

# The Effects of Impoundments on Streams

Region 4 Wetlands/401 Conference  
November 2, 2016

# Summary of 2012 Work

- Temp increased downstream
- Chl-a increased downstream
- Invertebrate community more tolerant (BI about 1.5 greater) downstream
- Possible invertebrate community shifts

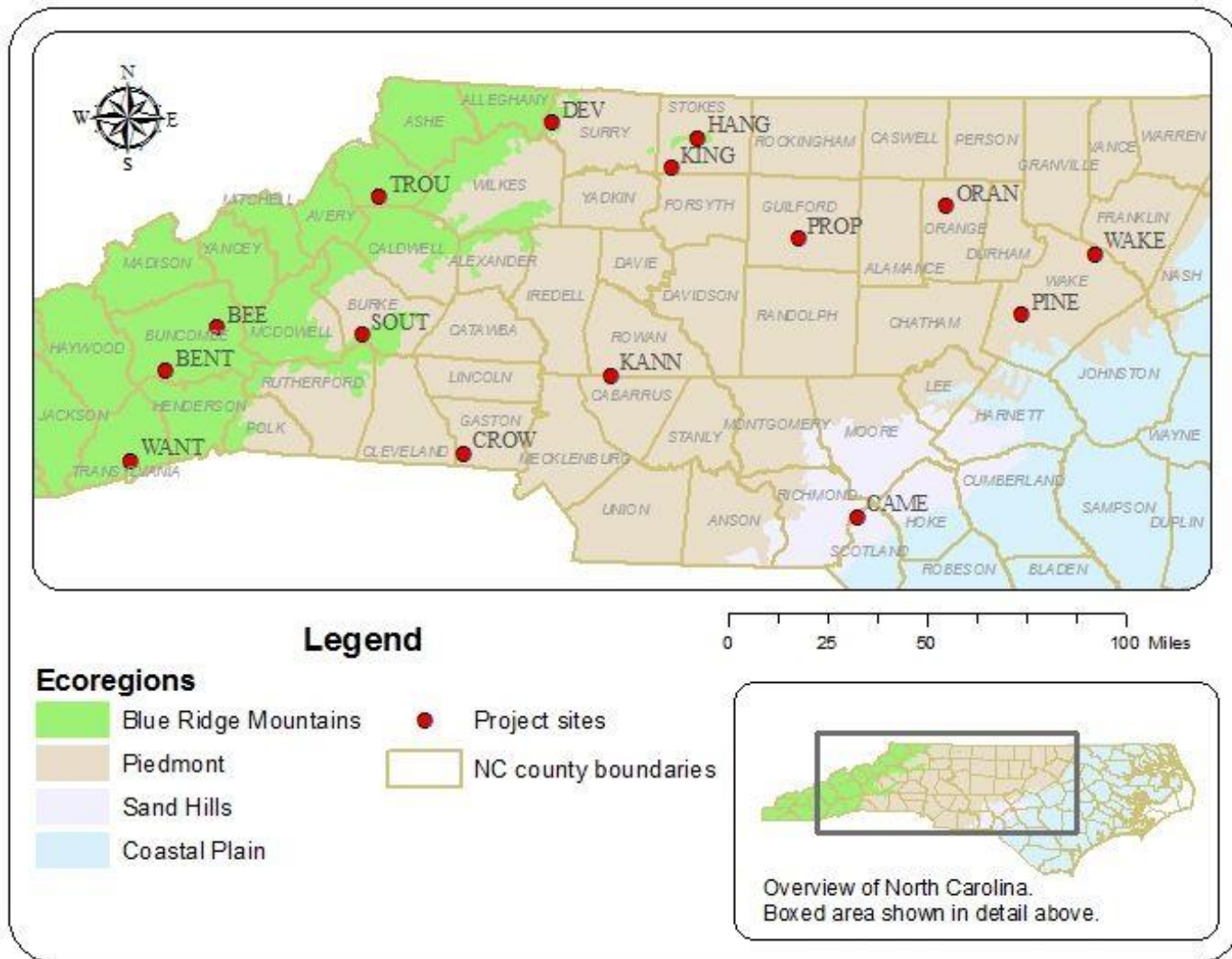
# Why Another Study?

- Can impacts be recreated?
- Better quantification of biological impairment
- How far downstream to recover from these impacts?

# Study Design

- 13 Lakes (8 Small, 5 Large, 7 Mountain, 5 Piedmont, 1 Sandhills, 1 Urban)
- 5 sampling locations/ lake/stream
- Small streams (site 1 < 3 mi<sup>2</sup> watershed) sampled May – June using Qual 4 method
- Large streams sampled July – Aug using Full Scale
- Chl-a sampled as well as usual parameters (DO, Temp etc)

# Location of Study Sites

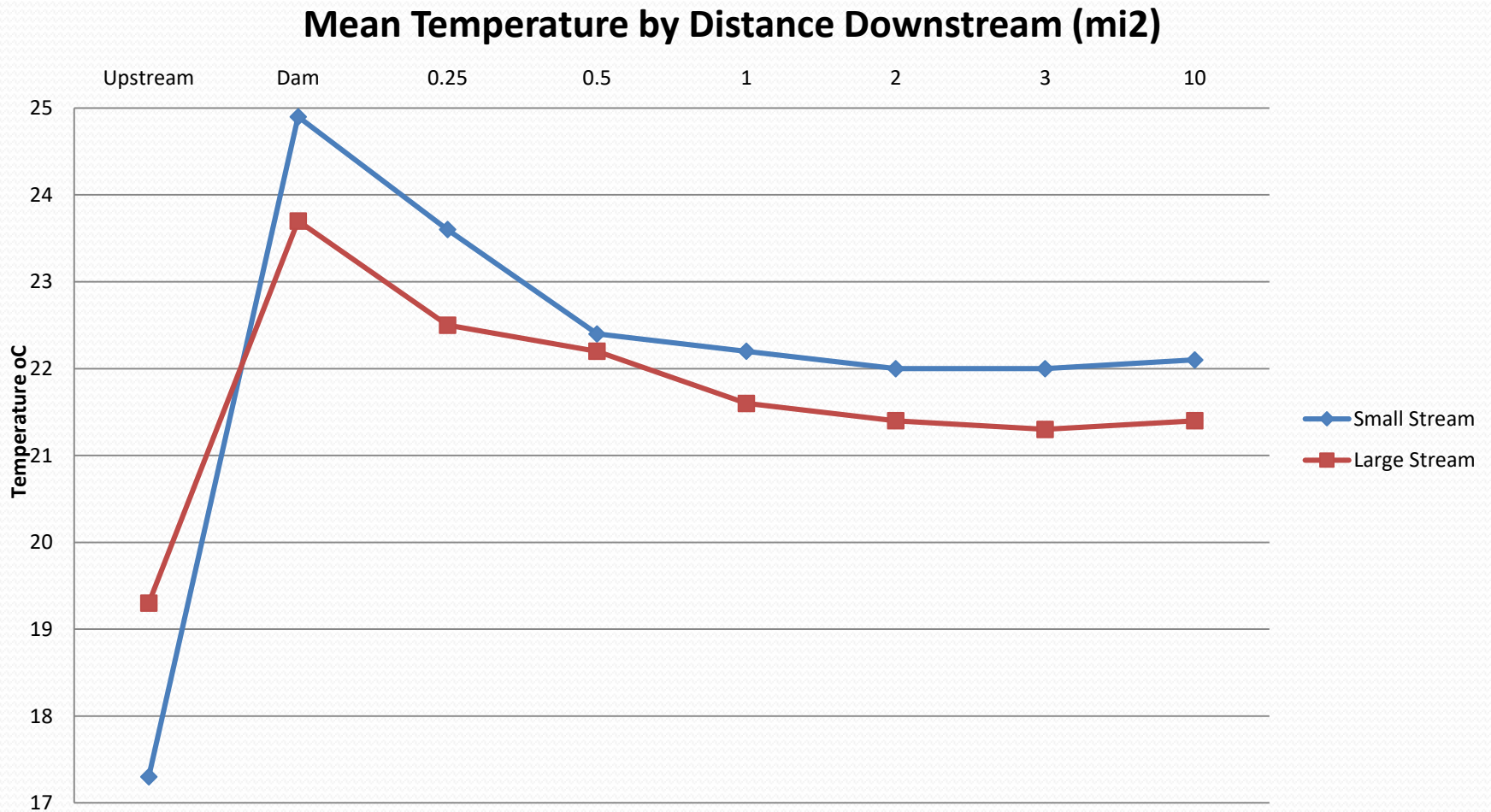




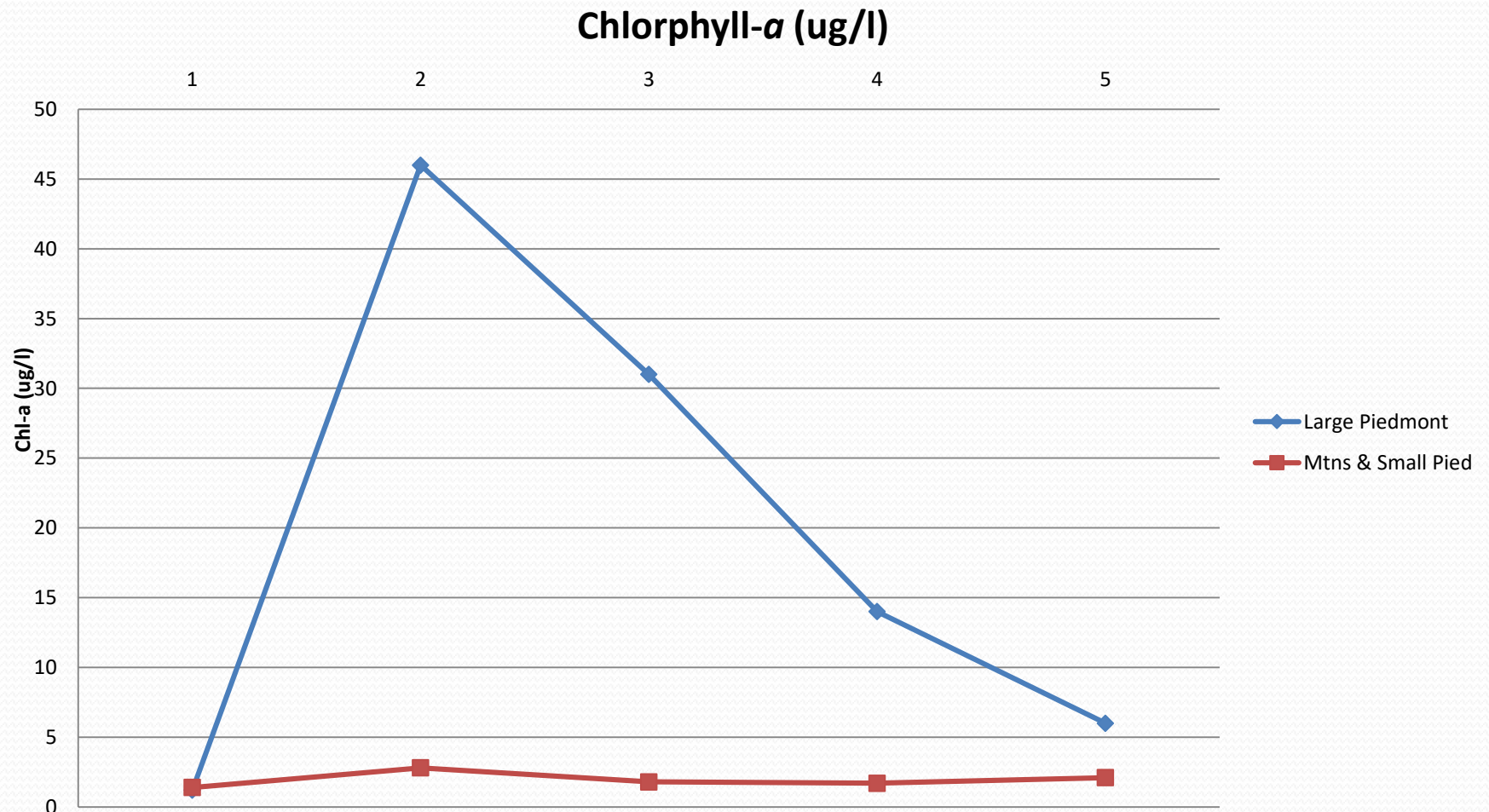


# Bent Creek

# Results - Temperature

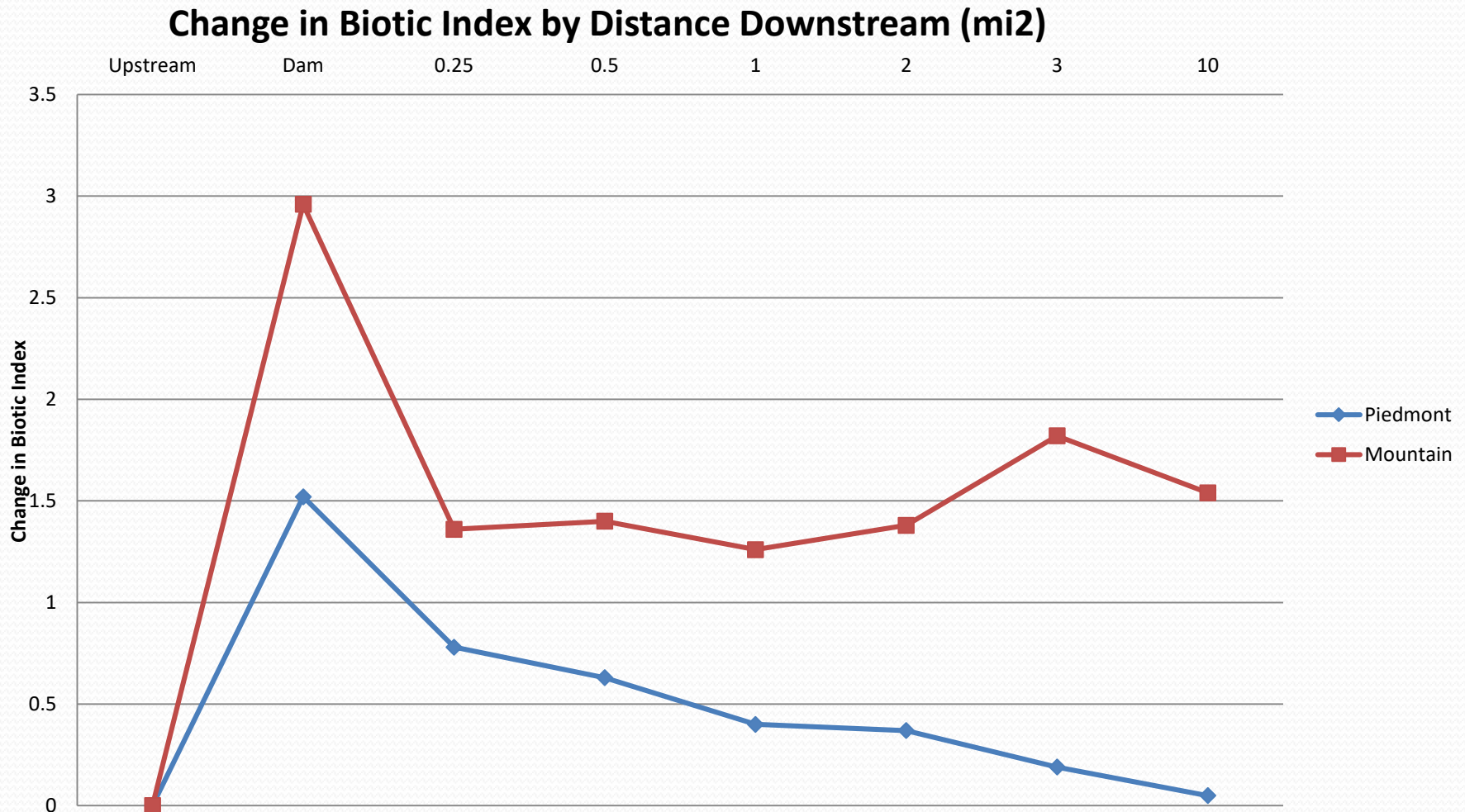


# Results – Chlorophyll-a





# Biotic Index Changes



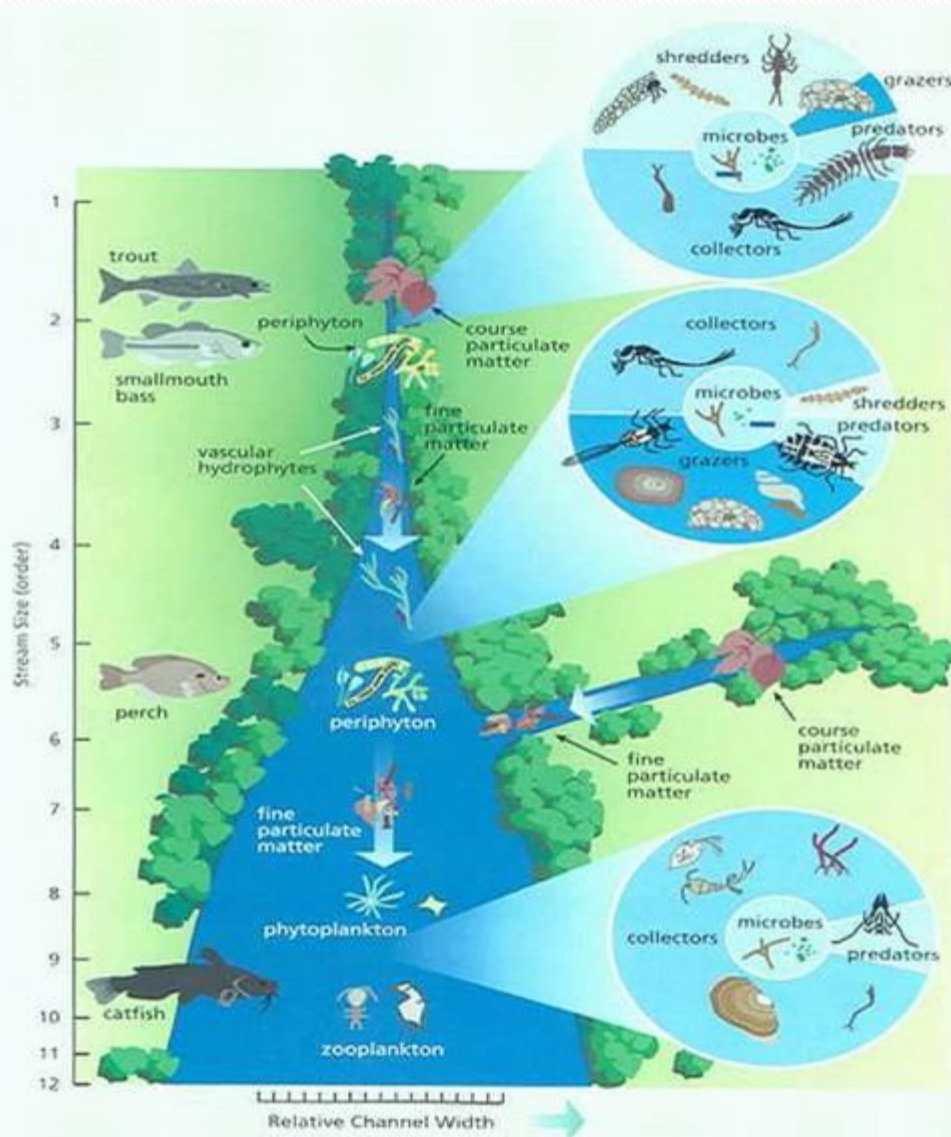
# Results -EPT Taxa Richness

- 7 streams EPTS declined 60-75%
- 3 declined 85%, 2 only declined 33%
- 4 streams never recovered
- 5 streams recovered in 1 mi<sup>2</sup>
- Other 3 streams recovered at 3.5, 4 and 9.5 mi<sup>2</sup>

# Bioclassification Recovery

- 7 streams dropped 2 bioclasses, 1 dam, 3 streams dropped 1 bioclass, 1 dropped 3, 1 dropped 4
- 6 streams recovered in  $< 1 \text{ mi}^2$ . 2 in  $1-5 \text{ mi}^2$ , Recovery occurred in  $> 9 \text{ mi}^2$  in 4 streams.
- Many with the fastest recovery were below smallest impoundments.

# River Continuum Concept



The RCC predicts how biological communities are modified because of catchment size and energy input. This concept has been tested worldwide and seems to hold true.

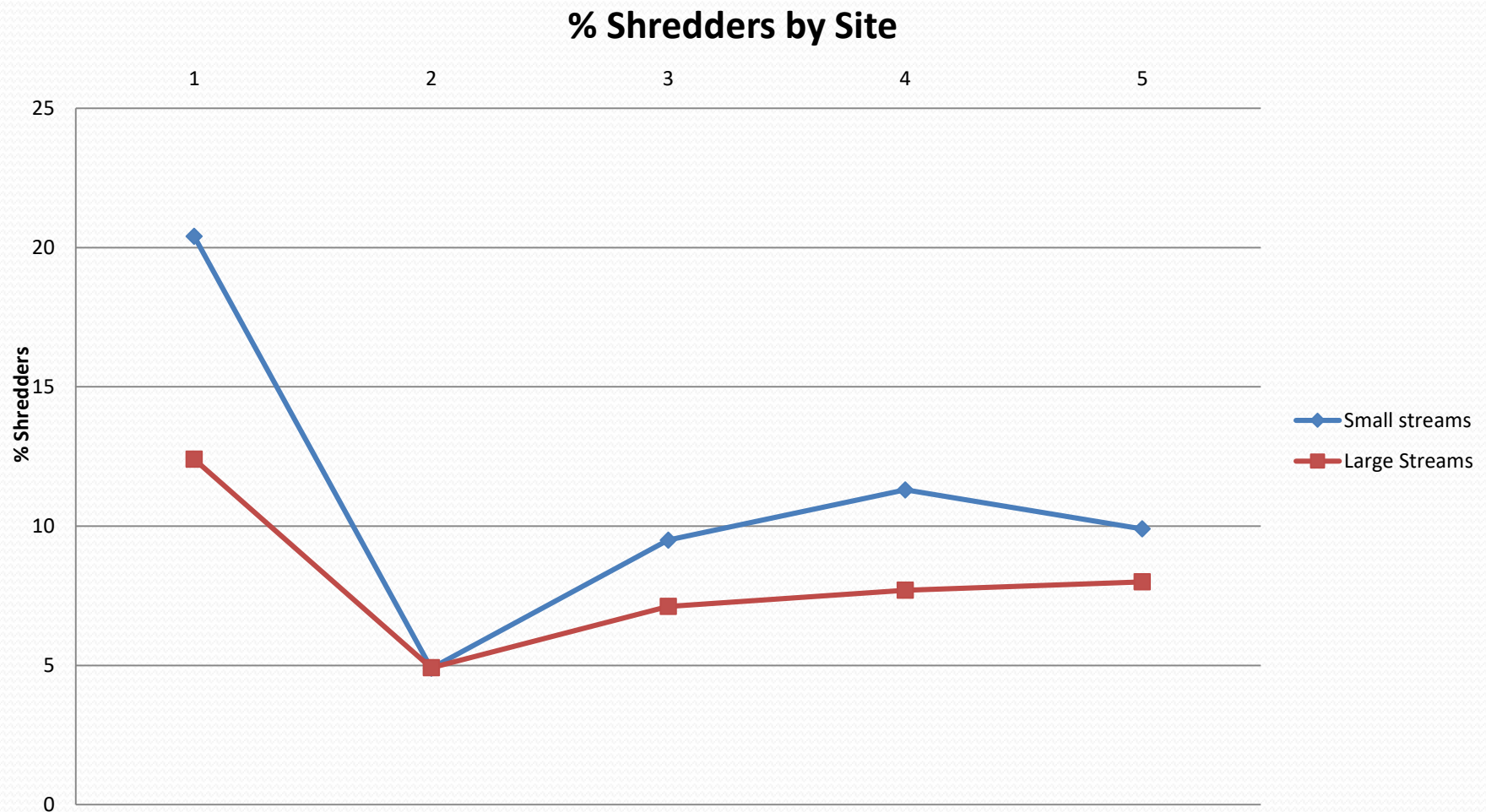
Headwaters dominated by shredders and few grazers, mid-order streams dominated by grazers, few shredders

# Predictions

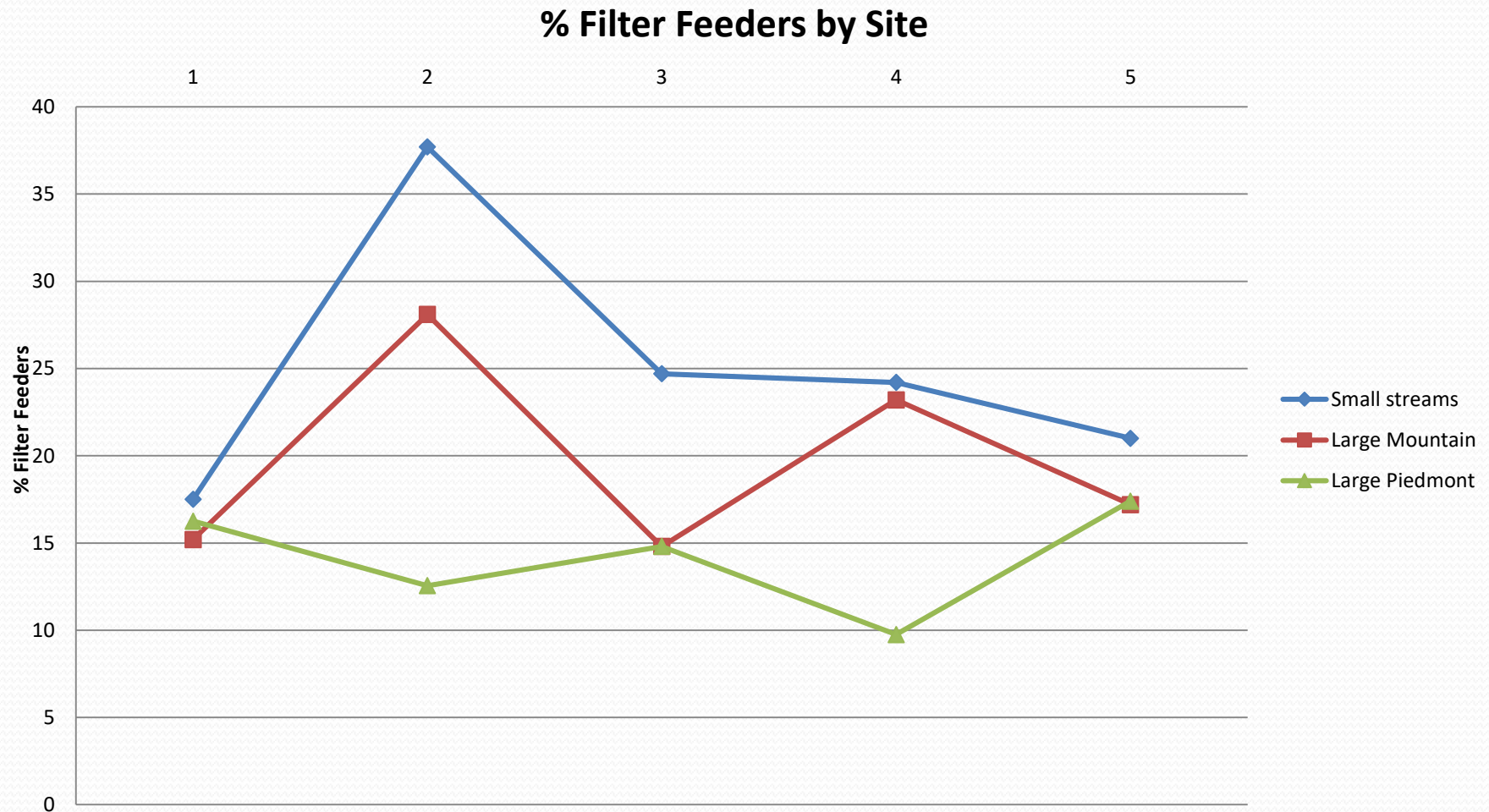
- Ponds should cut off flow of leaves so shredders should decline be dam
- Grazers should be low above the dam and increasing as go downstream
- Filter feeders should spike below the dam eating periphyton from pond, then decline



# Reality - Shredders

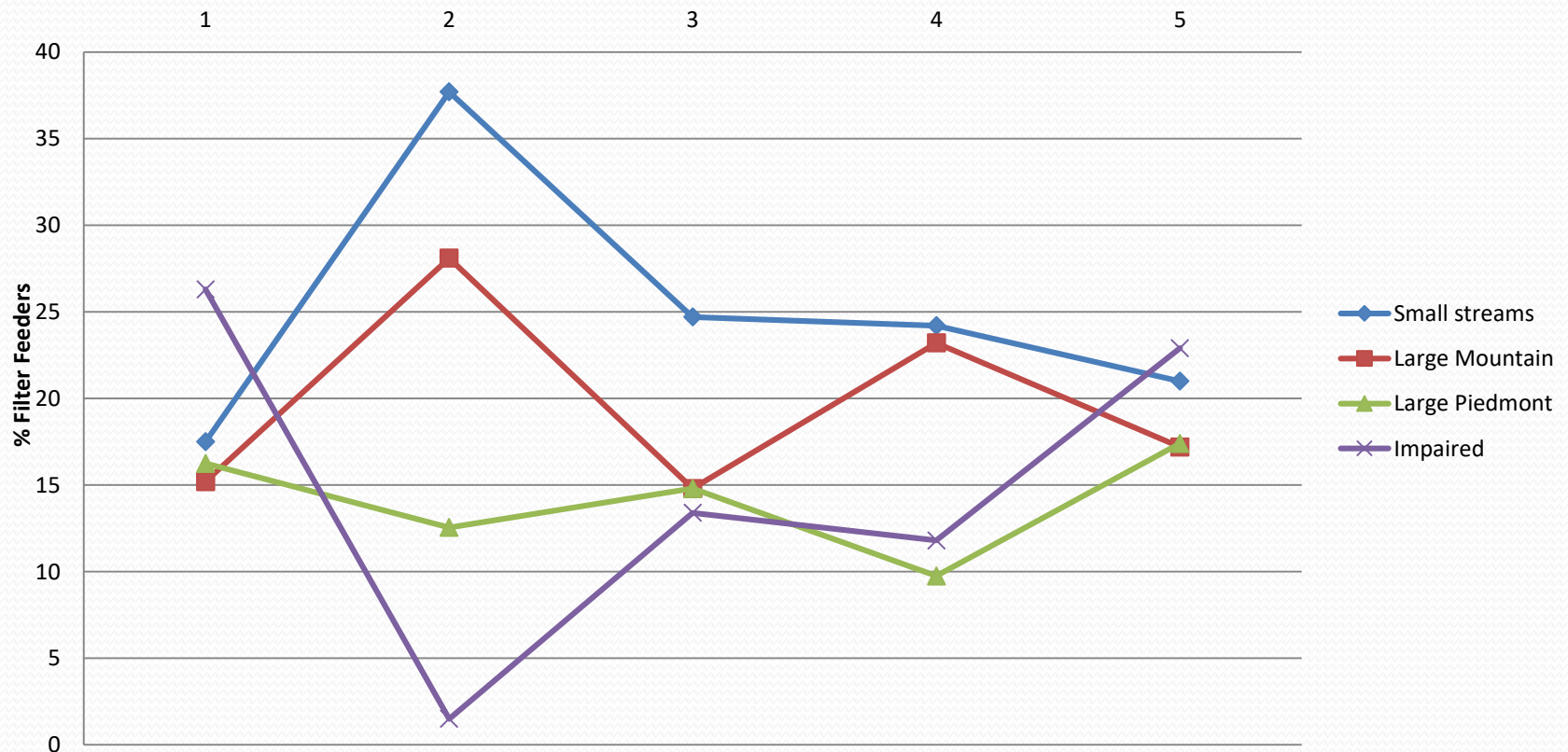


# Reality – Filter Feeders

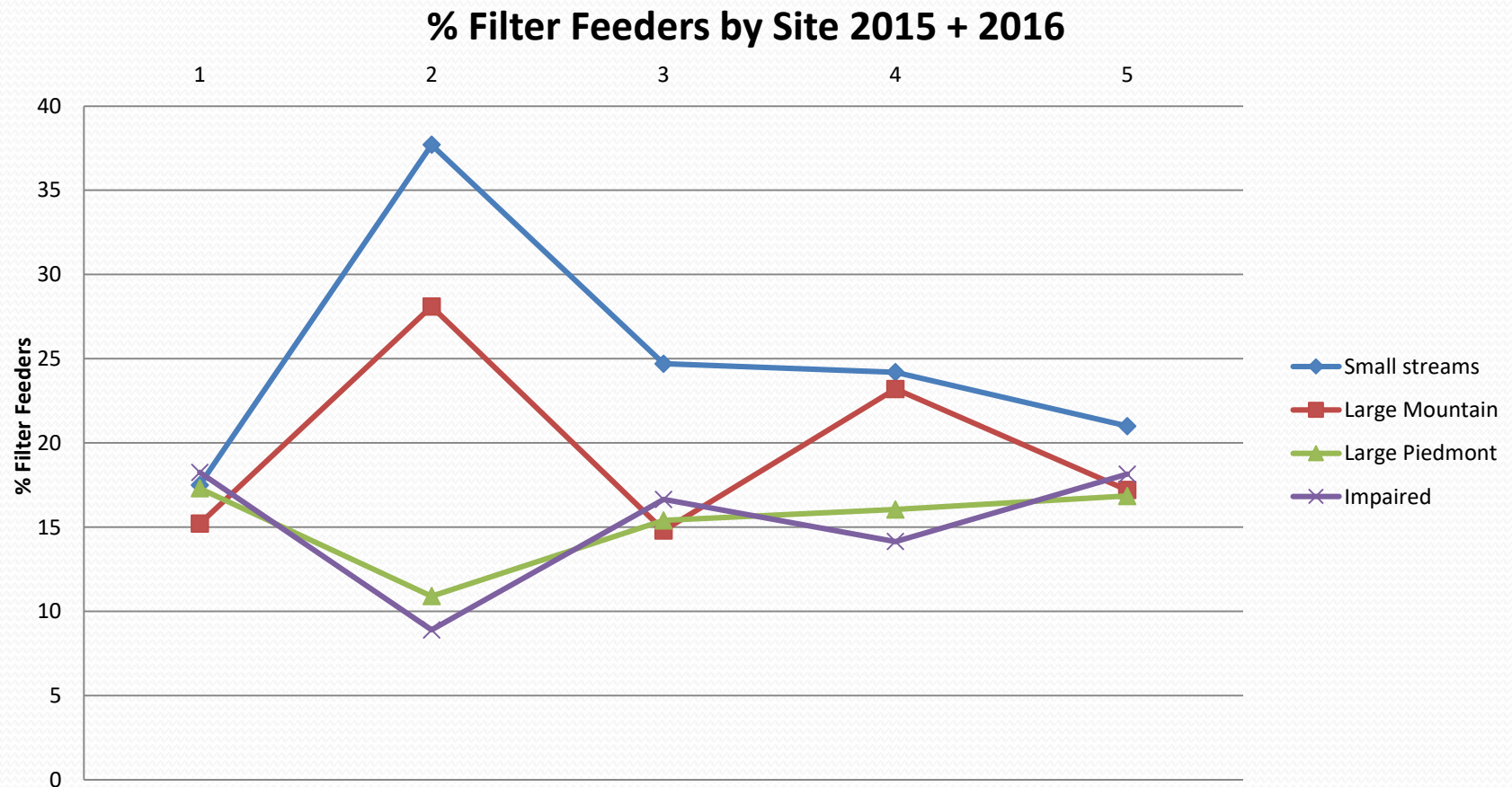


# Reality – Filter Feeders

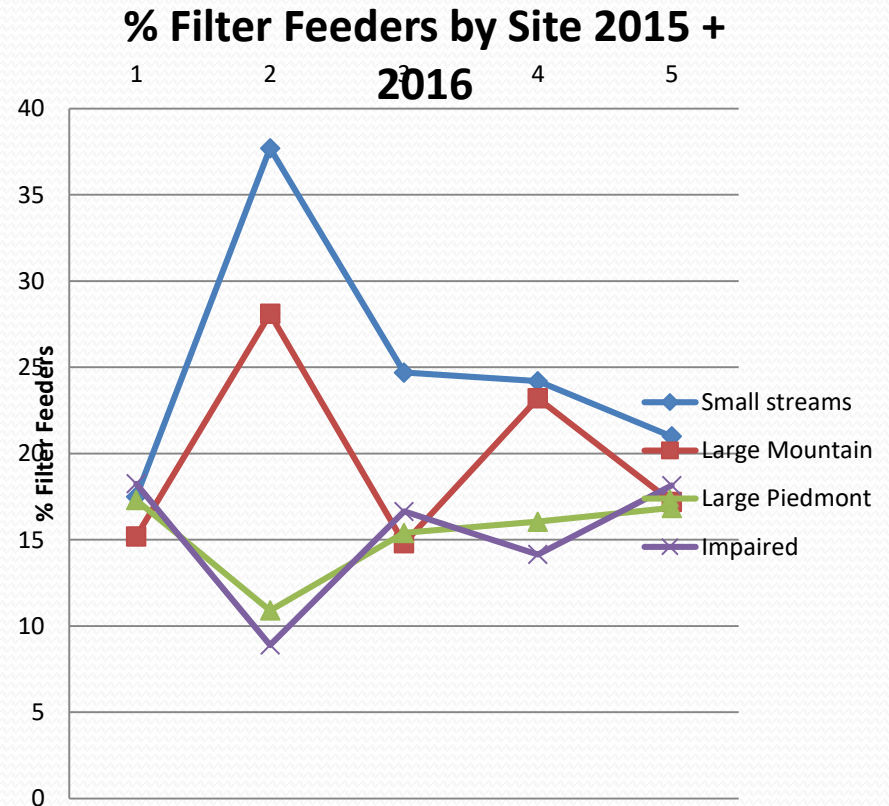
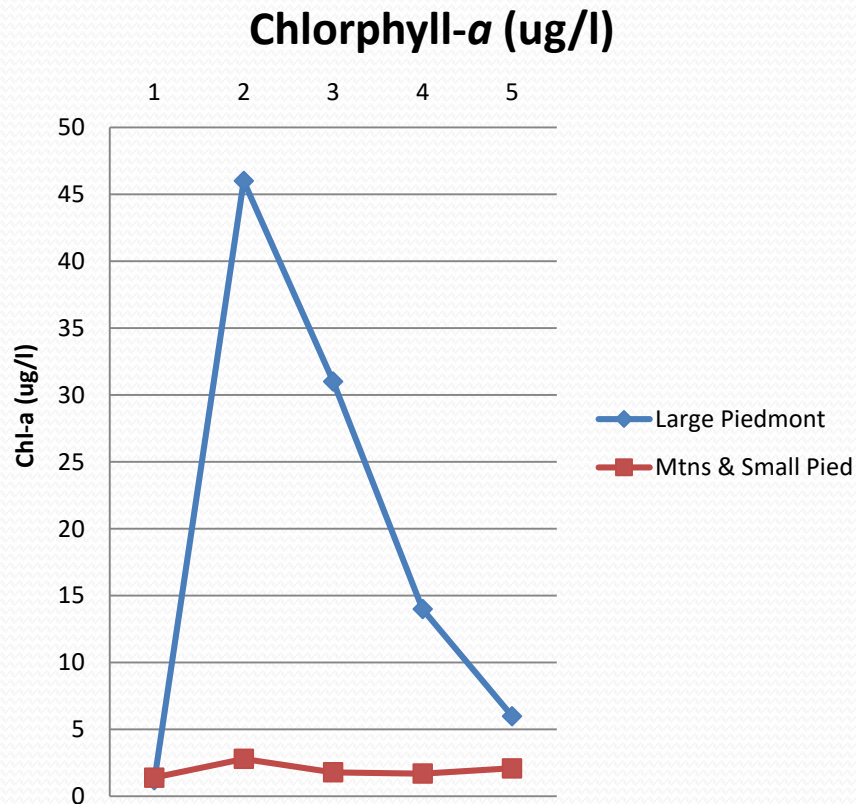
% Filter Feeders by Site 2015



# Filter Feeders – More Data



# Filter Feeders vs Chlorophyll





# Water Quality impairment at work?

- Large Piedmont sites 2, 3 and ½ of 4 Not Supporting
- Filter Feeders are a relatively intolerant group – mean TV 3.91
- Only 5 FF make up impaired community mean TV 6.5
- Range 4.9 (*Simulium*) to 7.9 (*Hydropsyche betteni*)

# Conclusions

- Are there downstream impacts of impoundments? YES!
- How far downstream do the impacts go? It depends
- Temperature – 5-8° jump be dam, cools by ½ mi<sup>2</sup> to warmer normal
- Chlorophyll-*a* – slight increase in Supporting streams, big spike in Not Supporting for 2-5 mi<sup>2</sup> downstream
- Bugs BI – 1.5-3 unit increase be dam. P streams recover in 3 mi<sup>2</sup>, M streams drop ½ spike in 0.25 mi<sup>2</sup> then stays

# Conclusions (Cont)

- Bugs EPTS – declined 24-88% be dam, 5 recover in 1mi<sup>2</sup>
- Bugs Bioclassification – declined 1-4 bioclass be dam 1/2 streams recovered >1mi<sup>2</sup>, 1/3 unrecovered at 9mi<sup>2</sup>
- Shredders - drop to 5% be dam, slight, incomplete recovery
- Grazers - respond to reach specific light not impound
- Filter Feeders – Mountain streams small Piedmont peaked be dam, grazed down pool phyto. Large Pied behaved like impaired, little grazing lots of chl-*a*

# Recommendations

- Dams are bad for streams. Don't permit any you don't have to.
- Consider requiring mitigation for impaired functions below dam. Maybe for  $\frac{1}{2}$  - 1 mi<sup>2</sup>
- Dam removal companies will want extra mitigation credits. Should they get them?