

***Lower Rio Grande and Lower Laguna Madre
Basin and Bay Expert Science Team
(LRG/LLM BBEST)***

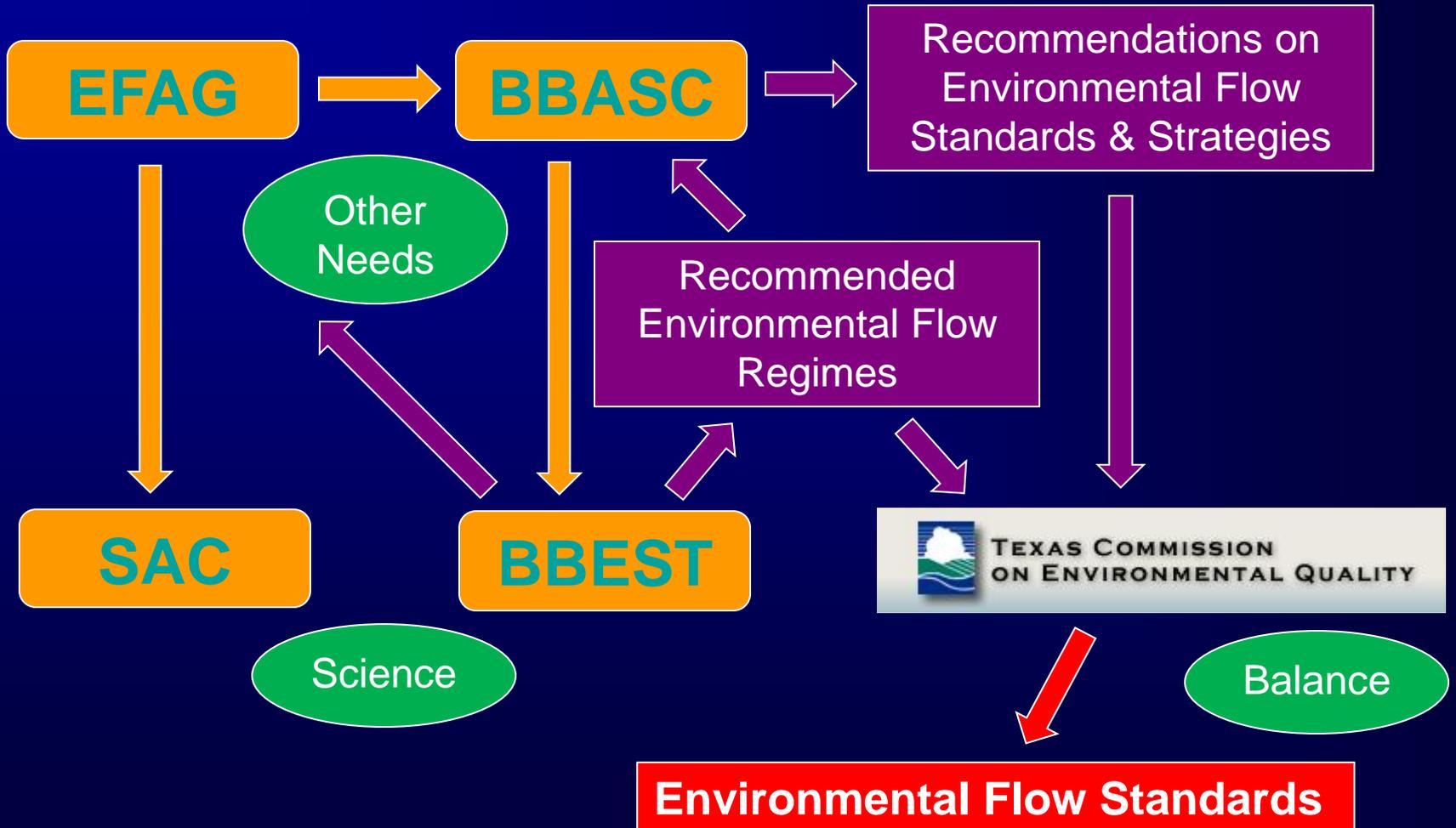
Freshwater Inflow Recommendations Study



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SB3 Environmental Flows Process



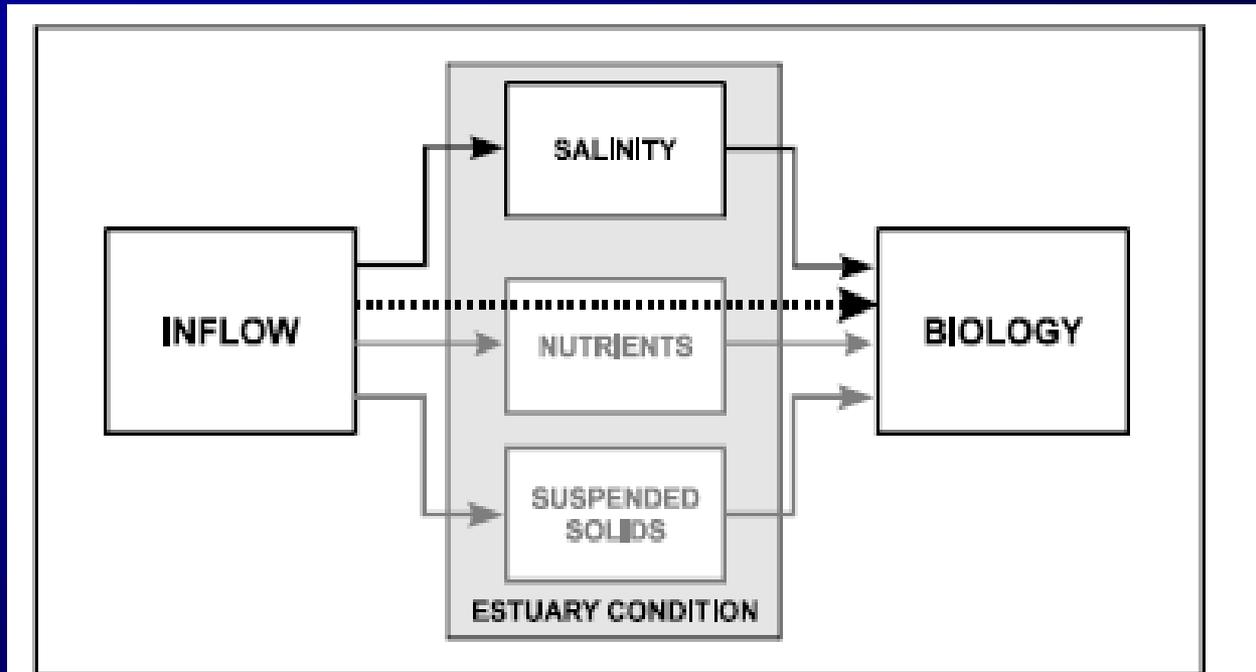
Basin & Bay Expert Science Teams (BBEST)

- 1) Comprised of technical experts with knowledge of the river basin and bay system and/or development of environmental flow regimes.
- 2) BBESTs **conduct freshwater inflow analyses and develop recommended environmental flow regimes based on best available science and existing data through a consensus process.**
- 3) Provide environmental flow regime recommendations by March 1, 2012.
- 4) Provide technical support to the BBASCs in development of recommendations on environmental flow standards & strategies, and their work plan.

LRG/LLM BBEST Recommendations Process

- 1) Overview of Estuary & Watershed**
- 2) Sound Ecological Environment ?**
- 3) Perform Hydrology Analyses**
- 4) Select Target Biological Species/Habitats for Inflow Regime Analyses**
- 5) Determine Inflow Regime Criteria for Focal Species**
- 6) Develop Environmental Flow Recommendations**
- 7) Produce Adaptive Management Plan**

Basis of Freshwater Inflow Effects



SAC

Figure 2.1-2 – Schematic of Relation of “Biology” to “Inflow”
(Compressed from Figure 2.2-1)

Effects of Freshwater Inflow on Estuarine Ecosystems
mediated through **three Estuarine Factors**

Lower Rio Grande – Laguna Madre System

Landcut

Port Mansfield

Port Mansfield
Ship Channel

Arroyo-Colorado

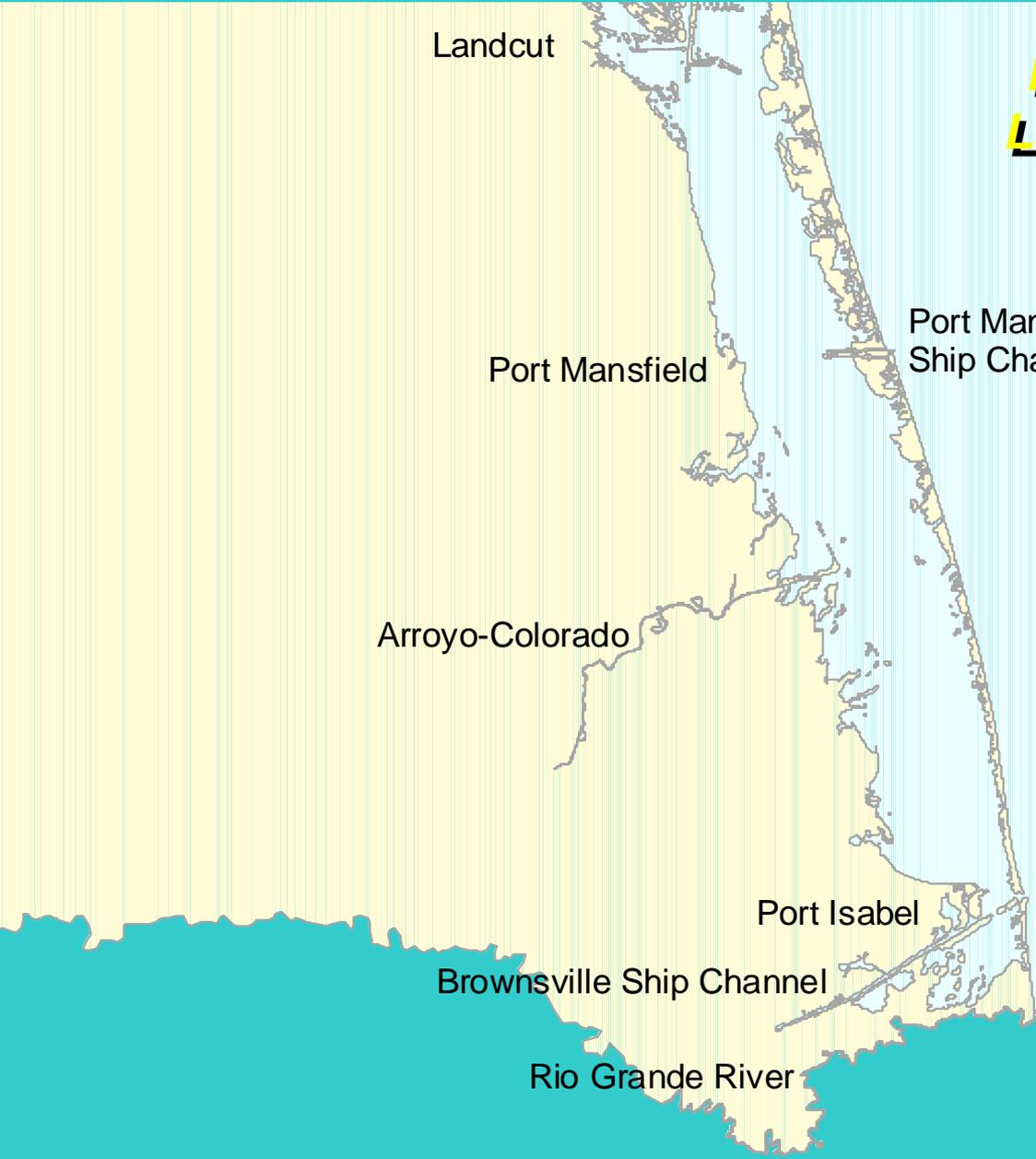
Port Isabel

Brazos
Pass

Santiago

Brownsville Ship Channel

Rio Grande River



Hydrology Analyses

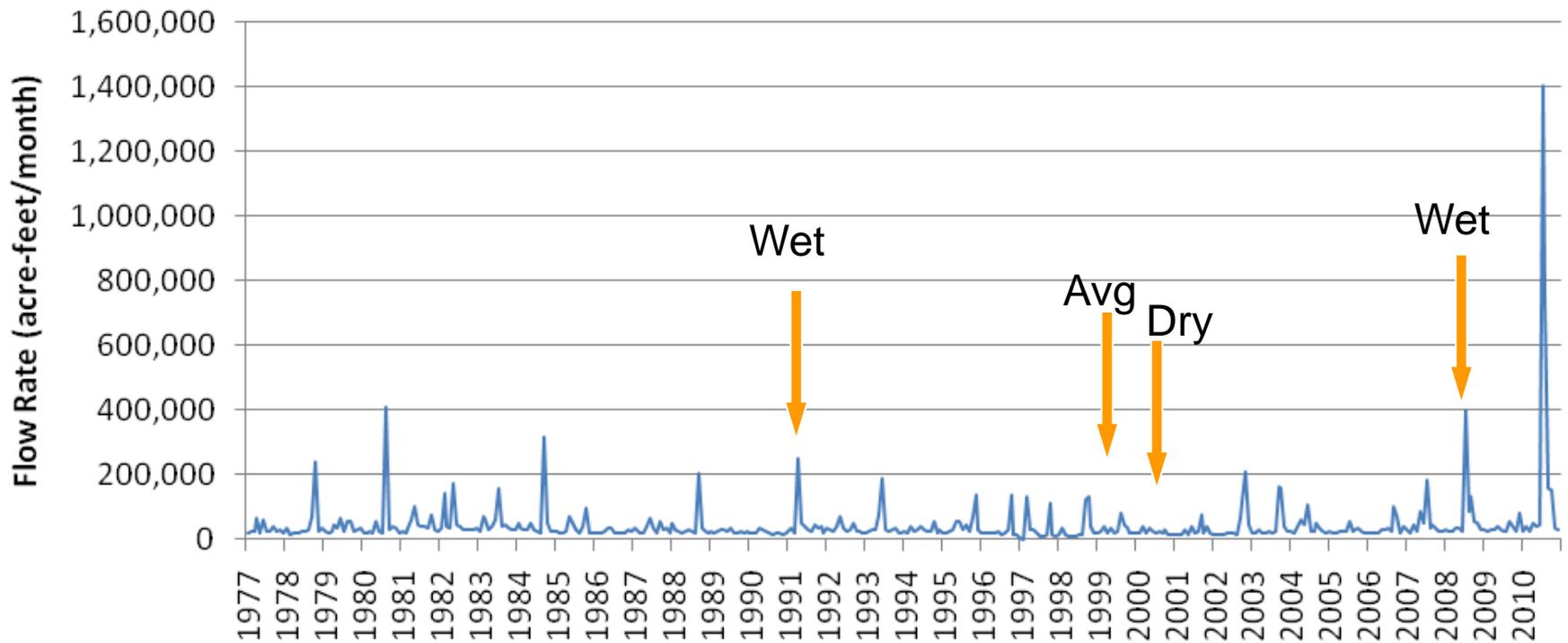
(Example: Rio Grande/LMadre)

- 1) Geographic Scope (Rio Grande Estuary & Lower Laguna Madre)**
- 2) Gage Selection (Anzalduas, Brownsville, Harlingen)**
- 3) Hydrographic Water Balance for LRGV**
- 4) Historical Flow Regimes Analyses (1960?)**
- 5) Surface Freshwater Inflows to Estuaries**

Lower Rio Grande – Arroyo Colorado System

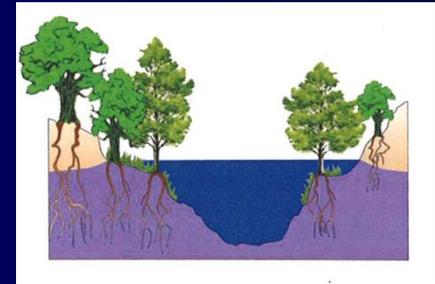


Period of Record: Monthly Combined Inflow to Lower Laguna Madre (1977 – 2010)

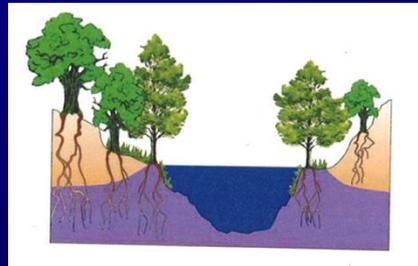


Flow Regime Components

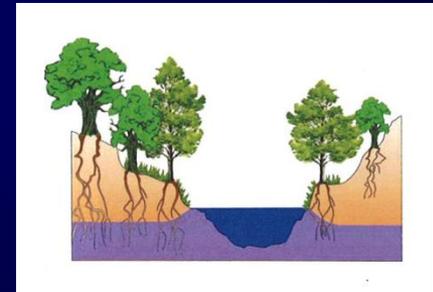
Overbank



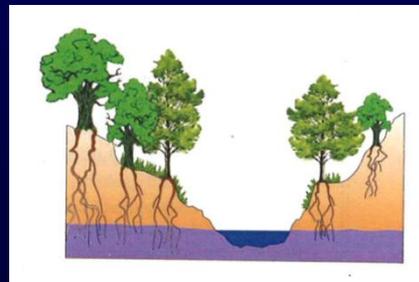
High Pulse



Base



Subsistence



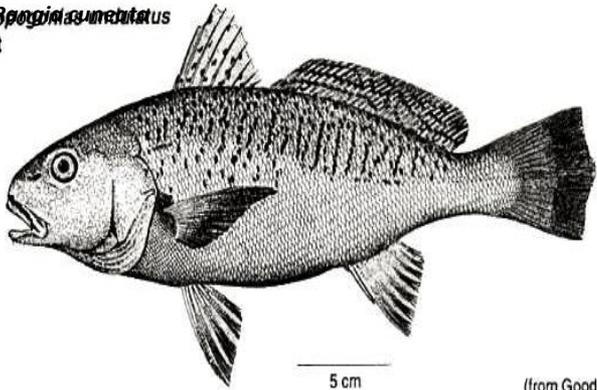
LRG/LLM BBEST Environmental Analyses

- q **Select Target Biological Species/Habitats for Inflow Regime Analyses**
- q **Determine Inflow Regime Criteria for Focal Species**
- q **Develop Environmental Flow Regime Recommendations**

Examples of Focal Species

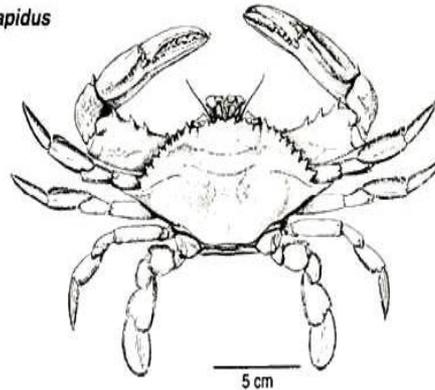
Sessile vs. Motile Species and Responses to Salinity or Nutrients

Micropogonias undulatus
Adult



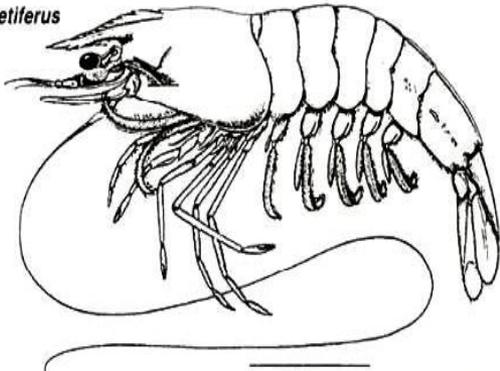
(from Goode 1884)

Callinectes sapidus
Adult

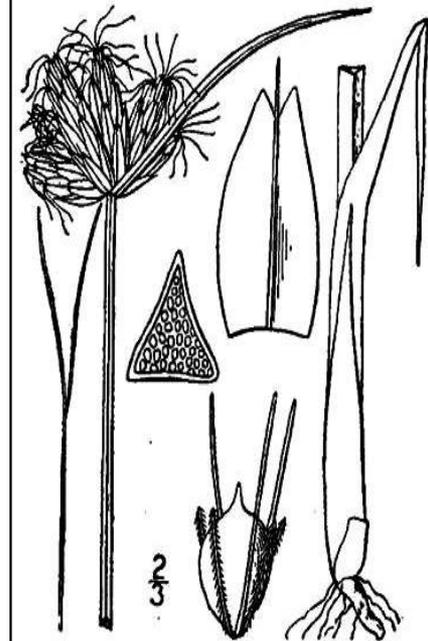
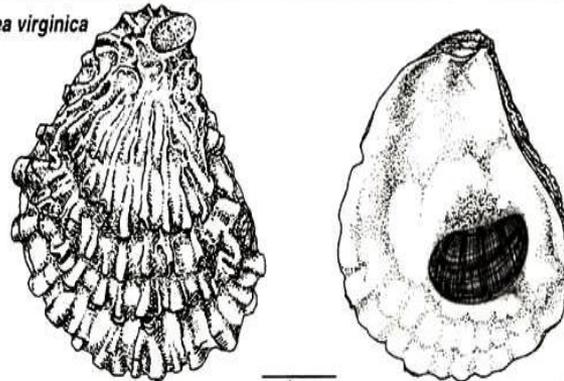


(from Goode 1884)

Penaeus setiferus
Adult



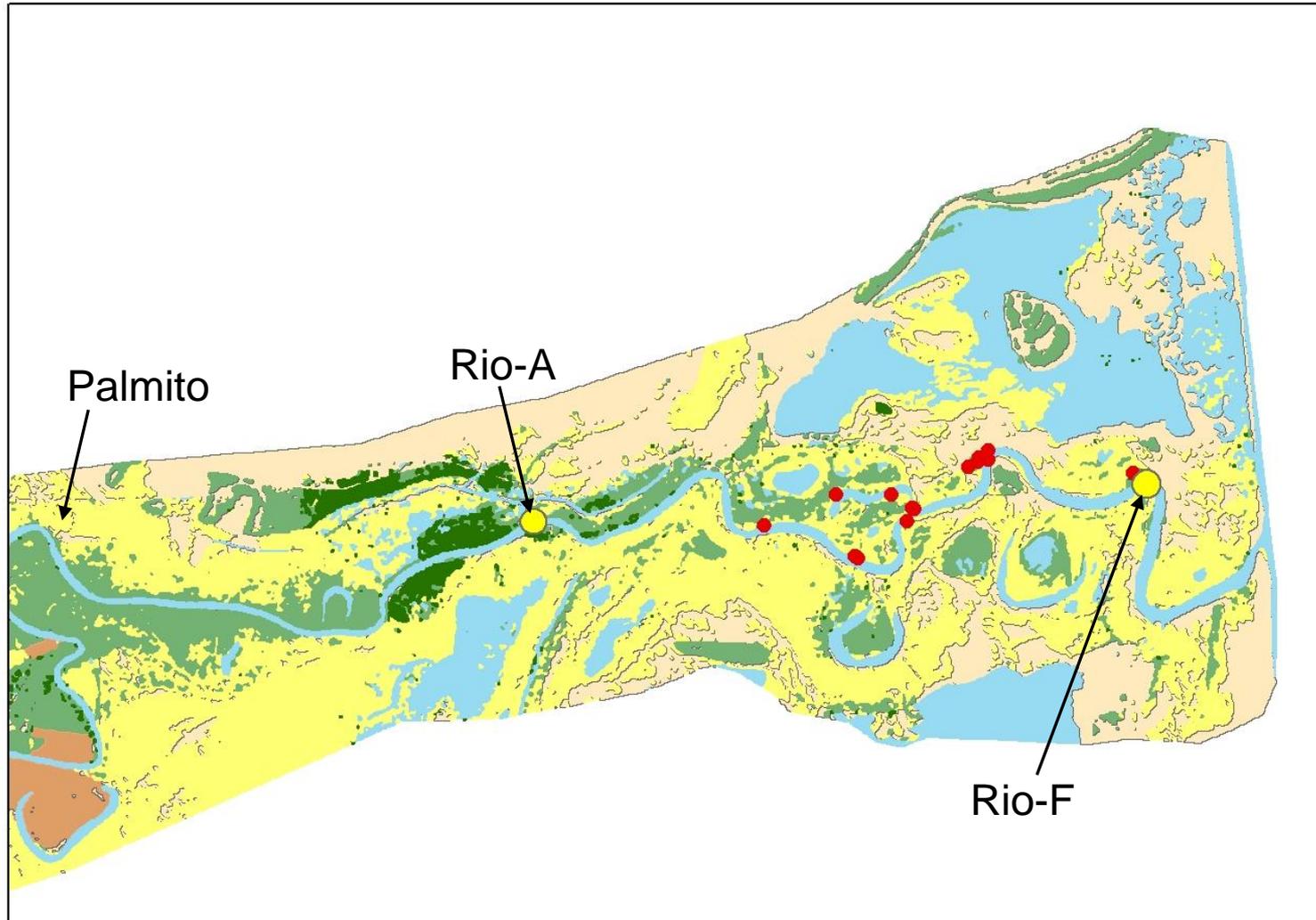
Crassostrea virginica
Adult



Freshwater Inflow Analyses

- 1) **Different Effects for Ecosystems of Tidal Rio Grande and Lower Laguna Madre**
- 2) **Hydrology and Salinity Impacts in Tidal Rio Grande**
 - 2a. **Mangroves /Spartina/Oysters**
- 3) **Water Clarity / Nutrient Responses in Lower Laguna**
 - 3a. **Submerged Seagrass Habitat**
- 4) **Synthesis of Freshwater Inflow Regime Components**

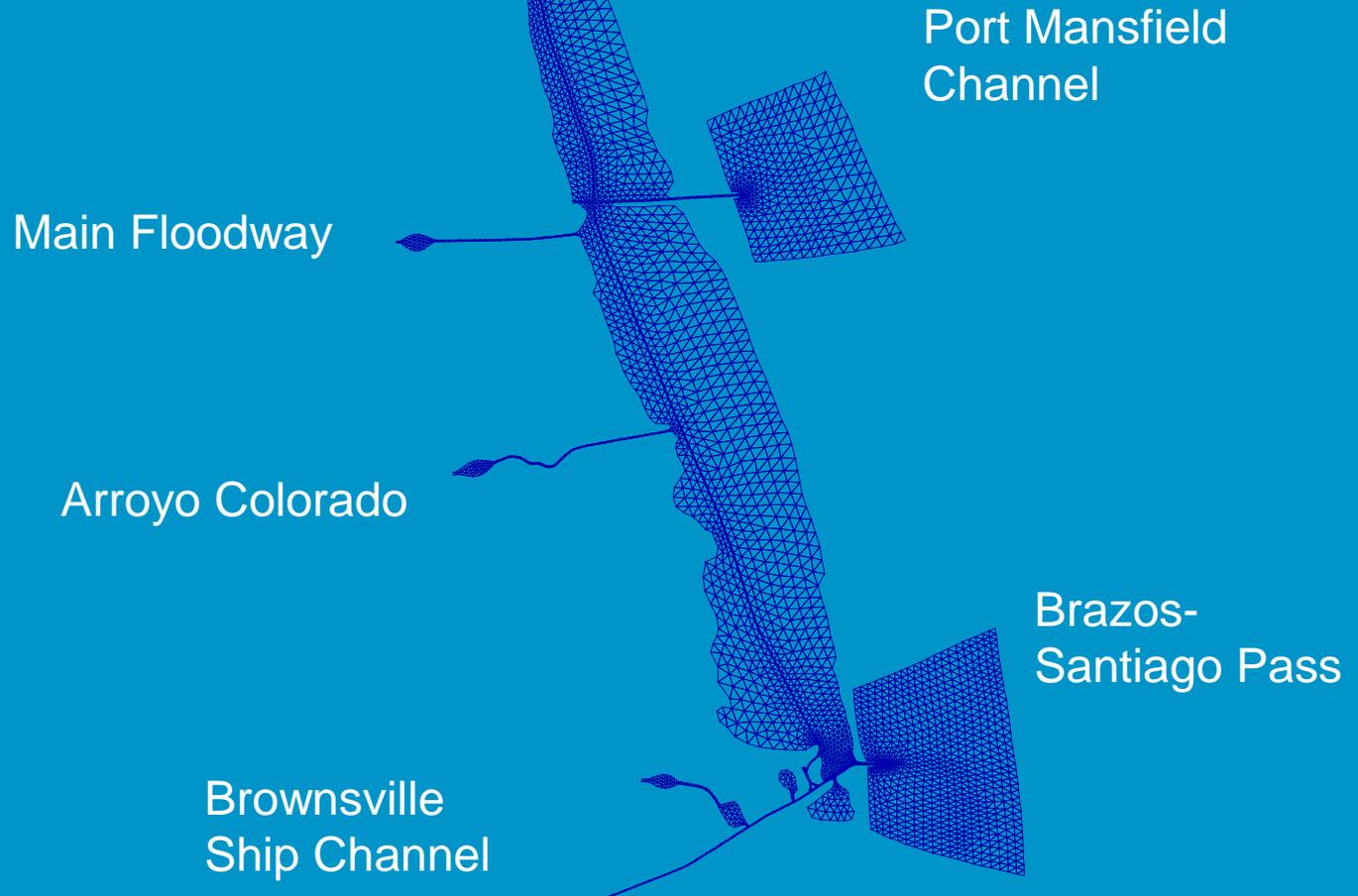
Lower Tidal Rio Grande Land Cover and extent of Estuarine Vegetation



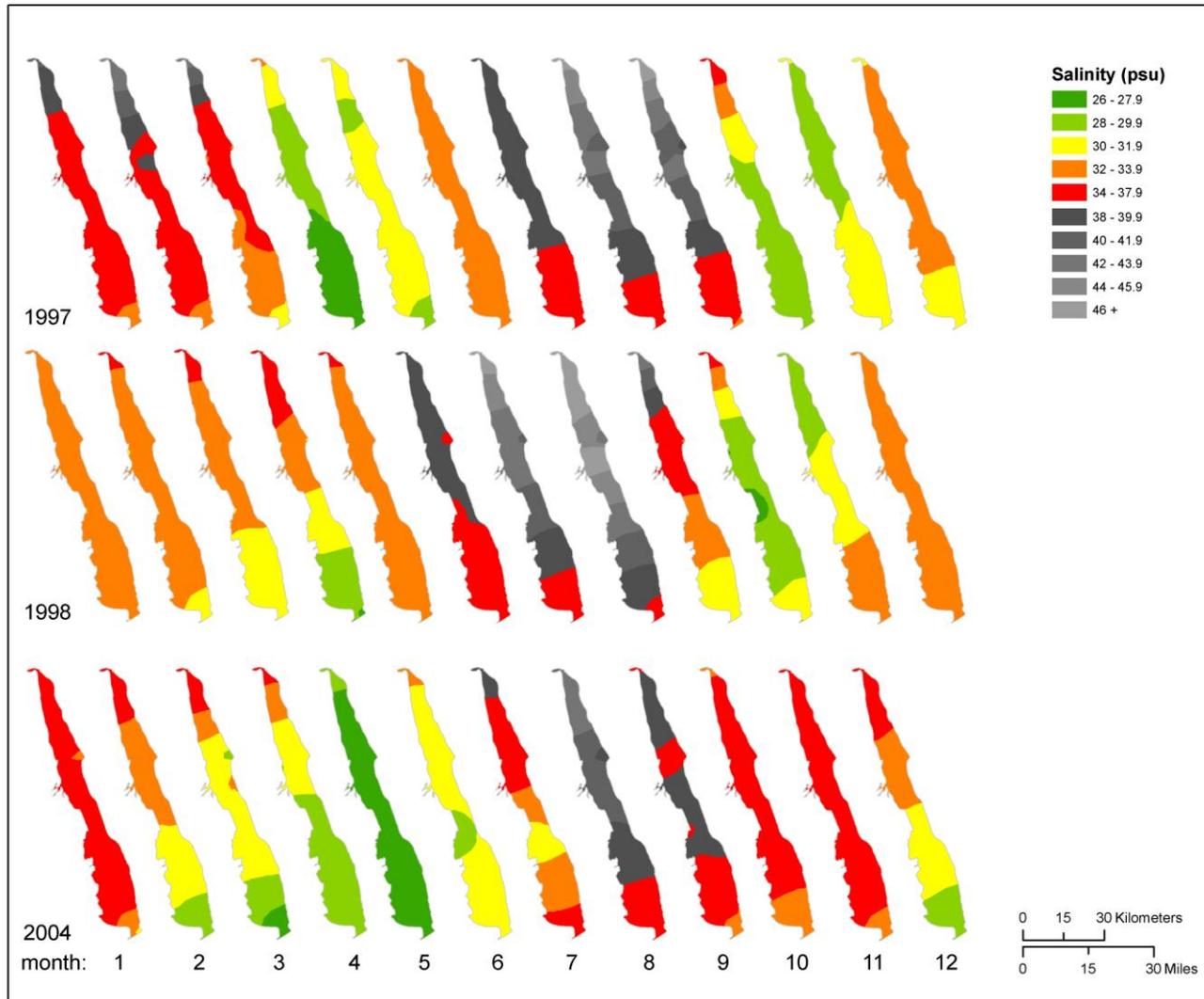


***2009 NAIP Imagery
of Lower Laguna Madre
and
Seagrass Distribution***

Use Lower Laguna Madre TxBLEND Model Grid to Demonstrate Effect of Inflows on Salinity and Nutrient Plumes



TxBLEND Model Monthly Salinity Patterns in Lower Laguna Madre

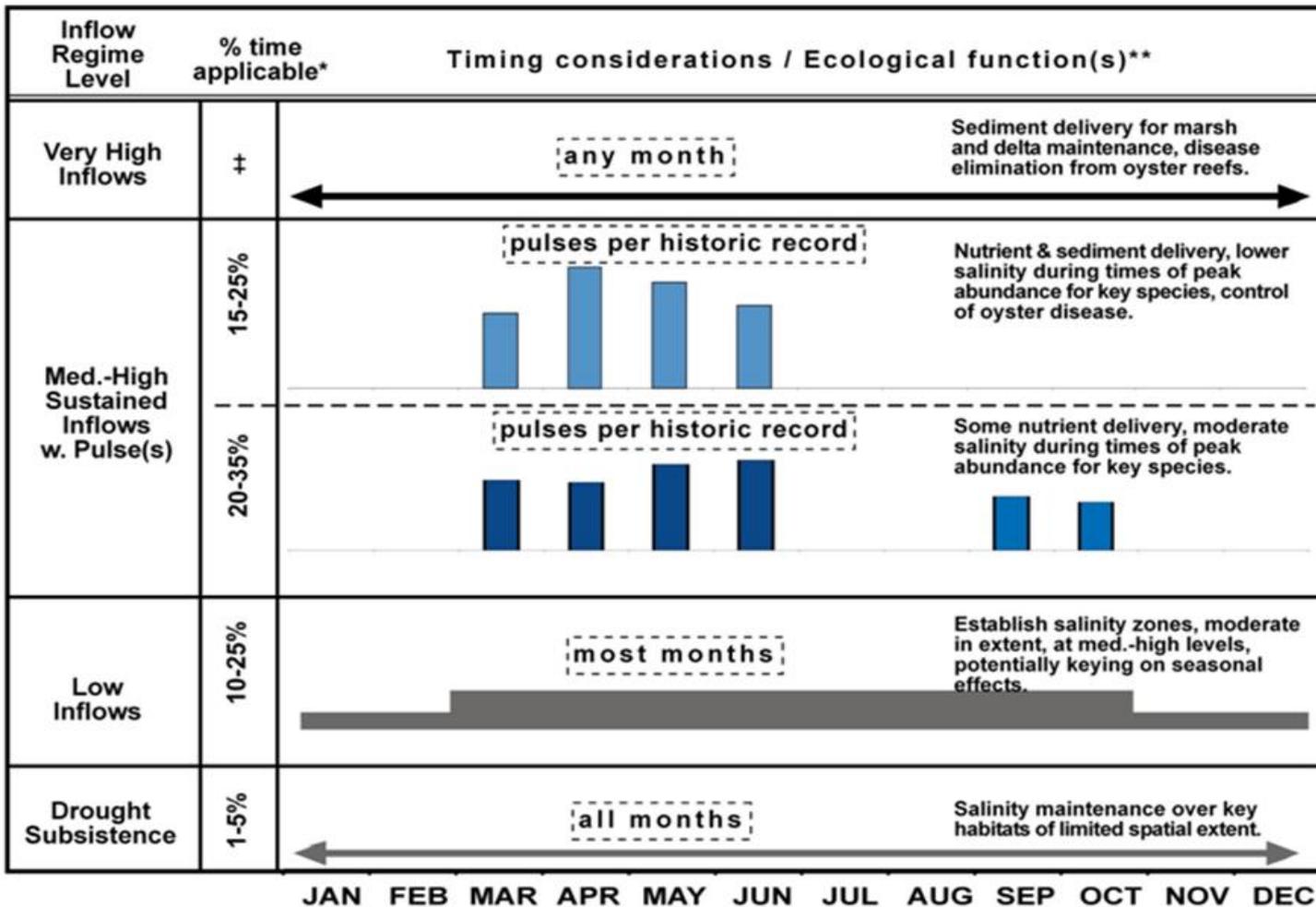


TxBLEND Model Salinity Plumes and Seagrass Impacts for Laguna Madre



Freshwater Inflow Analysis Summary

- 1) **Effects of Freshwater Inflow on Lower Laguna Madre or Rio Grande Estuary Ecosystems**
- 2) **Hydrology and Salinity impacts in tidal Rio Grande**
- 3) **Seagrass Habitat Response in Lower Laguna**
- 4) **Salinity and Nutrient Analyses for Seagrass**
- 5) **Synthesis of Freshwater Inflow Regime Components**
- 6) **Flow Recommendations**
- 7) **Adaptive Management**



note: *for illustrative purposes only to demonstrate relative frequencies of regime levels; **not meant to be an exhaustive list; ‡infrequent and may be closely tied to overbanking flows resulting from riverine considerations.

Model of Estuarine Inflow Regimes (from N. Johns, NWF)