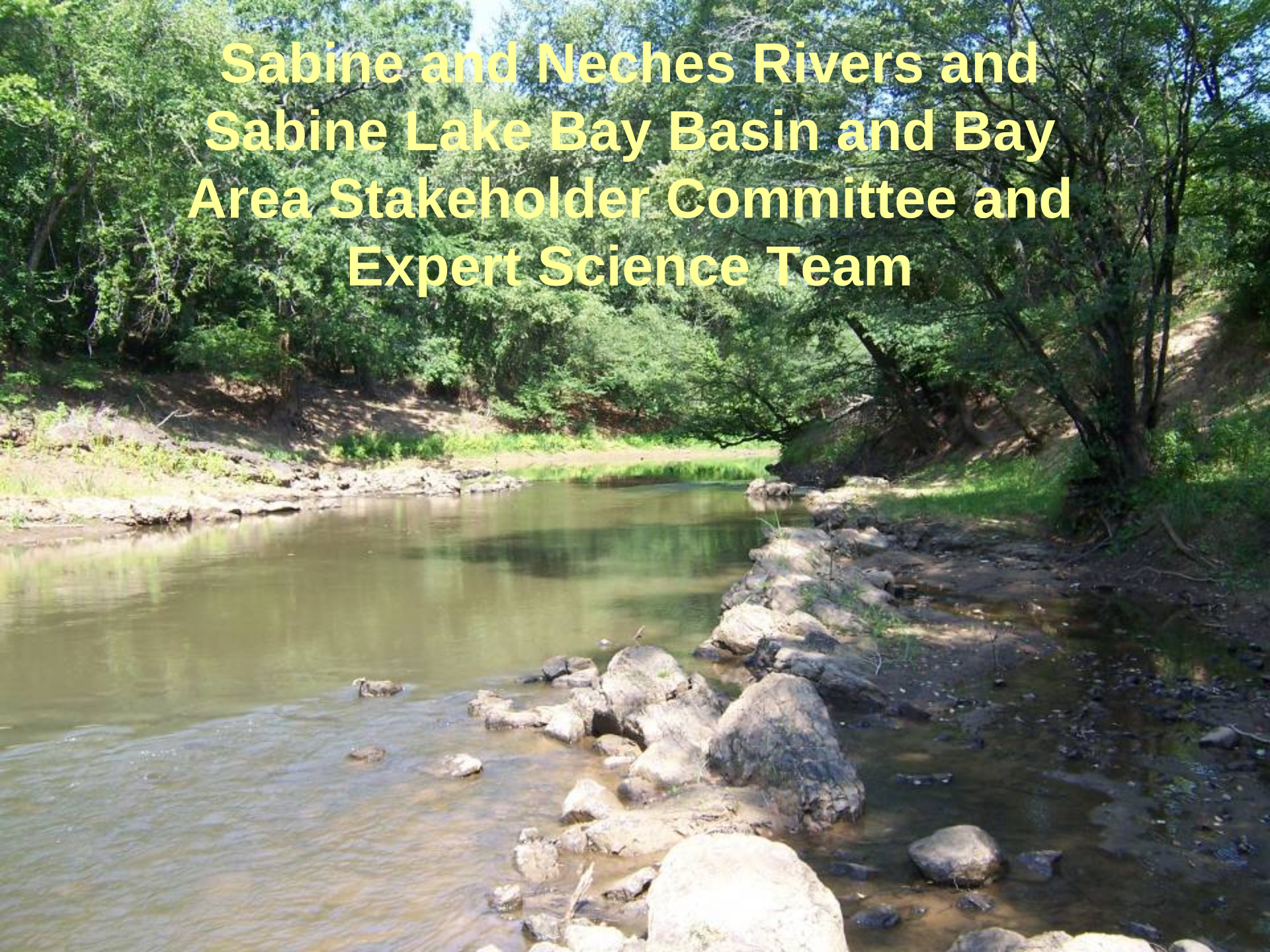
Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Area Stakeholder Committee and Expert Science Team



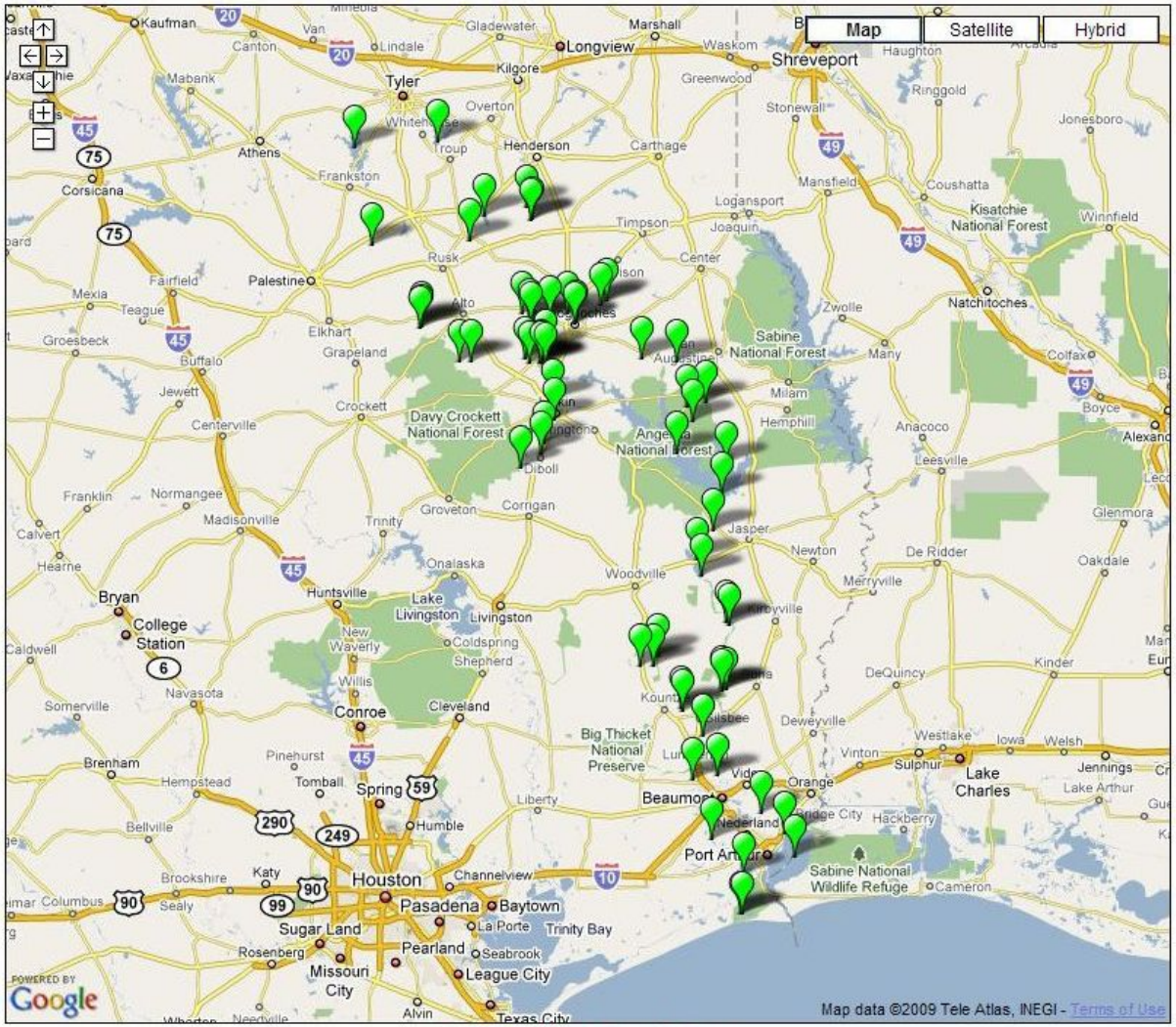
Environmental Flow Analysis – Available Data

- An extensive literature review was conducted by SFASU for the Neches and Angelina River Basins
- SRA also conducted an extensive review for the Sabine River.
- Agency personnel (TPW, TCEQ, TWDB) and the National Wildlife Federation also provided data from other basins and other studies

Angelina-Neches River Basin Bibliography Database

Texas Commission on Environmental Quality

Stephen F. Austin State University



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Waters of East Texas Center
Stephen F. Austin State University

Arthur Temple College of Forestry and Agriculture
Geographic Information Systems Laboratory

August, 2009

- Comprehensive literature review with TCEQ of all documents related to water quality, habitat, geomorphology, hydrology, and ecology
- Over 750 documents in Access Database with fully integrated searchable map.

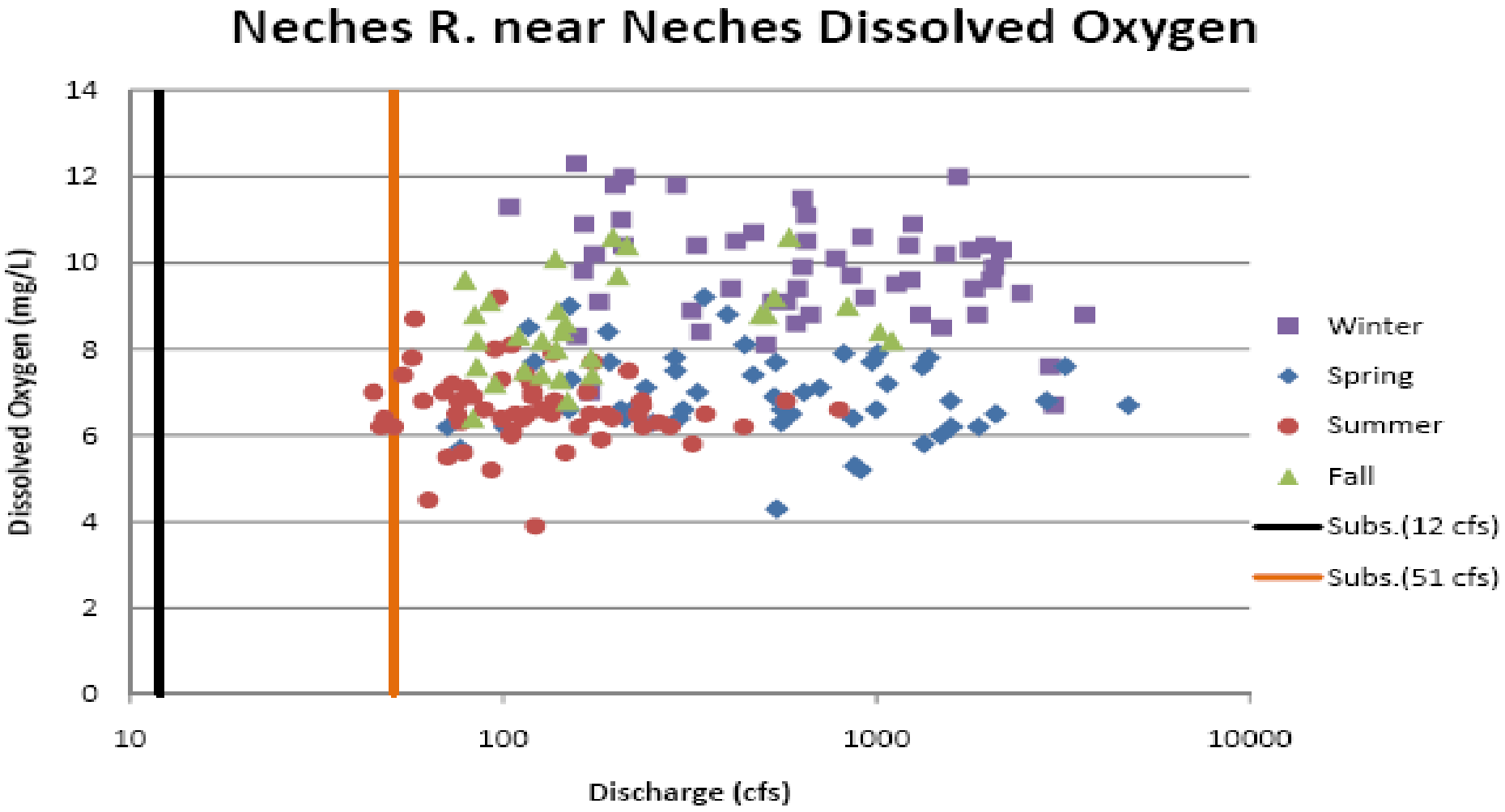
Environmental Flow Analysis – Available Data

- In spite of having all of this information available, several key deficiencies were noted (see Section 6 Unresolved Issues)
- “For example, the group agrees that it has set a certain bar for subsistence flows and at the same time agree that these flows are placeholders pending future studies and work which would provide information to fill data gaps.” (P. 101).

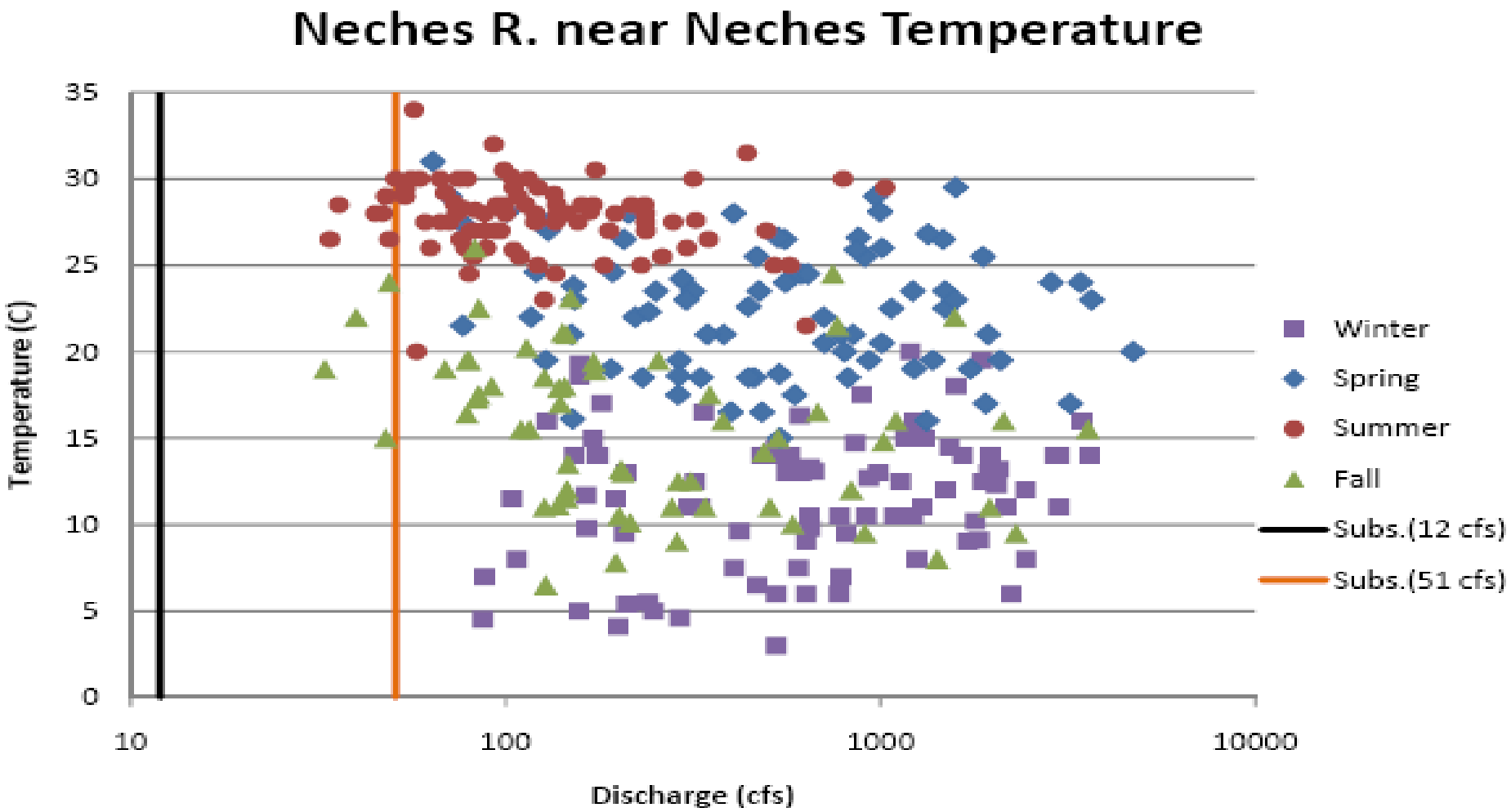
Environmental Flow Analysis – Available Data

- “Subsistence flows are infrequent low flows that occur during times of drought or under very dry conditions (TCEQ et al. 2008). The primary objectives of subsistence flows are to maintain water quality criteria and prevent loss of aquatic organisms due to, for example, lethal high temperatures or low dissolved oxygen levels. (SAC-2009-05, p. 7)

Environmental Flow Analysis – Available Data



Environmental Flow Analysis – Available Data



Subsistence Flows

- Subsistence flows are also important for
  - Providing life cycle cues
  - Providing refuge habitats
  - May help purge invasive species
  - Sustain a minimum level of connectivity between pools during dry times

Some ecological functions performed by instream flow regime components (adapted from Richter et al. 2006 and TCEQ et al 2008) and example evaluation approaches and level of effort associated with each approach (SAC-2009-05, p. 9)

Subsistence Flows – Ecological Role	**Evaluation Approaches (level of effort)**
Maintain water quality standards, i.e. suitable water temperatures, dissolved oxygen levels, and other parameters of water chemistry	7Q2 or other flow that protects water quality (low); existing water quality model (moderate); new water quality model (high)
Maintain critical aquatic habitats (e.g., riffles) and longitudinal connectivity	Visual observation (low); cross-section ratings and other hydraulic methods (moderate); habitat-based model (high)
Concentrates biota into limited space leading to increased predation, mortality, and other stressors	Literature review of life histories (low); biological sampling (moderate); bioenergetics and/or habitat models (high)
May shift community structure including changes in non-natives, lotic-adapted, and intolerant biota	Assemblage data analysis (low); biological sampling (moderate); population dynamics model (high)

Subsistence Flows

- Werner, F.T. 1982. Instream needs for the Sabine River below Toledo Bend. U.S. Fish and Wildlife Service Report, Houston, TX 34 pp.
  - Subsistence flow values recommended were comparable to 7Q2 values.
  - "During a drought year, flows should be provided which replicate previous low flow conditions, specifically the 7-day low flow which has occurred since 1968 or the recommended flow, whichever is less." (p. 25)
- However, 7Q2 has a two-year expected return interval which seems too frequent to be consistent with the adopted definition of subsistence flow.

Subsistence Flows

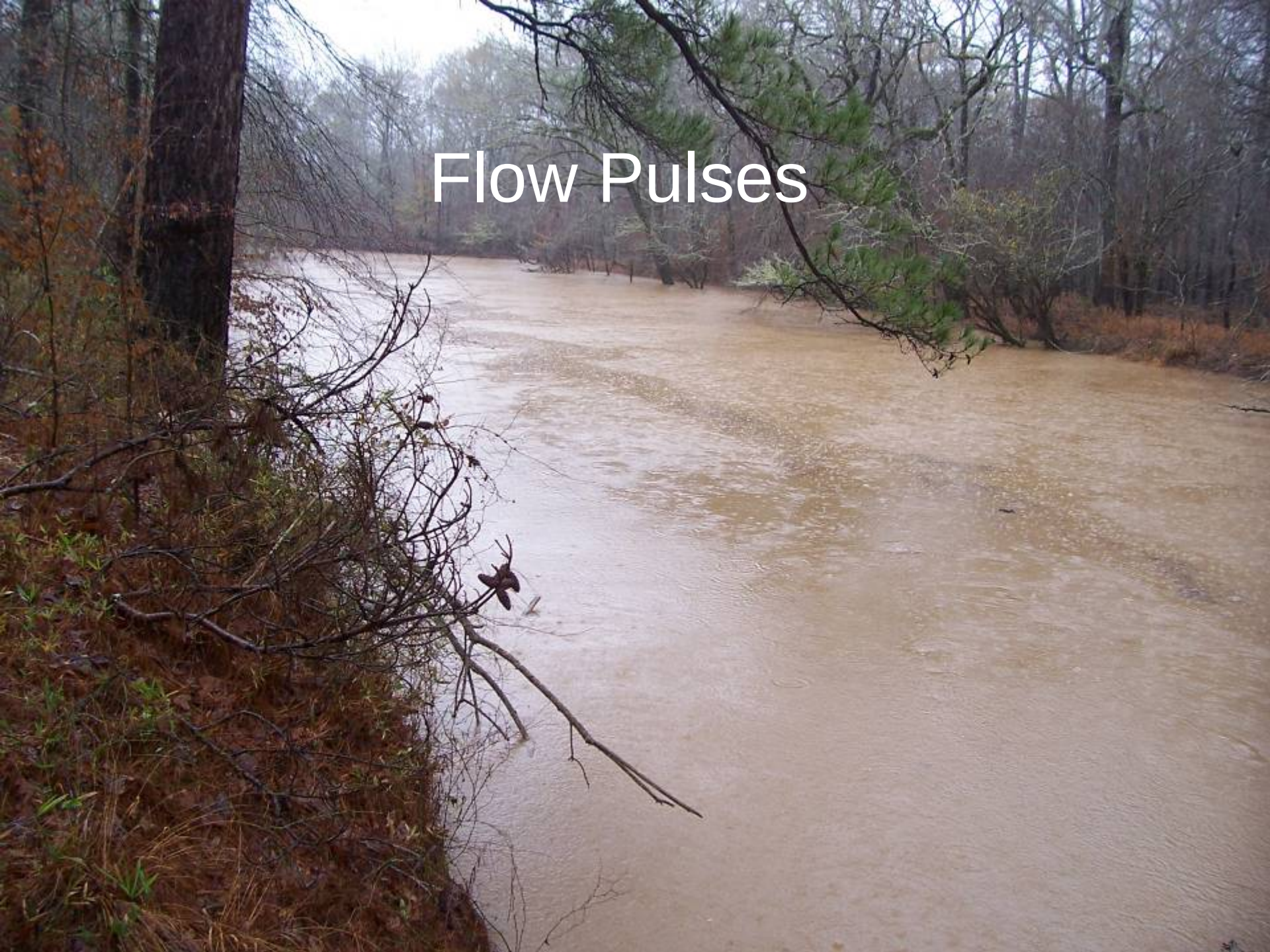
- Support also exists for Q95 (5th percentile)
  - "Q95 marks a significant point where below which conditions in the river change rapidly and hence the river is more sensitive to flow change." (Acerman and Dunbar, 2006).
  - Hardy and Addley (2006) used Q95 in the Klamath River as the ecological subsistence flow recommendation.
  - Bio-West (2008a) used the 5th percentile flow as a starting point for evaluating subsistence flow recommendations in the Colorado River.
- The biological sub-committee supported the 5th percentile as the appropriate placeholder pending future studies and work to fill this data gap.

Subsistence Flows

- HEFR-derived subsistence flows – median of the lowest 10 percent of historical base flows by season was adopted by the majority of the committee and was established as the flow recommendation by consensus as the place holder, while recognizing:
- “Active data collection and monitoring under subsistence flow conditions is recommended to more quantitatively assess the potential effects of extended periods of subsistence flows on native species.”
- Dry season flow pulses will be valuable as well.

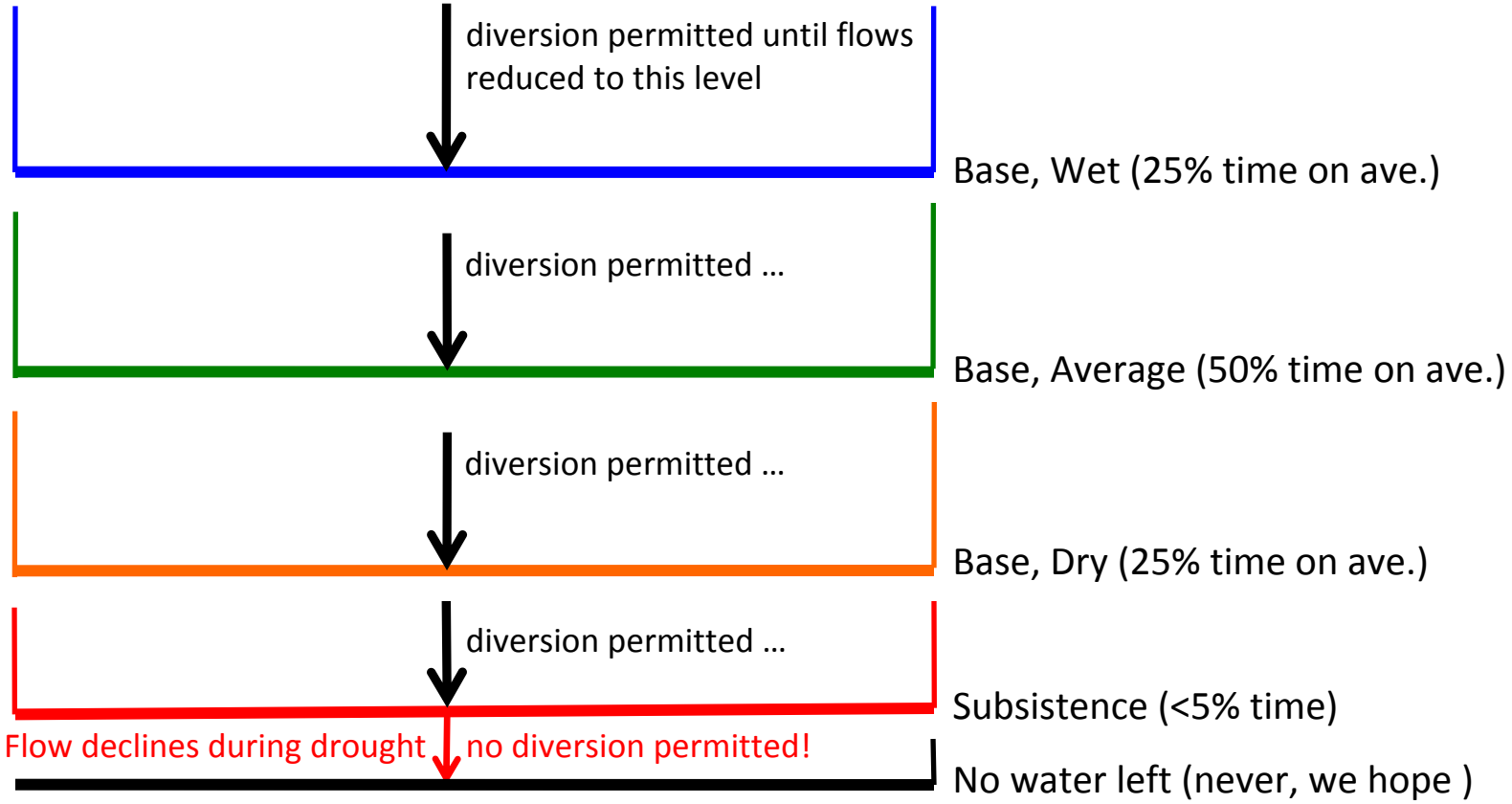
Subsistence Flows

- Diversion is permitted between dry base and subsistence values, raising the concern that subsistence flows may occur at a greater frequency than historically encountered.
- This could undermine the assumption of a sound ecological environment and may not be consistent with basic principles of sound ecological risk assessment.
- Once again, insufficient data and time prevented the committee from addressing this concern.


Flow Pulses

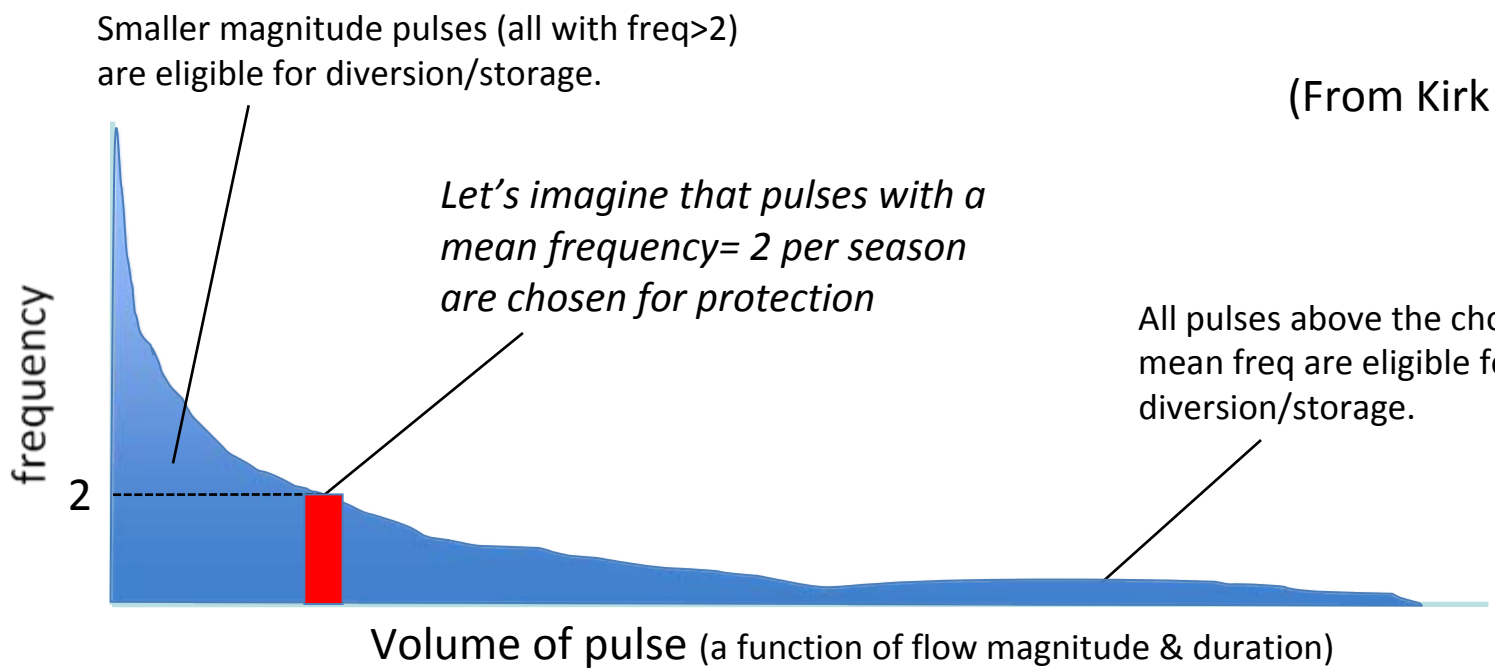
Interpretation of Subsistence and Base Flow Thresholds for Ecological Risk Management

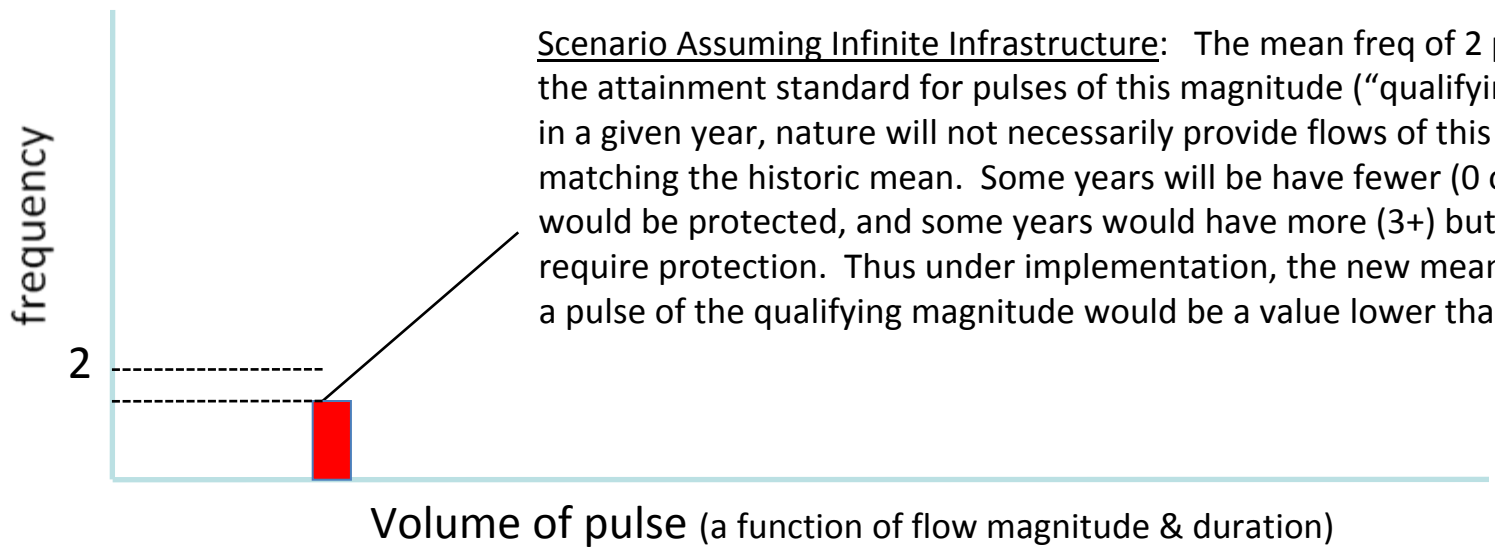
(From Kirk Winemiller)



Historic Seasonal Frequency Distribution of High Flow Pulses

(From Kirk Winemiller)





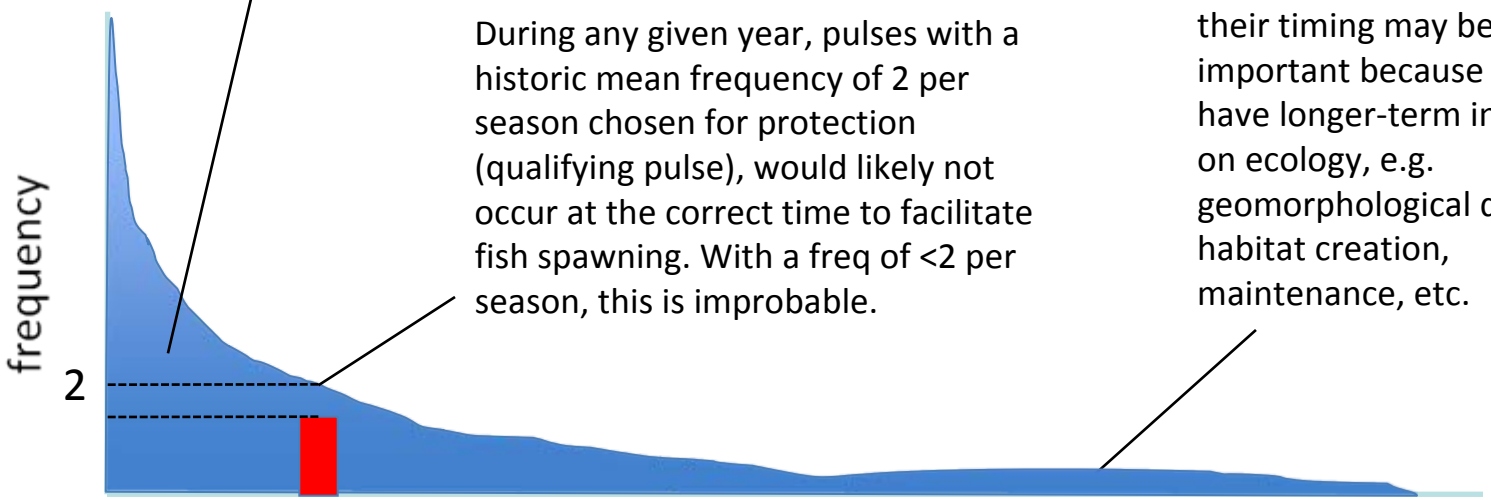
Scenario Assuming Infinite Infrastructure: The mean freq of 2 per season is the attainment standard for pulses of this magnitude ("qualifying pulse"), but in a given year, nature will not necessarily provide flows of this magnitude matching the historic mean. Some years will be have fewer (0 or 1) which would be protected, and some years would have more (3+) but only 2 would require protection. Thus under implementation, the new mean frequency for a pulse of the qualifying magnitude would be a value lower than 2.

(From Kirk Winemiller)

These smaller magnitude pulses have important functions on a yearly and often a seasonal basis. For example, pulses cue or trigger spawning by a great proportion of fish species, suspend silt so that fertilized eggs can survive on the substrate, etc. To eliminate these smaller but historically frequent pulses could be extremely harmful for population viability.

During any given year, pulses with a historic mean frequency of 2 per season chosen for protection (qualifying pulse), would likely not occur at the correct time to facilitate fish spawning. With a freq of <2 per season, this is improbable.

These infrequent high magnitude pulses have important functions, but their timing may be less important because they have longer-term influences on ecology, e.g. geomorphological dynamics, habitat creation, maintenance, etc.



Volume of pulse (a function of flow magnitude & duration)

Flow Pulses

- HEFR derived pulse flows (in bank) were used as place holders for flow recommendations.
- Further work should refine these values, particularly with reference to total volumes and durations.

Sabine Lake Estuary

- National Wildlife Federation and Texas Parks and Wildlife provided essential basic analyses.

Questions??