

KEY FINDINGS: POND AND BANK PILOTS PATH FORWARD



SRST Expert Panel Meeting
October 10, 2013

POND PILOT



KEY FINDINGS – POND PILOT

- Flooding effects mercury concentrations measured in the pond
- Biochar has reduced MeHg concentrations in some biota
- No measureable adverse effects on the benthic community
- Floodplain ponds represent discrete, dynamic, hydrologic systems



KEY FINDINGS – POND PILOT FLOODING

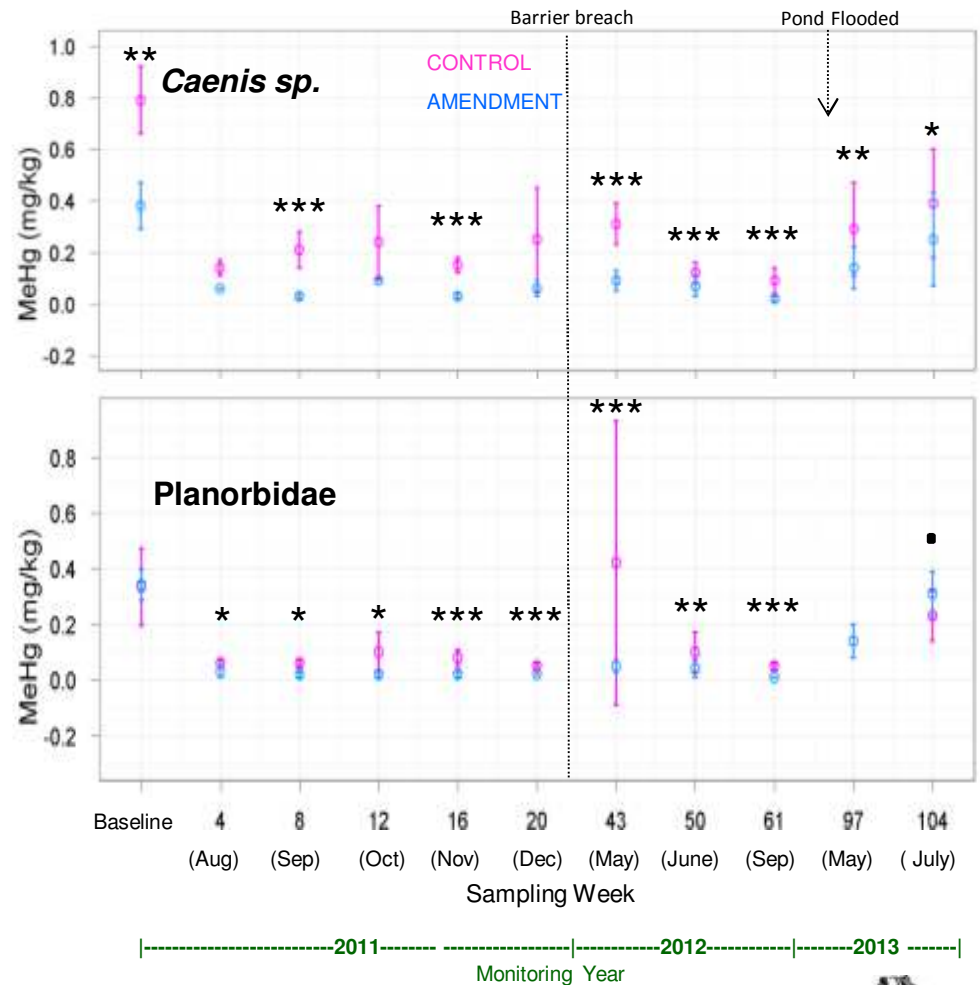
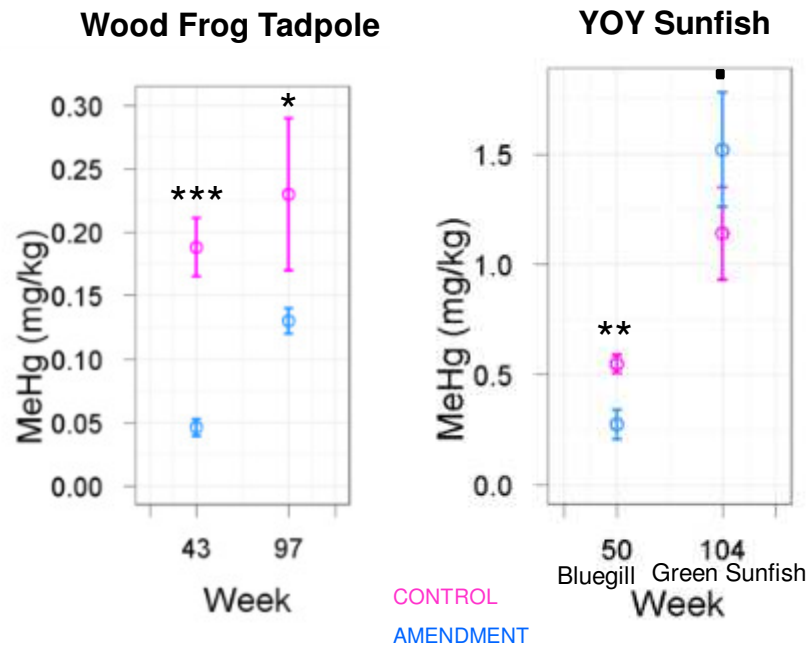
- Fresh particulate Hg deposition/burial of biochar
- Surface water mixing from overtopping barrier
- Redistribution of biochar
- Additional changes in water quality from water depth changes and turbidity
- Changes in sediment physical characteristics



KEY FINDINGS – POND PILOT

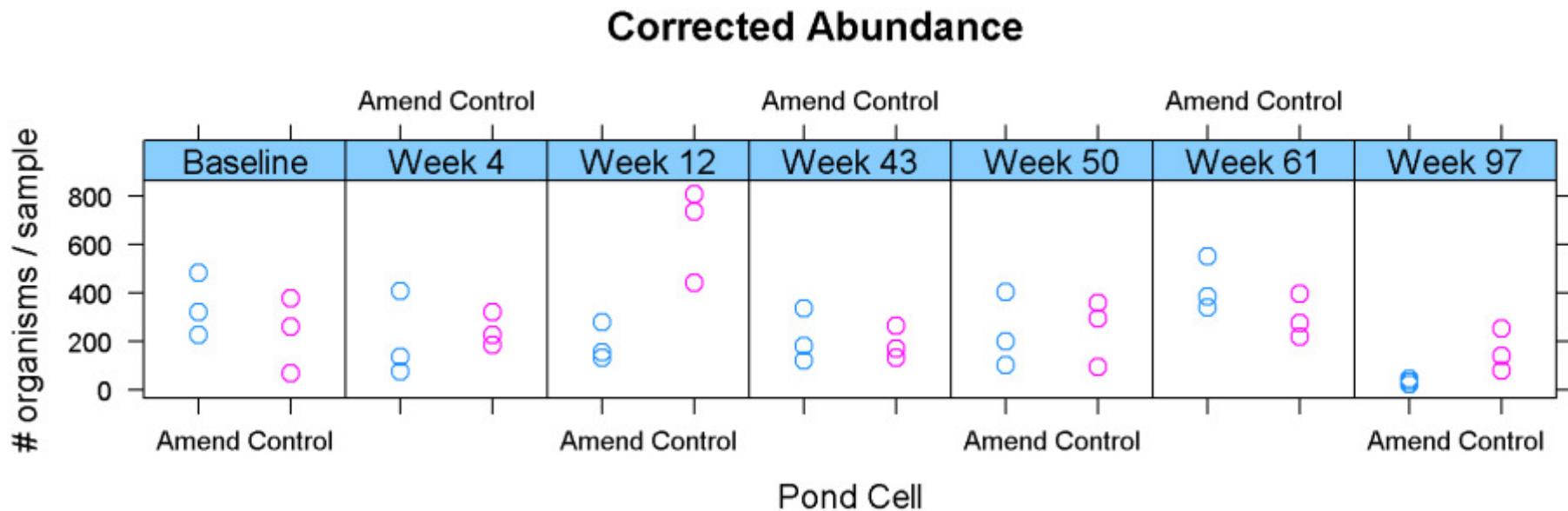
BIOTA MeHg REDUCTIONS

- Dietary differences among biota
- Micro-habitat differences of biota
- Baseline differences in mercury



KEY FINDINGS – POND PILOT BENTHIC COMMUNITY

- Micro-habitat differences of biota



BANK PILOT



KEY FINDINGS – BANK PILOT

- Pilot Bank is stable overall with isolated areas of erosion
- Vegetative communities are well established
- Declines in both THg and MeHg across all media



KEY FINDINGS – BANK PILOT

BANK STABILITY

- Geotextile fabric visible at edge of bank indicates that the bank has not retreated
- High traffic areas may need to be noted and accommodated in future designs



KEY FINDINGS – BANK PILOT VEGETATIVE COMMUNITY

- Increased growth of planted stock during Year-3
- EPA rapid bioassessment protocol scores have increased for vegetative protection



KEY FINDINGS – BANK PILOT

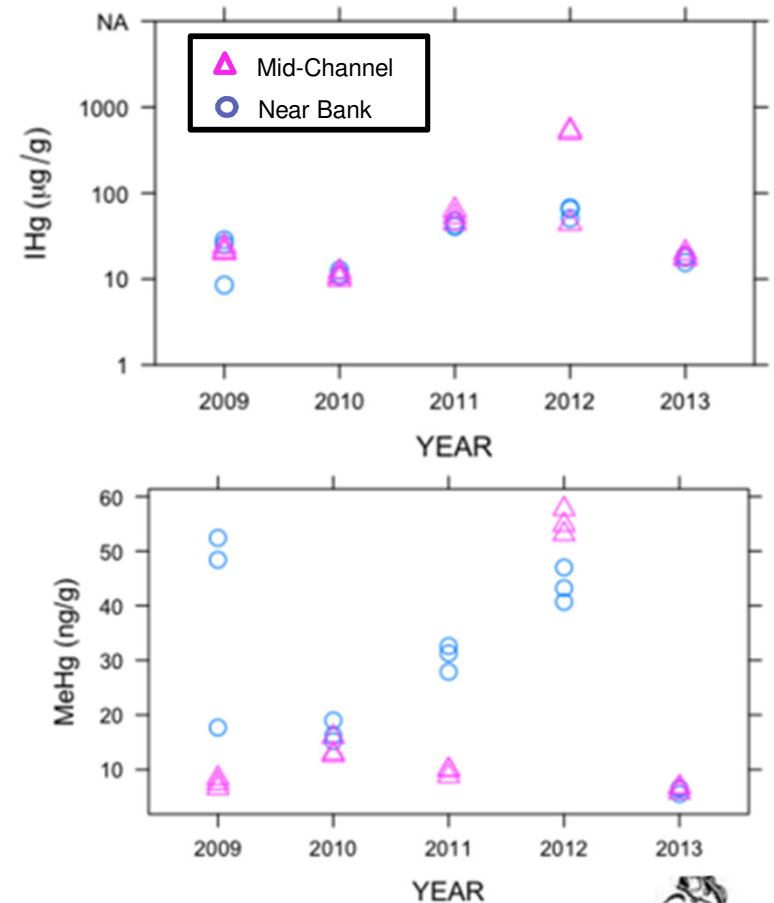
THg & MeHg in Media

- Declines in both THg and MeHg across all media
 - Higher discharges, lower temperatures in June 2013 than previous events
 - Outfall 001 load may be declining

Pore Water

Sampling Date	Mean FIHg (ng/L)	FIHG Range (ng/L)	SD	Mean FMeHg (ng/L)	FMeHG Range (ng/L)	SD
June 2009	53	2.26 - 131	42	10	1.04 - 40.5	11
July 2009	51	5.23 - 292	83	3.9	0.36 - 14.4	4.0
August 2009	82	2.73 - 510	153	2.3	0.04 - 6.83	2.0
June 2010	27	2.94 - 176	48	4.4	0.14 - 20.9	6.6
June 2011	27	14.1 - 47.8	13	3.3	0.13 - 13.7	4.5
June 2012	25	5.37 - 32.7	9	3.4	1.1 - 7.18	2.0
June 2013	9	4.48 - 21.1	4	2.1	0.26 - 4.49	1.4

Asiatic Clam Tissue



south river
SCIENCE TEAM

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KEY FINDINGS – BANK PILOT

THg & MeHg in Media

- Decreased THg concentrations on average
- Maximum THg concentrations decreased since 2012

Sediment

Sample ID	Sediment Type	Sample Date	THg (µg/g)	Average THg (mg/kg)	Standard Deviation	Relative Standard Deviation
<i>Pre-Stabilization</i>						
T1	Interstitial	August 2008	54	19	24	128%
T3 T5			19			
T6			1.2			
C	Bulk	March 2009	2.4			
<i>Post-Stabilization</i>						
A	Interstitial	November 2009	0.4	0.43	0.15	34%
B			0.3			
C			0.6			
UP		June 2010	1.9	1.1	0.8	78%
A			1.6			
B			0.3			
C			0.4			
UP		June 2011	3.9	3.8	1.1	28%
A			2.6			
B			3.6			
C			5.2			
UP		March 2012	1.7	3.1	1.9	62%
A			2.2			
B			2.6			
C			6.0			
UP		June 2012	4.1	3.1	0.8	27%
A			2.1			
B			3.2			
C			3.1			
UP		June 2013	1.3	1.3	0.40	30%
A			1.1			
B			1.9			
C			1.0			

PATH FORWARD – 2014 ACTIVITIES



POND PILOT

PROPOSED 2014 MONITORING

ANALYSIS	POST AMENDMENT MONITORING 2014		
	Spring	Summer	Post Storm Event
Surface Water			
FTHg & UTHg	X	X	X
FMeHg & UFMHg	X	X	X
Benthic Invertebrates (<i>Caenis</i> & Planorbidae)			
THg	X		X
MeHg	X		X
Benthic Community	X		X
Biological Tissue			
Tadpoles (THg & MeHg)	X		
Fish Tissue - YOY (THg & MeHg)		X	

BANK PILOT

PROPOSED 2014 MONITORING

- Continue Quarterly and post-storm monitoring (consider decreasing to bi-annual)
- Evaluate THg and MeHg in:
 - Sediments (March/June)
 - Biota (May-June)
 - Pore water (June)



ADDITIONAL SLIDES

Conclusions

Measure of Success for Pore Water and Surface Water

Addition of carbon amendment will reduce Hg concentrations in pore water and surface water by at least 50% within the amended cell

Barrier Breach

Flooding Event

Media		Sample Event												
		Baseline	Week 1	Week 2	Week 4	Week 8	Week 12	Week 16	Week 20	Week 43	Week 50	Week 61	Week 97	Week 104
		6/28/2011	7/19/2011	7/26/2011	8/8/2011	9/6/2011	10/4/2011	10/31/2011	11/30/2011	5/7/2012	6/25/2012	9/10/2012	5/20/2013	7/8/2013
Pore Water	IHg	↑ 28	↑ 268	↓ 59	↓ 53	↓ 49	↓ 69	↓ 12	↓ 34	↑ 4	↓ 61	↑ 59	↑ 6	--
	MeHg	↓ 50	↓ 56	↓ 24	↓ 67	↓ 29	↑ 1	↓ 63	↓ 35	↑ 2	↓ 45	↓ 64	↓ 20	--
Surface Water	IHg	↑ 3	↓ 66	↓ 75	↓ 37	↓ 37	↓ 40	↓ 50	↓ 46	↑ 28	↑ 5	↓ 8	↓ 1	↑ 14
	MeHg	↓ 24	↓ 76	↓ 67	↓ 73	↓ 70	↓ 71	↓ 78	↓ 74	↓ 67	↓ 65	↓ 73	↓ 46	↓ 42

Notes:

Decrease > 50%

Percent change of average amendment concentrations relevant to average control concentrations.

$$\% \text{ Change} = \frac{(\text{Control} - \text{Amendment})}{\text{Control}} \times 100$$



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Conclusions

Measure of Success for Biological Organisms

Addition of carbon amendment will reduce Hg concentrations in biological organisms by at least 50% within the amended cell.

Media		Barrier Breach								Flooding Event				
		Sample Event												
		Baseline	Week 1	Week 2	Week 4	Week 8	Week 12	Week 16	Week 20	Week 43	Week 50	Week 61	Week 97	Week 104
		6/28/2011	7/19/2011	7/26/2011	8/8/2011	9/6/2011	10/4/2011	10/31/2011	11/30/2011	5/7/2012	6/25/2012	9/10/2012	5/20/2013	7/8/2013
Chironomid	IHg	↑450	--	--	↓87	↓62	↓31	↓48	↓59	↓65	↑23	↓55	↓77	↑84
	MeHg	↓3	--	--	↓84	↓92	↓79	↑82	↓28	↓63	↓13	↓66	↓76	↓28
Caenis	IHg	↓40	--	--	↓61	↓32	↓45	↓56	↓83	↑11	↑396	↑18	↓5	↓11
	MeHg	↓52	--	--	↓56	↓86	↓65	↓80	↓75	↓71	↓43	↓73	↓54	↓37
Snail	IHg	↓27	--	--	↑42	↓64	↓63	↓71	↓91	↓24	↑102	↑64	↑183	↑170
	MeHg	↑2	--	--	↓54	↓62	↓81	↓78	↓67	↓87	↓19	↓65	↓1	↑36
Wood Frog (Tadpole)	IHg	--	--	--	--	--	--	--	--	↑10	--	--	↓42	--
	MeHg	--	--	--	--	--	--	--	--	↓76	--	--	↓43	--
Bluegill / Green Sunfish (yoy)	IHg	--	--	--	--	--	--	--	--	--	↓46	--	--	↓66
	MeHg	--	--	--	--	--	--	--	--	--	↓50	--	--	↑33

Notes:

Decrease > 50%

Percent change of average amendment concentrations relevant to average control concentrations.

$$\% \text{ Change} = \frac{(\text{Control} - \text{Amendment})}{\text{Control}} \times 100$$



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