

Mercury and methylmercury cycle in the Tagus Estuary, Portugal: Major findings of the PROFLUX Project

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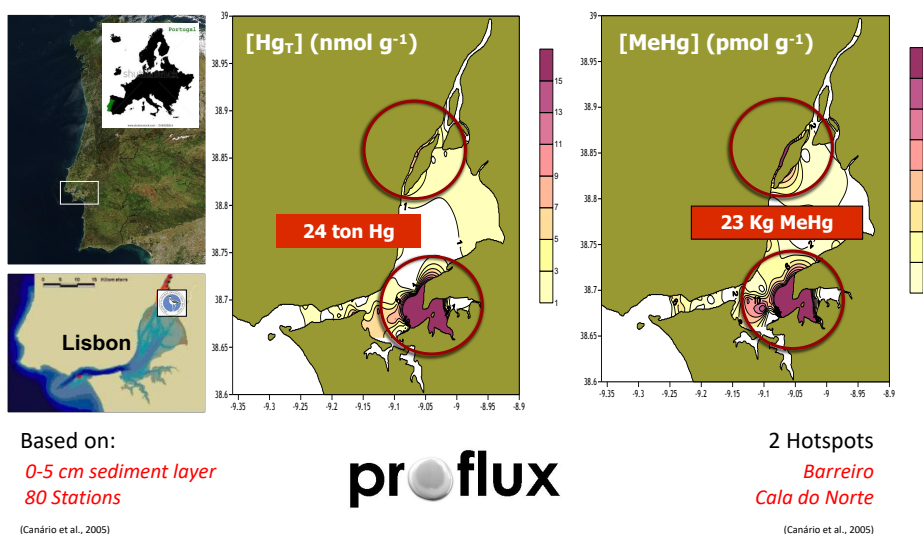
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Mercury in the Tagus Estuary



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Objectives of PROFLUX

- Objective 1 – To improve the understanding of Hg methylation and demethylation processes in contaminated sediments.
- Objective 2 – To evaluate the mechanisms responsible for the escape of Hg and MeHg from contaminated hotspots.
- Objective 3 – To evaluate the role of the Tagus estuary as a source or sink of Hg.

proflux

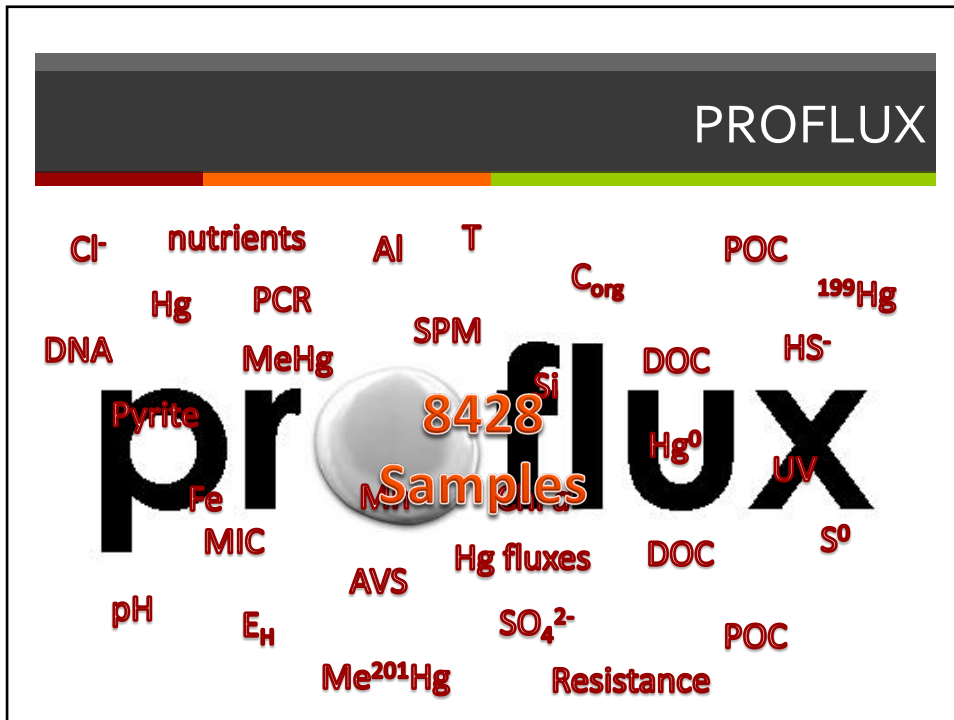
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Sampling Sites

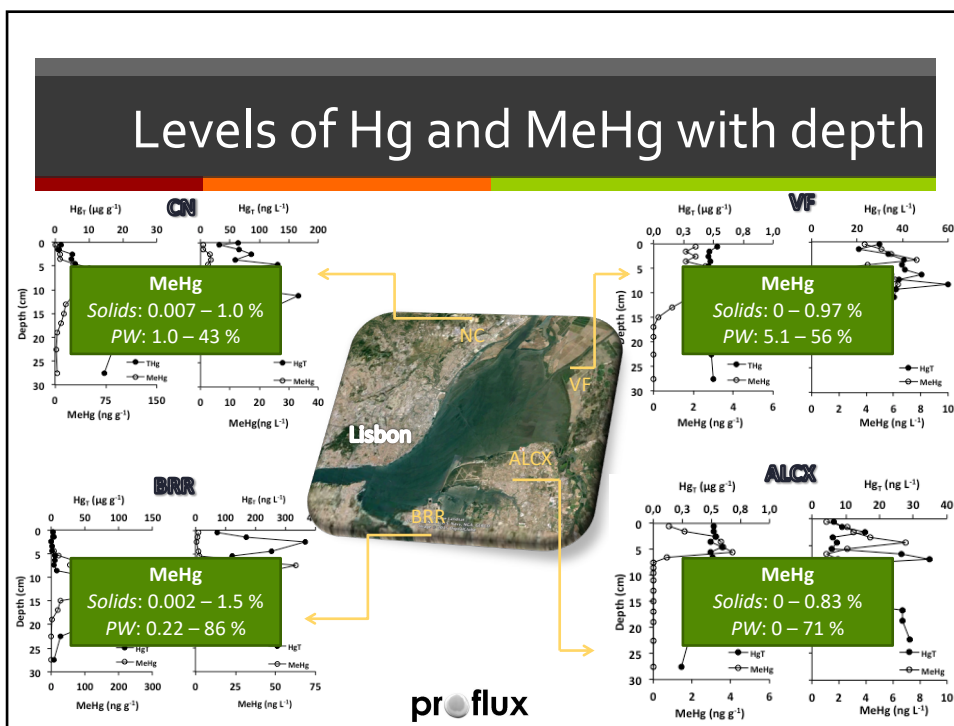


proflux

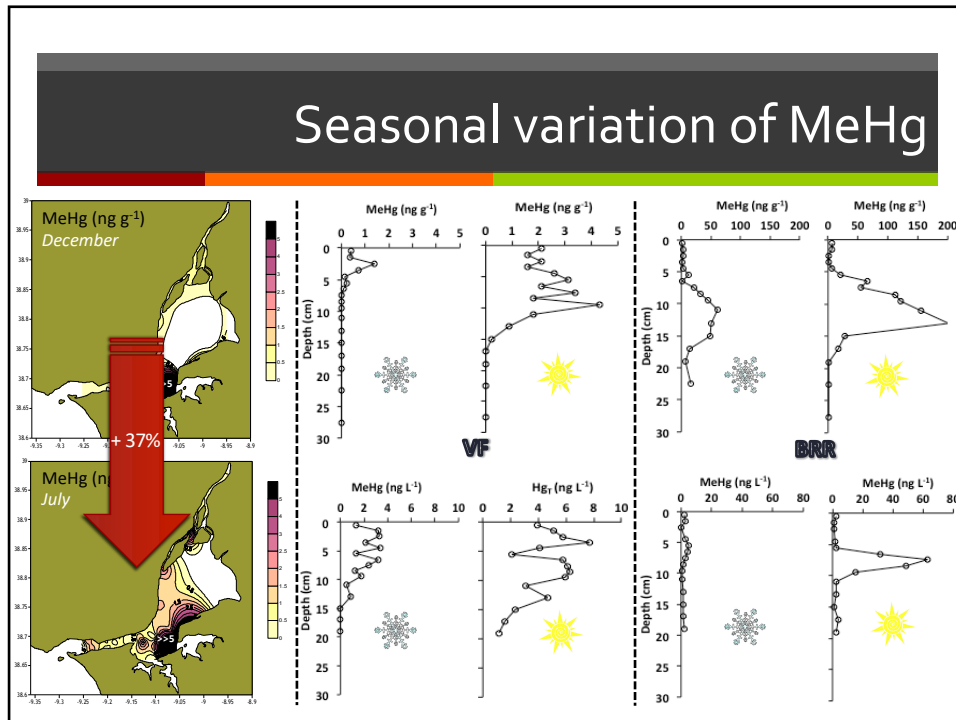
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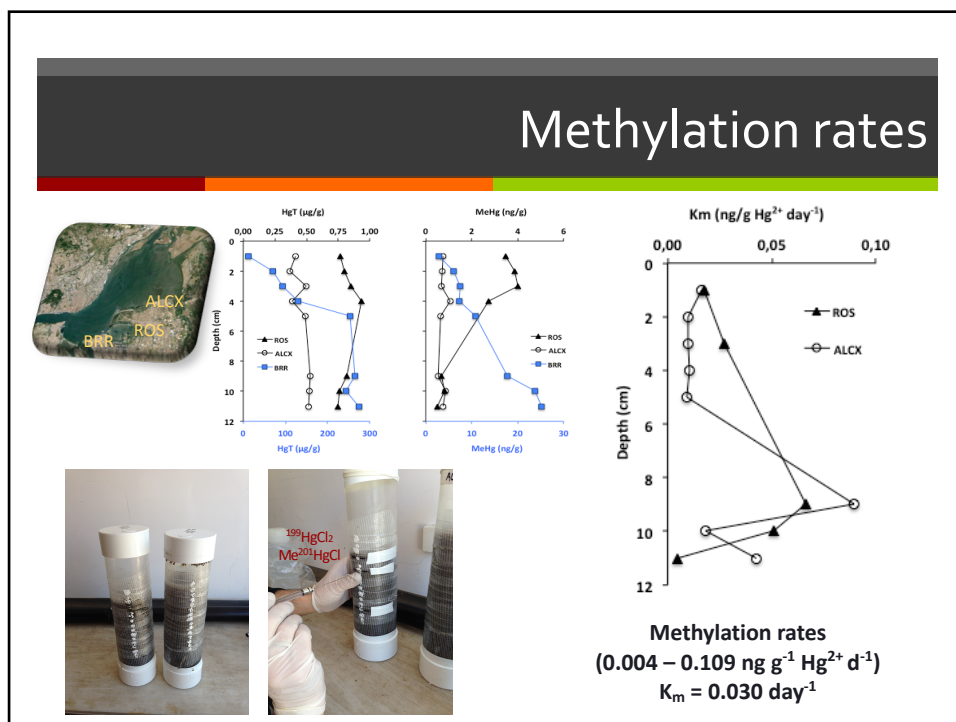
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Bacteria composition

Sampled area	Barreiro		North Channel		Alcochete		Biochemical characterization
Total number of Hg-R isolates ^a (% of total)	43 (46%)		24 (26%)		26 (28%)		
Isolates							
Aerobic bacteria	%	Gram/morphology	%	Gram/morphology	%	Gram/morphology	Genera identification ^c
	51	Gram ⁺ rod: 41% Gram ⁺ coccus: 2% Gram ⁻ rod: 5% Gram ⁻ vibrio: 5%	58	Gram ⁺ rod: 13% Gram ⁻ rod: 13% Gram ⁻ vibrio: 33%	54	Gram ⁺ rod: 54%	<i>Bacillus</i> sp. <i>Aeromonas</i> sp. Enterobacteriaceae sp. <i>Vibrio</i> sp. <i>Clostridium</i> sp.
Anaerobic bacteria	40	Gram ⁺ rods: 2% Gram ⁺ coccus: 12% Gram ⁻ rod: 26%	21	Gram ⁺ rod: 16% Gram ⁺ coccus: 4%	46	Gram ⁺ rod: 19% Gram ⁺ coccus: 8% Gram ⁻ rod: 19%	
SRB ^b	7	Gram ⁻ vibrio: 7%	21	Gram ⁻ vibrio: 21%	0	-	Electron Donor Electron acceptor Lactate Sulfate Formate Fumarate Nitrate Acetate

Bacillus sp. and Enterobacteriaceae sp. - were shown to reduce Hg

Clostridium sp. - were shown to methylate Hg

Sulfate-reducing bacteria (SRB) – main responsible for Hg methylation

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Mercury transport across interfaces

Diffusion

Collection of sediment cores and overlying water

$$J = -\frac{\varphi}{\theta^2} D_s \frac{dc}{dz}$$

$$DS_{Hg} = 6.47 \times 10^{-10} \text{ m}^2 \text{ s}^{-1} \text{ (Shultz, 2000)}$$

$$DS_{MeHg} = 2.0 \times 10^{-10} \text{ m}^2 \text{ s}^{-1} \text{ (Gill et al., 1999)}$$

Advection

to gas bubbler + Tekran

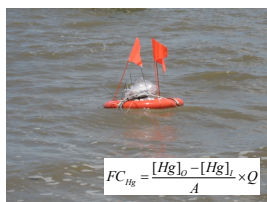


water and surface sediment sampling before inundation and 5, 10, 20, 30, 45, 60, 120 and 180 min after inundation

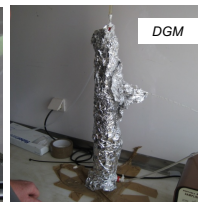


Particulate and dissolved Hg and MeHg, DGM, Hg water/air flux, Al, Si, Fe, Mn, nutrients, organic carbon, sulphur compounds, salinity.

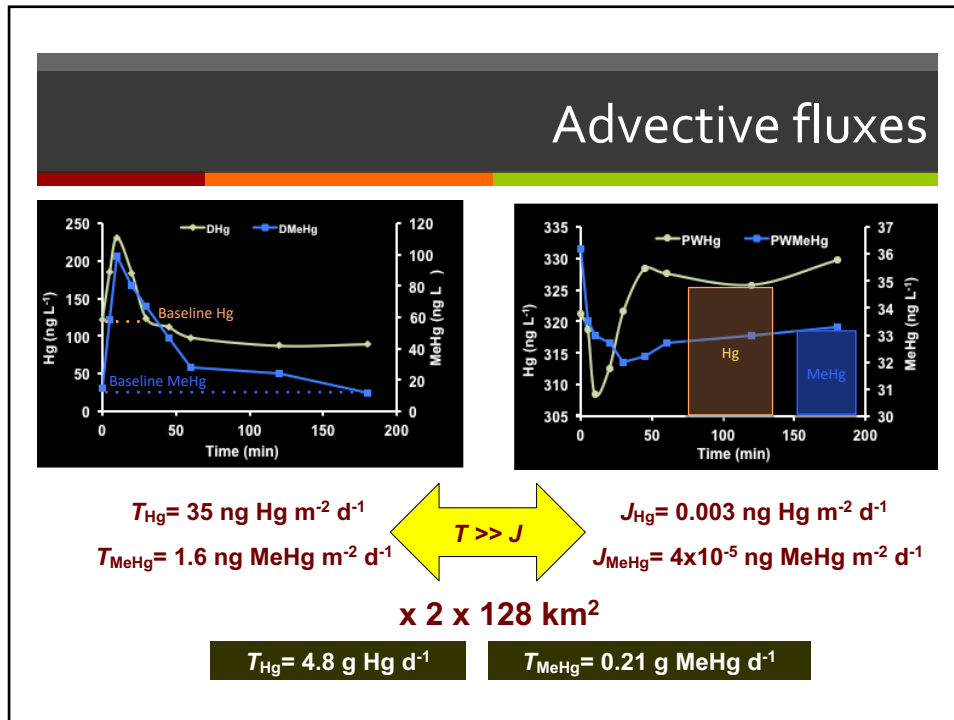
$$T = \sum (C_{i+1} - C_i) \frac{(h_{i+1} - h_i)}{2}$$



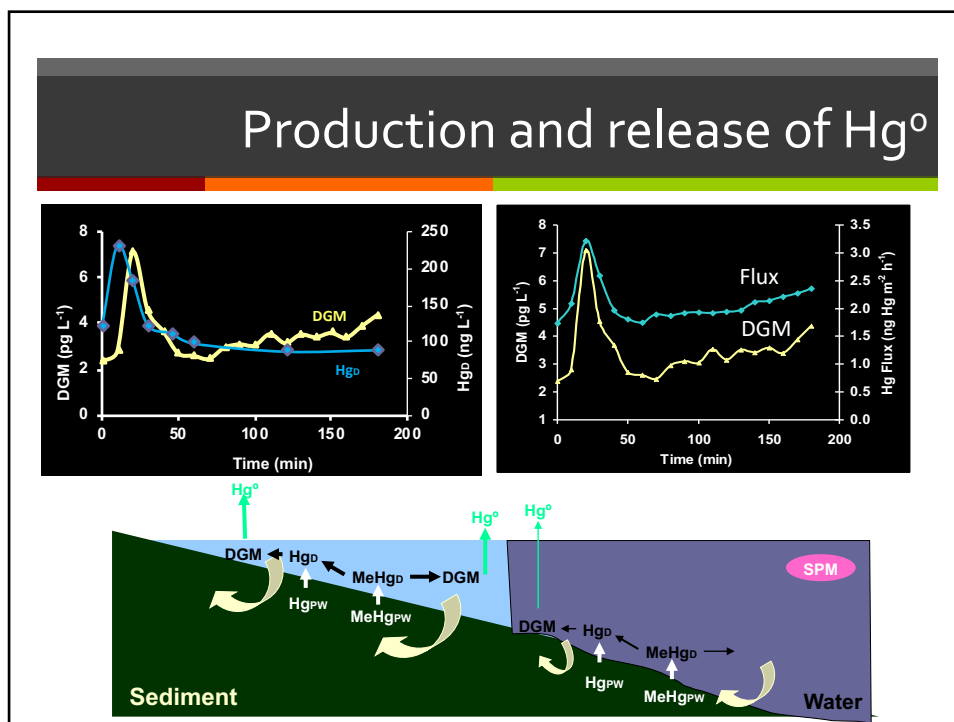
$$FC_{Hg} = \frac{[Hg]_0 - [Hg]_1}{A} \times Q$$



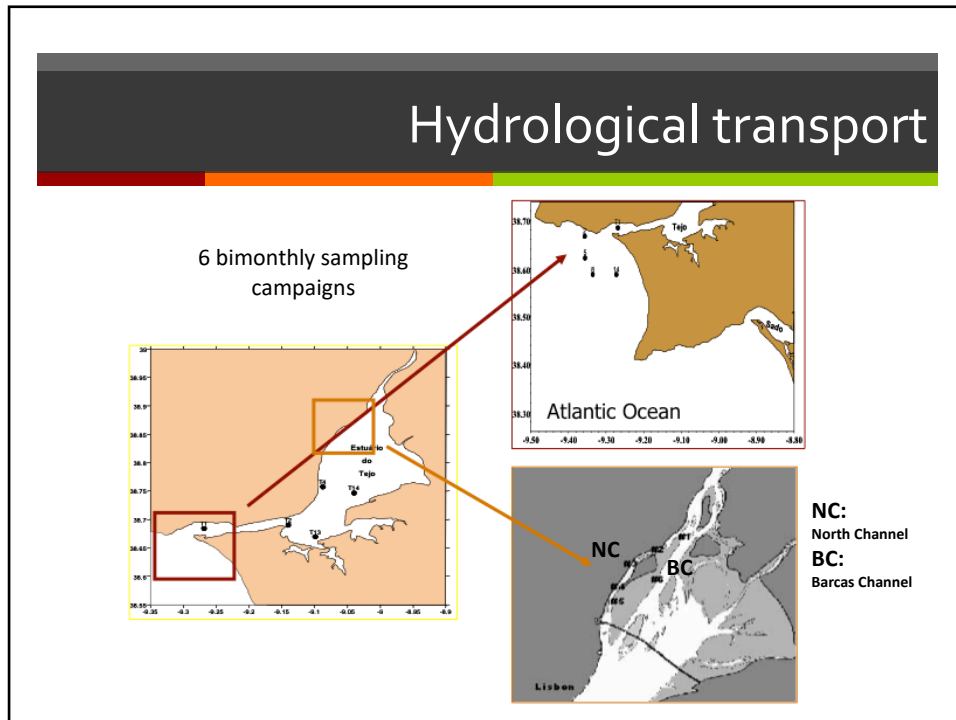
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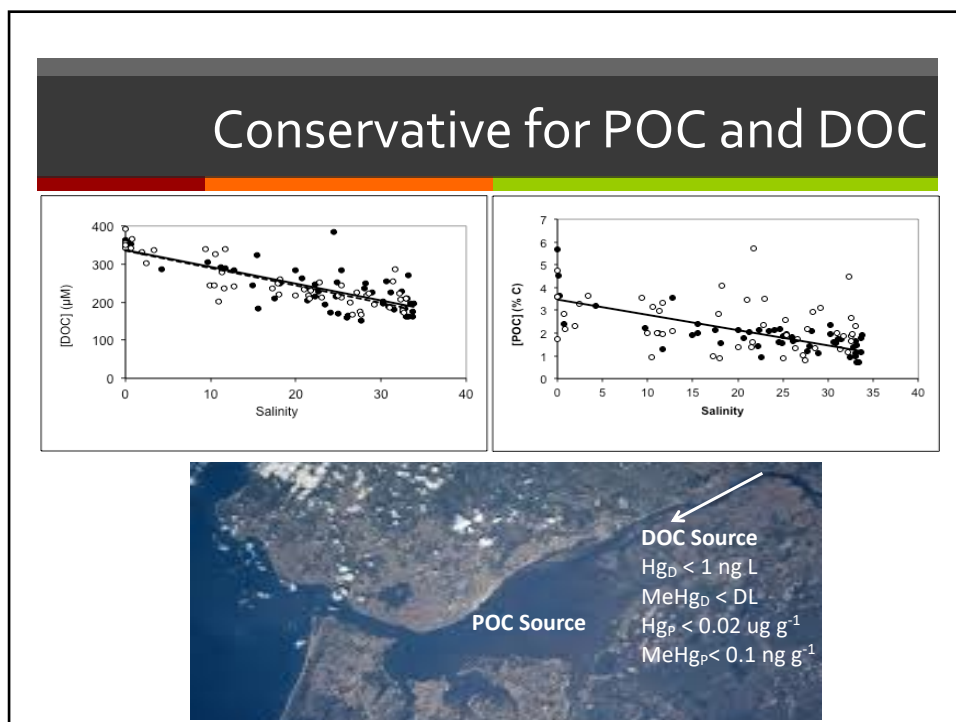
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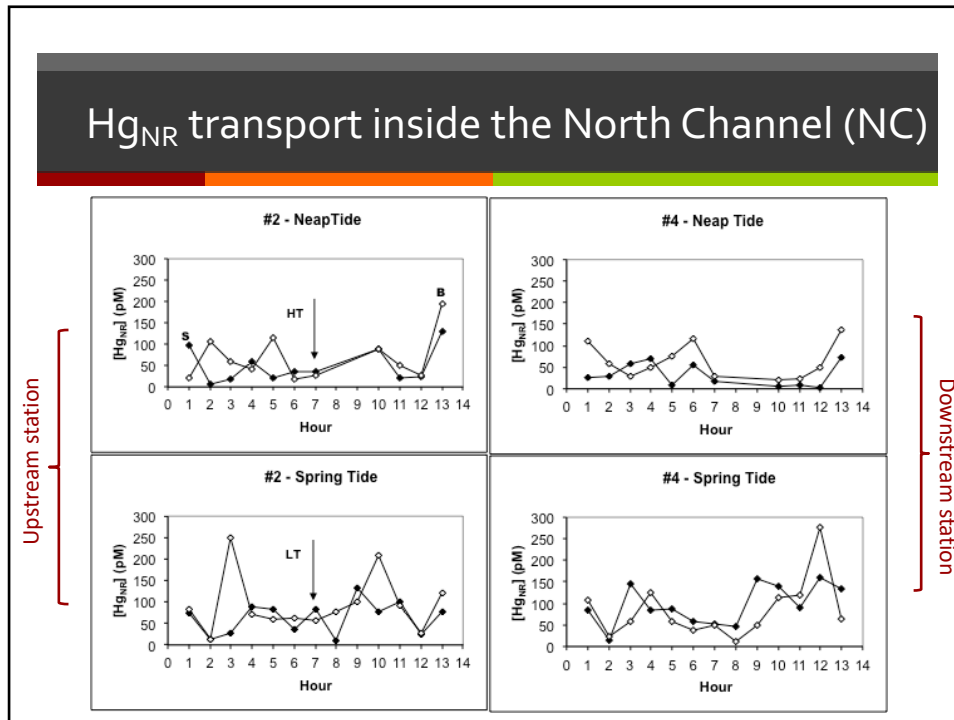
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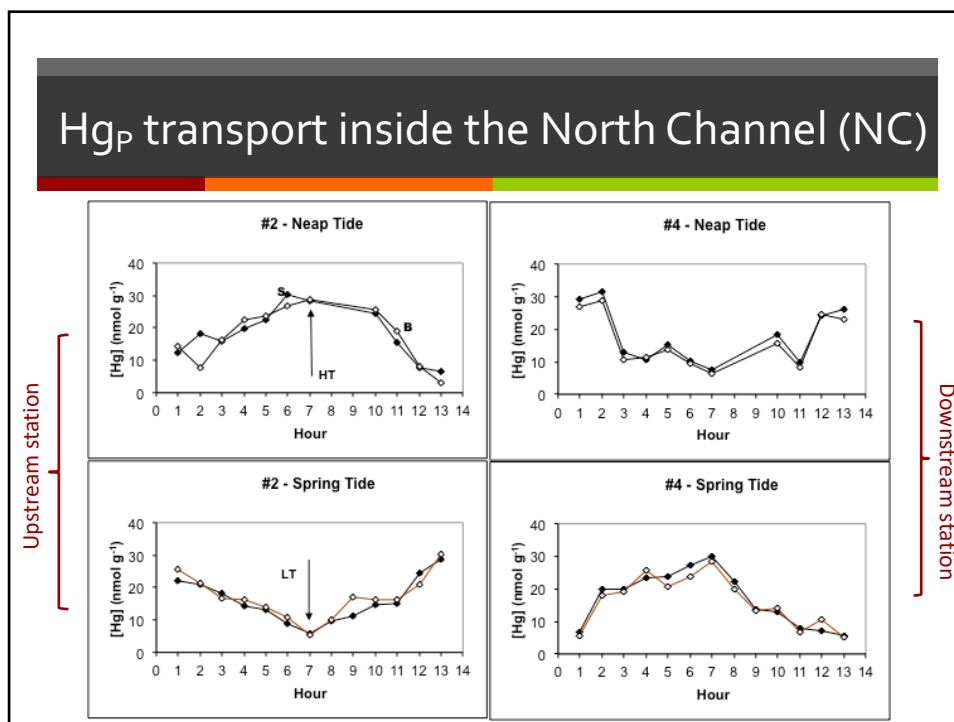
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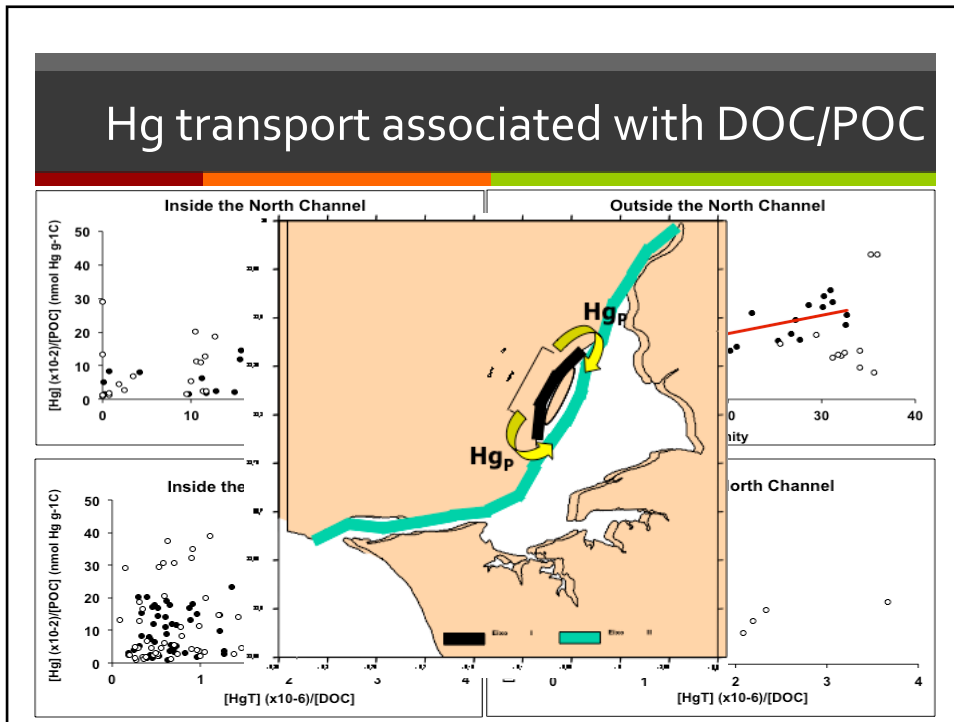
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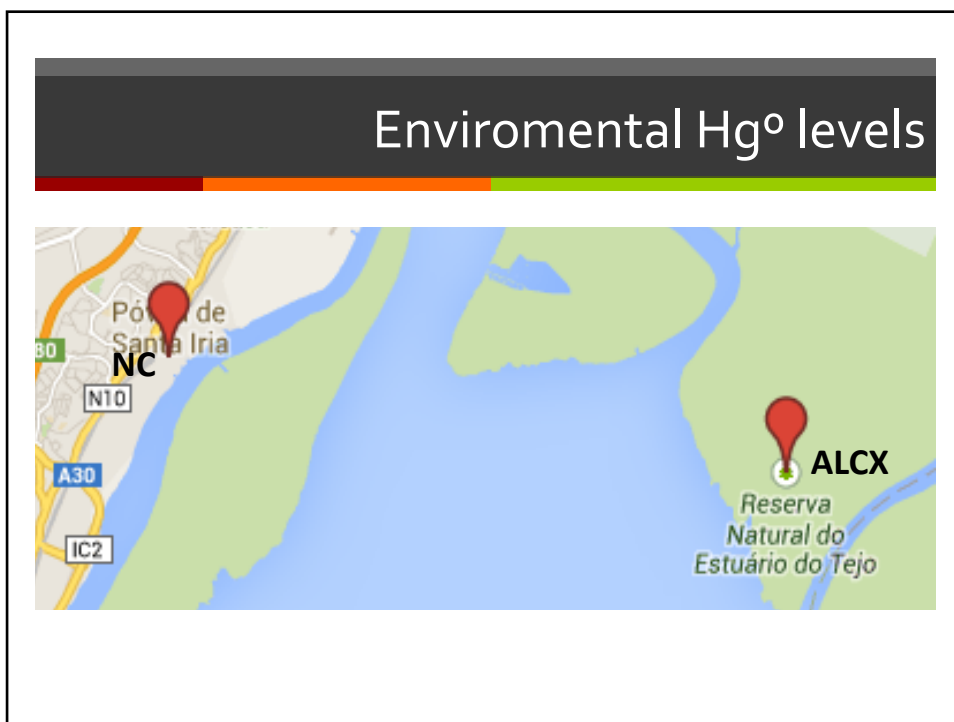
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