

# White River Macroinvertebrate Analysis, 2017-2019

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# Background



- ◆ Blooms of the filamentous green algae, *Cladophora glomerata*, occur in the White River drainage.
- ◆ USGS study investigating driving factors
- ◆ This study is investigating interactions between these blooms and the macroinvertebrate assemblages.
  - ◆ Sampling and study design by White River Conservation District, CPW, and TU
  - ◆ GEI did the data analysis

# Background- Additional Questions?

- ◆ Are the assemblages different among sites?  
Over time?
- ◆ Did the two different sampling methods or analysis by two different labs have an effect?
- ◆ What does the analysis of duplicate samples tell us?
- ◆ Did the insecticide spraying event in 2018 have any detectable effect?

# Sampling Plan (2017 – 2019)

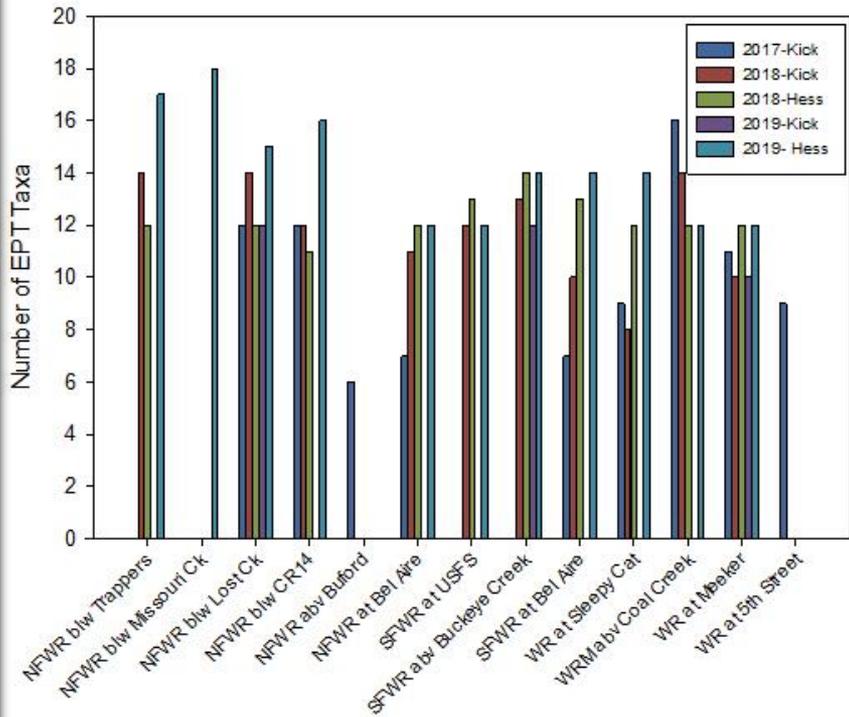
- ◆ Sites:
  - ◆ 4 on White River Mainstem (WRM)
  - ◆ 6 on North Fork White River (NFWR)
  - ◆ 4 on South Fork White River (SFWR)
- ◆ Kick and/or Hess Composite samples
- ◆ Taxonomic Analysis and some or all metric calculations by Timberline Aquatics or Utah State University



# Macroinvertebrate Assemblages

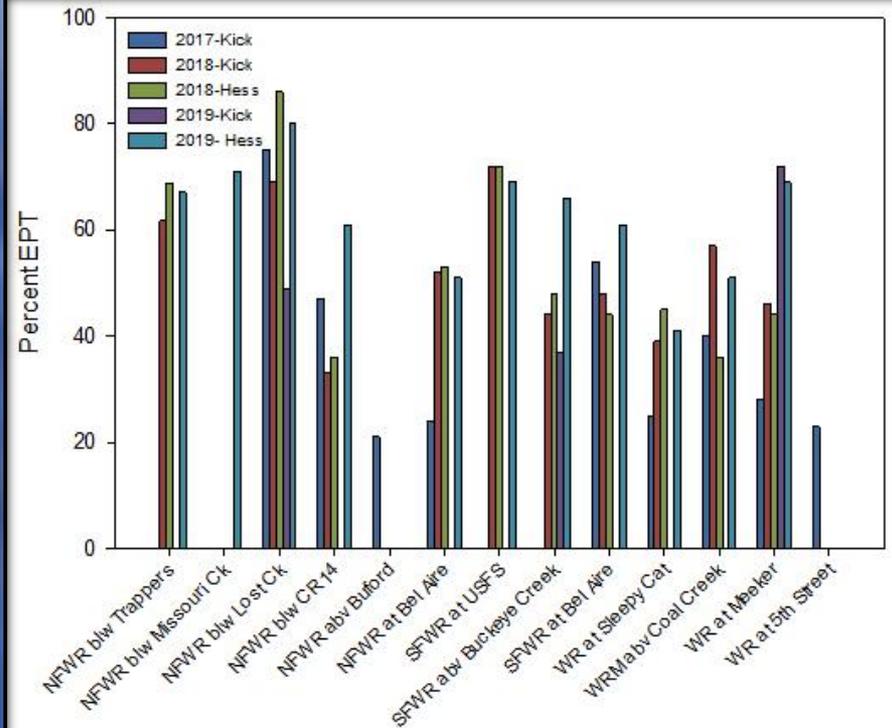
- ◆ Dominated by caddisflies and true flies
  - ◆ Mayflies also abundant
- ◆ MMI scores indicated attainment of the aquatic life use
- ◆ EPT organisms generally made up 1/3<sup>rd</sup> or more of the abundance.
- ◆ Diversity index values and HBI values indicated balanced communities largely dominated by taxa with low pollution tolerance values.

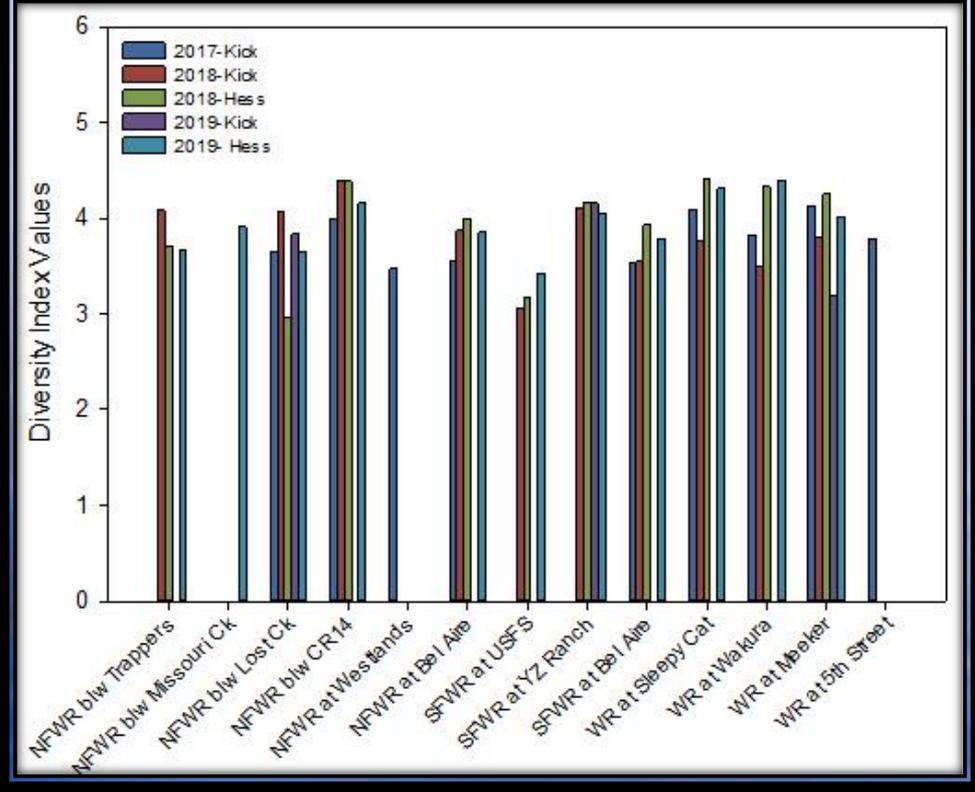




Number of EPT Taxa

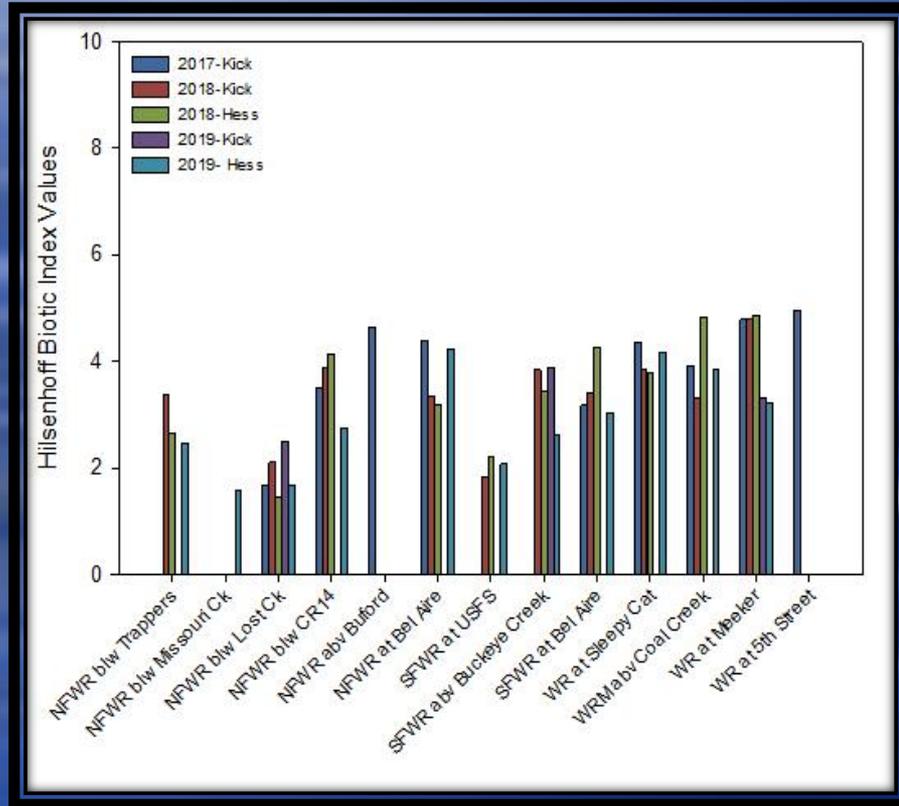
Percent EPT Abundance





← Diversity Index Values

Hilsenhoff Biotic Index (HBI) Values



# Duplicate Sample Analysis

- ◆ Similarity index values indicated each set contained from 40 to 67% of the same taxa.
- ◆ Several basic descriptive metrics had maximum % differences of 33 percent or less among the 6 sets; many remaining metrics had average % differences in this range
- ◆ This variability must be considered in the other analyses that follow.

# Hess Samples vs. Kick Samples

- ◆ Qualitative vs. Quantitative sampling methods.
- ◆ Most metric values relatively similar between the two sample types
  - ◆ 18% of the metrics analyzed differed statistically



# Comparison of Lab Outputs



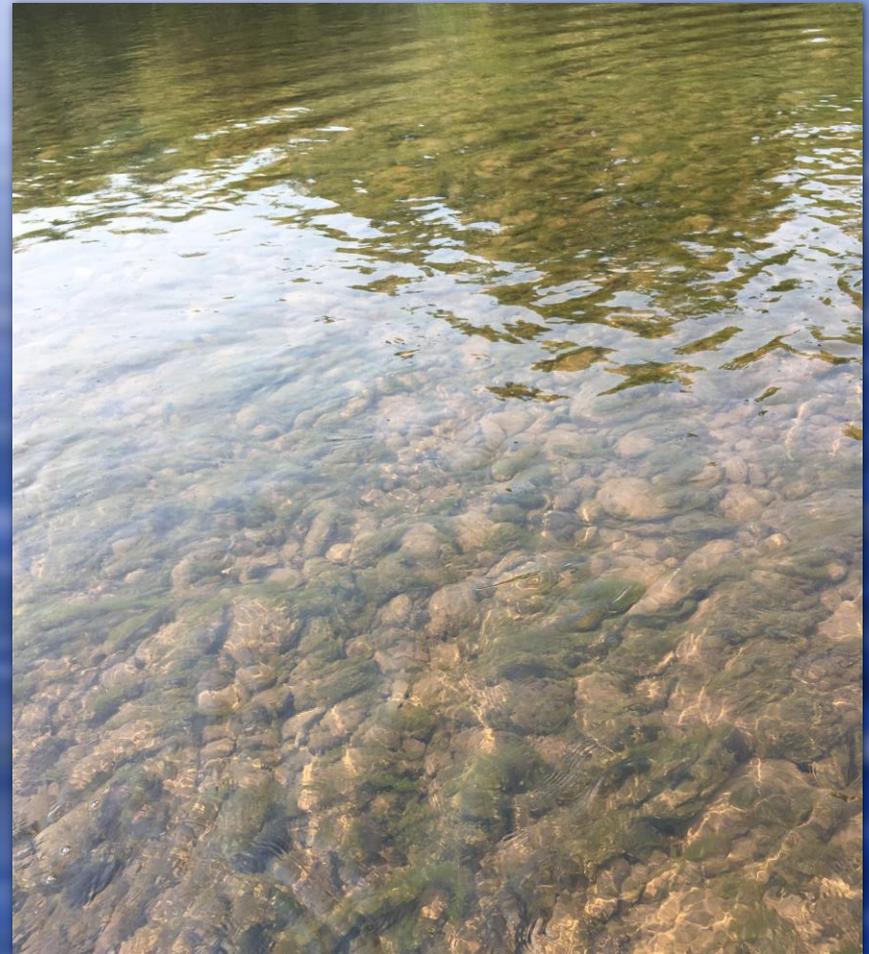
- ◆ Both labs appeared to identify taxa to the lowest possible level with few differences.
- ◆ Some differences in the lab outputs.
- ◆ Differences between labs did not influence the analyses.

# Differences Among Sites and Years

- ◆ Overall, trends among sites or years were difficult to detect with 3 years of data and without a consistent set of sites samples.
  - ◆ Variability in duplicate analysis also complicates trend detection
- ◆ A few patterns of note spatially:
  - ◆ Tributary sites were more similar to each other than to mainstem sites in some years based on similarity indices.
  - ◆ Geographic location also appeared to influence similarity among sites.

# Complex Interactions between *Cladophora* and macroinvertebrates

- ◆ Adverse Impacts:
  - ◆ ↓ attachment sites
  - ◆ ↓ food resources
  - ◆ ↓ habitat diversity and hard substrates
  - ◆ ↑ competition with taxa that benefit
  - ◆ Large diurnal shifts in dissolved oxygen
- ◆ Beneficial impacts:
  - ◆ ↑ food resources for grazers of *Cladophora* or the epiphytic algae that grows within it
  - ◆ Protection from flows and predation
  - ◆ ↑ substrate complexity



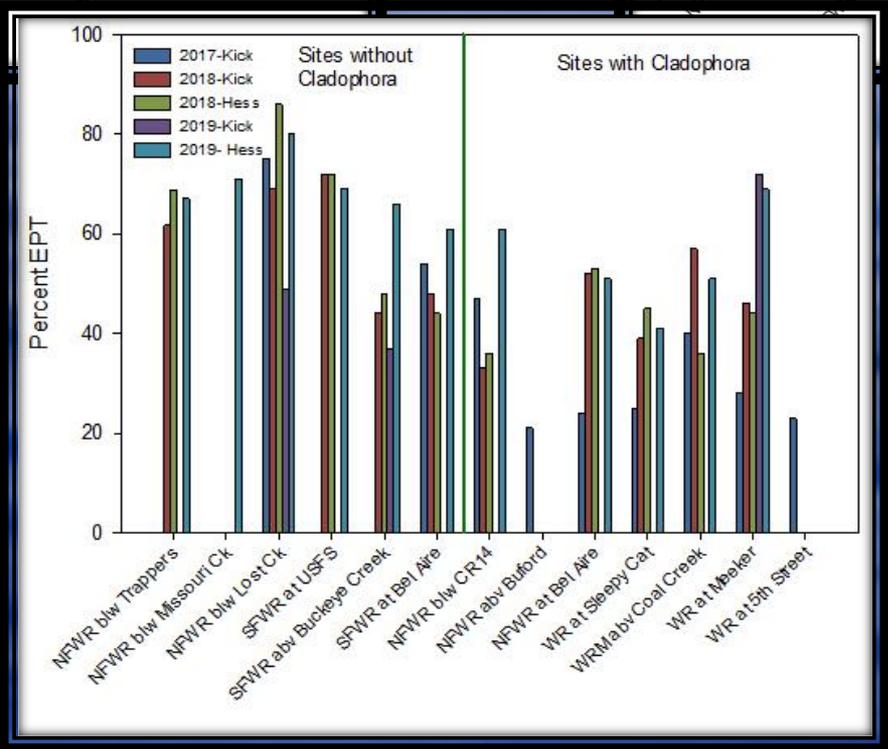
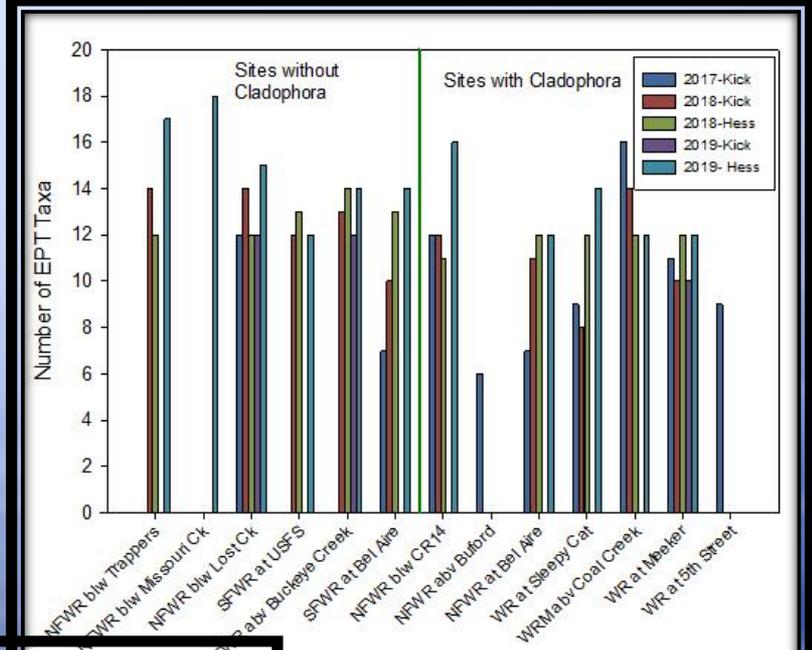
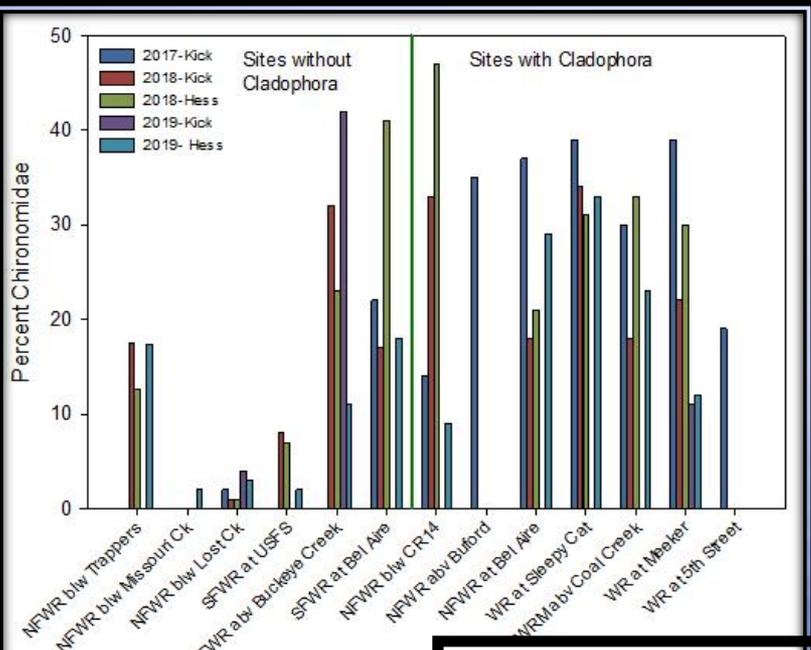
# *Cladophora* Study: Taxonomic Composition Analysis

- ◆ Not conclusive
- ◆ Caddisflies tended to dominate sites without *Cladophora* growths, while true flies commonly dominated sites with *Cladophora* growths.
- ◆ Similarity indices did not show any distinct trend with higher similarity between sites with (or without) *Cladophora*



# *Cladophora* Study: Statistical Analysis

- ◆ Several metric values differed between sites with and without *Cladophora*
  - ◆ Diversity higher at sites with *Cladophora*
  - ◆ More favorable values for metrics associated with EPT taxa and intolerant taxa at sites without *Cladophora*.
- ◆ Variability in metric values from the duplicate sample analysis and the limited number of years sampled indicate these patterns should be considered with caution until further data is collected.



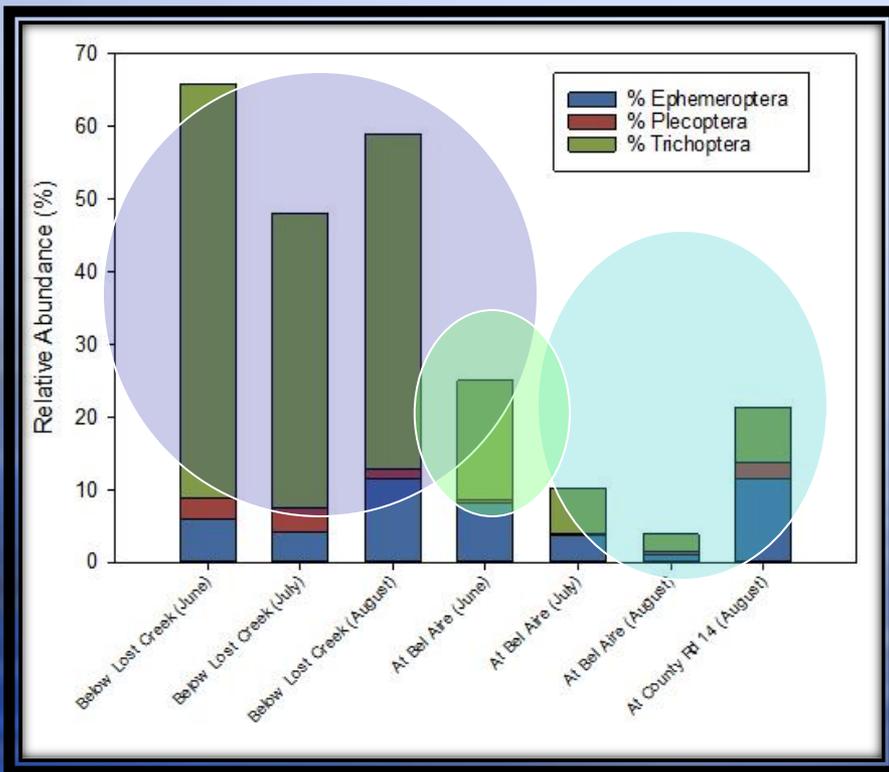
# Insecticide Effects?

- ◆ Spraying events occurred on the NFWR in late June and late July 2018.
- ◆ Sites on the SFWR and NFWR were sampled before the spraying event in June, and then after the spraying events in July and August.
- ◆ Sites on the North Fork White River that were sampled in July and August included one site upstream of the spraying event and one to two sites downstream.
- ◆ Of note, none of the sites sampled in June had *Cladophora* growths observed; sites on the North Fork White River had *Cladophora* growths observed in July and August.

# Insecticide Effects?

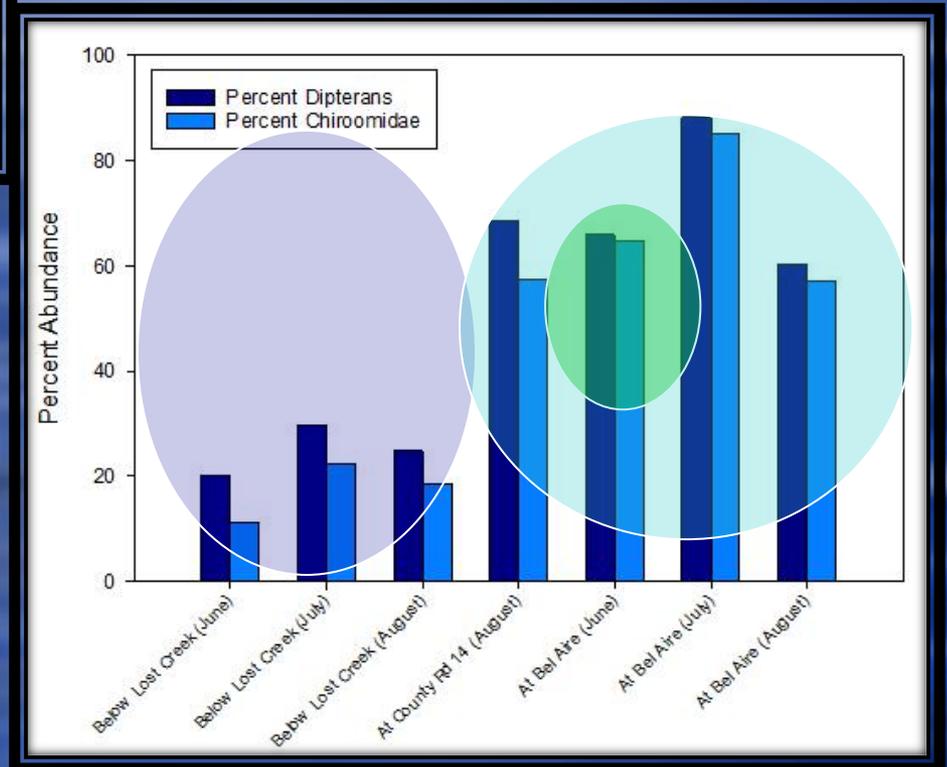
- ◆ Shifts in the taxonomic composition occurred at the impact site between June and July, but assemblages in August more closely resembled those in June
- ◆ Similar if less pronounced shifts occurred at the site upstream of spraying
- ◆ No similar shifts occurred at the South Fork sites





← Percent EPT

Percent Chironomids and True Flies ↓



# Summary

- ◆ Macroinvertebrate assemblages are balanced and diverse.
- ◆ Differences in sampling methods and laboratory analysis were minimal.
- ◆ Variability in the duplicate analysis indicates that further data should be collected.
- ◆ More data necessary to determine if macroinvertebrate populations between sites or years, as well as determining if aerial spraying of insecticides had an effect.
- ◆ Differences were noted between sites with and without *Cladophora*; this analysis would still benefit from further data collection, but more consistently suggested that *Cladophora* might be affecting macroinvertebrate assemblages.

# Overall Recommendations

- ◆ Continuing this study for additional years
  - ◆ Would help determine if the patterns observed were “real” or related to the naturally high interannual variability.
  - ◆ Select a consistent set of sites to sample
- ◆ Potential to redesign study to collect samples from sites in spring/early summer before *Cladophora* growths appear and then later
- ◆ Repeating the insecticide study with some changes to the sampling design to allow for better differentiation of effects of insecticides vs. *Cladophora* would also be informative.
  - ◆ Identify Chironomidae to genus/species level

# Sampling and Analysis Recommendations

- ◆ Use only one sampling method
  - ◆ **Better** Option: Continue to collect Hess composites
  - ◆ **Best** Option: Collect 3-5 replicate Hess samples and process them separately.
    - ◆ Greatly add to the ability to statistically analyze differences
- ◆ Use of a rating scale to describe density and thickness of *Cladophora* at each site or describing habitat differences through other measurements.

# Questions?



# Metrics

## ◆ Basic Metrics

- ◆ # of Taxa
- ◆ # of EPT Taxa
- ◆ MMI
- ◆ Diversity
- ◆ HBI

## ◆ Tolerance Metrics

- ◆ #/% Intolerant
- ◆ #/% Tolerant

## ◆ Functional Feeding Group Metrics

## ◆ Habitat Metrics

## ◆ Composition Metrics

- ◆ % Dominant Taxon
- ◆ #/% Chironomidae
- ◆ #/% Diptera
- ◆ #/% Ephemeroptera
- ◆ #/% Plecoptera
- ◆ #/% EPT
- ◆ #/% Trichoptera
- ◆ #/% Coleoptera
- ◆ #/% Insect
- ◆ #/% NonInsect

Stream/Site <sup>α</sup>	Year Sampled <sup>α</sup>		
	2017 <sup>α</sup>	2018 <sup>α</sup>	2019 <sup>α</sup>
<b>North Fork White River<sup>α</sup></b>			
North Fork White River Below Trappers Lake (3079) <sup>α</sup>	-- <sup>α</sup>	H, K <sup>α</sup>	H <sup>α</sup>
North Fork White River below Missouri Creek (445) <sup>α</sup>	-- <sup>α</sup>	-- <sup>α</sup>	H <sup>α</sup>
North Fork White River Below Lost Creek (6111) <sup>α</sup>	K <sup>α</sup>	H, K, H-P (June), H-P (July), H-P (August) <sup>α</sup>	H, HD, K <sup>α</sup>
North Fork River at County Road 14 (6110) <sup>α</sup>	K <sup>α</sup>	H, HD, K, KD, H-P (August) <sup>α</sup>	H <sup>α</sup>
North Fork River above Bufurd (6108) <sup>α</sup>	K <sup>α</sup>	-- <sup>α</sup>	-- <sup>α</sup>
North Fork River at Bel Aire (6107) <sup>α</sup>	K <sup>α</sup>	H, K, H-P (June), H-P (July), H-P (August) <sup>α</sup>	H <sup>α</sup>
<b>South Fork White River<sup>α</sup></b>			
South Fork White River at USFS Campground (3077) <sup>α</sup>	-- <sup>α</sup>	H, K <sup>α</sup>	H <sup>α</sup>
South Fork White River above Buckeye Creek (3078) <sup>α</sup>	-- <sup>α</sup>	H, K <sup>α</sup>	H, HD, K <sup>α</sup>
South Fork White River above Bel Aire (6106C) <sup>α</sup>	-- <sup>α</sup>	H-P (June), H-P (July) <sup>α</sup>	-- <sup>α</sup>
South Fork White River at Bel Aire (6106) <sup>α</sup>	K <sup>α</sup>	H, K, H-P (June), H-P (July) <sup>α</sup>	H <sup>α</sup>
<b>White River (Mainstem)<sup>α</sup></b>			
White River at Sleepy Cat (6105) <sup>α</sup>	K <sup>α</sup>	H, K <sup>α</sup>	H <sup>α</sup>
White River above Coal Creek (6104) <sup>α</sup>	K, KD <sup>α</sup>	H, K <sup>α</sup>	H <sup>α</sup>
White River at Meeker Pasture (6103) <sup>α</sup>	K <sup>α</sup>	H, K <sup>α</sup>	H, HD, K <sup>α</sup>
White River at 5 <sup>th</sup> Street (531) <sup>α</sup>	K <sup>α</sup>	-- <sup>α</sup>	-- <sup>α</sup>

