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

**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 (NHFGD 2014).

- Brook trout require cool, clean water and their presence often suggests good water quality (Kanno et al. 2014)
- Movement upstream occurs when water temperature exceeds thermal tolerance (20°C) and during spawning (Curry et al. 2002; Davis et al. 2015)
- Temperature and/or physical barriers can impact movement and genetic diversity may be reduced resulting in subpopulations at risk of extirpation (Warren Jr. & Pardew 1998; Kondratieff & Myrick 2006; Postle-Jaffers et al. 2009)
- In small populations, genetic impacts may be amplified when subpopulations become isolated and chances of inbreeding increase (Hudy et al. 2010; Kanno et al. 2014)
- Little data exists as to the genetic impacts of stream-crossing structures, like culverts, on brook trout (Pierbert et al. 2000; Torderot et al. 2014; Felson et al. 2015)

**Research Objectives**

1. Assess population demographics of brook trout
2. Track brook trout movement over time and space
3. Document impact of human and natural barriers on population genetics of brook trout

**Methods**

**Population demographics**
- Length, mass, scale samples:
  - a) Scale samples used to age fish
  - b) Growth calculated by mark-recapture length/mass change (7/23, 8/5 - 10/7/2016)

**Fish movement**
- Implanted PIT tags for:
  - a) Mark and recapture via e-fishing
  - b) Stationary antennae detections
  - c) Mean movement calculated by mark-recapture (7/23, 8/5 - 10/7/2016)

**Fish genetics**
- Fin clips:
  - a) Sequence 12 microsatellites identified by King et al. (2012)
  - b) Will be sequenced & analyzed in summer 2017

**Results**

**Population demographics**

**Age structure (Figure 1)**
- Age distribution GR3 & GR4 (with human impacts) differs from ECR1 (without)
- Highest fish abundance in the non-impacted stream, Tributary 1- ECR1 (N = 167)

**Discussion**

- Differences in age distributions = threat of subpopulation extinction in GR3 and GR4 (Fig 1)(Ohend et al. 2008)
- Greatest % body mass increase occurred in the least impacted stream, suggesting most food availability/least stress (Fig 2)
- Greatest movement trend occurring in the most impacted tributary, suggesting unfavorable conditions (Fig 3)
- 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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