

Pesticides in urban settings – Use of a Pesticide Toxicity Index to evaluate potential toxicity of stream water samples to macroinvertebrates

by

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What we know about modern-day pesticides:

- ❖ Commonly applied in urban settings
- ❖ Detected in stream water
- ❖ Large spatial and temporal variation
- ❖ Tend to occur as complex mixtures
- ❖ Have a wide range of toxicities to aquatic organisms

What we ^{don't} know:

- ❖ Combined toxicity of the entire pesticide mixture
- ❖ Response of stream biota
- ❖ Factors affecting potential toxicity

Pesticide Toxicity Index (PTI)

$$PTI_x = \sum_{i=1}^n \frac{E_i}{MTC_{x,i}}$$

Munn, M.D. and Gilliom, R.J., 2001, Pesticide Toxicity Index for freshwater aquatic organisms: U.S. Geological Survey Water-Resources Investigations Report 01-4077, 61 p.

Objectives:

- ❖ How does PTI vary in relation to urbanization?
- ❖ What other factors influence PTI in urban settings?
- ❖ Does change in PTI correspond with change in biological indicators?



PTI Cautions and Caveats :

- ❖ Use for relative rankings - not actual 'toxicity'
- ❖ Bioassays done on limited taxa
- ❖ Toxicities not available for all pesticides
- ❖ Pesticides may not be included in lab analyses
- ❖ Synergistic effects not accounted for

Study Area –

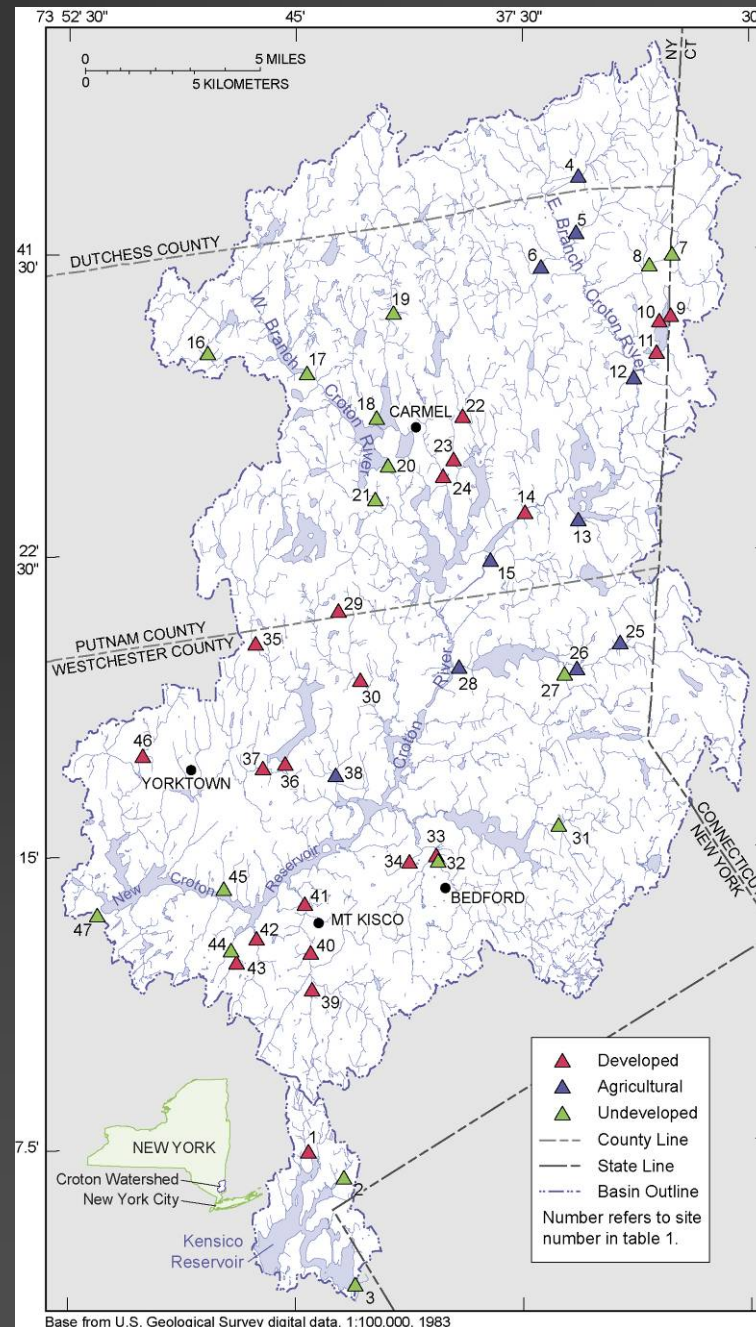
Croton watershed

NYC water supply

47 sites

small streams

range of urban



Methods-

Water samples:

All sites: Base-flow
summer 2000

Kisco R. site: 2-4X/month
& storms 2000-03



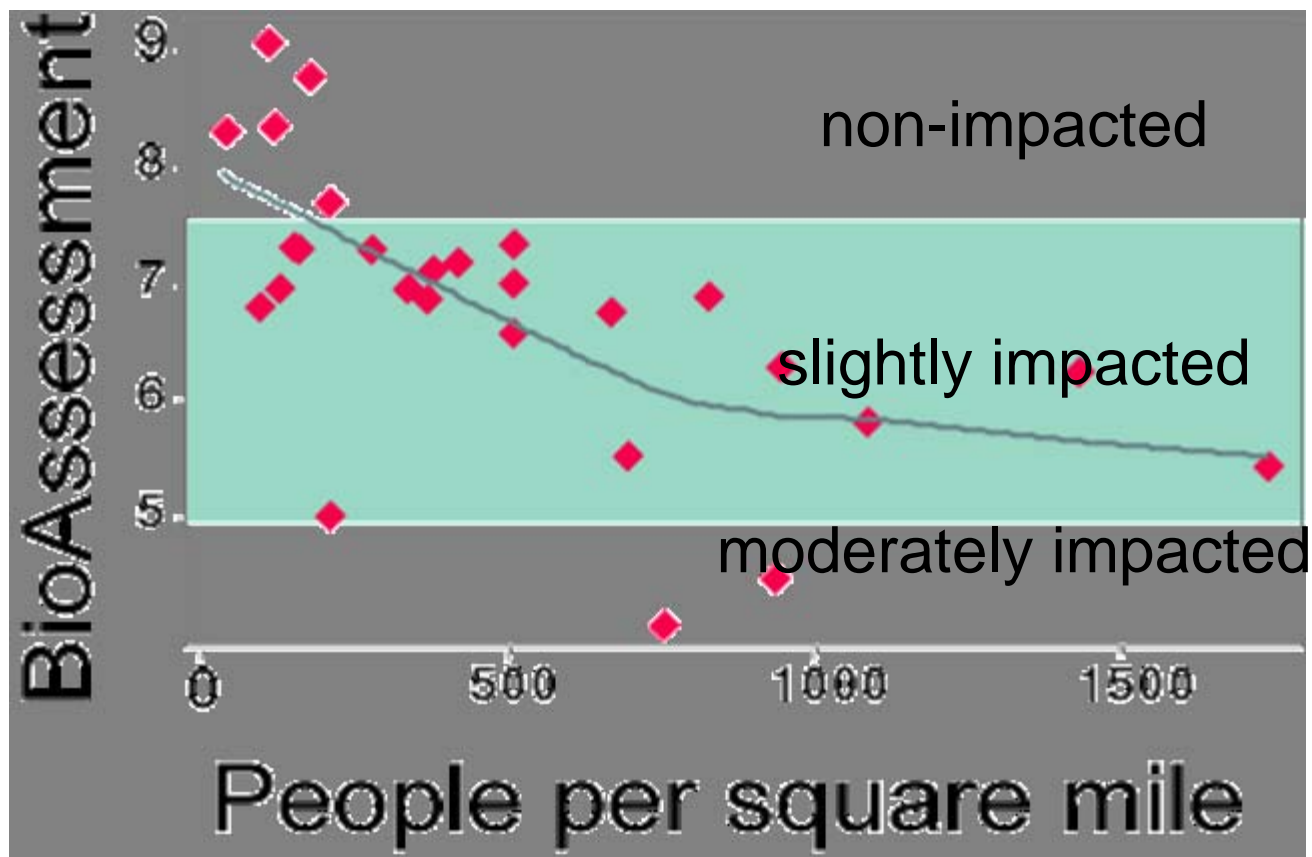
Macroinvertebrates:

Baseflow

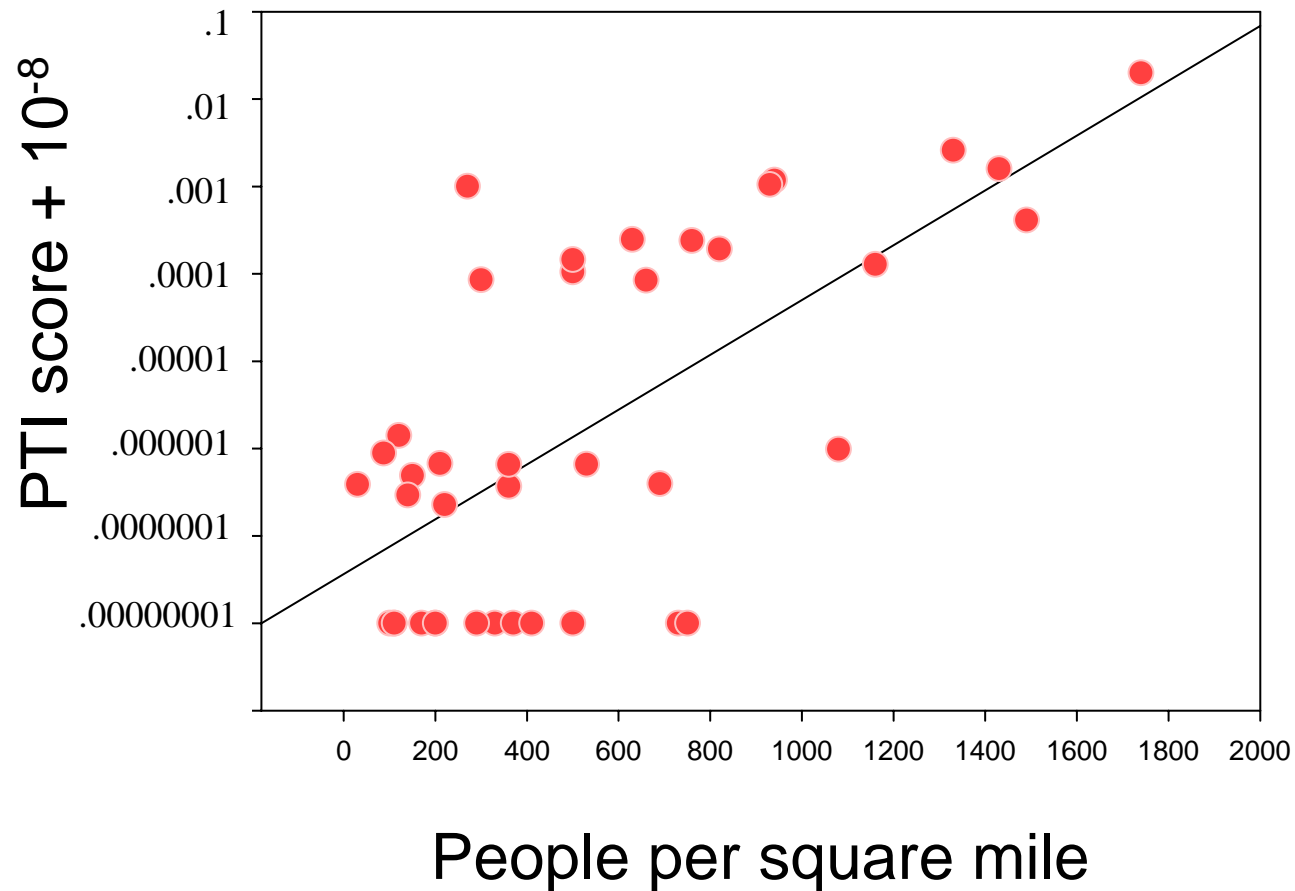
summer 2000



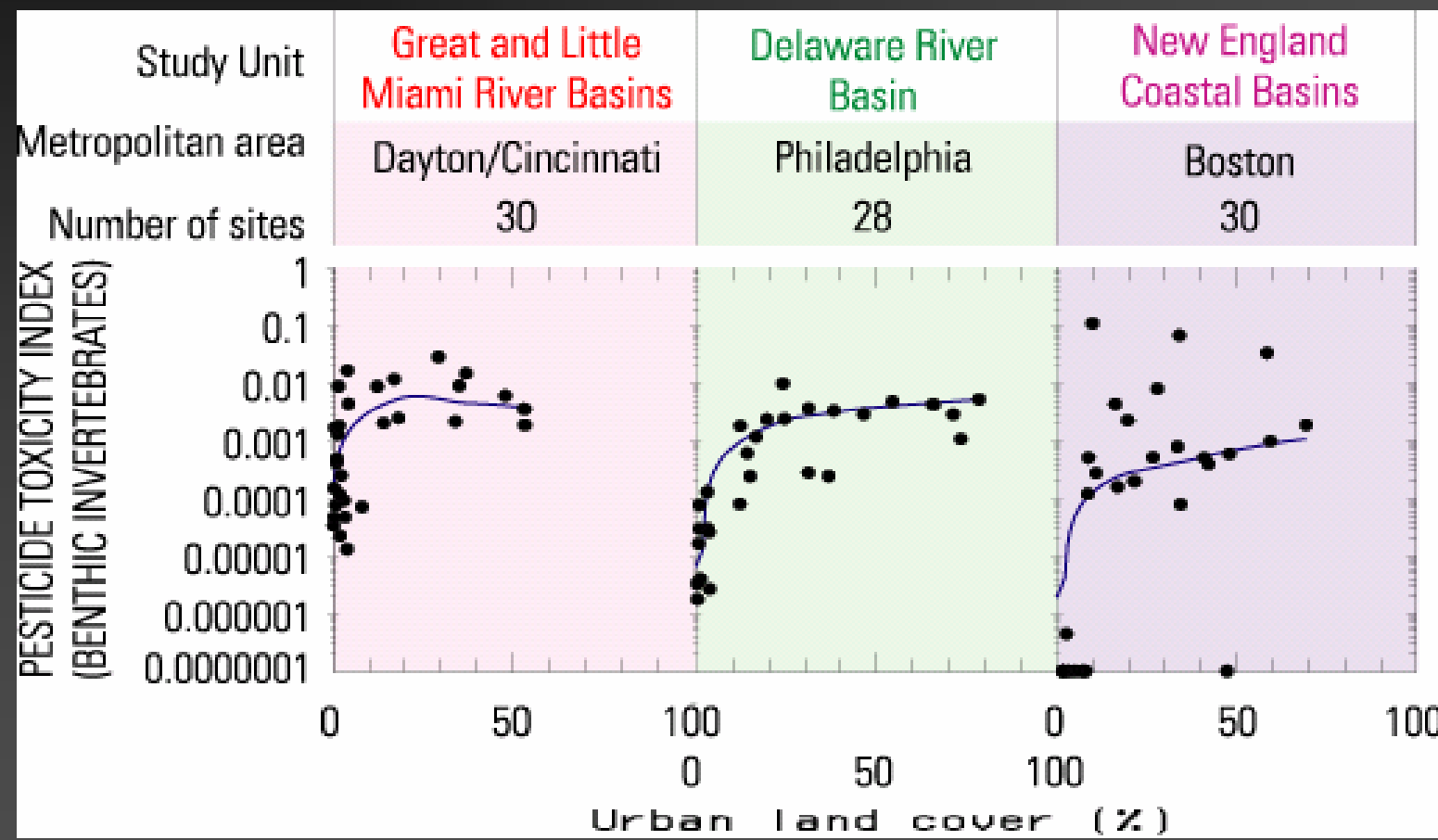
Results – Bioassessment index versus urban intensity



Results – PTI versus urban intensity indicator

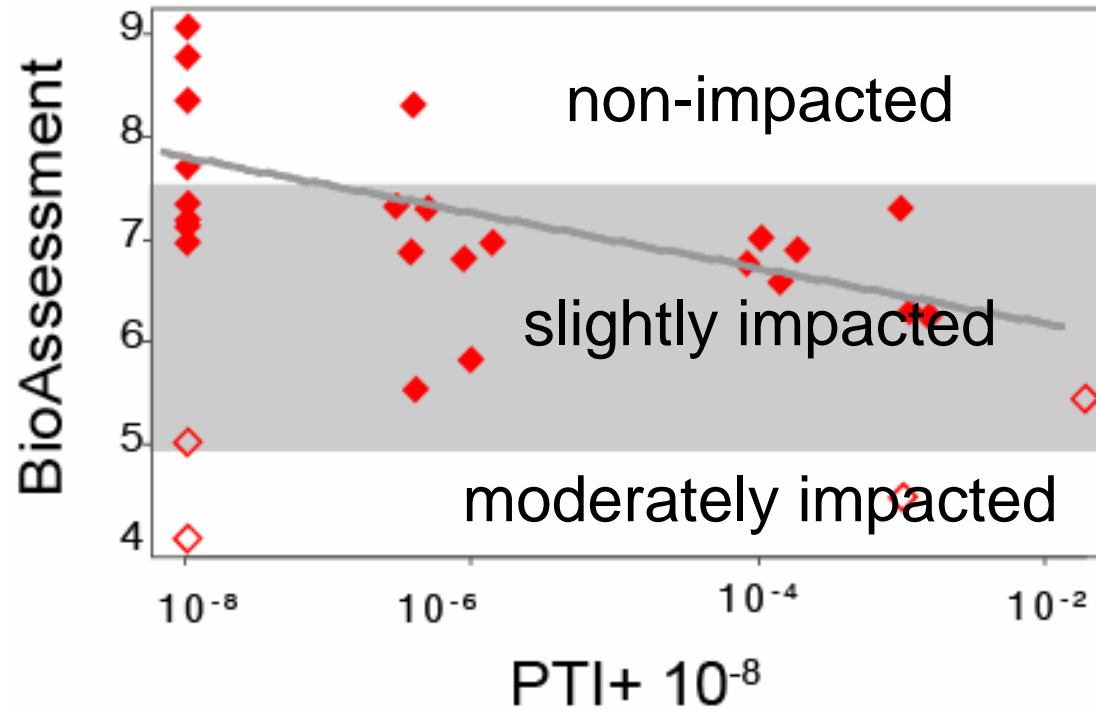


Results – Similar to other urban areas



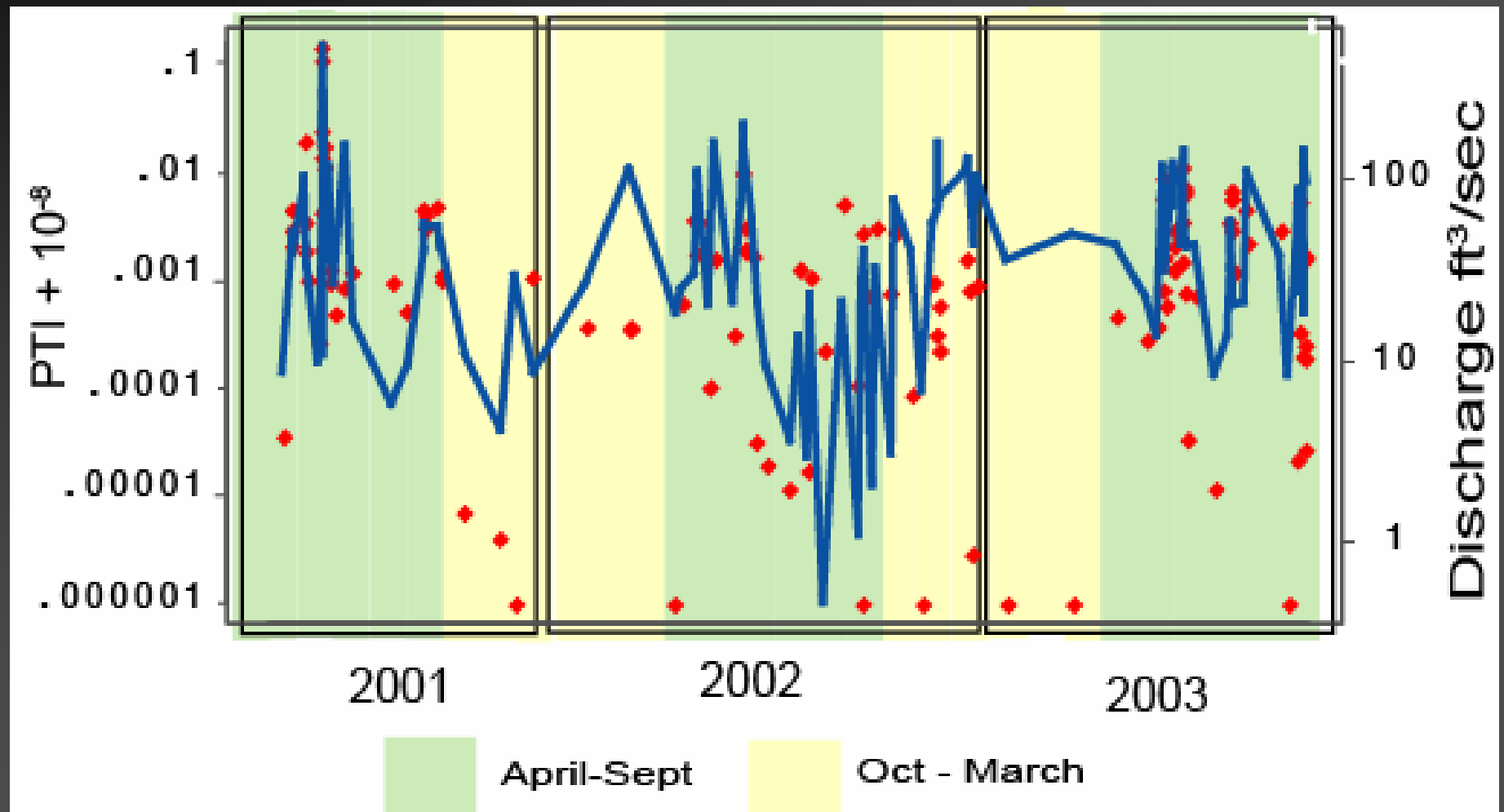
Source – NAWQA summary reports

Results – Bioassessment versus PTI score

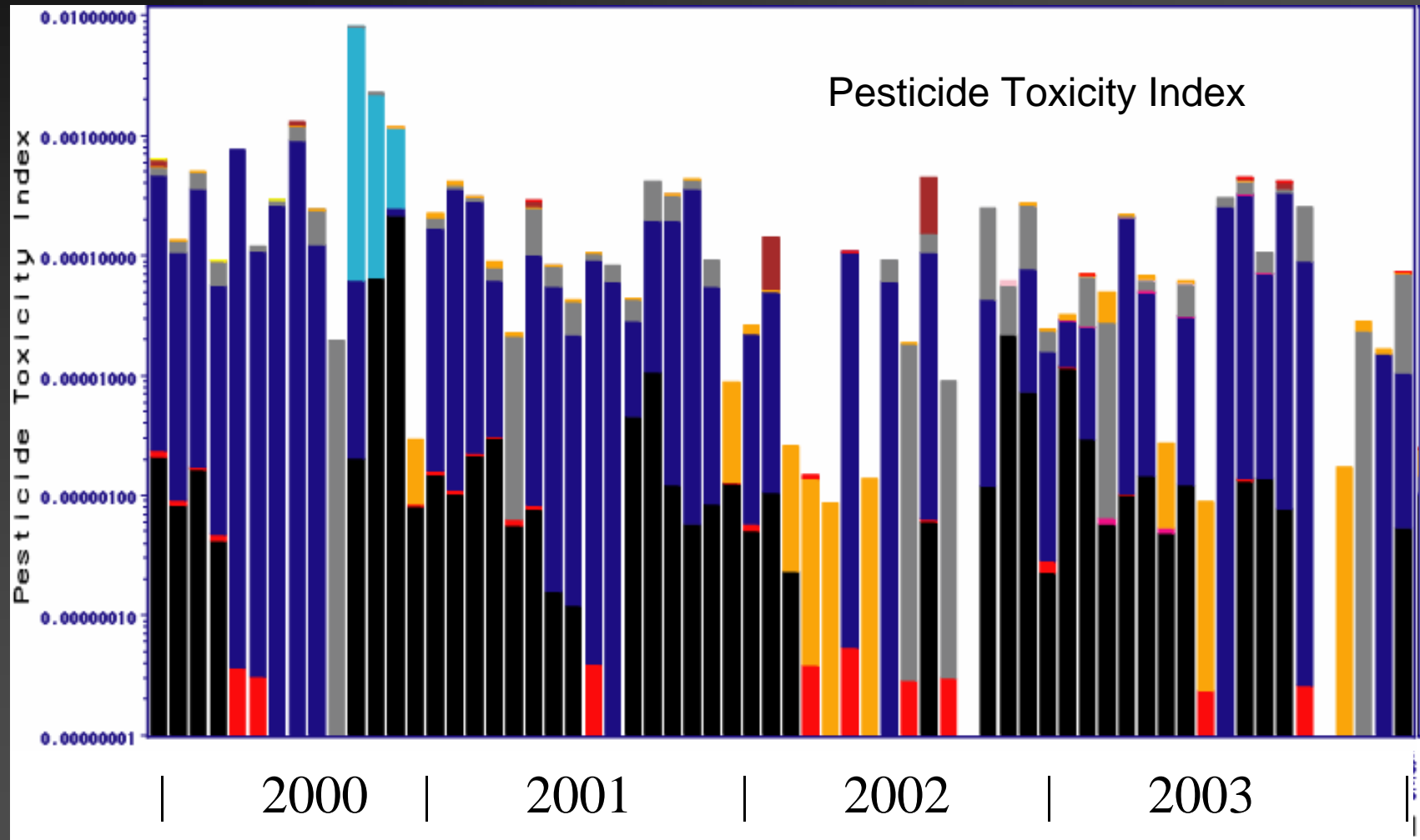


Results – Temporal variation; Kisco R. May 01-Sept 03

PTI varies with season and with flow



Results – PTI does not track total concentration



Conclusions:

- ❖ PTI is a useful tool for evaluating the effects of urbanization on Water Quality
- ❖ More information is needed
 - Toxicities of newer pesticides
 - Long-term trends in toxicity
 - Synergistic effects
- ❖ Relative PTI likely to increase with further urbanization
- ❖ Pesticide toxicity may be an important contributing factor to decline in aquatic biological health in urban streams