, Mazzotti et al. 2009	Quantitative	Much more abundant and widespread historically	Nesting range shrank from all of NEFB in 1930's to just the coastal mangrove by 1999; population center in ENP shifted from NEFB to Cape Sable beginning in the early 2000's
American crocodile abundance	Ogden 1978, Mazzotti and Dunson 1984, Moler 1991, Mazzotti 1999	Quantitative, inferred from field studies	Salinity stress reduced growth rate and survival of hatchlings and juveniles resulting in population decline since 1984	Declined from up to 2000 historically to less than 400 by 1970. Modest increases in nest number since but recovery not as fast as expected under a more historic flow regime
Mangrove terrapin	Dunson and Mazzotti 1989	Inferred from experimental results	Hatchling survival reduced from historical due to salinity stress	
West Indian manatee	Beard 1938, Hartman 1974, Odell 1979, Worthy 1998	Quantitative, inferred from field studies	Less use of NEFB due to salinity stress and salinity induced habitat changes	Declined from high use in 1938 to rare in 1990's relative to overall population numbers
Bottlenose dolphin	Torres 2009	Inferred from field studies	Reduction of preferred prey (see fish) species may explain minimal use of the Northeastern Basin	
Roseate spoonbills	Lorenz 2000, Lorenz et al. 2002, Lorenz et al. 2009	Quantitative, inferred from field studies	Lower nesting success due to salinity induced declines in prey number	Decline in the number of nests from 1259 in 1979 to less than 350 currently
Great white heron	Powell and Powell 1986, Powell et al 1989	Quantitative, inferred from field studies	Lowered nest productivity due to reduced prey base	Significant decline in nesting success in the mid-1980's compared to early 1920's
Eastern brown pelican	Kushlan and Frohring 1985, Ogden 1993	Quantitative, qualitative	Were common nesters in NEFB in 1980's but have only nested twice since 1991	Baywide nest numbers declined from 850 in 1976 to 350 in 1993.
Ospreys	Ogden 1987, Poole 1989, Ogden 1993, Bowman et al. 1989	Quantitative, inferred from field studies	Reduced nest numbers and nesting success due to low prey productivity	Baywide decline from 200 nests in the 1970's to 70 nests; disproportionately larger declines in NEFB.
Bald eagle	Curnutt 1996, Baldwin et al. 2012	Quantitative		Consistently about 30 territories baywide from 1958 to mid 1980's then declined to 50% occupancy in 2003, Territories in NEFB declined from 7 to 1 since mid-1980's.

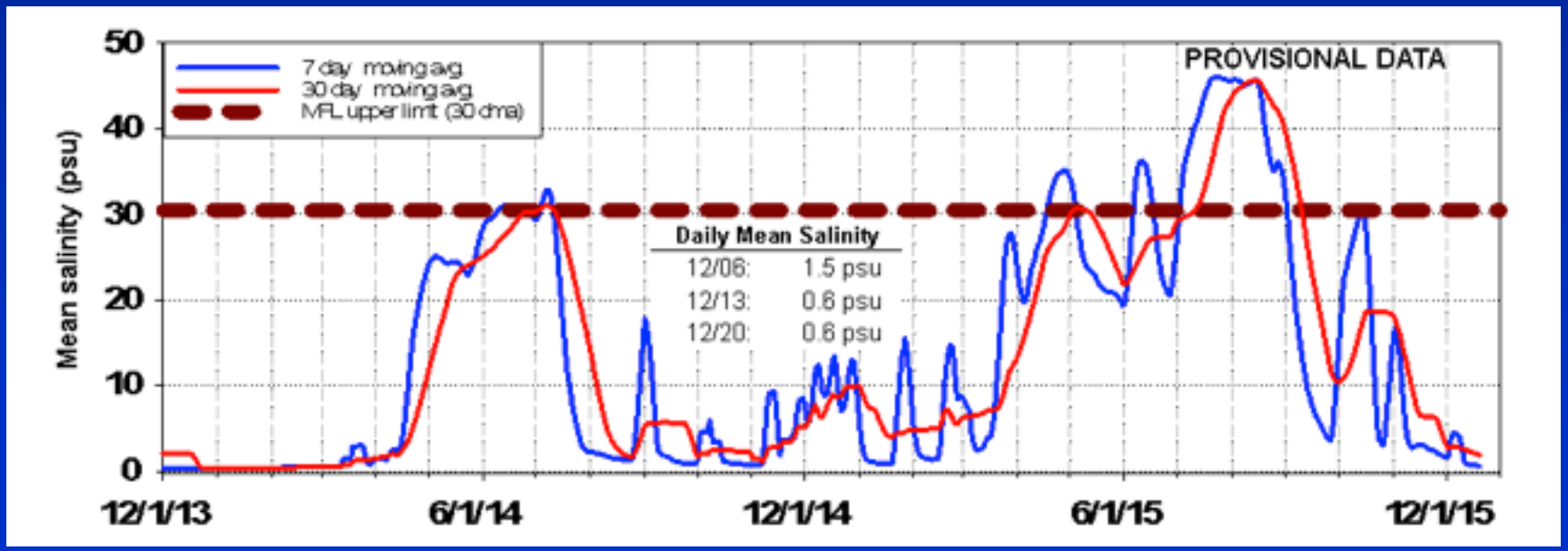


Small Fishes: Drop & Minnow Traps

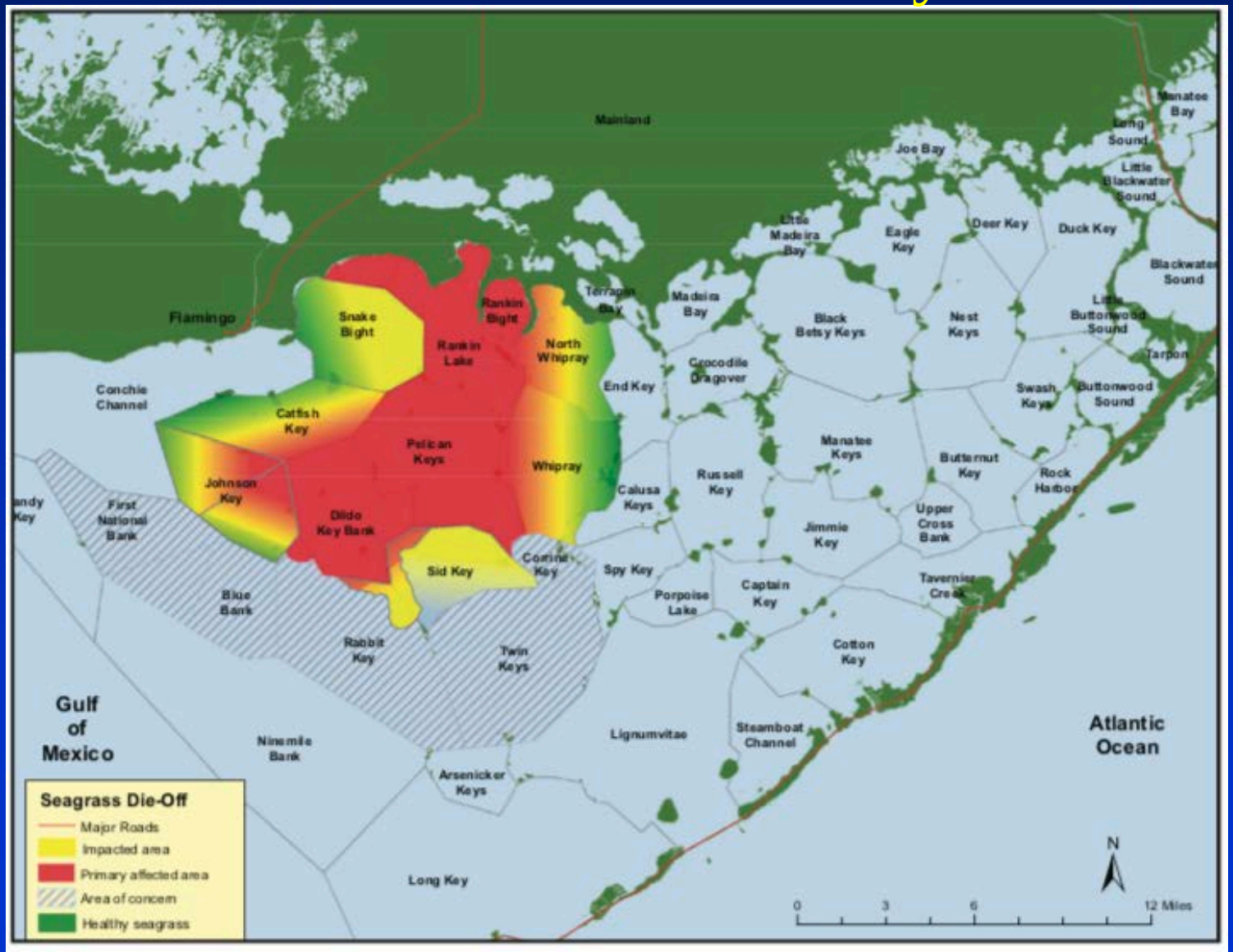
Minimum Flows and Levels (MFL)

- Required by statute to establish MFLs for waterbodies based on annual Priority List
- Identify the point at which further *withdrawals* cause significant harm to the water resources of the area
- Established for Florida Bay in 2006
- An “exceedance” occurs when the 30-day running average salinity exceeds 30 psu at the Taylor River salinity gage
- A “violation” occurs when an exceedance occurs during each of two consecutive years, more often than once in a ten-year period


A
Exceedance pair #1
1st
2nd
1st
Criterion
30 day moving avg.
MFL upper limit (30 dma)
50
40
30
20
10
0
1/2006
1/2007
1/2008
1/2009
1/2010
1/2011
1/2012
1/2013


7 day moving avg.
30 day moving avg.
MFL upper limit (30 dma)
PROVISIONAL DATA
Mean salinity (psu)
Daily Mean Salinity
12/06: 1.5 psu
12/13: 0.6 psu
12/20: 0.6 psu
50
40
30
20
10
0
12/1/13
6/1/14
12/1/14
6/1/15
12/1/15

2015-16 Sea grass die-off. Red indicates heavily affected, Yellow is partially Affected and Green is healthy



Hurricane Irma September 12, 2017

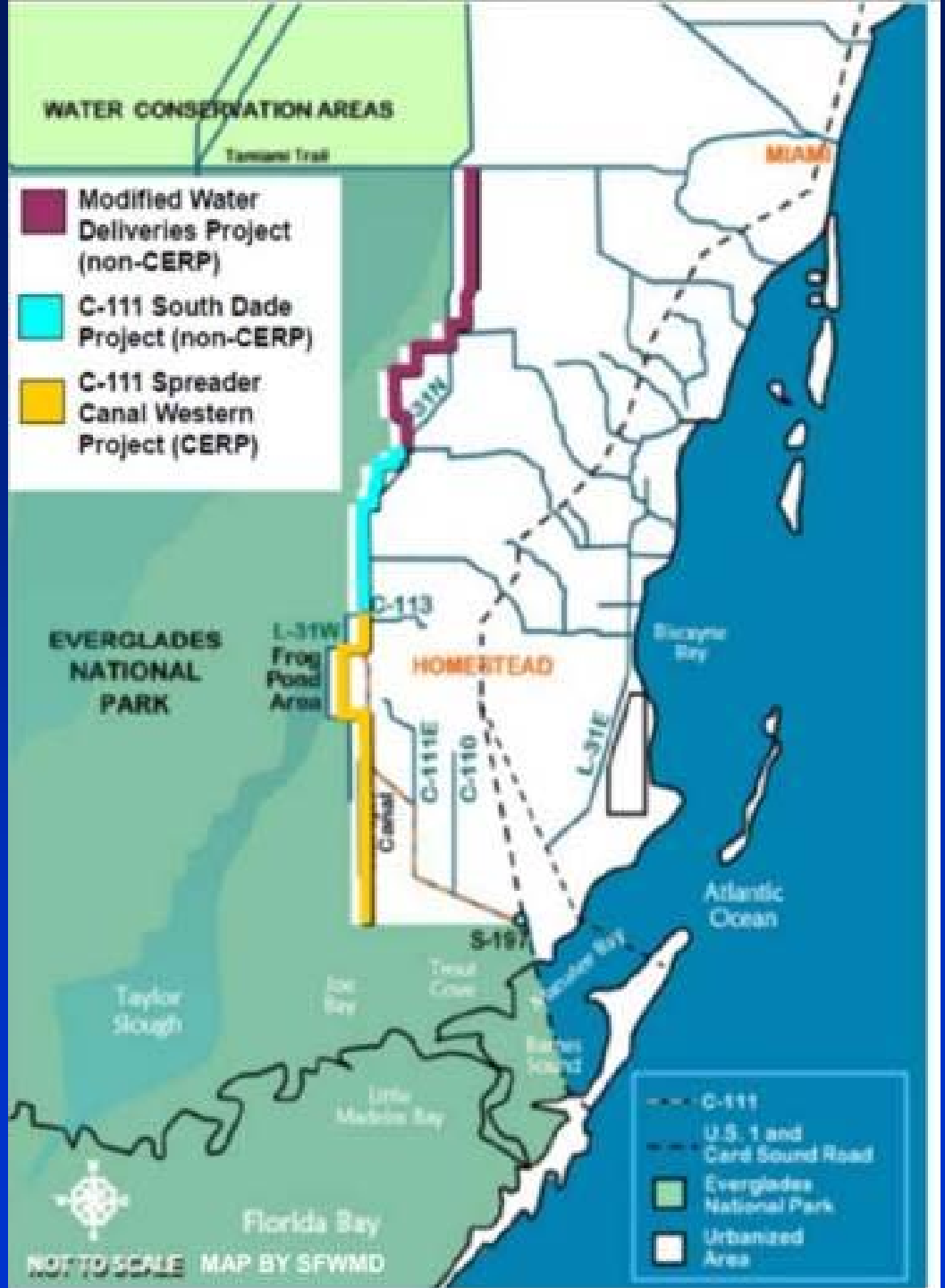

CONCH SCRAMBLE
PAR-TEE
ON THE WATER

2018 Algal Bloom

Boat Reconnaissance Oct 13 2018

How does this cycle end?

- Must restore freshwater flow to Taylor Slough and Florida Bay to avoid hypersaline conditions
- For 25 years, Everglades restoration efforts have been slowly but steadily putting infrastructure in place to increase flows
- Approximately $1 billion in taxpayer spent; justified by the promise of restoration


WATER CONSERVATION AREAS
Tamiami Trail
MIAMI
Modified Water Deliveries Project (non-CERP)
C-111 South Dade Project (non-CERP)
C-111 Spreader Canal Western Project (CERP)
S-31N
C-113
EVERGLADES NATIONAL PARK
L-31W
Frog Pond Area
HOMESTEAD
Biscayne Bay
C-111E
C-110
L-31E
Canal
Atlantic Ocean
S-197
Taylor Slough
Joe Bay
Trout Cove
Barnes Island
Little Madeira Bay
Florida Bay
NOT TO SCALE MAP BY SFWMD
C-111
U.S. 1 and Card Sound Road
Everglades National Park
Urbanized Area

The Combined Operational Plan (COP) integrates these projects

- Imperative that the operational plan maximize restoration benefits
- To date, most plan alternatives are more focused on flood control than restoration
- Residents and visitors to the Keys need to make our voices heard to protect everyone's investment in restoration efforts