

Remedy Evaluation Tools Statistical Models Update

Former DuPont Waynesboro Site - AOC 4

South River Science Team Meeting

April 24, 2020



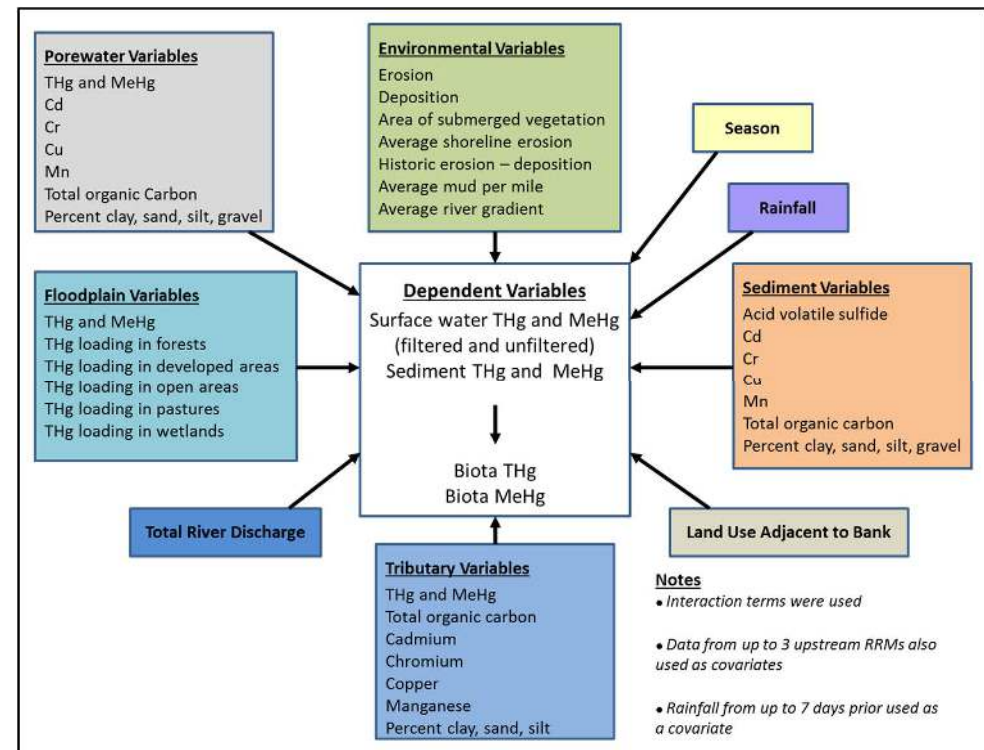
Outline

- Objective
- Background
- Machine Learning (ML)
 - Approach
 - Results
 - Summary
- Path Forward



Objective

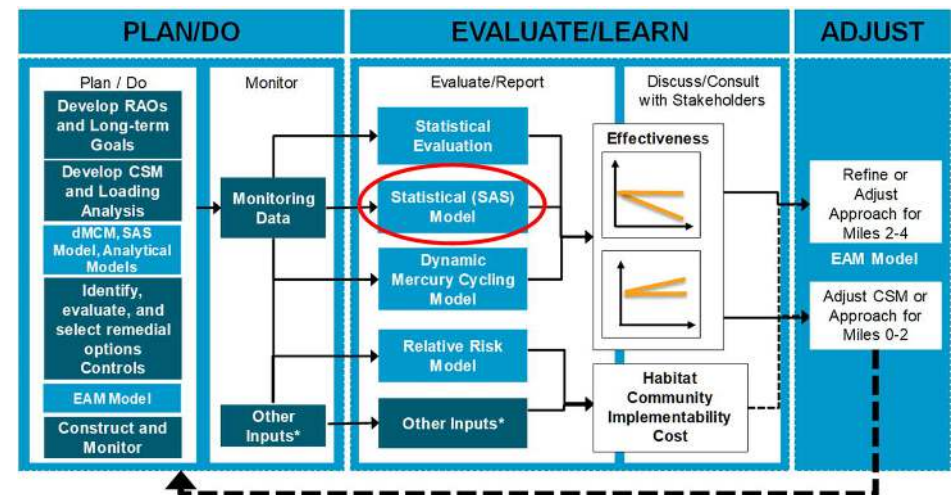
- Provide update on statistical models that were *improved* using Machine Learning



Background – Why Machine Learning Approach?

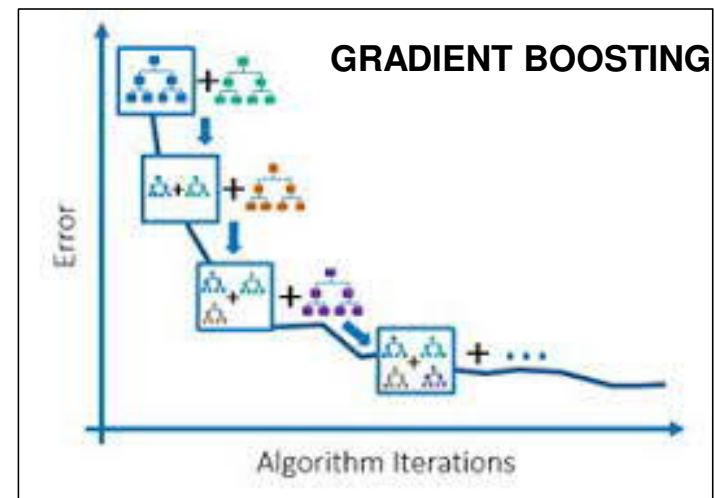
- Improved performance of models to support EAM
- Streamline modelling process to achieve greater efficiency and flexibility
- Adopt best available methods - datasets and regression models well-suited for ML

Enhanced Adaptive Management (EAM)

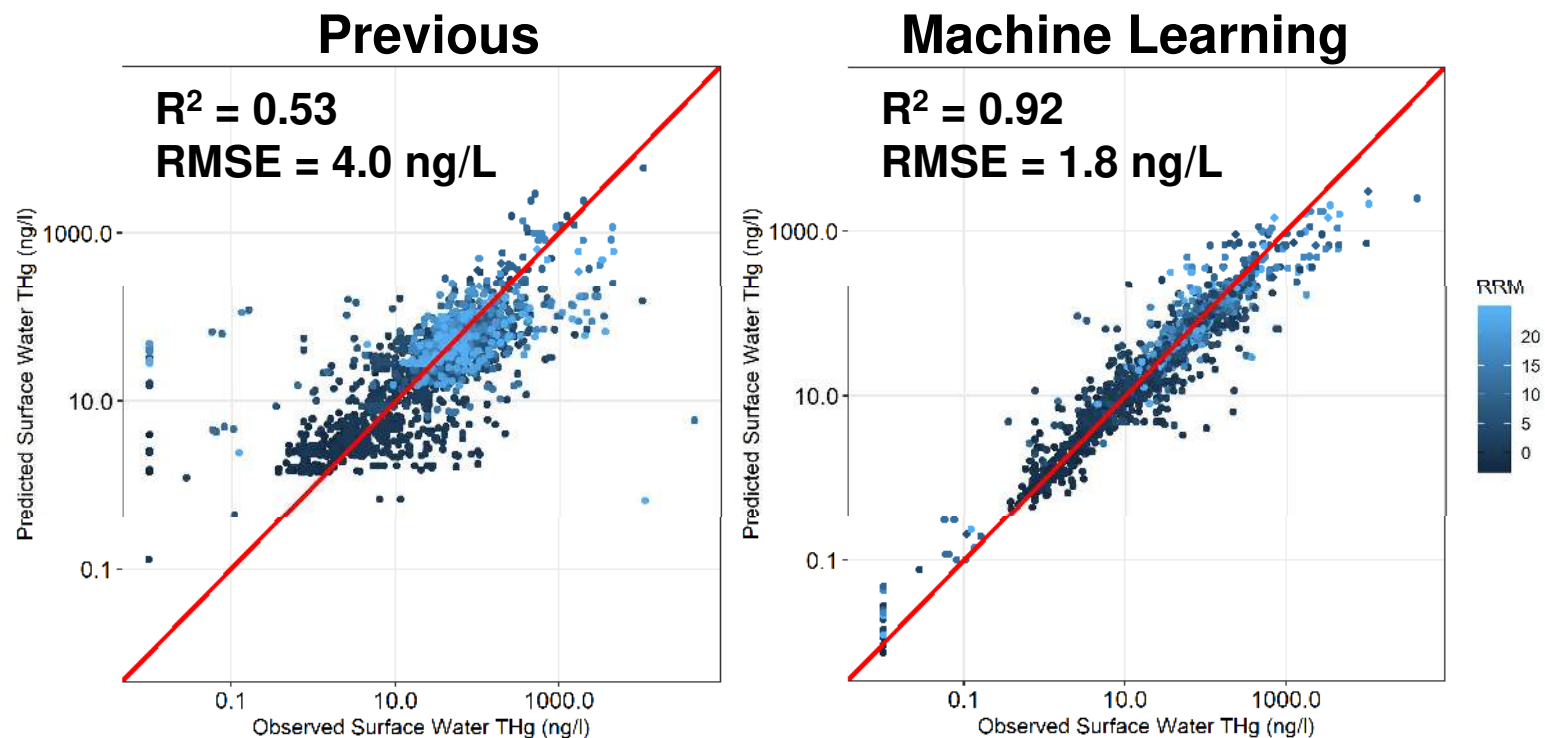


Machine Learning (ML) Approach

- Used ***Gradient Boosting***
- Retained the same primary variables from statistical models
- Modified approaches:
 - Primary variables
 - No interaction terms

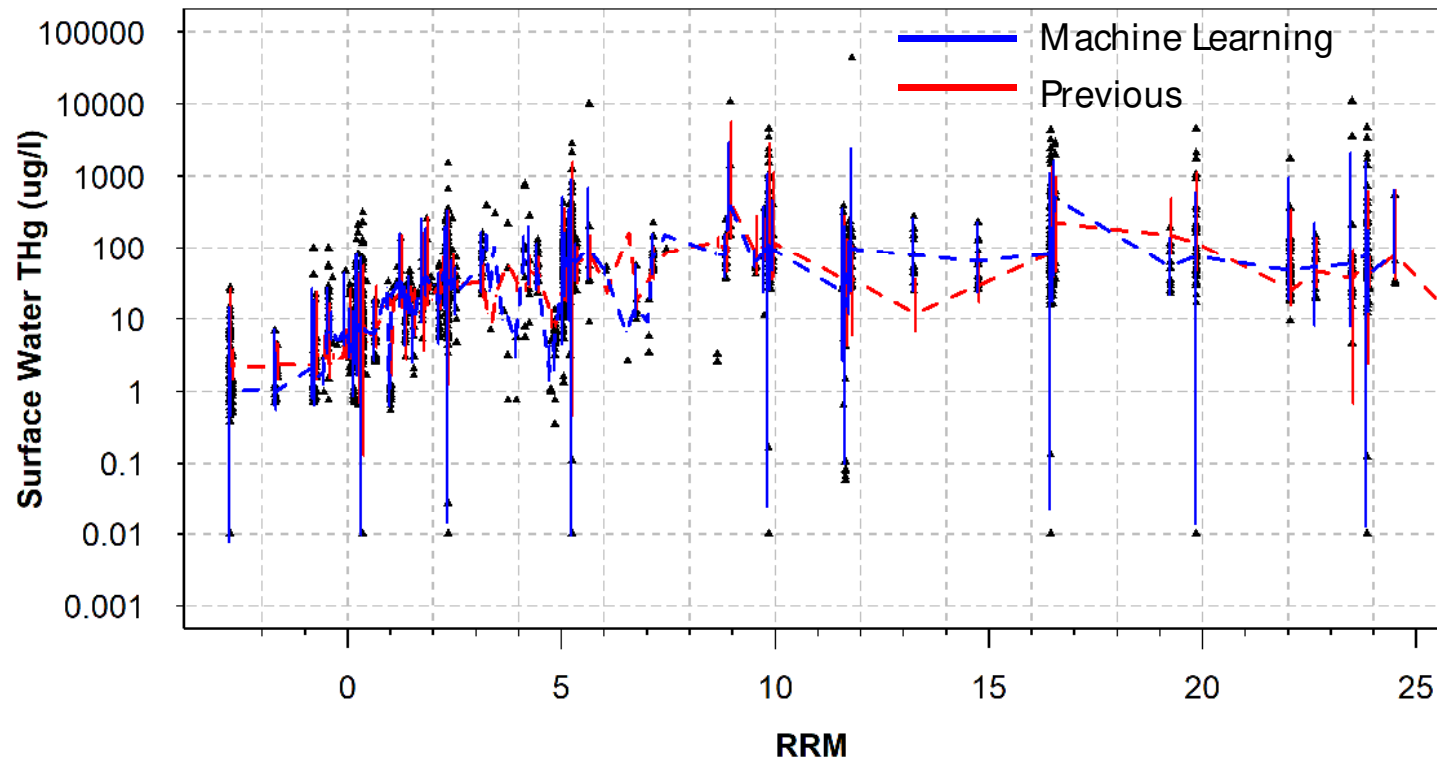


Results – Surface Water Total Mercury (THg) Predictions



Improved R^2 and RMSE

Results – Surface Water Total Mercury (THg) Predictions



Spatial trend in mean and range better represented by ML-based predictions

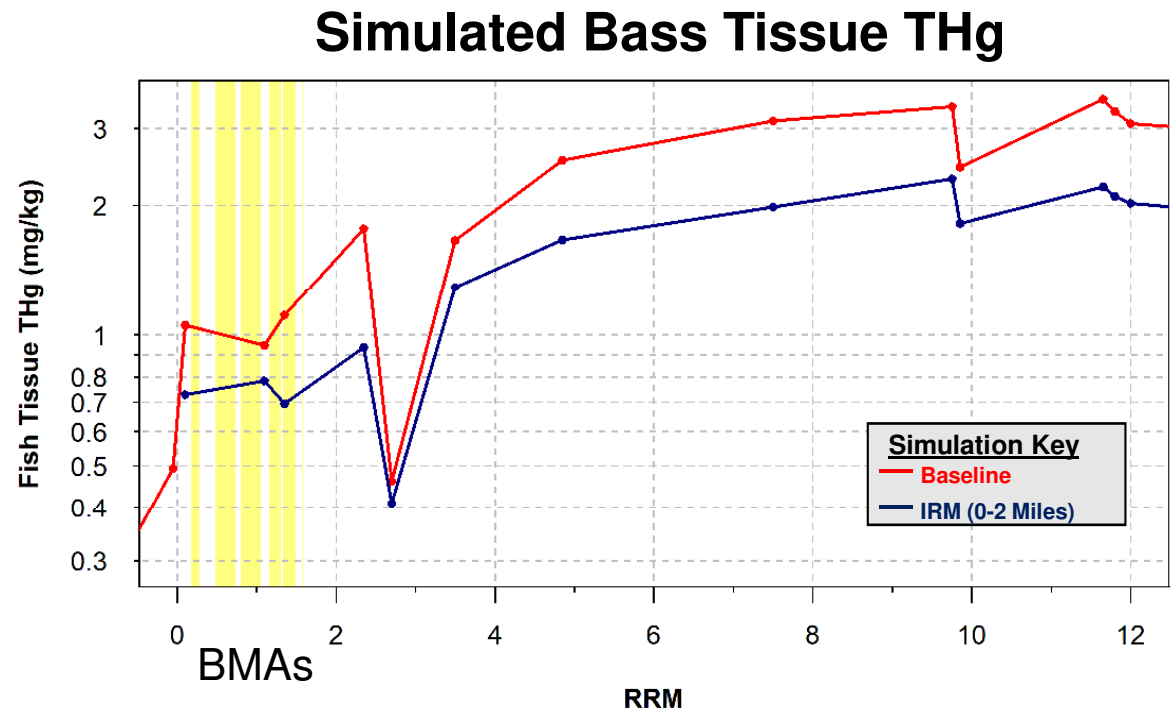
Overall Results

- **Higher** correlation (R^2) and **lower** root mean squared error (RMSE) for all three models: Surface water (SW), sediment (SED) and adult bass (BASS)

Models	R ²		RMSE	
	Previous	ML	Previous	ML
SW	0.53	0.92	4.0 (ng/l)	1.8 (ng/l)
SED	0.64	0.83	3.4 (ug/kg)	2.1 (ug/kg)
BASS	0.56	0.73	1.9 (mg/kg)	1.6 (mg/kg)

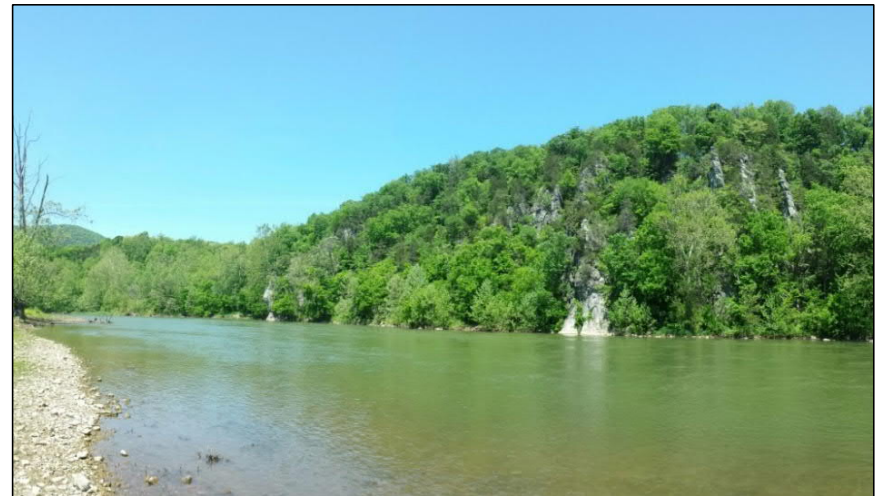
Simulation - Interim Remedial Measures

- Assumed 90% reduction of bank Hg loading within 0-2 miles
- ***Simulated changes in SW, SED, and BASS THg***



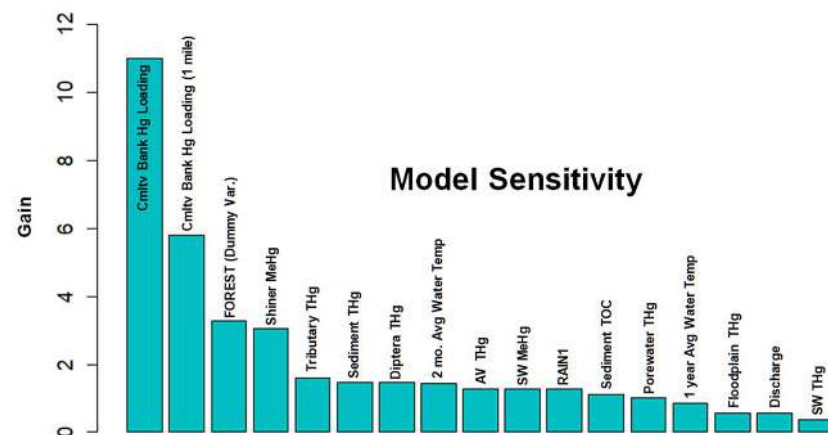
Summary

- Improved model performance
- Streamlined input processing
- Better flexibility and efficiency to run/ update
- All models operational
 - *Integrated adult bass model (in development)*



Path Forward

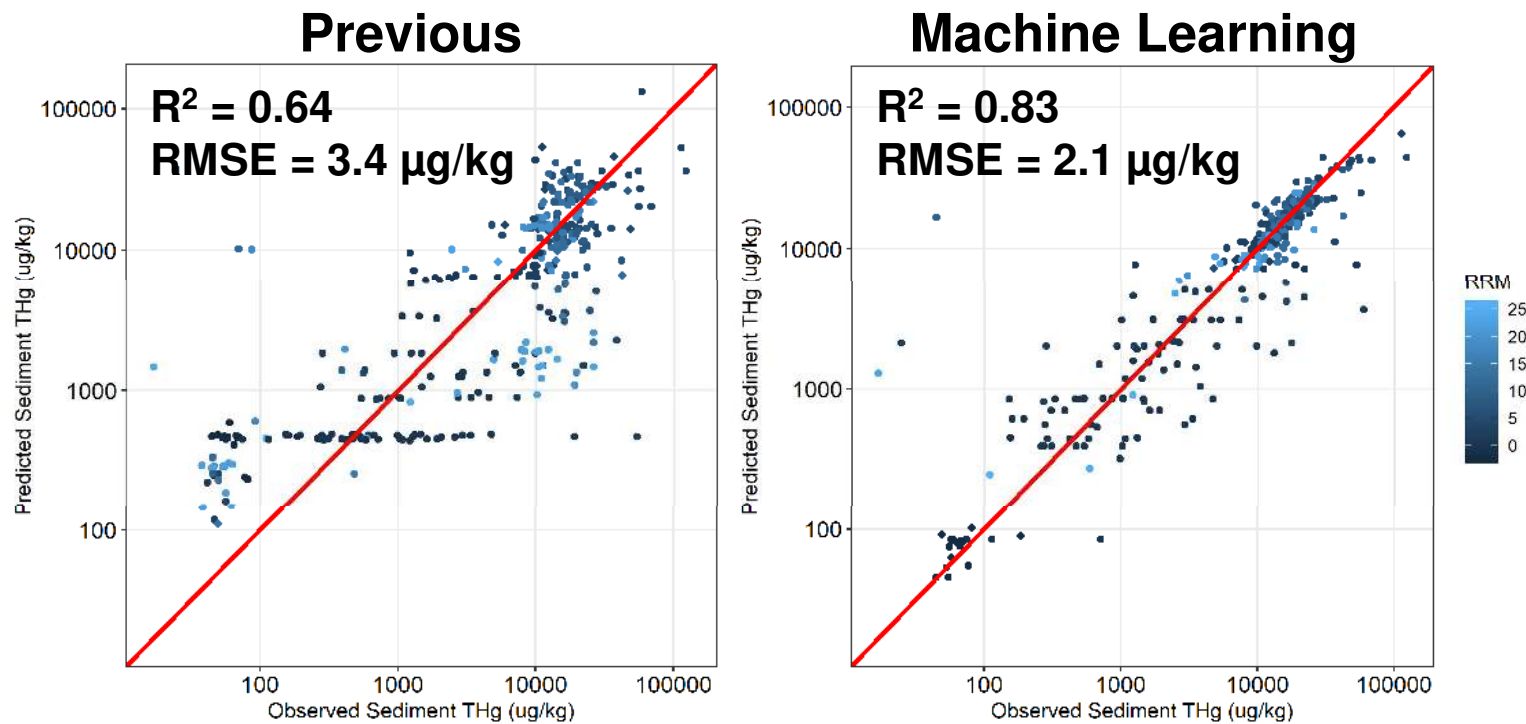
- Sensitivity evaluations
- Integrated model for adult bass model
 - Update simulations
- Support evaluation of monitoring data
 - Simulated predictions vs. observations
 - Coupling temporal trends in monitoring data and simulated reductions in SW, SED, and BASS THg.





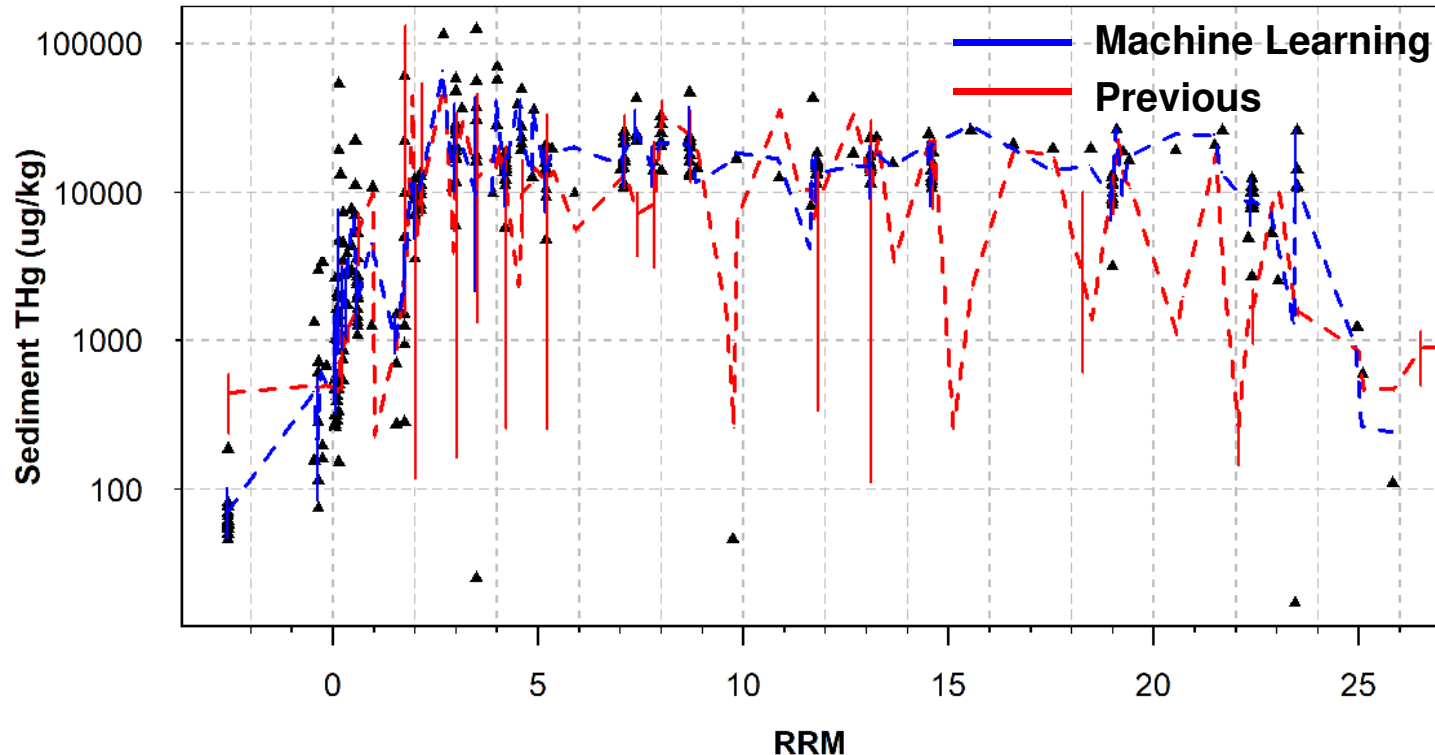
Thank You!

Results – Sediment THg Predictions



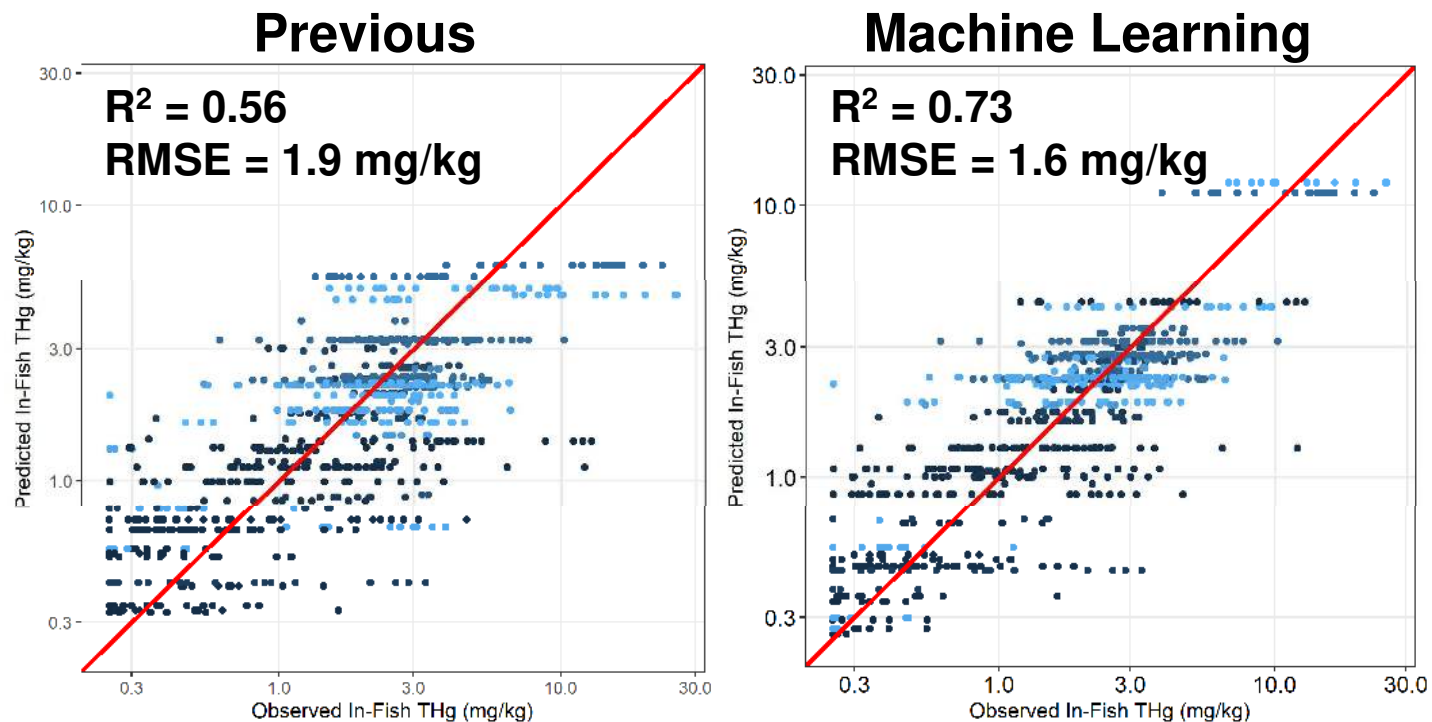
Improved R^2 and RMSE

Results – Sediment THg Predictions



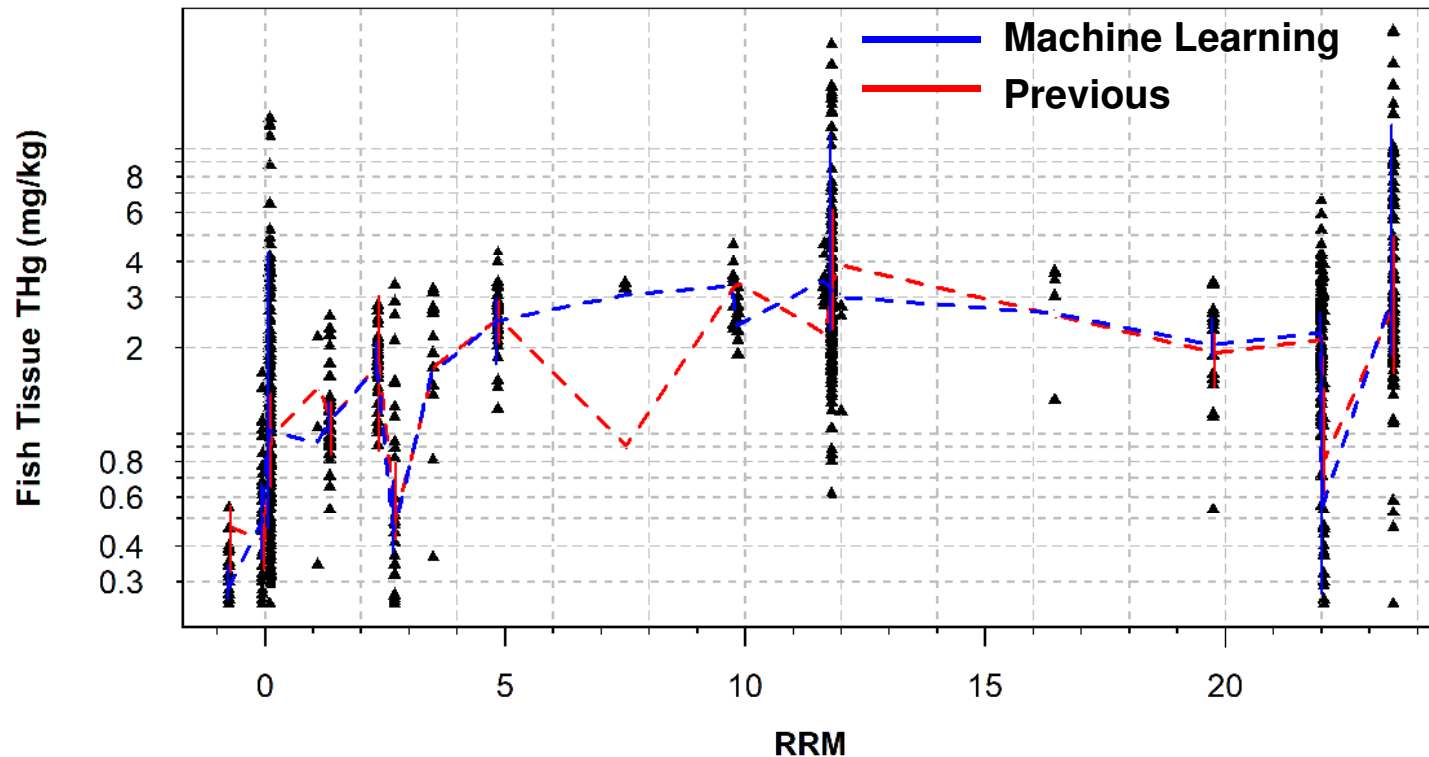
Spatial trend in mean and range better represented by ML-based predictions

Results – Adult Bass Tissue THg Predictions



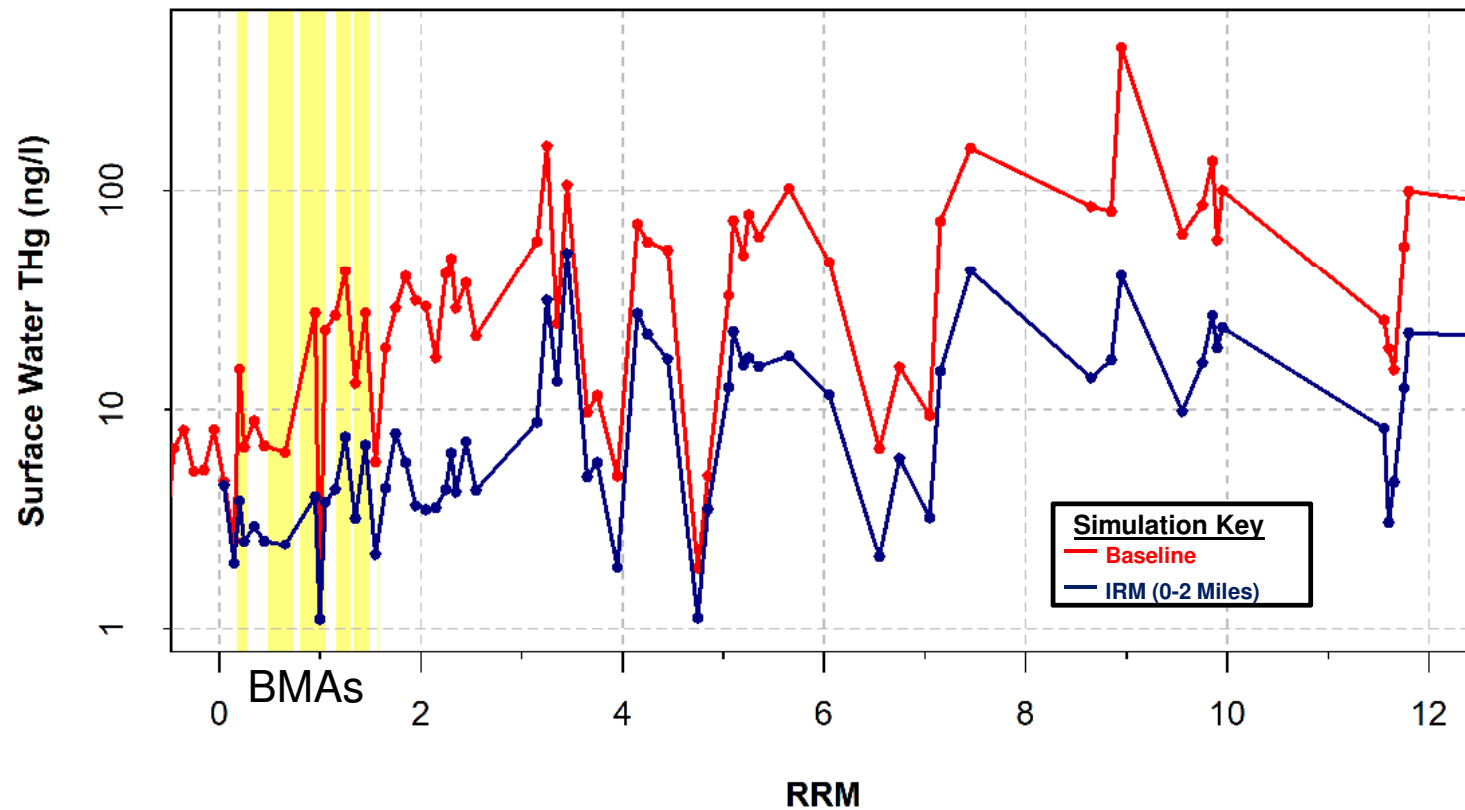
Improved R^2 and RMSE

Results – Adult Bass Tissue THg Predictions

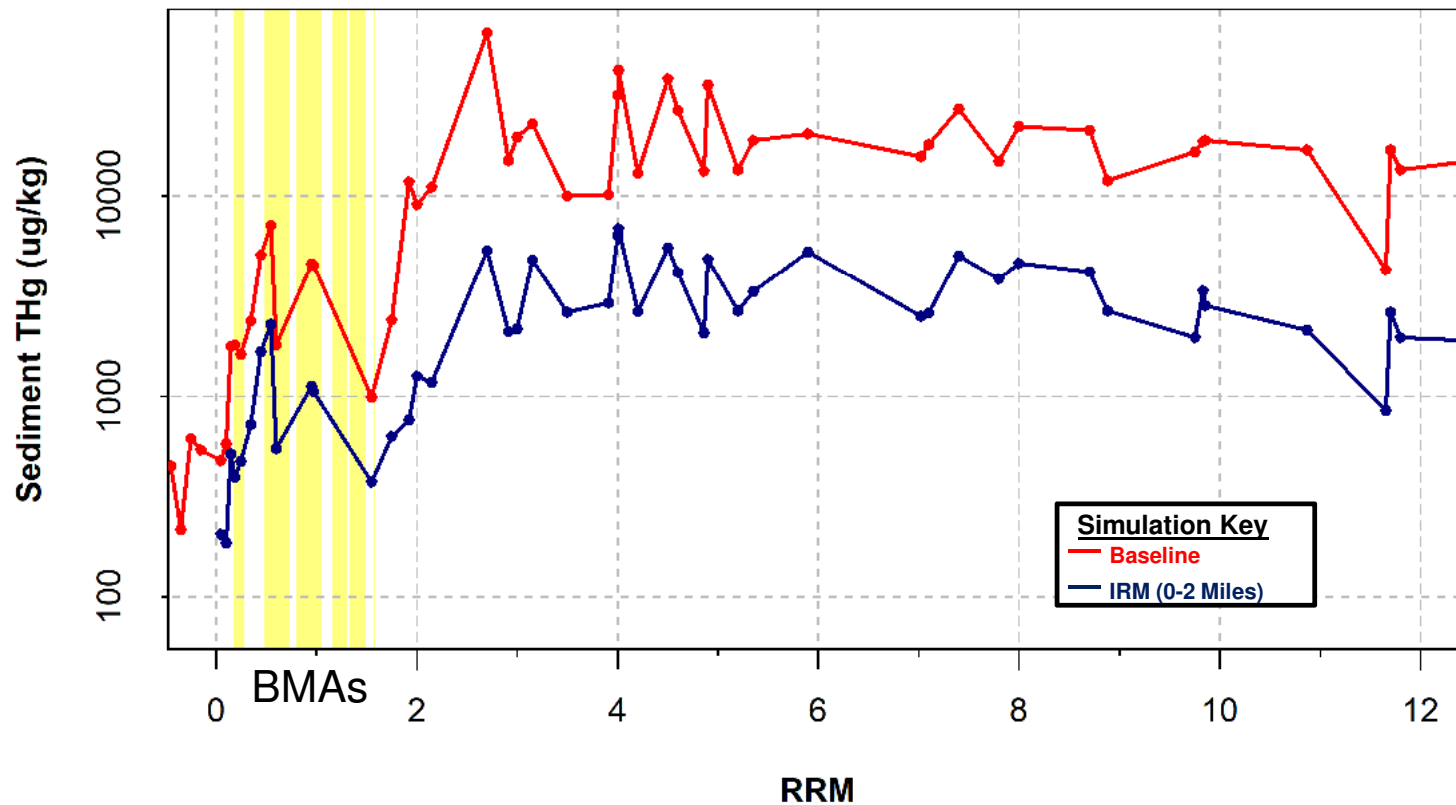


Spatial trend in mean and range better represented by ML-based predictions

Simulation – Surface Water THg



Simulation – Sediment THg



Simulation – Bass Tissue THg

