

# EFFECTS OF ALTERED HYDROLOGIC, TURBIDITY AND THERMAL REGIMES ON RAINBOW AND BROWN TROUT POPULATIONS IN THE UPPER ESOPUS CREEK

T.J. Ross and Bill Fisher – Cornell University

Barry Baldigo – USGS

Tom Baudanza – NYCDEP

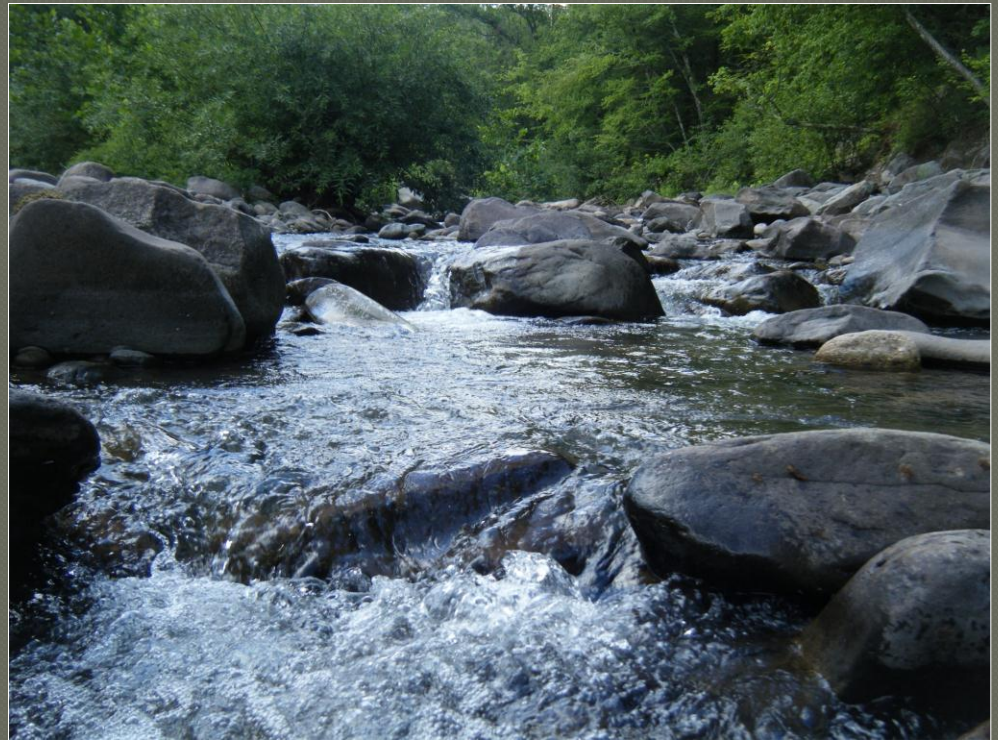
Mike Flaherty - NYSDEC



# OVERVIEW

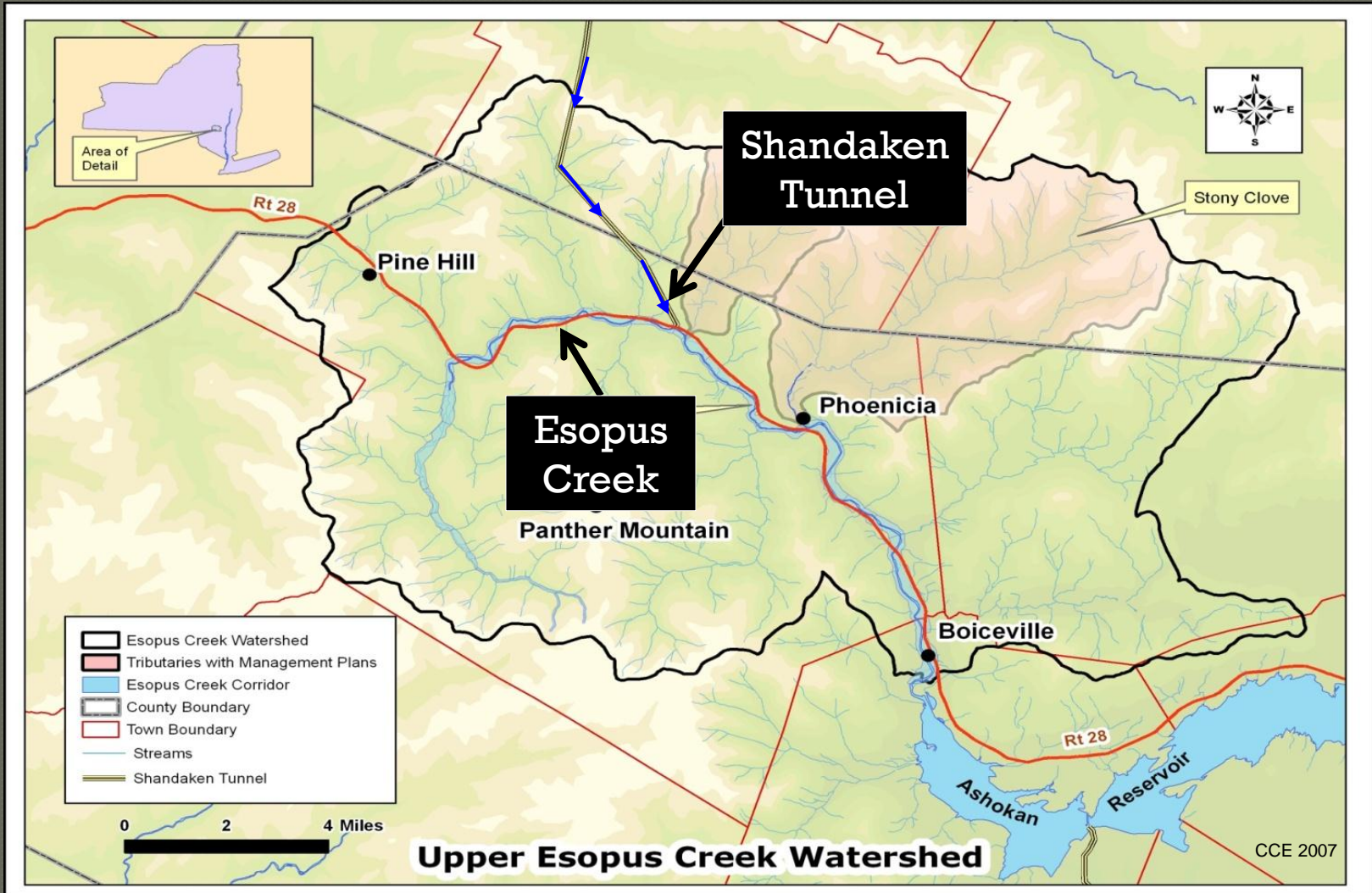
---

- ❑ Background
- ❑ Methods
- ❑ Results
- ❑ Conclusions
- ❑ Future research



Esopus Creek

# STUDY AREA



# STUDY SEGMENTS



Upstream segment



Downstream segment

| Segment    | Depth (m)   | Width (m)      | Velocity (m/s) | Temperature (°C) | Turbidity (NTU) |
|------------|-------------|----------------|----------------|------------------|-----------------|
| Upstream   | 1.11 (0.68) | 69.35 (47.07)  | 2.02 (1.15)    | 23.82 (0.76)     | 0.54 (0.35)     |
| Downstream | 1.59 (0.50) | 103.07 (42.21) | 3.91 (1.67)    | 19.49 (0.52)     | 6.17 (1.07)     |

# ISSUE: ALTERED STREAM CONDITIONS

- ❑ Angler concerns
  - Reports of decreased catch
  - Fears for health of trout populations
- ❑ Manager responses
  - Thermal benefits
- ❑ 2001 Civil Suit
  - TU vs. NYCDEP
- ❑ Initiation of current project and companion studies



Esopus Creek at Shandaken Tunnel



Brown trout

# RESEARCH QUESTION

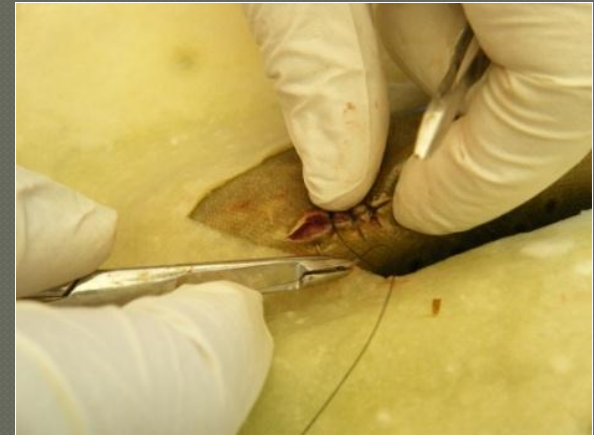
---

How are Shandaken Tunnel discharges affecting the Upper Esopus Creek trout populations?

- Assumption: differences in stream habitat should affect trout
  - Behavior and distribution
  - Physiological condition

# METHODS

- Radio-telemetry
  - Behavior and distribution
  - Apparent survival
  - Thermal refuge use
- Water-content analysis
  - Body composition level condition



Telemetry surgery



Muscle chunk removal for water-content determination

# METHODS

- Clinical chemistry
  - Cellular level condition



Blood sample collection  
for clinical chemistry



Evaluation of parasite  
abundance

# RESULTS

## □ Radio-telemetry

| <u>Segment</u>    | <u>Apparent Survival (days)</u> | <u>Daily Movement (m·day<sup>-1</sup>)</u> | <u>Total Movement (m)</u> | <u>Occurrence in Thermal Refuge Habitat</u> |
|-------------------|---------------------------------|--|---------------------------|---|
| <u>Upstream</u>   | 14.57 (13.85)                   | 110.10 (109.38)                            | 1182.52 (1060.31)         | 17/3%                                       |
| <u>Downstream</u> | 12.17 (7.6)                     | 99.4 (98.18)                               | 1108.7 (1057.64)          | 14.6%                                       |



Freshly tagged adult brown trout



Tagged adult rainbow trout

# RESULTS

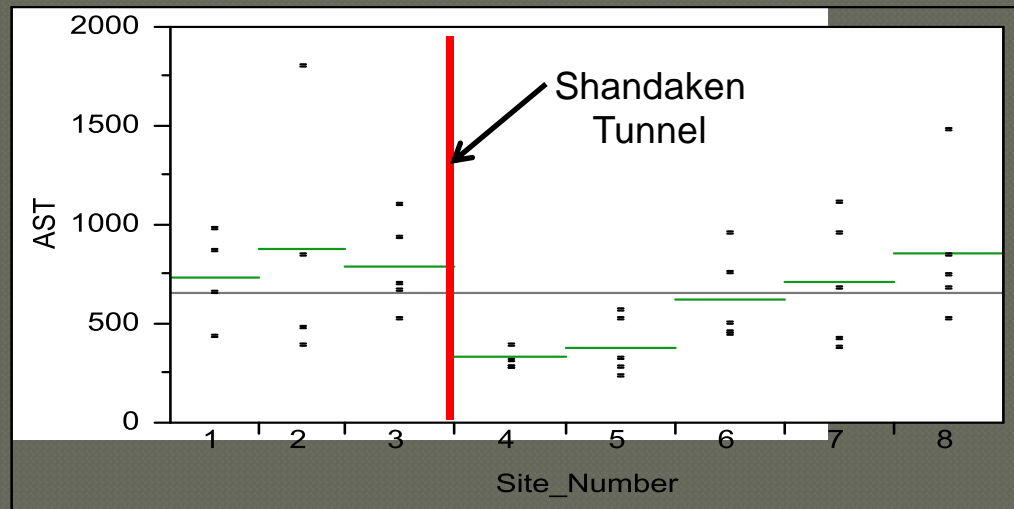
---

- **Clinical chemistry**
  - **Between-segment comparison**
    - **Upstream higher in:**
      - Potassium, phosphate, magnesium, total protein and globulin
    - **Downstream higher in:**
      - Albumin/globulin ratio

# RESULTS

## □ Clinical chemistry

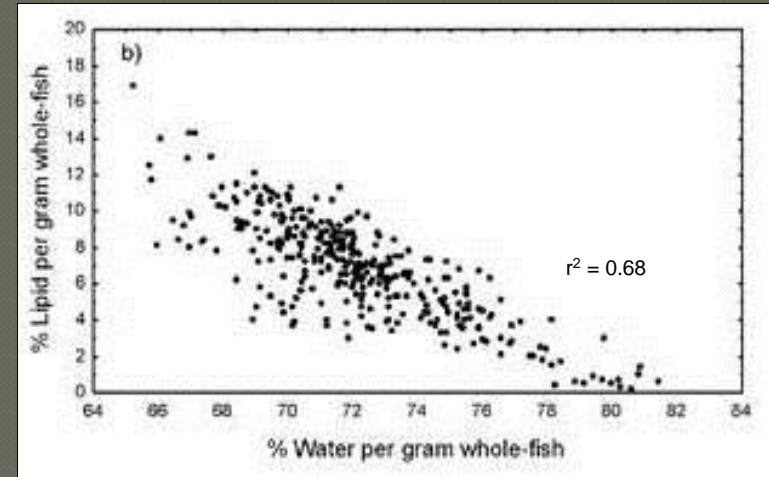
- Among-site comparison
- Observed trend in:
  - Sodium-potassium ratio, total protein, globulin, albumin-globulin ratio, and AST (aspartate aminotransferase)
  - Example: AST



# RESULTS

## ■ Lipid-content analysis

- Percent water and percent lipid relationship (Peters et al. 2007)
- Results
  - No differences upstream vs. downstream (77.3% vs. 76.7%, respectively)



Removed muscle plug

# CONCLUSIONS

---

- Differences observed :
  - Stream habitat
  - Clinical chemistry
- Differences not observed:
  - Movement rates
  - Apparent survival
  - Body composition condition
  - Thermal refuge use
- Assumption: differences in stream habitat should affect trout in all metrics quantified

Why was this not observed?

# CONCLUSIONS

---

- Possible reasons:
  1. Wrong metrics quantified
  2. Tradeoffs of stream segments
  
- Importance of additional summer of data collection

# FUTURE RESEARCH

---

- Diet
  - Stomach contents
  - Upstream vs. downstream
- Body composition condition
  - Tagging study
    - Real-time water and lipid contents
      - Bioelectrical impedance analysis
  - Field measurements and lab experiments
- Radio-telemetry
  - Less invasive surgical techniques
  - Improved transmitter design
  - Lengthened recovery time

# ACKNOWLEDGEMENTS

---

- United States Geological Survey
- New York State Department of Environmental Conservation
- New York City Department of Environmental Protection
- Cornell University
- Cornell Cooperative Extension
- Trout Unlimited
- New York Cooperative Fish and Wildlife Research Unit