

Characterizing Se and Hg Exposure in the Colorado River Food Web in Grand Canyon

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Background

- Selenium is an essential nutrient
- Narrow range between beneficial and detrimental
- Selenium is present in coal and fuel oil, many soils types, and some mineral deposits
- Enters aquatic ecosystems through natural and anthropogenic processes
- Elevated levels of Se in waters can occur:
 - Naturally in areas with Se-rich soils
 - Due to irrigation practices
 - During mining and smelting of ores rich in Se
 - During combustion of coal or fuel oil



Background

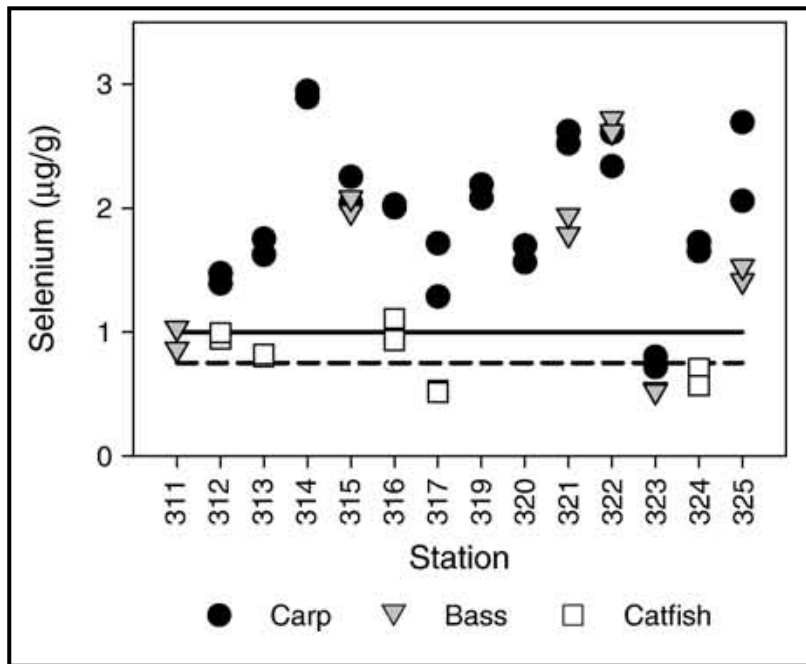
- Selenium and Mercury biomagnify in aquatic food webs
- Toxicity to fishes and wildlife well established
 - High levels of Se in fishes can cause:
 - Deformities
 - Reduced growth or reproductive output
 - Extirpation of species



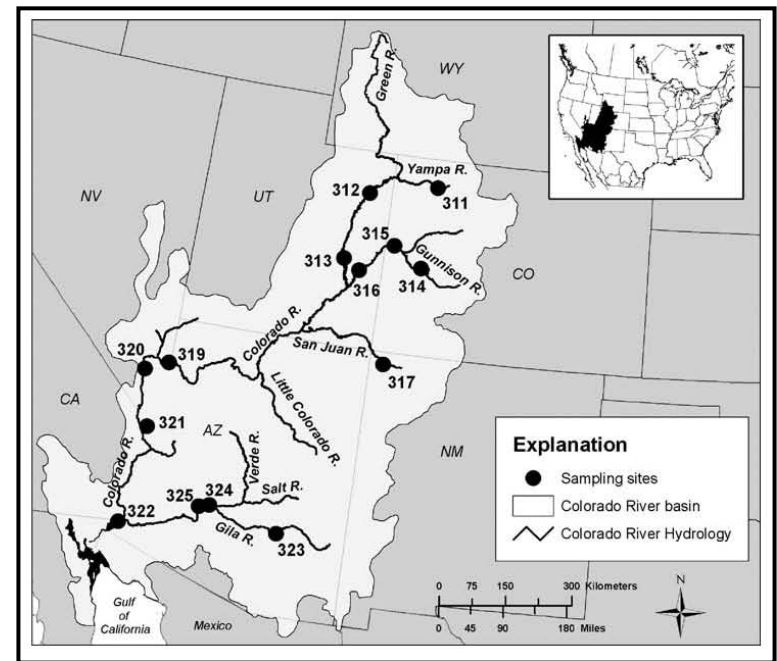
Background

Se and Hg in fishes exceed toxicity thresholds throughout CR basin

But, no data from Grand Canyon



Hinck and others 2007



Hinck and others 2007

- Comprehensive 'exposure characterization' in Grand Canyon is a logical next step



Research

- Objectives:
 - Quantify extent of contamination
 - Develop Se and Hg budgets
 - Export of Se and Hg to Riparian Ecosystems
- Plan:
 - Samples will be collected on June 2008 food base river trip
 - US EPA will fund Se and Hg analysis (~\$40k)



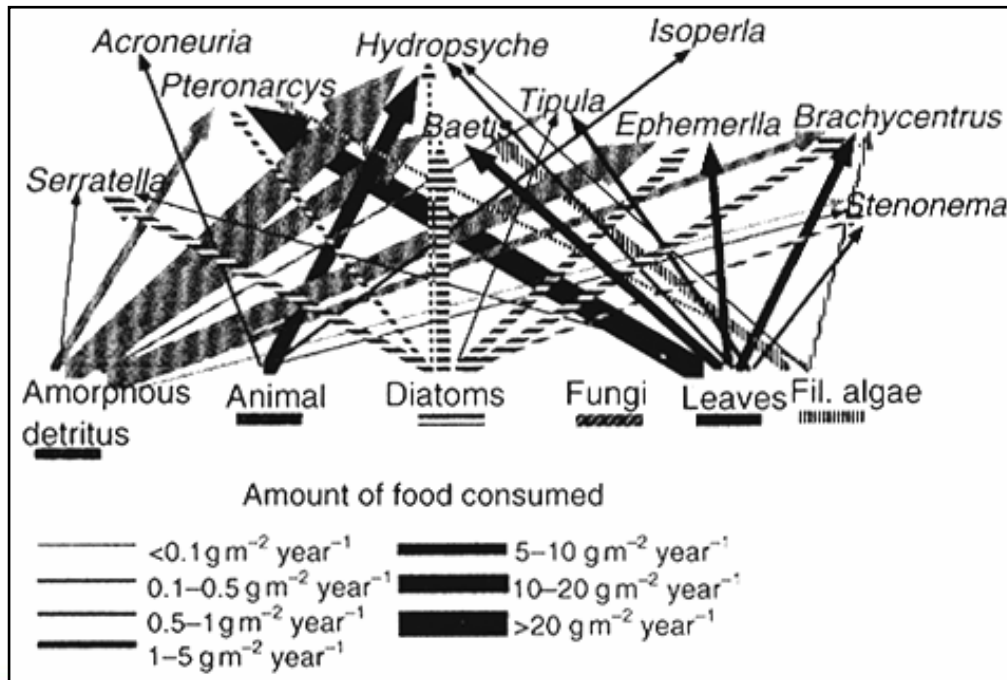
Quantify Extent of Contamination

- Se and Hg concentrations of all trophic levels will be determined at 6 sites (Lees Ferry, RM30, RM62, RM125, RM 165, RM225)
- Compare Se and Hg concentrations of inverts and fishes with toxicity thresholds to determine next steps:
 - additional research
 - formal risk assessment
 - no further action
- Toxicity thresholds already determined for many taxa present in the CRE



Se and Hg Budget

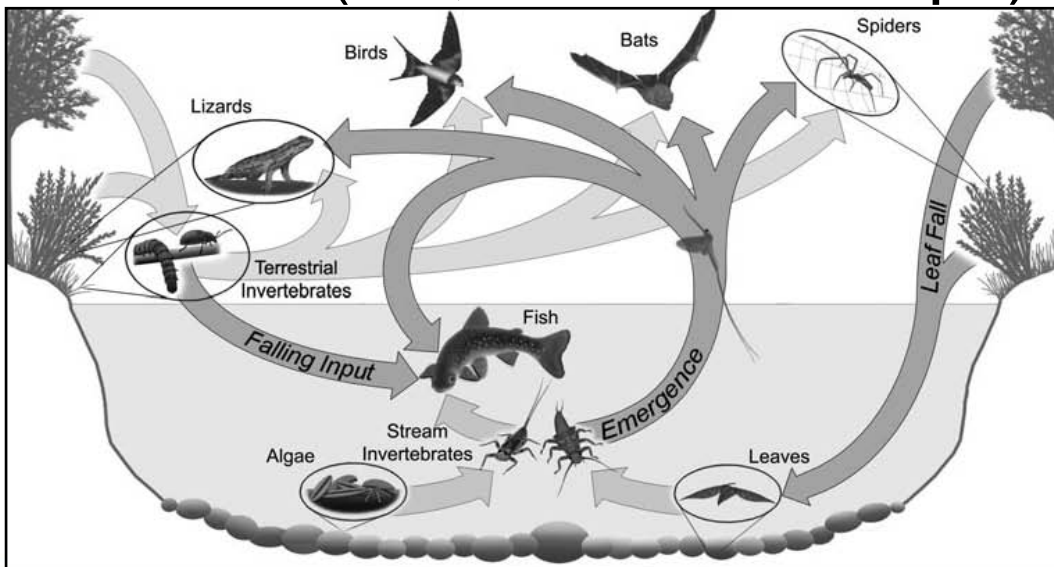
- Link Se and Hg data with quantitative food web to identify Se and Hg flux across trophic levels



This will yield a quantitative food web with units of Se and Hg. Can identify how much Se and Hg are in each species/taxa and how it got there.

Export of Se and Hg to Riparian Ecosystem

- Estimate numbers of emergent insects from secondary production of aquatic life stages
- Combine this with Se and Hg data to assess risk to terrestrial insectivores (i.e., birds and herps)



Emergent insects are a major route of material transport across aquatic-terrestrial boundary

From: Baxter and others,
Freshwater Biology 50(2) 2005



Conclusions

- Se and Hg in fishes exceed toxicity thresholds throughout the Colorado River Basin
- The exposure characterization we have planned for the Grand Canyon represents a logical next step
- US EPA is providing the funding

