

Deriving Sediment PRGs from  
PCB Congener-Specific Risk  
Assessment—How to Function in  
an Embarrassment of Riches

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# PCB Congener-Specific Aquatic ERA Methods

- Measured congener conc in sediment & fish
- Modeled dose to piscivorous receptors
- Protective fish conc for specific congener
$$\text{TRV}_{\text{TEQ}} * (\text{TEQ}_{\text{congener}} / \text{TEQ}_{\text{total}}) / \text{TEF}_{\text{congener}}$$
- Congener-specific sediment PRG  
BSAF based on Gobas model calibrated with site-specific data

# Sediment Congener PRGs (ppb)

River Reach	77	105	118	126
2	0.64	4.51	10.19	0.0175
3	0.39	4.73	13.40	0.0189
5	0.33	4.96	14.36	0.0149

# PRG Conversion

- Convert congener PRGs to total PCB PRGs based on the site-specific sediment composition

$$\text{PRG}_{\text{congener}} / (\text{Sed Conc}_{\text{congener}} / \text{Sed Conc}_{\text{PCB}})$$

- Used site-specific regression congener sediment conc vs PCB conc

# Congener-specific Total-PCB PRGs (ppm)

River Reach	77	105	118	126
2	0.32	0.94	0.76	0.50
3	0.25	0.95	0.86	0.52
5	0.23	0.97	0.88	0.47

# Range of Total-PCB PRGs

- 2- to 4-fold range in LOAEL-based PRGs for a single receptor
- 4- to 15-fold range in NOAEL-based PRGs
- 7- to 30-fold range overall  
(NOAEL to LOAEL)

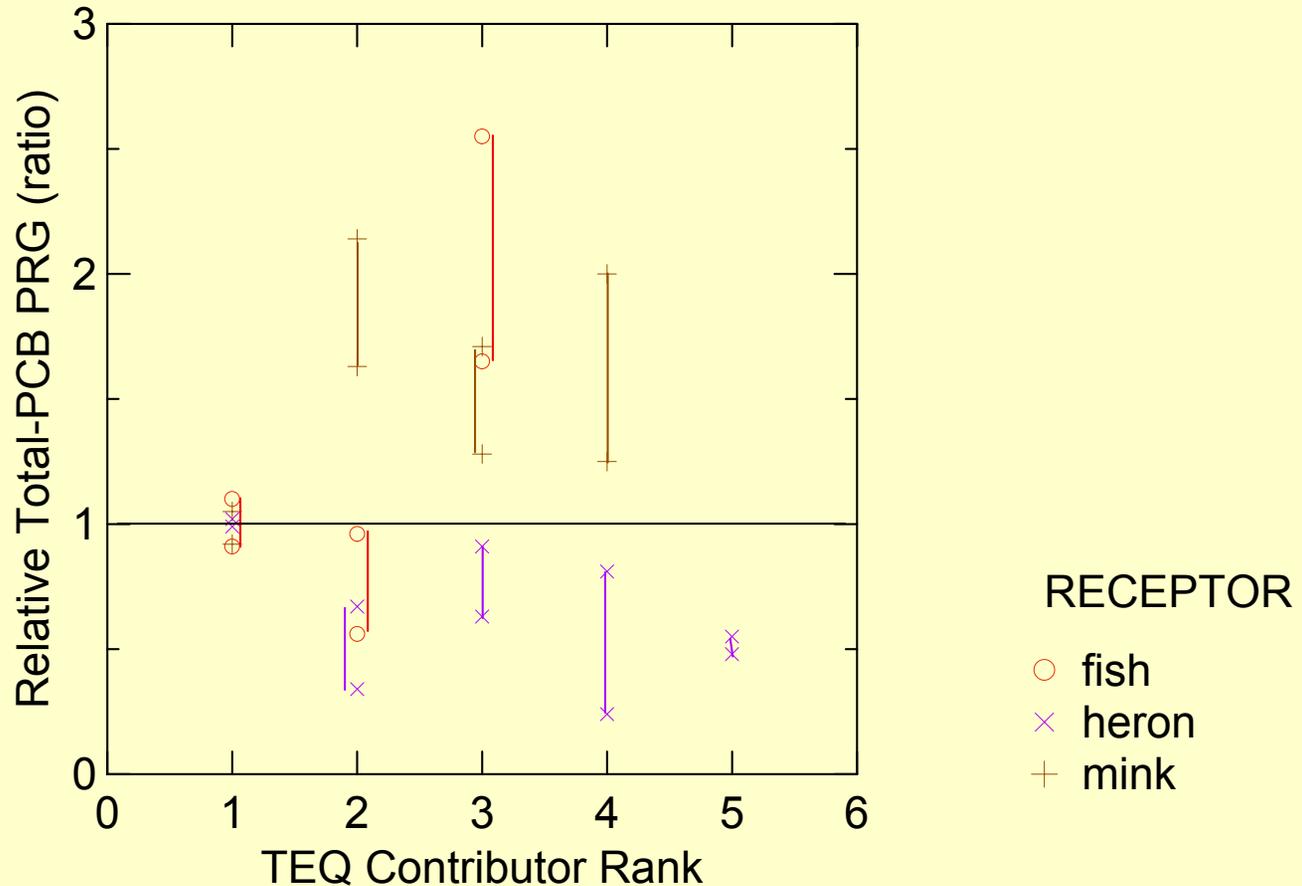
# Options

- Use PRGs derived from all congeners (mean, LCL or UCL, or high or low range)
- Use the PRG derived solely from the congener that is the largest contributor to the TEQ
- Combine in some manner the PRGs from the few largest contributors to the TEQ

# Risk Management Decision

- Protect the most sensitive receptor at the upper end of its PRG range

# Congener-specific total-PCB PRGs Normalized to 1<sup>st</sup> Contributor to TEQ



## Variability in PRG Estimates by Rank Contribution to TEQ

TEQ Rank	Coefficient of Variation (CV) Range	N
1st	0.02 – 0.10	3
2nd	0.07 – 0.35	3
3rd	0.13 – 0.25	3
4th	0.17 – 0.73	3
5th	0.05	3
All	0.24 – 0.53	9 – 15

## Congener Rank Order and Percent Contribution to TEQ

Receptor	1 <sup>st</sup> Contributor		2 <sup>nd</sup> Contributor		3 <sup>rd</sup> Contributor	
	Congener	% TEQ	Congener	% TEQ	Congener	% TEQ
fish	126 or 77	40 – 42	77 or 126	28 – 38	118	13 – 23
heron	105	28 – 31	66 or 77	23 – 26	118 or 66	17 – 22
mink	126	34 – 44	118	25 – 33	156 or 105	11 – 13
	4 <sup>th</sup> Contributor		5 <sup>th</sup> Contributor			
heron	77 or 118	12 – 14	126	6 – 7		
mink	105 or 156	10 – 11				

# Apparent Inference

- Variance of PRG estimates derived from specific congeners is proportional to the rank contribution of the congeners to the total TEQ

# But

- Apparent relation between rank TEQ contribution and PRG variance did not occur in a second ERA
- Terrestrial ERA
  - Measured soil and earthworm congener conc
  - Modeled exposure to robin eggs
    - 2 different bioaccumulation models

# Terrestrial ERA

- Risk characterized on
  - TEQ basis (4 congeners)
  - HI basis (sum of HQs of 3 congeners)
  - Closely similar risk estimates
- Calculated PRGs from HI approach
  - Site-wide average soil-earthworm BAFs and soil congener-PCB ratios

# Relative Total PCB PRGs

HI Rank	Model 1		Model 2	
	HI Fraction	Relative PRG	HI Fraction	Relative PRG
1 <sup>st</sup>	0.73	1	0.95	1
2 <sup>nd</sup>	0.20	1.2	0.04	1.2
3 <sup>rd</sup>	0.06	1.2	0.01	1.3

# Disaggregated Model 1

- Risk characterized separately for each sample location (8)
- PRGs calculated on basis of sample-specific soil-earthworm BAFs and soil congener-PCB ratios
- CVs are virtually identical regardless of HI rank

# Comparison between Examples

- Different procedures for
  - BAFs (calibrated model vs point estimate)
  - Media congener-PCB ratios (regression vs point estimate)
  - Aquatic ERA also involved some extrapolation of fish data between age classes (not necessary for earthworms)

# Variability in PRGs

- Not inherent in TEQ approach
  - Any TEQ contributor will generate identical PRGs if the input data do not vary
- Difference in PRGs based on different congeners in the aquatic ERA stem from variability/uncertainty in modeling BAFs, sediment congener/PCB ratios, and data extrapolations

# Variability in PRGs

- Do not seem to be simple generally applicable rules for prioritizing PRG estimates according to rank contribution of congeners to the total TEQ
- May be a leverage effect for low rank congeners that amplifies existing variability/uncertainty through the PRG calculation