Mercury Biogeochemistry in Madre de Dios Peru: Artisanal and Small-Scale Gold Mining

Madre de Dios, Peru

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Mercury (Hg) is a potent neurotoxin that readily accumulates in food webs and poses significant human health risks, especially children. The largest global contributor to atmospheric Hg is Artisanal and Small-scale Gold Mining (ASGM). During ASGM, liquid Hg is used to separate gold from sediment, releasing large amounts of Hg to air and land. Our goal is to understand how Hg from ASGM impacts aquatic ecosystems and people in MDD.

Objectives

- Characterize mercury concentrations in the environment and communities.
- Understand the impacts of artisanal and small-scale gold mining on the environment and human health.

Methods

- Collect samples of sediment, fish, and suspended solids in Madre de Dios (MDD);
- Collect human samples of hair, blood, and toenails; administer an extensive survey.
- We visited 17 communities along MDD to collect environmental samples in March 2013 and June 2013
- Human health testing begins in January 2014.

Mercury from ASGM → Aquatic Environment → Fish and Communities

ASGM site near Boca Inambari in MDD (March 2013)

Environmental sampling for sediment in MDD (Lauren Wyatt, June 2013)

A common non-carnivorous fish, Boca Chico, in MDD (June 2013)

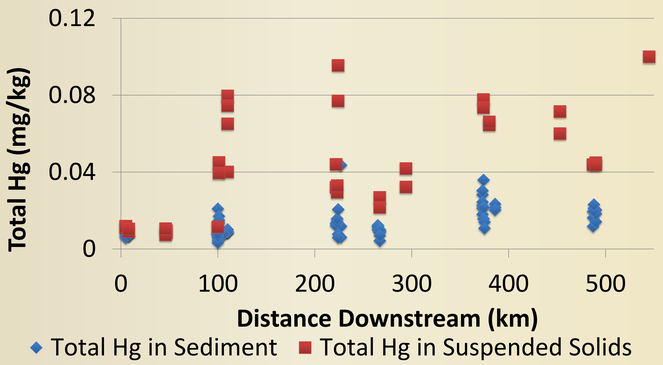
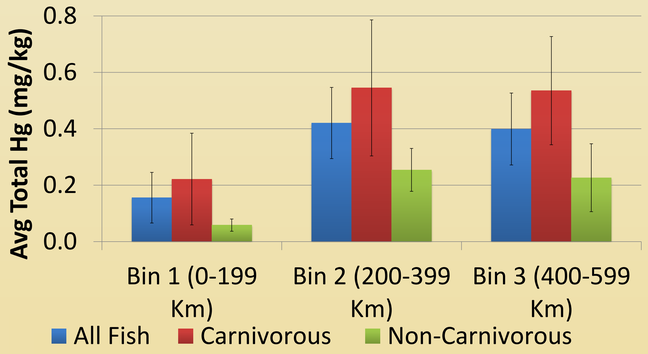


Figure 1 (Left): Sediment and Suspended solids Hg concentrations. Suspended solids have higher concentrations, showing transport throughout the watershed.

Figure 2 (Right): Fish Hg separated by Bins downstream. Fish Hg increases significantly downstream from Bin 1. Total mercury in fish exceeded World Health Organization Limit for Human Consumption of 0.5 mg/kg in 24% of fish samples (n=92).



Conclusions

(1) **Fish mercury concentrations are high in the Madre de Dios and increase downstream, exceeding WHO Limits in nearly 25% of the fish. Human exposure to mercury through fish consumption may be high.**

(2) **There is at least one diffuse source of mercury in Madre de Dios. Identifying the source and its direct influence is an obstacle we will address.**

The Research Team

This research involves a unique partnership between Duke, and governmental and non-governmental organizations in Peru, including:

- DGHI, Pratt, and the Nicholas School
- Bass Connections Team including Duke undergrads and grad students, post-docs, researchers and faculty
- US Naval Medical Research Unit in Peru (NAMRU-6)
- Ministerio de Salud and DIRESA, the regional health directorate in Peru

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