

Temporal and Spatial Characteristics of Mercury Contamination in the Everglades during the Past Three R-EMAP Phases

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Objectives

- Investigate temporal variations of Hg contamination in the Everglades from 1995-2005
- Analyze spatial patterns of Hg distribution in the Everglades

R-EMAP

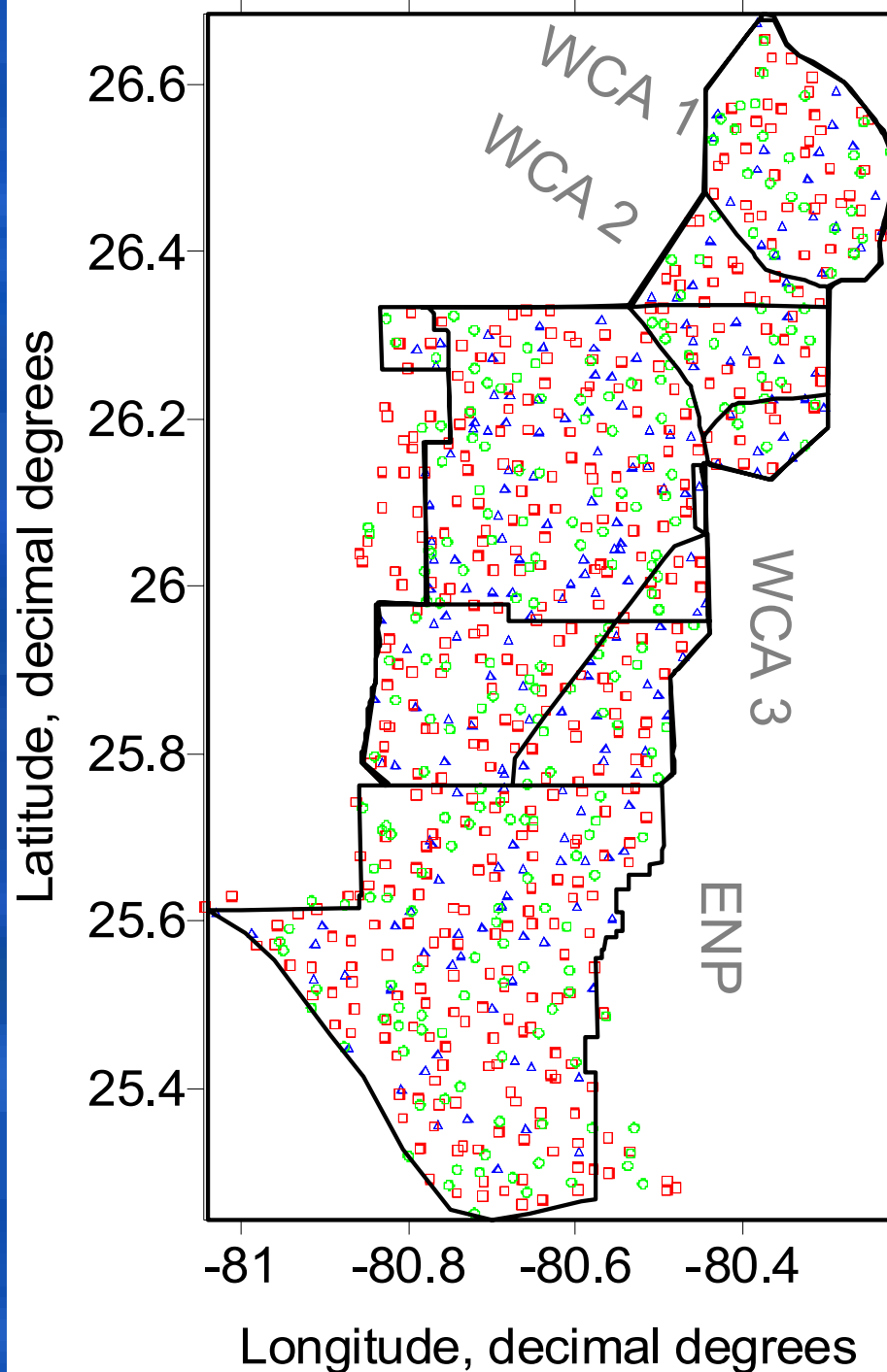
- Phase I: 1995-96
- Phase II: 1999
- Phase III: 2005

- Sampling sites

▶ △ Phase I
(1995-96)

▶ ○ Phase II
(1999)

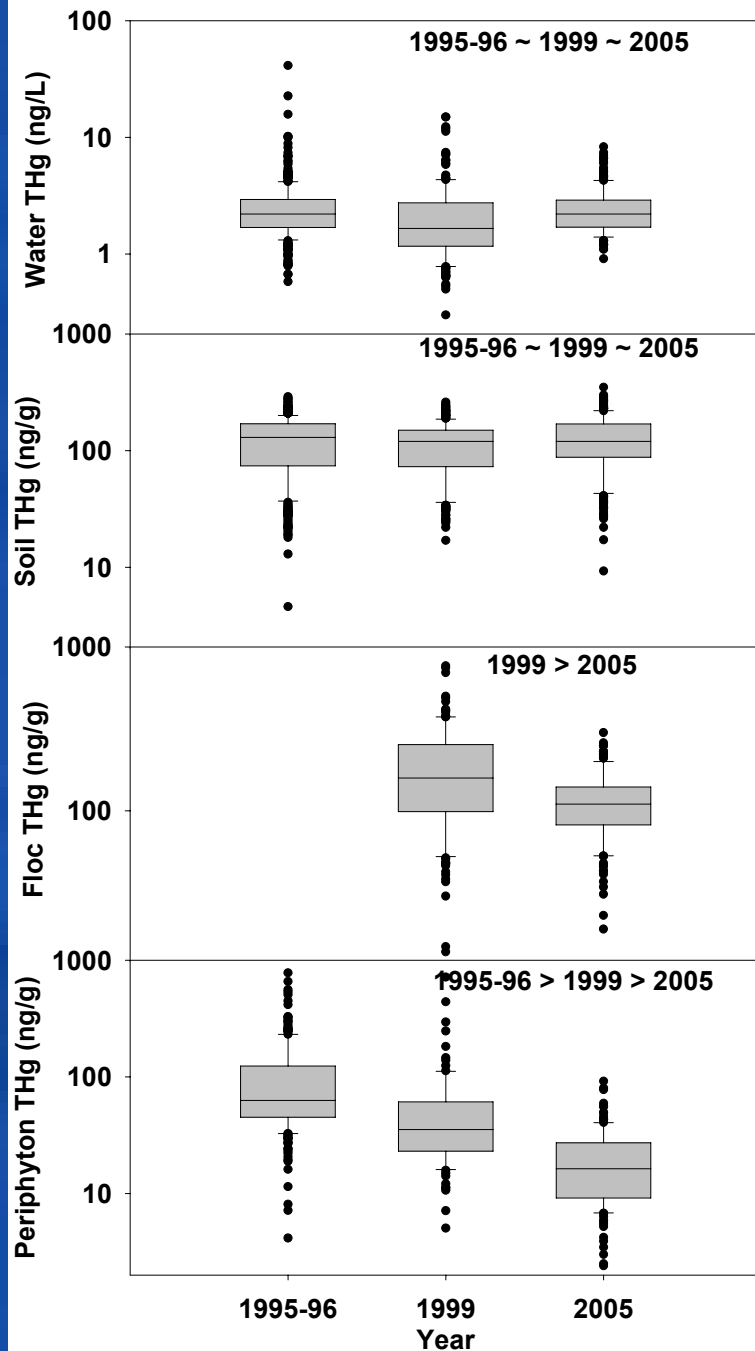
▶ ◻ Phase III
(2005)



Data Analysis

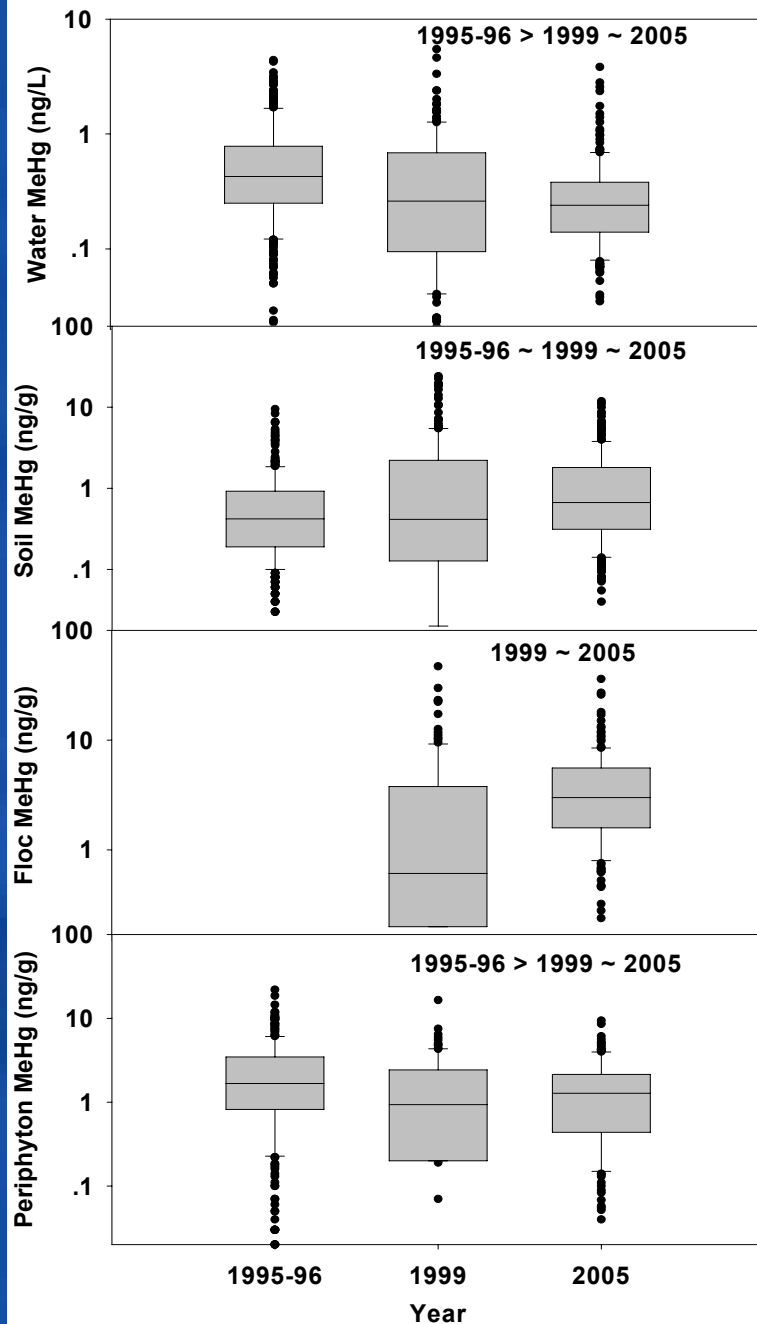
- Ecosystem-wide temporal patterns of Hg contamination in the Everglades
 - Box plot
 - Wilcoxon rank sum test
- Spatial variations in Hg distribution
 - Contour map
- Temporal patterns of Hg in subareas
 - WCA1, 2, 3, and ENP

Temporal variations in THg



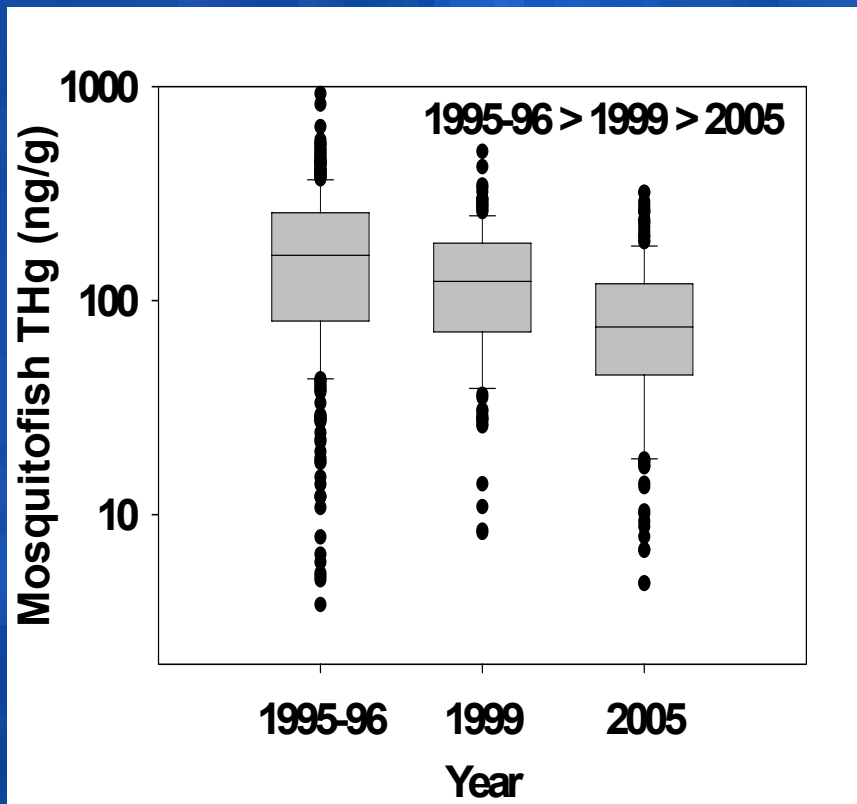
- **Water:** no significant temporal difference from 1995 to 2005
- **Soil:** no difference
- **Floc:** decreased from 1999 to 2005
- **Periphyton:** decreased from 1995 to 2005

Temporal variations in MeHg



- **Water:** decreased from 1995 to 1999 and no change between 1999 and 2005
- **Soil:** no difference between 1995 and 1999 and increased in 2005
- **Floc:** increased from 1999 to 2005
- **Periphyton:** decreased from 1995 to 1999 and no change between 1999 and 2005

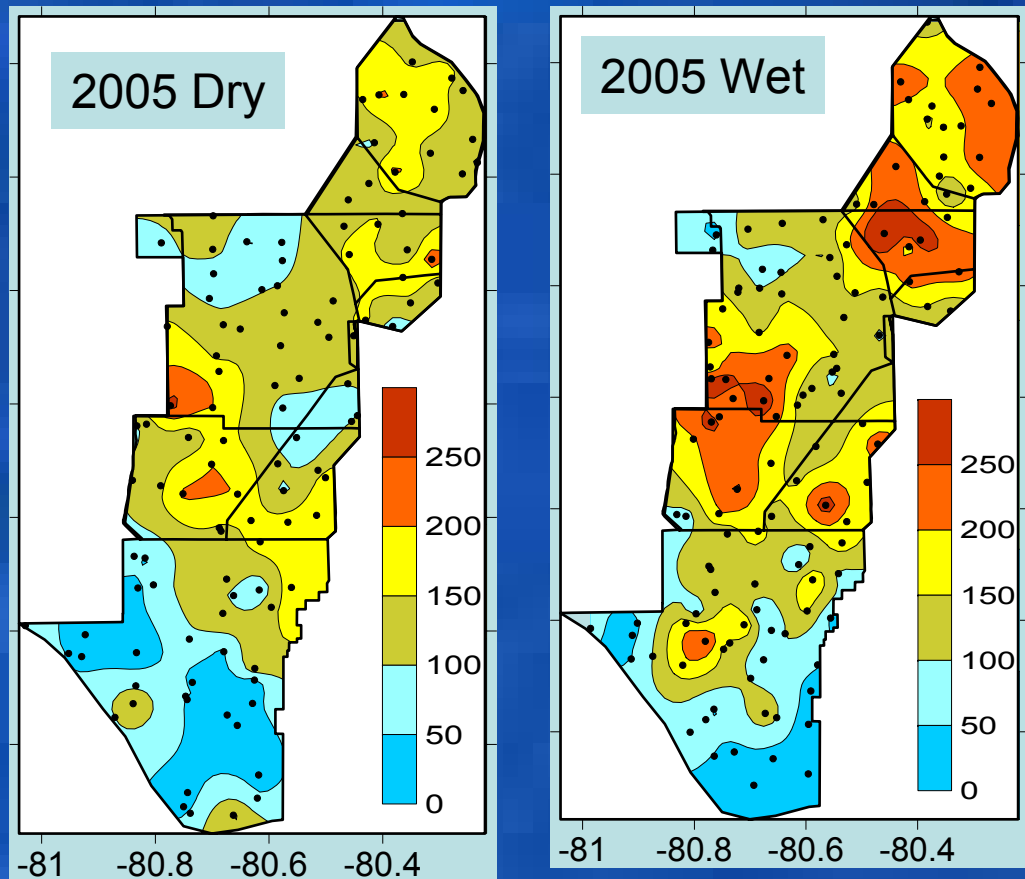
Temporal variations in mosquitofish THg



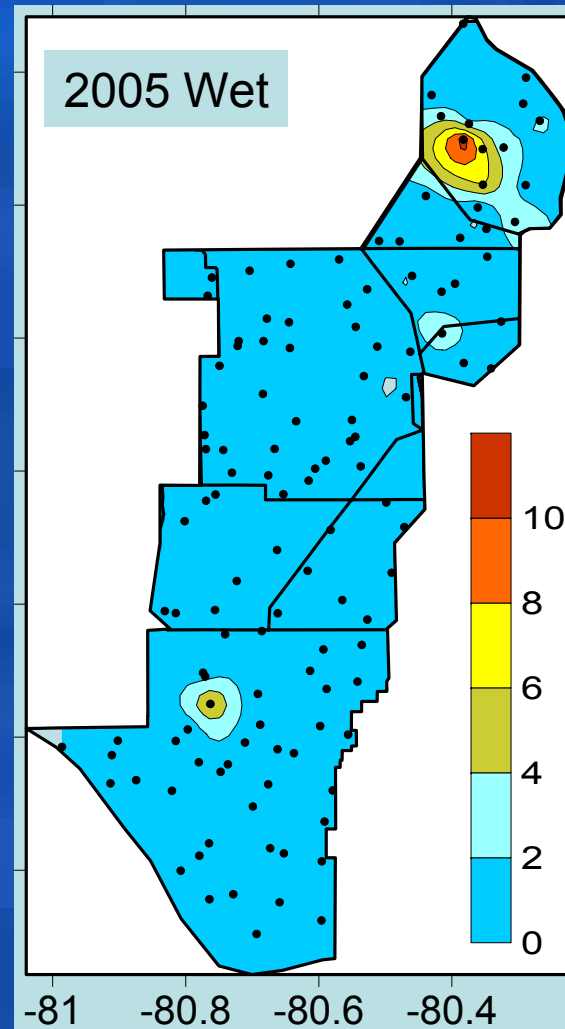
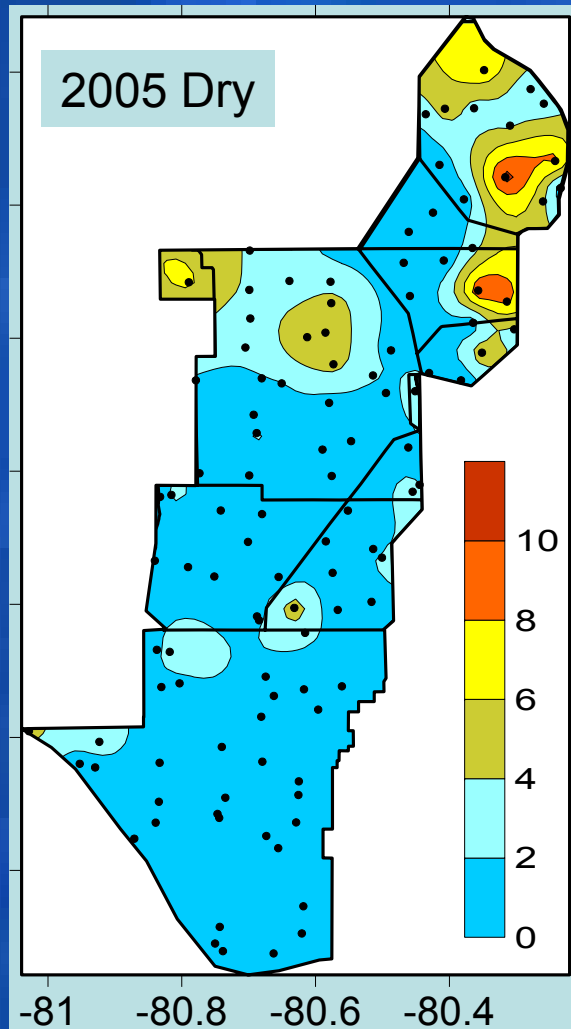
- Decreased continuously from 1995 to 2005
- Mean concentration in 2005 was 90.7 ± 5.1 ng/g
- USFWS recommended 100 ng/g in prey fish in order to protect top predators
- USEPA recommended 77 ng/g at trophic level 3 for protection of birds and mammals

Spatial variations in Hg distribution

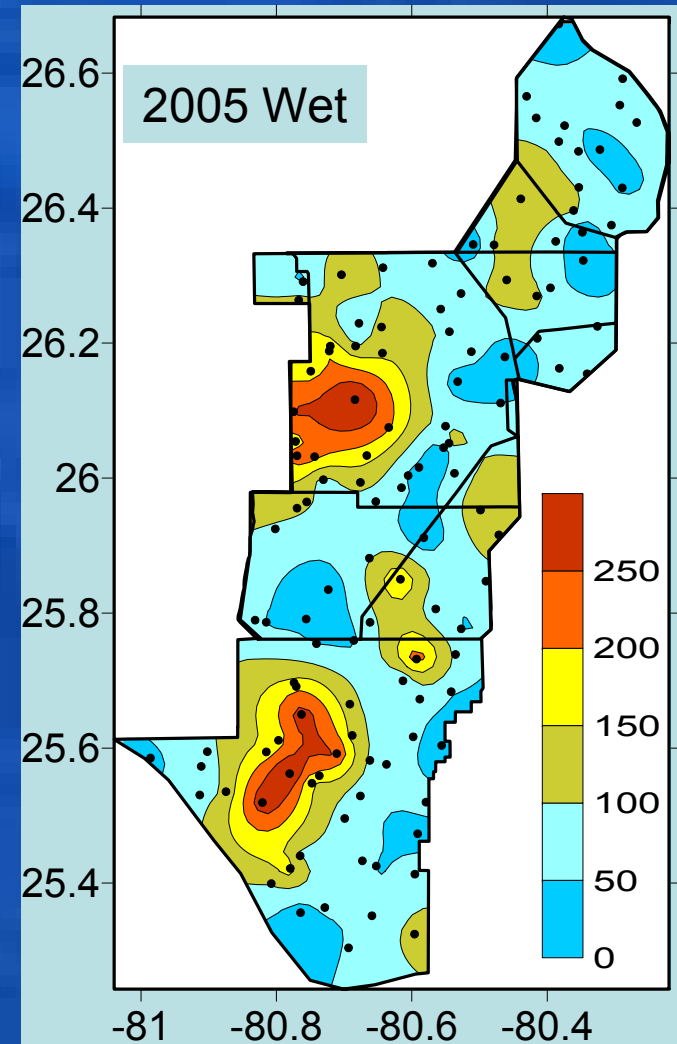
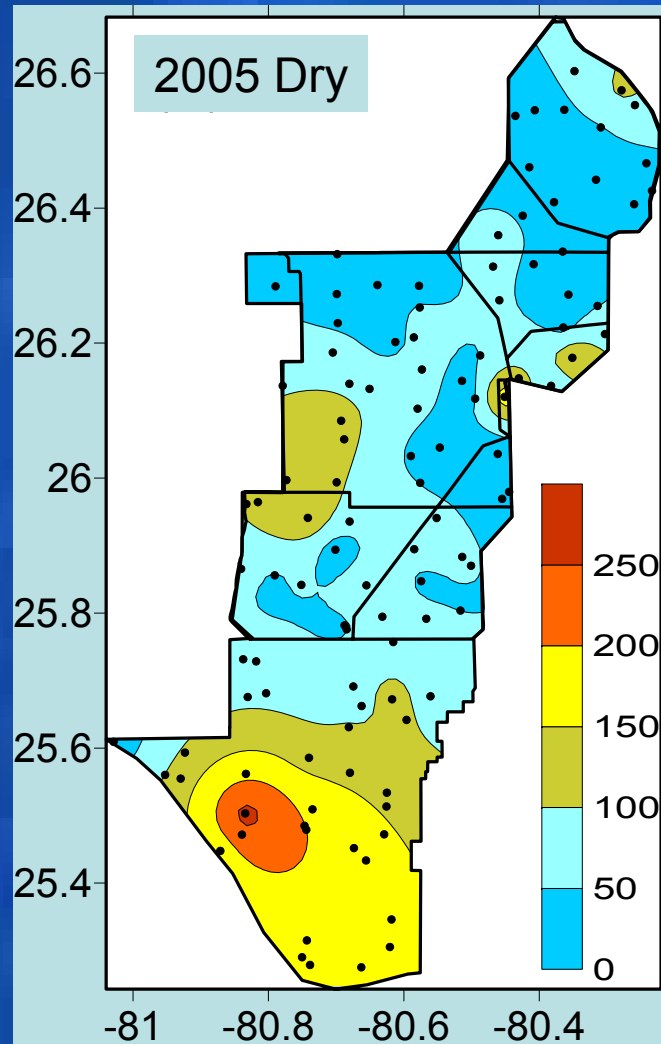
- Hg distribution in the Everglades is highly spatial.
- For example,
 - Soil THg



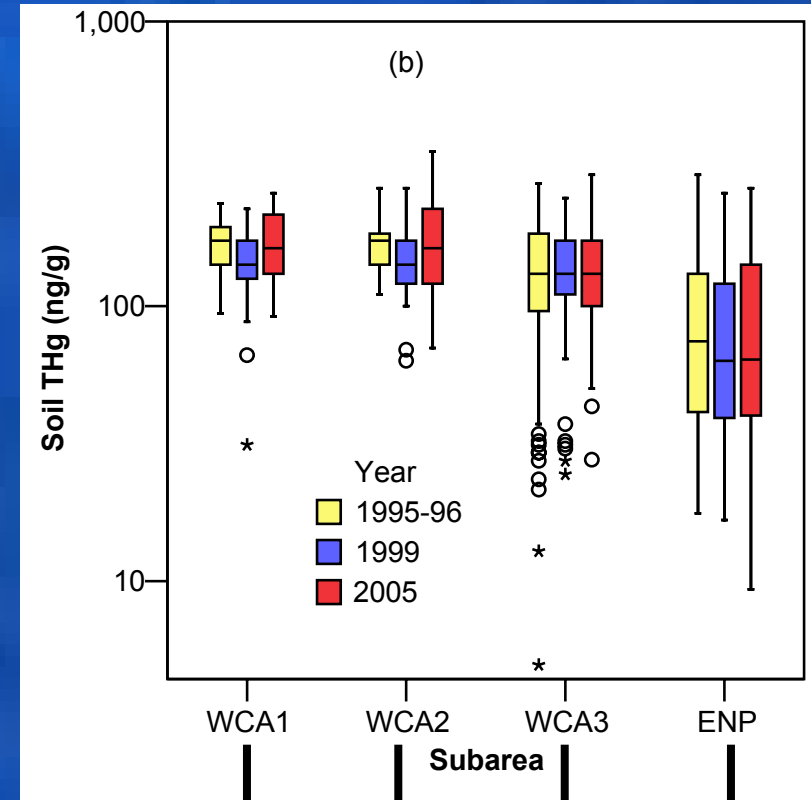
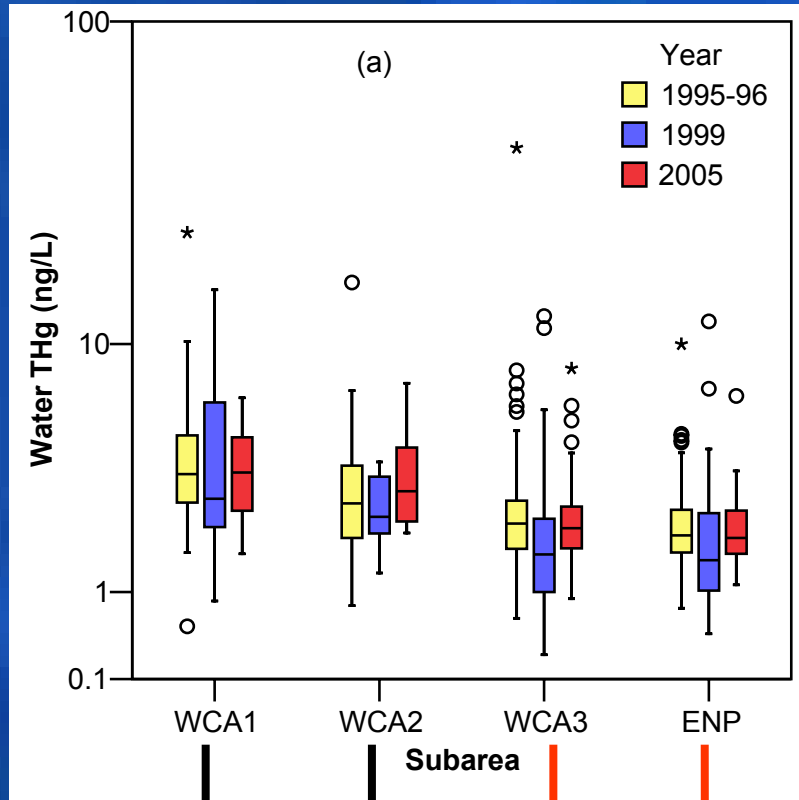
- Soil MeHg



- Mosquitofish THg



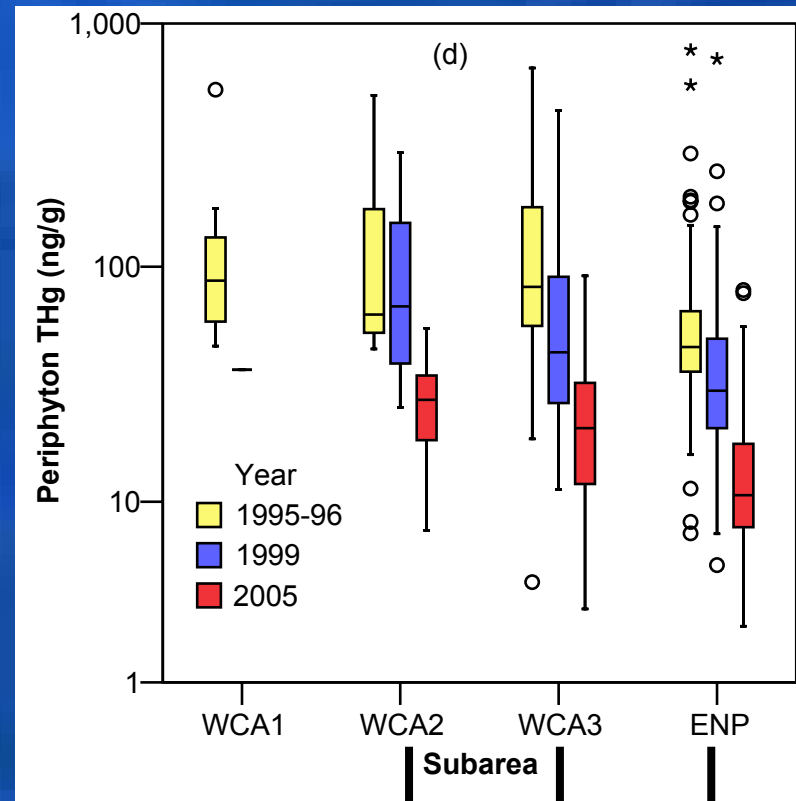
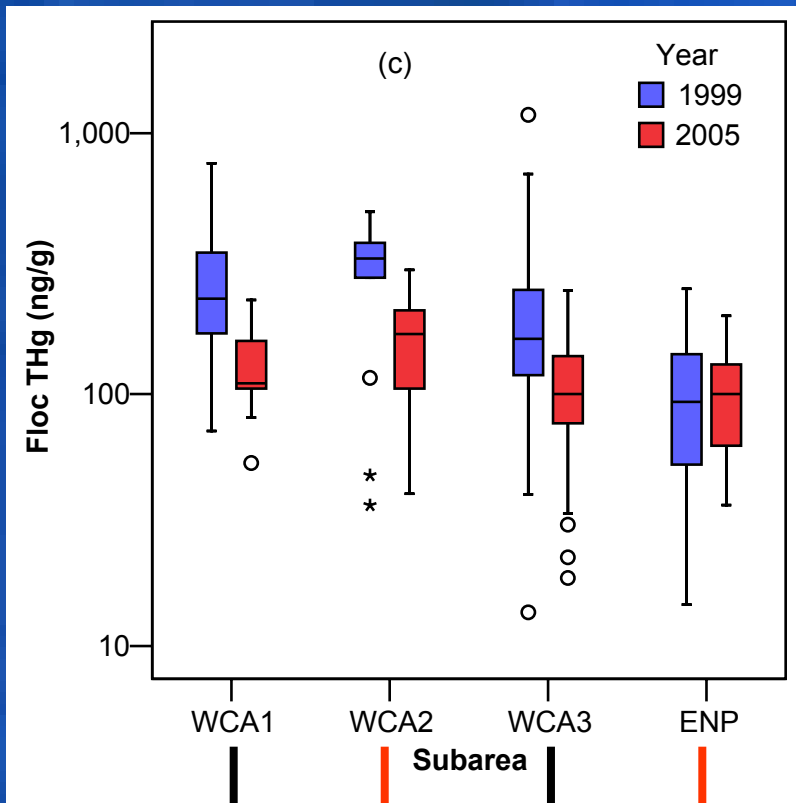
Spatial variations in THg temporal trends



Follow ecosystem-wide pattern

Follow ecosystem-wide pattern

1999 is lower than 1995 and 2005

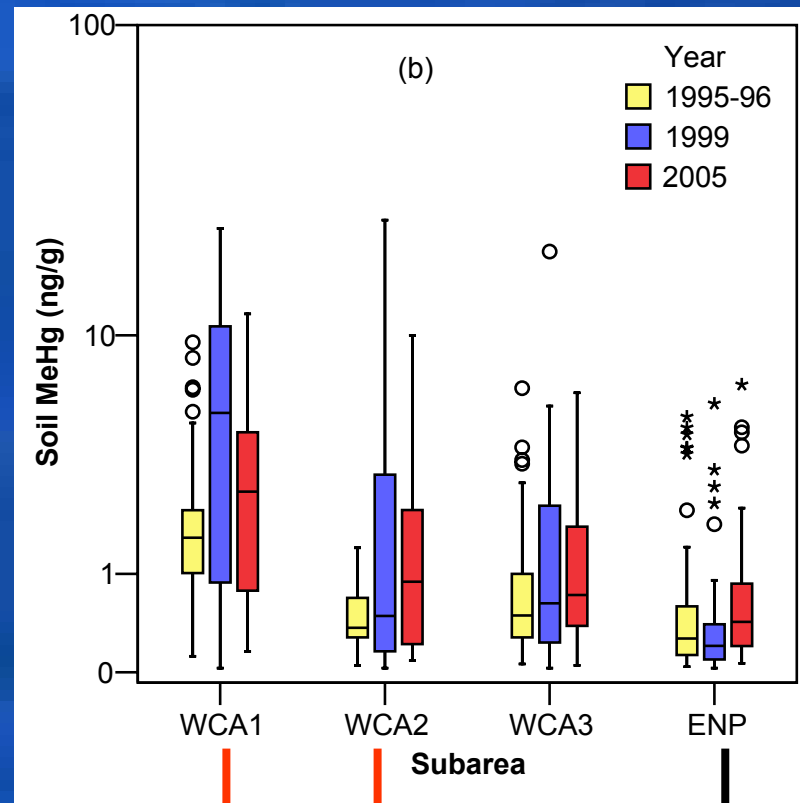
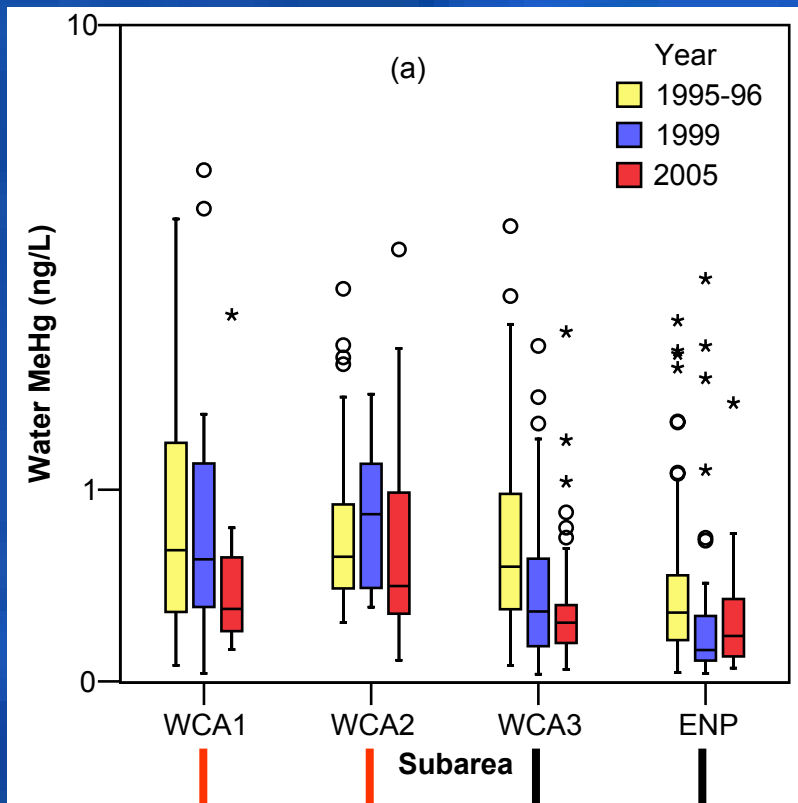


Follow ecosystem-wide pattern:
1999 > 2005

Follow ecosystem-wide pattern:
1995 > 1999 > 2005

No difference between 1999 and 2005

Spatial variations in MeHg temporal trends

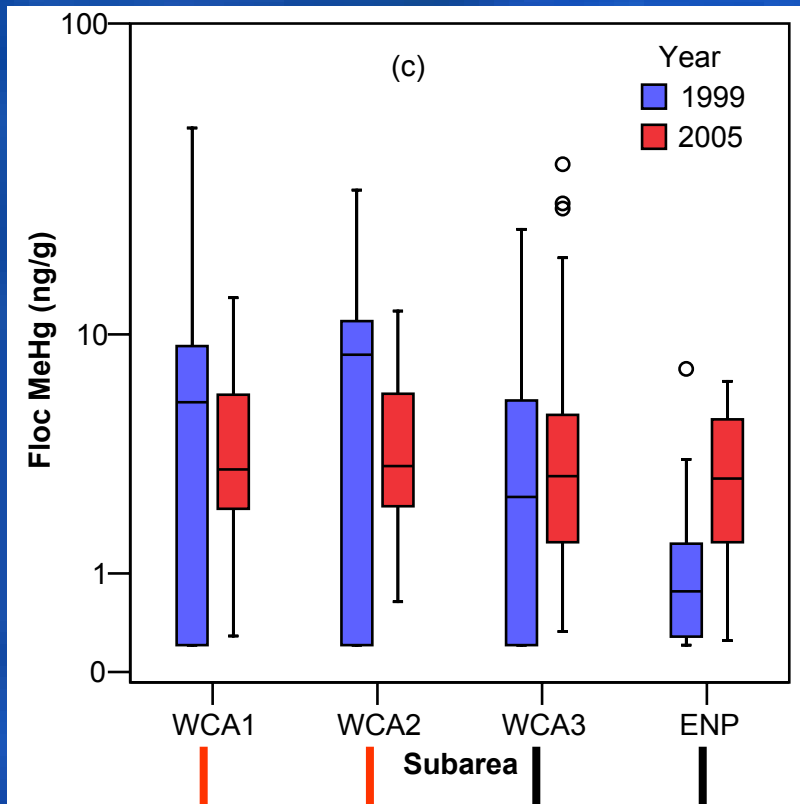


Follow ecosystem-wide pattern:
1995 > 1999 ~ 2005

Follow ecosystem-wide pattern:
1995 ~ 1999 < 2005

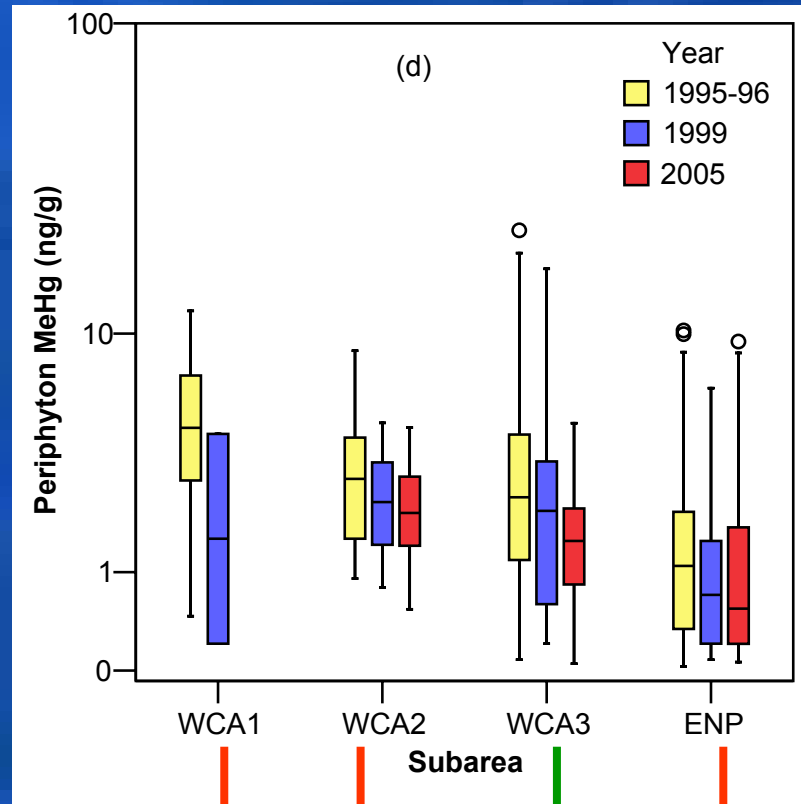
No difference from 1995 to 2005

No difference from 1995 to 2005



Follow ecosystem-wide pattern:
1995 > 2005

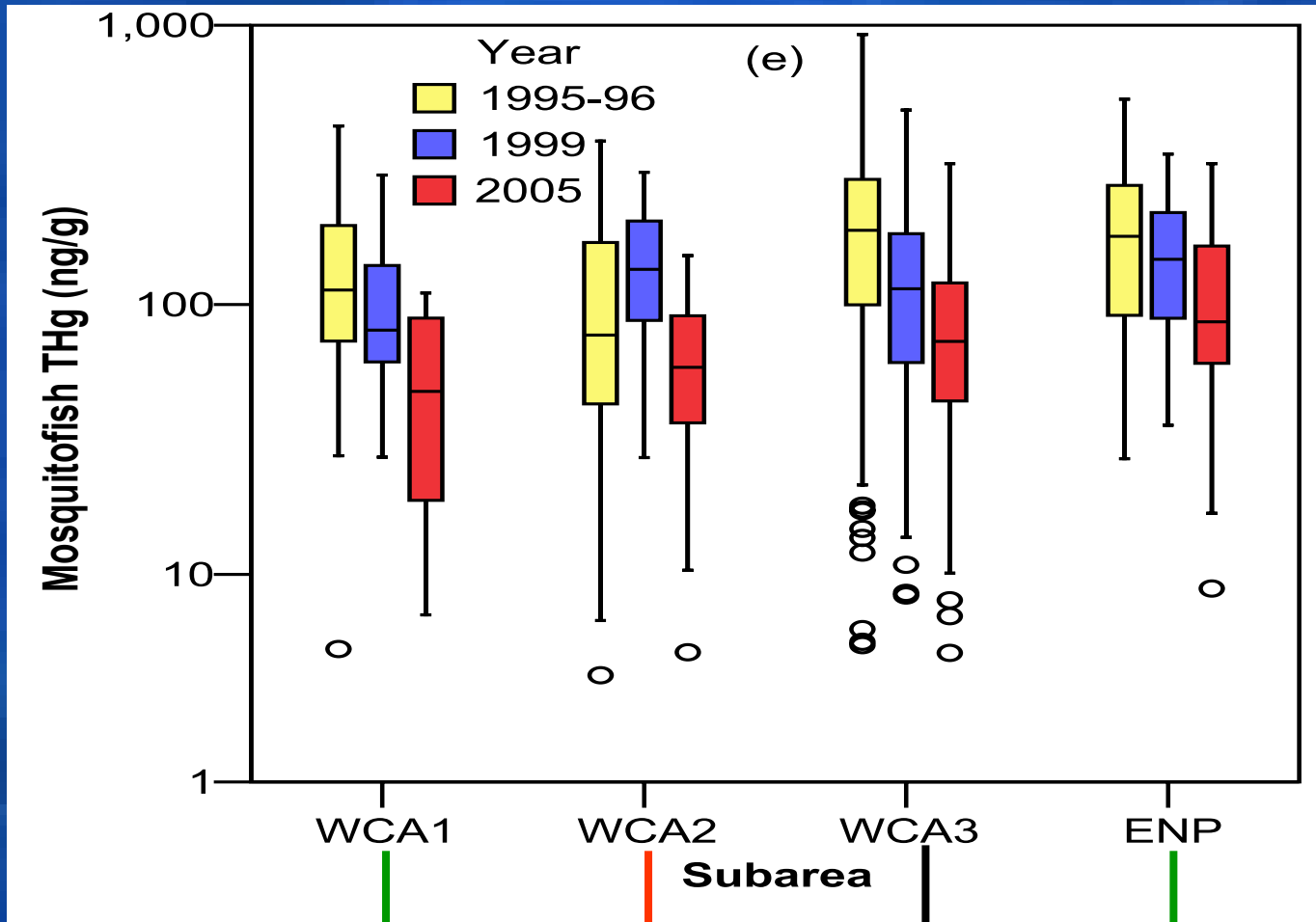
No difference from 1999 to 2005



1995 > 2005

No difference from 1999 to 2005

Spatial variations in temporal trends of mosquitofish THg



1995 ~ 1999 > 2005

No difference from 1995 to 2005

Follow ecosystem-wide pattern

1995 ~ 1999 > 2005

		WCA1	WCA2
THg	Water	NS	NS
	Soil	1995-96 > 1999 > 2005	NS
	Floc	1999 > 2005	NS
	Periphyton	NS	1995-96 ≈ 1999 > 2005
	Mosquitofish	1995-96 ≈ 1999 > 2005	NS
MeHg	Water	NS	NS
	Soil	NS	NS
	Floc	NS	NS
	Periphyton	NS	NS

		WCA3	ENP
THg	Water	1995-96 ≈ 2005 > 1999	1995-96 ≈ 2005 > 1999
	Soil	NS	NS
	Floc	1999 > 2005	NS
	Periphyton	1995-96 > 1999 > 2005	1995-96 > 1999 > 2005
	Mosquitofish	1995-96 > 1999 > 2005	1995-96 ≈ 1999 > 2005
MeHg	Water	1995-96 > 1999 ≈ 2005	1995-96 > 1999 ≈ 2005
	Soil	1995-96 > 2005	1999 < 1995-96 < 2005
	Floc	1999 < 2005	1999 < 2005
	Periphyton	1995-96 > 2005	NS

Summary

- Mosquitofish THg decreased continuously from 1995 to 2005 in the Everglades
- Mixed temporal patterns were observed for environmental compartments
- Different subareas in the Everglades exhibited different temporal patterns in THg and MeHg
 - WCA1 and WCA2 showed less temporal changes
 - WCA3 and ENP THg basically followed the ecosystem-wide temporal patterns, but with some exceptions
- Hg distribution and cycling in the Everglades are spatially dependent and thus evaluating the effect of the alterations in ecological conditions (e.g. due to restoration activities) on Hg cycling should consider these spatial characteristics

Acknowledgements

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