Macroinvertebrates in Headwater Streams Across EPA Region IV in the Southeast.

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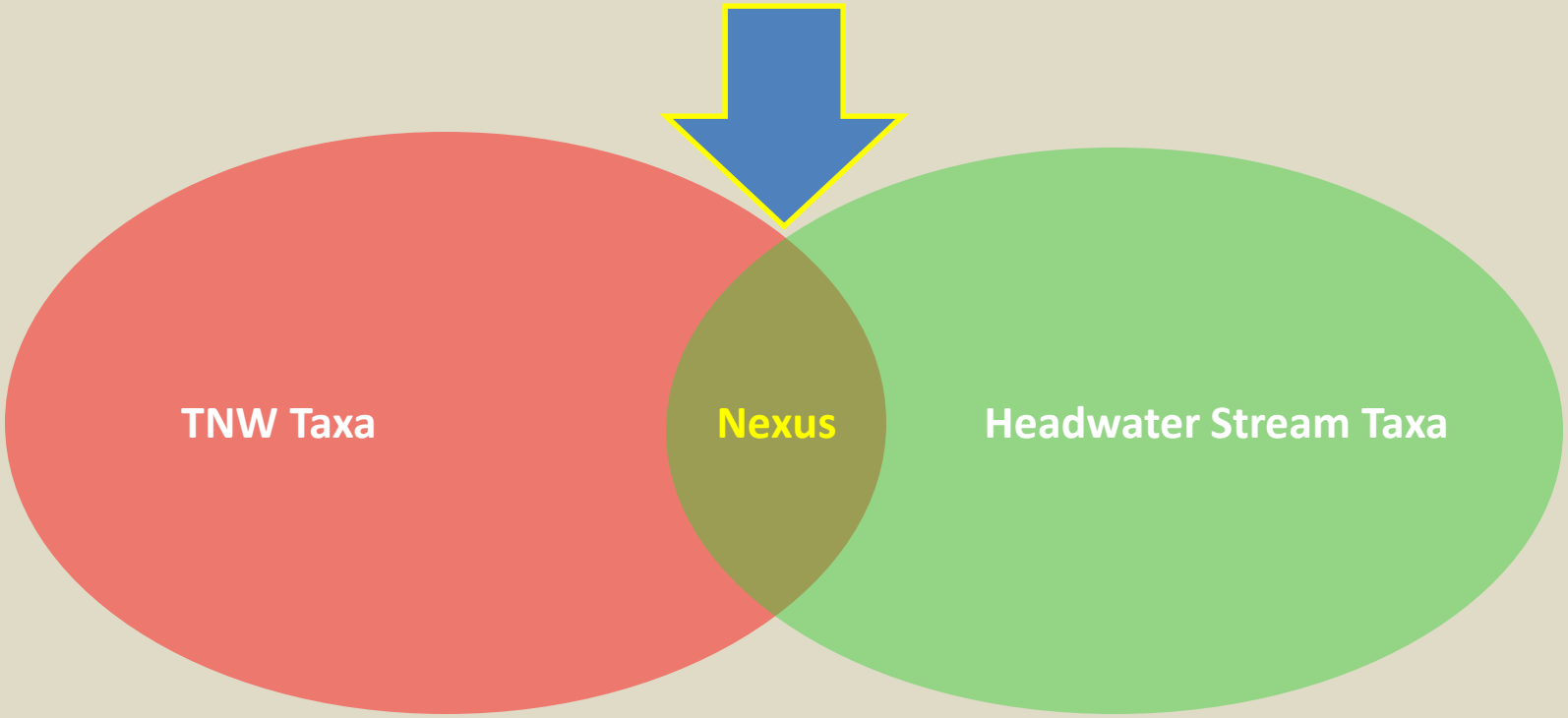
History

- Rapanos/Carabell (2006) Supreme Court decision
  - Intermittent streams are jurisdictional if they can be determined to have "relatively permanent water" or a "significant nexus" with TNW's

- NC wants to make the fuzziness more clear in order to protect those stream miles that meet the criteria

Overlap with TNW's

Biological connection between headwater streams and TNW's



History

- The USACE and EPA are interested to see if results will be similar throughout Region 4

Project Goals:

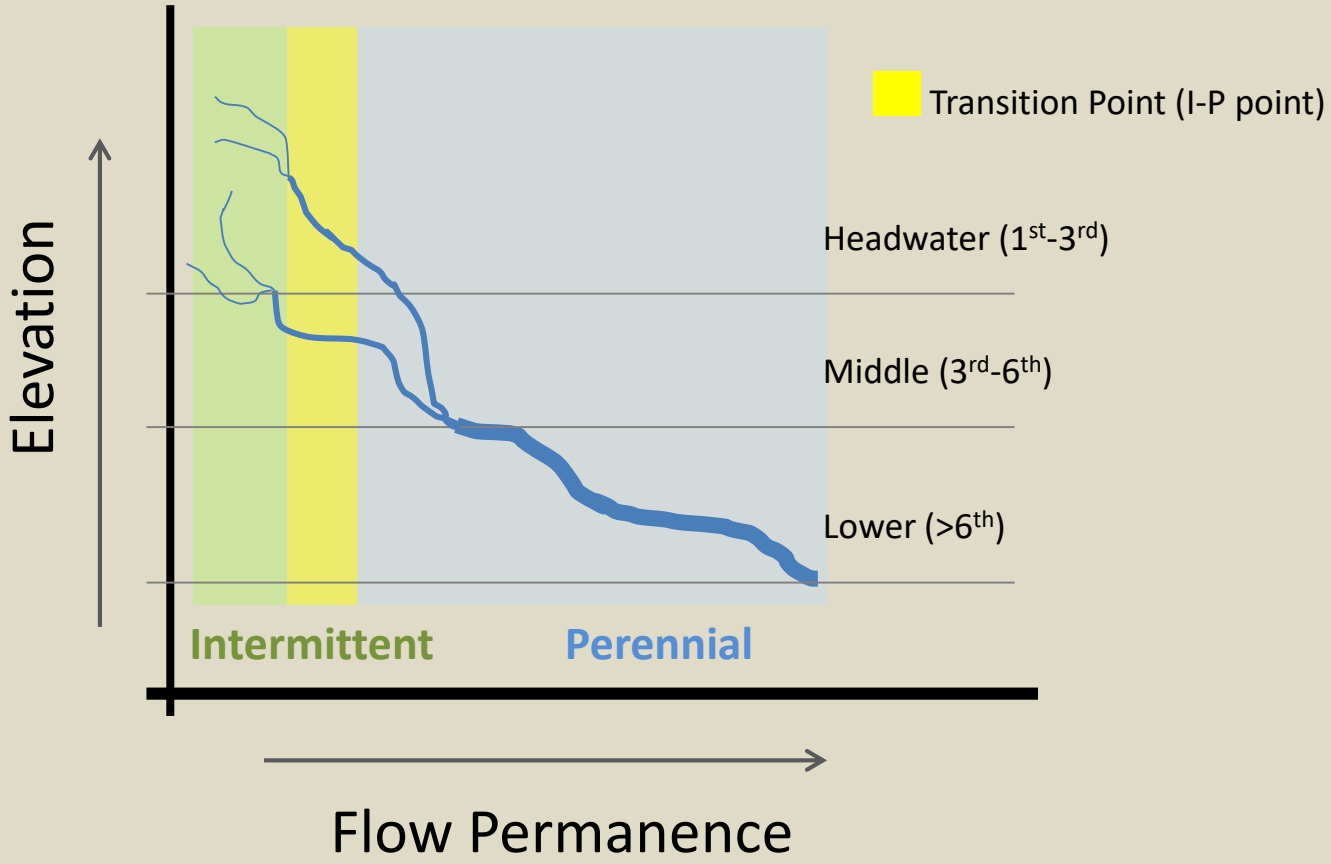
1. Document hydrologic regimes in headwater streams to determine RPW.
2. Characterize macroinvertebrate fauna in headwater streams to demonstrate significant nexus with TNW's.

Headwater Streams

Hydrology

- Small, sometimes intermittent channels
- Flow from several weeks to months each year
- Organic debris lines or piles sometimes present
- Soil-based evidence of high water table sometimes present

Headwater Streams



Headwater Streams

Biology

- Diverse and abundant benthic community
- Generally, macroinvertebrate communities differ between intermittent and perennial streams
- Unique habitat and water quality settings harbor distinct biota

*…Headwater species include **permanent residents as well as migrants** that travel to headwaters at particular seasons or life stages. Movement by migrants links headwaters with downstream and terrestrial ecosystems, as do exports such as emerging and drifting insects. ….Exemplifying this diversity are three unmapped headwaters That **support over 290 taxa**. Even intermittent streams may support rich and distinctive biological communities…*

Meyer, Judy L., David L. Strayer, J. Bruce Wallace, Sue L. Eggert, Gene S. Helfman, and Norman E. Leonard, 2007. The Contribution of Headwater Streams to Biodiversity in River Networks. *Journal of the American Water Resources Association* (JAWRA) 43(1):86-103. DOI: 10.1111/j.1752-1688.2007.00008.x

Study Area

Region IV (Southeast)

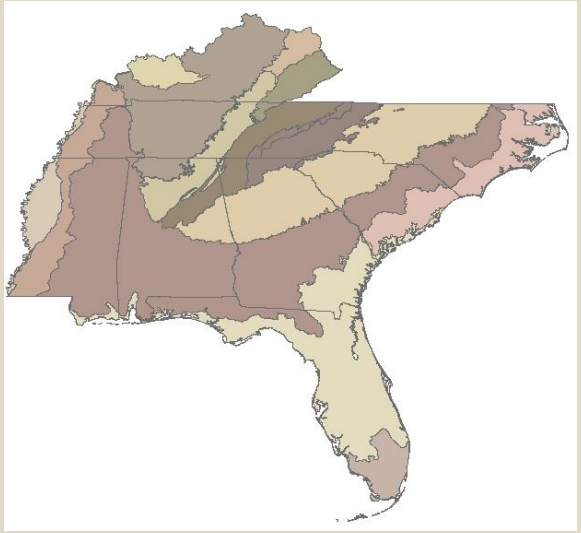
13 Level III Ecoregions

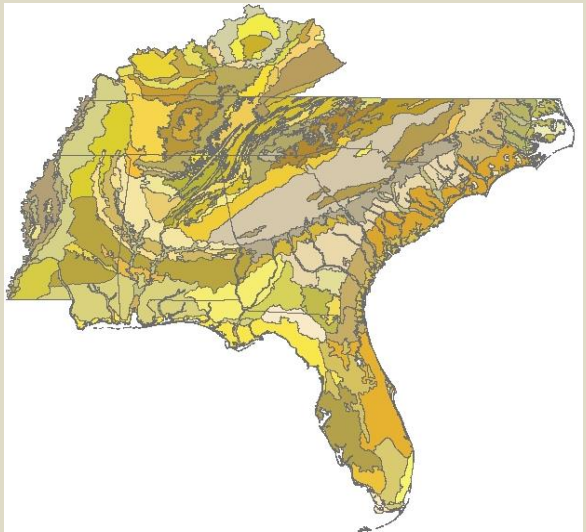
45 Level IV Ecoregions

TN: 48
SC: 30
GA: 35
FL: 20
AL: 19
MS: 24
KY: 42

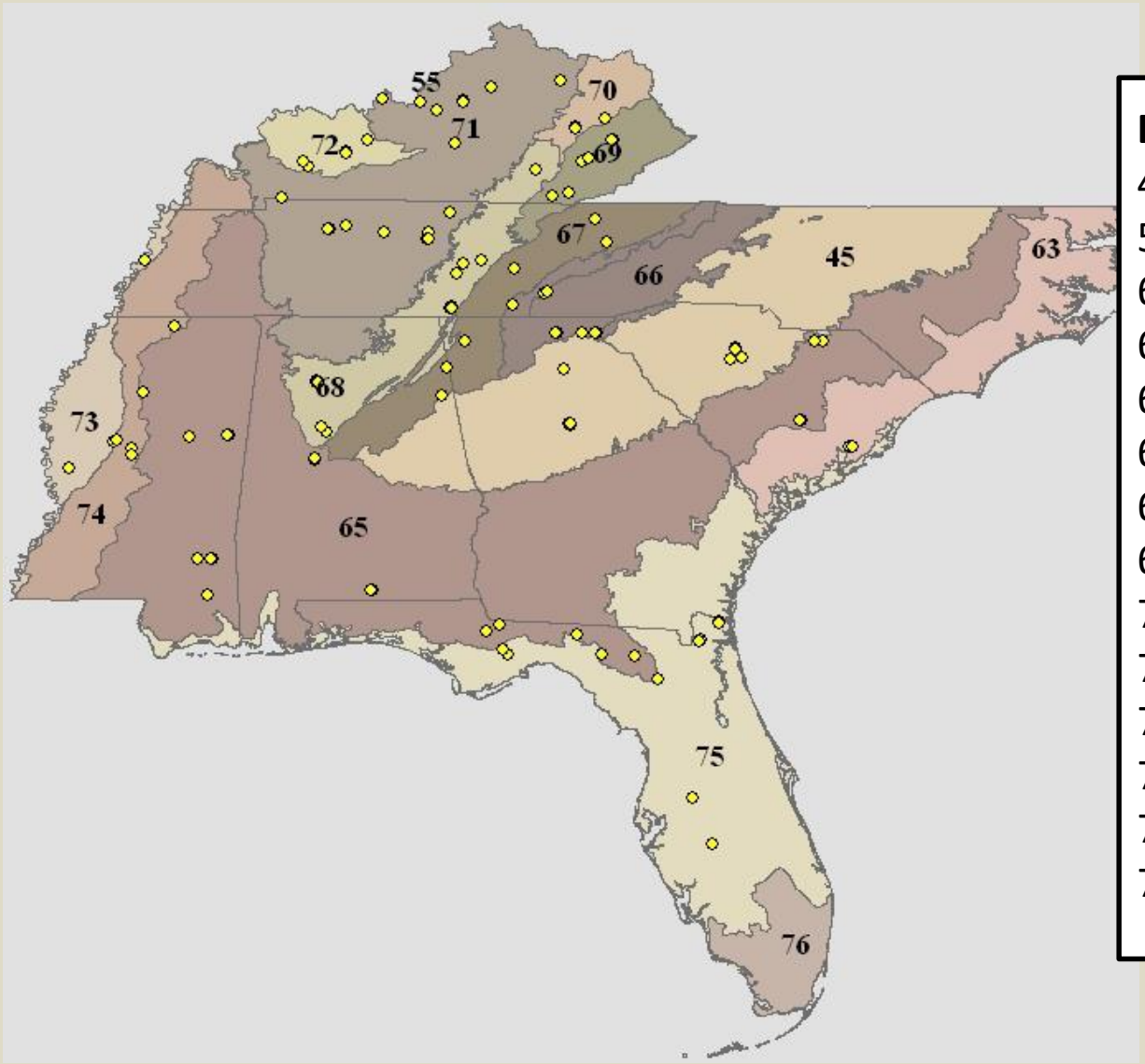
Total Samples: 218*

*before 6Nov11





Study Area



EPA Region 4 Level III

45. Piedmont
55. Eastern Corn Belt Plains
63. Middle Atlantic Coastal Plain
65. Southeastern Plains
66. Blue Ridge
67. Ridge and Valley
68. Southwestern Appalachians
69. Central Appalachians
70. Western Allegheny Plateau
71. Interior Plateau
72. Interior River Valleys and Hills
73. Mississippi Alluvial Plain
74. Mississippi Valley Loess Plains
75. Southern Coastal Plain

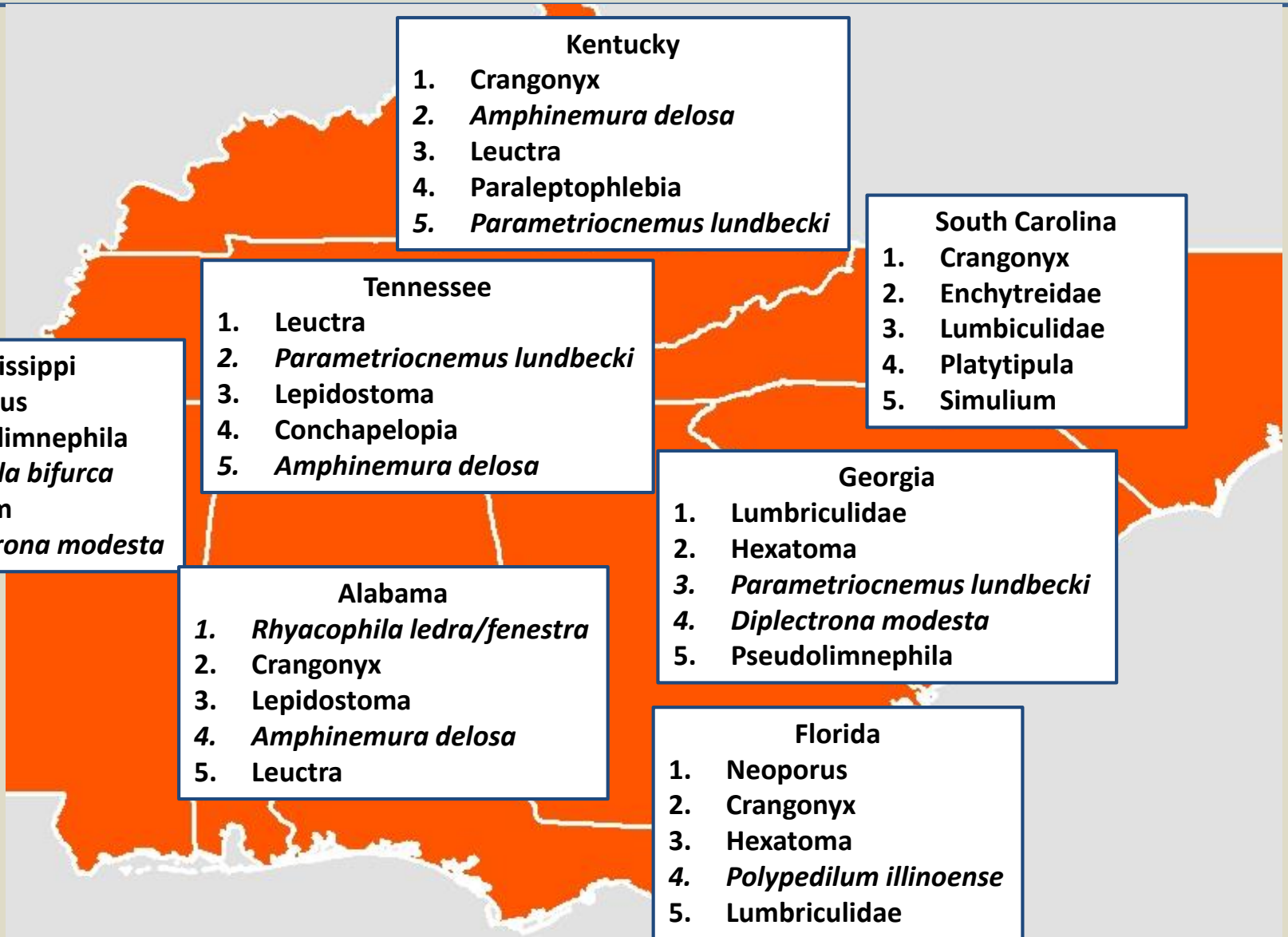
Methods

Site Selection:
- Use Gazetteer to identify stream
- Selected minimally impacted watersheds
- Locate stream and hike to find origin
- Determine flow period transitions (ephemeral, intermittent, perennial)

Benthic sampling method:
- 2 qualitative sweeps per site
- Composite sample
- Preserve in EtOH

Laboratory Method:
- Pick 100% of invertebrates
- Identify to genus or species
- Consult with regional experts and taxonomists at NCDWQ Biological Assessment Unit

Common Taxa



Kentucky

1. Crangonyx
2. *Amphinemura delosa*
3. Leuctra
4. Paraleptophlebia
5. *Parametriocnemus lundbecki*

South Carolina

1. Crangonyx
2. Enchytreidae
3. Lumbiculidae
4. Platytipula
5. Simulium

Tennessee

1. Leuctra
2. *Parametriocnemus lundbecki*
3. Lepidostoma
4. Conchapelopia
5. *Amphinemura delosa*

Mississippi

1. Neoporus
2. Pseudolimnephila
3. *Synurella bifurca*
4. Pisidium
5. *Diplectrona modesta*

Georgia

1. Lumbriculidae
2. Hexatoma
3. *Parametriocnemus lundbecki*
4. *Diplectrona modesta*
5. Pseudolimnephila

Alabama

1. *Rhyacophila ledra/fenestra*
2. Crangonyx
3. Lepidostoma
4. *Amphinemura delosa*
5. Leuctra

Florida

1. Neoporus
2. Crangonyx
3. Hexatoma
4. *Polypedilum illinoense*
5. Lumbriculidae

Common Taxa

All States

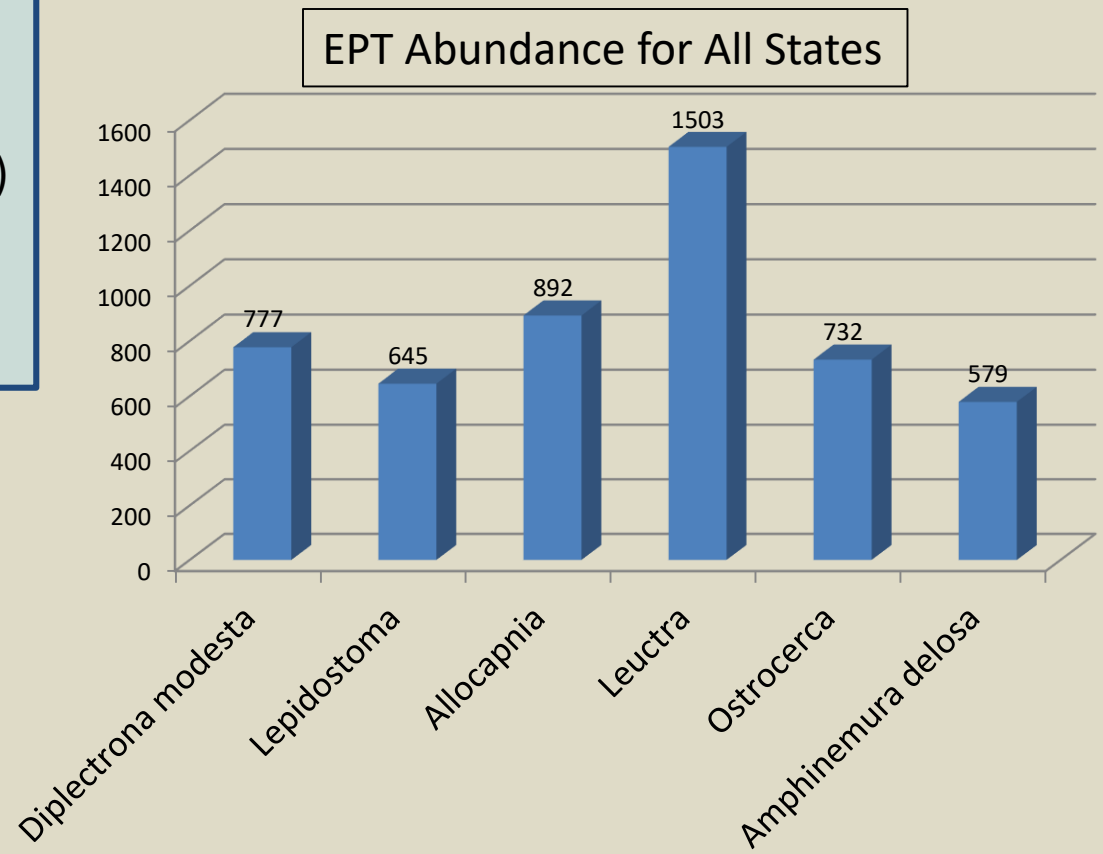
Frequency (n=218 samples)

1. Crangonyx (40%)
2. *Parametriocnemus lundbecki* (31%)
3. Conchapelopia (28%)
4. Lumbriculidae (27%)
5. Neoporus (24%)

All States

Abundance

1. Crangonyx
2. *Lirceus fontinalis*
3. *Paratendipes albimanus*
4. Leuctra
5. *Tribelos jacundis*

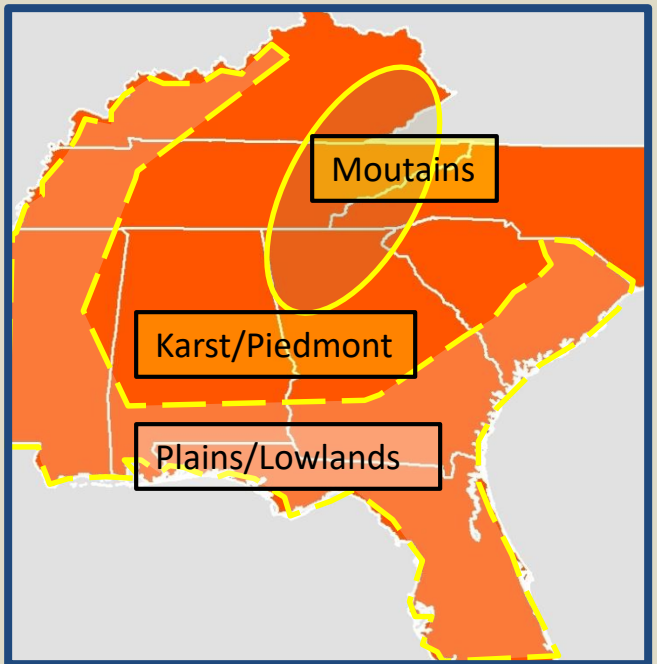


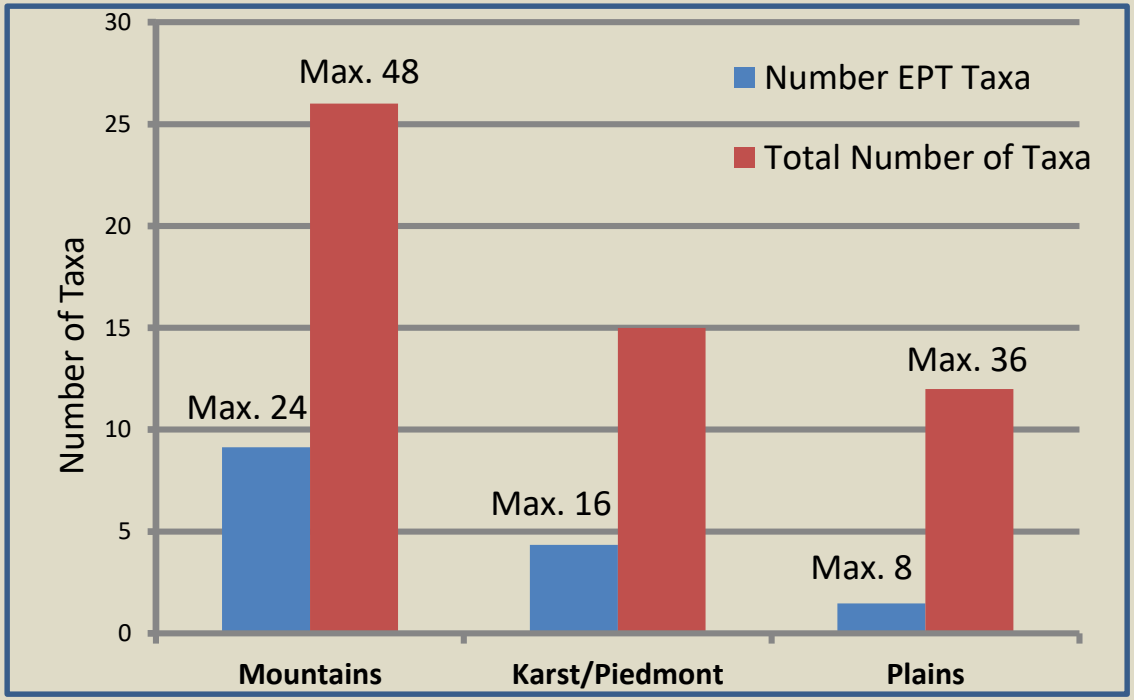
Variability between Ecoregions

Mountains (66, 67, 69, 70): 48 samples

Karst and Piedmont (71, 68, 45, 72): 98 samples

Plains and Lowlands (75, 65, 73, 74, 55, 63): 71 samples





Regional Distributions

Peltoperlidae

Peltoperla

Distribution: TN, VA, WV, KY*

Tallaperla

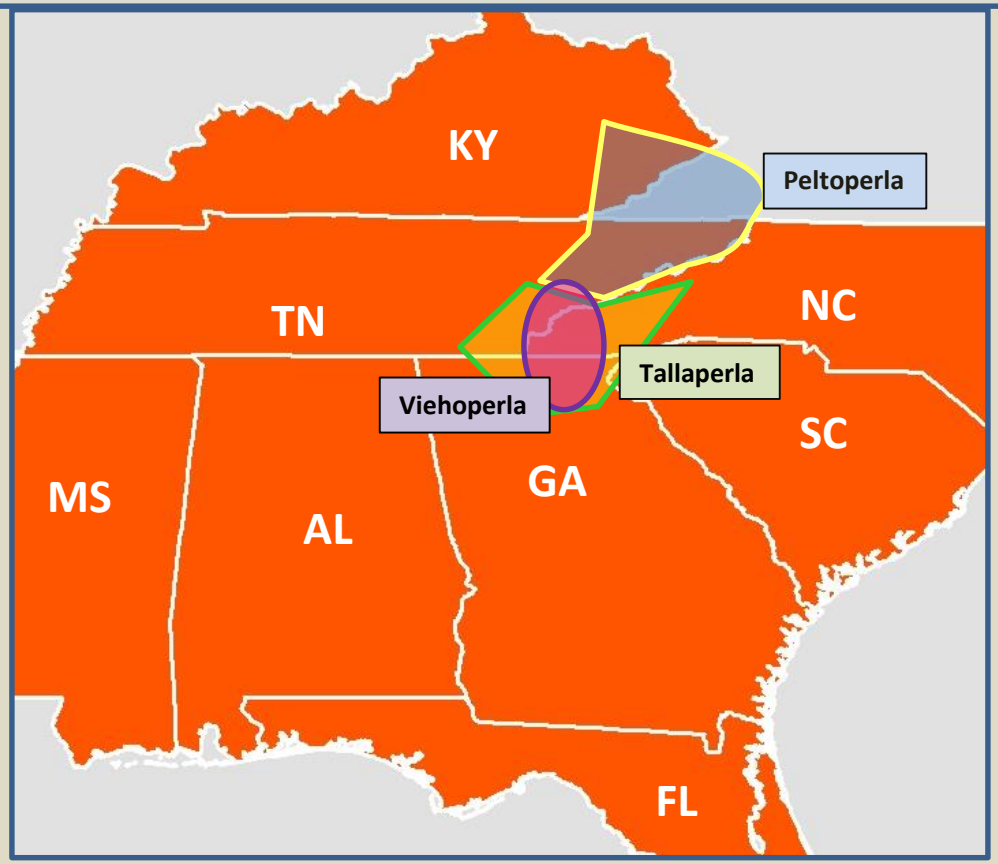
Distribibution: TN*, GA*, NC

Viehoperla

Distribution: GA*, NC

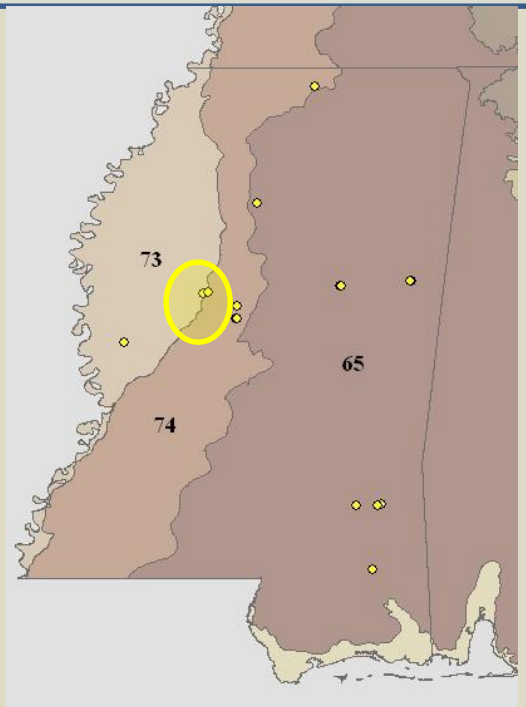
Occurrence: rare

*collected from sites on this project

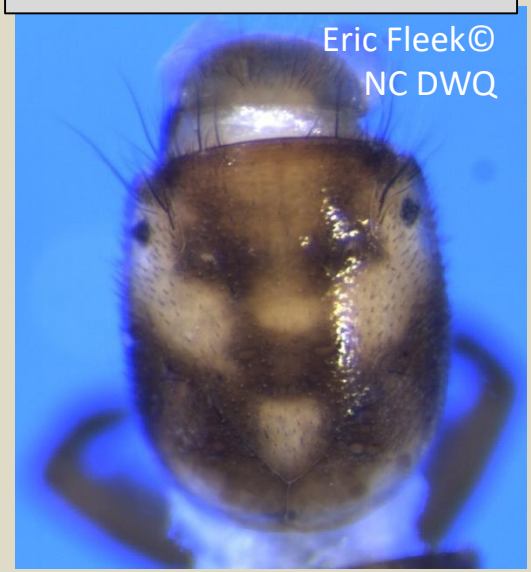


Rare and Weird Taxa

- Possible range extension or new species of Diplectrona collected from the Bluff Hills ecoregion (74a) in western MS



Name: *Diplectrona rossi ?*
Location: western MS
Habitat: spring seep



Name: *Diplectrona rossi* Morse
Location: eastern Louisiana
Habitat: spring seep

Rare and Weird Taxa

<u>Caddisflies</u>

*Homoplectra monticola**

Goerita betteni

Theliopsyche

<u>Stoneflies</u>

Beloneuria stewarti^*

georgiana^*

*Diploperla morgani**

Homoplectra monticola

Theliopsyche sp.

*Listed as significantly rare or vulnerable to Extirpation (NC NHP 2010, Morse et al. 2008)

^suspected, awaiting confirmation

Taxa as Perennial Indicators

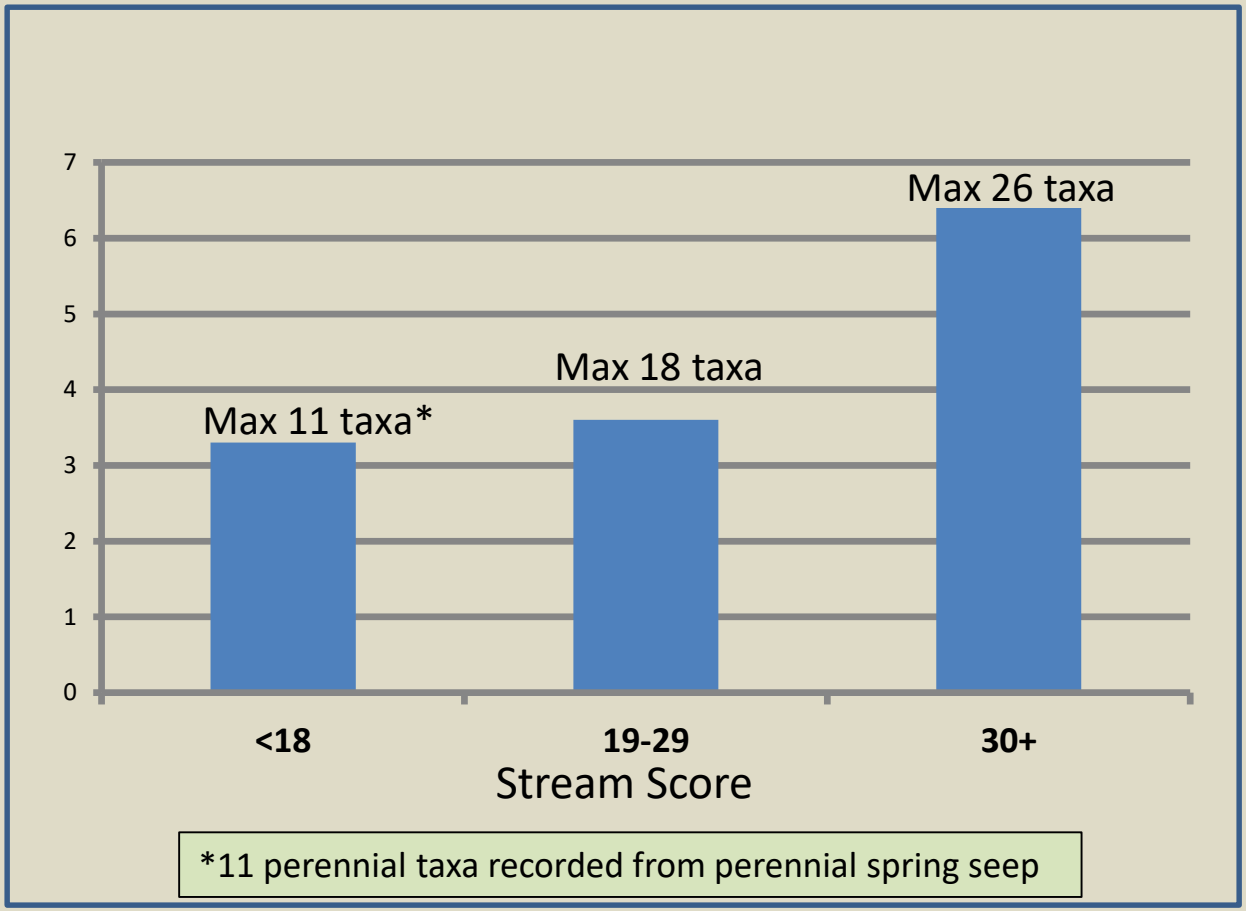
Table 2: Ephemeroptera, Plecoptera and Trichoptera (EPT) perennial stream indicators

Order:	**Ephemeroptera (Mayflies)**	**Plecoptera (Stoneflies)**	**Trichoptera (Caddisflies)**
Family:	Baetidae	Peltoperlidae	Hydropsychidae
	Caenidae	Perlidae	Lepidostomatidae
	Ephemerellidae	Perlodidae	Limnephilidae
	Ephemeridae		Molannidae
	Heptageniidae		Odontoceridae
	Leptophlebiidae		Philopotamidae
	Siphlonuridae		Polycentropidae
			Psychomyiidae
			Rhyacophilidae

Table 3: Additional indicators of perennial streams

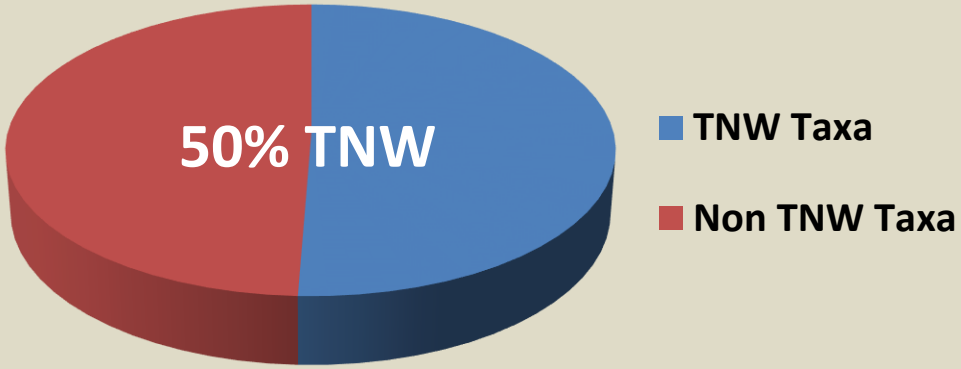
	Megaloptera	**Odonata**	**Diptera**	**Coleoptera**	**Mollusca**
Family:	Corydalidae	Aeshnidae	Ptychopteridae	Elmidae	Unionidae
	Sialidae	Calopterygidae		Psephenidae	Ancylidae
		Cordulegastridae			Planorbidae
		Gomphidae			Pleuroceridae
		Libellulidae			
Family & ***Genus:***			Tipulidae *Tipula* sp.	Dryopidae *Helichus* (adult)	

Taxa as Perennial Indicators

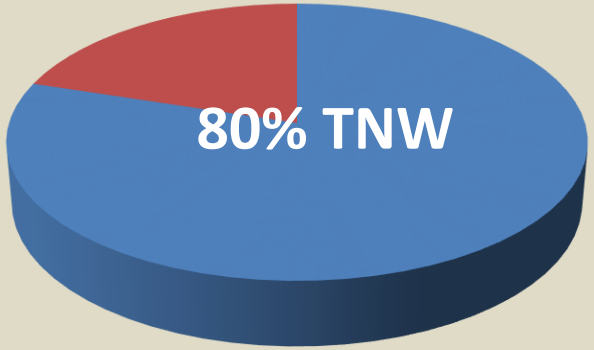


TNW Taxa

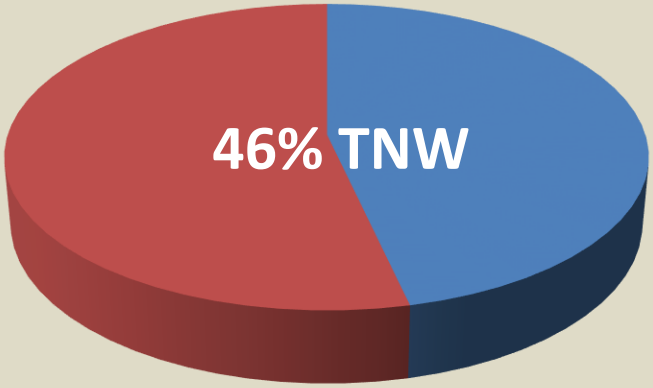
South Carolina: 81/160 taxa



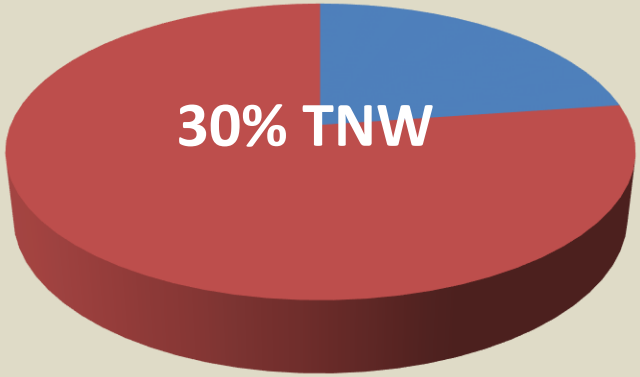
Florida: 111/139 taxa



Kentucky: 91/196 taxa

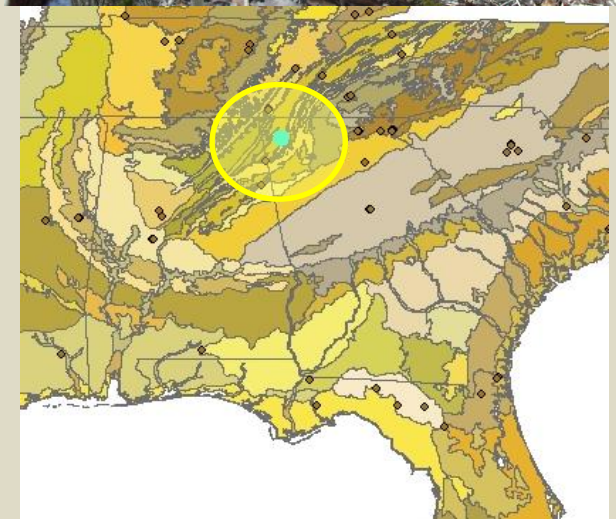


Mississippi: 38/129 taxa

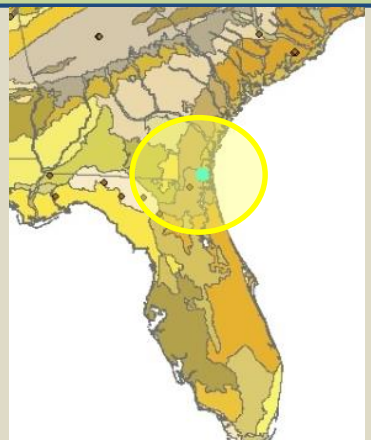


Issues

Streams that appear as streams-no intermittent reach



Streams that appear as wetlands



Conclusions

- Supporting evidence showing large amount of diversity.
  - as many as 48 taxa per sample
  - found over 200 aquatic taxa in headwaters
- Located several rare taxa that are vulnerable to extirpation
  - many species listed on State Rare/Threatened lists were found in small streams and springs.

Conclusions

- Finding significant overlap between headwater communities and TNW's
  - as much as 80% overlap for statewide taxa generated in headwater streams
  - several TNW taxa found in each sample
- Supporting evidence to show significant nexus between headwaters and TNW's.
  - Same species occur in headwaters as TNW
  - Headwaters act as source population for many species

Acknowledgments

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