Trophic Transfer Models for South River

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Core Premise

Once mercury enters the biota, its most important movements to understand are those involving trophic movement. Its movement can be modeled quantitatively.

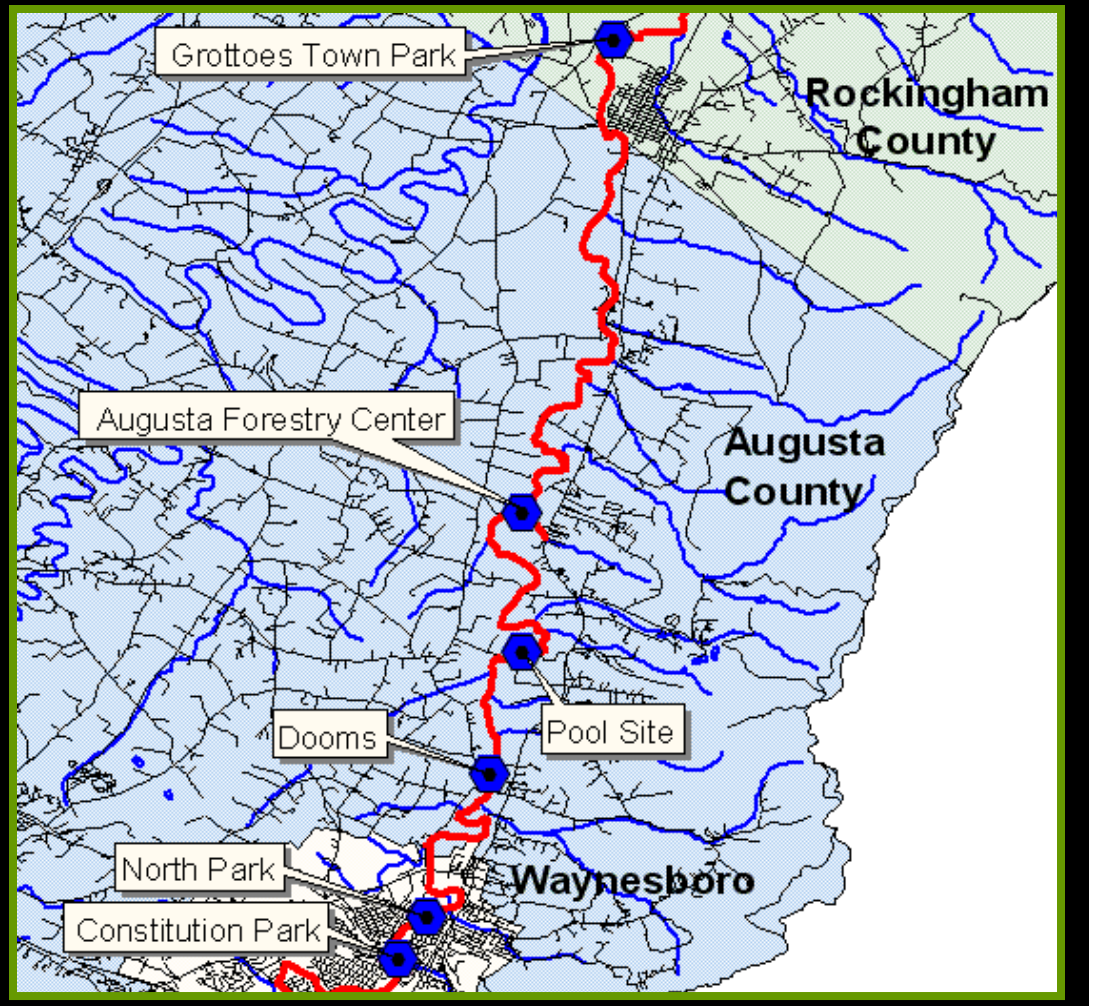
Goals

Can models effectively predict mercury biomagnification in South River?

- –One model for contaminated region or several?
- –Trend in model parameters with distance from past source?
- –Is the predictive capability of models sufficient?
- –Can % methylHg be quantified with trophic position

Sampling Sites - 2007

- Constitution Park (0.6 mi)
- North Park (2.0 mi)
- Dooms (5.2 mi)
- Pool (≈8.7 mi)
- Crimora (AFC) (11.8 mi)
- Grottoes (22.4 mi)



2007 URS/VIMS Sampling

Biomagnification Models

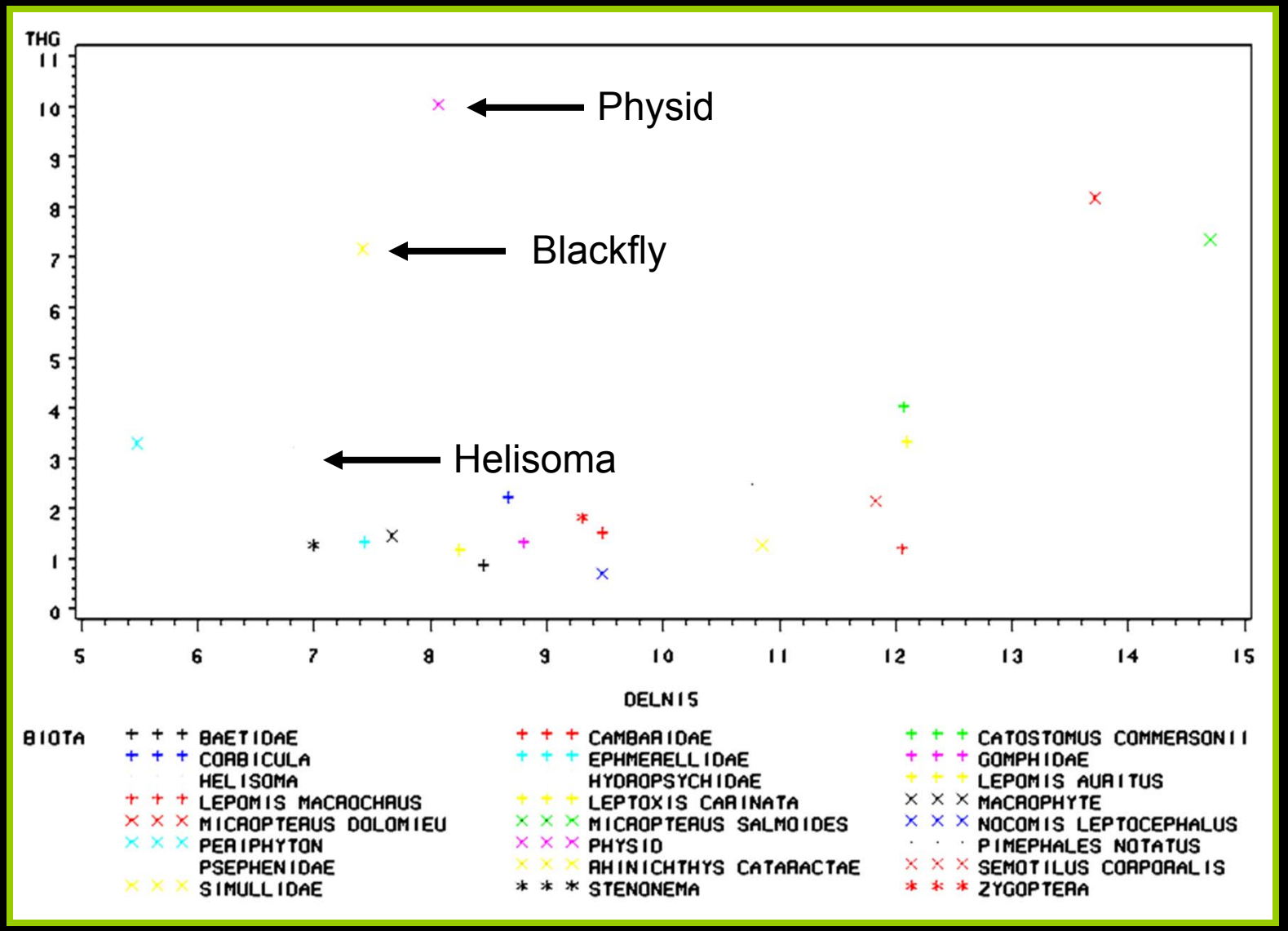
$$[Hg]_i = e^{a} e^{b\delta\ ^{15}N_i} \text{ or } e^{a} e^{b_1\delta\ ^{15}N_i + b_2 RM}$$

Baseline

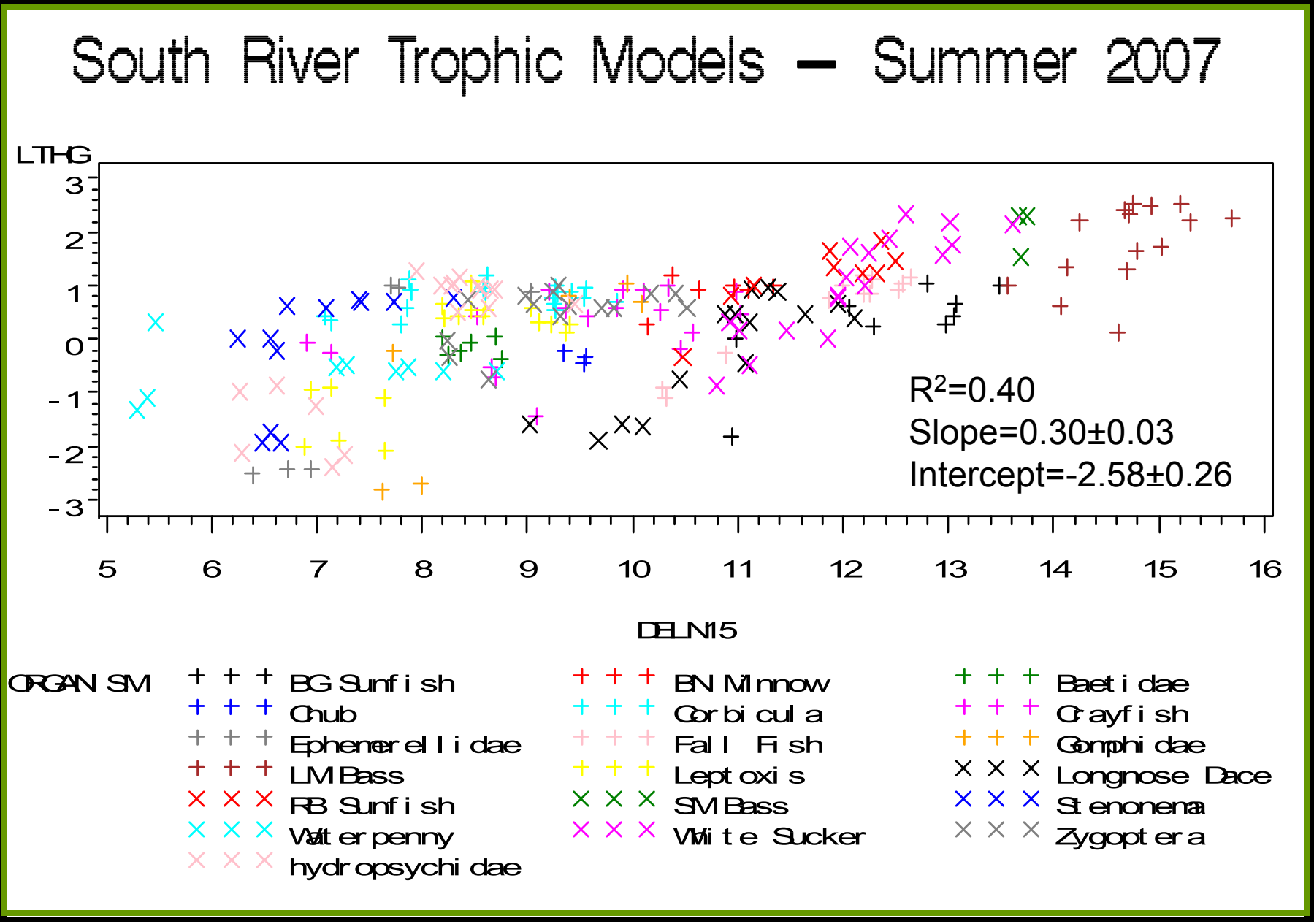
Biomagnification

Distance

Biomagnification Models

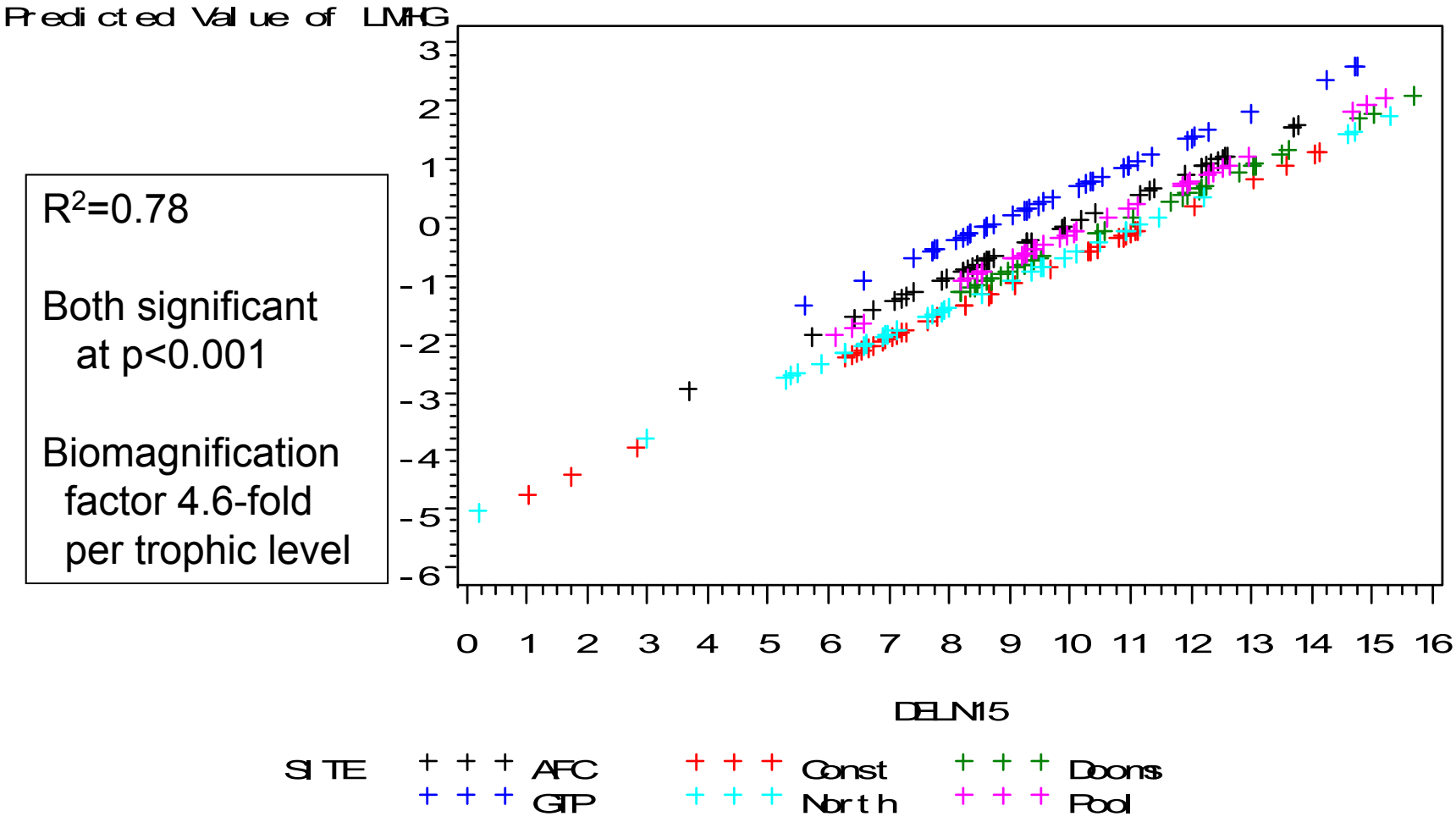


Total Mercury Model



Methylmercury Models

South River Trophic Models – Summer 2007

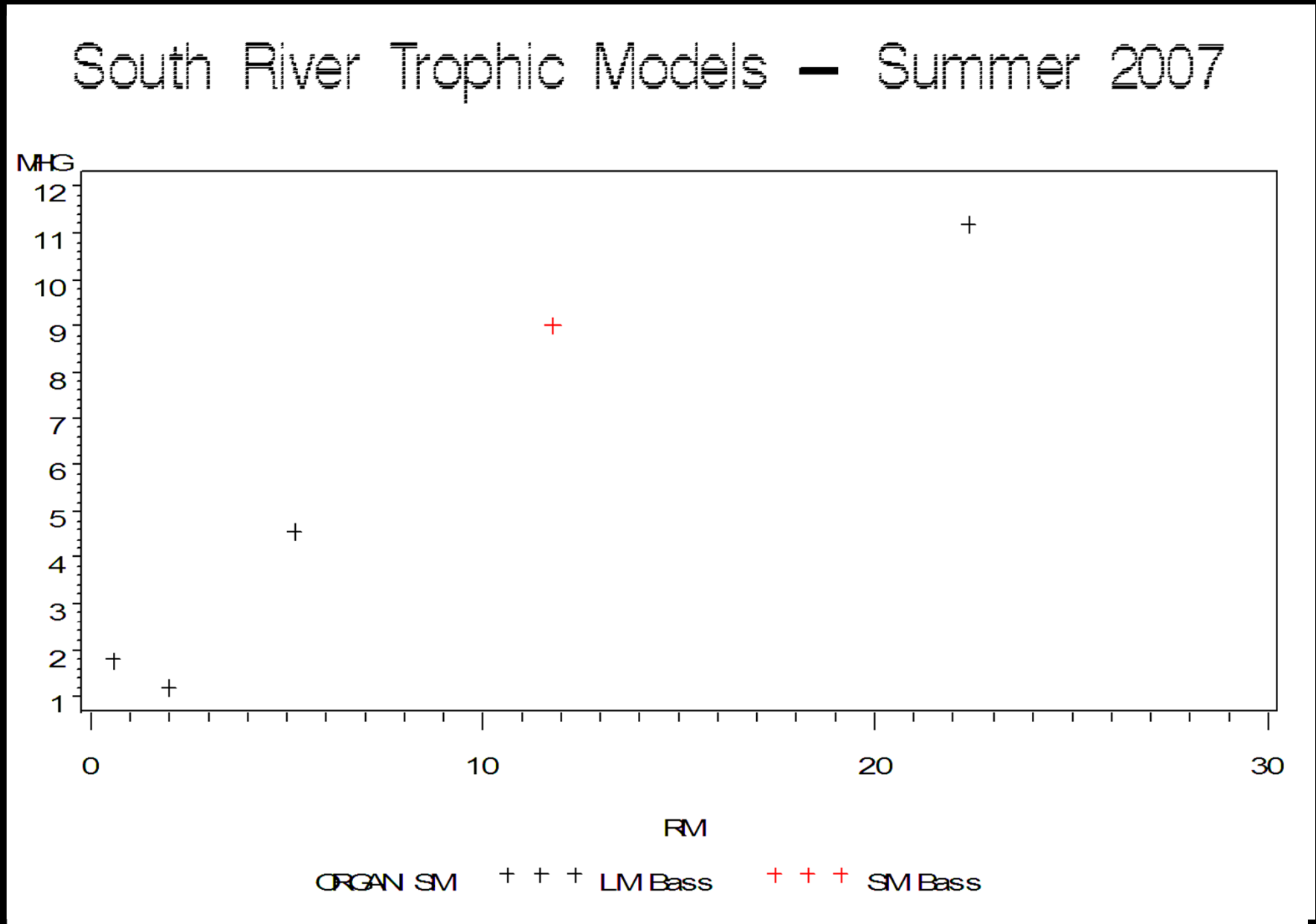


R^2=0.78

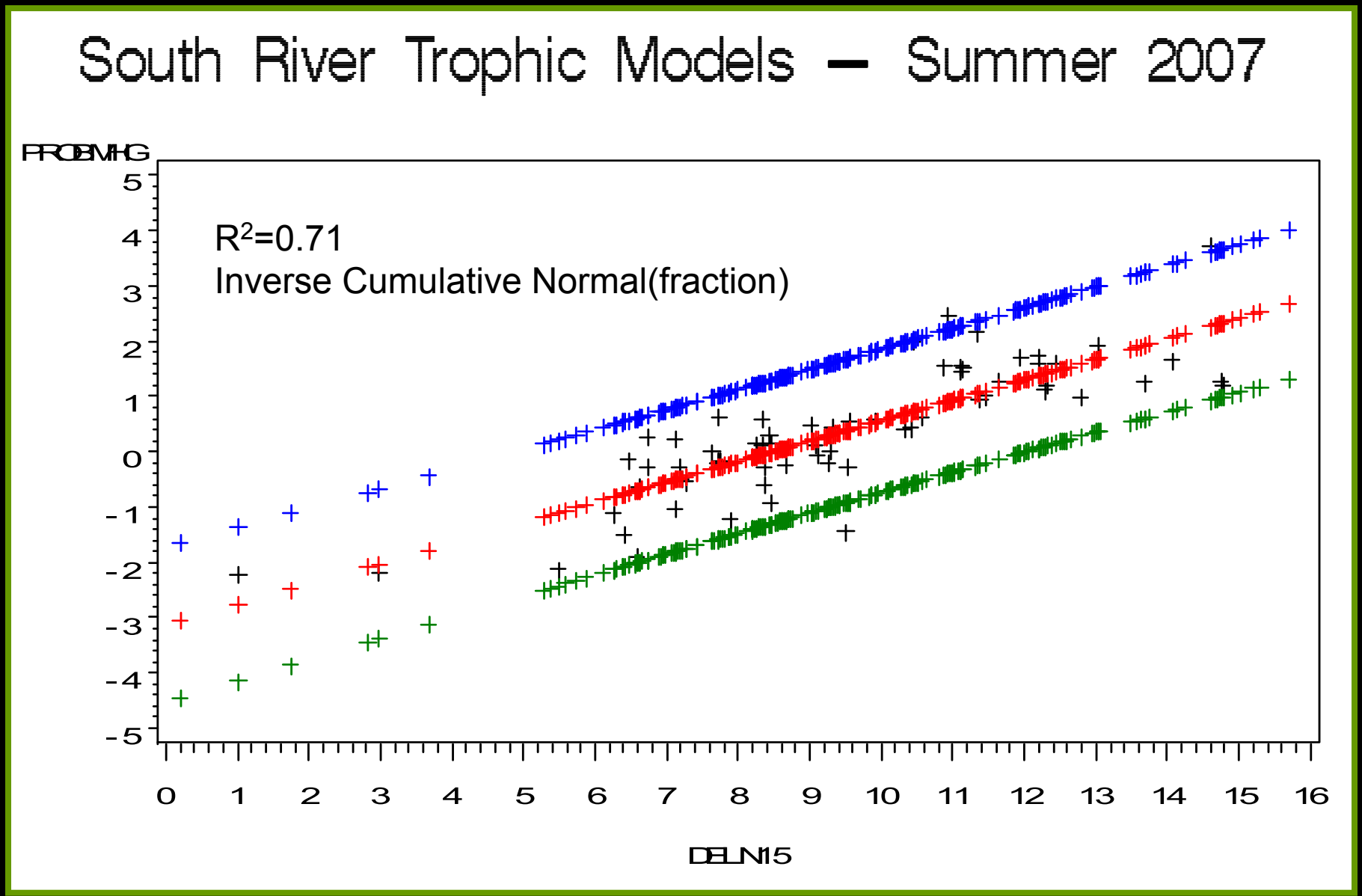
Both significant at p<0.001

Biomagnification factor 4.6-fold per trophic level

Large Mouth Bass



Fraction MethylHg Model



Model Summary

1. Currently, total mercury models not possible.
   Procedurally-defined periphyton will likely improve.
2. Methylmercury models viable for prediction.
   4.6-fold increase per trophic level increase.
   Intercept increases with distance downriver.
3. Fraction methylmercury predictive models viable.
4. Inorganic mercury is trophically diluted.

Conclusion

1. Single reach model for management predictions.
    > Methylmercury
    > Fraction as methylmercury
    > Probably total mercury soon
2. Are important “outlier” biota to keep in mind.
3. More methylmercury enters food web with distance downriver. Reason for “Hump”?
4. Essentially all methylmercury at 2^0 consumer and higher.
5. Inorganic mercury is trophically diluted.