UC Davis Center for Watershed Sciences:

Fall River Rainbow Trout Migration Project

April 2018 Update

Project Overview and Findings:

- The Center for Watershed Sciences began Fall River rainbow trout migration project in 2013 with support from the Fall River Conservancy, California Trout, and the California Department of Fish and Wildlife
- In the past five years, there have been 2,262 fish tagged over 9 tagging events (Table 1)
- 22% (n = 496) of the tagged fish have been seen again either by physical recapture (n = 29) or at the PIT tag antenna locations at Thousand Springs and Bear Creek (Figure 1C)

Tagging Date	Number of fish tagged	Mean fork length (mm)
Apr 2013	248	306.8
Jul 2013	245	238.0
Apr 2014	399	272.3
Nov 2014	297	406.5
Apr 2015	374	284.3
Nov 2015	157	375.0
Apr 2016	163	339.9
Apr 2017	105	301.2
Nov 2017	274	340.4
Total	**2262**	**313.4**

Table 1. Summary of rainbow trout tagging events

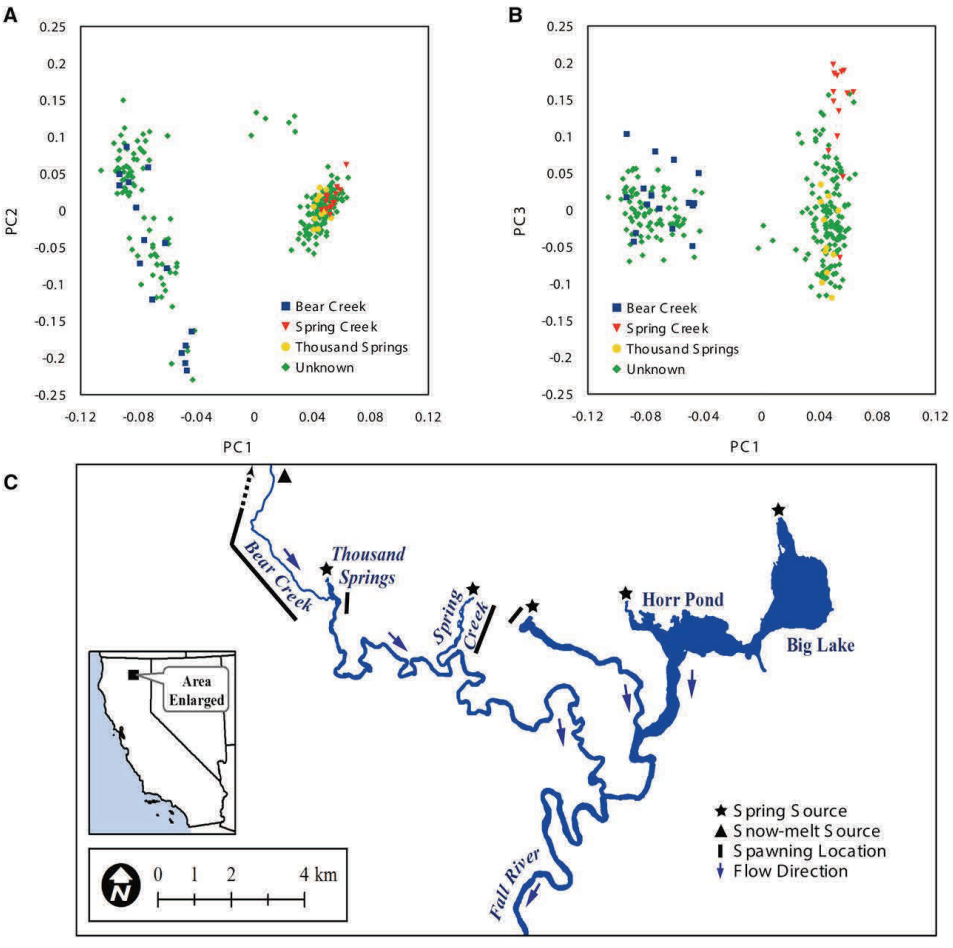

Figure 1. Panels A and B: Biplots from a principal component analysis of genetic data showing distinct separation of Bear Creek and spring-fed spawning sub-populations. Panel C: Overview of Fall River tributaries and rainbow trout spawning areas. Figure from Ali et al. 2016.

Genetically Distinct Sub-populations:

- Genetic data collected from fin clips taken from each tagged fish has shown two distinct sub-populations of rainbow trout living together in the Fall River (Figure 1).
- The two sub-populations are divided into spring-fed spawning and snowmelt source spawning groups which utilize the springs-fed (Thousand Springs, Spring Creek, Ja She) and Bear Creek spawning habitats respectively
- There is very little apparent gene flow between populations despite intermingling in the main stem Fall River during non-spawning times

Spawning Timing:

- The antenna detection data shows an extended spawning duration, October to July, for spring-fed spawning fish and a more traditional spawning timing in the snowmelt system of Bear Creek (Figure 2)
- The stable flow and cool water temperatures year-round from the spring sources provide a buffer to annual climatic variability. Conversely, the snowmelt system is highly dependent precipitation and resulting snowmelt
- In the spring-fed locations, spawning area is limited near the springs, but stable spring-fed water conditions allow an extended spawning season

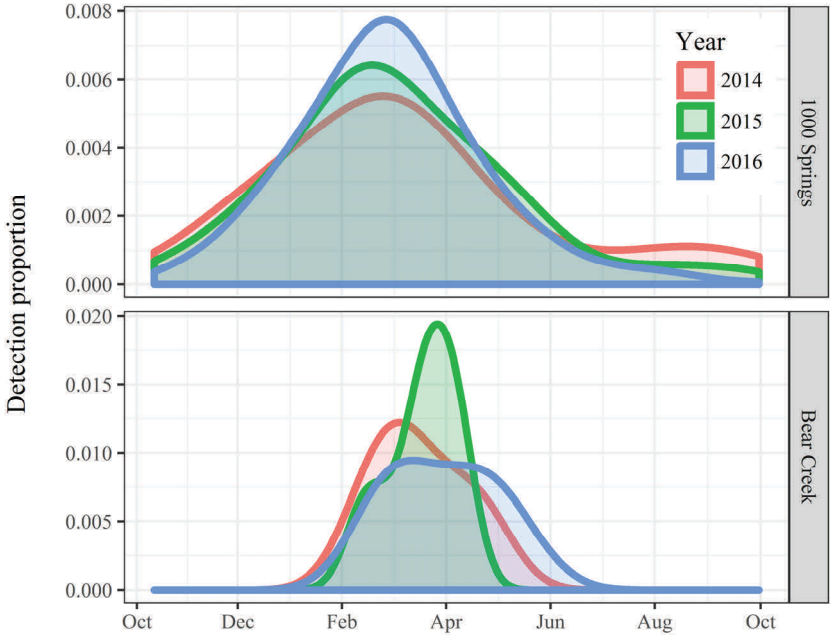

Figure 2. Rainbow trout detection proportion in the spawning locations derived from PIT antenna data.

Perseverance Through the Drought:

- Over the course of this experiment Fall River and Bear Creek have experienced some extreme conditions with a historic multi-year drought from 2012-2015 followed by the wettest year on record in 2017
- At the height of the drought in the spring of 2015, Bear Creek experienced an early disconnection in the beginning of April which likely occurred before any juveniles could have emerged and migrated downstream to the Fall River
- Adult mortalities due to stranding were observed in large numbers by DFW in the lower reaches of Bear Creek
- While the effects of the drought on the Bear Creek populations have not been fully realized, it does appear that a portion of the population was able to persist through the drought
- Preliminary PIT antenna data from March 2018 shows that 23 tagged fish were seen migrating through Bear Creek meadow (sample detections shown in Figure 3)
- These fish included individuals tagged at every tagging event dating back to the first one in April 2013.

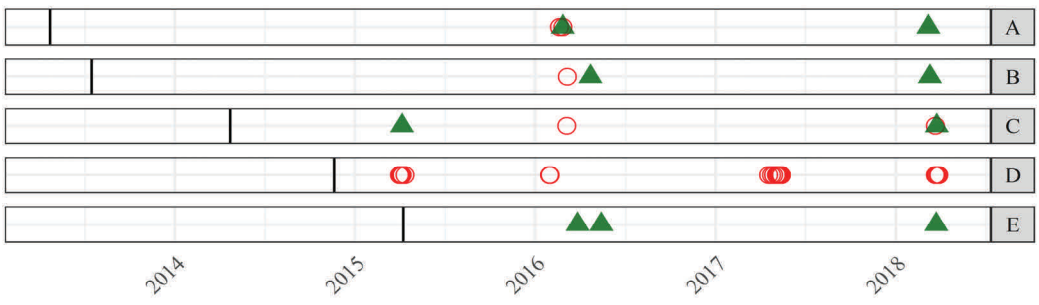

Figure 3. Detection histories for a sample of tagged fish seen in multiple years since the drought. Date of tagging (black bar), Bear Creek detections (green triangles), and Thousand Springs detections (red circles).