CERP Interim Goals

Committee on Independent Scientific Review of Everglades Restoration Progress
04 February 2020

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Presentation Outline

1. RECOVER's current effort
2. Hydrology/Modeling
3. Examples of ecological findings
   - Oysters in the St. Lucie Estuary
   - Alligators in the Greater Everglades
   - Salinity in Florida Bay

Interim Goals Are:

- Planning tools that estimate likely success of the CERP as projects are constructed and operated
- A basis for reporting forecasted progress to policy makers and the public
- Tools to implement adaptive management strategies

Interim Goals – Who & How

- Interim goals "shall be developed [by RECOVER] through the use of appropriate models and tools…and best available science and information"
- RECOVER's new recommendations are being developed using the RSM-BN and RSM-GL with a 41-year period of simulation
- Recommended indicators derived from CERP performance measures, ecological models and programmatic guidelines

RECOVER's 5-Year Plan

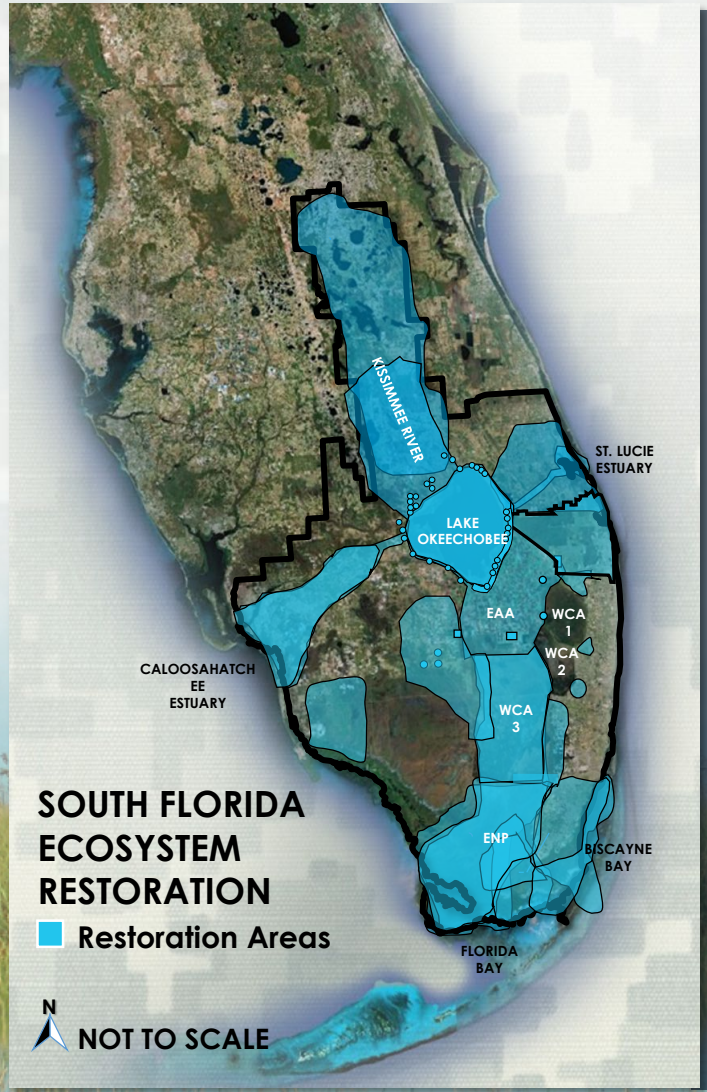
- Confirmed and revised original list of Interim Goal indicators
- Two 'interim' time periods modeled with projects from the 2018 Integrated Delivery Schedule
  - 2026
  - 2032 CEPP (A-2 flow equalization basin)
  - 2032 PACR (A-2 reservoir and stormwater treatment area)
- IG Report due 30 March

Ecological Models and Indicators for Interim Goals

- American oysters the in Northern Estuaries
- Lake Okeechobee submerged aquatic vegetation
- Aquatic fauna regional populations in Everglades wetlands
- Alligator production suitability index
- System-wide wading bird nesting pattern (WADEM)
- Apple snail population (surrogate for snail kite)
- Everglades Landscape Vegetation Succession (ELVeS)
- Marl Prairie
- Everglades Peat Soil Oxidation
- Submerged aquatic vegetation in Southern Estuaries
- Juvenile shrimp densities
- Juvenile spotted seatrout
- American crocodile growth and survival

Hydrology/Modeling

Hydrologic Modeling Strategy: Implement Authorized Projects and Use Available Operations from Previous Studies



NON-CERP & FOUNDATION PROJECTS

- Modified Water Deliveries to Everglades National Park
- Kissimmee River Restoration
- C-111 South Dade
- C-51/Storm Water Treatment Area (STA) 1E
- Storm Water Treatment Areas/Restoration Strategies
- Tamiami Trail Bridging & Roadway Modifications
- Herbert Hoover Dike (HHD)Rehabilitation
- Seminole Big Cypress Critical Project

CERP GENERATION 1 PROJECTS

- Indian River Lagoon (IRL) – South
- Picayune Strand
- Melaleuca Annex Facility

CERP GENERATION 2 PROJECTS

- C - 43 Reservoir
- Broward County Water Preserve Areas (WPA)
- C-111 Spreader Canal Western Project
- Biscayne Bay Coastal Wetlands Phase 1

DECEMBER 2016 AUTHORIZATION

- Central Everglades Planning Project (CEPP)

PLANNING EFFORTS

- Loxahatchee River Watershed Restoration
- Western Everglades Restoration
- Lake Okeechobee Watershed Restoration

EVERGLADES AGRICULTURAL AREA STORAGE RESERVOIR

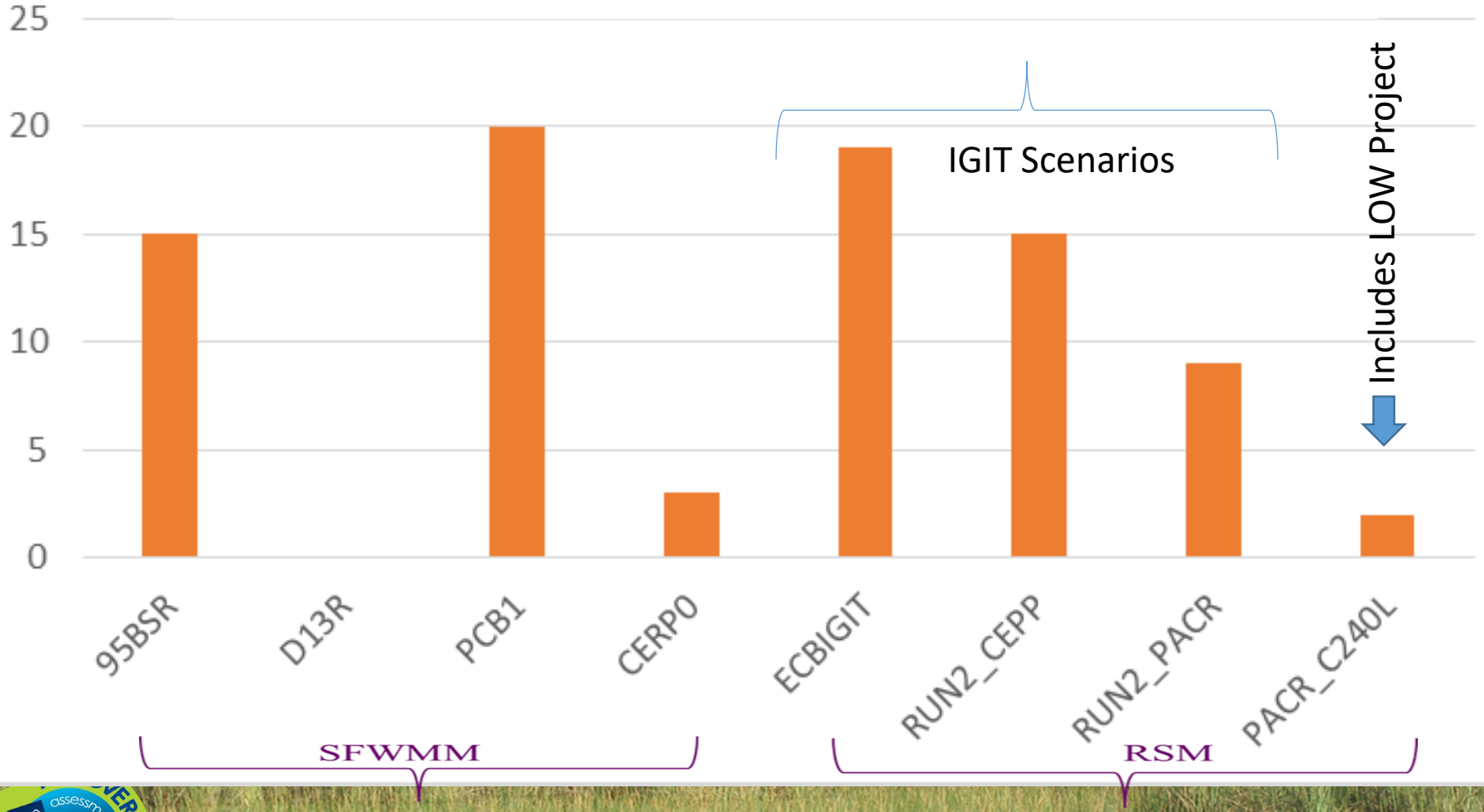
Lots of Moving Pieces from a Modeling Perspective….

- The current Interim Goals Interim Targets effort is the first attempt to report progress using updated data sets and methodologies (previous efforts used modeling information directly from the RESTUDY)
- Differences can be attributed to new project information, updated hydrology and/or revised evaluation methods & datasets
- For the IGIT effort, it is important to remember that NOT all CERP components are included in the incremental runs (only those planned in the July 2018 IDS) and runs do not always include the “latest and greatest” COP, South Dade, C23/C24, etc… updates
- Generally, relative water supply changes (with project relative to comparable base) will be less dramatic since all IGIT runs use permitted demands (which are regionally consistent with RESTUDY assumptions for magnitude and spatial pattern)

General Hydrologic Observations Within the Northern Everglades

- Generally, high Lake stage trends envisioned in CERP are being realized, but low Lake stage performance is not as similar
- Generally, Lake Okeechobee affects on the Northern Estuaries are trending toward outcomes envisioned in CERP
- Basin runoff trends are less similar
  - Changes are observed due to differences in runoff estimation (RESTUDY used modified historical data and later efforts used hydrologic modeling)
  - For St Lucie, IRL project features (e.g. Ten Mile Creek) have been designed differently than originally conceptualized
  - For Caloosahatchee, C43 ASR / Backflow to Lake Okeechobee and C43 ASR components are not considered in IGIT scenarios

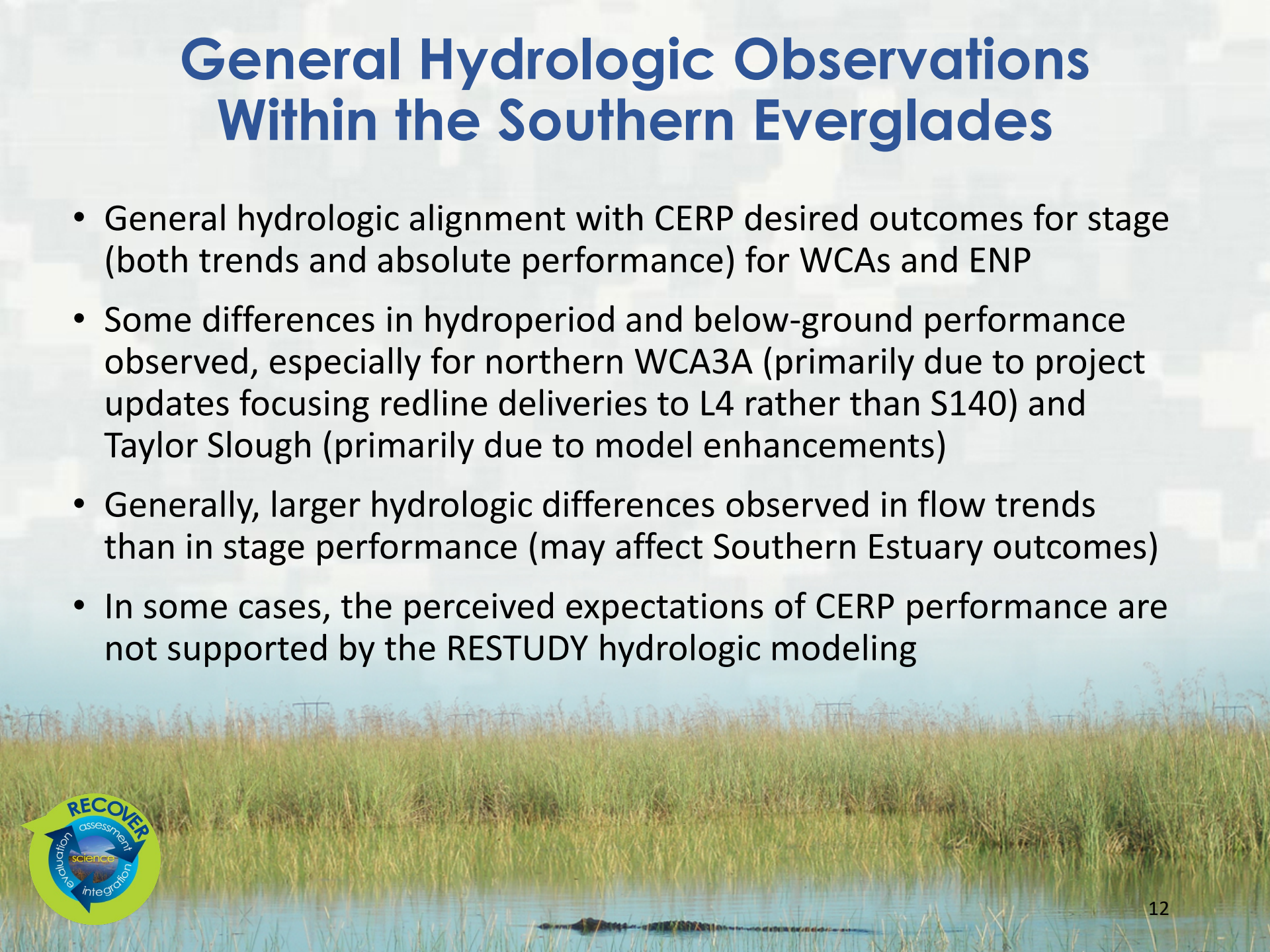
Number of Lake O. Triggered High Discharge Months to the Northern Estuaries



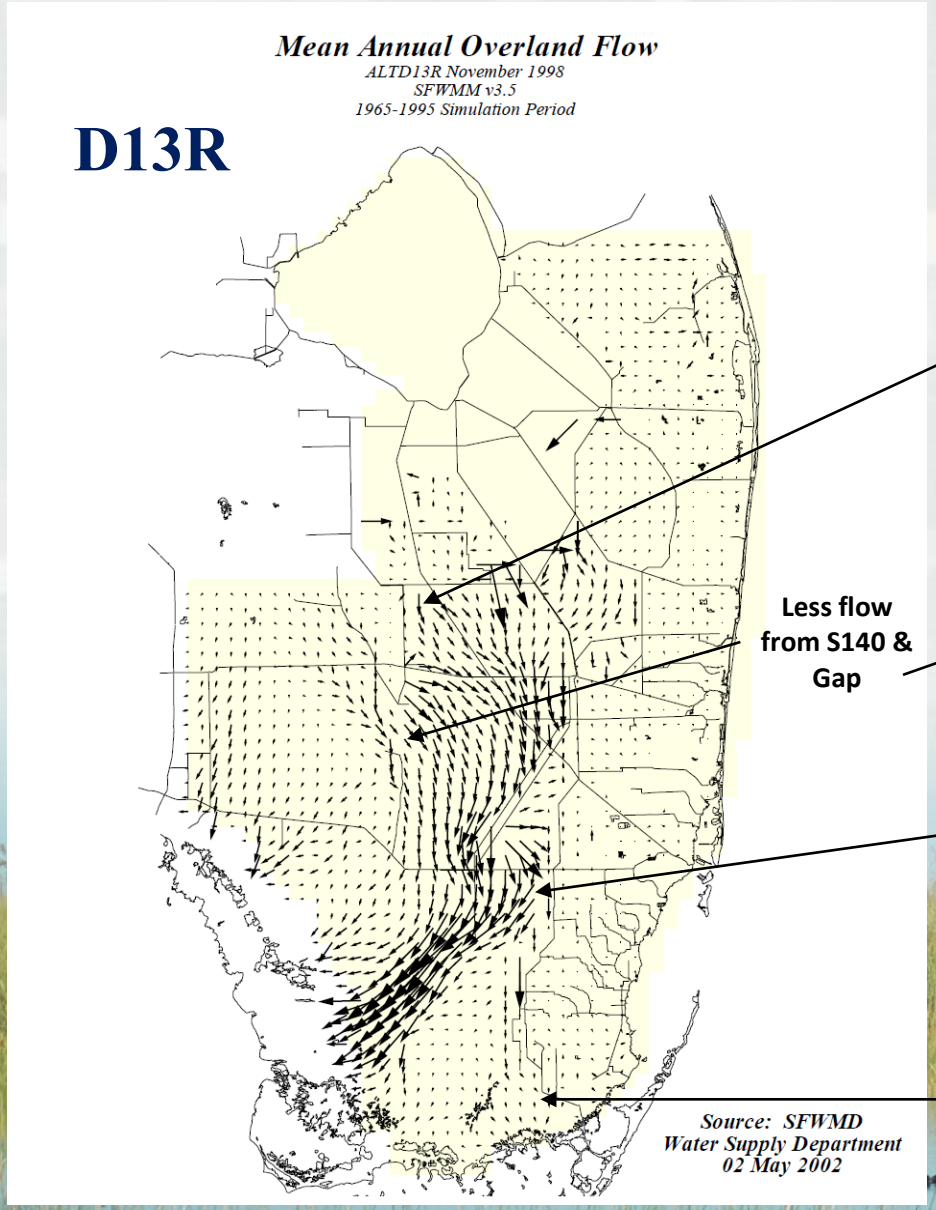
Note: All data summarized for a consistent 1965-1995 Period of Simulation
95BSR & PCB1 (Baselines) and D13R & CERPO (with Project) are from previous CERP & RECOVER planning efforts
ECBIGIT (Baseline) and RUN2_CEPP & RUN2_PACR (with Project) are IGIT Scenarios; C240L includes LOW project

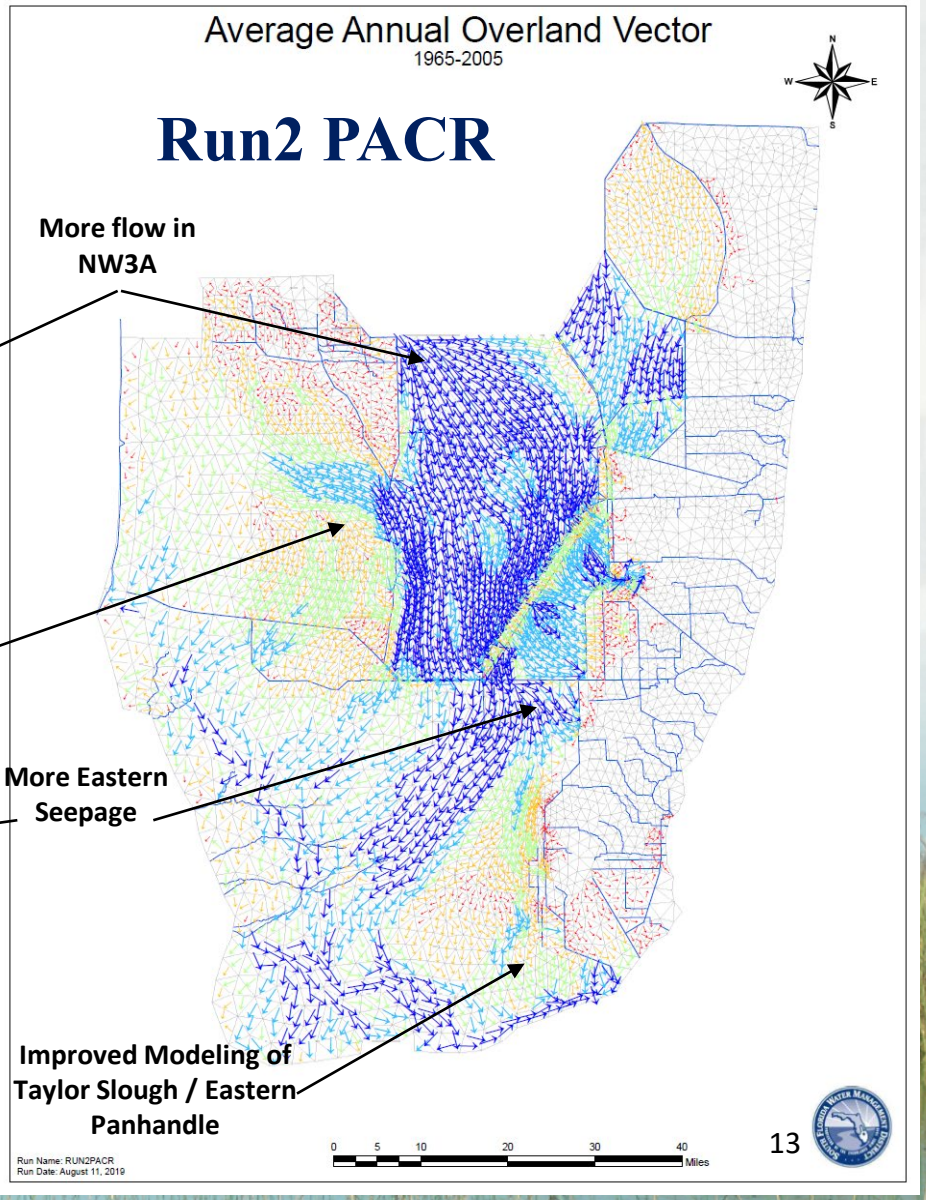
General Hydrologic Observations Within the Southern Everglades

- General hydrologic alignment with CERP desired outcomes for stage (both trends and absolute performance) for WCAs and ENP
- Some differences in hydroperiod and below-ground performance observed, especially for northern WCA3A (primarily due to project updates focusing redline deliveries to L4 rather than S140) and Taylor Slough (primarily due to model enhancements)
- Generally, larger hydrologic differences observed in flow trends than in stage performance (may affect Southern Estuary outcomes)
- In some cases, the perceived expectations of CERP performance are not supported by the RESTUDY hydrologic modeling

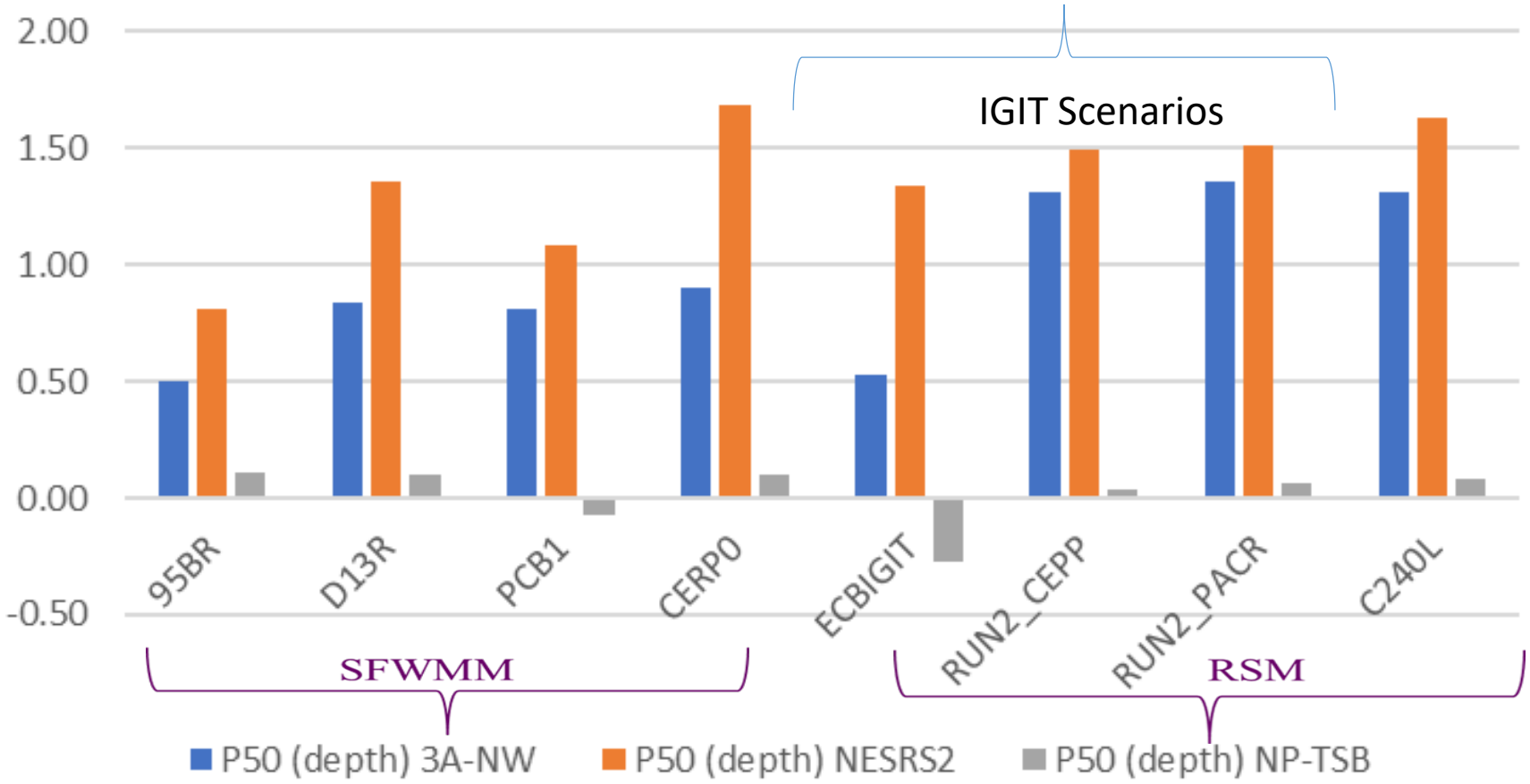


The BIG Picture for Flow…





Key Gages, Median Water Depth (ft)



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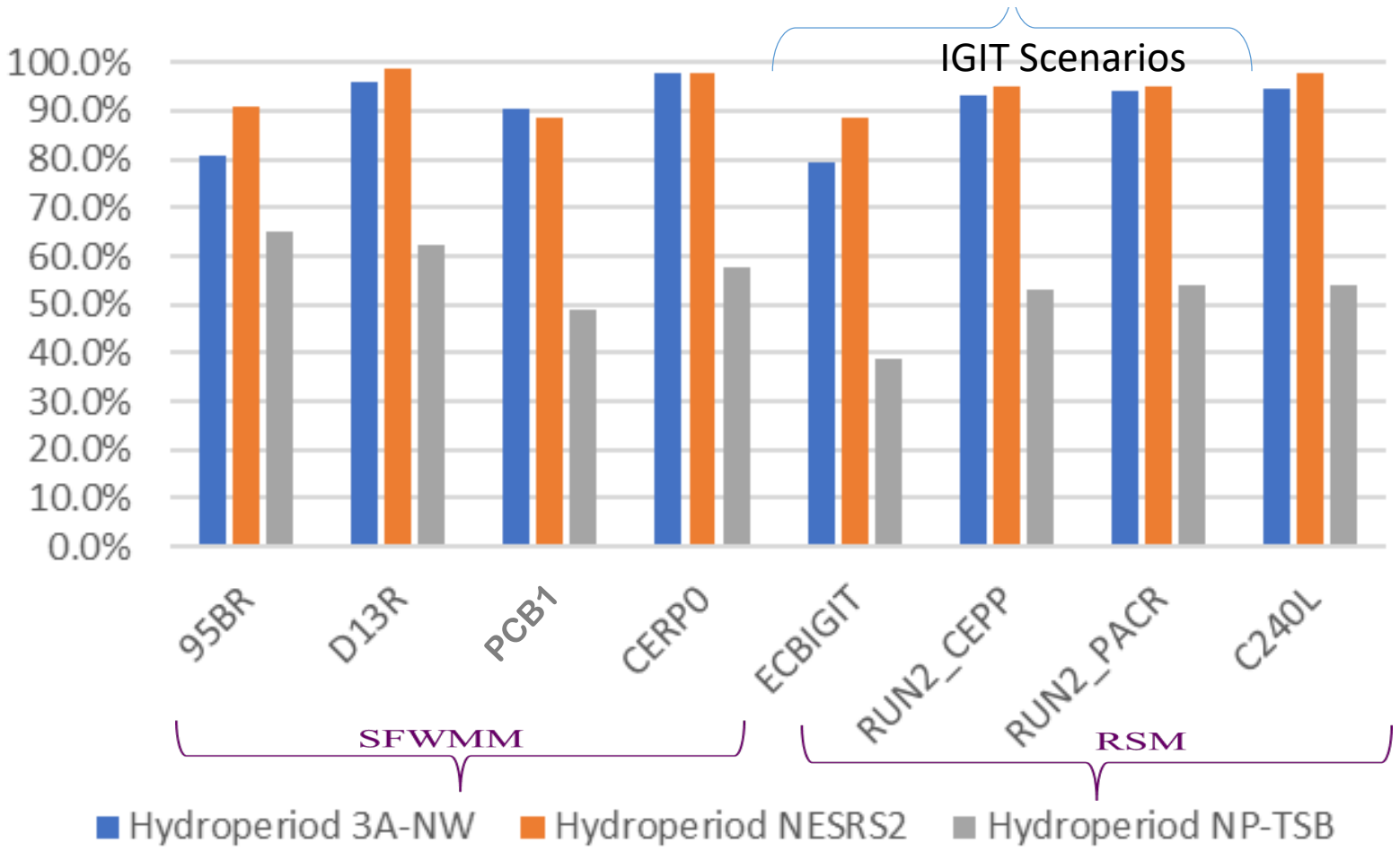
Key Gages, Hydroperiod



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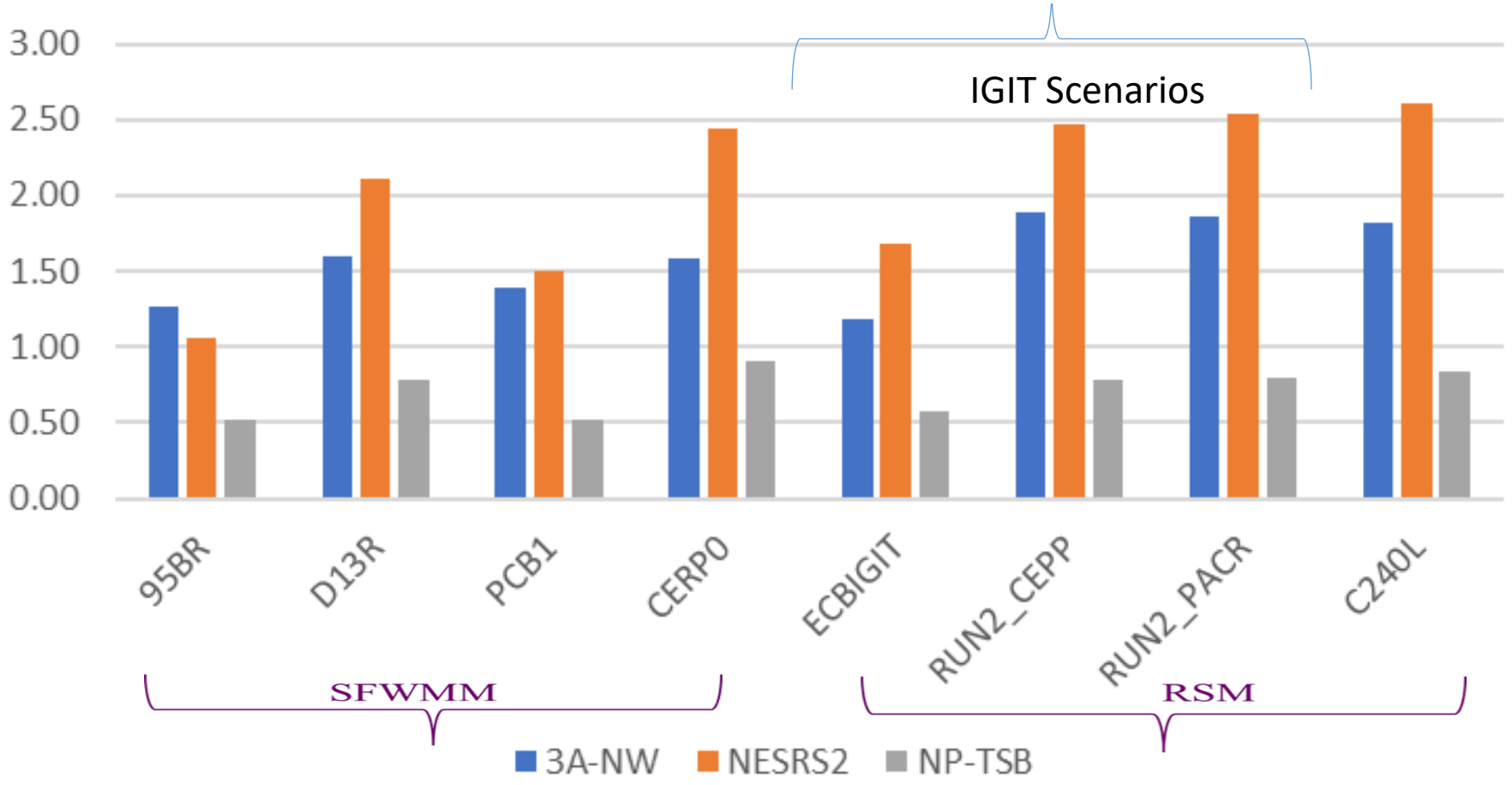
Key Gages, 90th Percentile Water Depth (ft)



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Oysters in the St. Lucie Estuary

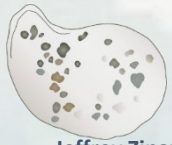
Habitat Suitability Index (HSI) Model

HSI: a spatially explicit, fine scale model

- Identify capacity of a given habitat to support a species of interest (USFWS 1981)
  - Eastern oyster (*Crassostrea virginica*)
    - Supportive conditions modeled : **salinity, temp, substrate**

Salinity

Temperature



Jeffrey Zipay

Substrate

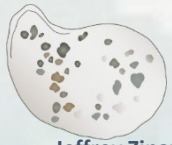
Habitat Suitability Index (HSI) Model

HSI: a spatially explicit, fine scale model

- Identify capacity of a given habitat to support a species of interest (USFWS 1981)
  - Eastern oyster (*Crassostrea virginica*)
    - Supportive conditions modeled : **salinity, temp, substrate**
- Quantify value of a management alternative, i.e., future scenarios CERP projects are online:
  - **Existing Base ("ECB-IGIT")**
  - **Future 1: 2026 ("RUN12026")**
  - **Future 2: 2032, including CEPP ("RUN2CEPP")**
  - **Future 3: 2032, CEPP PACR ("RUN2PACR")**

Salinity

Temperature



Jeffrey Zipay

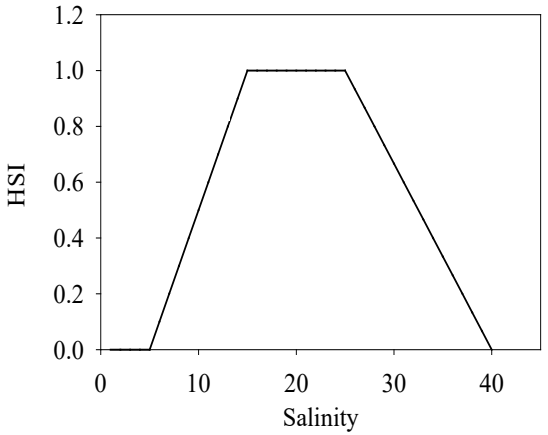
Substrate

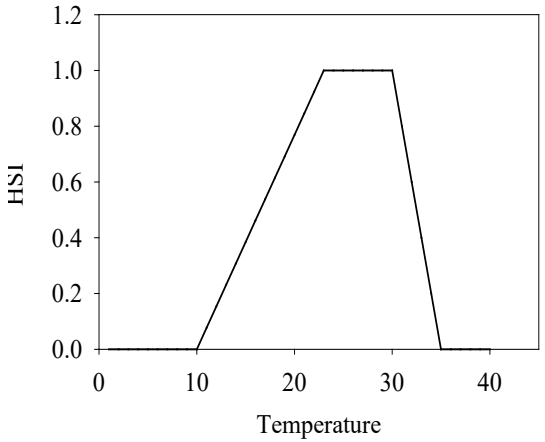
Oyster Suitability Functions

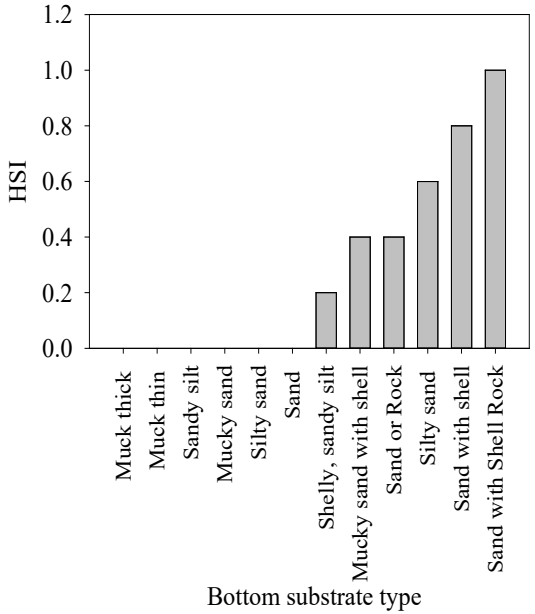
Optimal HSI = 1.0
Salinity 15–25

Optimal HSI = 1.0
Temp 23–30°C

Optimal HSI = 1.0
Oyster Shell







Model Information

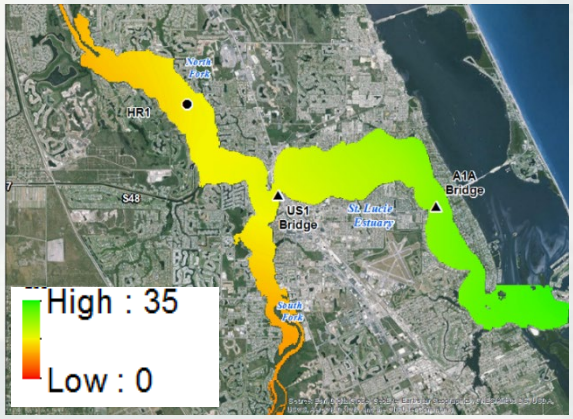
HSI Scores 0–1.0

Resolution 100x100 ft

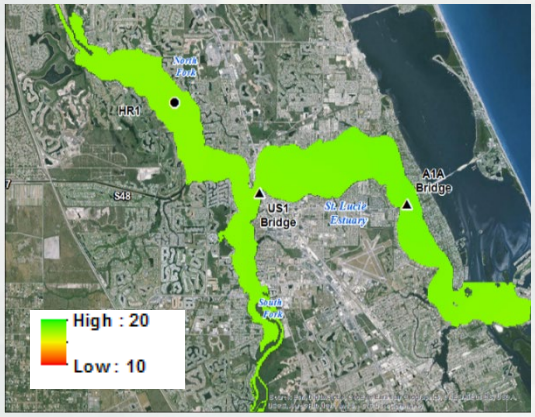
Mean over POR 1965–2005

Oyster Suitability Functions

Optimal HSI = 1.0
Salinity 15–25



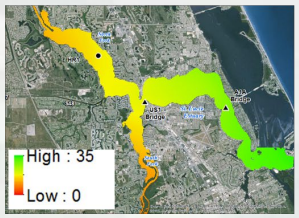
Optimal HSI = 1.0
Temp 23–30°C



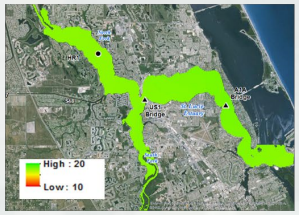
Optimal HSI = 1.0
Oyster Shell

Oyster HSI Map Generation

Optimal HSI = 1.0
Salinity 15–25



Optimal HSI = 1.0
Temp 23–30°C

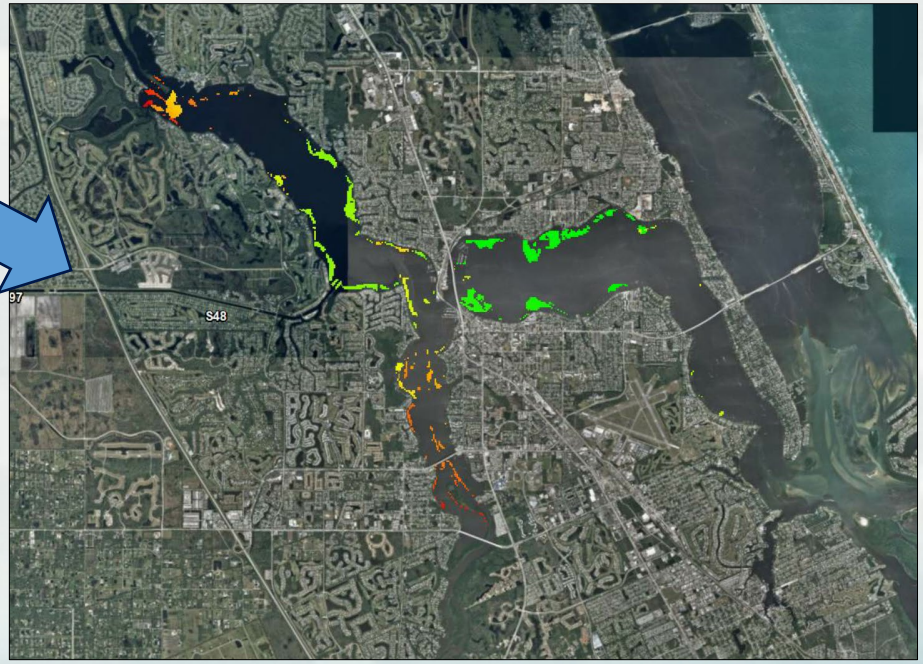


Optimal HSI = 1.0
Oyster Shell

HSI= $\sqrt[3]{}$((Bottom substrate type)(Salinity)(Temperature))

Poor	Fair	Good	Very good
0-0.25	0.25-0.50	0.5-0.75	0.75-1.0

Composite HSI Map



St. Lucie Estuary IG: Oyster HSI Preliminary Results

St. Lucie Oyster Habitat Suitability Index Preliminary Results

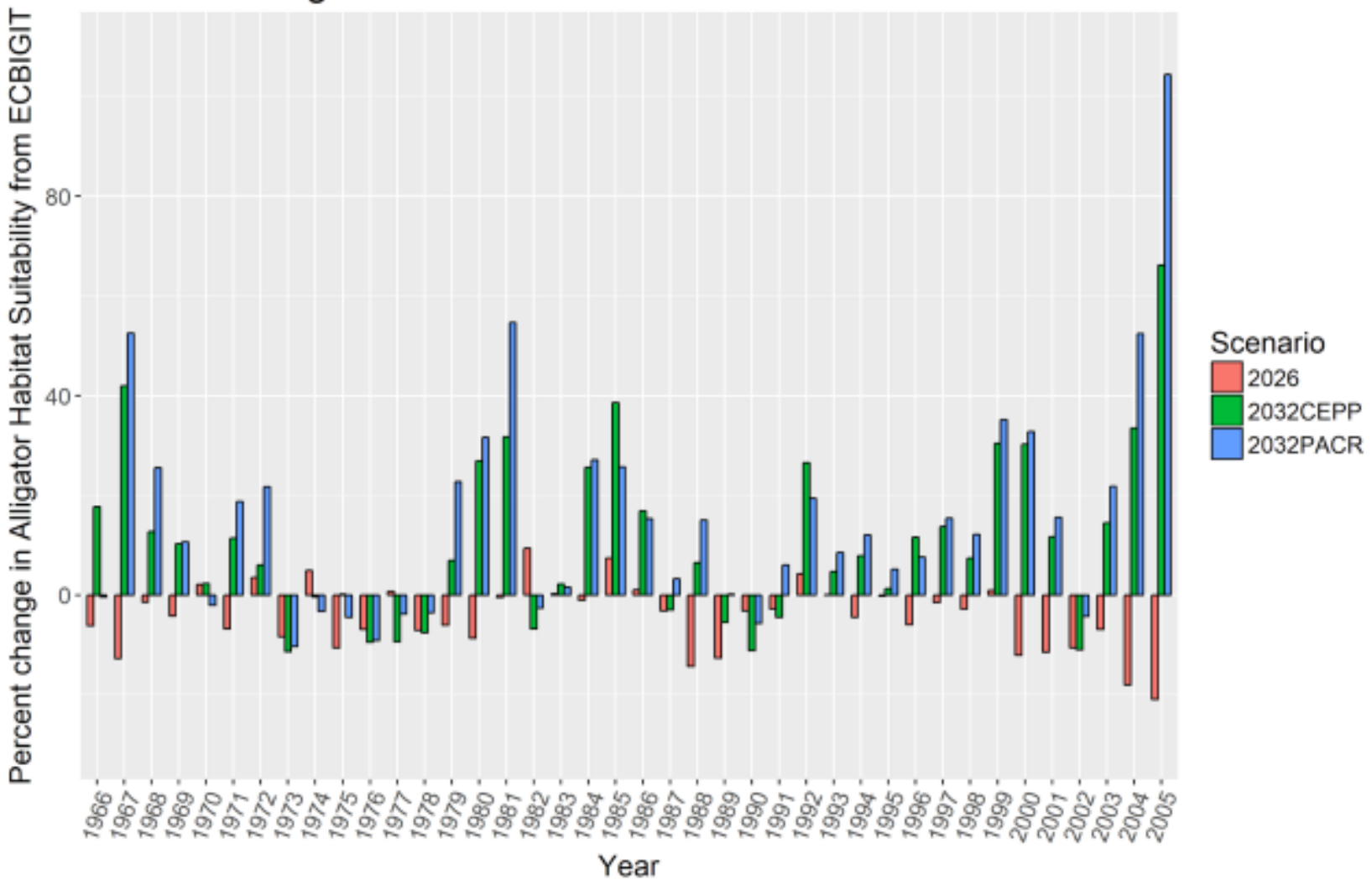
	Oyster Acres in different oyster HSI categories			
	Poor	Fair	Good	Very good
Oyster HSI	0-0.25	0.25-0.50	0.5-0.75	0.75-1.0
ECBIGIT	4148	24	73	260
RUN12026	4124	19	67	295
RUN2CEPP	4113	18	65	310
RUN2PACR	4108	17	63	317

Alligators in the Greater Everglades

Alligator Ecological Models

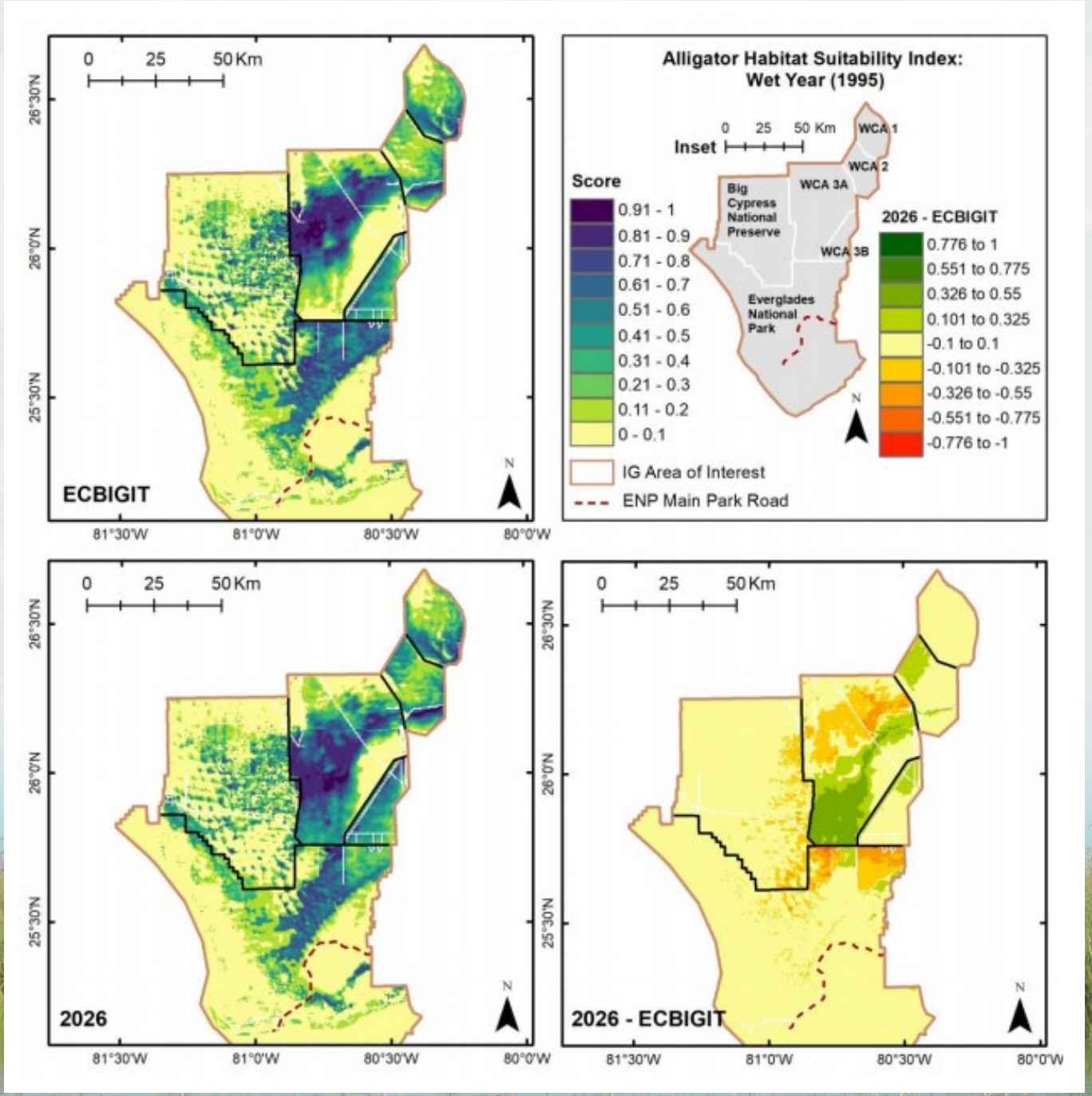
The Alligator ecological model estimates suitability annually for five components of Alligator production:

1. Land cover suitability
2. Breeding potential (female growth and survival from April 16 of the previous year – April 15 of the current year)
3. Courtship and mating (April 16 – May 31)
4. Nest building (June 15 – July 15)
5. Egg incubation (nest flooding from July 01 – September 15)


Alligator Habitat Suitability:
Percent change from ECBIGIT for each scenario
Percent change in Alligator Habitat Suitability from ECBIGIT
80
40
0
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year
Scenario
2026
2032CEPP
2032PACR

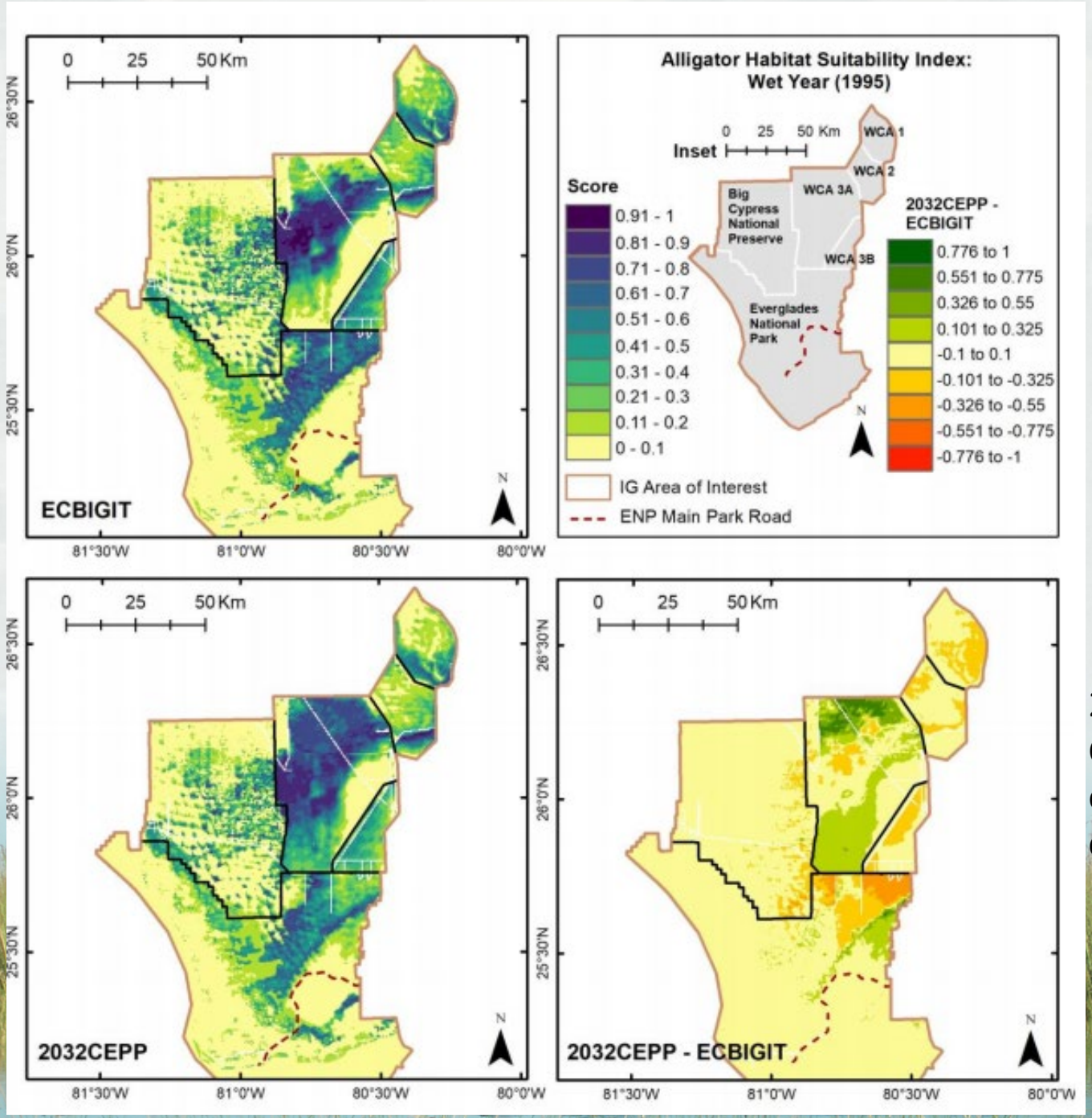
Existing condition

2026



2026 – existing condition

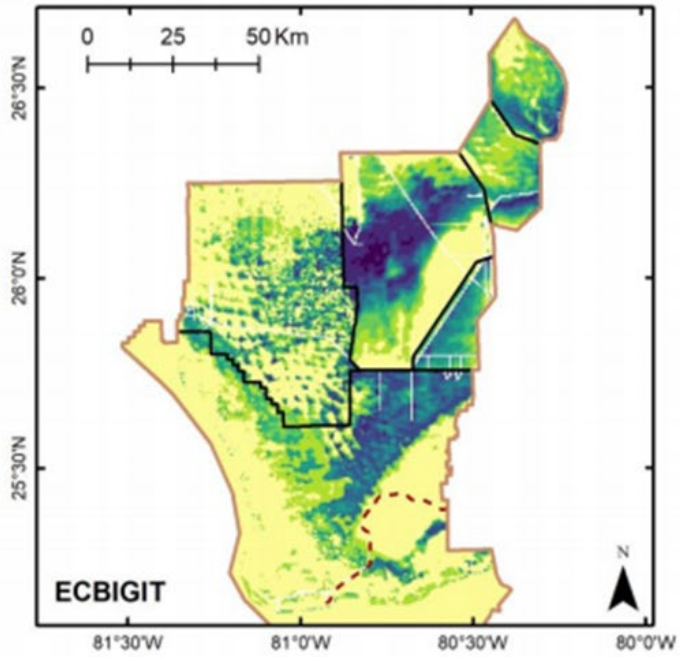
Existing condition

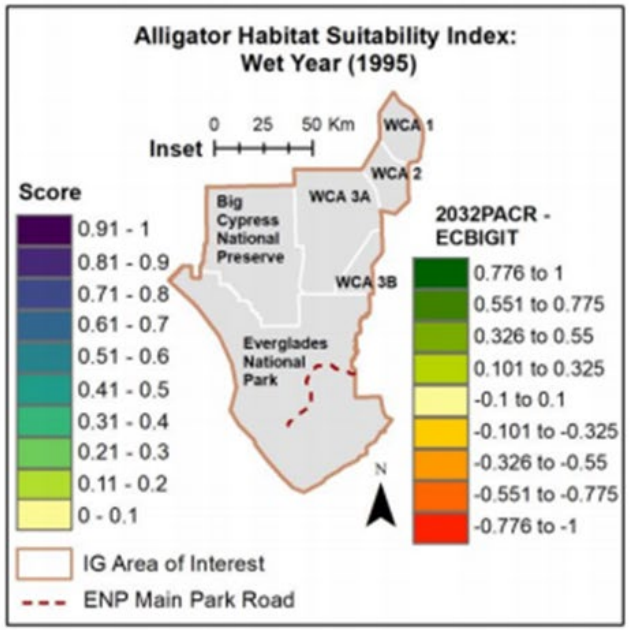


2032 CEPP

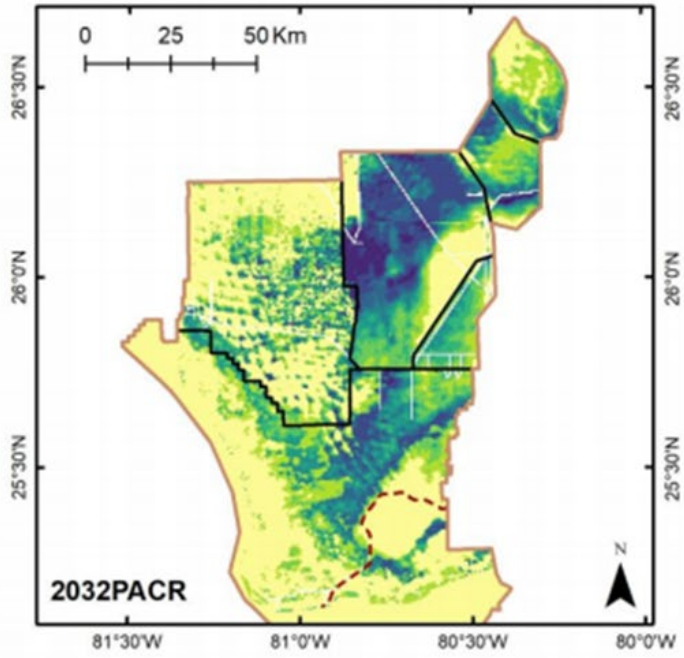
2032 CEPP – existing condition

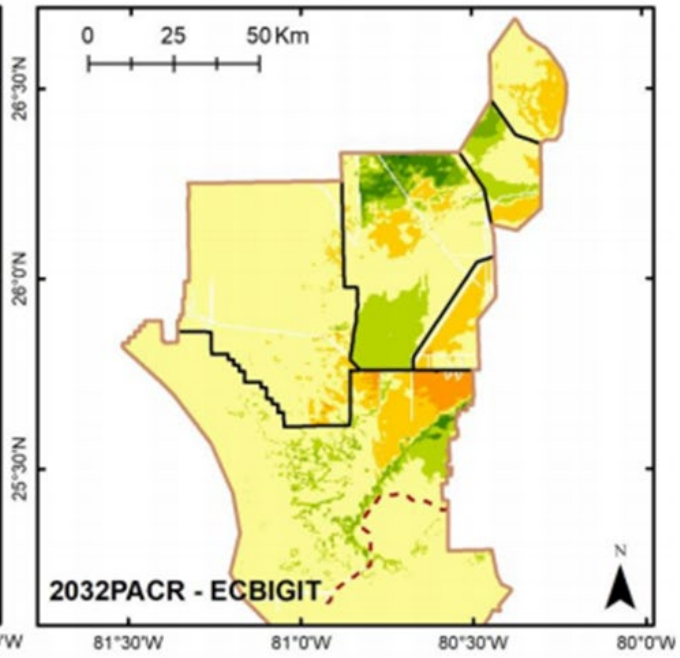
Existing condition





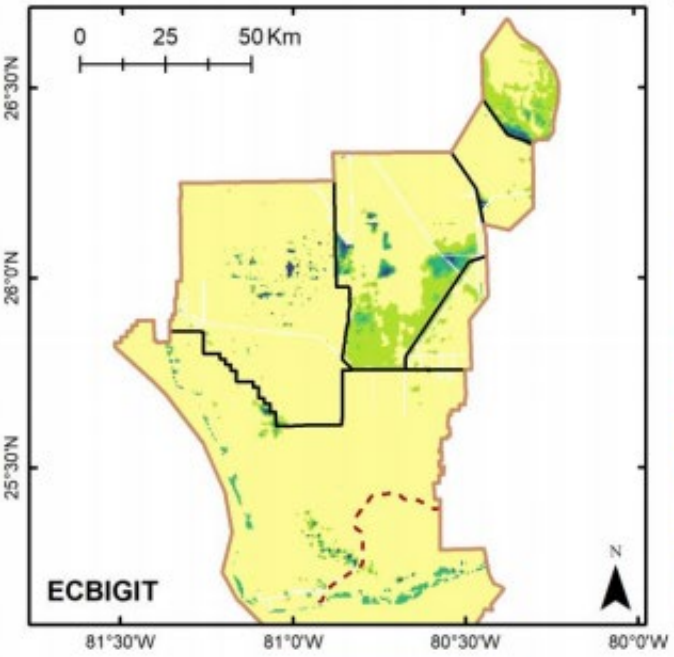
2032 PACR

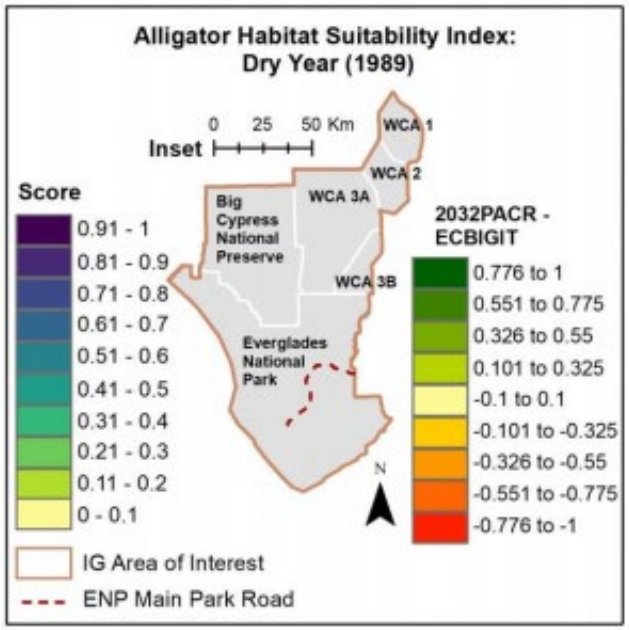




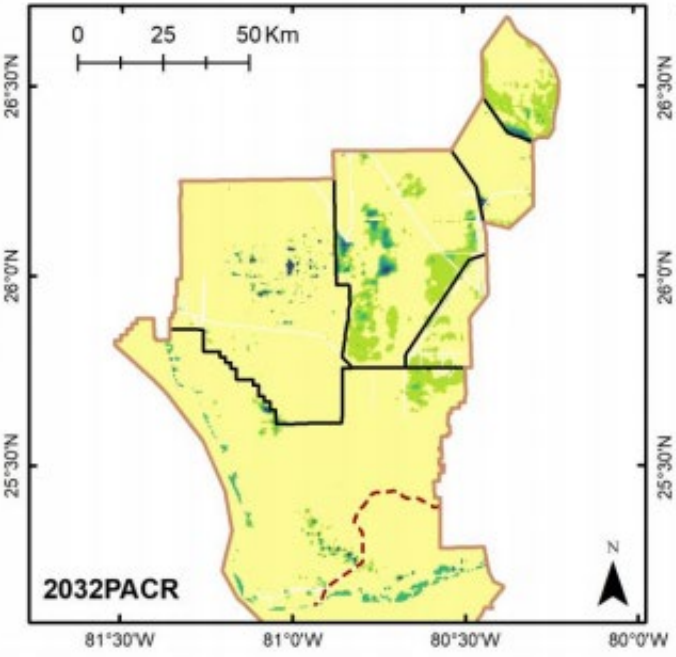
2032 PACR – existing condition

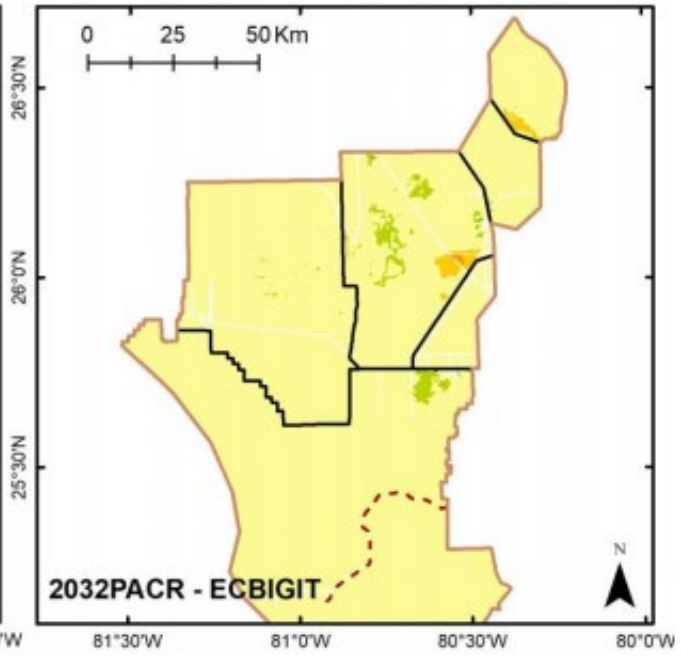
Existing condition





2032 PACR

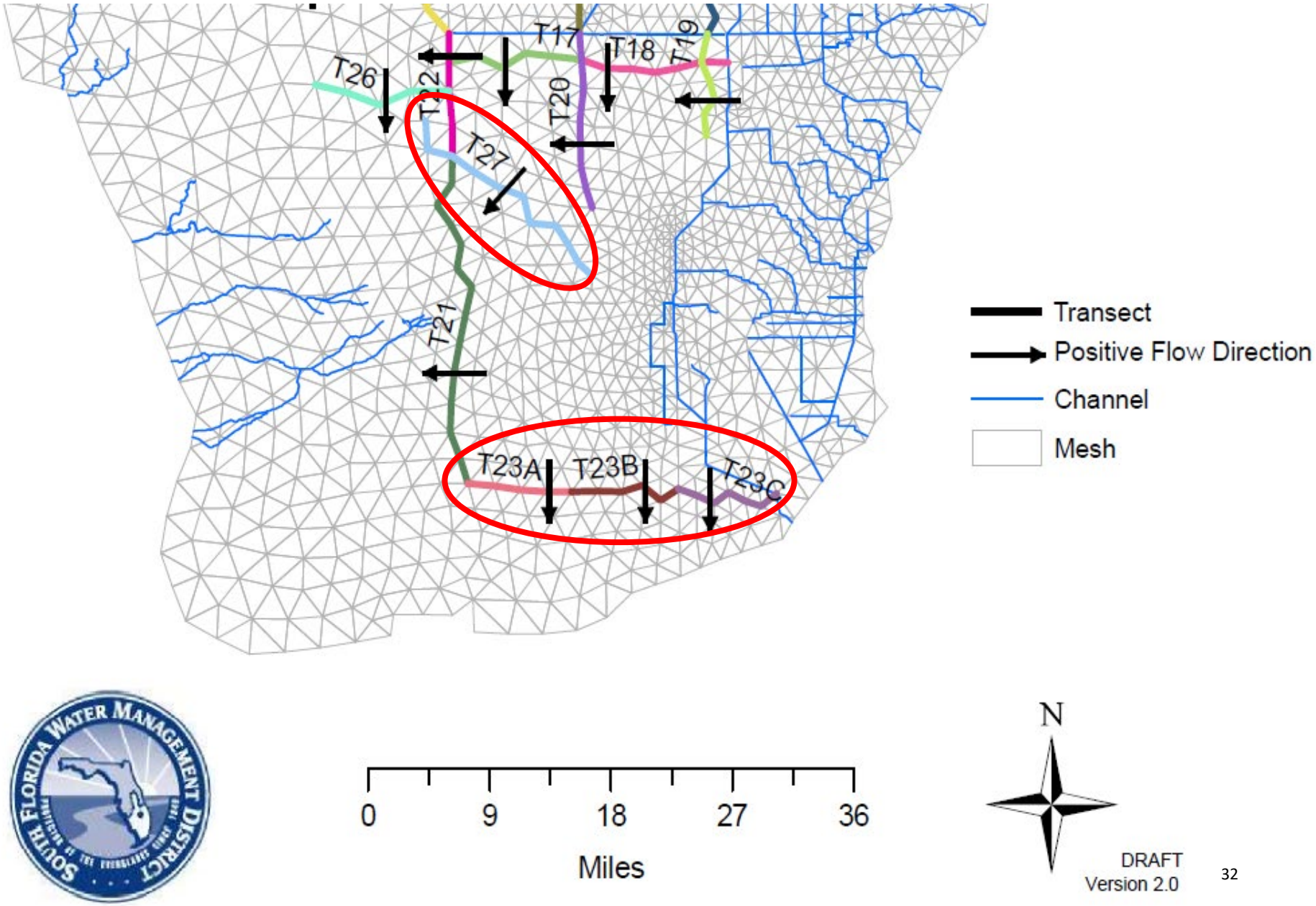


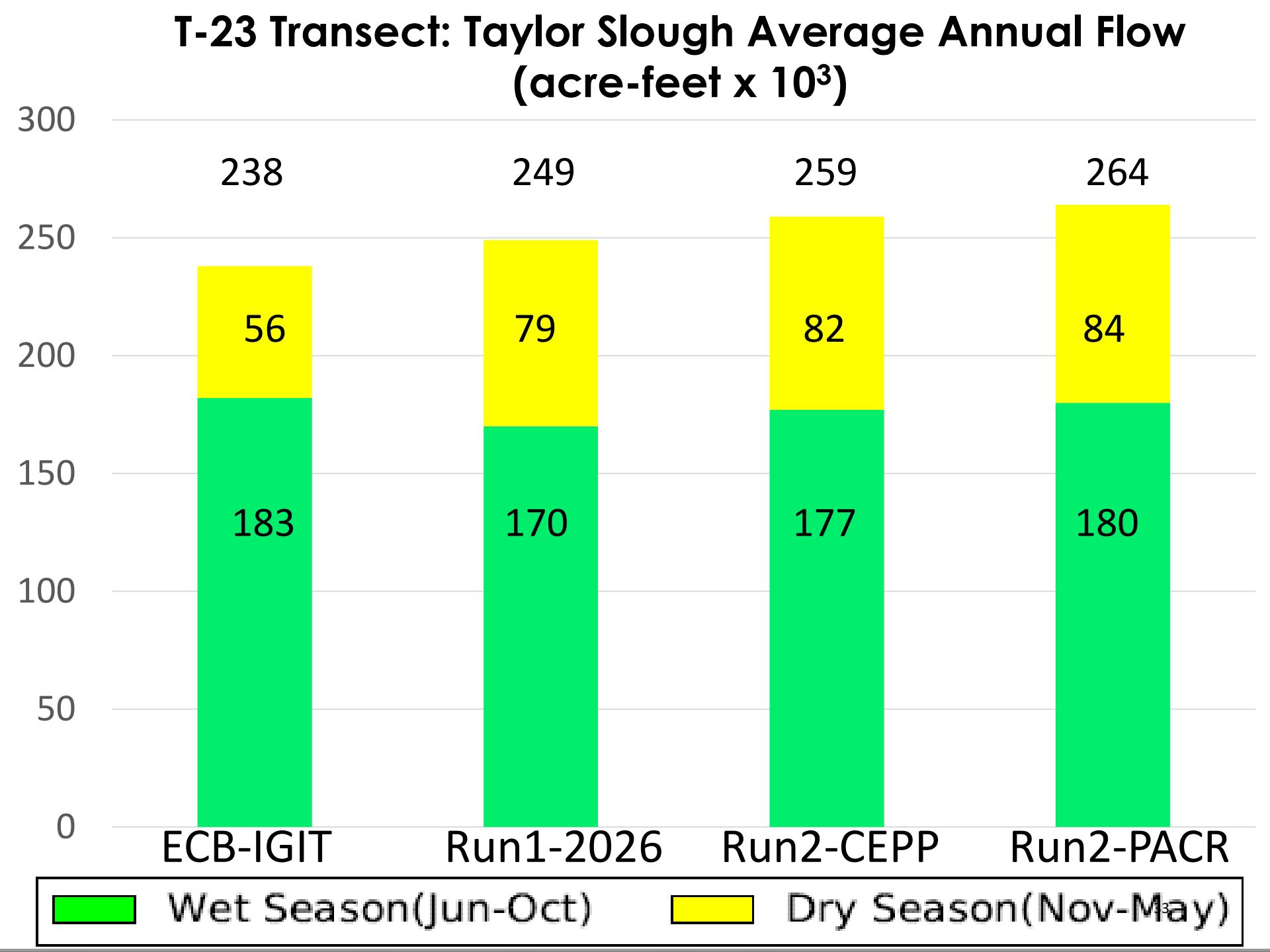


2032 PACR – existing condition

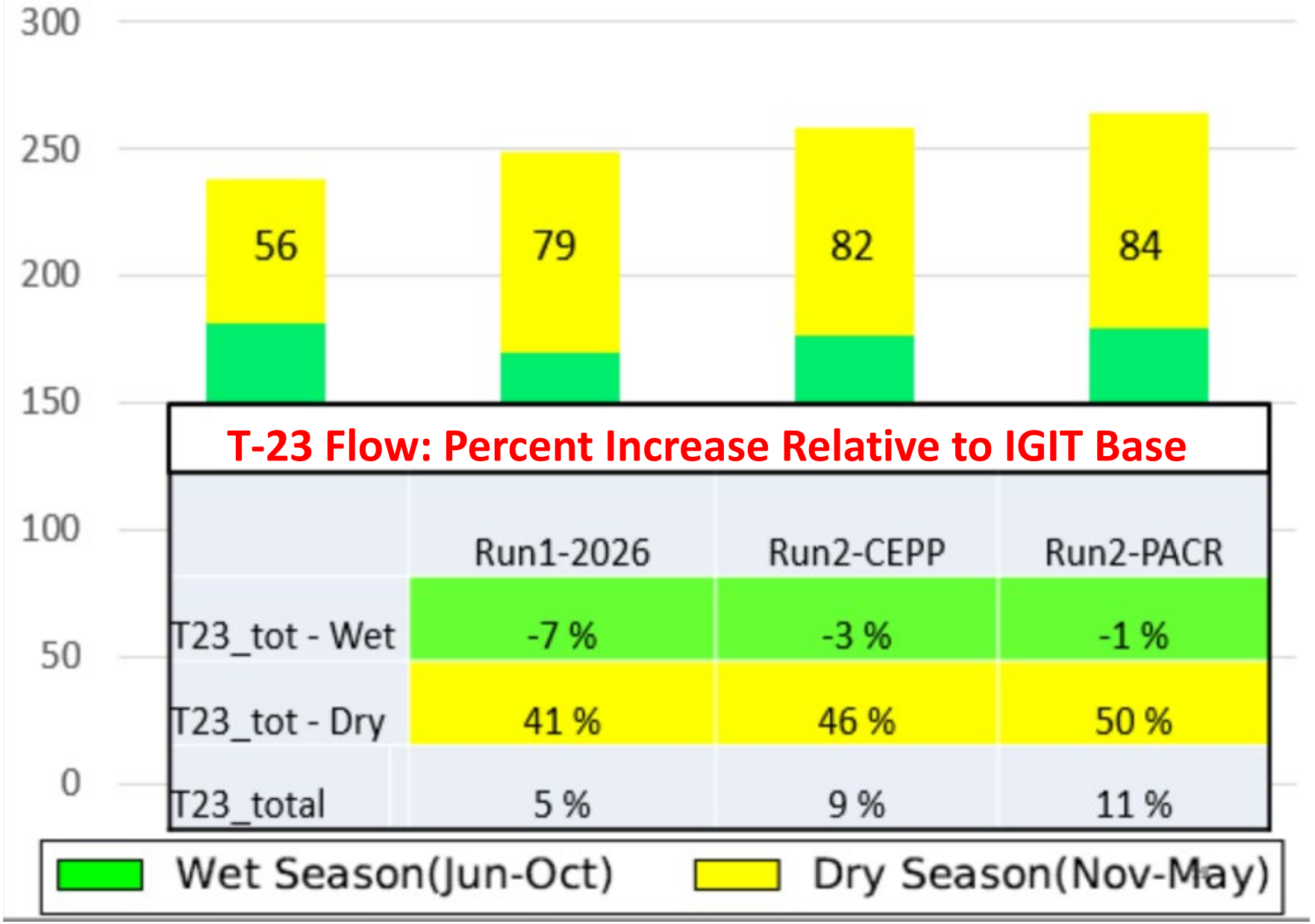
Florida Bay Salinity

Shark River Slough and Taylor Slough Flow Transect Locations




T-23 Transect: Taylor Slough Average Annual Flow
(acre-feet x 10³)
300
250
200
150
100
50
0
238
249
259
264
56
79
82
84
183
170
177
180
ECB-IGIT
Run1-2026
Run2-CEPP
Run2-PACR
Wet Season(Jun-Oct)
Dry Season(Nov-May)

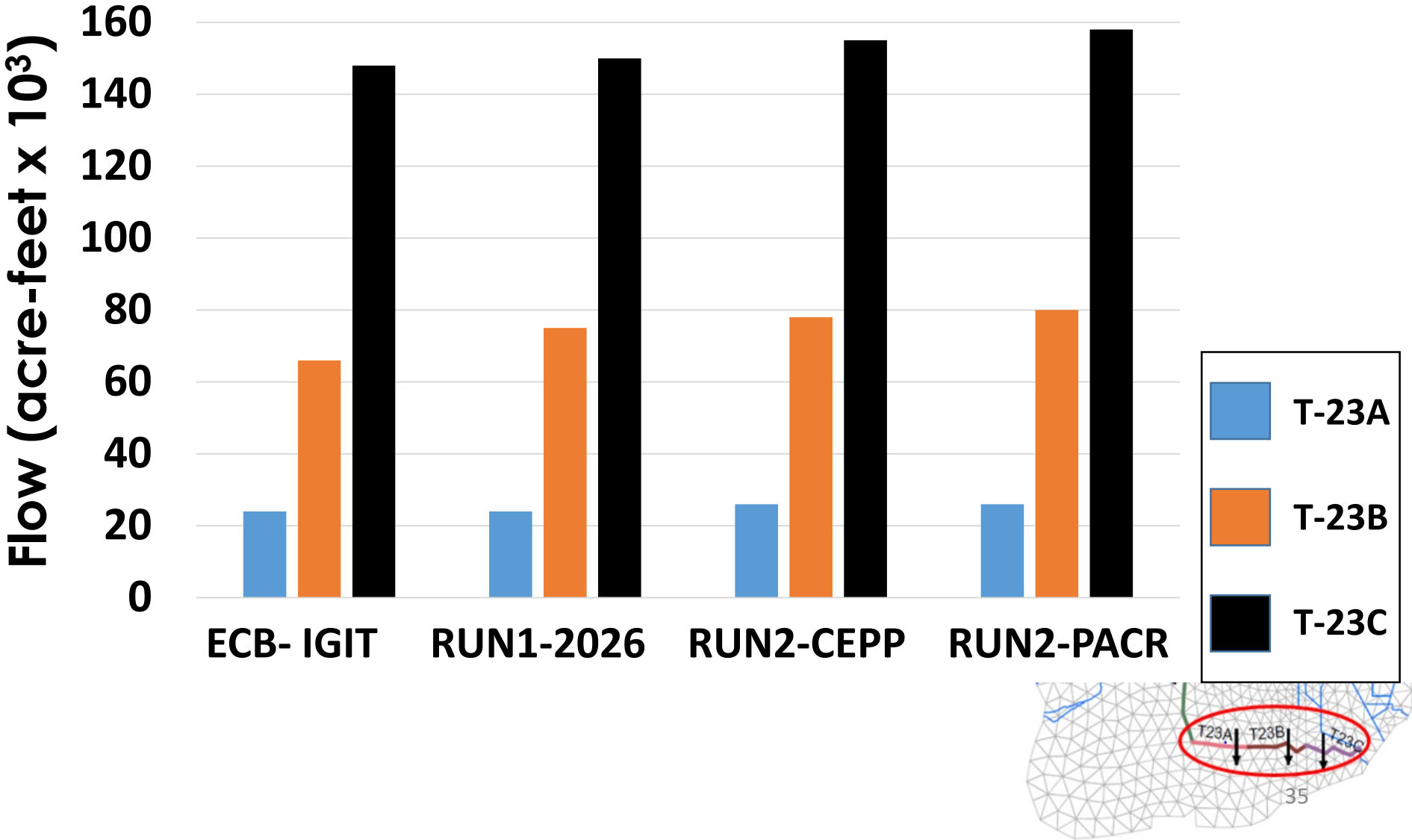
Taylor Slough Flow: Expected Dry Season Increases



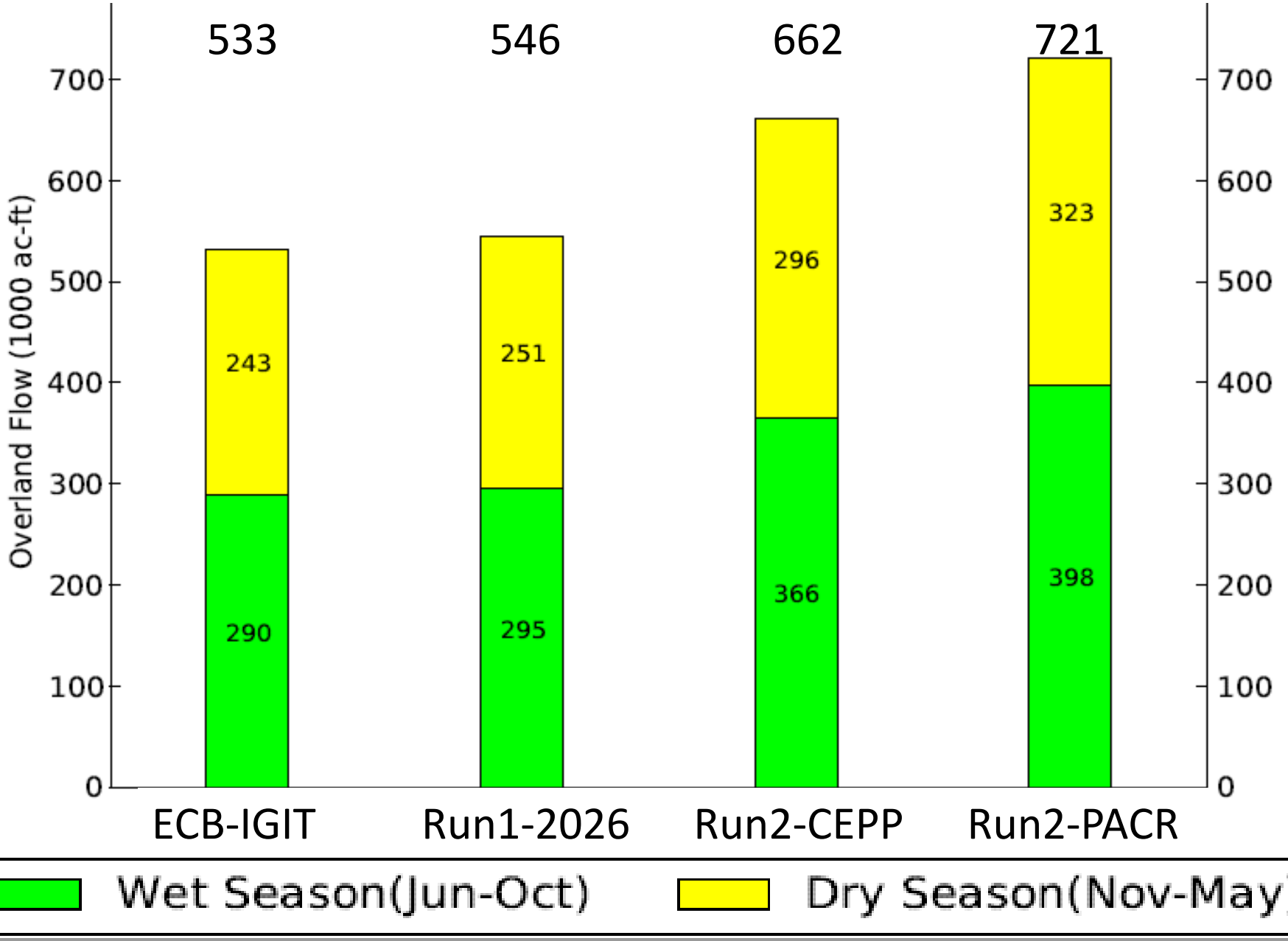
T-23 Flow: Percent Increase Relative to IGIT Base

	Run1-2026	Run2-CEPP	Run2-PACR
T23_tot - Wet	-7 %	-3 %	-1 %
T23_tot - Dry	41 %	46 %	50 %
T23_total	5 %	9 %	11 %

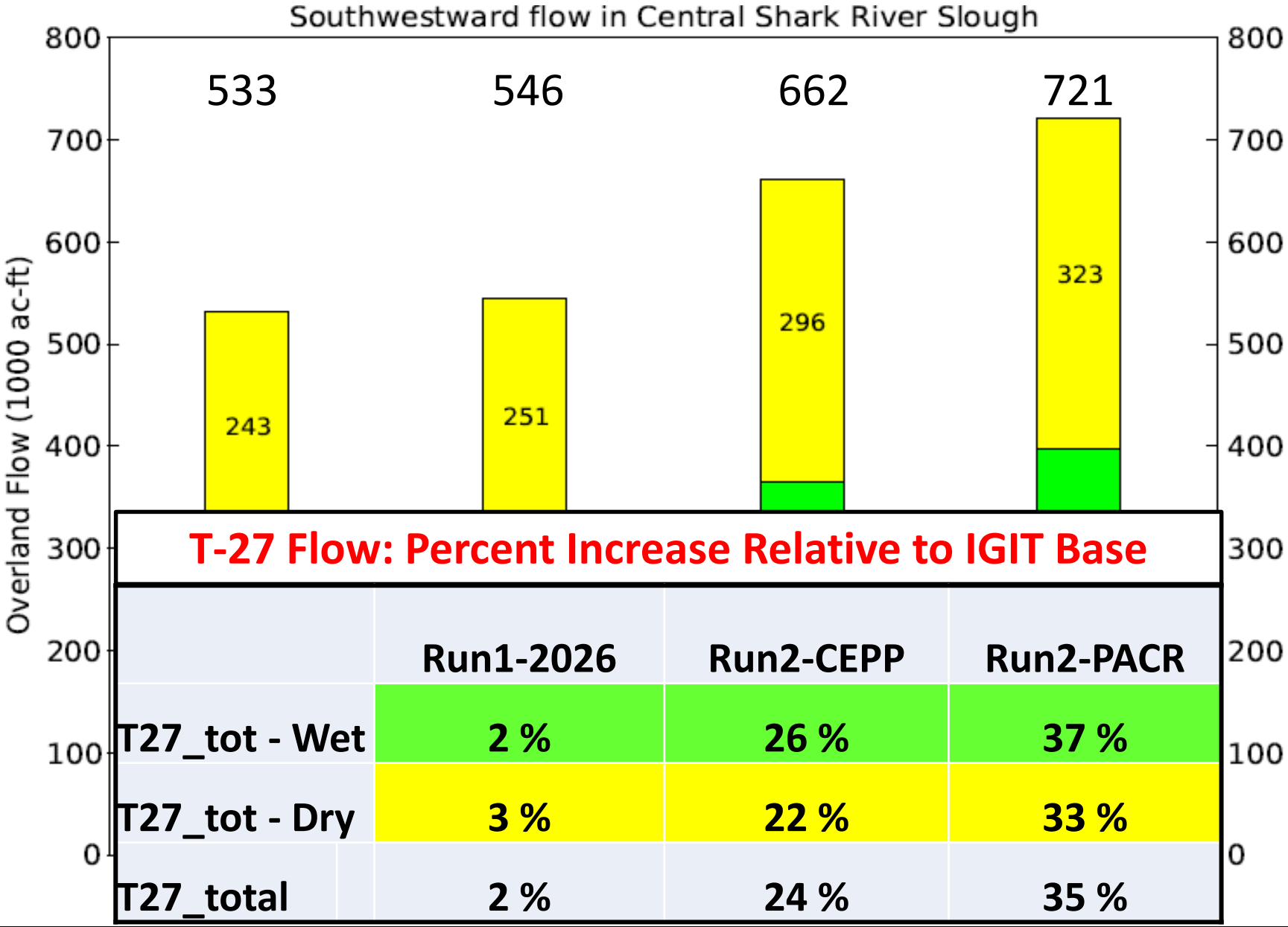
Interim Goals T-23 Transect Flow: East - West Distribution



T-27 Transect: Shark River Slough Average Annual Flow (acre-feet x 10^3)



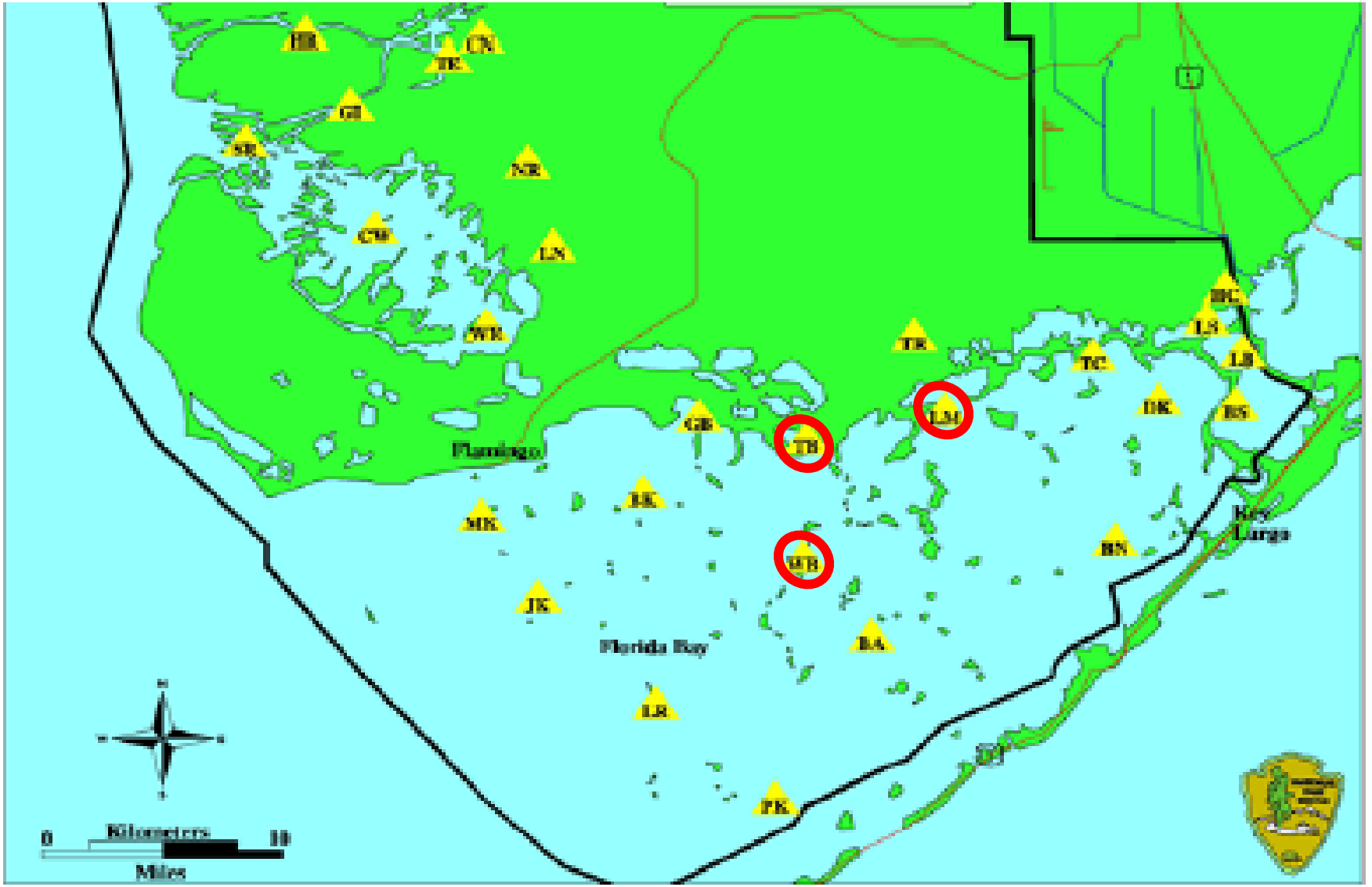
Shark River Slough Flow: Expected Dry and Wet Season Increases



T-27 Flow: Percent Increase Relative to IGIT Base

	Run1-2026	Run2-CEPP	Run2-PACR
T27_tot - Wet	2 %	26 %	37 %
T27_tot - Dry	3 %	22 %	33 %
T27_total	2 %	24 %	35 %

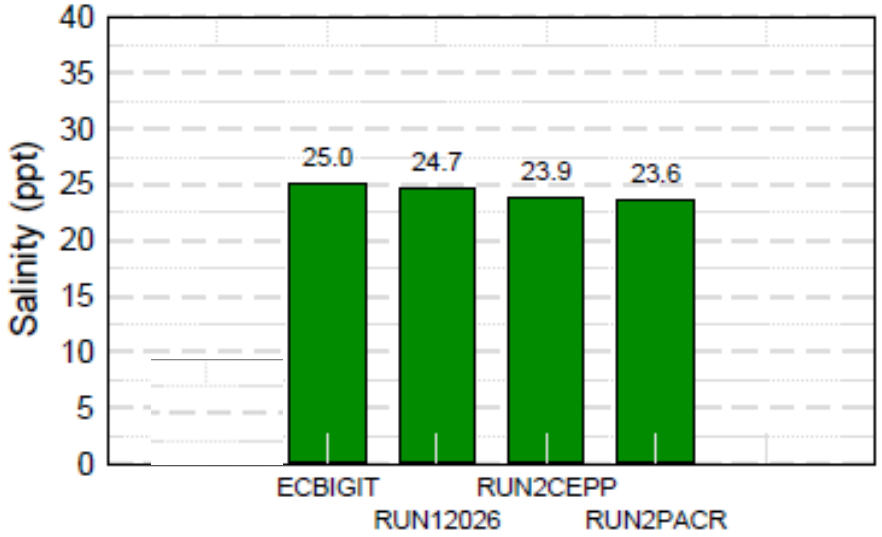
Estimating Florida Bay Salinity via Multiple Regression Models: Site Locations



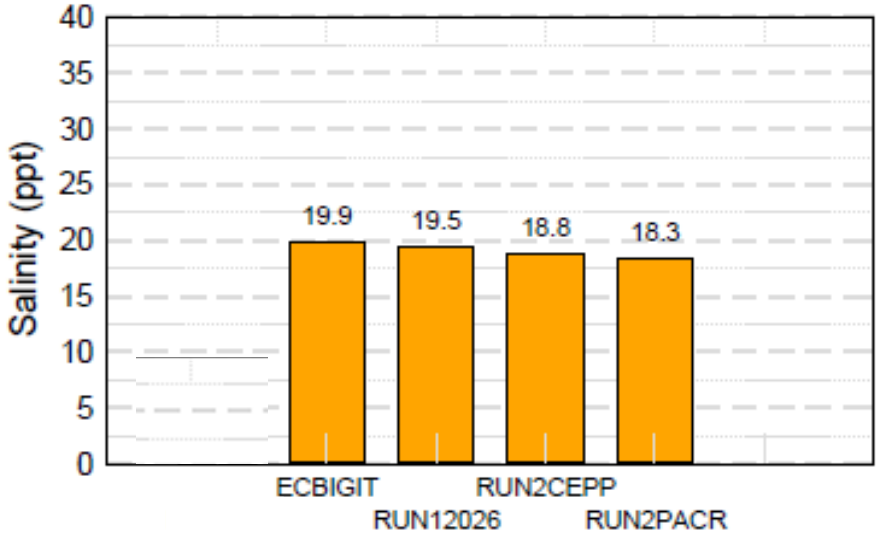
Salinity for Little Madeira Bay

(1981 - 2000)

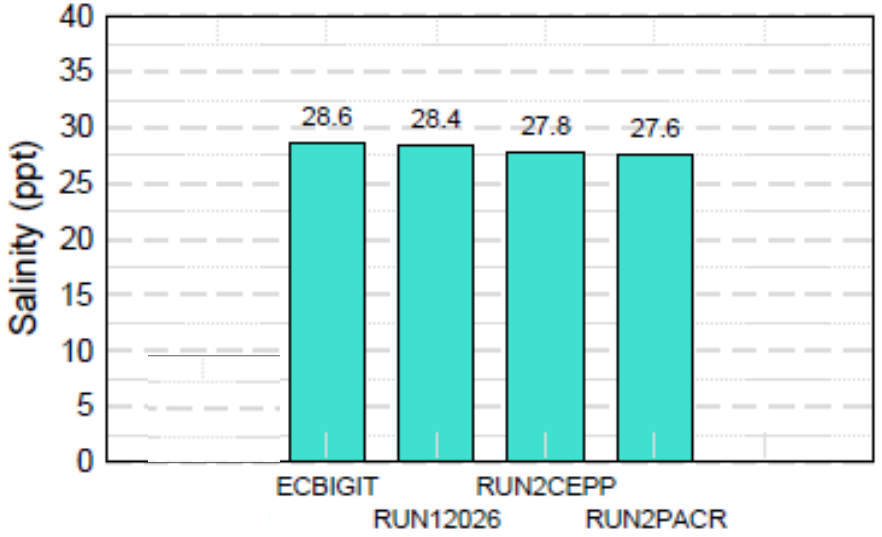
Annual Means



25th Percentile



75th Percentile

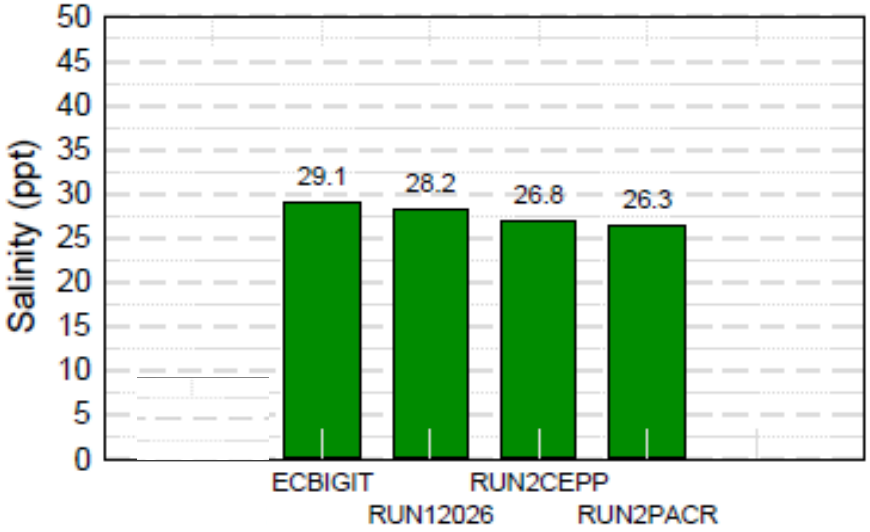


RSM: N/A
Run Date: Tue Aug 20 09:36:35 2019
Script Used: salinity_generator.scr (ID135)
Filename: madeira_bay_salinity_4in1.agr

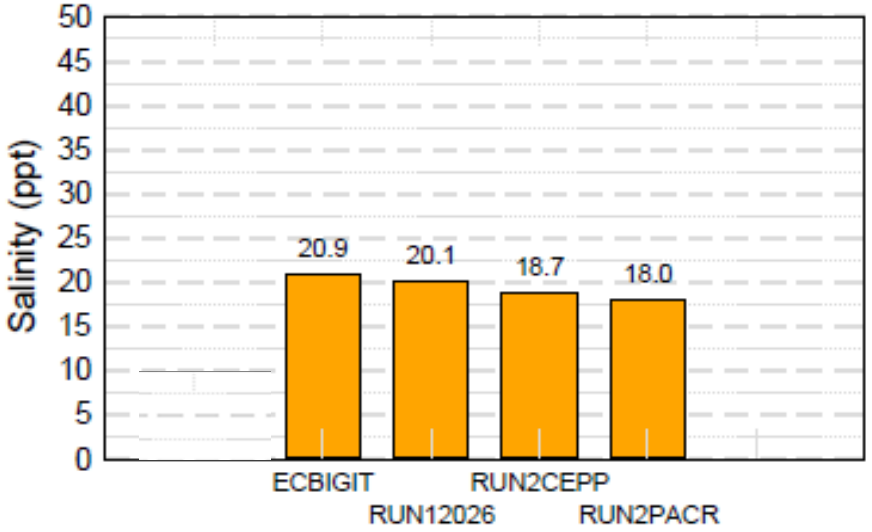
Salinity for Terrapin Bay

(1981 - 2000)

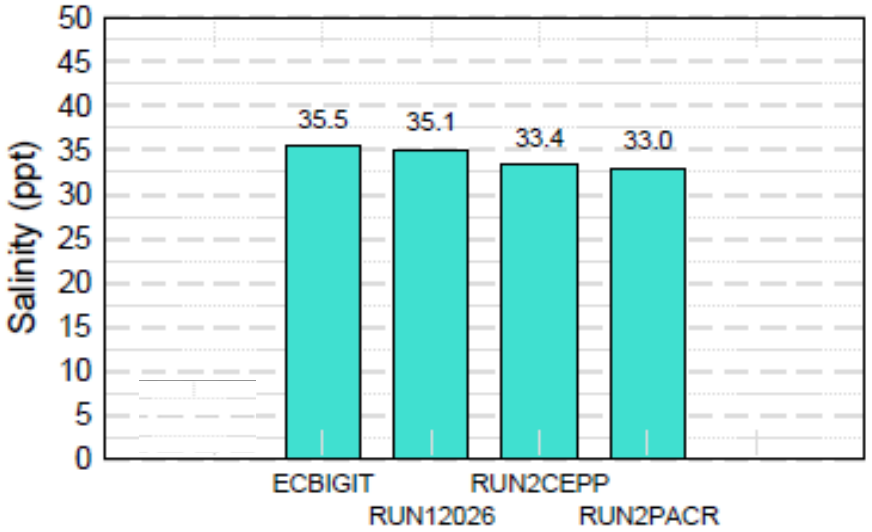
Annual Means



25th Percentile



75th Percentile



RSM: N/A
Run Date: Tue Aug 20 09:36:20 2019
Script Used: salinity_generator.scr (ID135)
Filename: terrapin_bay_salinity_4in1.agr

Thank you!

Discussion