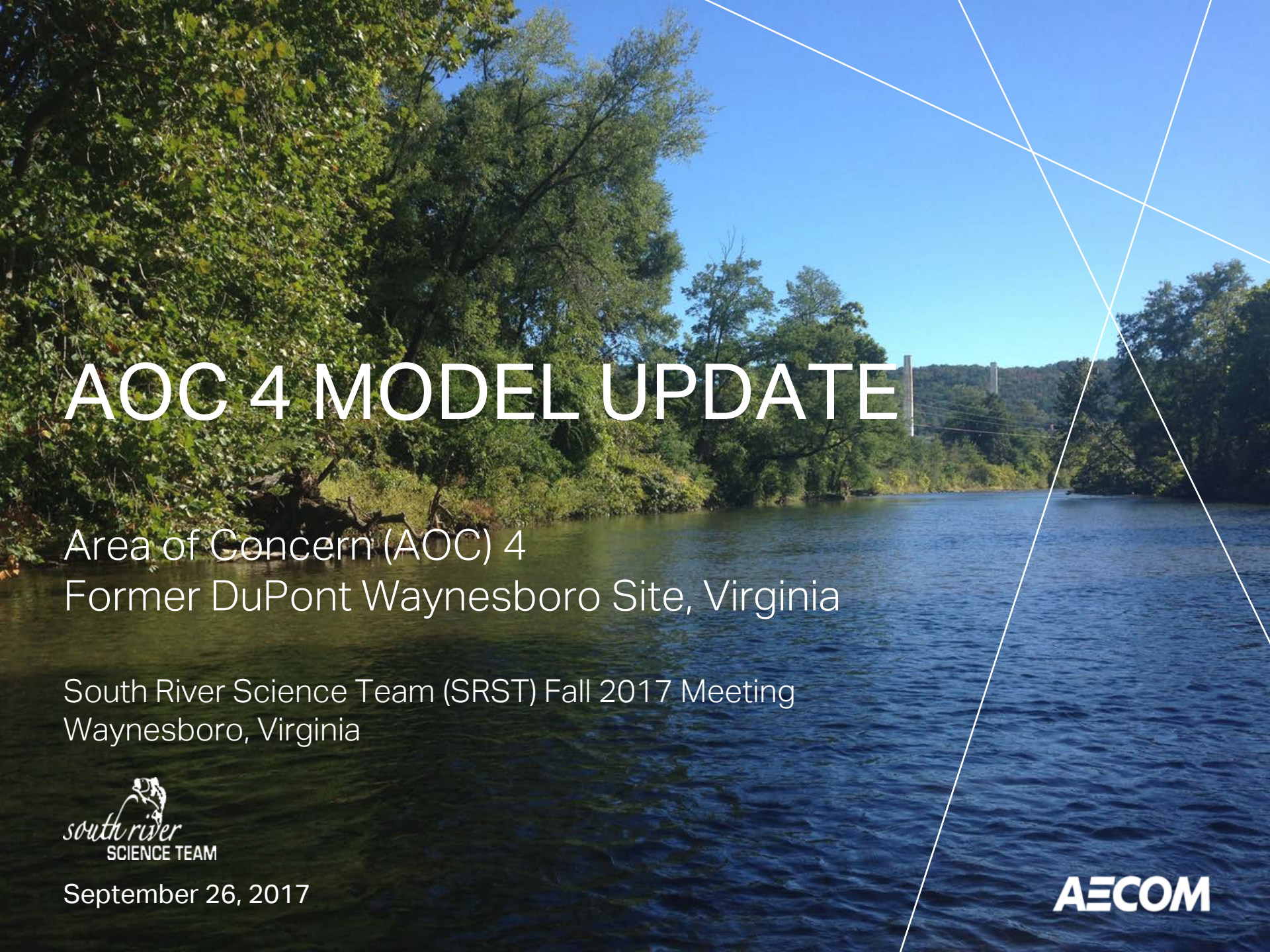

AOC 4 MODEL UPDATE

Area of Concern (AOC) 4
Former DuPont Waynesboro Site, Virginia

South River Science Team (SRST) Fall 2017 Meeting
Waynesboro, Virginia

south river SCIENCE TEAM

September 26, 2017

AECOM

Agenda

- Objectives
- Models
  - Background
  - Simulations
  - Results
- Overall Summary
- Path Forward

General Objectives

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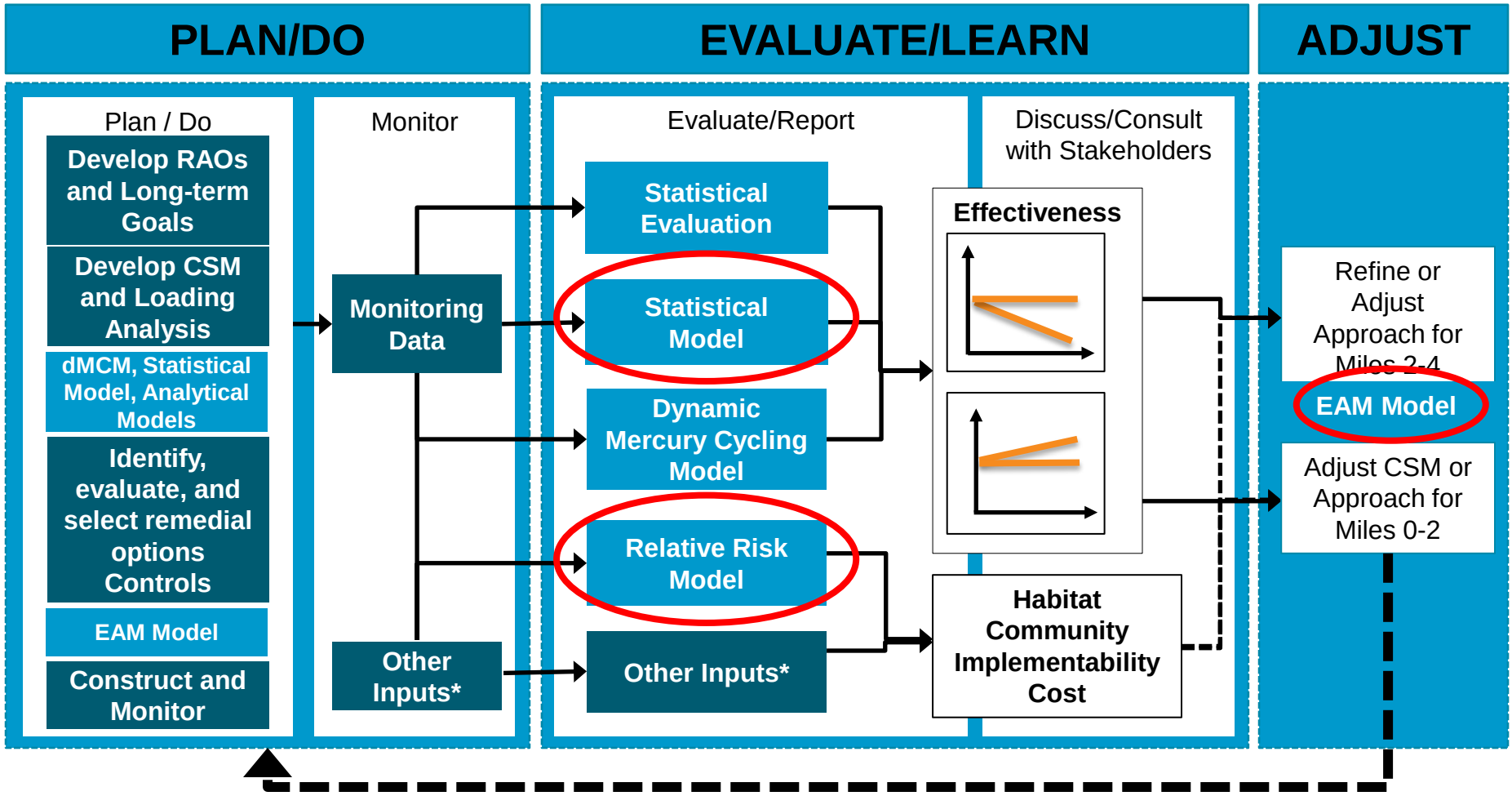
- Identify ***critical*** variables for a system
- Understand the system ***response*** to perturbation(s)
- Keep in mind that a model is
  - A ***reasonable*** representation of … the reality
  - Not the same as … the reality

Specific Objective



*Other Inputs include: Habitat condition improvements, permitting and implementation issues encountered and actual costs

Statistical Models

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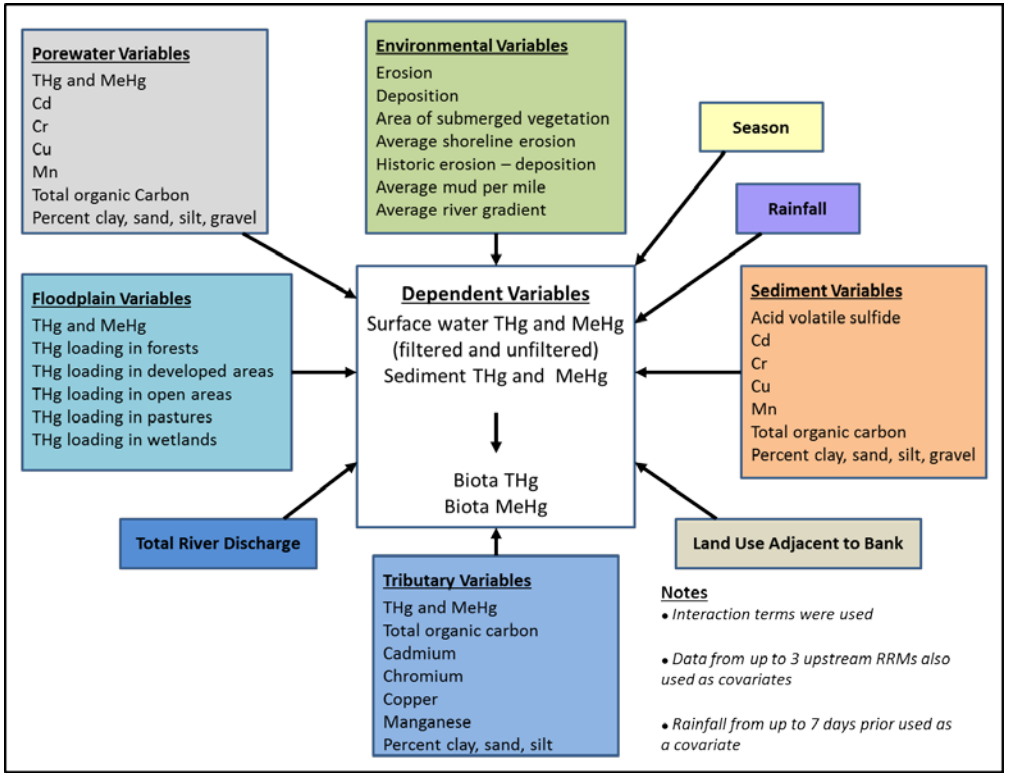
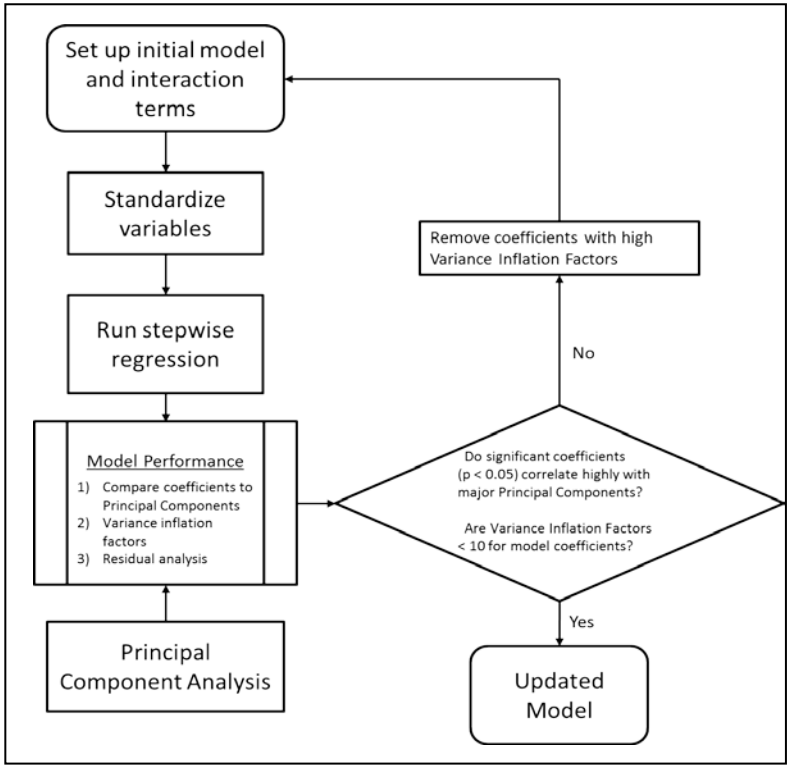
Background

Variables/Datasets

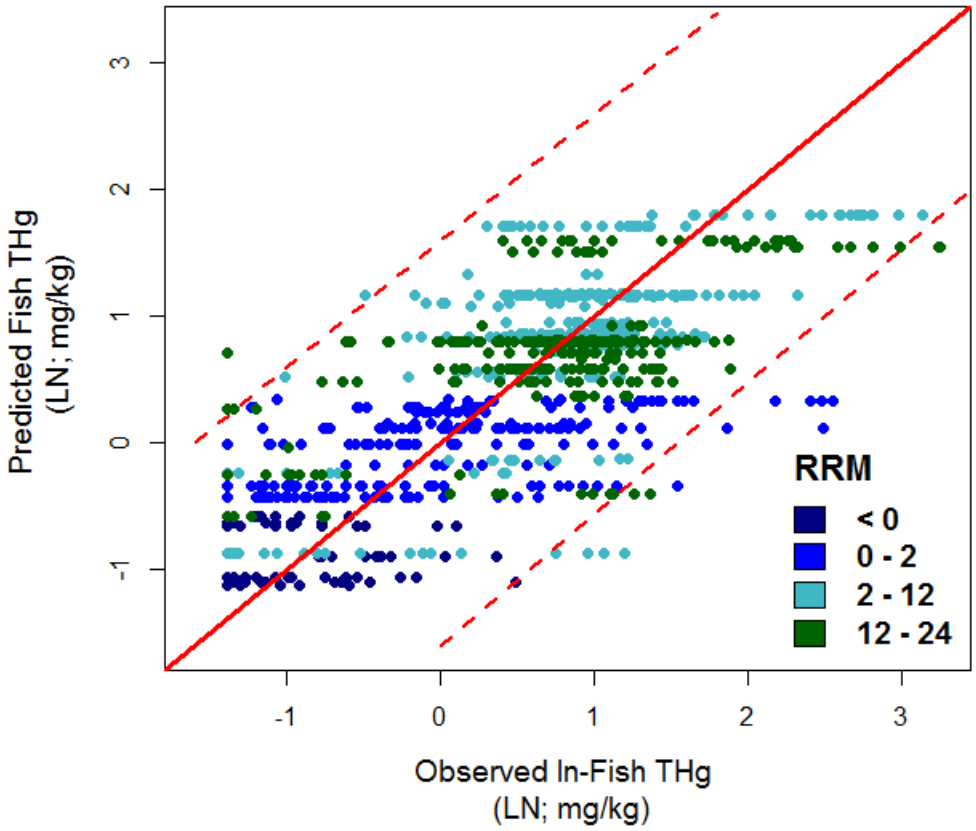


Process



Model Performance – Bass THg

- R^2 = 0.56 (n = 903)
- Predictions within ± 4.5 times of the observations
- Riverbank THg loading important predictor in the model



A ***reasonable representation*** of the South River System

Simulations

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Scenario	Simulations
Baseline	Pre-remediation conditions
IRM CP	Completed IRM at Constitution Park (CP)
IRM – In Progress	IRM in Progress at Rail Road Bridge (RR), WWTP, North Park (NP), Allied Concrete (AC)
IRM (0-2 Miles)	IRM at all BMAs identified within 0-2 miles
Complete Bank Control (0-2 Miles)	100% load reduction at BMAs identified within 0-2 miles

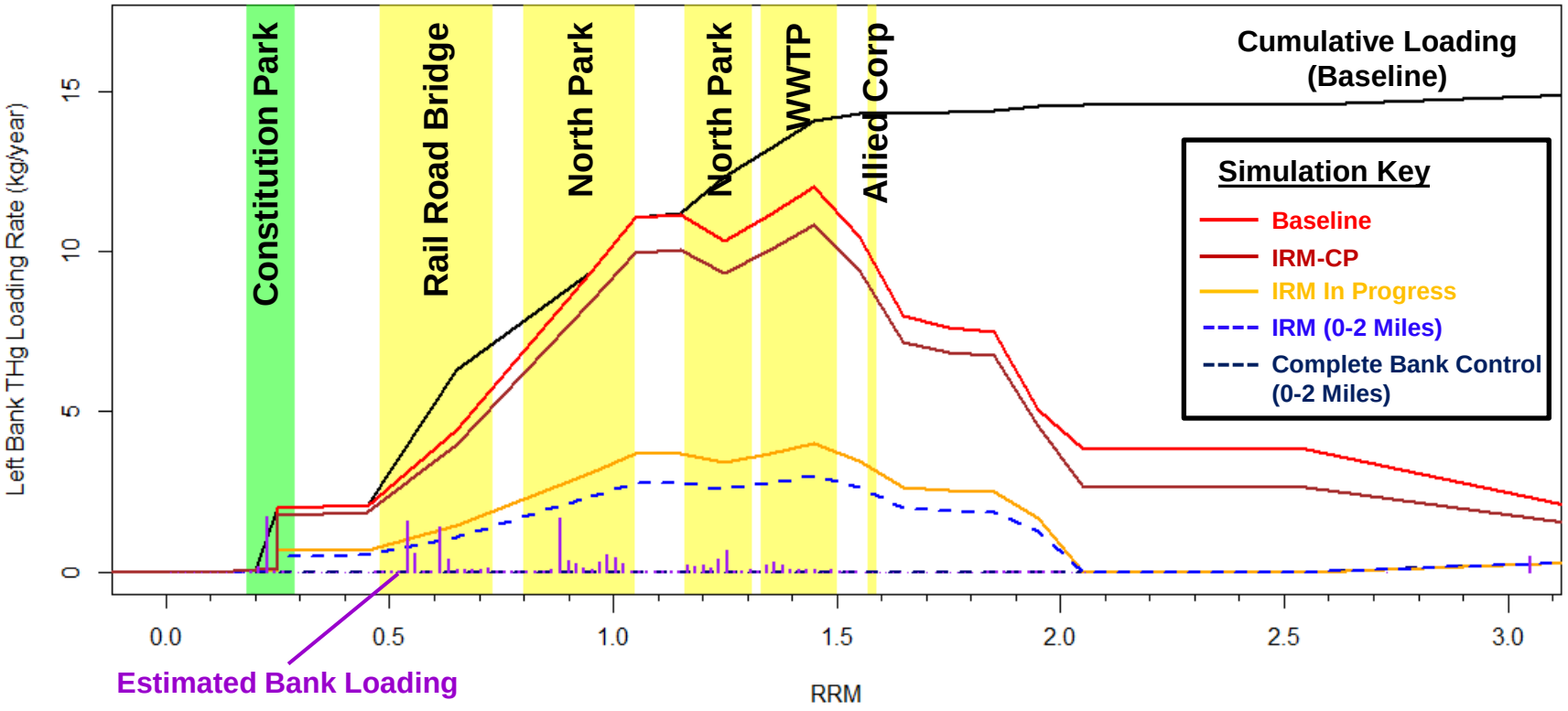
IRM (Interim Remedial Measure):

- Preservation, restoration, and habitat enhancement
- Assumed 75% THg load reduction for the BMA(s)

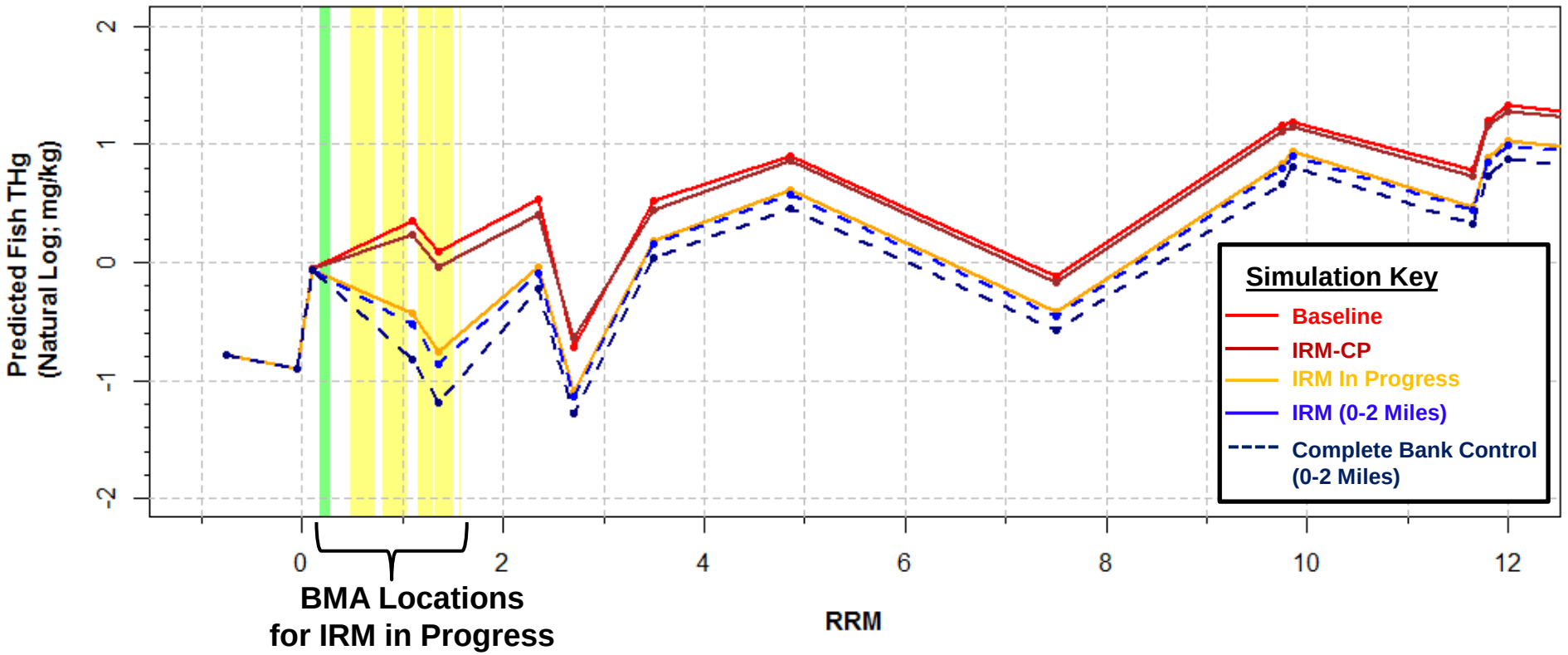
Complete Bank Control:

- Similar to the Pilot Bank Study
- Assumed 100% THg load reduction for the BMAs in 0-2 miles

Perturbation - Load Reduction



System Response – Bass THg



Barring the model uncertainties and limitations (e.g., the time), fish tissue THg is predicted to decline in response to loading rate reductions, with greater predicted declines in the BMA areas than downstream

System Response – Bass THg

Scenarios	RRM 2.35			RRM 11.8		
	Prediction	Δ	Δ%	Prediction	Δ	Δ%
Baseline	1.71	--	--	3.32	--	--
IRM-CP BMA	1.48	0.23	13	3.17	0.15	5
IRM - In Progress	0.96	0.75	44	2.43	0.89	27
Overall IRM	0.92	0.79	46	2.34	0.98	30
Complete Bank Control	0.80	0.91	53	2.08	1.24	37

Δ = Predicted Baseline – Predicted for a Scenario

Δ% = Δ as percentage of the Predicted Baseline

Greater predicted declines at RRM 2.5 (immediately downstream of the BMA areas) than at RRM 11.8 (downstream areas)

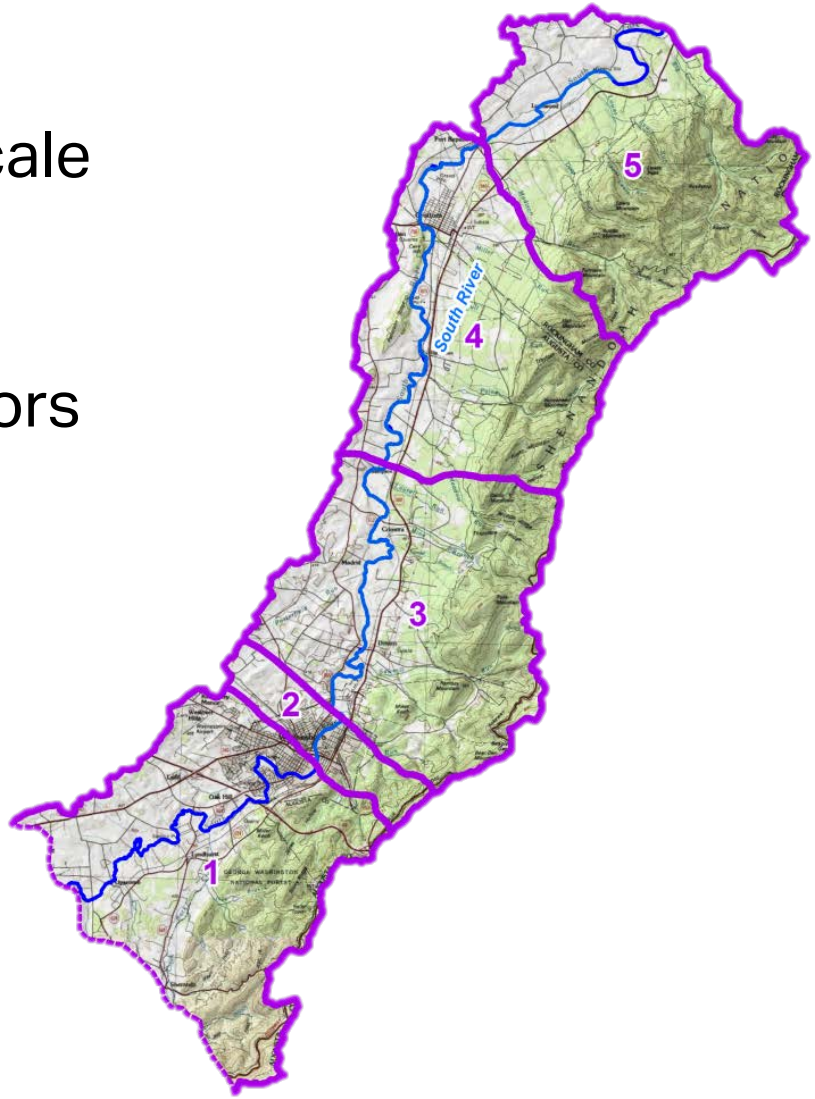
Statistical Models - Summary

- Limitations (temporal) and uncertainties remain on the modeled system response—*one of several tools*
- Inferences about the IRM based on the preliminary Post-IM data are premature
- Modeled predict declines in fish tissue THg in response to the progressive completion of IRM within 0-2 miles
- Greatest response in fish tissue THg is predicted within or immediately downstream of 0-2 miles

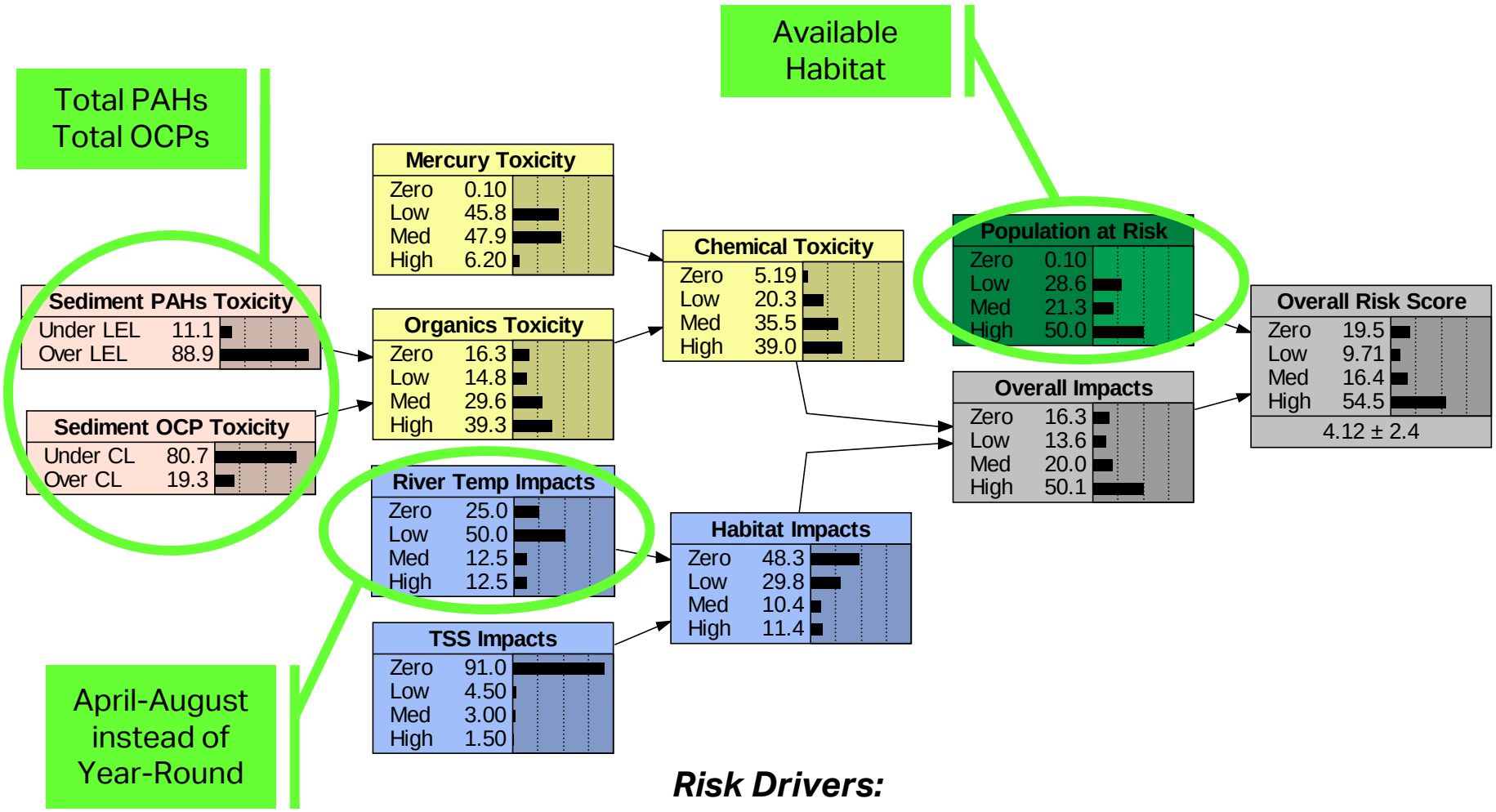
Relative Risk Models (RRMs)

Background

- Watershed/ Regional Scale
- *Relative* Risk
- *Multiple* Stressors/Factors
- Endpoints
  - Smallmouth Bass
  - Carolina Wren
  - River Use



RRM for Smallmouth Bass (SMB)



Risk Drivers:

Population at Risk > Mercury Toxicity > River Temperature

Simulations

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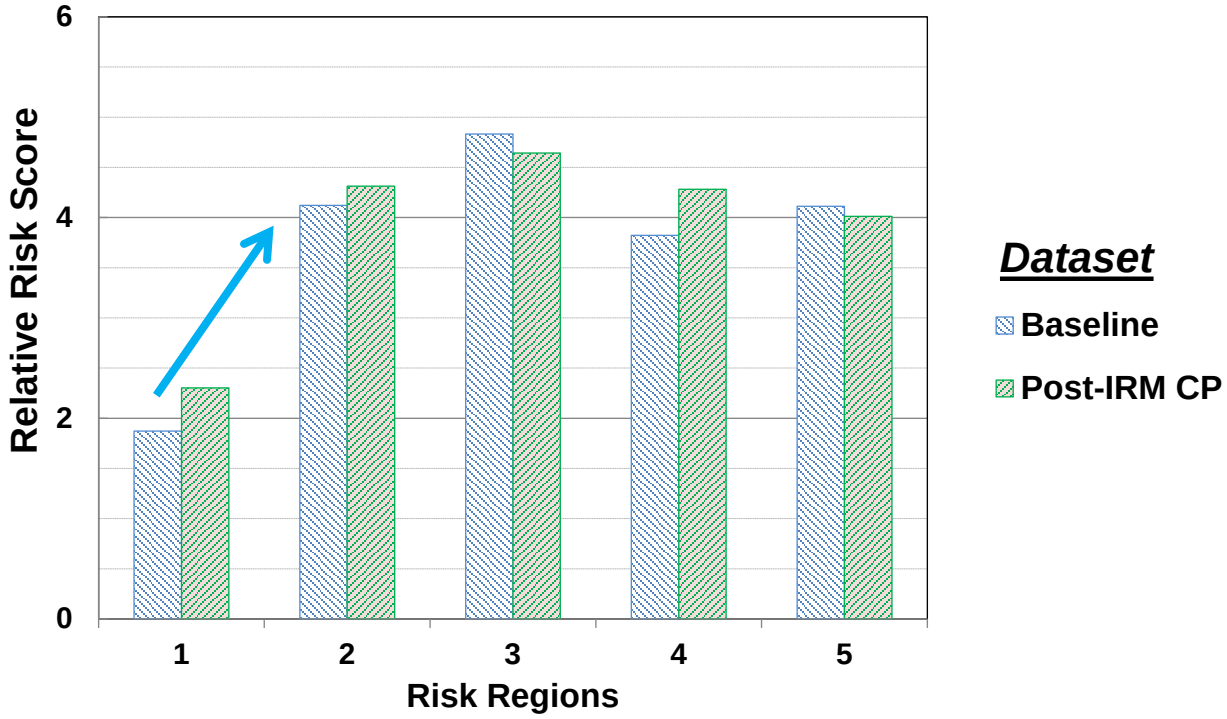
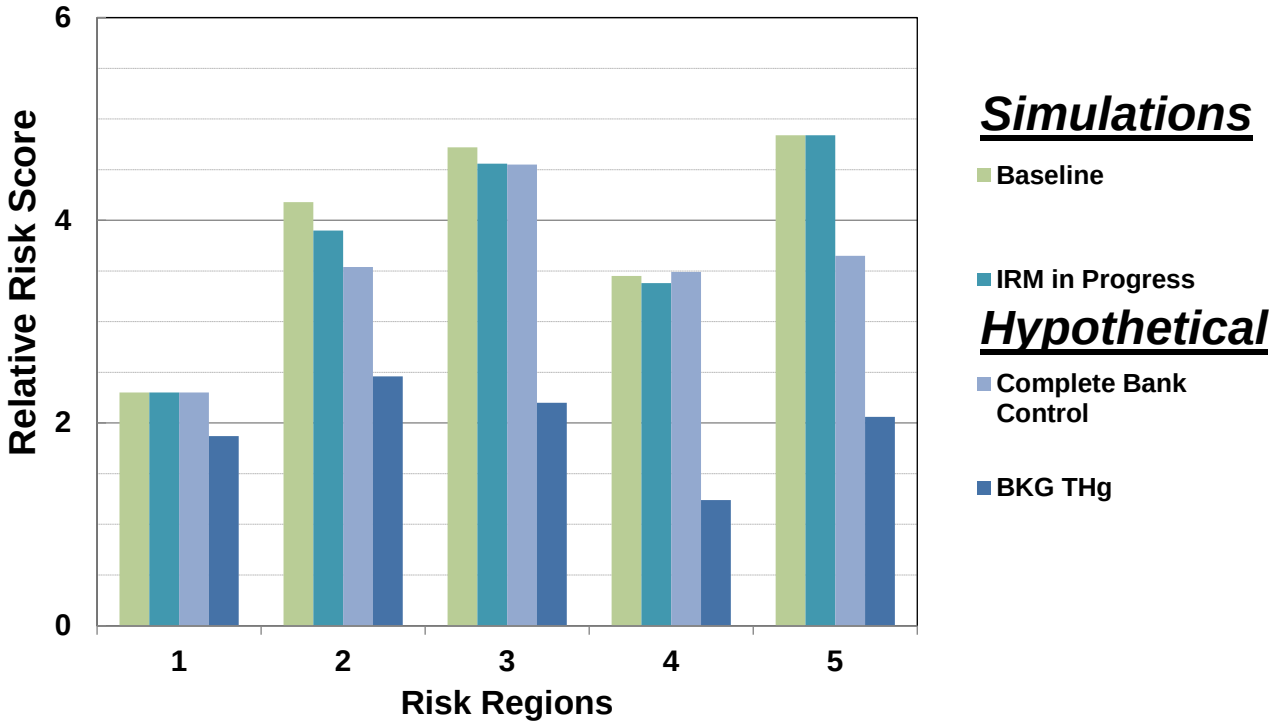
Mode	Scenario	Description
Observed	Baseline	Pre-remediation (2015-2016 data)
	Post-IRM CP	Post-remediation (2017 data)
Predicted	Baseline	Predicted Baseline
	IRM CP	Completed IRM at Constitution Park
	IRM in Progress	Following IRM at Phase I BMAs
	IRM (0-2 Miles)	Following IRM within 0-2 Miles
	Complete Bank Control	100% Load reduction within 0-2 Miles
Hypothetical	BKG THg	Assumes tissue THg distributions similar to Risk Region 1 (Reference/ Background Area)

"Observed" Relative Risks



- Relative risk lower in Region 1 than in Regions 2-5
- Changes in Post-IM relative risk not likely related to the IRM at CP – too early for inferences

Simulated Relative Risks



- General declines predicted for simulations, but insufficient to reach Region 1 levels
- Background (BKG) based relative risk scores similar among regions, but vary to reflect non-mercury factors

Summary

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- Relative risk lower in Region 1 than in downstream Regions 2-5
- Premature to evaluate preliminary Post-IM data
- Simulations predict insufficient decrease in RR scores in downstream regions to reach Region 1 levels
- Relative risks based on background similar among regions but vary, reflecting risk contributions from non-mercury factors

Enhanced Adaptive Management (EAM) Spreadsheet Model

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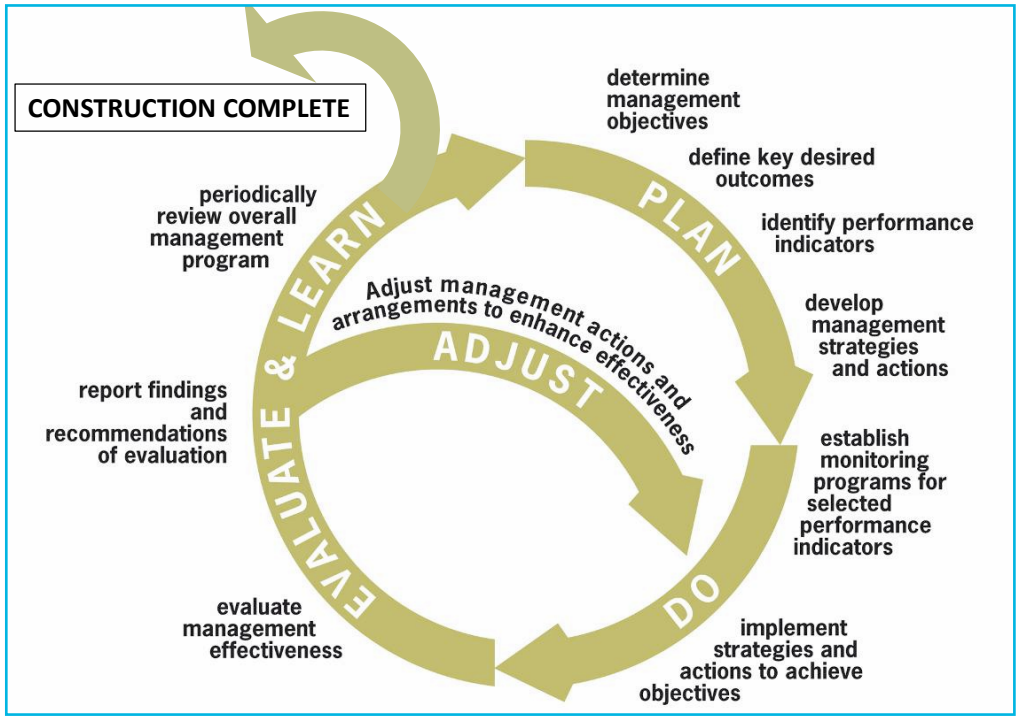
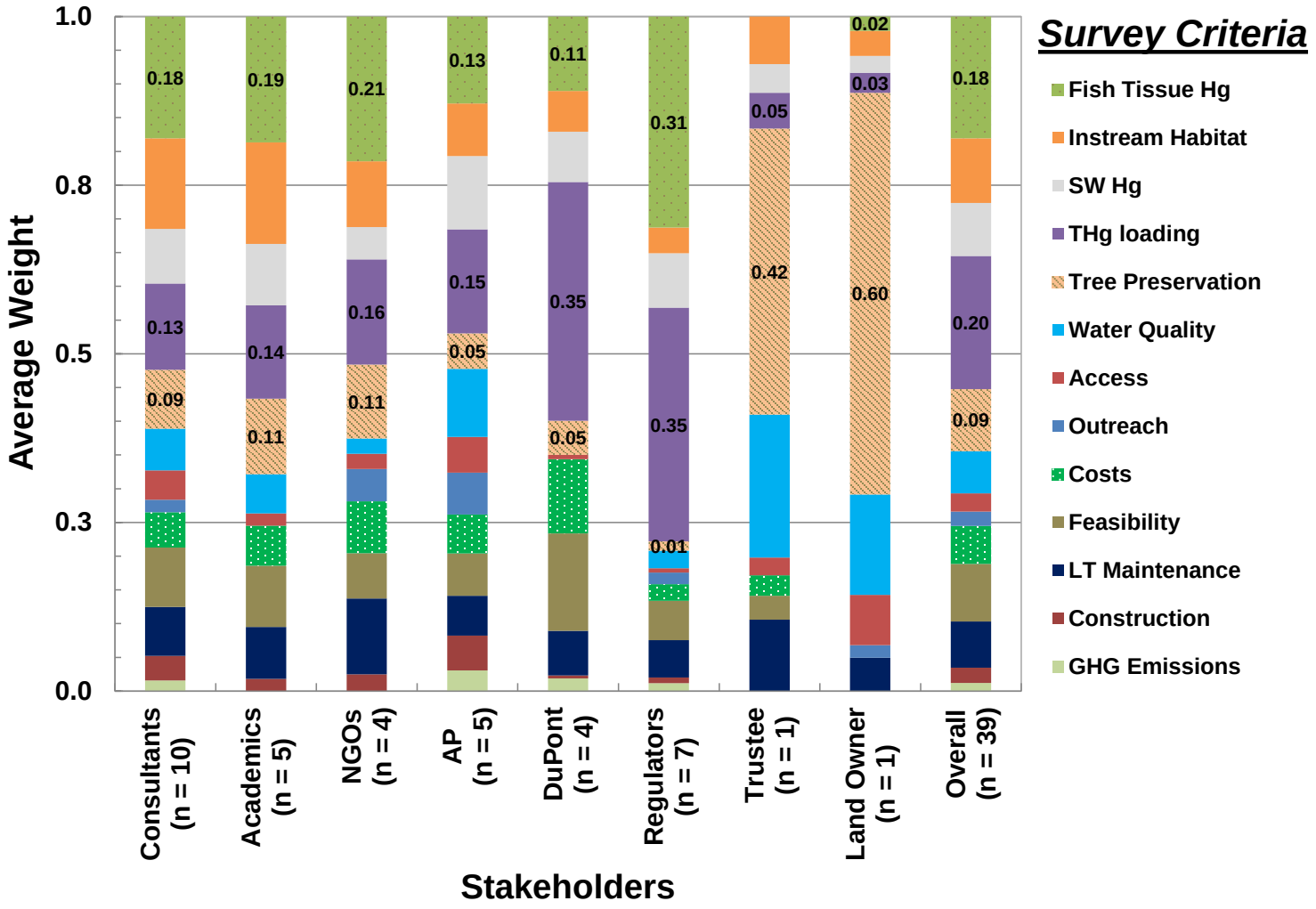
Background

- User Manual
- Criteria Survey
  - 7 Stakeholder groups
  - 13 Criteria
- Demonstration
- Simulations
  - Natural Recovery
  - IRM Approach
  - Complete Bank Control

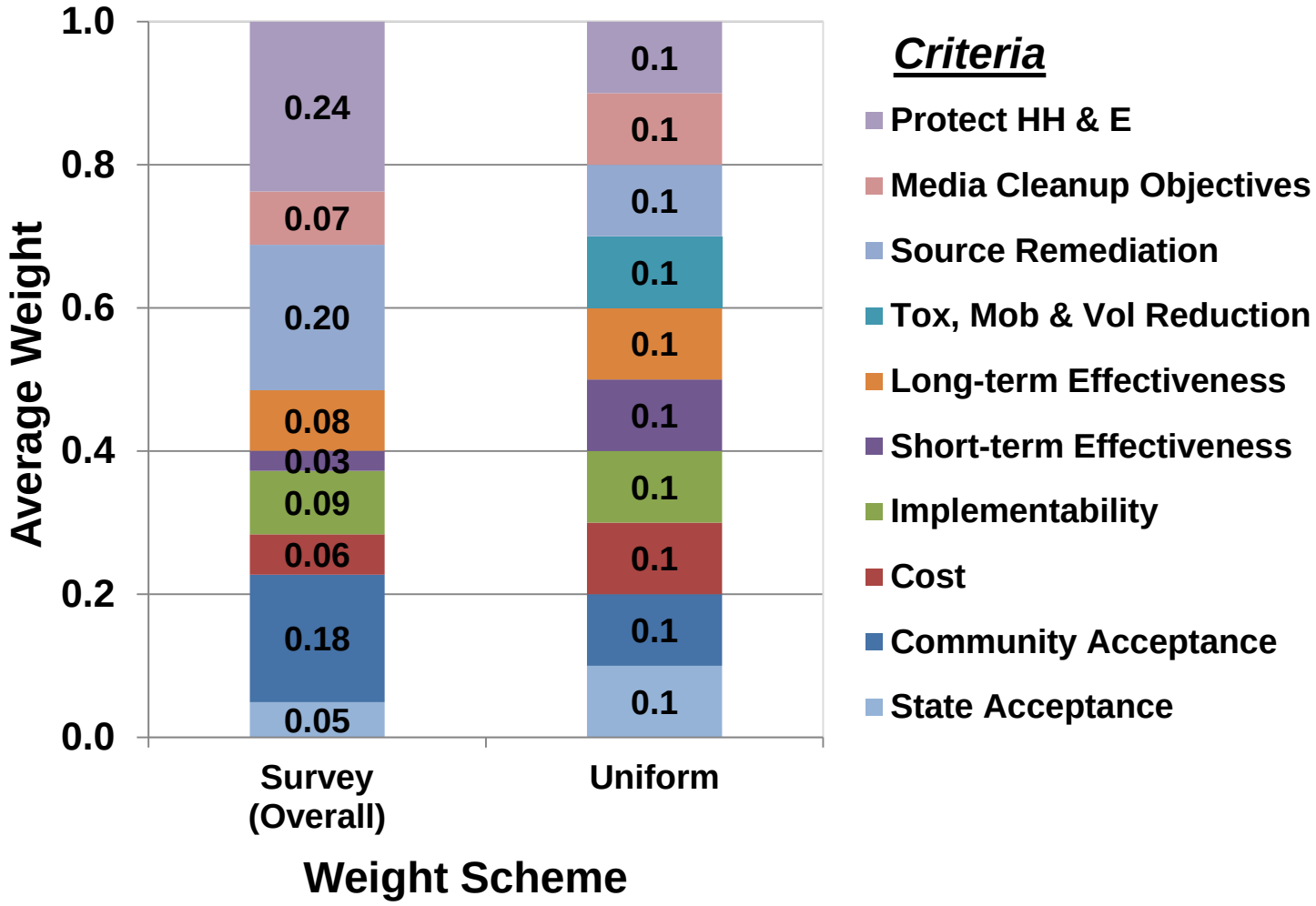


Adapted from Jones (2005), Tasmanian Parks & Wildlife Service

Criteria and Weights-Survey Results



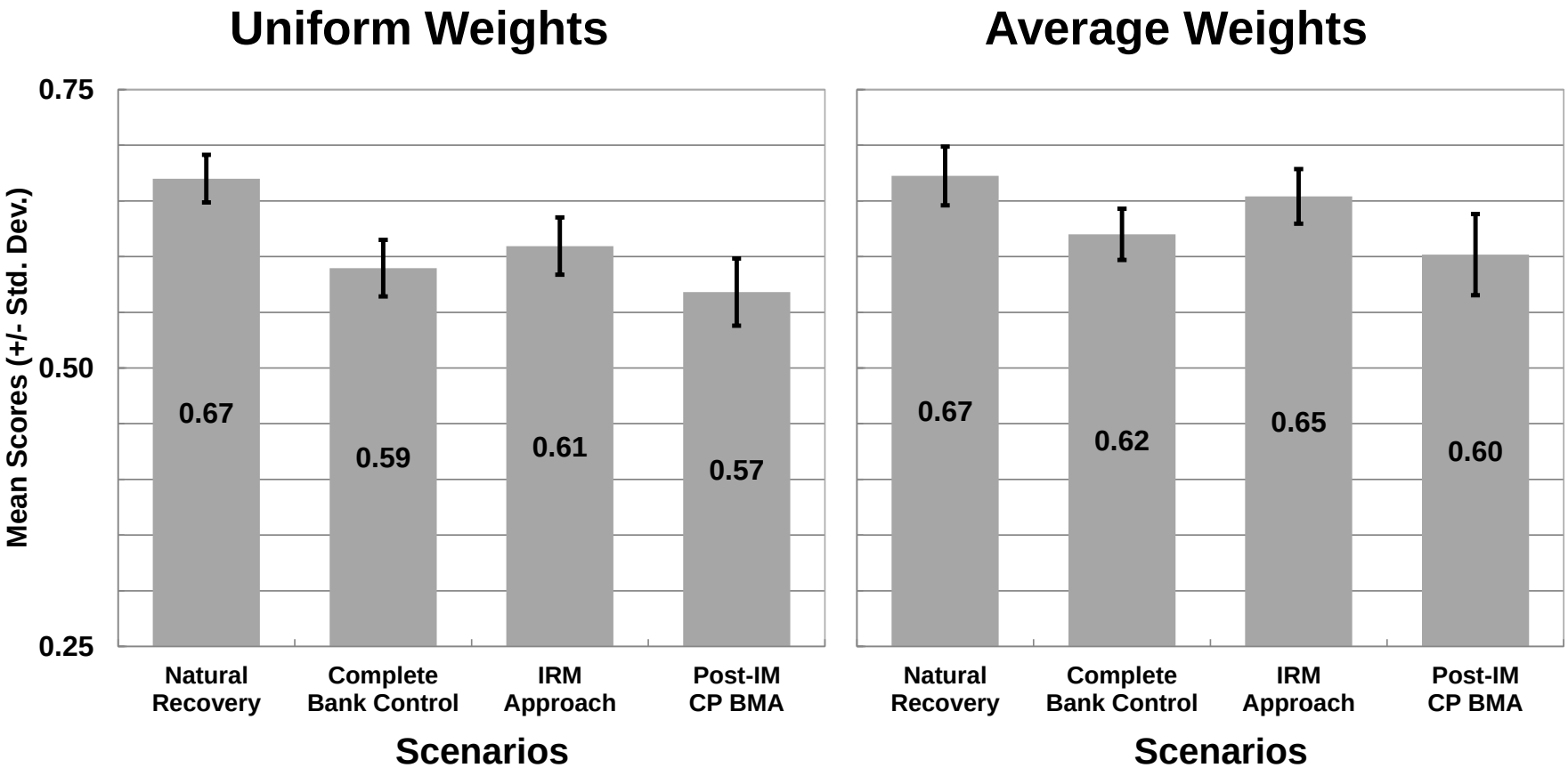
Criteria - Overall



Calculation Scenarios

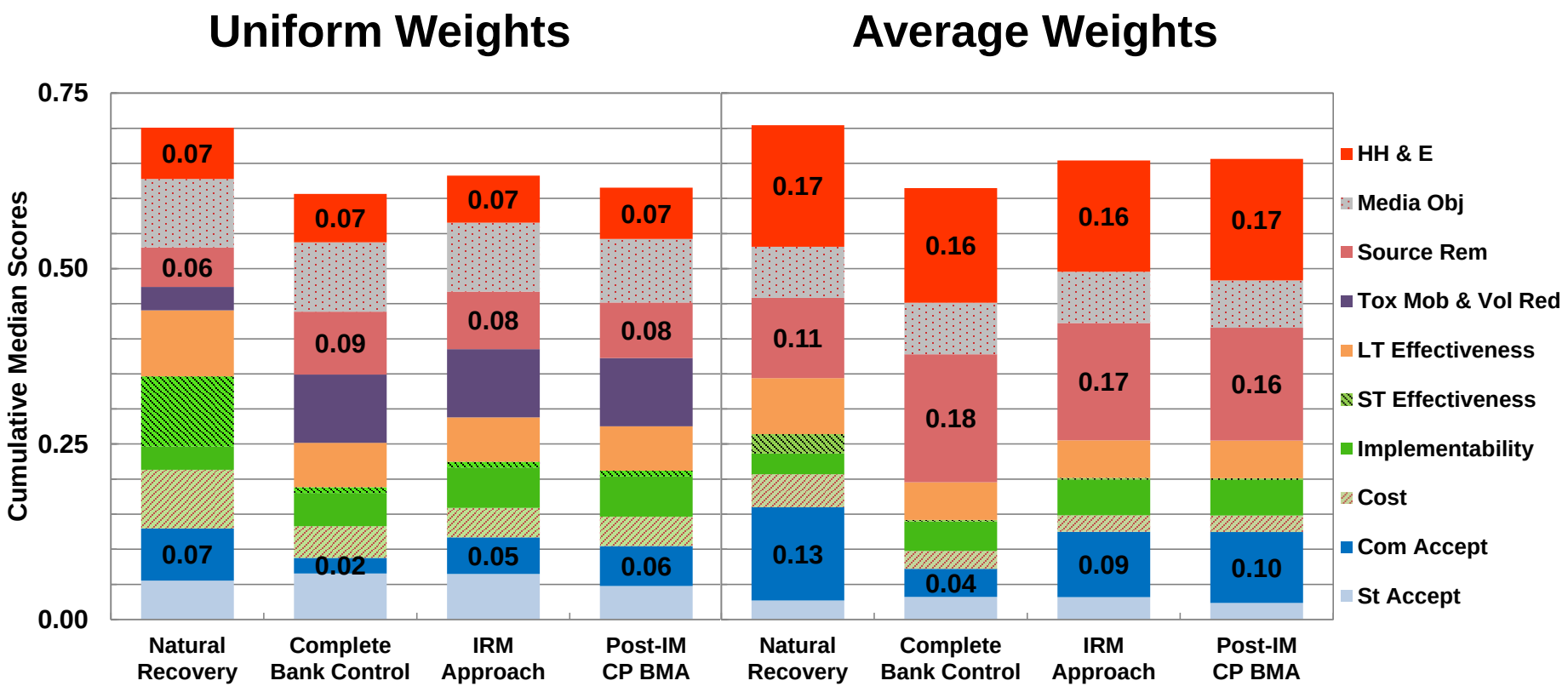
Scenario	Description
Natural Recovery	Pre-remediation (2015-2016 data); no disturbance to the banks and riparian areas; includes monitoring
IRM Approach	Current IRM approach for the BMAs within the 0-2 miles: balances THg load reduction, habitat restoration/enhancement, and preservation of mature trees; includes short- and long-term monitoring
Complete Bank Control	(Hypothetical) Complete removal/stabilization of the BMAs in 0-2 miles; focus on THg load reduction; does not consider preservation of mature trees; includes short- and long-term monitoring
Post-IM CP	(*For initial comparisons to the IRM Approach*) Based on preliminary "post-remediation" data (2017) following the completion of IRM at Constitution Park (CP) BMA

Results – Mean Scores



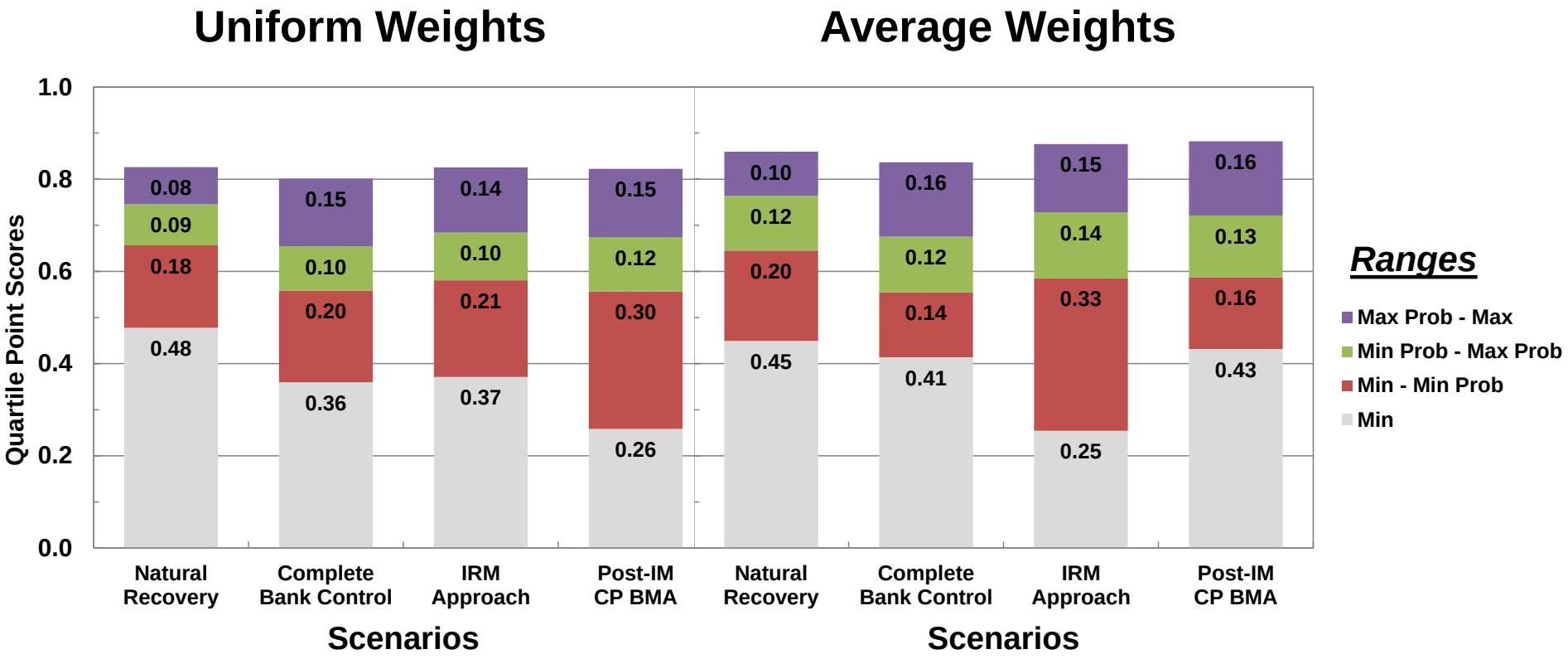
NR and IRM *NOT* different under Average Weight
Non-NR scenarios *NOT* different

Results – Median Scores



Which criteria are driving the scores?

Results – Quartile Scores



Weight Matters!

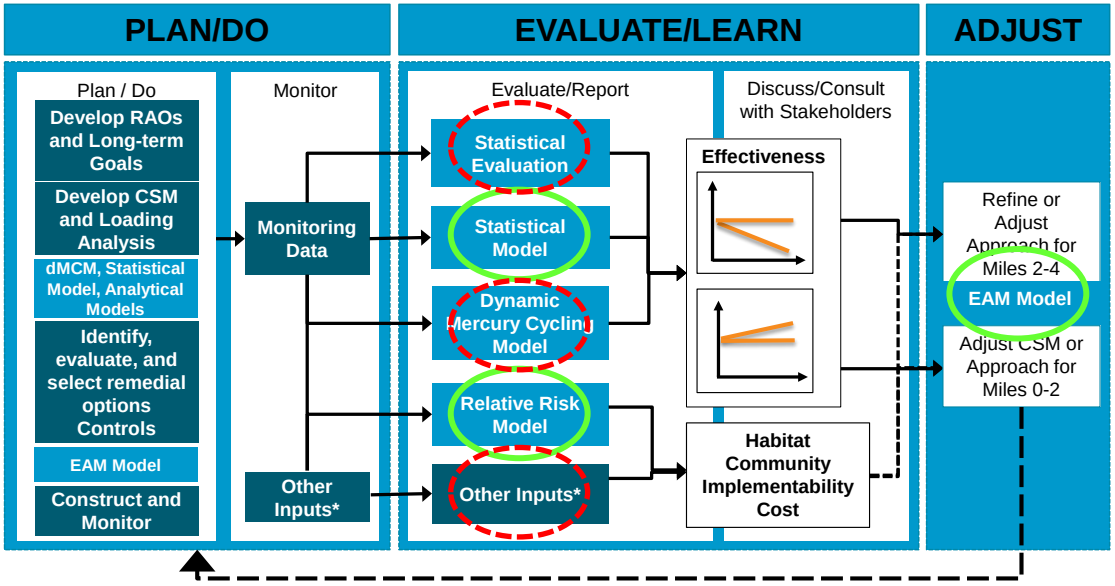
Overall Summary & Path Forward

Overall Summary

- Preliminary model applications complete
- EAM criteria and weights critical
- Post-IM data premature for evaluation
- Model integrations in progress

Path Forward

- Update calculations as more data become available
- Update/ refine models as necessary
  - Structure
  - Criteria
- Develop/enhance predictive capability



Thank You

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September 26, 2017

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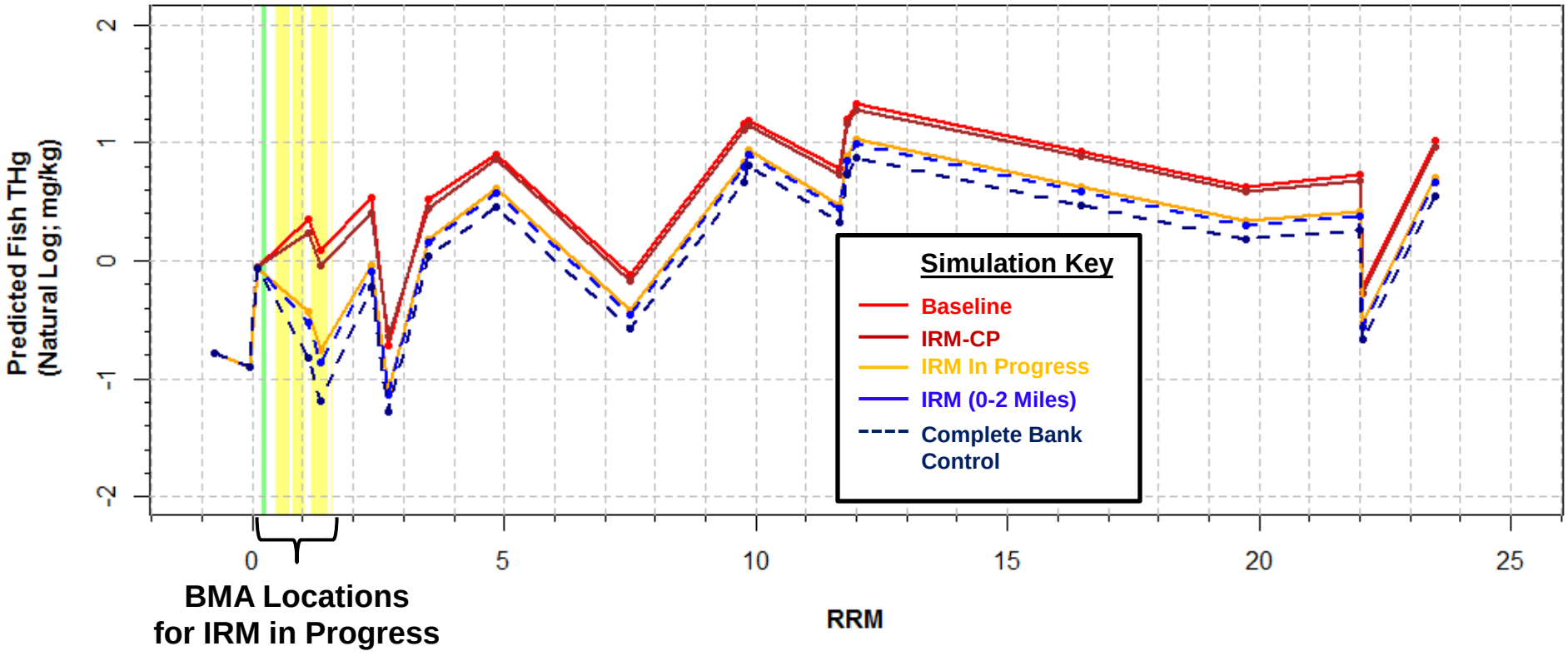
System Response – Bass THg



Results - Relative Risk Scores

Scenario	Risk Regions				
	1	2	3	4	5
Based on Observations					
Baseline	1.87	4.12	4.83	3.82	4.11
Post-IRM CP	2.30	4.31	4.64	4.28	4.01
Based on Simulations					
Baseline	2.30	4.18	4.72	3.45	4.84
IRM CP	2.30	4.09	4.72	3.45	4.84
IRM in Progress	2.30	3.90	4.56	3.38	4.84
IRM (0-2 Miles)	2.30	3.82	4.51	3.38	4.59
Complete Bank Control	2.30	3.54	4.55	3.49	3.65
BKG THg	2.30	2.46	2.20	1.24	2.06

- Relative risk scores higher in Regions 2-5 than in Region 1
- Changes in Post-IM relative risk scores not likely related to the IRM at CP – too early for inferences
- General declines predicted for simulations, but insufficient to reach Region 1 levels
- Background (BKG) based relative risk scores similar for regions, but vary to reflect non-mercury factors