TEXAS

PARKS &

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Overview of Environmental Flows in Texas

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Article 1 SB 3/HB 3 Environmental Flows 80th Texas Legislature

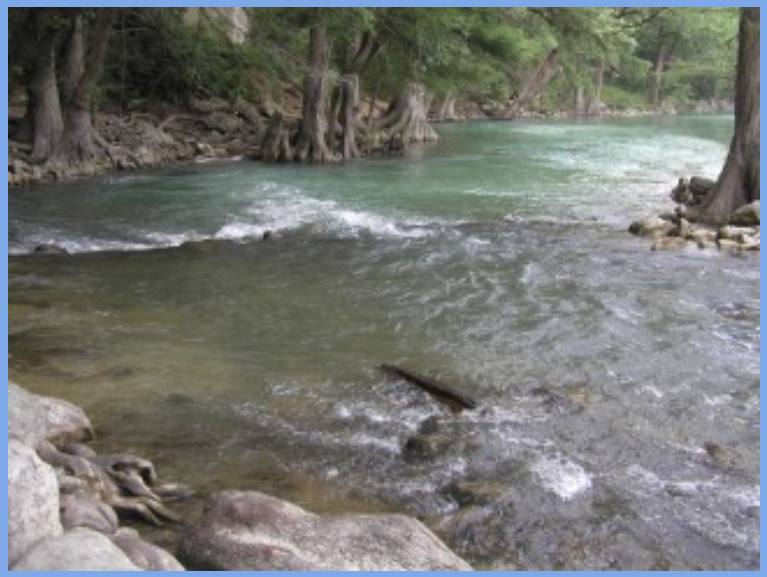
Senate Bill 3 and House Bill 3 set out a new regulatory system for protecting environmental flows; consensus-based regional approach involving a balanced representation of stakeholders

What are environmental flows?

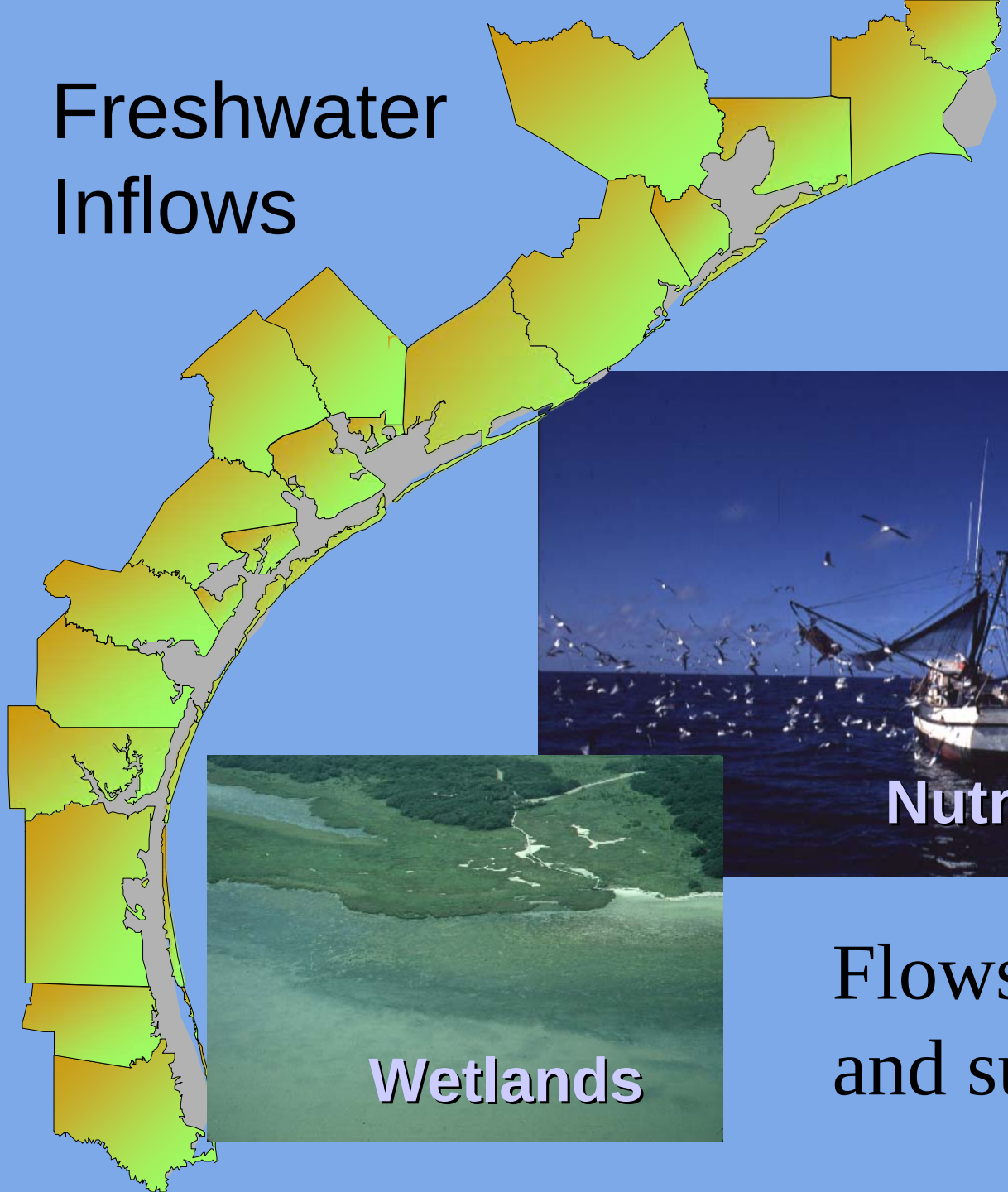
Flows that remain in the stream (instream flows). Instream flows provide for aquatic and riparian habitat; water quality protection; recreation; navigation; and freshwater inflows to bays and estuaries.

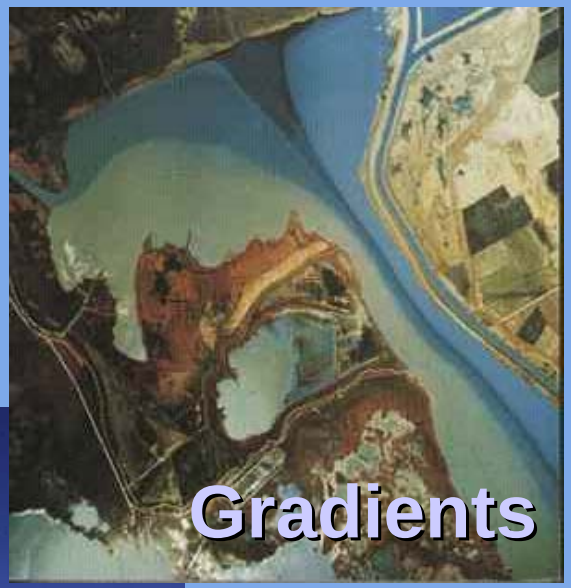
Instream Flows

- Instream flow is the amount of water running in a river, usually measured by volume moving down the channel in specified amount of time.
- A variety of instream flows are needed to maintain a healthy river.



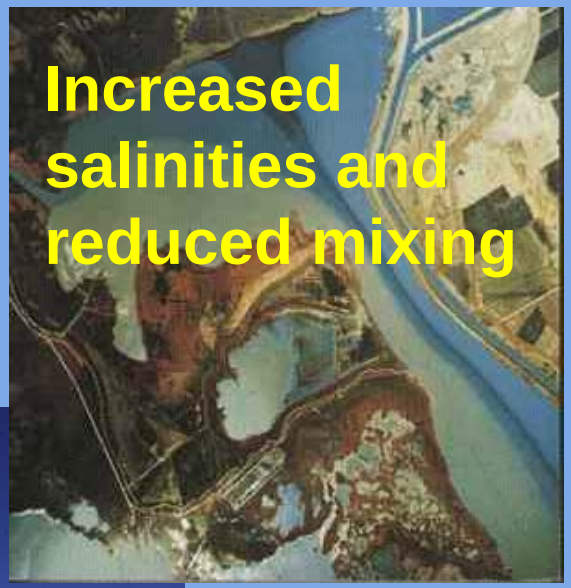
Freshwater Inflows

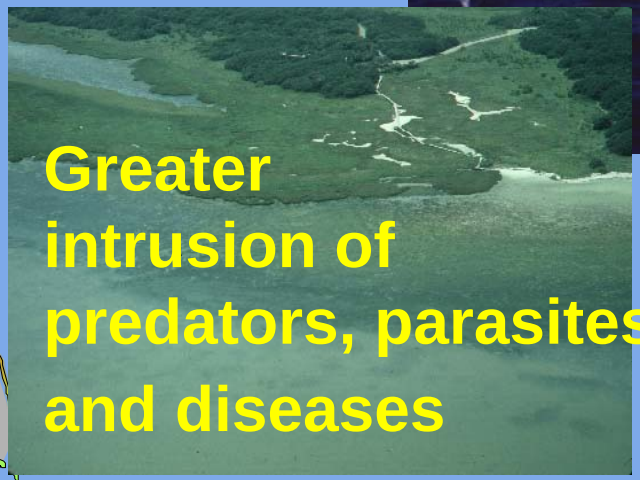




Flows which create and sustain estuaries.

Reduced freshwater Inflow can result in





changes to the estuarine ecosystem.

Why are environmental flows important?
(Ecosystem services)

Maintenance of native and rare species, biodiversity, and habitat

Water quality and assimilative capacity

Channel maintenance

Recreation

Economics

Aquatic Ecosystem Value

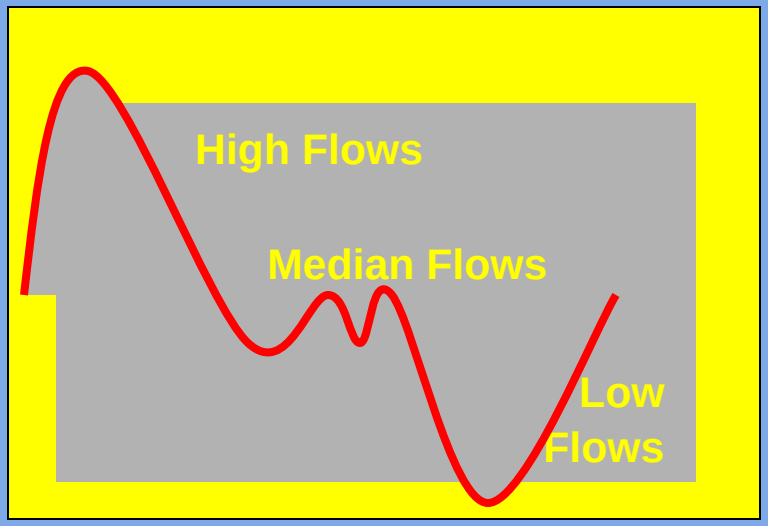
- **Rivers and streams provide habitat for 268 species of Texas fish**
- **91% of Texans polled felt protecting state's water resources "very important"**
- **Texas ranks 2nd nationally in angler days and money spent on fishing**
- **Sportsmen spend $6.6 billion per year in Texas**

- Analyses indicate that each dollar of bay and estuary related tourist and recreationist expenditure resulted in about $1.81 in total value of output, $0.75 of personal income, and $1.15 of value added in the regional economy. In addition, an employment multiplier of about 37 jobs per million dollars of tourist and recreationist expenditures is indicated by the analysis. (Tanyeri-Abur, et al. 1998)

Instream science: changing paradigm

- Standard setting – single flow value throughout the year (7Q2)
- Standard setting - some flow variability within the year (Lyons Method)
- Hydrology-based flow regime – uses hydrologic record to develop flow regime with inter and intra annual variation
- Instream flow study – (wading) boots in the water study linking hydrology, biology, water quality, geomorphology, physical processes

Environmental Flow Regime Definition

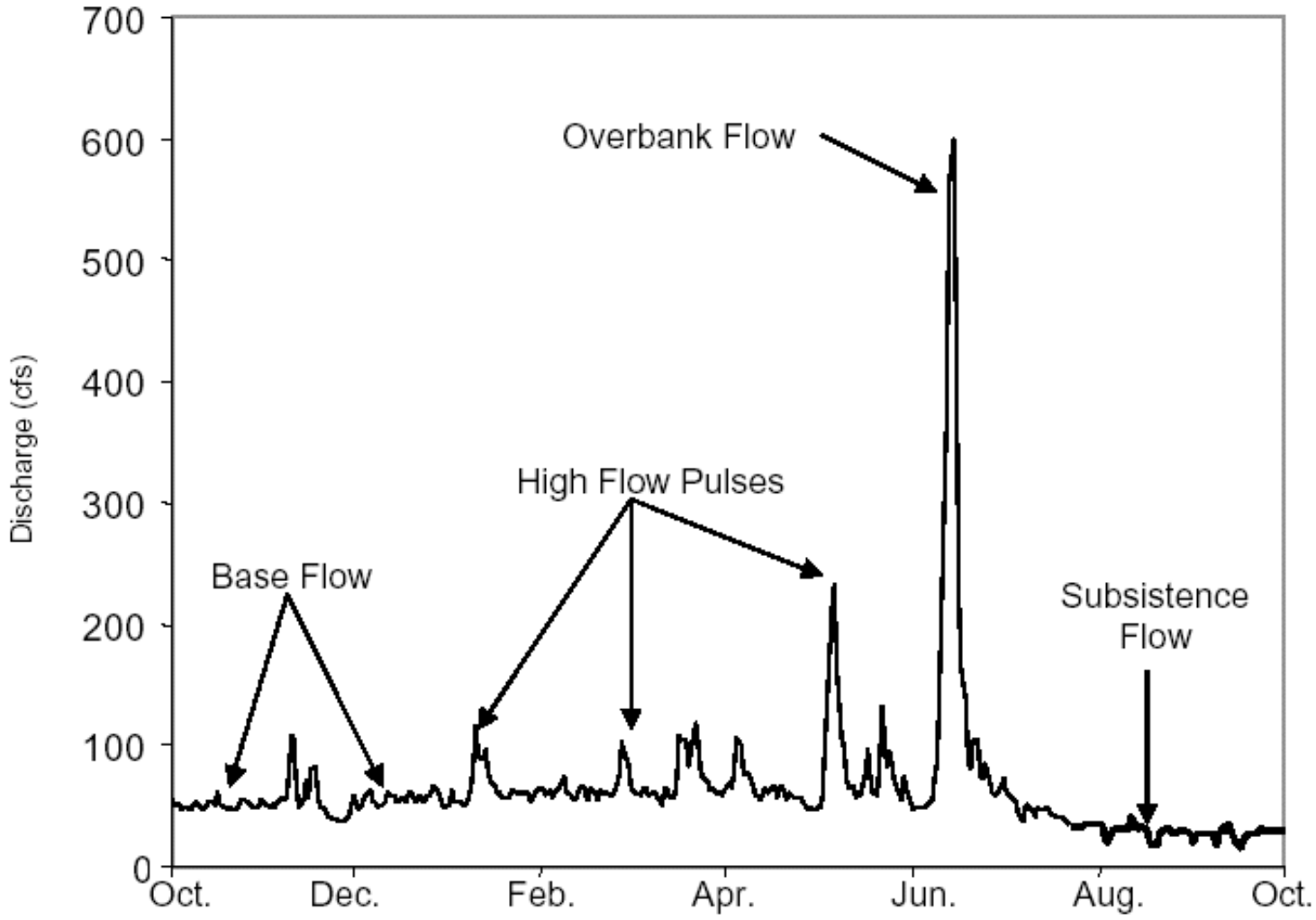


"A schedule of flow quantities that reflects seasonal and yearly fluctuations that typically would vary geographically, by a specific location in a watershed, and that are shown to be adequate to support a sound ecological environment and to maintain the productivity, extent, and persistence of key aquatic habitats in and along the affected water bodies."

Instream Flow Components

- **Subsistence flows: Infrequent, naturally-occurring low flows**
- **Base flows: Normal flow conditions between storm events**
- **High flow pulses: Short-duration, in-channel, high flow events, following storm events**
- **Overbank flows: Infrequent, high flow events that exceed the normal channel**

Instream Flow Components



Sound Ecological Environment

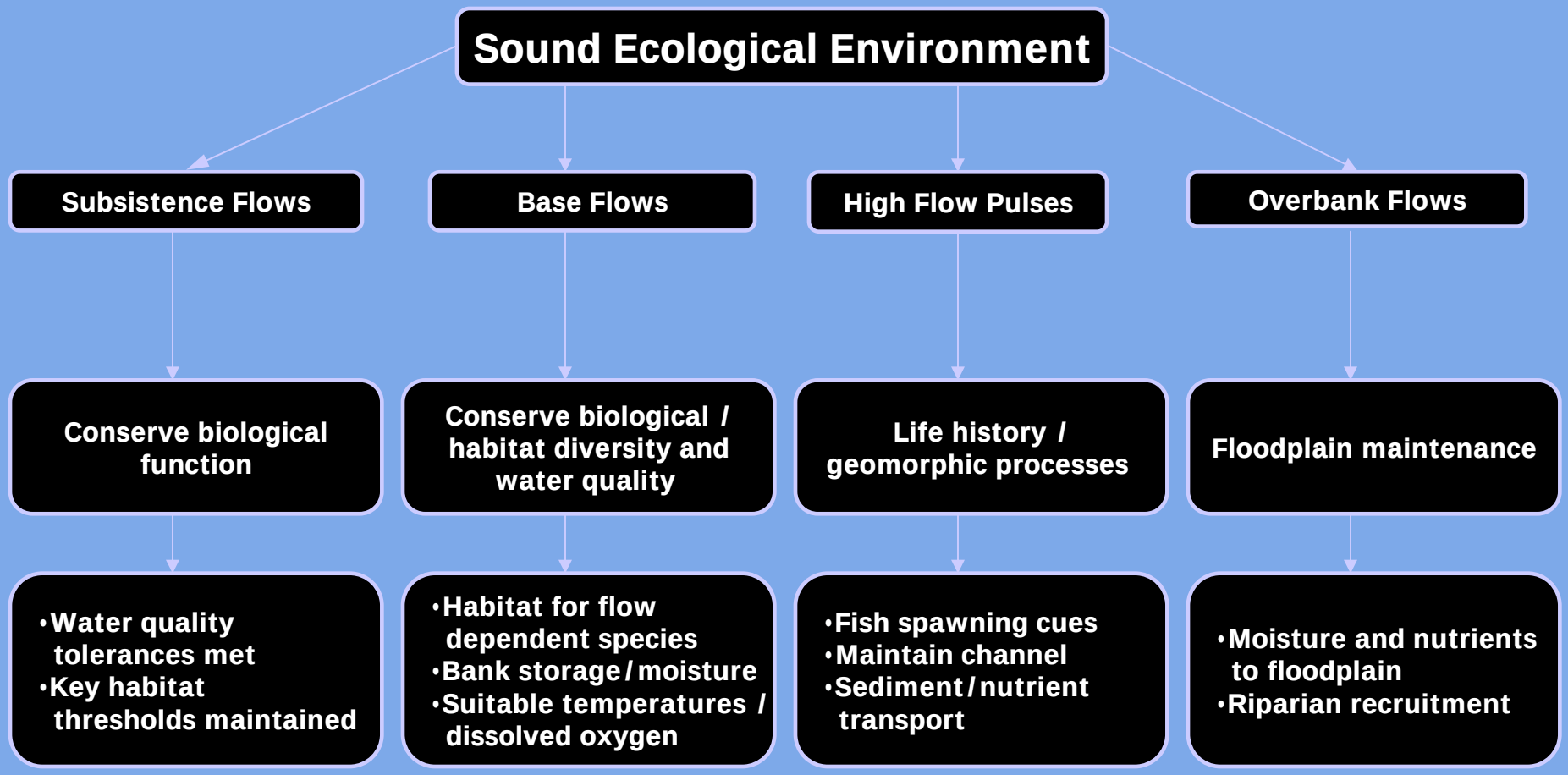
Conserve Biodiversity

- fish, invertebrates, mussels, plants
- riparian diversity

Maintain Ecological Integrity

- processes and functions that create and maintain habitat and physicochemical conditions that support biotic survival, growth, and reproduction

Simple Conceptual Model



Sample Instream Flow Matrix

- Wet year
- Average year
- Dry year

Overbank Flows	**4,000-10,000 cfs** for 2-3 days Once every 3-5 years Channel Maintenance Riparian Connectivity, Seed dispersal Flooplain habitat
High Flow Pulses	**700-1500 cfs** for 2-3 days 2-3 X per year every year Sediment transport Lateral connectivity Fish spawning **1800 cfs** for 2 days 1 X per yr every other year “Big River fish” spawning between Jul 15 - Aug 15
Base Flows	**300-450 cfs** maintain biodiversity and longitudinal connectivity **100-150 cfs** Fish habitat **150-300 cfs** Spring spawning **40-50 cfs** Fish habitat **90-100 cfs** Fish habitat
Subsistence Flows	**35 - 55 cfs** Maintain water quality (35 cfs) and key habitats in May (55 cfs)

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

Instream Flow Studies

SB2 directs TPWD, TCEQ, and TWDB to work Cooperatively to establish an instream flow data collection and evaluation program for determining flow conditions in the state's rivers and streams necessary to support a sound ecological environment.

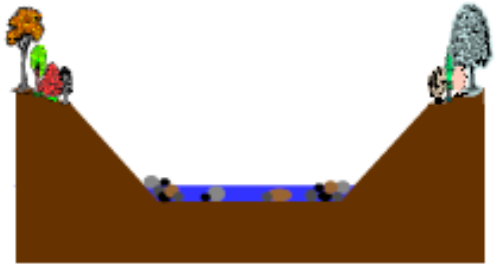
LCRA has completed an instream flow study for the Lower Colorado River – Blue Sucker habitat has been revisited under LCRA-SAWS Water Project.

SCHEDULE OF RECOMMENDED FLOWS FOR THE COLORADO RIVER DOWNSTREAM OF AUSTIN FROM MOSIER AND RAY (1992):

MONTH	Subsistence/Critical (cfs)		Target (cfs)		
	Austin	Bastrop	Bastrop	Eagle Lake	Egypt
January	46	120	370	300	240
February	46	120	430	340	280
March	46	500	560	500	360
April	46	500	600	500	390
May	46	500	1030	820	670
June	46	120	830	660	540
July	46	120	370	300	240
August	46	120	240	200	160
September	46	120	400	320	260
October	46	120	470	380	310
November	46	120	370	290	240
December	46	120	340	270	220

Aquatic Habitat: Instream Flow Guidelines - Lower Colorado River

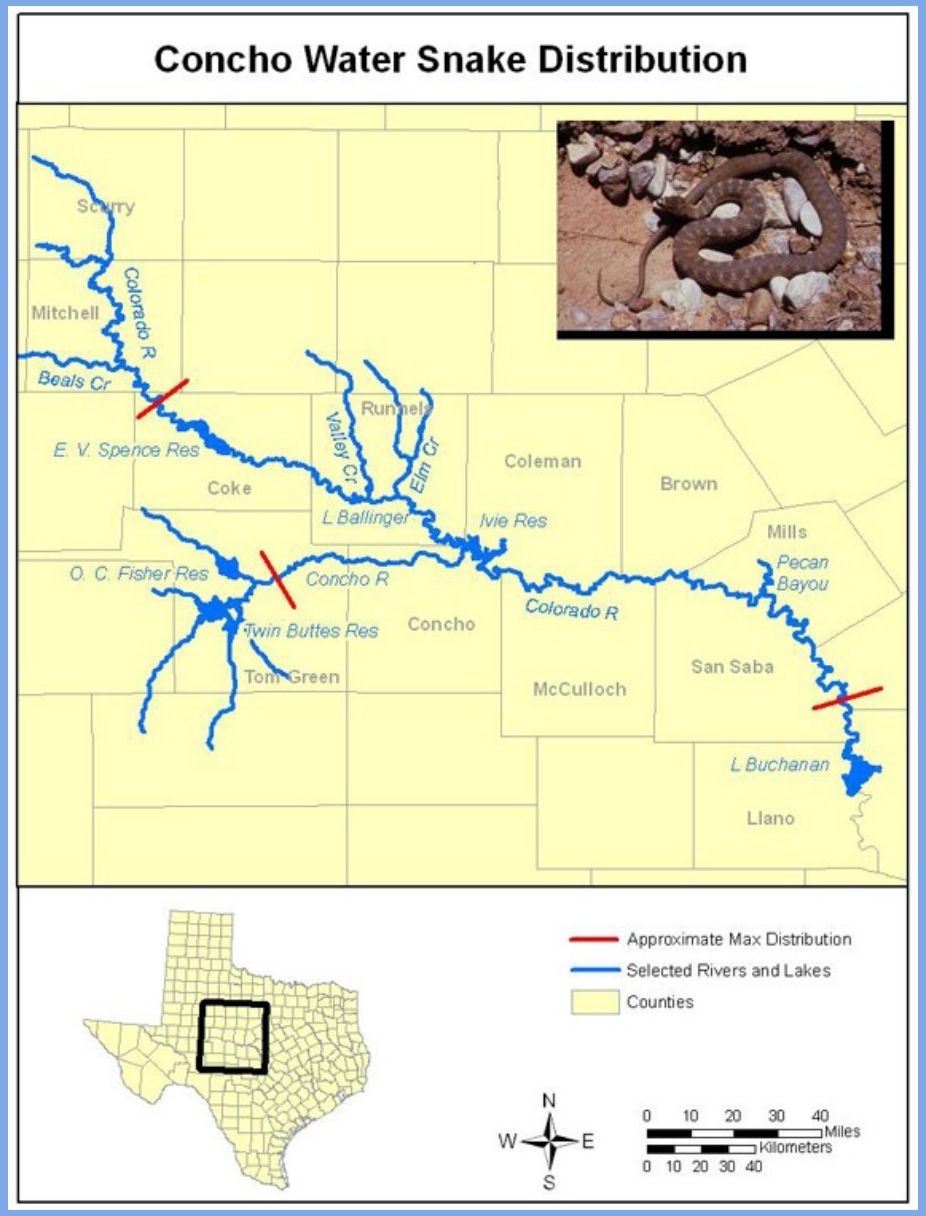
- Five Instream Flow Recommendation Categories
  - Subsistence, Base, High Flow Pulses, Channel Maintenance, and Overbanking
- Recommendations applied at four locations
  - Austin, Bastrop, Columbus, and Wharton



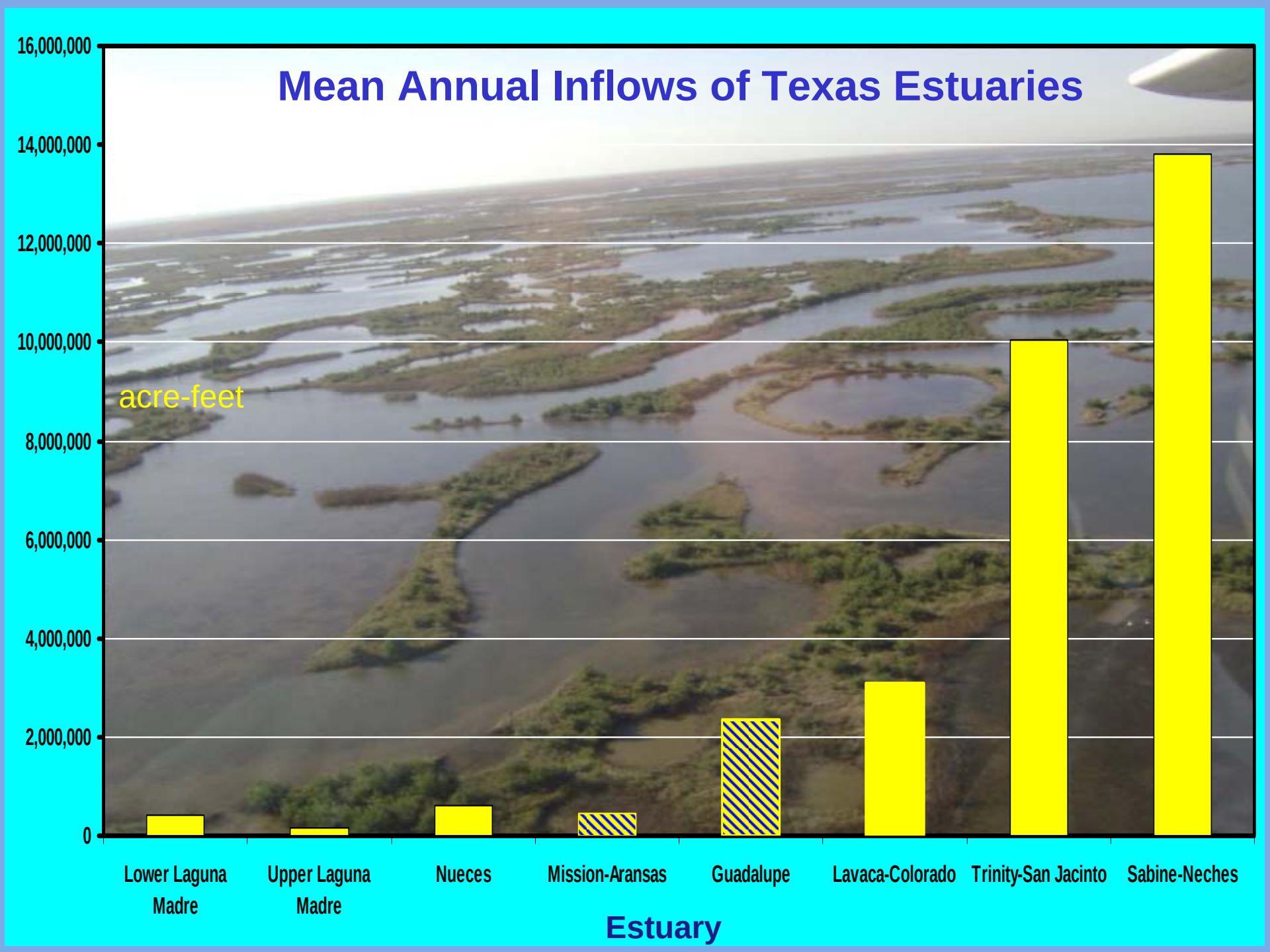
Comparison of flow recommendations at Bastrop

BASTROP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Target (WMP)	370	430	560	600	1030	830	370	240	400	470	370	340
Critical (WMP)	120	120	500	500	500	120	120	120	120	120	120	120
Base Dry (LSWP)	313	317	274	287	579	418	347	194	236	245	283	311
Base Average (LSWP)	433	497	497	635	824	733	610	381	423	433	424	450
(LSWP)	208	274	274	184	275	202	137	123	123	127	180	186

There is limited information on environmental flow needs in the upper Colorado and Lavaca river basins. However, the concepts that have been used in the lower basin incorporating a full range of flows will be useful in addressing environmental flow needs in other parts of the Colorado – Lavaca Bay Basin Area.

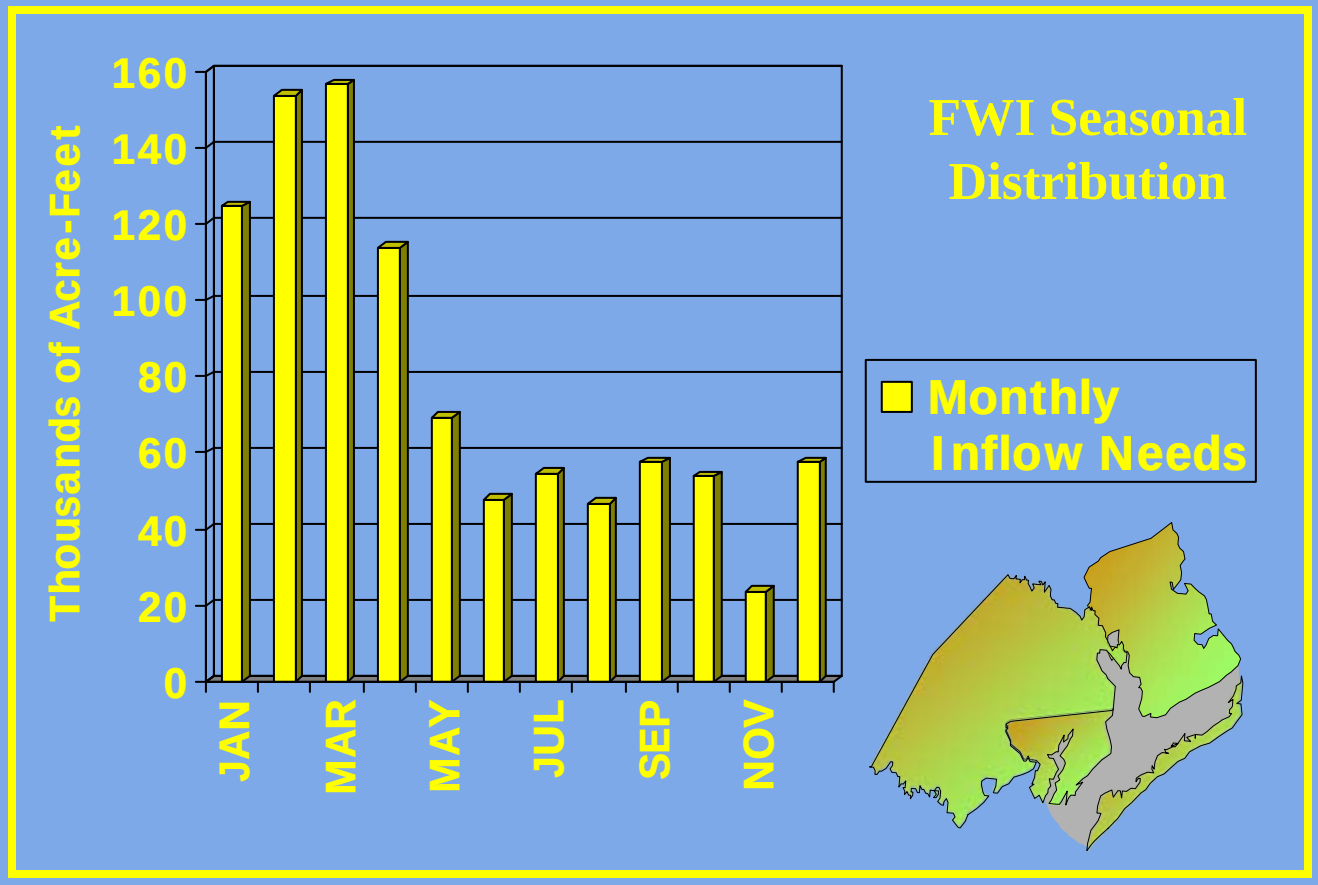


Freshwater Inflows - Matagorda Bay

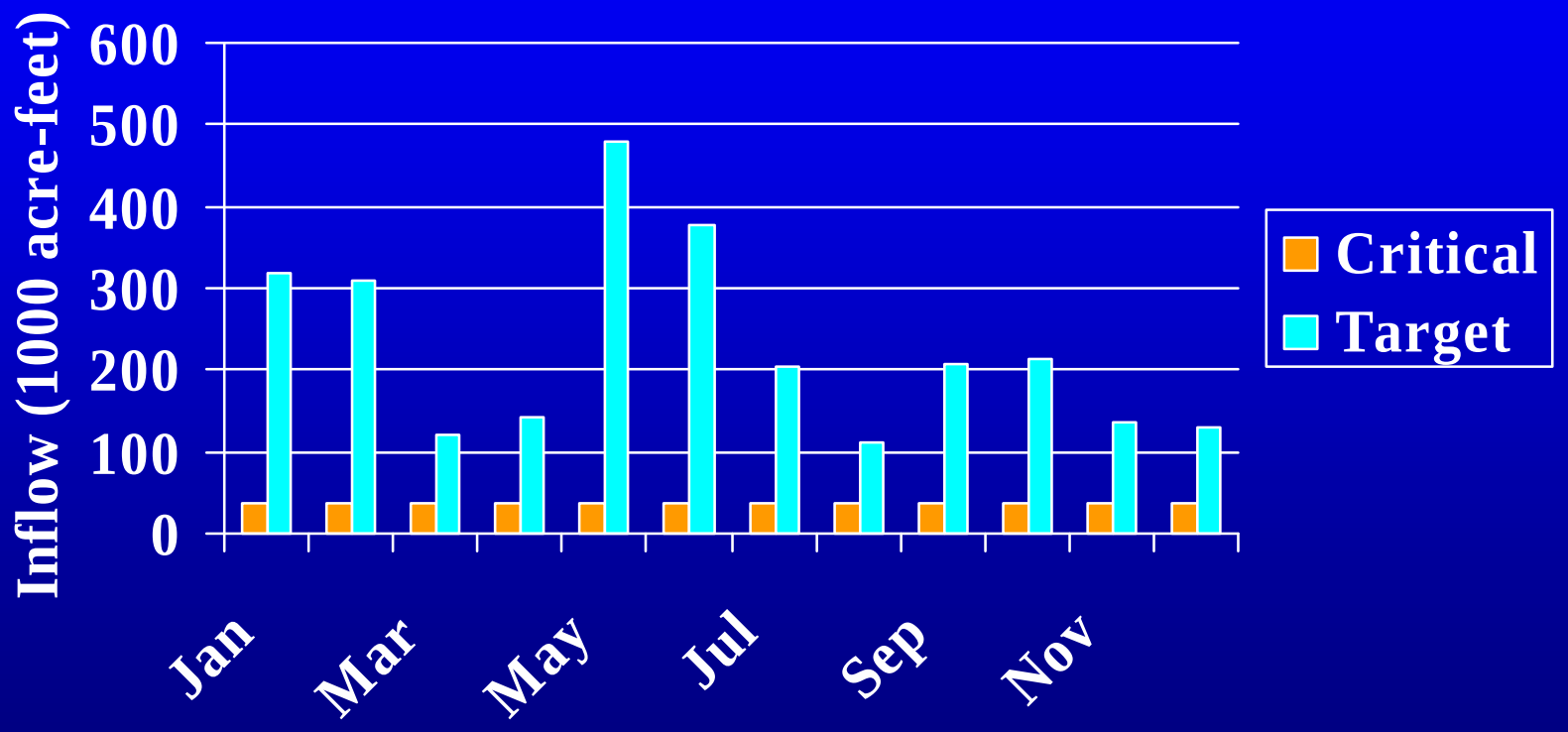

Mean Annual Inflows of Texas Estuaries
acre-feet
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
Lower Laguna Madre
Upper Laguna Madre
Nueces
Mission-Aransas
Guadalupe
Lavaca-Colorado
Trinity-San Jacinto
Sabine-Neches
Estuary

Delivery of Freshwater Inflows Must Incorporate Seasonality to Have Any Ecological Significance

The recommended FWI is often expressed as a single annualized number, but always infers the sum of monthly inflows



Freshwater Inflow Needs of the Matagorda Bay System (2006)

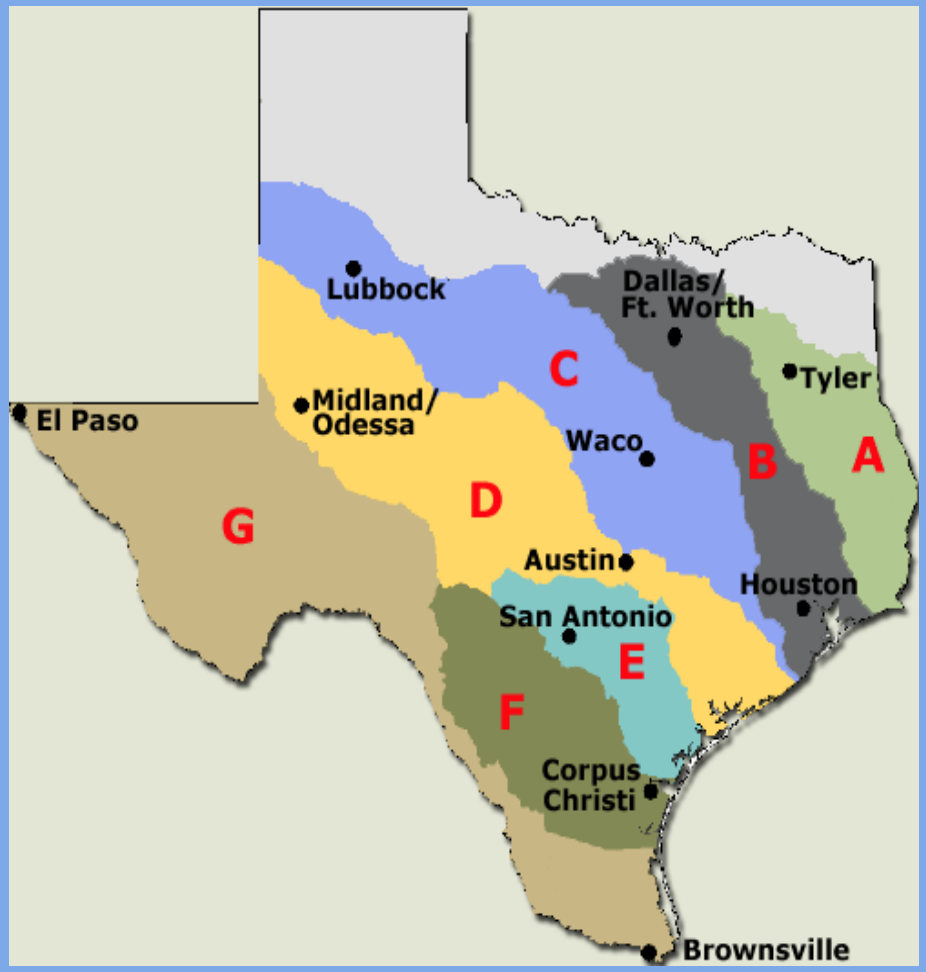


Matagorda Bay Inflow Criteria (Colorado River)
Matagorda Bay Health Evaluation
LSWP 2008

MBHE Inflow Criteria

- MBHE studies and inflow criteria most comprehensive to date
- Maintain bay health and productivity
- Relies on multiple measures of bay health (Salinity, Habitat, Nutrients, Benthic Condition, Abundance)
- Encompasses total flow spectrum
- Addresses seasonal flow and variability
- Establishes frequency achievement guidelines for all criteria flow levels

Bay/Basin Areas



A. Sabine & Neches Rivers/Sabine Lake Bay Area (light green) 2008-2011

B. Trinity & San Jacinto Rivers/Galveston Bay Area (grey) 2008-2011

C. Brazos River/Bay & Estuary Area (blue) 2010-2013

D. Colorado & Lavaca Rivers/Matagorda & Lavaca Bays Area (yellow) 2009-2012

E. Guadalupe, San Antonio, Mission, & Aransas Rivers/Mission, Copano, Aransas & San Antonio Bays Area (aqua) 2009-2012

F. Nueces River/Corpus Christi & Baffin Bays Area (dark green)
2010 – 2013

G. Rio Grande/Rio Grande Estuary & the Lower Laguna Madre Area (tan)
2010 -2013

How to determine an environmental flow regime

How to determine an appropriate environmental flow regime

- Bay and Basin Expert Science Team
- Results from existing studies
- Desktop methods or other alternatives
- SAC produced documents and guidance (HEFR)

Questions?