**Restoring flow in the Beebe River: Implications for Eastern brook trout**

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**Introduction**

The Beebe River watershed (Campton & Sandwich, NH) is home to wild, headwater populations of Eastern brook trout (*Salvelinus fontinalis*). Of the seven tributaries, five are impacted by undersized road crossings ([Jeffers et al. 2009](#)).

- Brook trout require cool, clean water and their presence often suggests good water quality ([Kanno et al. 2014](#)).
- Movement upstream begins during onset of spawning and when water temperature exceeds thermal tolerance (20° C) ([Curry et al. 2002; Davis et al. 2015](#)).
- Genetic diversity is reduced and subpopulations become subject to extirpation by stochastic events when barriers impact this movement ([Poplar-Jefferis et al. 2009](#)).
- In small populations, this is amplified when subpopulations become isolated, increased chances of inbreeding ([Kanno et al. 2014](#)).
- Little attention has been given to the genetic impacts of stream-crossing structures, such as culverts, on fish communities ([Torterotot et al. 2014](#)).

**Research objectives**

1. Assess current population demographics of brook trout and the influence of the stream/surrounding habitat
2. Influence of road crossings on stream geomorphology and fish movement
3. How population genetics have been affected by road crossings

**Methods**

1. **Population demographics:**
   - **Growth**
   - **Movement**

   ![Fig 1. Study streams GR3, GR4 and ECR1 located in the Beebe River Uplands property, owned by The Conservation Fund (Sandwich & Campton, NH, USA)](#)

2. **Techniques**
   - Length/mass of all brook trout captured
   - Fin clip for genetic sample
   - PIT tag implantation: unique identity ([Kanno et al. 2014](#))
   - Scale sample for age verification
   - Fixed antennae recording
   - 31 temperature, 3 specific conductance/flow sensors

3. **Evaluating stream-crossing structures**
   - 12 microsatellites will be further sequenced from ≥48 fish from each subpopulation (identified by King et al. 2012)
   - 31 temperature, 3 specific conductance/flow sensors

**Results**

**Fig 2. Age structure**

- Erratic age distribution in tributaries with human impacts
- Highest fish density in the non-impacted tributary, ECR1 (200 m, n=167)

**Fig 3. Growth**

- Mean body mass change showed an increasing correlation
- The only significance was found between GR4 and GR3 (p=0.006 using Bonferoni correction)

**Discussion**

This project documents the effects of habitat fragmentation and the importance of connectivity in a wild trout system. With greatest movement occurring in the most impacted tributary, our data amplifies the importance of removing man-made barriers (Fig 4). Based on current age demographics, consecutive years of limited or unsuccessful spawning could result in subpopulation extirpation in GR3 and GR4 (Fig 2) ([Chund et al. 2008b](#)). We predict culvert removal will increase fish movement into and within tributaries, providing enhanced access to thermal refuge and spawning habitat, resulting in increased genetic variation.

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**References**