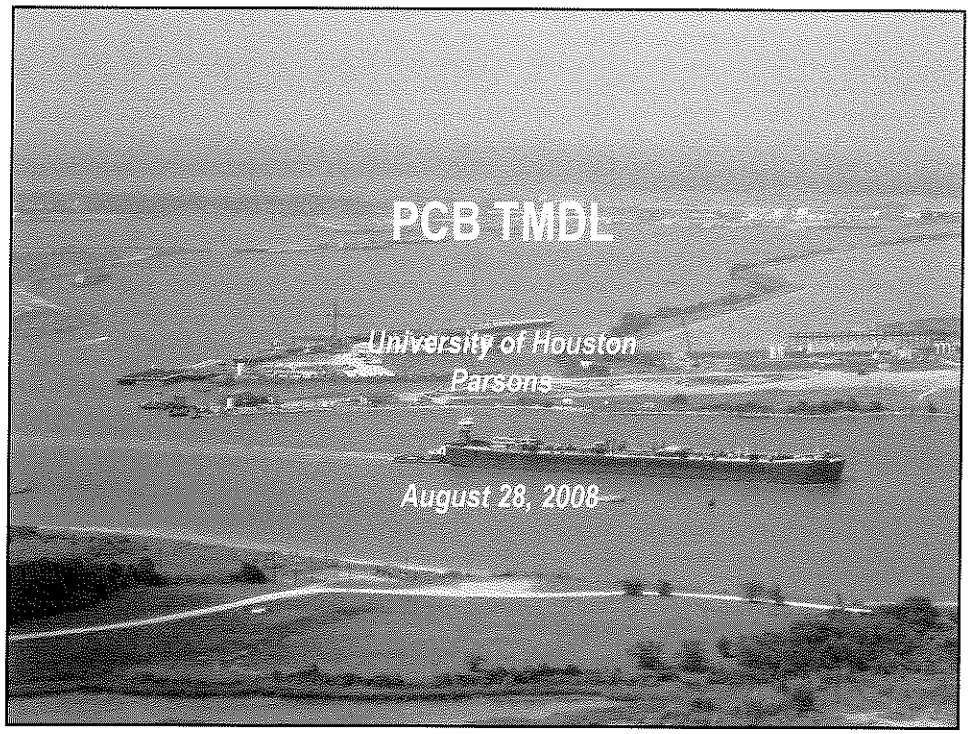
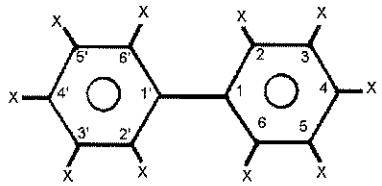


PCBs are:

- Double aromatic ring chlorinated organics



- 209 possible congeners
- Liquid at ambient conditions
- Low volatility
- Very insoluble, hydrophobic, and lipophillic

Industrial Chronology

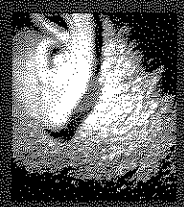
PCBs first been produced by Swan Chemical Company in 1929

1929 → World War II	Used as dielectric fluid in transformers
Late 1940s → Early 1970s	Used for: • Dielectric fluids • Heat transfer fluids • Heat resistant hydraulic fluids • Plasticizers • Lubricants • Carbonless copy paper • Laminating agents • Paints • Other misc. applications

PCB manufacture **banned in the US in 1977** (Monsanto last company to produce them)

Toxicological Risk

- Average background PCB concentration in human serum: 0.9-1.5 ppb (ATSDR, 2000)
- IARC lists PCBs as "probably carcinogenic"
- Coplanar PCBs are "dioxin-like"
- Drinking water MCL: 0.5 ppb
- Also a POP (1/2 life: 30-40 yrs)
- Global (found in Arctic)

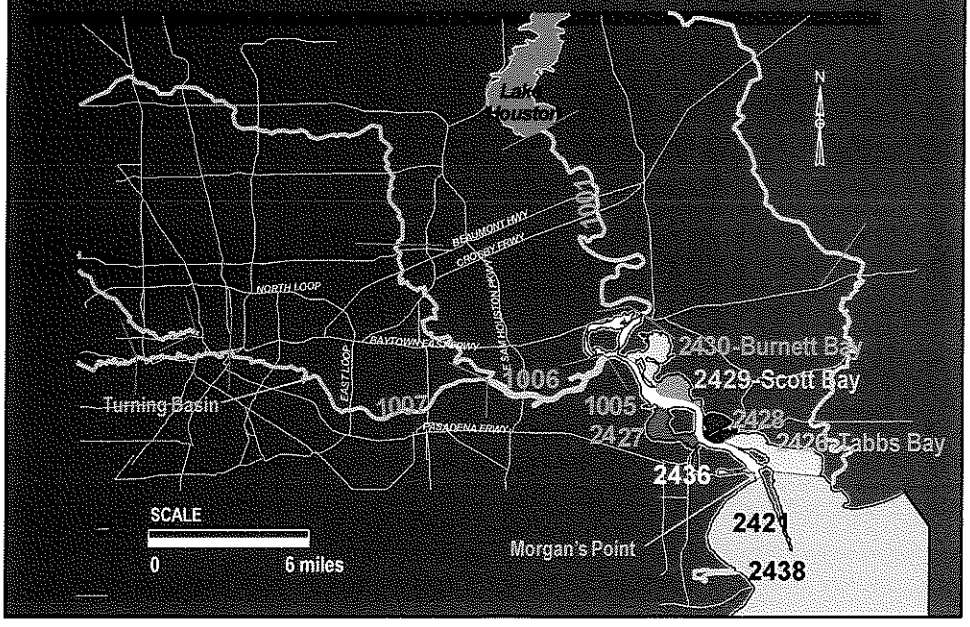


Chloracne in a herbicide production worker

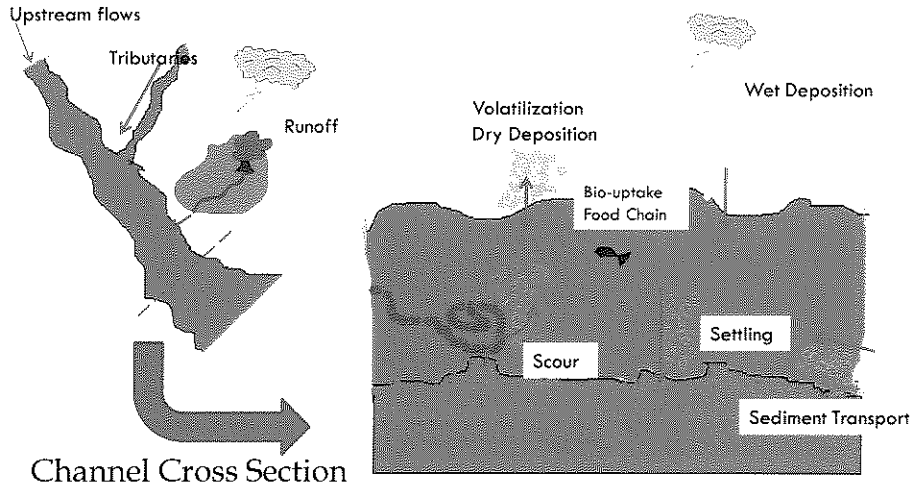
Galveston Bay Watershed Dioxin and PCB UH Studies

- Began in 2001 with a 1 yr planning study
- Sampling in 2002 – 2005 for dioxin with one snapshot for PCBs in 2002-2003
- PCB focused study began in FY07 with sampling in FY08
- Dioxin TMDL planned for FY09

HSC and Upper Galveston Bay



Transport Pathways



PCB Results

Concentration Comparison to Other Studies

HSC Water: 0.49-12.49 ng L^{-1}

New York Harbor: 6.7-9.4 ng L^{-1} (Totten et al., 2001)

➢ Highest concentration seen

HSC Sediment: 4.18-4,601 ng g^{-1}-dry wt

Venice Lagoon, Italy: 2-2,049 ng g^{-1}-dry wt *(Frignani et al., 2001)*

➢ Highest concentration seen

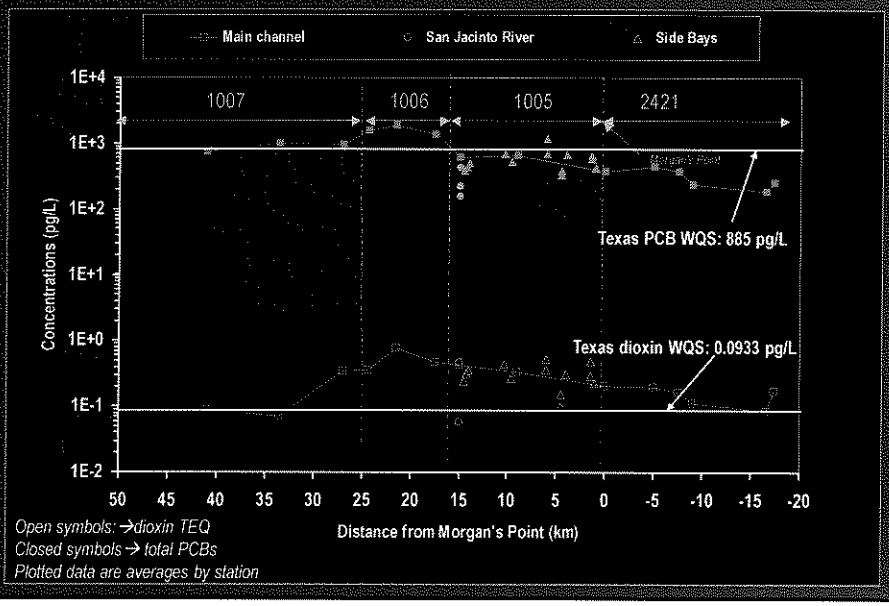
HSC Fish: 4.13-1,596 ng g^{-1}-wet wt

Eman River, Sweden: 20.6-1,244 ng g^{-1}-wet wt (Bremle et al., 1995)

➢ One of the highest concentrations seen

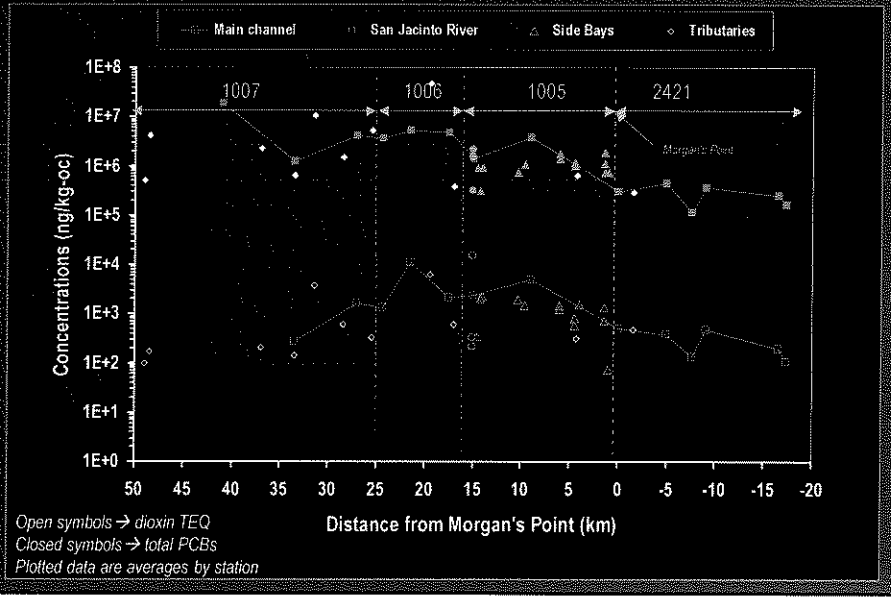
Total-Σ of 209 congeners similar the studies

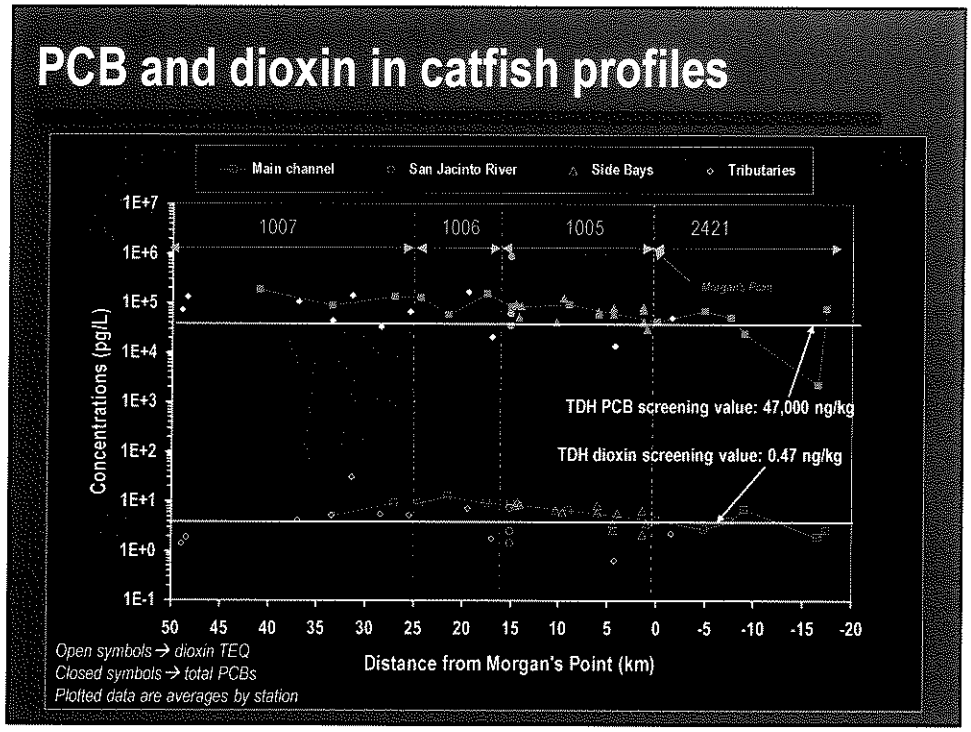
PCB and dioxin in water profiles

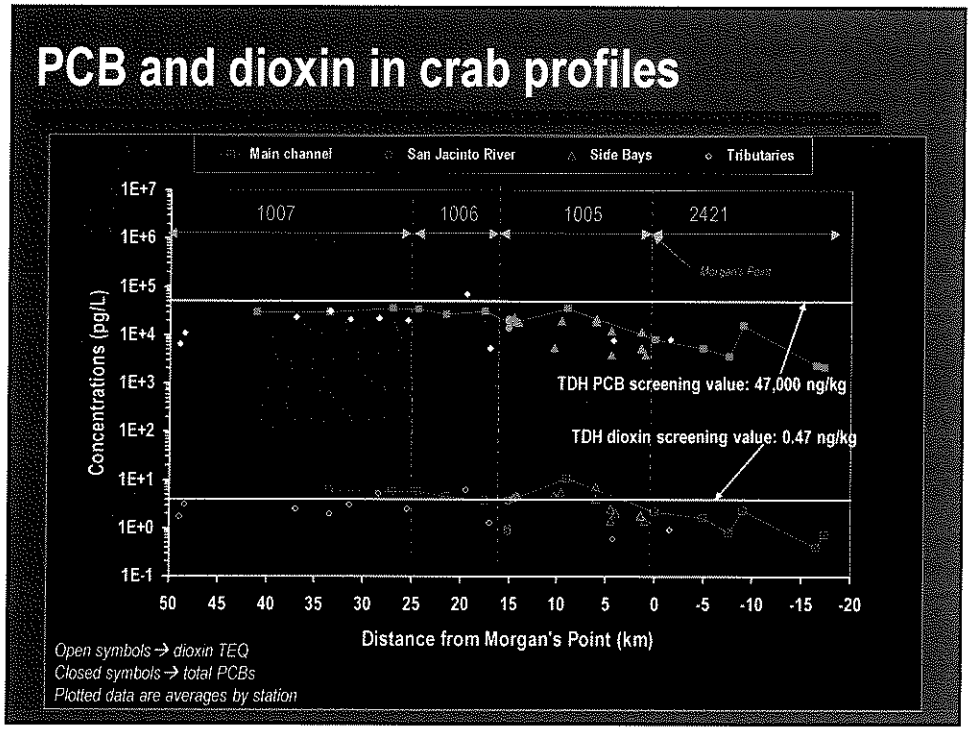


they will not exceed

PCB and dioxin in sediment-oc profiles



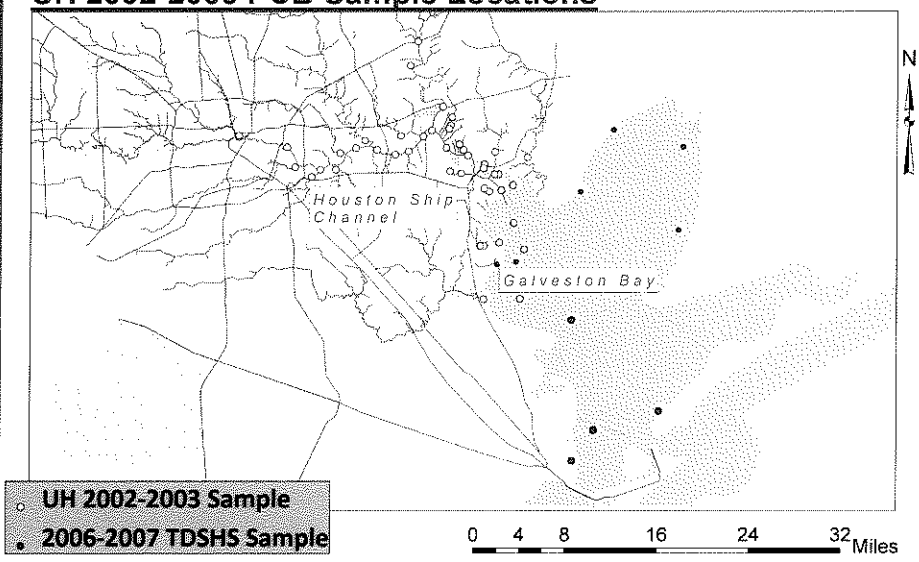

PCB and dioxin in catfish profiles
Main channel
San Jacinto River
Side Bays
Tributaries
1007
1006
1005
2421
Morgan's Point
TDH PCB screening value: 47,000 ng/kg
TDH dioxin screening value: 0.47 ng/kg
Concentrations (pg/L)
1E+7
1E+6
1E+5
1E+4
1E+3
1E+2
1E+1
1E+0
1E-1
50 45 40 35 30 25 20 15 10 5 0 -5 -10 -15 -20
Distance from Morgan's Point (km)
Open symbols → dioxin TEQ
Closed symbols → total PCBs
Plotted data are averages by station


PCB and dioxin in crab profiles
Main channel
San Jacinto River
Side Bays
Tributaries
1007
1006
1005
2421
Morgan's Point
TDH PCB screening value: 47,000 ng/kg
TDH dioxin screening value: 0.47 ng/kg
Concentrations (pg/L)
1E+7
1E+6
1E+5
1E+4
1E+3
1E+2
1E+1
1E+0
1E-1
50 45 40 35 30 25 20 15 10 5 0 -5 -10 -15 -20
Distance from Morgan's Point (km)
Open symbols → dioxin TEQ
Closed symbols → total PCBs
Plotted data are averages by station

PCB Fish Sampling Studies

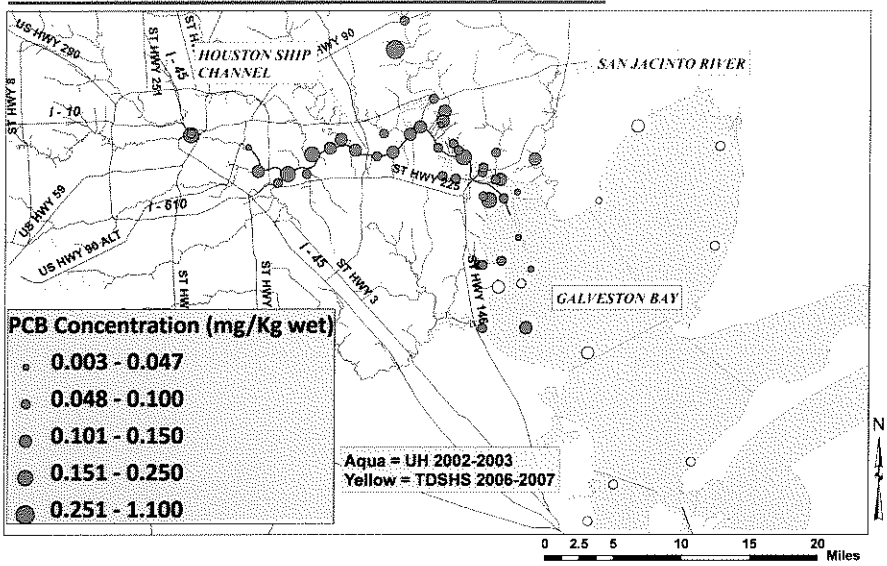
- 2002-2003 UH
  - Samples collected in Houston ship channel and Upper Galveston Bay
  - Samples collected for catfish only
  - 101 samples collected over 45 sites in three sampling phases
- 2006-2007 DSHS
  - Samples collected in Upper Galveston Bay, Trinity Bay and Lower Galveston Bay
  - 9 Spotted Seatrout and 3 Gaftopsail Catfish collected in Lower Galveston Bay
  - 6 Spotted Seatrout and 6 Gaftopsail Catfish collected in Upper Galveston Bay and Trinity Bay
- 2008 UH
  - Samples collected in Houston ship channel and Upper Galveston Bay
  - Samples collected for catfish and Seatrout/Atlantic Croaker
  - 26 samples collected for catfish and 19 samples for Seatrout/Atlantic croaker

UH 2002-2003 PCB Sample Locations



UH 2002 – 2003 samples include catfish only

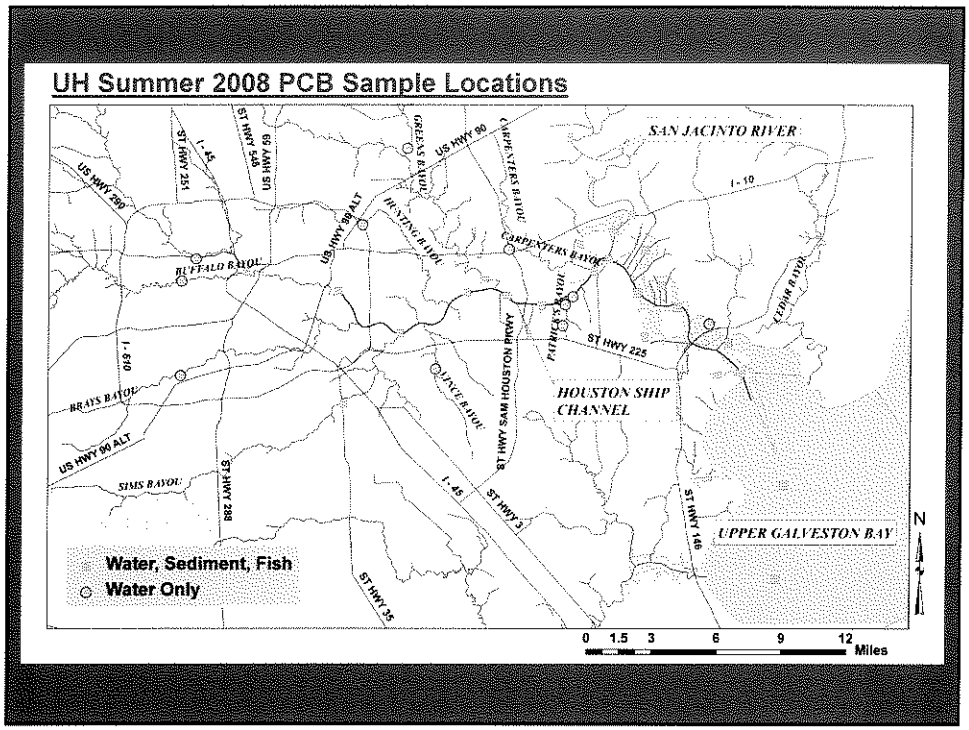
UH 2002-2003 Catfish PCB Comparison

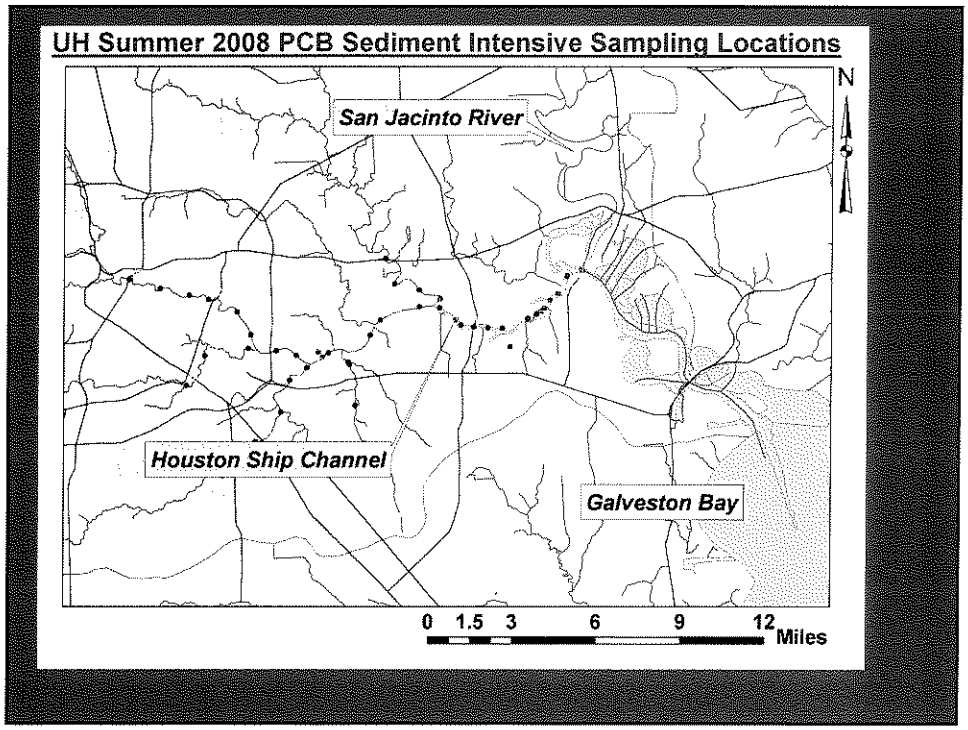


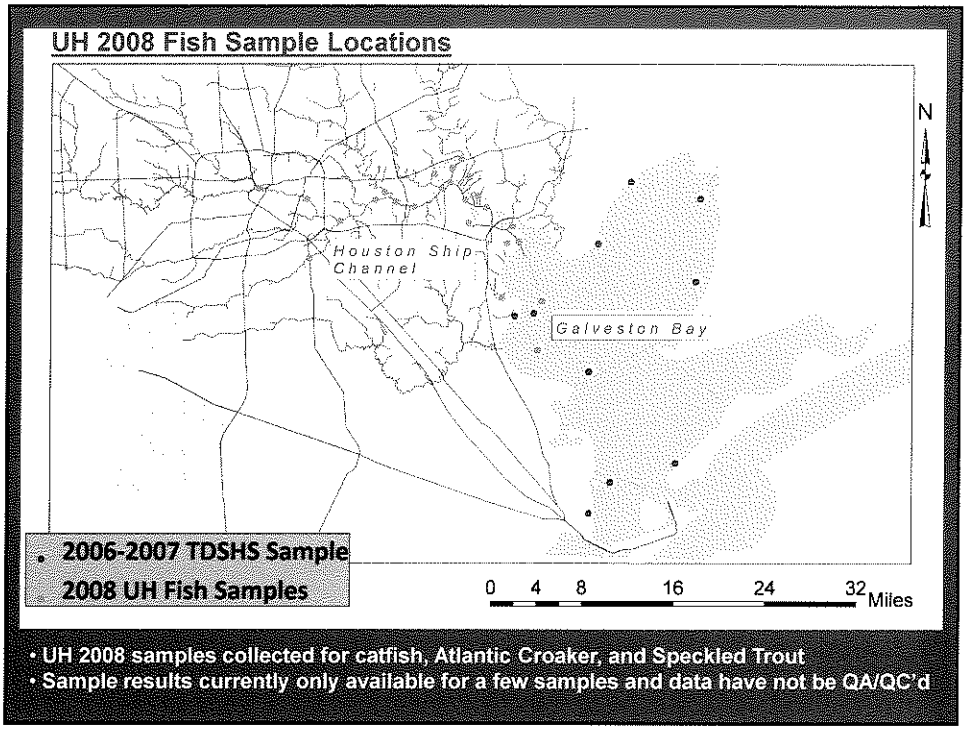
- UH catfish species were collected in the order of Hardhead> Blue> Gafftopsail>Channel
- PCB concentration is the sum of 43 congeners mentioned in McFarland and Clarke (1989)

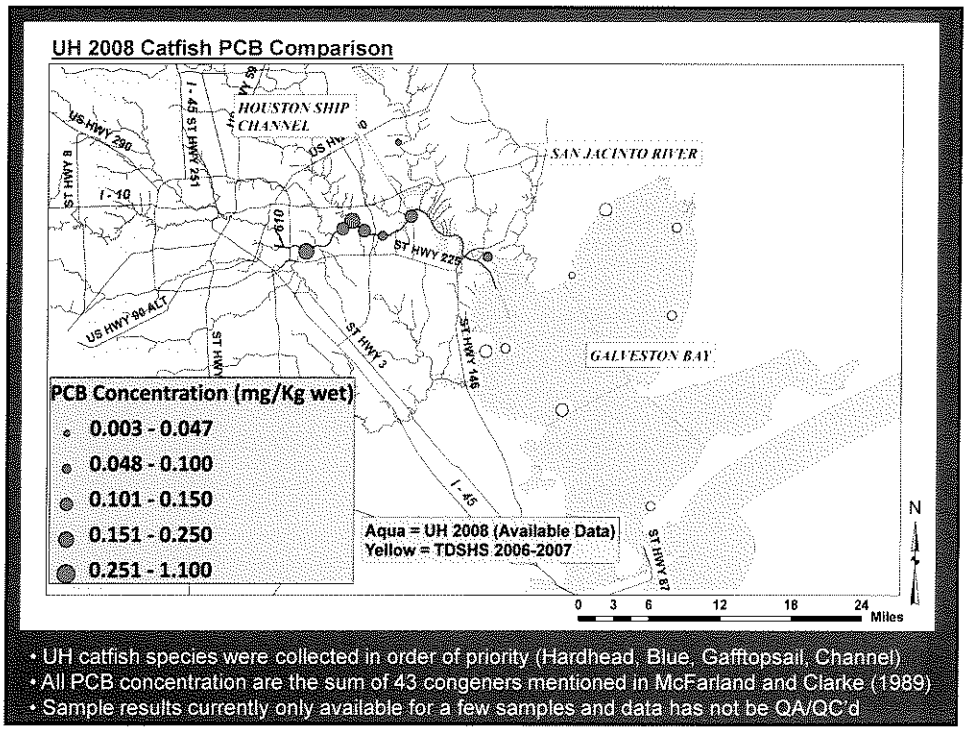
The 43 PCB Congeners

8	77	126	169
18	81	128	170
28	82	138	177
37	87	151	179
44	99	153	180
49	101	156	183
52	105	157	187
60	114	158	189
66	118	166	194
70	119	167	201
74	123	168	

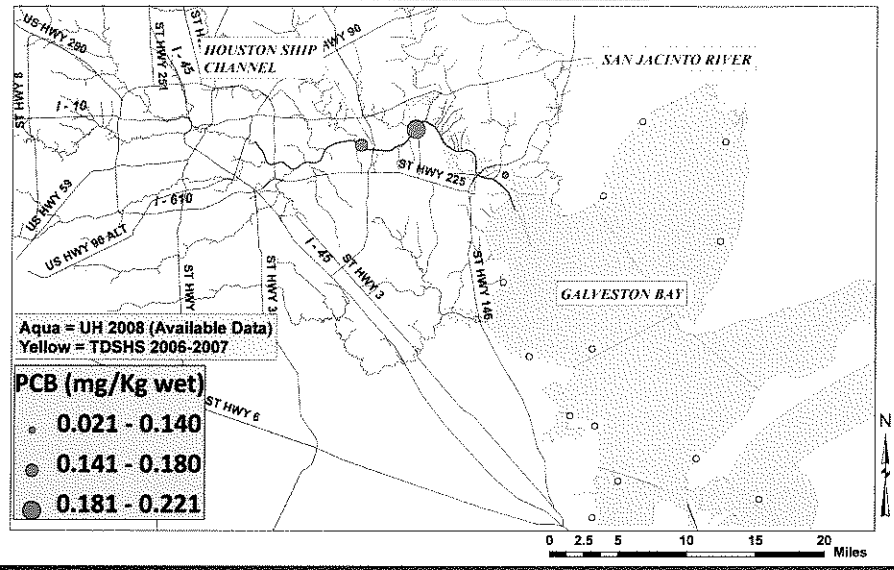

UH Summer 2008 PCB Sample Locations
SAN JACINTO RIVER
HOUSTON SHIP CHANNEL
UPPER GALVESTON BAY
BUFFALO BAYOU
BRAYS BAYOU
SIMS BAYOU
HUNTING BAYOU
GREENS BAYOU
CARPENTERS BAYOU
PATRICKS BAYOU
CEDAR BAYOU
VINCE BAYOU
US HWY 290
US HWY 90
US HWY 90 ALT
ST HWY 225
ST HWY 3
ST HWY 35
ST HWY 288
ST HWY 146
ST HWY SAM HOUSTON PKWY
I - 45
I - 10
I - 610
Water, Sediment, Fish
Water Only
N
0 1.5 3 6 9 12 Miles


UH Summer 2008 PCB Sediment Intensive Sampling Locations
San Jacinto River
Houston Ship Channel
Galveston Bay
N
0 1.5 3 6 9 12 Miles


UH 2008 Fish Sample Locations
Houston Ship Channel
Galveston Bay
N
2006-2007 TDSHS Sample
2008 UH Fish Samples
0 4 8 16 24 32 Miles
• UH 2008 samples collected for catfish, Atlantic Croaker, and Speckled Trout
• Sample results currently only available for a few samples and data have not be QA/QC'd

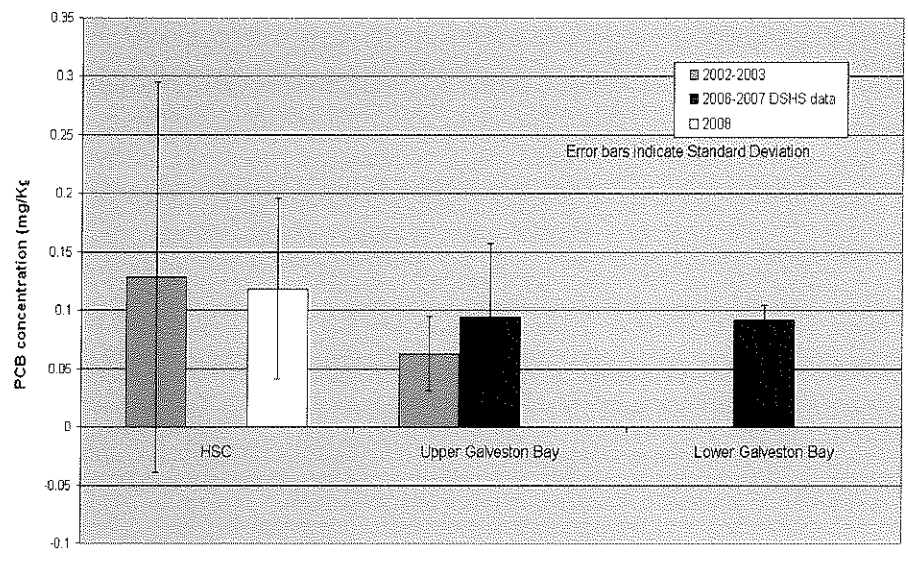

UH 2008 Catfish PCB Comparison
HOUSTON SHIP CHANNEL
SAN JACINTO RIVER
GALVESTON BAY
US HWY 290
I-10
ST HWY 225
US HWY 90-ALT
ST HWY 3
ST HWY 146
I-45
ST HWY 87
PCB Concentration (mg/Kg wet)
0.003 - 0.047
0.048 - 0.100
0.101 - 0.150
0.151 - 0.250
0.251 - 1.100
Aqua = UH 2008 (Available Data)
Yellow = TDSHS 2006-2007
N
0 3 6 12 18 24 Miles
• UH catfish species were collected in order of priority (Hardhead, Blue, Gafftopsail, Channel)
• All PCB concentration are the sum of 43 congeners mentioned in McFarland and Clarke (1989)
• Sample results currently only available for a few samples and data has not be QA/QC'd

UH 2008 Speckled Trout PCB Comparison

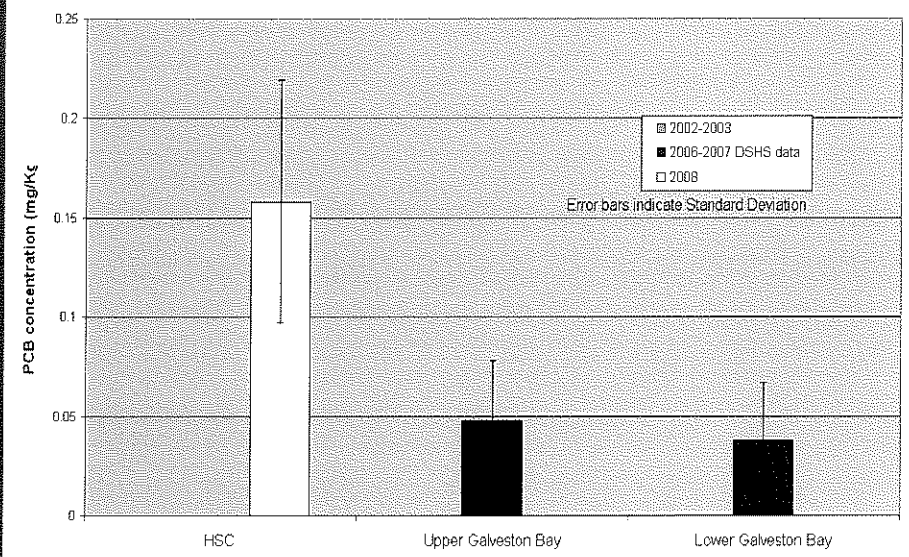


- PCB concentration is the sum of 43 congeners mentioned in McFarland and Clarke (1989)
- Sample results currently only available for a few samples and data have not be QA/QC'd

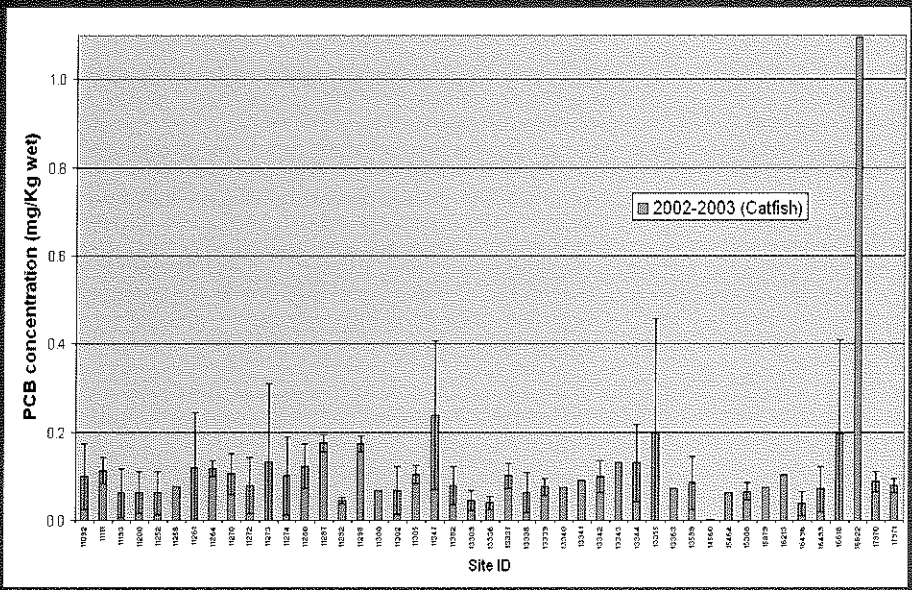
Comparison of PCB data by Location (Catfish)

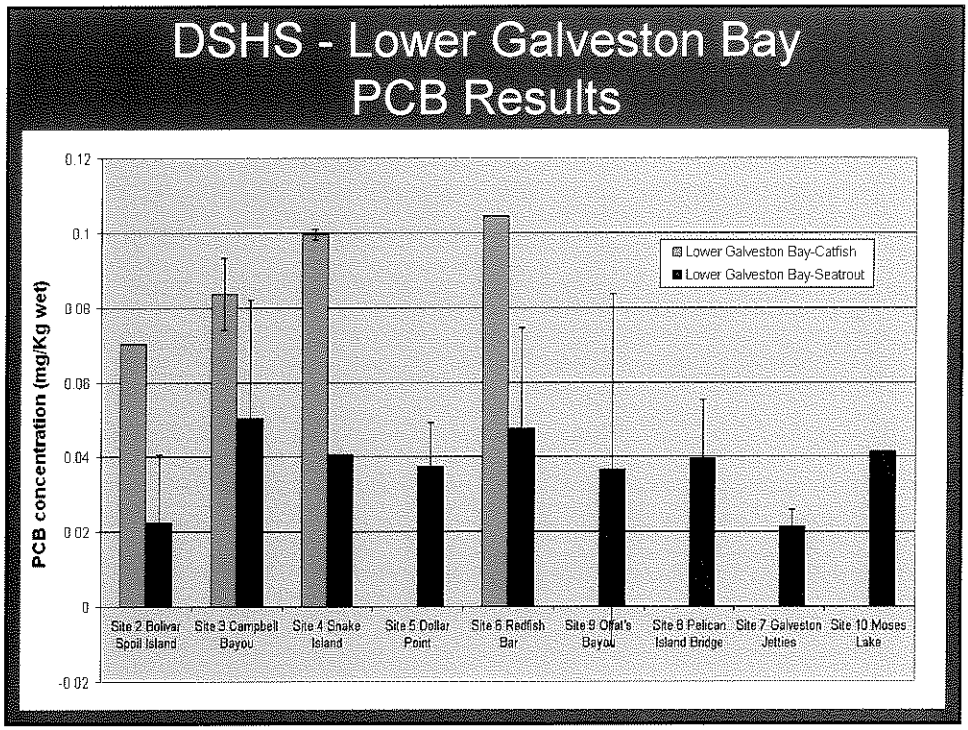


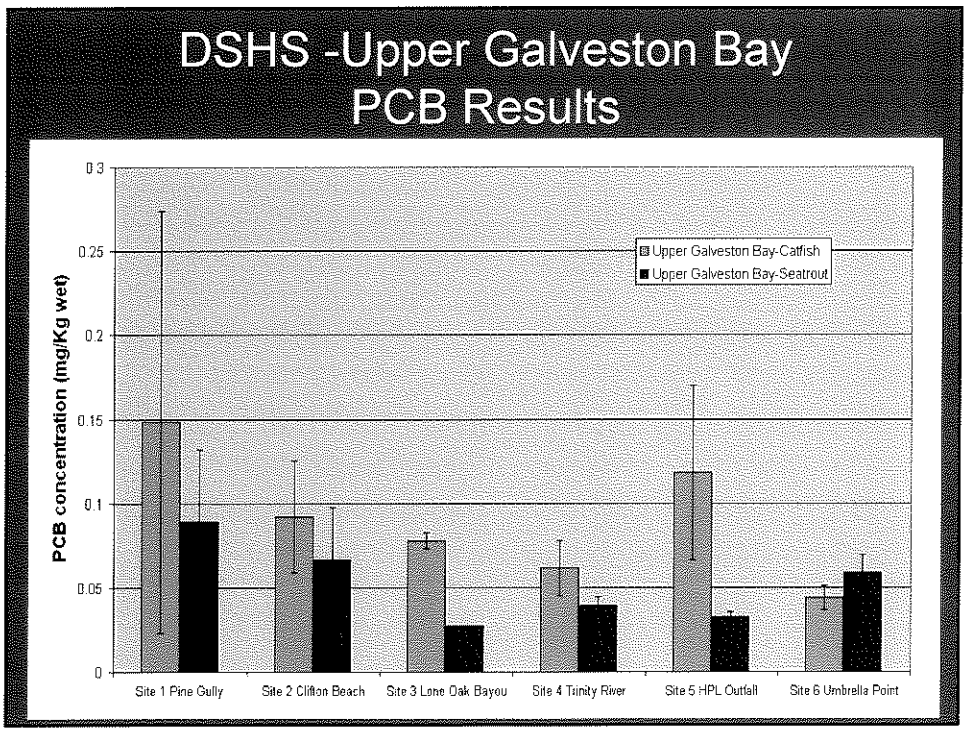
Comparison of PCB data by Location (Seatrout)



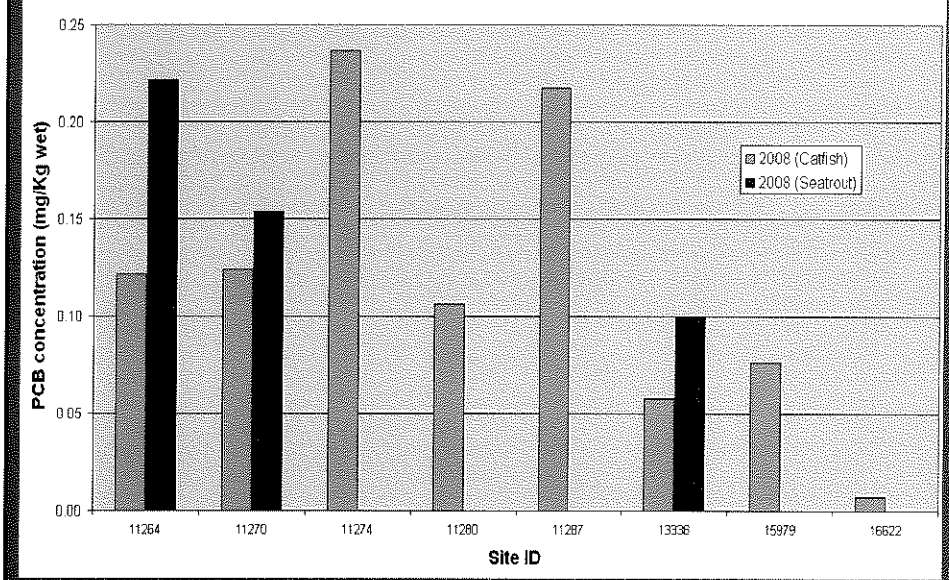
2002-2003 PCB Sampling Results




DSHS - Lower Galveston Bay
PCB Results
PCB concentration (mg/Kg wet)
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
Lower Galveston Bay-Catfish
Lower Galveston Bay-Seatrout
Site 2 Bolivar Spoil Island
Site 3 Campbell Bayou
Site 4 Snake Island
Site 5 Dollar Point
Site 6 Redfish Bar
Site 9 Offat's Bayou
Site 8 Pelican Island Bridge
Site 7 Galveston Jetties
Site 10 Moses Lake


DSHS -Upper Galveston Bay
PCB Results
PCB concentration (mg/Kg wet)
0.3
0.25
0.2
0.15
0.1
0.05
0
Upper Galveston Bay-Catfish
Upper Galveston Bay-Seatrout
Site 1 Pine Gully
Site 2 Clifton Beach
Site 3 Lone Oak Bayou
Site 4 Trinity River
Site 5 HPL Outfall
Site 6 Umbrella Point

2008 UH Sampling Results



What's Next..

- Wet weather sampling for PCB, source studies, and another ambient snapshot
- PCB modeling
- Dioxin TMDL FY09