

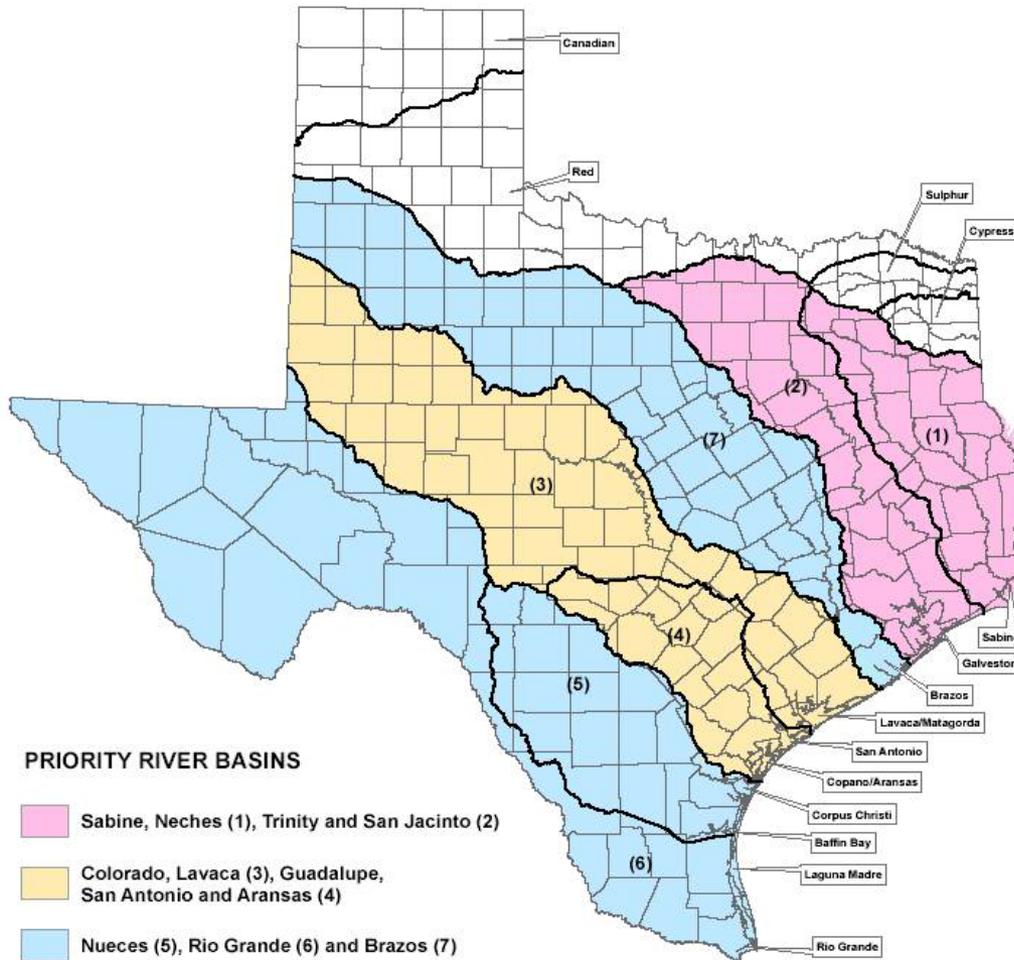
# Cypress Flow Project Environmental Flow Regime and Analysis Recommendation

Presentation to the Texas Environmental Flows Science Advisory  
Committee

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## PRIORITY RIVER BASIN AND BAY SYSTEMS



# SB3 Authority

In a “basin” for which there is no ongoing flow process, the law also allows:

“an effort to develop information on environmental flow needs and ways in which those needs can be met by a voluntary consensus-building process.”  
Sec. 11.02362(e).

# These recommendations

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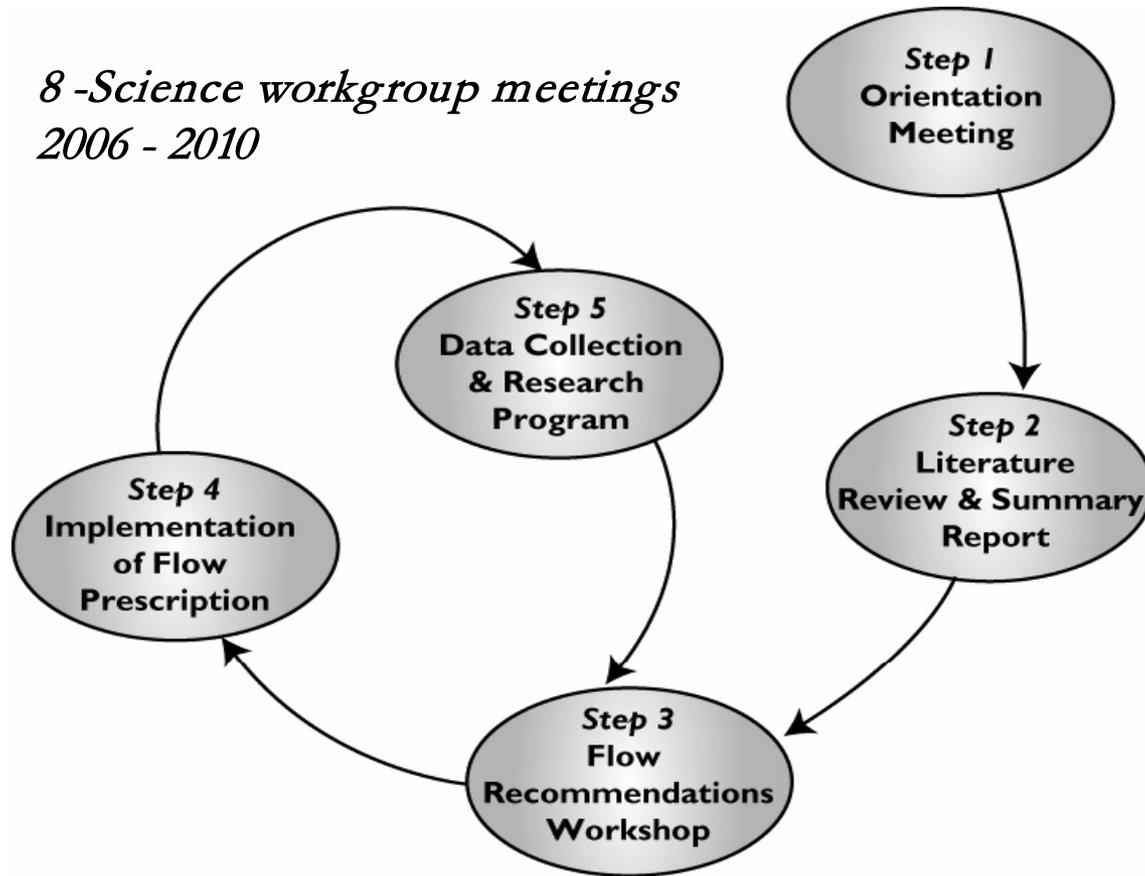
- ▶ Meet SB3 legislative mandate to develop an environmental flow “regime” and “analysis”
- ▶ Began as part of a Sustainable River Program project, however it aligns very closely with guidance provided by the SAC.
- ▶ Use best available science: thorough review and application of the current state of instream flow science, targeted data collection and analysis and best professional judgment
- ▶ Protect a sound ecological environment and weredeveloped based on a hydrologic analysis and the application of overlays for biology, water quality, geomorphology and connectivity to predict ecosystem response to flow.



# Process - Timeline

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*8-Science workgroup meetings  
2006 - 2010*



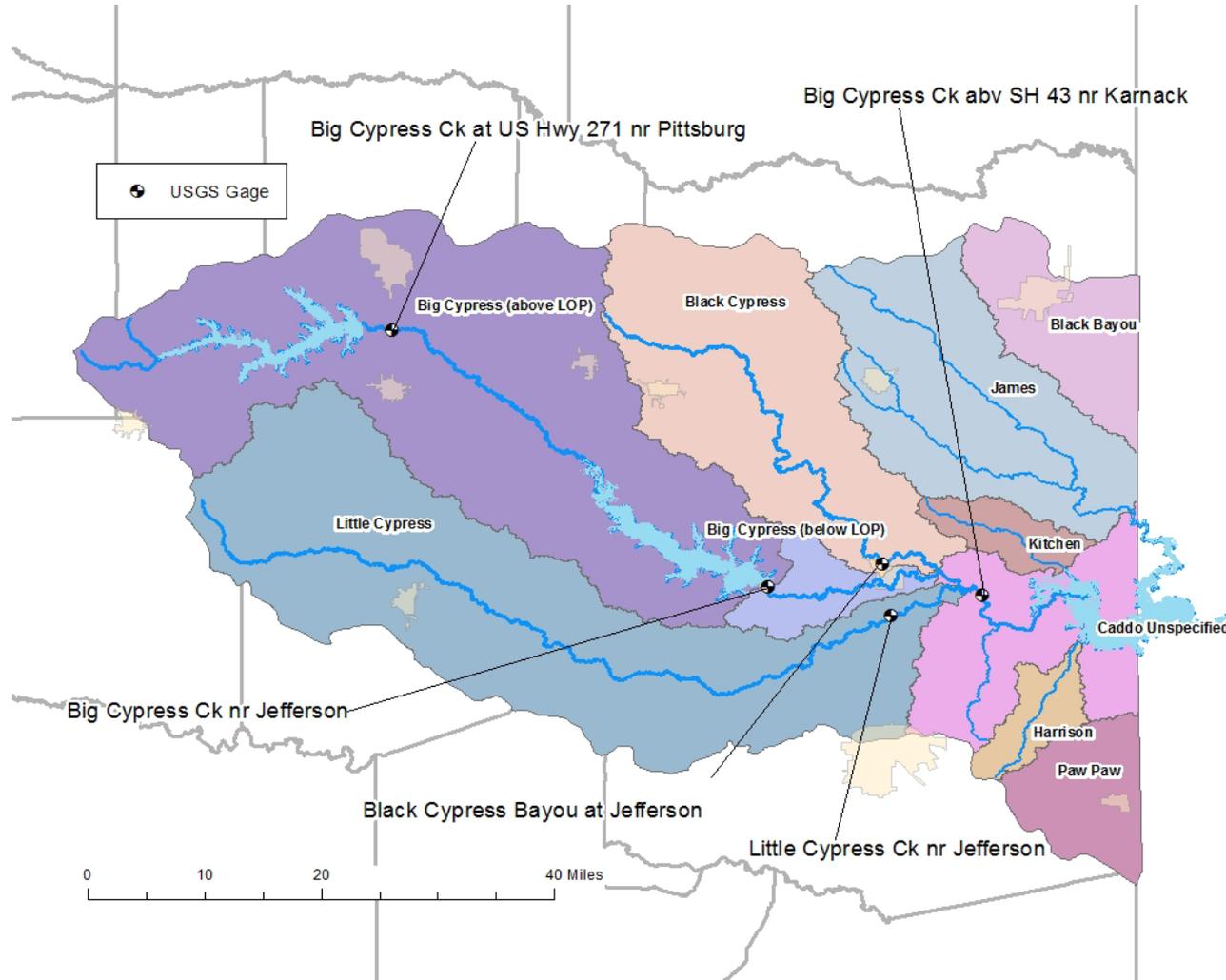
*December 2004*

*April 2005*

*May 2005, October 2006 & December 2008*



# Geographic scope



# Building Blocks

## Instream Flow Building Blocks Big Cypress Creek

Floods

<p>20,000 cfs for 2-3 days Every 10 years *For channel migration</p>
<p>3,000-10,000 cfs for 2-3 days Every 3-5 years *Maintain aquatic habitat in floodplain *Riparian seed dispersal *Inhibition of upland vegetation for both creek &amp; lake *Seed dispersal *Vegetation removal</p>

3000 = flow that connects to oxbows and other off-channel wetlands upstream of Jefferson.

High Flow Pulses

<p>2,500 cfs for 2-3 days Every 2 years * For channel maintenance * Oxbow connectivity</p>
<p>1,500 cfs for 2-3 days 3-5X a year every year * 1 occurring in March for Paddlefish * Sediment transport * Waterfowl habitat flushing (Includes December)</p>

2,500 = about mean bankfull over the reach studied.

2-3 days = peak period for high-flow and floods.

Low Flows

Maintain biodiversity and connectivity (backwater & oxbows)											
396	500	536	445	264	140	70	41	40	49	94	275
Pre-dam median		Benthic drift & dispersal, fish spawning				Fish habitat			Pre-dam median		
268	347	390	330	150	79	35	40	40	40	90	117
Fish habitat		Spawning habitat			Maintain aquatic diversity			Fish habitat			
90	90	218	198	114	49	13	8.4	8.4	40	90	90

**Key**

- Wet Year
- Avg Year
- Dry Year

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

# Biology

## Life History

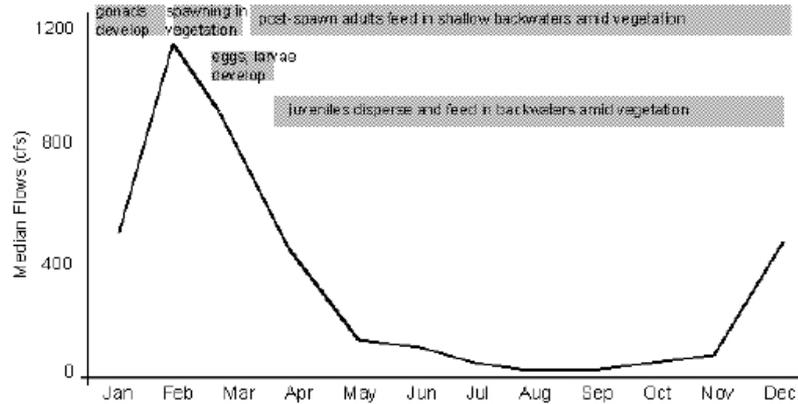
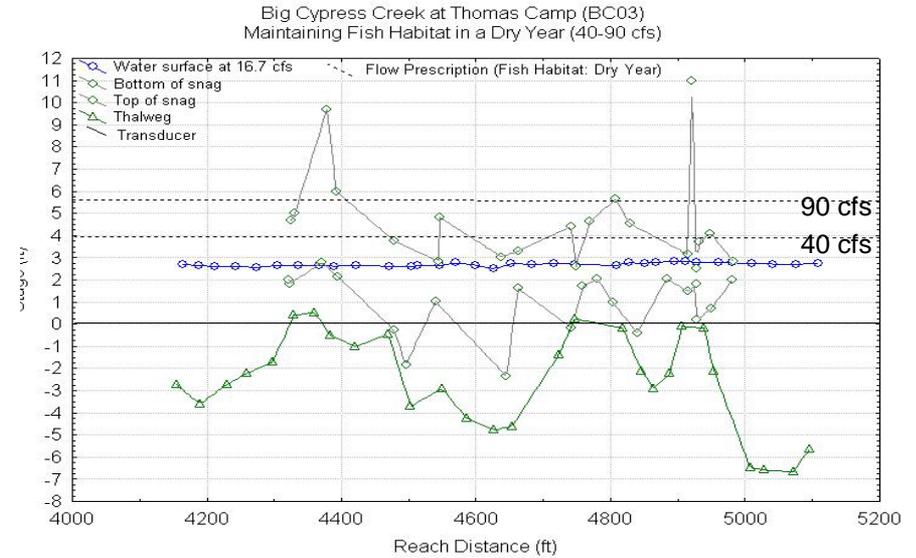
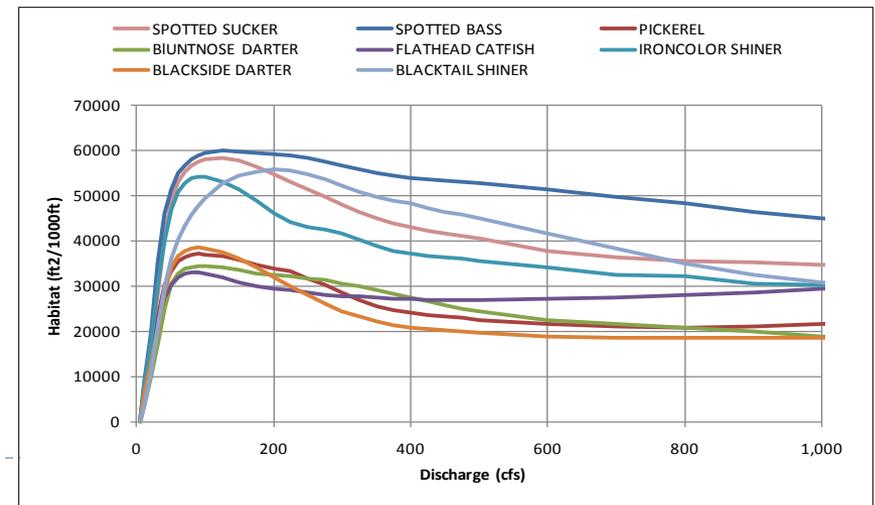
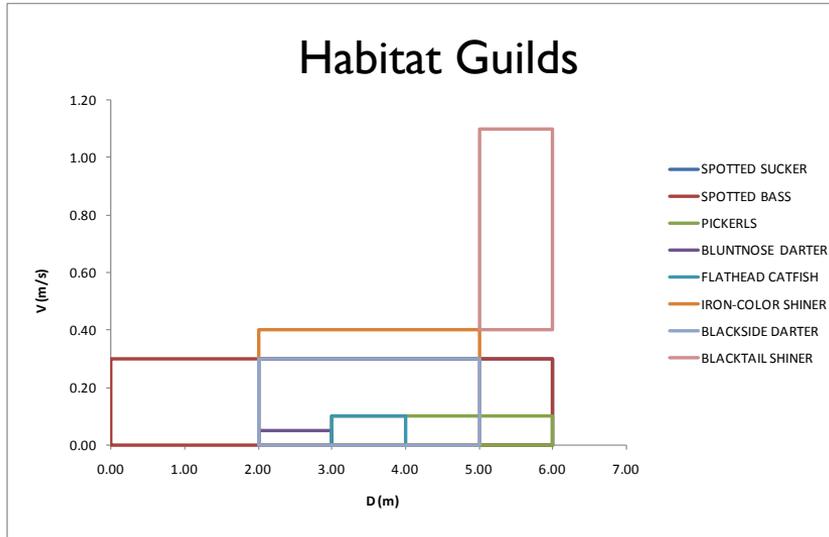


Figure 20. Chain pickerel (backwater-dependent species) life cycle in relation to seasonal flow (portrayed relative to pre-1957 median flows in Big Cypress Bayou).

## Field Surveys



## Modeling



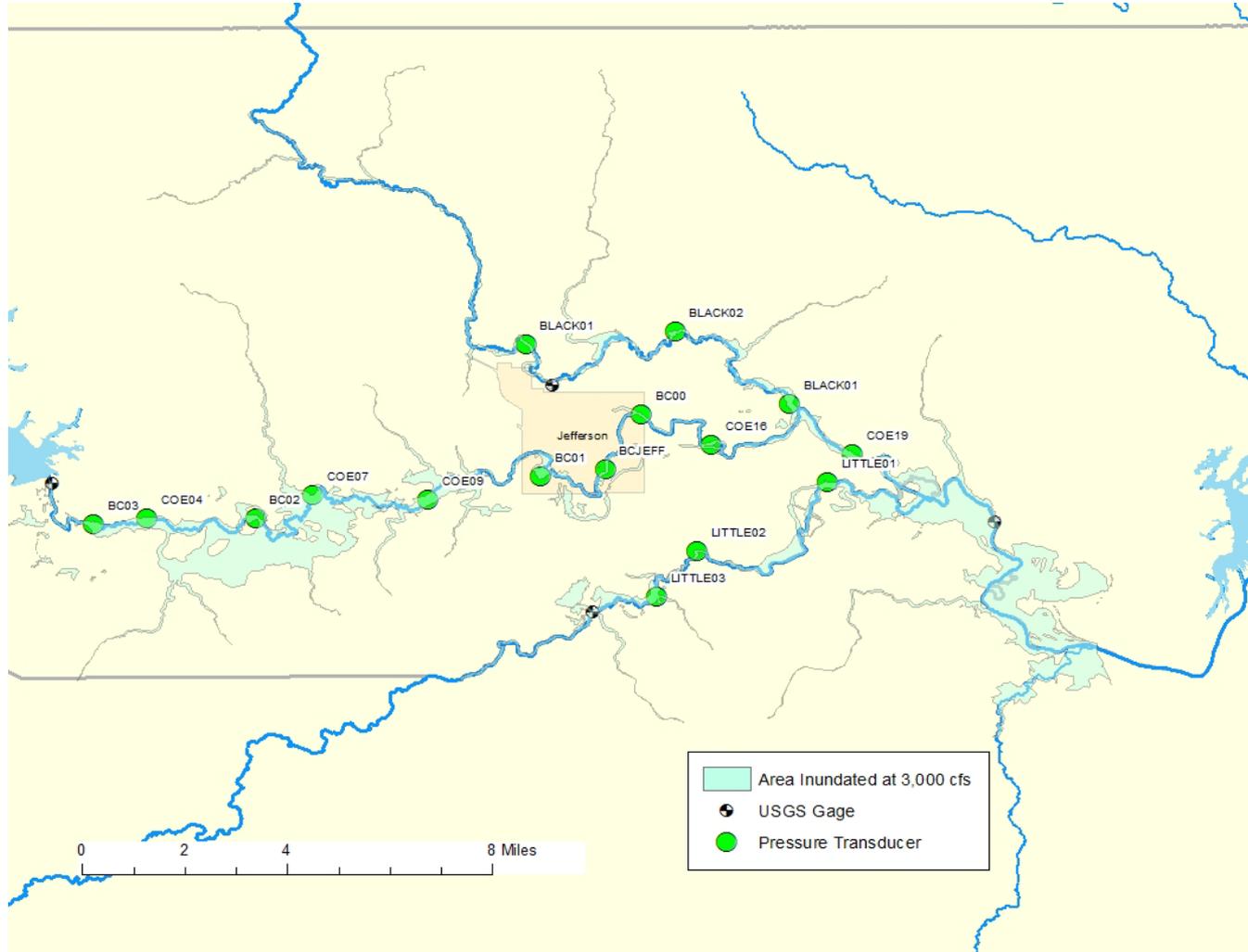
# Water Quality

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- ▶ Identify water quality constituents of concern
  - ▶ pH, mercury (in fish tissue), elevated bacteria, depressed dissolved oxygen concentration (DO) and nuisance vegetation
- ▶ Relationship to Flow Regime Components
  - ▶ *Subsistence* - Diurnal variation of DO
  - ▶ *Low Flow during Summer* - Change in temperature
  - ▶ *Pulses* - Flushing and refresh of pools or backwater areas
  - ▶ *Pulses* - Overbanking, interaction with maintenance flows; post-event influx of vegetation and organic matter
- ▶ Potential water quality modeling tasks
  - ▶ *Subsistence flows* – Daily and/or diurnal DO kinetic analysis
  - ▶ *Base flows* - Evaluate summer (Jul-Aug) low flows against 8.4cfs 7Q2 for Big Cypress



# Connectivity



# “all reasonably available science”

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- ▶ identified and described available data and utilized these data appropriately?
  - ▶ Texas A&M summary report, annotated bibliography and supplements
- ▶ novel research results?
  - ▶ not really followed natural flow regime paradigm using IHA (100+ applications worldwide), IFIM, floodplain inundation, and traditional geomorphology analyses
- ▶ respect to appropriateness for the basin, acceptance in the discipline, and consideration of alternatives?
  - ▶ significant amount of basin specific data. e.g. life history info for fish is generic, but the species selected as indicators are basin specific.



# “scientifically derived process for predicting ecosystem response to changes in flows”

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- ▶ parameters to define and delineate the ecological environment, specifically with respect to:
  - ▶ parameters measuring ecosystem “health”
    - ▶ Riverine dependent fish guilds, effective discharge, dissolved oxygen, wetland inundation
  - ▶ organisms selected
    - ▶ based on flow dependency and on habitat/reproductive guilds
  - ▶ habitats and their delineation
    - ▶ floodplain access and spawning cues based on life history literature, swift and slack water guilds defined by site specific sampling.
  - ▶ measures of ecological function
    - ▶ instream habitat availability, maintenance of water quality and sediment transport (SAC 2004) and riparian and watershed connectivity.
  - ▶ geographical variation within the basin
    - ▶ More strictly quantitative to narrative in moving from Big Cypress (highly regulated) to Little to Black (least impacted)
- ▶ quantitative or qualitative relations employed
  - ▶ ID- habitat model, inundation mapping, stream power calculations, review of water quality flow relationships



## “based solely on the best available science”

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- ▶ extraneous to the ecosystem, especially societal constraints, such as other water needs?
  - ▶ Other uses of water were not considered at all in the development of the flow regime. There were times when implementation issues were brought up (max. release from reservoir, downstream flooding) however these were always tabled for future discussion.
  - ▶ Recommendations took different forms, from strictly qualitative (Building Blocks) to more narrative or hybrid approaches. These decisions were made primarily in response to a science based understanding of the ecosystem needs but were also informed by implementability constraints and on the current state of the resources.



# “schedule of flow quantities reflecting seasonal and yearly fluctuations”

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- ▶ data on ecosystem measures in specifying flow levels
  - ▶ includes a full range of flows.
- ▶ multiple sites in the basin, or has a procedure for performing the necessary evaluations to derive such recommendations been prepared
  - ▶ complete flow regime recommendations were developed at three primary sites and a methodology was endorsed for development at other sites in the basin
- ▶ attainment frequencies
  - ▶ although the Cypress Workgroup did not take a vote on attainment frequencies, it was generally agreed that mimicking the historical attainments would be the goal and an analysis was performed to demonstrate how these might be achieved for Little and Black Cypress and the challenges this will present in Big Cypress.



“adequate to support a sound ecological environment and to maintain the productivity, extent and persistence of key aquatic habitats ”

- ▶ how is a sound environment defined and quantified
- ▶ assumptions regarding the current conditions
  - ▶ While recognizing that multiple factors maybe exerting a stress on the ecosystem (p. 10), changes in riverine fish and wetland plant community, water quality concerns and assumed changes in sediment transport would be restored or maintained by key flow regime components.
- ▶ **sensitivity/uncertainty**
  - ▶ addressed primarily in the section on the natural flow regime and through on-going adaptive management

