Influence of ecological factors on contaminant burdens in Chesapeake watershed blue catfish

ROB HALE, TROY TUCKEY & MARY FABRIZIO

VIRGINIA INSTITUTE OF MARINE SCIENCE
GLOUCESTER POINT, VA

Sustainable Fisheries Goal Implementation Team
December 3, 2013

Contaminants in blue catfish

- *Collaborators*
  - *Collections*
    - *Mary Groves (MD DNR)*
    - *Greg Garman (VCU)*
    - *Bob Greenlee (VA DGIF)*
    - *VIMS Trawl Survey*

  - *Analyses:*
    - *Mark La Guardia, Matt Mainor & Drew Luellen (VIMS)*
    - *Gary Rice (W&M)*
    - *UC Davis Isotope Laboratory*

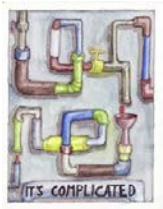
Chesapeake Bay Program
A Watershed Partnership

Contaminants in blue catfish

- *Rationale*: Are there health risks in promoting human consumption as an avenue for blue catfish population control?

- *Objective*: Evaluate diverse contaminants levels in fish from 3 major tributaries (James, Rappahannock & Potomac) –compare to human consumption advisories (where applicable)

Chesapeake Bay Program
A Watershed Partnership



Contaminants in blue catfish

From VDH Website

- "The meal advisories listed in the tables are based on protecting the general public from adverse health effects of contaminants. A meal is considered to be a 8 oz serving of fish."

- "High risk individuals such as women who are pregnant or may become pregnant, nursing mothers, and young children are advised not to eat any fish contaminated either with polychlorinated biphenyls (PCBs) or mercury from the respective advisory areas."

US EPA 2000

Table 4-3. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Methylmercury

Risk Based Consumption Limit[a]	Noncancer Health Endpoints[b]
Fish Meals/Month	Fish Tissue Concentrations (*ppm, wet weight*)
Unrestricted (>16)	0 - 0.029
16	>0.029 - 0.059
12	>0.059 - 0.078
8	>0.078 - 0.12
4	>0.12 - 0.23
3	>0.23 - 0.31
2	>0.31 - 0.47
1	>0.47 - 0.94
0.5	>0.94 - 1.9
None (<0.5)	>1.9

[a] The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.
[b] Chronic, systemic effects.

Notes:
1. Consumption limits are based on an adult body weight of 70 kg and an interim RfD of $1x10^{-4}$ mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for methylmercury is 1×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

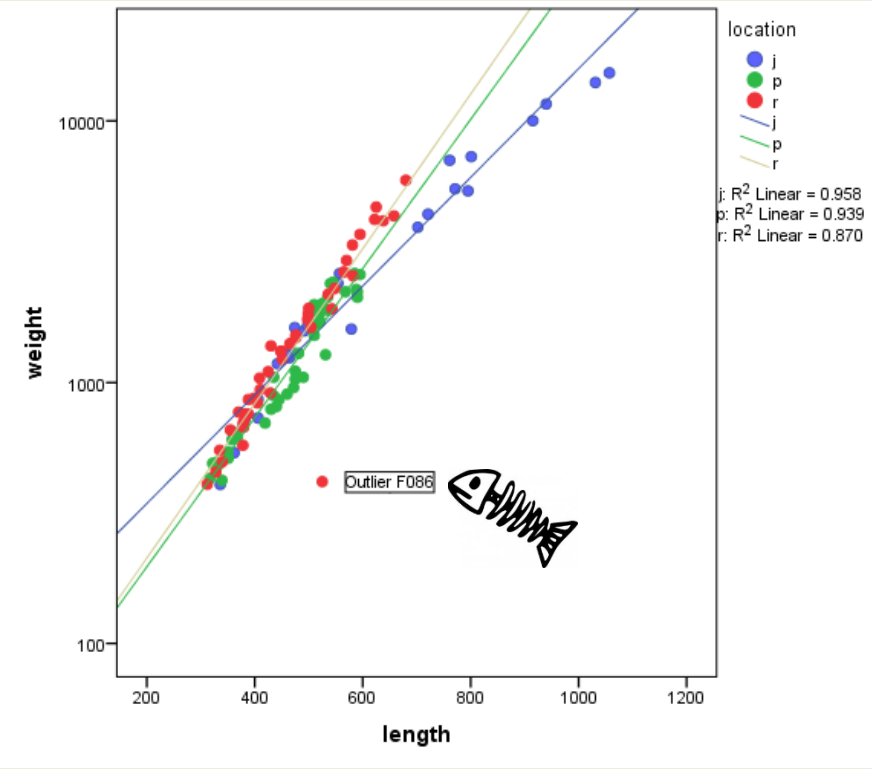
Contaminants in blue catfish

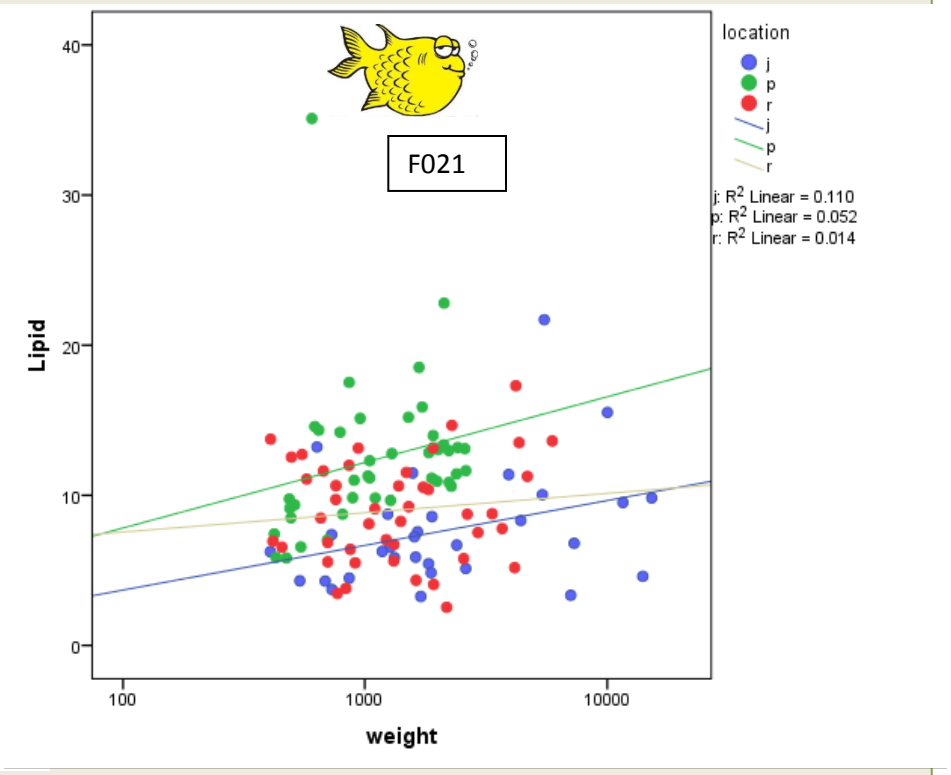
- *Approach*:
  - Collect fish of lengths likely consumed in a fishery
  - Analyze contaminants: Hg, PCBs, OC pesticides, PBDEs
  - Analyze stable isotopes ($\delta^{15}N$ & $\delta^{13}C$), lipid content, weight, gender
  - Explore relationship between contaminant levels & biological parameters

Chesapeake Bay Program
A Watershed Partnership

Results

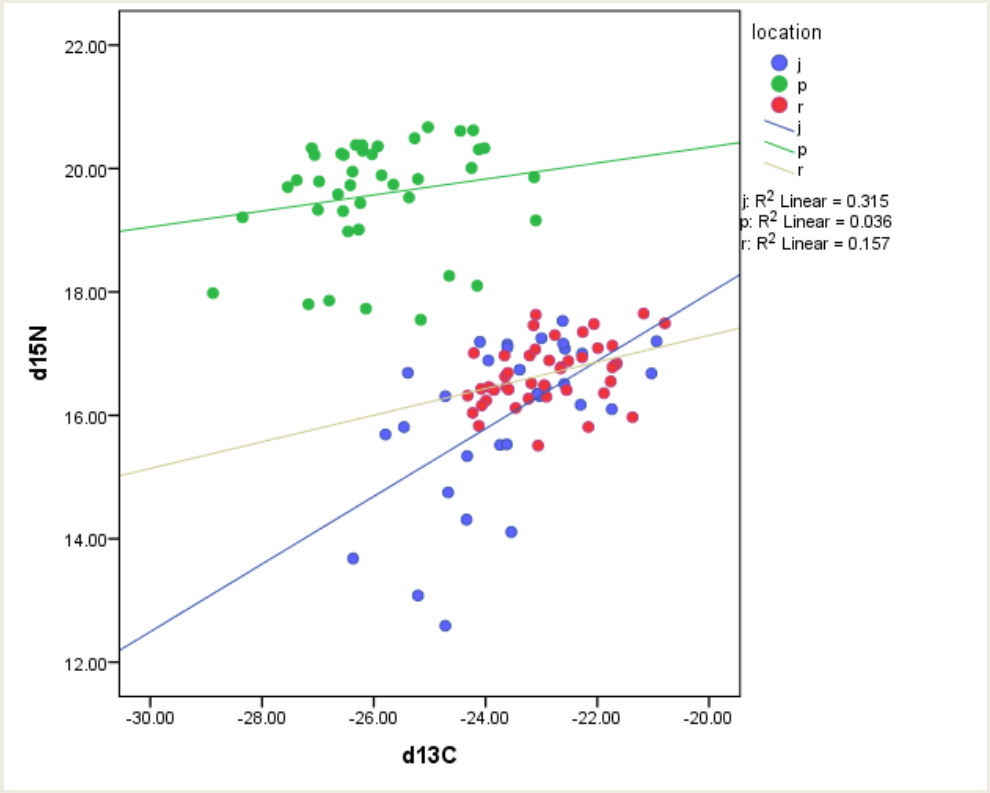
- *Weight (g), length (mm), lipid (% dry wt)*
- *Are Potomac fish "fatty"?*

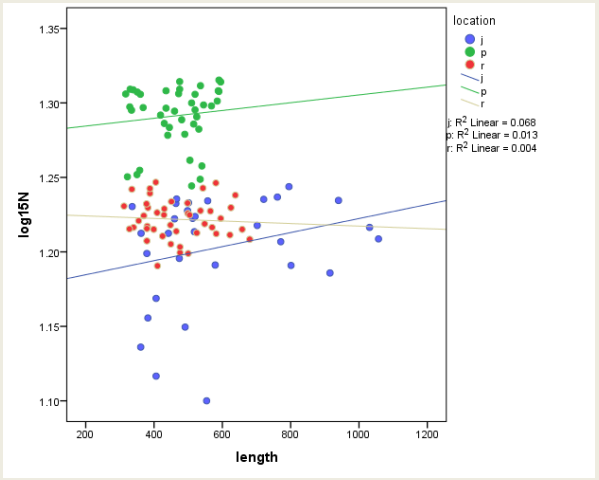


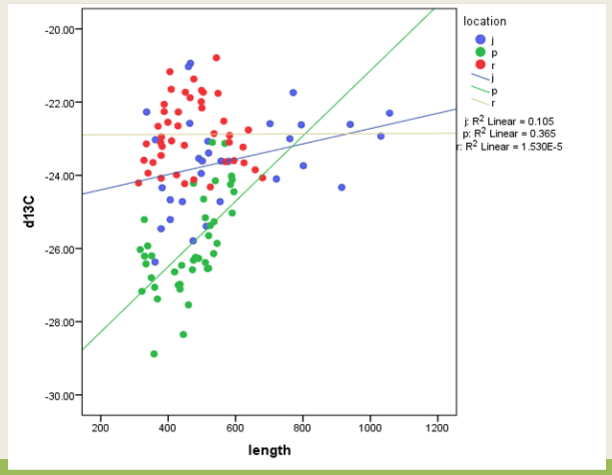


Isotopes

- *Stable isotopes- Potomac "different"*

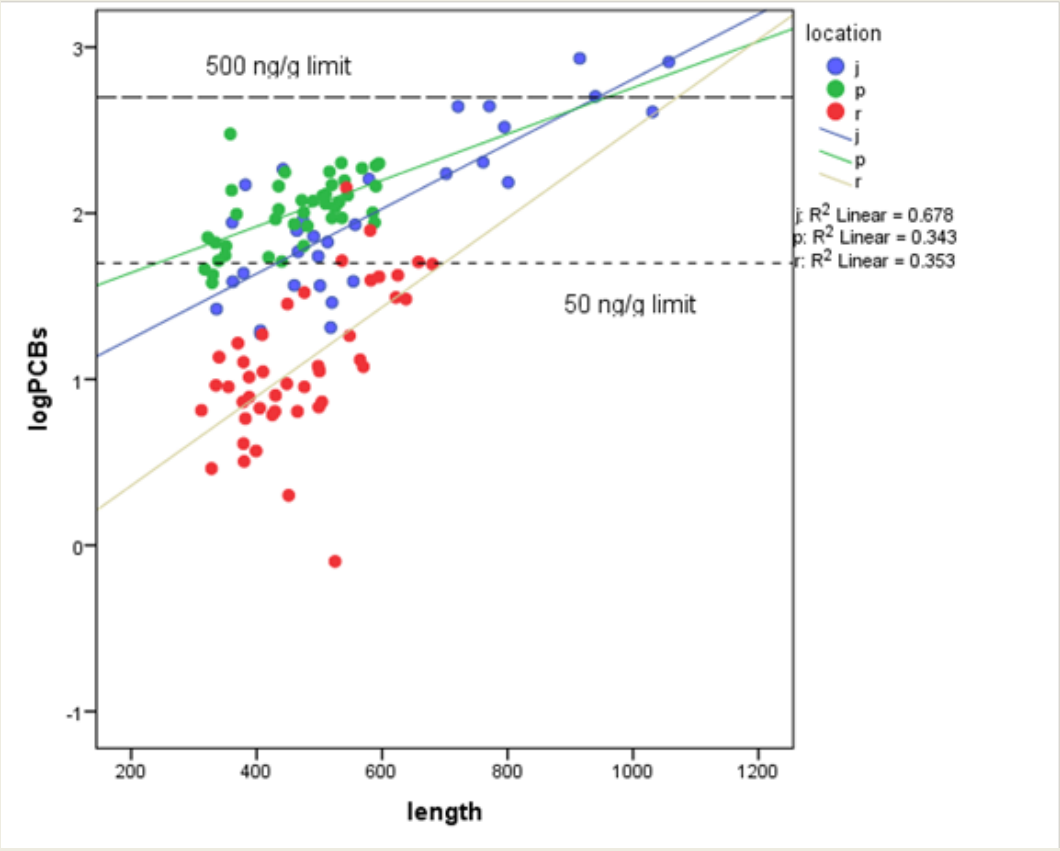






PCB Results

- *PCBs (ng/g wet weight) vs length*
- *Trigger levels 50 (2 meals) & 500 µg/kg (no meals)*

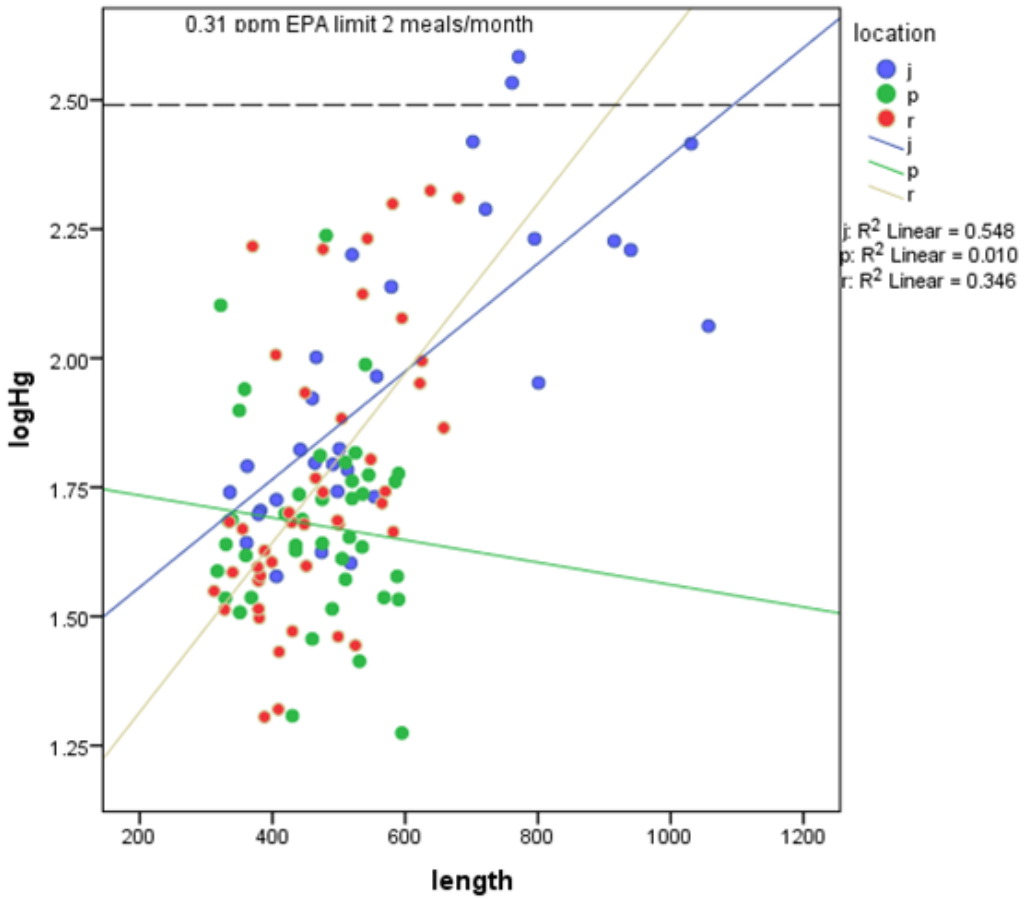


Existing PCB Advisories

	Meals per month (8 oz)
James	
>800 mm	zero
<800 mm	2
Rappahannock	2 or less
Potomac	3

Hg Results

- *Hg vs length; Trigger levels 310 µg/kg (2 meals)*



No pre-existing main-stem state Hg advisories

EPA 2000

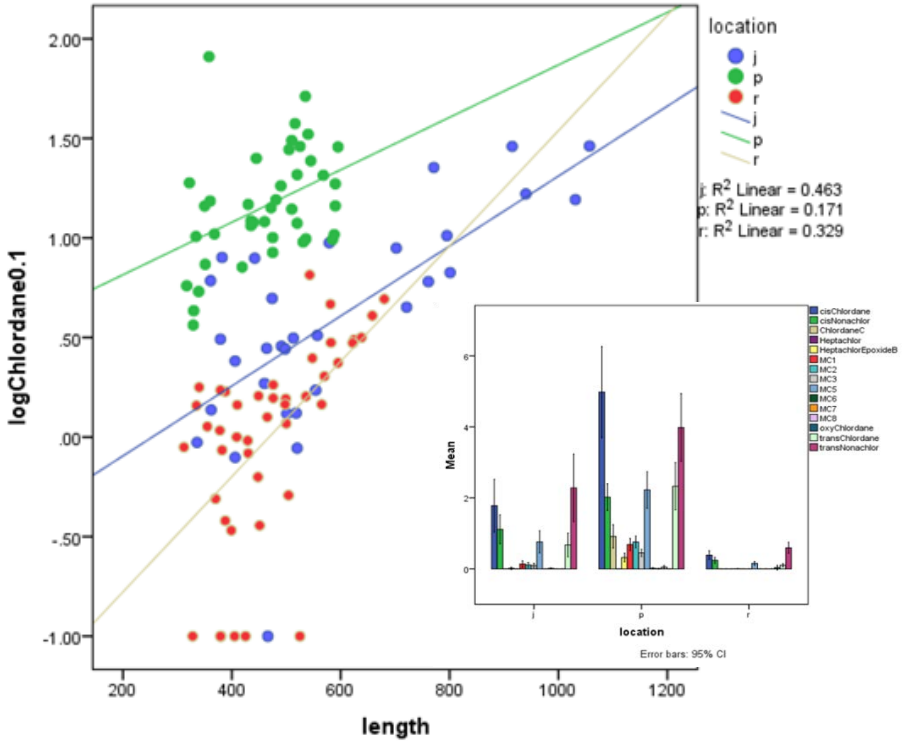
Table 4-3. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Methylmercury

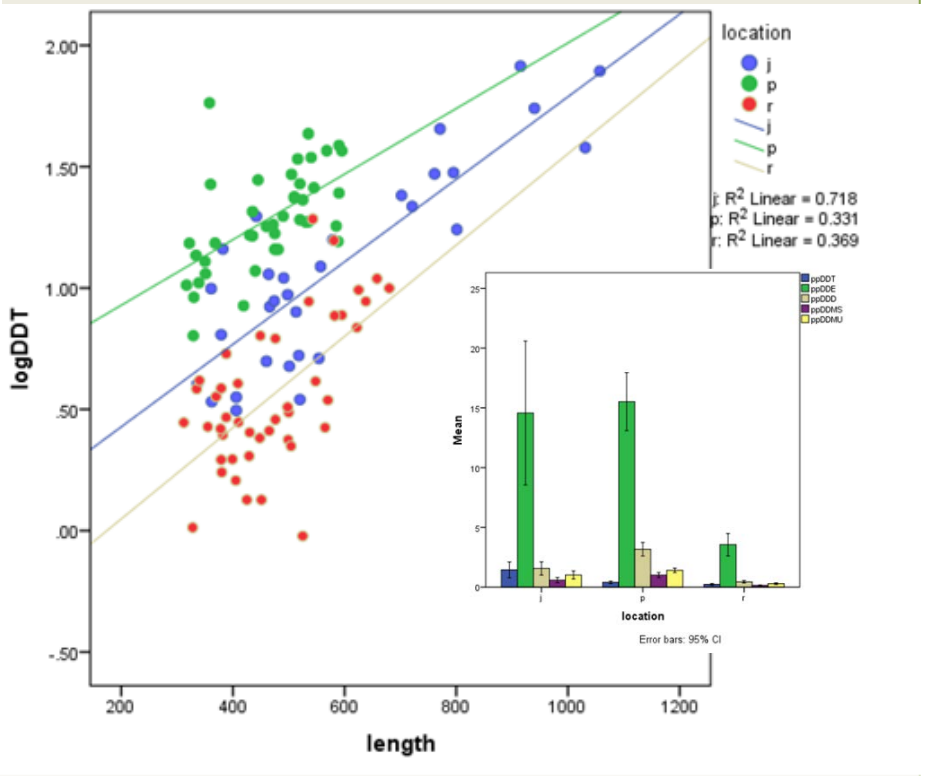
Risk Based Consumption Limit[a]	Noncancer Health Endpoints[b]
Fish Meals/Month	Fish Tissue Concentrations (*ppm, wet weight*)
Unrestricted (>16)	0 - 0.029
16	>0.029 - 0.059
12	>0.059 - 0.078
8	>0.078 - 0.12
4	>0.12 - 0.23
3	>0.23 - 0.31
2	>0.31 - 0.47
1	>0.47 - 0.94
0.5	>0.94 - 1.9
None (<0.5)	>1.9

[a] The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.
[b] Chronic, systemic effects.

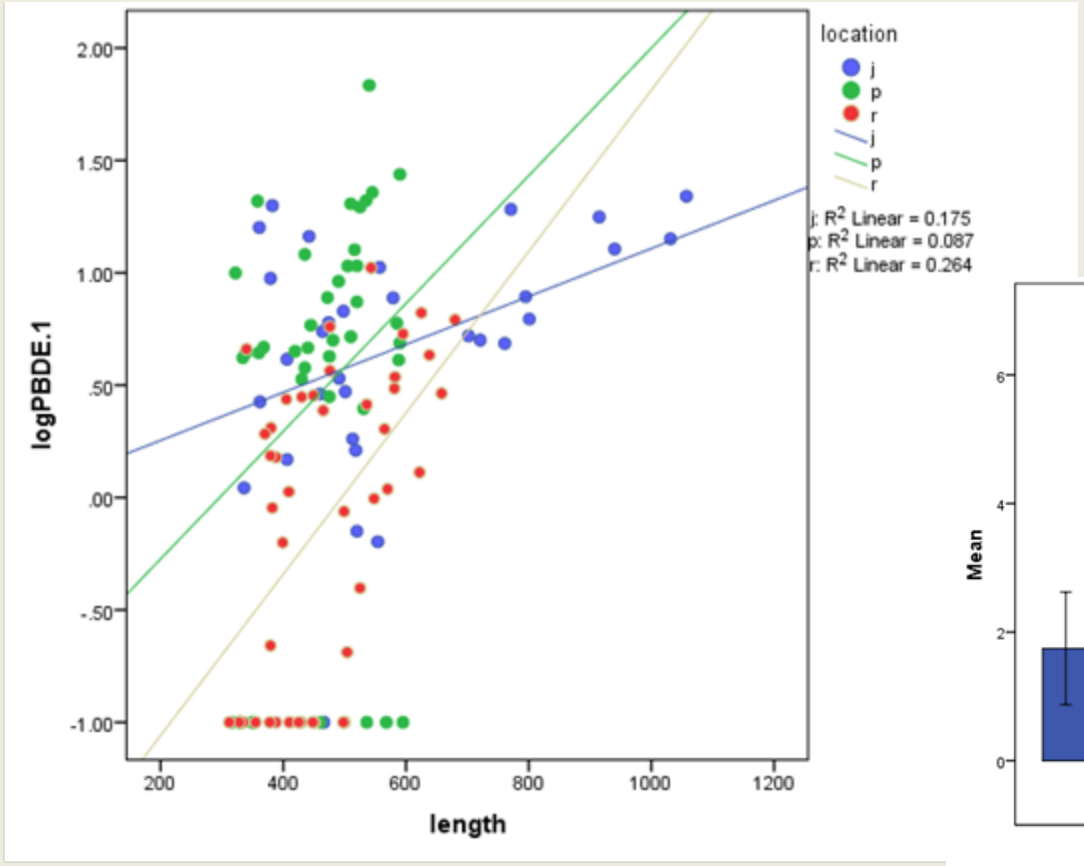
Notes:

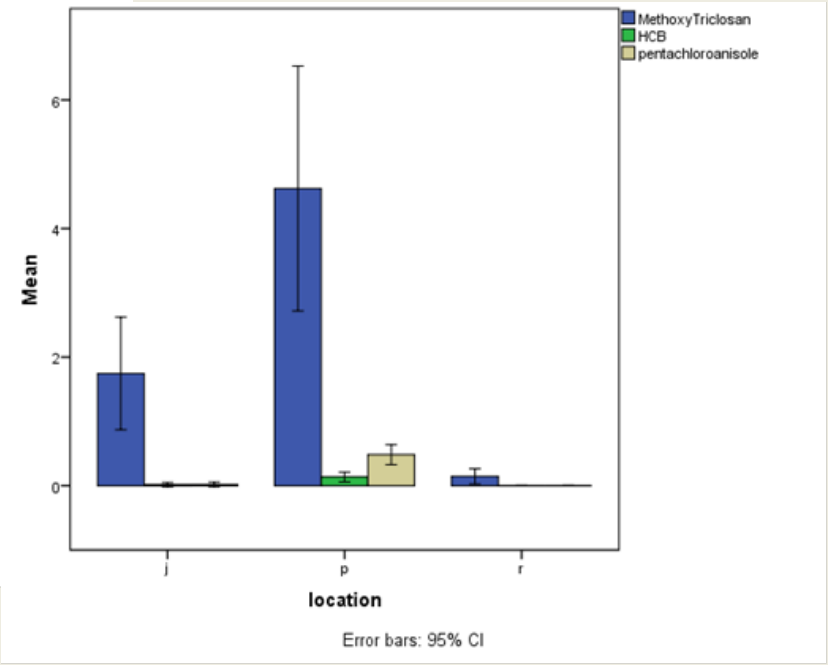
Preliminary Results – Chlordane & DDTs





Preliminary Results – PBDEs & Others





Contaminants in blue catfish

- *Potential relevance/impacts*:
  - Contaminant levels consistent with current advisories
    - "Risk" does not account for:
      - multiple contaminant exposures
      - individual fish variability
  - Contaminant levels & character vary by river
    - Most fish levels increase with length
    - Catfish ecological factors differ by river
    - Potomac is high - linkage to ecological parameters

Chesapeake Bay Program
A Watershed Partnership