

Validation of a Stream and Riparian Habitat Assessment Protocol using Stream Salamanders in the Southwest Virginia Coalfields.



Sara Sweeten and Mark Ford
Virginia Tech
Department of Fish and Wildlife Conservation

Habitat Assessment

- Quantifying stream and riparian habitat important
 - Land use alterations
 - Reclamation/Recovery
- Stream habitat Rapid Bioassessment Protocol (RBP)
 - Estimation of 10 stream habitat variables (Score: 0-20)



U.S. Army Corps of Engineers Functional Assessment of High-gradient Headwater Streams

- Functional Capacity Index (FCI): Score 0-100
 - **Habitat FCI**
 - Capacity of stream and riparian ecosystem to provide for wildlife communities
 - Vertebrates and invertebrates
 - **Biogeochemical FCI**
 - Retainment and transfer of inorganic/organic materials
 - Respiration and decomposition
 - **Hydrology FCI**
 - Dissipation of energy
 - Flow, velocity and transport of water downstream

U.S. Army Corps of Engineers Protocol

Noble et al. 2010

Hydrology FCI

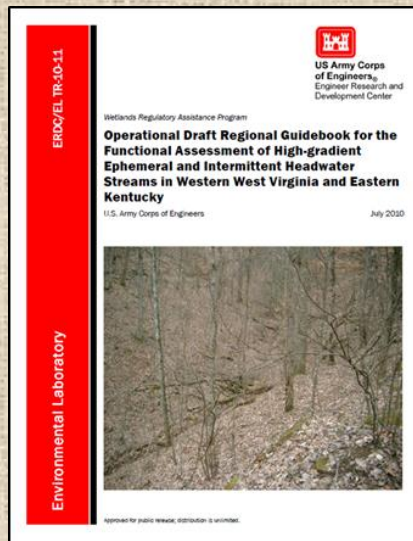
Stream Embeddedness
Substrate Size
Bank Erosion
LWD
Land Use

Biogeochemical FCI

Stream Embeddedness
LWD
Tree DBH
Saplings & Shrubs
Detritus Cover
Herbaceous Cover
Land Use

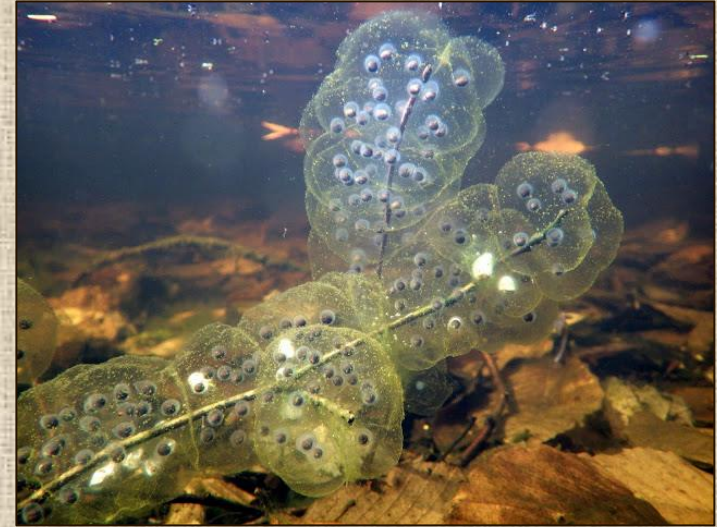
Habitat FCI

Canopy Cover
Stream Embeddedness
Substrate Size
LWD
Tree DBH
Tree Snags
Saplings & Shrubs
Tree Species Richness
Detritus Cover
Herbaceous Cover
Land Use



Salamanders

- Mole Salamanders (*Ambystoma*)
 - Jefferson Salamander
 - Spotted Salamander
 - Stout-bodied
 - Breed in ponds and temporary pools
 - Live in burrows in forest



Salamanders

- Eastern Newt (*Notophthalmus viridescens*)
 - Rough skin
 - Ringed spots



Salamanders

- Lungless Salamanders (Plethodontids)
 - Terrestrial (*Plethodon*)
 - Red-backed Salamander
 - Slimy Salamander
 - Ravine Salamander



Lungless Salamanders (Plethodontids)

Stream:

- Red/Mud/Spring Salamanders
- Brook Salamanders (*Eurycea*)
 - Two-lined Salamander
 - Long-tailed Salamander
- Dusky Salamanders (*Desmognathus*)
 - Northern Dusky
 - Seal Salamander
 - Mountain Dusky
 - Black Mountain Dusky



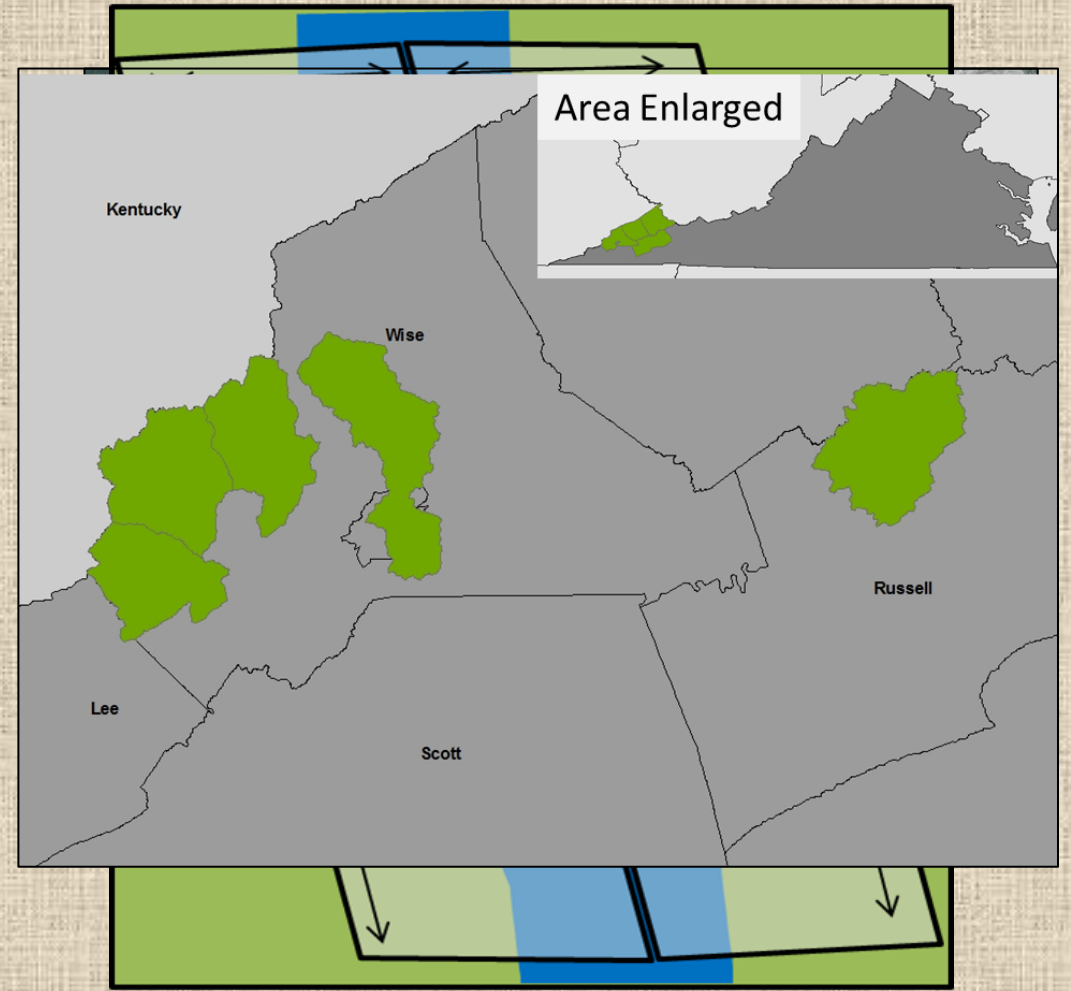
Why Stream Salamanders?

- High, stable densities
 - Up to 3.5/m²
- Long-lived
 - 10+ years
- Aquatic and terrestrial phases
- Keystone faunal group
 - Intermediate trophic role
- Low mobility
- Abundances linked to:
 - Forestry practices
 - Urbanization



Methods

- 70 Sites in Virginia
 - 5 HUC-12 watersheds
 - First and second order streams
 - Visited 3 times: Summer 2013
 - 25 m x 10 m quadrat: Habitat
 - 25 m x 5 m quadrat: Salamanders
- GIS analysis for land use
- Occupancy and abundance
 - Program Presence



Methods

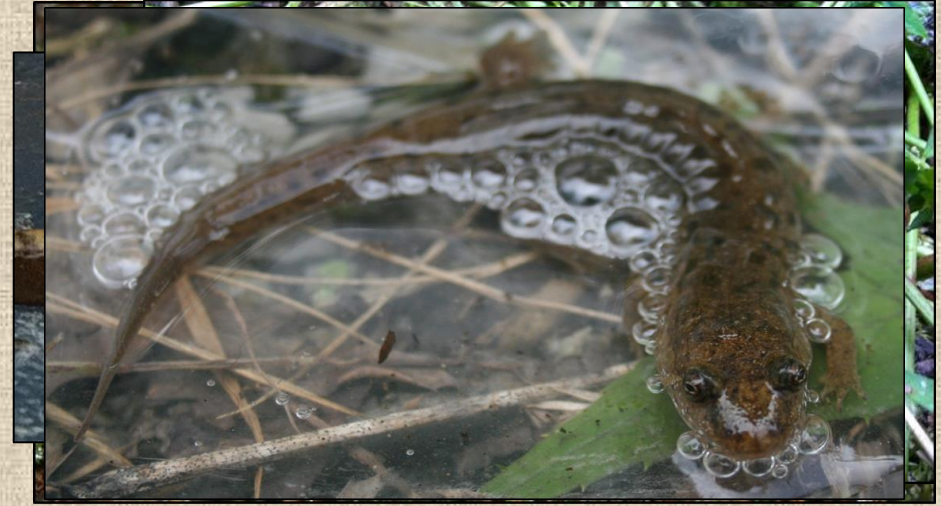
- **Canopy cover:** Percent canopy cover (3 measurements)
- **Tree DBH:** Mean DBH of trees in quadrat
- **Large woody debris:** Number of dead, down woody stems
- **Snags:** Number of standing dead trees
- **Stream embeddedness:** Percent covered, surrounded, or buried by fine sediment (30 substrate pieces)
- **Substrate size:** 30 substrate measurements
- **Bank erosion:** Percent of left and right stream bank eroded
- **Detritus cover:** Percent detritus cover in 1 x 1 m plot (6 plots)
- **Herbaceous cover:** Percent herbaceous cover in 1 x 1 m plot (6 plots)
- **Sapling/Shrub density:** Number of woody stems (< 4 inch DBH)
- **Riparian vegetation species richness:** Ratio of native species to invasive species



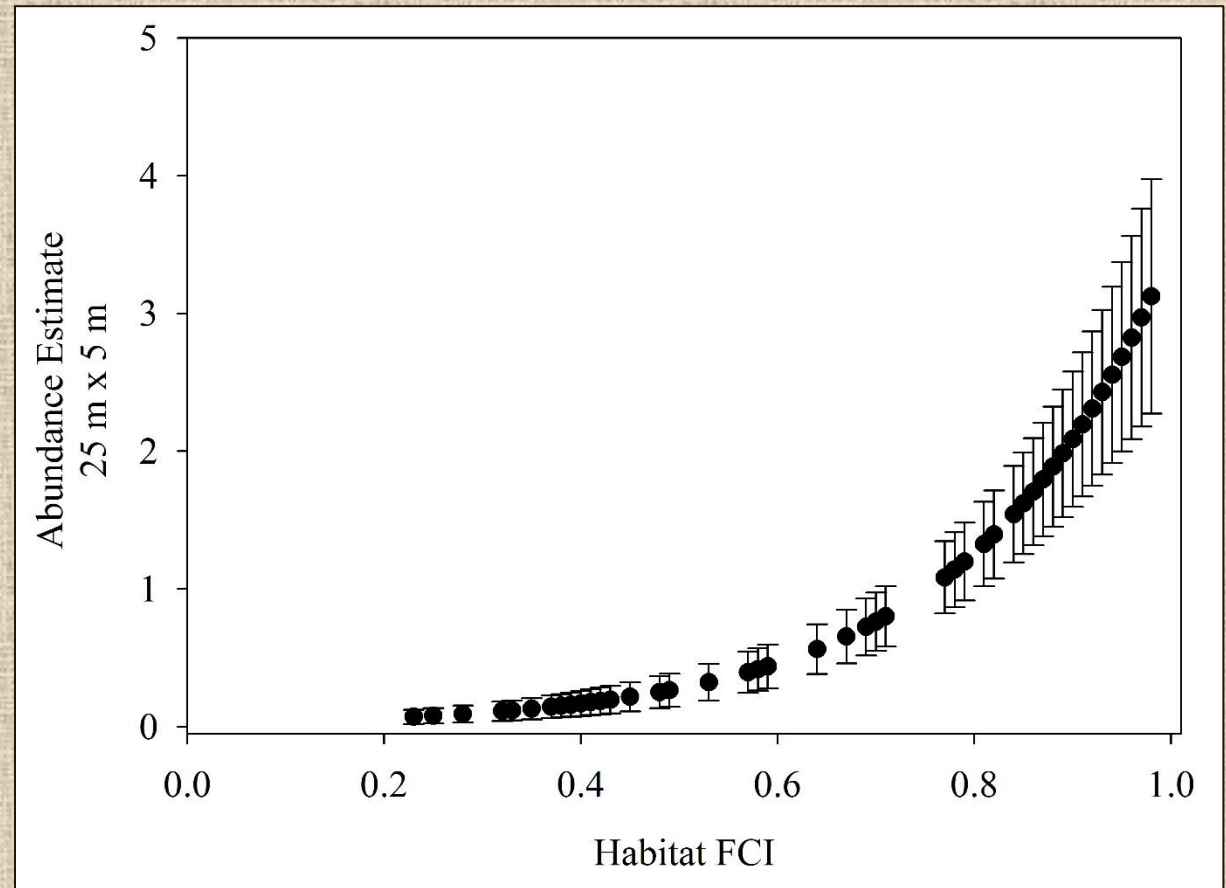
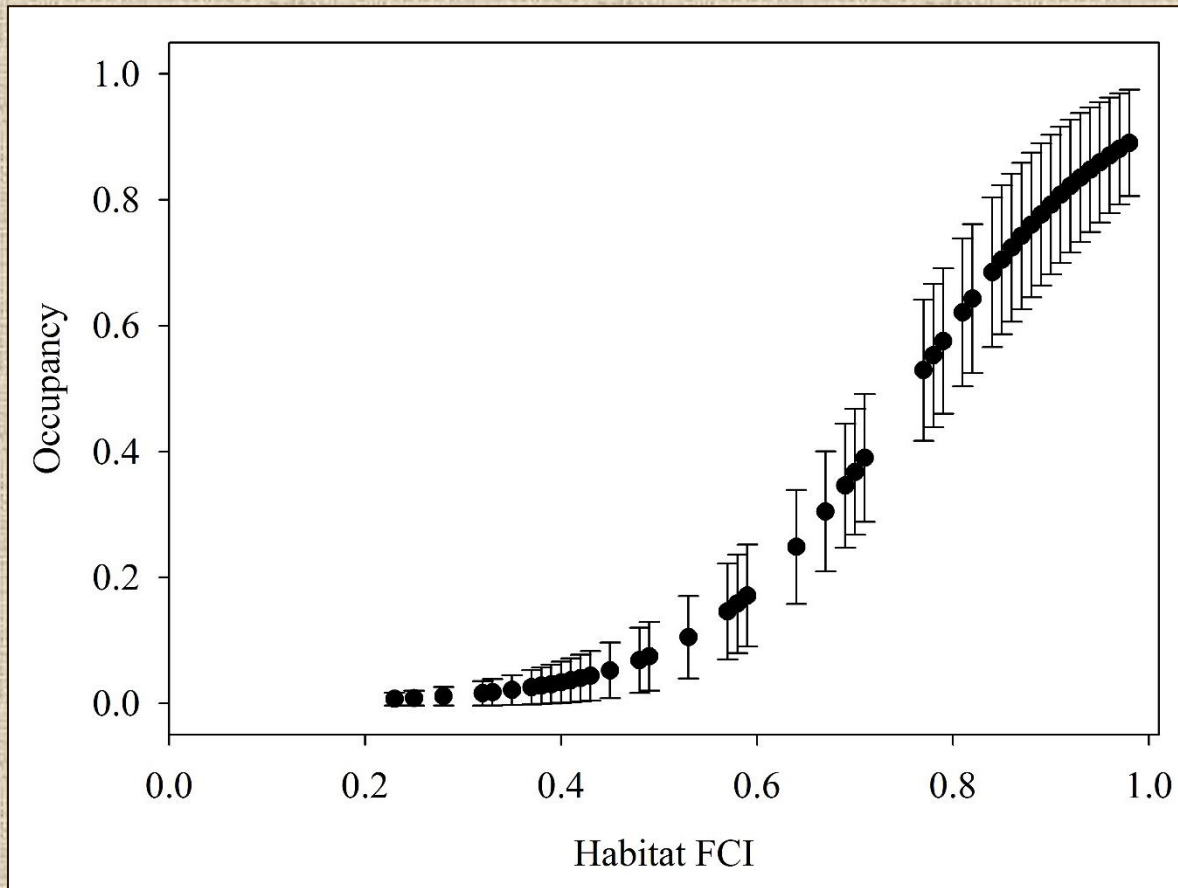
Results



- 1150 Individuals; 9 species
- Four groups with sufficient data
 - Northern Dusky Salamander (*D. fuscus*)
 - Seal Salamander (*D. monticola*)
 - Mountain Dusky Salamander (*D. ochrophaeus*)
 - Brook Salamanders (*Eurycea*) Adult & Larval
 - Southern Two-Lined Salamander (*E. cirrigera*)
 - Long-tailed Salamander (*E. longicauda*)

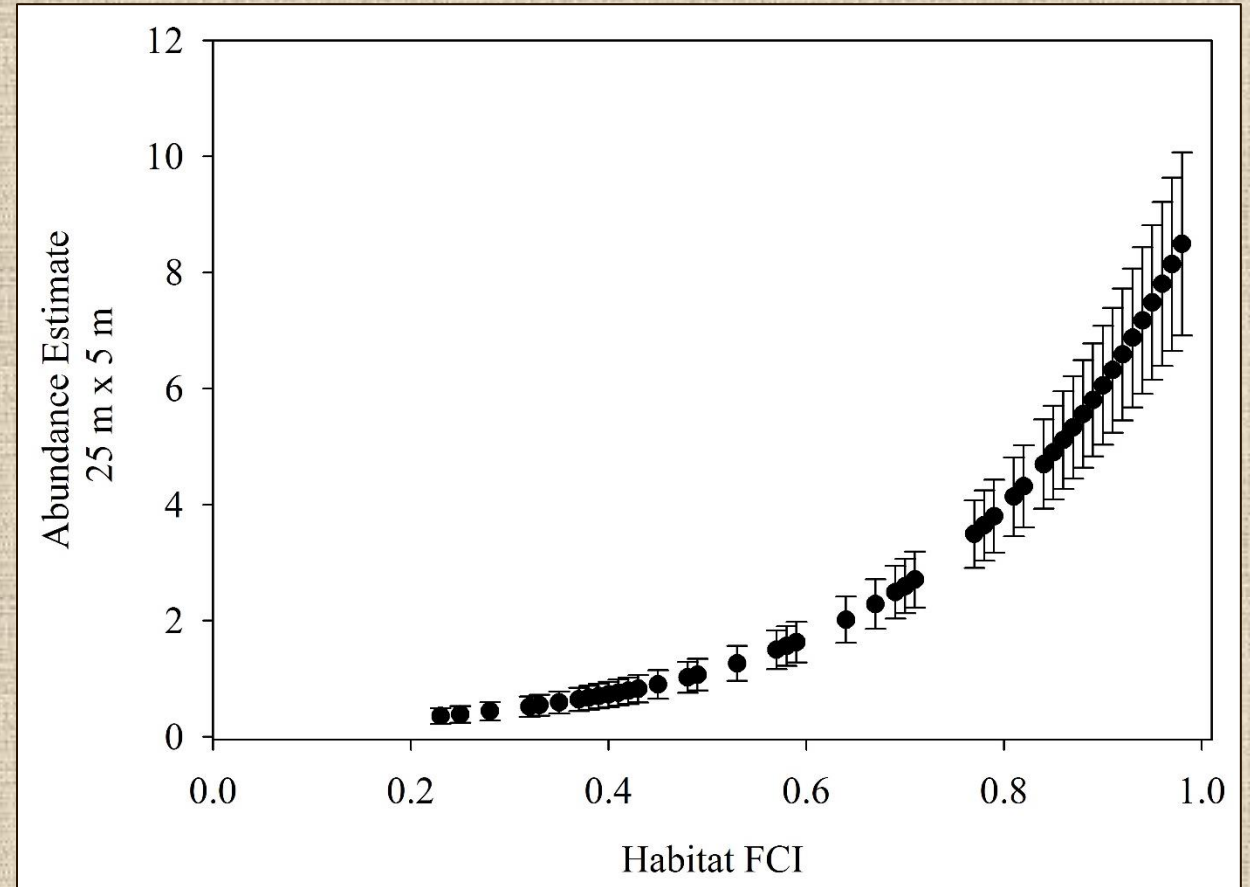
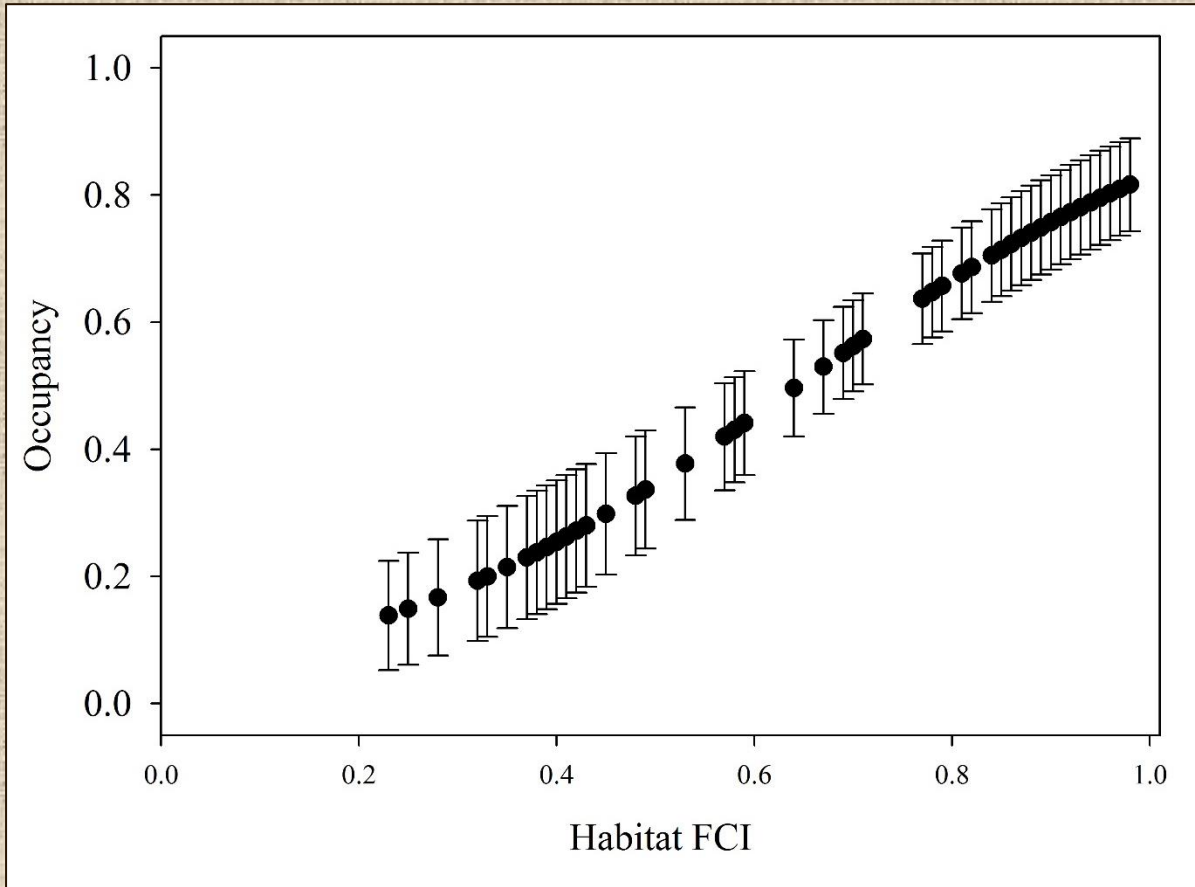


Northern Dusky Salamander (*Desmognathus fuscus*)

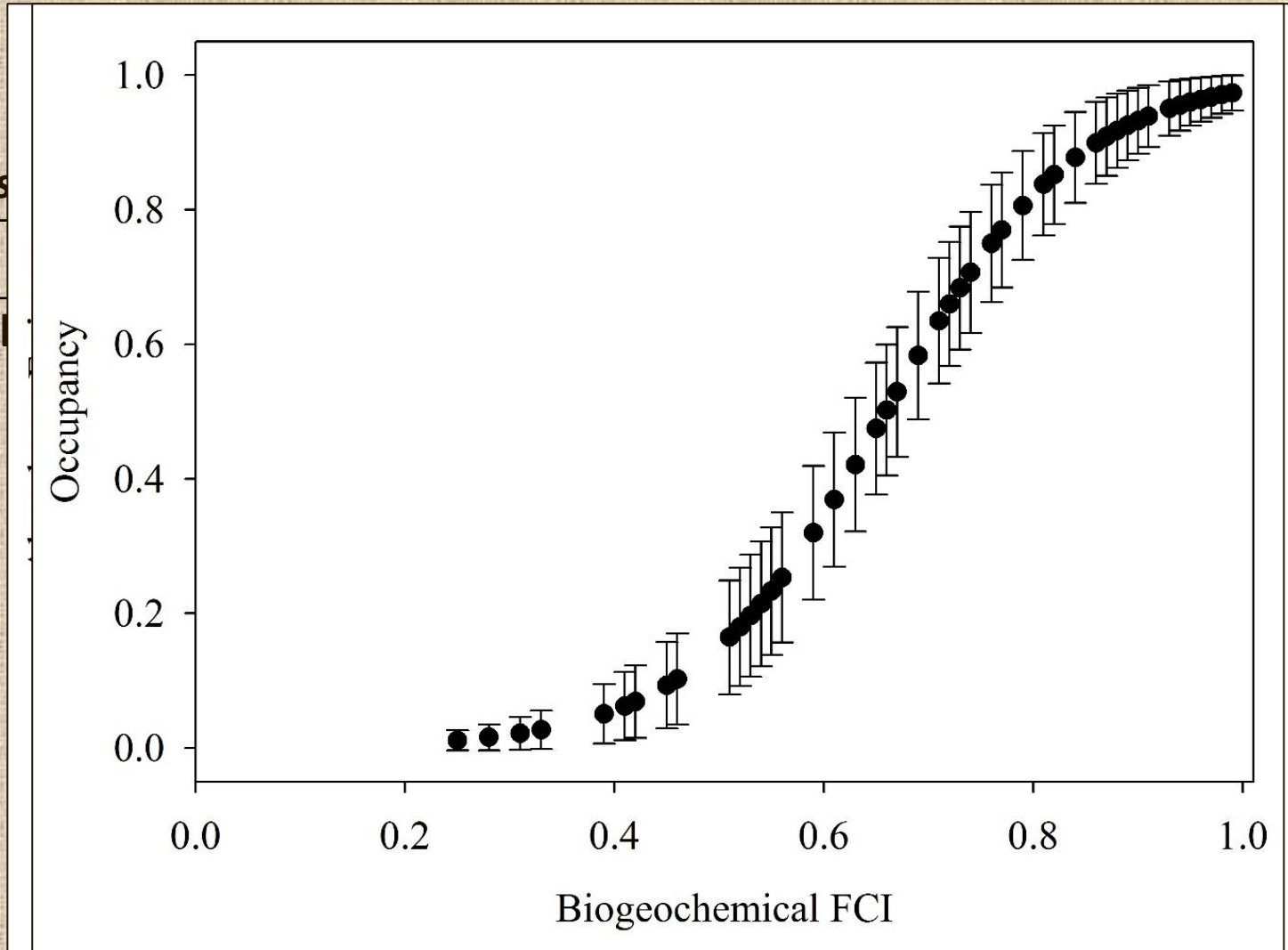


Mountain Dusky

(Desmognathus ochrophaeus)



Seal Salamander (*Desmognathus monticola*)



Desmognathus

Model

Biogeochemical

Habitat FCI

Hydrology FCI

Null

Abundance

ΔAIC

ω_i

0.00

1.00

19.33

0.00

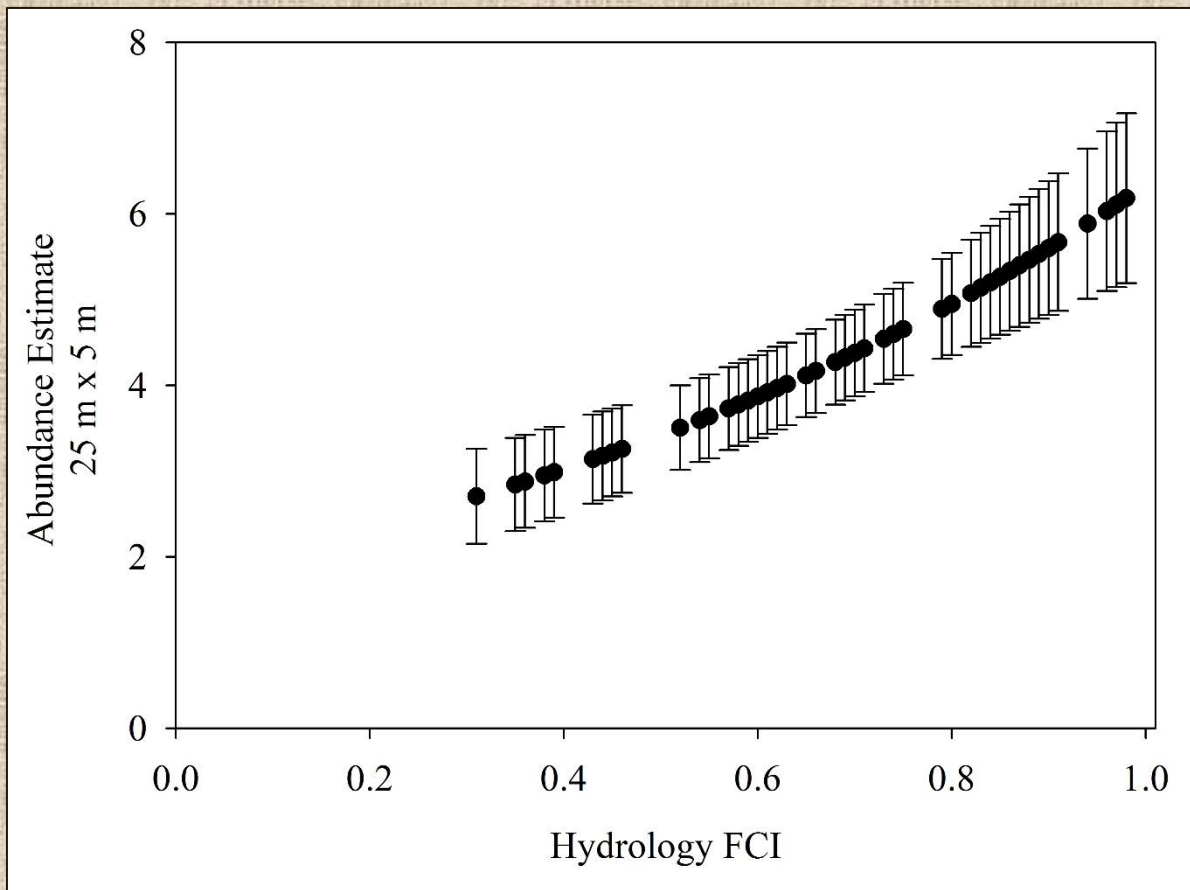
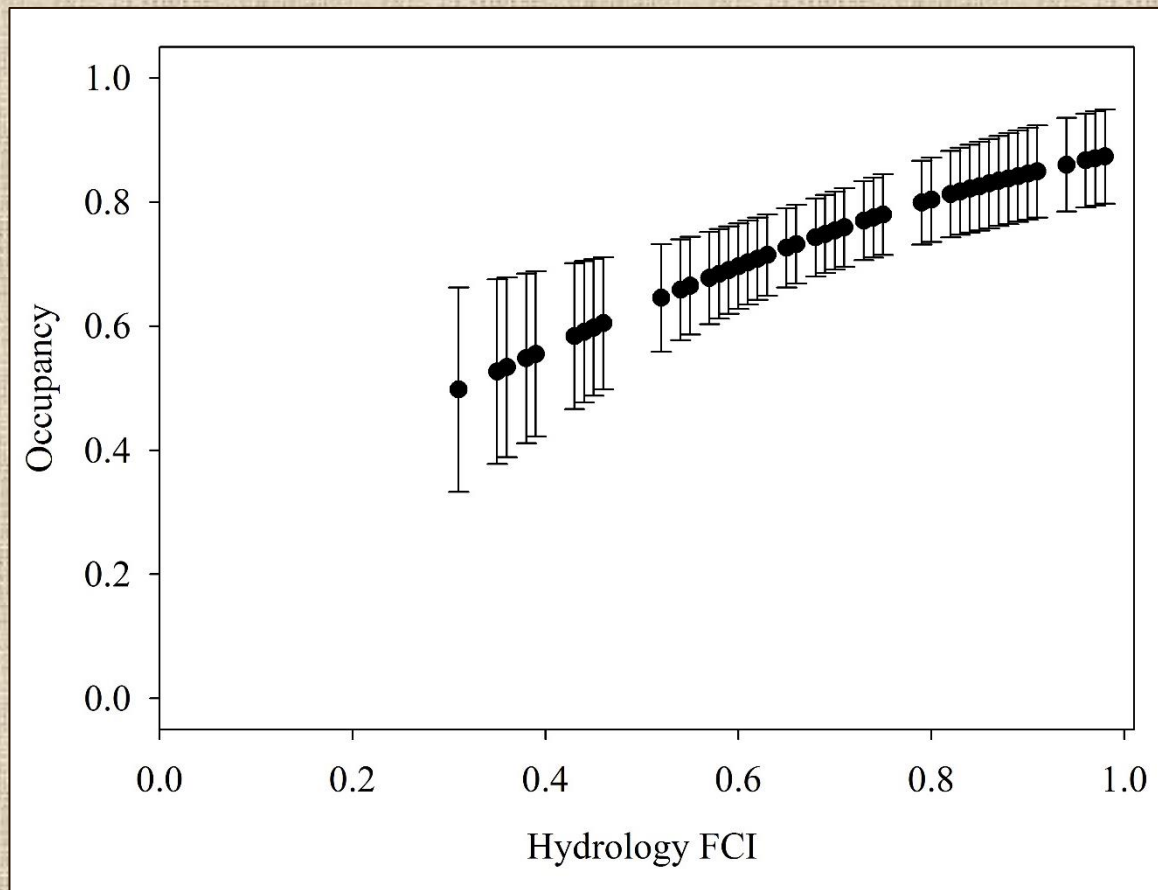
74.39

0.00

123.50

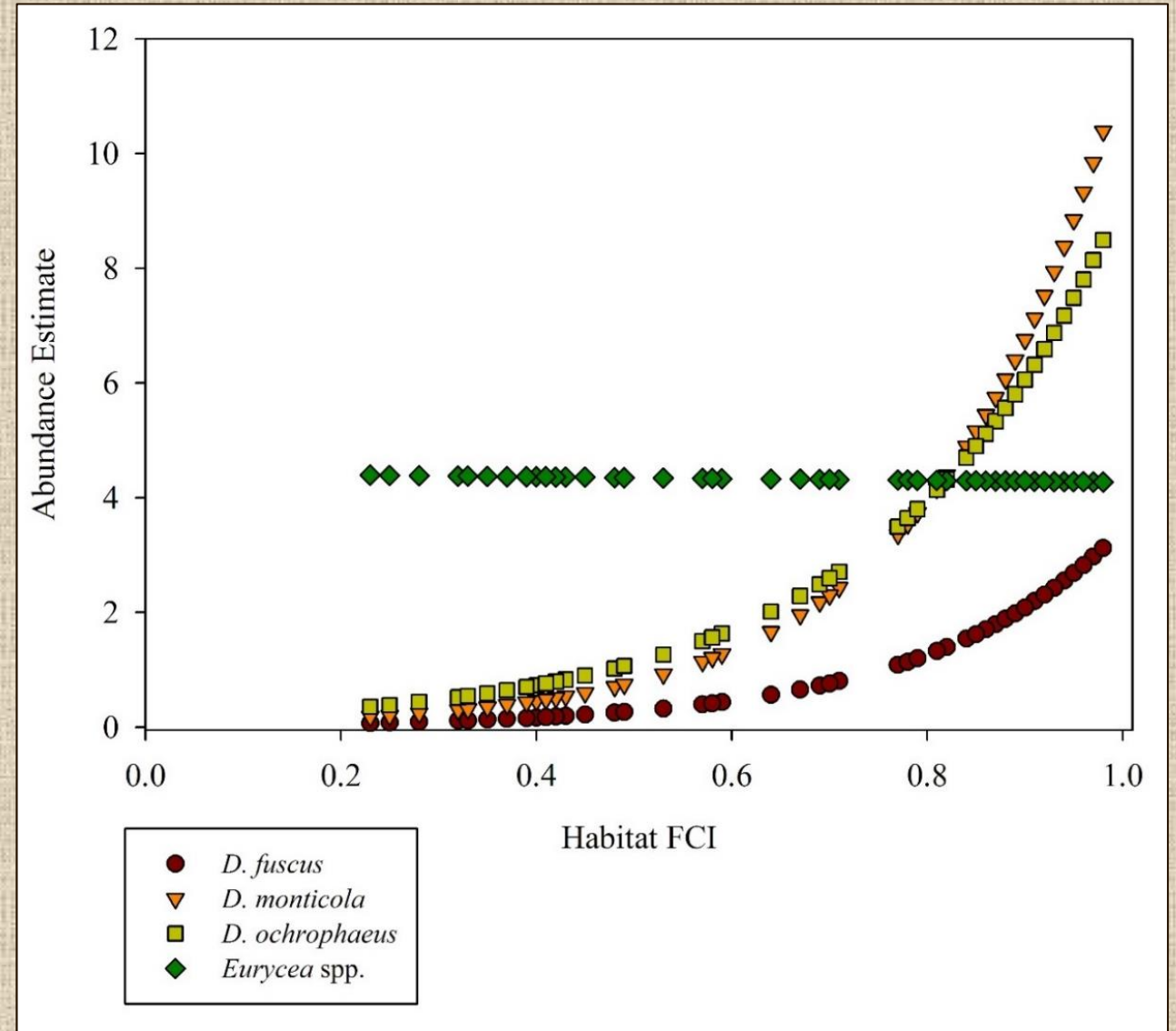
0.00

Brook Salamanders (*Eurycea* spp.)



USACE Habitat Assessment Protocol

- Habitat FCI
 - Occupancy analysis
 - Top model
 - Northern Dusky
 - Mountain Dusky
 - Abundance analysis
 - Top model
 - Northern Dusky
 - Mountain Dusky
 - Seal Salamander



Summary

- Dusky Salamanders (*Desmognathus*):

- Disturbance avoider
- Mature, forest-like conditions
- Habitat FCI



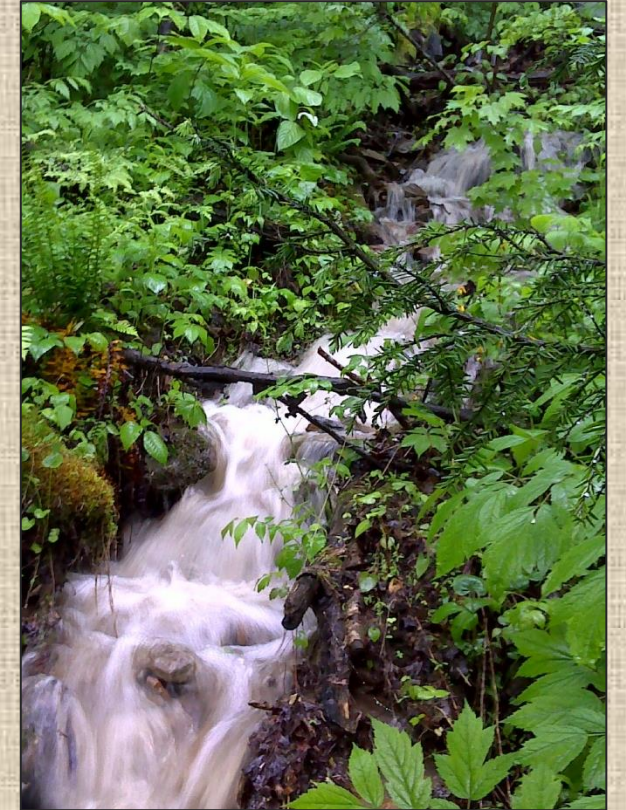
- Brook Salamanders (*Eurycea*):

- Disturbance tolerant
- Large-scale land use
- FCI not useful



Management Implications

- **Dusky Salamanders as Indicators?**
 - Preliminarily as riparian habitat indicators
 - More research needed
- **Riparian Habitat:**
 - Restoration of riparian habitat important
 - Development of riparian specific planting guidelines
 - Quick-growing tree species
- **Total salamander abundances:**
 - Not all salamanders are created equal
 - Combining may produce inaccurate results



Acknowledgements:

- Appalachian Research Initiative for Environmental Science (ARIES)
- Alpha Natural Resources
- A & G Coal Corporation
- Red River Coal Company
- Powell River Project
- Heartwood Forestland Group
- Appalachian Technical Services, Inc. (ATS)
- Environmental Monitoring, Inc. (EMI)
- US Geological Survey
- Virginia Cooperative Fish and Wildlife Research Unit
- Virginia Department of Game and Inland Fisheries
- USDA Forest Service
- Fellow Graduate Students



Questions?

