

A Review of Mercury Monitoring and Research Activities in the Everglades, 1995-2008

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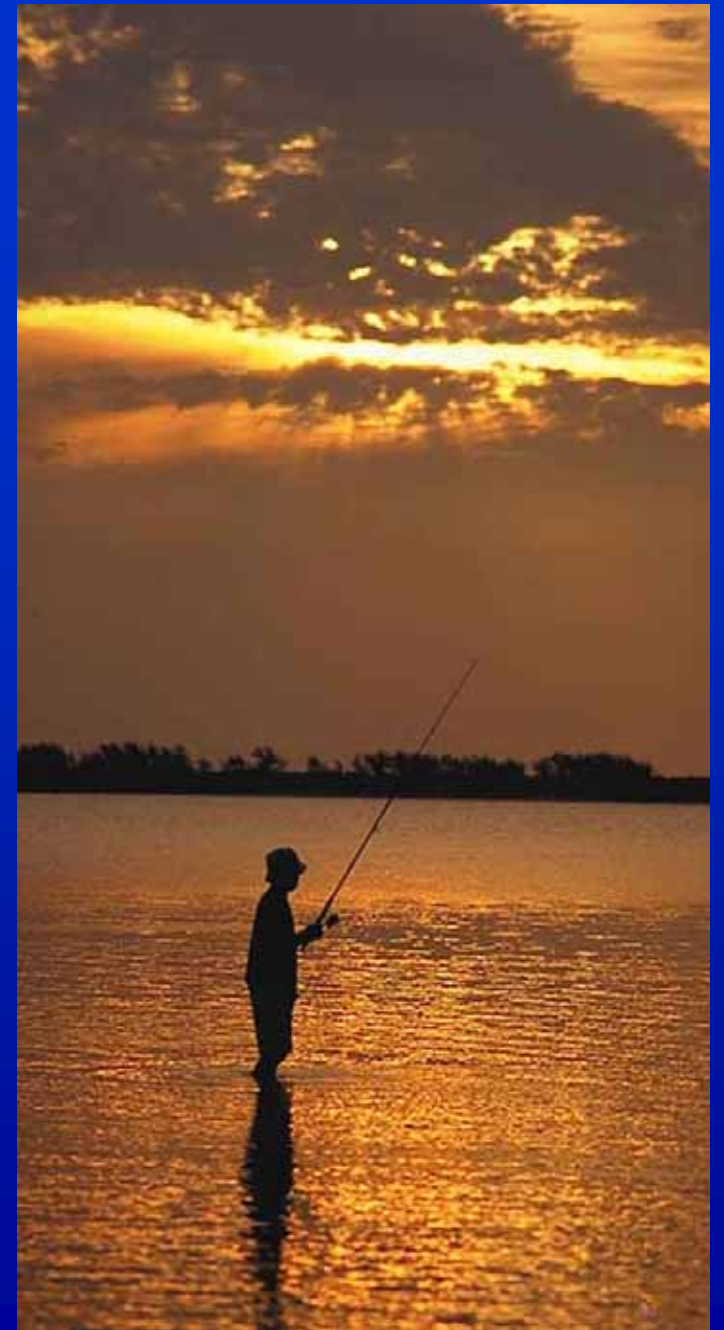
Funding & Support: USGS-PES, NPS USF&WS, USEPA, FDEP, SFWMD

WARNING

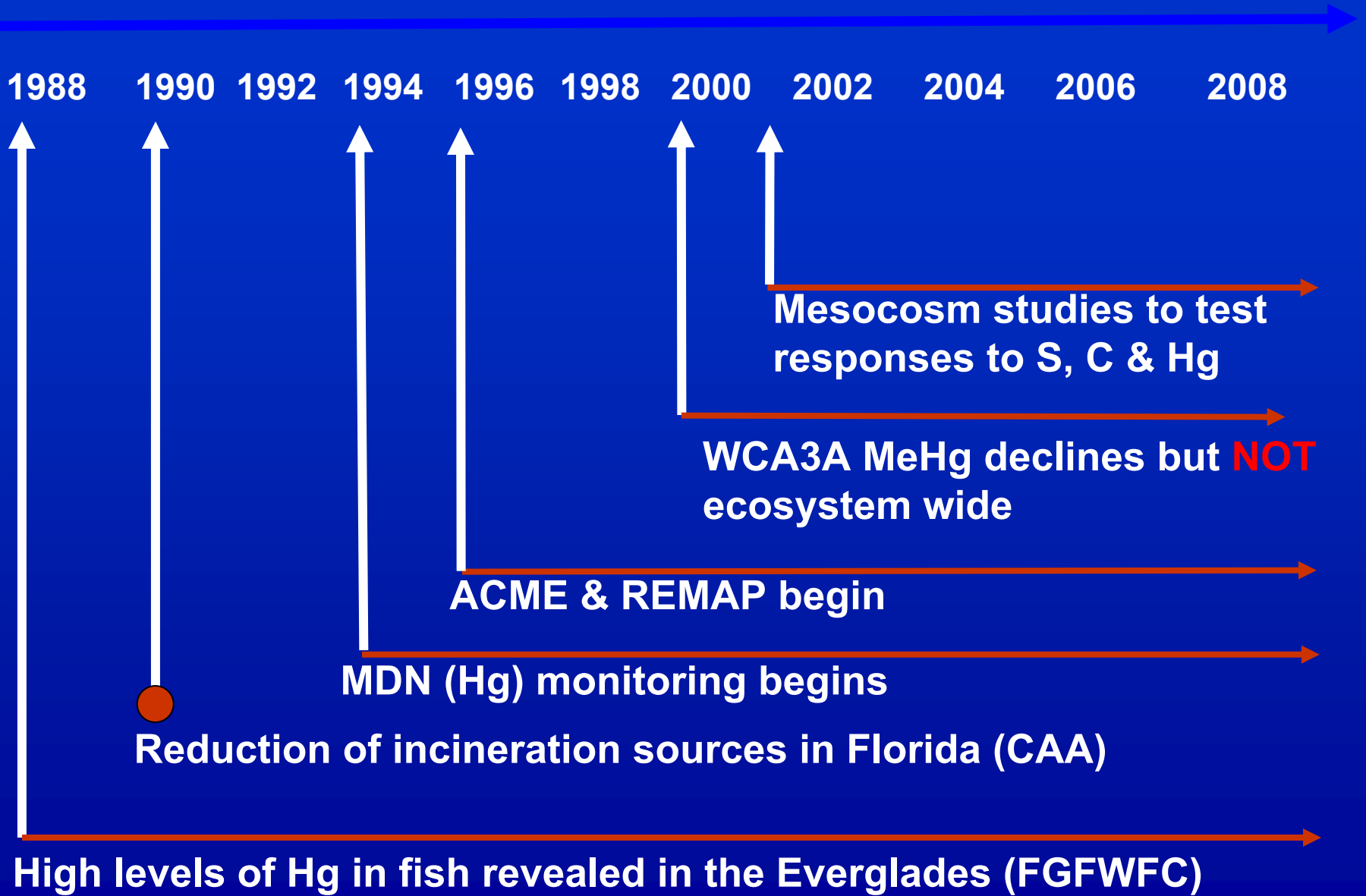
The Florida Department of Health and Rehabilitative Services has issued a health advisory urging limited consumption of largemouth bass and warmouth caught in certain portions of the Everglades due to excessive accumulation of the element mercury.

- Fish caught in Arthur R. Marshall Loxahatchee National Wildlife Refuge (Water Conservation Area 1) should not be eaten more than once per week by adults and not more than once per month by children under 15 and pregnant women.
- Fish caught in Water Conservation Areas 2a and 3 should not be eaten at all.

For additional information, contact the Florida Department of Health and Rehabilitative Services at (405) 355-3018.



South Florida Mercury Timeline



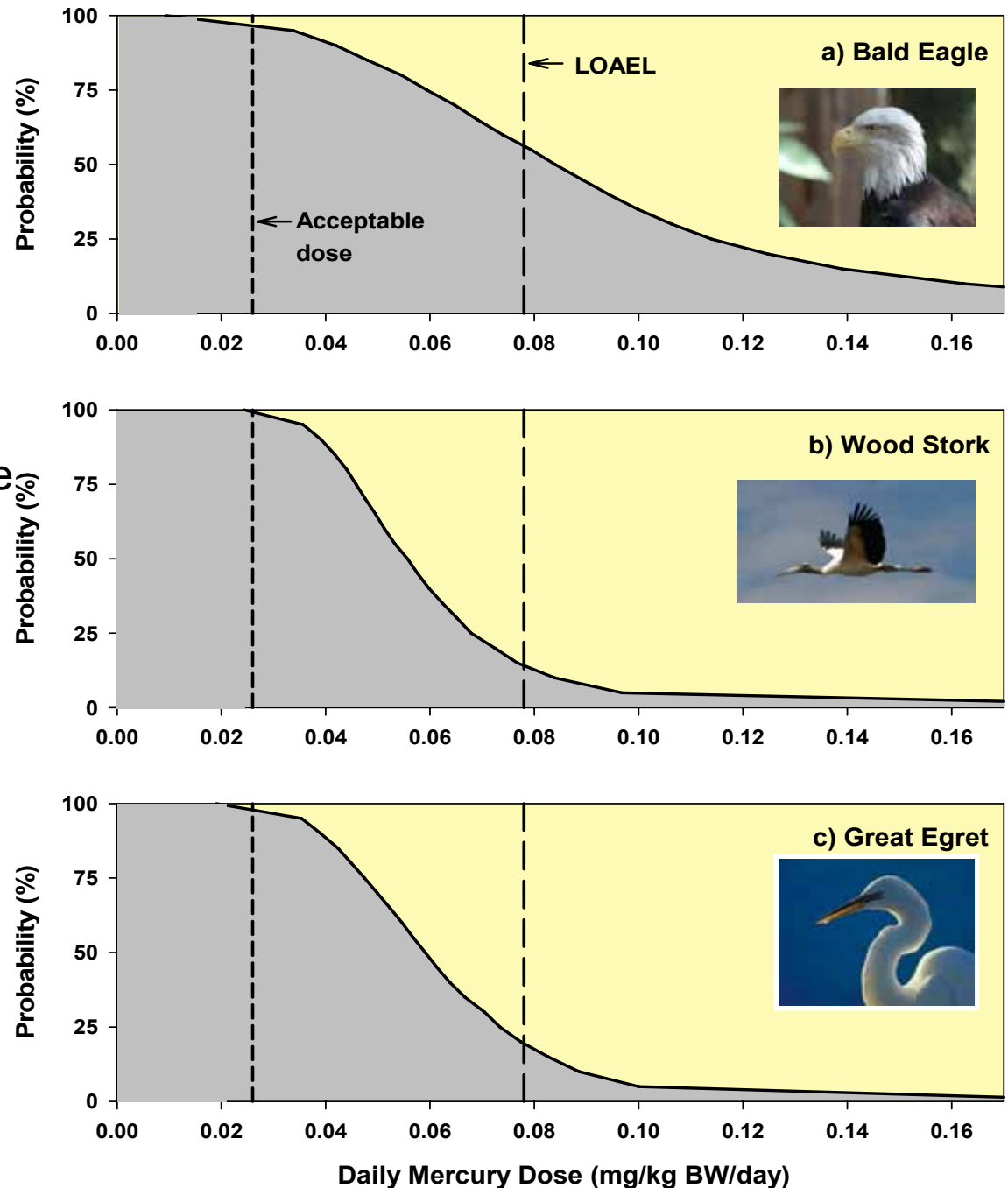
Daily MeHg intake for birds foraging in northern ENP was estimated using Monte Carlo methods and compared to literature-derived effects thresholds.

- 98% - 100% probability that these birds would experience exposures above the acceptable dose

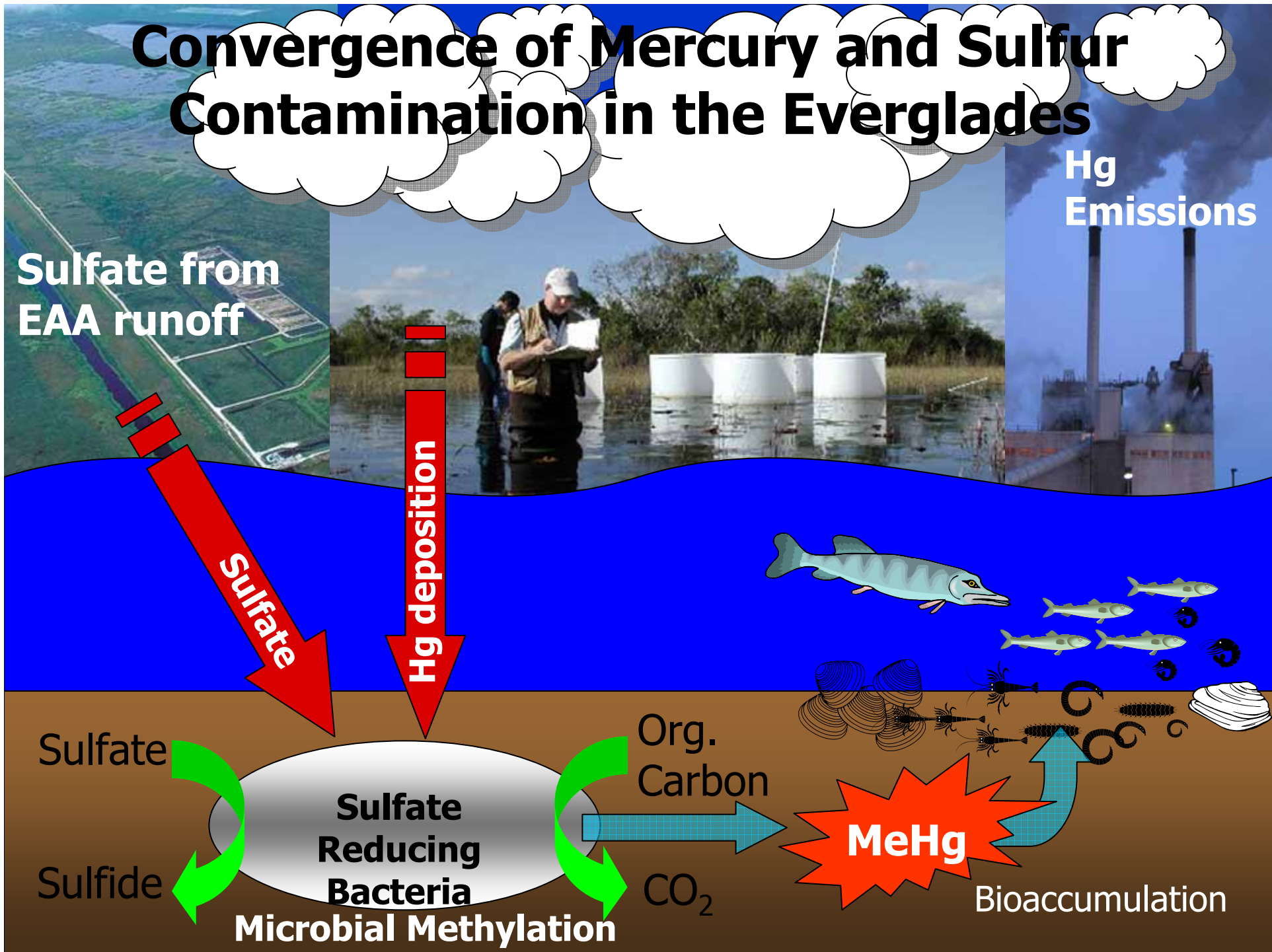
- 14% to 56% probability that exposures would exceed the lowest-observed-adverse-effect level (LOAEL)

- results also raise concerns regarding other wildlife in ENP including the Seaside Sparrow, and panther.

(Rumbold et al. in press)



Convergence of Mercury and Sulfur Contamination in the Everglades



Marsh Sampling 1995-2005

EMAP probability based
design

Phase I Canal = 1993-95

Phase I Marsh = 1995-96

Phase II Marsh = 1999

Phase III Marsh = 2005

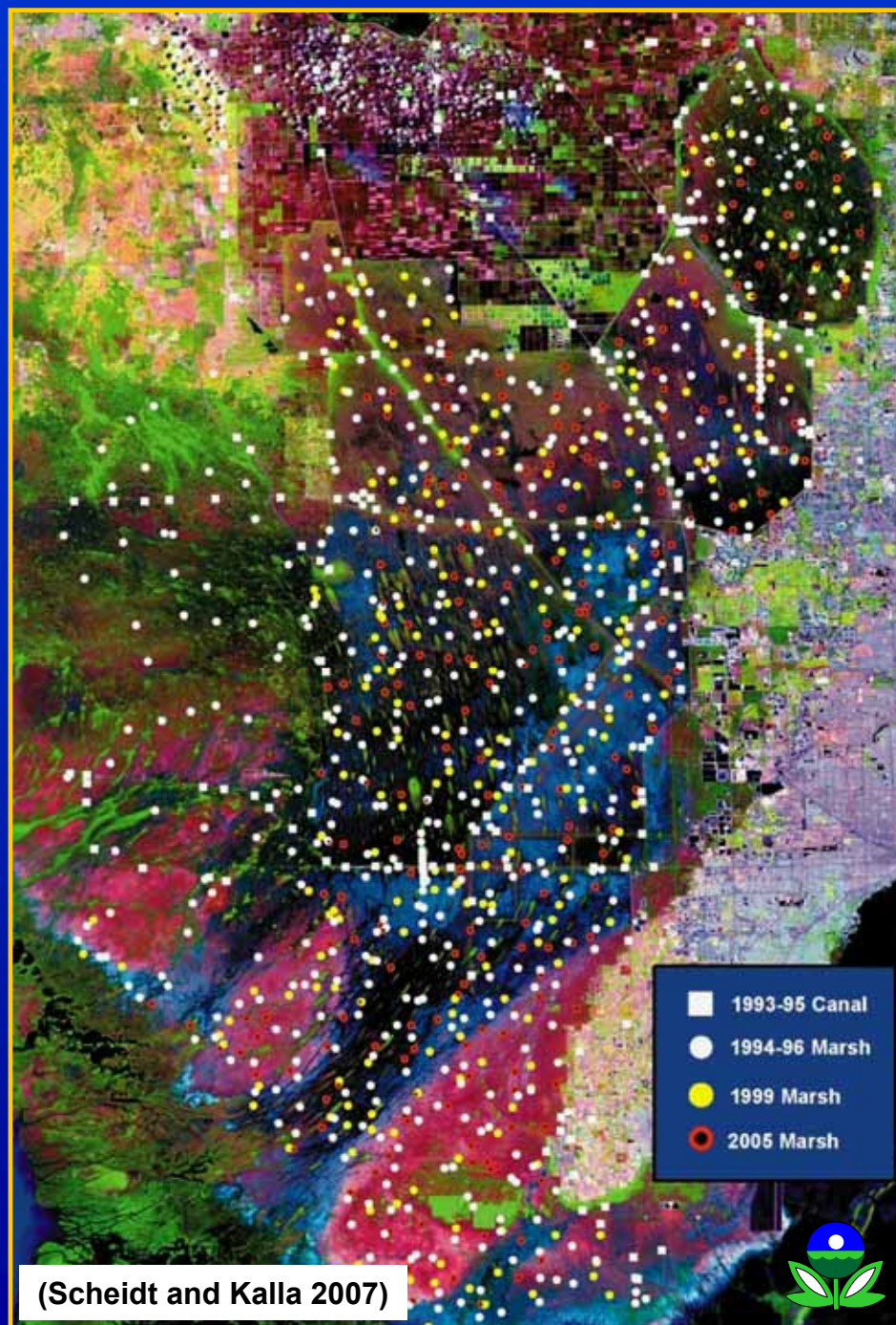
1145 Sample Sites

~100,000 biogeochemical
data values

~\$6M investment to date

Collaborative multi-agency
federal-state effort

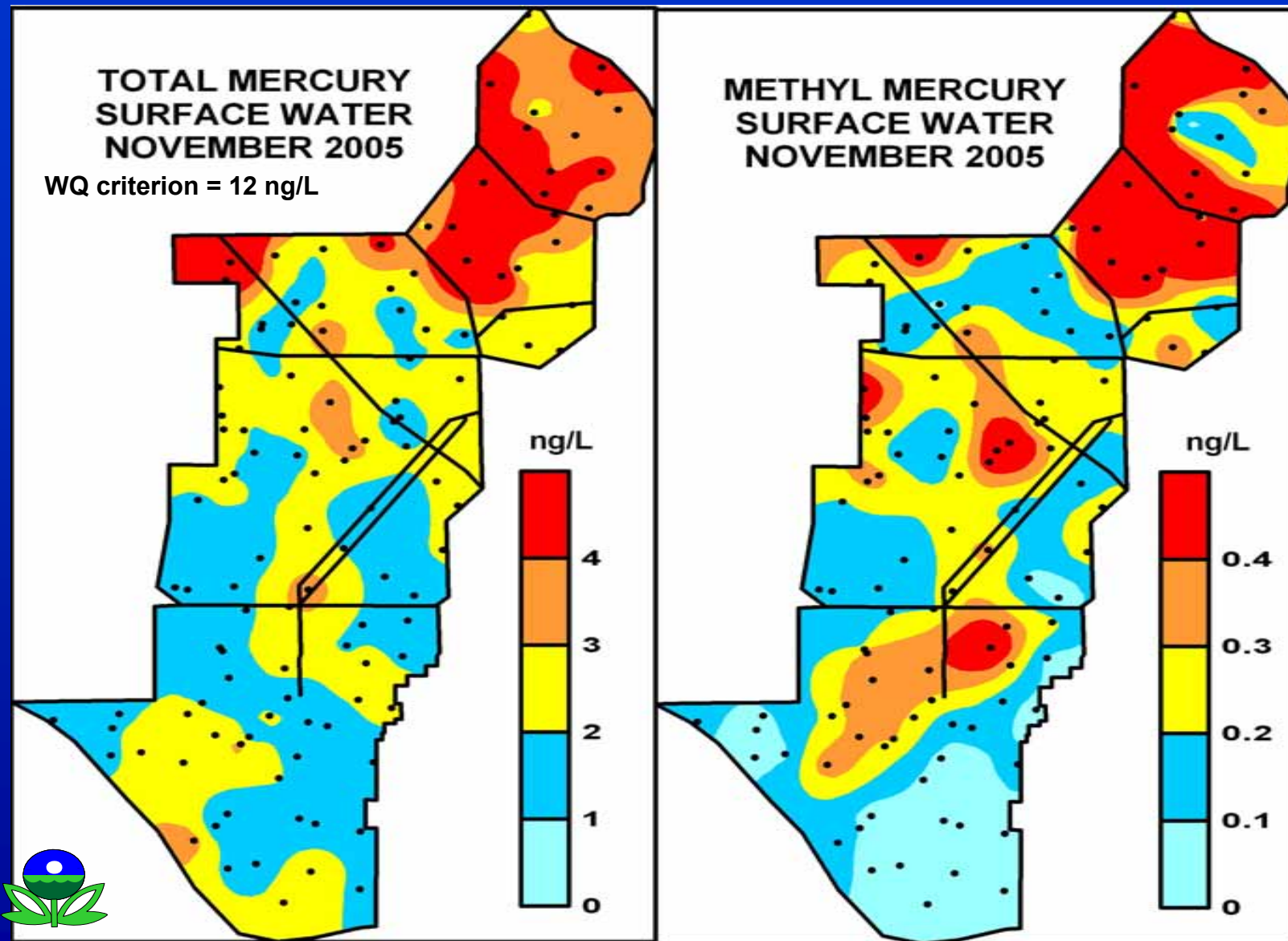
CERP cost ~ \$11 billion



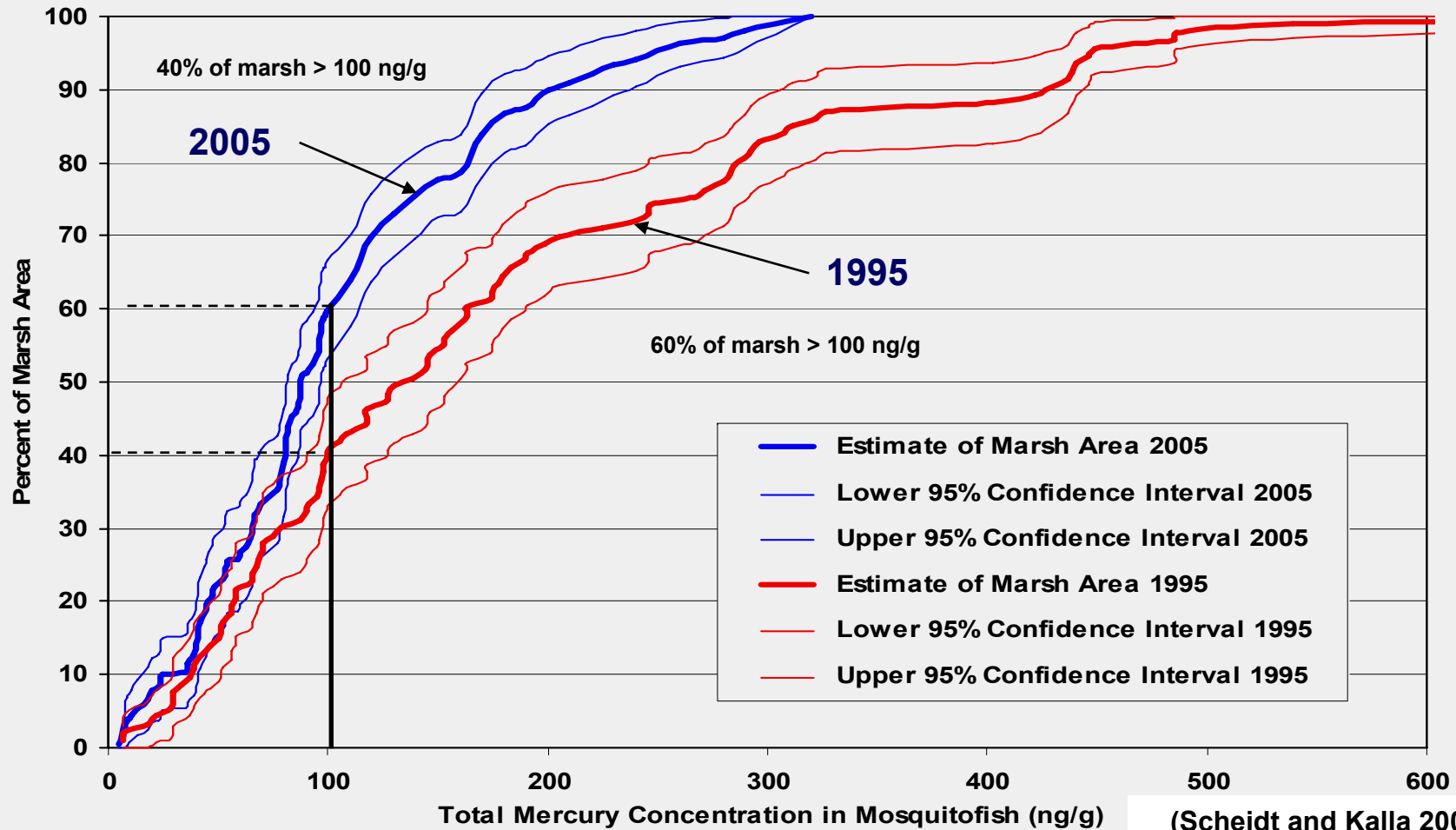
(Scheidt and Kalla 2007)



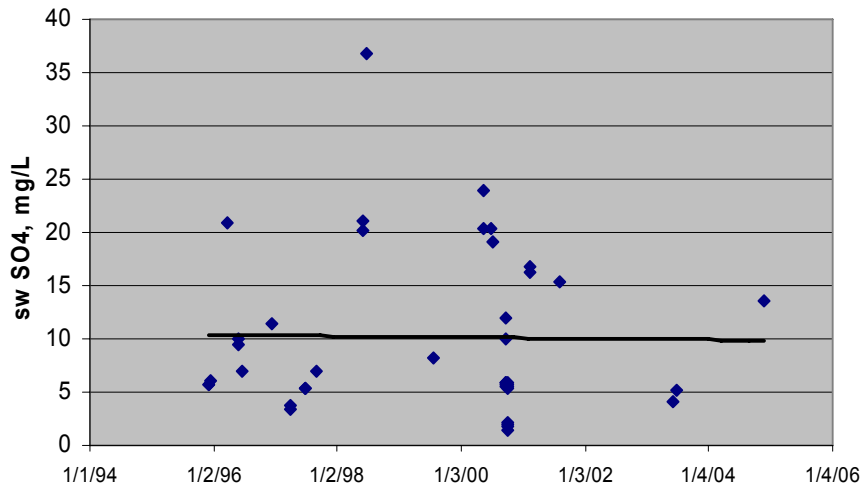
REMAP Everglades Hg and MeHg in Water



Mosquitofish Mercury, 1995 & 2005 (Wet Season)

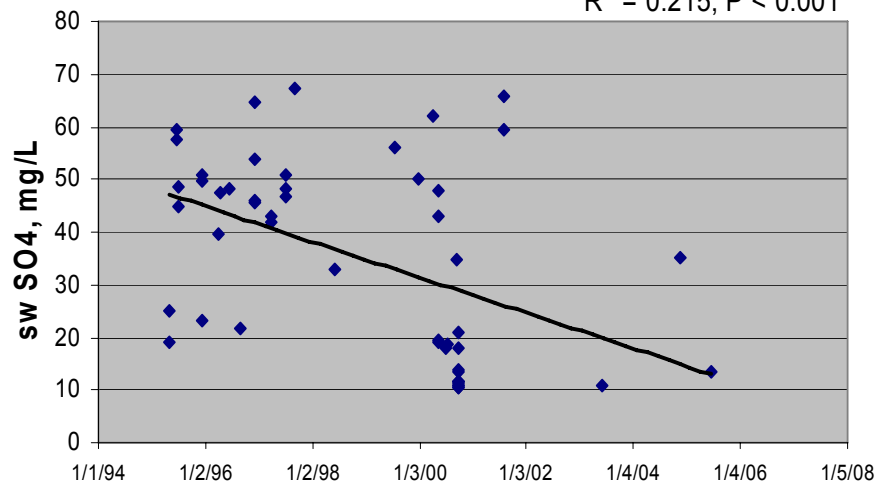


2BS $y = -0.0002x + 15.881$
 $R^2 = 0.0003; P > 0.9$

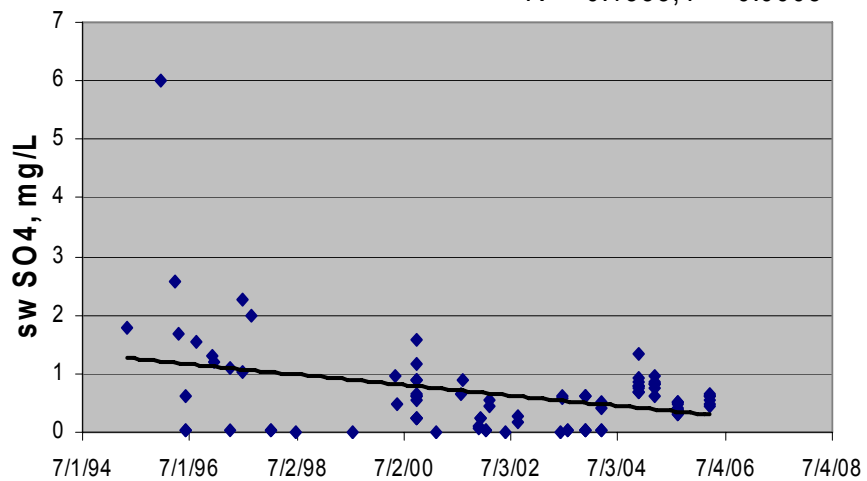


F1

$y = -0.0092x + 368.95$
 $R^2 = 0.215, P < 0.001$

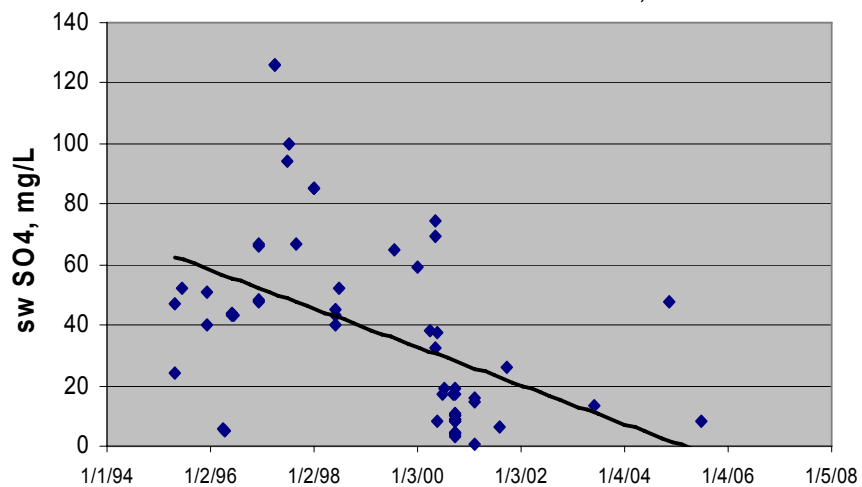


3A15 $y = -0.0002x + 9.7777$
 $R^2 = 0.1333; P < 0.0005$

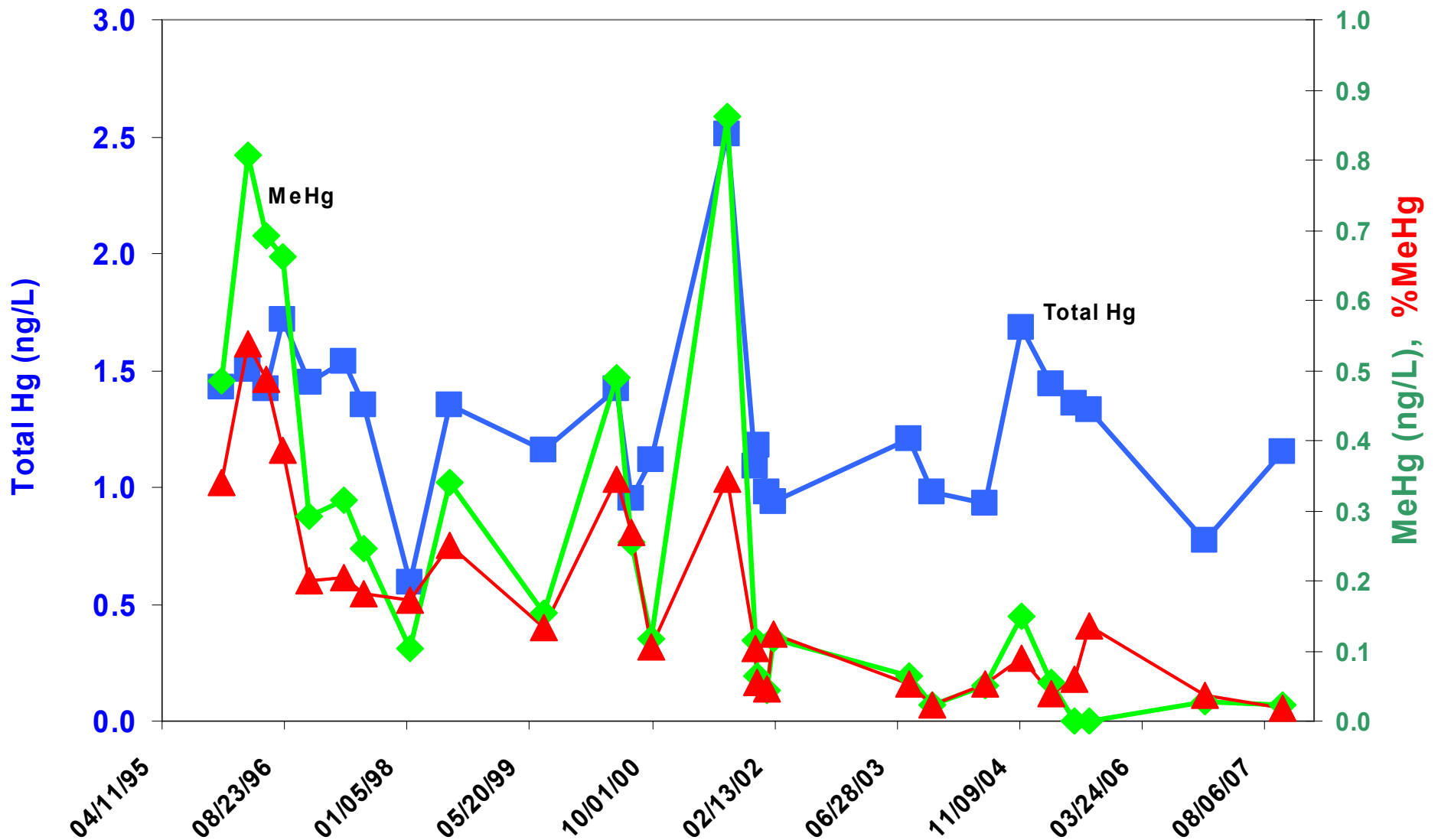


U3

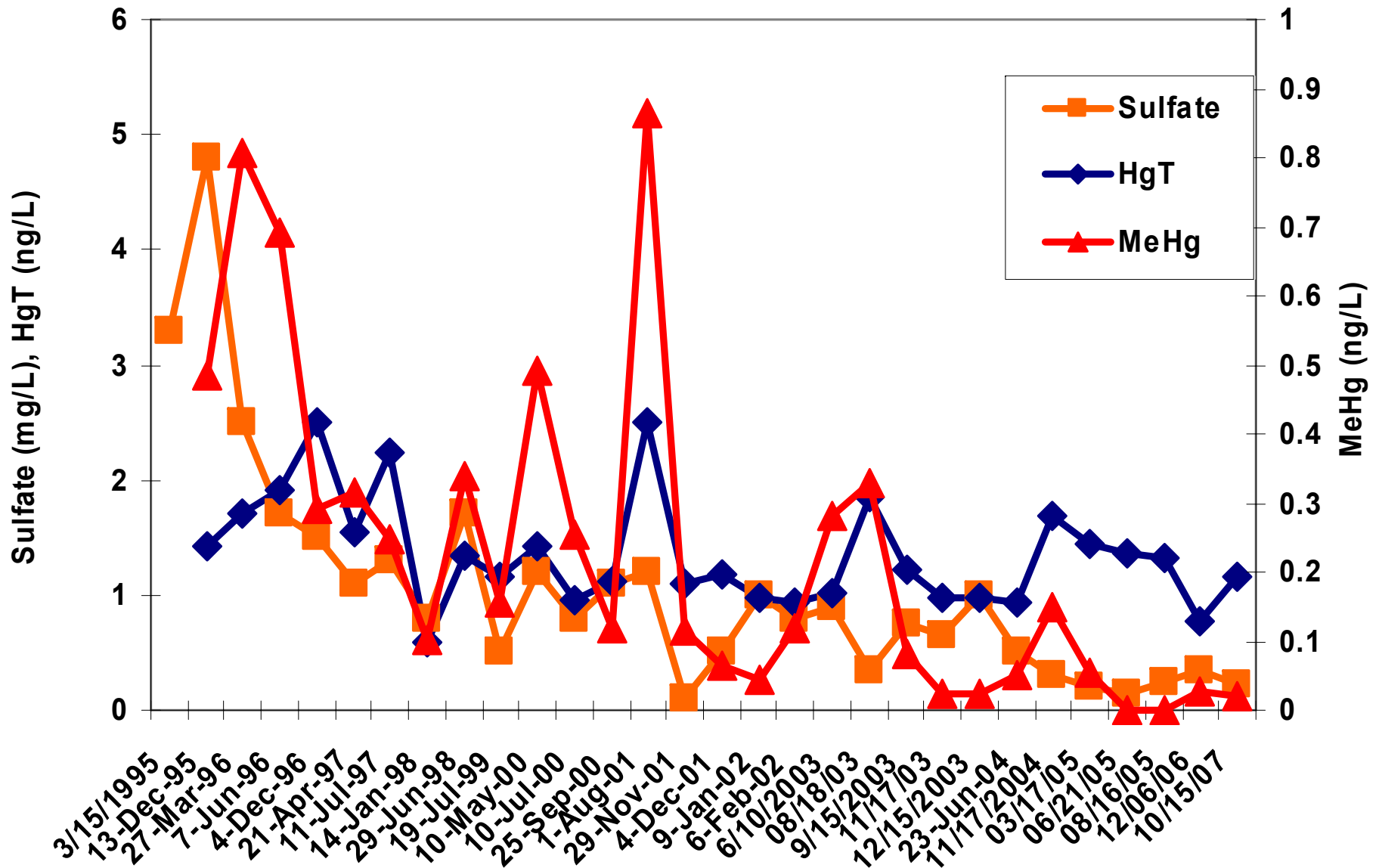
$y = -0.0174x + 667.41$
 $R^2 = 0.2246; P < 0.0002$



Everglades Hg & MeHg Time Series

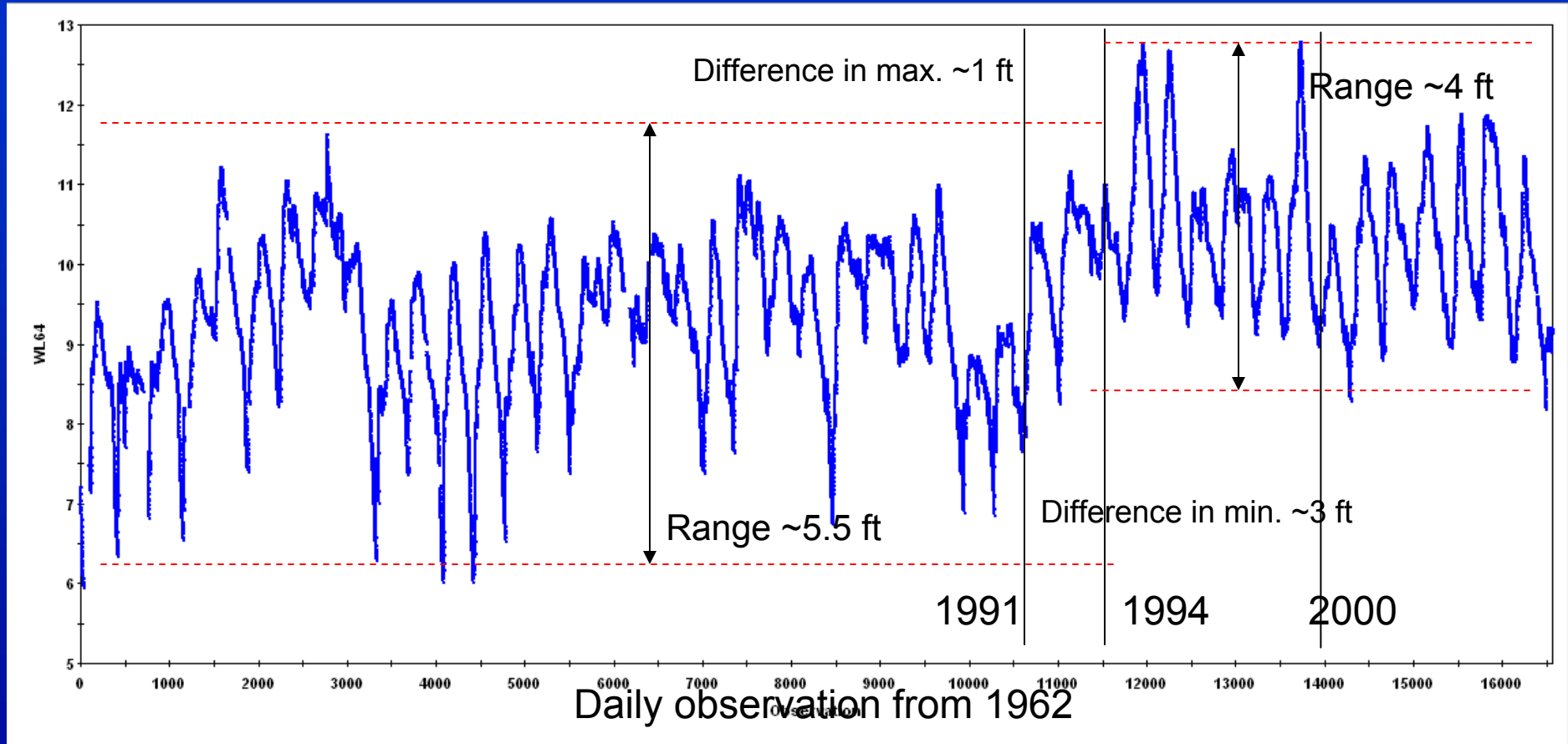


SO₄, MeHg & HgT Time Series

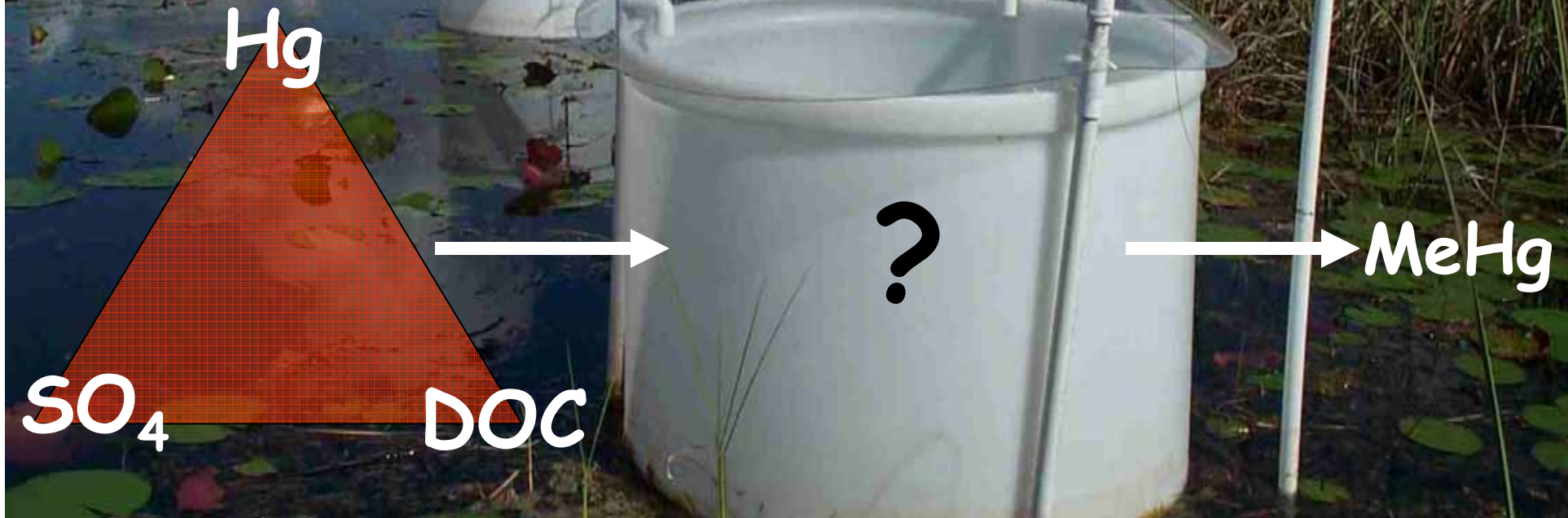


So, what happened with sulfate...?

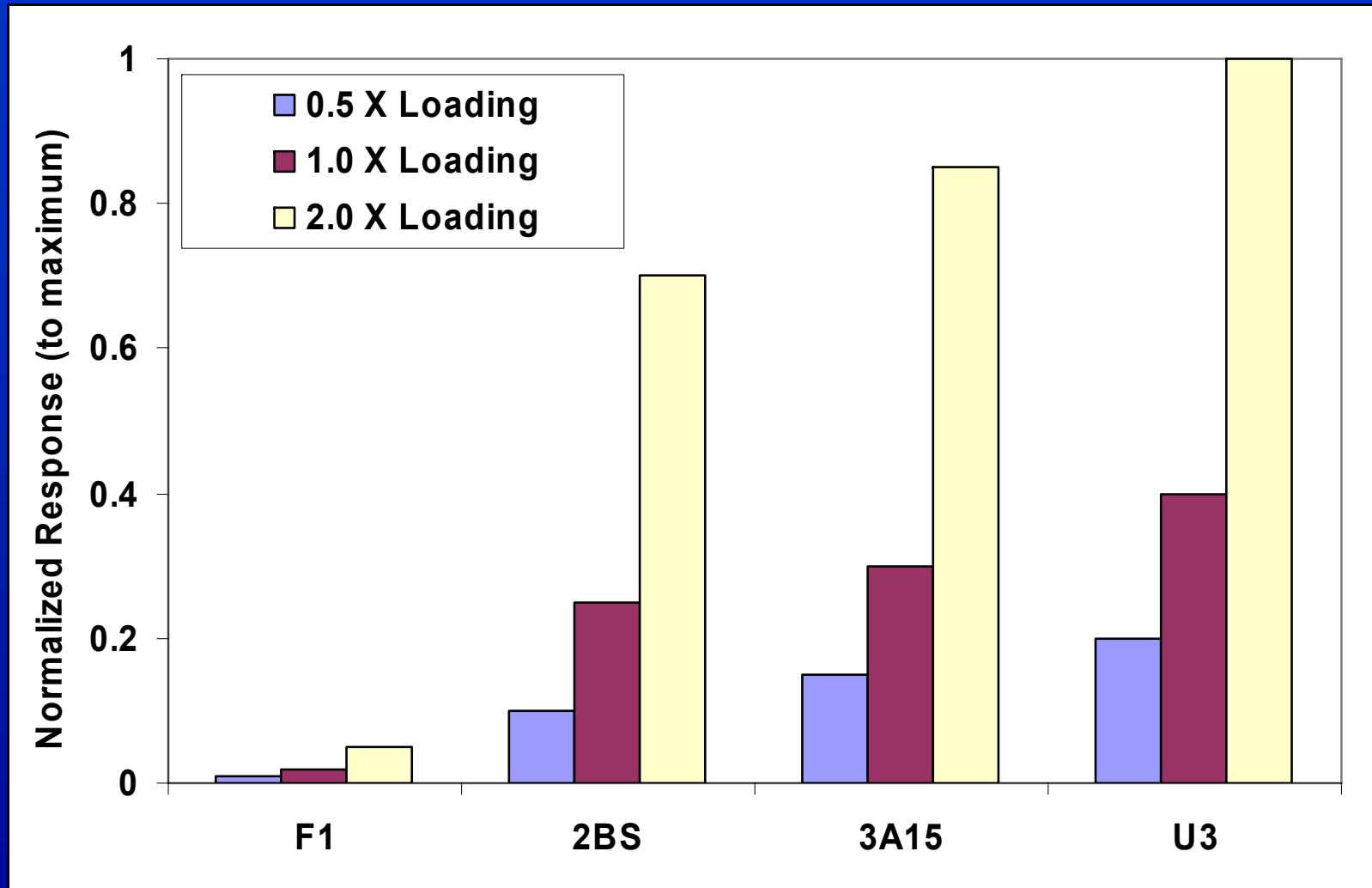
Water levels for WCA3A, 1962-2008



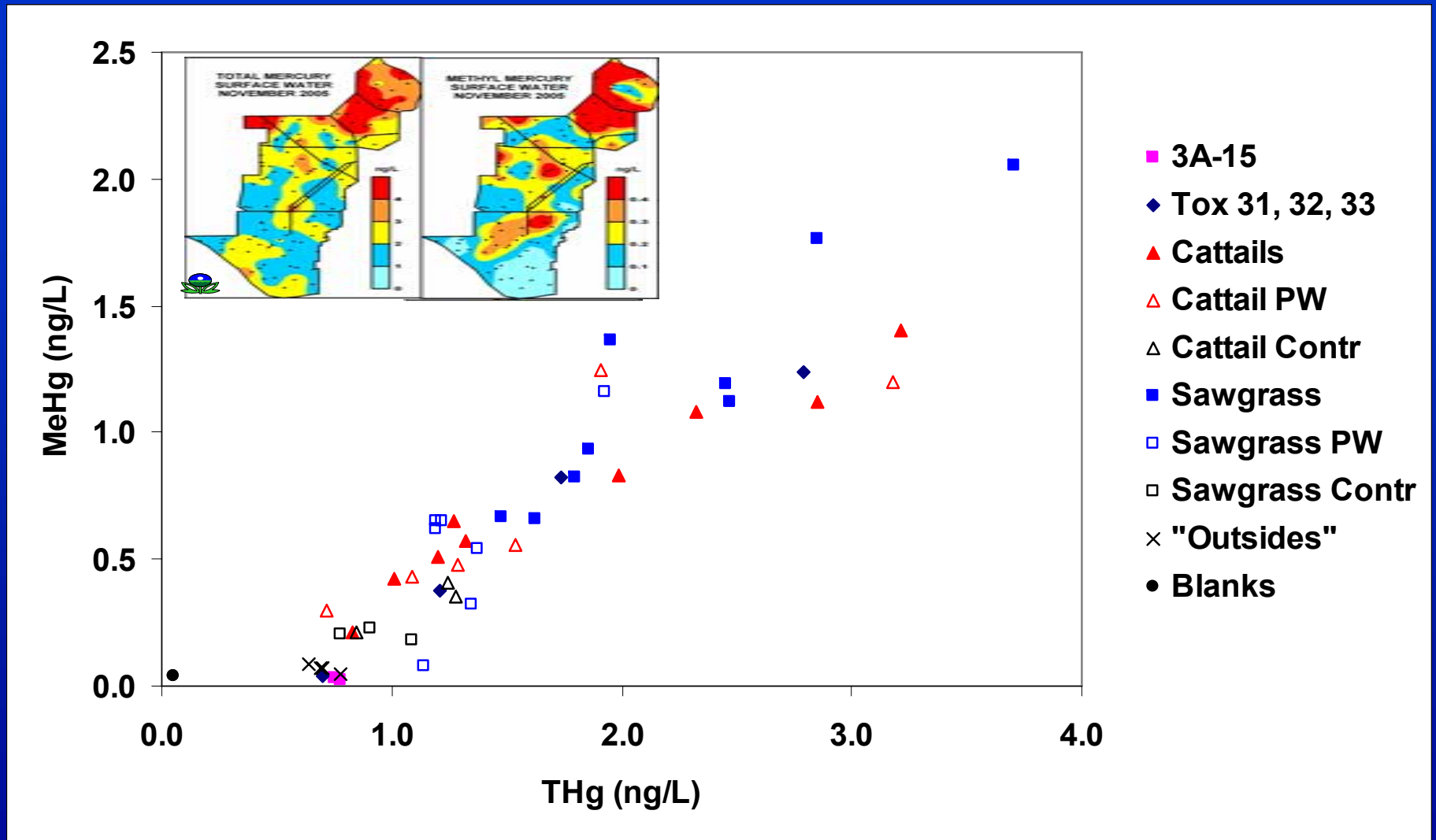
What's driving long-term MeHg levels in the Everglades?

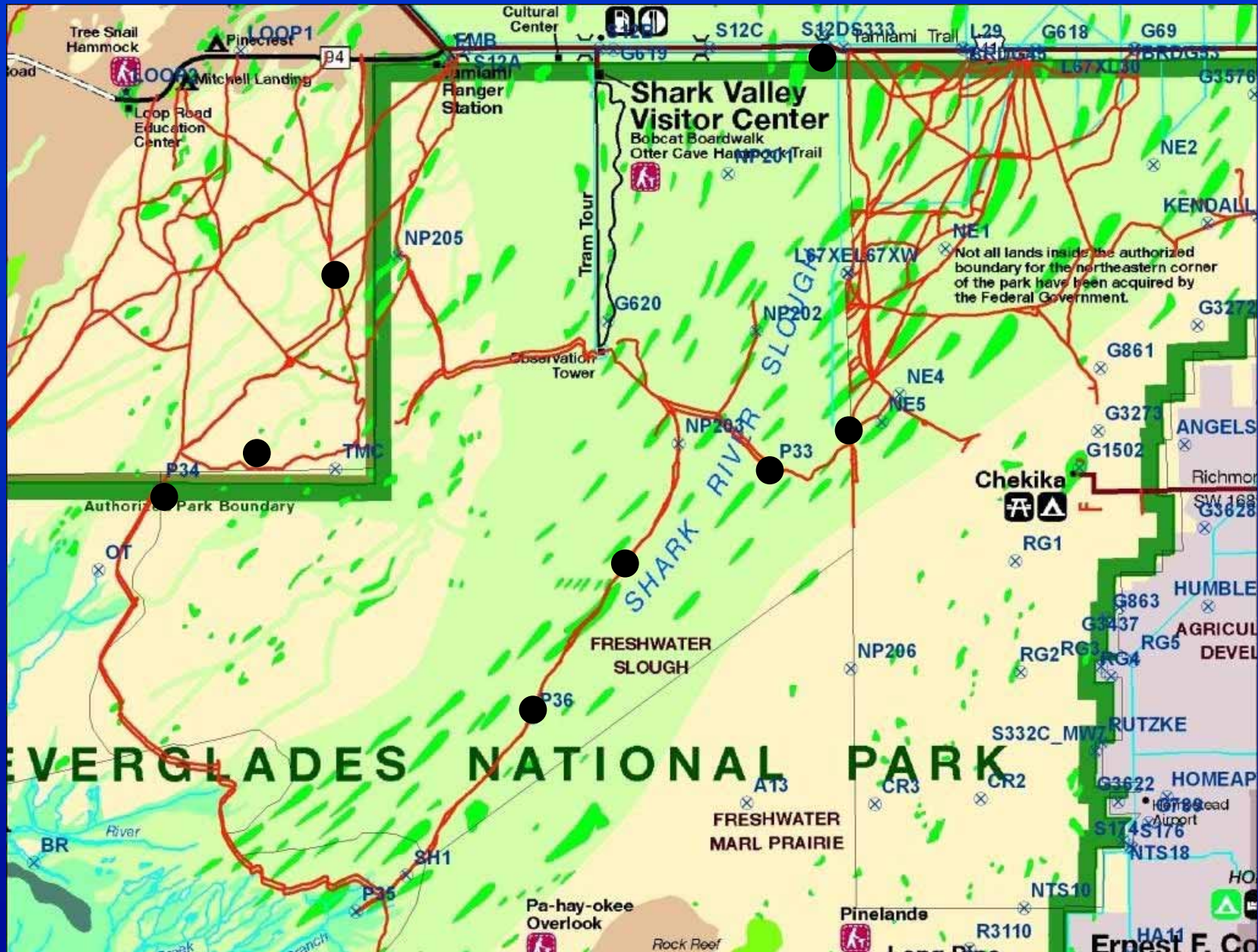


Multi-Site Dose Responses



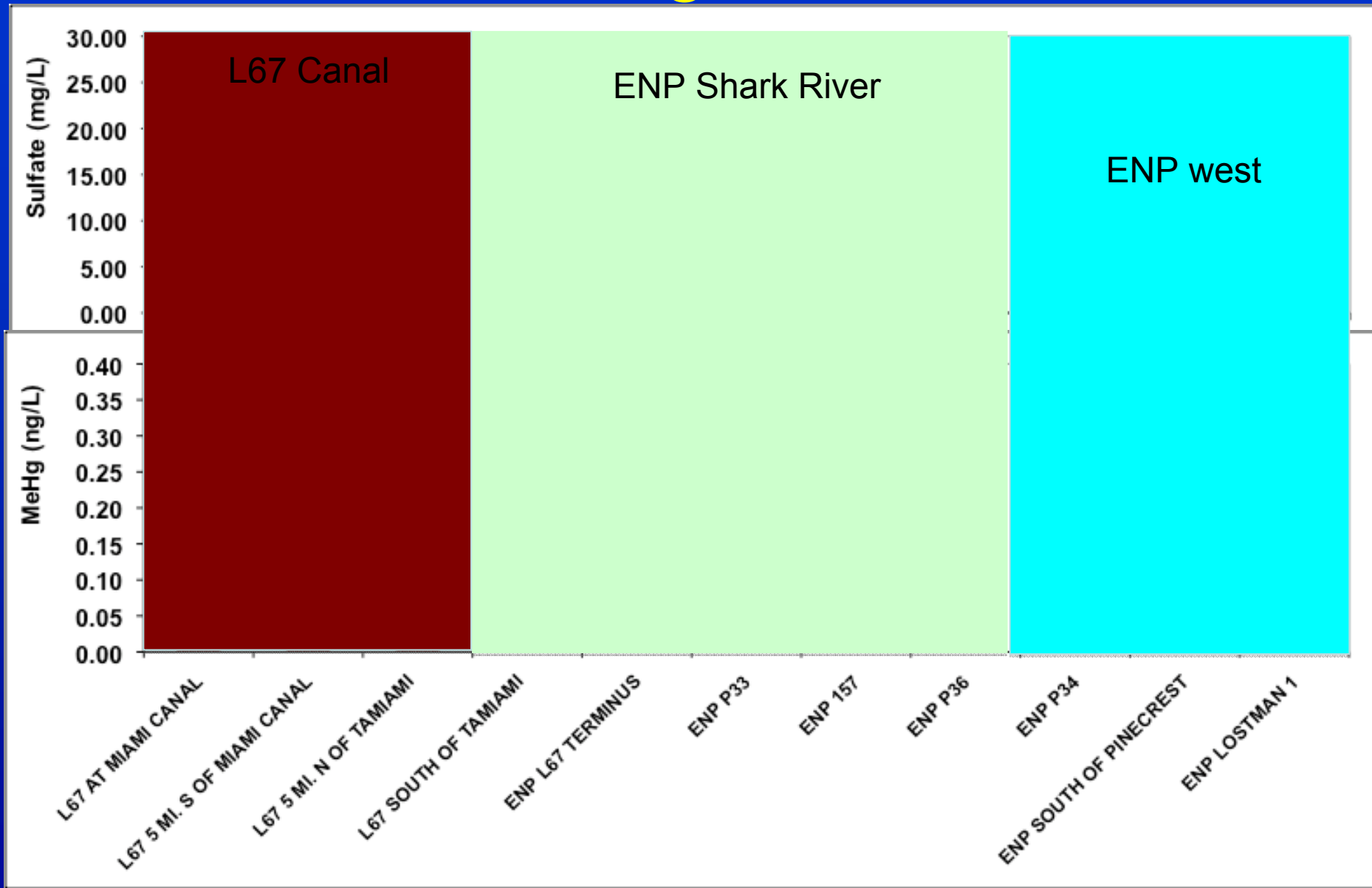
Sorting it all out – the complexities of Hg, S and C



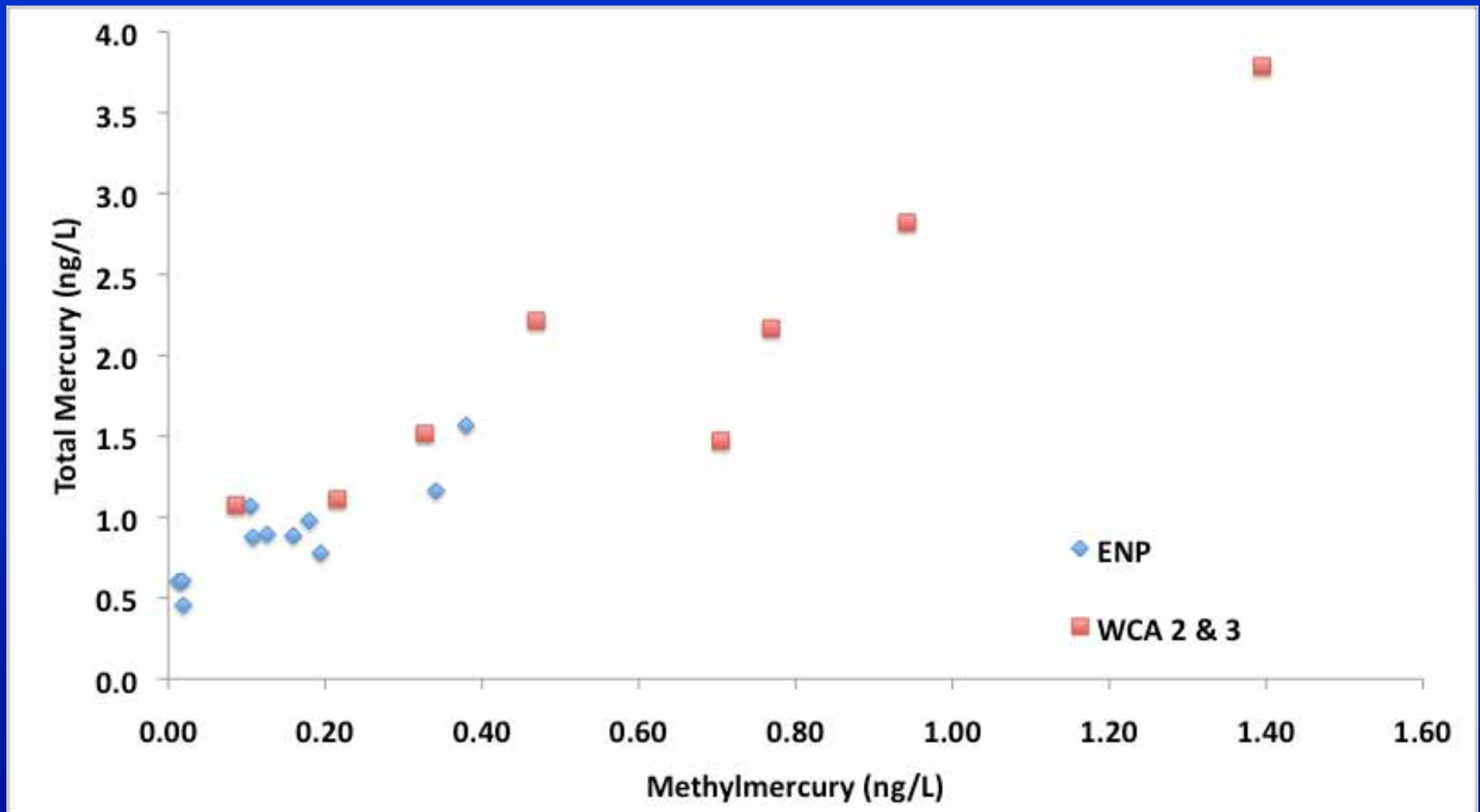


Sampling locations for October 2007 ENP Transect Sampling

Sulfate and MeHg in Northern ENP



Northern ENP vs WCA 2 & 3 Comparison



Summary:

- The Everglades Hg problem arises from the convergence of two contaminant sources (**Hg and sulfate**)
- Ecosystem-wide sample shows elevated MeHg zones that appear to be controlled by sulfate distributions (zones have **not** been stationary over the past 13 years)
- Recent samples from very pristine ENP and BCNP suggest the Everglades has **not always had a mercury problem**
- Fish Hg levels continue to be above safe levels, and the combined information from all the state and federal agency programs is providing a means to understand these trends (**relative to other factors: water quality**) and provide a basis for anticipating future Hg levels (as a result of restoration).
- Although the multi-agency Hg research program in the Everglades has provided much about the controls of MeHg production and bioaccumulation that are applicable across all aquatic ecosystems, equally important have been this programs contributions to the basic understanding of the biogeochemical processes that are critically important to this **sensitive ecosystem.**



Time Series for Mercury Deposition in South Florida 1993-06

