Oncorhynchus mykiss

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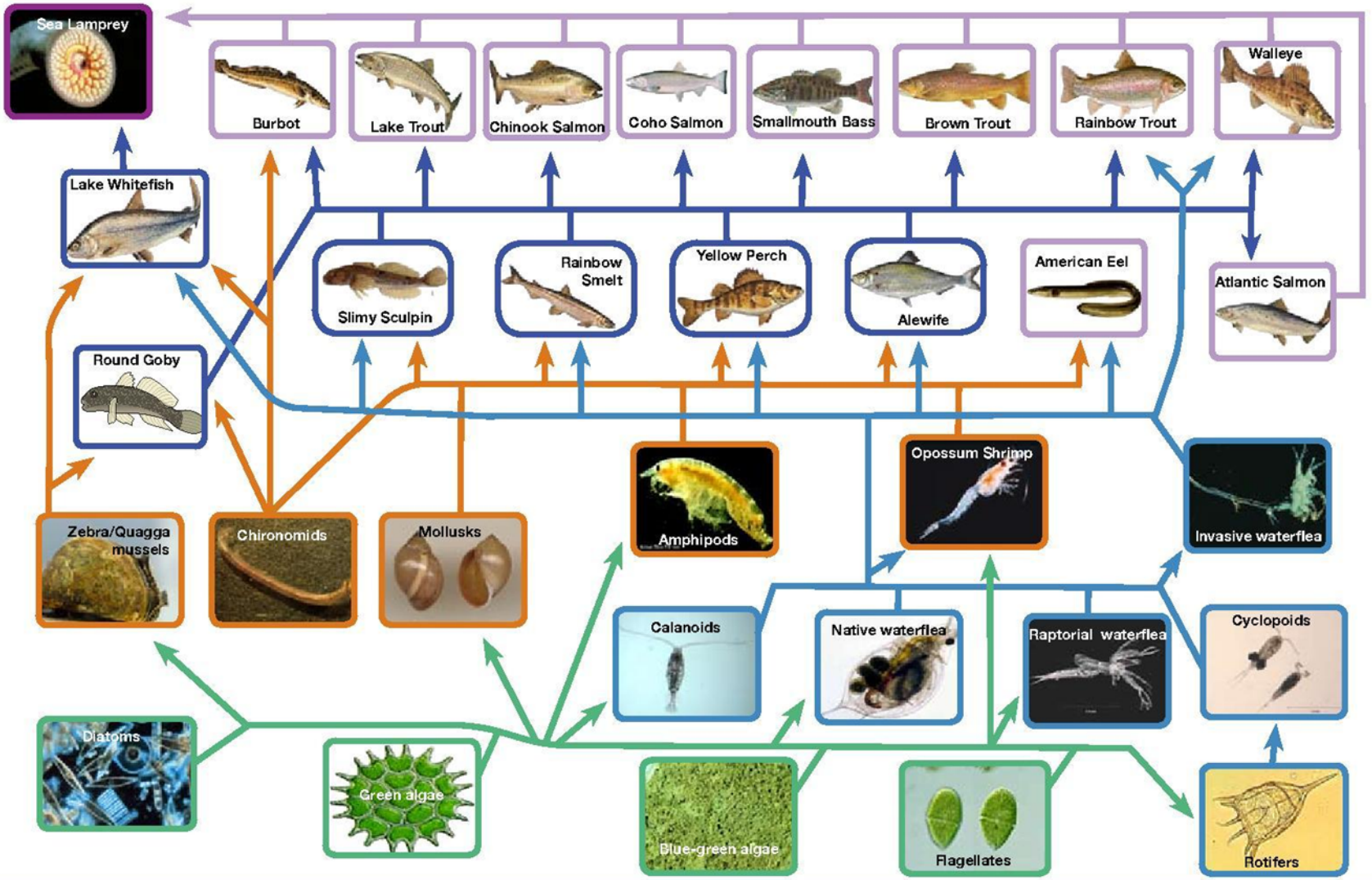
The Niagara River

Niagara River is a destination for sport fish: trout, salmon, perch and walleye.

- The Niagara River is 36 miles in length divided into two parts by Niagara Falls.
- The lower river is 14 miles in length and runs along the boundary of our school district.

Our Story

Lake Ontario Food Web



Foodweb based on "Impact of exotic invertebrate invaders on food web structure and function in the Great Lakes: A network analysis approach" by Mason, Krause, and Ulanowicz, 2002 - Modifications for Lake Ontario, 2009.

NOAA, Great Lakes Environmental Research Laboratory, 4840 S. State Road, Ann Arbor, MI
734-741-2235 - www.glerl.noaa.gov

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Rationale

Fish Advisories Are Posted for Our Area That Determine the Quantity and Types of Fish We Ingest. We Wondered If A Fish Caught in the Niagara River Would Show Higher Levels of Toxic Chemicals.

Niagara River, downstream of Niagara Falls (Niagara)	White sucker	Up to 1 meal/month	DON'T EAT	PCBs, Mirex, Dioxin
	Lake trout	Greater than 25", up to 1 meal/month; Less than 25", up to 4 meals/month	DON'T EAT	PCBs, Mirex, Dioxin
	Carp, Channel catfish, White perch	DON'T EAT	DON'T EAT	PCBs, Mirex, Dioxin
	Brown trout	Greater than 20", up to 1 meal/month; Less than 20", up to 4 meals/month	DON'T EAT	PCBs, Mirex, Dioxin
	All other fish	Up to 4 meals/month	DON'T EAT	PCBs, Mirex, Dioxin

Hypothesis:

To Determine if Various Tissue Samples of Steelhead Trout Caught in the Niagara River Contain a Distribution in Lead Concentrations.

Collaboration:

David Stewart Ph.D

Stacy Ruvio Ph.D

Timeka Snead, Undergraduate Student

D'Youville College, Buffalo, New York, USA

We Needed Steelhead

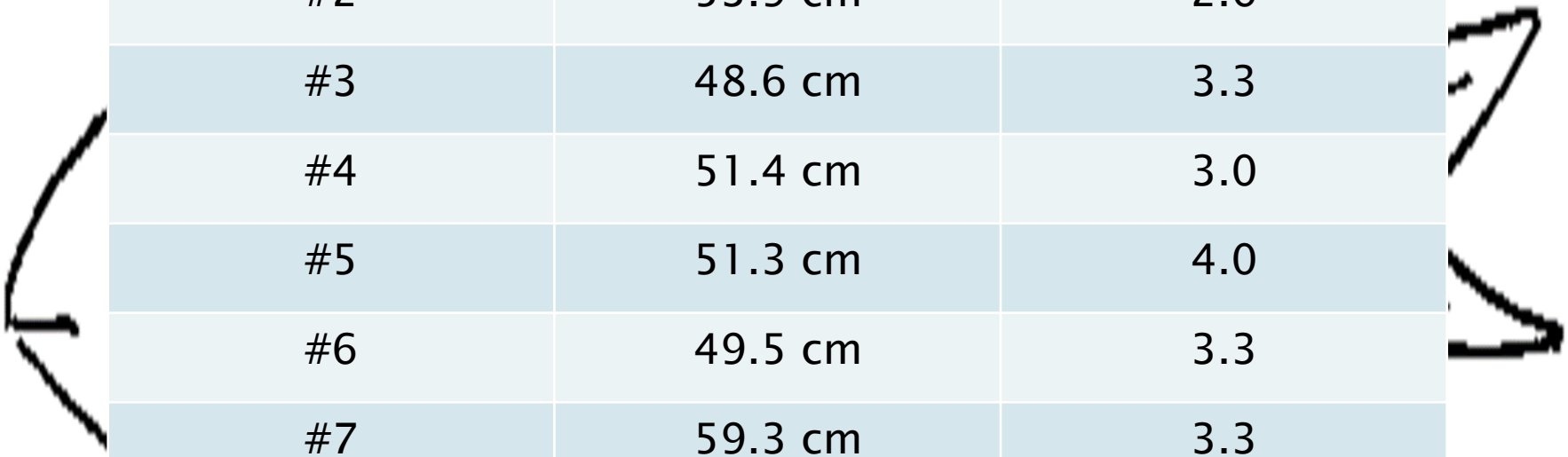
We had a fishing charter captain catch nine (9) Steelhead trout for us to analyze.

Water Samples and GPS coordinates were collected at the spot where the Steelhead fish were caught in the Lower Niagara River

Captain Matt Yablonsky
Wet Net Charters

Scales and Length for Age

Fish Sample	Length in cm	Age from Scales
#1	57.7 cm	3.3
#2	53.9 cm	2.6
#3	48.6 cm	3.3
#4	51.4 cm	3.0
#5	51.3 cm	4.0
#6	49.5 cm	3.3
#7	59.3 cm	3.3
#8	47.4 cm	3.3
#9	49.8 cm	3.0



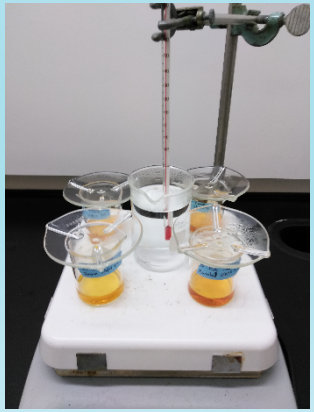
Dissection of the Steel Head for tissue samples:

- Fillet
- Liver
- Gonads
- Spleen
- Heart
- Skin
- Scales
- Gills
- Intestine

Primary Tissue Samples Tested: Fillets, Liver and Gonads

Experimental Design

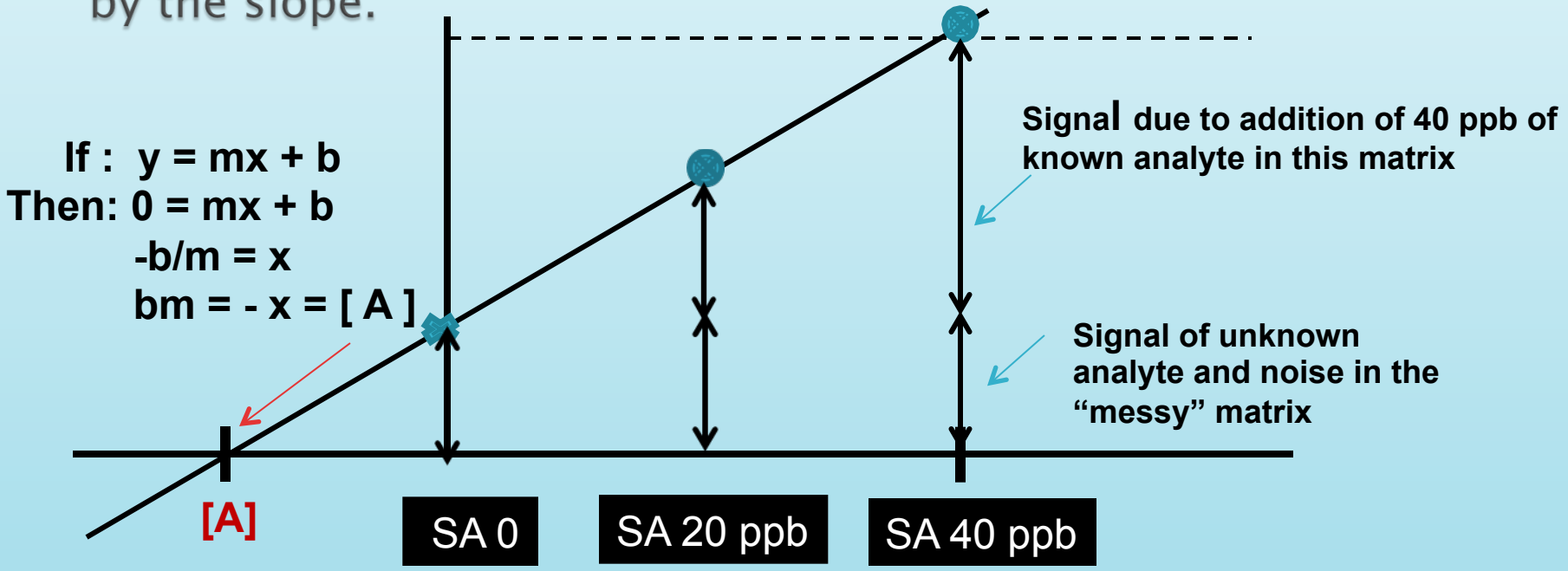
- Dried and massed each fish tissue sample.
- Dissolved the fish tissue samples in nitric acid to create a homogenized tissue sample.
- Standard addition of known lead concentrations to aliquots of all samples.
- Atomic Absorption Spectrometry (AAS).
- Statistical analysis and interpretation of data.
- Correlations and conclusions
- Future experimentation



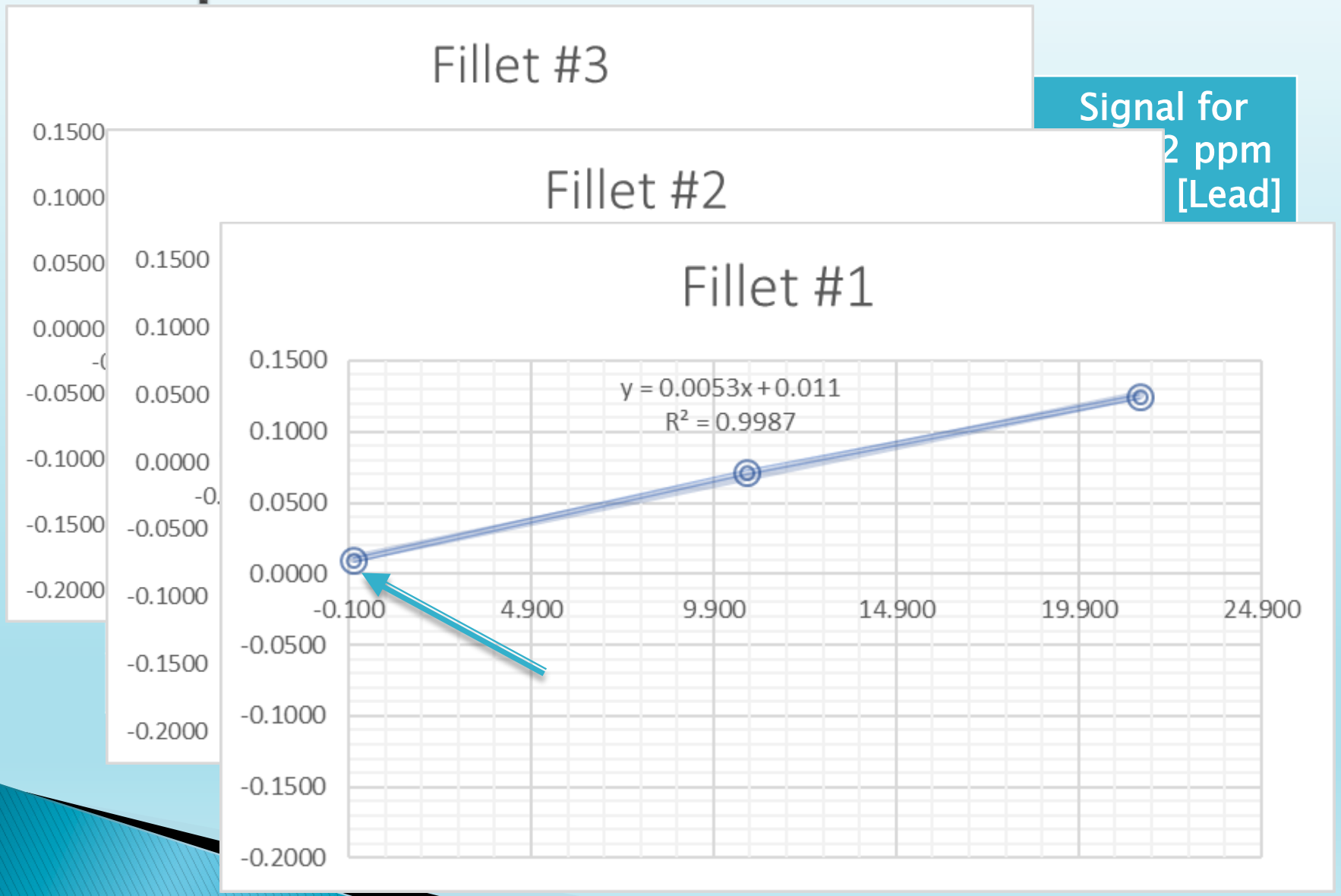
Using the Atomic Absorption Spectrometer

Concentration Calculation for Standard Addition

A standard solution (solution of known concentration of analyte) is added to the unknown solution so any impurities in the unknown are accounted for in the calibration. Knowing how much standard solution was added, a graph is used to *extrapolate* the concentration of the unknown solution. The concentration of the analyte is equal to the y-intercept divided by the slope.



Sample Data


Fillet #3
Fillet #2
Fillet #1
y = 0.0053x + 0.011
R² = 0.9987
0.1500
0.1000
0.0500
0.0000
-0.0500
-0.1000
-0.1500
-0.2000
-0.100
4.900
9.900
14.900
19.900
24.900
Signal for
2 ppm
[Lead]

Results:

- Data suggests Steelhead Trout do not absorb lead ions to any appreciable extent.

- Tissue samples when compared to the water samples taken at the catch site, did not show any appreciable differences in concentration.

WHO Target: 1.75 mg/person/week

$$\frac{\text{25ml sample}}{\text{~1g fillet tissue sample}} \times \frac{\text{2.57 ng lead}}{\text{1ml of soln}} = \frac{\text{64.3 ng lead}}{\text{1g fillet sample}}$$

Our Detection Level

$$\frac{\text{68.8 ng}}{\text{1g fillet sample}} \times \frac{\text{1000g}}{\text{1 Kg}} \times \frac{\text{1 mg}}{10^6 \text{ ng}} = \frac{\text{0.0643 mg lead}}{\text{1 Kg fillet sample}}$$

$$\frac{\text{0.0643 mg lead}}{\text{1 Kg fillet sample}} = \frac{\text{1.75 mg/person/week}}{\text{X Kg fillet sample}} = \text{27.2 Kg fish/person/week}$$

Experimental Considerations

- Lead does not make very soluble compounds. Perhaps we did not detect lead in the fish tissues since lead compounds would be trapped in the sand and silt on the bottom of the river

- Test for PCB's, Mirex and Dioxin which have been detected in fish tissue by the EPA

Google Image

What We Do Know:

- Results show that we can generate data that shows standard addition calibration curve within a trial sample.
- We have a valid methodology to test for lead concentrations in organic tissue samples.

What's Next?

Dr. Stewart and our research team are looking into writing a grant to extend the project:

- Re-design this experiment with considerations
- Purchase equipment to analyze PCB 's

David Stewart Ph.D.
Stacy Ruvio, Ph.D
Timeka Snead
Michelle Hinchliffe
Colleen Glor
Paul Casseri
Jared Taft
John Mango
Our Parents