

An Evaluation of Temporal Variability in MeHg Fish Tissue Sample Results

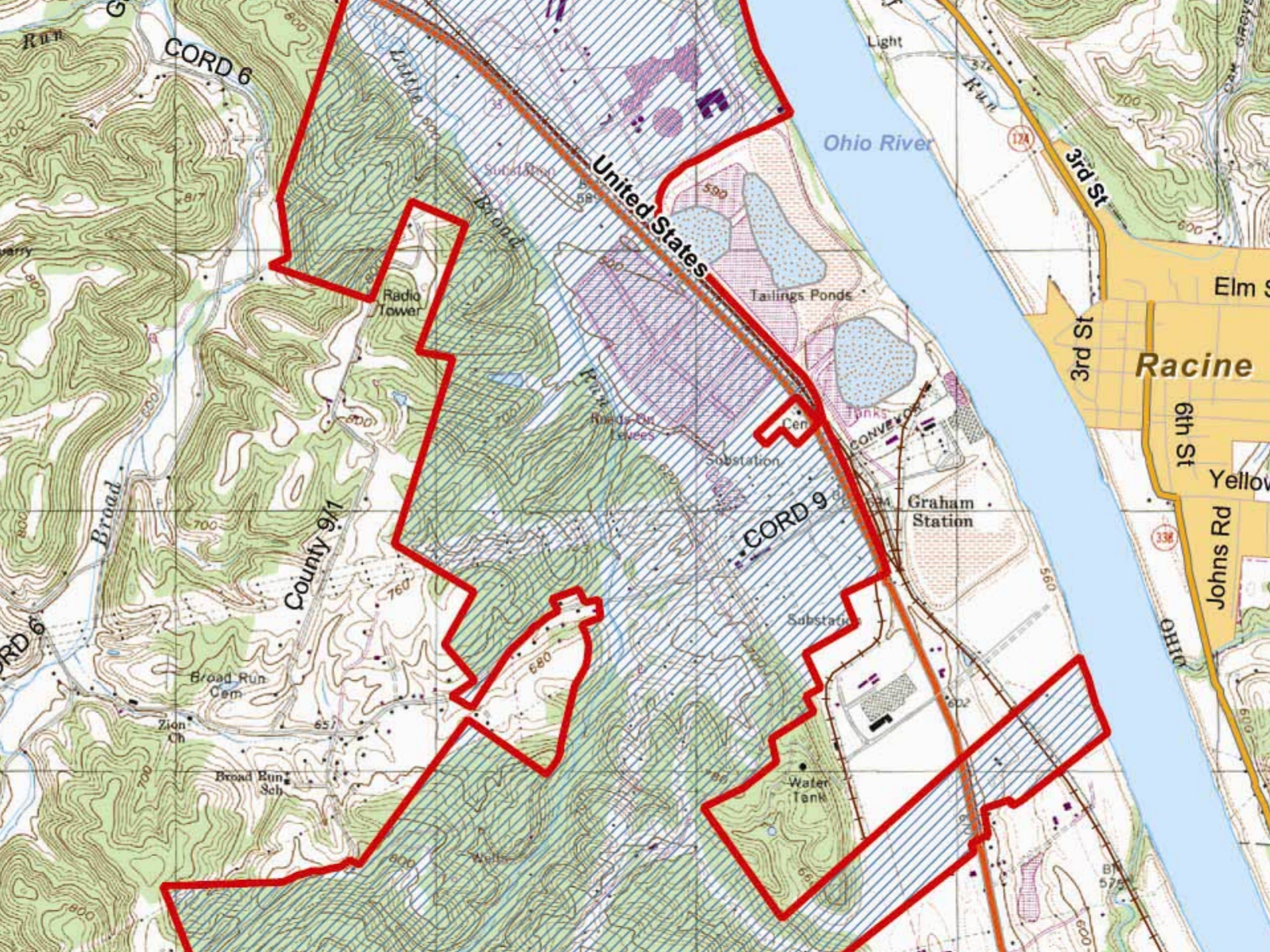
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Objectives

- Assess seasonal and annual variation in fish fillet MeHg concentrations at one location
- Does the magnitude of variability differ between species?
- Implications for WQ impairment assessment

Study Location

- Appalachian Power Company
Sporn/Mountaineer Plants
- RM 241.9 to 242.4
- Upstream and downstream of wastewater discharge



Methods

- Three species collected – bluegill, sauger, hybrid striped bass
- Collected by electrofishing in May 2010, October 2010, October 2011
- Fish length, weight, and age





Hybrid Striped Bass

<i>Collection date</i>	<i>Mean composite length (mm)</i>	<i>Age(s)</i>	<i>Sample MeHg (mg/kg)</i>	<i>Average MeHg (mg/kg)</i>
May 2010	462 315	--- ---	0.123 0.115	0.117
October 2010	373 249	1, 2 1	0.106 0.075	0.0905
October 2011	319 460	1 1, 2	0.165 0.334	0.207

Sauger

<i>Collection date</i>	<i>Mean composite length(mm)</i>	<i>Age(s)</i>	<i>Sample MeHg (mg/kg)</i>	<i>Average MeHg (mg/kg)</i>
October 2010	334	2	0.132	0.109
	222	1	0.086	
October 2011	391	3, 4	0.330	0.234
	344	2, 3	0.217	
	221	1, 2	0.155	

Bluegill

<i>Collection date</i>	<i>Mean length (mm)</i>	<i>Age</i>	<i>Sample MeHg (mg/kg)</i>	<i>Average MeHg (mg/kg)</i>
October 2011	183	3	0.099	0.108
	137	2 , 3	0.116	
October 2010	162	---	0.056	0.047
	147	---	0.034	
	188	---	0.052	

Results – Sources of Variation

- Fish size and age: hybrid striped bass and sauger show clear affect of size/age; larger, older fish have higher MeHg levels
- Annual variability in average MeHg concentration (all fish sizes pooled) differed by a factor of 2.3 (HSB, bluegill) and 2.1 (sauger)

Implications – WQ Impairment Monitoring

- In this study, spatial variability was neutralized.
- For trophic level 4 fish, the size/age of fish co-varies with MeHg and thus must be accounted for:
 - > use a length-standardized MeHg level
 - > specify strict size range requirement
 - > mixing small with large fish for an “average” size fish will produce nothing but a hypothetical fish

Options in Assessment Decision

<i>Option</i>	<i>Result</i>	<i>Problems</i>
Select maximum value across all species and years	0.334 mg/kg (hybrid striped bass)	94% of total information is lost
Select species w/ highest avg MeHg	0.234 mg/kg (sauger)	86% of information lost. Ignores annual variability and assumes 100% cons.
Select trophic level-specific maximum avg MeHg	TL4 – 0.234 mg/kg TL3 - 0.108 mg/kg avg= 0.171mg/kg	71% of information lost. Variation among TL [MeHg] is lost.

A Better Option

- 1) Standardize size/age MeHg for TL4 fish.
- 2) Each year, calculate TL-weighted mean MeHg using species-specific geometric mean levels weighted by sample size.
- 3) When multiple years of data available, calculate average using sample size as weighting factor. ***100% data utilization.***