Recent Changes in Nesting Patterns of Roseate Spoonbills Suggest Adaptation to Sea Level Rise And Climate Change

A Work In Progress

Jerome J. Lorenz

Audubon FLORIDA

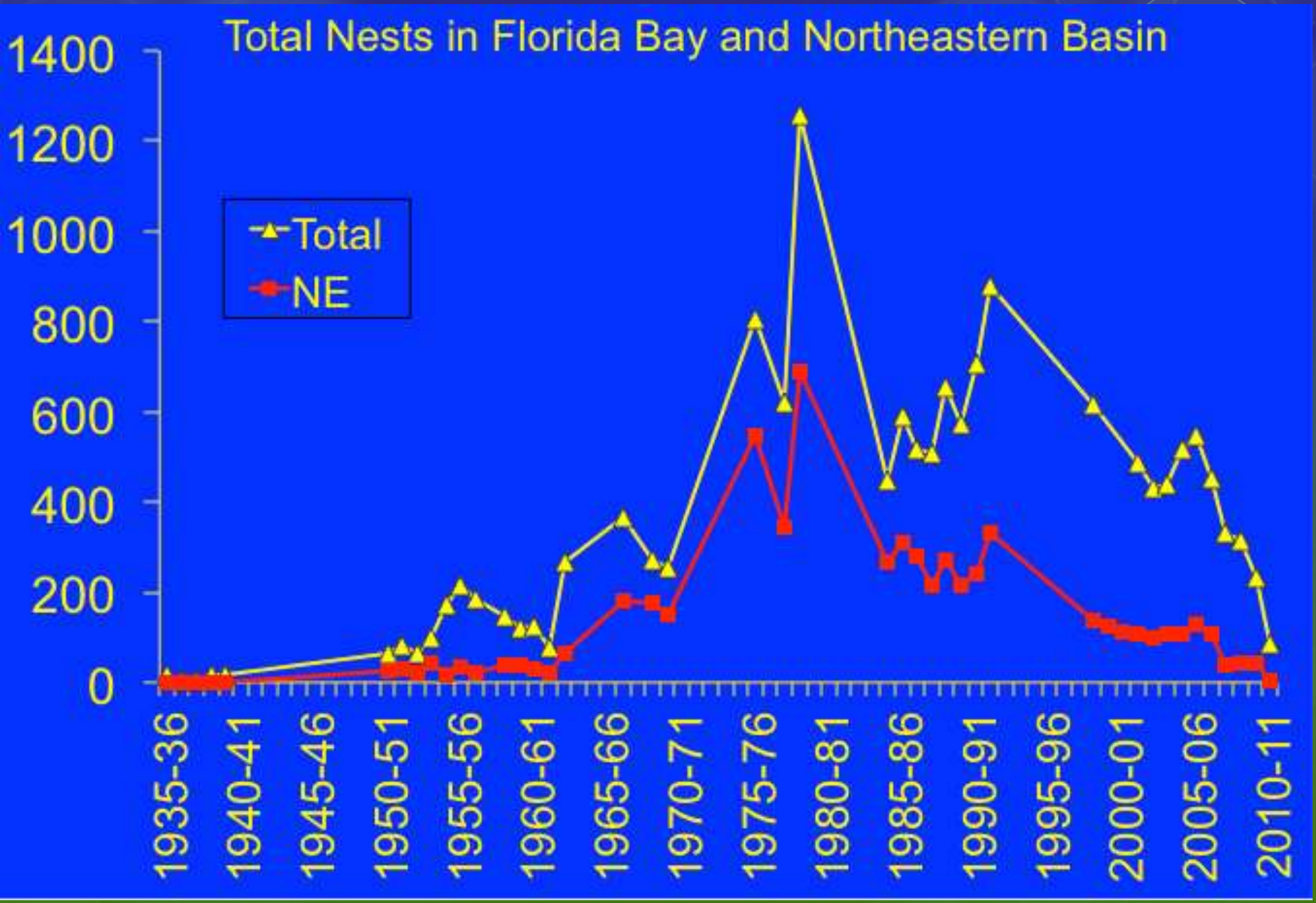
Collaborators

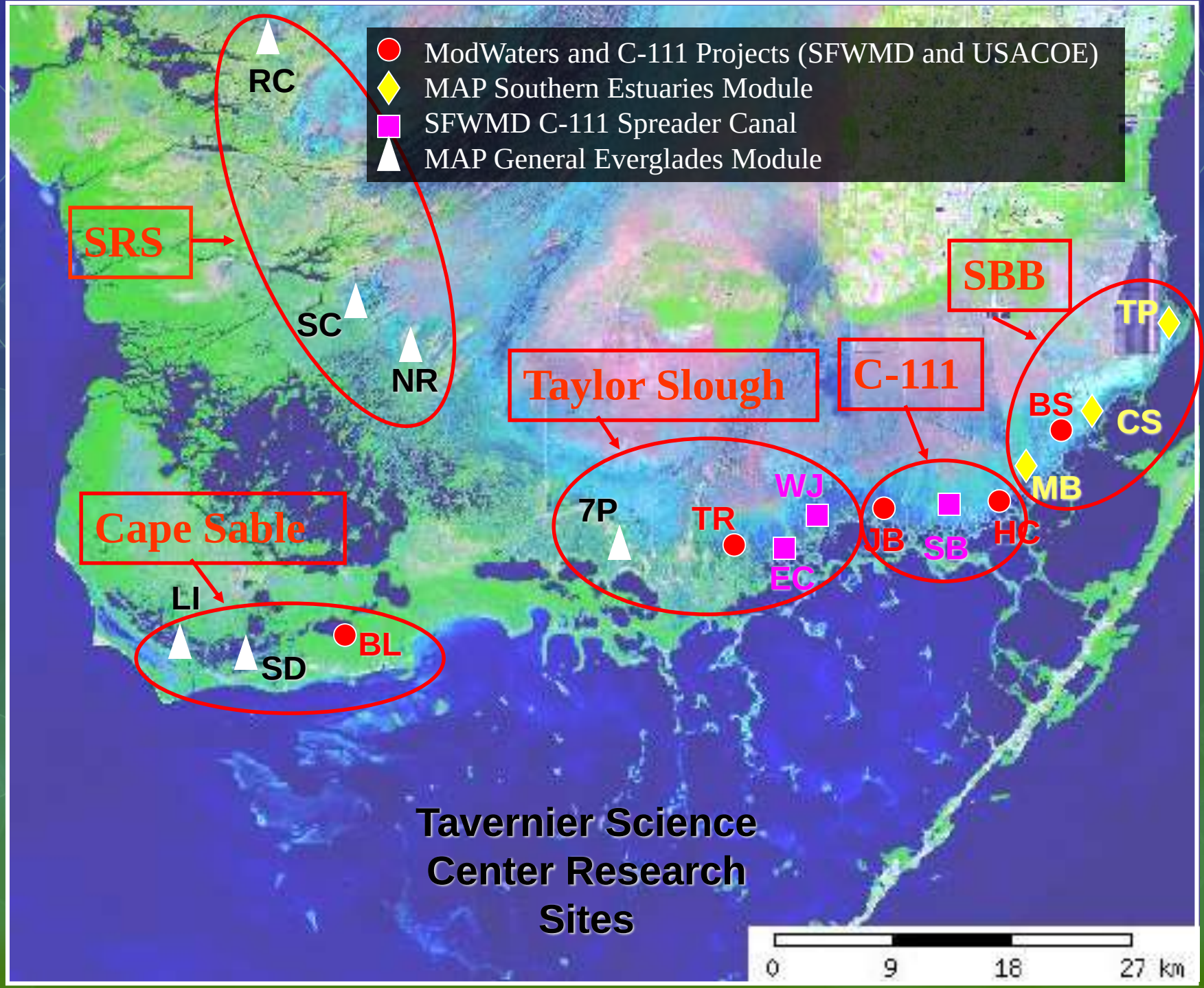
Audubon Florida

- ESC: Peter Frezza, Michelle Robinson, Mike Kline
- CSS: Shawn Clem, Jason Lauritson
- FCIS: Ann Paul, Mark Rachal

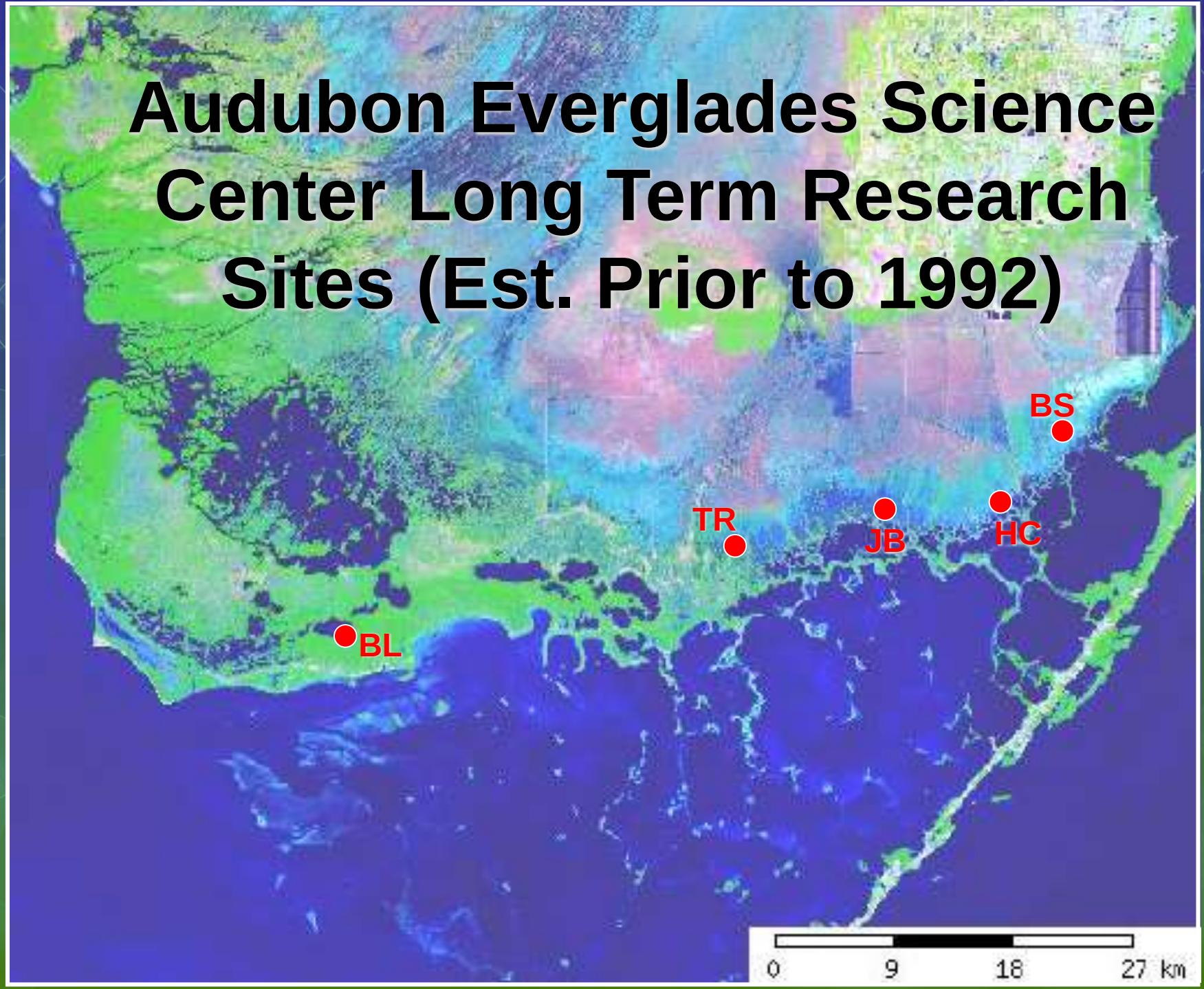
Other Agencies

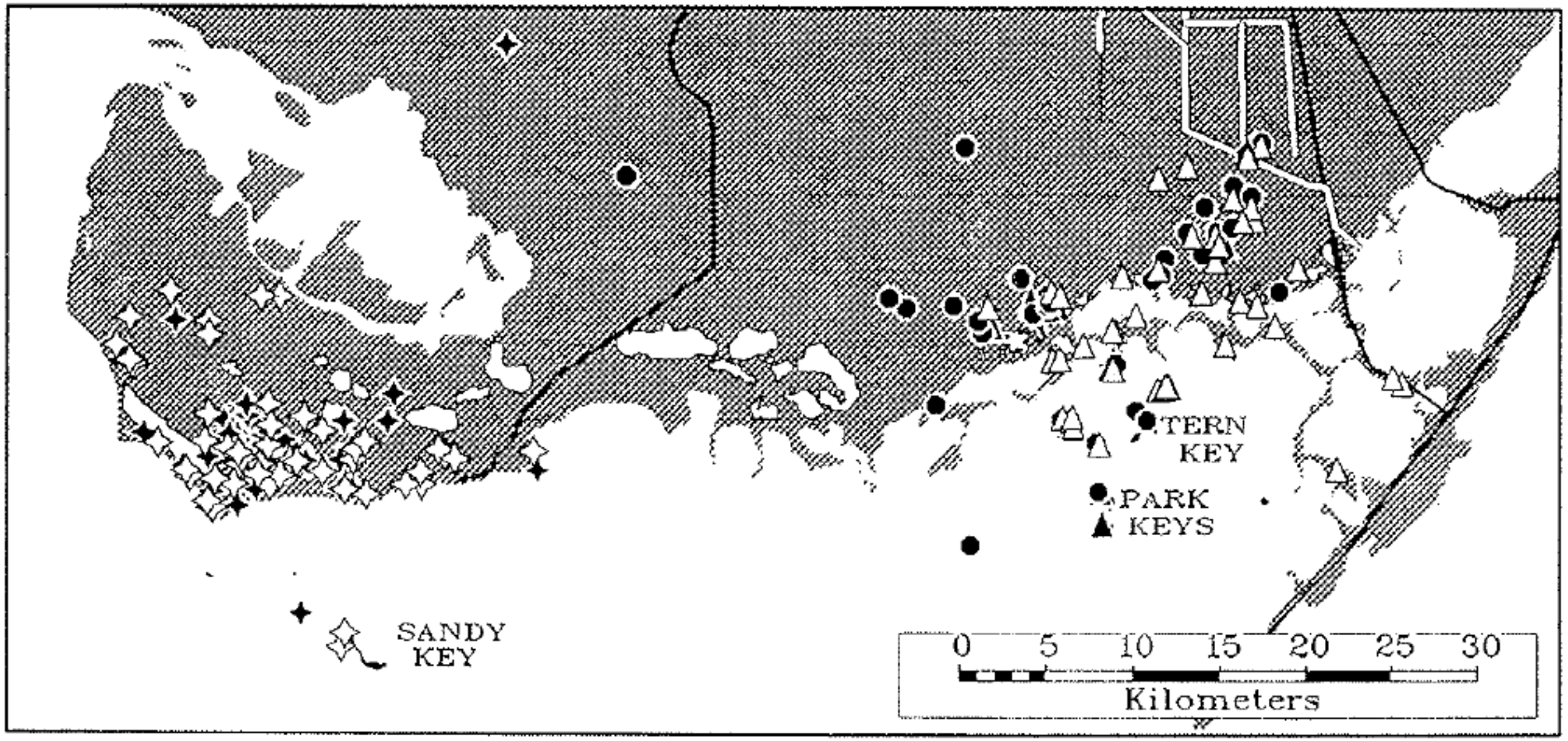
- Elsa Alvear, Elizabeth Lago (BNP)
- Lori Oberhofer (ENP)
- Mark Cook (SFWMD)
- Dale Gawlik and Co. (FAU)
- Peter Frederick and Co. (UF)
- Bill Loftus (Free Loader)
- David Cox (PIAS)
- Gen Anderson (SAAF)
- And a cast of dozens


Total Nests in Florida Bay and Northeastern Basin
Total
NE
1400
1200
1000
800
600
400
200
0
1935-36
1940-41
1945-46
1950-51
1955-56
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
1990-91
1995-96
2000-01
2005-06
2010-11


ModWaters and C-111 Projects (SFWMD and USACOE)
MAP Southern Estuaries Module
SFWMD C-111 Spreader Canal
MAP General Everglades Module
RC
SRS
SC
NR
SBB
TP
Taylor Slough
C-111
BS
CS
MB
WJ
7P
TR
EC
JB
SB
HC
Cape Sable
LI
BL
SD
Tavernier Science Center Research Sites
0
9
18
27 km

Audubon Everglades Science Center Long Term Research Sites (Est. Prior to 1992)

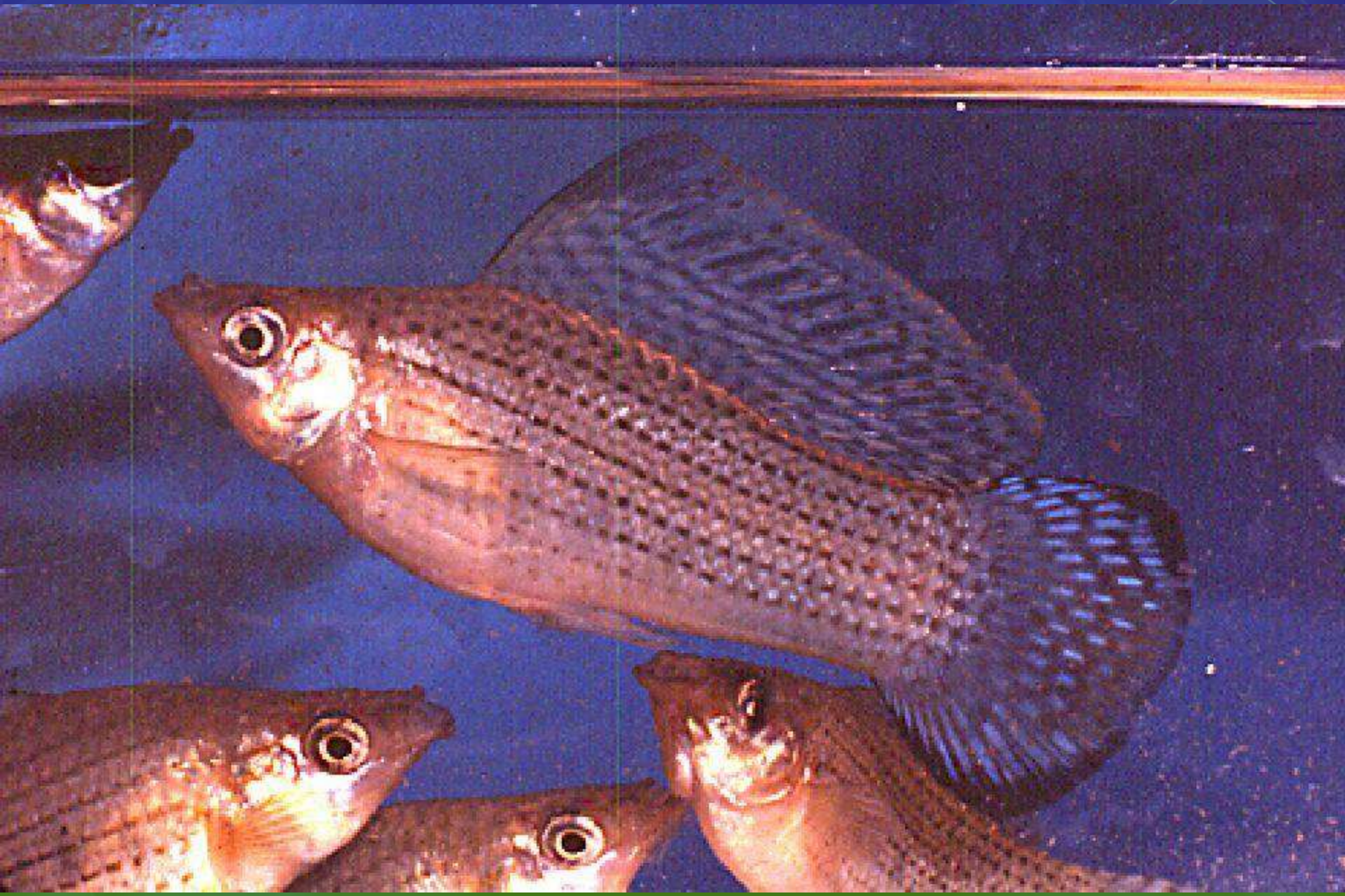


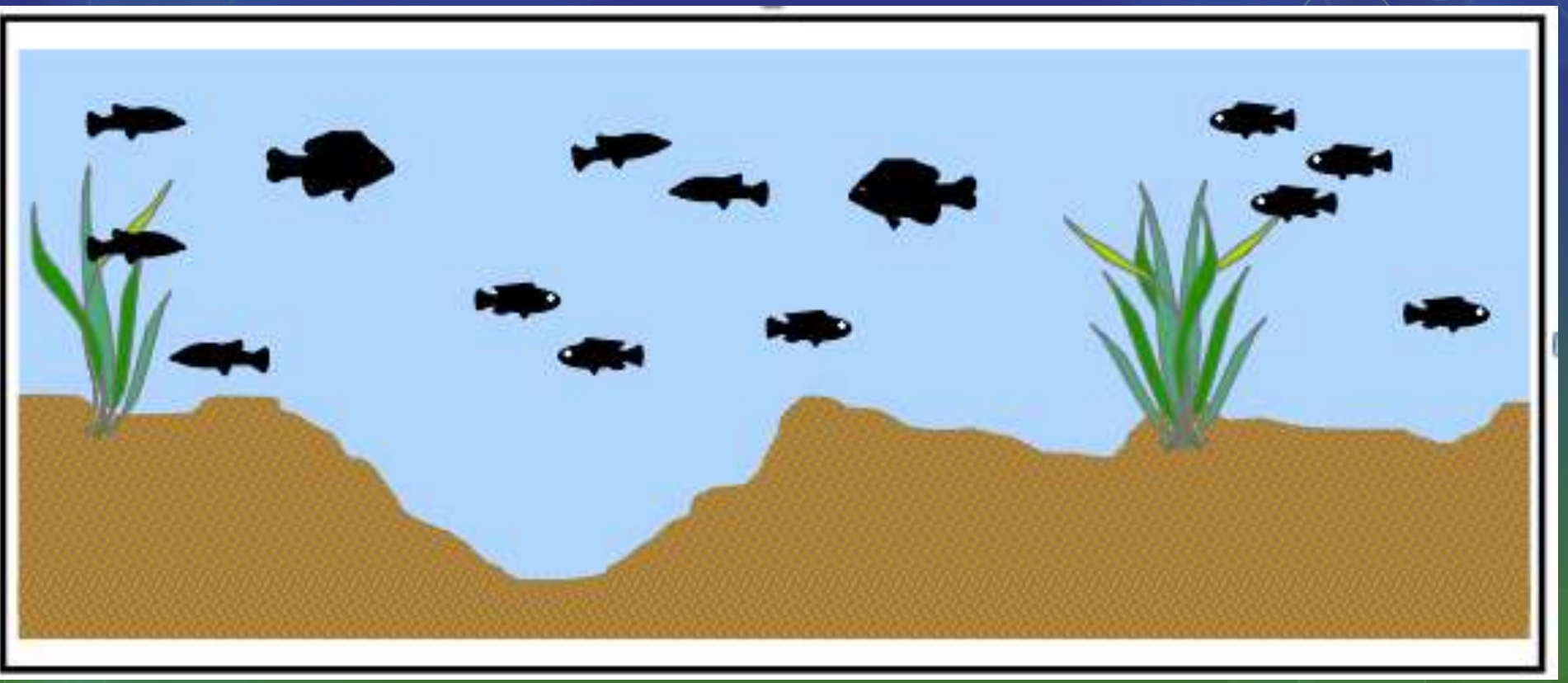

TERN
KEY
PARK
KEYS
SANDY
KEY
0 5 10 15 20 25 30
Kilometers

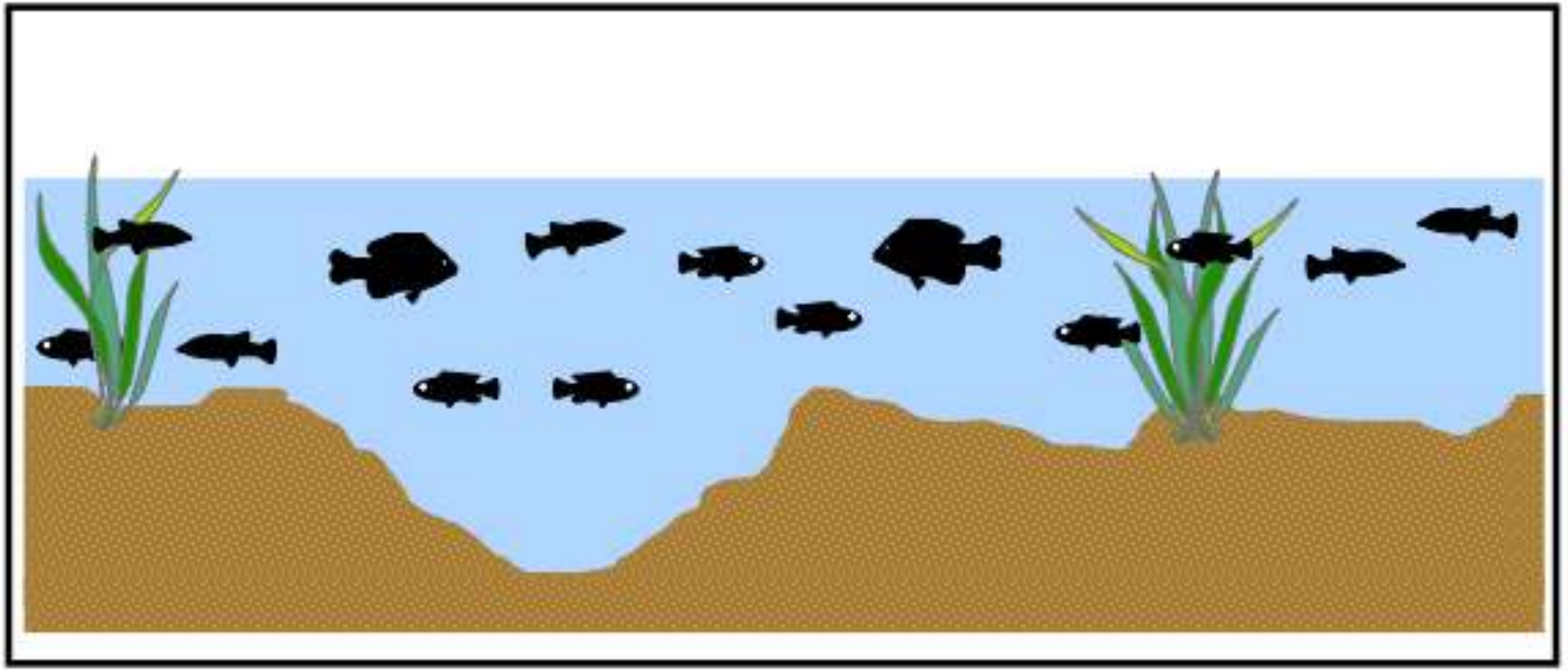
Hydrology and Vegetation Surveys

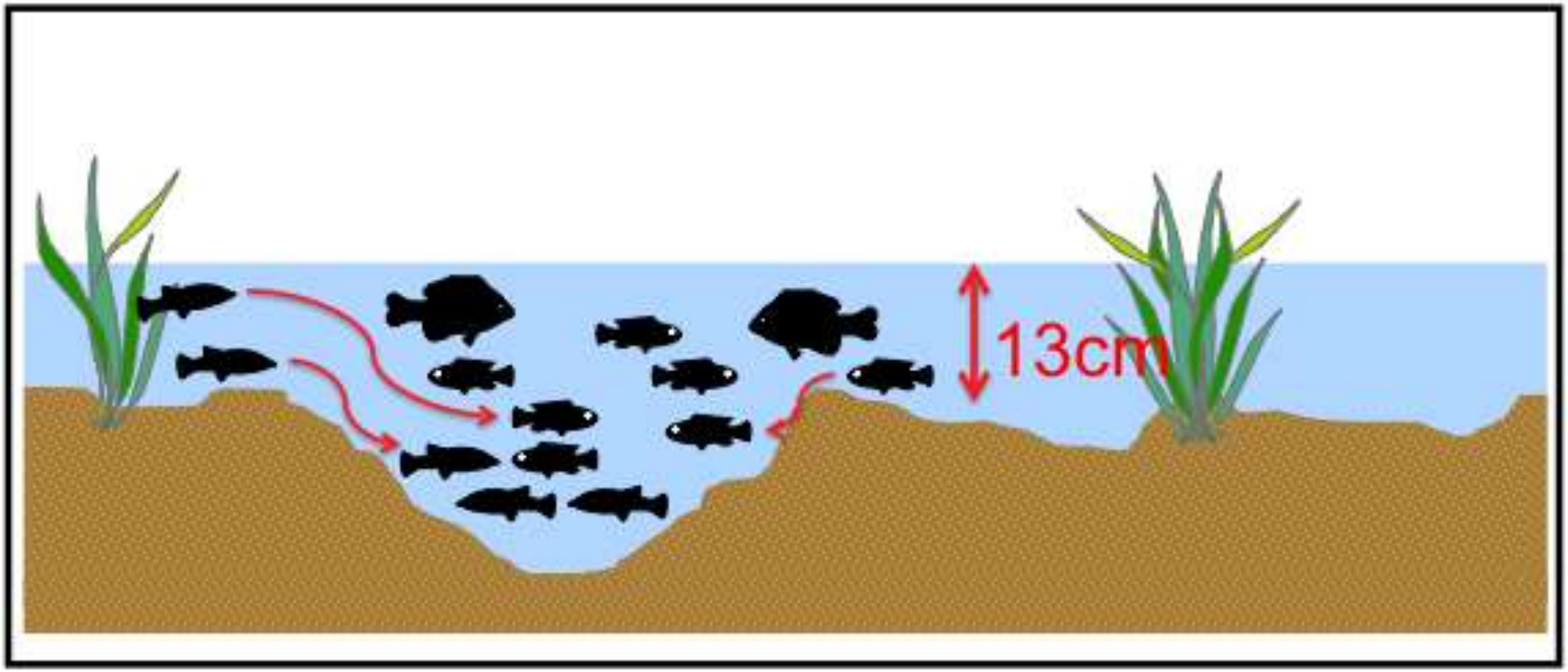
Prey Fish Surveys

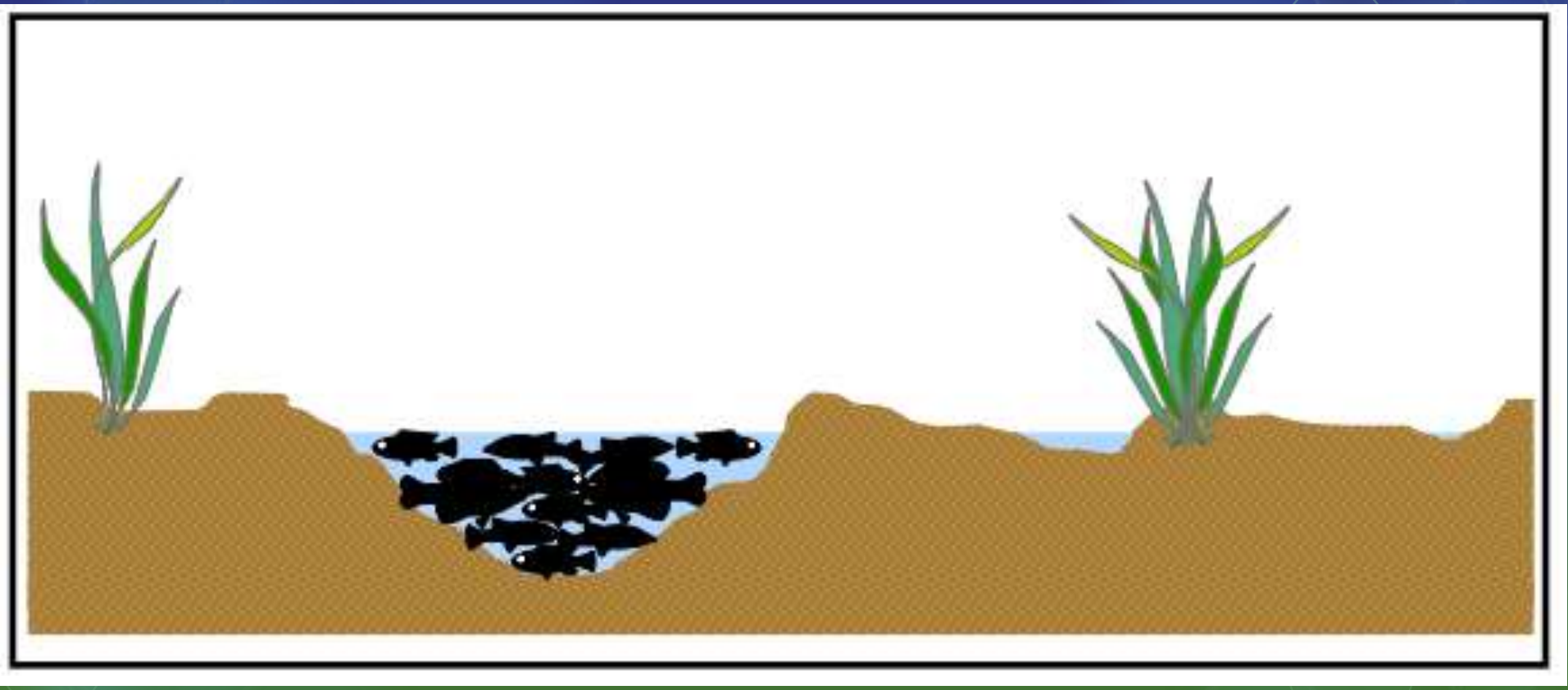

0
1cm
2
3
4
5

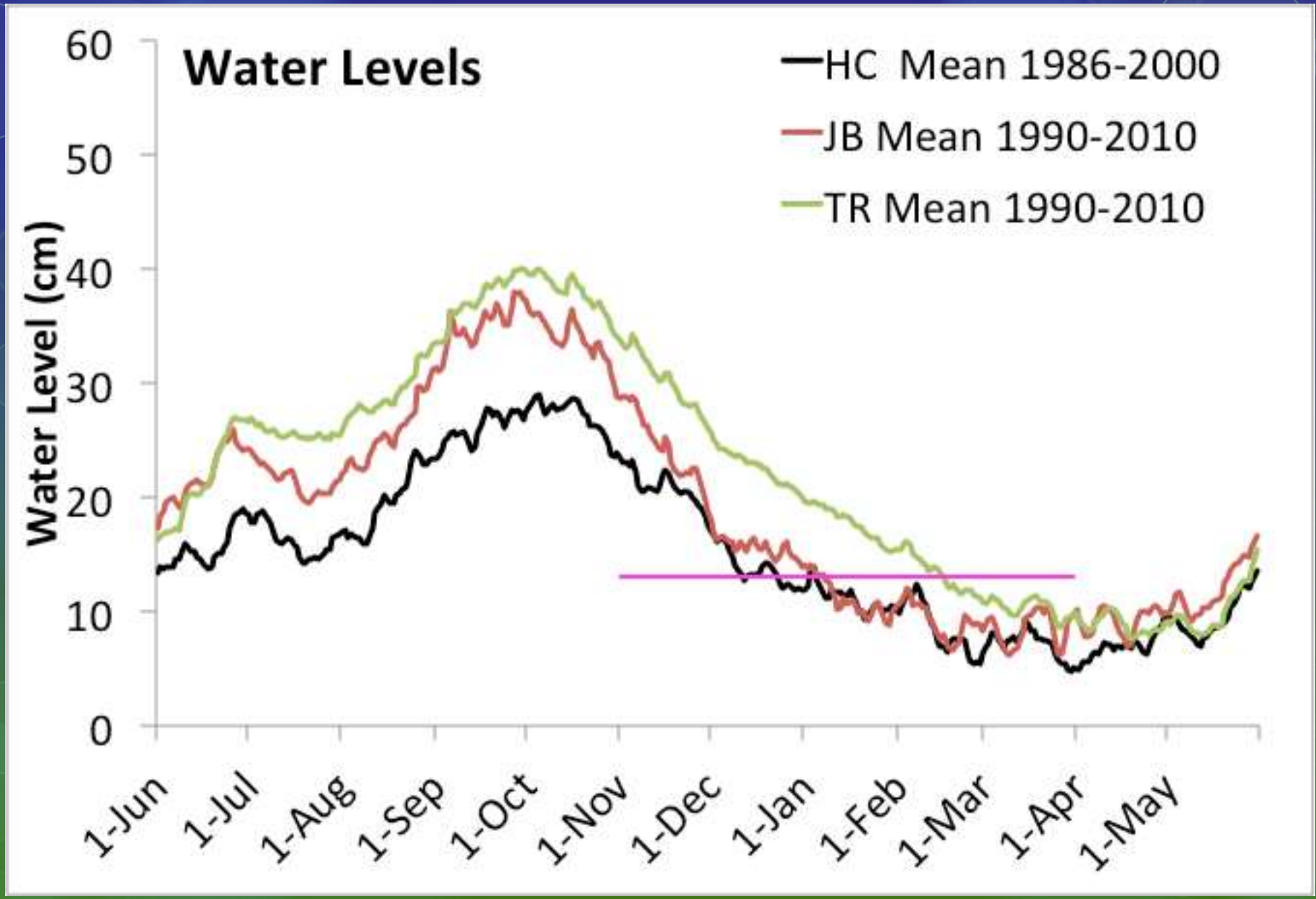







13cm



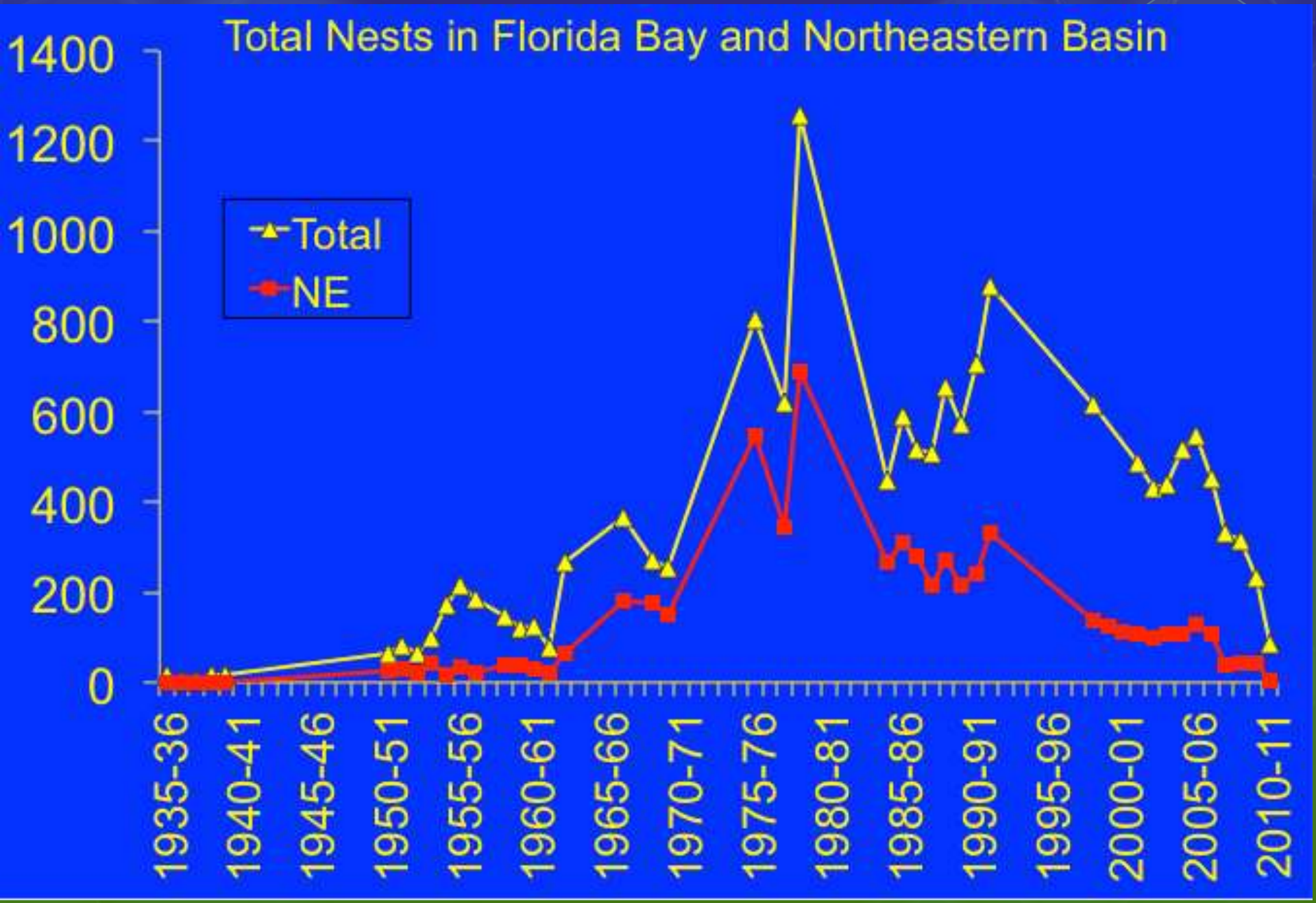

Water Levels
HC Mean 1986-2000
JB Mean 1990-2010
TR Mean 1990-2010
Water Level (cm)
60
50
40
30
20
10
0
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May

ECOLOGICAL INDICATORS

INTEGRATING, MONITORING, ASSESSMENT AND MANAGEMENT

for the CERP

Spoonbills are being used as an indicator species to judge the success (or failure) of the CERP.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Total
NE
1400
1200
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1935-36
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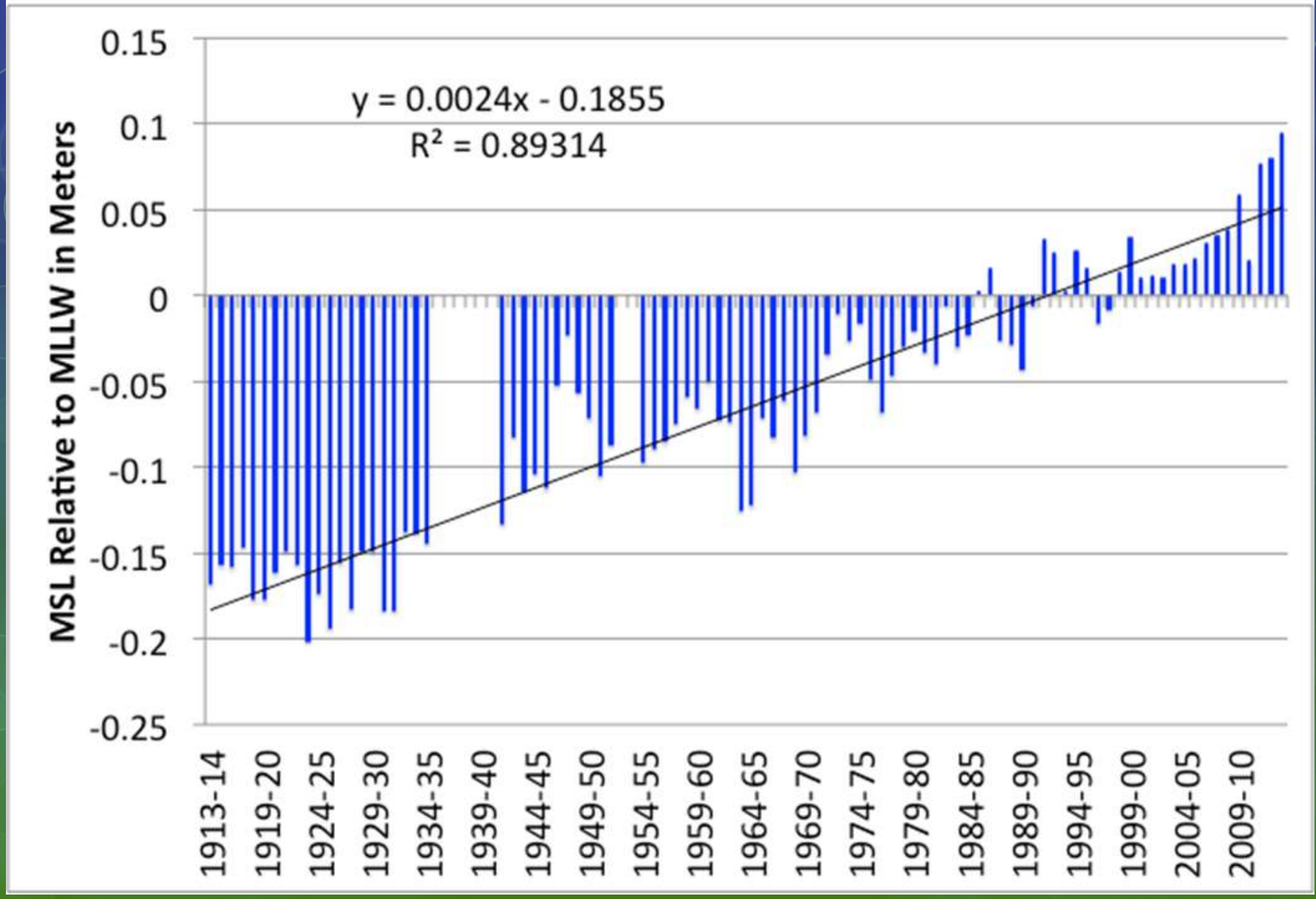
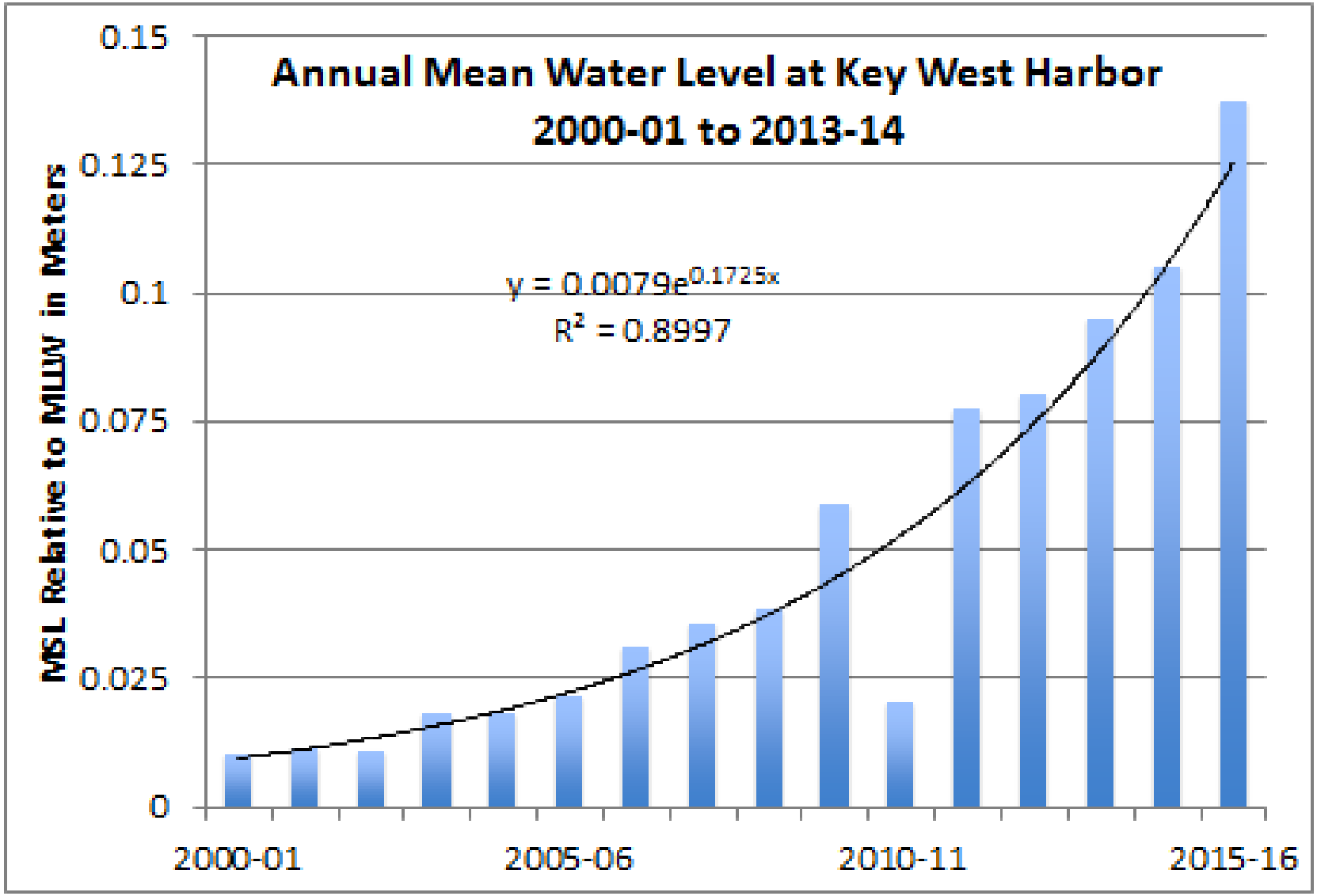
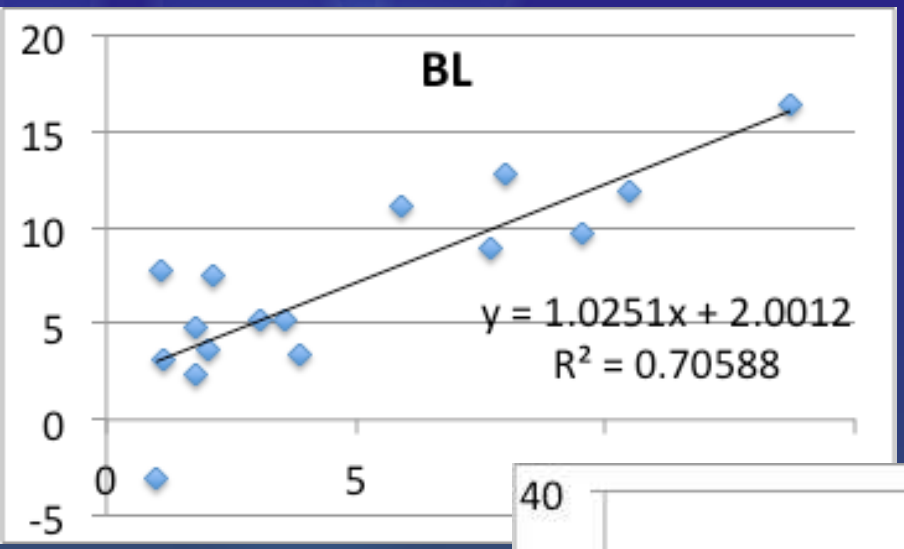
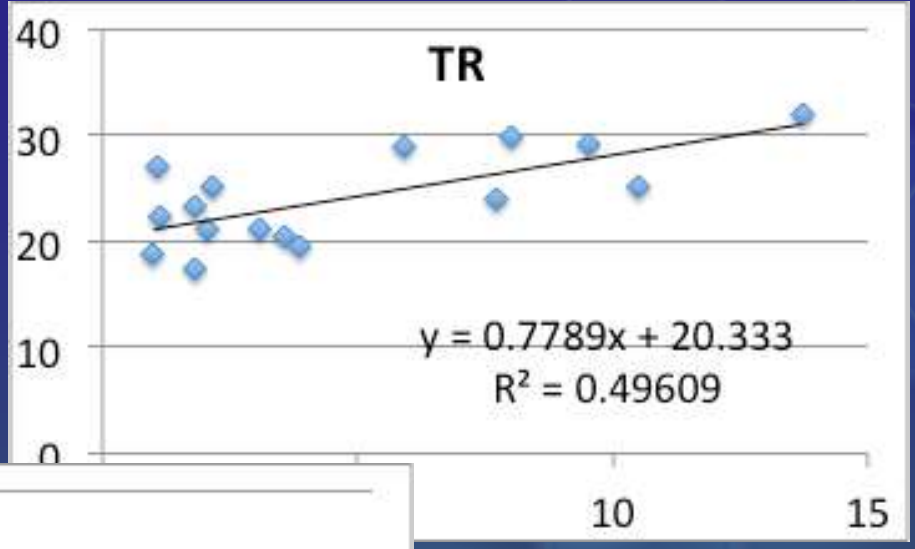
1950-51
1955-56
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
1990-91
1995-96
2000-01
2005-06
2010-11

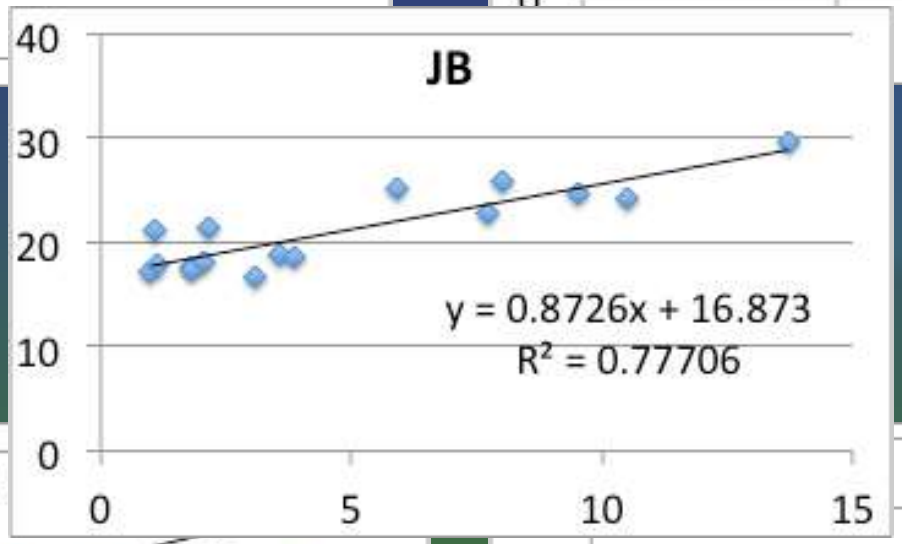
Annual Mean Water Level Key West Harbor 1913-2014

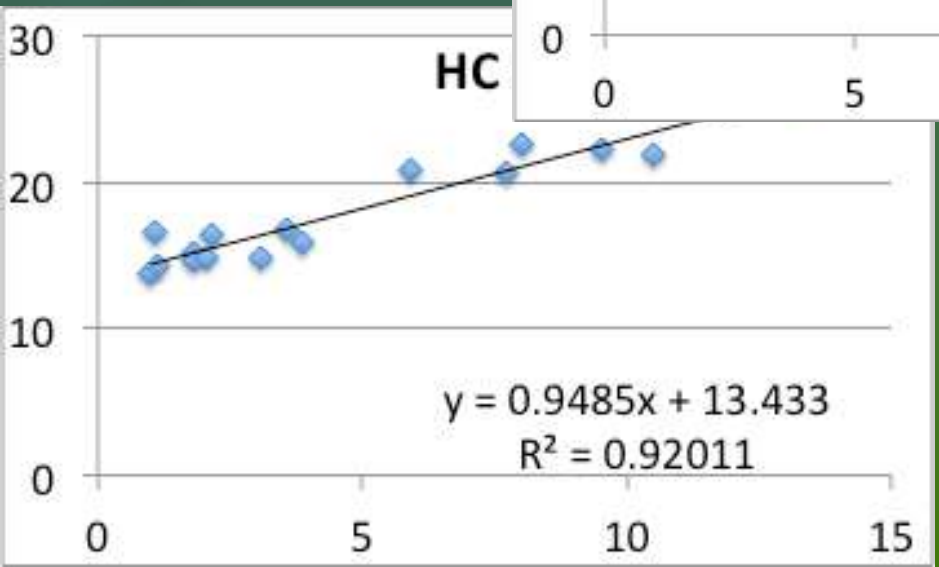


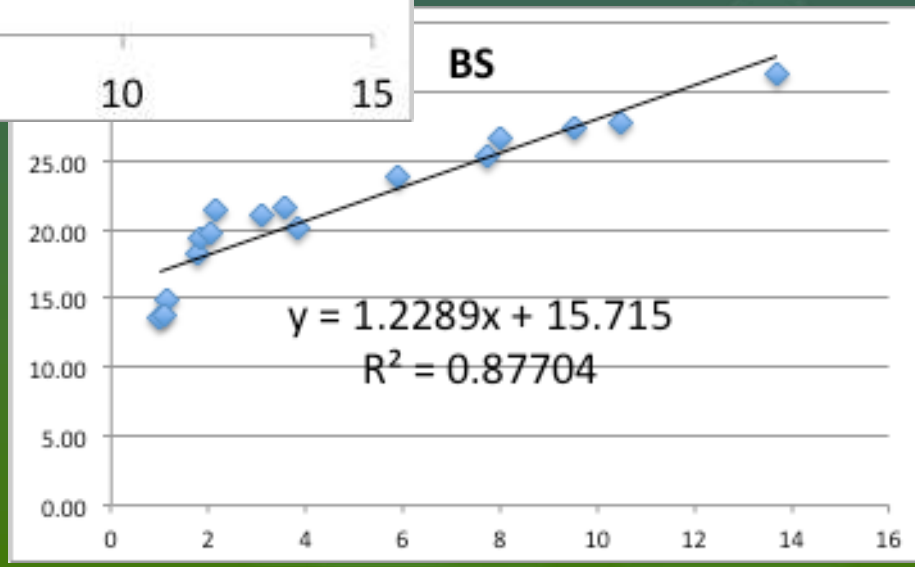

Annual Mean Water Level at Key West Harbor
2000-01 to 2013-14
MSL Relative to MLLW in Meters
0.15
0.125
0.1
0.075
0.05
0.025
0
y = 0.0079e^0.1725x
R² = 0.8997
2000-01
2005-06
2010-11
2015-16

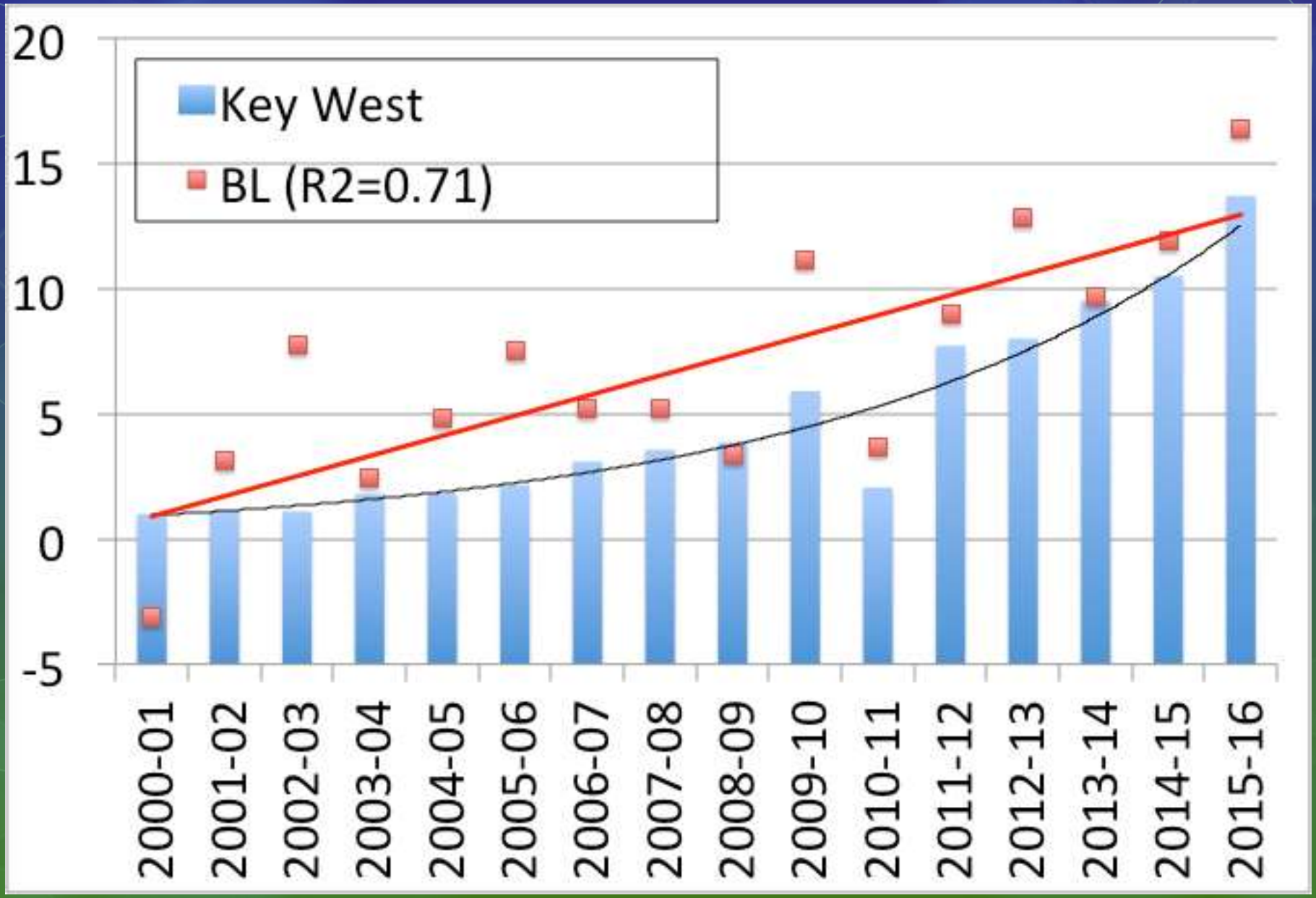

BL
y = 1.0251x + 2.0012
R² = 0.70588

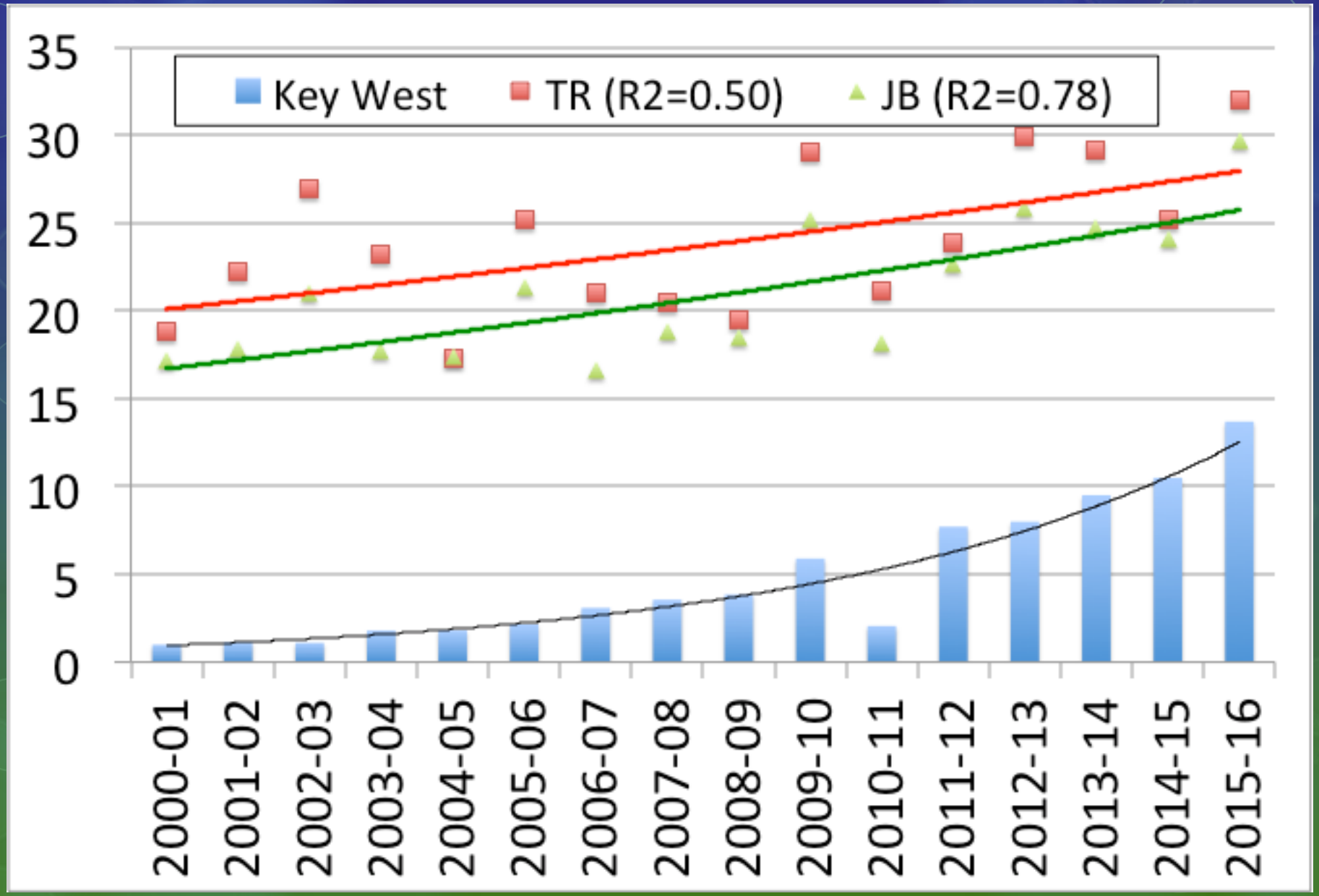

TR
y = 0.7789x + 20.333
R² = 0.49609

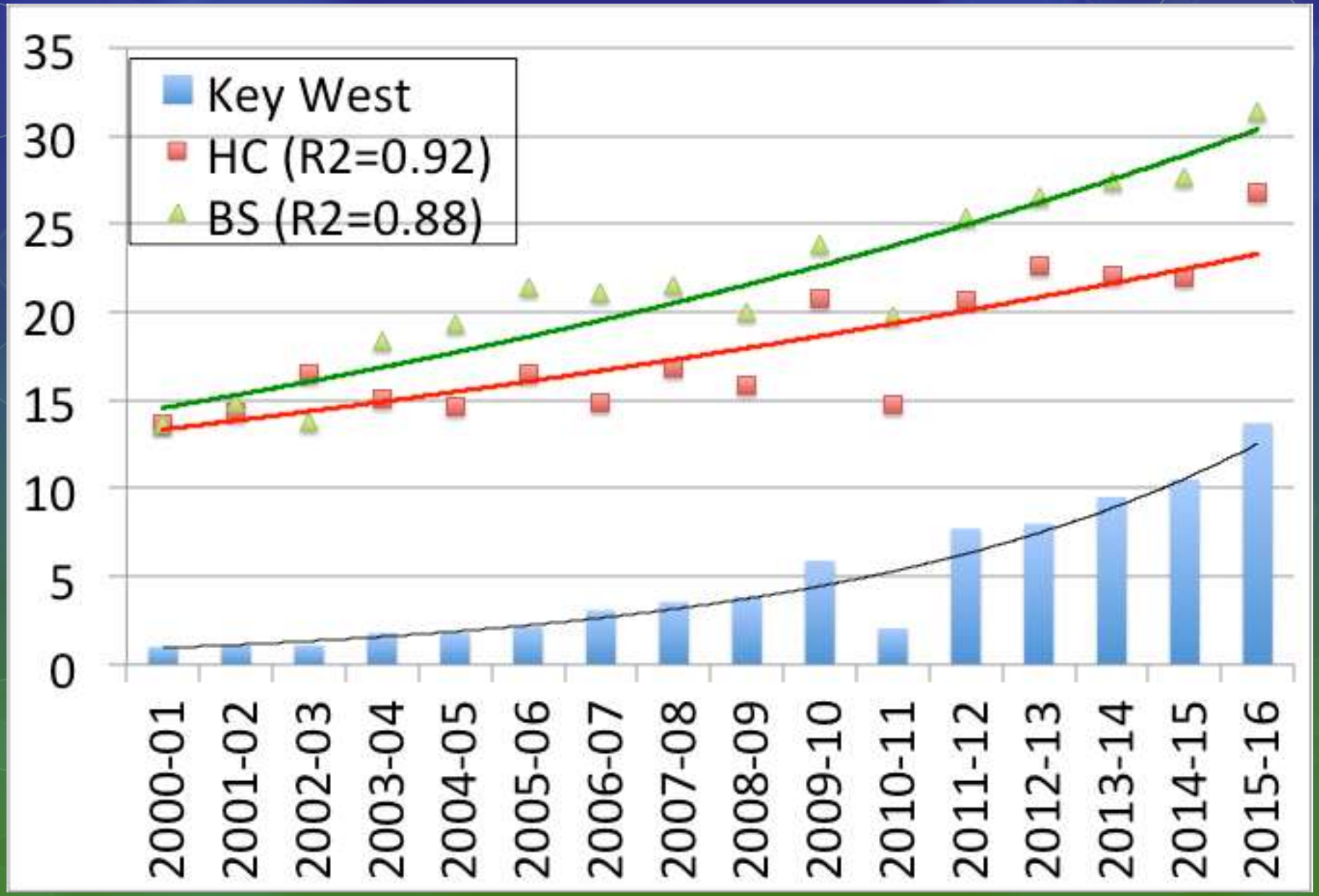

JB
y = 0.8726x + 16.873
R² = 0.77706

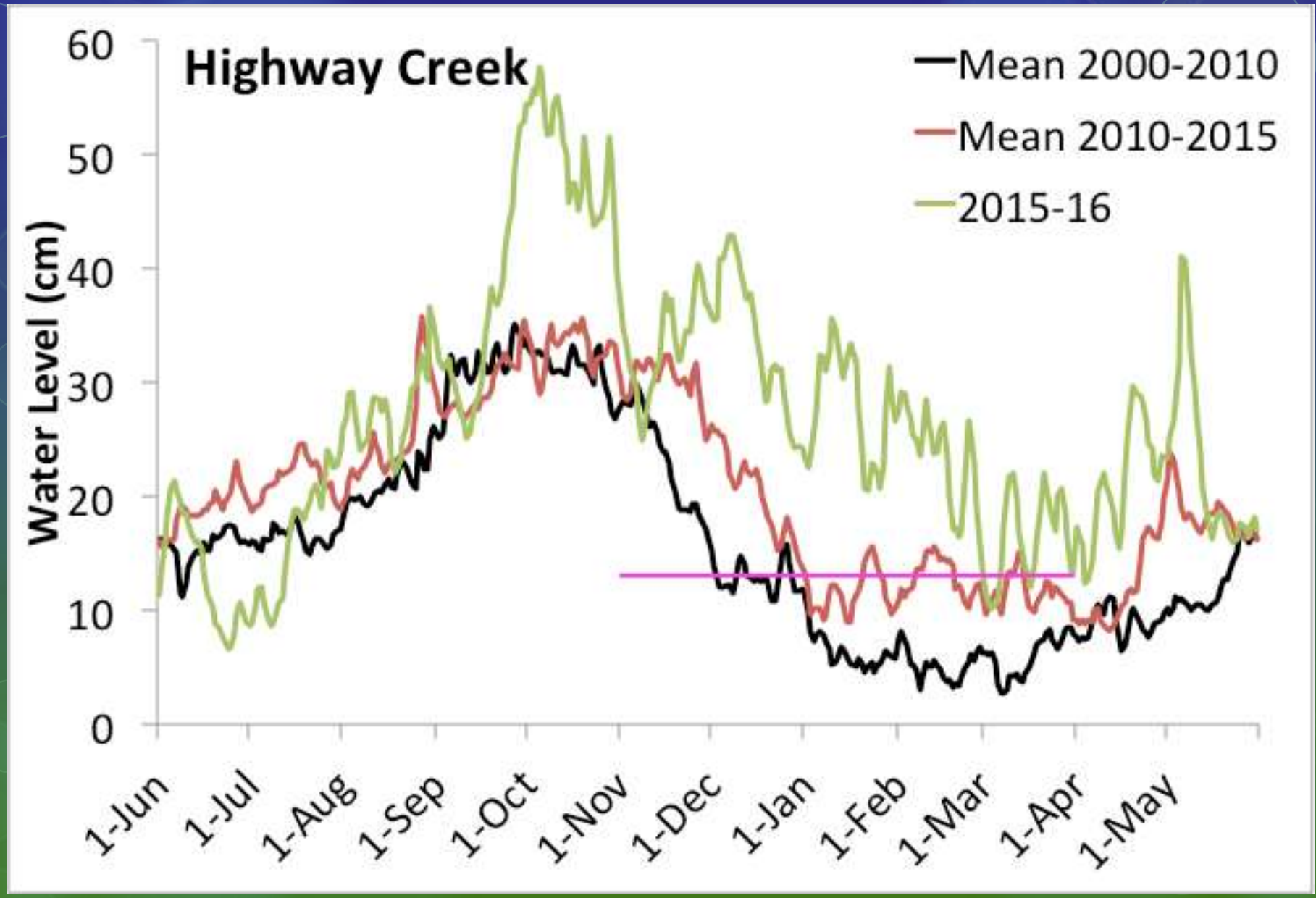

HC
y = 0.9485x + 13.433
R² = 0.92011

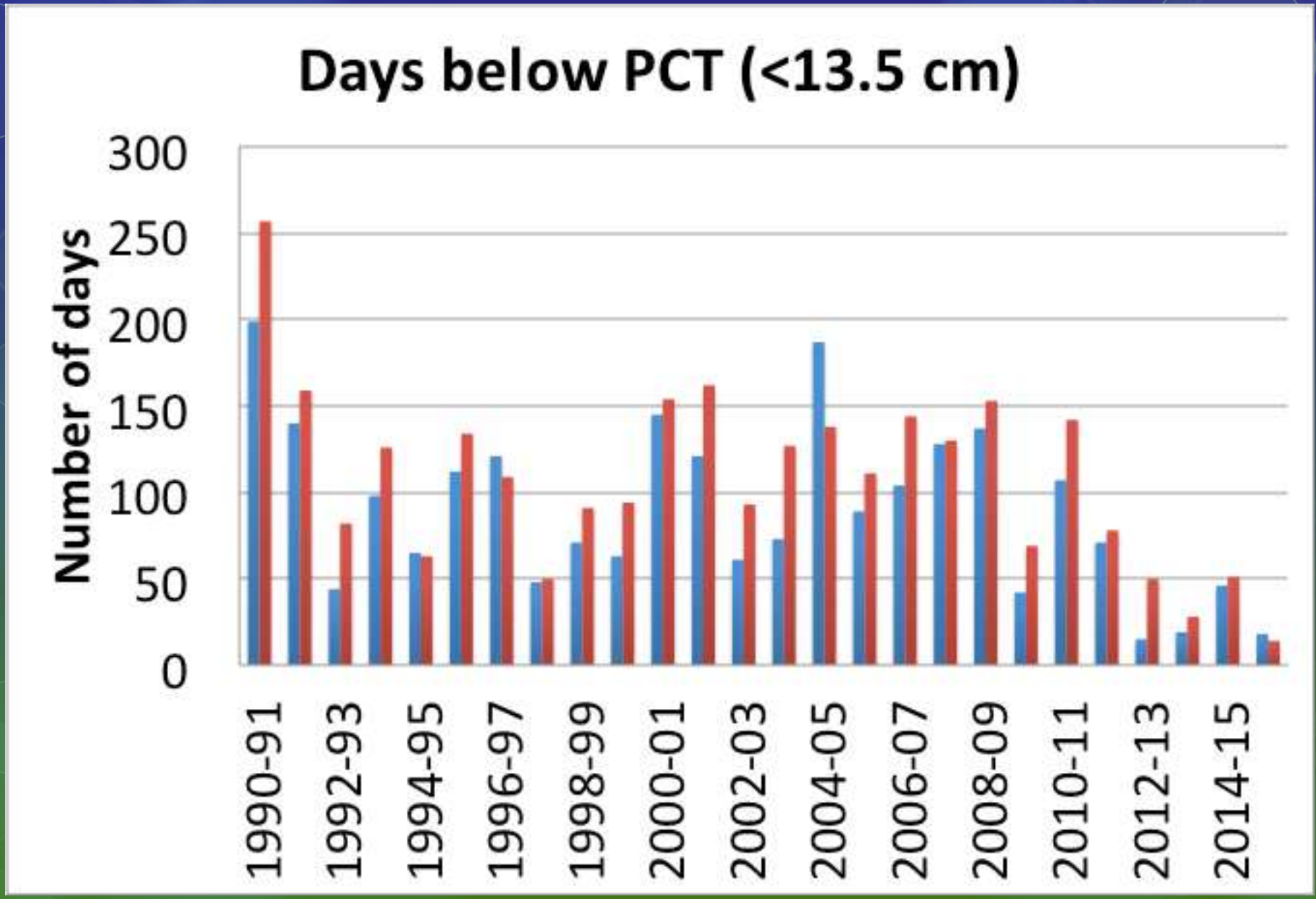

BS
y = 1.2289x + 15.715
R² = 0.87704

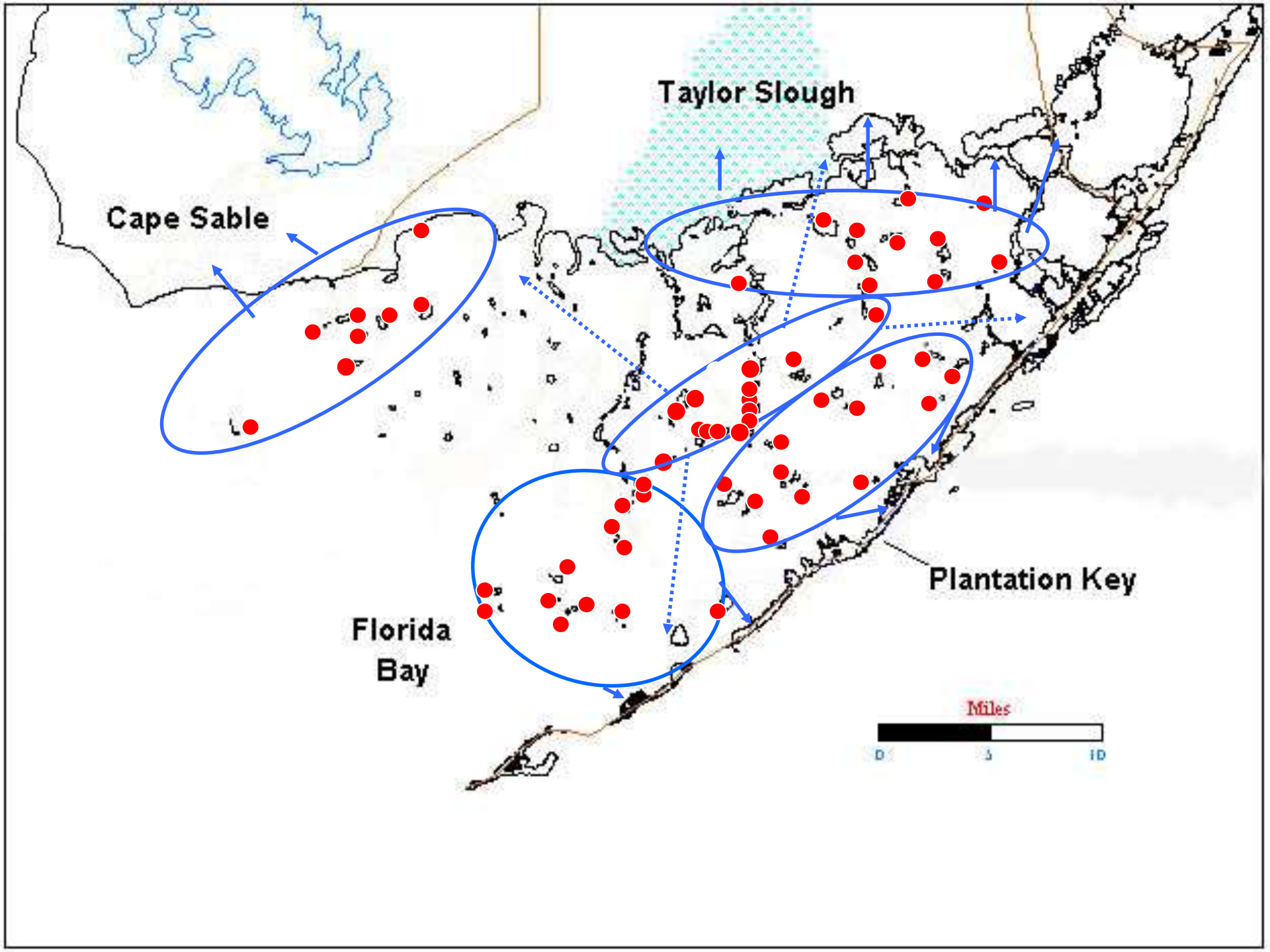

Key West
BL (R2=0.71)
20
15
10
5
0
-5
2000-01
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16

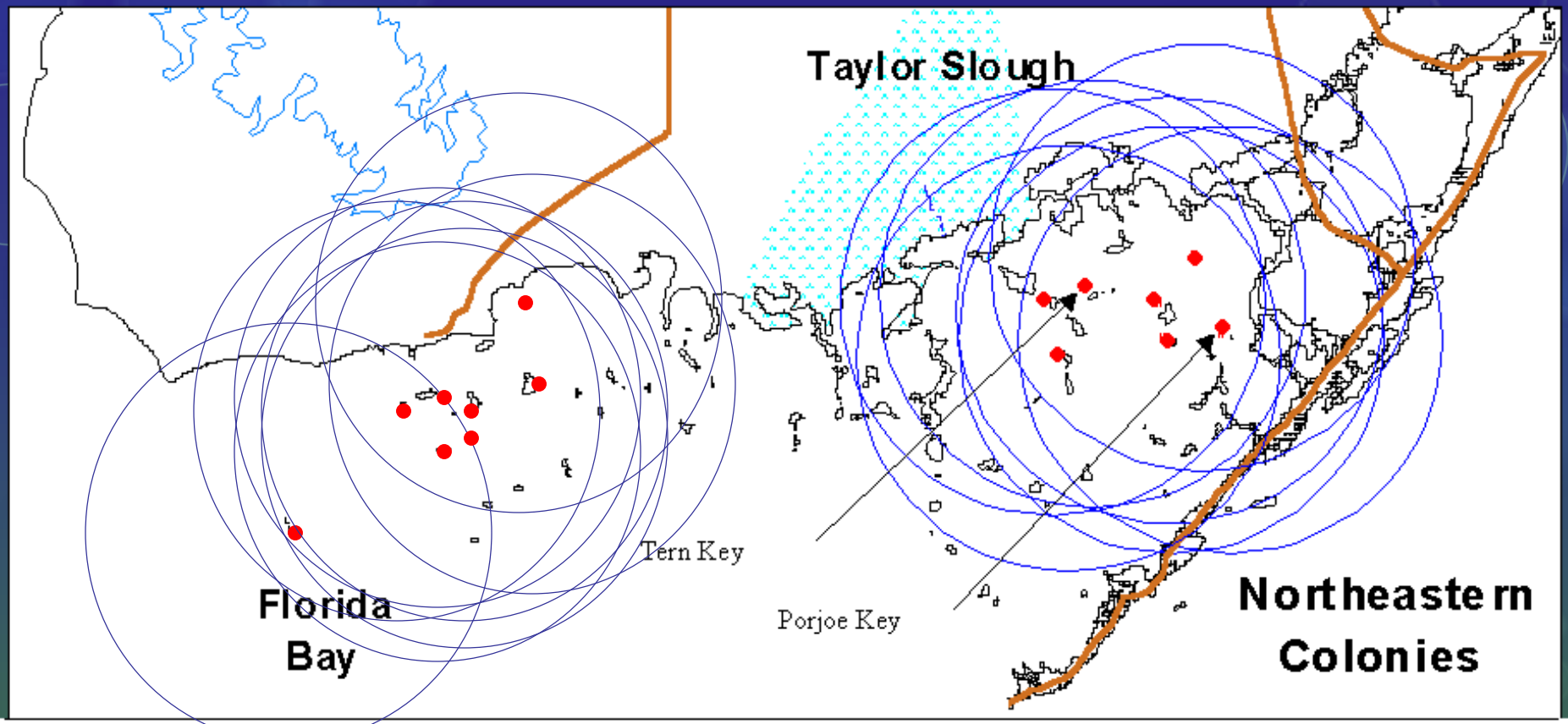

35
30
25
20
15
10
5
0
Key West
TR (R2=0.50)
JB (R2=0.78)
2000-01
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16


35
30
25
20
15
10
5
0
Key West
HC (R2=0.92)
BS (R2=0.88)
2000-01
2001-02
2002-03
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16


Highway Creek
Mean 2000-2010
Mean 2010-2015
2015-16
Water Level (cm)
60
50
40
30
20
10
0
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May

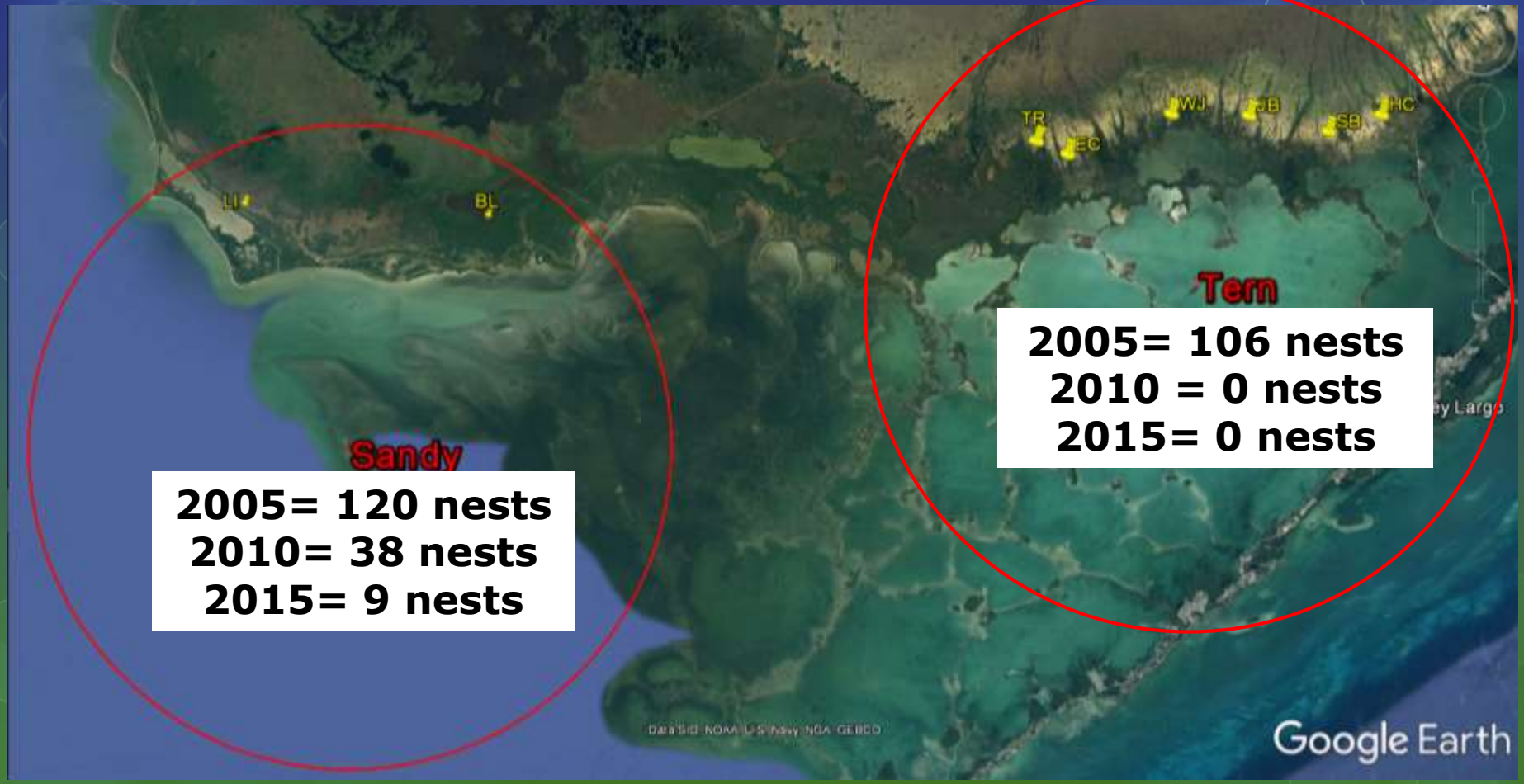

Days below PCT (<13.5 cm)
Number of days
300
250
200
150
100
50
0
1990-91
1992-93
1994-95
1996-97
1998-99
2000-01
2002-03
2004-05
2006-07
2008-09
2010-11
2012-13
2014-15


Taylor Slough
Cape Sable
Florida
Bay
Plantation Key
Miles
0
5
10

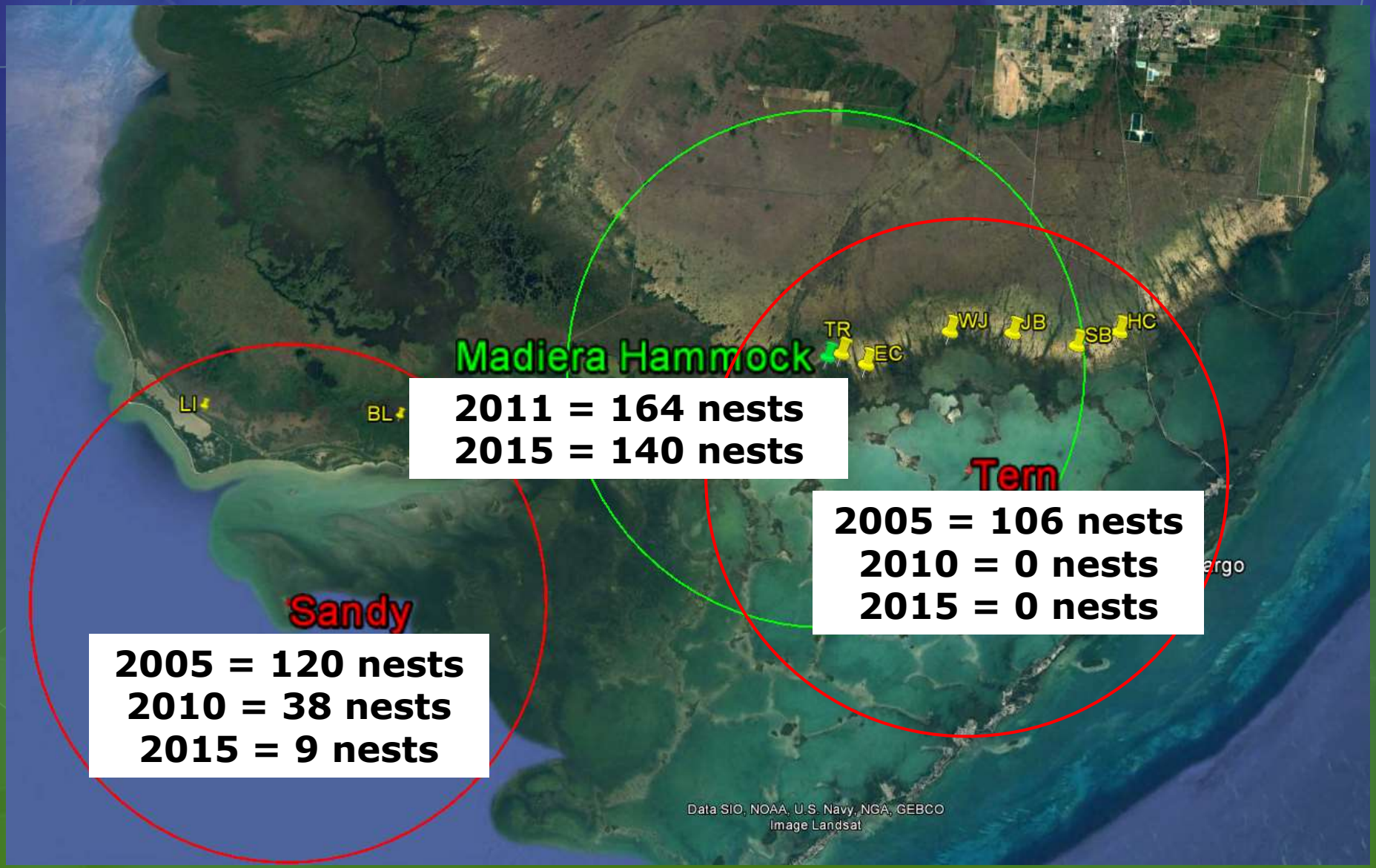


Roseate Spoonbill Nesting Sites In Northeastern and Northwestern Florida Bay

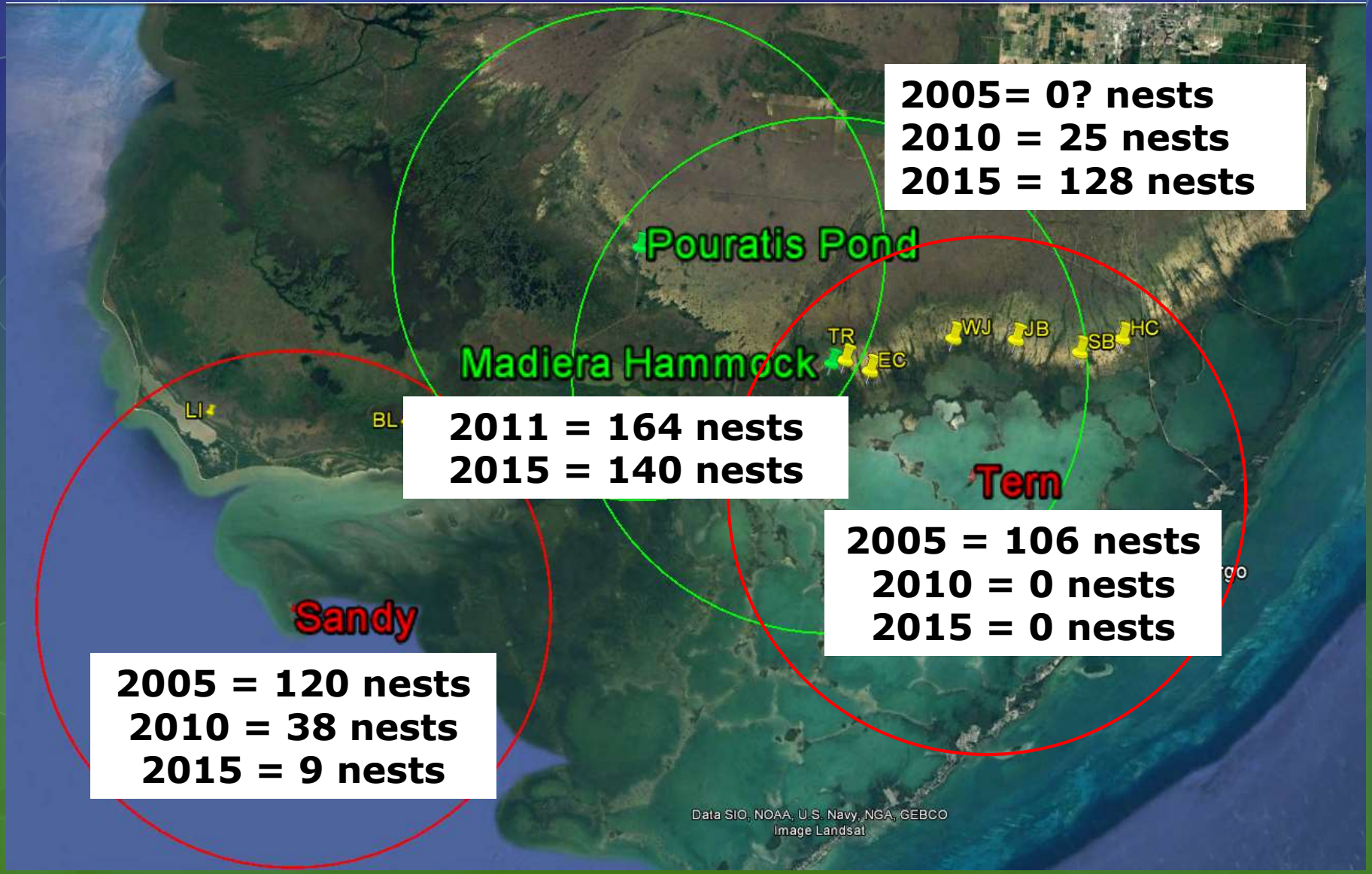
Largest Roseate Spoonbill Colonies

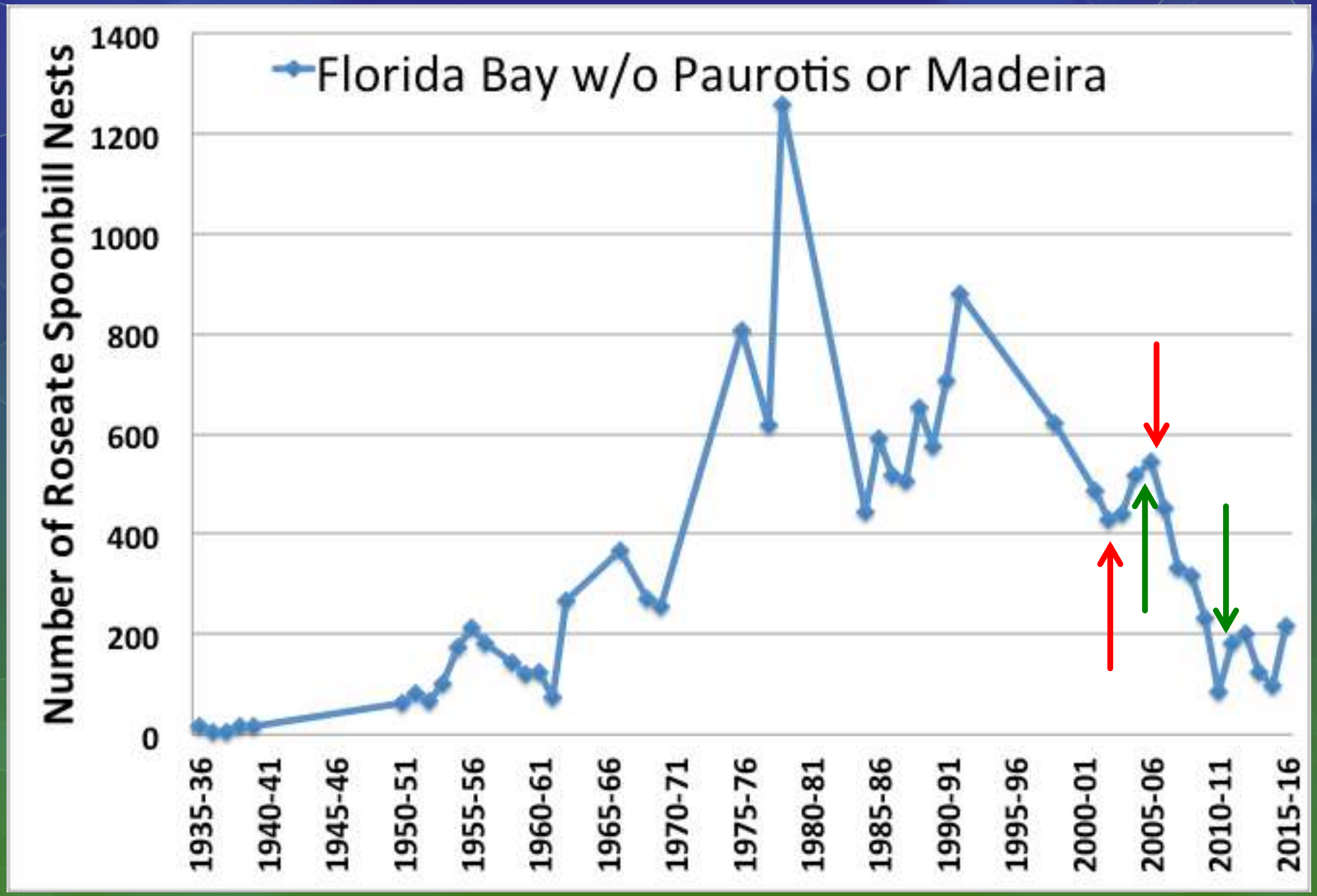


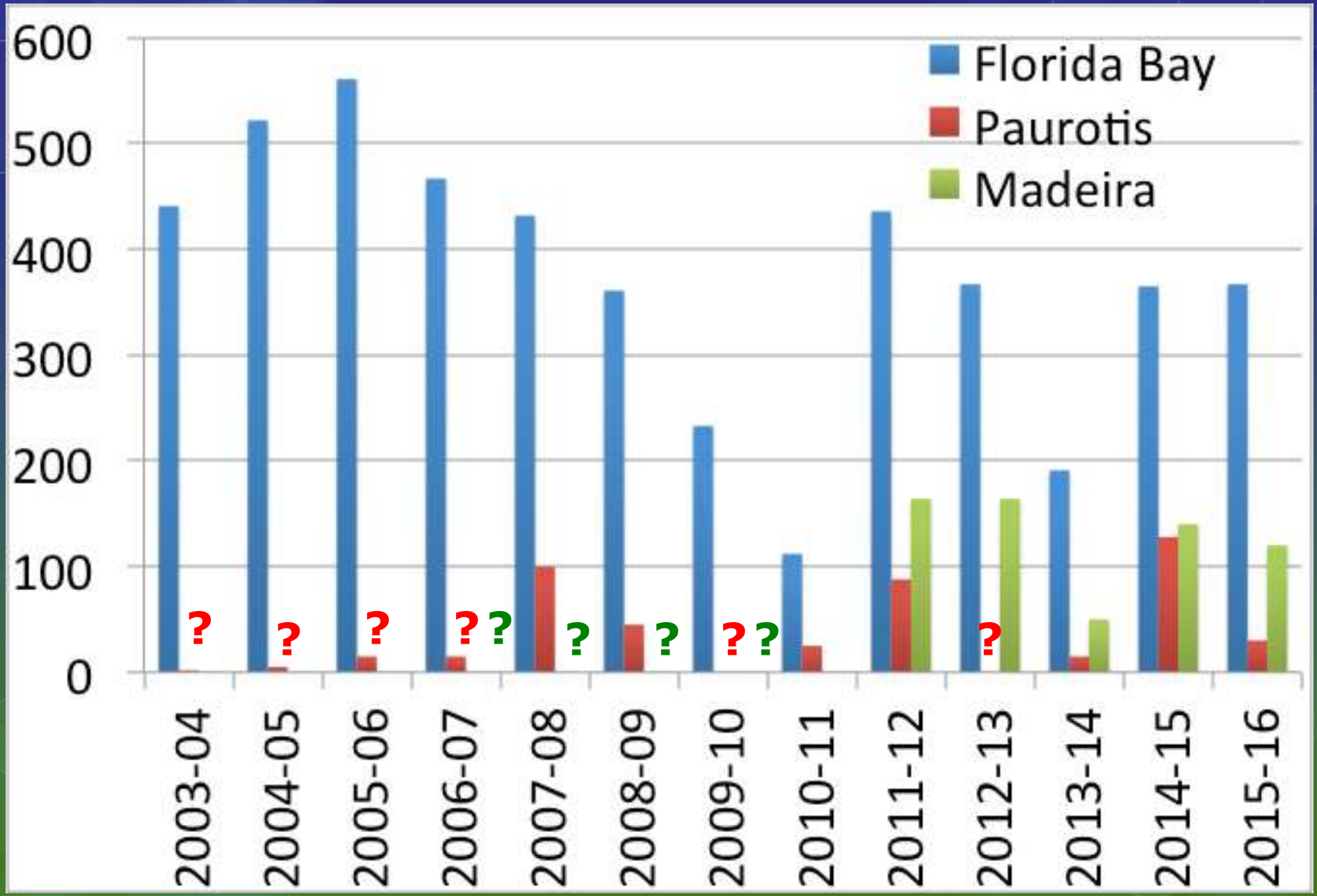
Largest Roseate Spoonbill Colonies

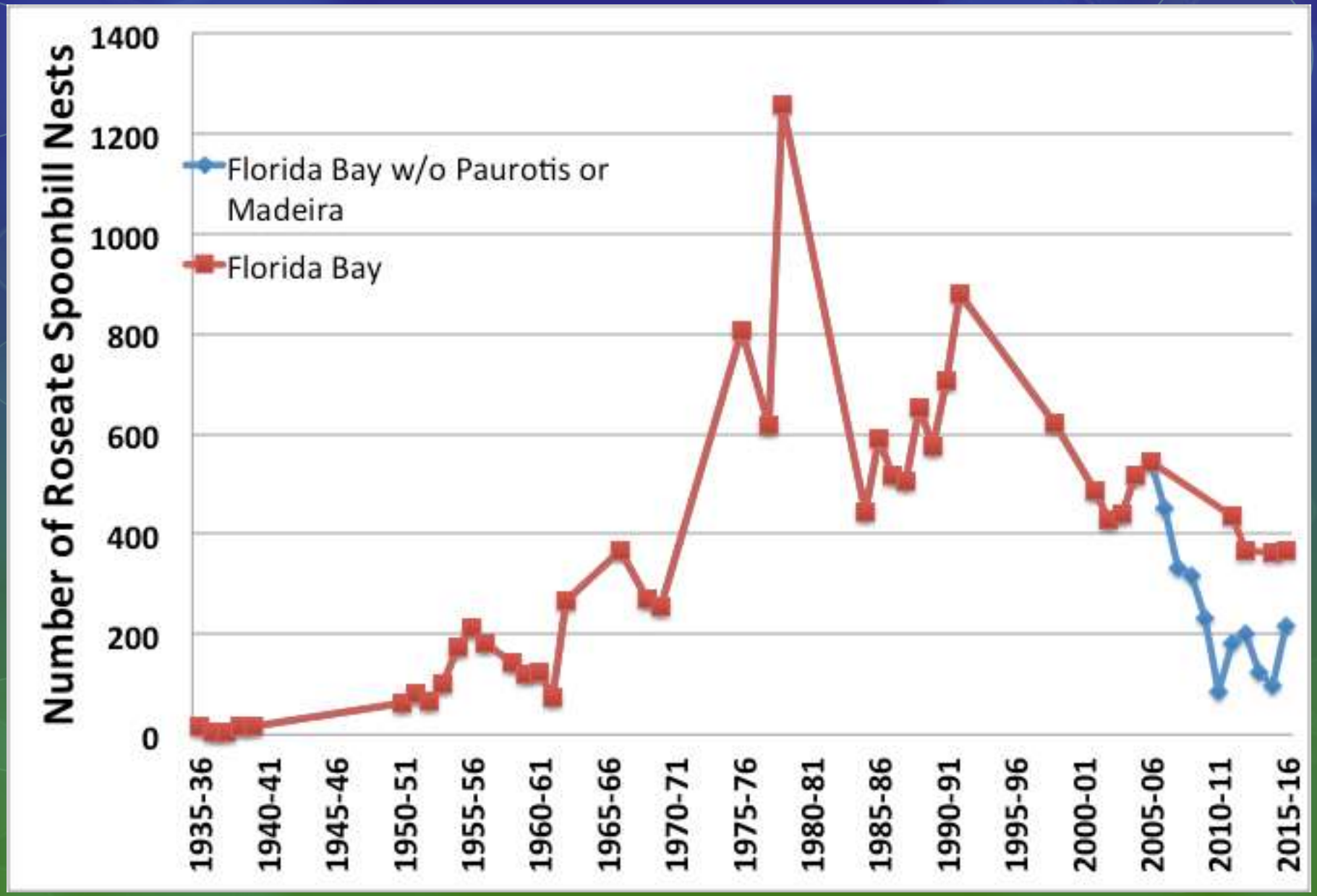


Largest Roseate Spoonbill Colonies



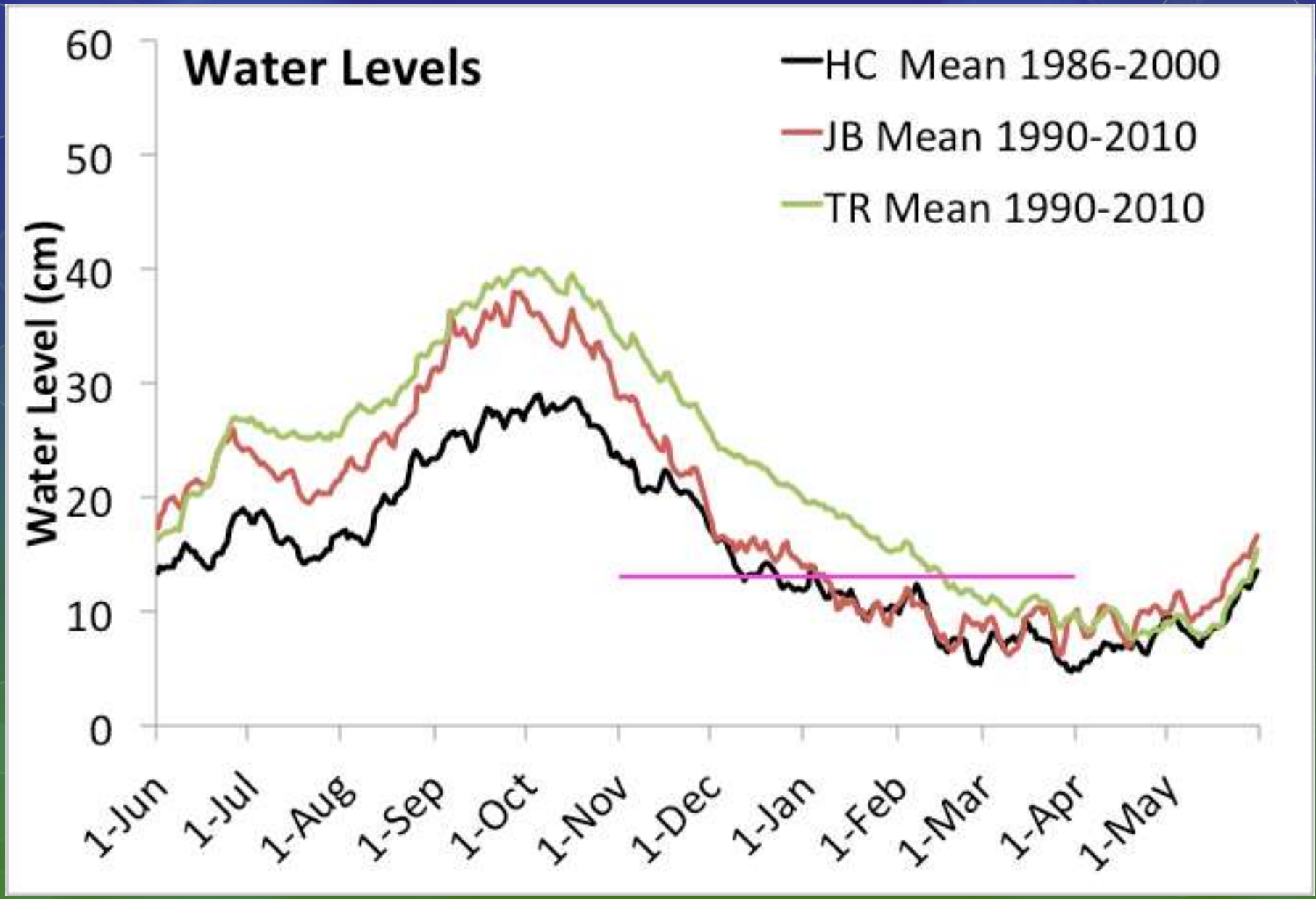

Florida Bay w/o Paurotis or Madeira
Number of Roseate Spoonbill Nests
1400
1200
1000
800
600
400
200
0
1935-36
1940-41
1945-46
1950-51
1955-56
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
1990-91
1995-96
2000-01
2005-06
2010-11
2015-16

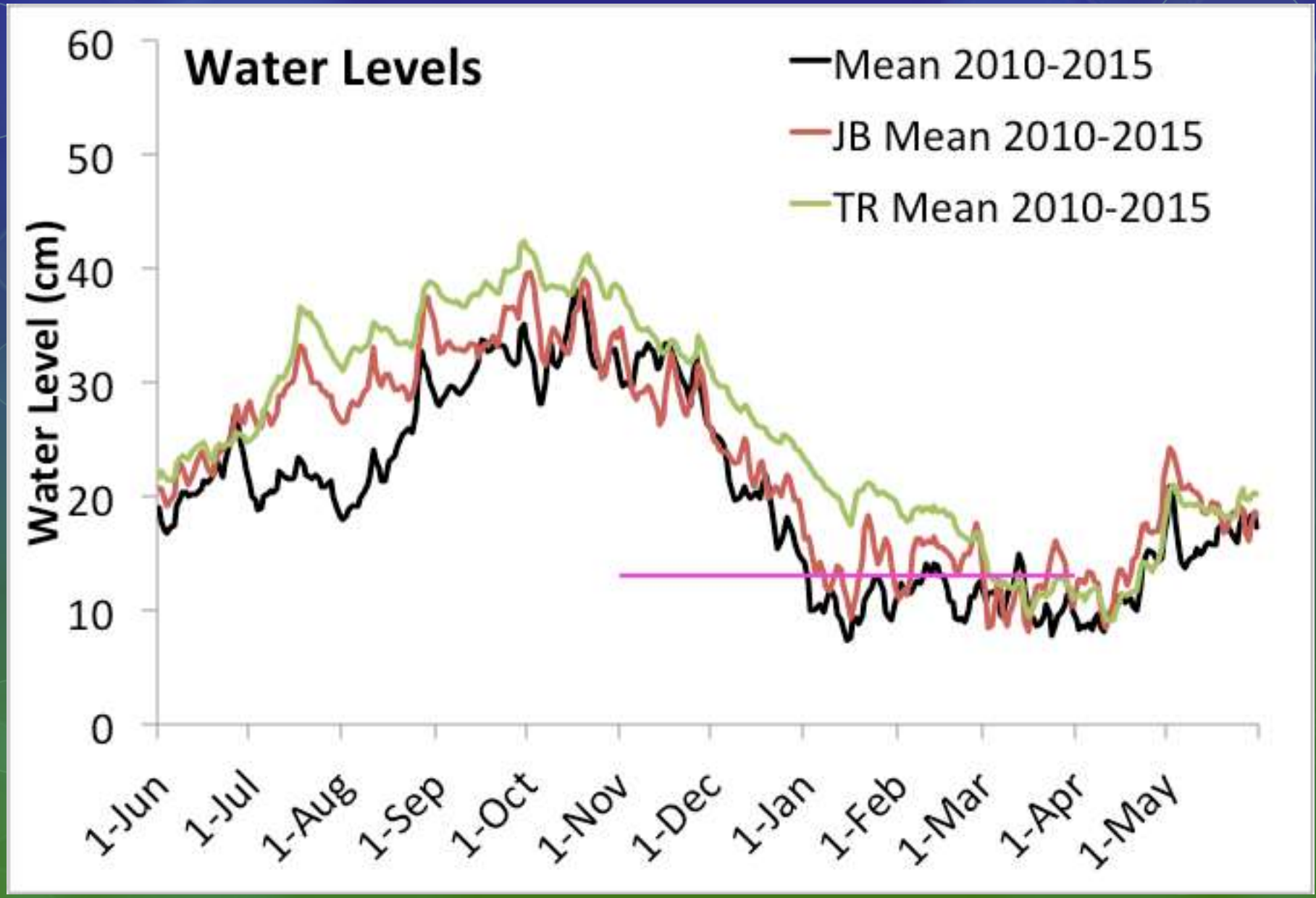

600
500
400
300
200
100
0
Florida Bay
Paurotis
Madeira
? ? ? ? ? ? ? ? ? ? ? ?
2003-04
2004-05
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14
2014-15
2015-16

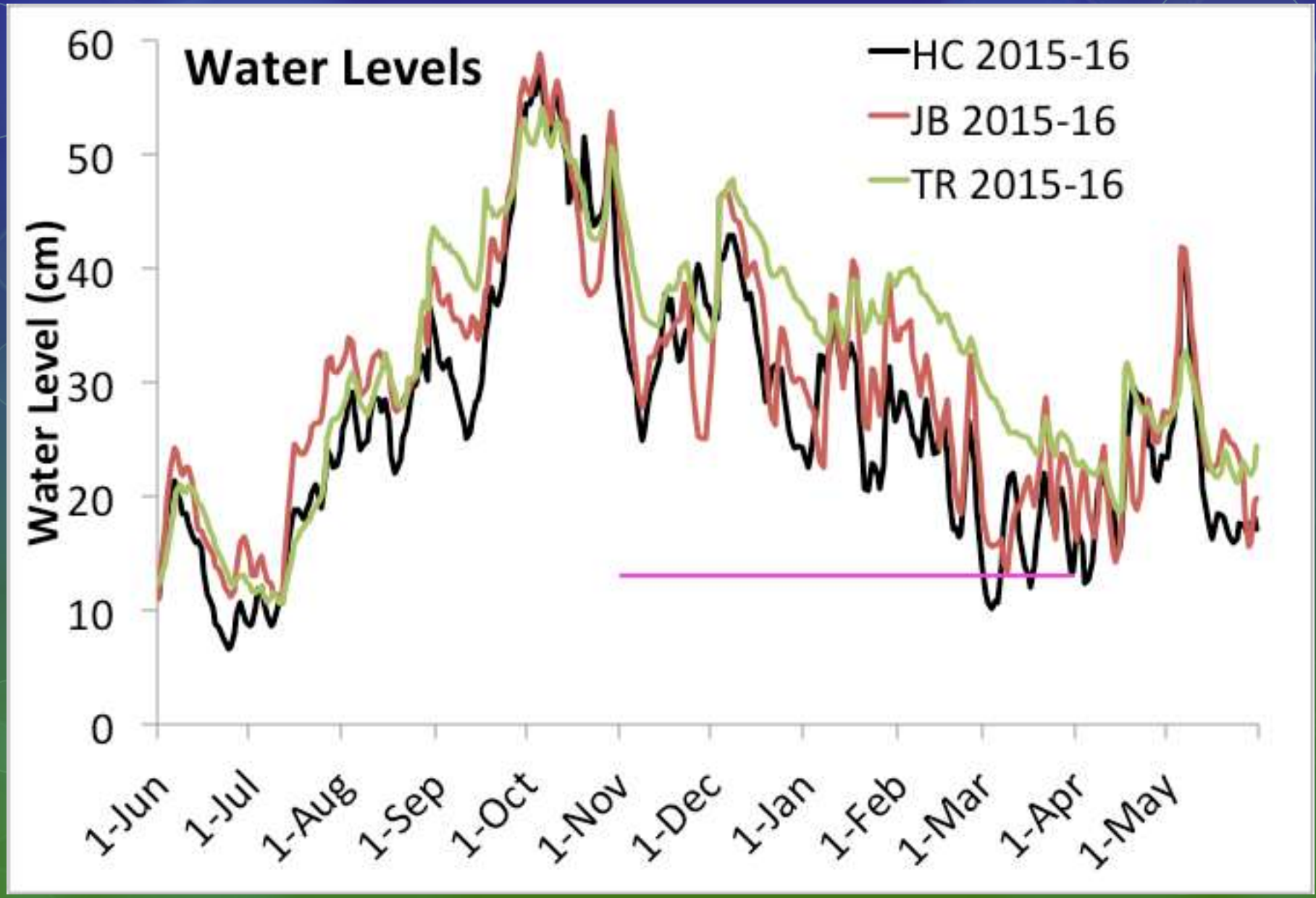

Number of Roseate Spoonbill Nests
1400
1200
1000
800
600
400
200
0
Florida Bay w/o Paurotis or Madeira
Florida Bay
1935-36
1940-41
1945-46
1950-51
1955-56
1960-61
1965-66
1970-71
1975-76
1980-81
1985-86
1990-91
1995-96
2000-01
2005-06
2010-11
2015-16

Nesting Dates

- 1936-2010 = November 1st – December 31st
- 2011-2014 = January 1st – January 10th
- 2015 = January 24th
- 2016 = February 5th

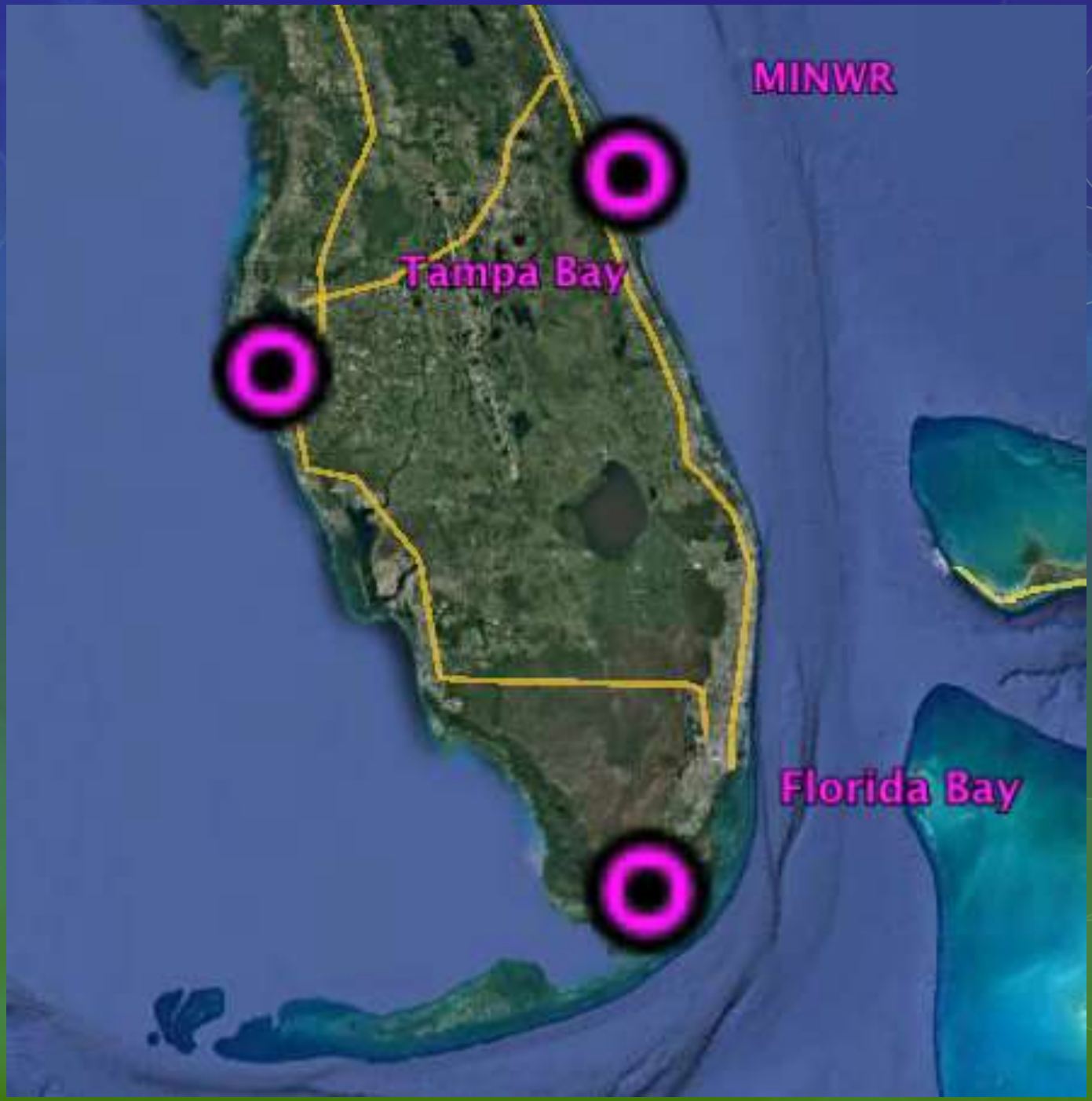

Water Levels
HC Mean 1986-2000
JB Mean 1990-2010
TR Mean 1990-2010
Water Level (cm)
60
50
40
30
20
10
0
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May

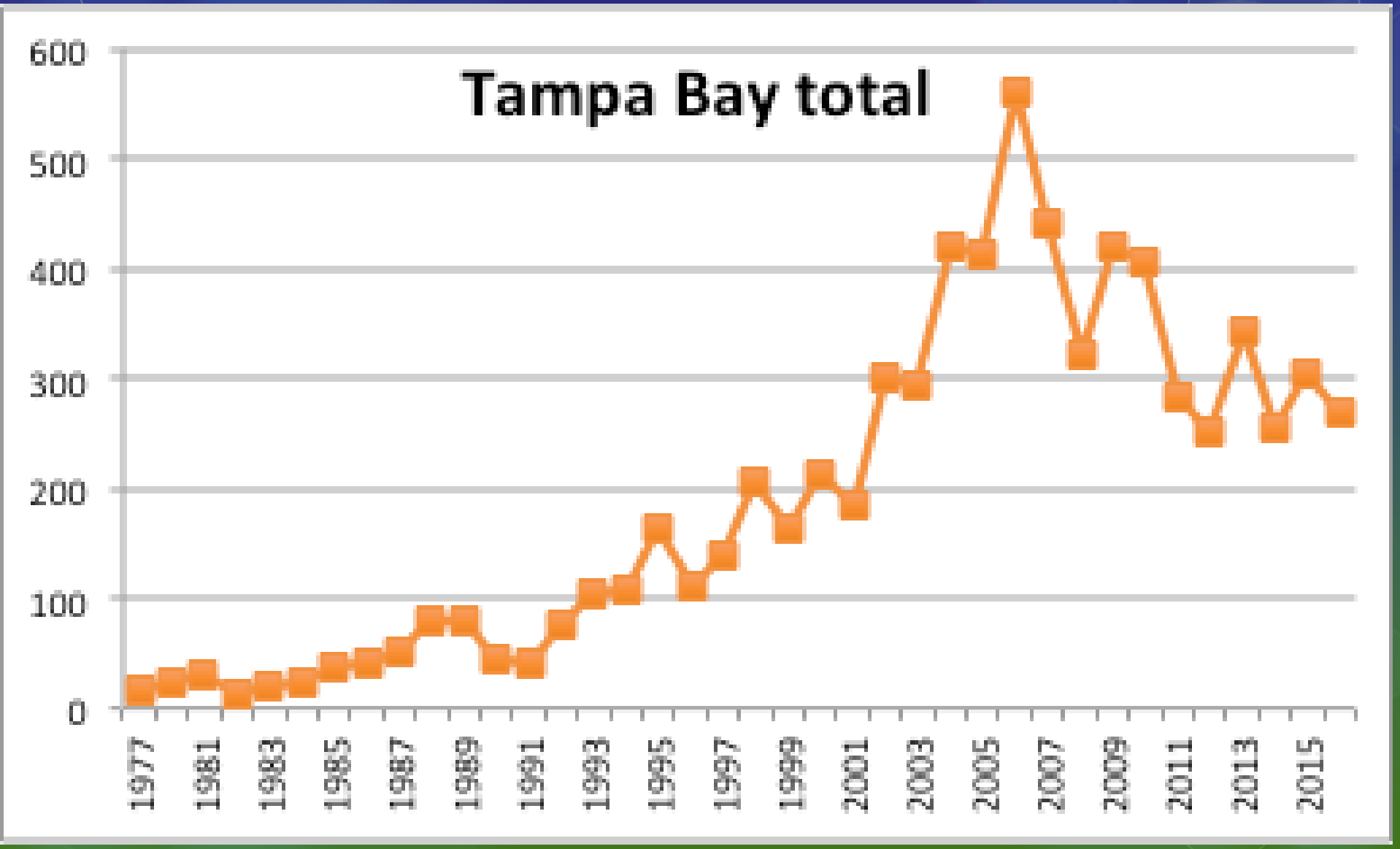

Water Levels
Mean 2010-2015
JB Mean 2010-2015
TR Mean 2010-2015
Water Level (cm)
60
50
40
30
20
10
0
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May


Water Levels
HC 2015-16
JB 2015-16
TR 2015-16
Water Level (cm)
60
50
40
30
20
10
0
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May

Regional Colony Additions

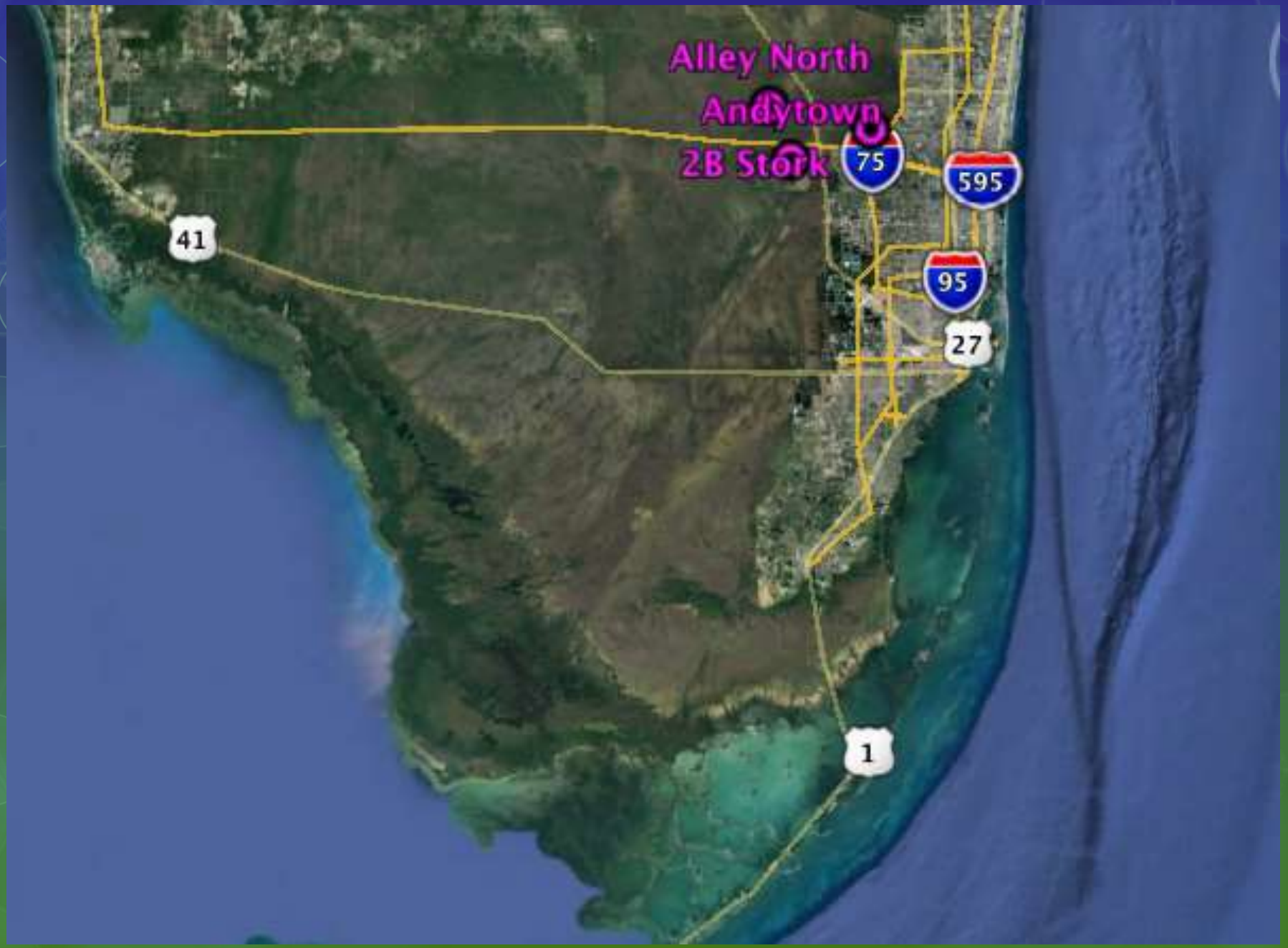
- Tampa Bay Colonies 1978
- MINWR Colonies 1987
  - All Colonies to this point were on islands in Estuaries


MINWR
Tampa Bay
Florida Bay


Tampa Bay total
600
500
400
300
200
100
0
1977
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015

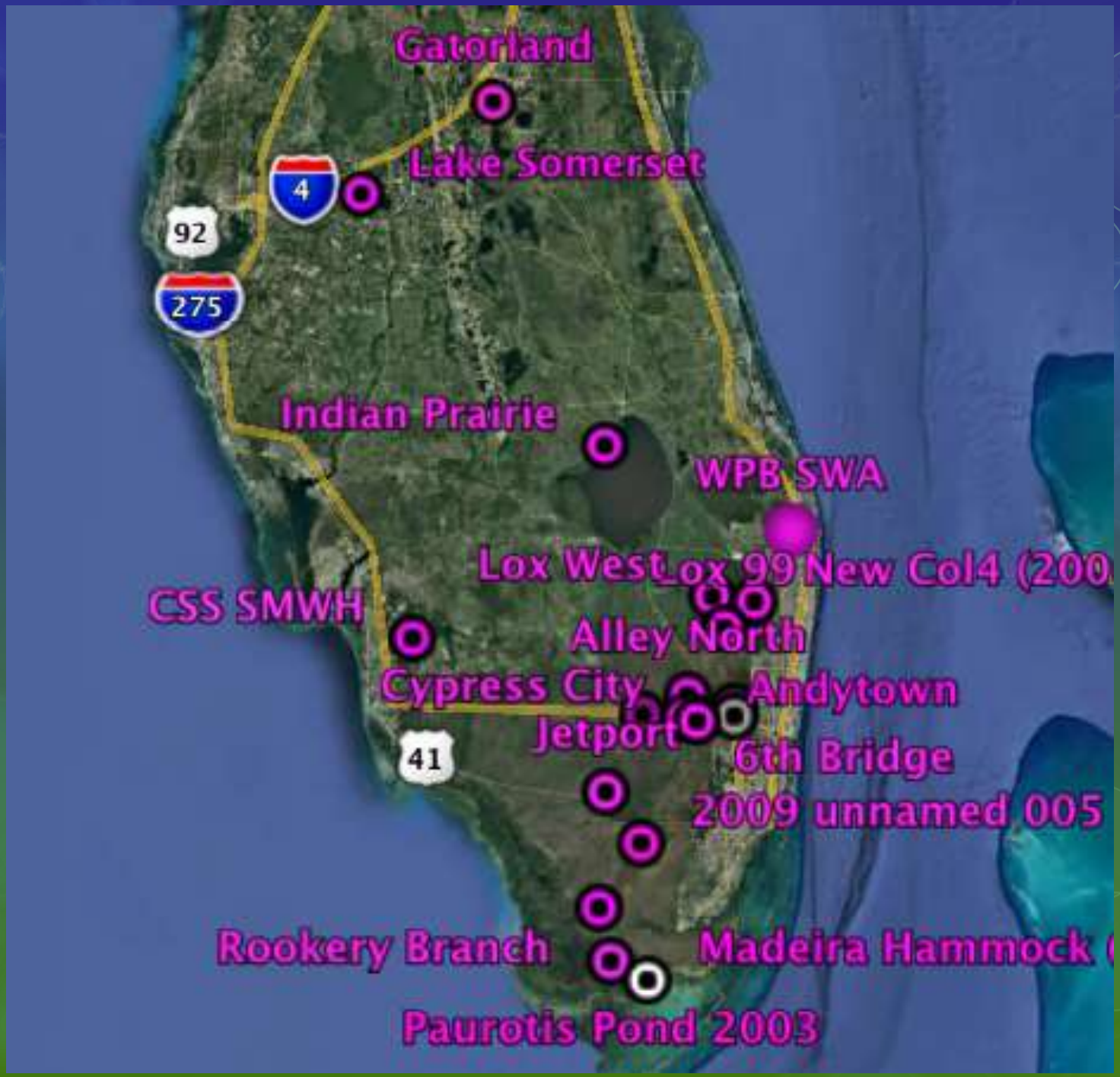
Regional Colony Additions

- Tampa Bay Colonies 1978
- MINWR Colonies 1987
  - All Colonies to this point were on islands in Estuaries
- 3 colonies between 1987 and 2000


Alley North
Andytown
2B Stork
75
595
41
95
27
1

Regional Colony Additions

- Tampa Bay Colonies 1978
- MINWR Colonies 1987
  - All Colonies to this point were on islands in Estuaries
- 3 colonies between 1987 and 2000
- 23 colonies between 2000-2010

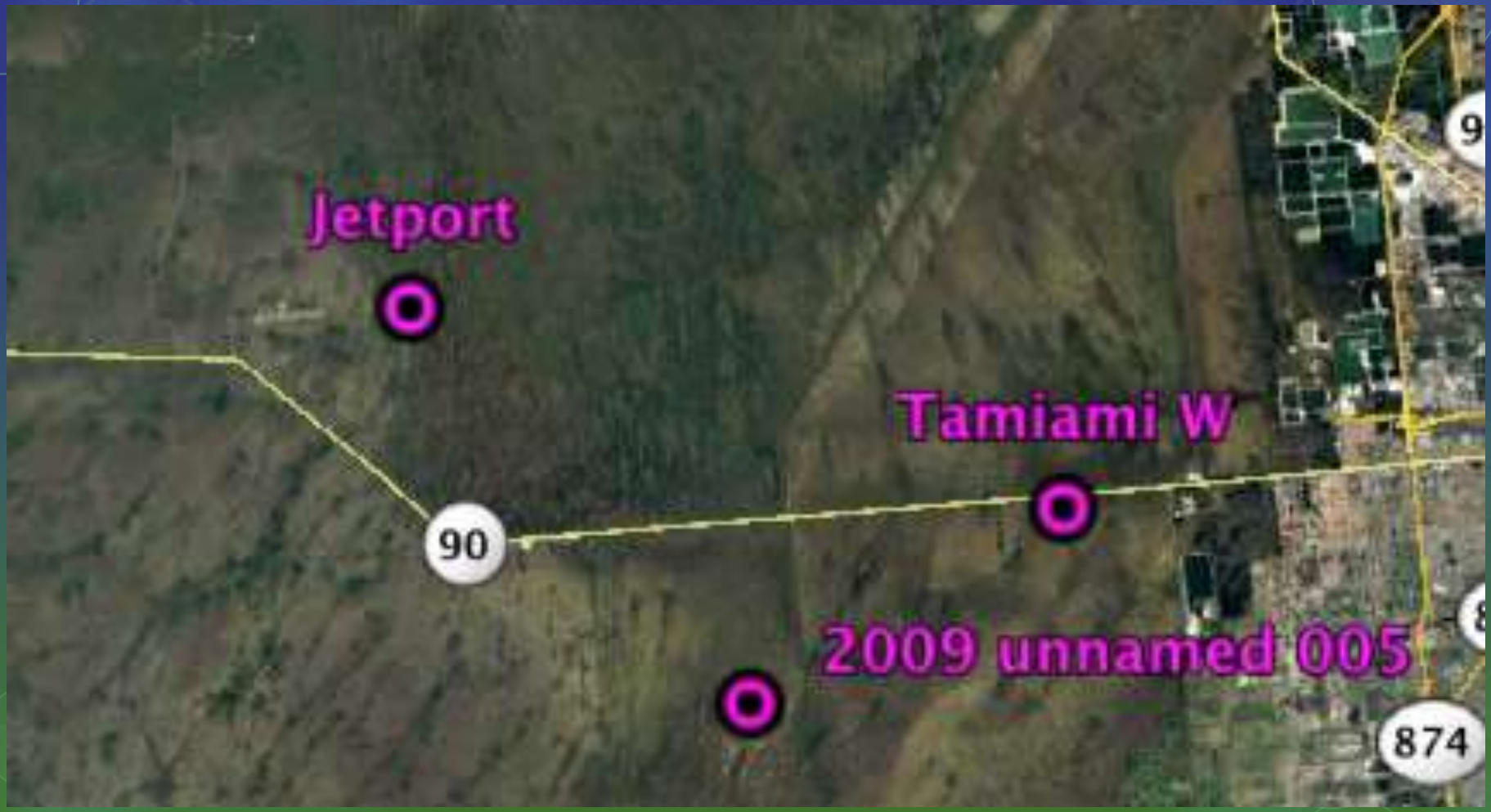

Gatorland
Lake Somerset
4
92
275
Indian Prairie
WPB SWA
Lox West
Lox 99 New Col4 (200
CSS SMWH
Alley North
Cypress City
Andytown
Jetport
41
6th Bridge
2009 unnamed 005
Rookery Branch
Madeira Hammock
Paurotis Pond 2003

Regional Colony Additions

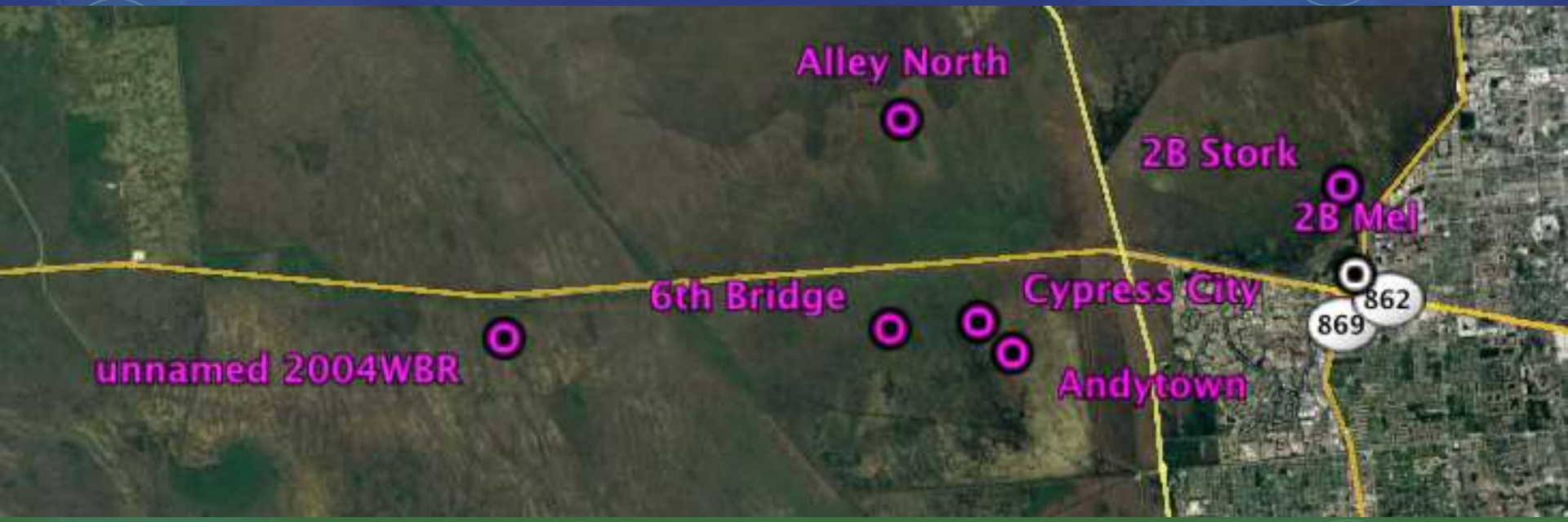
- Tampa Bay Colonies 1978
- MINWR Colonies 1987
  - All Colonies to this point were on islands in Estuaries
- 3 colonies between 1987 and 2000
- 23 colonies between 2000-2010
- 14 Colonies Between 2001-2017
  - Out of the 40 colonies added since 1992 5 were Estuarine Islands, 9 were Coastal and 26 were inland.


Jones Lagoon
Paurotis Pond 2003
Madeira Hammock (2006,2010)
1

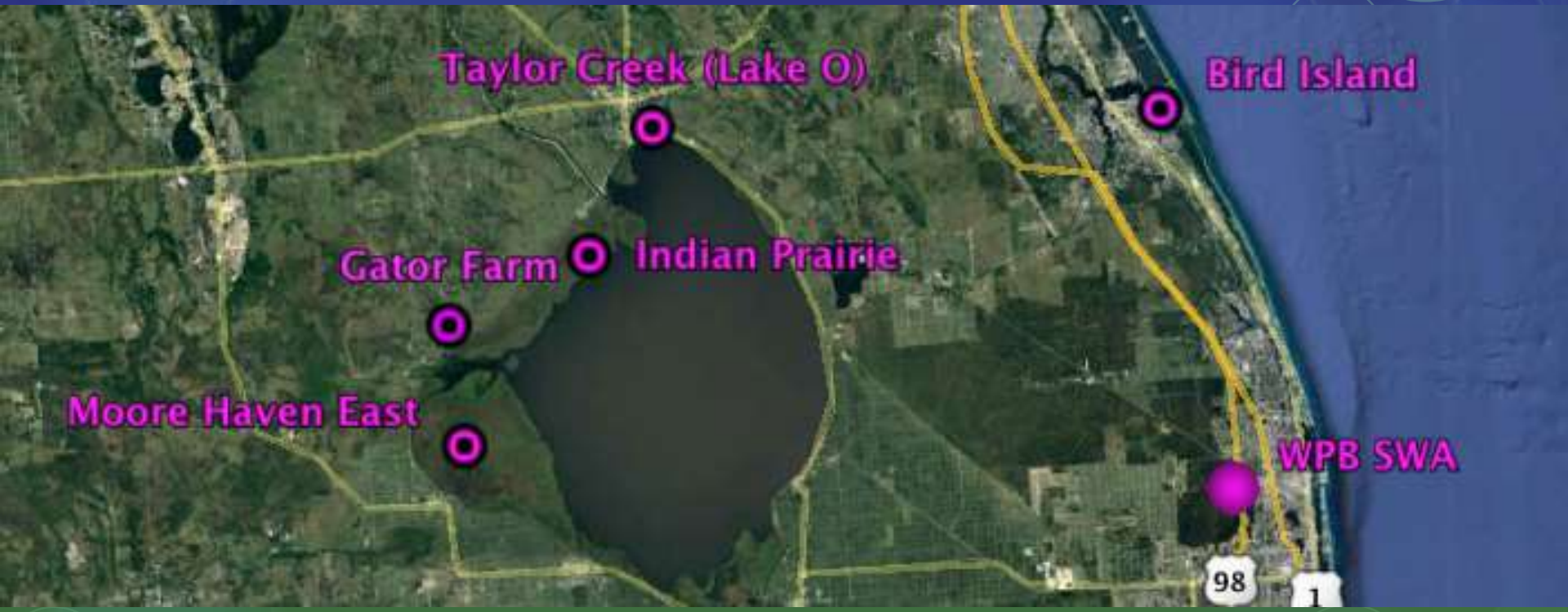

1-LostmansCreek
1-CabbageBay
1-BroadR
1-OtterCr
Rookery Branch

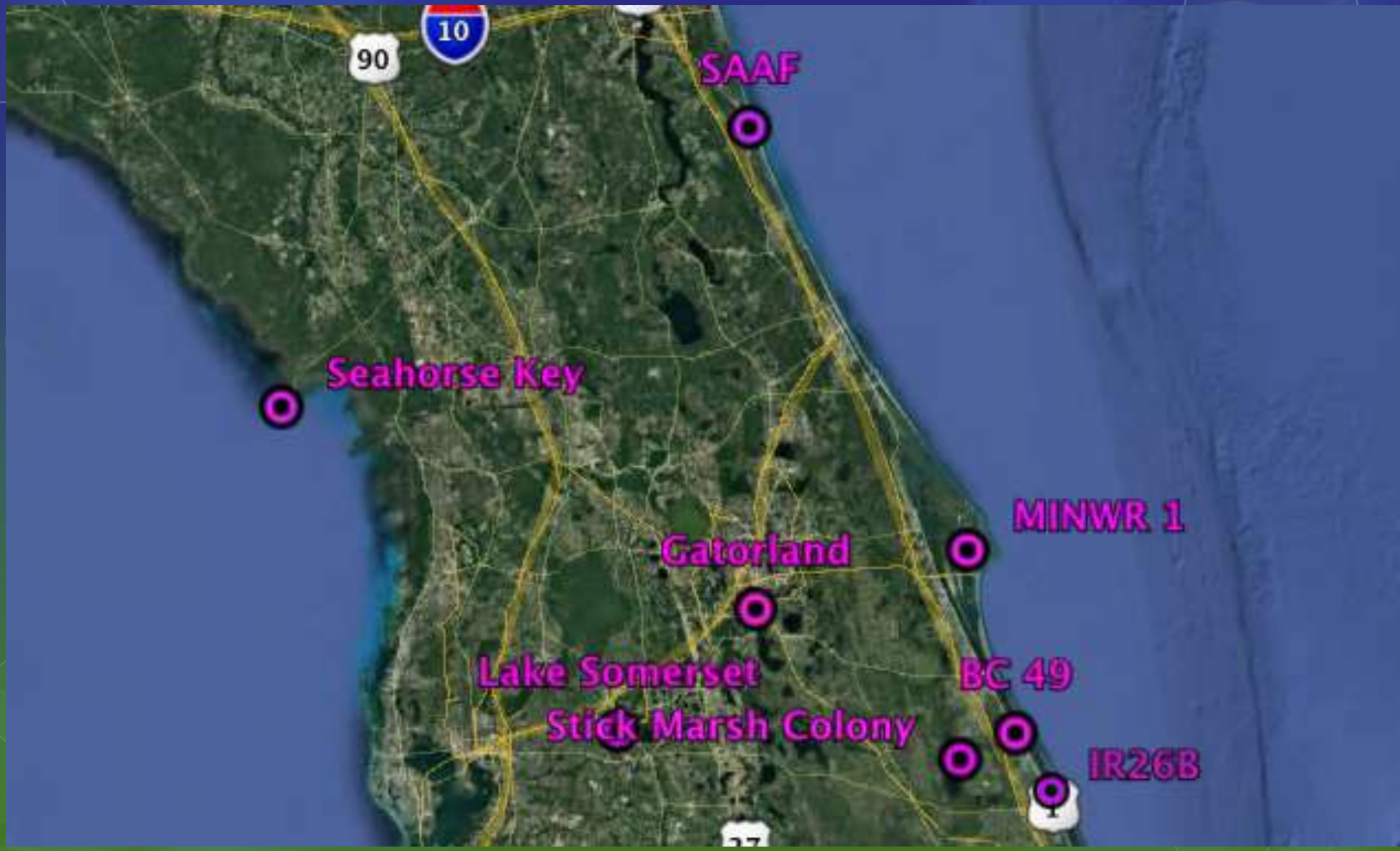

Jetport
Tamiami W
90
2009 unnamed 005
874


CSS Wost 2
CSS SMWH
Cypress east
Barron Collier 29


Alley North
2B Stork
2B Mel
6th Bridge
Cypress City
862
869
unnamed 2004WBR
Andytown

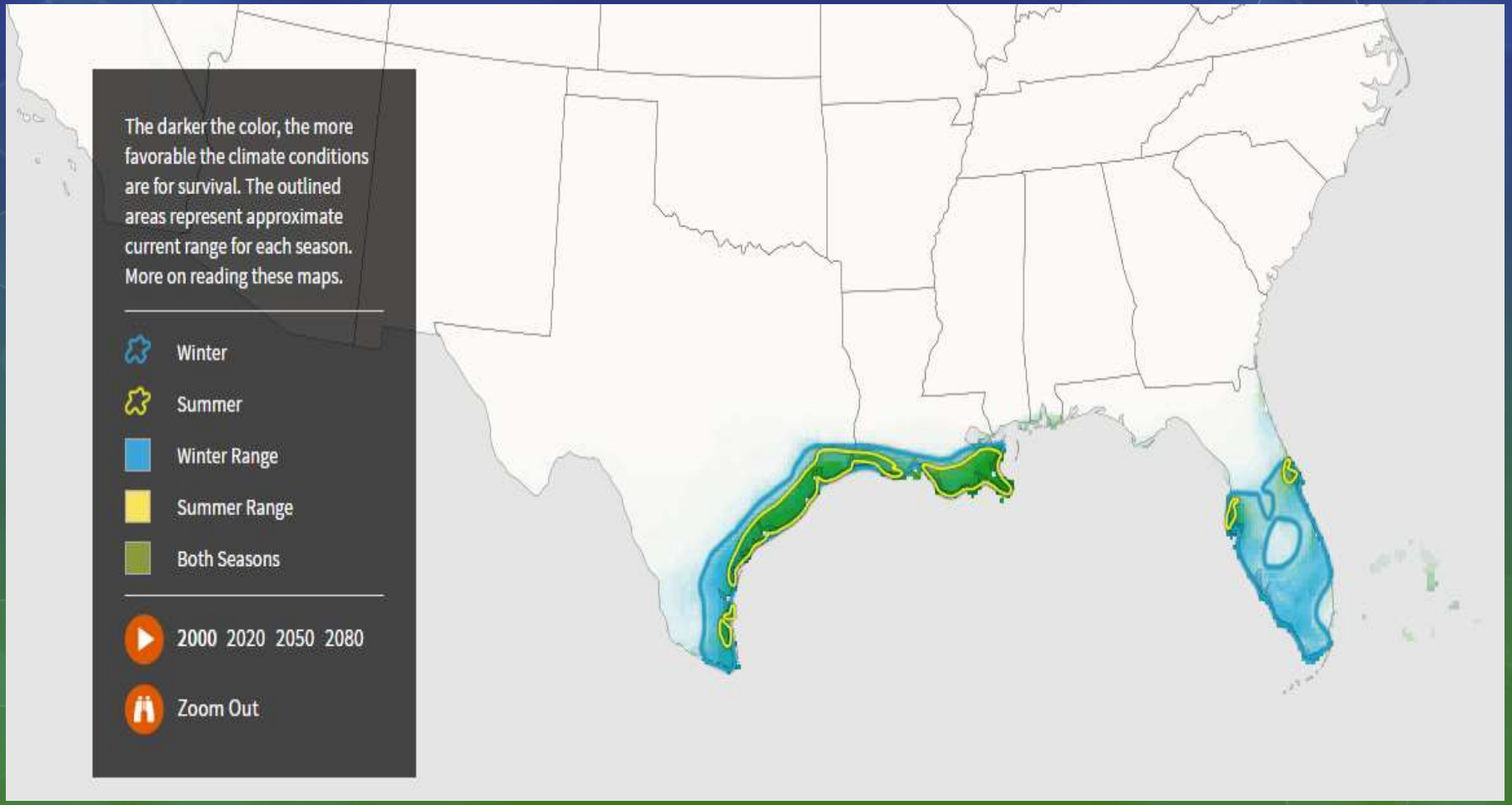

Lox West
New Col4 (2008)
Lox 99 Welt


Taylor Creek (Lake O)
Bird Island
Gator Farm
Indian Prairie
Moore Haven East
WPB SWA
98
1

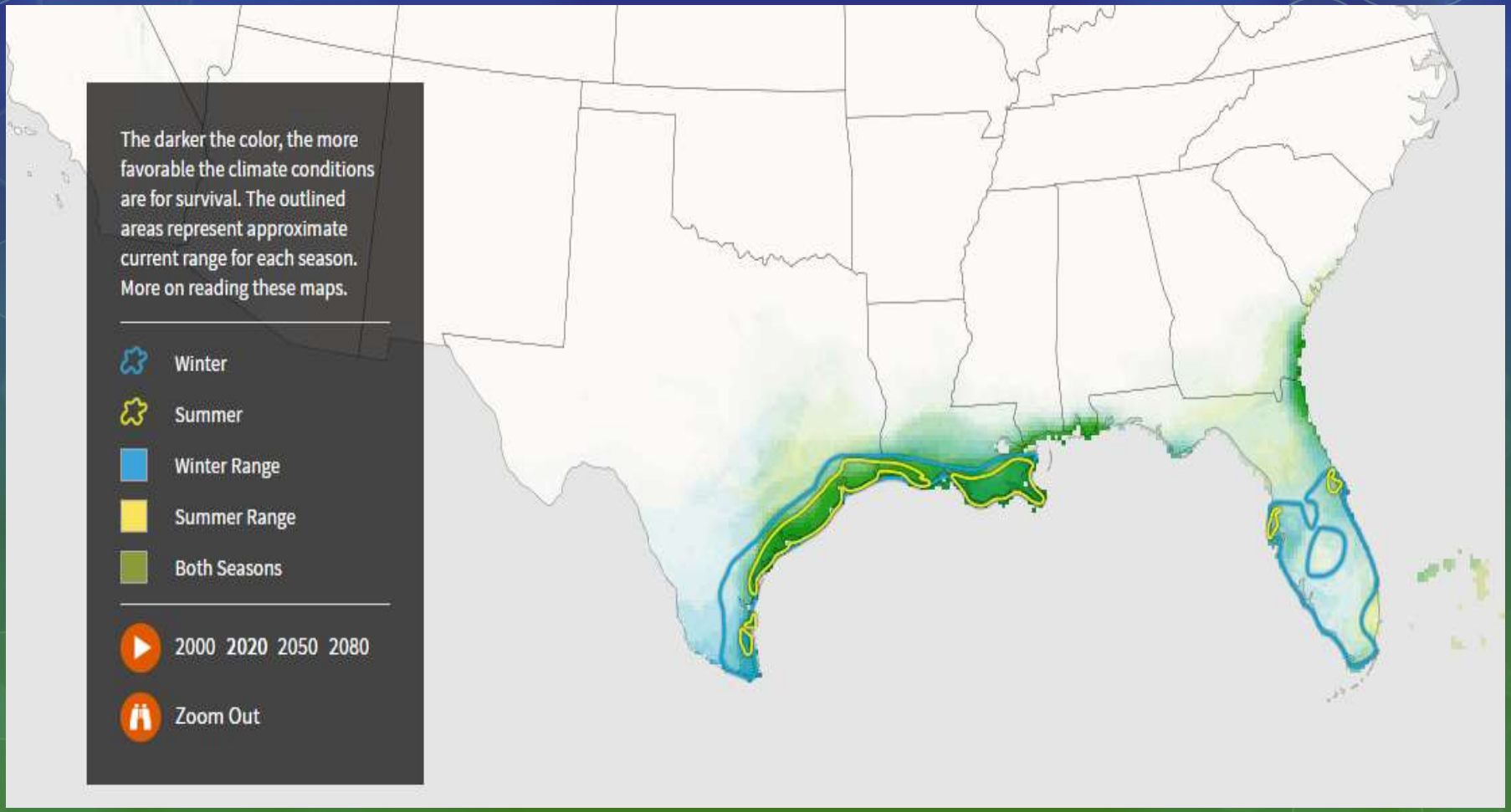

10
90
SAAF
Seahorse Key
MINWR 1
Gatorland
Lake Somerset
BC 49
Stick Marsh Colony
IR26B


21
Pinckney Island NWR?
516
84
25
Durango Colony
1
SAAF

Roseate Spoonbill Range 2000



Predicted Roseate Spoonbill Range 2020



Conclusions

1. Spoonbills are moving away from their traditional nesting sites in the estuaries in corralation with rising sea levels
2. They are nesting further north than was ever recorded even prior to plume hunting era presumable with warmer temperatures
3. Highlights the value of long-term data sets