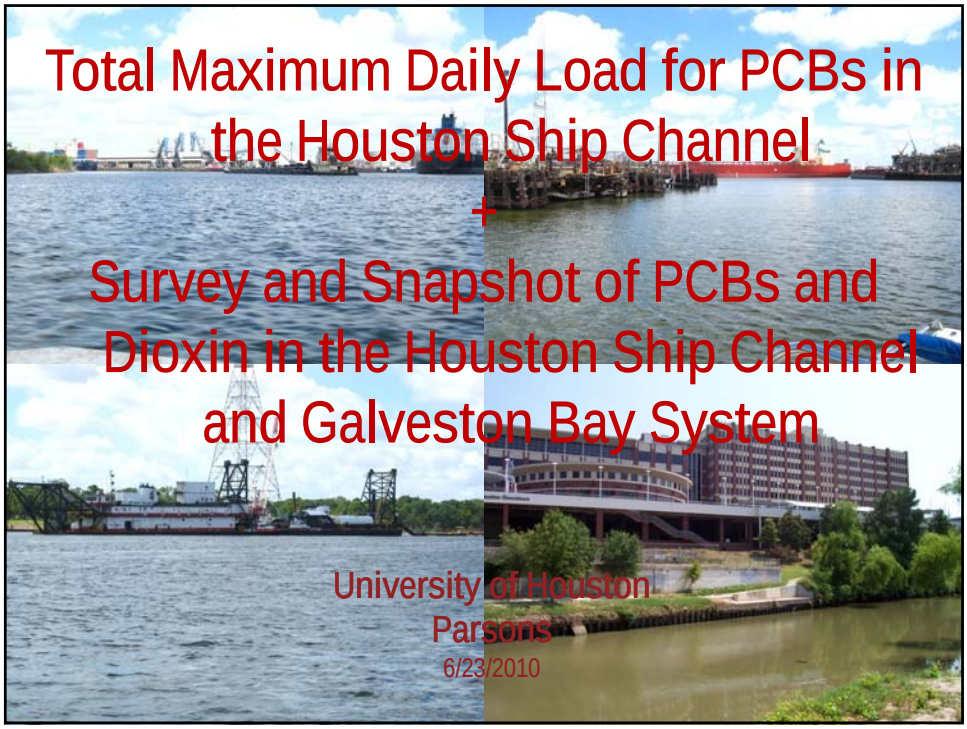
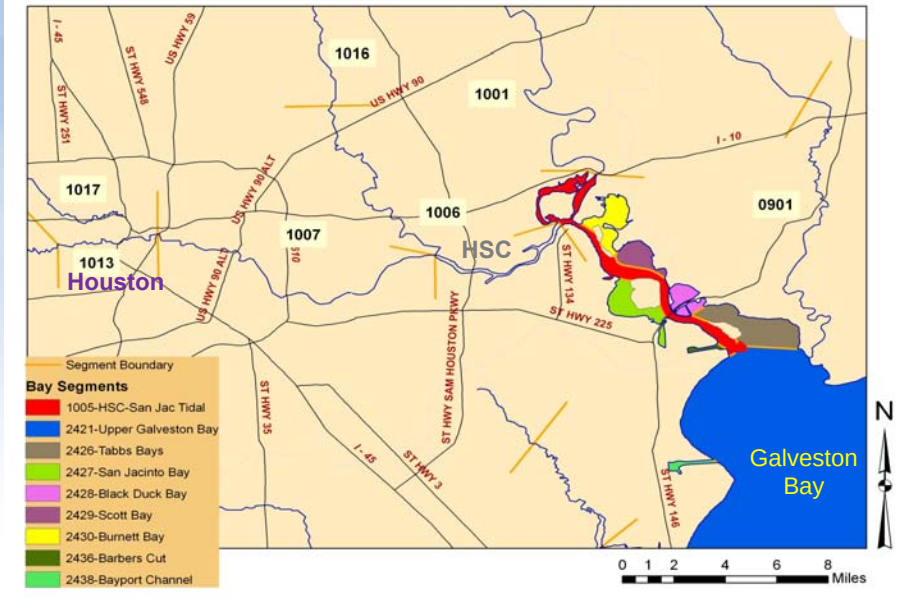


Outline

- Total Maximum Daily Load for PCBs in the Houston Ship Channel
  - FY09 PCB results from the Houston Ship Channel (HSC) and Galveston Bay.
  - Effluent and Runoff Sampling Results
- Proposed Sampling Plan
  - Survey of PCBs and Dioxin in the Galveston Bay System
  - Snapshot of PCBs and Dioxin in the Houston Ship Channel and Galveston Bay

Total Maximum Daily Load for PCBs in the Houston Ship Channel

Houston Ship Channel Segments

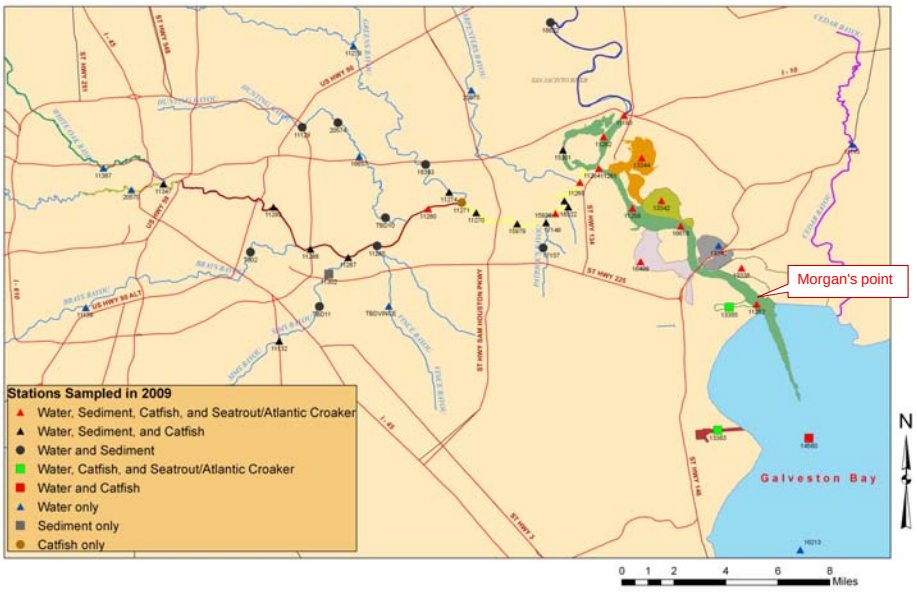


FY 2009 PCB Sampling

- PCB ambient sampling
  - Samples collected for water, sediment, and tissue in HSC and Upper Galveston Bay
    - 47 sites sampled for water (dissolved & suspended)*
    - 35 sites sampled for sediment
    - 30 sites sampled for catfish and 16 sites sampled for seatrout or Atlantic croaker.
- PCB runoff sampling
  - 7 sites sampled once and 1 site sampled twice for water (dissolved & suspended (1-40 μm and >40 μm))*.
- PCB effluent sampling
  - 16 effluent sites sampled for effluent (dissolved & suspended)*.
- PCB concentrations calculated as sum of 43 congeners; non-detects assumed as ½ MDL

**High-volume sampling technique*

FY 2009 PCB Ambient Sampling Locations



QA/QC Summary

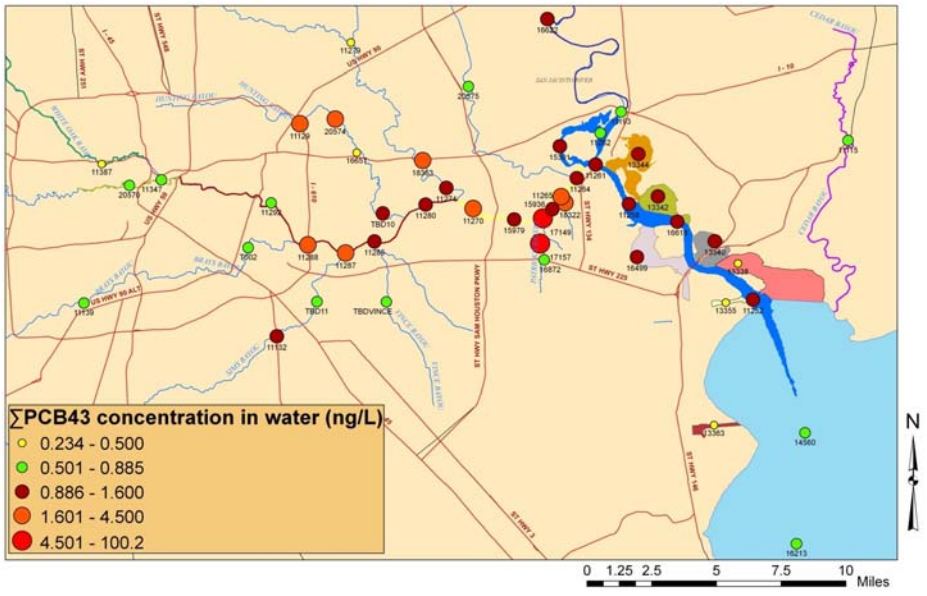
Media	Analysis	Number of samples collected	Number of sample results obtained from laboratory	Number of sample results reviewed for QA/QC	% Results reviewed for QA/QC
Water	TSS, DOC, TOC	81	81	81	100%
Sediment	Grain size and Solids content	42	42	*	*
Water	PCB (209 Congeners)	174	174	174	100%
Sediment	PCB (209 Congeners)	42	42	42	100%
Sediment	TOC	42	42	42	100%
Fish	PCB (209 Congeners), Lipid and Moisture content*	58	58	58	100%

*QA/QC not required

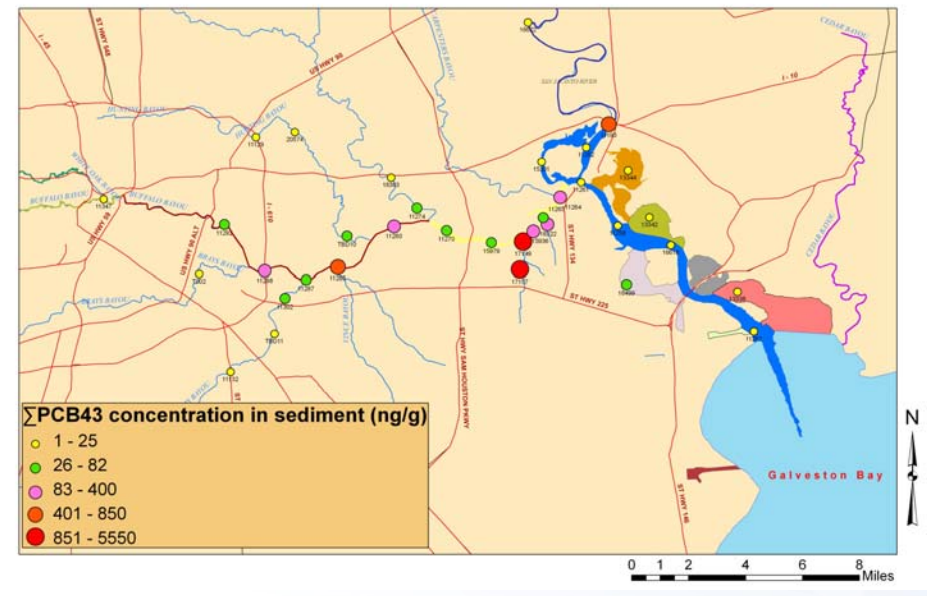
Summary Statistics for DOC and TSS by Sample Type

	Count	Mean	Median	Minimum	Maximum	Standard Deviation
Ambient samples						
DOC (mg/L)	48	6.3	6.3	2.3	15.5	2.3
TSS (mg/L)		31.8	30	2	93	20.6
Effluent samples						
DOC (mg/L)	16	15.2	10.4	2.5	48.5	12.0
TSS (mg/L)		27.9	17	2	137	34.6
Runoff samples						
DOC (mg/L)	9	7.6	7.3	5.6	11.5	1.7
TSS (mg/L)		115	99	63	221	57

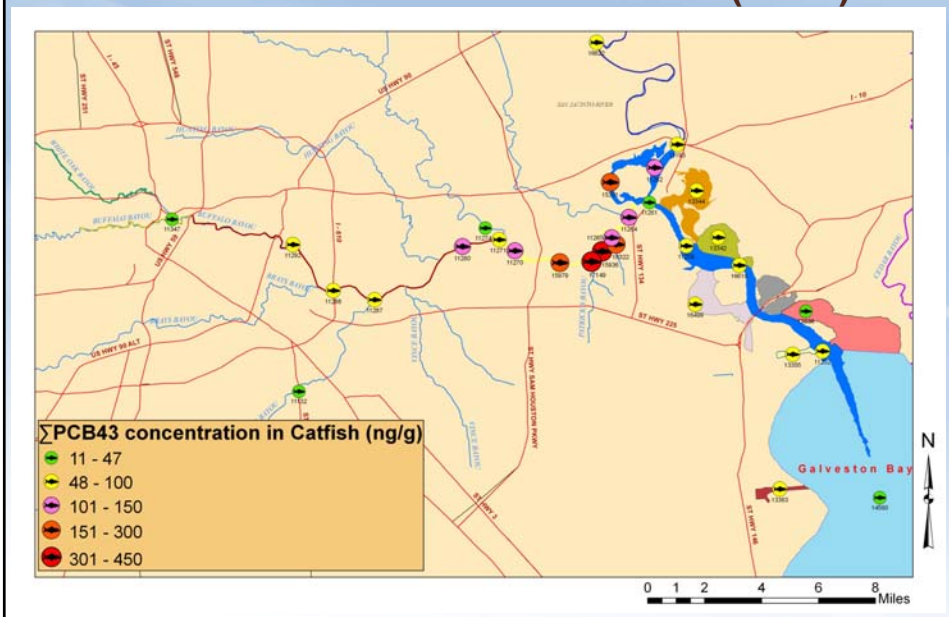
PCB Concentrations in Water (2009)



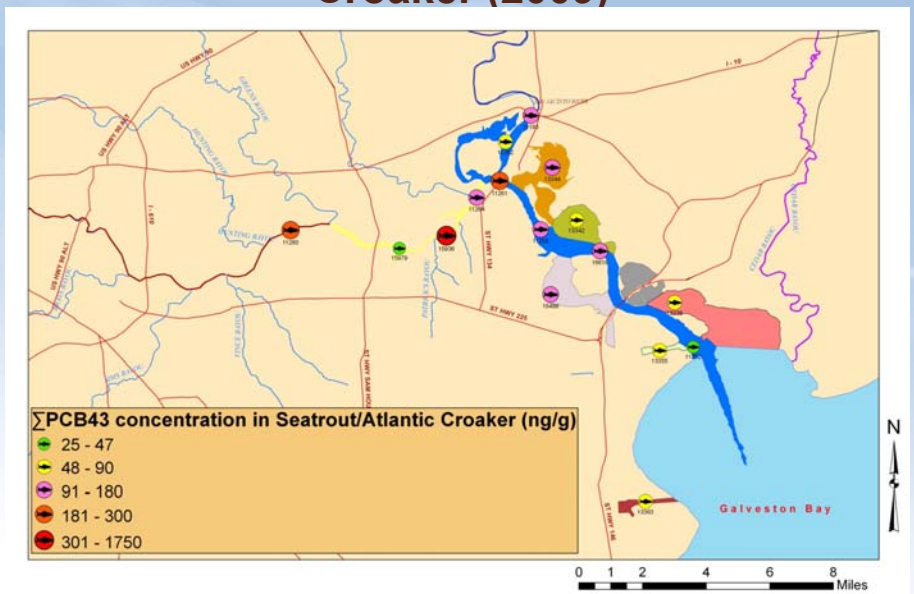
PCB Concentrations in Sediment (2009)



PCB Concentrations in Catfish (2009)



PCB Concentrations in Seatrout/Atlantic Croaker (2009)

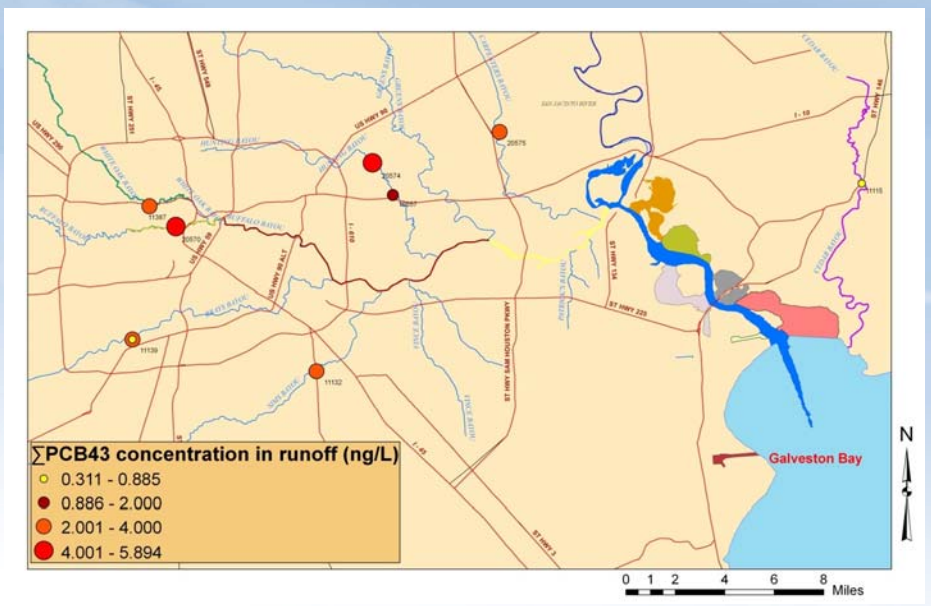


Comparison of Percent Stations Exceeding Water/Tissue Quality Standards

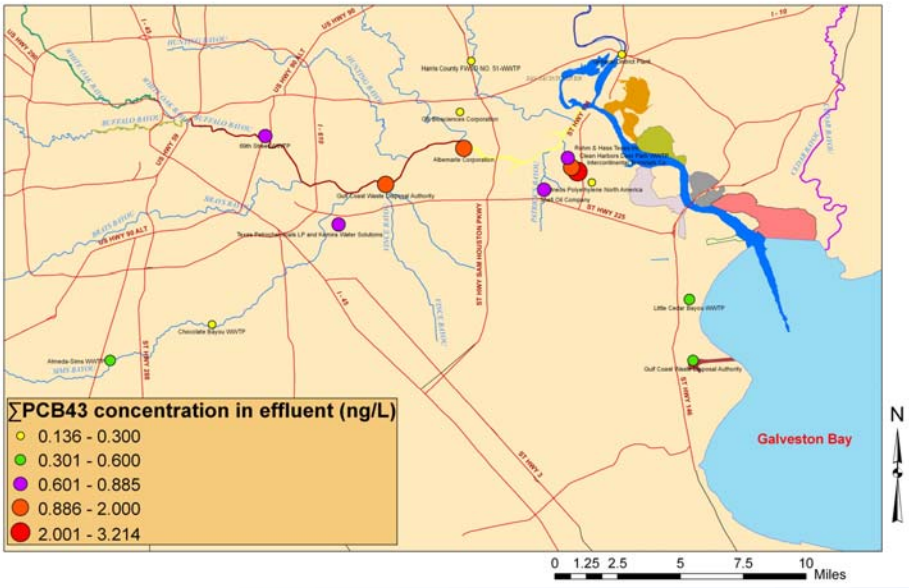
Sampling		Water[a]	Catfish[b]	Seatrout/Atlantic Croaker[b]
2002-2003	Stations sampled	32	45	Not sampled
	Stations that exceed standard	12	36	
	Station exceedance (%)	38%	80%	
2008	Stations sampled	37	26	19
	Stations that exceed standard	15	19	16
	Station exceedance (%)	41%	73%	84%
2009	Stations sampled	48	30	18[c]
	Stations that exceed standard	28	24	16[c]
	Station exceedance (%)	58%	80%	89%

a WQS (0.885 ng/L)
b DSHS Health Assessment Comparison Value (47 ng/g)
c Species sampled
* ∑43 congeners

PCB Concentration in Runoff (2009)



PCB Concentration in Effluent (2009)



Correlations Between PCB and Water Column Parameters

	DOC (mg/L)	TOC (mg/L)	TSS (mg/L)	Suspended PCB (ng/L)	Dissolved PCB (ng/L)
DOC (mg/L)	1				
TOC (mg/L)	.995**	1			
TSS (mg/L)	.165	.152	1		
Suspended Total PCB (ng/L)	.034	.056	.067	1	
Dissolved Total PCB (ng/L)	.085	.098	.044	.789**	1

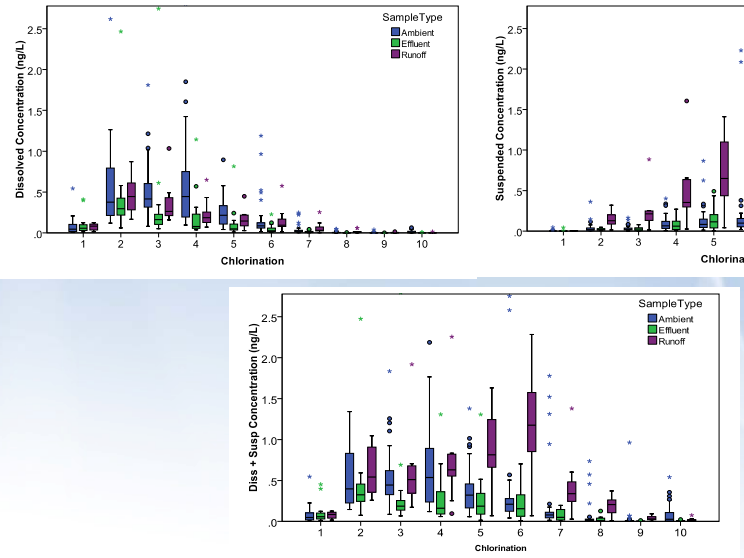
← All unique combinations of station and sample type (n=73)

Ambient samples only (n=48) →

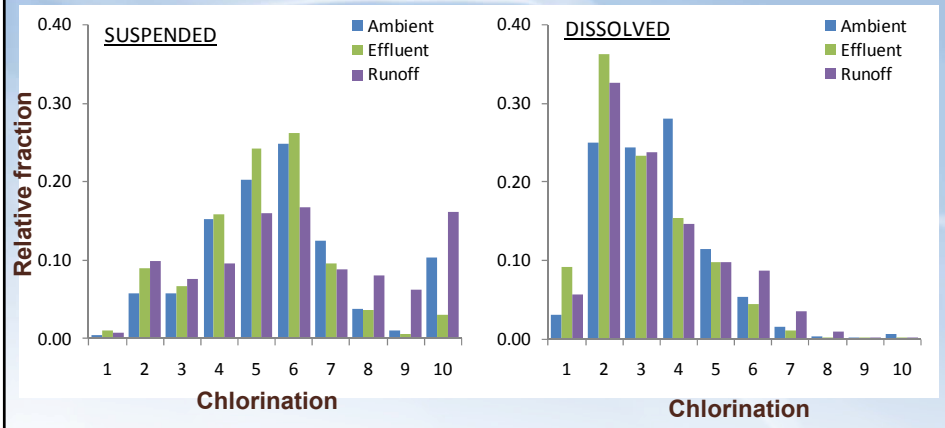
	DOC (mg/L)	TOC (mg/L)	TSS (mg/L)	Suspended Total PCB (ng/L)	Dissolved Total PCB (ng/L)
DOC (mg/L)	1				
TOC (mg/L)	.961**	1			
TSS (mg/L)	-.045	-.126	1		
Suspended Total PCB (ng/L)	.327*	.415**	.122	1	
Dissolved Total PCB (ng/L)	.573**	.628**	.196	.790**	1

* Bolded and double asterisked correlations are significant (two tailed) at the p=0.01 level and the p=0.05 level for a single asterisk

PCB Homolog Profiles for Ambient, Effluent, and Runoff Samples

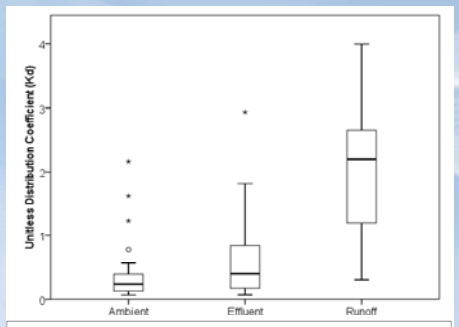


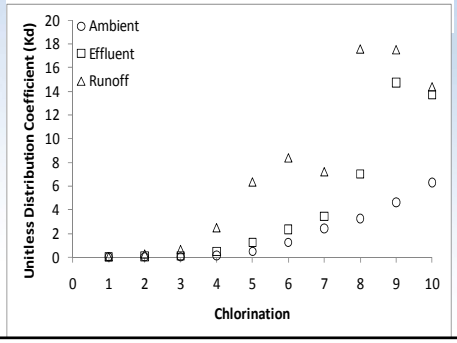
PCB Homolog Profiles for Ambient, Effluent, and Runoff Samples



- Dissolved phase is similar in most sample types: ambient, effluent, and runoff.
- Suspended phase shows a greater difference than was observed with the dissolved phase for all three sample types.

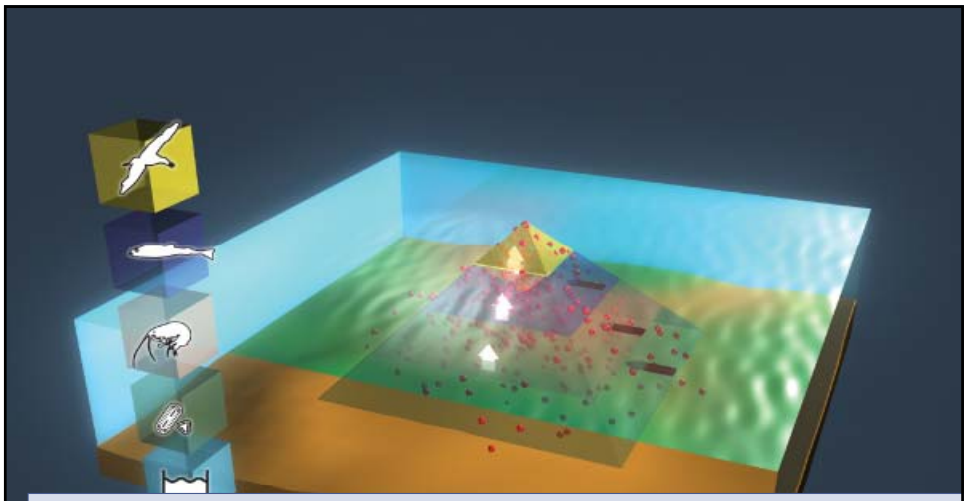
PCB Partitioning





- Runoff samples show dominant PCB concentrations in suspended phase compared to ambient and effluent.
- However, when the amount of sediment per volume is taken into account, ambient and runoff show no statistical difference.

- Partitioning levels increase with increasing chlorination in all three samples types, but the increasing trend not the same.
- Simple linear partitioning models normally used to describe this behavior may not always be adequate for effluent and runoff conditions



Proposed Sampling Plan

- Snapshot of PCBs and Dioxin in the Houston Ship Channel and Galveston Bay
- Survey of PCBs and Dioxin in the Galveston Bay System

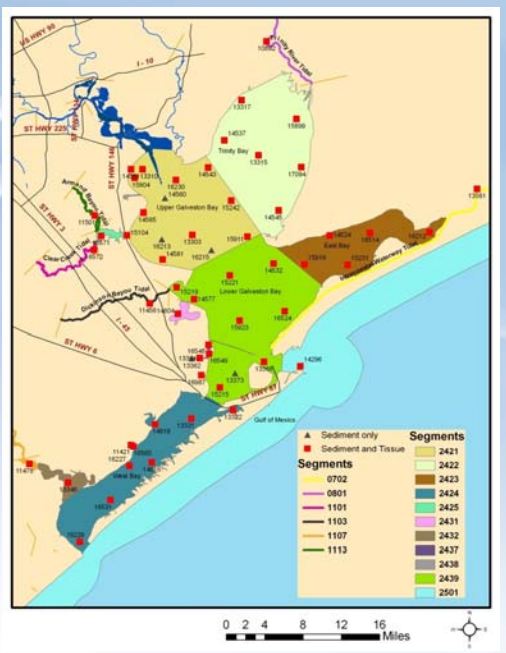
Parameters of Interest

Parameter	In-stream Water	Bed Sediment	Tissue
TSS	Y	NA	NA
DOC	Y	NA	NA
TOC	Y	Y	NA
Solids Content	NA	Y	NA
Grain size	NA	Y	NA
Lipid content	NA	NA	Y
PCB dissolved in water	Y	NA	NA
PCB in suspended sediment	Y	NA	NA
PCB in sediment	NA	Y	NA
PCB in fish tissue	NA	NA	Y
Dioxin dissolved in water	Y	NA	NA
Dioxin in suspended sediment	Y	NA	NA
Dioxin in sediment	NA	Y	NA
Dioxin in fish tissue	NA	NA	Y

Survey of PCBs and Dioxin in the Galveston Bay System - Selection Criteria

- Reference Conditions
- Potential Sources
- Spatial Distribution
- Physiography and hydrography
- Add-on opportunities
- Secondary considerations

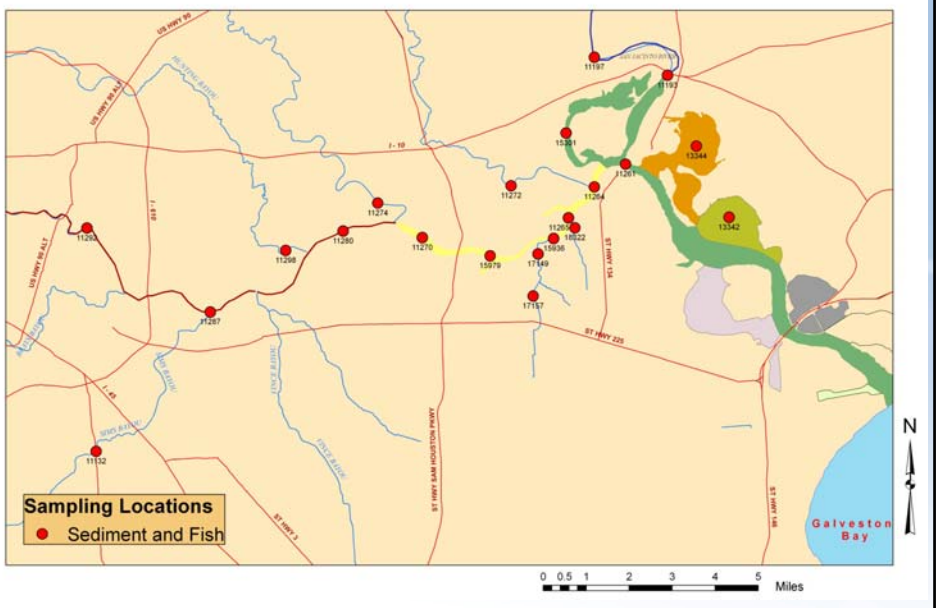
Proposed Sediment and Fish Sampling Locations in the Galveston Bay System



Snapshot of PCBs and Dioxin in the Houston Ship Channel and Galveston Bay - Selection Criteria

- Provides a framework for decision making for the PCB/dioxin constituents on a system-wide basis.
- Includes snapshot of PCBs and dioxins in sediment and tissue in the HSC and a snapshot of PCBs and dioxins in water in the HSC and Galveston Bay.
- Station selection based on high concentrations observed from 2002-2003, 2008 and 2009 sampling results.
- Monitoring plan consists of collecting 25 high-volume water samples, 21 bottom sediment samples, and up to 21 tissue samples.
- Proposed locations may change.

Proposed Sediment and Fish Sampling Locations in Houston Ship Channel



Proposed Water Sampling Locations in Houston Ship Channel and Galveston Bay