Fish Kills in the South Branch of the Potomac River

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West Virginia Department of Environmental Protection

Division of Water and Waste Management

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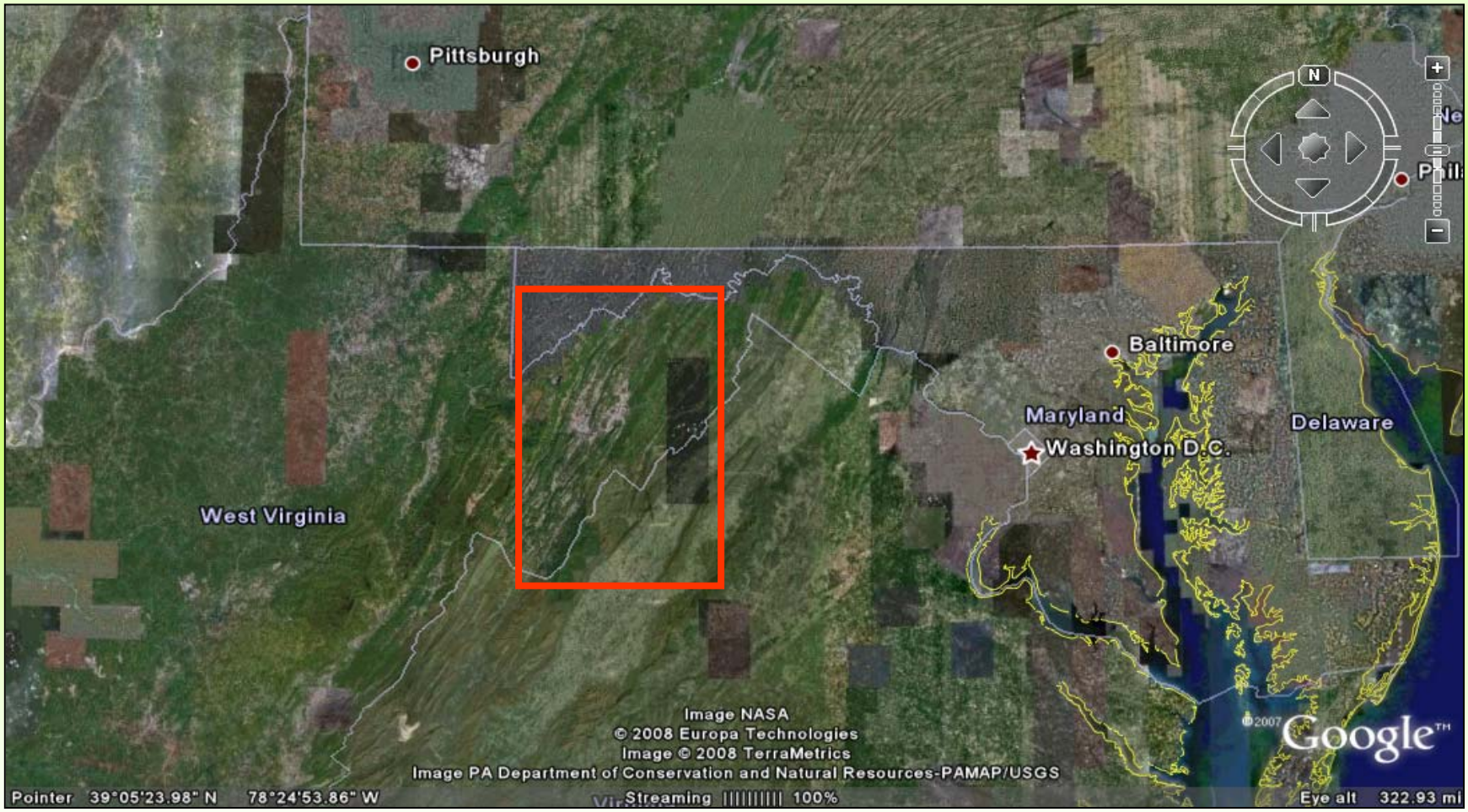
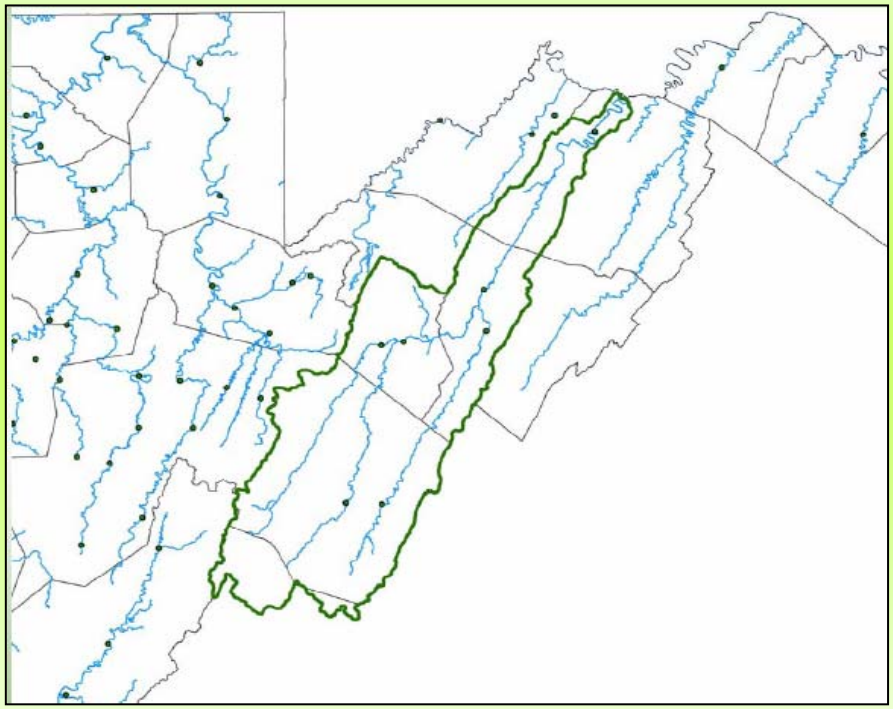
South Branch of the Potomac Valley, West Virginia



Approximately 110 miles due West of Washington, DC

South Branch Watershed



- Drainage – 1372 square miles
- Population – 22 individuals/sq. mile (Kanawha 221)
- Land use – mainly forested and agricultural
- Discharges – NPDES permits
  - 4 Sewage > 100,000 gpd
  - 20 Sewage <50,000 gpd
  - 3 aquaculture
  - 3 car wash
  - 4 water trtmt. plant backwashes
  - 2 Industrial Individual Permits

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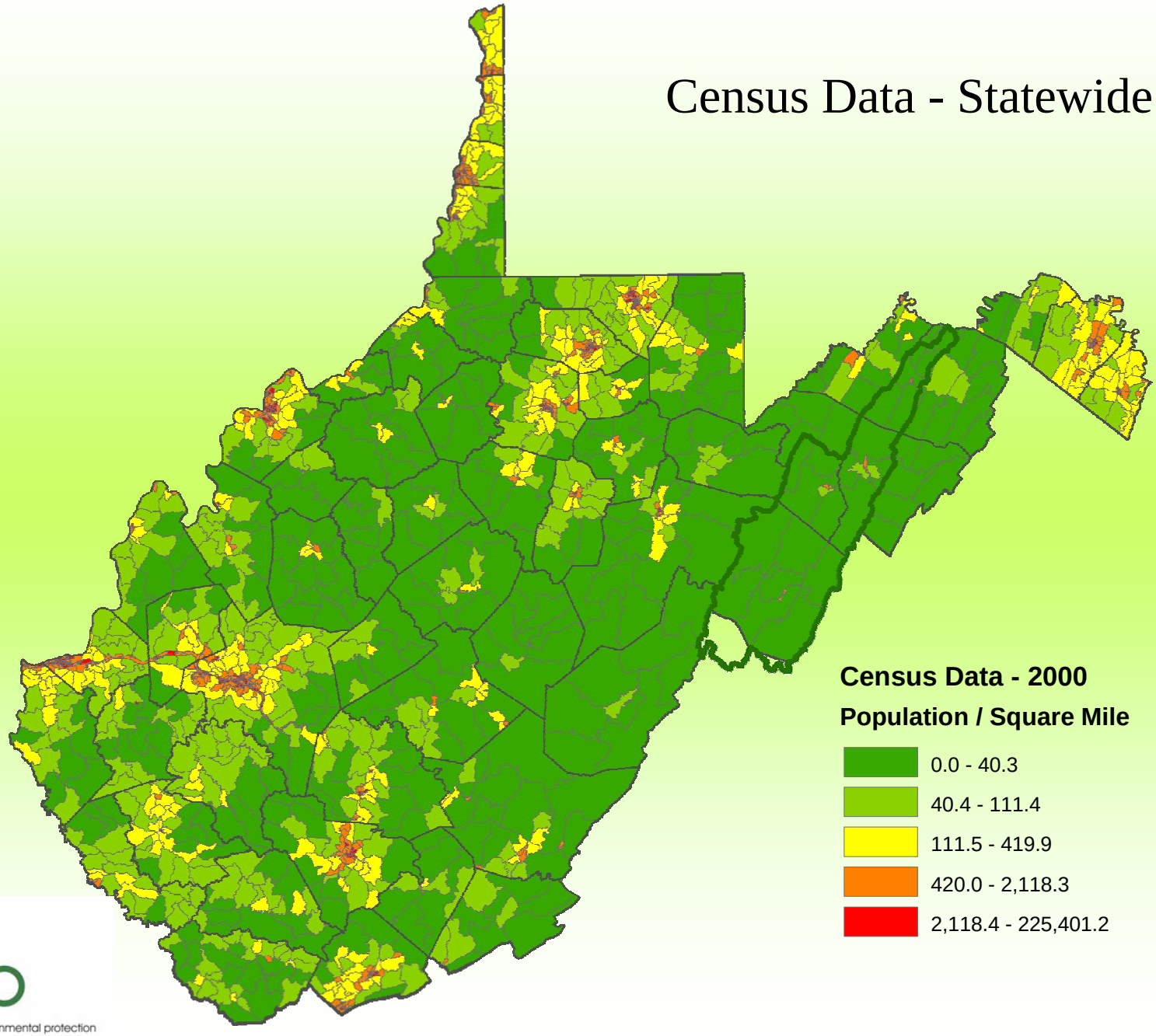
Census Data - Statewide



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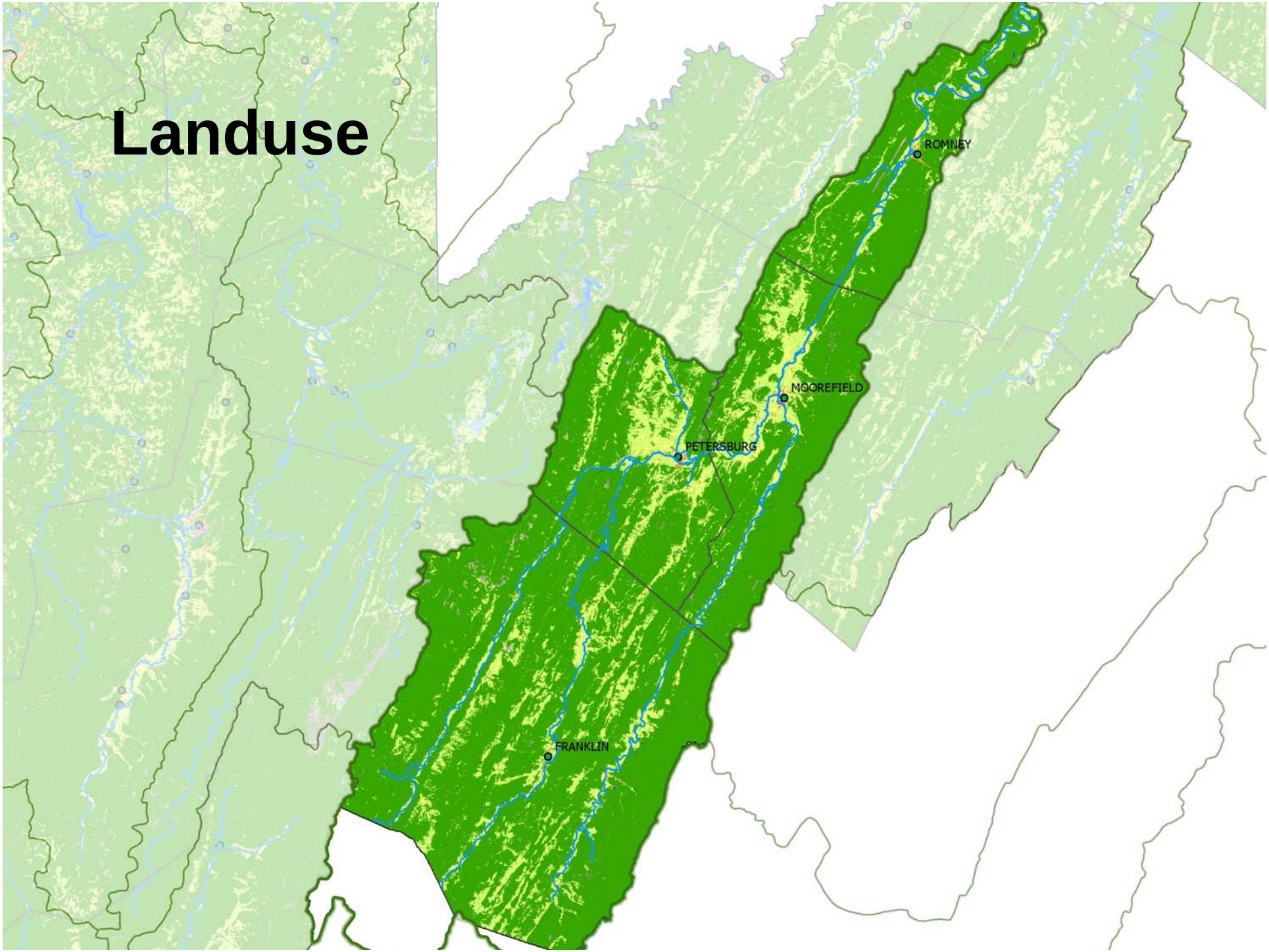
Landuse



Fish Kill Investigation History

- **May 2002 – 1st large kill; smallmouth bass, redbreast sunfish (previous years reports of low numbers of suckers) Memorial Day**

- **May 2006 – large numbers of suckers dying; fallfish - again Memorial Day**

- **April – May 2007 – Small number of suckers dying Upper Tract/Smokehole area, later other species Petersburg/Moorefield**

- **April 2007 – Bass, Suckers and sunfish dying in Virginia's North Fork and South Fork of Shenandoah**

- **April/May 2007 Kills in James River, Virginia**

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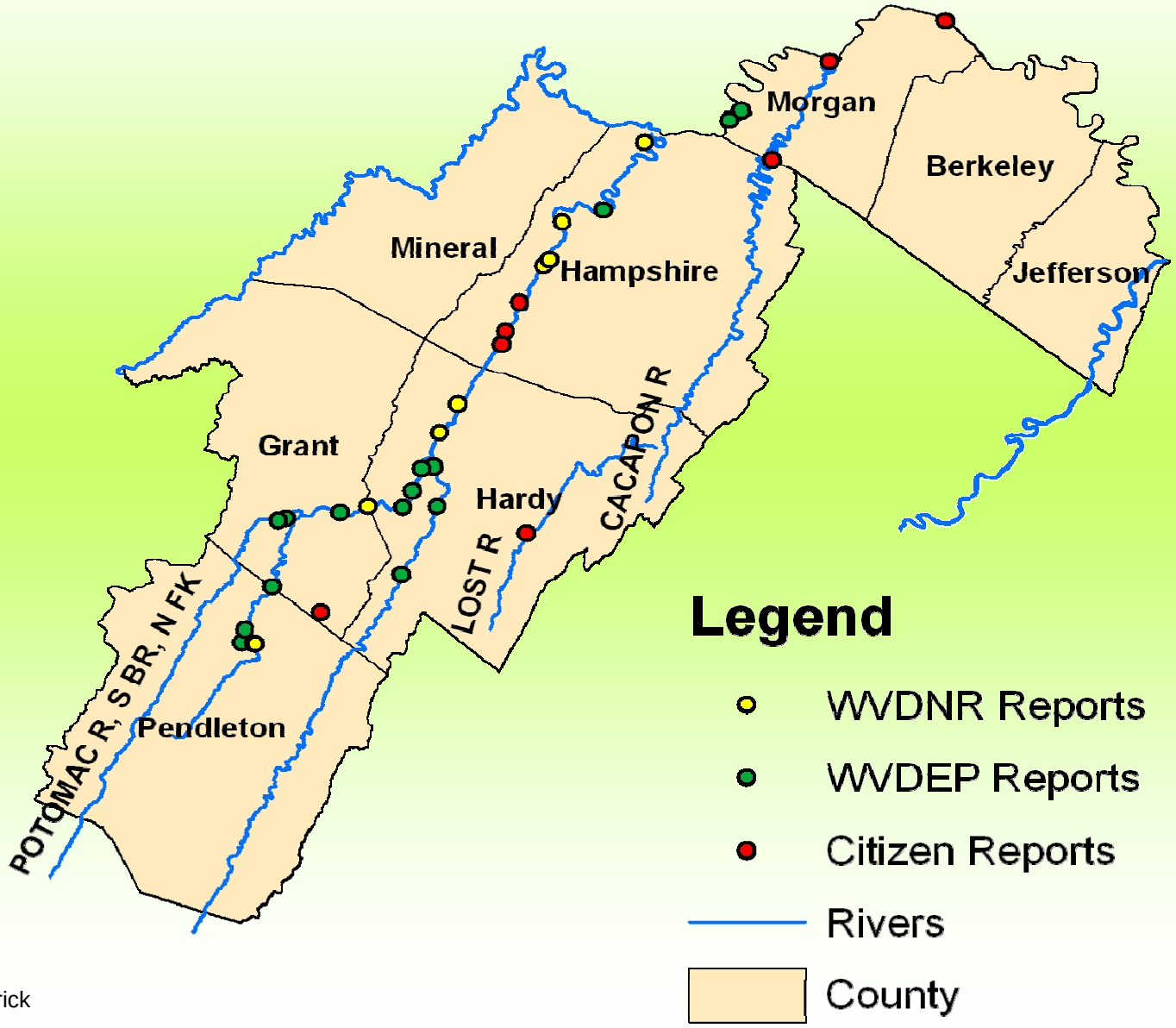
South Branch Fish Kill
May 24, 2006


April ’07 Upper Tract

Fish Kill 2007



Courtesy of Jim Hedrick
WVDNR

Possible Causes of the Kills:

Virginia's

- Algae
- Bacteria
- Ammonia
- Sediment contaminants
- Aquatic macrophytes
- Pathogens
- Parasites
- Water temperature
- Ag chemicals
- Ag density
- Manure applications
- Biosolids
- Immune suppression
- Chronic stressor
- Body burden
- Fish density
- Fish health
- Meth labs

West Virginia's

- Most of Virginia's list +
- Gypsy moth spraying
- Poultry disinfectants
- Roxarsone
- Fire suppression foam
- Antibacterial ingredients
- Mercury
- Caterpillars
- Point Source

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Possible causes of the kills

- Pathogens ?
- ~~Toxic~~ algae
- Endocrine disrupters / immune ? suppression
- pH
- Nutrients

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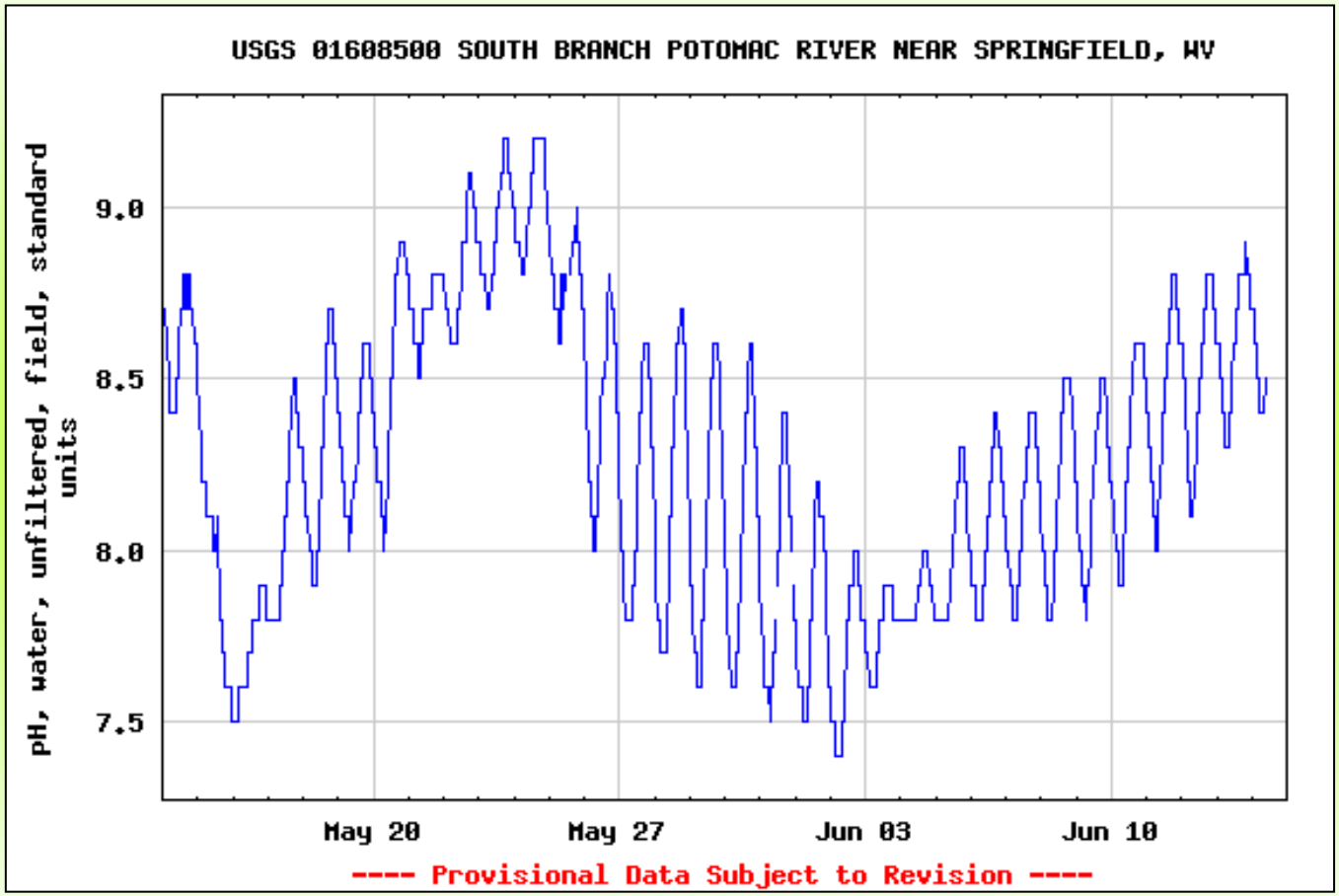
pH highs and swings

- pH's often reach 9.3
- pH swings of >1 unit/day
- But, some WV rivers have similar patterns



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Possible causes of the kills

- ~~Pathogens~~
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- Endocrine disrupters / immune suppression ?
- pH ?
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Sediment bound ammonia

- Ammonium binds to negatively charged sediment particles because of its own positive charge

- It remains tightly bound until. . .
  - Nitrogen fixing bacteria
  - Chemically stripped away (high pH)

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Sediment ammonium data

- South Branch at Moorefield = 215 ppm
- South Branch at Upper Tract = 145 ppm
- WWTP outfall near Charleston = 46 ppm
- South Branch above Franklin = <20ppm (mdl)
- Davis Creek = <20ppm (mdl)
- Elk River = <20ppm (mdl)
- Opequon Creek = 236 ppm

- But, very little ammonia in the water column

How would it kill fish?

- Nesting fish would introduce ammonium laden sediment into the surrounding water
- Ammonium would be changed to the more toxic unionized ammonia which has no affinity to the sediment
- Nesting fish would constantly be in contact with this toxic layer of sediment

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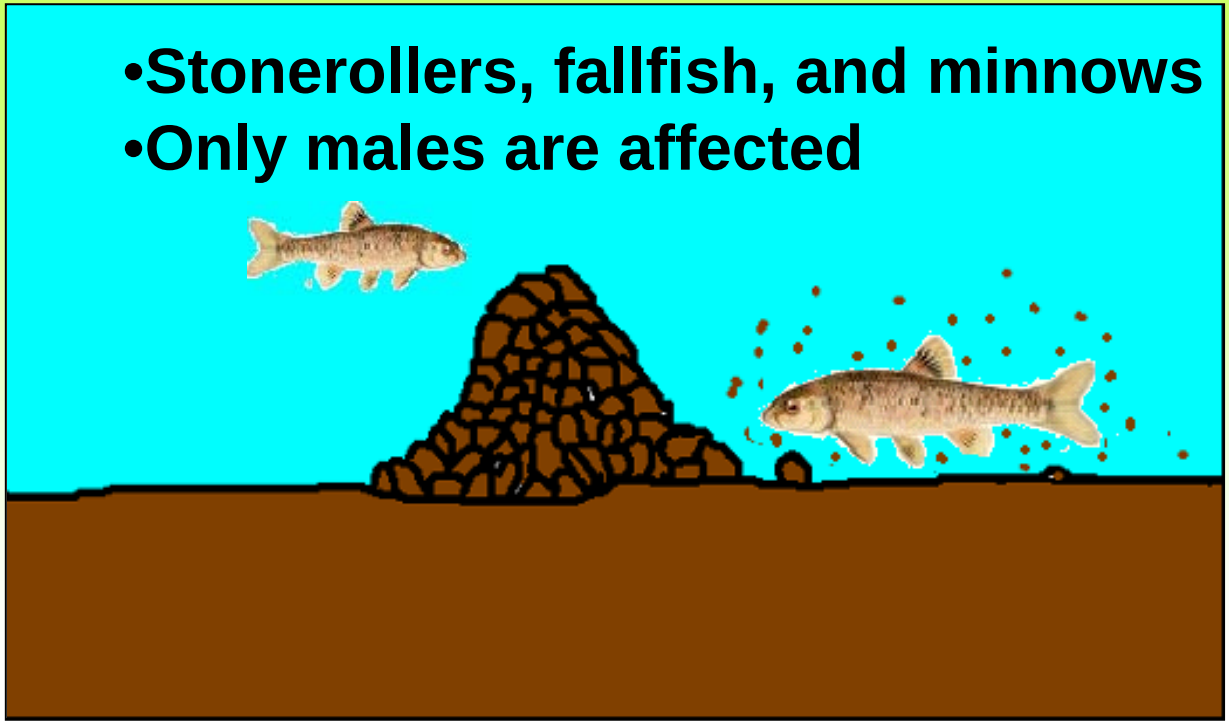
Fish Kill Observations

- Timing suggests relationship with spawning
- Dimorphism of kill events
- No juveniles or YOY's



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Welton Park
May 10, 2007

The perfect storm

- High levels of ammonium in the sediment
- Actively spawning fish
- High pH's in the water column

Equals

- Localized unionized ammonia exposure

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Possible causes of the kills

- Pathogens ✗
- Toxic algae ✗
- Endocrine disrupters / immune suppression ?
- pH ? ✗ ✓
- Nutrients ✓

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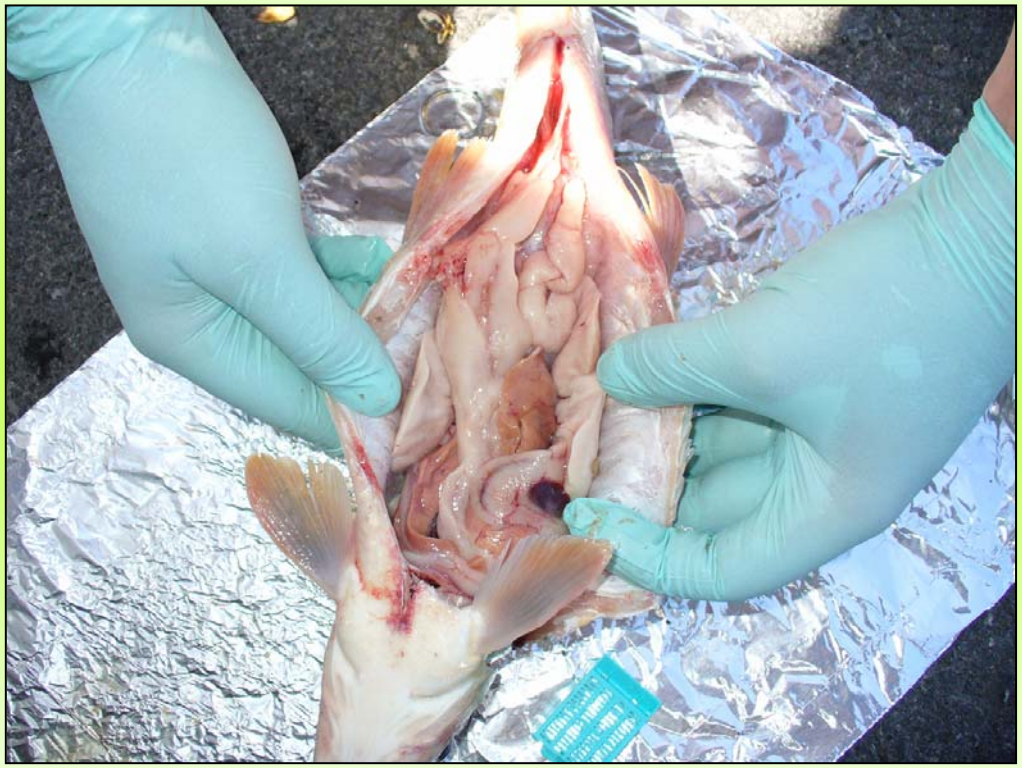
What next -- 2008

- Toxic algae
- Pathogen studies
- Water chemistry
- Histopathology
- Parasitology
- Sediment sampling
- Sediment pore water



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Groups Involved

- WV DNR
- WV DEP
- WV Dept. of Agriculture
- USGS
- USFWS Fish Health lab
- EPA Region 3 Office
- EPA CADDIS
- VA DEQ
- Friends of the Shenandoah River
- Tetra Tech Inc.
- Chesapeake Bay Foundation
- WVU
- WV Bur. For Public Health
- ICPRB
- VA DGIF
- Virginia Commonwealth Univ.
- James Madison Univ.
- Virginia Tech.
- Tennessee Tech. Univ.
- Potomac Water Watch
- Cacapon Institute
- Shenandoah River Keeper
- TN and Associates
- WV Homeland Security and Emergency Mgmt.
- And others

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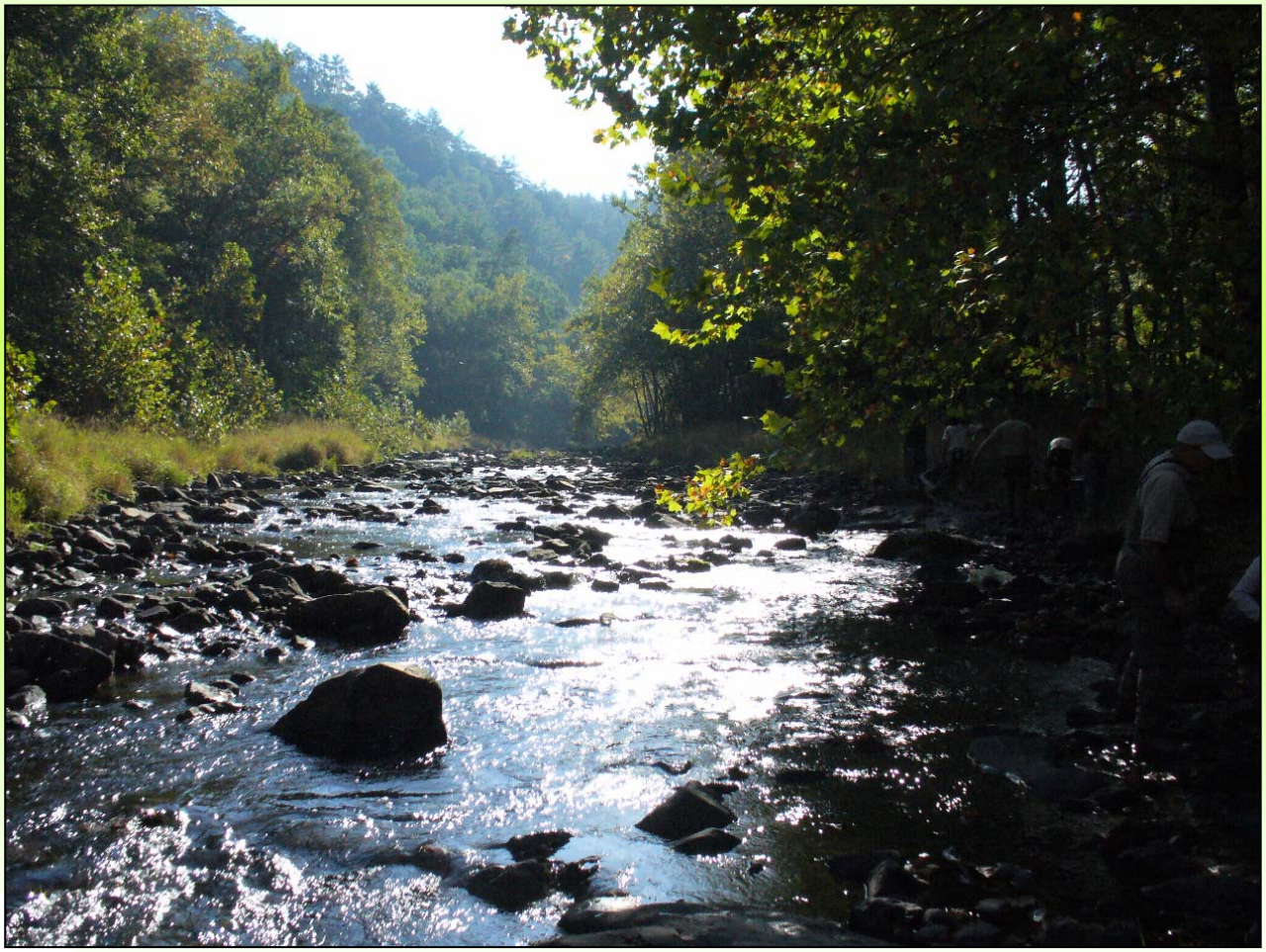
Questions ?



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