

# Environmental Flows Context of the Upper Nueces River Basin and Relationship to Hill Country Aquifers



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# Outline

- Ryan
  - Background, context, and available information by discipline
  - TNC work
- Darwin
  - U.S.G.S. study and preliminary results





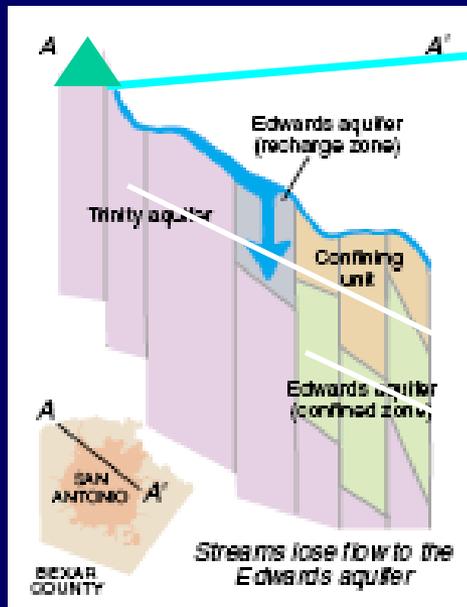
# Instream Flows Context



## Springs



## Streams and Rivers



groundwater contribution from Edwards (Plateau), Trinity

Human uses

From: Water quality in South-Central Texas, Texas, 1996-98 / by Peter W. Bush...[et al.]. p. cm. -- (U.S. Geological Survey Circular ; 1212)

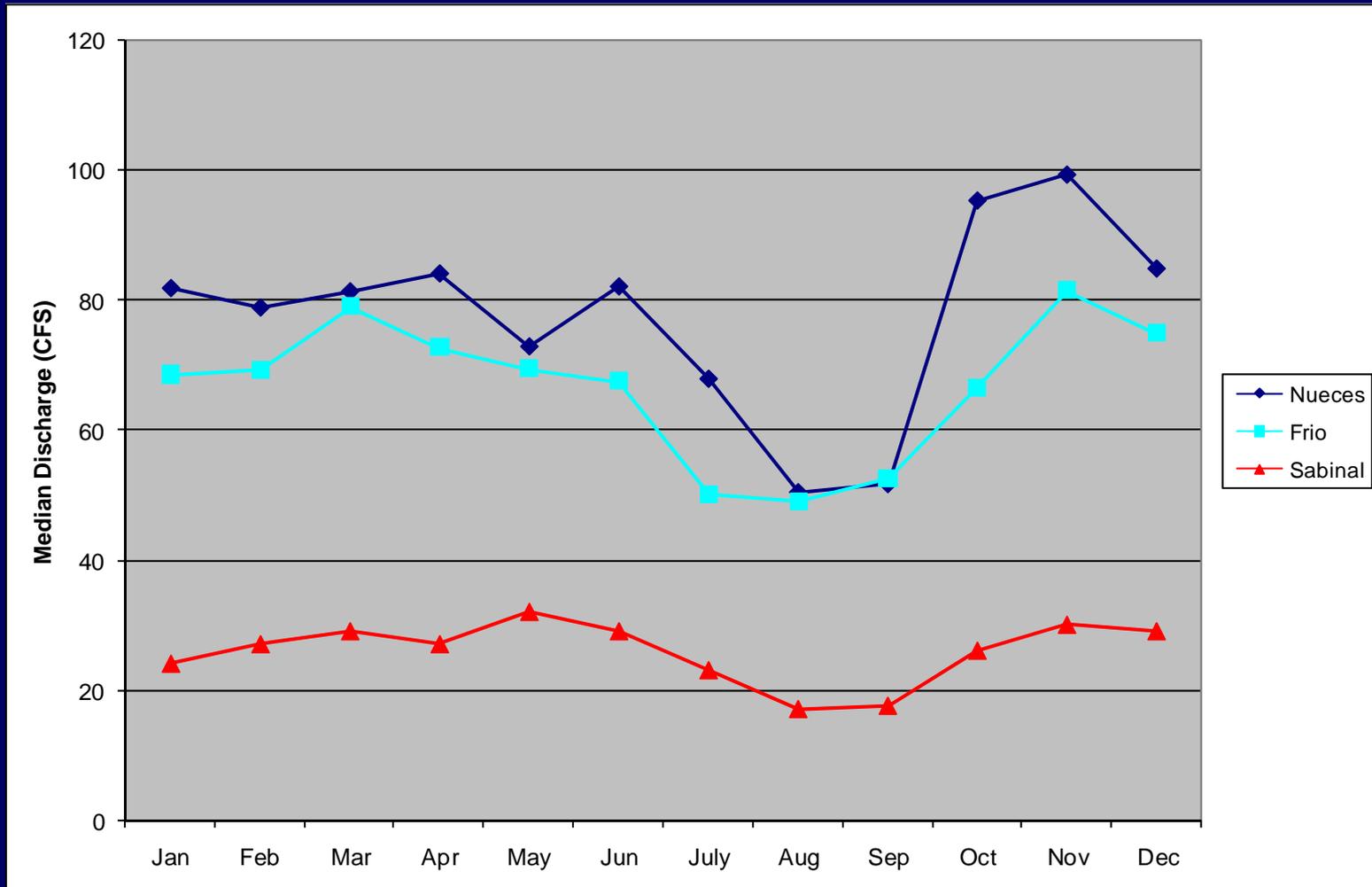
# Hydrology

- Data for HEFR: 8 USGS streamflow gages in upper basin
  - All but 2 are at the top of BFZ recharge zone
- Additional information, research
  - Wealth of information from EAA et al.
    - E.g., watershed models
  - USGS study
  - TNC Indicators of Hydrologic Alteration (IHA) analysis
  - More

# Hydrology

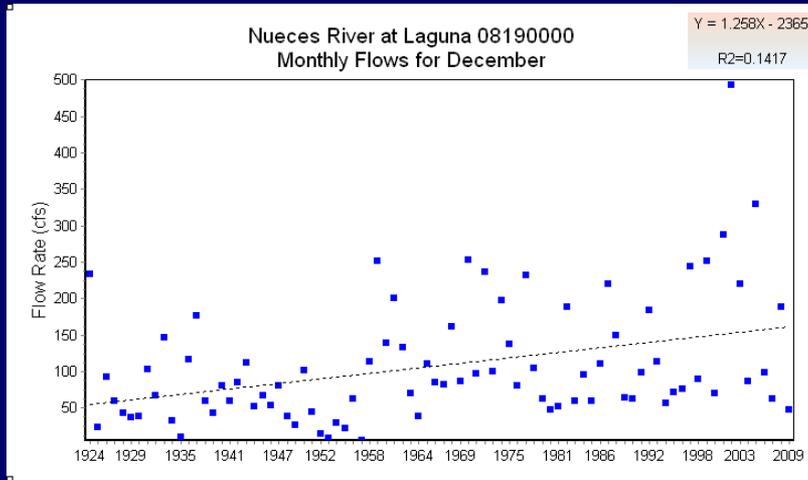
- IHA analysis
- 3 gages
  - Nueces River at Laguna (POR: 1923-present)
  - Frio River at Concan (POR: 1923-present)
  - Sabinal River near Sabinal (POR: 1942-present)
- Used defaults, entire period of record
- Drought of record

# Monthly Median Flow

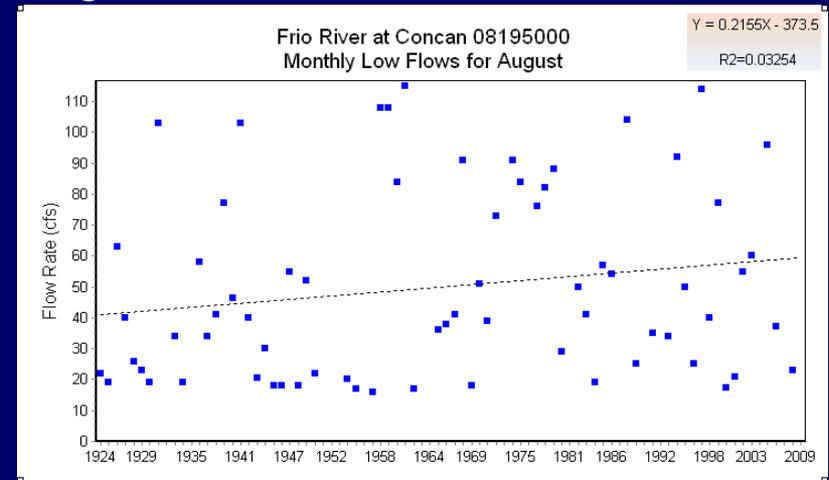


# Low Flow Trends?

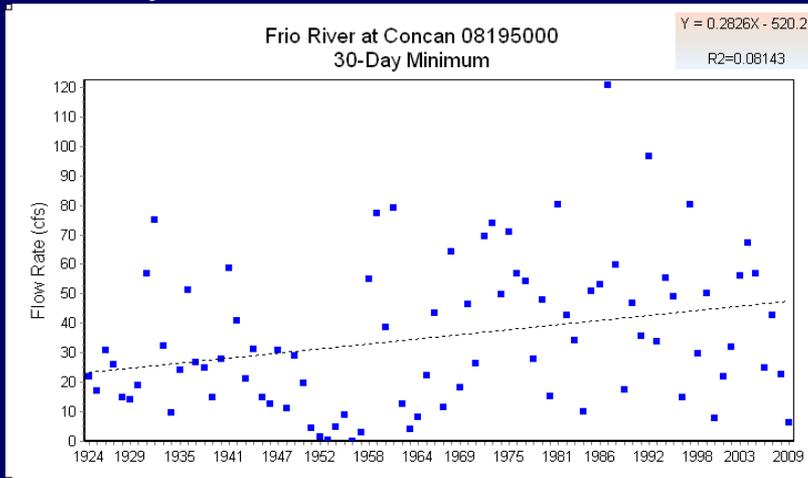
## December Median Flow



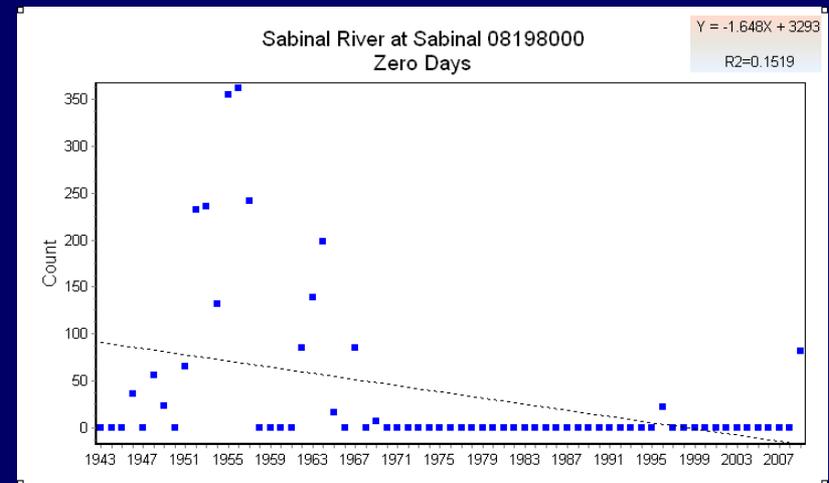
## August Low Flow



## 30-Day Minimum Flow

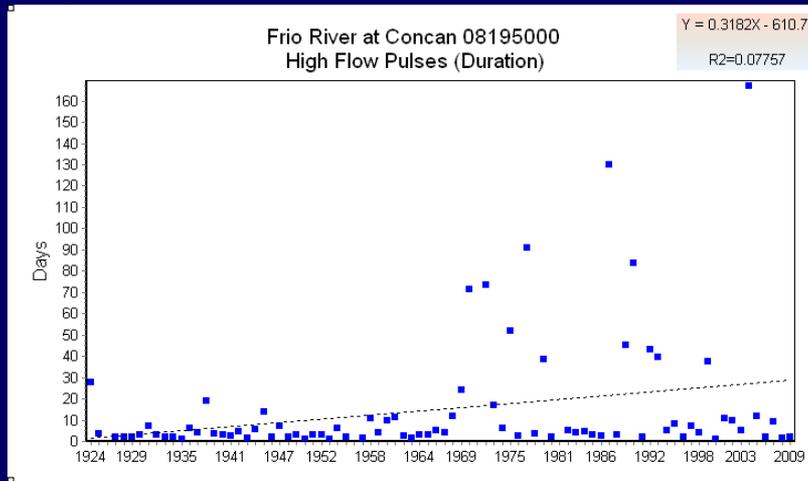


## # Zero Flow Days

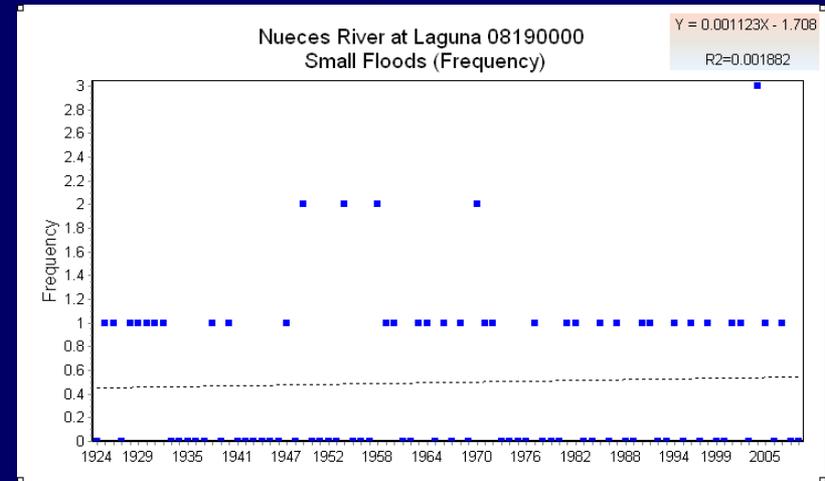


# High Flow Trends?

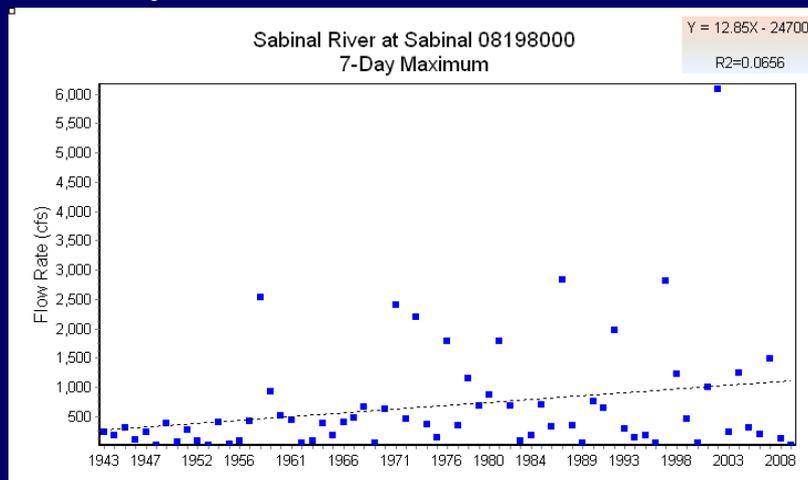
## High Flow Pulse Duration



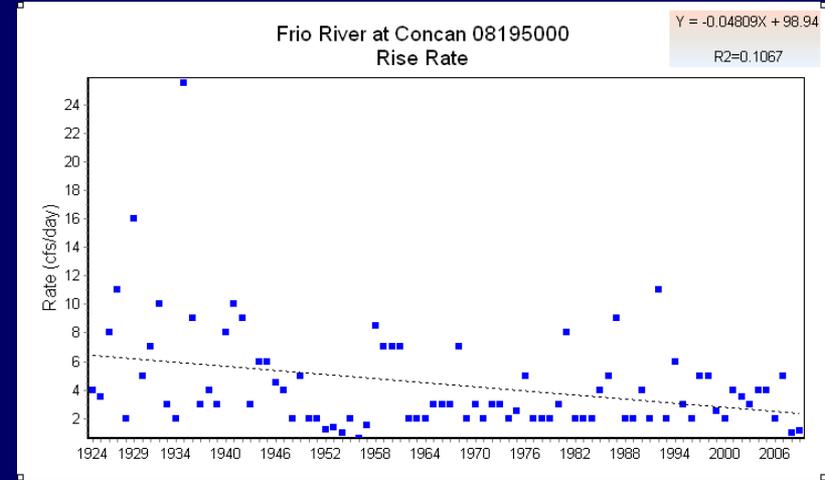
## Small Flood Frequency



## 30-Day Maximum Flow



## Rise Rate

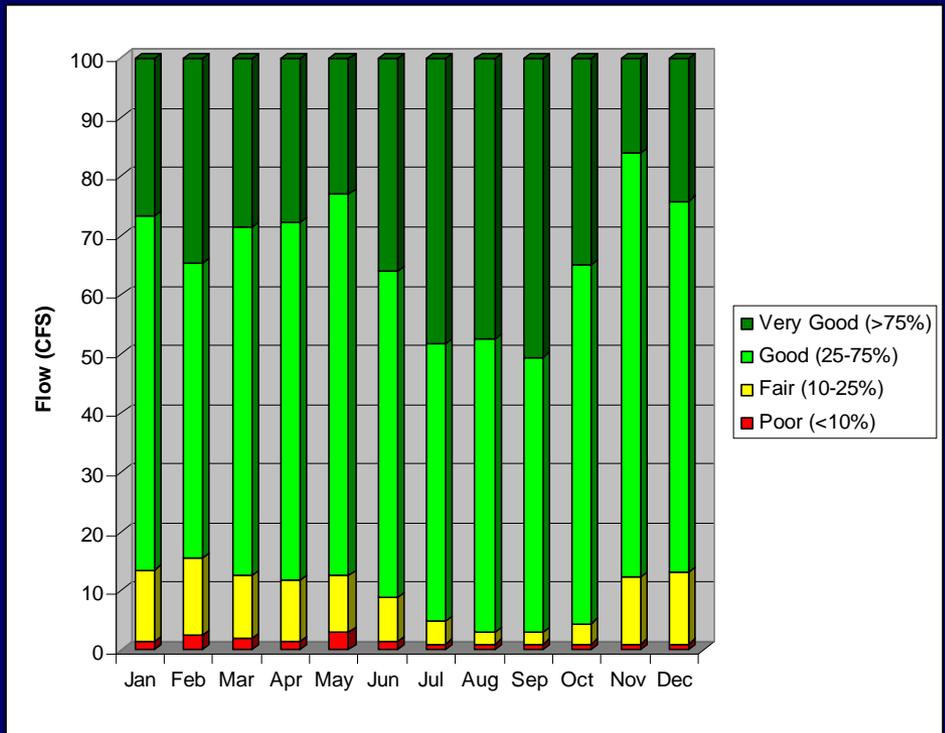


# Hydrology

- IHA Environmental Flow Components used to populate flow matrix
- Used in TNC-led conservation planning
  - Hydrology piece of ecological integrity assessment
    - Monthly low (i.e., base) flow numbers used to monitor base flow “status”

Monthly Base Flow Rating Thresholds for Average or Wet Hydrologic Conditions

Sabinal River At Sabinal, TX

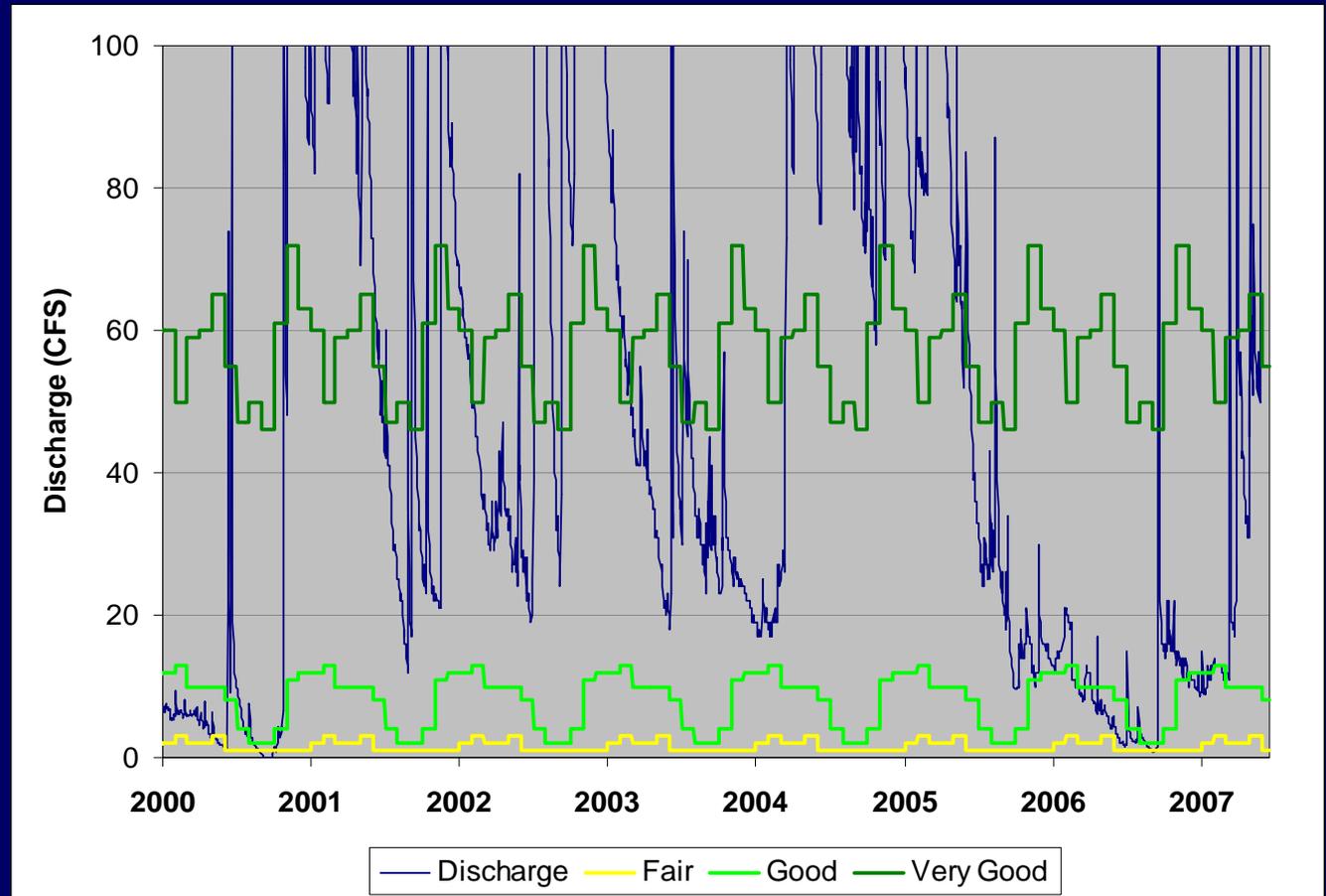


# Ecological Integrity

## Sabinal River – Monthly Base Flow

Daily Flow and  
Thresholds  
2000-2007

Sabinal River  
At Sabinal, TX



# Biology

- Flow-dependent species
  - Basin endemic fishes (Plateau shiner, Nueces River shiner, Nueces roundnose minnow)
  - Edwards Plateau species – greenthroat darter, Texas shiner
  - Spring-dependent species – spring salamanders
  - Guadalupe bass (introduced, but genetically pure)
  - Other fishes – e.g., gray redbhorse
- Riparian vegetation communities
- Mollusks? Other invertebrates?



# Biology

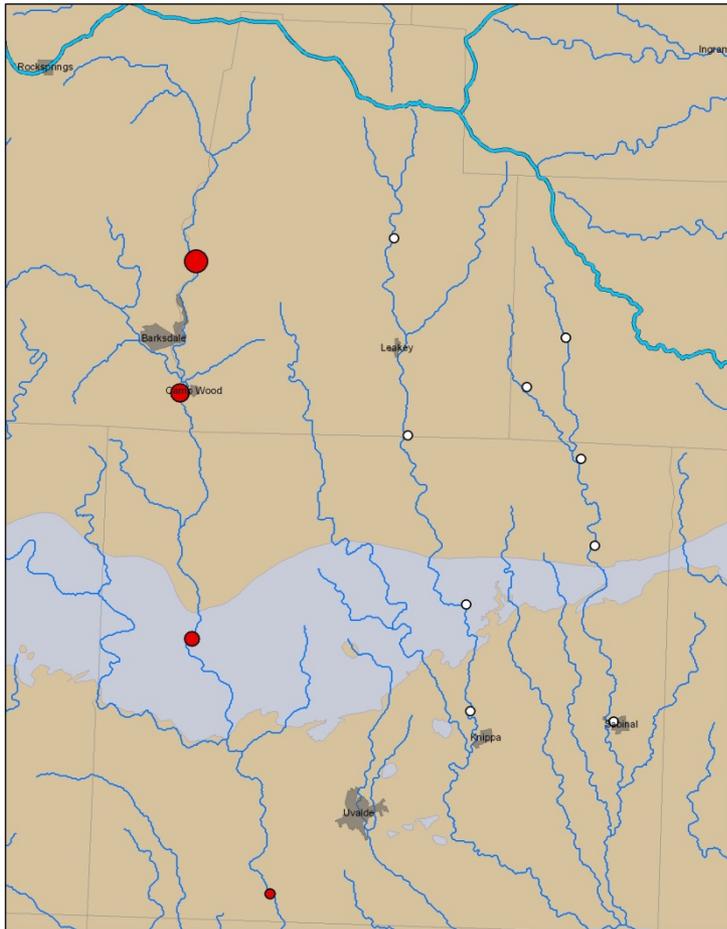
- No Nueces River basin habitat simulation or other flow-ecology work that I know of
- Little Nueces-specific habitat data or suitability criteria for fishes, etc
- Do have habitat data and HSCs for some spp. from other rivers that could be transferred
  - E.g., Bonner et al – Blanco, Pedernales, etc

# Biology – Endemic fishes

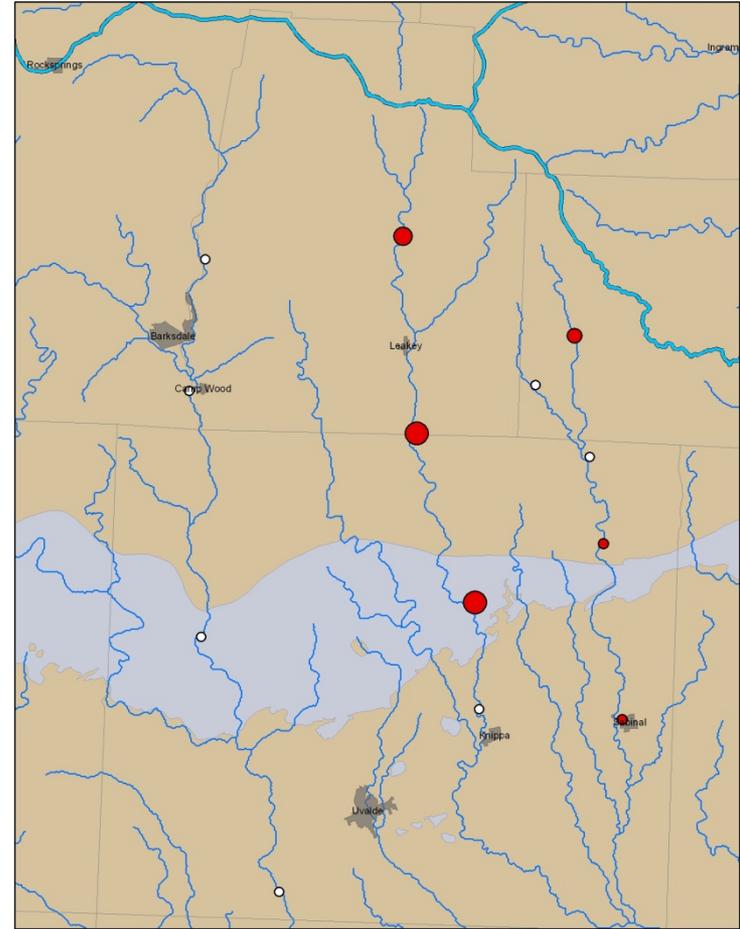
- Edwards et al. 2008
- Objectives
  - Determine status and range of 3 Nueces River basin endemic minnows
  - Evaluate habitat needs
  - Material for description of Nueces River shiner
- Proposed listings

# Edwards et al. 2008

Nueces River shiner

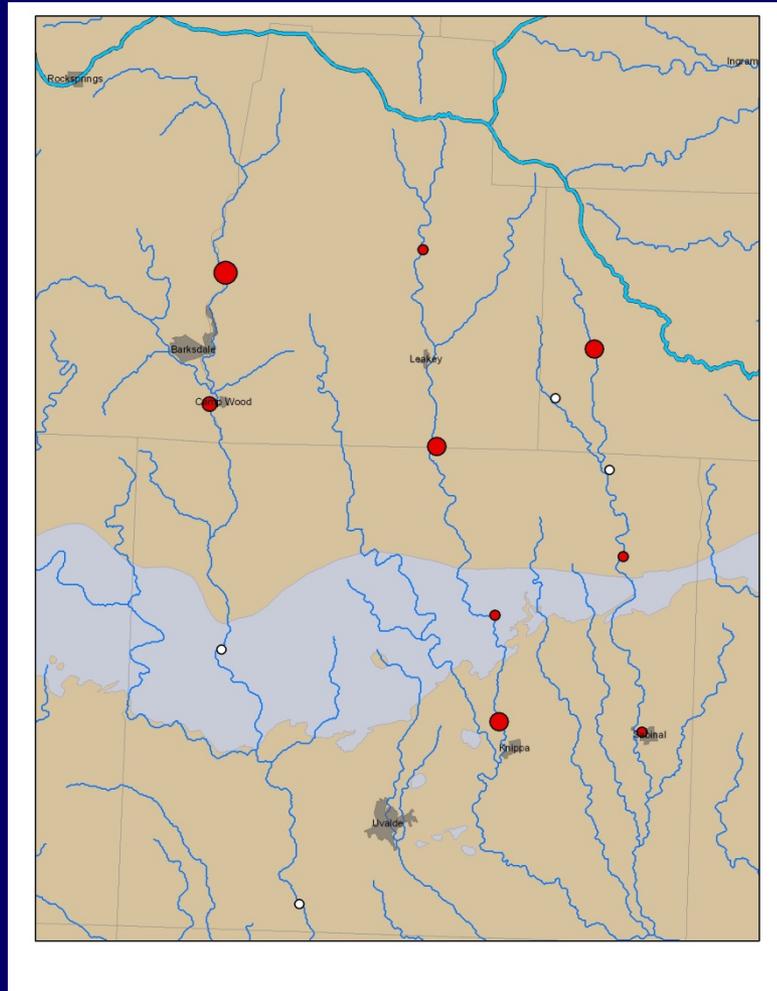


plateau shiner

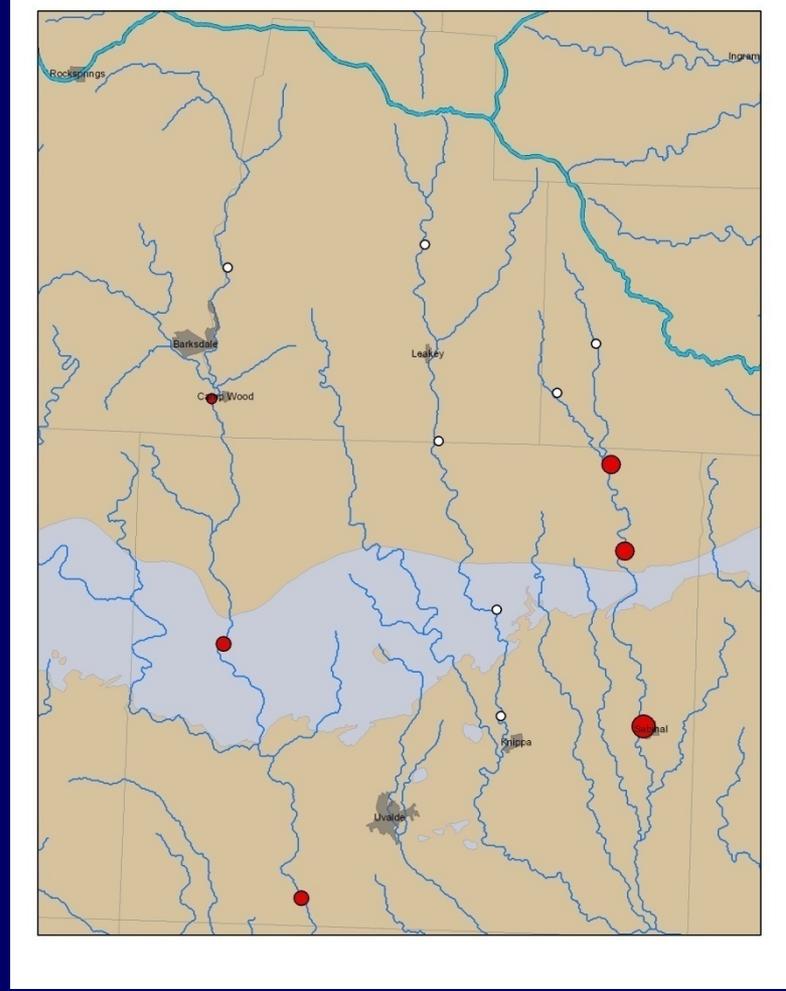


# Edwards et al. 2008

Nueces roundnose minnow



Guadalupe bass



# Water Quality

- Subsistence flow – published 7Q2's
- Clean Rivers Program – 5 segments in upper basin
  - 2111 Upper Sabinal River, 2112 Upper Nueces River, 2113 Upper Frio River, 2114 Hondo Creek, 2115 Seco Creek
- WQ impairments
  - 2010 – Upper Frio River (fish and macrobenthic community, carried forward from 2006 listing)
  - Former – Lower Sabinal River (nutrients?), Upper Frio (DO)

# Geomorphology

- Geomorphic setting
  - Steep slopes, confined valleys in headwaters
  - More floodplain, alluvial aquifer development lower
  - Sediment transport is an important process
- Transportation issue, control efforts
- Existing studies
  - e.g., Heitmuller et al. 2005 (bedload in EP rivers)