Distribution Of Mercury In Ecosystem Components In The Everglades: A Mass Budget Perspective

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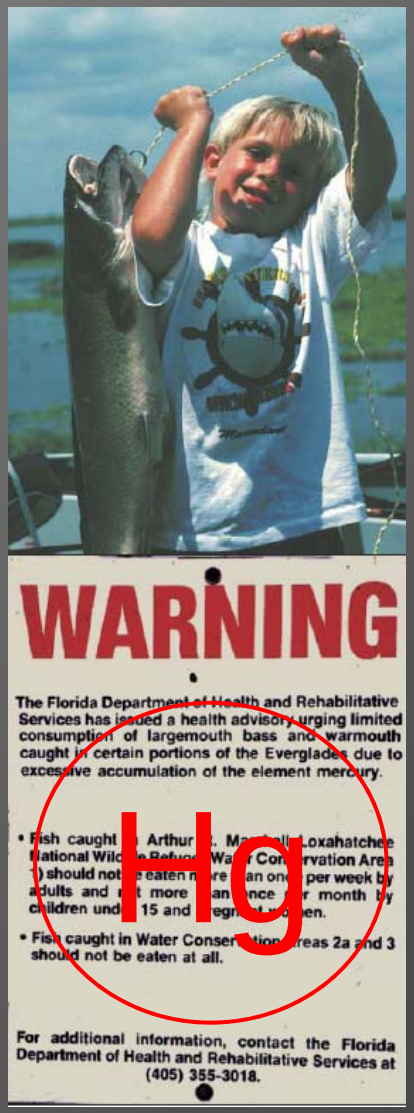
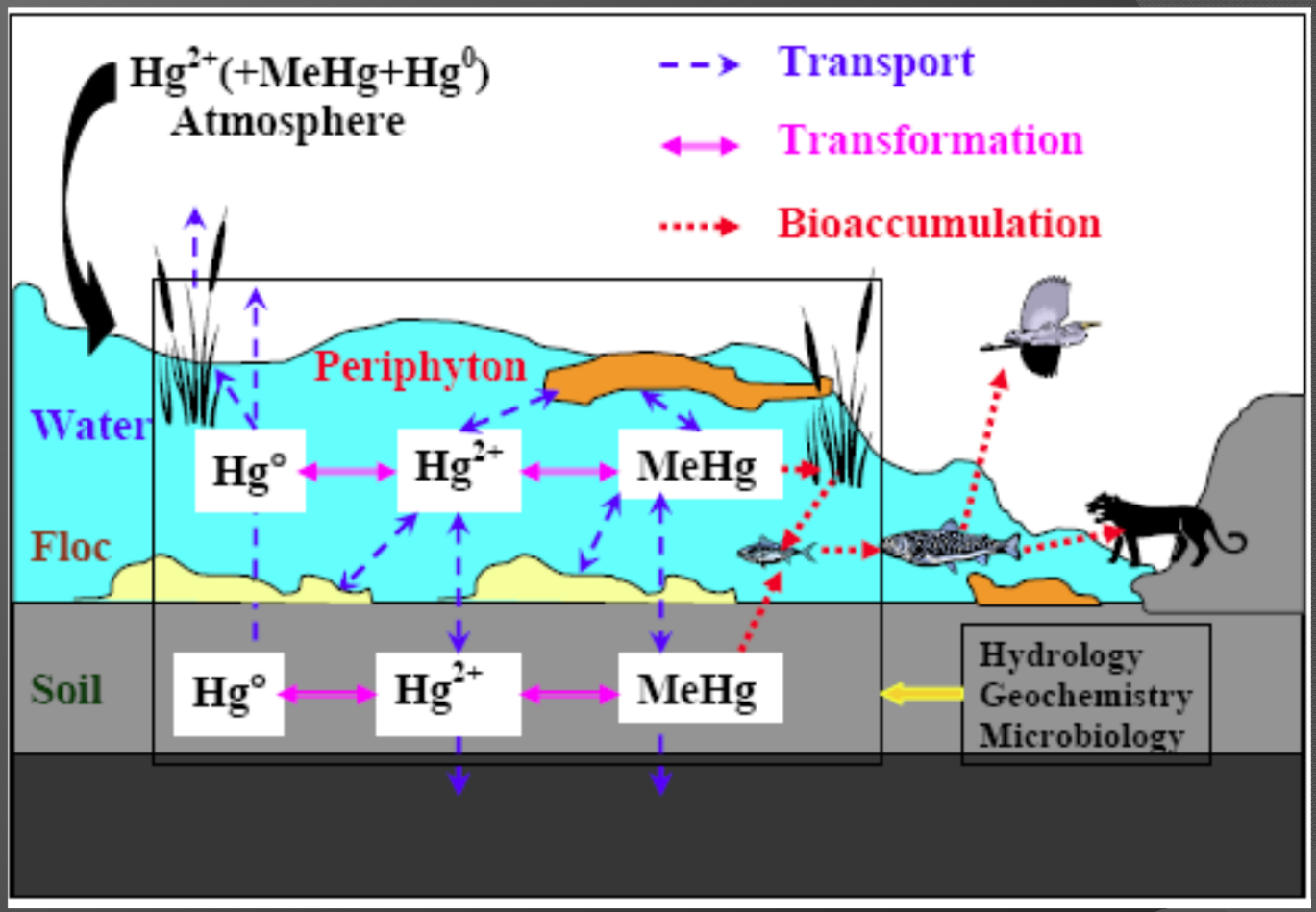
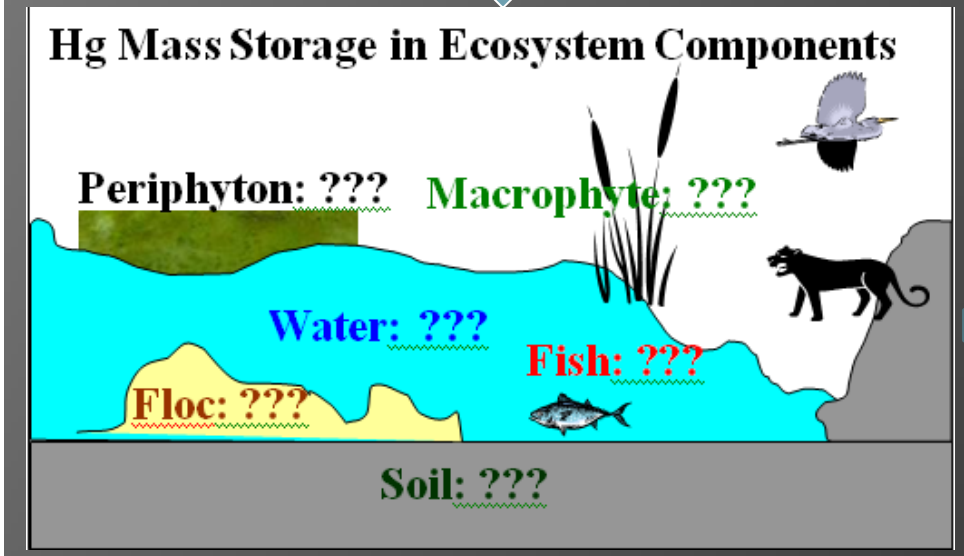
Hg contamination in the Everglades



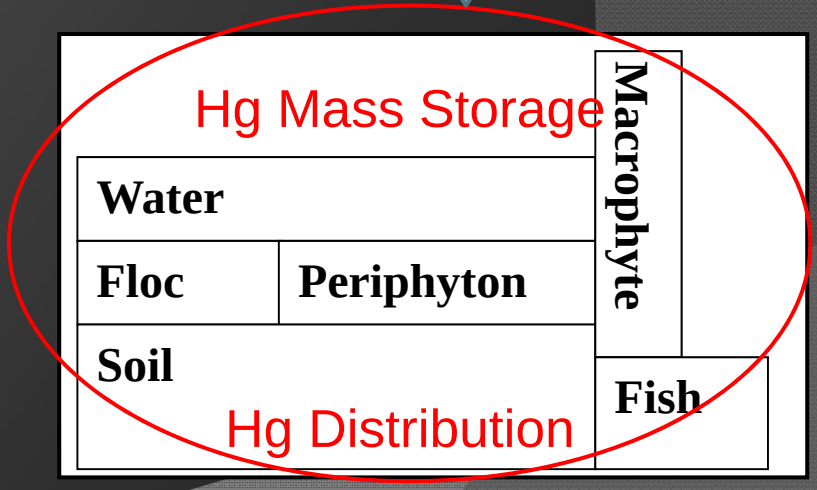
Mercury Cycling in the Florida Everglades



Ecosystem-wide Study



Simplified Model



Regional Environmental Monitoring and Assessment Program (R-EMAP)

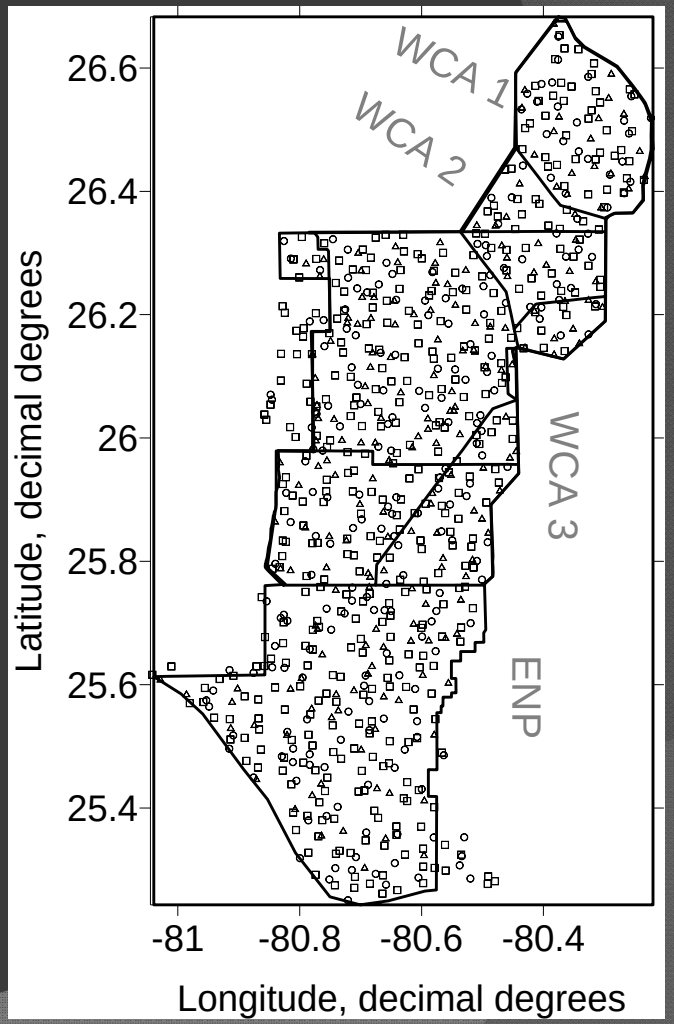
Ecosystem-wide Sampling

Probability Sampling Design

Phase III:
2005

Phase IV:
2013-2014

(Scheidt and Kalla, 2007; Stober et al. 2001)



Hg Mass Storage Calculations

Horvitz-Thompson Theorem

THg concentration

Soil mass

Soil:

$$M_{SD}^{THg} = \frac{\sum_{i=1}^{n} \frac{C_{SD}^{THg}{}_i \times d_{SDi} \times BD_{SDi}}{\pi_i}}{\sum_{i=1}^{n} \left(\frac{1}{\pi_i}\right)} \times A \times 10^6$$

THg mass

Inclusion probability

(Horvitz and Thompson 1952; Stober et al. 2001; Liu et al., 2011)

Hg Mass Storage Calculations

Water:

$$M_{SW}^{THg} = \frac{\sum_{i=1}^{n} \frac{C_{SW\ i}^{THg} \times d_{SW\ i}}{\pi_i}}{\sum_{i=1}^{n} (\frac{1}{\pi_i})} \times A \times 10^{3}$$

Periphyton:

$$M_{PE}^{THg} = \frac{\sum_{i=1}^{n} \frac{C_{PE\ i}^{THg} \times BM_{PE\,i}}{\pi_i}}{\sum_{i=1}^{n} (\frac{1}{\pi_i})} \times A$$

Macrophyte:

$$M_{PE}^{THg} = \frac{\sum_{i=1}^{n} \frac{C_{PE\ i}^{THg} \times BM_{PE\,i}}{\pi_i}}{\sum_{i=1}^{n} (\frac{1}{\pi_i})} \times A$$

Floc:

$$M_{FC}^{THg} = \frac{\sum_{i=1}^{n} \frac{C_{FC\ i}^{THg} \times d_{FC\,i} \times BD_{FC\,i}}{\pi_i}}{\sum_{i=1}^{n} (\frac{1}{\pi_i})} \times A \times 10^{6}$$

Fish:

$$M_{FS}^{THg} = \frac{\sum_{i=1}^{n} \frac{C_{FS\ i}^{THg} \times W_{FS\,i} \times BM_{FS\,i}}{\pi_i}}{\sum_{i=1}^{n} (\frac{1}{\pi_i})} \times A$$

Databases

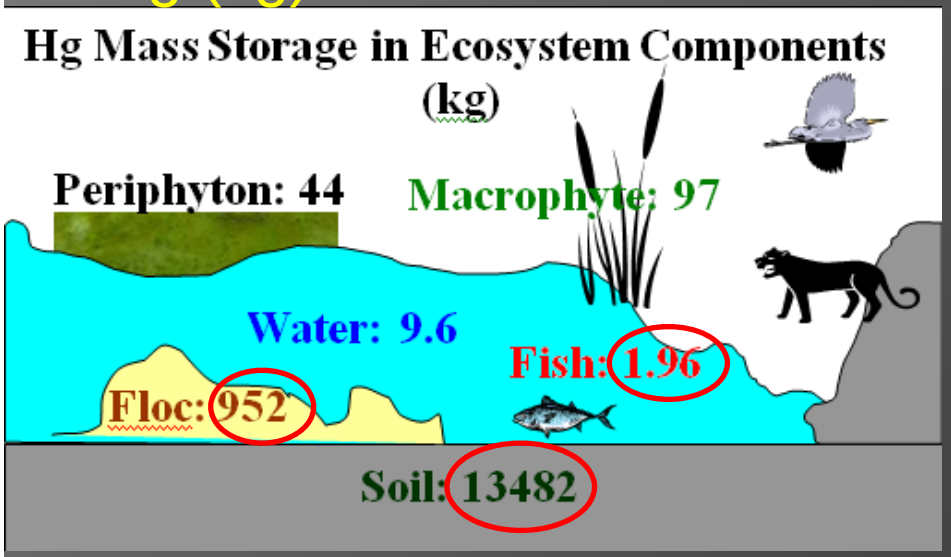
- EPA Everglades R-EMAP
- USGS ACME
- SFWMD DBHRDRO
- Others

(Gaff et al., 2004; Gaiser, 2008; Gilmour et al., 2006; McCormick et al., 1998)

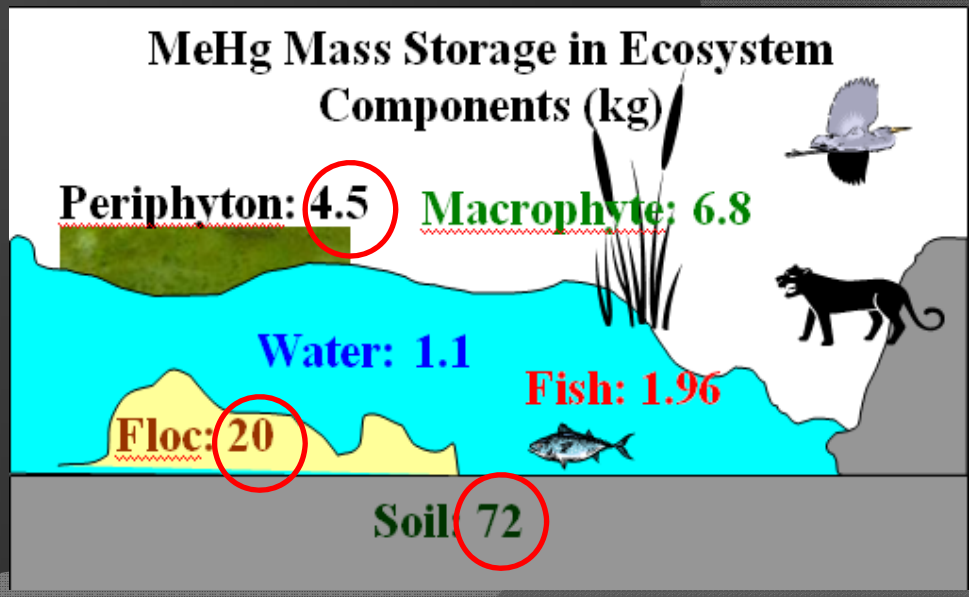
Hg mass storage in the Everglades

THg (kg)

2005



MeHg (kg)

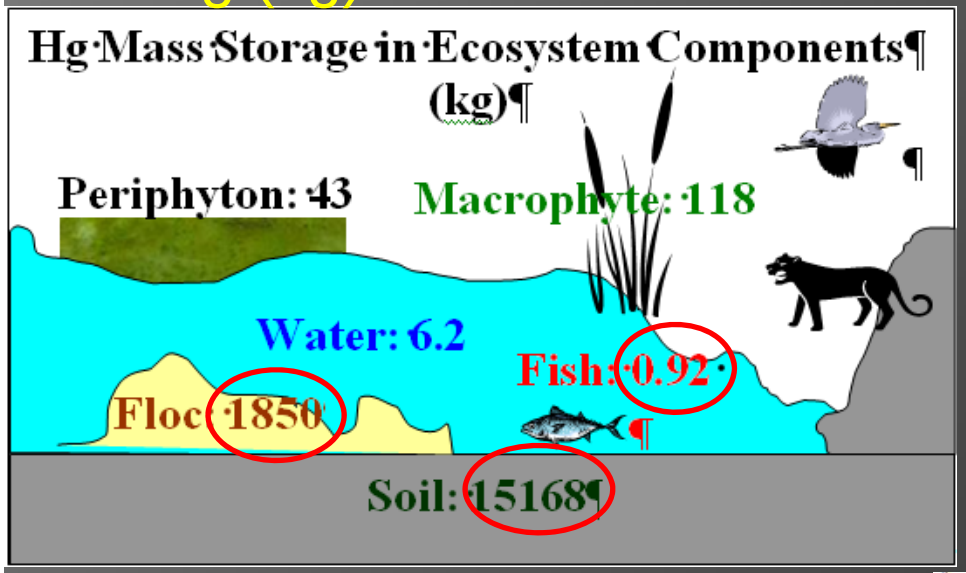


(Liu et al., 2011)

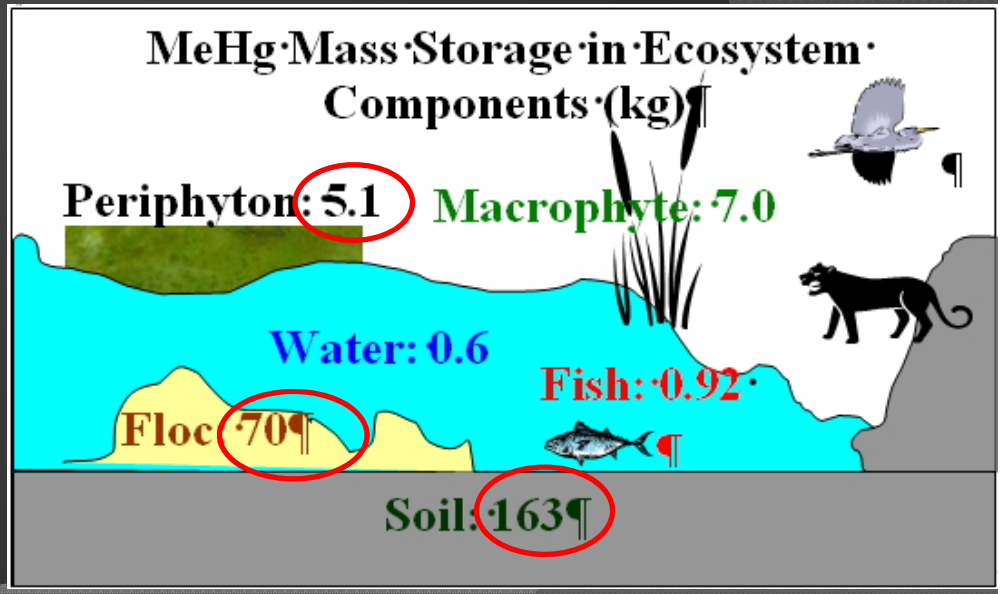
Hg mass storage in the Everglades

THg (kg)

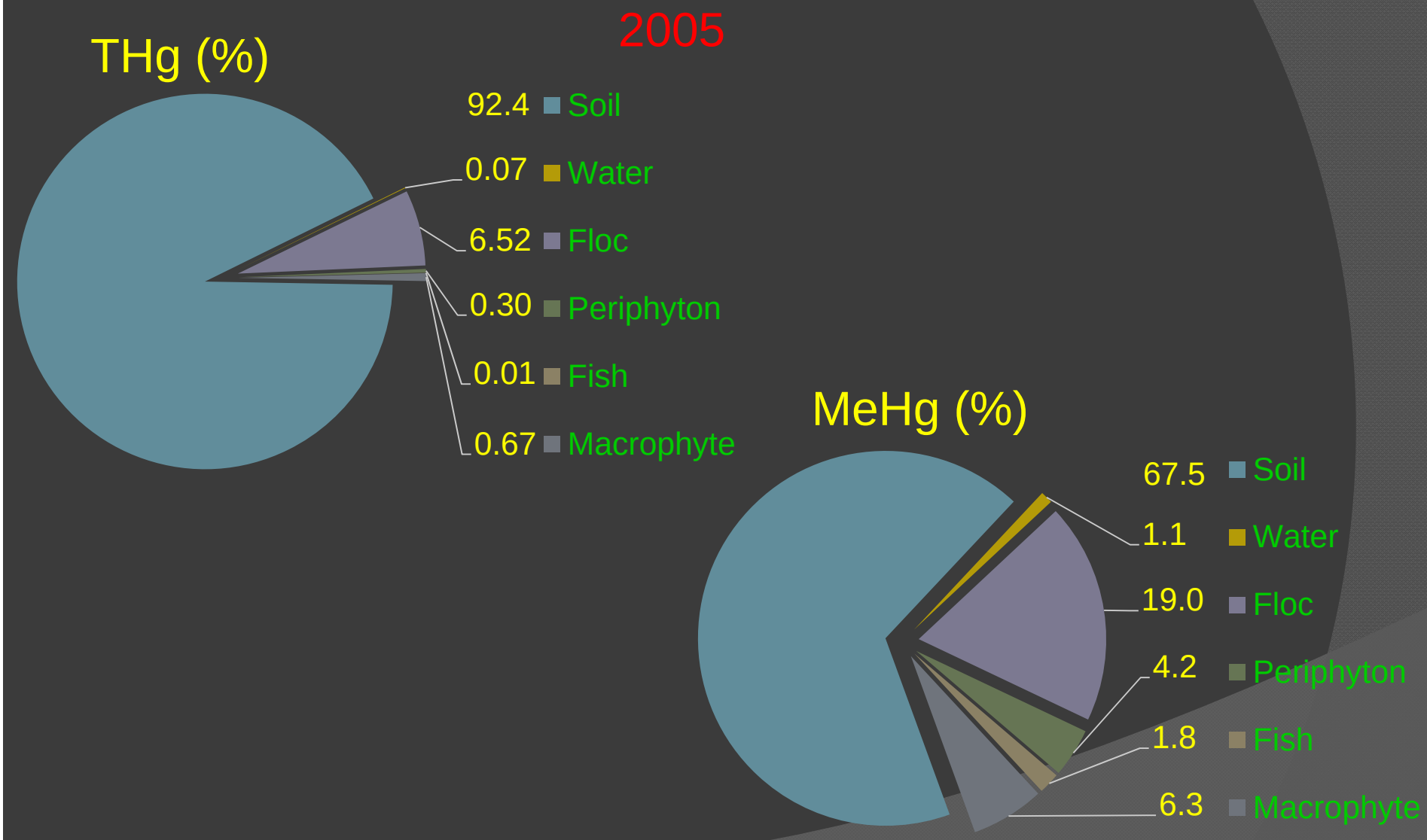
2014



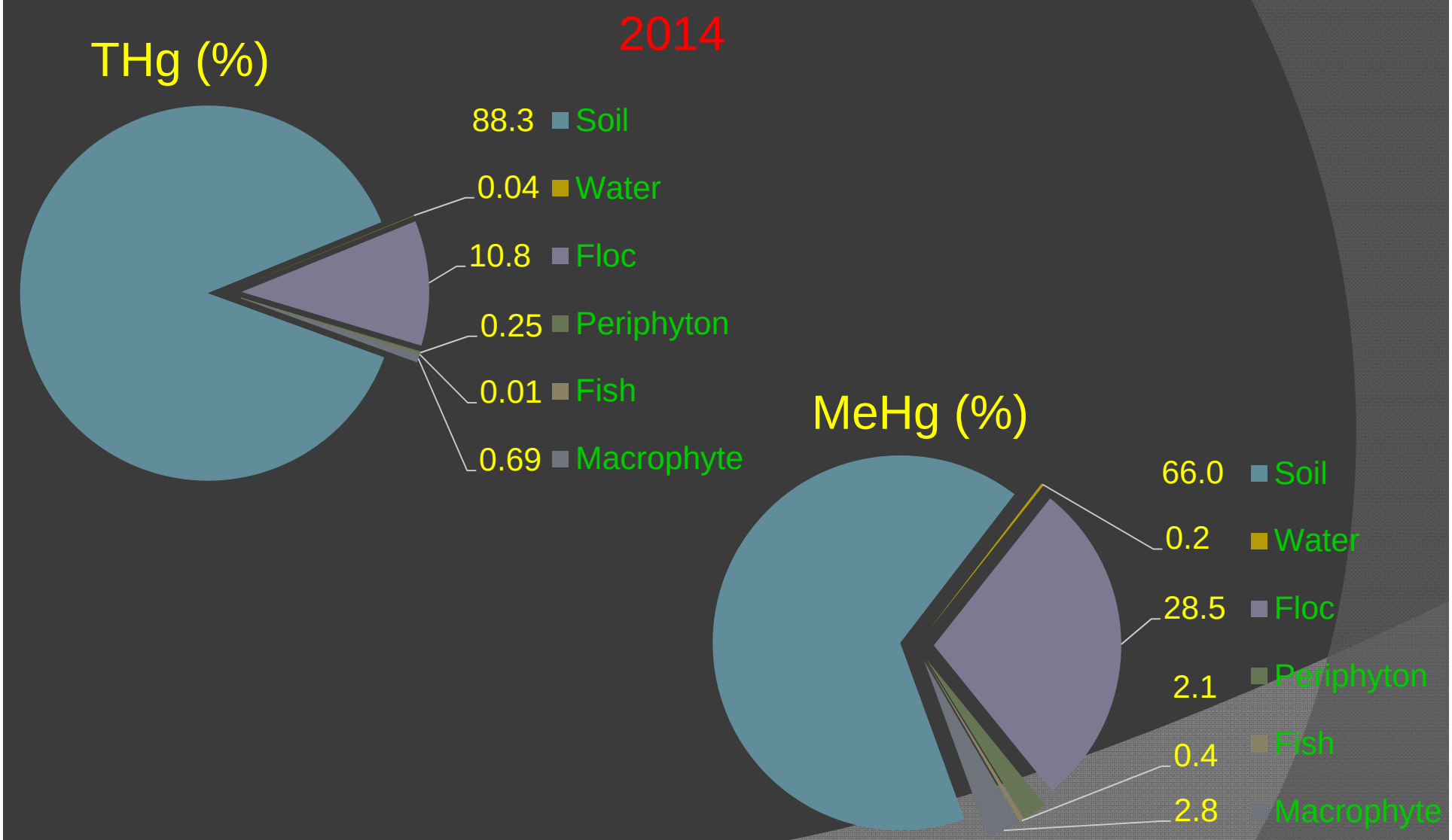
MeHg (kg)



Hg distribution in ecosystem components

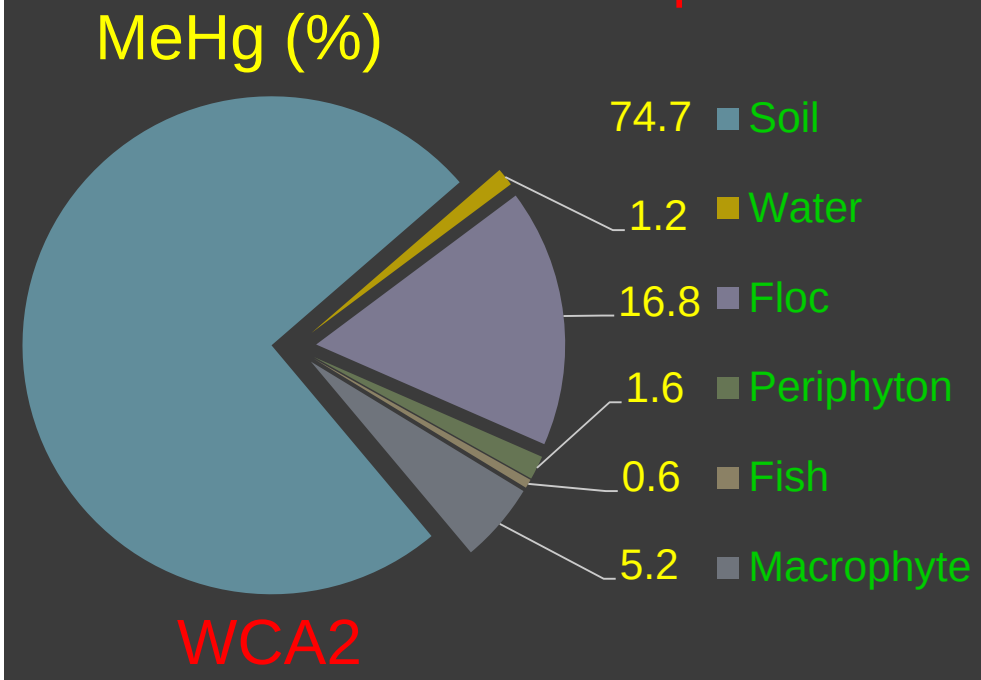


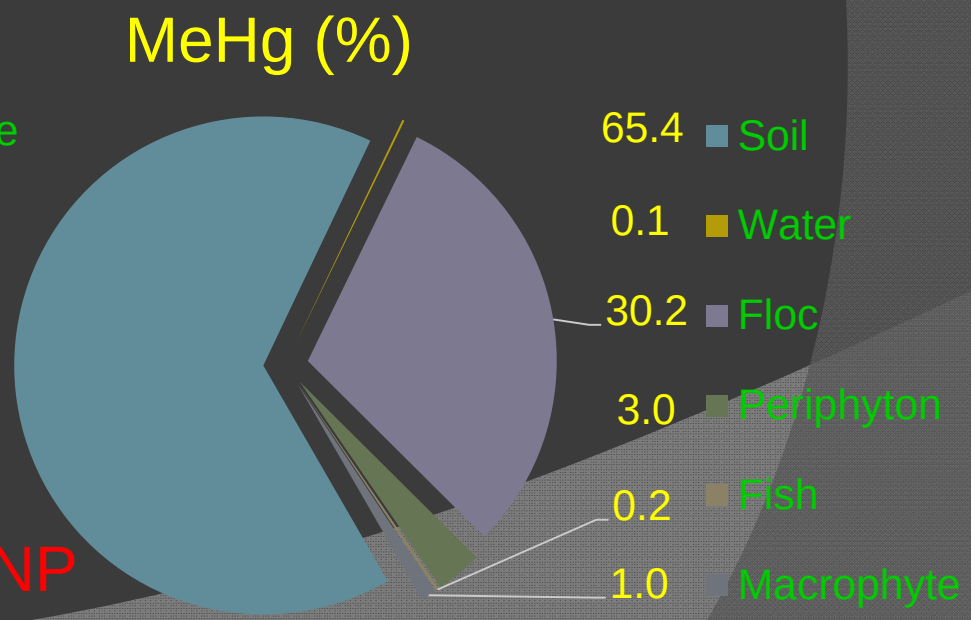
Hg distribution in ecosystem components



Hg distribution in ecosystem components

Spatial differences





Summary

- THg mass: Soil (and floc)
- MeHg mass: Soil, floc, macrophyte, and periphyton
- Hg storage: More complete mass budget of Hg;
  Hg distribution: Implication on Hg cycling and accumulation

Acknowledgements

- EPA Office of Research and Development
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- Florida Department of Environmental Protection