

Characterizing stream origins across the southeastern USA using benthic macroinvertebrate assemblages



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Division of Water Quality

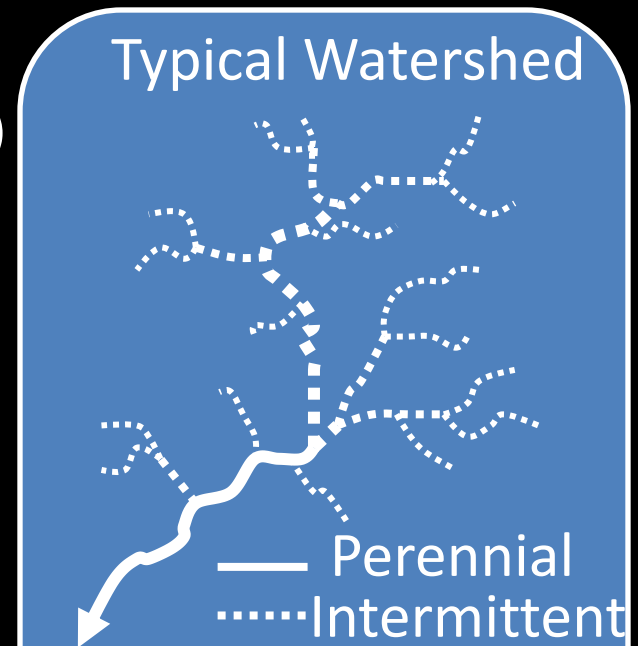
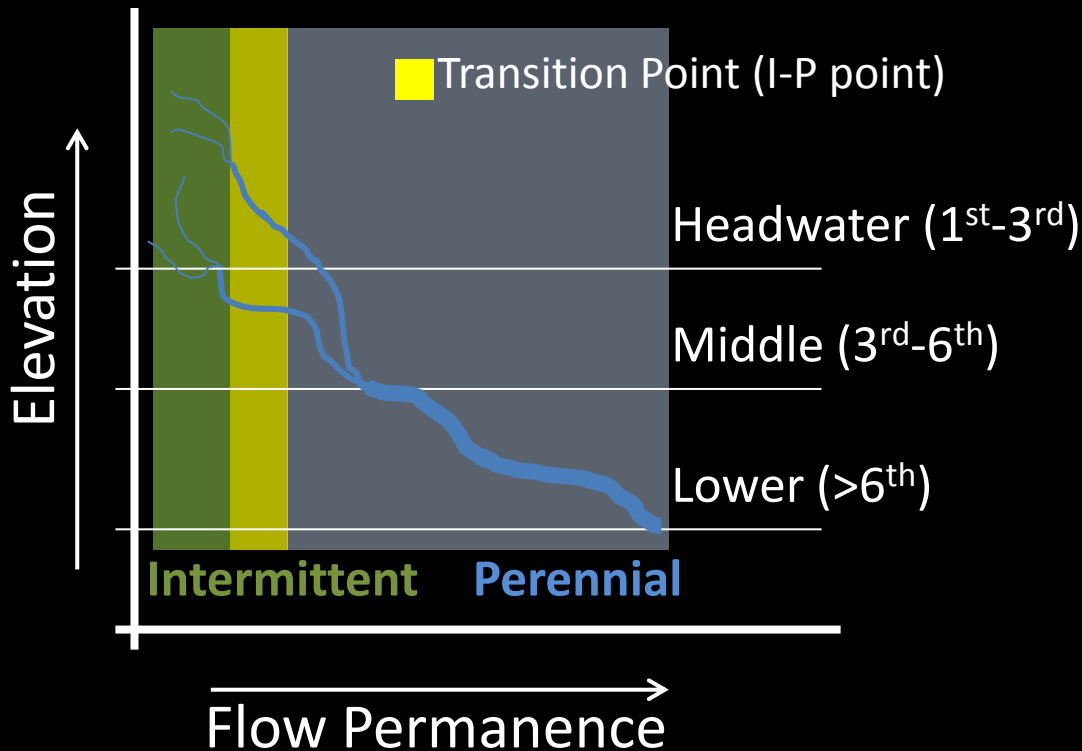
Program Development Unit



N.C. Division of Water Quality

Headwater Streams

- Generally, small, low order (1st – 3rd)
- Comprise 50 – 70% of stream miles in the US
- **Prone to temporary drying**
- Contribute greatly to regional biodiversity in stream networks



Stream Origin Types

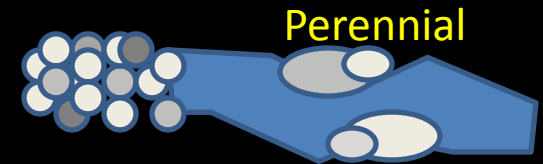
Transitional Streams

- 86% of study sites
- located mainly in Piedmont and Plains Regions
- E/I and I/P transition points shifted yearly



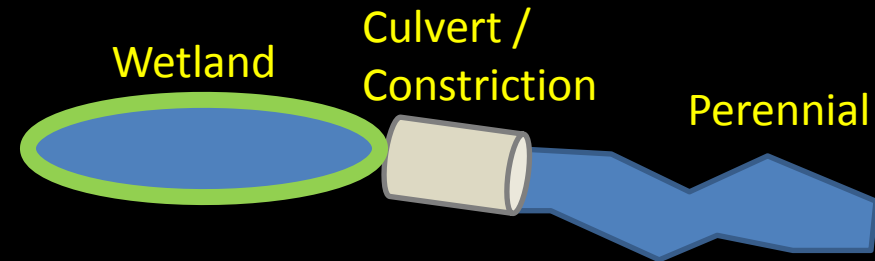
Perennial Spring Seeps

- 19% of study sites
- located mainly in Mountain Regions



Constricted Wetlands

- 16% of study sites
- Located mainly in Coastal Plains and Mississippi Delta



Transitional



Perennial Spring Seeps

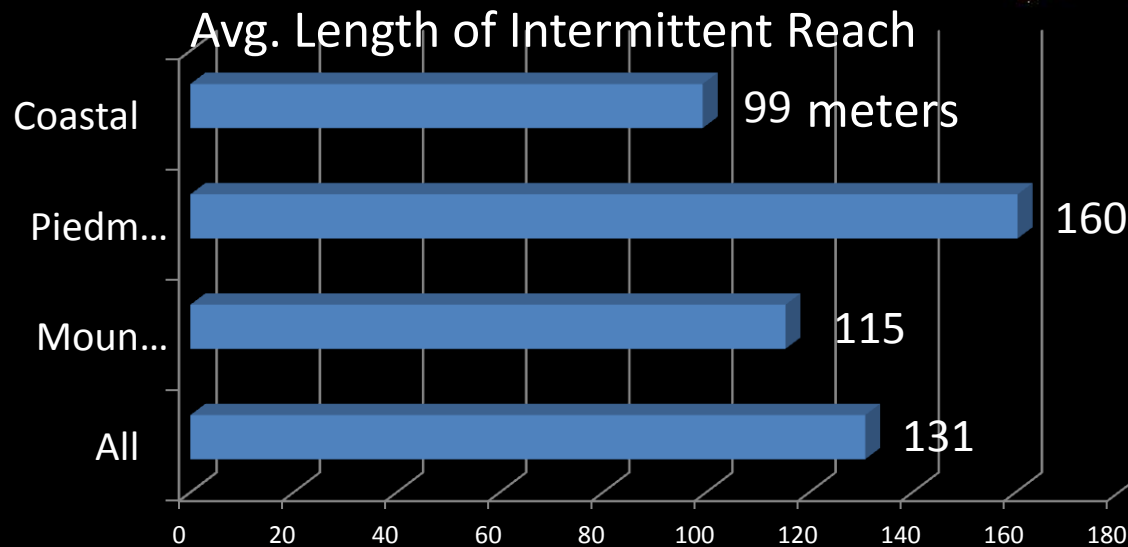
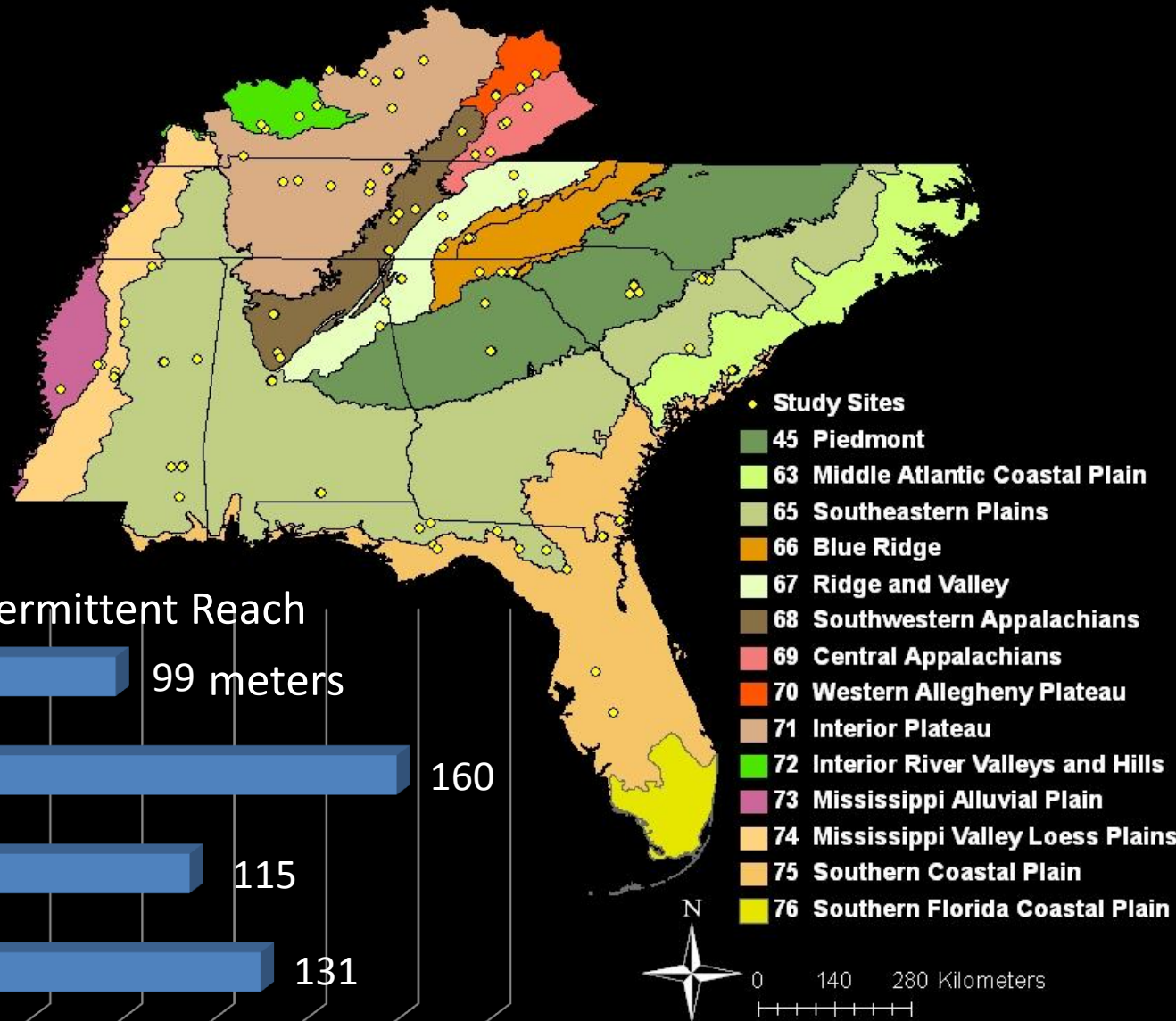


Constricted Wetlands

Study Area and Design

126 Total Sites
238 Total Samples
12 Total Ecoregions

Study Period
Dec 2008 – Sept 2011
Visit sites 2 times
-Winter/Spring
-Summer/Fall



Field Sampling Methods

Qualitative Sweep:

- 2 locations
- Performed in best available habitat (riffle, pool, leaf pack, root mats)

NC DWQ Stream Identification Form v 3.1

- generated scores (19-30 intermittent, 30+ perennial)
- used to identify intermittent and perennial origins

Laboratory Methods

Macroinvertebrate Sorting:

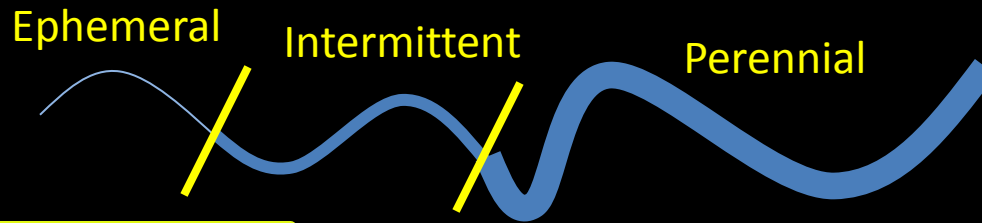
- 100 % of individuals per sample

Identification:

- lowest practical taxonomic level
 - 41 % species-level, 55 % genus-level



Transitional Streams



Intermittent

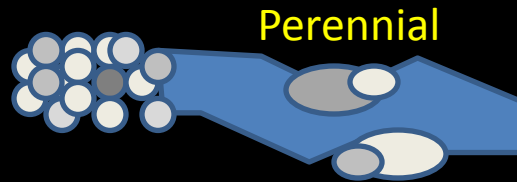
1. *Crangonyx* (Amphipoda)
2. *Parametriocnemus* (Diptera)
3. *Lepidostoma* (Trichoptera)
4. *Conchapelopia* (Diptera)
5. *Hexatoma* (Diptera)

Perennial

1. *Crangonyx* (Amphipoda)
2. *Amphinemura delosa* (Plecoptera)
3. *Neoporus* (Coleoptera)
4. *Lepidostoma* (Trichoptera)
5. *Leuctra* (Plecoptera)

	Aquatic Taxa	Aquatic Abundance	Perennial Indicators	PIT Abundance	EPT Diversity	Diptera Diversity	Non-Insect Diversity	Non-Insect Abundance			
Transitional Streams											
Upstream	15	↑.01	201	2	↑.01	21	↑.05	3	6	3	92
Downstream	20		203	5		28		5	8	3	62
Perennial Spring Seeps											
Upstream	21		234	6		38		6	10	3	103
Downstream	23		247	8		50		8	11	3	44
Constricted Wetlands											
Upstream	20		345	4		22		4	8	5	214
Downstream	19		281	3		21		3	7	5	151

Perennial Spring Seeps



Perennial

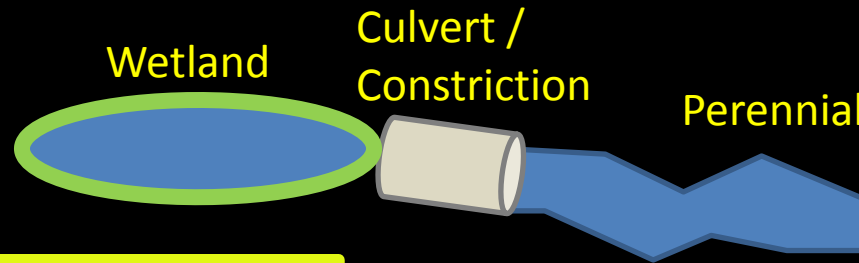
1. *Nigronia fasciatus* (Megaloptera)
2. *Lepidostoma* (Trichoptera)
3. *Leuctra* (Plecoptera)
4. *Pisidium* (Veneroida)
5. *Amphinemura delosa* (Plecoptera)

EPT from Seeps

1. *Wormaldia* (Trichoptera)
2. *Paraleptophlebia* (Ephemeroptera)
3. *Molanna blenda* (Trichoptera)
4. *Diplectrona modesta* (Trichoptera)
5. *Allocapnia* (Plecoptera)

	Aquatic Taxa	Aquatic Abundance	Perennial Indicators	PIT Abundance	EPT Diversity	Diptera Diversity	Non-Insect Diversity	Non-Insect Abundance
Transitional Streams								
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Constricted Wetlands



1. *Crangonyx* (Amphipoda)
2. *Parametriocnemus* (Diptera)
3. *Lepidostoma* (Trichoptera)
4. *Leuctra* (Plecoptera)
5. *Cordulegaster* (Odonata)

Chironomidae

1. *Parametriocnemus*
2. *Natarsia*
3. *Tanytarsus*
4. *Corynoneura*
5. *Thienemaniella*

	Aquatic Taxa	Aquatic Abundance	Perennial Indicators	PIT Abundance	EPT Diversity	Diptera Diversity	Non-Insect Diversity	Non-Insect Abundance
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Perennial Indicators

Drunella allegheniensis



Eric Fleek©

Nigronia serricornis



Eric Fleek©

Ophiogomphus sp.



Eric Fleek©

Ephemeroptera

Plecoptera

not Capnidae

Trichoptera

not Ironoquia

Odonata

Megaloptera

Diptera

Ptychopteridae

Tipula

Coleoptera

Elmidae

Psephenidae

Helichus

Mollusca

Unionidae

Ancylidae

Planorbidae

Pleuroceridae

Vertebrates

Hansonoperla appalachia



Eric Fleek©



Ceraclea ophioderus

Eric Fleek©

Cheryl Gregory©



Rare and Weird Taxa

Caddisflies

*Homoplectra monticola**

Goerita betteni

Theliopsyche

Stoneflies

*Beloneuria stewarti**^

*georgiana**^

*Diploperla morgani**



Homoplectra monticola
Or
Diplectrona marianae



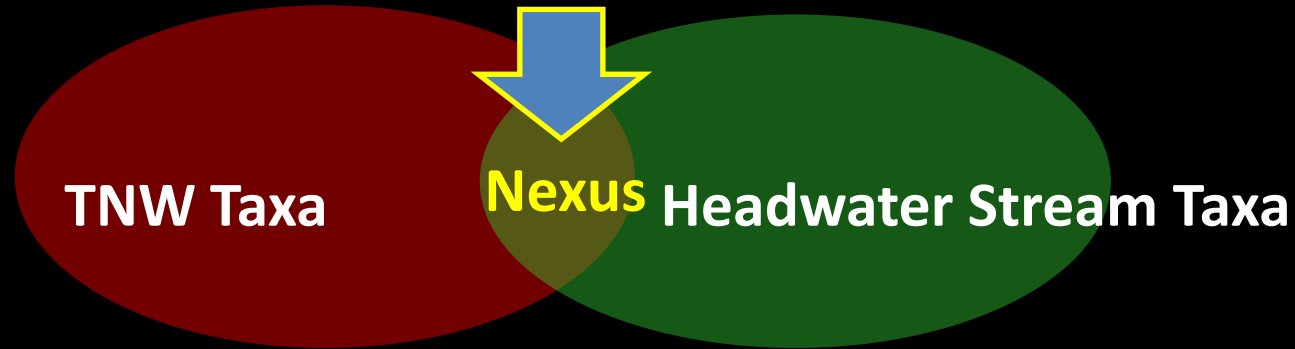
Theliopsyche sp.

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

^suspected, awaiting confirmation

Overlap with Traditionally Navigable Waters (TNW)

Biological connection between headwater streams and TNW's

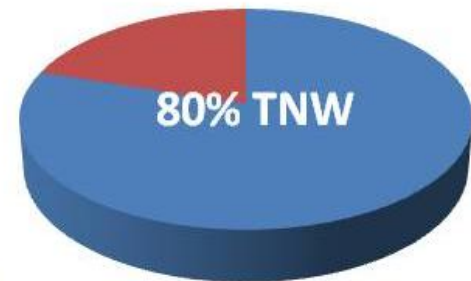


South Carolina: 81/160 taxa

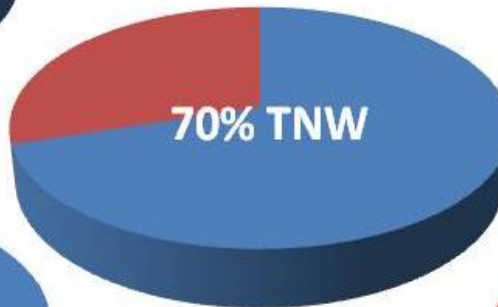


■ TNW Taxa
■ Non TNW Taxa

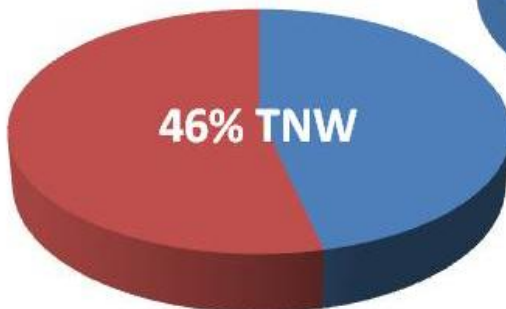
Florida: 111/139 taxa



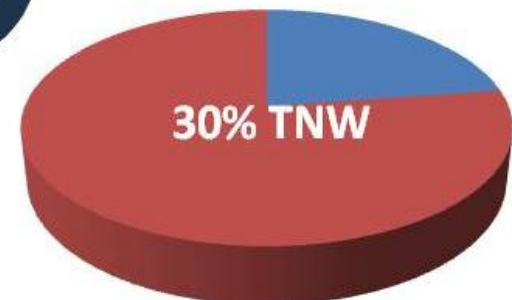
Tennessee: 216/308



Kentucky: 91/196 taxa

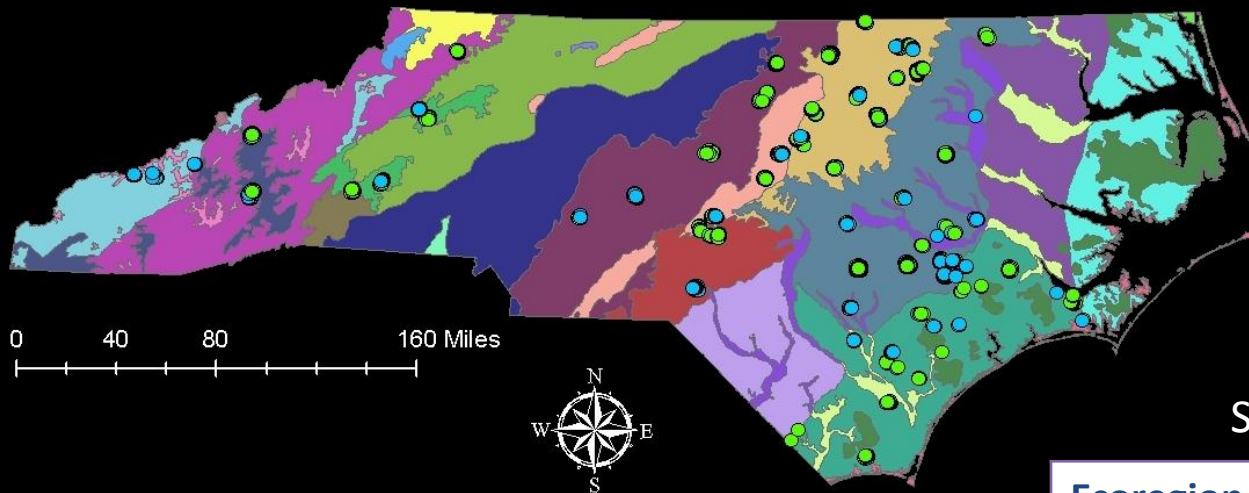


Mississippi: 38/129 taxa



Future of Temporary Waters in NC

Headwater Stream Mapping Sites North Carolina Division of Water Quality



13 Ecoregions

85 sites

~ 700,000 m stream

- 176,360 m Int.
- 530,596 m Per.

Stream Length Accuracy

Ecoregion	Model	USGS
Carolina Slatebelt	83%	51%
Triassic Basins	94%	45%
Sand Hills	108%	152%
Rolling Coastal Plain	95%	119%
Carolina Flatwoods	129%	101%



Periann Russell unpub. data (2012)

Acknowledgments

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NC DWQ Biological Assessment Unit

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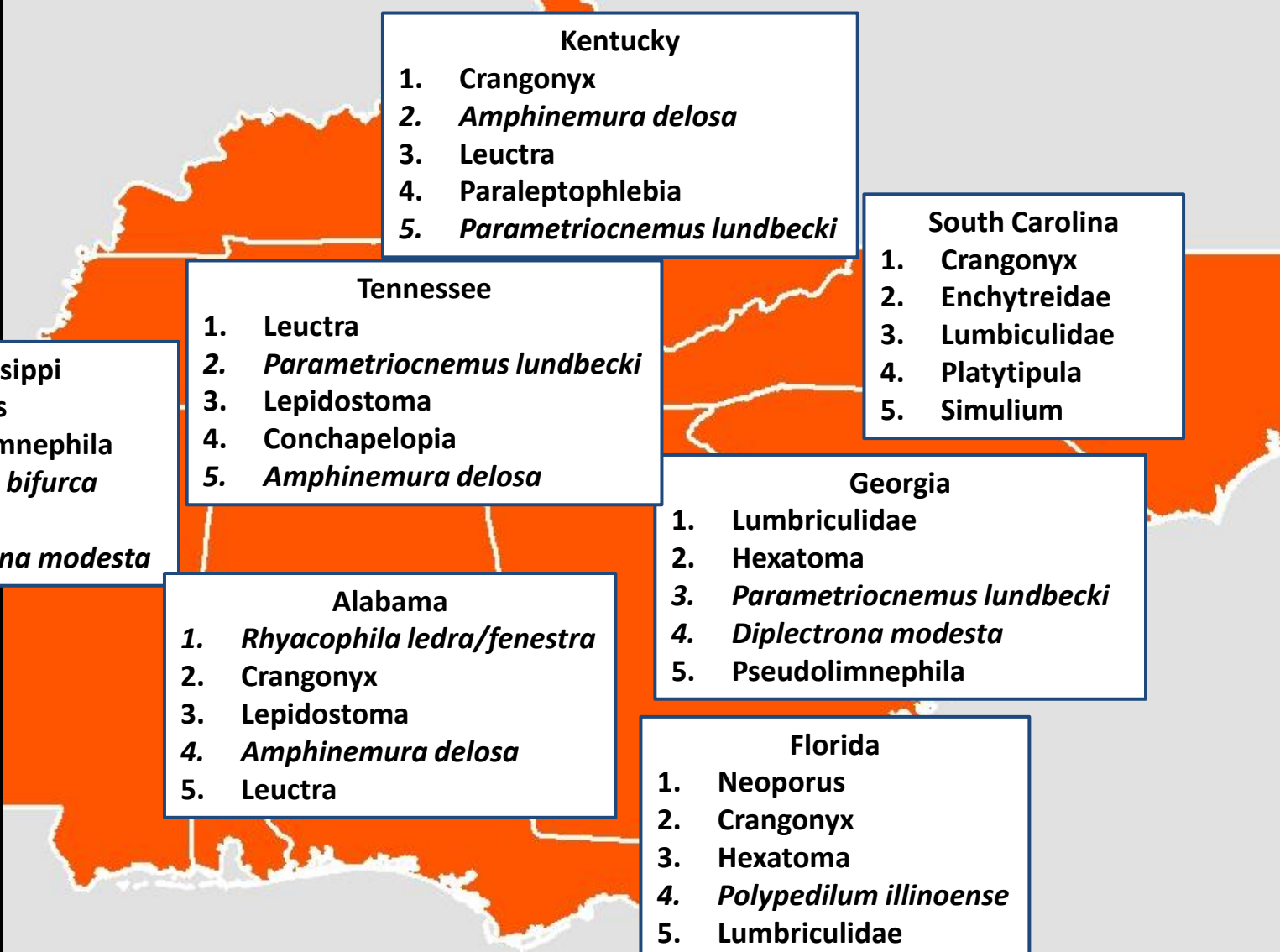
Mike Floyd-US FWS



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Characteristic Communities



Kentucky

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

South Carolina

1. Crangonyx
2. Enchytreidae
3. Lumbriculidae
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