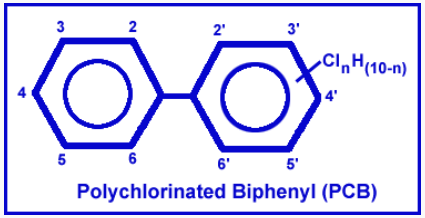
Grasse River, NY
Activated Carbon Pilot Study

Marc S. Greenberg, Ph.D.
U.S. EPA – Office Of Superfund Remediation And Technology Innovation
Environmental Response Team
2890 Woodbridge Ave.
Edison, NJ 08837
732-452-6413
greenberg.marc@epa.gov

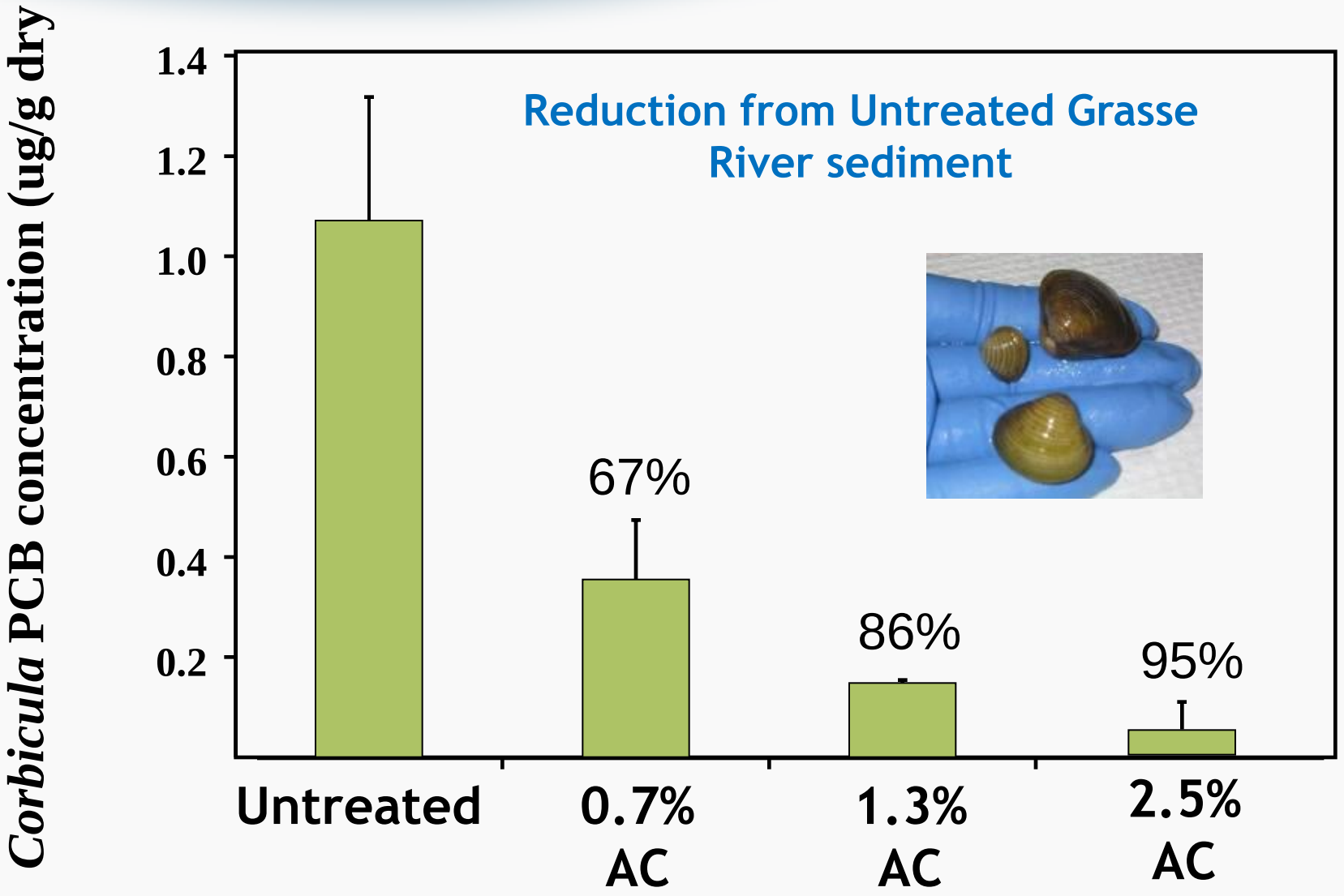
Grasse River, New York, USA



- Massena, NY
- Historic use & release of PCBs

- Near Saint Regis Mohawk Tribe
- Fish consumption advisory
- Managed land sources at plant site
- Past remedial action includes sediments—1995 NTCRA

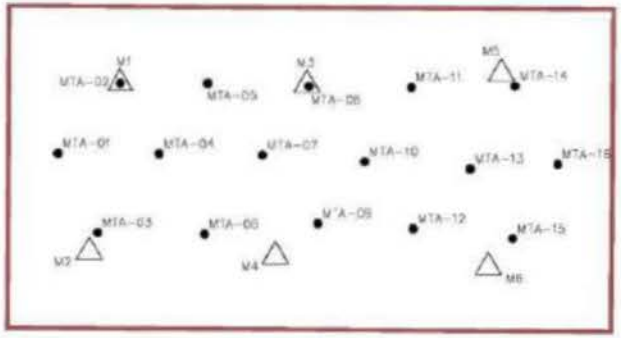
Stanford Lab Bioaccumulation Study



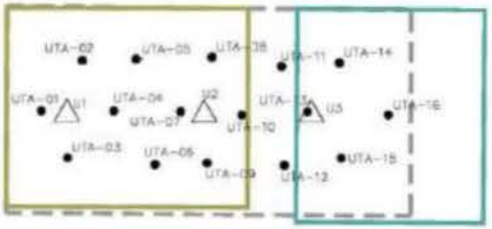
DELIVERY DEVICES USED AT GRASSE RIVER, NY

Tine injection system
Designed and built by Brennan with inputs from collaborators

Injection and mixing in an enclosed rototiller
Designed and built by Brennan with inputs from collaborators

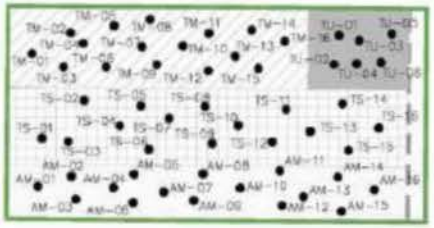


Mixed Tiller (75’ x 100’)



Tine Sled
(50’ x 60’)

Unmixed
Tiller
(50’ x 50’)



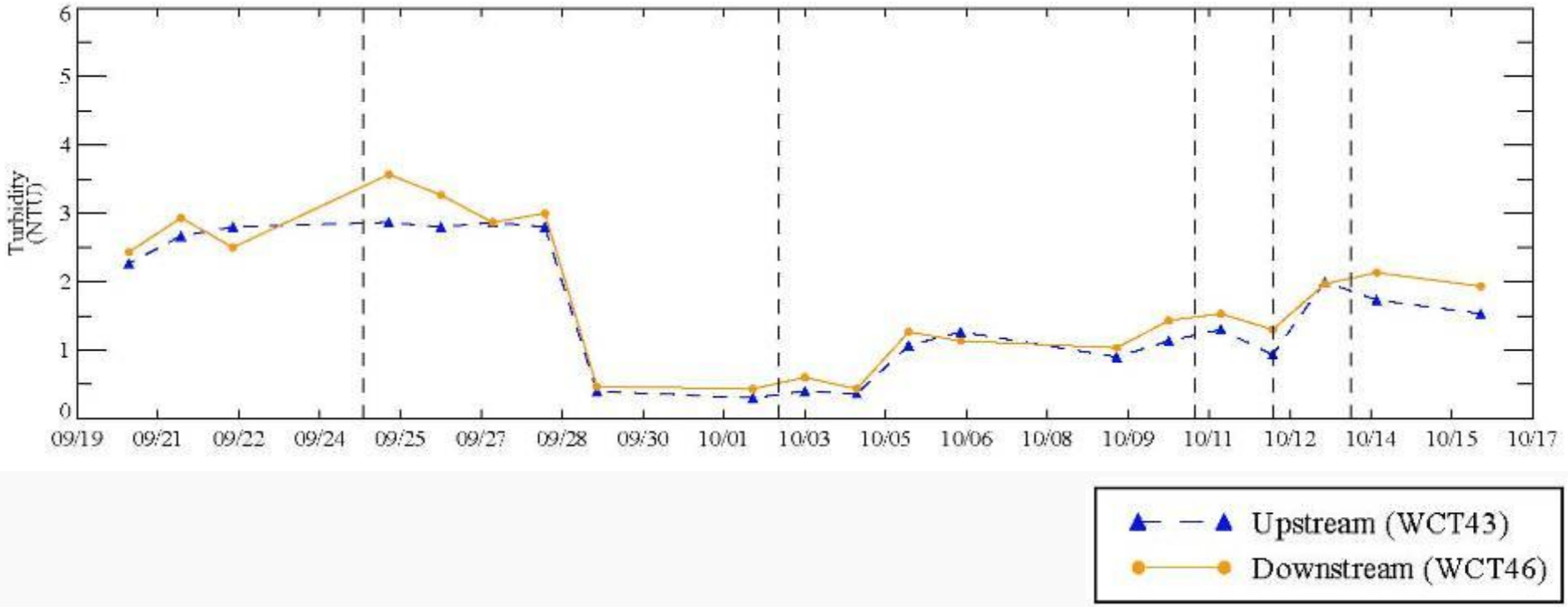
Initial
(50’ x 100’)

Target dose of activated carbon = 0.5x TOC in surficial sediments (+50% safety factor)

Grasse River ACPS
Baseline & Long-Term Monitoring

Parameter	Baseline (Aug/Sep '06)	After Placement (Oct '06)	Year 1 (Fall '07)	Year 2 (Fall '08)	Year 3 (Fall '09)
Carbon in sediment cores (BC)	√	√	√	√	√
Field PCB biouptake	√		√	√	√
Lab PCB biouptake	√		√	√	√
Equilibrium	√		√	√	√
Desorption	√		√	√	
Benthic community	√		√	√	√
Erosion potential	√		√	√	
Impact of AC on aquatic plant growth					√

Fall 2006 Water Quality Monitoring Results

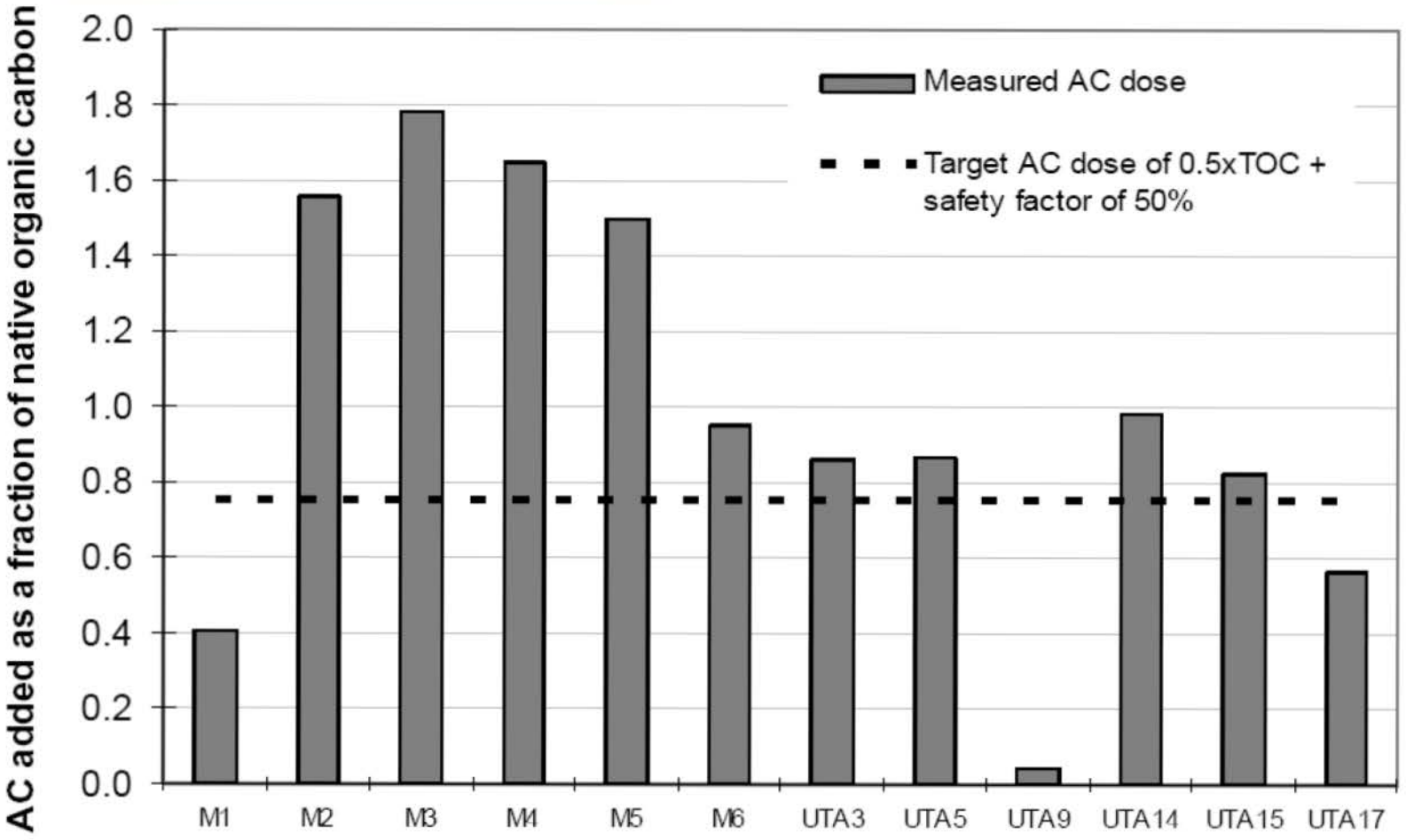


- **Water column PCB monitoring during construction**
  - No measurable changes in water column PCB concentrations observed downstream of the study area during application

Data from Alcoa

Post-Application Core Sampling

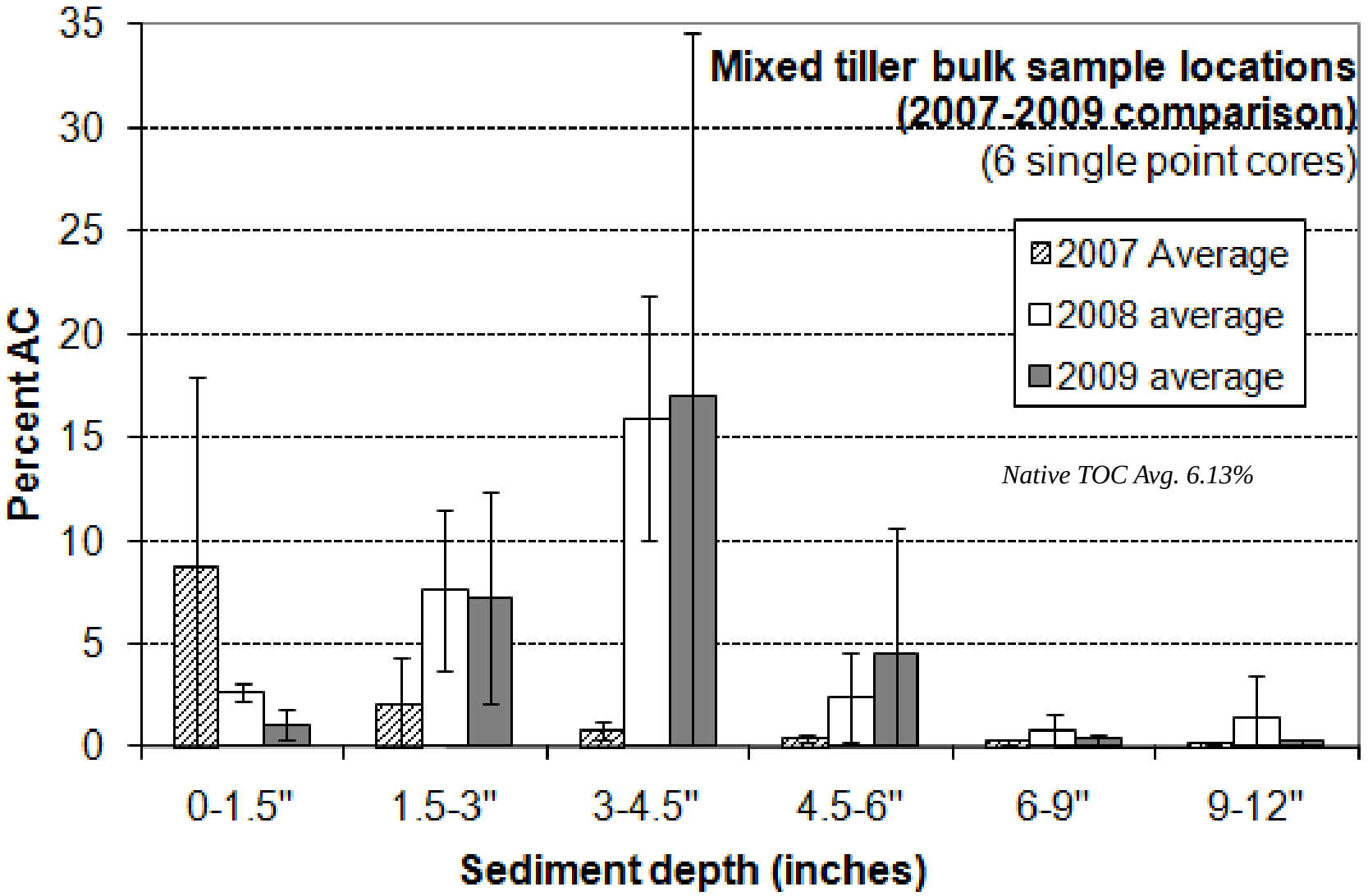
Dose of AC achieved in sediment 2007 sampling data



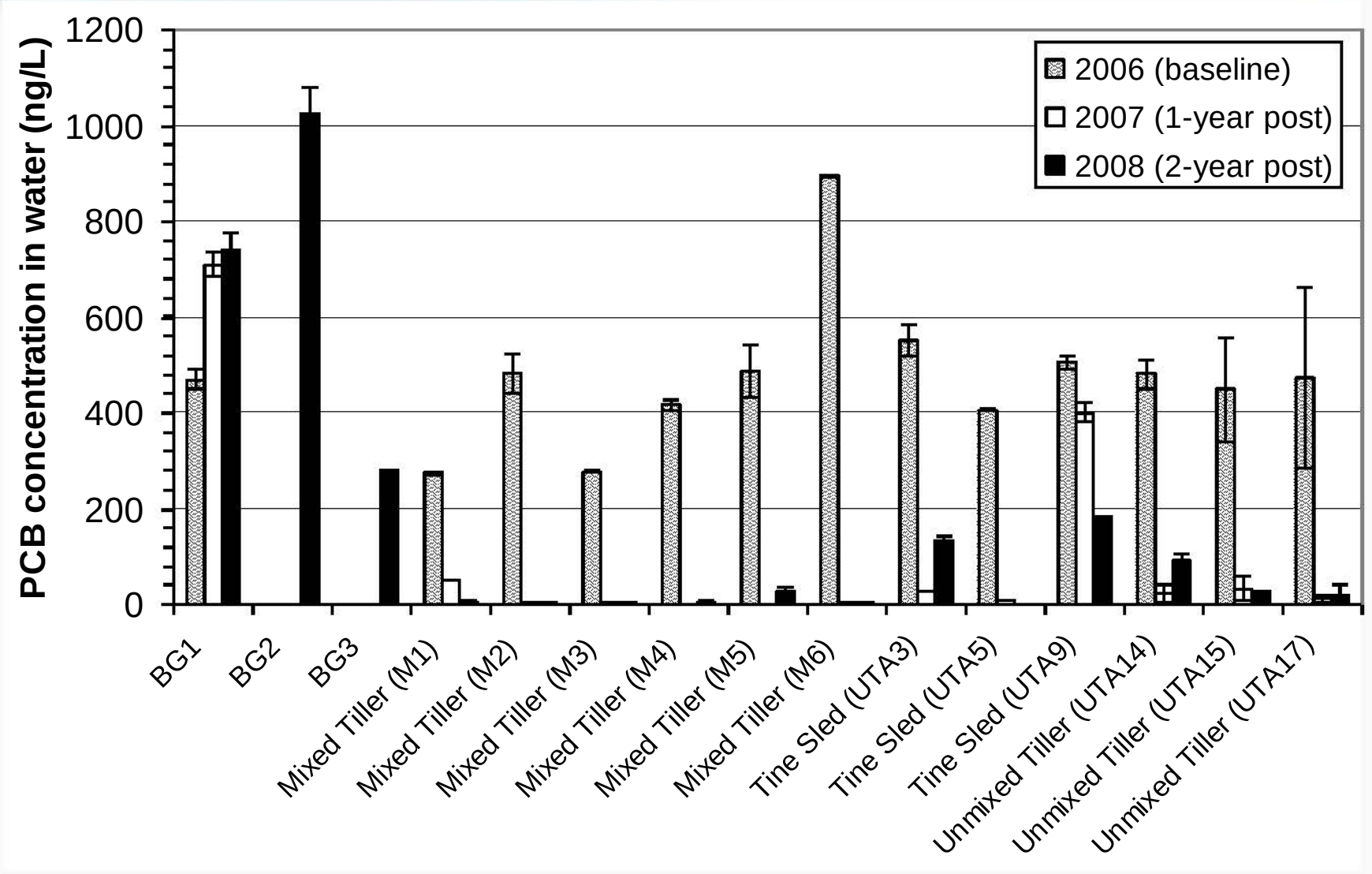
- Measured AC addition achieved at sampling sites compared to the target dose of half of native TOC plus safety factor of 50%

Data from Alcoa

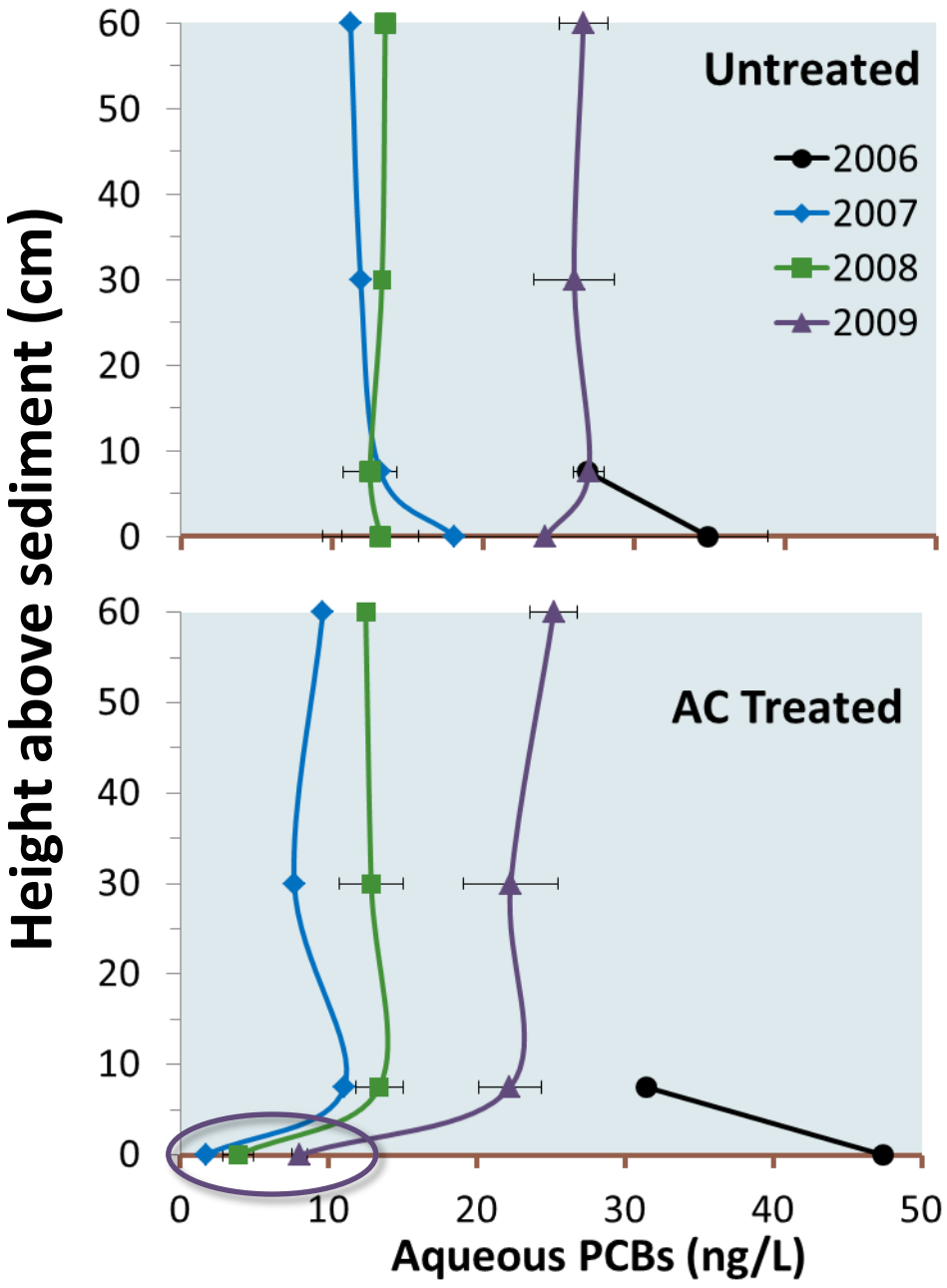
Carbon Profile with Time



Aqueous Equilibrium



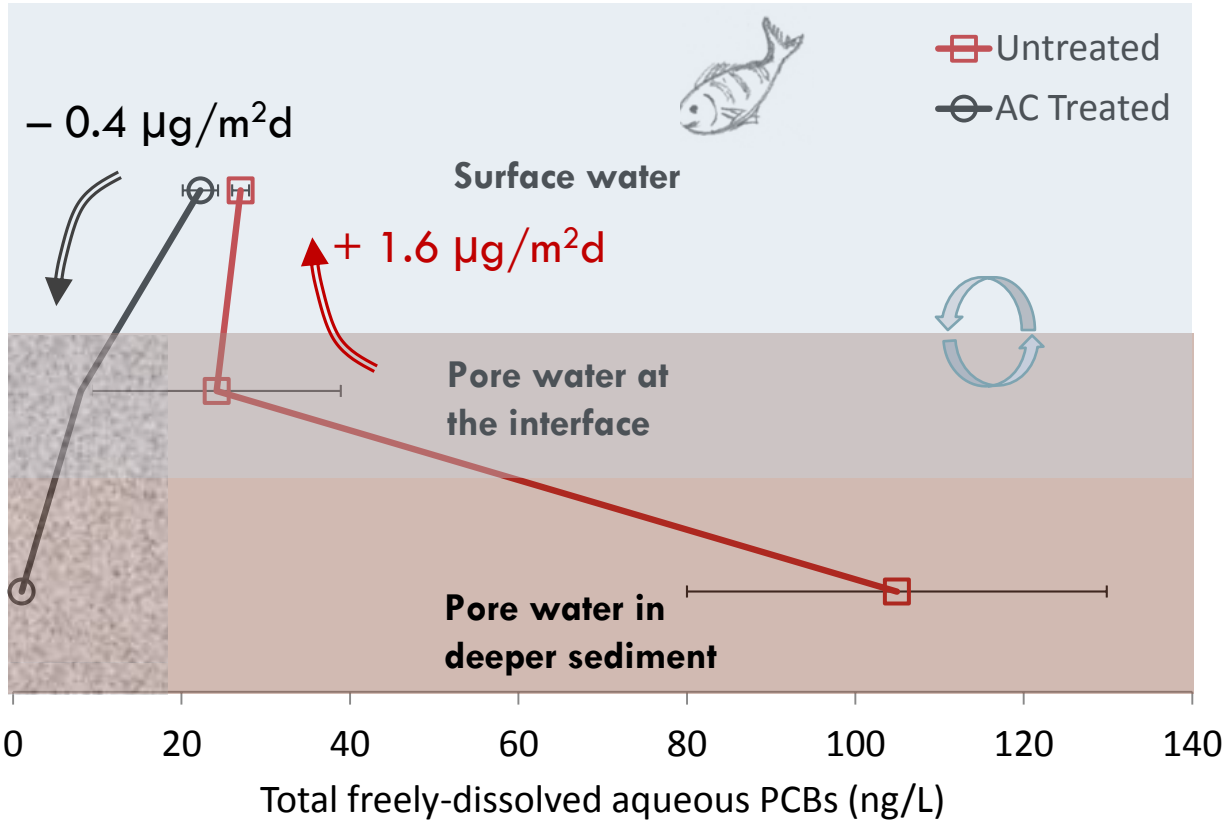
PCB IN WATER BASED ON IN-SITU PASSIVE SAMPLERS



Reduced aqueous PCB on sediment surface at AC treated sites compared to overlying water

Data from UMBC, Beckham & Ghosh

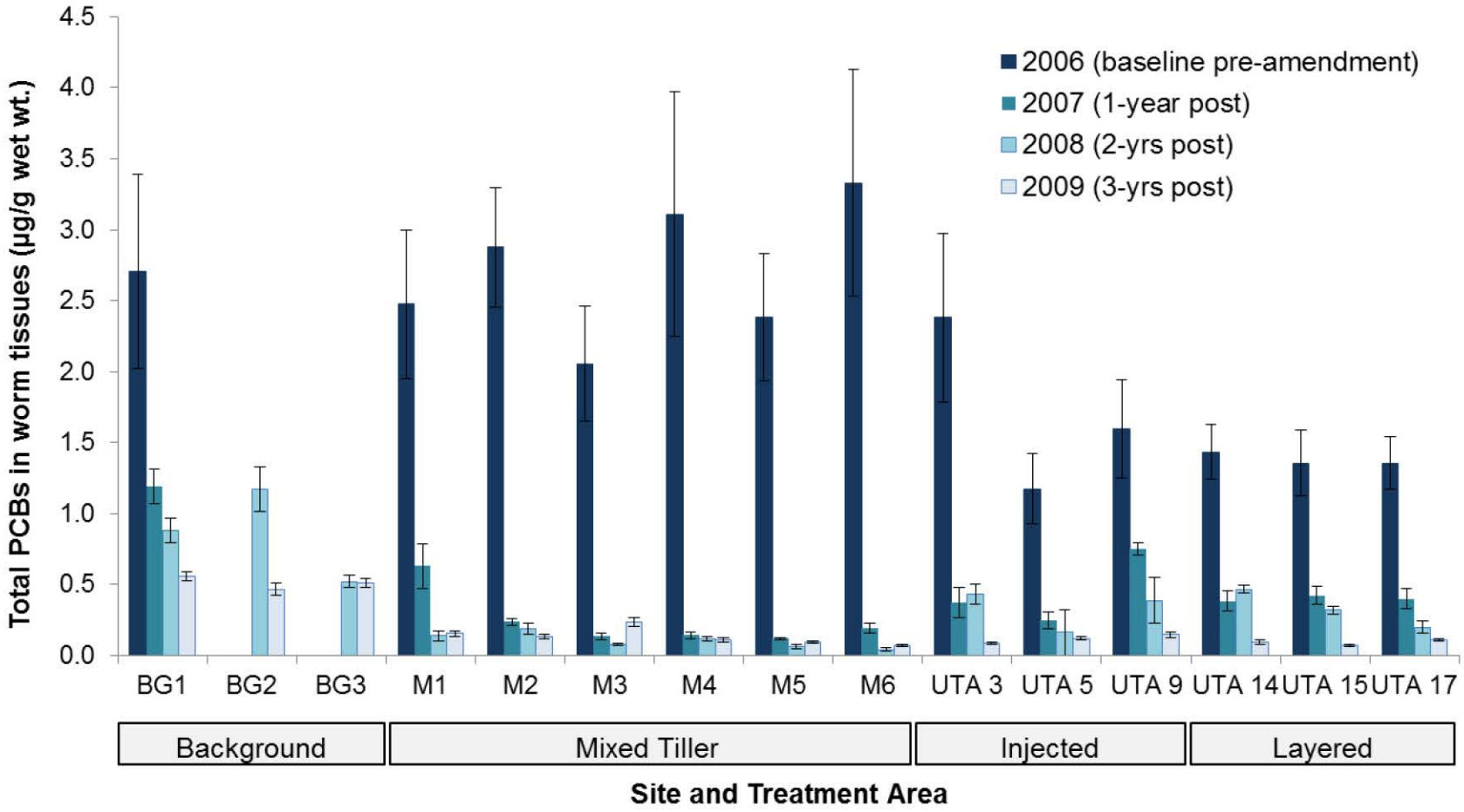
Pore water – Surface water
PCB Gradient in Grasse River, 2009



Flux ($\mu g/m^2 d$) = $k_f(C_{pw} - C_{sw})$

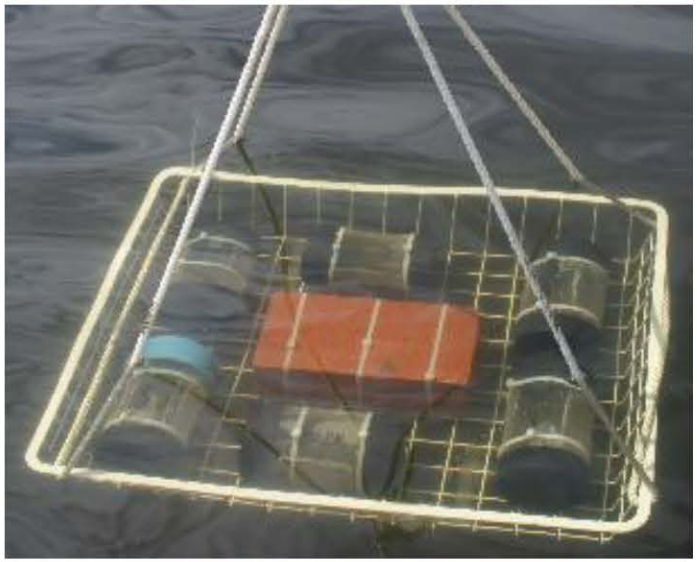
Data from UMBC, Beckham & Ghosh

Laboratory Bioaccumulation in *L. variegatus*



Data from UMBC, Beckham & Ghosh

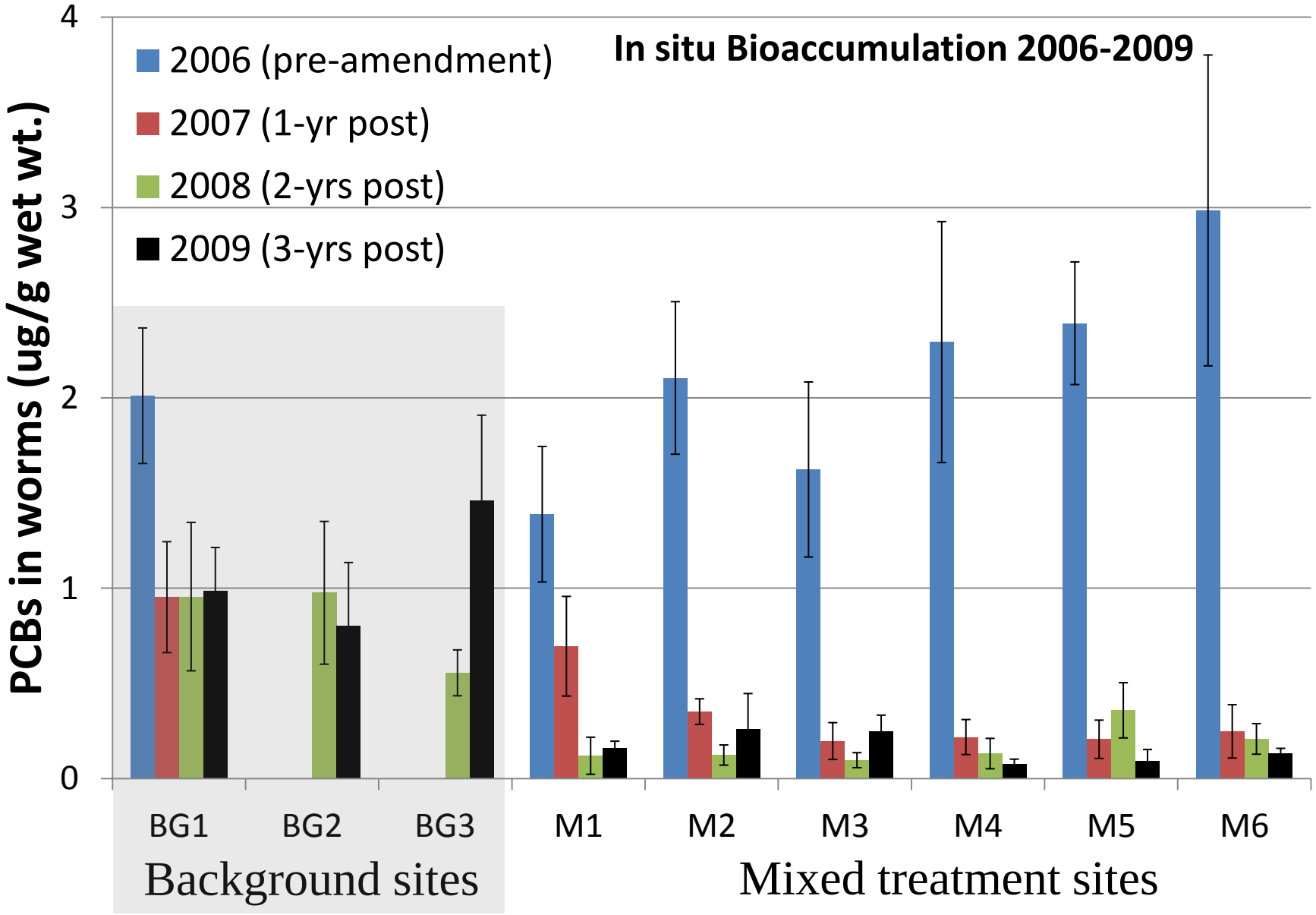
IN-SITU PCB MONITORING STUDIES



In-river deployment of field exposure cages with *L. variegatus* for baseline study (method adapted from Burton et al. 2005)

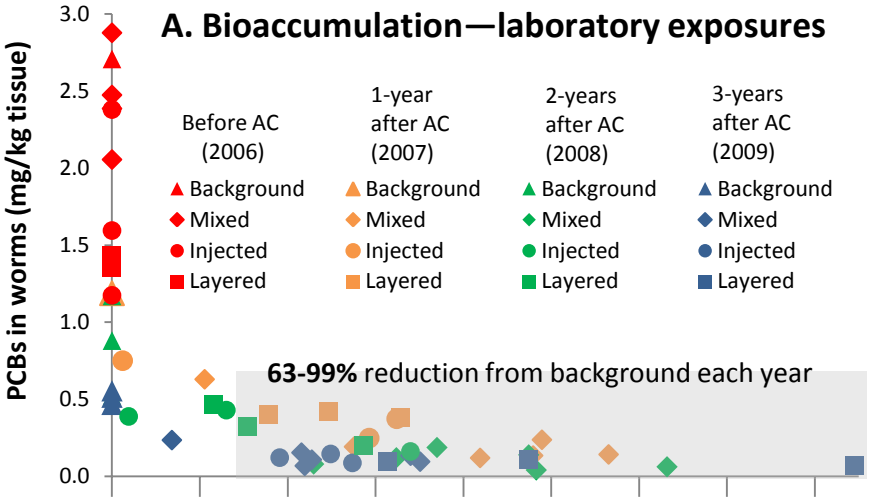
PCB IN L. VARIEGATUS IN-SITU EXPOSURE

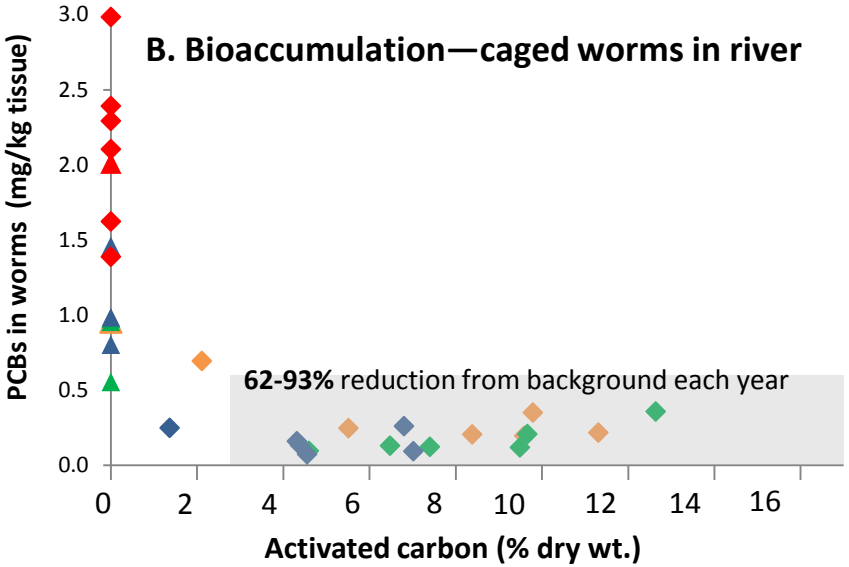
Data from UMBC, Beckham & Ghosh

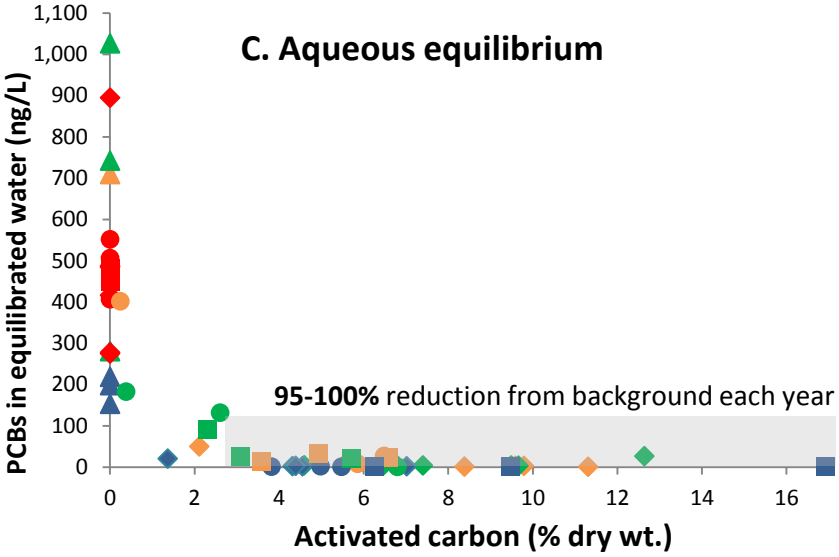


- % reduction over 3 years: 46% in BG sites and 92% for Mixed Tiller sites

PCB IN WORMS AND WATER VS. CARBON DOSE



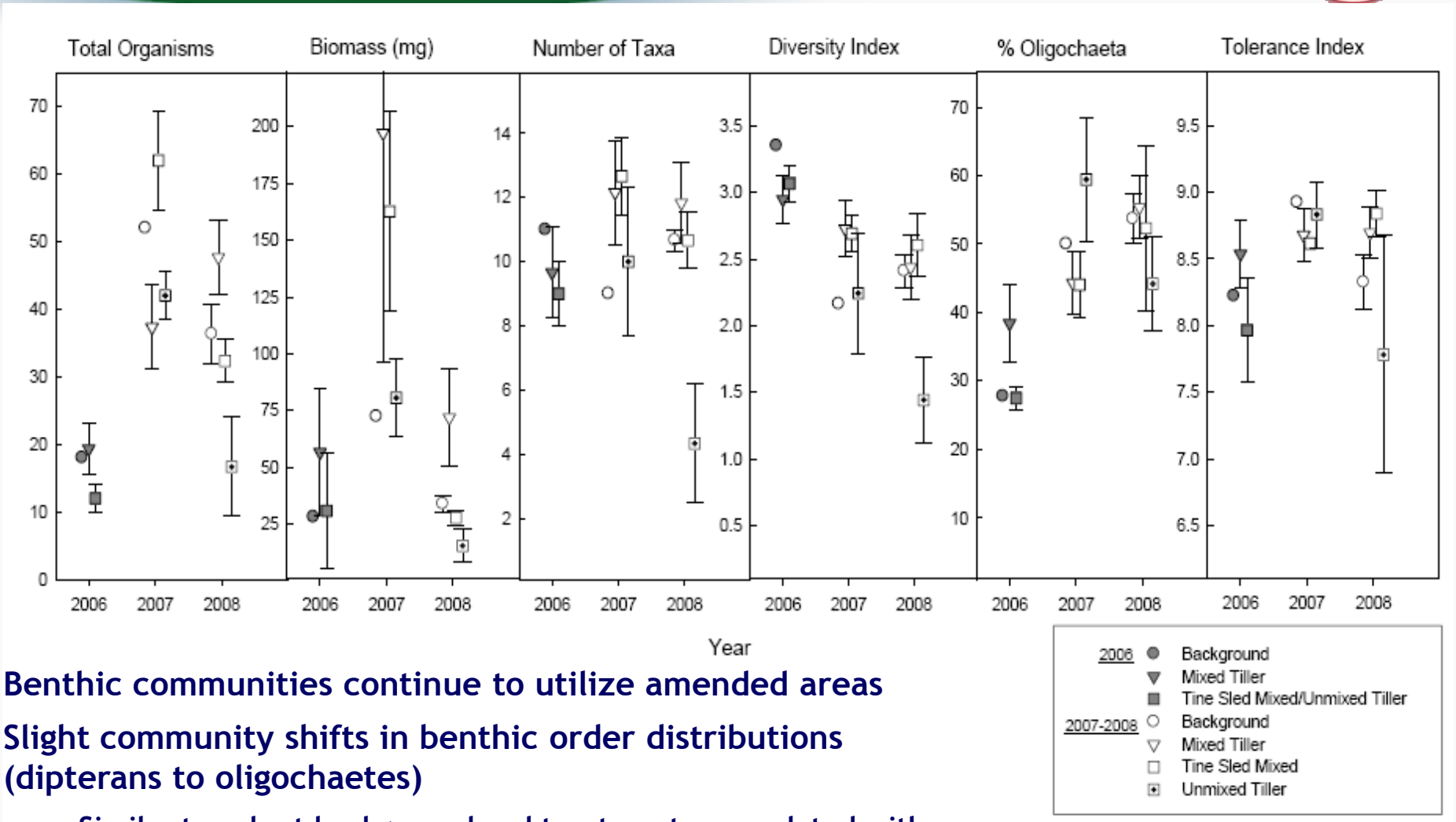




- Reduced uptake in field plots with increasing AC dose
- **> 90% reduction for all treatment sites by 2009 for AC dose >4%**
- Little incremental benefit above 5%AC
- Tighter range in aqueous PCBs compared to worms

Data from UMBC, Beckham & Ghosh

Benthic Invertebrate Monitoring



- Benthic communities continue to utilize amended areas
- Slight community shifts in benthic order distributions (dipterans to oligochaetes)
  - Similar trends at background and treatments, correlated with temporal variability in grain size
- Possible 2008 benthic community effect in Unmixed Tiller area

Data from Alcoa

Moving forward

- **Carbon amendments appear to be promising enough for serious consideration in remedies**
- **AC can be applied to sediment at the field scale**
- **AC remained in place 3 years after placement**
- **Reductions in porewater PCB levels & desorption**
- **Reductions in tissue PCB levels**
- **No major changes to benthic community due to amendment**
- **Over time, the AC-amended sediment is covered with new sediment deposits**
- **Successful pilot scale demonstration of reduction in bioavailable PCBs in the sediments**

Acknowledgements

Young Chang, EPA Region 2,
Grasse River Study Area RPM

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University of Maryland, Baltimore County

THANK YOU FOR YOUR ATTENTION TODAY