Guadalupe, San Antonio, Mission, & Aransas Rivers and
Mission, Copano, Aransas, & San Antonio Bays
Basin & Bay Area Stakeholders Committee (GSA BBASC)

Work Plan for Adaptive Management

Compilation of Preliminary Scopes of Work
October 11, 2011
PART II: Bays and Estuaries
Updated November 11, 2011

Bays & Estuaries
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9. Diversion and Return Flow Data for Freshwater Inflow Estimates (in development)

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Bays & Estuaries – Subject Item #1

~~Scouring of Passes & Impacts on Estuarine Ecology~~Role of Cedar Bayou in the Exchange of Water and Meroplankton to the Guadalupe Estuary

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What: Scouring of Passes ~~& Impacts on Estuarine Ecology~~

Why: Identified by GSA BBASC. The coastline of Texas has a nearly continuous set of barrier islands that separate the coastal bays and estuaries from the open Gulf of Mexico. The number of passes or points of seawater exchange between coastal bays and the open Gulf are limited. These passes are maintained by the natural exchanges of water between the bays and Gulf that result from freshwater inflows and tidal exchange. This water movement removes sediments from the passes to allow for the free exchange of water. Since the construction of several deep water passes that are dredged and maintained to depths needed by large sea-going vessels, the number of natural passes have decreased, since most of the water exchange tends to occur through the path of least resistance in the deeper channels rather than traveling across broad bays and through shallower natural passes. Many estuarine species of finfish, shellfish and other ecologically important species move between the bays and the Gulf of Mexico through these passes, and their life-cycles are dependent on these points of exchange.

Where: The best known example of a natural pass that remains within the Guadalupe-San Antonio Bay and Basin region is Cedar Bayou, a natural pass that has historically separated San Jose and Matagorda Islands. This pass has been closed by natural sedimentation several times, and has been re-opened through manmade and natural processes on several occasions. The pass closed in early 2008 and has remained closed since. The Army Corp of Engineers has recently issued a permit that would allow for re-opening of Cedar Bayou once a funding source has been found.

How: When Cedar Bayou is re-opened, a study is needed to determine the rates of water exchange through the opening, the ability of this flow to remove sand at the Gulf exchange point to keep the pass open, and to quantify the exchange of early life history stages of fish and shellfish through this pass, to help quantify its value to the regional estuarine ecology~~.~~.

~~The biological study should begin before the pass is completed, since it will be important to compare the estuarine communities before and after the reopening of Cedar Bayou. The abundances of early life history stages of fish and shellfish ideally should be studied over an annual cycle before and after the reopening of Cedar Bayou.~~

Who: Studies could be carried out by state agencies (TPWD, TWDB) and/or university/state partnerships such as the Mission-Aransas National Estuarine Research Reserve, or through an RFP through Texas Sea Grant to university investigators.

Cost: $75,000 [basis: 1 fte for 12 months over 2 years plus field work expenses]

~~***Bays & Estuaries – Subject Item #2***~~
~~***Marine Wetland Effects on Commercial & Recreational Fishing***~~

~~***** Refocused to Instream Flows #21 *****~~

~~***Bays & Estuaries – Subject Item #3***~~
~~***Impacts of Levees***~~

~~***** In Development *****~~

~~***Bays & Estuaries – Subject Item #4***~~
~~***Impacts of Saltwater Barrier***~~

~~***** In Development *****~~

Bays & Estuaries – Subject Item #5

~~*Sediment Transport Affecting Guadalupe Delta*~~

~~What:~~ EVALUATION OF SEDIMENT TRANSPORT AFFECTING THE GUADALUPE ESTUARY DELTA -

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This study aims to evaluate sediment transport and loading entering the Guadalupe Estuary, primarily into Mission Lake, over a range of hydrologic conditions. This is particularly important during peak inflow periods, when the largest pulses of sediments are brought in that contribute to accretion of a prograding delta system in Mission Lake. This new sediment accretion should offset the potential sediment that is lost to the lower, older Delta which is undergoing subsidence and decay. This project builds on previous work in Guadalupe Estuary by TWDB and the Bureau of Economic Geology, Univ. of Texas at Austin, and a current joint project by the USGS /TWDB that is evaluating sediment input of the Trinity River into Trinity Bay. The objectives of this work are:

1. Collect flow and sediment transport data in the Guadalupe River above Mission Lake, and calculate loadings to Mission Lake proper with its prograding delta.
2. Evaluate the range in sediment concentrations over major inflow hydrographs to determine inflow vs. sediment loading relationships.
3. Determine from in situ field measurements, the current rate of subsidence occurring in the lower (older) portion of the Guadalupe Delta, and calculate whether current sediment diversion into Mission Lake offsets this subsidence.

Why: Sediment delivery from the Guadalupe River to the estuary is necessary to maintain the shallow-water marshes, especially in the upper estuary, deltaic reaches. Concentrations of riverborne suspended sediment are affected by natural conditions (soil erosion and streambed re-suspension) and can also be affected by upstream human activities (construction, timber harvesting, certain agricultural practices, and hydraulic alteration). The lower Guadalupe Delta consists of abandoned distributary channels and lakes below the South fork of the Guadalupe River. This portion of the Guadalupe Delta has been gradually cut off from the main flow of the Guadalupe River since Traylor Cut was formed in 1935. Freshwater inflow (also containing nutrients and suspended sediment) has thus been deprived from this lower delta region and emergent marshes have been eroding and subsiding. Sediment input from Traylor Cut now empties into Mission Lake,where a new delta is prograding. Although the lower, old Delta contains considerable low salinity wetlands in the interior area, which are thought to function as important nursery habitat for estuarine organisms, sedimentation dynamics remain poorly defined. This area is steadily being lost as marshlands become submerged, and the amount of sediment deposition required to maintain shallow-water backmarsh areas has not been characterized. Because these loadings are unknown, freshwater inflow estimates to satisfy sediment loading requirements have not been accurately included in the current SB3 inflow regimes.

Where: The lower Guadalupe delta consists of the old distributary channels and interior lakes below the South fork of the Guadalupe River. This portion of the Guadalupe Delta has been cut off from the main flow of the Guadalupe River since inflows and sediments now empty primarily

into Mission Lake. Sediment input into Mission Lake via Traylor Cut is contributing to a new prograding delta there.

How: Sediment Collection and Discharge Measurements: USGS streamgauge No. 8188800 on the Guadalupe River near Tivoli, TX would be the primary location for suspended sediment sample collection and discharge measurements. This project could employ a methodology similar to that developed for the project completed on the Trinity River titled, *An Evaluation of the Variability of Trinity River Nutrient and Sediment Concentration into Galveston Bay during High Flow*, and would identify changes in sediment concentrations during flood periods, as compared to base or low flow periods. This task should follow USGS procedures for discharge measurements, and sediment (total suspended and size fractionation) collection that exist at the commencement of this study. Emphasis would be placed on high-flow events. The attenuation/backscatter signal of an acoustic Doppler velocity meter (ADVM) could be used to evaluate the relation between backscatter and sediment concentration. An option is that an OBS probe could be installed with the instrumentation at Tivoli. This would include a recording current meter, so the gauge is set up for digital measurement and data logging. Blucher Inst/TCOON has had much experience with OBS technology for measuring TSS in the Coastal Bend bays. An automatic measurement would greatly relieve the problem of analyzing water-sample determinations, especially sample collection during floods.

Subsidence measurements in the old Delta would be performed according to methods in earlier studies by UT-Bureau of Economic Geology or by Harte Research Inst.

When: This would be a 6 year study, done in 2 phases. The first phase would be 3yrs with at least 3 years of actual in situ field sampling of sediment inputs, plus subsidence measurements during 2 of these yrs. The second phase would be another 2-3 yrs, including field sampling and development of a numerical sediment transport model.

Who: The sediment transport/loading project would need to be funded through a joint funding agreement between the USGS and the TWDB, as currently performed in Trinity and Matagorda Bays. The sampling and measurement of sediment discharge requires a crew of 2-3 trained Hydrologists (or Hydrographers) to operate machinery, process samples, and measure stream flow. Analytical services for sediment sampling could be provided by the USGS National Water Quality Lab. Blucher Institute should be part of the automated recording measurements.

A Subsidence analysis project in the old Delta could be conducted by an experienced contractor such as UT Bureau of Economic Geology or the Harte Research Inst. at TAMU-CC.

Cost: Total cost is $650,000 over 6 years. Required funds for the sediment transport project are estimated at $500,000 total with USGS contributing Cooperative Water Program funding and the TWDB contributing from its Research and Planning Fund. This funding is divided up into 2 phases. Subsidence study costs are estimated at ~~$~~$125,000, and a contractor (e.g. HRI, UT-BEG) would need outside funding to support their work.

TASK BUDGET

TASK DESCRIPTION		AMOUNT
Sediment Transport and Loadings Study (2 phases)		$ 500,000
	Phase 1 – 3yrs	$250,000
	Phase 2 - 3 yrs	$250,000
Subsidence Study		$150,000
	TOTAL COSTS	$650,000

Bays & Estuaries – Subject Item #6
Sea Level Rise Associated with Climate Change

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What: Sea Level Rise Associated with Climate Change

Why: Identified by the GSA BBASC. Threats to the estuaries are predominantly in form of:
1) threats to barrier islands integrity with implications for large changes in circulation and salinity;
2) potential inundation and loss of wetlands;

How:
1a) synthesis of existing information on range of predicted sea level rise;
1b) assessment of vulnerability / development of scenarios of change;
1c) applications of hydrodynamic circulation-salinity models;

2a) assessment of vulnerability via field assessment of vegetation species and communities;
(Note: addressed in Subject Item #11)
2b) literature synthesis of salinity/inundation requirements and tolerances of vegetation~~s~~ species
(Note: addressed in Subject Item #13)
2c) predictions by coupling 2a & b with insights and predictions from 1.

When[1]:
1a) 4-6 months to complete
1b) 2-3 months after 1a;
1c) 6-8 months after 1b.

2a) 4-6 months to complete
2b) 4-6 months after 2a;
2c) 6-8 months after 2b.

Who: 1a) literature synthesis by university investigator; 1b) workshop with experts, convened by TPWD or TWDB; 1c) TWDB or contractor.
2a) field investigations by private contractor(s) or university(ies); 2b) same as 2a); 2c) TWDB or contractor.
Cost:
1a) literature synthesis -$17,000
[basis: 1 fte university investigator for 3 months at $35 / hr]

[1] note these are study durations, not billable hour / cost estimates.

1b) vulnerability assessment / scenario workshop- $11,000
[basis: 1 fte agency personnel for1 months at $35 / hr; $5000 travel & stipends]

1c) model applications - $34,000
[basis: 1 fte agency or contractor for 6 months at $35 / hr]

2a) field vegetation assessment $26,000
[basis: 1 grad student fte for 3 months at $20/hr and 1 fte supervisory level for 3 months at $35 / hr]

2b) literature synthesis -$17,000
[basis: 1 fte university investigator or contractor for 3 months at $35 / hr]

2c) wetlands change predictions - $25,000
[basis: 1 fte university or contractor for 4 months at $35 / hr]

Bays & Estuaries – Subject Item #7
Hydrodynamic & Salinity Modeling Improvements

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What: Hydrodynamic & Salinity Modeling Improvements

Why: As described in Section 4 of the GSA BBEST report and in two memos from the TWDB to the BBEST (described therein as TWDB 2010a, 2010b) there are certain inflow conditions and certain geographic areas of the Guadalupe and Mission-Aransas Estuaries that have proven somewhat difficult for TxBlend to predict salinity accurately. There are also new salinity monitoring data from fixed stations in the Mission Aransas National Estuarine Research Reserve. Section 7.1.2.1of the GSA Environmental Flows Recommendation Report recognized the need for additional efforts to calibrate and improve TxBlend model performance.

Where: A systematic re-examination of entire model domain across various inflow levels to identify underperforming spatial areas and inflow conditions. However, the previous TWDB and BBEST efforts did identify problematic TxBlend performance in the upper portion of the Guadalupe Estuary and in the Copano Bay portion of the Mission-Aransas Estuary. For the upper portion of the Guadalupe Estuary, the TWDB previously identified certain inflow-salinity characteristics that are more challenging for TxBlend to predict.

When[2]: 4-6 months from initiation. 1-2 months for model reassessment and gathering of most up-to-date inflow and salinity data. 2-4 months to recalibrate and validate model, including a interactive feedback meeting with outside peer group.

Who: TWDB with potential support / data from other State agencies, Guadalupe-Blanco River Authority, and the Mission Aransas National Estuarine Research Reserve.

Cost:
$22,000 - $35,000
[basis: 1 fte for 4-6 months at $35 / hr]

[2] note these are study durations, not billable hour / cost estimates.

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Bays & Estuaries – Subject Item #8

Bay & Marsh Salinity & Water Level Data Collection & Monitoring

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What: Bay & Marsh Salinity & Water Level Data Collection & Monitoring

Why: Two related items identified by the GSA BBEST.
1a) Implement concurrent salinity and water level monitoring in marsh wetland areas and adjacent open bay waters to establish linkages and (b) conceptual models of interrelationships between these two components [for application to/ refinement of inflow recommendations].

2) Modeling analyses between water levels in the Guadalupe River, tides, and salinity of overlying Guadalupe Delta flood waters should be performed. This would allow development of a specific Delta inundation – salinity model for correlating inundation of Guadalupe Delta with riverine FWI events.

The BBEST discussed wetland plants and their salinity sensitivity, and thus potential as a habitat for derivation / cross checking inflow recommendations, but key information is missing to relate response to inflows. For marsh inundation, similar insights on need for pulse / inundation / salinity response at estuary, but key information missing. This Workplan Task would also be heavily linked to Task 13 Salinty-Sensitive Plant Monitoring.

Where: 1a) concurrent monitoring in fringing marshes and/or marshes along tidal streams.

2) would have to be supported by some field component in Guadalupe delta for basic data support

When[3]: 1a) 18-24 months to complete
1b) 6-8 months after 1a.

2a) field component) 18-24 months to complete, contingent upon deploying during right weather conditions
2b) modeling analyses) 6-8 months after 2a.

Who: 1a) agency, contractor, or university; 1b) agency, contractor, or university
2a) field component - agency, contractor, or university; 2b) modeling: agency, contractor, or university

[3] note these are study durations, not billable hour / cost estimates.

Cost:

1a) marsh salinity sampling; deploy sondes / monitor: $40,000
[basis: 1 fte supervisory level for 3 months at $35 / hr; 1 technician / graduate student fte for 6 months at $20/hr and $4000 equipment cost] note: this cost estimate is supported by similar but shorter effort underway along Sabine Lake.

1b) conceptual models / interrelationships: $17,000
[basis: 1 fte university investigator, contractor supervisory level for 3 months at $35 / hr]

2a) field component - $28,000
[basis: 1 fte supervisory level for 2 months at $35 / hr; 1 technician / graduate student fte for 4 months at $20/hr and $4000 equipment cost]
2b) modeling, application - $17,000
[basis: 1 fte university investigator, contractor supervisory level for 3 months at $35 / hr]

~~Bays & Estuaries – Subject Item #9~~
~~Diversion & Return Flow Data for Freshwater Inflow Estimates~~

~~* In Development ***~~**

Bays & Estuaries – Subject Item #10
Rangia Clam ~~& Eastern Oyster~~ Investigations

What: *Rangia* Clam ~~& Eastern Oyster~~ Investigations

Why: In Section 7.1.2.1of the GSA Environmental Flows Recommendation Report, the BBEST recognized the need for additional efforts related to *Rangia* clams ~~and oysters~~ more specifically as follows:

1) Implement investigation of the location-specific reproductive requirements of *R~~r~~angia* clams. These requirements are the very core of the BBEST work with this species and were assumed equal to those found in literature derived from studies in other Gulf and Atlantic Seaboard states.

~~2) Implement investigation of the location-specific requirements of eastern oysters with regard to avoiding the dermo parasite.~~

~~3~~2) Develop a better assessment of the distribution and abundance patterns of ~~rangia~~ *Rangia* in the Guadalupe and Mission-Aransas Estuaries via appropriate sampling design and field equipment. TPWD data was used by BBEST, but these are essentially accidental catch since there is no actual sampling of *Rangia*, per se.

~~Guadalupe and Mission-Aransas Estuaries via appropriate sampling design and field equipment. TPWD data was used by BBEST, but these are essentially accidental catch since there is no actual sampling of *Rangia*, per se.~~

Item (1) is partially covered in an ongoing investigation into salinity patterns as a driver of population spatial coverage, but that work assumes the reproductive requirements are consistent with existing literature. More specific information needs to be pursued via laboratory assessments or intensive field test and monitoring.

Additionally, information ~~from item 2) above would strongly support any efforts to refine~~ the salinity suitability curve / habitat modeling approach for oysters referenced as part of Estuary Task 14 [and parts (-1) and (2~~3~~) would support refinements in the *Rangia* habitat modeling refinements]

Where: Site specific studies in the upper brackish portions of the Guadalupe and Mission-Aransas Estuaries for ~~rangia~~ *Rangia* items (1) and (~~3~~2). ~~For the oyster areas of the estuaries, the currently collected dermo data would need to be synthesized with salinity and salinity duration information based on TPWD, TWDB, GBRA, Mission-Aransas NERR and other sonde data.~~

When[4]:

[4] note these are study durations, not billable hour / cost estimates.

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1) reproductive requirements of ~~rangia~~*Rangia*: ~~this~~ 18-24 months from initiation.
~~2) oysters – dermo: 12-18 months from initiation.~~
2~~3~~) distribution and abundance patterns of ~~rangia~~*Rangia*: 2-4 months from initiation for each estuary.

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Who:

1) additional field and/ or laboratory assessments by university.

~~2) dermo data from TPWD and Dr. Sammy Ray synthesized with salinity and salinity-duration information based on TPWD, TWDB, GBRA, Mission-Aransas NERR and other sonde data. Synthesis by university or contractor with support from TPWD and Dr. Ray.~~

~~3~~2) private contractor(s) or university(ies).

Cost:

1) lab or field study probably in range of - $80,000 -$90,000
[basis: 1 grad student fte for 18 months at $20/hr and ¼ fte supervisory for 18 months at $35 / hr]

~~2) Dermo synthesis in range of $67,000-$100,000~~
~~[basis: contractor or university investigator, 1 fte for range of 12-18 months at $35 / hr]~~

~~3~~2) distribution and abundance patterns of ~~rangia~~*Rangia*: approximately $50-60,000 or $25,000-30,000 per estuary [basis: similar study performed by contractor on Sabine Lake during Sabine-Neches BBEST work]

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Bays & Estuaries – Subject Item #11
~~*Delta Inundation & Salinity Modeling*~~

~~What:~~ ~~DEVELOPING~~ DEVELOPMENT OF AN INUNDATION AND SALINITY MODEL OF THE ~~-~~GUADALUPE ESTUARY LOWER DELTA AND ADJACENT BAYS ~~GUADALUPE ESTUARY LOWER DELTA -~~

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The purpose of this study is to evaluate inundation and salinity dynamics of the lower portion of the Guadalupe Estuary Delta over a range of hydrologic conditions. Based on land surface topography and water monitoring data, an inundation and salinity model would be developed. This project builds on previous work by the Texas Water Development Board that evaluated salinity exchange and water level changes in Texas Bays. The objectives of this work are:

1. Collect flow and water level data at control points in the lower Delta lakes and interior marshes, and in the open part of Guadalupe and Hynes Bay above San Antonio Bay proper. Obtain and analyze LIDAR elevation data.
2. Evaluate exchange of water using monitored water level and salinity measurements over tidal cycles and inflow pulses.
3. Modify and apply a suitable model (perhaps TxBLEND or SELFE) that correlates inflow from the Guadalupe River, with salinities and water levels between the open Guadalupe Bay and the interior regions of the lower Guadalupe Delta.

Why:
The lower Guadalupe Delta consists of the old distributary portions below the South fork of the Guadalupe River. This portion of the Guadalupe Delta has been gradually cut off from the main flow of the Guadalupe River since Traylor Cut was formed in 1935. Freshwater inflows (also containing nutrients and suspended sediment) have been deprived from this lower delta region, and it has been eroding and subsiding since. Although this lower Delta interior contains considerable low salinity wetlands, and is thought to function as nursery habitat for estuarine organisms, hydrologic dynamics remain poorly defined, and the tidal inundation of this backmarsh area has not been characterized. If a shallow marsh inundation model is developed, the need for freshwater inflows in supporting the biological productivity of such wetland areas can be included in BBASC adaptive management of the Guadalupe/San Antonio Bay system, as well as other Texas estuaries. Currently, this important lower Delta area is not included in assessing freshwater inflow needs of estuaries as part of the SB3 process.

Where: The lower Guadalupe Delta consists of the old distributary channels and interior lakes below the South fork of the Guadalupe River. This portion of the Guadalupe Delta has been cut off from the main flow of the Guadalupe River, which now empties inflows and sediments primarily into Mission Lake.

When: 30 months from project initiation. 18 months for model design and development, analysis of LIDAR data, and gathering of sufficient up-to-date water level and salinity data. 12 months to calibrate and validate model.

Who: This project may require multiple entities working in collaboration on various aspects of the project. Based on previous experience modeling coastal wetland areas and estuaries, the Texas Water Development Board (TWDB) is the logical candidate to carry-out the project or, if necessary, coordinate with collaborating subcontractor(s). A few groups (e.g. Harte Research Inst., UT-Bureau of Economic Geology) have considerable expertise in the area of LIDAR data analysis.

Cost: This project requires three distinct phases: (1) Acquiring LIDAR data of land surface topography/elevation within the lower Guadalupe Delta; (2) Monitoring of salinity and water levels within the Guadalupe Deltic Marsh~~a~~ and nearby upper Guadalupe and Hynes Bays; and, (3) Development of an inundation and hydrodynamic model which includes the Guadalupe Delta.

It may be possible to obtain existing LIDAR data for use in development of the model grid. If so, this cost should be minimal. However if recent LIDAR data is unavailable, the cost of funding this data collection effort could be significant. The study will require one- to two-years of field data collection for salinity and water surface elevation in the study area. This effort will require instruments to be purchased (or borrowed) for long-term deployment at strategic locations and to be serviced and maintained by field staff. Data collection also will require processing and quality assurance. An estimated cost for this portion of the project is $75,000. Development of a model of wetland inundation will require extending an existing bay hydrodynamic and salinity transport model (*e.g*., TxBLEND) to include the delta area *or* developing a new bay-delta model using another hydrodynamic model (*e.g*., SELFE). The estimated cost for this effort is $125,000.

BUDGET

TASK	DESCRIPTION	AMOUNT
1.	**Obtain Lidar Data for Study Area**	**?**
2.	**Salinity Collection and Water level Measurements**	$ 75,000
3.	**Model Development**	**$125,000**
	TOTAL (minimum)	$200,000

Bays & Estuaries – Subject Item #12
Life Cycle Habitat & Salinity Studies for Key Faunal Species

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What: Life cycle habitat & salinity studies for key faunal species
Why: As described in sections 4.1.5 and 4.3.1 of the GSA BBEST report, recruitment of post-larval and juvenile life history stages of many species may depend on freshwater inflows producing regions of reduced salinity within estuaries, and some species may derive enhanced benefit from these salinity reductions occurring during particular seasons. Spring rains may reduce salinities in coastal estuaries for several months due to the long turnover times of most bays on the south Texas coast. This freshwater inflow also provides nutrients that stimulate primary productivity that helps enhance the productivity of the entire food web. Although the BBEST originally planned to use the white shrimp (*Litopenaeus setiferus*) and blue crabs (*Callinectes sapidus*) as key species for characterizing freshwater inflow needs of the Mission-Aransas and Guadalupe estuaries, after review of available data from TPWD, review of the published scientific literature and consultation with local and national scientific experts, it was the consensus of the BBEST that the relationships between freshwater inflow and abundances of these key species were not direct, but included other confounding factors that would require additional study.
How: An initial approach would include additional review of scientific literature and existing data sets to identify the most likely confounding factors that complicate the relationships between salinity and the abundances of key species such as white shrimp and blue crabs. Once these factors are determined, field and/or laboratory studies can be designed to understand how the confounding factors interact with salinity to affect the populations of these key species. Hopefully, these additional scientific studies will guide future efforts to determine environmental flow requirements of Texas estuaries based on the requirements of these valued key species.
Where: Entire basin, or initial study within San Antonio Bay, with its higher freshwater inflow and more consistent salinity gradient.
When: 6 months for dedicated review of literature and available data. TBD for recommended additional studies
Who: Literature review and data review by university investigator. RFP for additional studies issued through Sea Grant or comparable agency.
Cost: Literature and data review: $35,000 [basis 1 fte for 6 months at $35 per hour]. Field/laboratory studies TBD.

Bays & Estuaries – Subject Item #13

~~Salinity Sensitive Plant Monitoring~~

~~What:~~

The Distribution and Abundance of Marsh Vegetation in Relation to Salinity and Elevation in the Guadalupe Estuary Delta

~~ANALYSIS OF SALINITY SENSITIVE PLANTS AND SALINITY REGIMES IN THE GUADALUPE ESTUARY DELTA~~

The purpose of this study is to determine distribution and abundance of salinity-sensitive wetland plants in the Guadalupe Estuary delta below the south fork of the Guadalupe River and to monitor their associated salinity regimes. From these data, quantitative status and trends of low-salinity tolerant plants and their salinity tolerance limits would be assessed. This project builds on previous qualitative work by Benton et al. (1984) under TWDB contract, and by the Bureau of Economic Geology, Univ. of Texas at Austin, that reported on wetland plant occurrence/distributions in the Submerged Lands of Texas series for Guadalupe and San Antonio Bay (White et al. 1987). The proposed project would also overlap with the work to be performed in the BBASC Work Plan element #11, "*Development of an Inundation and Salinity Model of the Guadalupe Estuary Delta and Adjacent Bays*~~Developing an Inundation and Salinity Model of the Guadalupe Delta~~". The objectives of this project are:

4. Determine distribution/ abundance of dominant, wetland vascular plant species along elevation transects in the Guadalupe Delta interior below the south fork of the Guadalupe River, and along the shorelines of Guadalupe and Hynes Bay.
5. Monitor the salinity and inundation (water level) regimes which are associated with these dominant wetland species occurrence and abundance.
6. Develop regression models that correlate dominant wetland plant abundance (production) with inundation and salinity variables so that the plants could be used as focal species to assess freshwater inflow (FWI) needs for the Guadalupe/San Antonio Estuary.

Why:

The lower Guadalupe Delta (including Guadalupe Bay) is known to contain a variety of low-salinity sensitive, wetland vegetation (i.e. plant species such as arrowhead, bulrushes, sedges, and aquatic grasses). Because these species are restricted to growth salinities below 2 – 4 psu and represent fixed, stationary habitats, they would comprise good candidates for low-salinity tolerant (so-called oligohaline) focal species in FWI analysis for the Estuary. However, information from Texas on these plants' distribution and productivity, especially in relation to the salinity gradient in the Delta area, is poorly known, making them difficult at this time to analyze as focal species in quantitative freshwater inflow regime assessments (similar to oysters). This Guadalupe Delta survey and monitoring project of targeted, salinity-sensitive plant communities is recommended as part of the GSA BBASC adaptive management plan.

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Where: The project area comprises the Guadalupe Delta region below south fork of the Guadalupe River, and also includes Guadalupe and Hynes Bays shorelines. A dynamic salinity gradient in this region produces the narrow salinity range required by the oligohaline vegetation under certain limited inflow regimes.

How: Project includes 3 tasks:

1. Surveys of wetland plant distribution on a monthly basis (or bimonthly from November to March), using fixed, defined transects along a tidal elevation gradient. Identify dominant species.
2. Monitoring dominant plant seasonal abundance (biomass) and physico-chemical parameters associated with their occurrence. This project will employ standard plant monitoring methodology at transect sampling sites and should use automated recording instruments for salinity and water levels. Primary locations for bay tide levels and discharge measurements will provide open-bay salinity and water levels during flood periods, as compared to base or low flow periods .
3. Integrating these field-collected data into regression models that relate dominant plant production to freshwater inflow related factors including back-bay salinity and inundation regimes, and corresponding data from the open Guadalupe Bay .

Who: Study to be performed by trained wetlands biologist or botanist (university researcher or consultant/contractor)

When: Two year field study and 1 year overlapping statistical analysis work (2-years total).

Cost:

This project could be funded through a joint funding agreement between the TWDB and CMP. The work requires 2-3 trained quantitative ecologists to survey/collect plants, process biomass samples, and maintain water level and salinity meters. Water quality monitoring meters (e.g. datasondes) and water level gauges must be maintained, thus this project would best be performed as part of the BBASC Work Plan element #11~~Inundation Modeling project~~. Total required funds for the project is $105,000.

TASK	DESCRIPTION	AMOUNT
4.	**Field Surveys and Water Level/Salinity Monitoring** (2 yrs)	$ 75,000
5.	**Regression Analysis of Plant Production/Inundation/ Salinity Data and Calculations of Plant vs. Salinity Tolerance Limits**	$30,000
	TOTAL COST	$105,000

Bays & Estuaries – Subject Item #14
Habitat Suitability Models for Eastern Oysters, Blue Crabs, & White Shrimp

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What: Habitat Suitability Models for Oysters, Blue Crabs, & White Shrimp

Why: Identified by the GSA BBEST.
1) Develop basin-wide, multi-parameter Habitat Suitability Models for a) eastern oysters as well as for b) blue crabs and c) white shrimp.
2) Implement investigation of the location specific requirements of eastern oysters with regard to avoiding the dermo parasite.

Part (1a) would be a refinement for the oyster modeling already performed. The salinity suitability curve utilized by BBEST was for whole year avg. salinity from literature. May need to be refined for summer and geographic specificity. Other refinements could include additional parameters like substrate and possible time-specific curves based on 6-24 mon. antecedent conditions as indicated by literature addressing cumulative effects of dermo and checks on dermo due to low salinity and low temperature episodes. Parts (1b) and (1c) may be better as a separate undertaking because of still unresolved conceptual issues related to motile species. Should involve a principal investigator and expert panel/workshop for conceptual model development.

This Workplan Task would also be heavily informed by results of Tasks 10 and 12.

Where: in both the Guadalupe and Mission-Aransas Estuaries.

When[5]:
1a) 18-24 months to complete
1b and 1c) each 9-12 months to complete, not contingent upon 1a.
~~2~~d) oysters —dermo: 12-18 months from initiation.

Who:
1) contractor, or university with agency support.
2) dermo data from TPWD and Dr. Sammy Ray synthesized with salinity and salinity-duration information based on TPWD, TWDB, GBRA, Mission-Aransas NERR and other sonde data. Synthesis by university or contractor with support from TPWD and Dr. Ray.

Cost:

[5] note these are study durations, not billable hour / cost estimates.

1a) oyster habitat suitability model refinement: $11,000 - $22,000
[basis: 1 fte university investigator / contractor level for 2-4 months, depending upon scope, at $35 / hr]

1b and c) motile species (blue crab, white shrimp) habitat suitability model development: $33,000
[basis: 1 fte university investigator / contractor level for 4 months at $35 / hr;
1 fte agency personnel for1 months at $35 / hr; $5000 travel & stipends]

1d) Dermo synthesis in range of - $67,000 -$100,000
[basis: contractor or university investigator, 1 fte for range of 12-18 months at $35 / hr]

Bays & Estuaries – Subject Item #15
Nutrient Load & Concentration Monitoring

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What: Nutrient load and concentration monitoring
Why: As described in Section 4 of the GSA BBEST Report and in Section 7.1.2.3 of the Adaptive Management Plan, an increased nutrient load that may accompany freshwater inflows can result in serious degradation of the estuarine environment through the increase in the frequency of hypoxic (low oxygen) events and through the stimulation of harmful algal blooms that may result on fish kills. In addition, increased inputs of major nutrients (mainly N, but also P) may result in increased algal growth which decreases water clarity and reduces the amount of seagrasses in these estuaries.
Where: The Mission-Aransas Estuary is monitored for nutrients on a monthly basis at 5 locations by the Mission-Aransas National Estuarine Research Reserve, as part of their standard System-Wide Monitoring Program. The reserve staff is also measuring nutrient load from the Mission and Aransas Rivers with funding from the US Environmental Protection Agency. Similar monitoring in San Antonio Bay is needed. An intensive study of freshwater inflows, nutrient concentrations and biological responses in San Antonio Bay was carried out during 1987-88 by the University of Texas Marine Science Institute with funding from the TWDB. The study period included a period with a large pulse of freshwater into the bay. The data from the proposed study would provide a useful comparison to current conditions.
How: Water samples for nutrient analysis should be collected on a monthly basis from the combined flow of the San Antonio and Guadalupe Rivers that enters the head of San Antonio Bay, and from a minimum of an additional 3 sites along the salinity gradient of San Antonio Bay. When water samples are collected, profiles of water column temperature, salinity, oxygen concentration and chlorophyll concentration should also be collected at each site.
When: Nutrient collection should occur over at least a 12 month period, but if funds allow, a 2 year study would be preferable.
Who: Samples could be collected by TPWD or staff of the Mission-Aransas National Estuarine Research Reserve. Sample analysis can be performed by the Mission-Aransas NERR, who already performs analysis of nutrient samples from Aransas and Copano Bays.
Cost: If samples can be collected by TPWD or other agency without cost, nutrient analysis for 4 locations would cost $180 per month (3 replicates per station x 4 stations x $15 per sample), or $2160 per year. If Mission-Aransas NERR collects samples, additional costs of $250 per month would be needed to cover the cost of boat use fees and fuel, or an additional $3000 per year. Personnel costs would be covered by TPWD and/or Mission-Aransas NERR personnel.