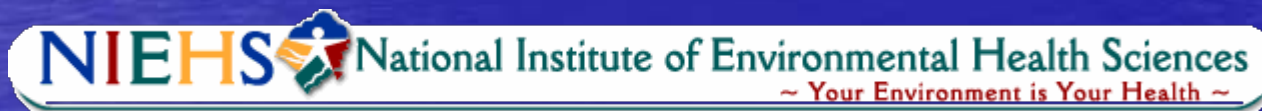
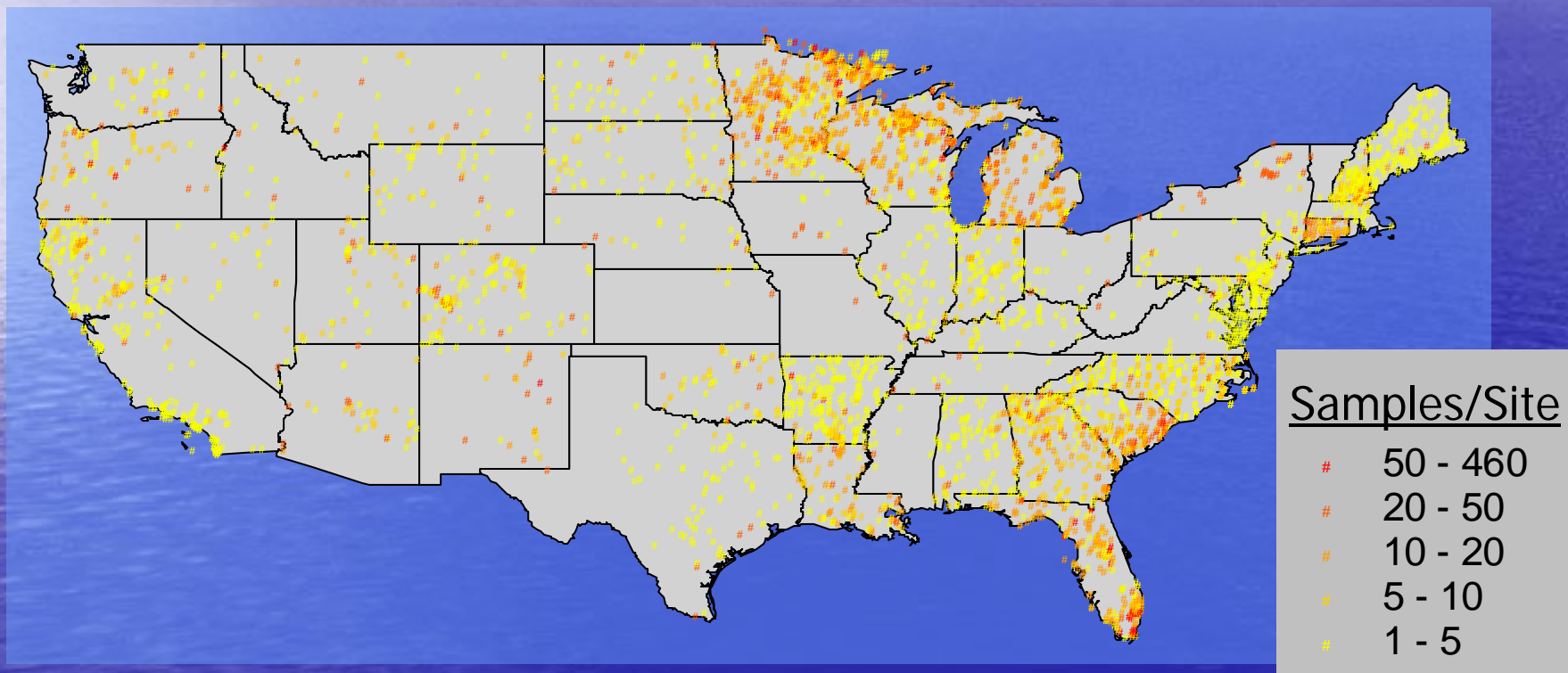


# EMMMA: a web-based system for Environmental Mercury Mapping, Modeling, and Analysis

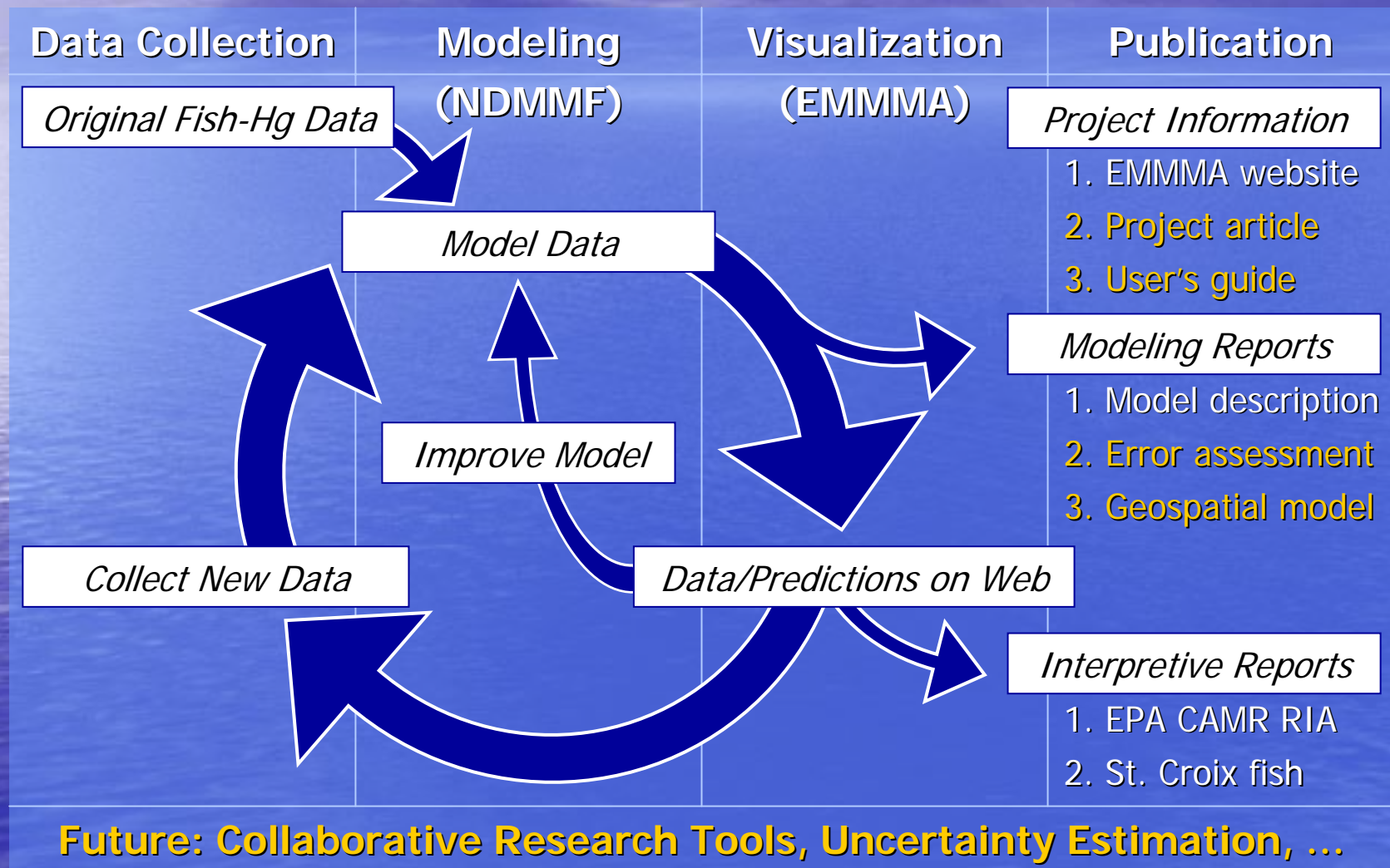
Steve Wente, Paul Hearn, David  
Donato, and John Aguinaldo



# Samples in Fish-Hg Compilation



# NDMMF<sup>1</sup> / EMMMA<sup>2</sup> Progress & Plans





# National Descriptive Model of Mercury in Fish (NDMMF)

(<http://pubs.usgs.gov/sir/2004/5199/pdf/2004-5199.pdf>)

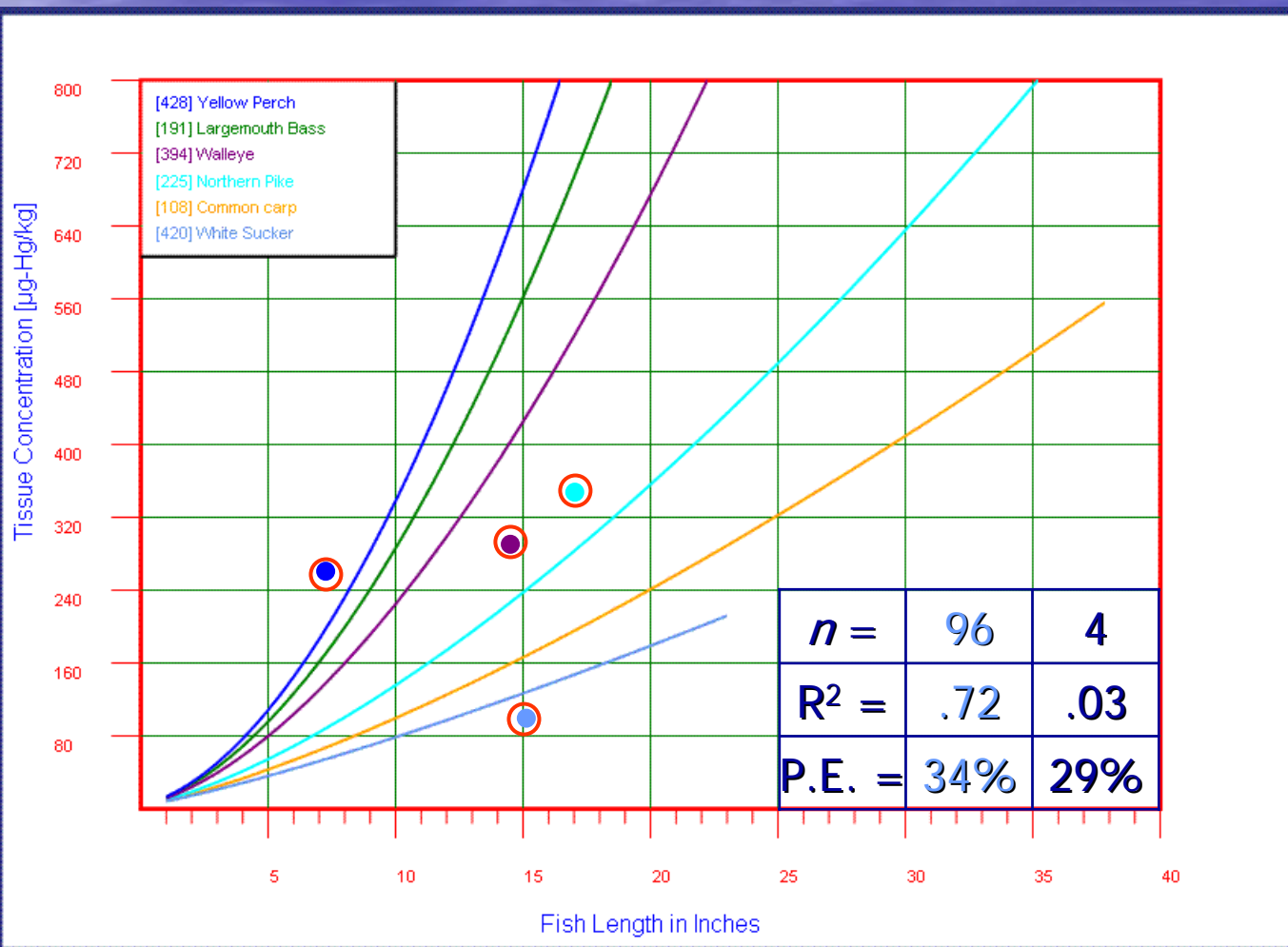
- Statistical model (analysis of covariance)
- Objectively partitions Hg variation between:
  - Sample characteristics (species, tissues sampled, & fish length); and
  - Spatiotemporal variation – differences among sampling events (specific site & time)
- Calibrated to national dataset ( $n > 58,000$ )

# NDMMF Accuracy – St. Croix Study

(<http://pubs.usgs.gov/sir/2006/5063/pdf/2006-5063.pdf>)

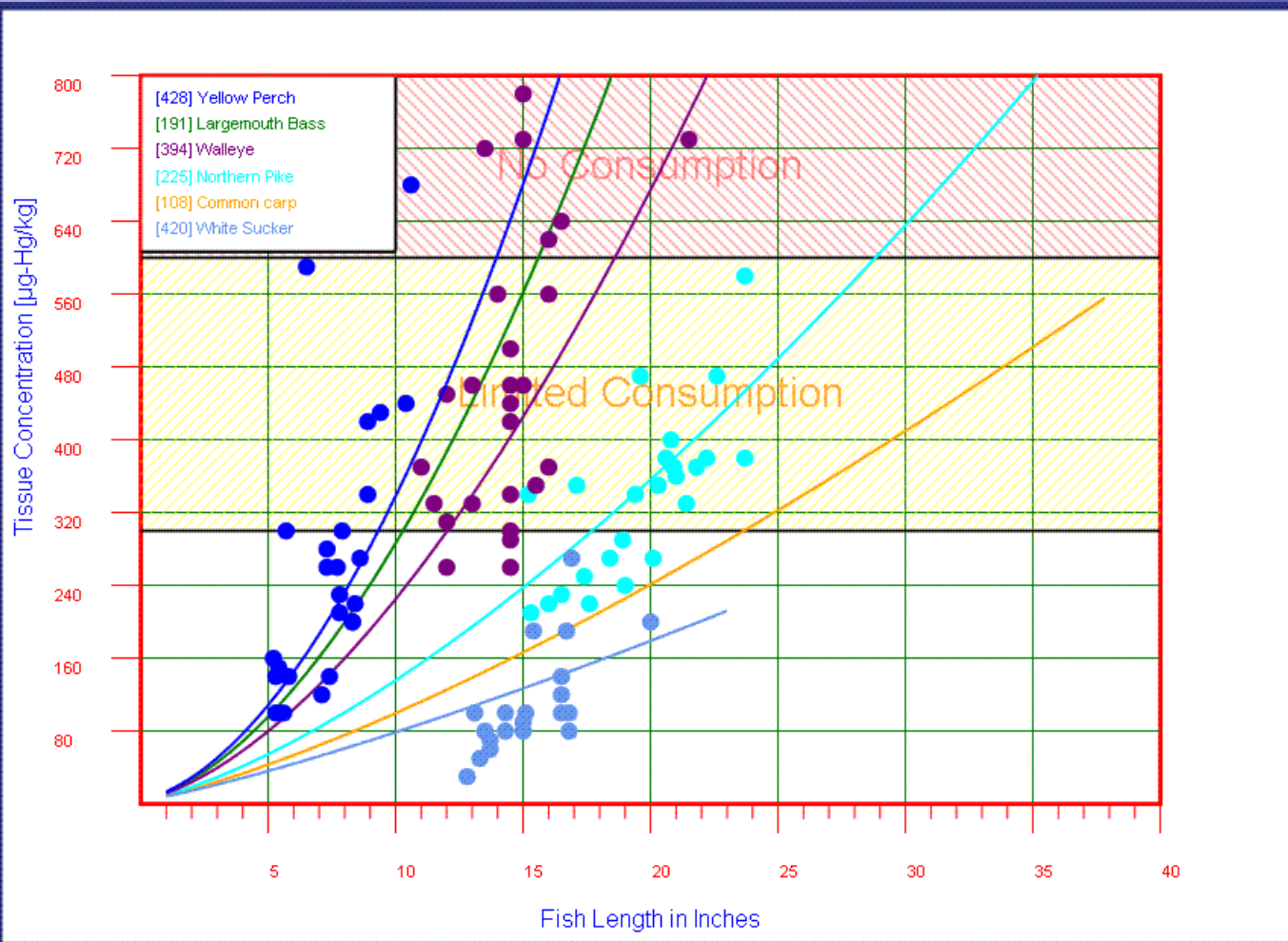
Site # ( <i>n</i> )	Range (µg/kg)	R <sup>2</sup>	Prediction Error
1 (14)	22 – 403	0.94	22.5
2 (14)	27 – 224	.78	21.5
3 (14)	23 – 830	.78	41.7
4 (14)	19 – 299	.94	20.1
5 (11)	13 – 299	.85	35.6
6 (14)	12 – 414	.88	33.0
7 (14)	24 – 209	.70	39.7
8 (14)	21 – 269	.75	34.2
9 (14)	22 – 414	.91	28.2
10 (14)	21 – 611	.96	35.2
11 (14)	22 – 506	.89	34.7
12 (14)	8.2 – 243	.96	25.2
13 (14)	7.3 – 95	.94	36.1
14 (14)	7.8 – 374	.95	26.7
Overall	7.3 – 830	.89	31.6

# NDMMF Accuracy Issue

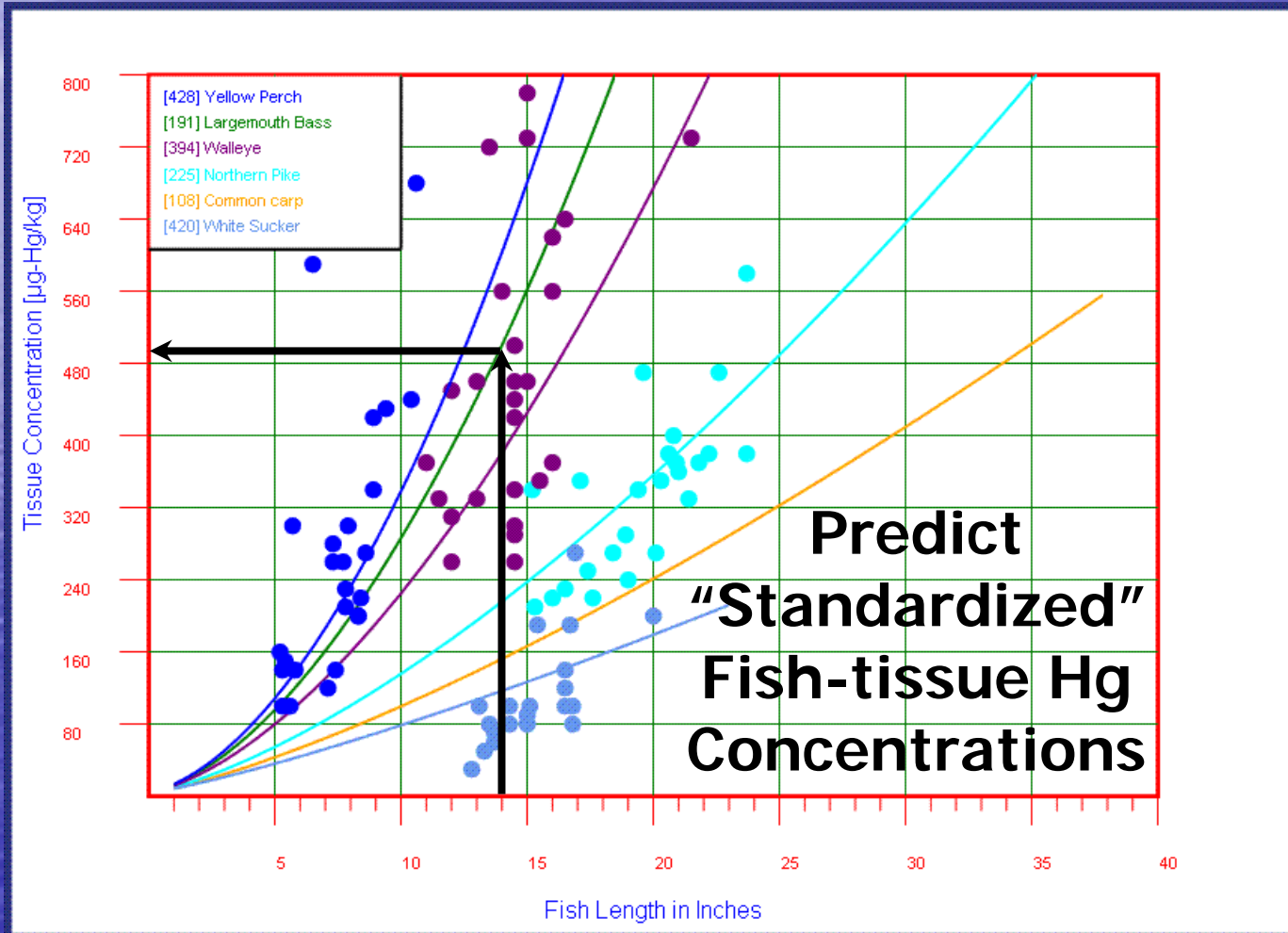




# Applications: Comprehensive Fish Advisories

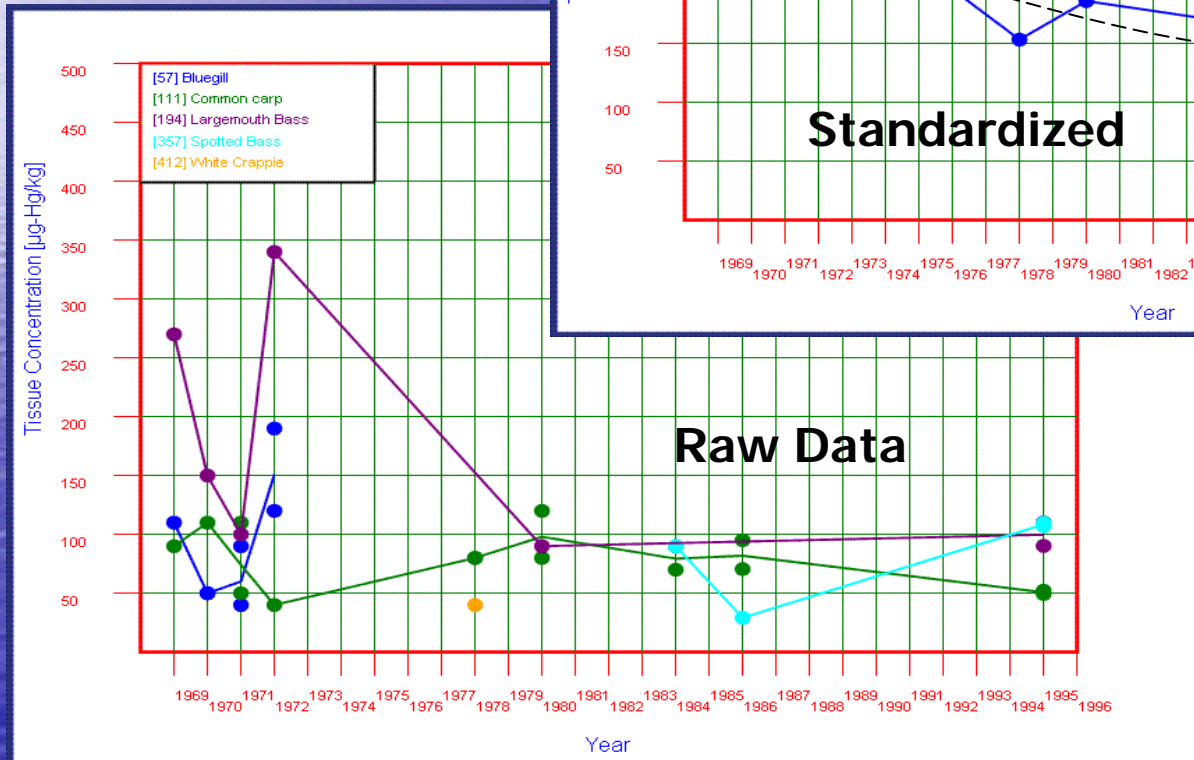
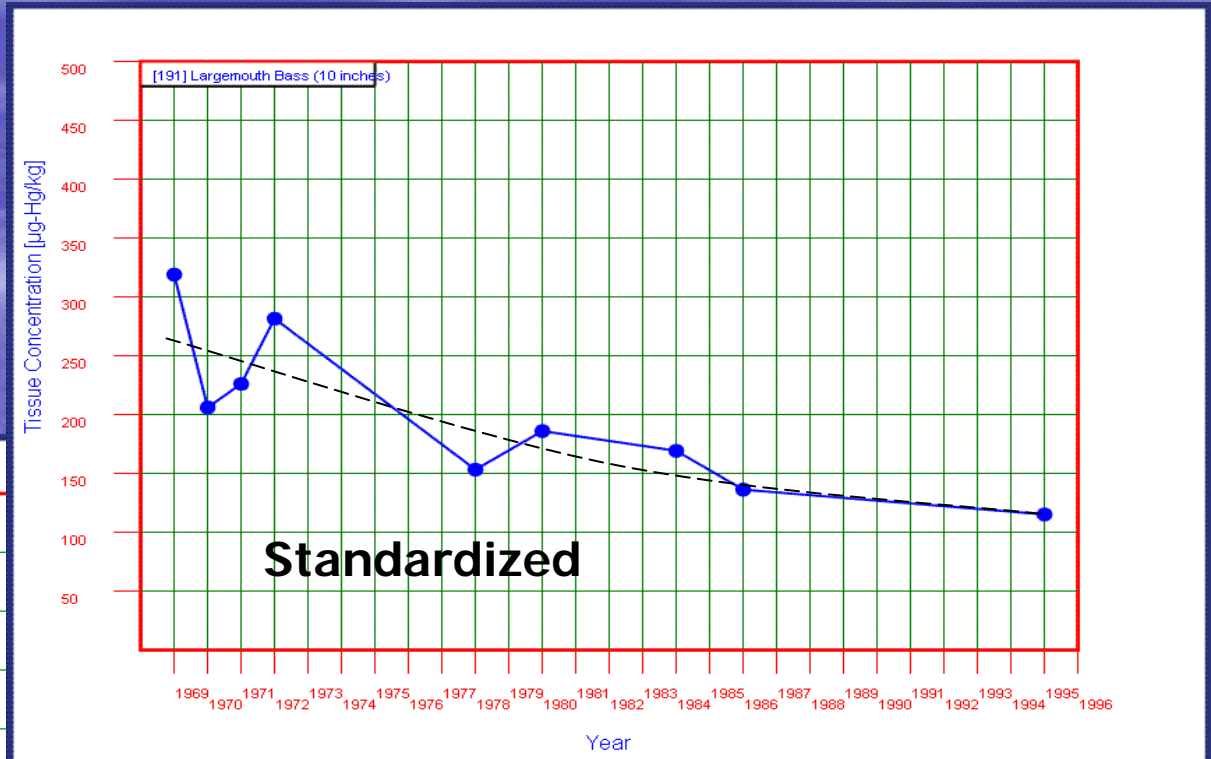


# Applications: Assessing Spatiotemporal Variation

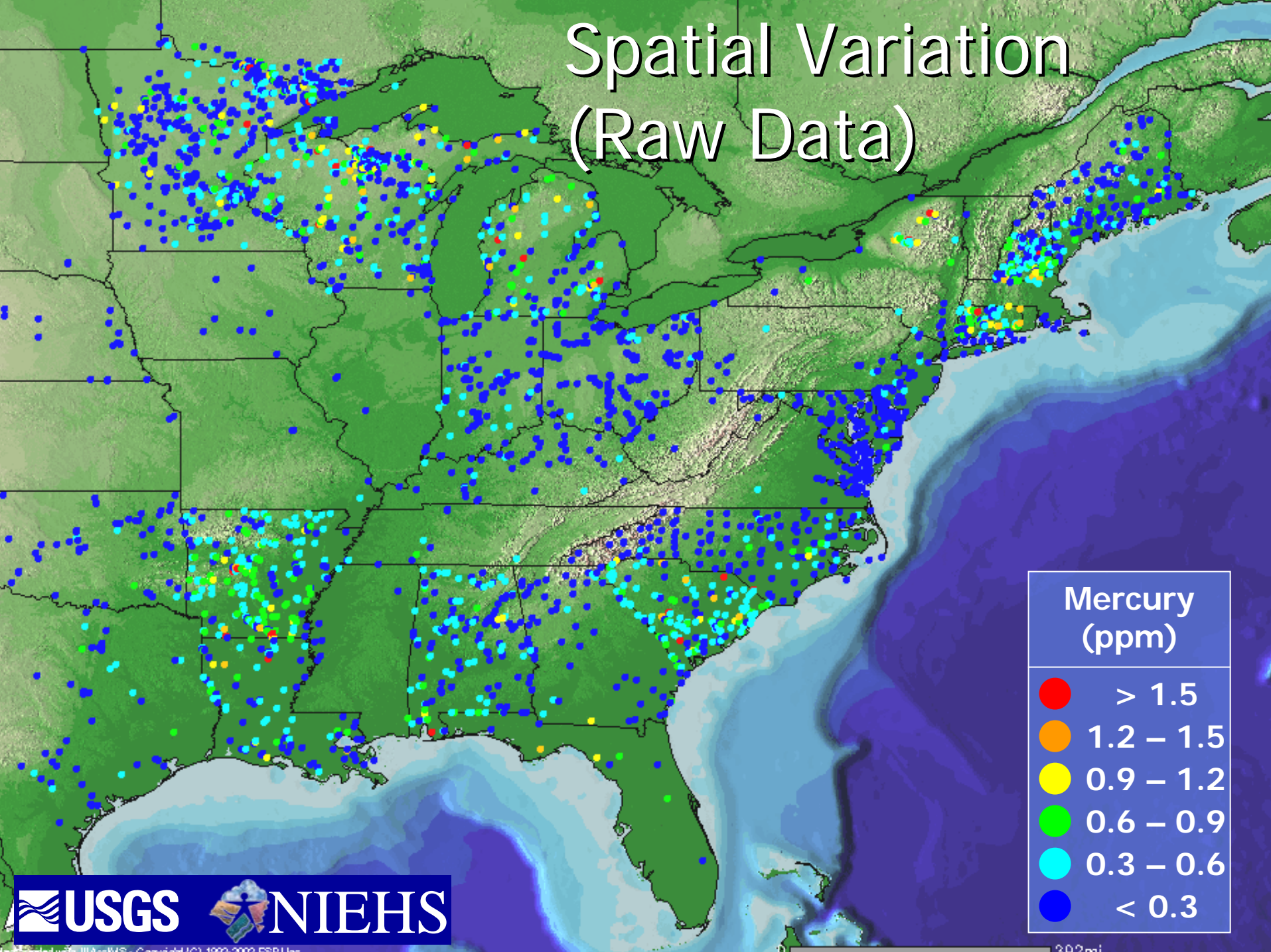




# Temporal Trends



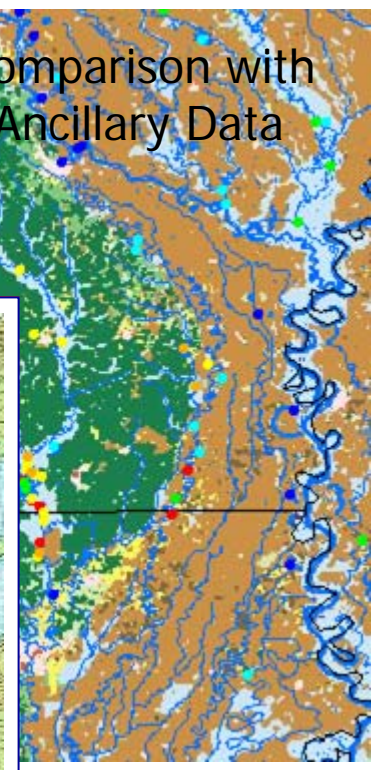
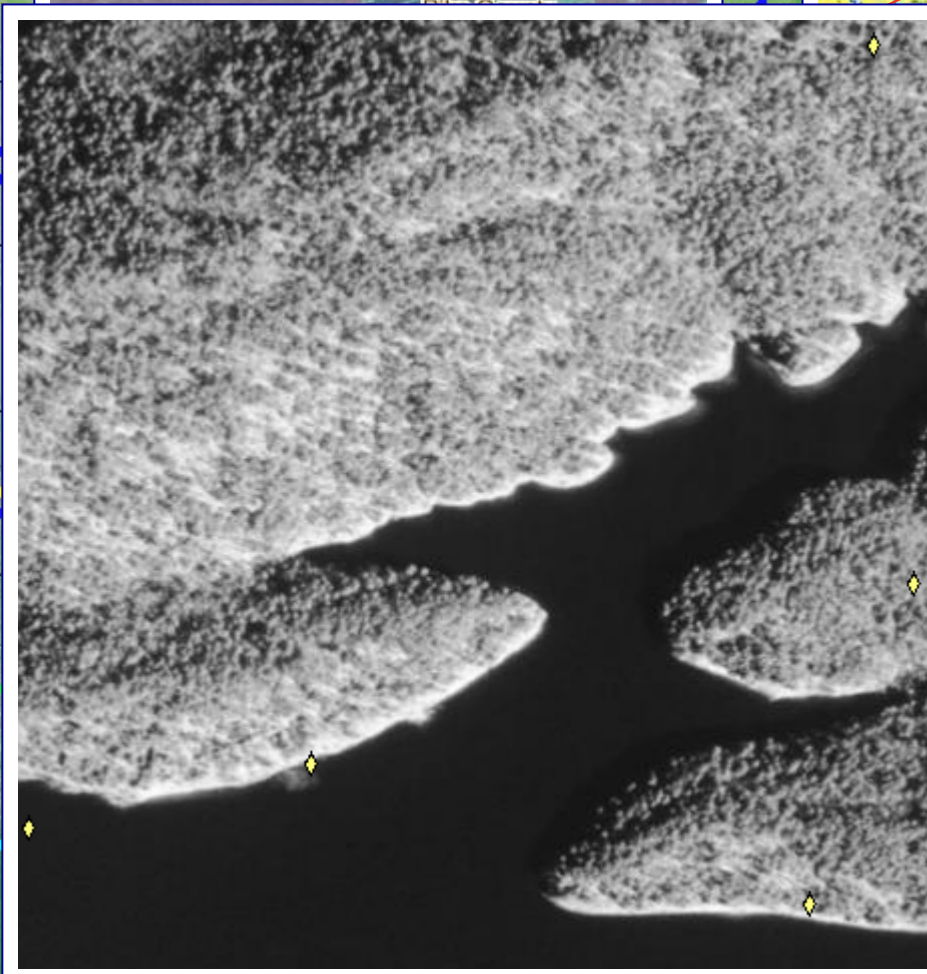
# Spatial Variation (Raw Data)





# Spatial Variation

Comparison with  
Ancillary Data



Mercury  
(ppm)





# Value of EMMMA

- Planning of monitoring projects
- Visualizing fish-mercury variation
  - Across sample characteristics (assess model fit, fish consumption advisories)
  - Spatiotemporal variation (maps & time trends)
- 'Eternal' QA/QC & peer-review
  - Easy access to & comparison of data & models
  - Rapid improvement in 'mercury science'

# Questions?

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Paul Hearn [phearn@usgs.gov](mailto:phearn@usgs.gov)

EMMMA <http://emmma.usgs.gov>

