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National Descriptive Model of Mercury in Fish Tissue

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NIEHS National Institute of Environmental Health Sciences
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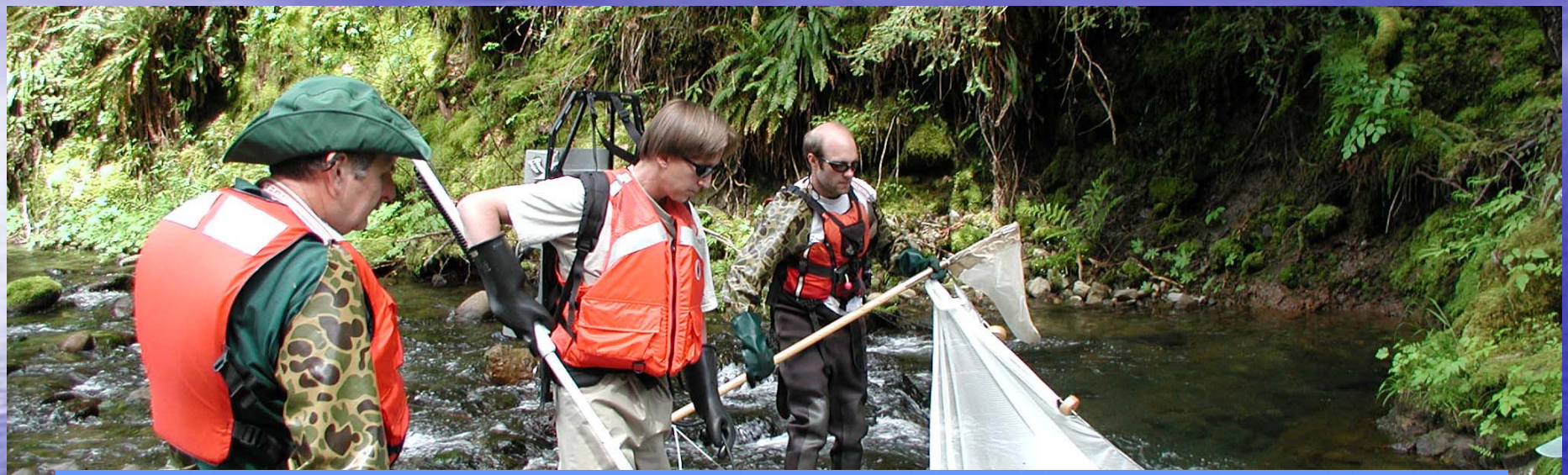
Sampling for Mercury in Fish



- Spatial variation
- Temporal variation
- Fish consumption advisories

Problem 1: Cost of Information

Species	Size Class 1	Size Class 2	Size Class 3
A	?	Sampled	Sampled
B	?	Sampled	?
C	Sampled	?	?
D	?	?	Sampled
E	?	?	?

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Problem 2: Difficult Comparisons

	Sampling Events						
Species	1	2	3	4	5	6	7
A	X	X		X			X
B		X	X		X		X
C	X		X	X		X	
D		X		X		X	
E	X		X			X	

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Possible Sample Designs

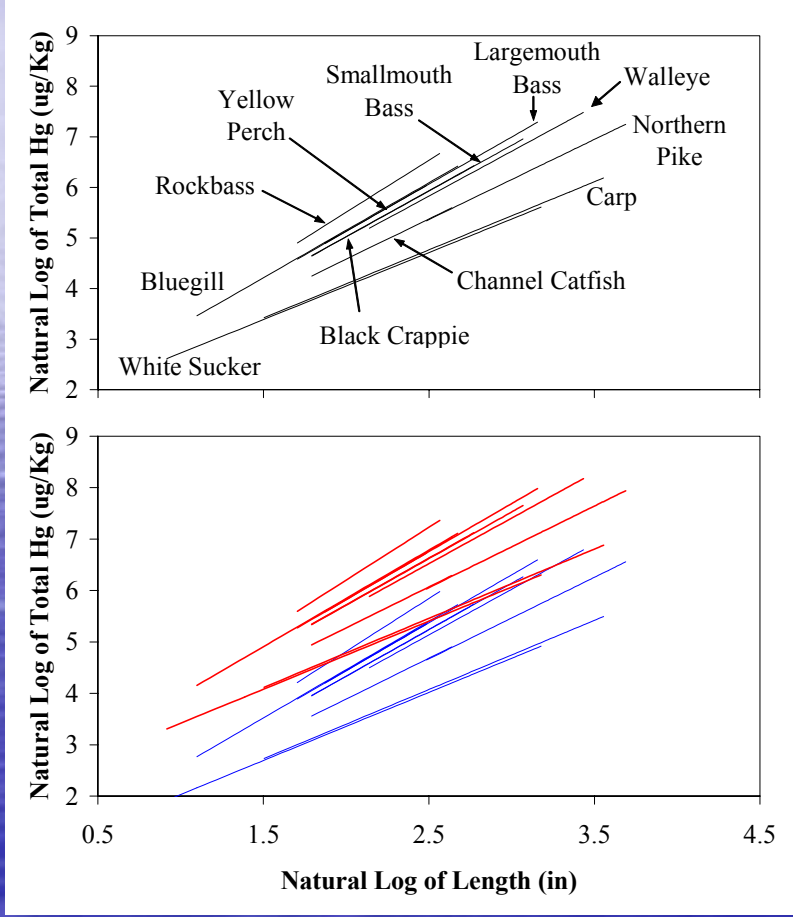
- Collect fish samples with consistent characteristics
  - Species confined to definite ranges
  - Cannot compare to existing data
- Use existing data
  - Must use model to make samples comparable
  - Variations in quality of existing studies

Fish Hg Model Details

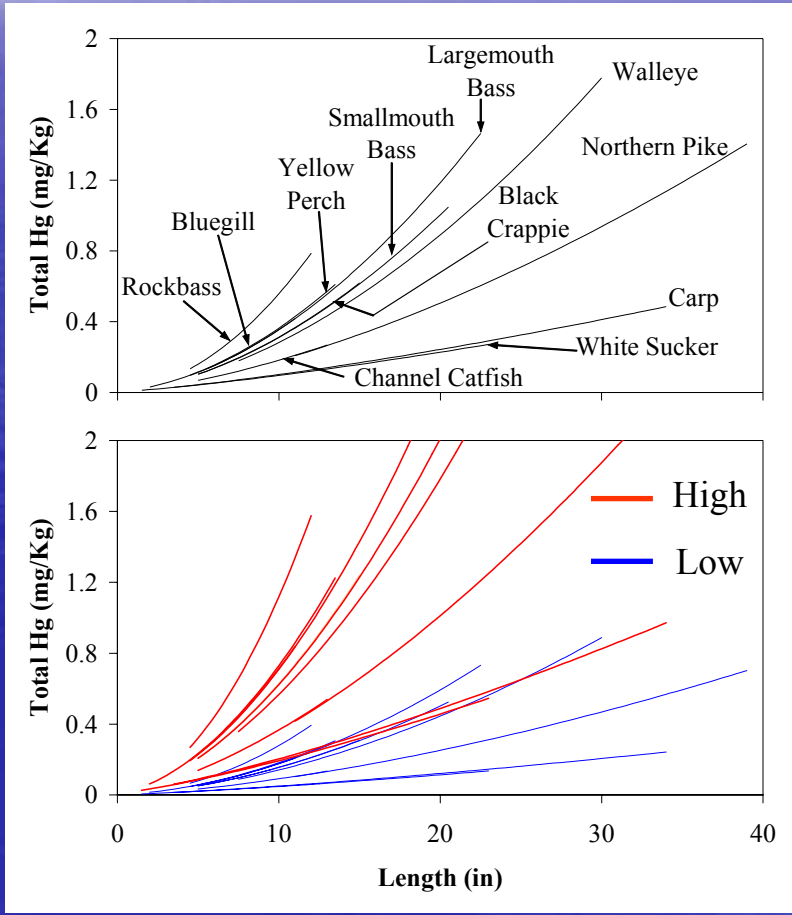
- Regression method (Covariance model)
- Accounts for:
  - Less than detection limit values
  - Species (Hg increases with trophic position)
  - Tissues sampled (skin-off fillet > skin-on > whole fish)
  - Fish length (larger fish are higher in Hg)
- Calibrated to national dataset (45,605)

Simple yet Realistic Description

Log-log Space



Arithmetic Space



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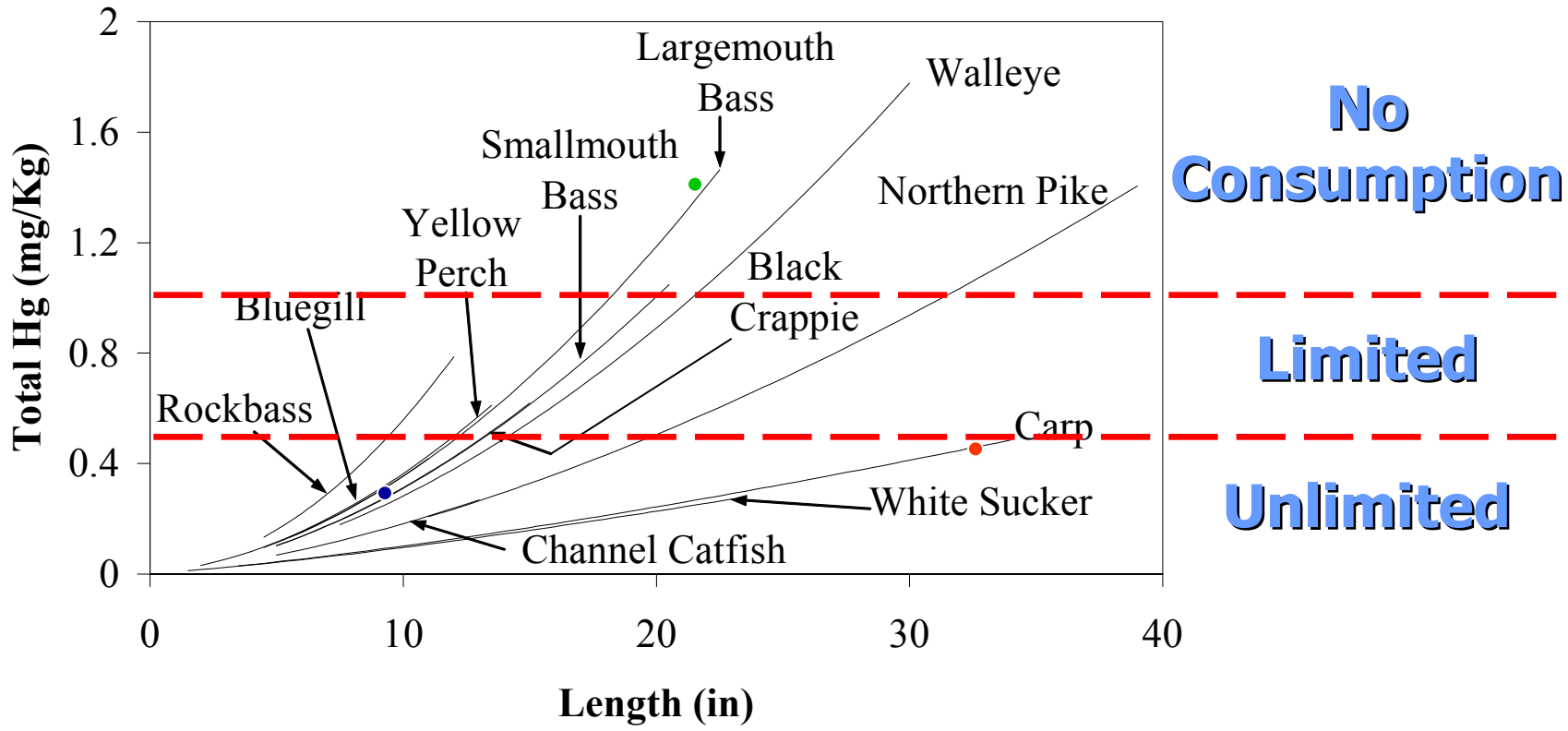
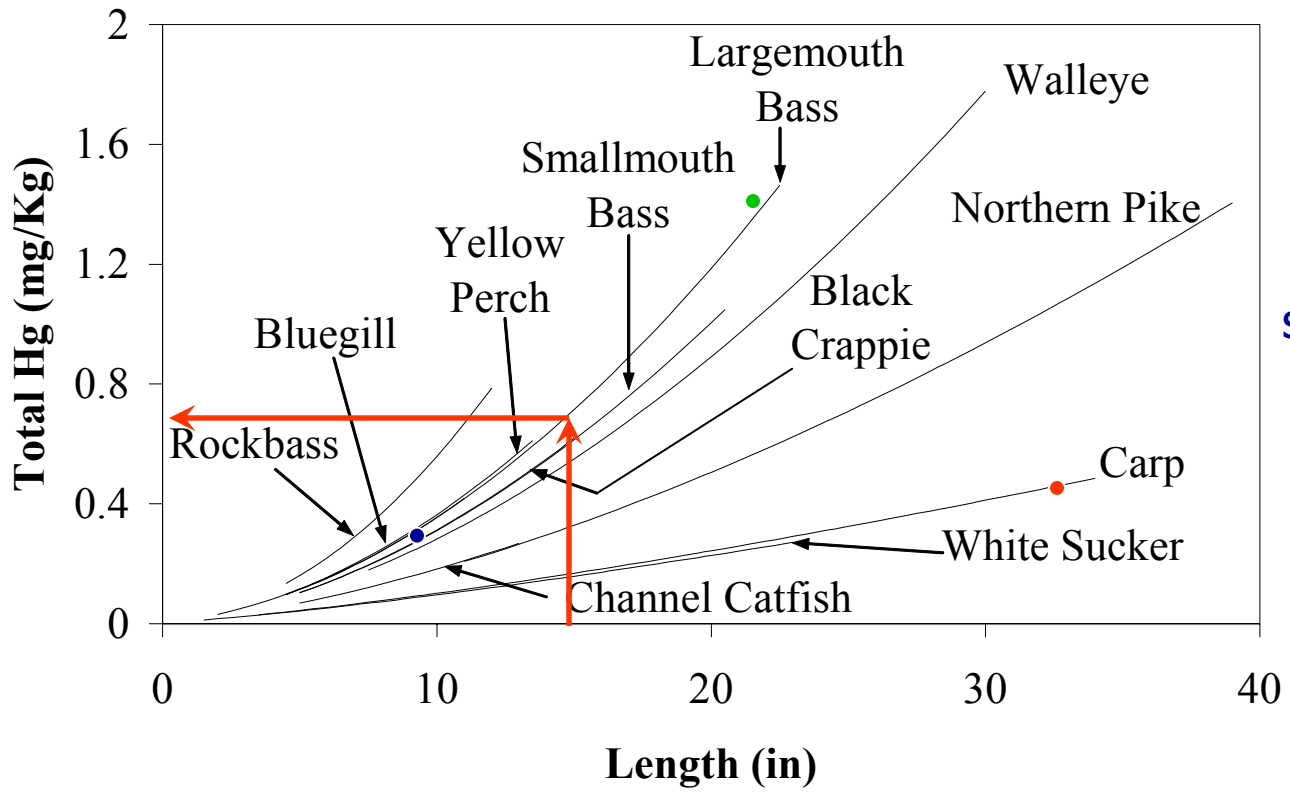
Consumption Advisory

Species	Size Class 1	Size Class 2	Size Class 3
A	?	?	?
B	?	Sampled	?
C	Sampled	?	?
D	?	?	Sampled
E	?	?	?



Standardize Sample Type

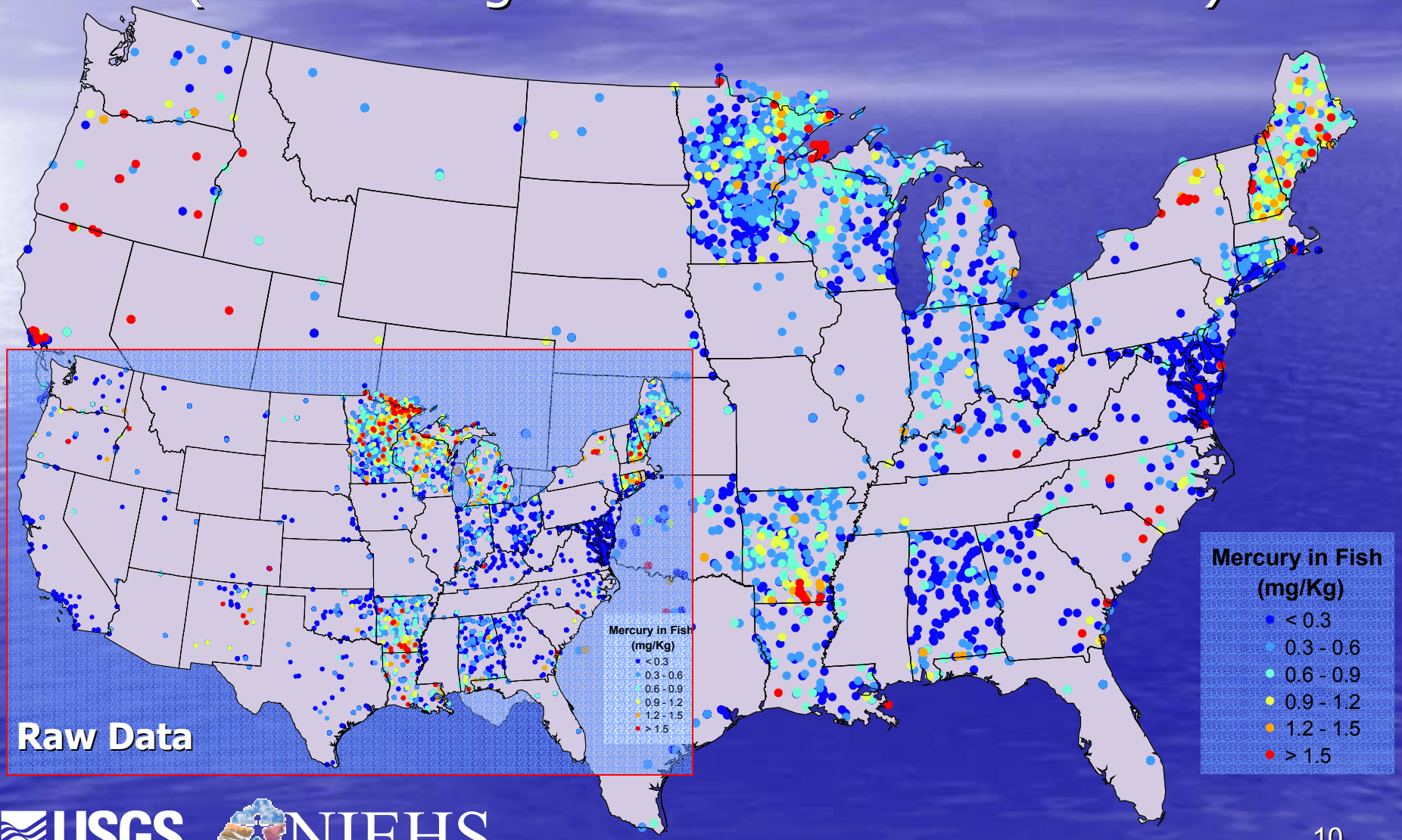
	Sampling Events						
Species	1	2	3	4	5	6	7
A		X		X			X
B	X	X	X		X		X
C	X		X	X		X	
D	X	X		X		X	



Estimate concentration of a standard sample type (e.g. 14 inch skin-off largemouth bass fillets) for all sampling events (specific site and time)

Modeled 'Spatial' Variation

(14 inch Largemouth Bass Skin-off Fillets)



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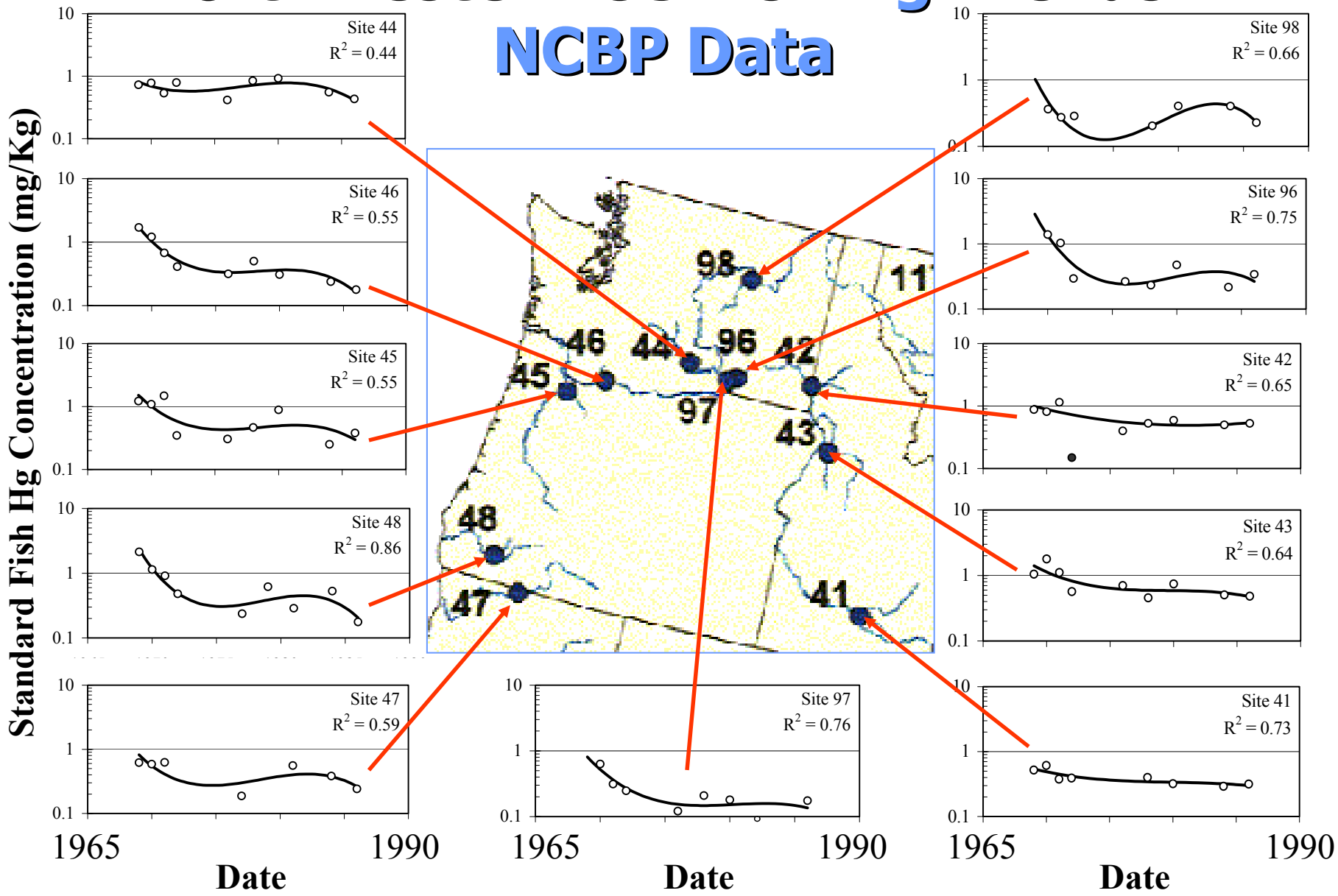
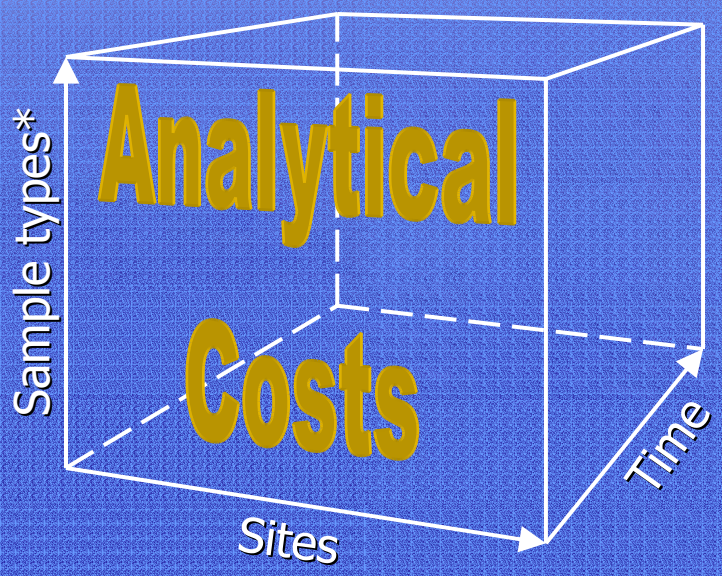
Northwestern US Fish Hg Trends: NCBP Data



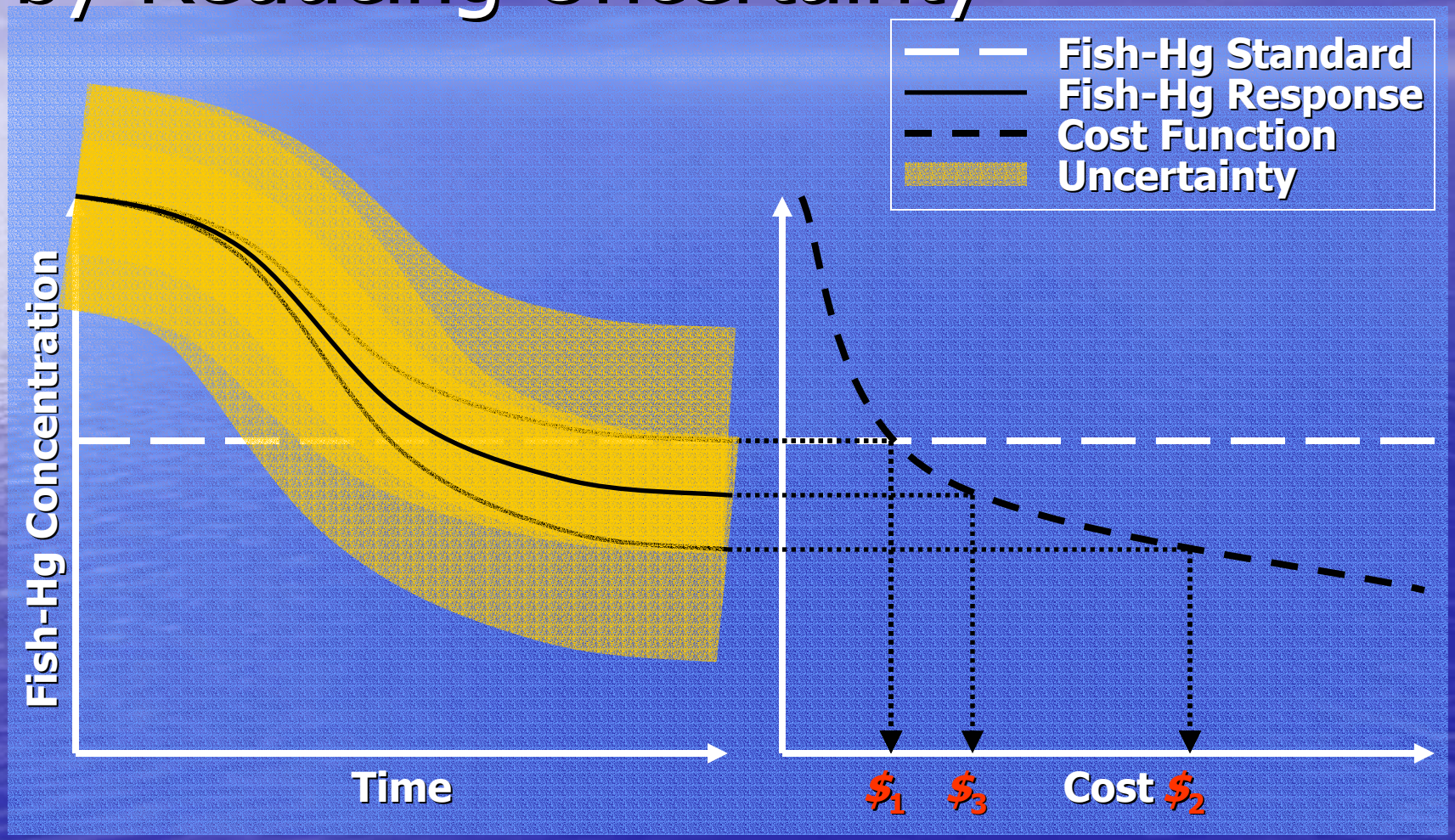
Analytical Cost Reduction

Species	5
Size classes	3
Sites	50
Years	5
Replicates	4
Cost/Sample	$100
Size classes	$1,500,000
Covariance	$100,000



*Sample types is number of species × size classes × tissue types

Model Reduces Compliance Costs by Reducing Uncertainty



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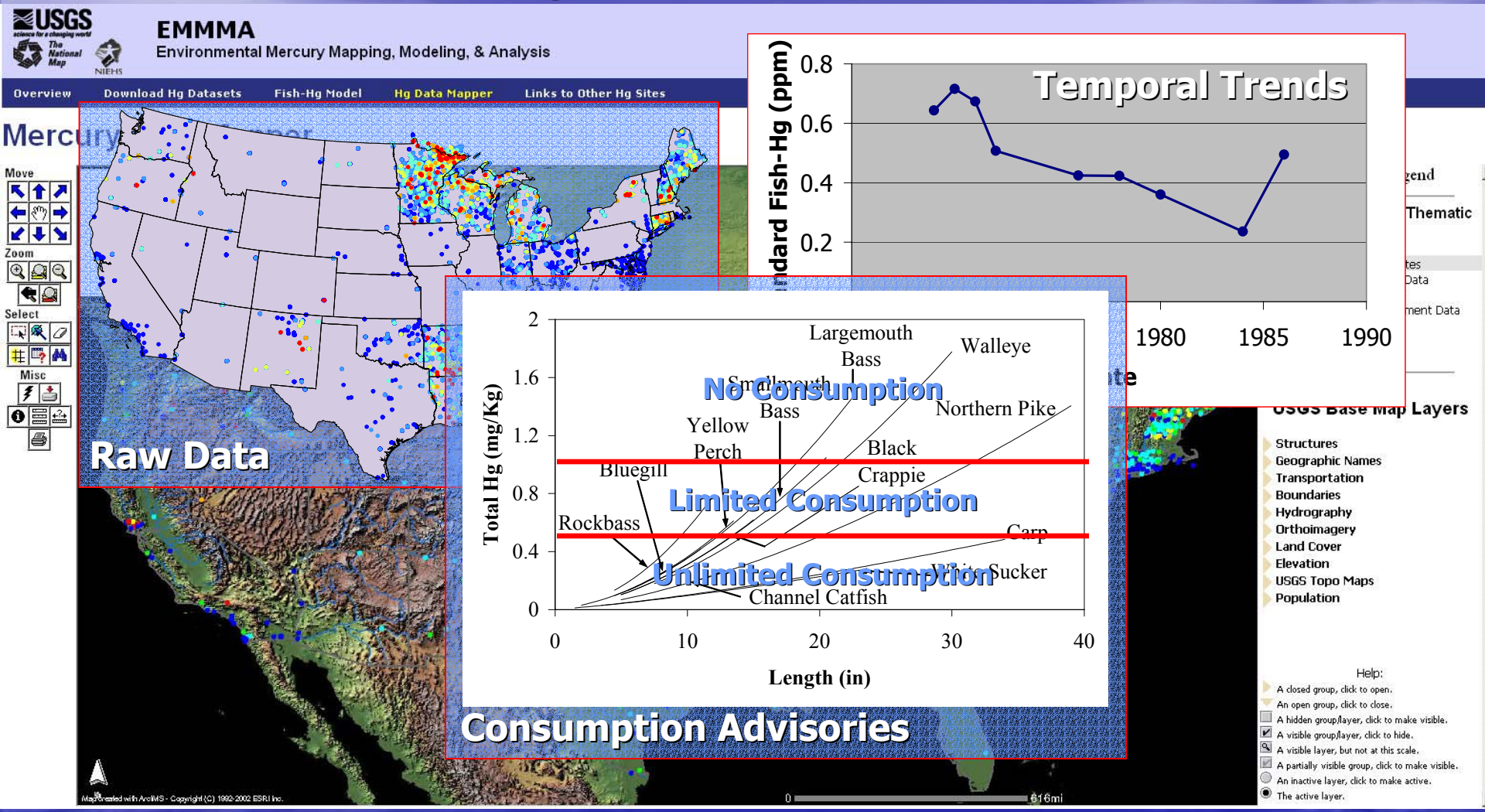
Project Website



"Continuously updated" data & analysis

Benefits of National Model

- More comprehensive fish consumption advisories
- Better description of spatial and temporal trends
- Reduced analytical and compliance costs

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