

# Potential impacts of US Army Corps of Engineers update of Water Control Manual on Apalachicola mussel habitat

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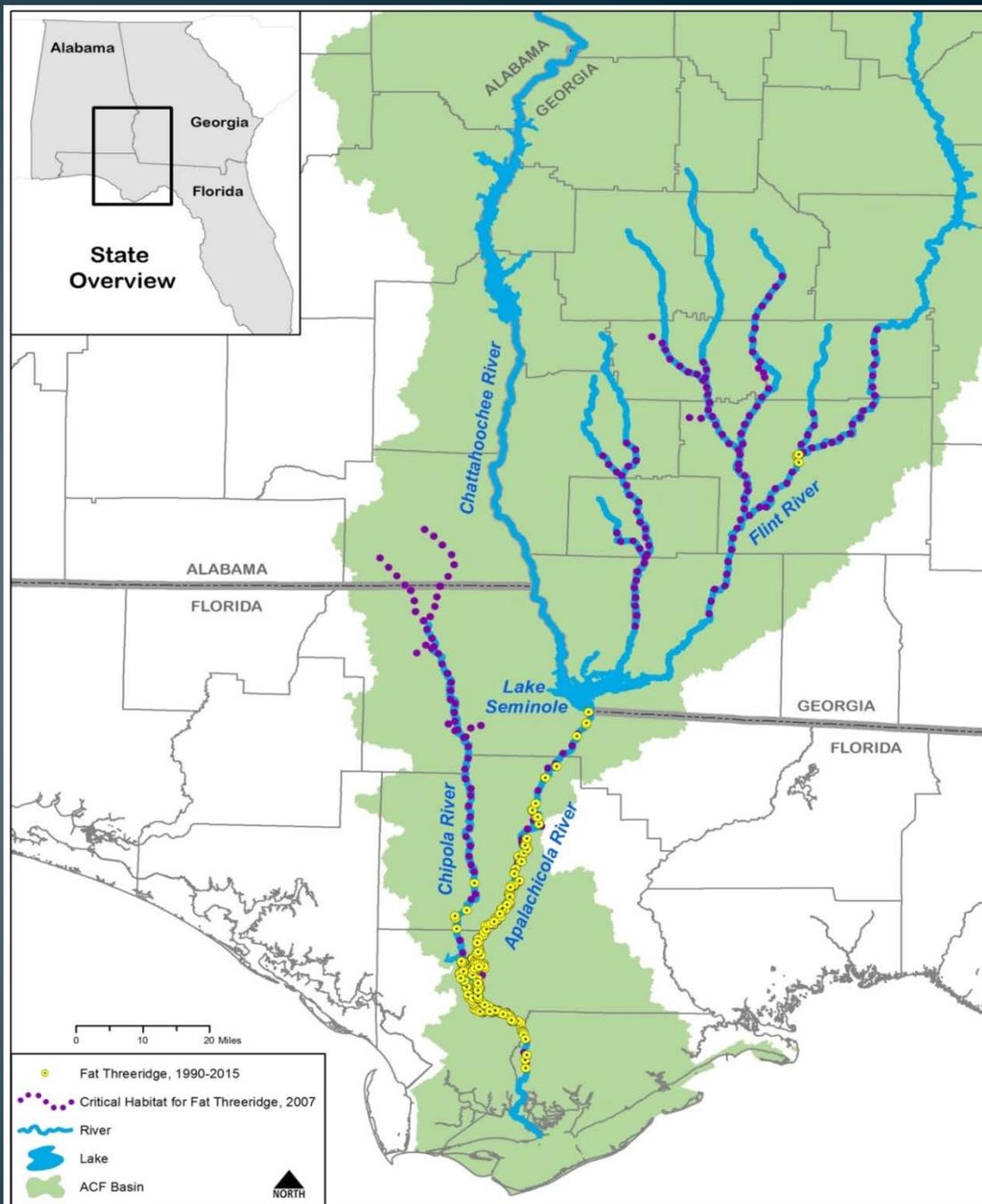
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# September 2016 Biological Opinion

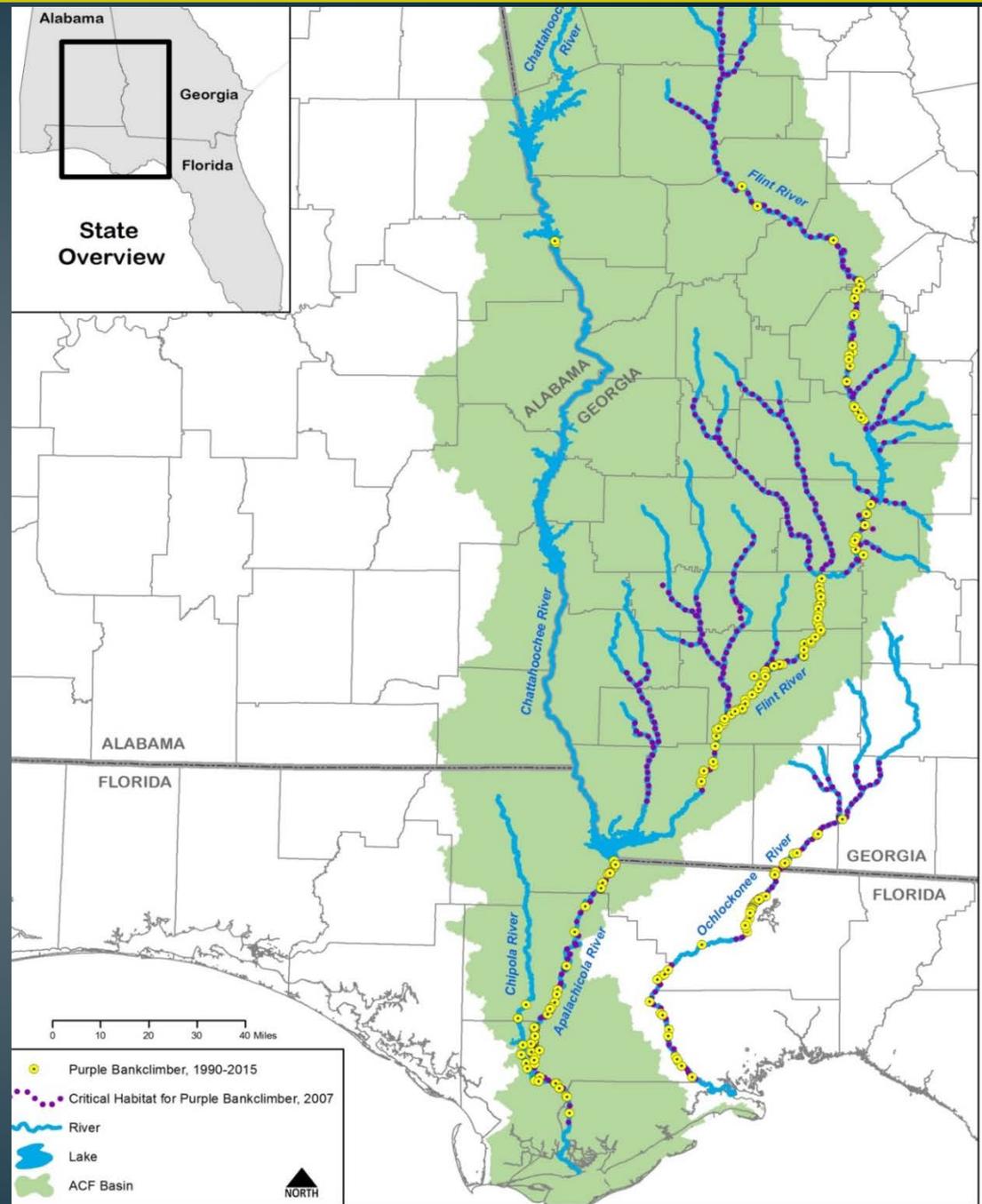
- Endangered Species Act section 7 consultation on the US Army Corps of Engineers (Mobile District) Update of the Water Control Manual (WCM) for the ACF basin in Alabama, Florida and Georgia and a Water Supply Storage Assessment (WSSA)
- Highlights of approach and analyses
- 3 federal T&E mussel species: fat threeridge (E), purple bankclimber (T), Chipola slabshell (T) and their designated critical habitats



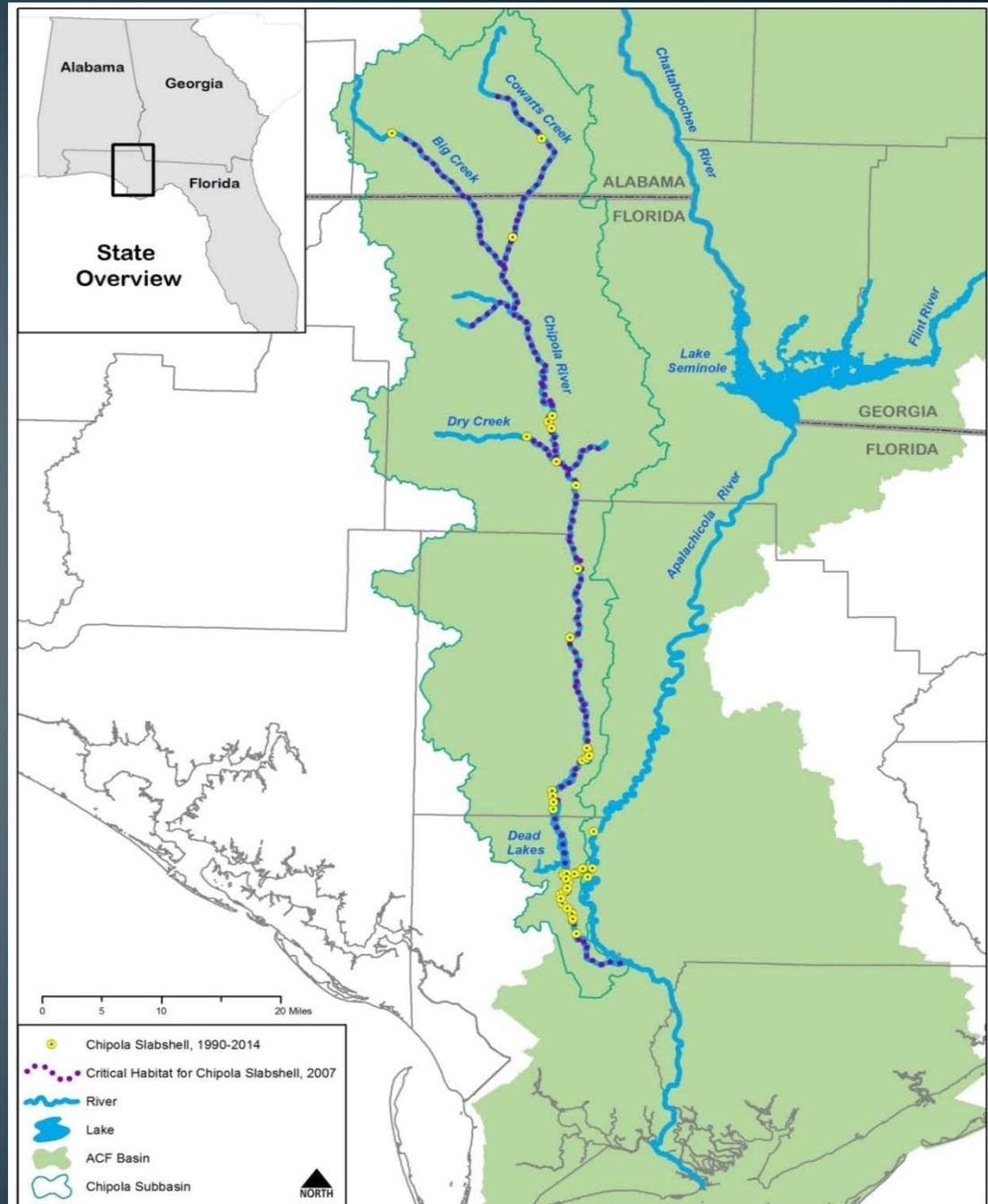
# Fat threeridge: 1990-2015 occurrences and critical habitat



# Purple bankclimber: 1990-2015 occurrences and critical habitat



# Chipola slabshell: 1990-2015 occurrences and critical habitat



# Critical Habitat & Primary Constituent Elements

- A geomorphically stable stream channel
- A predominantly sand, gravel, and/or cobble stream substrate
- Permanently flowing water
- Water quality
- Fish hosts

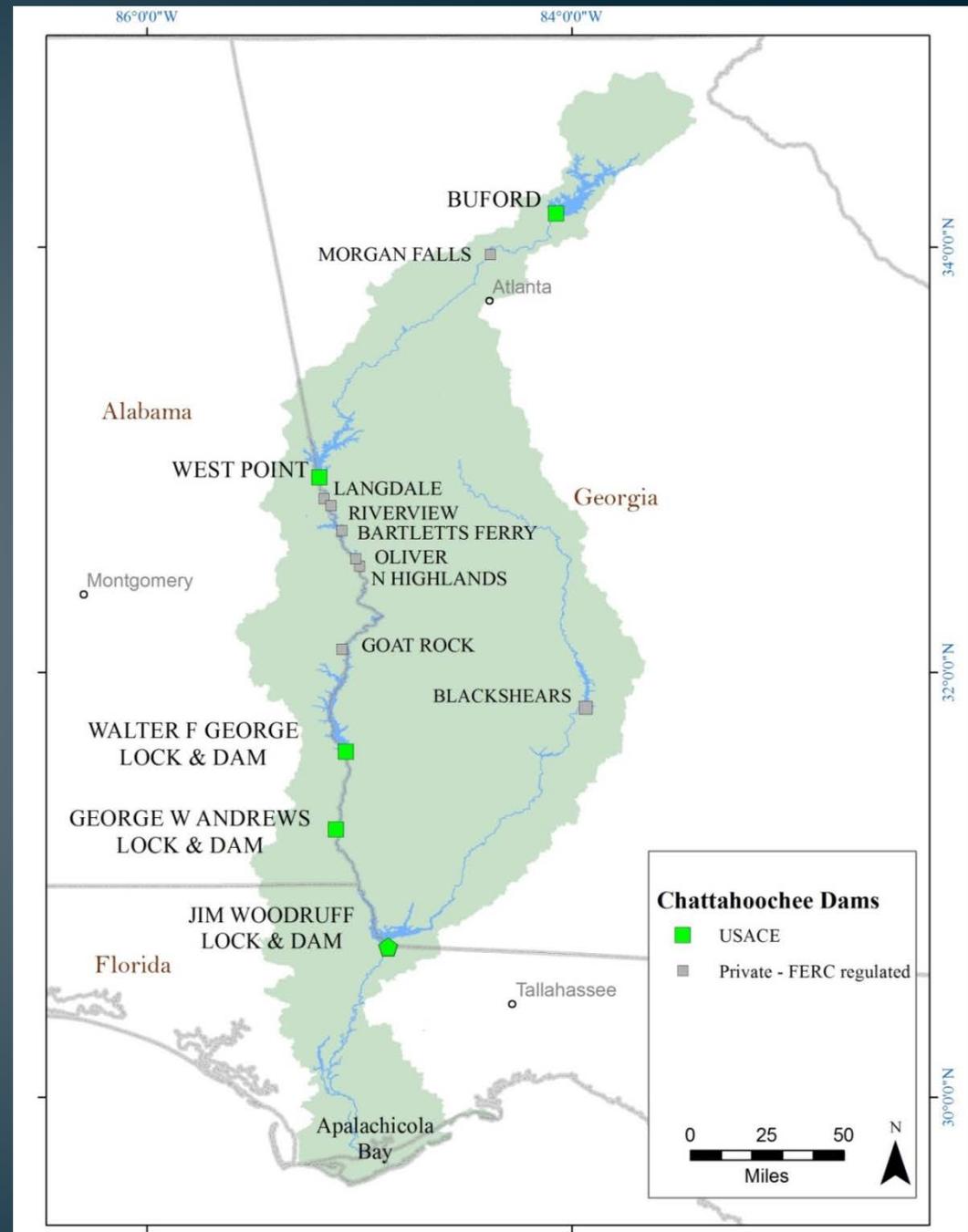


# Select summary of consultation history

- **May 22, 2012—previous BO on the Revised Interim Operating Plan for Woodruff Dam (RIOP) and associated water released to Apalachicola**
- **May 31, 2016—USACE submits Biological Assessment (BA) for update of WCM (amendments continued through late August 2016)**
- **September 14, 2016—USFWS issues Biological Opinion (BO)**
  
- **\*\*Final EIS published Dec. 16, 2016**
- **Review period extended to Feb. 1, 2017**

# ACF Basin

- 5 USACE projects included in BO
- 14 total projects on mainstem rivers



# What is the Water Control Manual?

- Guidelines for continued operations of projects in the ACF basin in a balanced manner to achieve all authorized project purposes...
- Fish and Wildlife Conservation including:
  - Federally-Listed Species - water releases for federally-listed, threatened, and endangered species below Jim Woodruff Dam on the basis of seasonal requirements (spawning, non-spawning, and winter),
  - Reservoir Fish Spawning, Tailrace Dissolved Oxygen Levels, Fish Passage, Management of Project Lands (Eufaula National Wildlife Refuge),
- Water Quality,
- Water Supply,
- Drought Operations,
- Extreme Drought Operations,
- Navigation,
- Flood Risk Management,
- Hydroelectric Power Generation,
- Recreation



# What are proposed changes in WCM?

- Compared to existing management, the USACE proposes to modify
  - Action zones
    - Used to manage Lanier, West Point, and George at the highest level possible within balance of authorized purposes (1 more water, 4 less water)
  - Drought operations
    - Triggered when composite conservation storage falls into Zone 3 (rather than Zone 4)
  - Storage at Lake Lanier
    - <379 mgd
  - Ramping during prolonged low flow
  - Navigation
    - Provide 16,200 cfs flow (7 ft channel) Jan.-May in Zone 1-2

# Conservation Measures

- “Actions that benefit or promote recovery of listed species that a Federal agency includes as an integral part of its proposed action and that are intended to minimize or compensate for potential adverse effects of the action on the listed species.”
- Fish passage
  - Locking cycles at Woodruff between 0800–1600 hours
  - One in the morning and one in the afternoon
  - Studies ongoing to determine the most appropriate technique and timing
- Daily releases are guided by two parameters:
  - Minimum discharge (cfs)
  - Maximum fall (down-ramping) rate (ft/day)

# Minimum discharge

Months	Composite conservation storage zone	Basin inflow (BI) <sup>a</sup> (cfs)	Min. Releases from Jim Woodruff Lock and Dam <sup>b</sup> (cfs)	BI available for storage <sup>a</sup>
March–May	Zones 1 and 2	$\geq 34,000$ $\geq 16,000$ and $< 34,000$ $\geq 5,000$ and $< 16,000$ $< 5,000$	$= 25,000$ $= 16,000 + 50\% \text{ BI} > 16,000$ $= \text{BI}$ $= 5,000$	Up to 100% BI > 25,000 Up to 50% BI > 16,000
	Zone 3	$\geq 39,000$ $\geq 11,000$ and $< 39,000$ $\geq 5,000$ and $< 11,000$ $< 5,000$	$= 25,000$ $= 11,000 + 50\% \text{ BI} > 11,000$ $= \text{BI}$ $= 5,000$	Up to 100% BI > 25,000 Up to 50% BI > 11,000
June–November	Zones 1, 2, and 3	$\geq 22,000$ $\geq 10,000$ and $< 22,000$ $\geq 5,000$ and $< 10,000$ $< 5,000$	$= 16,000$ $= 10,000 + 50\% \text{ BI} > 10,000$ $= \text{BI}$ $= 5,000$	Up to 100% BI > 16,000 Up to 50% BI > 10,000
December–February	Zones 1, 2, and 3	$\geq 5,000$ $< 5,000$	$= 5,000$ $= 5,000$	Up to 100% BI > 5,000
If Drought Triggered	Zone 3	NA	$= 5,000^d$	Up to 100% BI > 5,000
At all times	Zone 4	NA	$= 5,000$	Up to 100% BI > 5,000
At all times	Drought Zone	NA	$= 4,500^e$	Up to 100% BI > 4,500

**Notes:**

- Basin inflow for composite conservation storage in Zones 1, 2, and 3 is calculated using the 7-day moving average basin inflow. Basin inflow for composite conservation storage in Drought Operations, Zones 3 and 4 or lower (Drought Zone) is calculated using the one-day basin inflow.
- Consistent with safety requirements, flood risk management purposes, and equipment capabilities.
- Drought plan is triggered when the composite conservation storage falls into Zone 3, the first day of each month represents a decision point.
- Once drought operation triggered, reduce minimum flow to 5,000 cfs following the maximum ramp rate schedule.
- Once composite storage falls below the top of the Drought Zone ramp down to a minimum release of 4,500 cfs at rate of 0.25 ft/day based on the USGS gage at Chattahoochee, Florida (02358000).

# Maximum fall rate

Approximate release range (cfs)	Maximum fall rate (ft/day)
> 30,000 <sup>a</sup>	No ramping restriction <sup>b</sup>
> 20,000 and ≤ 30,000 <sup>a</sup>	1.0 to 2.0
Exceeds Powerhouse Capacity (~ 16,000) and ≤ 20,000 <sup>a</sup>	0.5 to 1.0
Within Powerhouse Capacity and > 10,000 <sup>a</sup>	0.25 to 0.5
Within Powerhouse Capacity and ≤ 10,000 <sup>a</sup>	0.25 or less

*Notes:*

<sup>a</sup> Consistent with safety requirements, flood risk management purposes, and equipment capabilities.

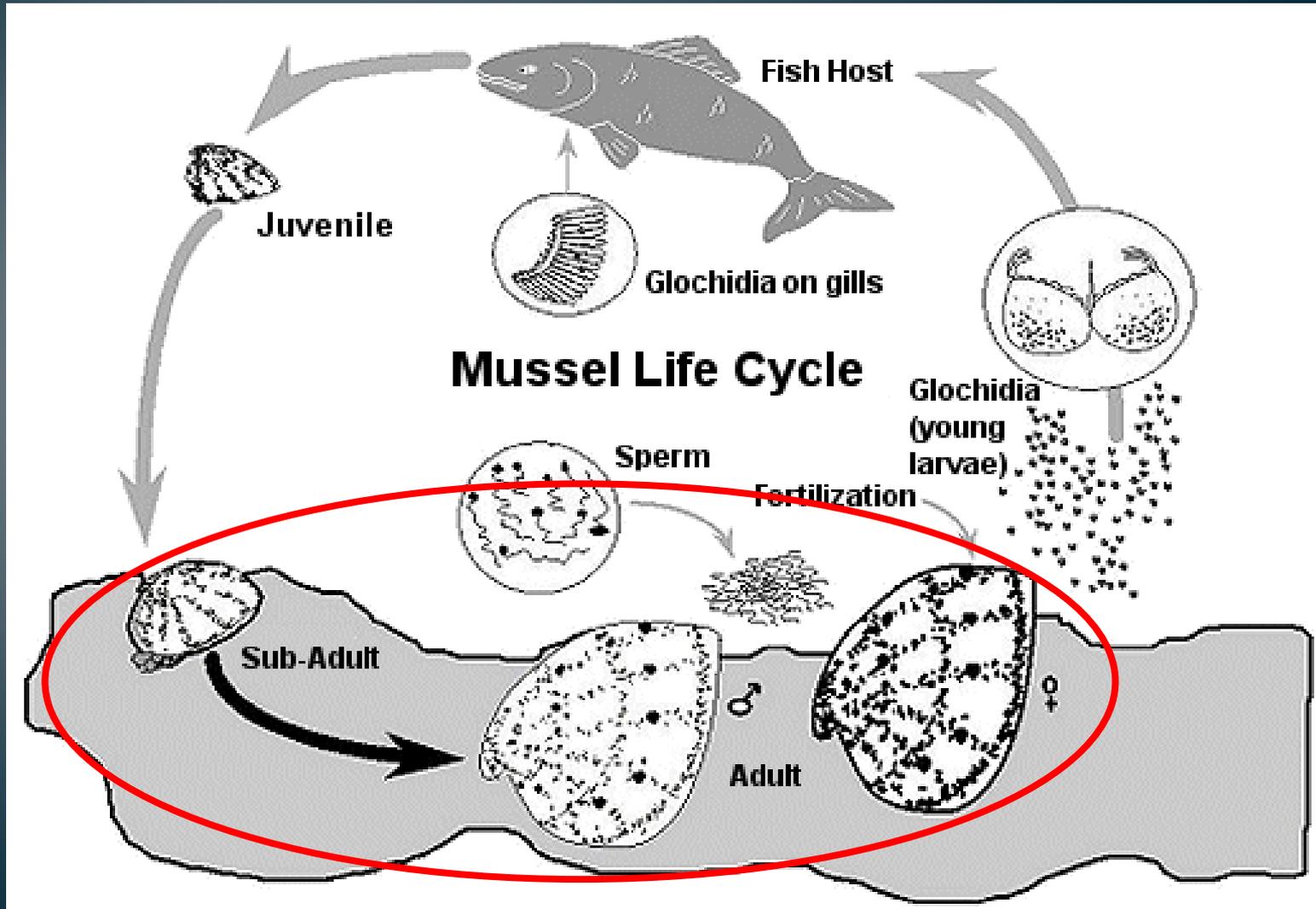
<sup>b</sup> For flows greater than 30,000 cfs, it is not reasonable or prudent to attempt to control the down-ramping rate, and no ramping rate is required.

Suspended when flows <7,000 cfs for >30 consecutive days and managed to match the fall rate of basin inflow

# Two models of river storage and discharge

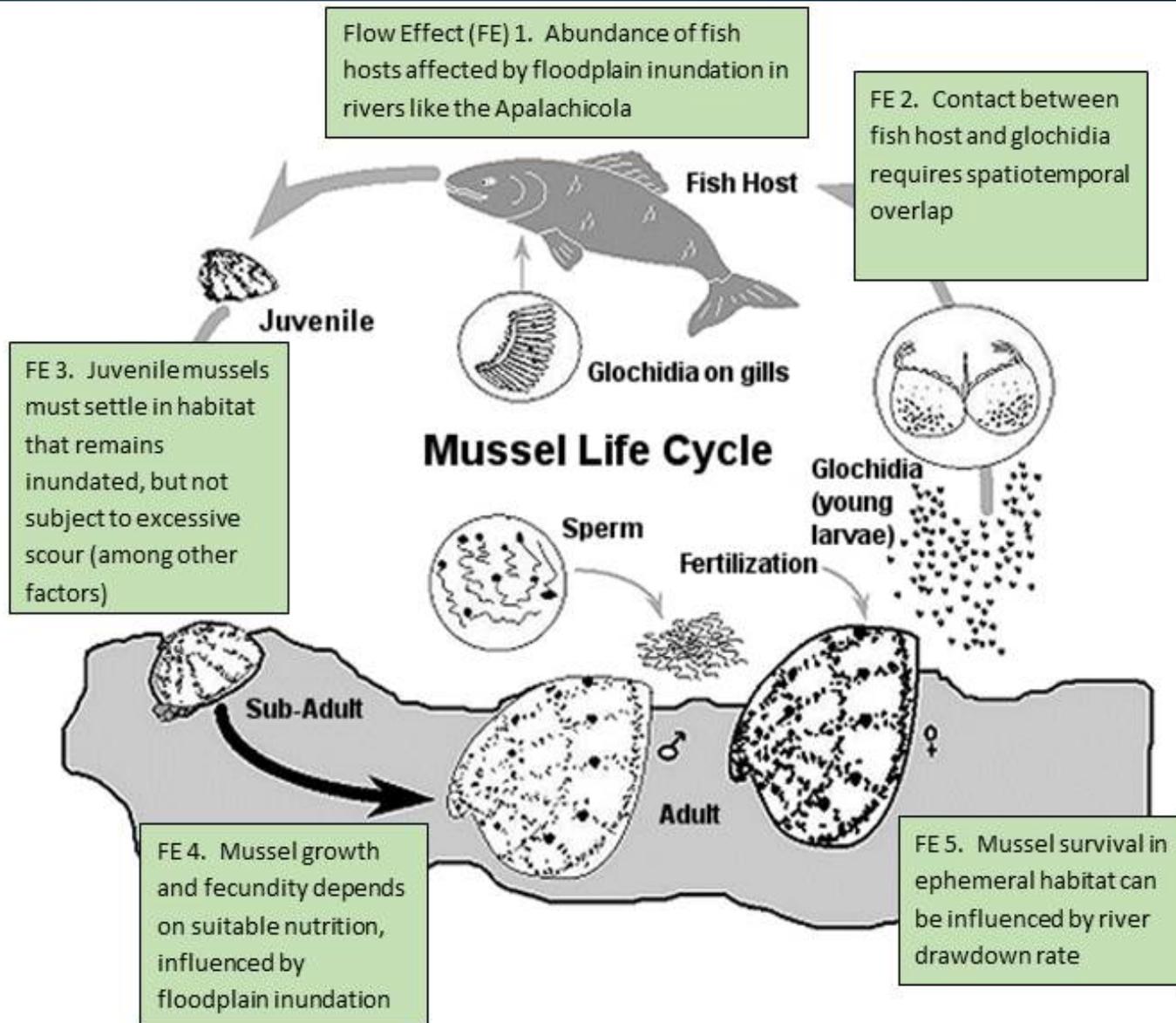
- Both models used to predict rules for water control manual management compared to RIOP management
- ResSim
  - Developed by USACE
- ACF-STELLA
  - Developed by Water Without Borders
  - Calibrated with ResSim model (Leitman et al. 2015)
  - Slightly different assumption about how to meet navigation
- Dataset based on observed data from 1939-2012
- Daily flow at Chattahoochee gage

# Mussel life history



(diagram from Iowa Mussel Team 2002)

# Conceptual model of river flow and mussel life history



# Conceptual model: Fat threeridge & Chipola slabshell



FE 1 - Floodplain Access for Spawning (spring - late summer or end of growing season)

FE 2 - Low Flow during Infection (late spring-early summer)

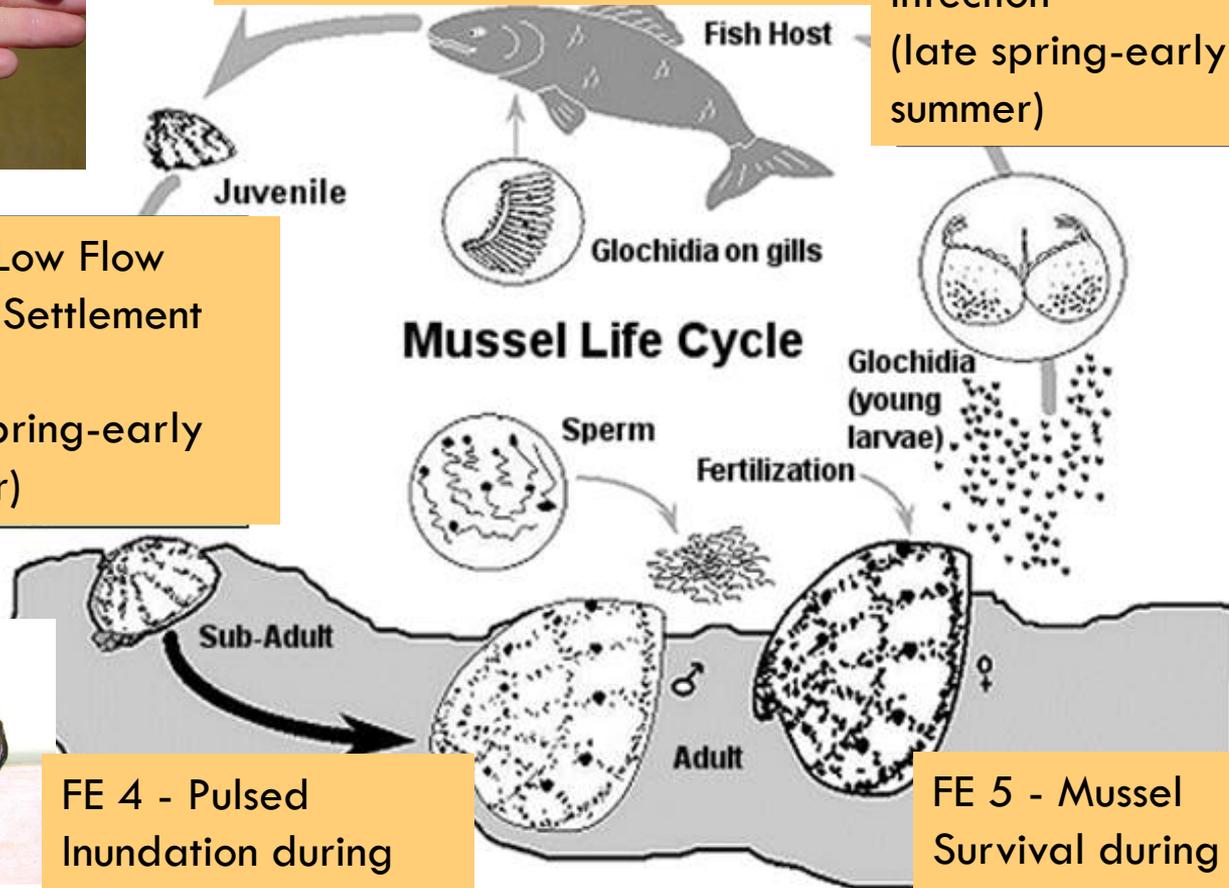
FE 3 - Low Flow during Settlement (late spring-early summer)

(late spring-early summer)

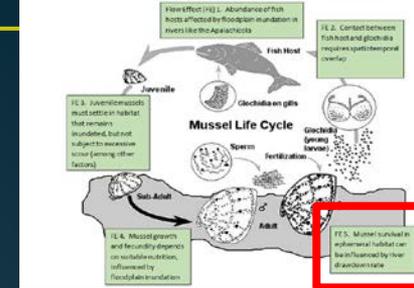


FE 4 - Pulsed Inundation during late growing season (summer-fall)

FE 5 - Mussel Survival during Drawdown and Low Flow (year round)

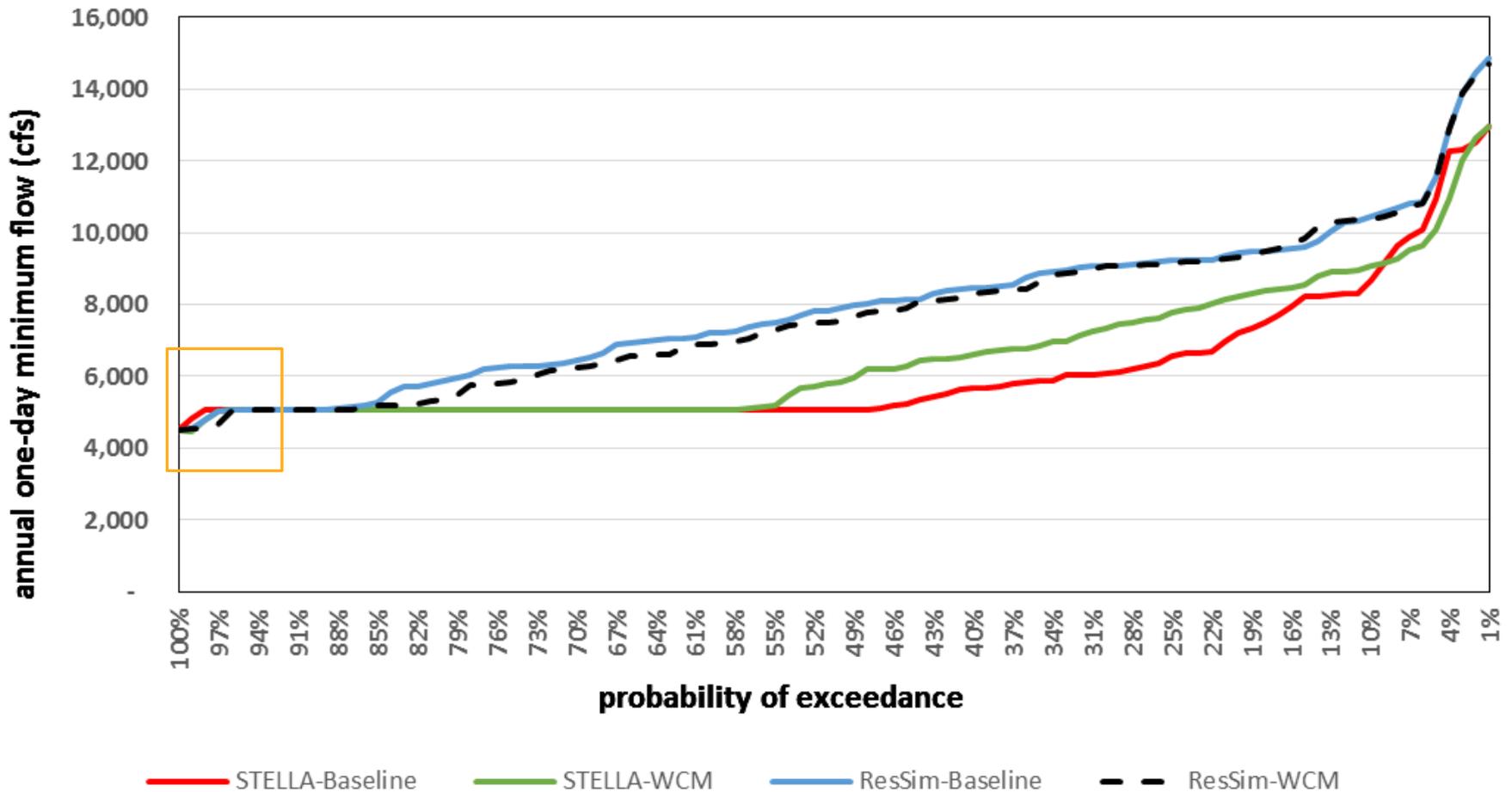


# Flow effect 5: Mussel Survival

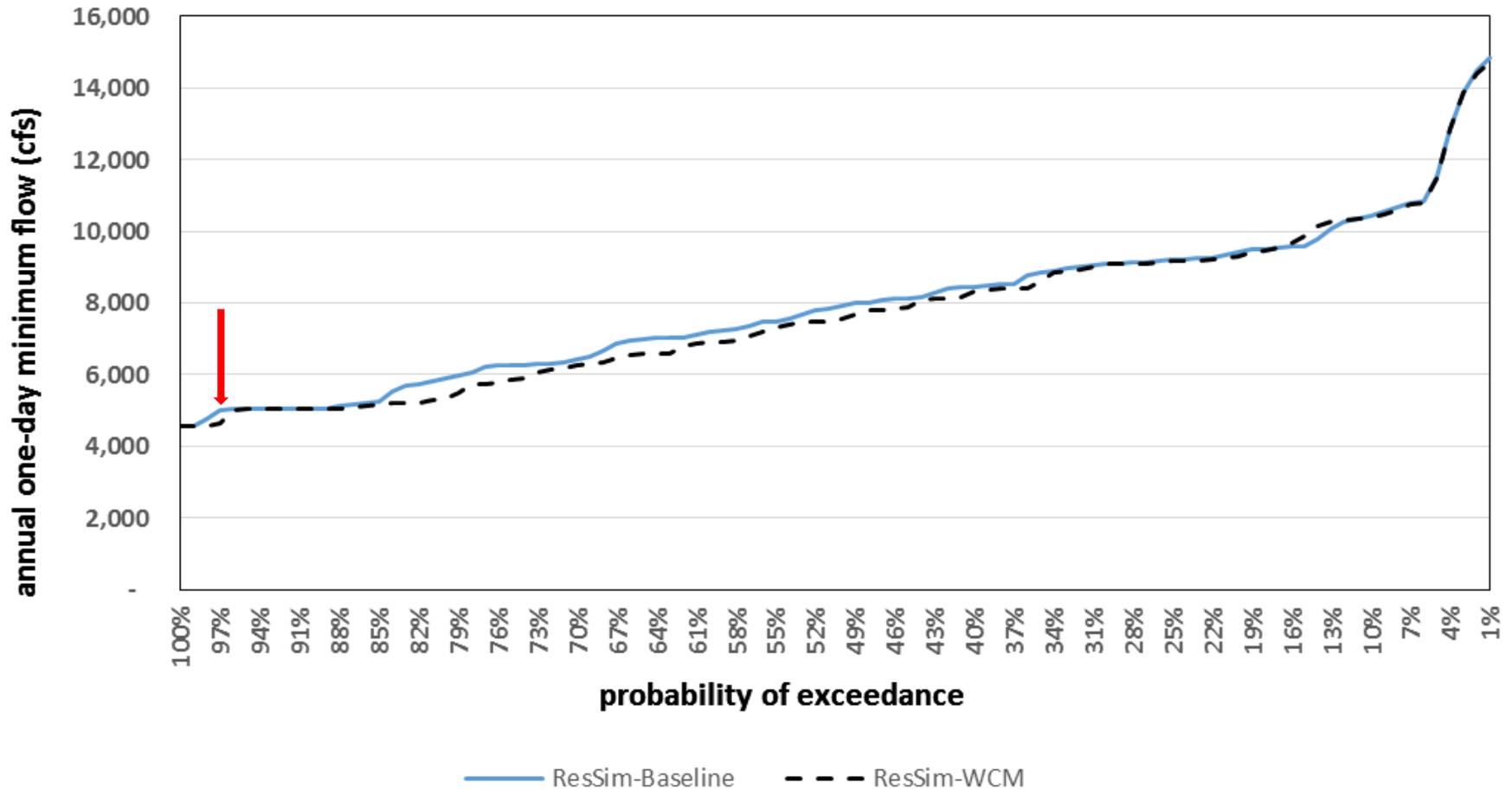


Specifics of timing and flow thresholds		Flow effect	What's better	Results
Metric ID	Hydroecological Metric Title	Species Ecology	Interpretation	WCM effect
M7				
M8				
M9				

# M7: Probability of exceedance plot showing the annual one-day minimum flow

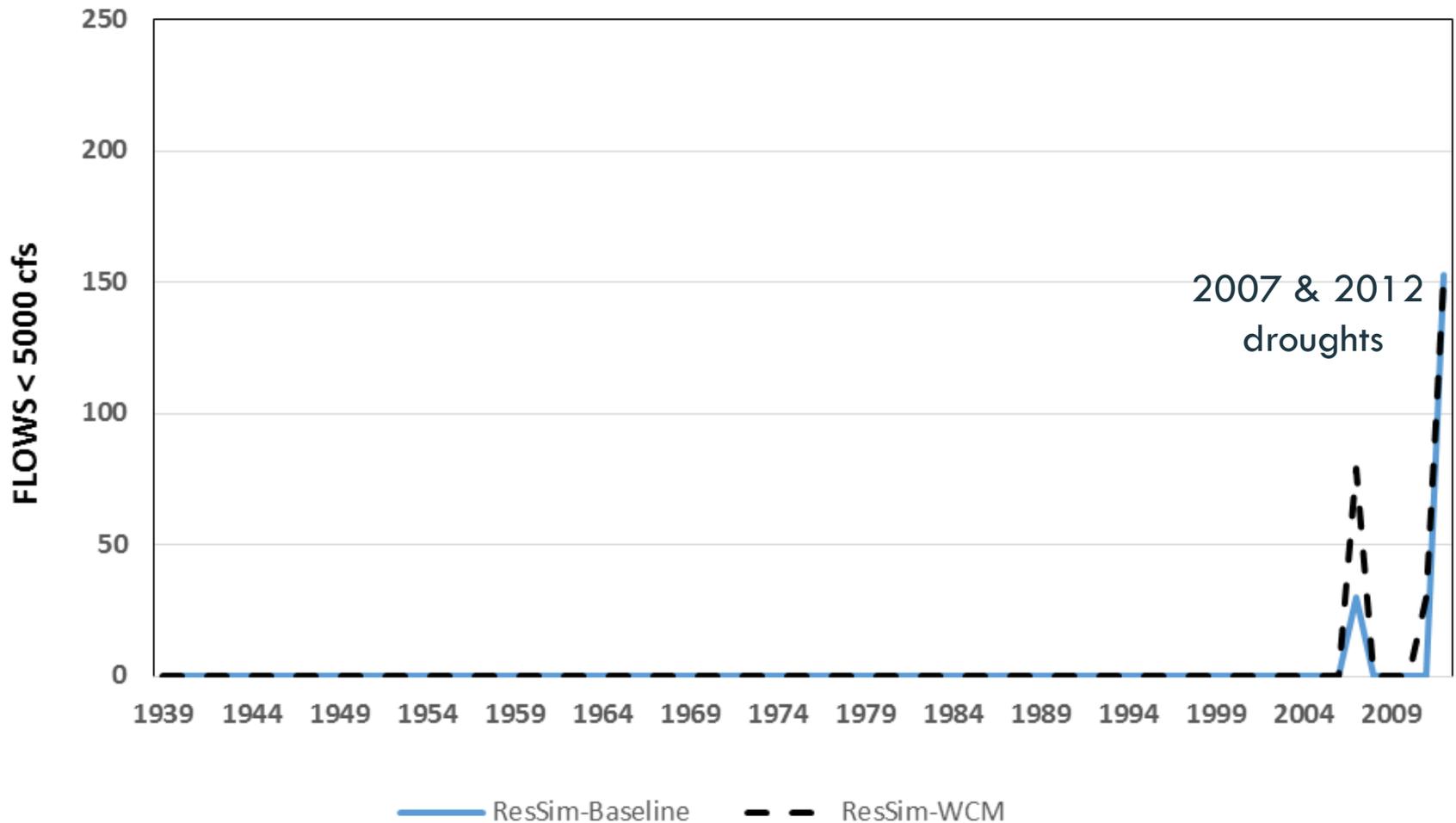


# M7: Probability of exceedance plot showing the annual one-day minimum flow

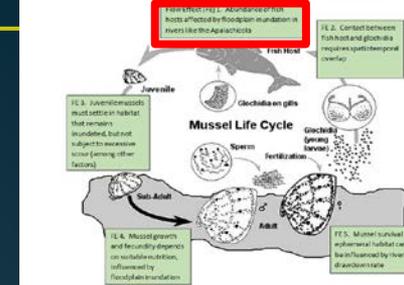


Increase from 2% to 3% chance in seeing flow <5000 cfs in any year

# M8: Annual number of days when flows are continuously <5,000 cfs



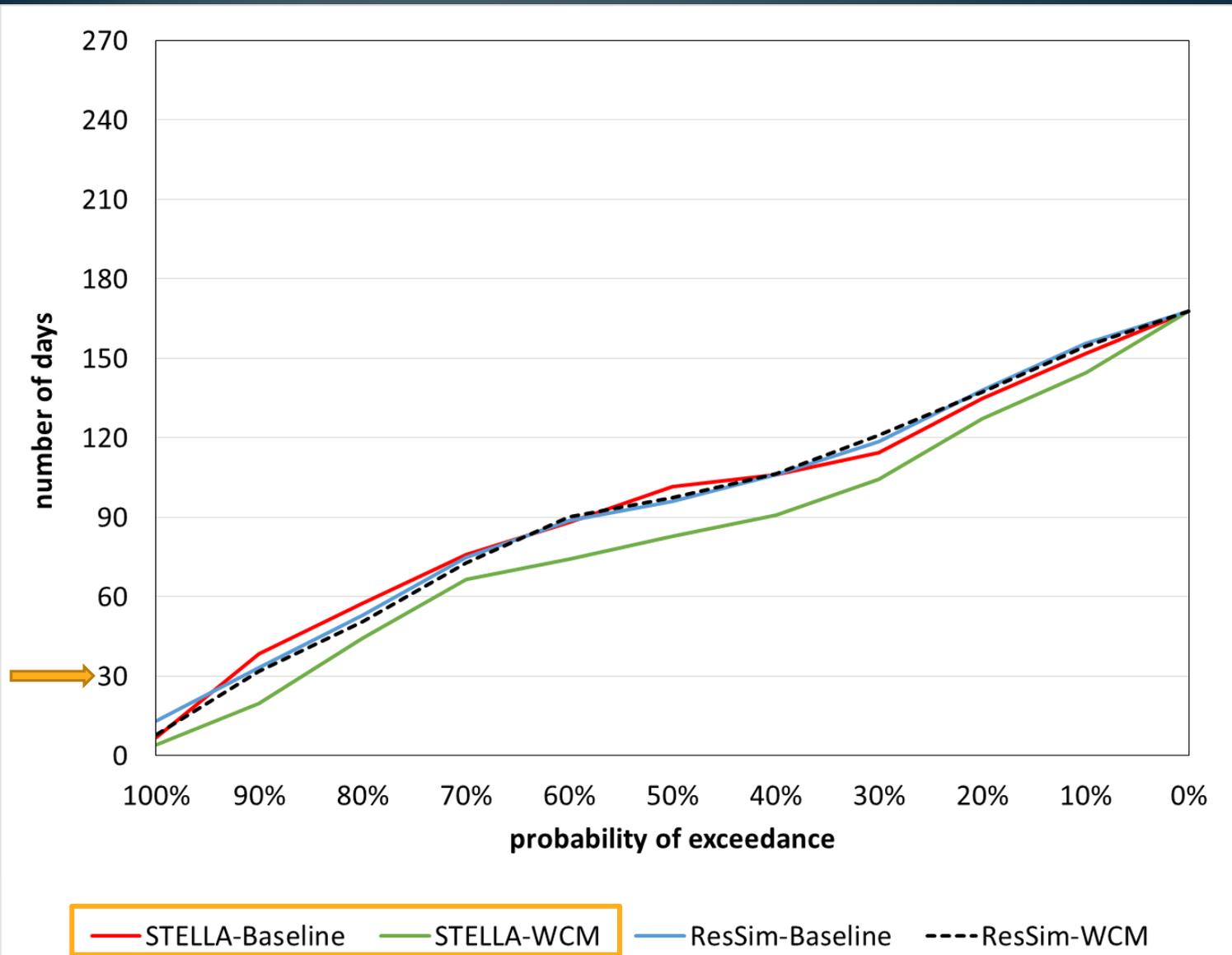
- WCM 49 more days <5,000 cfs in 2007 (79 total) and the WCM spent 29 days more (182 total) in 2011-2012
- Both low flow metrics inference = expect flows < 5000 cfs in 3-4% of years



# Flow effect 1: Host Fish Production

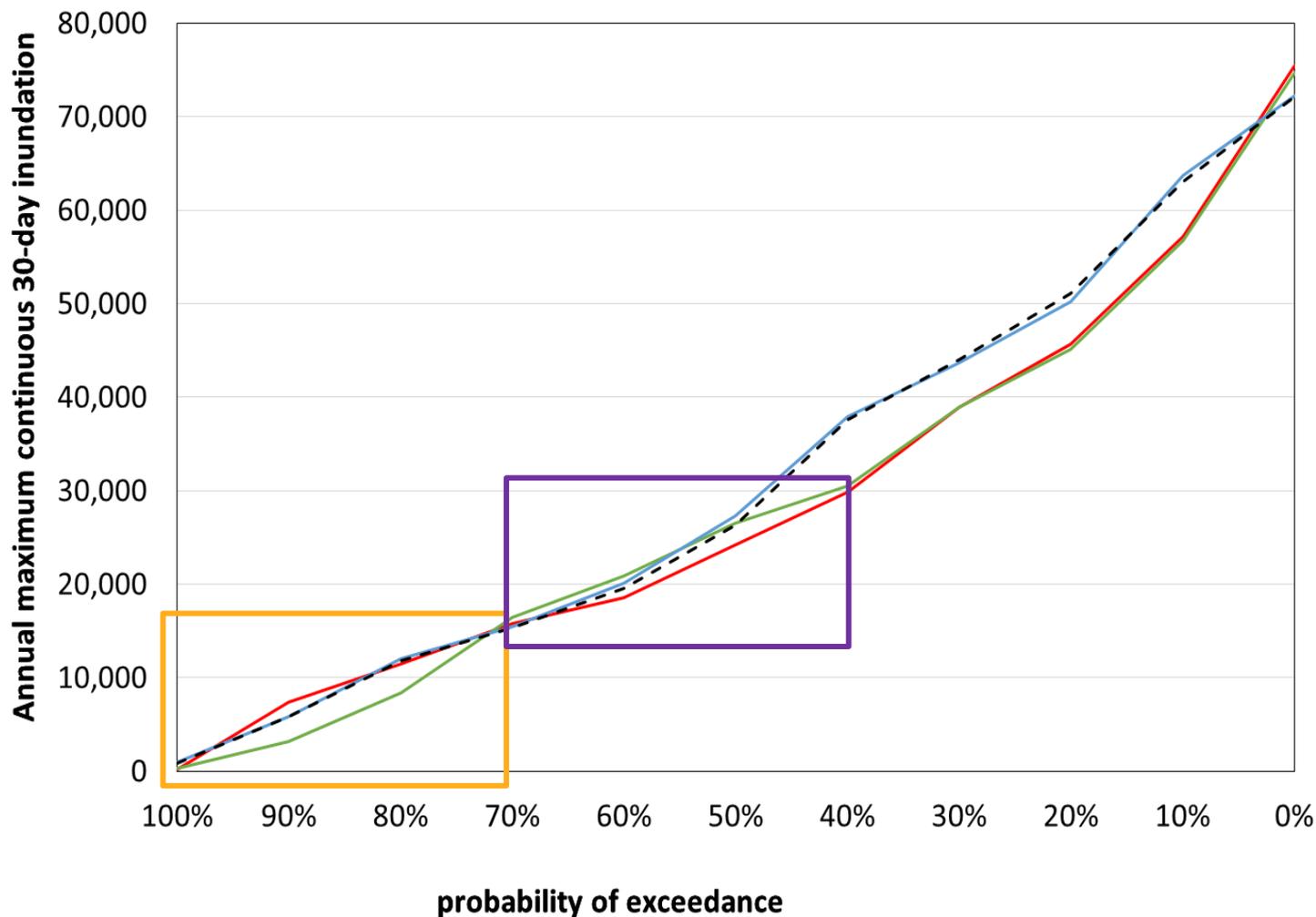
Metric ID	Hydroecological Metric Title	Species Ecology	Interpretation	WCM effect
M1				
M2	Floodplain Access for Spawning- % days inundated (Mar 1-Aug 15)	Host Fish Production	higher % days of floodplain inundation better for host fish	negative
M3	Floodplain Access for Spawning, 30-day inundation acres (Mar 1-Aug 15)	Host Fish Production	more acres inundated better for host fish	negative

# M3: Number of days between March 1 and August 15 with flows $>16,200$ cfs



- 93% to 84% under WCM
- 9% less chance that fish host won't spawn in the floodplain during the WCM

# M4: Max. acres cont. inundated for 30 days between Mar 1-Aug 15 with flows >16,200 cfs



- Avg. 433 ac/year (i.e., 6%) reduction under WCM
- In years with lower inundation, 2,794 ac/yr (38%) reduction
- In years with intermediate inundation, 1,169 ac/yr increase
- 9% less time and 6% less acreage for host fish recruitment

— STELLA-Baseline    — STELLA-WCM    — ResSim-Baseline    - - - ResSim-WCM

# Effect on fat threeridge population



- Recent work (Adam's talk) indicates population seems stable and may be increasing in lower and middle Apalach/lower Chipola
- Current estimates
  - 6 -18 mil; mean = 12 mil
- Flows 4,500 cfs-5,000 cfs
  - 0.09-1.2% mortality based on 3 previous instances <5,000 cfs
  - Assume 0.18% mortality = approximately 22,000 individuals
- Flows > 5,000 cfs
  - 0.07% mortality under RIOP
  - Assume 0.1% mortality = approximately 12,000 individuals
- Anticipated mortality due to low flows = 34,000 individuals

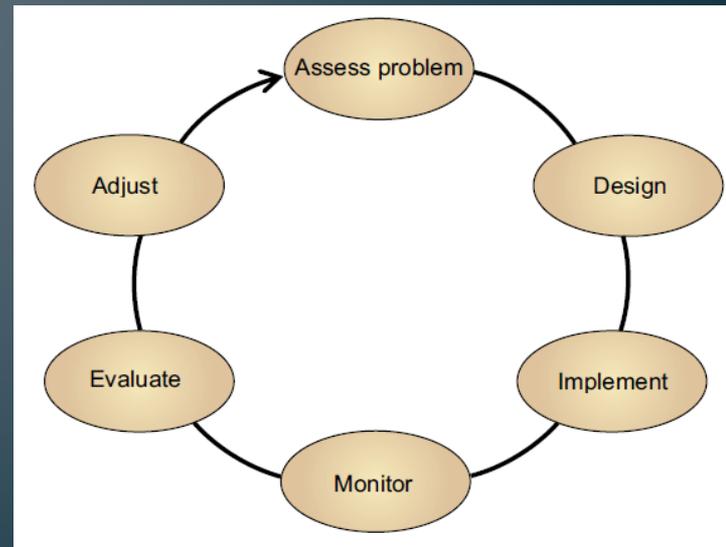
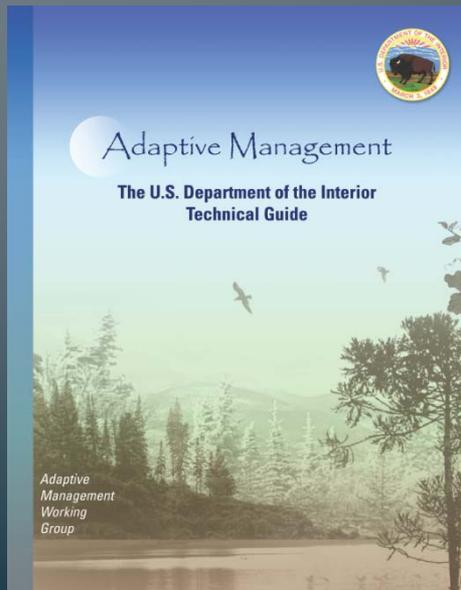
# Effects of WCM to critical habitat



- Permanently flowing water
  - Increase in probability of time at flows less than 5,000 cfs
  - Dewatered habitat is not permanently lost or habitat lost for conservation
- Fish hosts
  - Reductions in floodplain inundation and time inundated that limit fish recruitment & availability could negatively impact mussel recruitment
    - USACE will monitor frequency of conditions causing take; a year with less than 30 consecutive days of at least 31,000 ac of floodplain inundation between March 1 and August 15 will not occur more than once in the next five years
- Water quality
  - Additional data and modeling would be beneficial on this topic
    - USACE will monitor temperature, DO, salinity at 5 gages

# Adaptive management

- Develop and adaptive management framework for the basin that will incorporate new information
- Establish an Adaptive Management Technical Team (AMTT)
- Evaluate and refine avoidance and minimization efforts and monitoring for listed species based on input from AMTT



# Questions?



Download the Biological Opinion at:  
[www.fws.gov/panamacity/acf](http://www.fws.gov/panamacity/acf)