Methylmercury Risk Analysis at Muskrat Falls

Alternative model inputs and remediation scenarios

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Independent Expert Advisory Committee, Newfoundland and Labrador

Agenda

- Alternative model inputs
  - Updated fish/seal data
  - Alternative habitat fractions
- Approach to modeling effects of capping wetlands (Scenario “A”)
- Effect of soil removal (Scenario “B”)
- Exposure forecasts for both scenarios and baseline assumptions
- Documents submitted by Nalcor
- Q&A about submissions to date

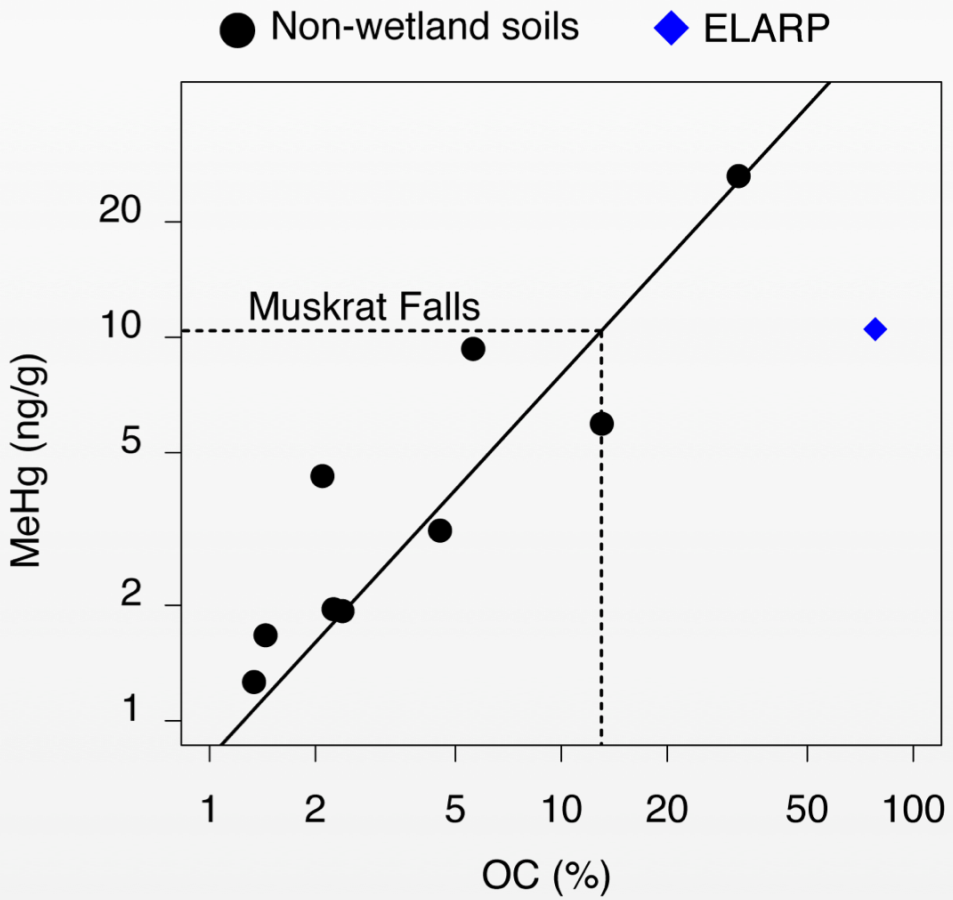
Alternative model inputs

- Pre-flooded modeled exposures almost unchanged
- Modestly reduced forecasts for post-flooding MeHg exposures relative to previous assumptions
  - Lake trout and ouananiche (minor contributors) do not increase under alternative assumptions
  - Atlantic salmon (important contributor) increases less

	Calder et al. (2016)	IEAC values
Fish and seal THg, mean (SD), ppm		
Atlantic salmon muscle	0.07 (0.02)	0.07 (0.04)
Brook trout muscle	0.11 (0.03)	0.07 (0.04)
Lake trout muscle	0.99 (0.46)	0.75 (0.35)
Rainbow smelt muscle	0.11 (0.05)	0.06 (0.06)
Ringed seal muscle	0.16 (0.22)	0.16 (0.79)
Foraging fraction in Churchill River below Muskrat Falls		
Lake trout	100%	0%
Ouananiche	100%	0%
Foraging fraction in Lake Melville		
Atlantic salmon	0–50%	0–20%

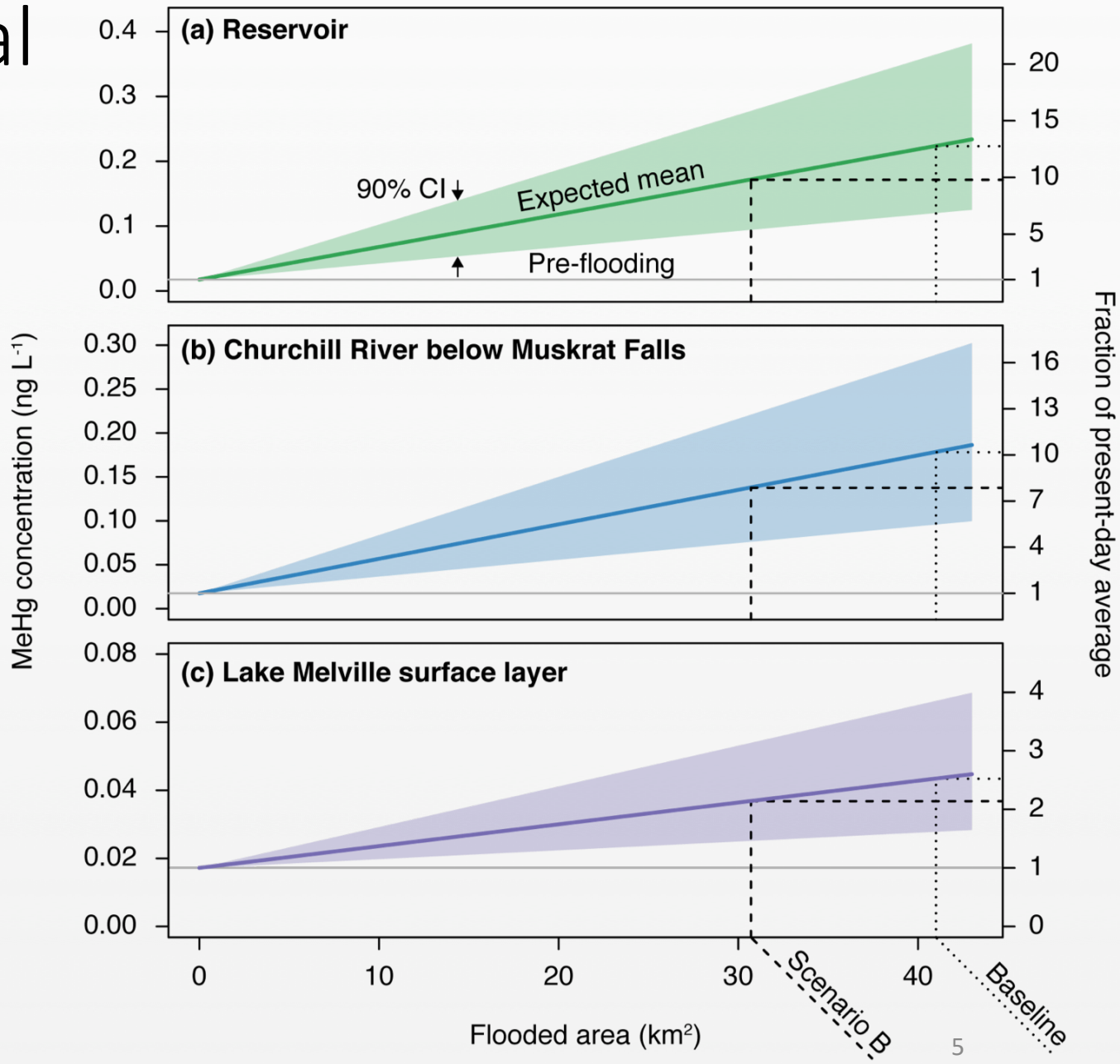
Scenario A: capping wetlands

- Wetlands very important for MeHg in pristine ecosystems
- Also important in flooded systems
  - But sub-linear with respect to carbon
- Continuing to assume flooded land approximately interchangeable with non-wetland soil for purposes of Calder et al. (2016 model)



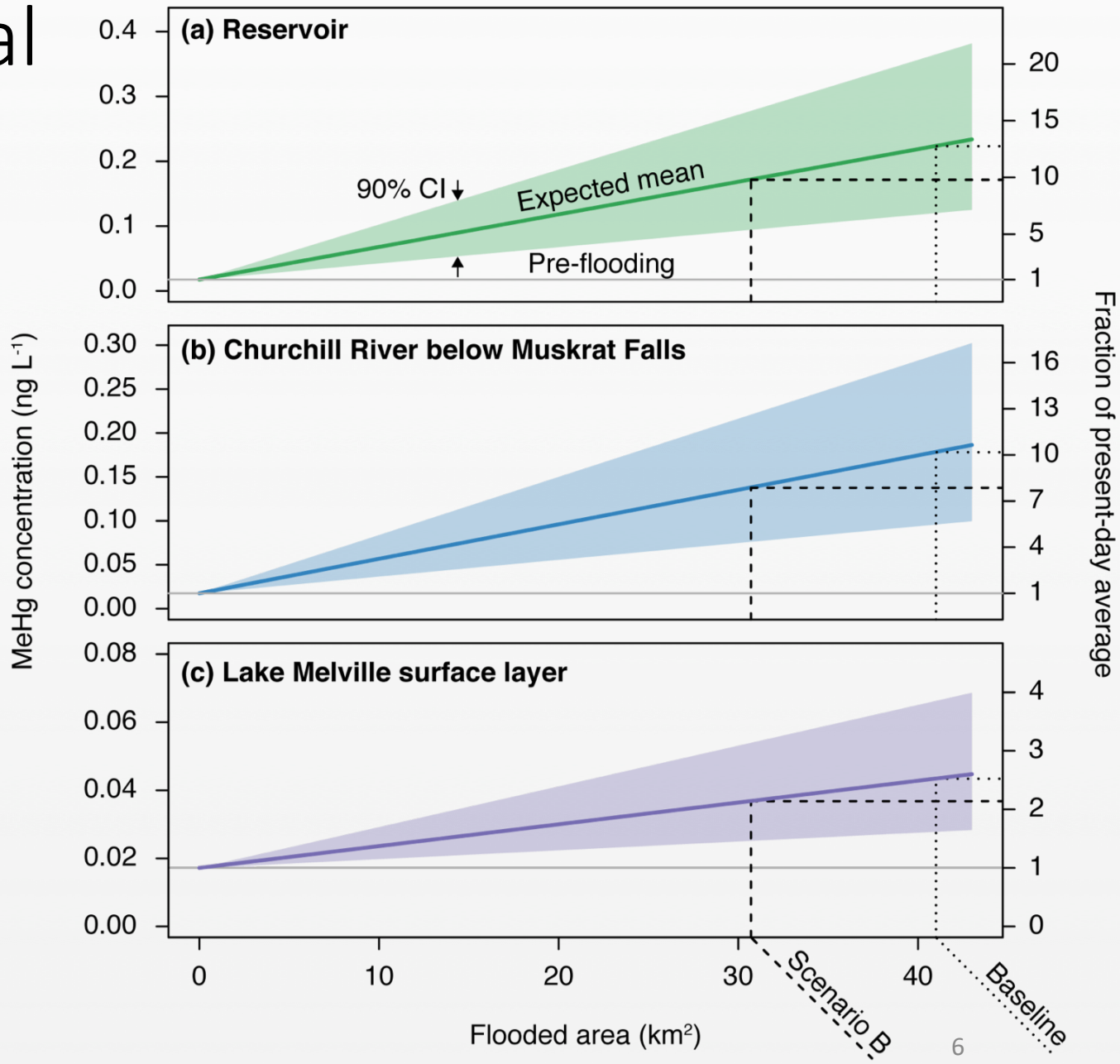
Peak MeHg proportional to flooded area

- Model assumes 0 flooded soil → 0 excess MeHg released to system
- Increases proportional to flooded area
- Scenario "A" → small decrease in flooded area (2%) so small impact
  - Again: data suggest wetlands will not be disproportionate contributors to MeHg



Scenario "B": substantial soil removal

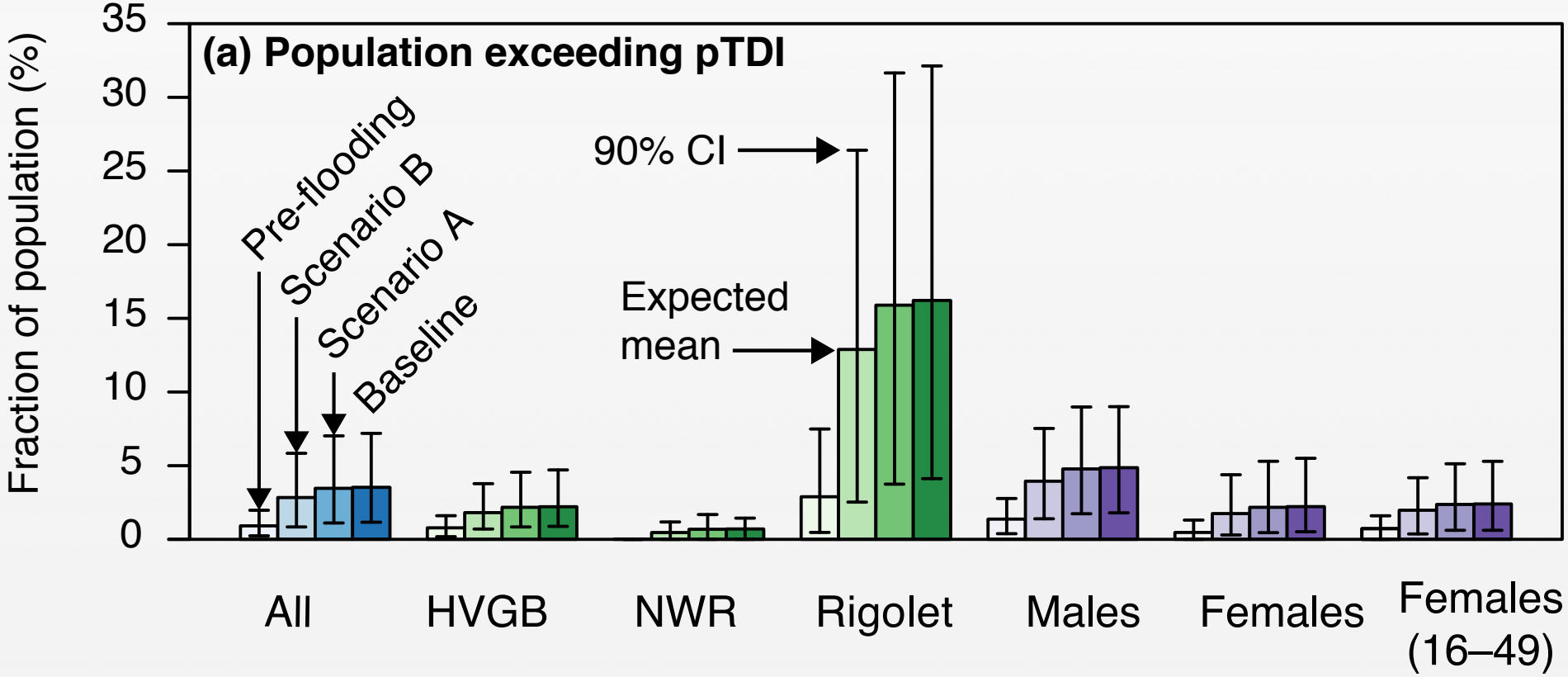
- Removal of ¼ of the labile organic carbon
- Peak excess MeHg reduced by ¼ in each of the compartments
- More removal → smaller peak MeHg



Updated exposure forecasts

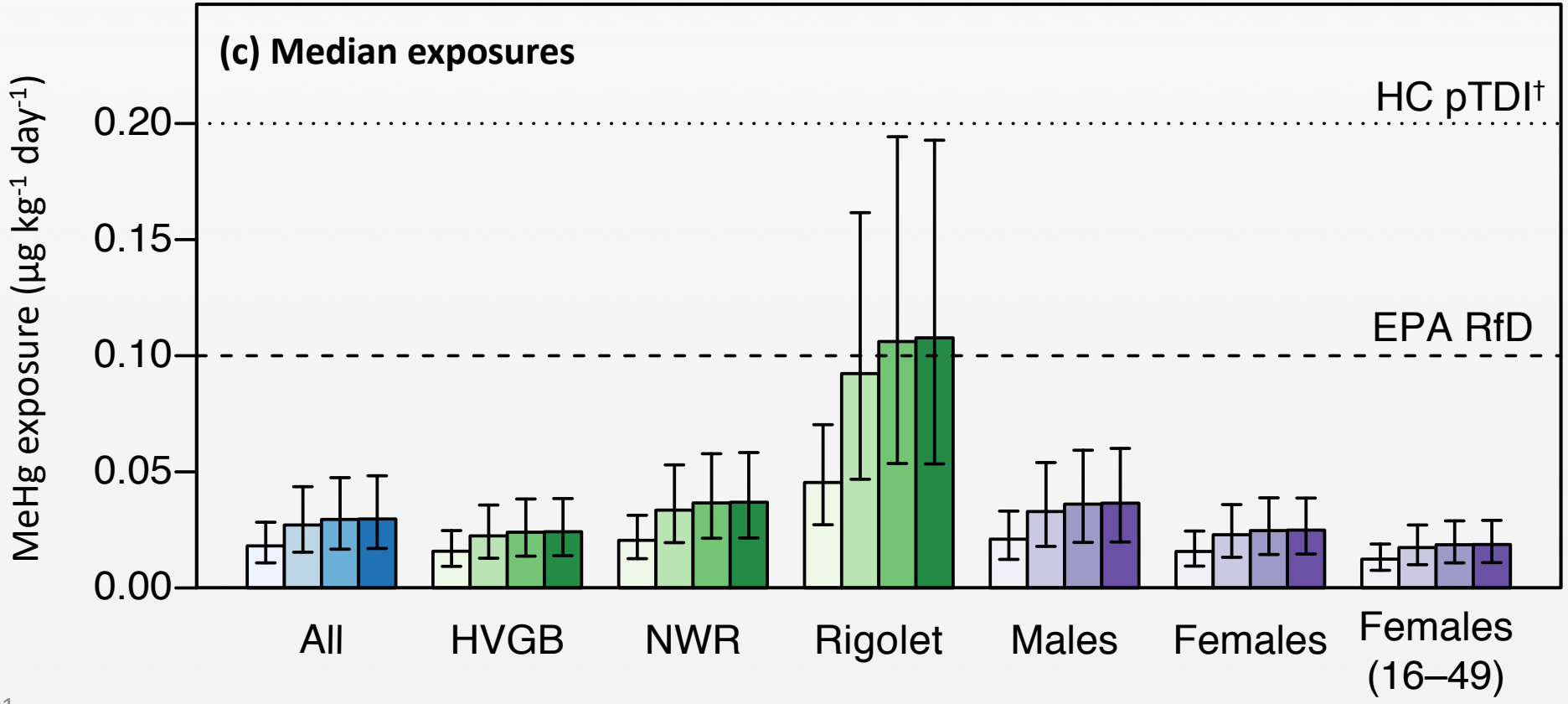
- Overall, relatively few individuals (<5%) exceed Health Canada pTDI now or in future, incl. women 16-49; Rigolet vulnerable.

- Scenario "B" provides some mitigation



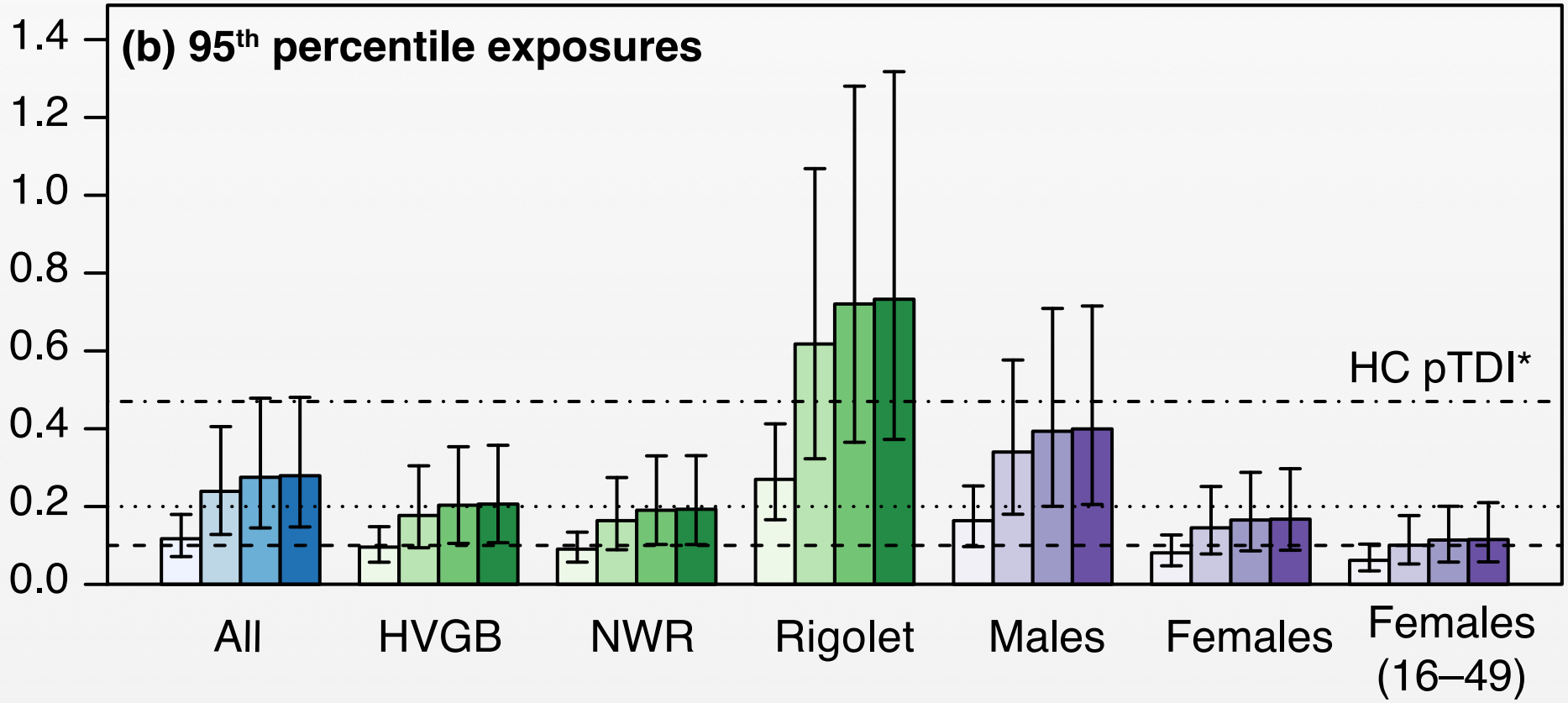
Updated exposure forecasts

- Median exposures will likely continue to be below regulatory guidelines



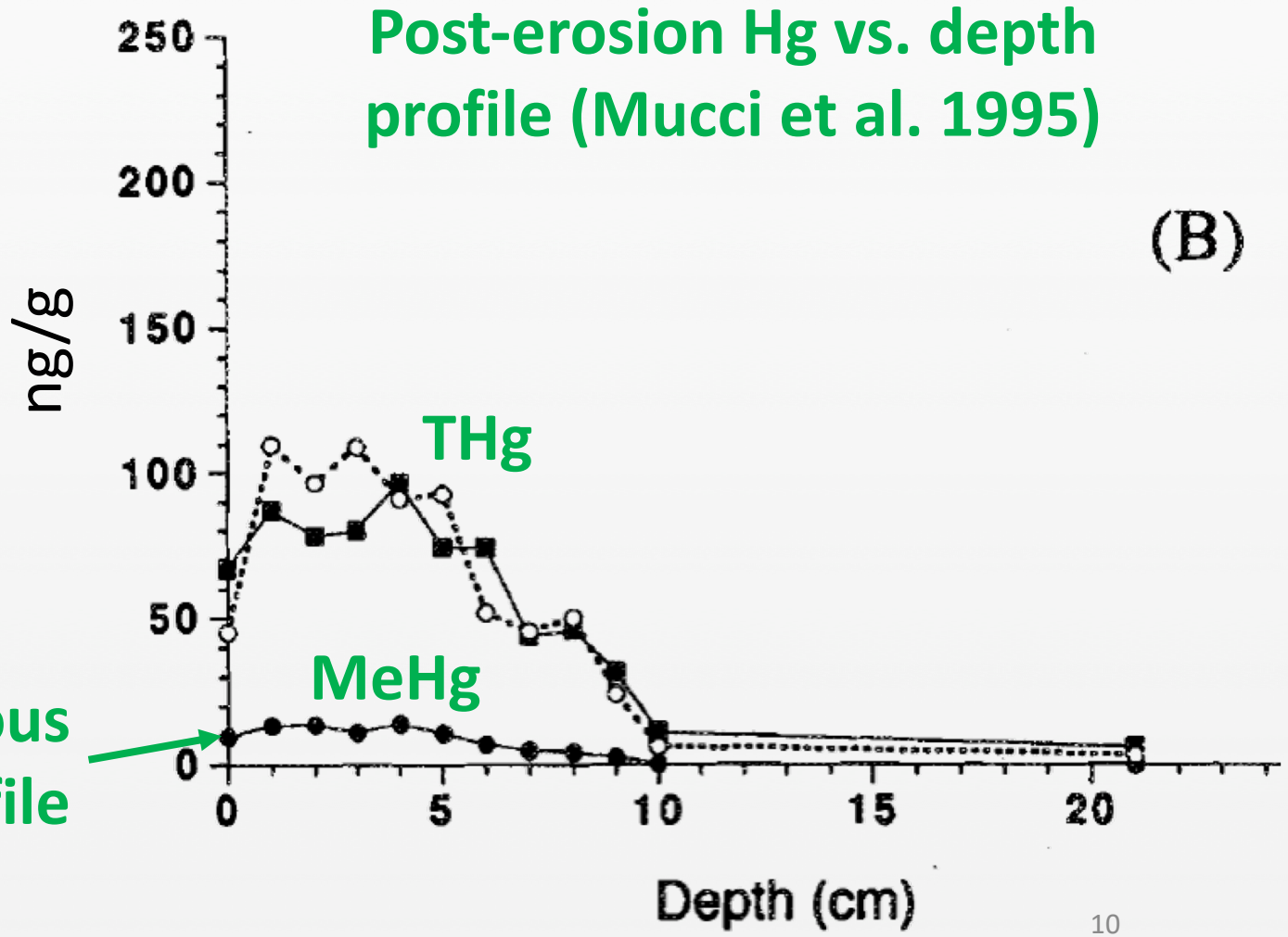
Updated exposure forecasts

- ≥95th population percentile: exposure risks that are somewhat mitigated by Scenario B
- For example: Women 16-49 at 95th percentile with respect to EPA RfD



Hesslein document

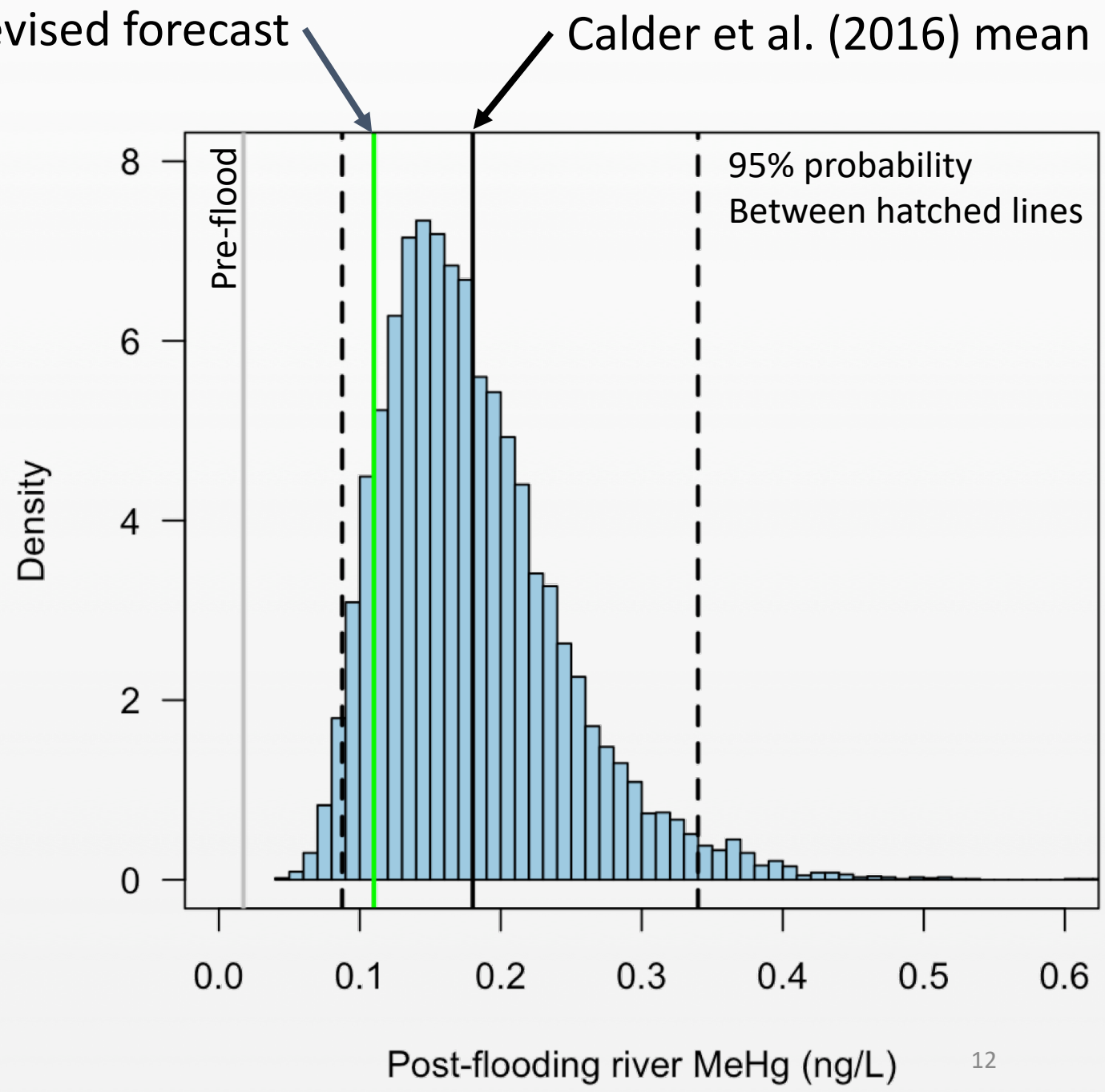
- His argument: upward fluxes of MeHg controlled by molecular diffusion in soils
- Likely true at ELA, stagnant lakes
- Full-scale reservoirs: erosion, homogenization



Azimuth document

- Some misrepresentations
  - Peak vs. 10-year-average fluxes
  - Scope of model (e.g., Photodemethylation)
- Many reasons Site C different from Muskrat Falls (detailed in paper)
  - **Soil organic carbon**
  - Flooded area, residence time
- Claim that THg and OC do not allow forecasted MeHg levels
- Contradicts Reed Harris's work
  - RH's revised forecasts are within the distribution proposed by Calder et al.

Reed Harris's peak MeHg values are within the 95% CI forecasted by Calder et al. (2016)



Other questions?