



LCRA-SAWS Water Project

# *Matagorda Bay Health Evaluation*

***BBEST***

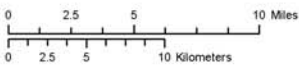
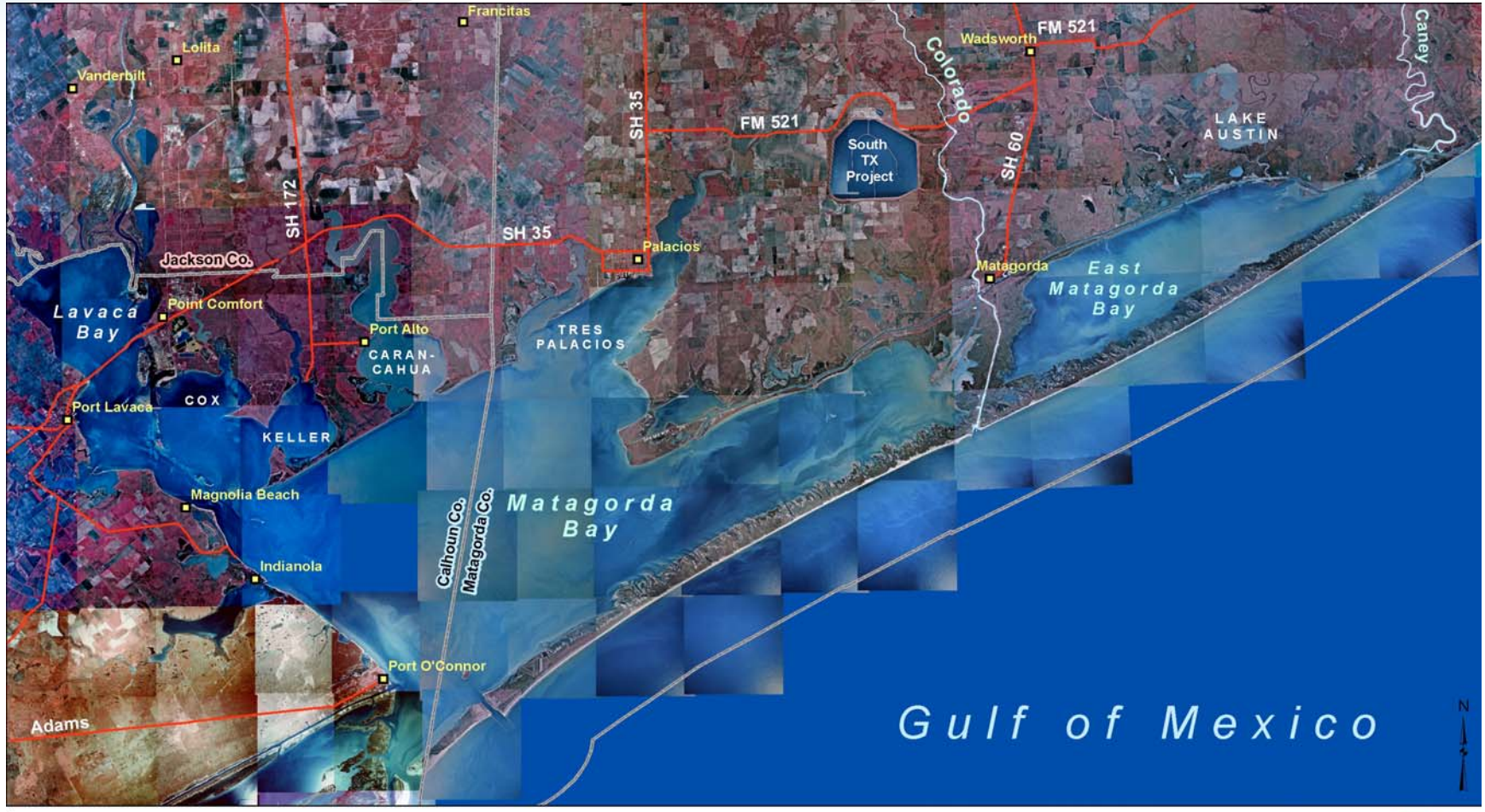
*March 11, 2009*

*Bryan Cook, LCRA*





# Matagorda Bay



Matagorda Bay

1:250,000



# *Response Models*

- ◆ Salinity
- ◆ Habitat
- ◆ Nutrients
- ◆ Benthic Condition
- ◆ Abundance



# ***MBHE Inflow Criteria - Rationale and Basis***

- ◆ Employs (to the extent possible) all completed MBHE response models
- ◆ Covers full range of inflows
- ◆ Reflects flow seasonality
- ◆ Includes recommendations for achieving various flow levels
- ◆ Recognizes potential for adaptive management



# *Rationale and Basis (cont'd)*

- ◆ Addresses only Colorado River Inflow
- ◆ Focuses on Eastern Arm of Matagorda Bay
- ◆ Employs multiple “Design Areas” for linking Bay Health response to inflow



# *Technical Components*

- ◆ Habitat
- ◆ Salinity-Inflow Relationships
- ◆ Freshets



# *MBHE Habitat Assessment Tools*

## ◆ Trophic level habitat modeling

- Low estuarine marsh
- Shellfish (brown shrimp, white shrimp, blue crab)
- Forage fish (Atlantic croaker, Gulf menhaden)

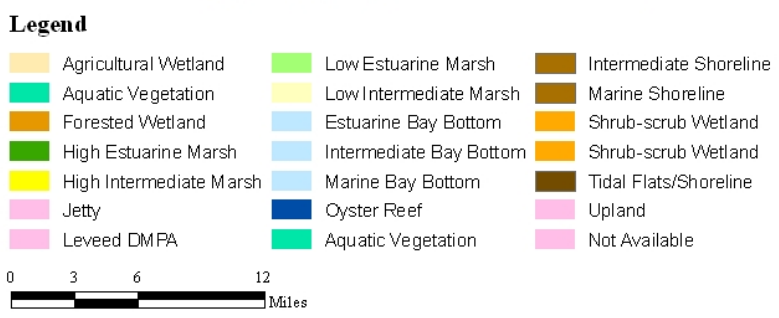
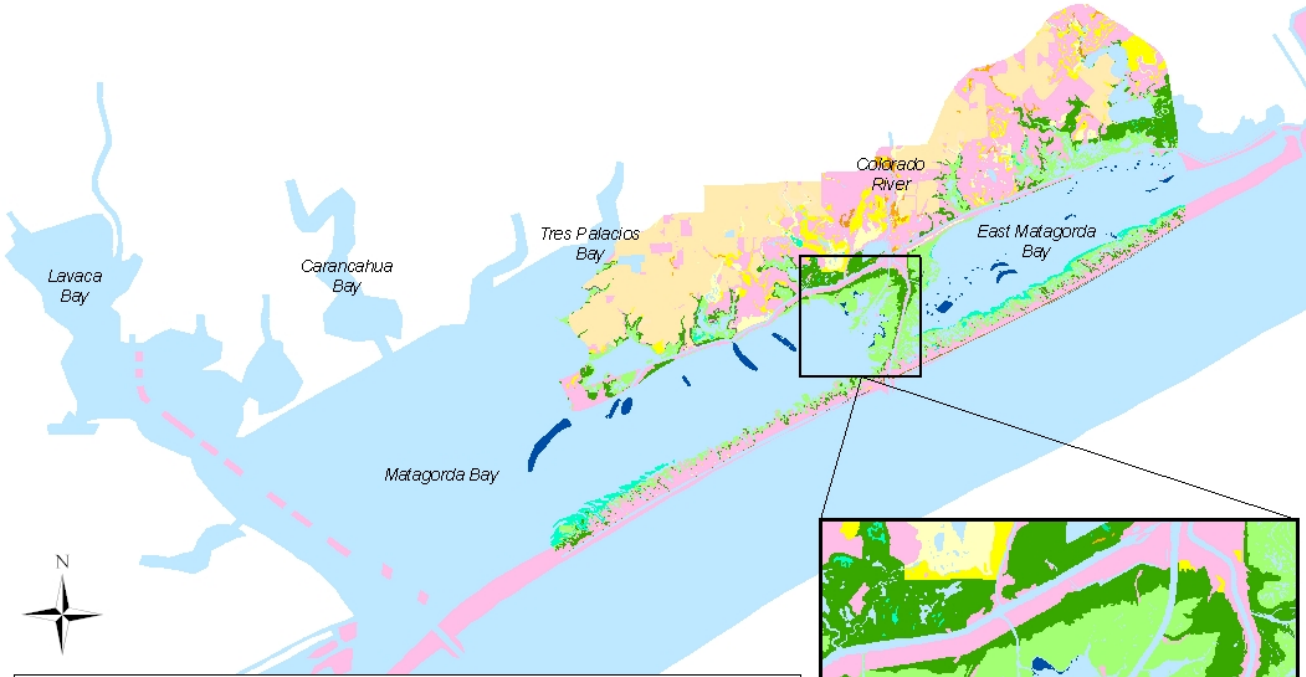
## ◆ Oyster health

- Dermo Condition Index

## ◆ Dr. Paul Montagna's benthic studies



# Study Area Physical Habitats

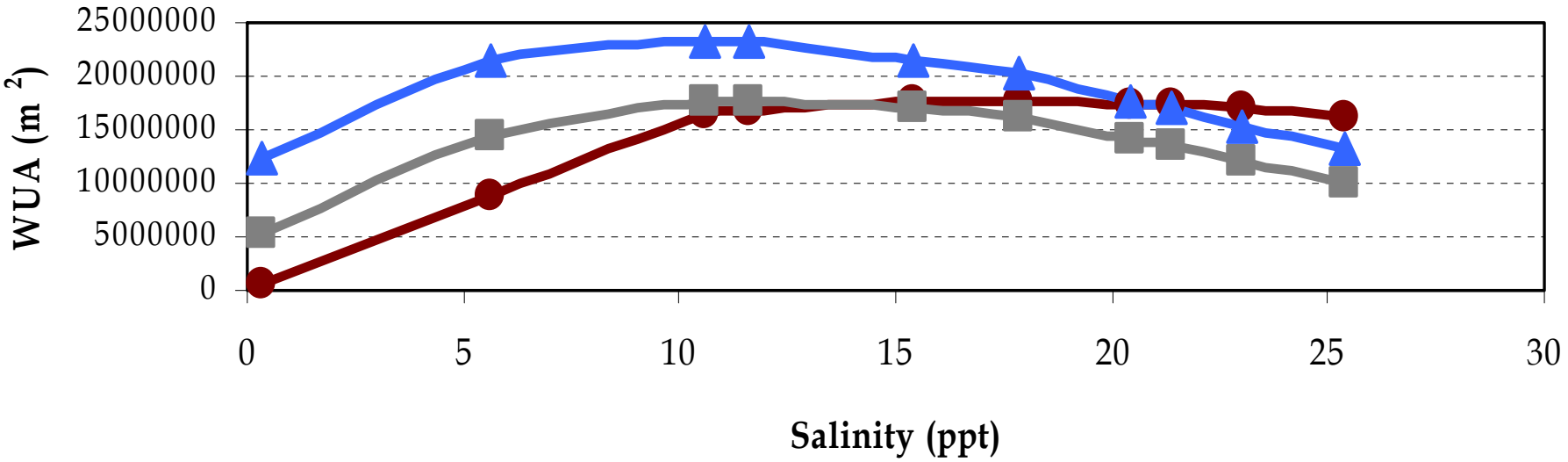






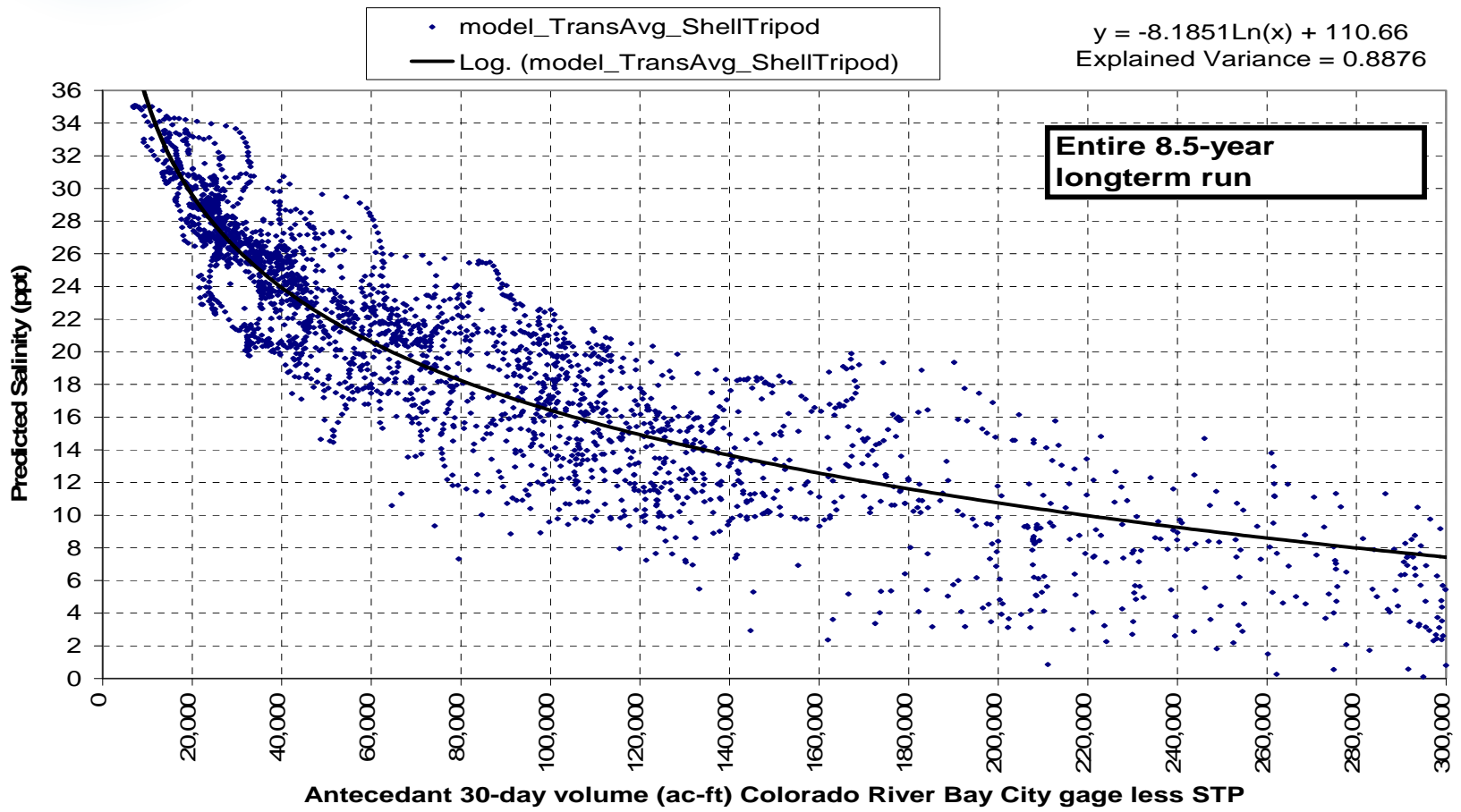
# Weighted Useable Area

COLORADO RIVER DELTA - Shellfish  
Weighted Usable Area VS. Salinity



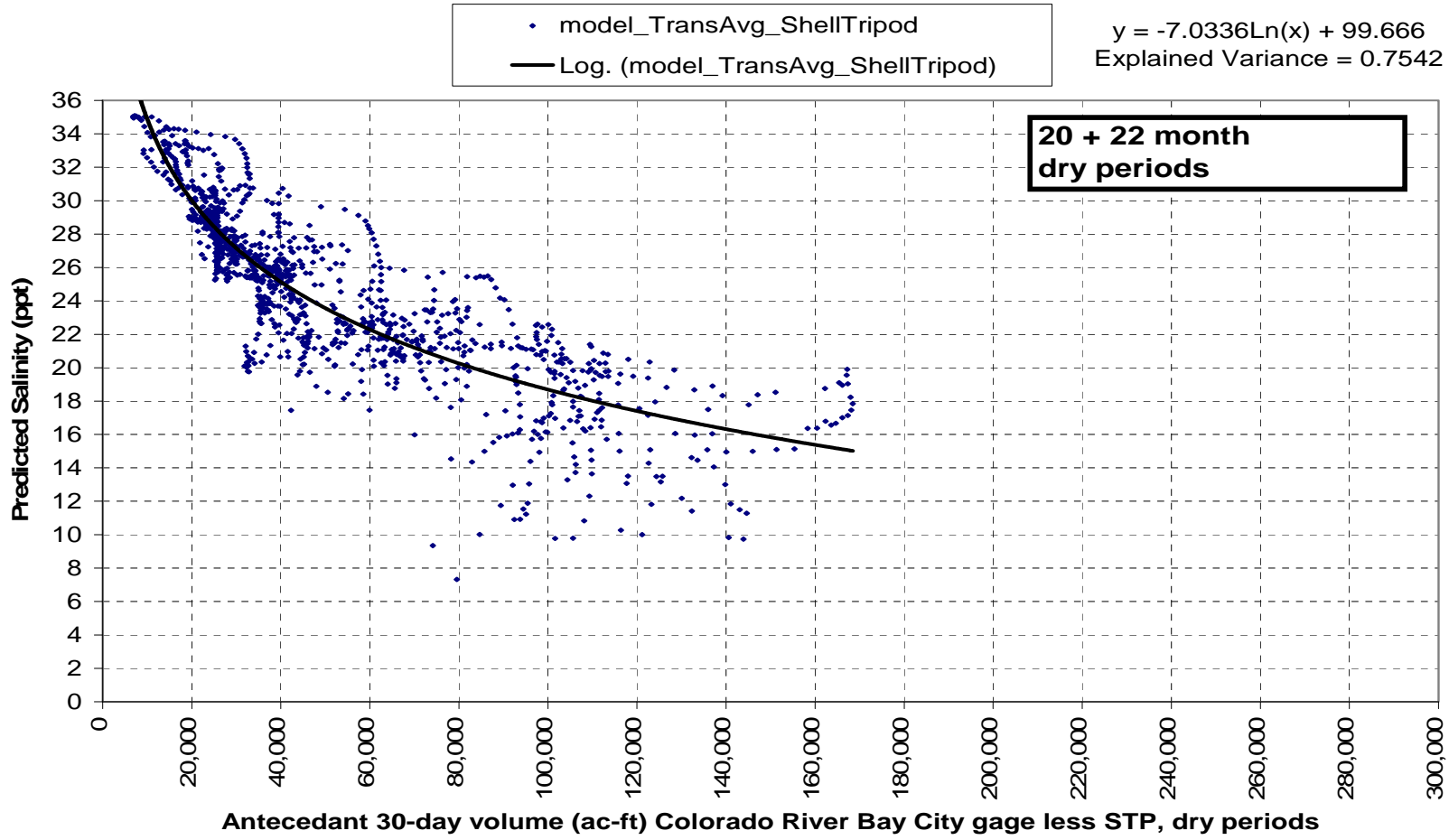


# SMB\_Tripod Transect - Linear Regression (8.5 year)





# SMB\_Tripod Transect – Linear Regression (Low Flow)



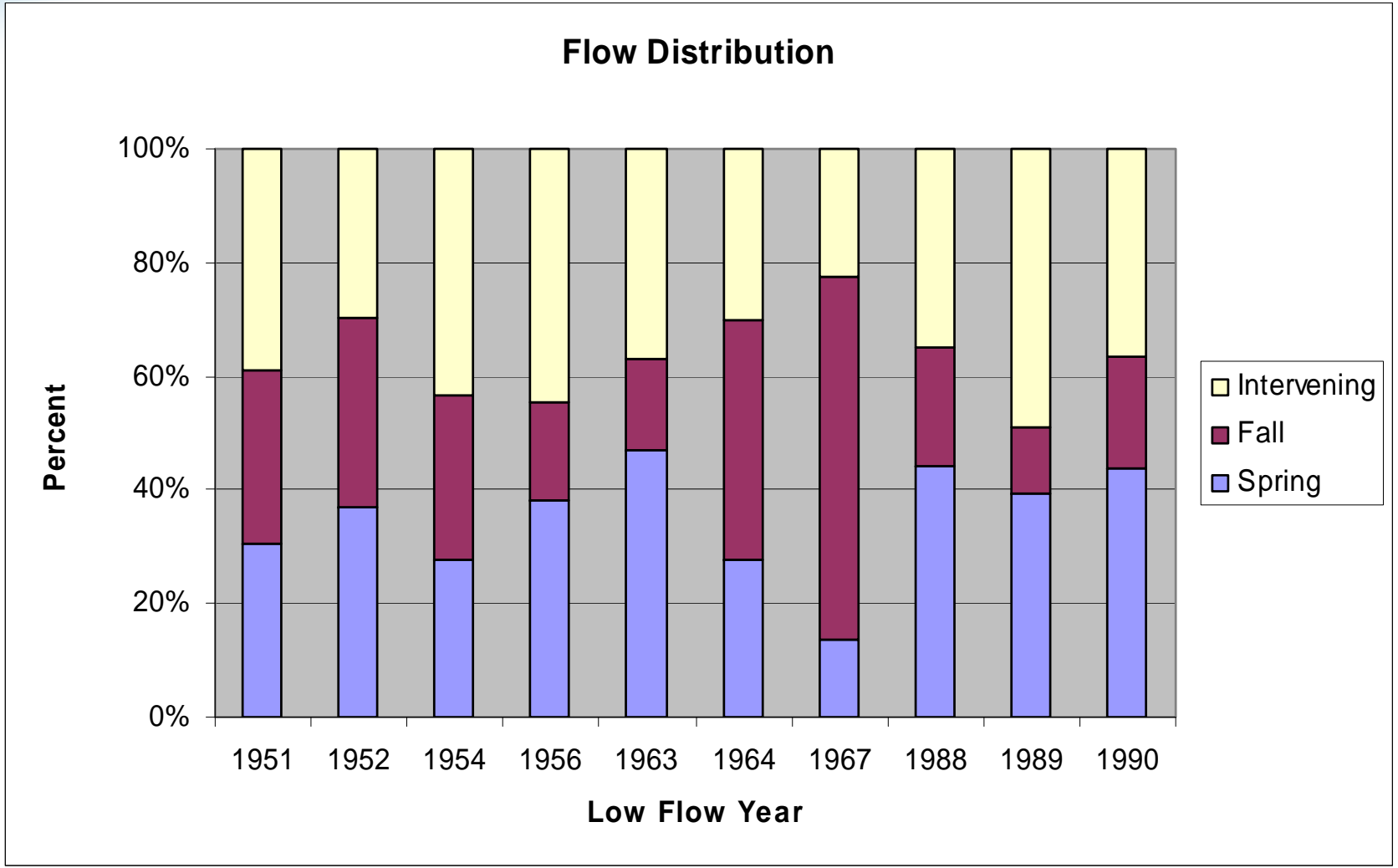


# Blending 8.5-year and Low Flow Regressions

Salinity (ppt)	Flow (AF)		
	Low Flow Eq.	Normal Eq.	
15	168,951	119,025	Apply Normal Eq.
16	146,560	105,337	
17	127,136	93,222	
18	110,287	82,501	
19	95,670	73,013	
20	82,991	64,616	
21	71,992	57,185	Apply Normal Eq.
22	62,451	50,609	
23	54,175	44,788	
24	46,995	39,638	Linear Interpolation
25	40,767	35,079	
26	35,364	31,045	
27	30,677	27,474	Apply Low Flow Eq.
28	26,611	24,315	
29	23,085	21,518	
30	20,025	19,044	
31	17,371	16,854	
32	15,069	14,915	Apply Low Flow Eq.



# *Freshet Distribution – Low Flow*





# *MBHE Inflow Criteria Objectives*

Category	Criterion	Condition	Bay Components
Long-Term	Avg Vol & Variability	Existing Essential	Primary productivity & adequate food supply
Inflow Regime	MBHE 4	High Quality	Primary productivity, oyster, habitat, benthic, shellfish, forage fish, marsh
	MBHE 3	Quality	Oyster, habitat, benthic, shellfish, forage fish, marsh
	MBHE 2	Sustain	Oyster, habitat, benthic, shellfish, forage fish, marsh
	MBHE 1	Tolerable	Oyster, habitat, benthic
Minimum	Threshold	Refuge	All species/habitats



# *Seasonal Components of Inflow Regime*

Inflow Criteria	Flow		Seasonal		
	AF / 30 days	Annualized	Spring (38%)	Fall (27%)	Intervening (35%)
MBHE 4	95,000	1,140,000	433,200	307,800	399,000
MBHE 3	54,000	648,000	246,200	175,000	226,800
MBHE 2	37,000	444,000	168,700	119,900	155,400
MBHE 1	25,000	300,000	114,000	81,000	105,000



# Summary of Freshwater Inflow Criteria, Design Areas Salinity Ranges

	Threshold	MBHE 1	MBHE 2	MBHE 3	MBHE 4	Long-term Volume and Variability
<b>Design Area</b>	Delta	Delta Edge to Mad Island Transect	Delta Edge to Mad Island Transect	Delta Edge to Mad Island Transect	Delta Edge to Mad Island Transect	EAMB
<b>Salinity range across area (ppt)</b>	< 30 <sup>1</sup>	27-29	24-26	20-23	15-18	Average <sup>4</sup>
<b>Trophic Level</b>						
<b>Primary Production</b>	Low	Low	Low	Moderate	High	Normal <sup>5</sup>
<b>Oyster Health</b>	Refuge <sup>2</sup>	Refuge <sup>2</sup>	Poor <sup>2</sup>	Fair	Good	Normal <sup>5</sup>
<b>Benthic Condition</b>	Fair / Poor	Poor	Fair	Good	Peak	Normal <sup>5</sup>
<b>Marsh Productivity</b>	Fair	Fair	Good	Good	Good	Normal <sup>5</sup>
<b>Shellfish Habitat</b>	Good <sup>3</sup> / Poor	Good <sup>3</sup> / Poor	Selected <sup>3</sup> / Fair / Poor	Selected <sup>3</sup> / Fair	Selected <sup>3</sup> / Good	Normal <sup>5</sup>
<b>Forage Fish Habitat</b>	Poor / Refuge	Poor / Refuge	Poor	Fair	Good	Normal <sup>5</sup>

<sup>1</sup> This would be typical when no significant local watershed inflows have occurred.

<sup>2</sup> Potentially detrimental to select reefs based on Dermo Condition Index. However, a condition experienced a similar amount of time historically.

<sup>3</sup> Ranking applies to brown shrimp. Blue crab and white shrimp habitat ranks lower.

<sup>4</sup> The long-term average salinity will be in the mid teens but include very low and high periods.

<sup>5</sup> Indicators of productivity and health will be normal, but will experience variations during dry and wet periods.





# *Inflow Criteria – Volumes, Variability, and Achievement Guidelines*

Criteria	Flow Volumes Acre-Feet (AF)			Achievement Guideline
Long-Term Volume	Average inflow of at least 1.4 to 1.5 MAF per year			100%
	Coefficient of Variation > 0.8			
Regime	Spring	Fall	Intervening	
	(AF/ 3 mo.)	(AF/ 3 mo.)	(AF/ 6 mo.)	
MBHE 4	433,200	307,800	399,000	35%
MBHE 3	246,200	175,000	226,800	60%
MBHE 2	168,700	119,900	155,400	75%
MBHE 1	114,000	81,000	105,000	90%
Threshold	Maintain 15,000 AF per month			100%



# *Stakeholder Involvement*

- ◆ Resource Agency/Environmental Group Interaction
- ◆ LSWP Science Review Panel (SRP) Input



# *Summary*

- ◆ MBHE studies and inflow criteria most comprehensive to date
- ◆ Provides for a “threshold” minimum flow maintenance
- ◆ Addresses seasonal flow and variability
- ◆ Specifies an “achievement guideline” for each criterion
- ◆ Provides for maintenance of long-term flow volume and variability



# Comparison with 2006 FINS

Inflow Criteria	FINS (2006)	MBHE	ACHIEVEMENT GUIDELINE
Long-term Volume and Variability		1.4 to 1.5 Million Acre Feet (MAF) per year, Coefficient of Variation should exceed 0.8.	100% - Based on Water Availability Modeling (WAM) results.
FINS Target	Monthly flow targets for the Colorado River ranging from 60,400 AF in April to a high of 255,400 in May. The sum of the individual monthly targets is 1,427,800 AF for the year.		Based on Lake levels and inflow to the Highland Lakes. No set percentage to be achieved is specified.
MBHE 4		Spring and Fall seasonal pulses plus additional flow in the intervening months. Based on monthly average flows of 95,000 acre-feet. The sum of seasonal flows is 1,140,000 AF for the year.	35% - Based on Water Availability Modeling (WAM) results (see discussion in Section 5.2).
MBHE 3		Spring and Fall seasonal pulses plus additional flow in the intervening months. Based on monthly average flows of 54,000 acre-feet.	60% - Operating protocol "triggers" are to be established to manage flows by releases from storage so as to satisfy.
MBHE 2		Spring and Fall seasonal pulses plus additional flow in the intervening months. Based on monthly average flows of 37,000 acre-feet.	75% - Operating protocol "triggers" are to be established to manage flows by releases from storage so as to satisfy.
FINS Critical	Monthly inflow criteria of 36,000 AF per month		Based on Lake levels and inflow to the Highland Lakes. No set percentage to be achieved is specified.
MBHE 1		Spring and Fall seasonal pulses plus additional flow in the intervening months. Based on monthly average flows of 25,000 acre-feet.	90% - Operating protocol "triggers" are to be established to manage flows by releases from storage so as to satisfy.
Threshold		Monthly inflow criteria of 15,000 AF per month	100% - Use storage as necessary.



# *Matagorda Bay Health Evaluation*

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*Questions?*

