



WELCOME

Caloosahatchee River MFL Rule Development Workshop #2

June 1, 2018



MFL Criteria Development

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June 1, 2018

Minimum Flows and Minimum Water Levels

Chapter 373.042 Florida Statutes

- Department or Governing Board shall establish a minimum flow or minimum water level for surface water courses, aquifers and lakes...
- MFLs identify the point at which further withdrawals will cause "significant harm" to the water resources or ecology of an area

Chapter 40E-8.021 (31), Florida Administrative Code

- Significant Harm – means the temporary loss of water resource functions, which result from a change in surface water or groundwater hydrology, that takes more than two years to recover but is less severe than serious harm



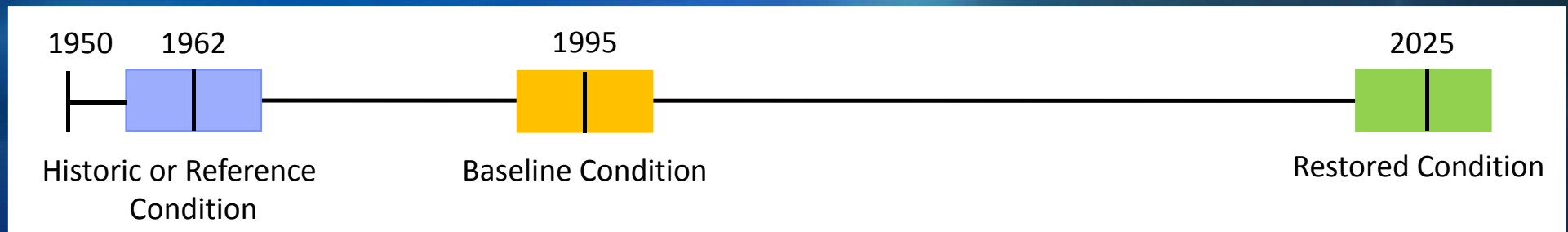
Caloosahatchee MFL Draft Rule Criteria

- **Magnitude:** 30-day moving average flow of 400 cfs at S-79
- **Duration:** An MFL exceedance occurs during a 365-day period when the 30-day moving average flow at S-79 is below 400 cfs and the daily average salinity has exceeded 10 at the Ft. Myers salinity monitoring station for more than 55 consecutive days.
- **Return Frequency:** An MFL violation occurs when an exceedance occurs more than once in a five-year period

Note: MFL exceedances are expected until the recovery strategy is completed and operational

RESTORATION

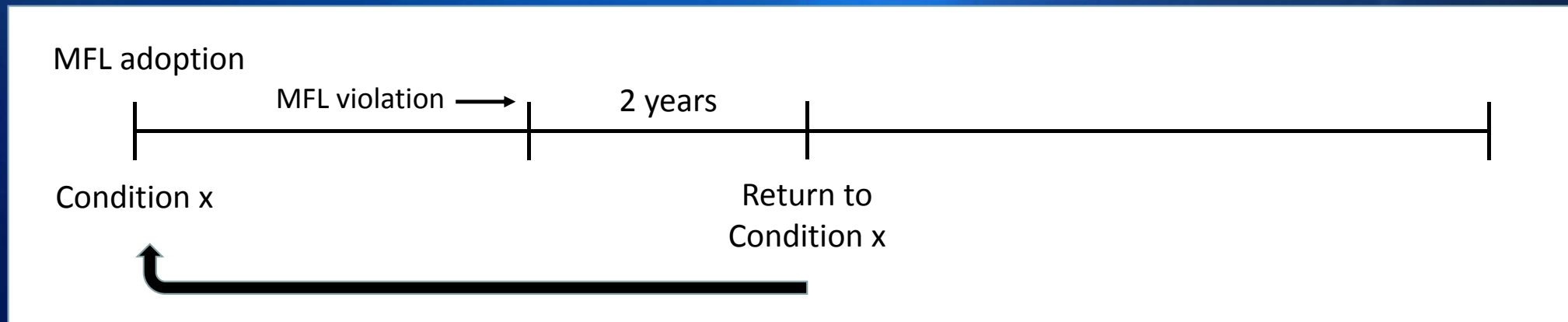
- **Restoration** – renewing degraded, damaged, or destroyed ecosystems and habitats in the environment by active human intervention and action



- **Historic or Reference Condition** – Pre-impact or pre-disturbance condition
- **Baseline Condition** – Pre-restoration condition used as a benchmark from which to measure restoration-related change
- **Restored Condition** – Condition that achieves a pre-determined condition target; often a percentage of the historic condition

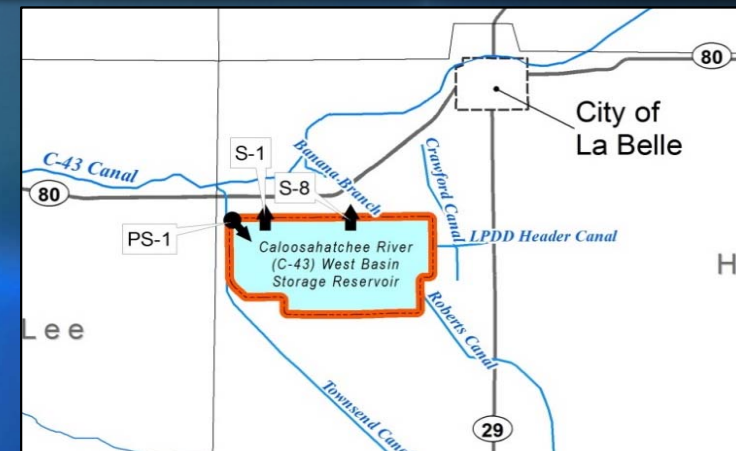
Recover/Recovery

- **Significant Harm** – Temporary loss of water resource functions which result from a change in surface or groundwater hydrology, that takes more than two years to **recover**...
- **Recover** in context to the definition of significant harm is a return to the condition of the water resource function at the time of MFL adoption



Recover/Recovery

- **Recovery Strategy** – Development of additional water supplies and other actions, consistent with the authority granted by this chapter to:
- Achieve recovery to the established minimum flow or minimum water level as soon as practicable
 - Comprehensive Everglades Restoration Plan (CERP) – planning process
 - Congressional Authorization and Appropriation





Questions ?

Technical Concerns and Questions

➤ Flow

- Change in flow if May was included
- Most sensitive species

➤ Duration

- How was it derived

➤ Return Frequency

➤ Position of Low Salinity Zone

➤ High Salinity Events

- Effects on other indicator species

➤ Comparison of existing versus proposed criteria

Flow Criteria - Effects of May on Dry Season

	Dry (Nov-Apr)	DryMay (Nov-May)	ANOVA p-value
Flow at S-79	1393.0 $\pm$ 2116.5	1347.4 $\pm$ 2055.9	p = 0.274
Surface Salinity	8.4 $\pm$ 6.7	8.6 $\pm$ 6.9	p = 0.076
Average Salinity	8.9 $\pm$ 6.7	9.1 $\pm$ 6.8	P = 0.105

“Dry” represents the standard SFWMD dry season - November to April. Flow at S-79 and salinity at Ft. Myers.

“DryMay” is the standard dry season with the addition of all May data during the POR from 1/1993-12/2016.

Including May has an small effect on flows at S-79 in the dry season

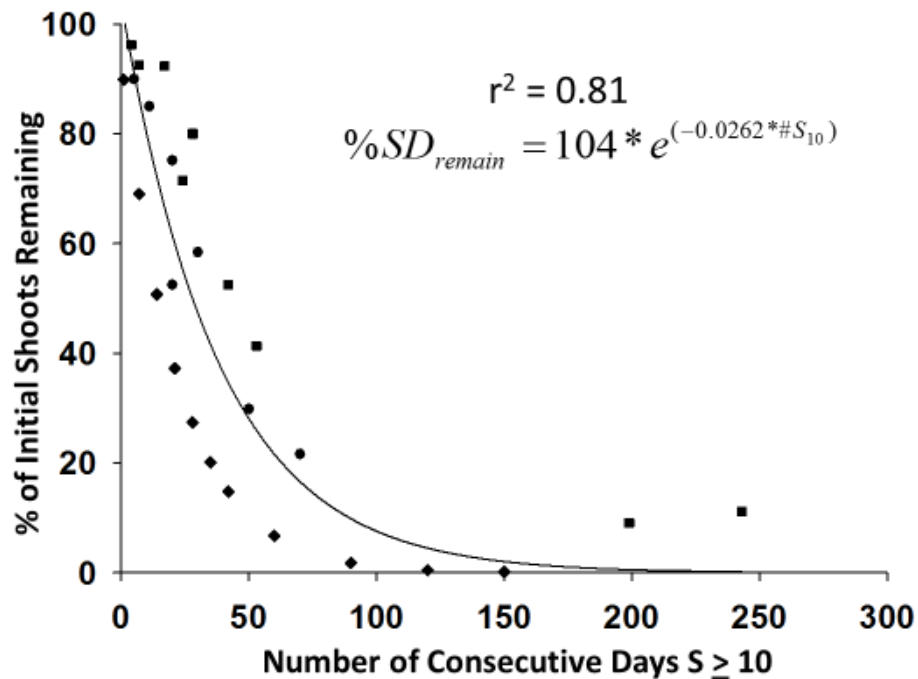
Flow Criteria – Based on Most Sensitive Species

- 2002 peer review panel recommended an analysis of multiple indicators
- The re-evaluation used a resource-based approach which consisted of 11 different science components
- 2017 peer review stated, “the requirements for multiple indicator species were quite complete and scientifically sound and added strength to validity of MFL recommendation.”
 - Primary reliance on *Vallisneria* is less useful
 - Peer Review Panel suggested studying a different indicator to support duration component in the future

Duration – How Duration was Derived

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

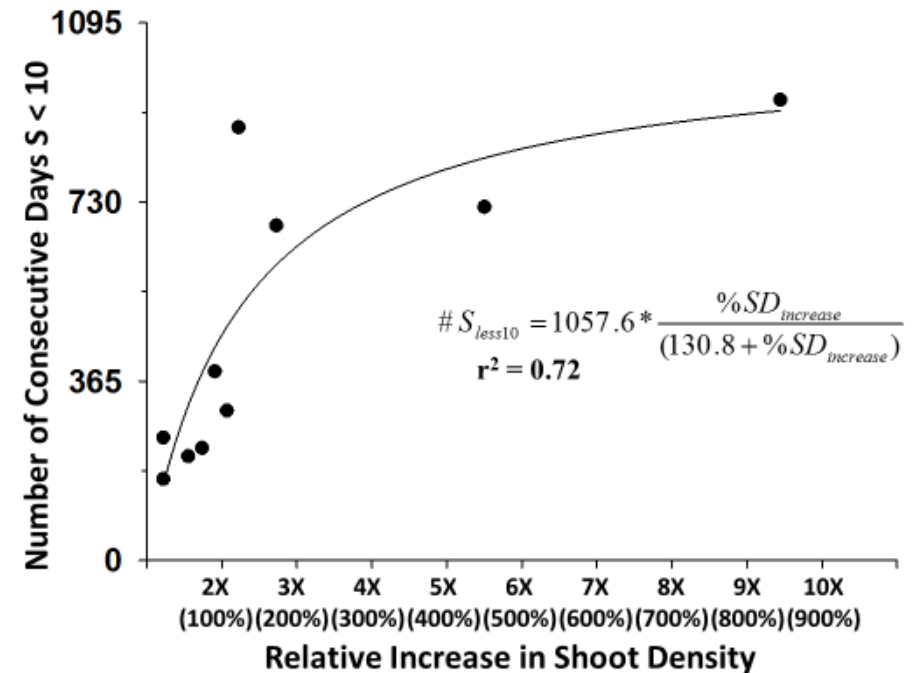
CRE MFL DURATION – TAPE GRASS EXPOSURE



14

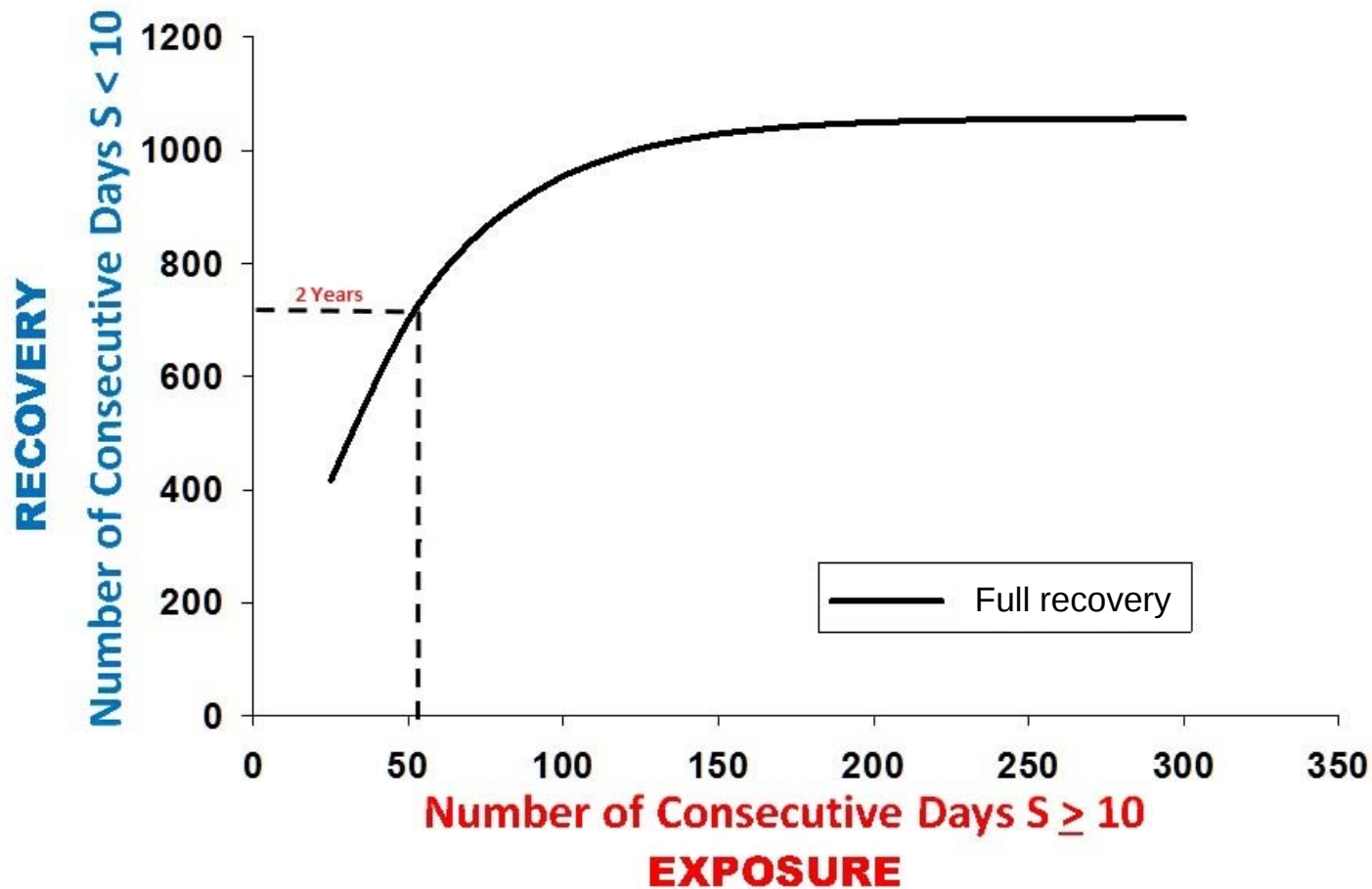
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

CRE MFL DURATION – TAPE GRASS RECOVERY



14

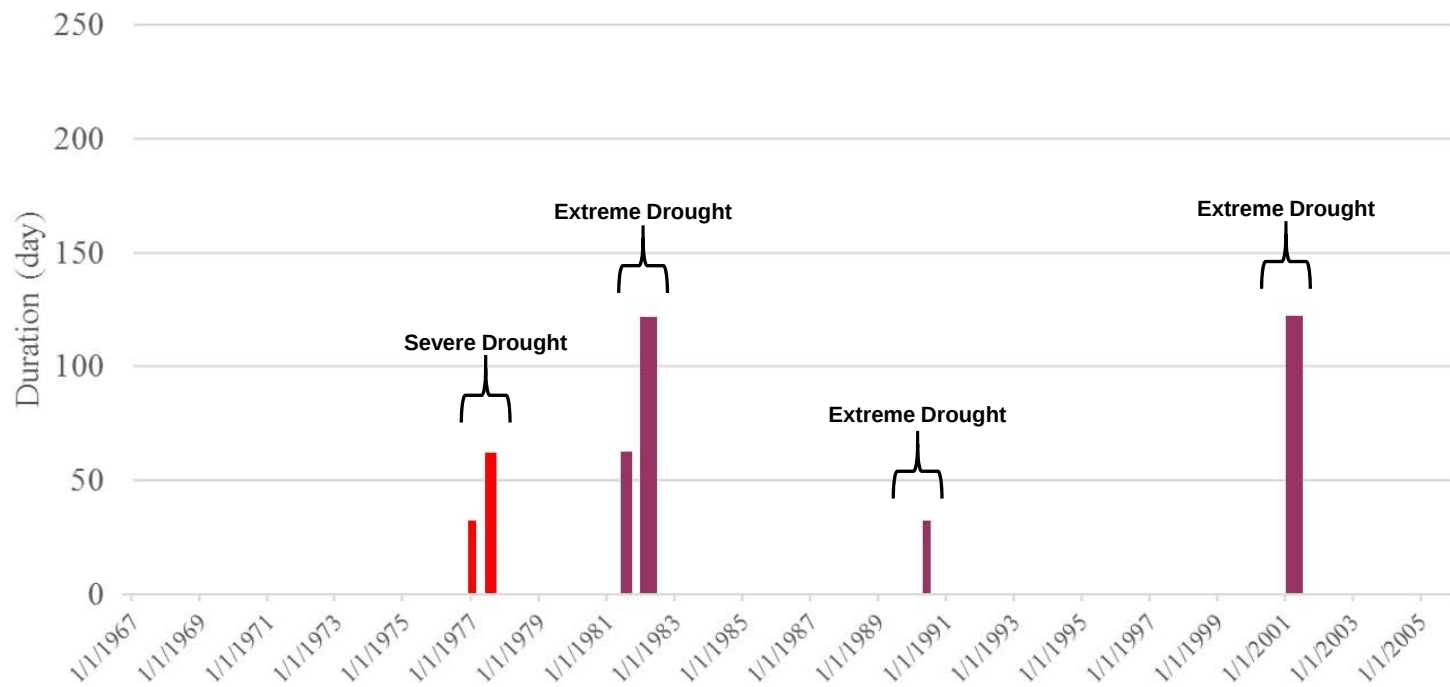
Duration – How Duration was Derived



Return Frequency

Regional Drought Conditions during Combined Exceedance Events in the CRE¹

Combined events for FCBW400, flow target 400 cfs

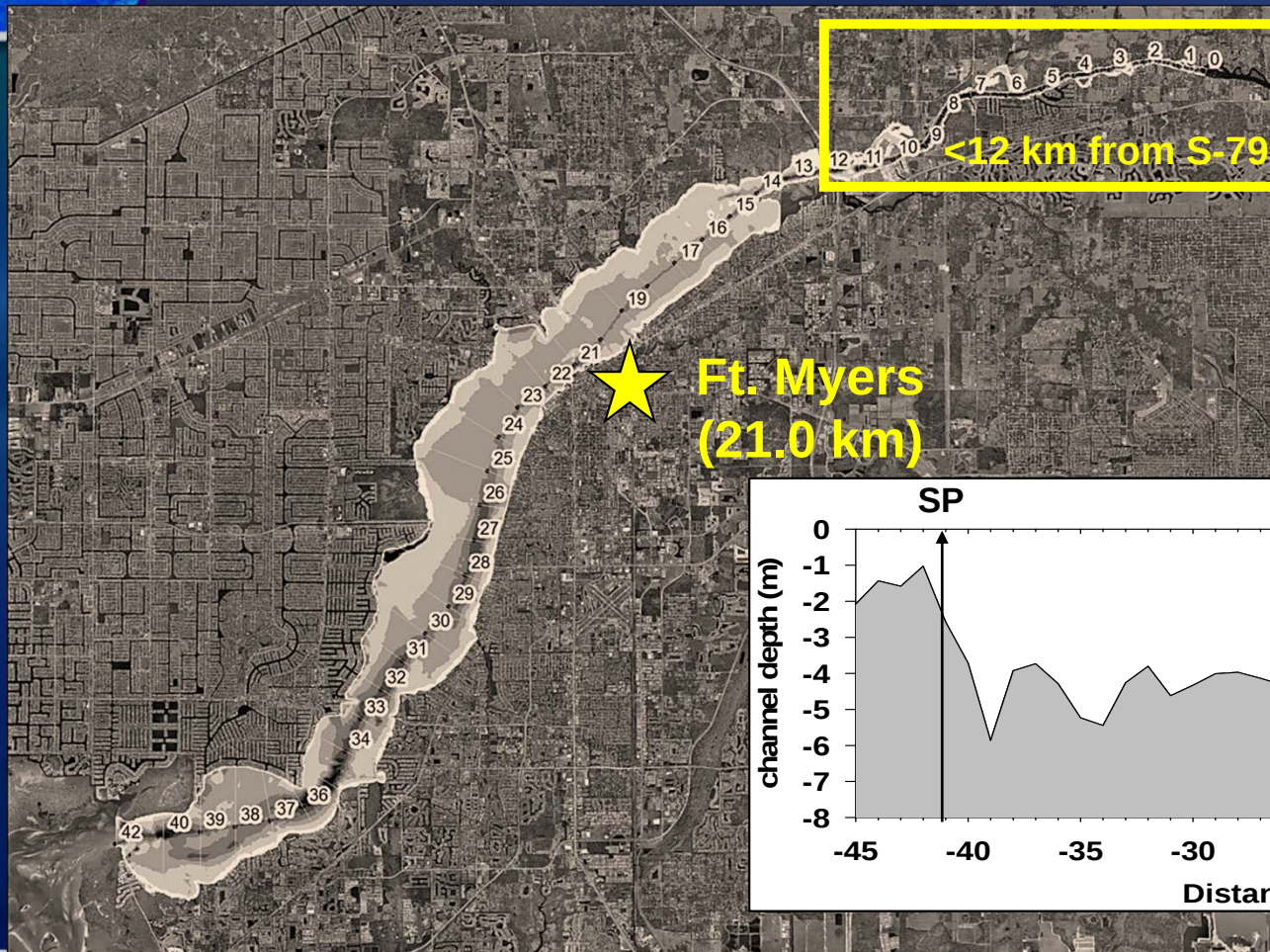
Palmer Drought Severity Index²

Extreme Drought	≤ -4.00
Severe Drought	-3.00 to -3.99
Moderate Drought	-2.00 to -2.99
Index Mid-range	-1.99 to $+1.99$
Moderately Moist	$+2.00$ to $+2.99$
Very Moist	$+3.00$ to $+3.99$
Extremely Moist	$\geq +4.00$

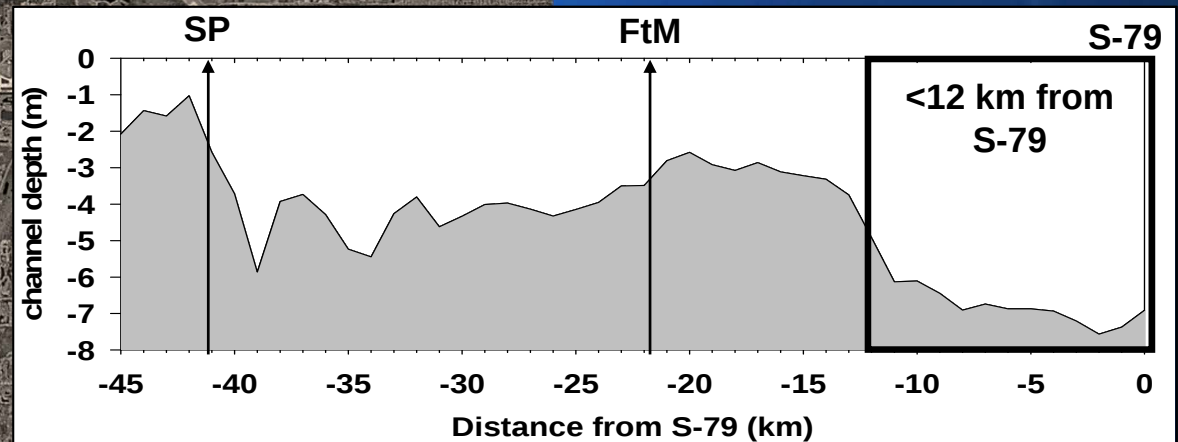
¹ From National Oceanic and Atmospheric Administration/National Centers for Environmental Information at <https://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/psi/200201-200312>.

² Palmer, W.C. 1965. Meteorological Drought. *Research Paper No. 45*. U.S. Weather Bureau. National Oceanic and Atmospheric Administration Library and Information Services Division, Washington, D.C.

Isohaline Position Analysis (Low Salinity Zone)



Potential planktonic
habitat compression &
impingement $X_5 < 12$ km



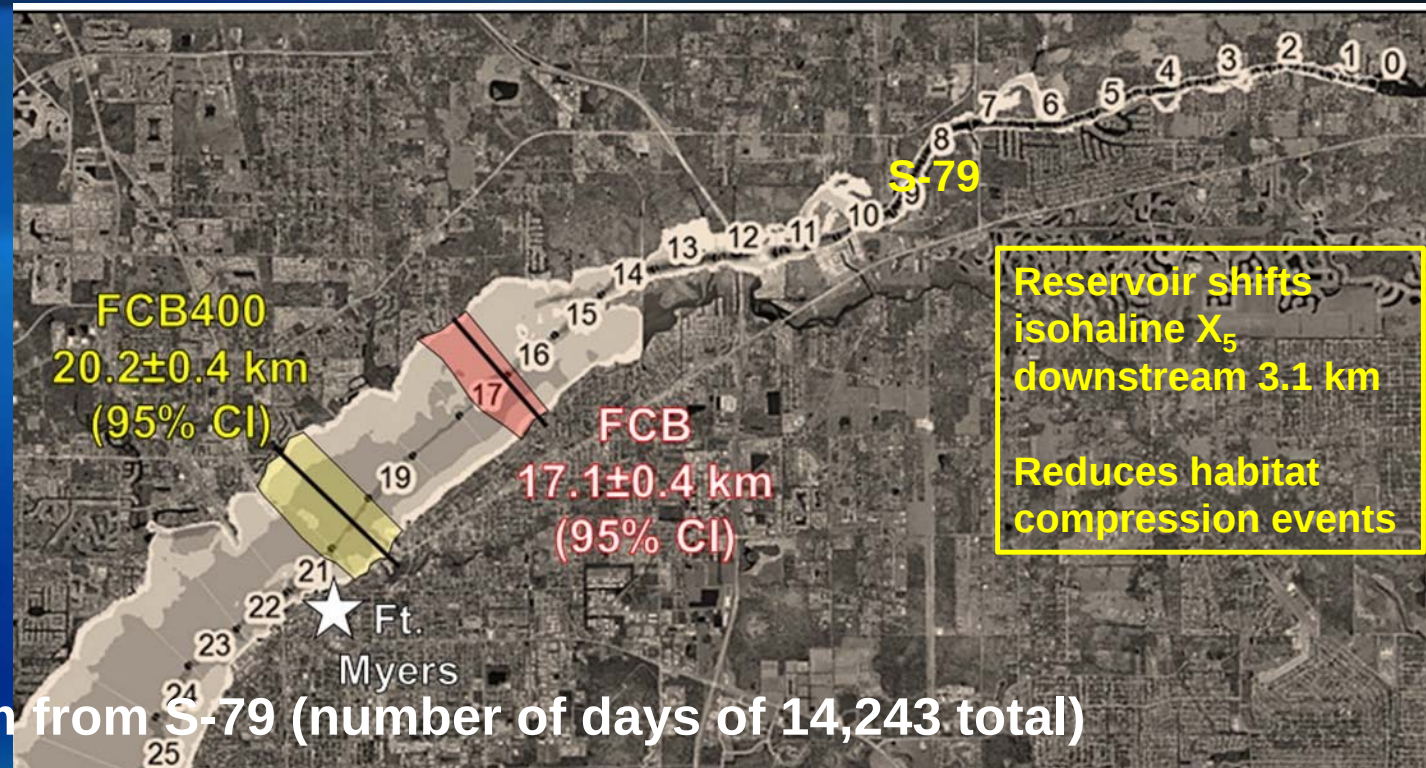
Dry Season Isohaline – Salinity = 5 (X_5)

Legend

- FCB Without C-43 Reservoir
- FCB400 With C-43 Reservoir

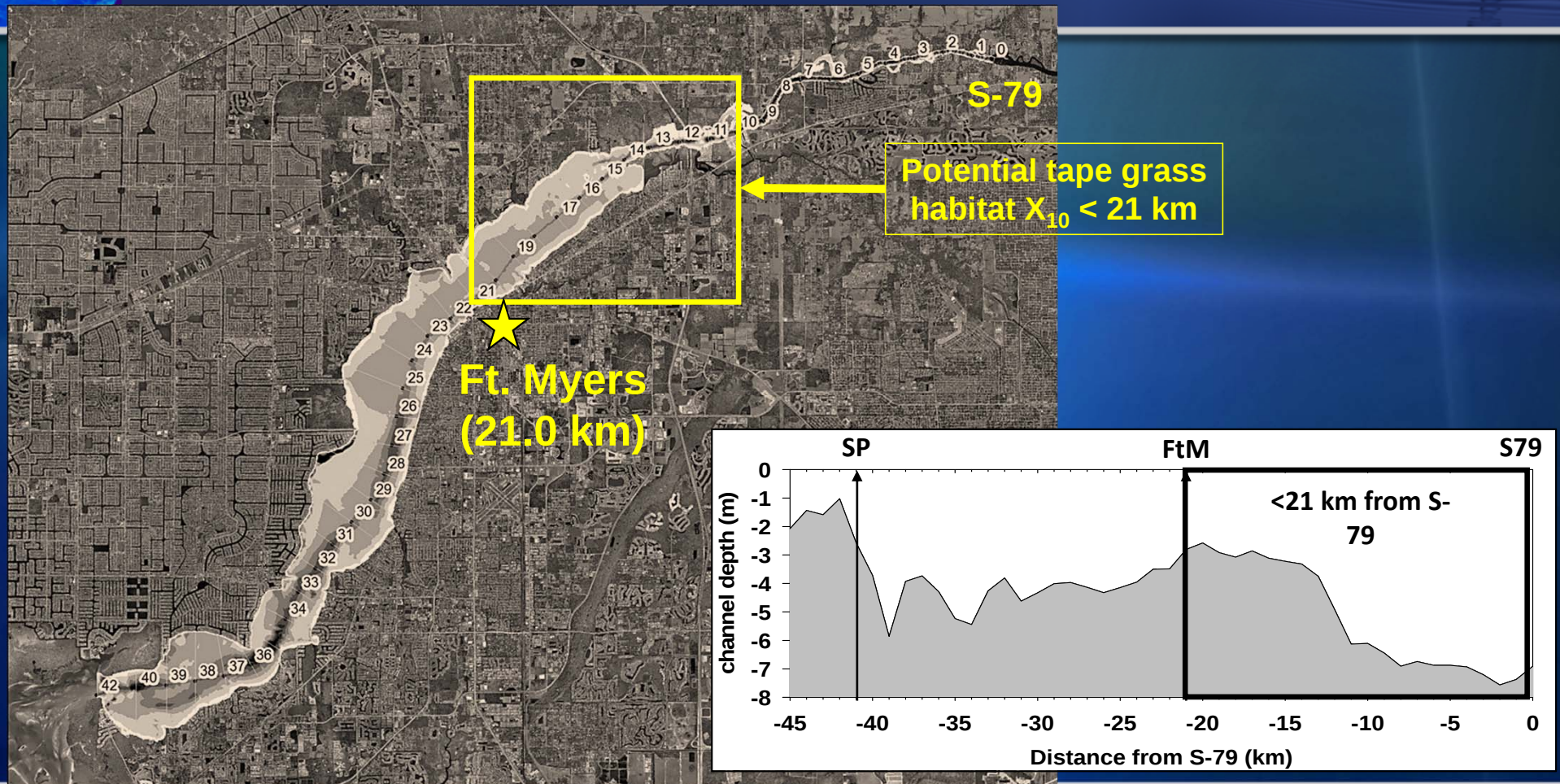
FCB = Future Condition Base
model simulation

$X_5 < 12$ km from S-79 (number of days of 14,243 total)

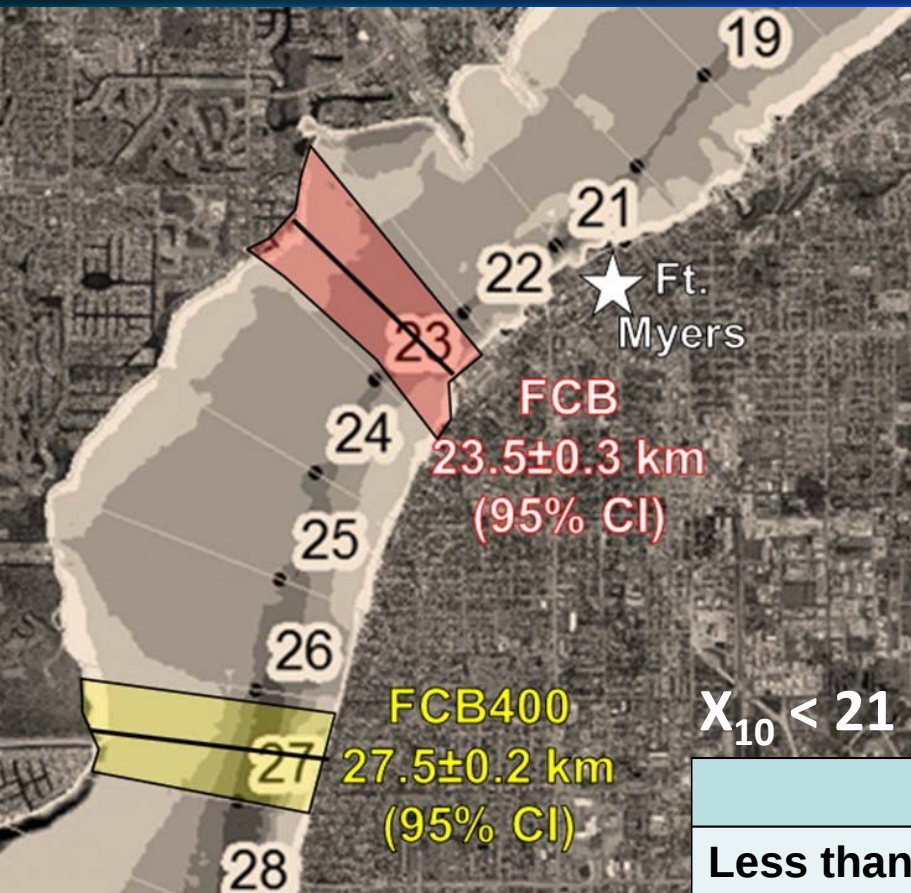


	No Reservoir	With Reservoir	Difference
Less than 12 km	3709	2025	45.4% Reduction

Dry Season Isohaline - Salinity = 10 (X_{10})



Dry Season Isohaline – Salinity = 10 (X_{10})



Legend

- FCB Without C-43 Reservoir
- FCB400 With C-43 Reservoir

FCB = Future Condition Base model simulation

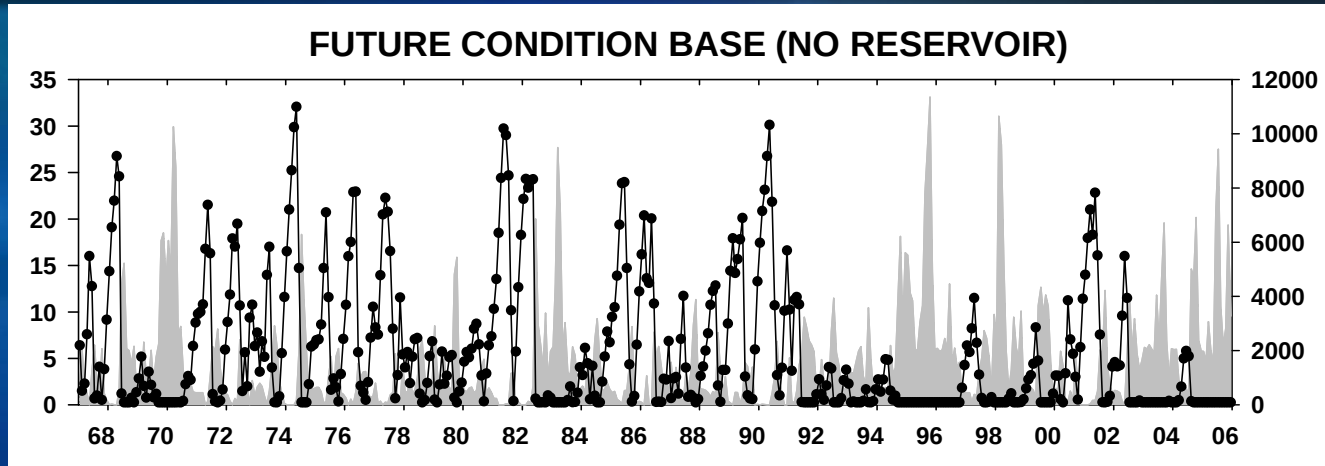
Reservoir shifts isohaline X_{10} downstream 4 km

Provides additional protection for tape grass habitat

	FCB	FCB400	Difference
Less than 21 km	3914	2458	37.2% Reduction

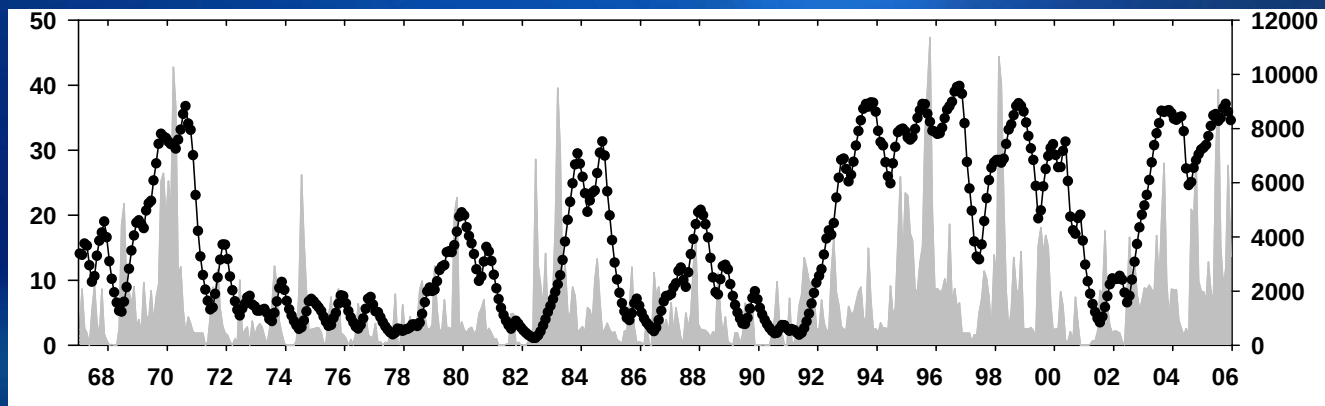
Effects on High Salinity Events

Salinity



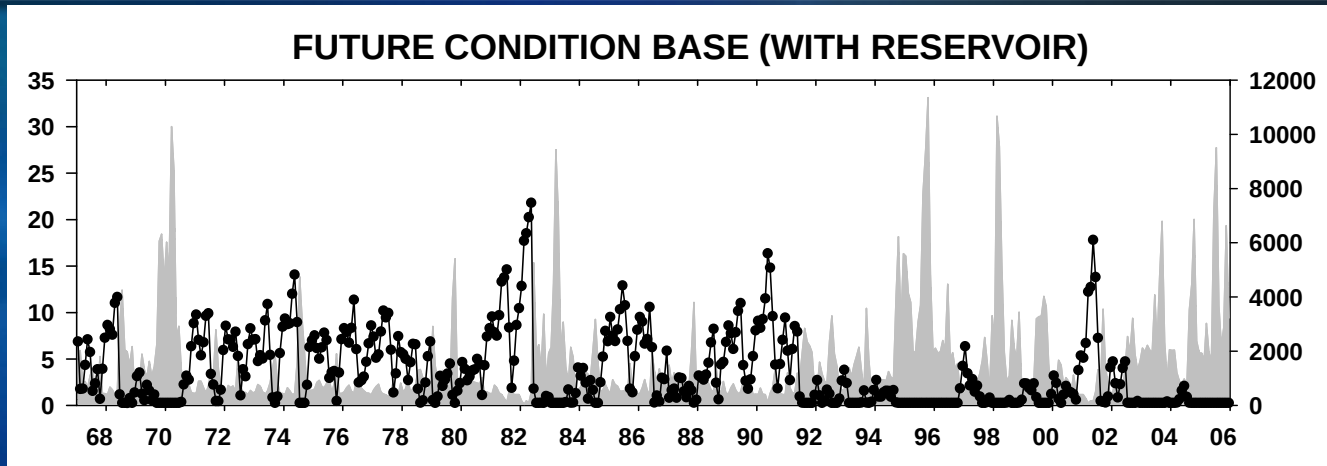
Inflow at S-79 (cfs)

Vallisneria
Shoot Biomass
(gdw m⁻²)



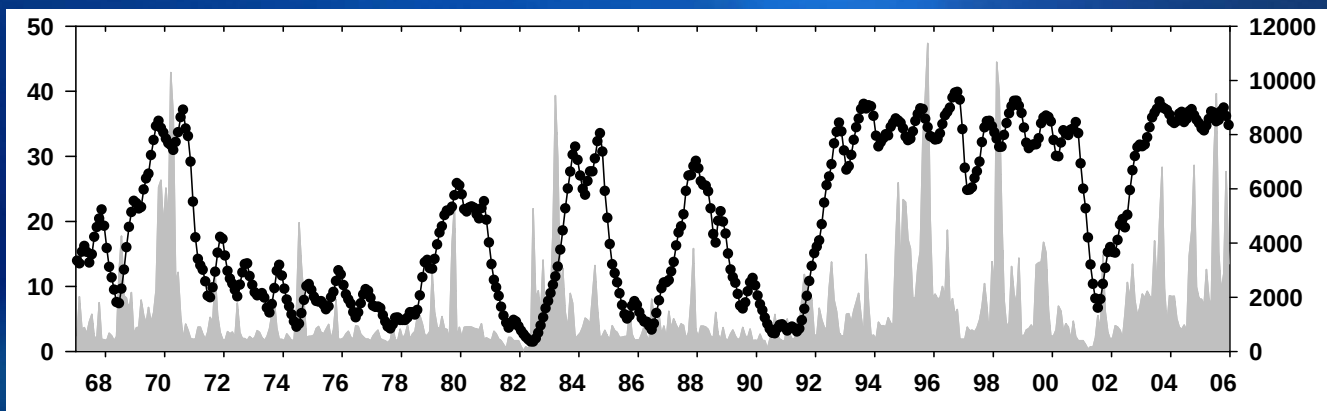
Effects on High Salinity Events

Salinity



Inflow at S-79 (cfs)

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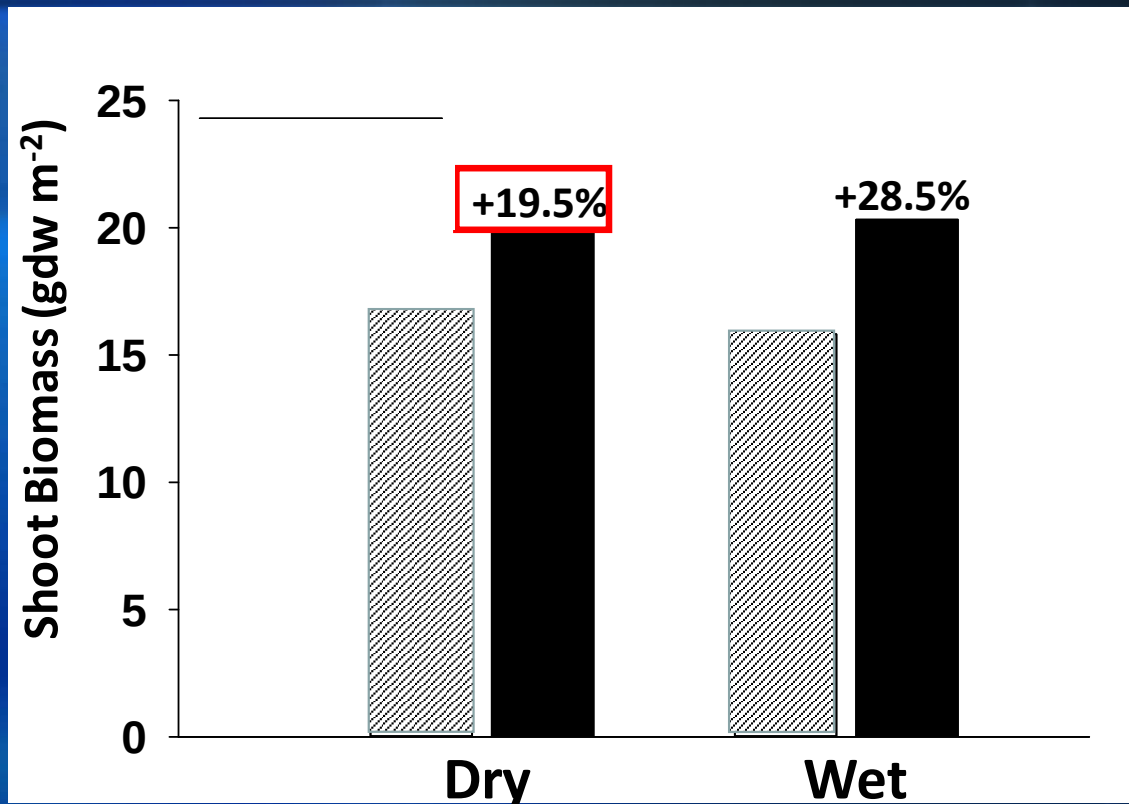


Effects on High Salinity Events

Legend

-  Without C-43 Reservoir
-  With C-43 Reservoir

Future Condition Base simulation



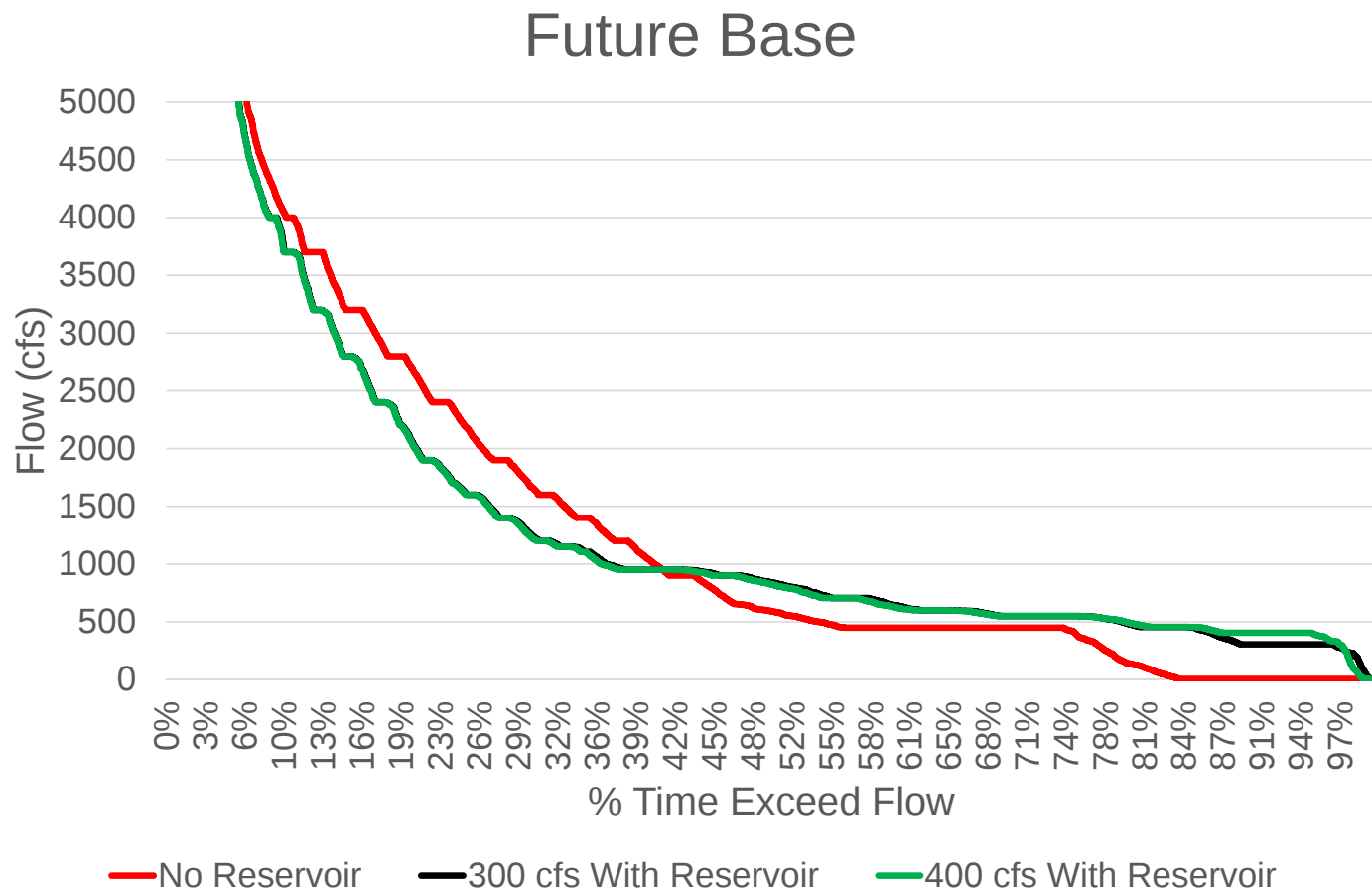
Effects of season (dry vs. wet) and inflow scenario (No Res. vs. With Res) on the average simulated tape grass shoot biomass (gdw m⁻²) at SAV Monitoring Site 1 from 1/1/1967 to 12/31/2005



C-43 Reservoir Benefits - Zooplankton

<u>Total # of Compression Events</u>	<u>No Res.</u>	<u>With Res.</u>	<u>%Change</u>
Lironeca spp. (isopod)	29	4	-86.2
Edotia tribola (isopod)	29	5	-82.8
Americamysis almyra (mysid)	50	31	-38.0
Clytia spp. (jellyfish)	28	4	-85.7
Bowmaniella brasiliensis (mysid)	26	4	-84.6
Gobiidae preflexion (Goby larvae)	24	2	-91.7
Anchoa mitchili (Common Anchovy)	54	7	-87.0
Mnemiopsis leidyi (comb jelly)	54	7	-87.0

Comparison of Existing vs. Proposed Criteria



Comparison of Existing vs. Proposed Criteria

- For the proposed minimum flow of 400 cfs the number of high salinity events decreases with the proposed criteria (i.e., more water is delivered to the estuary)
- Water available to estuary is determined by the reservoir capacity (i.e., there is a finite amount of water available)
- The proposed minimum flow is more protective of the suite of ecological indicators
- To eliminate all of the high salinity events other local and regional storage projects would be required



Questions ?



Summary of the C-43 Reservoir Benefits

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June 1, 2018



Summary of C-43 Reservoir Benefits

- Change in different flows ranges at S-79
- Salinity and combined events
- Isohaline position changes (Low Salinity Zones)
 - X_5 and X_{10}
- Changes in Shoot Biomass for *Vallisneria*
- Positive effects on planktonic species
 - Habitat Compression





C-43 Reservoir Benefits – Flows and Events

<u>Simulated Flows at S-79 (cfs)</u>	<u>w/o C-43</u>	<u>with C-43</u>	<u>Change</u>
# months 0-400	104	14	-86.5%
# months 401-2800	292	388	+32.9%
# months 2801-4500	40	38	-5.0%
# months >4500	32	28	-12.5%

<u>Salinity and Combined Events</u>	<u>w/o C-43</u>	<u>with C-43</u>	<u>Change</u>
Average # of days/salinity event	162	137	-15.4%
Average salinity/event	19.6	13.8	-30.6%
Total # of combined events	26	6	-77%



C-43 Reservoir Benefits – Low Salinity Zone

<u>Isohaline Position (X_5)</u>	w/o C-43	with C-43	<u>Change</u>
X_5 Dry Season Mean + SD	17.1 $\pm$ 13	20.2 $\pm$ 10.2	3.1 km
X_5 Number of Days < 12 km	3709	2025	-45.4%
X_5 Average # of days/event < 12 km	127	70	-44.9%

<u>Isohaline Position (X_{10})</u>	w/o C-43	with C-43	<u>Change</u>
X_{10} Dry Season Mean + SD	23.5 $\pm$ 13.1	27.5 $\pm$ 8.3	4 km
X_{10} Number of Days < 21 km	3914	2458	-37.2%

C-43 Reservoir Benefits - Tape Grass

<u>Vallisneria (Site 1)</u>	<u>w/o C-43</u>	<u>with C-43</u>	<u>%Change</u>
Total # events $S \geq 10$ for 55 days	20	6	-70.0%
Average # of days/event	137	115	-16.4%
Dry Season Change in shoot biomass			+19.5%
Wet Season Change in shoot biomass			+28.5%

*Period of Record for Tape Grass Model
Simulation 1/1/1967-12/31/2005*



Tape Grass



C-43 Reservoir Benefits - Zooplankton

<u>Average Location/Event (km)</u>	<u>No Res</u>	<u>With Res</u>	<u>Change (km)</u>
Lironeca spp. (isopod)	0.0	8.6	8.6
Edotia tribola (isopod)	1.2	7.8	6.6
Americamysis almyra (mysid)	4.4	10.0	5.6
Clytia spp. (jellyfish)	0.0	5.9	5.9
Gobiidae preflexion (Goby larvae)	4.2	10.2	6.0
Anchoa mitchili (Common Anchovy)	7.8	9.8	2.0
Mnemiopsis leidyi (comb jelly)	11.0	11.2	0.2

(Event = Center Of Abundance < 12 km)

C-43 Reservoir Benefits – Animation

- Model animation – 2000-2001 Dry Season
- Animation During an Extreme Drought
- Additional Animations are located the MFL webpage
- <https://www.sfwmd.gov/our-work/mfl>



C-43 Construction near Roberts Canal

Conclusions from Additional Science

- Confirms and supports the proposed MFL criteria is protective of key indicator species and their habitats
 - Isohaline position analysis demonstrates the low salinity zones are beneficial for indicator species
 - Zooplankton
 - 80-90% reduction of habitat compression events for 7 of 8 species
 - Vallisneria
 - Shoot biomass is predicted to increase ~20% and ~29% dry and wet seasons

Conclusions from Additional Science

➤ Confirms recovery strategy (C-43 Reservoir) will:

- Achieve recovery the MFL flows once operational
- Provide a more stable salinity regime for the Caloosahatchee during the dry season
- Result in a 33% increase in higher flows from 401-2800 cfs



Construction of S-470 intake structure



Questions ?



Next Steps

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June 1, 2018



Public Input / Comment Period

- Draft MFL Rule Language, MFL Technical Support Documentation, Peer Review Report, etc. is available at the Caloosahatchee MFL website:
 - <https://www.sfwmd.gov/our-work/mfl>
- All written comments are due in 2 weeks: Friday, June 15, 2018
- Send to Toni Edwards at: tedwards@sfwmd.gov

Rule Development Schedule

<u>Caloosahatchee MFL Rule Development Activity</u>	<u>Expected Date</u>
Water Resources Analysis Coalition (WRAC)	June 7, 2018
Request Review by Office of Fiscal Accountability and Regulatory Reform	July 12, 2018
Publish Proposed Rule in Florida Administrative Register	July 12, 2018
Public Comment Period	July/August 2018
Rule Adoption/ Public Hearing	September 2018
Rule becomes effective 20 days after filing with Dept. of State	November 2018



Questions ?

Thank You