



Ecological Flow Modeling to Determine Habitat Availability During Low-Flow Periods In the Shenandoah River Basin

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Shenandoah Valley Water Conference

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**Northern Shenandoah Valley
Regional Commission**

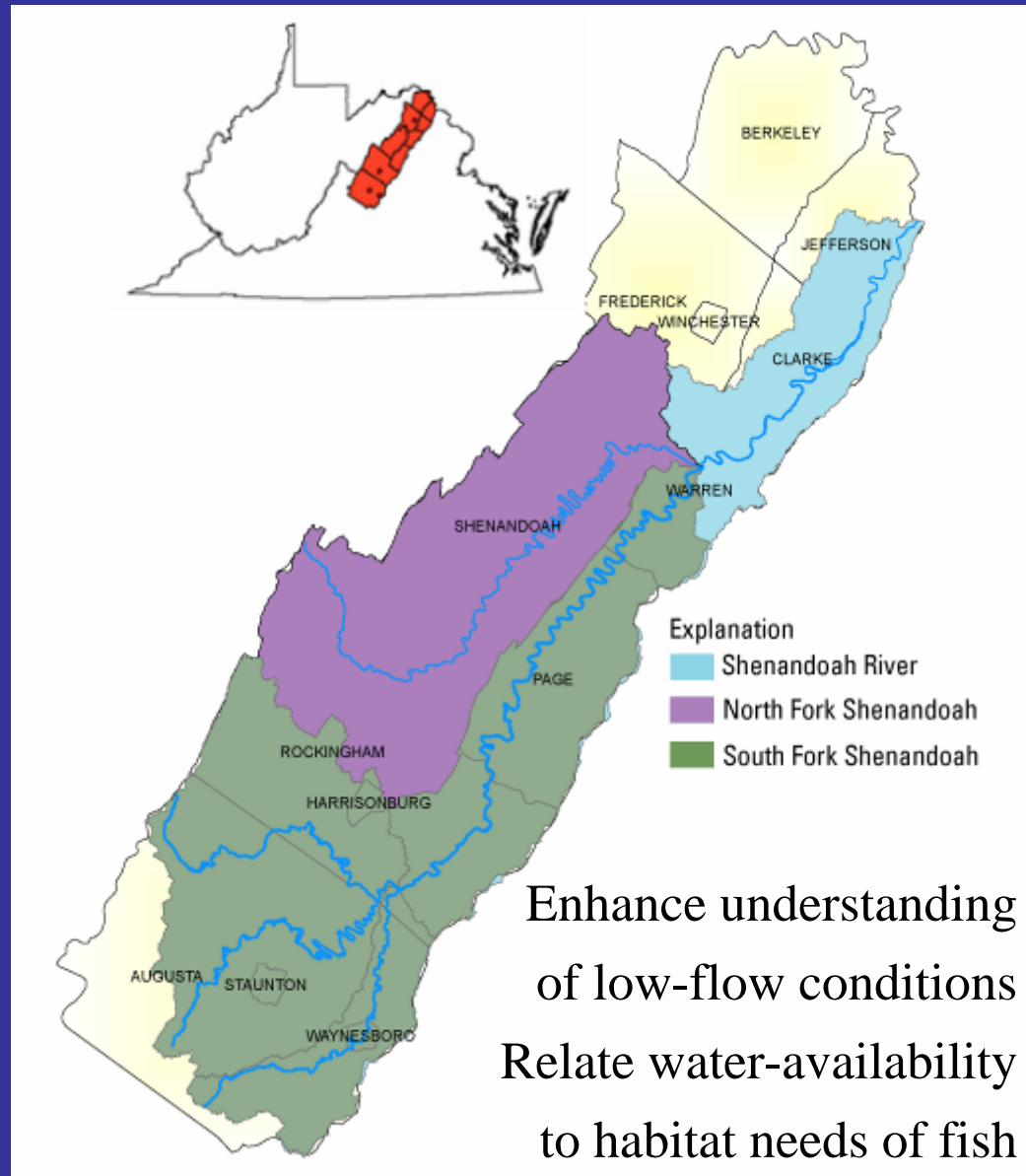
**Central Shenandoah Planning
District Commission**

In Cooperation with the US Geological Survey

What is an Ecological Flow? (MIF, Thresholds, Conservation Flows)



Set of streamflow conditions that support the needs of the biological community



Ecologically Focused Drought Assessment

Precipitation Deficits

Streamflow Statistics -----> Fish Habitat Availability

Ground-Water Levels

Reservoir Storage



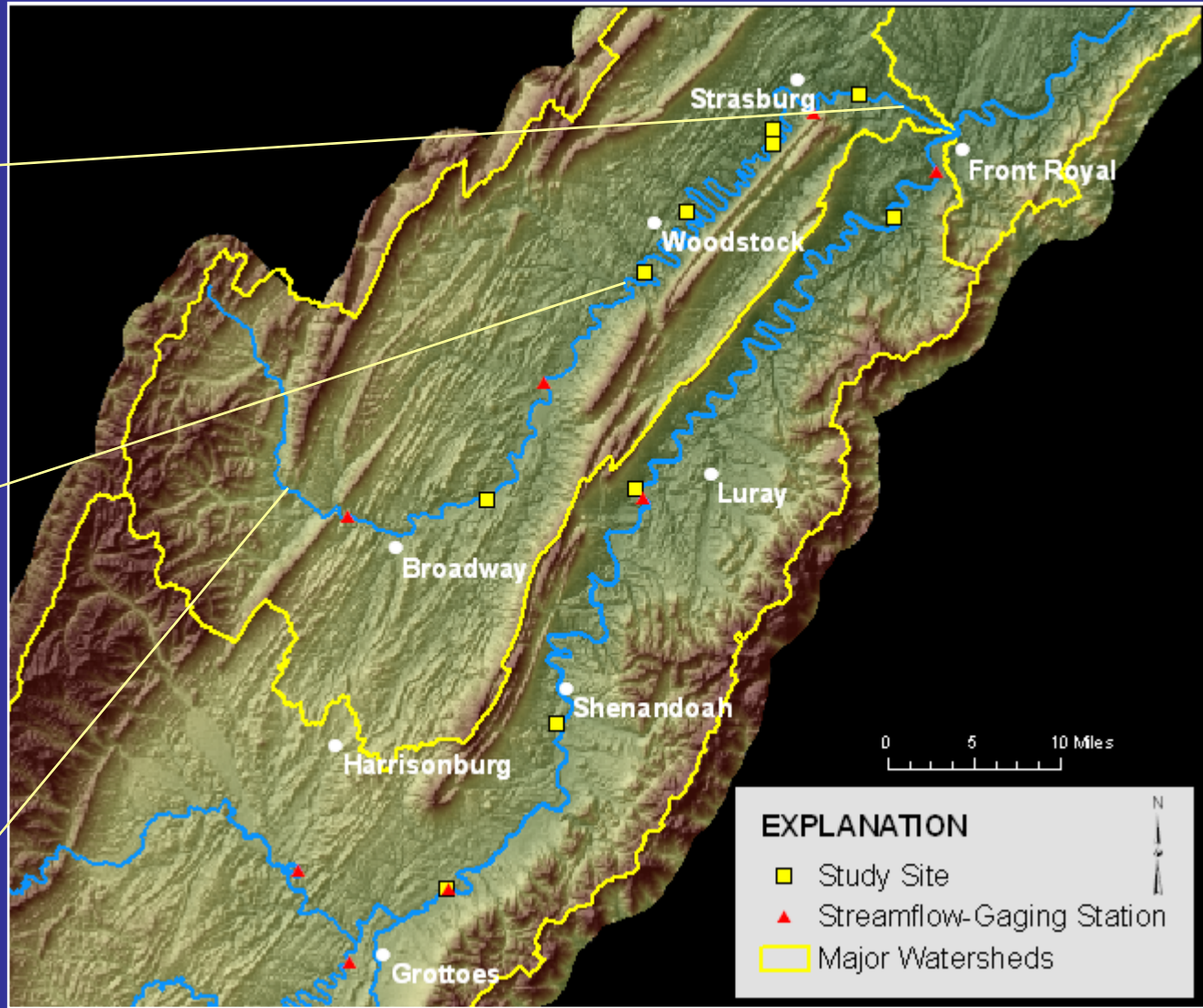
Fish photos: Jenkins, R.E. and Burkhead, N.M. (1993)
and Google images

How are Ecological Flows Developed for Water Resources Management?

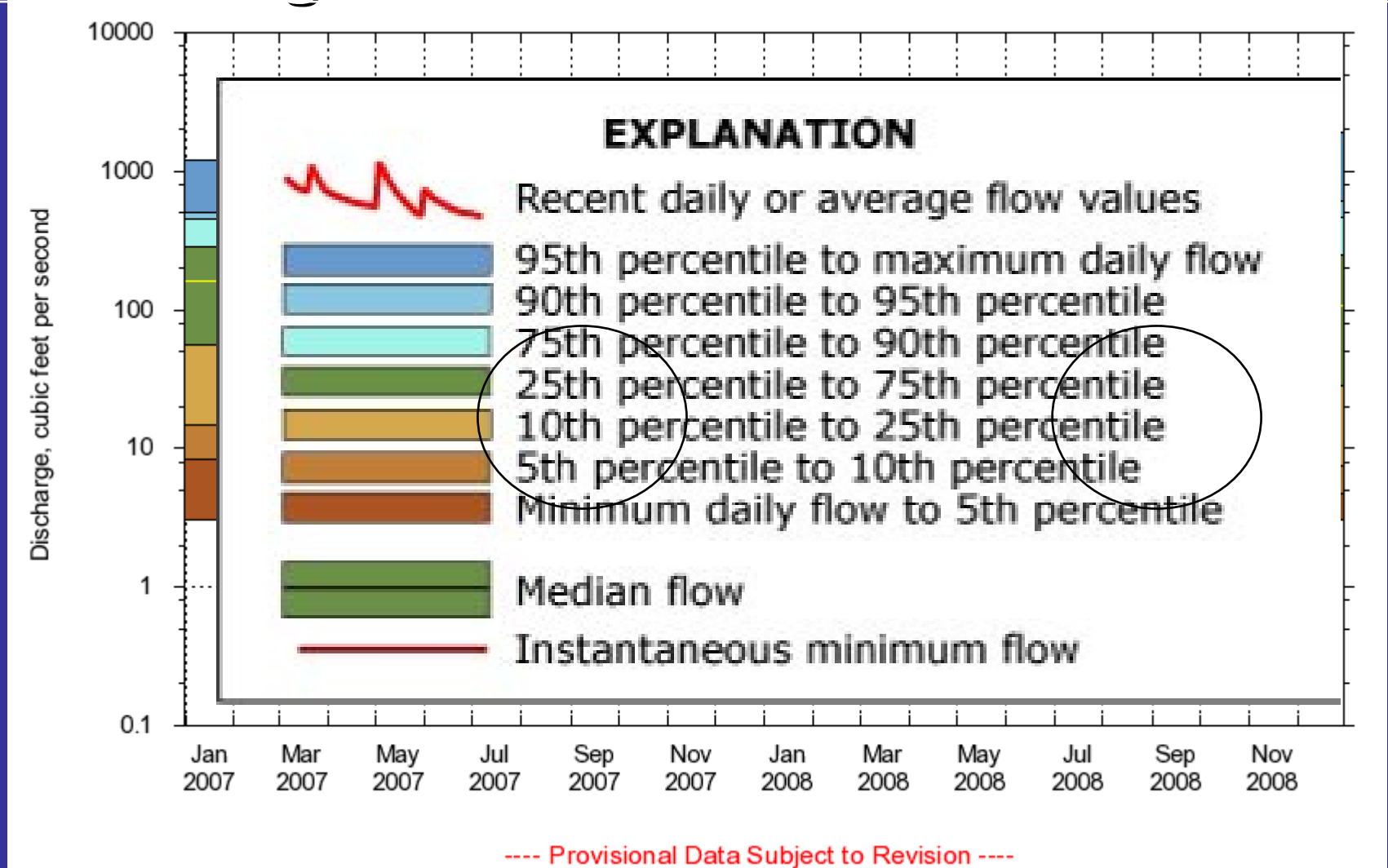
- Select a biological measure of concern
- Quantify river habitat characteristics
- Characterize flow regime
- Determine species habitat preferences
- Model flow scenarios to demonstrate ideal to unsuitable habitat conditions



North Fork and South Fork Shenandoah River Study Sites and Stream Gages



Flow Duration: Monthly Statistics and 28-day Average Streamflow at Cootes Store



Quantify Habitat Suitability Criteria for a Diverse Warm Water Fish Community

Measure *ecologically relevant* physical habitat characteristics and behaviors

- How are fish behaviors related to location in the water column (top, middle, bottom) or water velocity?

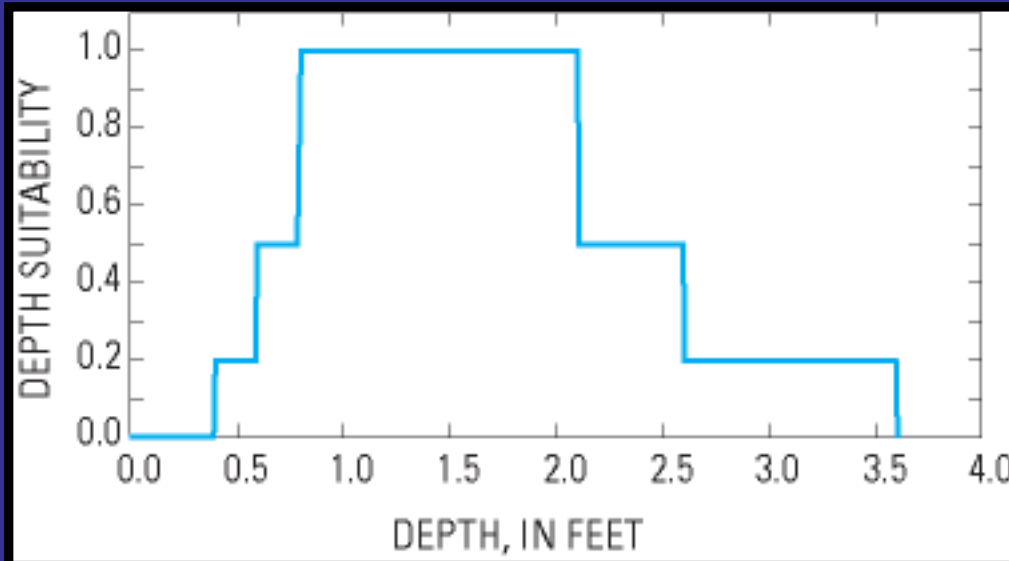
Measurements:

- Identification to species (30+)
- Total water-column depth
- Average water velocity
- Behavior (feeding, holding, fleeing)
- Bed material and cover (grass, bedrock, logs)

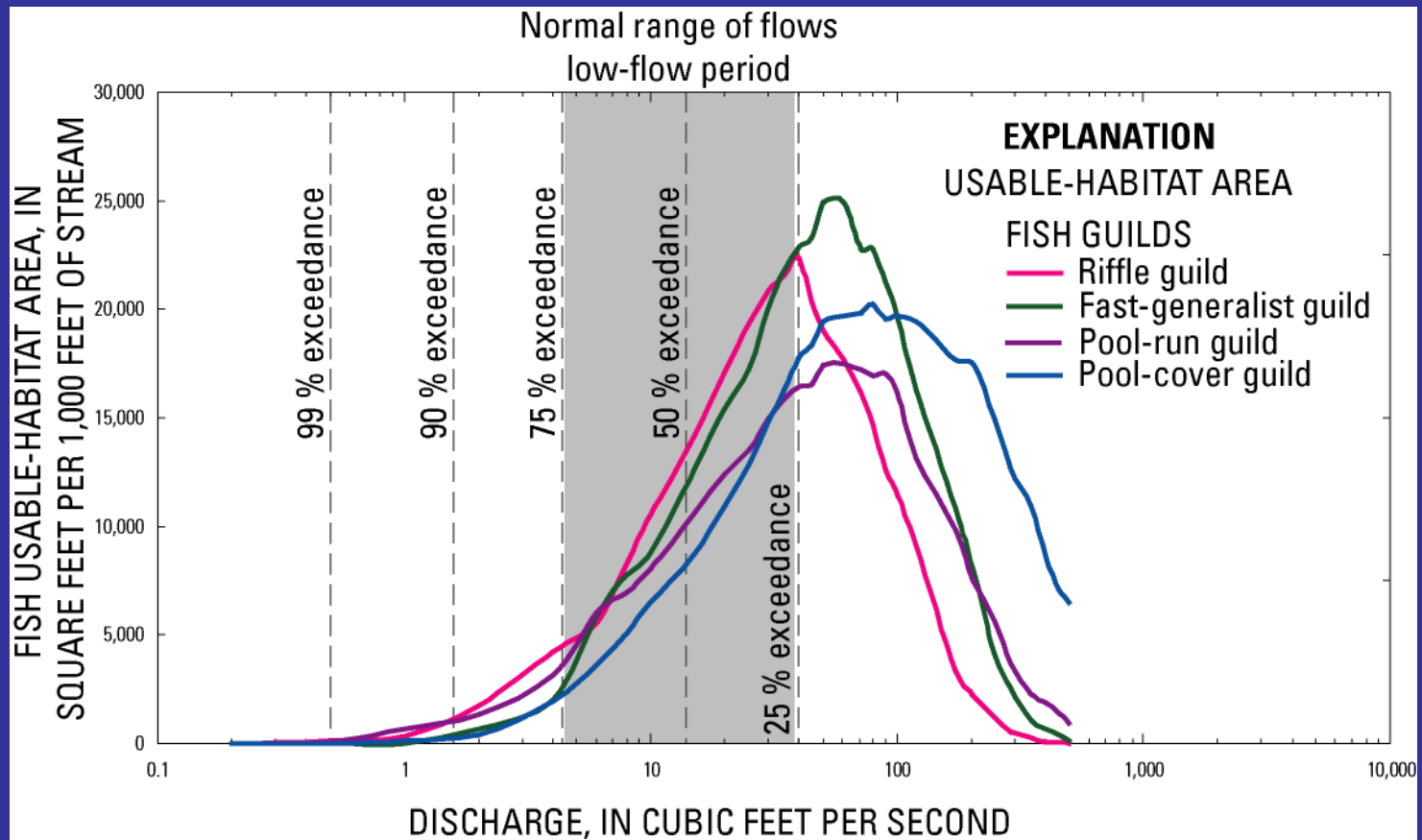


Fish Habitat-Suitability Curve Field Methods

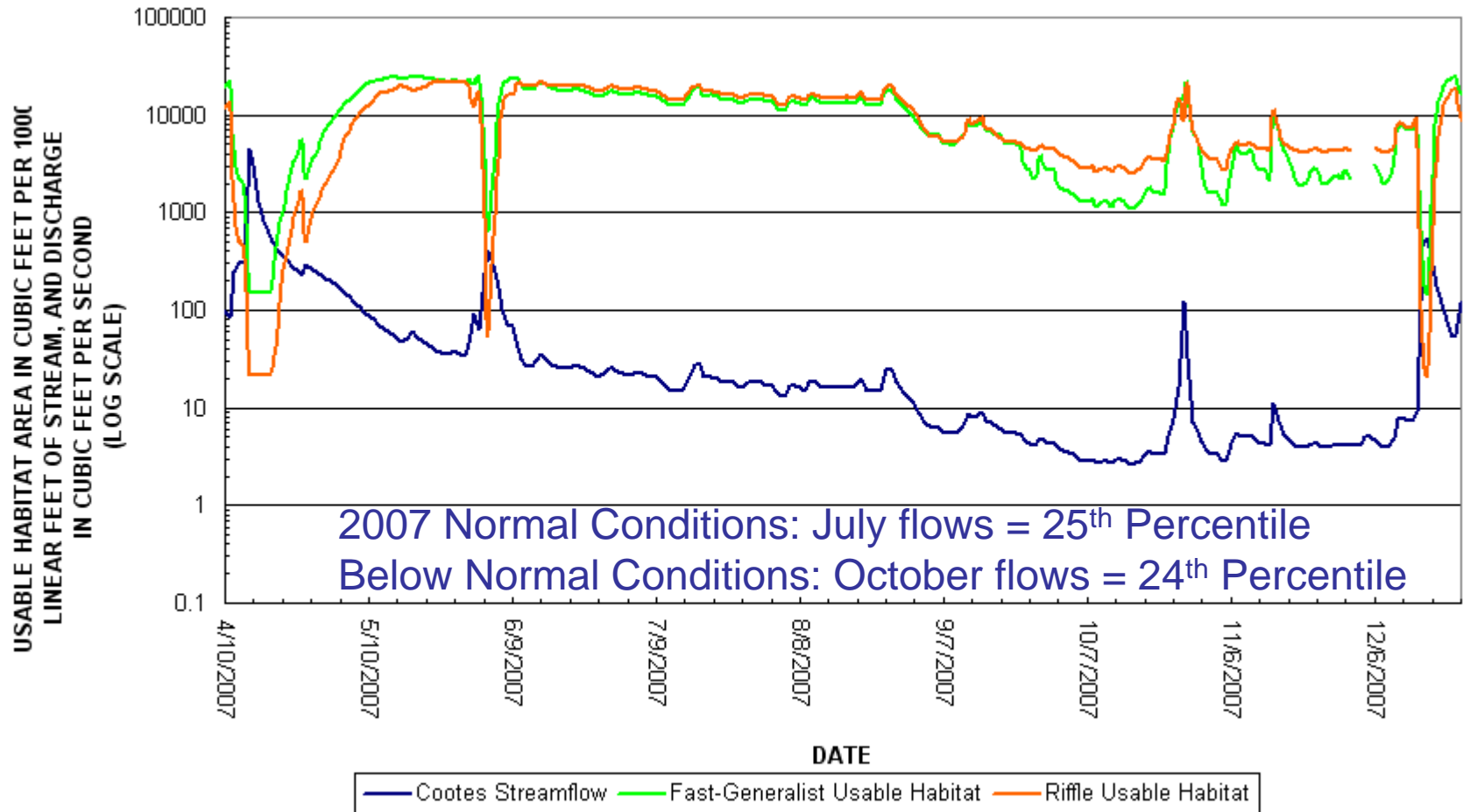
- Snorkeling
- Pre-positioned electro-shocking
- Habitat Suitability Curve



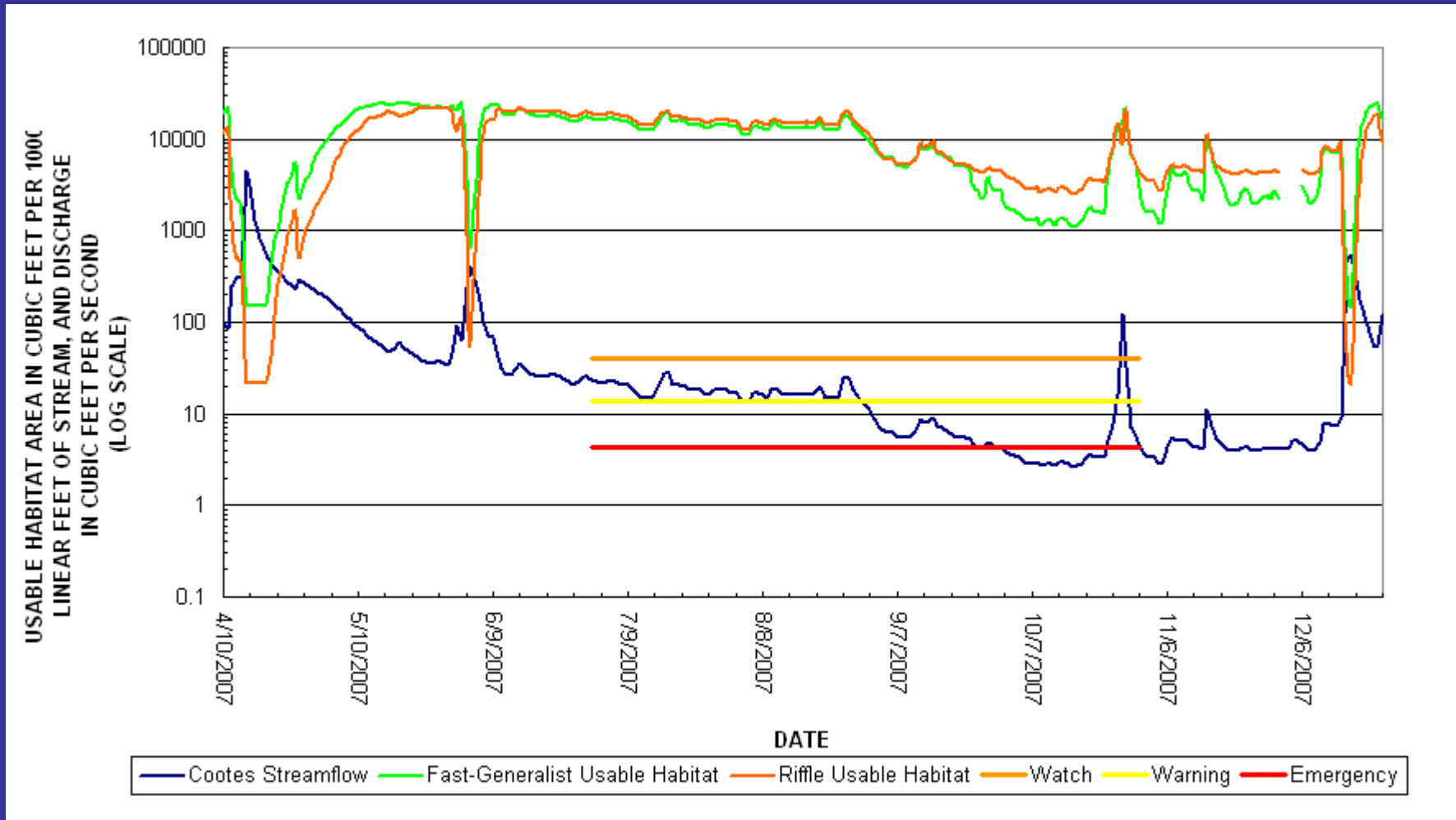
Cootes Store Habitat-Discharge Relation and Low-Flow Statistics



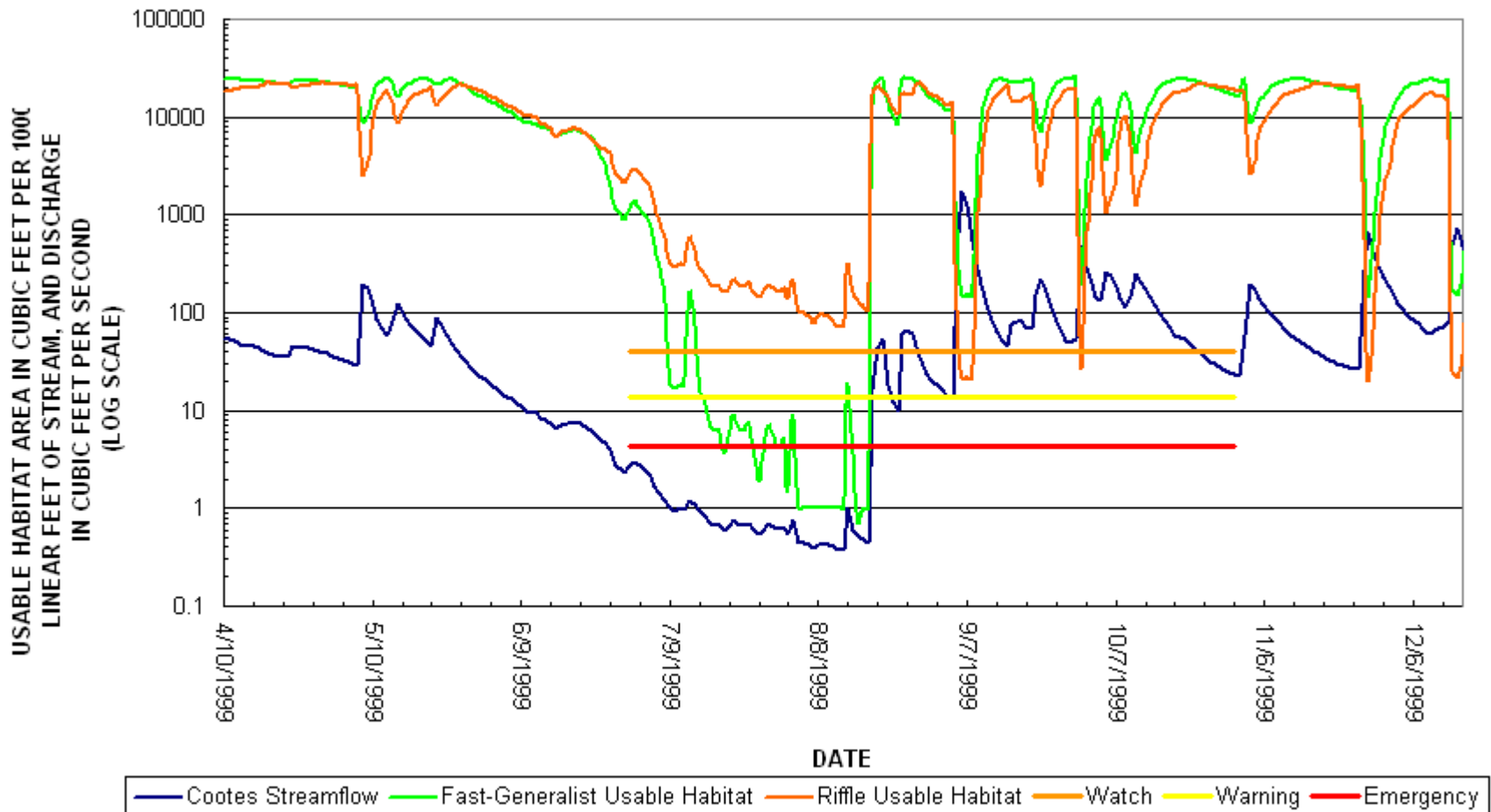
1999, 2007 Habitat and Flow Conditions: Riffle and Fast-Generalist Fish



How do we Establish Thresholds Indicate both Habitat and Water Availability?



Evaluate Ecological Flows Against 1999 Drought Year



Evaluating Ecological Flows: Drought Thresholds Used in Local Plans

Upper Shenandoah River Basin

Draft Drought Response and Contingency Plan

Drought Watch Indicators for Broadway:

“Cootes Store USGS gage between 25th and 10th percentile”

Watch = 15 cfs – 4.6 cfs

Ecological Flow Thresholds presented in the last slide:

Watch = 40 cfs

Warning = 14 cfs

Emergency = < 4.4 cfs

Questions?



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Model Development to Identify Ecological Flows

