



Emerging Contaminant Sampling in the Susquehanna River Basin – Sediment & Passive Water Sampling

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ABSTRACT

The Pennsylvania Department of Environmental Protection's (PADEP) Division of Water Quality (DWQ) has implemented a multiyear effort to characterize emerging contaminants both in the Susquehanna River basin and throughout Pennsylvania. Sediment, passive water samples, and grab water samples were collected from 2012 through 2016. Sampling continues in 2017.

Introduction

Emerging contaminants such as hormones, pharmaceuticals, personal care products, and other organic contaminants are a growing concern in freshwater sources. Most programs do not have routine monitoring of these compounds. As a response to the young-of-year (YOY) smallmouth bass issues in the Susquehanna River Basin, PADEP began an extensive monitoring program of the basin for a variety of these contaminants. Sampling has expanded to characterize many of the state's waters for emerging contaminants. Sampling began in 2012 with four sites and has grown to include 27 sites in 2017 (Figures 1 & 2).

Materials and Methods

In 2012, DWQ staff deployed 4 polar organic chemical integrated samplers (POCIS) in the Susquehanna River at Harrisburg and Delaware River to test for total estrogenicity. In 2013 through 2016, sampling expanded yearly, going up the watersheds into smaller tributaries. Sediment, passive water samples, and grab samples were collected. Sediment was tested for pesticides, PCBs, hormones, wastewater compounds and/or metals. Passive samplers were tested for pesticides, PCBs, hormones, wastewater compounds, pharmaceuticals, and PBDEs. Semi-permeable membrane devices (SPMDs) were used, in addition to POCIS. Grab samples were tested for total estrogenicity and pesticides. Sediment collection was generally centered on YOY SMB spawning areas or areas with potential for spawning.

Results and Discussion

Sediment 2013 – 2016 Data: Pesticide & PCB sediment testing halted after 2014 due to lack of detections. Hormones & wastewater compounds sampling continues from 2013 – present (Figure 3). Data is pending for 2016.

Pesticide 2013 – 2016 Grabs: 28 out of 50 pesticides were detected overall. Most common: acetochlor, atrazine, metolachlor, CIAT, prometon, & simazine. Highest concentrations mainly on large rivers (Susquehanna, Juniata, Delaware) and tributaries in upper Juniata basin & Lancaster county. Highest total concentration in upper Juniata basin. Most pesticides were detected at low concentrations.

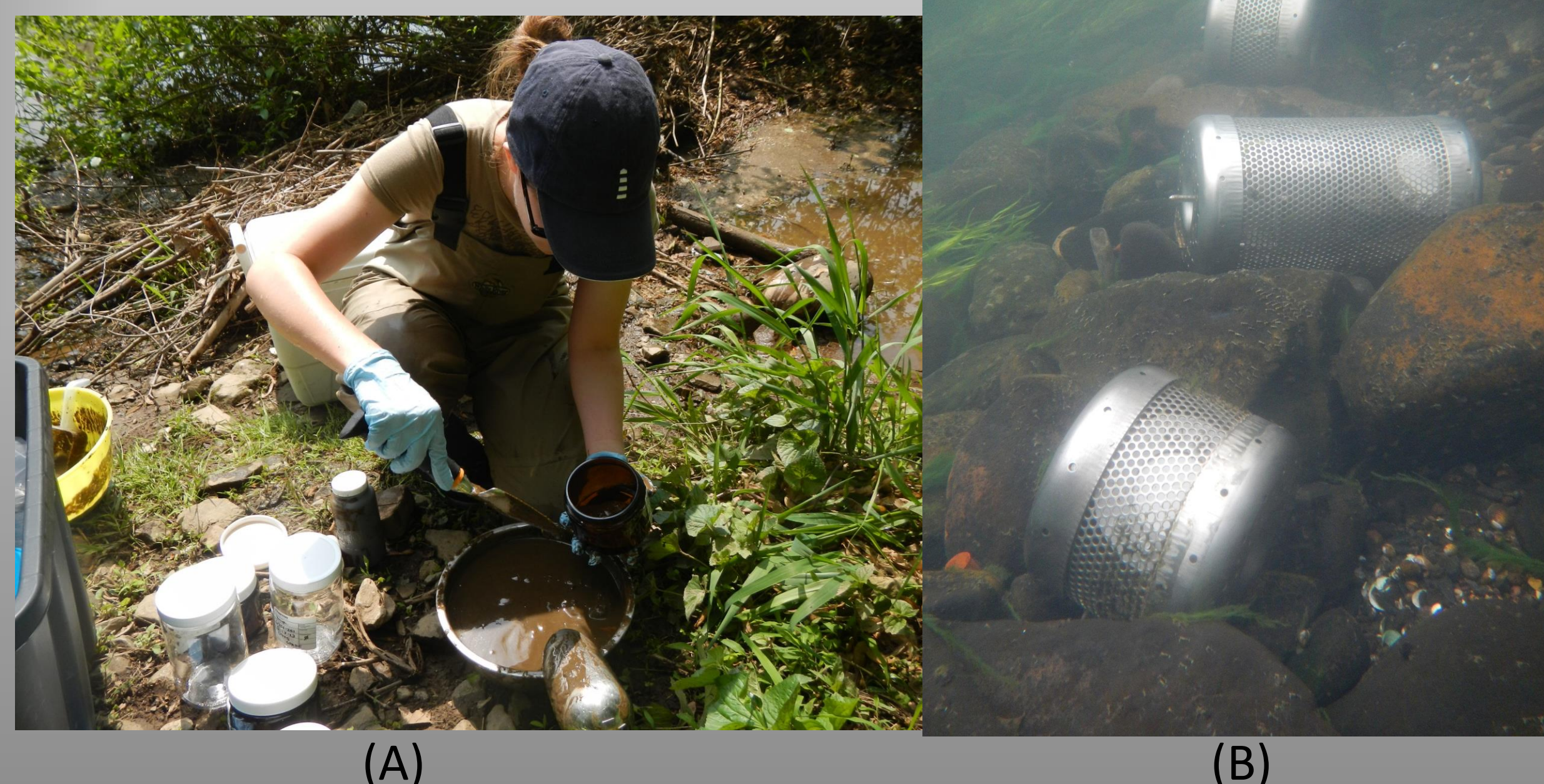


Figure 1. (A) Collecting streambed sediment, (B) Passive samplers deployed.

Results and Discussion Continued...

Total Estrogenicity 2012 – 2016 Grabs: Highest in upper Juniata River and the Lancaster area of the Susquehanna watershed (Figure 4). All detections were in samples collected in spring. Includes all estrogenic activity in sample (hormones + other compounds).

Figure 2. Sediment and passive sampler sites, 2012 - 2016

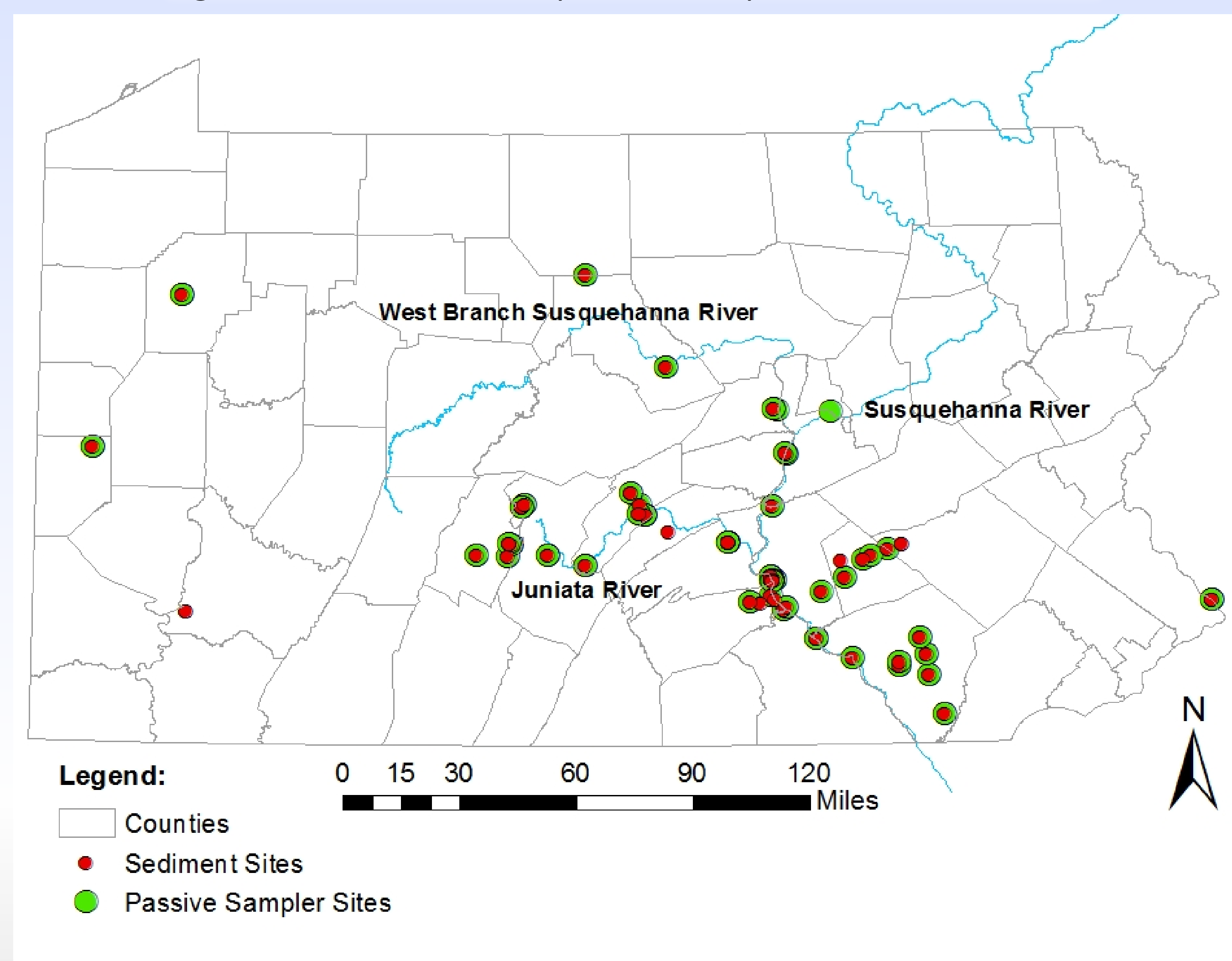
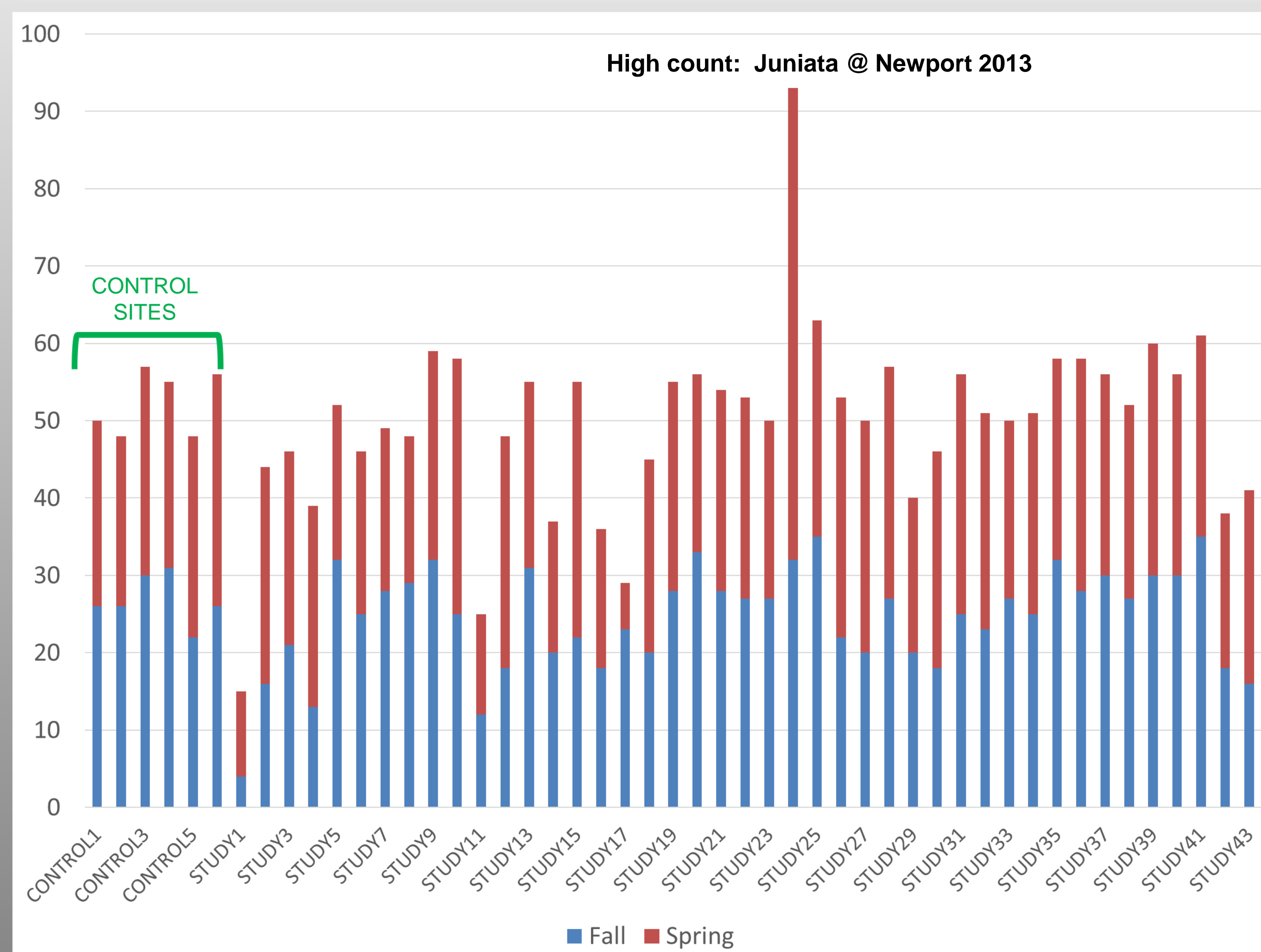


Figure 3. Number of hormones & wastewater compounds detected per sample in sediment in Fall (blue) & Spring (red). Control sites bracketed in green.



Results and Discussion Continued...

Passive Samplers 2014 – 2015 Data: Wilcoxon Signed Rank test showed significant difference for a number of compounds detected between spring and fall samples at the same site ($p = 0.02367$); number detected was frequently higher in spring. Highest number of compounds detected were on Quittapahilla Creek (92) and Yellow Breeches Creek (80). Lowest number of compounds detected was Kettle Creek @ Cross Fork (20). Lowest overall in Upper Susquehanna. Pharmaceutical data pending for 2014-2015. Data pending for 2016. See Figure 5 for distribution by major drainage basin. **Future Work:** Sampling is continuing in 2017.

Figure 4. Total estrogenicity grab water samples (2012 – 2016).

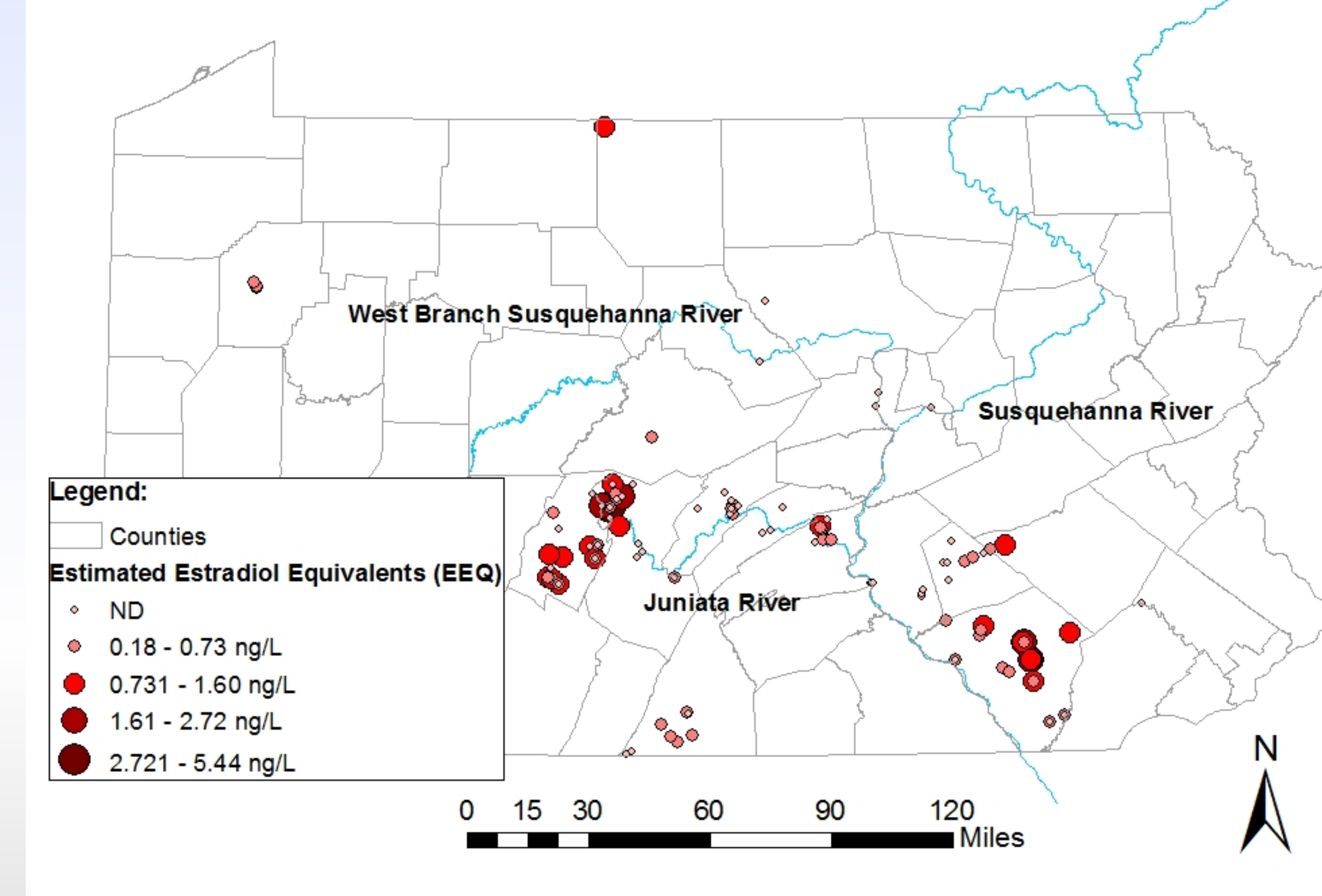
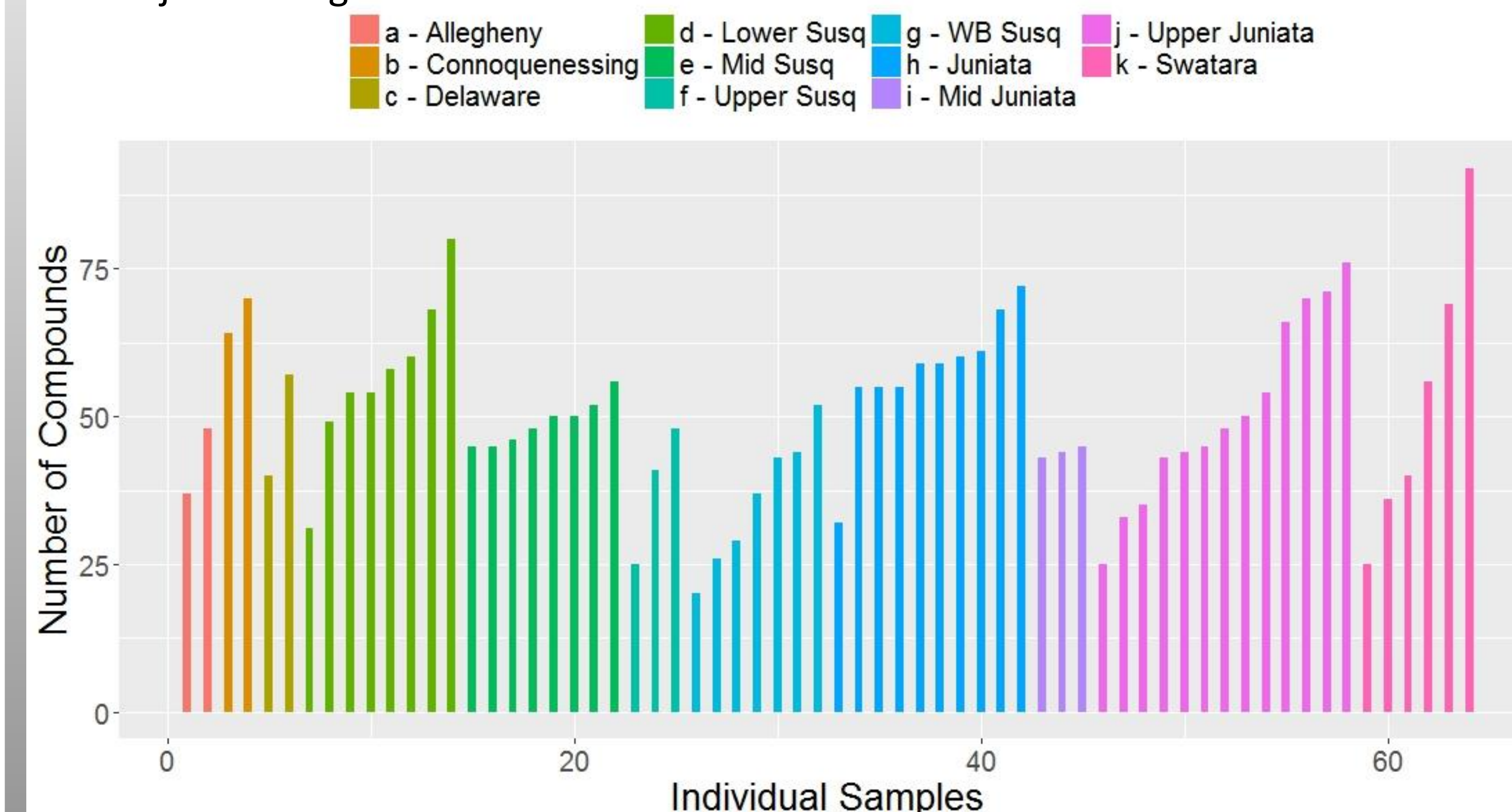


Figure 5. Passive samplers - Number of compounds detected (2014 - 2015), by major drainage basin.



References

PA DEP. 2013. Streambed Sediment Collection Protocol. http://files.dep.state.pa.us/Water/Drinking%20Water%20and%20Facility%20Regulation/WaterQualityPortalFiles/Methodology/2013%20Methodology/Streambed_Sediment_Protocol.pdf.