Determining the Relative Importance of Water Column and Sediment Methylation Rates in the Nacimiento Reservoir, California

Major Finding: Profundal sediment derived MeHg accounts for half of summer hypolimnion concentrations.

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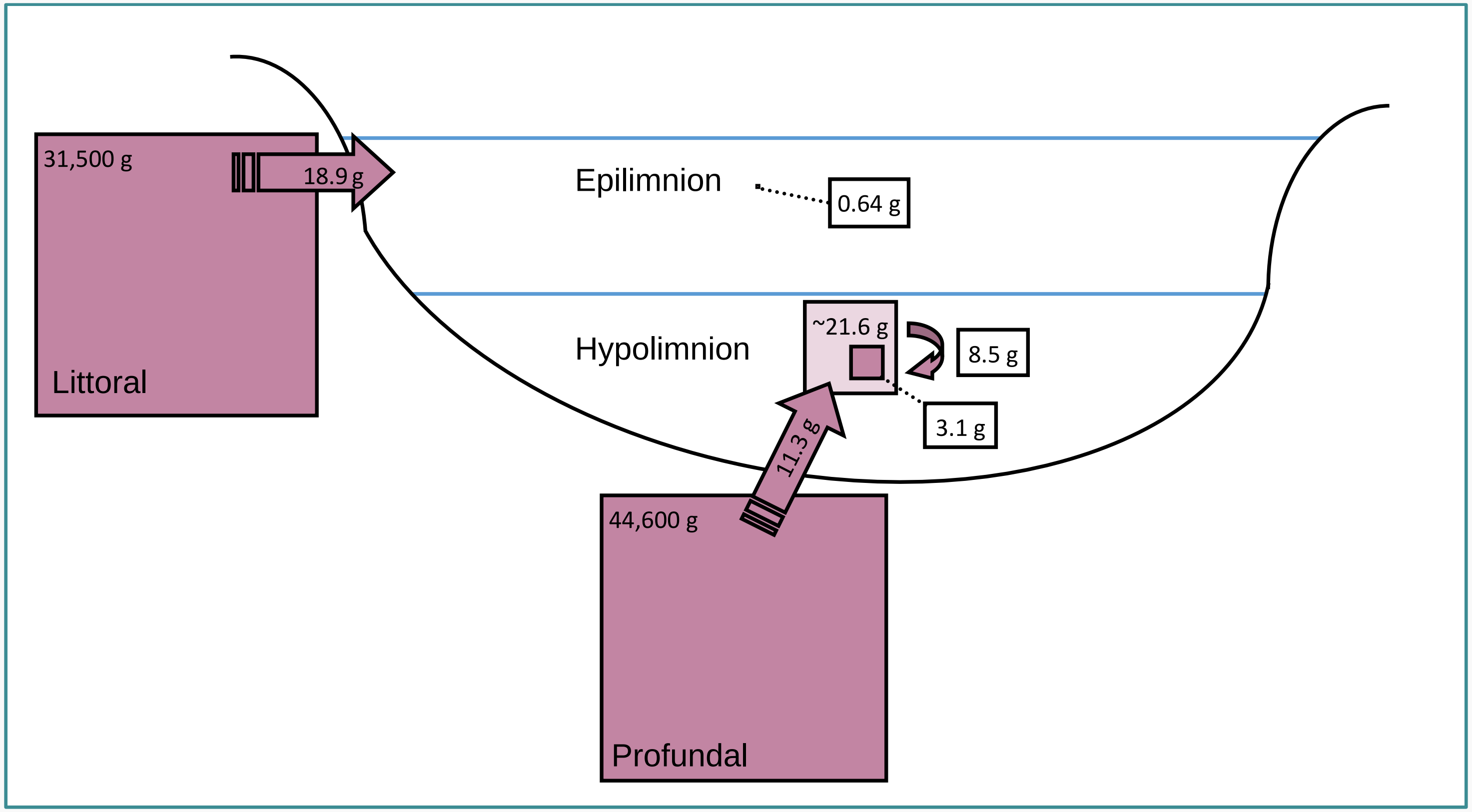
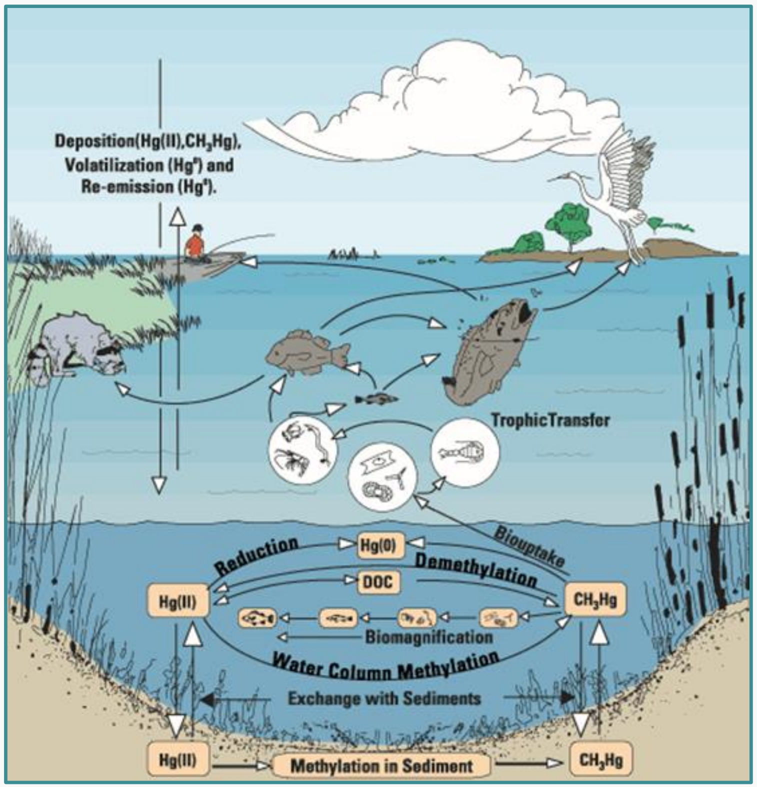
Where we are Going:
Simplified MeHg Conceptual Diagram



Roadmap

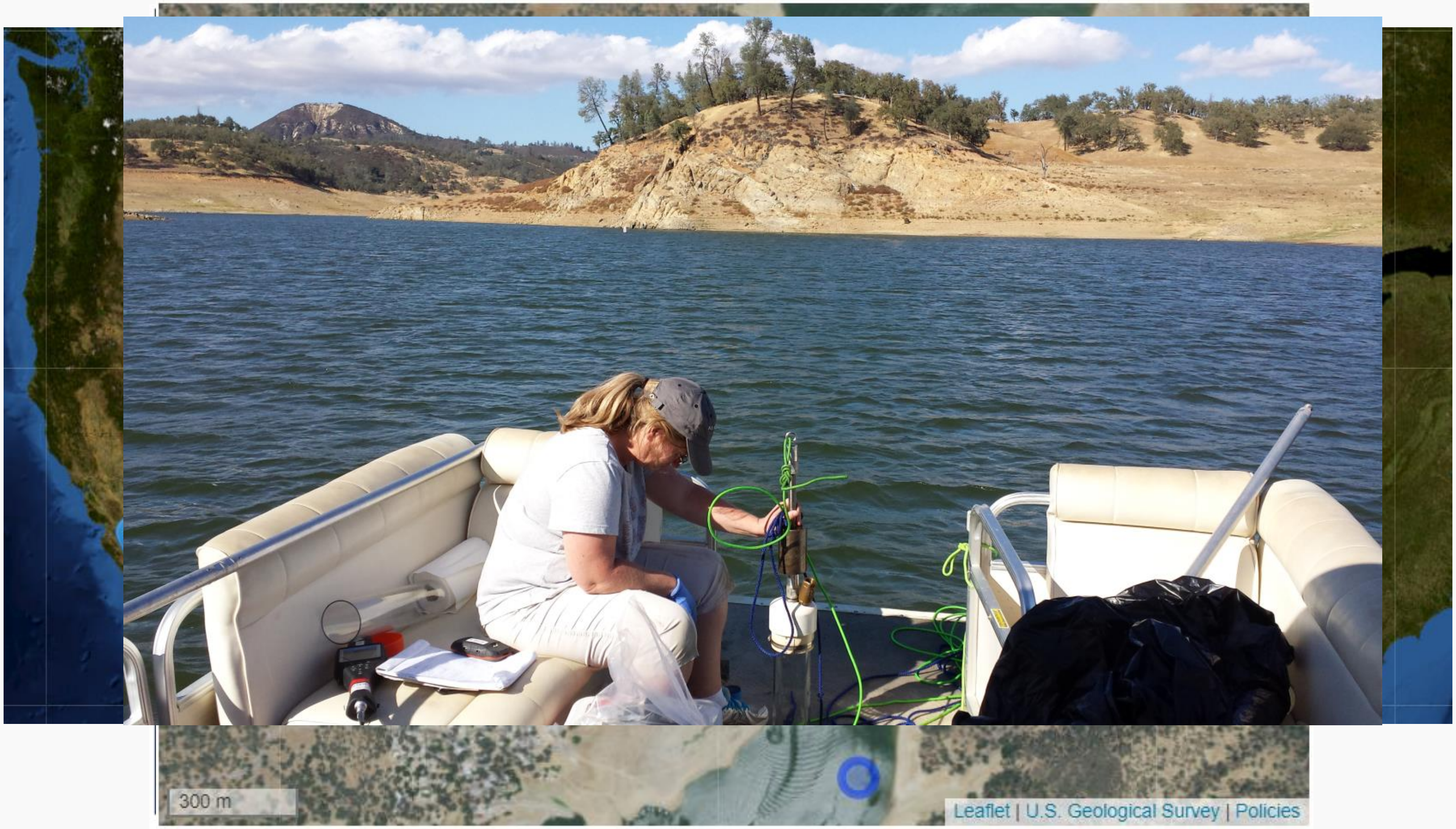
- Mercury
- Nacimiento Reservoir
- Experimental set up
- Analysis
- Summary

The Problem with Mercury



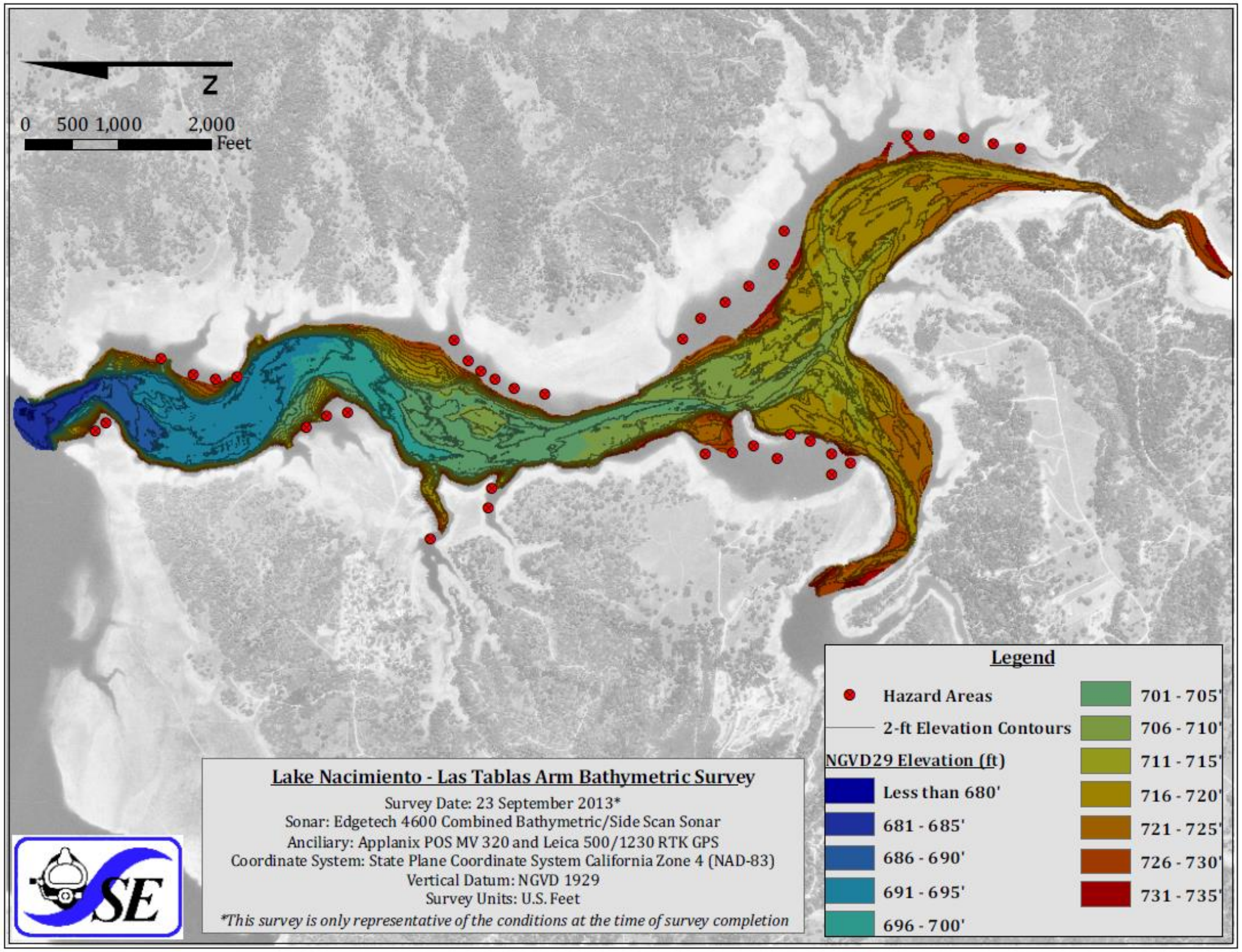
- Global pollutant
- Used in gold mining
- Ionic Hg converted to organic MeHg in anoxic conditions
- MeHg strongly bioaccumulates and biomagnifies

Nacimiento Reservoir

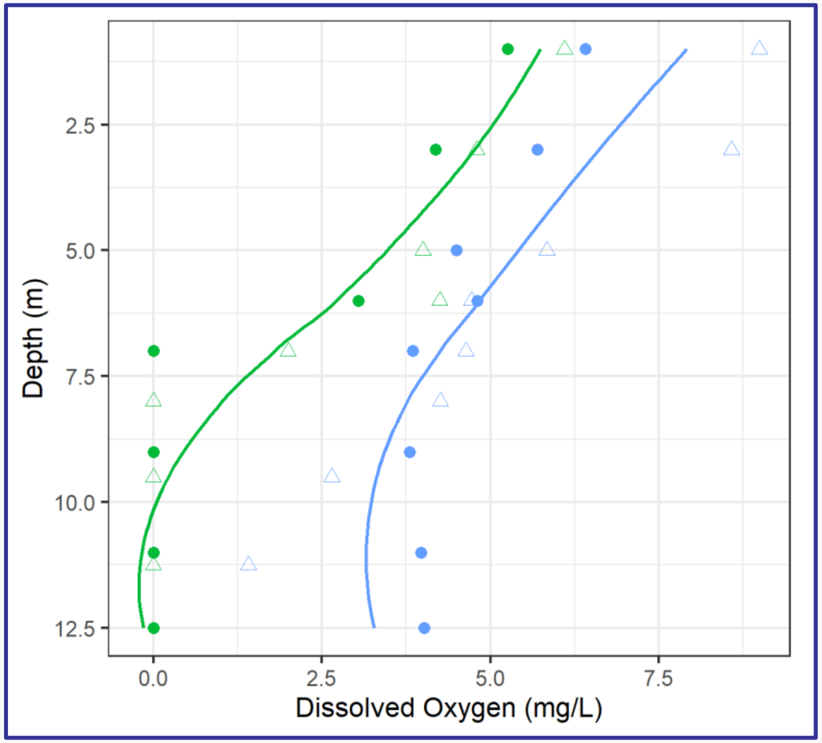


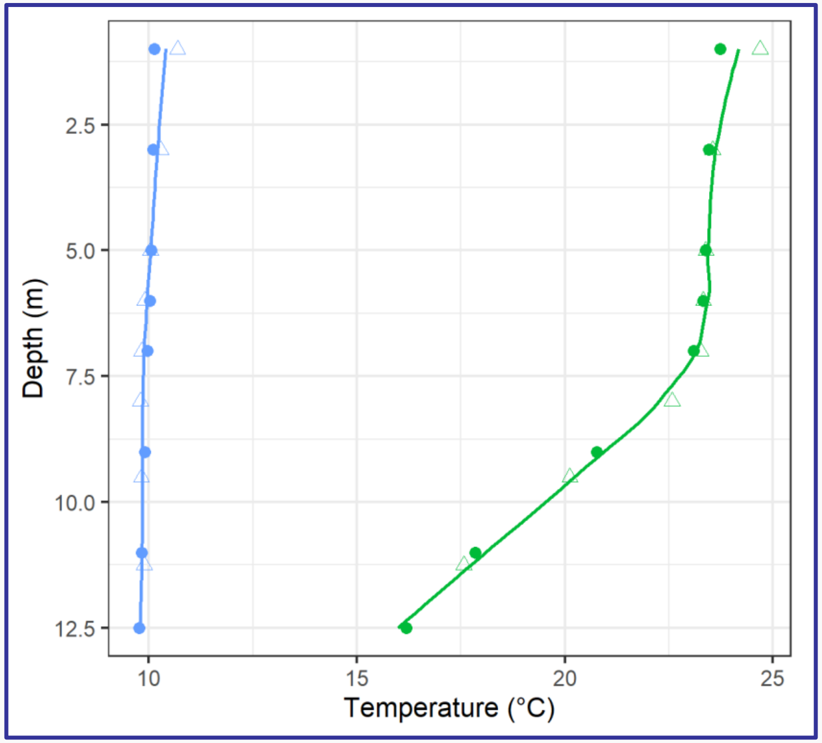
Hg Isotope Spike

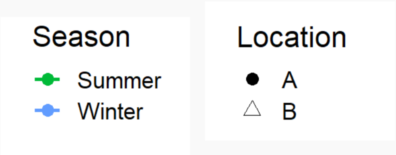
- Top 4 cm of sediment were spiked
  - (1 cm increments)
- ^{198}Hg and $^{204}MeHg$ equilibrated with lake water to assess methylation and demethylation rates


N
0 500 1,000 2,000
Feet
Legend
Hazard Areas
2-ft Elevation Contours
NGVD29 Elevation (ft)
Less than 680'
681 - 685'
686 - 690'
691 - 695'
696 - 700'
701 - 705'
706 - 710'
711 - 715'
716 - 720'
721 - 725'
726 - 730'
731 - 735'
Lake Nacimiento - Las Tablas Arm Bathymetric Survey
Survey Date: 23 September 2013*
Sonar: Edgetech 4600 Combined Bathymetric/Side Scan Sonar
Anciliary: Applanix POS MV 320 and Leica 500/1230 RTK GPS
Coordinate System: State Plane Coordinate System California Zone 4 (NAD-83)
Vertical Datum: NGVD 1929
Survey Units: U.S. Feet
*This survey is only representative of the conditions at the time of survey completion
SE

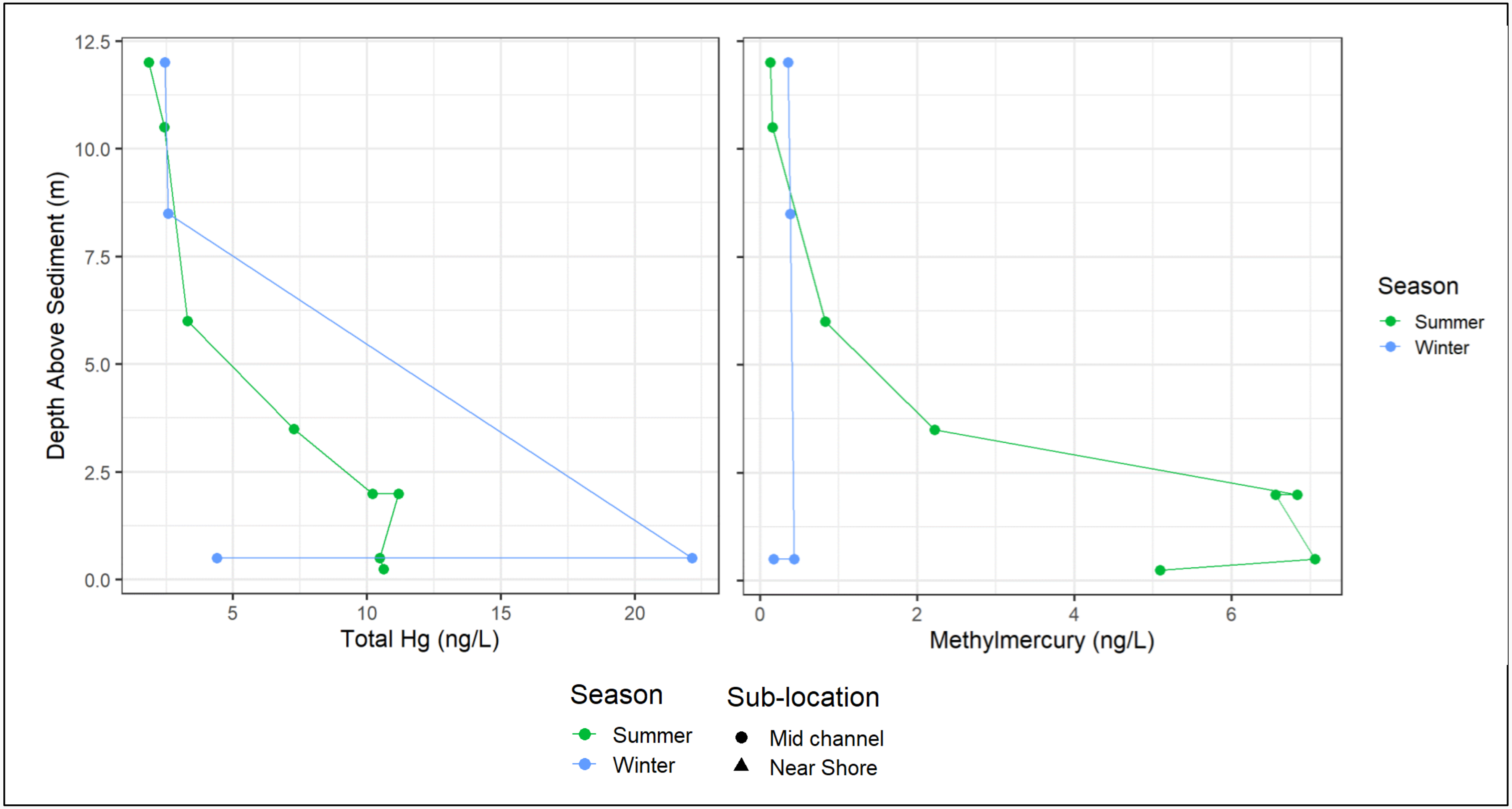
Surface Water Seasonal Variation



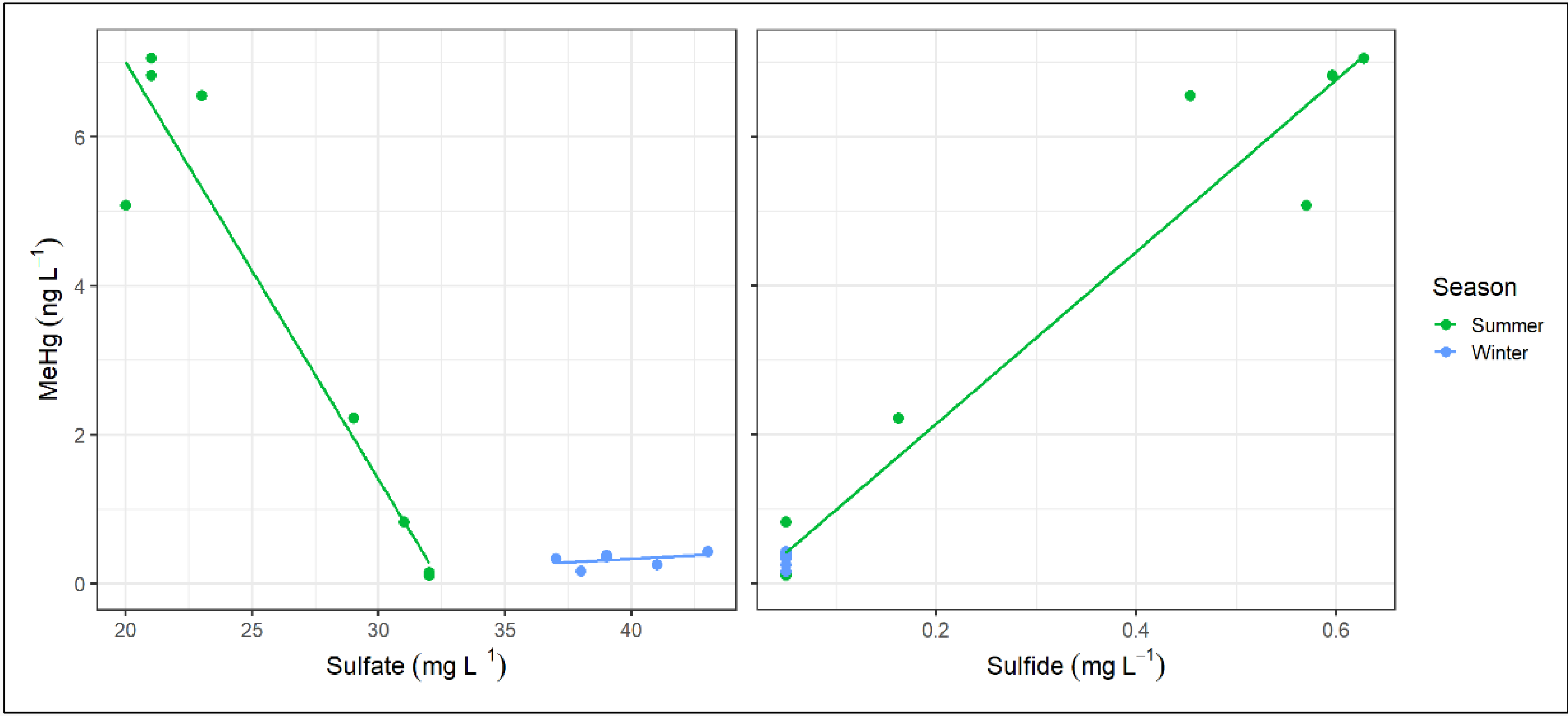


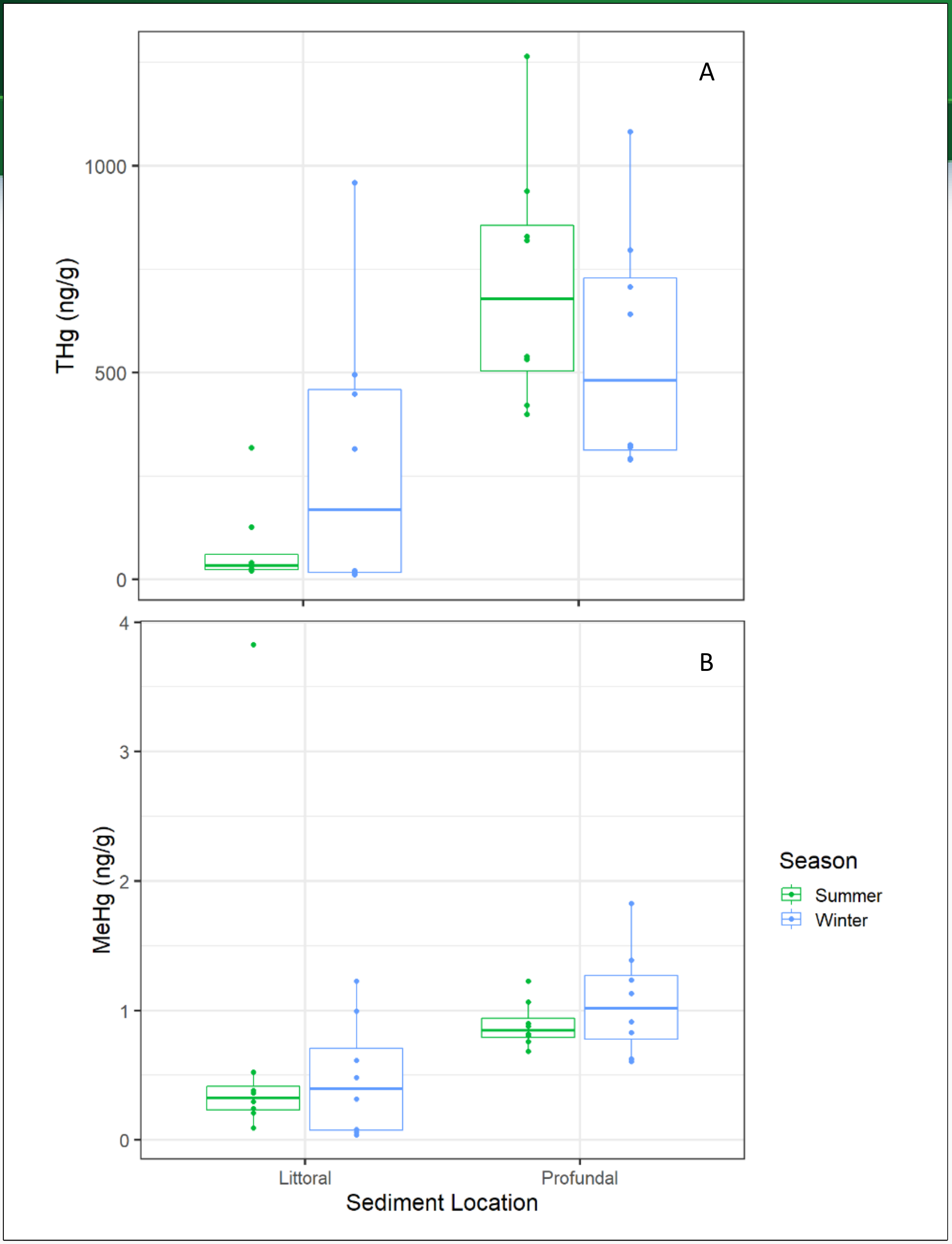


Surface Water Mercury Variation



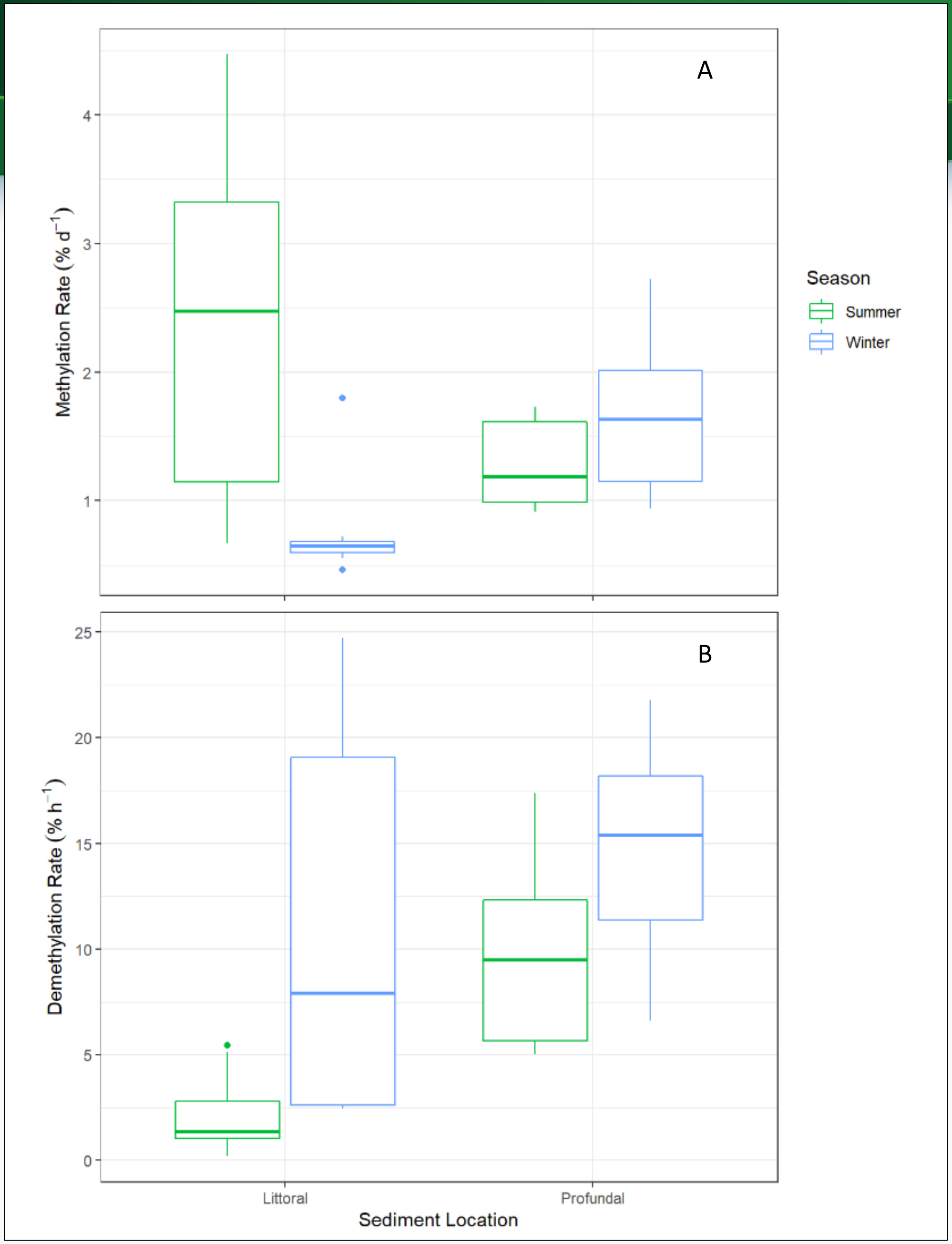
Surface Water Relationships





Sediment Variation

- Concentration of THg (A) and MeHg (B) found in the top 4 cm of sediment



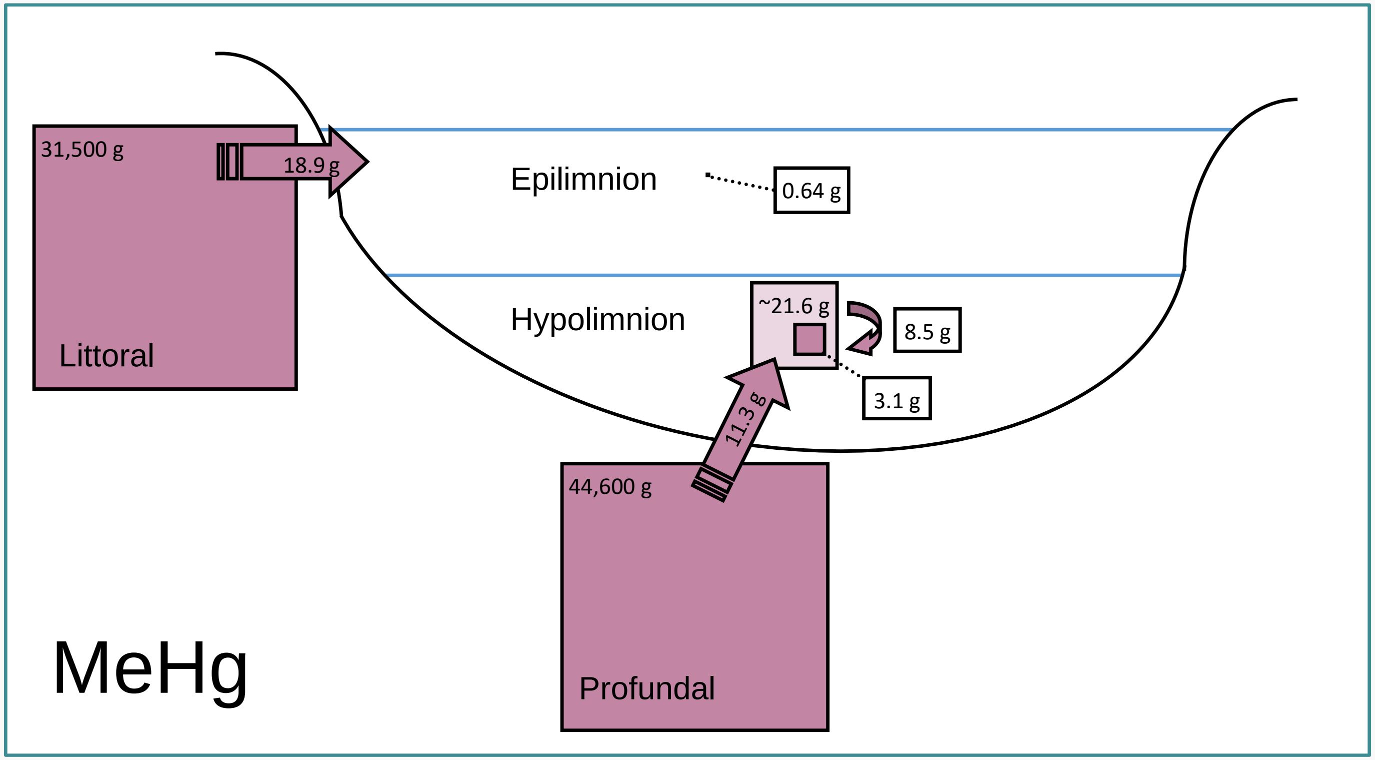
Sediment Variation

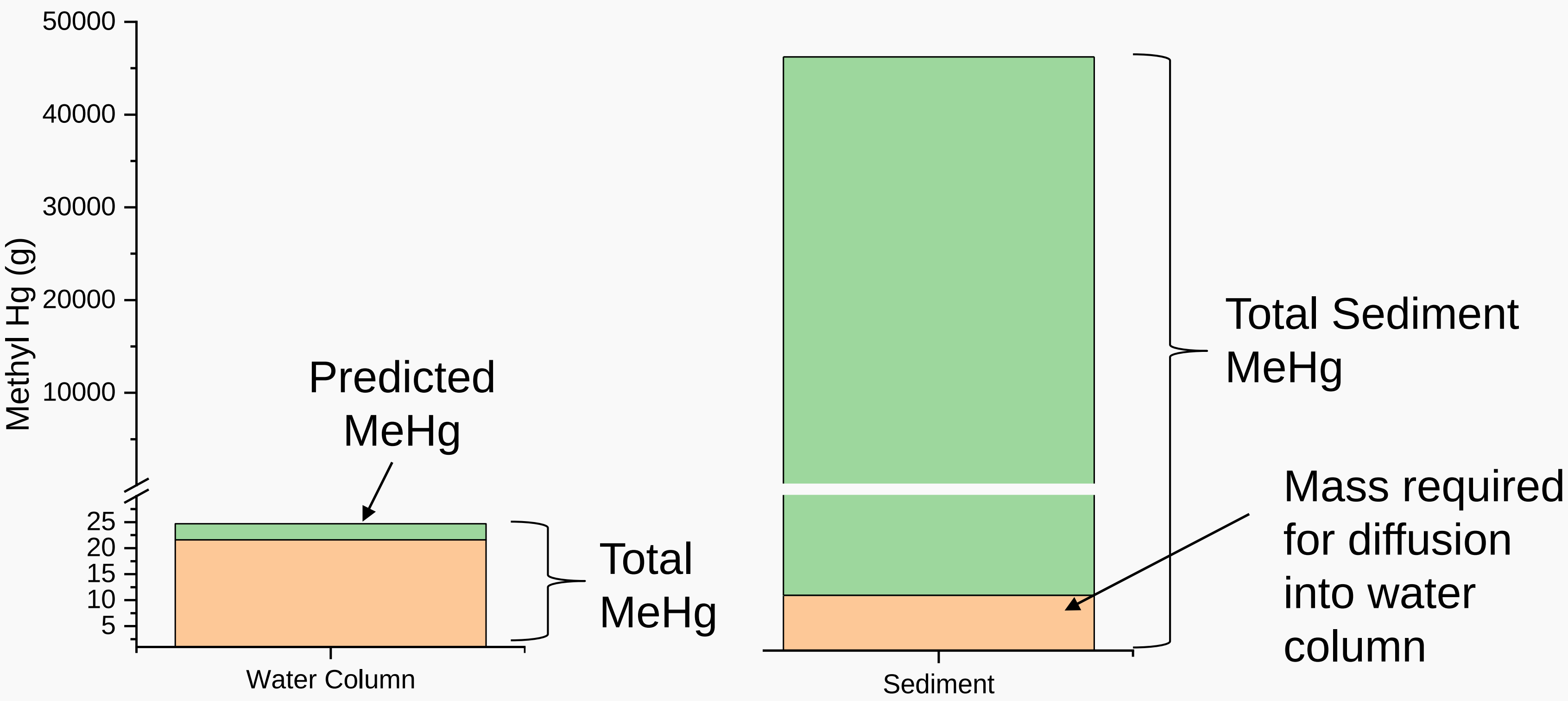
- Rate of methylation (A) and demethylation (B) in the first 4 cm of sediment

Profundal Sediments are Important!

$$MeHg_t = K_m * K_{dm} * Hg_i^{2+} * (1 - e^{-k_{dm}*t})$$

$$Load = \frac{Dispersion * [MeHg]}{Dispersion\ Length}$$




Methyl Hg (g)
50000
40000
30000
20000
10000
25
20
15
10
5
Predicted
MeHg
Total
MeHg
Water Column
Total Sediment
MeHg
Mass required
for diffusion
into water
column
Sediment

Acknowledgements

- Jenny Goetz, etc?