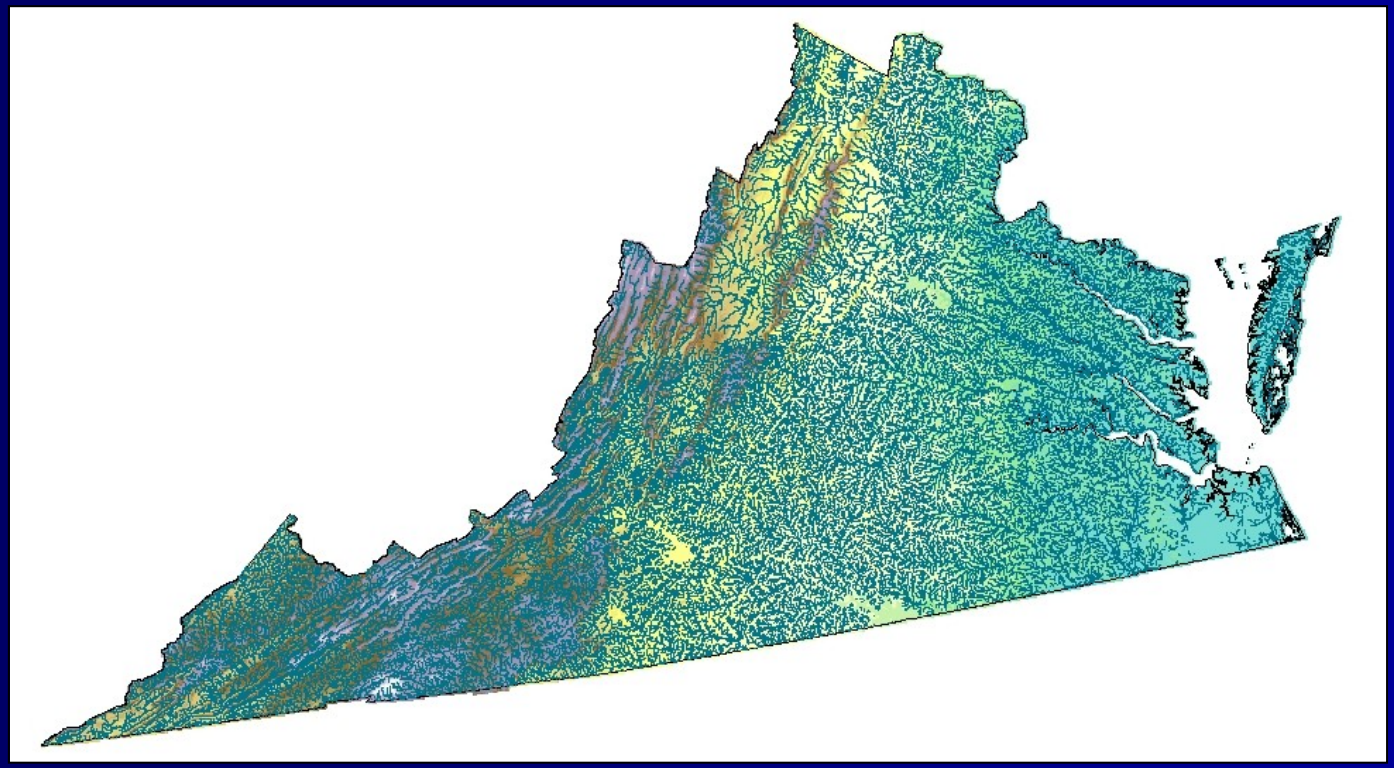
DEQ's Freshwater Probabilistic Monitoring (ProbMon) Program

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

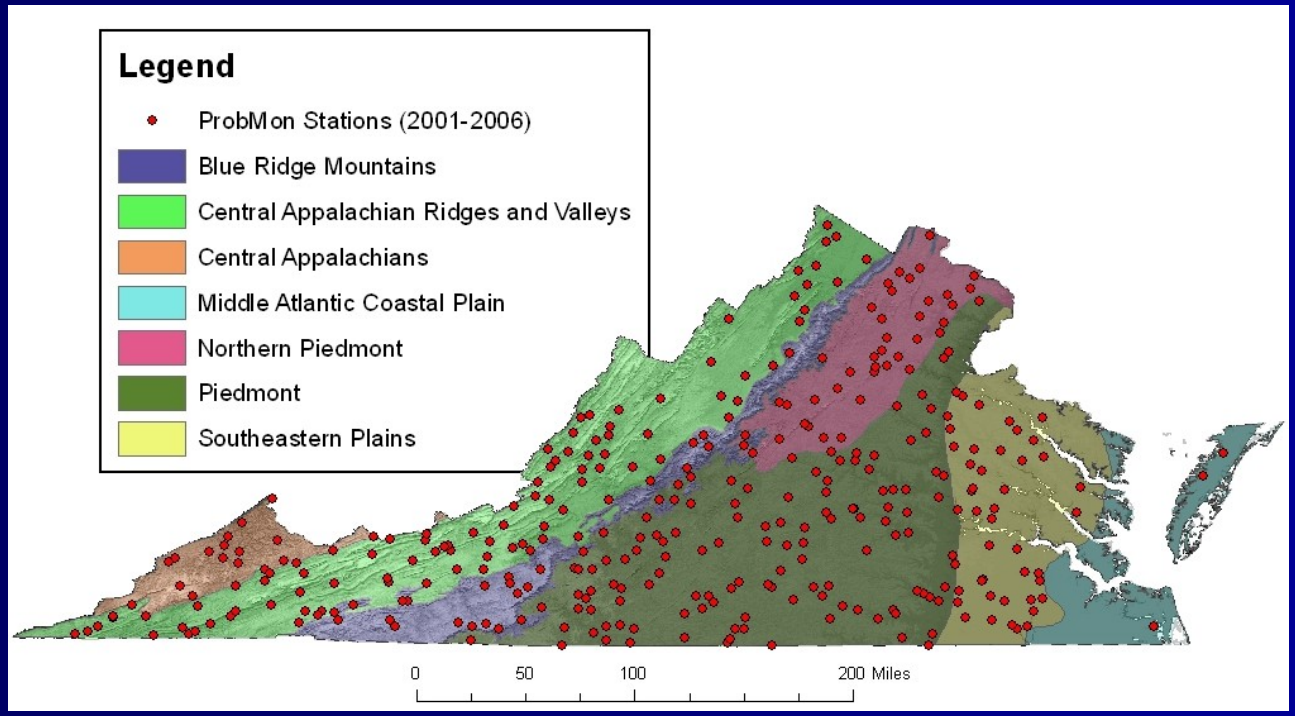
Welcome Aimee to VA!

Virginia's Water Resources



- Target population perennial freshwater river and streams
- NHD circa 1999 sample frame is 49,142 miles

2001-2006 Sample Sites



- 15% sample frame is non-perennial, tidal, or reservoir
- Chemistry data 41,557 miles; Biology data 35,680 miles

Hydrologic Conditions

(Tiffany Severs, Jackie Carl and Michael Hutchison)

	Spring ProbMon (n=349)	Fall ProbMon (n=285)
Rising Limb	57	36
Stable	267	219
Falling Limb	25	30
8% fall samples validated by field collection (r2=0.93)		

Hydrologic Condition	Percentile	Spring ProbMon Data Collection
Low Flow	<10	2.4
Below Normal	10 to 24	7.2
Normal	25 to 74	57.8
Above Normal	75 to 89	23.3
High Flow	> 90	9.3

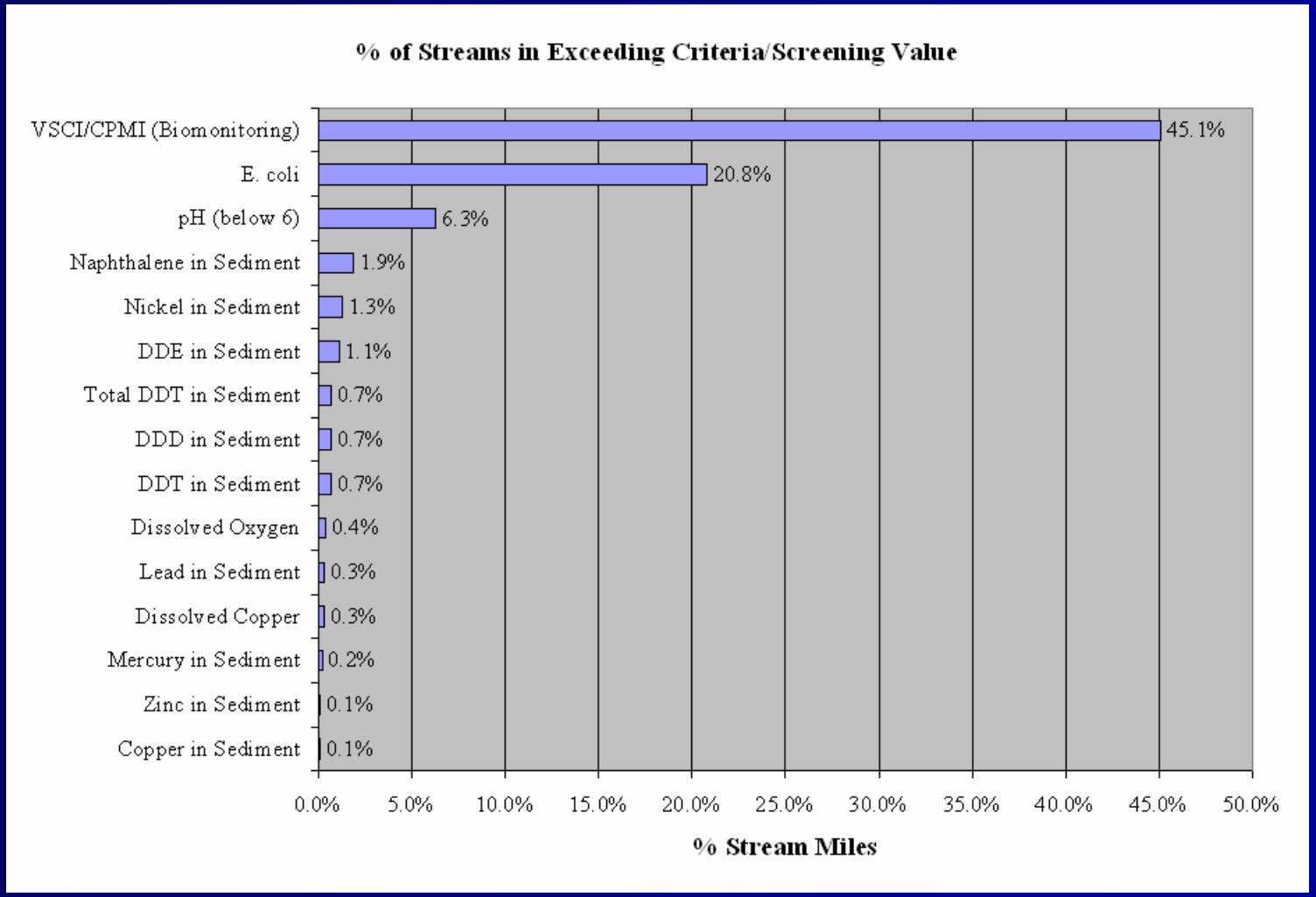
Hydrologic Condition	Percentile	Fall ProbMon Data Collection
Low Flow	<10	25.0
Below Normal	10 to 24	22.0
Normal	25 to 74	44.0
Above Normal	75 to 89	7.7
High Flow	> 90	1.3

305b Report Preview

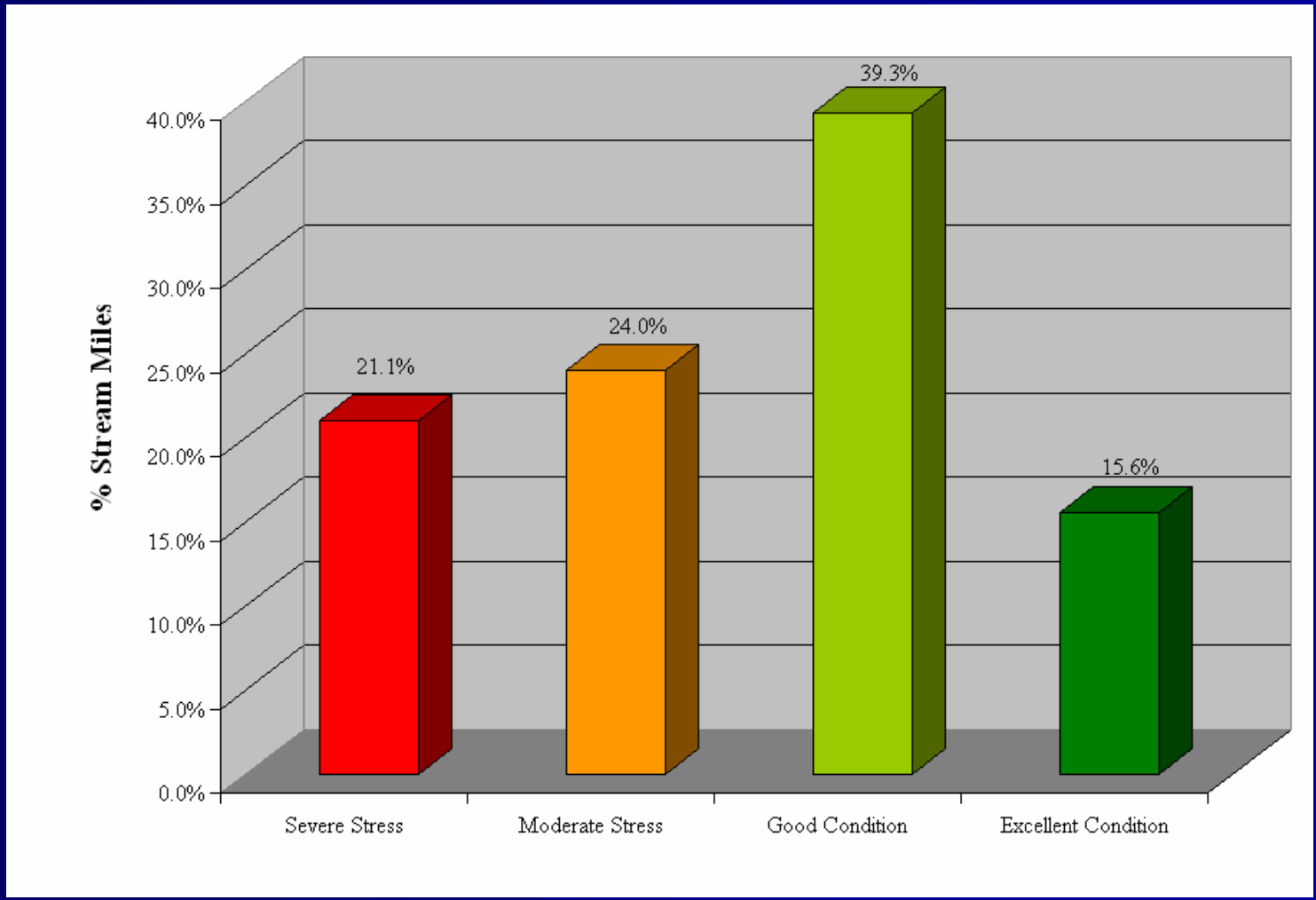
First comprehensive chapter in 2008 305b report using freshwater ProbMon data (and 2008 Assessment Database)

- Reported 44 parameters with water quality standards/screening values
- 36 of 44 were found at unacceptable level in less than 1% of stream and rivers
- Largest issues statewide were aquatic life use (biomonitoring tools) and bacteria

MegaChart


% of Streams in Exceeding Criteria/Screening Value
VSCI/CPMI (Biomonitoring)
45.1%
E. coli
20.8%
pH (below 6)
6.3%
Naphthalene in Sediment
1.9%
Nickel in Sediment
1.3%
DDE in Sediment
1.1%
Total DDT in Sediment
0.7%
DDD in Sediment
0.7%
DDT in Sediment
0.7%
Dissolved Oxygen
0.4%
Lead in Sediment
0.3%
Dissolved Copper
0.3%
Mercury in Sediment
0.2%
Zinc in Sediment
0.1%
Copper in Sediment
0.1%
0.0% 5.0% 10.0% 15.0% 20.0% 25.0% 30.0% 35.0% 40.0% 45.0% 50.0%
% Stream Miles

VSCI/CPMI Results



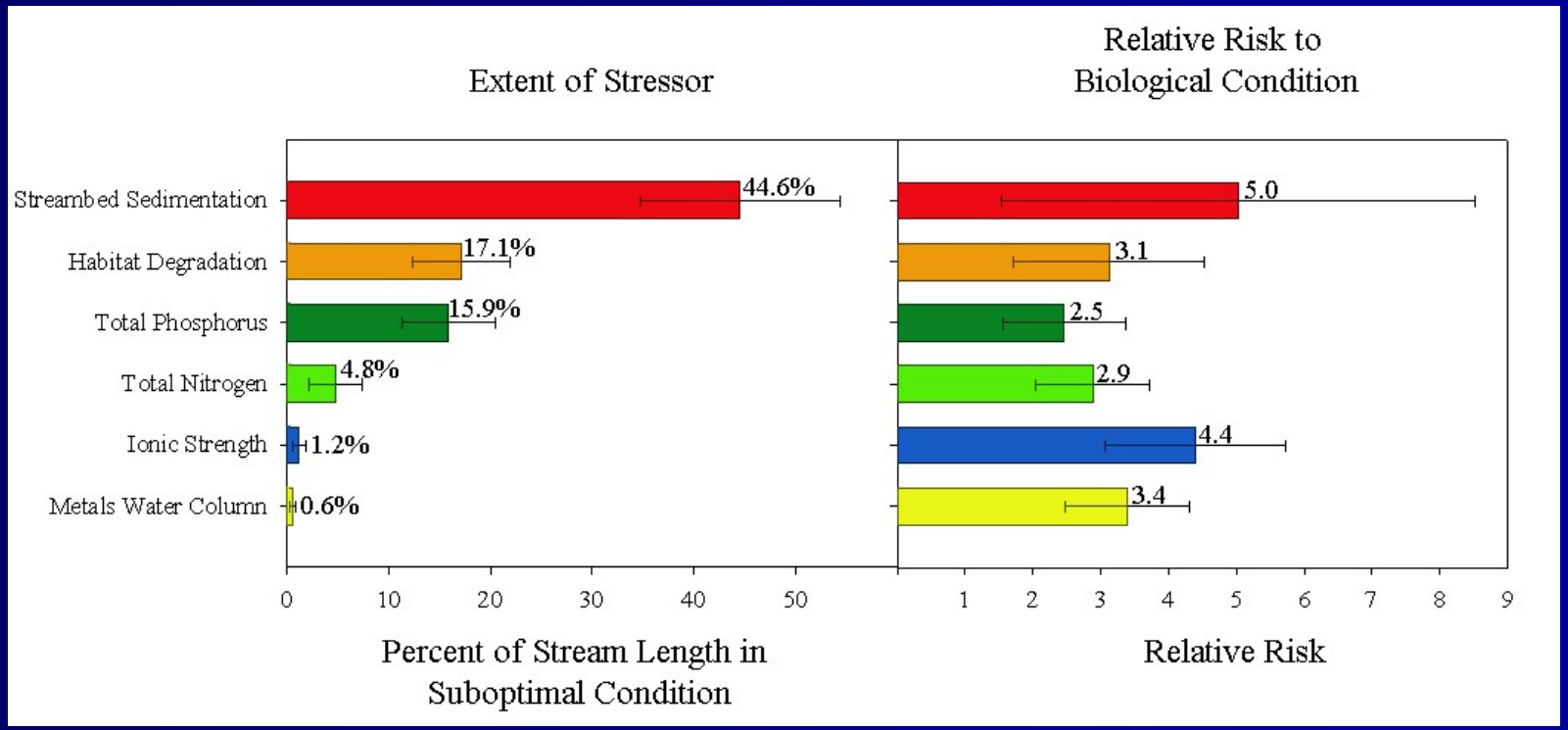
Water Quality Stressors

Response Parameters	Optimal	Suboptimal	Classification Reference
Virginia Stream Condition Index	>60	<50	(VDEQ 2007)
Coastal Plain Macroinvertebrate Index	>16	<16	(VDEQ 2007)

Stressor Parameters	Optimal	Suboptimal	Classification Reference
Total Nitrogen (mg/L)	<1	>2	(VDEQa 2006)
Total Phosphorus (mg/L)	<0.02	>0.05	(VDEQa 2006)
Habitat Degradation (unitless)	>150	<120	(USEPA 1999)
Streambed Sedimentation (unitless)	>-0.3	<-1.0	(Kaufmann 1999)
Ionic Strength (TDS mg/L)	<100	>350	(VDEQb 2006b)
Metals Water Column (unitless)	<1	>2	(Clements 2000)

- Relative Risk Calculations
- Borrowed terminology from the medical field
- Report RR greater than 1 (CI included)

Statewide Relative Risk



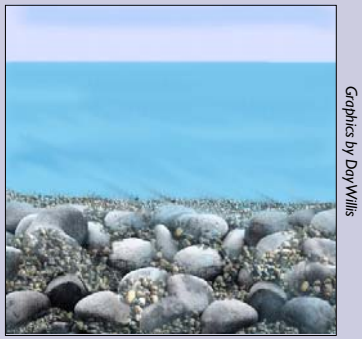
Statewide Relative Risk

THE IMPACT OF SEDIMENT ON BENTHIC HABITATS ...

In a healthy stream, spaces between rocks provide habitat for benthos ...

As fine sediment begins to accumulate, this habitat is reduced ...

Interstitial spaces are beginning to fill in ...



Benthic habitat completely fills in as fine sediment settles out.

Graphics by Day Willis

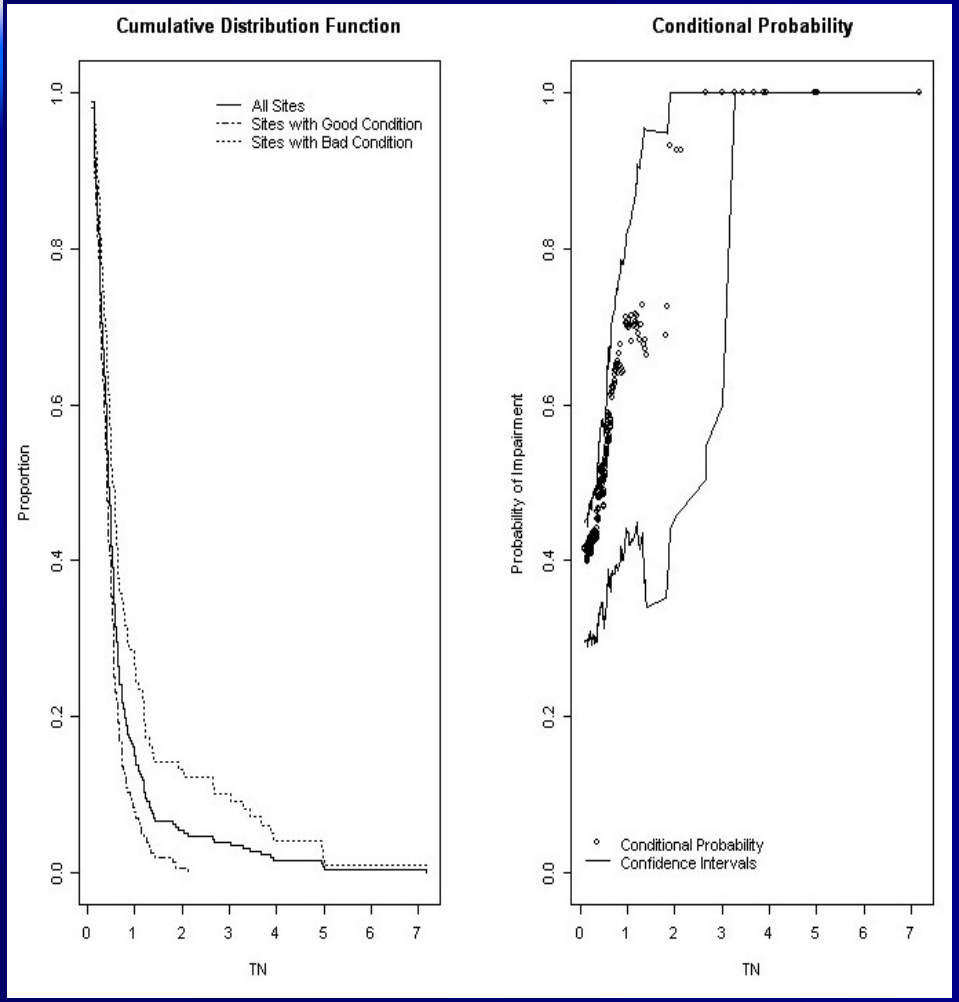
Sedimentation is one of the most prevalent impacts to benthic communities. Excess sediment fills interstitial spaces in between stream substrates used by aquatic organisms for habitat. Until recently, tools for rapidly quantifying sedimentation impacts in streams have been inadequate. Methods existed for describing dominant particle size, but it was difficult to differentiate between natural conditions and anthropogenic problems. Virginia has a variety of stream types; many are naturally sand/silt bed streams, so simply measuring the size of the sediment particles cannot differentiate natural and human-influenced sediment load.

$$RR = \frac{\Pr(\text{Poor VSCI/CPMI, given poor sediment condition})}{\Pr(\text{Poor VSCI/CPMI, given good sediment condition})}$$

Condition Probability

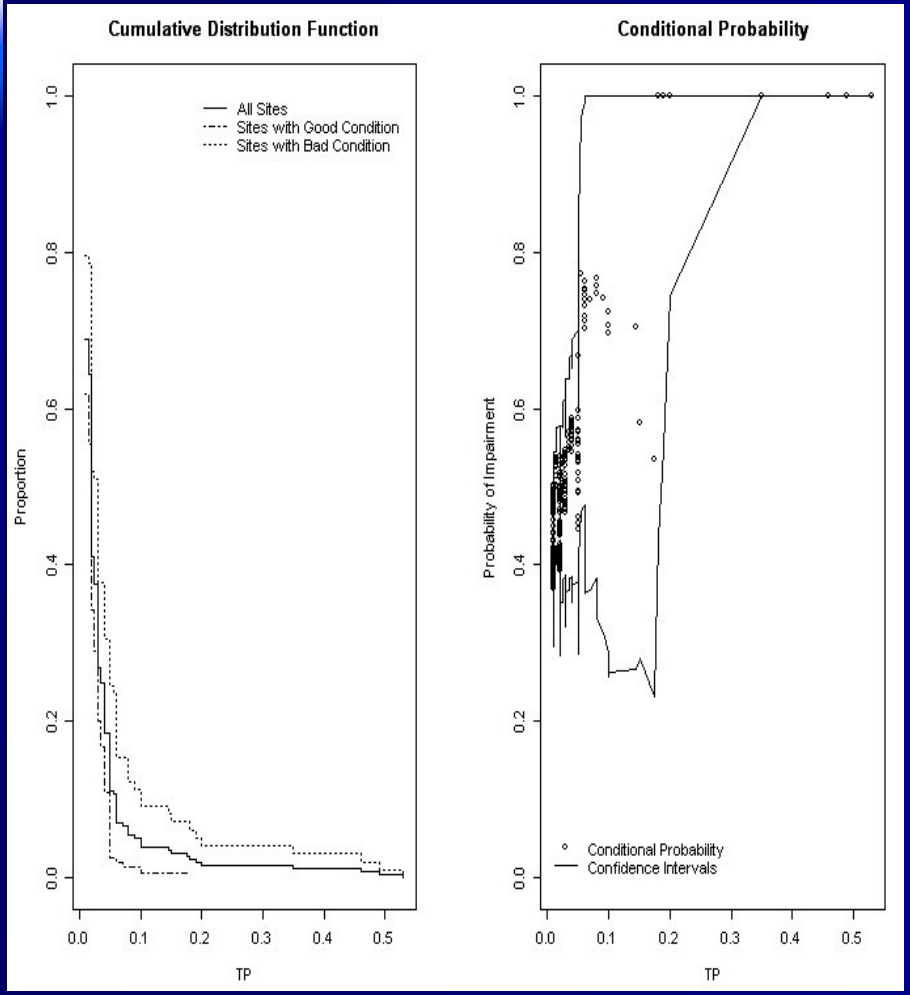
- Probability of event ‘y’ occurring, when it is known that some event ‘x’ has occurred and ‘x’ has exceeded some threshold (i.e. above WQS)
- In English:
  - What is the probability of a VSCI below 60 when TN is above 2 mg/L?
  - What is the probability of a VSCI below 60 when TP is above 0.05 mg/L?
- Can look for thresholds of ‘impact’ by identifying a ‘changepoint’ – Non-overlapping CI

Condition Probability (TN)



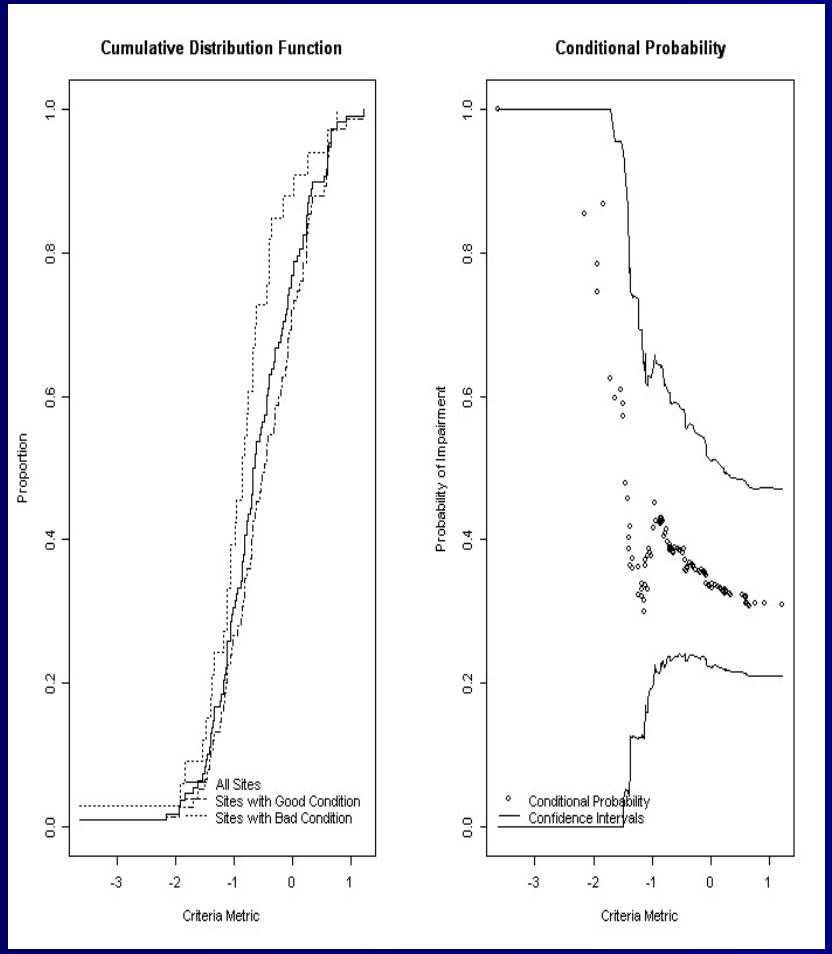
- Background: 41.3%
- Changepoint: 0.5 mg/L
- 90% probability of VSCI below 60 when TN is 1.91 mg/L

Condition Probability (TP)



- Background: 41.3%
- Changepoint: 0.05 mg/L
- 90% probability of VSCI below 60 when TP is 0.2 mg/L

Condition Probability (LRBS)



- Background: 30.8%
- Changepoint: -0.95
- 90% probability of VSCI below 60 when LRBS is less than -2.15

Summary of Benefits of ProbMon

- Biomonitoring
  - Doubled the number of reference sites
  - Validated VSCI (new biomonitoring tool)
  - Identification of stressor(s)
- New Technologies
  - Relative bed stability
  - Virtual fish
- Assessments
  - Statistical confidence of hundreds of water quality parameters
  - Set baseline for ecological/chemical trend analysis (pivot table!)
- Research
  - Provides design for testing new methods
  - Monitoring strategy allowed VDEQ to obtain grant money
- Community
  - Provide summaries to the public
  - Partnerships (DGIF, EPA, USGS, VT, VCU)

Acknowledgements
Thanks Lou!

Acknowledgements

WE NEED A NEW PICTURE!

Tony Olsen, EPA Corvallis Office, for assistance and support with random site selection, weighting, and CDF Curve generation

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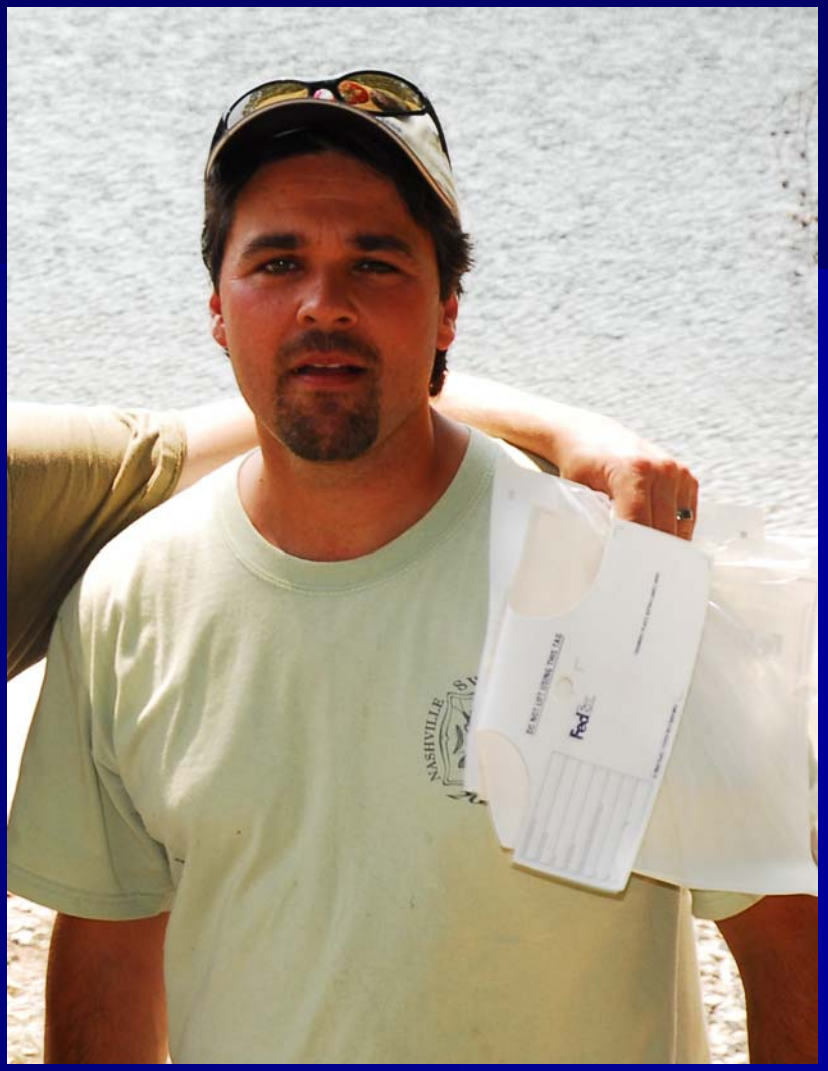
Questions?



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