

**RECOMMENDATIONS OF THE AD-HOC  
WORKING GROUP OF THE NORTH  
CAROLINA ECOLOGICAL FLOWS  
SCIENCE ADVISORY BOARD**

**JULY 16, 2013**

*Conducted by: RTI and USGS*

*Funded by: Environmental Defense  
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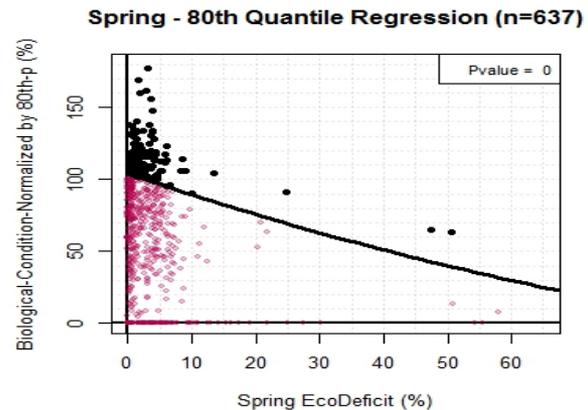
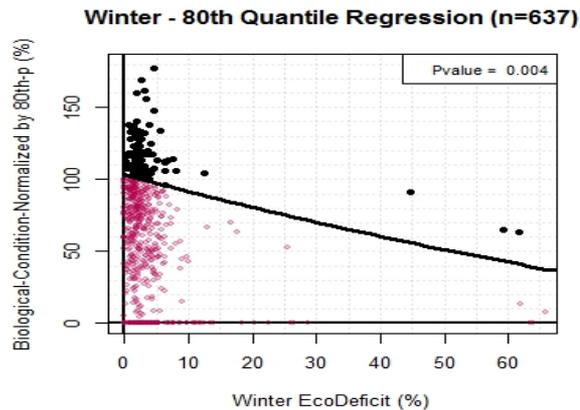
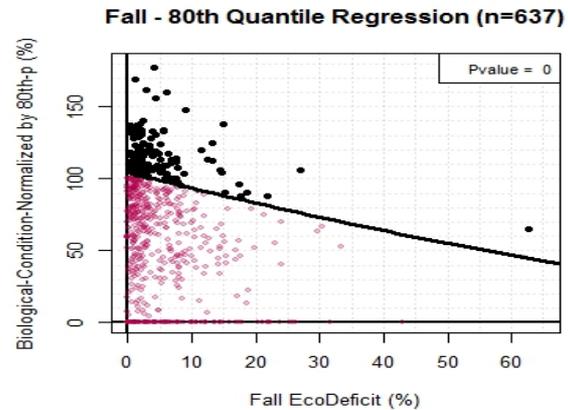
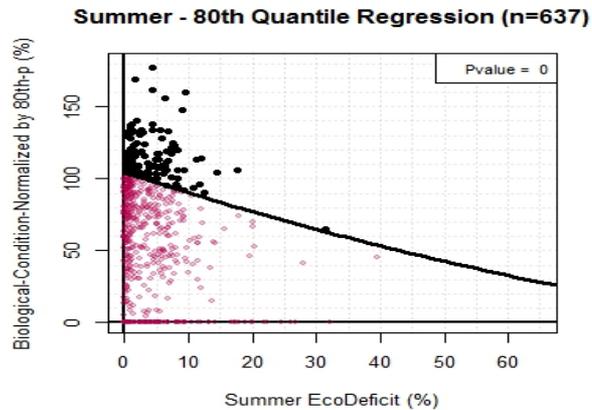
# BASIS

- North Carolina General Assembly Law 1743 requires NCDENR to determine the minimum flows needed to maintain ecological integrity of surface waters
- Quantitative relationships between changes in flows and health of biologic assemblages within surface waters have not been previously established for North Carolina
- An *ad-hoc* working group of the EFSAB has been working to derive data-based correlations between changes in surface water flows and ecological response considering both fish and benthos
- The timeframe and resources dedicated to this effort have been limited
- Based on the data available and analysis completed to date, the members of the *ad-hoc* working group have reached consensus on a set of recommendations

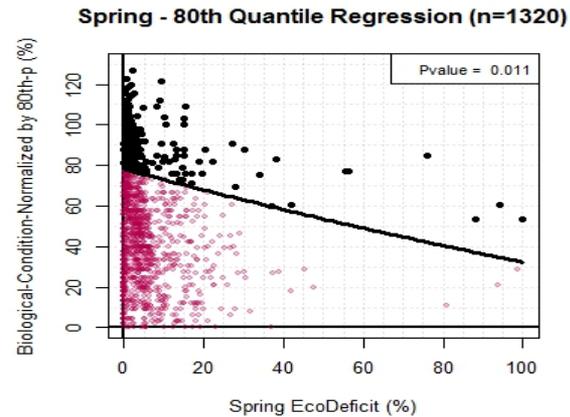
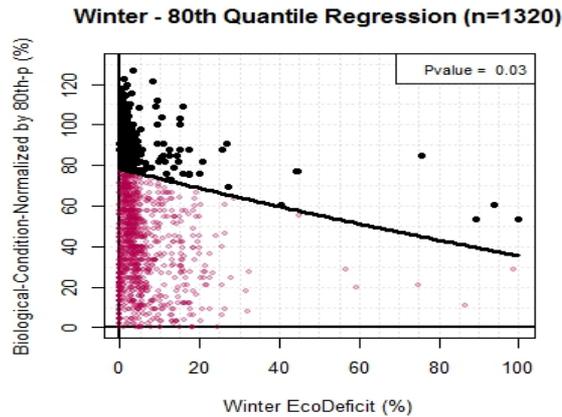
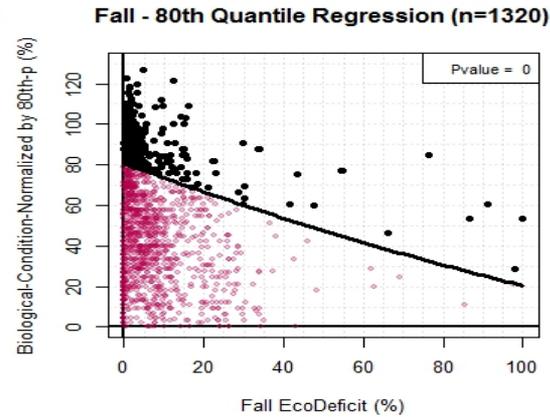
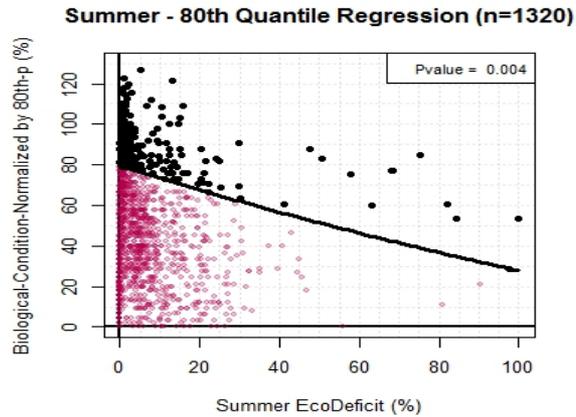
# RECOMMENDATIONS

1. The diversity of species within the riffle-run guild should be used as the basis for measure of ecological integrity for fish populations using the Shannon-Weaver Index. Ecological integrity of benthos should be based on EPT richness.
2. A reduction in fish diversity or benthos species richness of 10 percent or more represents a probable violation of ecological integrity.
3. Five metrics should be considered by NCDENR for evaluation further alterations of surface water flow conditions:
  - i. Decrease in annual 30-day minimum flow;
  - ii. Summer eco-deficit;
  - iii. Fall eco-deficit;
  - iv. Winter eco-deficit;
  - v. Spring eco-deficit.
4. The statistica model employed to establish ecological responses to changes in flow metrics should be based on:
  - i. Fish data normalized by the 80<sup>th</sup> percentile Shannon-Weaver index value by drainage basin;
  - ii. Benthic data normalized by the 80<sup>th</sup> percentile EPT Richness value (within the “excellent” DWQ Benthic Site Condition Class;
  - iii. Non-linear 80<sup>th</sup> quantile regressions of the normalized data.
5. Further data collection and research should be undertaken to enhance the preliminary flow-biology relationships developed through the work of the *ad-hoc* advisory group.

# RIFFLE-RUN FISH GUILD RESPONSE CURVES

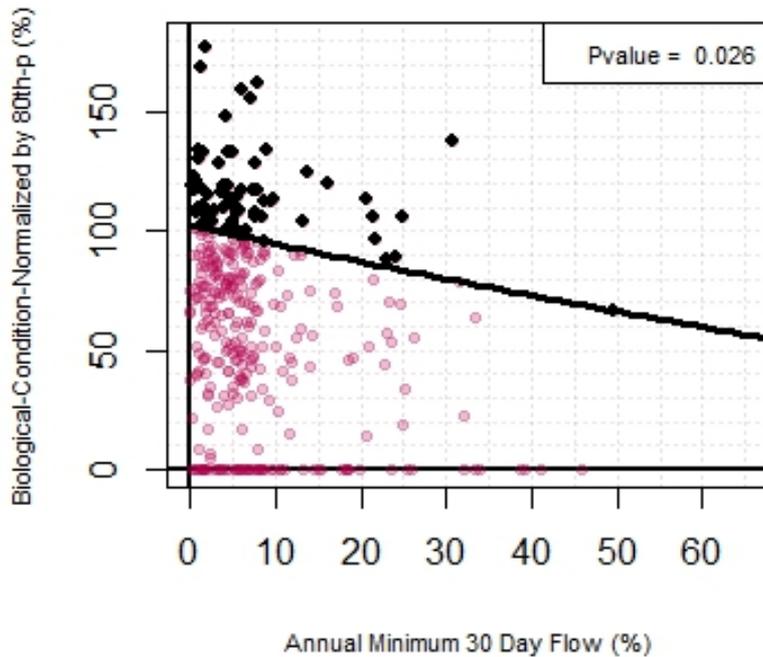


# BENTHIC RICHNESS RESPONSE CURVES

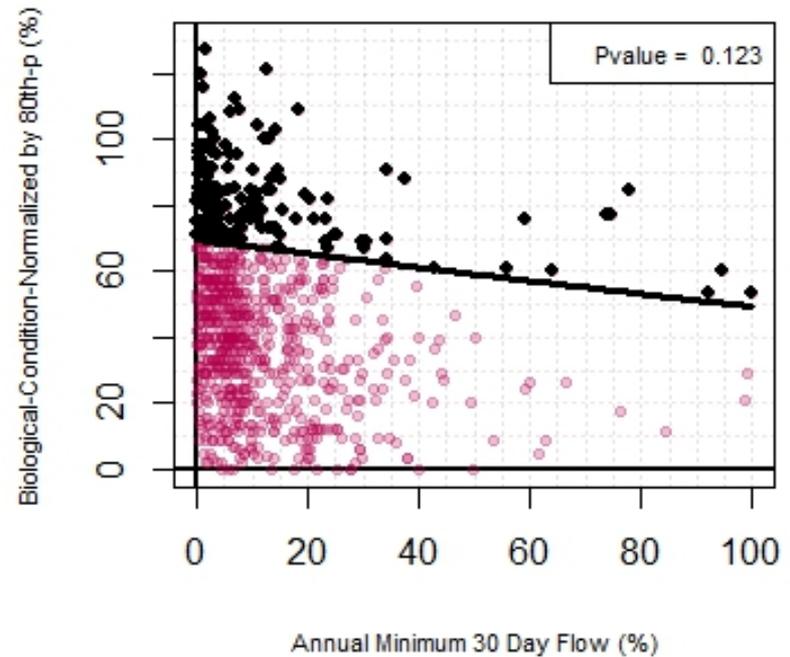


# RESPONSE TO DECREASES IN 30-DAY MINIMUM FLOWS

Annual 30 Day Minimum Flow - Fish (n=349)



Annual 30 Day Minimum Flow - Benthic (n=837)



## Stream Fish Community Sample Sites (n=858)

