Factors Affecting Hg Concentrations in Biota

- Productivity (biodilution)
- Macrophyte Hg interception and uptake
- Hg deposition
- Photoreduction
- Hg bioavailability
- Microbial community
- Bioaccumulation/trophic level interactions
- pH, redox
- Sulfate
- Hydroperiod
- Iron, carbon
- Demethylation
- Macrophyte Hg interception and uptake
- MeHg in Biota
Community-Related Trophic Variability Contributes to Variations in Mosquitofish (*Gambusia holbrooki*) Mercury Concentrations in Water Conservation Area 2A

Forrest Dierberg¹, Mike Jerauld¹, Tom DeBusk¹, Dawn Sierer-Finn¹, Janelle Potts¹, Nichole Larson¹, and Ben Gu²

¹ DB Environmental, Inc., Rockledge, FL, USA
² South Florida Water Management District, West Palm Beach, FL, USA

Special Session on Mercury Cycling, Transport, and Effects in the Everglades
GEER 2015
Coral Springs, FL

April 23, 2015
**Gambusia** bioaccumulation factors (fish THg:water MeHg) among and within major Everglades compartments

EMHS (2010-13)
Hypothesis: *Trophic level and interactions between Gambusia and their food items are important variables in accounting for differences in Hg body burdens of Gambusia across the Everglades landscape.*

Rationale:
1. *Gambusia* Hg poorly correlated to water and soil MeHg, and sulfate (REMAP 2005)
2. Wide variation in *Gambusia* Hg within a given sulfate concentration (REMAP 1995-96, 1999, 2005)
3. Persistent differences in *Gambusia* Hg among sites not attributable to sulfate (EMHS)

Mean SW sulfate levels; n=7

- ENR: 37 mg/L
- WCA2-U3: 17 mg/L
- WCA2-F1: 19 mg/L
- WCA3-15: <0.4 mg/L
Bivariate Normal Ellipses (P=0.90) of *Gambusia* Tissue Hg vs. Sulfate as a Function of Vegetation Community Type from R-EMAP Wet and Dry Seasons in 1995-96, 1999, and 2005

Mean *Gambusia* tissue Hg concentrations (ng/g):
- cattail – 48
- sawgrass - 162
- wet prairie - 144
Recent Record of Surface Water Dissolved MeHg, Sulfate, and *Gambusia* THg Concentrations in WCA-2A

**Surface Water:**
n=3 for F2-Cat, F2-Chara and U3 Jan 2015
n=6 for U3 2013 and 2014

**Fish:**
n=3
Do *Gambusia* Hg “hotspots” across the Everglades landscape reflect local areas of longer food chains and differing diet, resulting in greater biomagnification (Loftus 2000; Abbey-Lee et al. 2012; Hagerthey et al. 2014)?

```
Trophic level  1  2  3  4

F1/F2  Green algae  Invert_a  *Gambusia*

U3  Periphyton  Invert_a  Invert_b  *Gambusia*
```

“Bioaccumulation through the diet is a major determinant of Hg concentration in fishes and invertebrates in the Everglades” –Loftus (2000)
Hypothesis Restated: Variations in Gambusia diet and number of steps in the food chain over time, and among locations, may explain observed temporal and spatial differences in fish tissue and gut Hg content within Everglades marshes.
Conclusions

• Persistent trends in Everglades mosquitofish THg not well explained by geochemical factors.
  • e.g., fish THg at F1/F2 consistently low compared to U3; apparent higher levels of fish THg in Chara vs. cattail communities at F2

• U3 fish tissues and gut contents enriched in $^{15}$N, suggesting higher trophic position.

• For several WCA-2A and WCA-3A sites, additional food chain stable isotope and Hg analyses currently underway.

• Among and within Everglades compartments, need to consider trophic position as a key parameter that can influence Gambusia tissue Hg levels.
Acknowledgments

Funding agencies included:
1. Everglades Agricultural Area Environmental Protection District
2. Florida Department of Environmental Protection
3. Florida Department of Agriculture and Consumer Services
4. The South Florida Water Management District