

# Sicklefin Redhorse Survival in the Little Tennessee River Basin

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# Introduction

## ▶ Hiwassee River basin

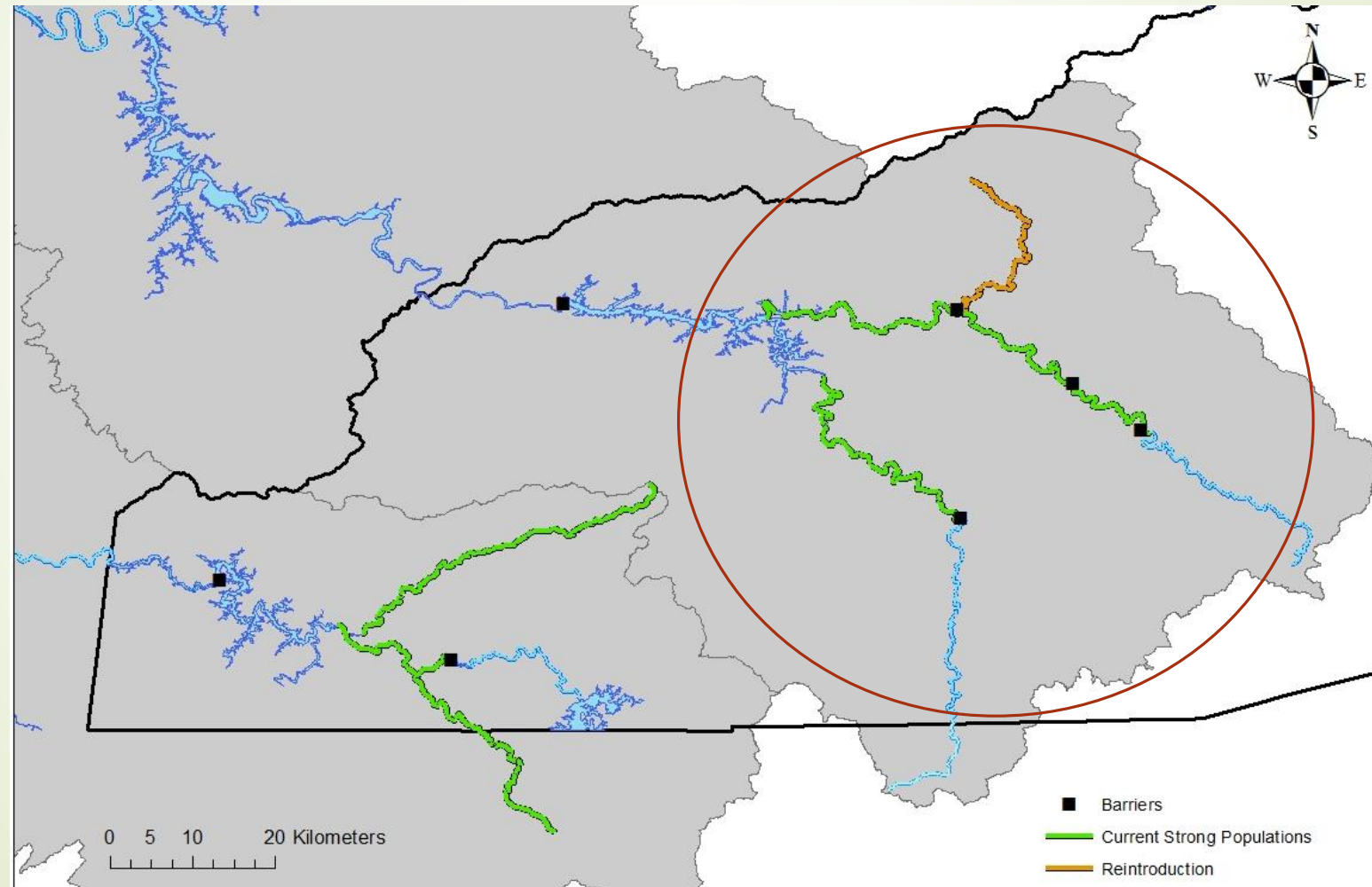
▶ Brasstown Creek (GA and NC)

▶ Valley River

## ▶ Little Tennessee River basin

▶ Tuckasegee River

▶ Little Tennessee River





# Objectives

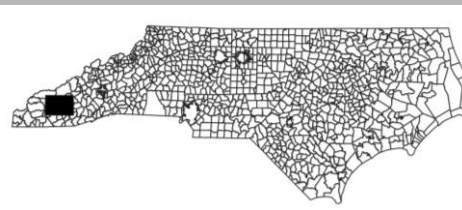
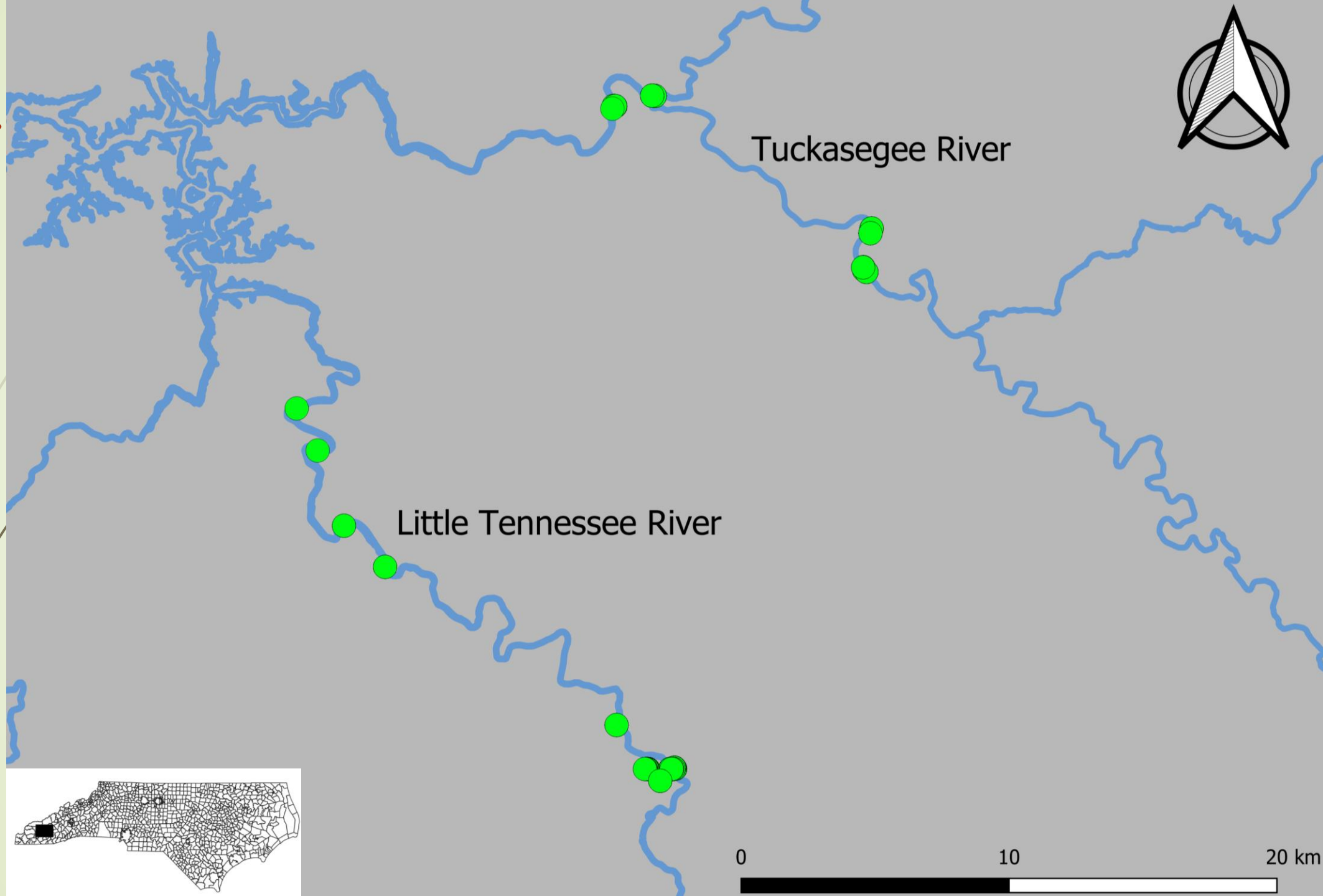
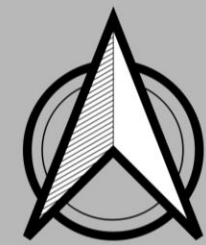
- Estimate annual survival
  - Function of:
    - Sex
    - River
    - Year

# NCWRC Surveys

- Annual surveys
  - Little Tennessee River
  - Tuckasegee River
- During spawning migration
- Detecting and deploying PIT tags
- TL, TW, sex, breeding condition



**NCWRC and EBCI**  
Photo by Gary Peeples, USFWS






# Cormack-Jolly-Seber (CJS) model

- Estimates Apparent Survival
- Model 1: Individual Variation
  - Fixed Effects:
    - Sex
    - River
- Model 2: Individual Variation + Time Variation:
  - Fixed Effects:
    - Sex
    - River
  - Random Effects:
    - Year

# Parameter estimation

- Bayesian inference using Stan
- Vague prior probability distribution for all parameters



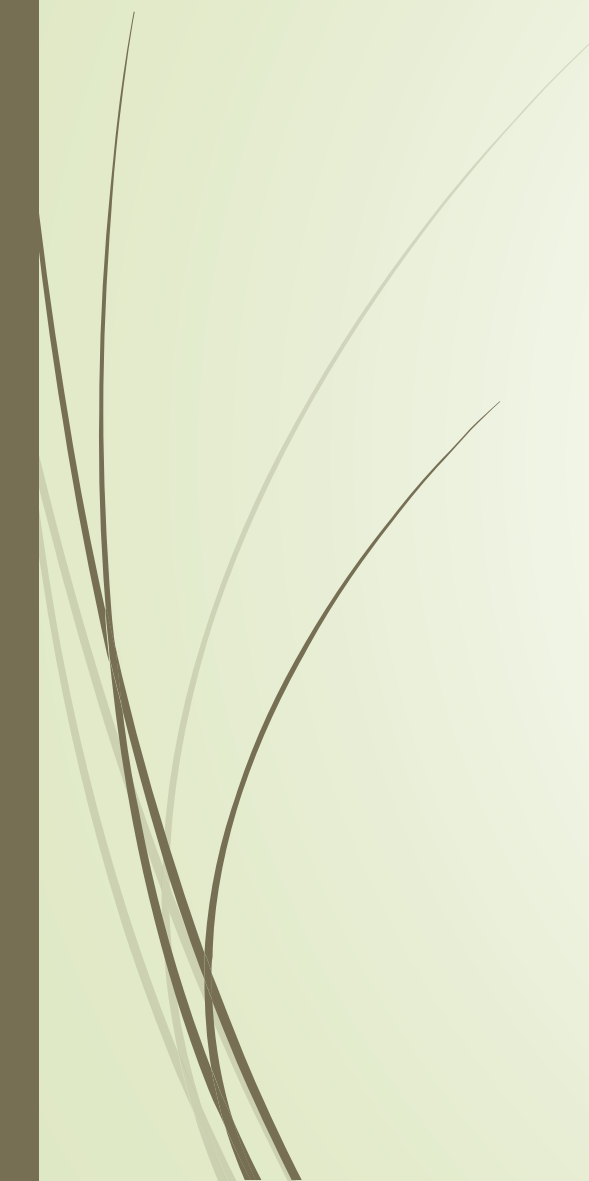



# Results

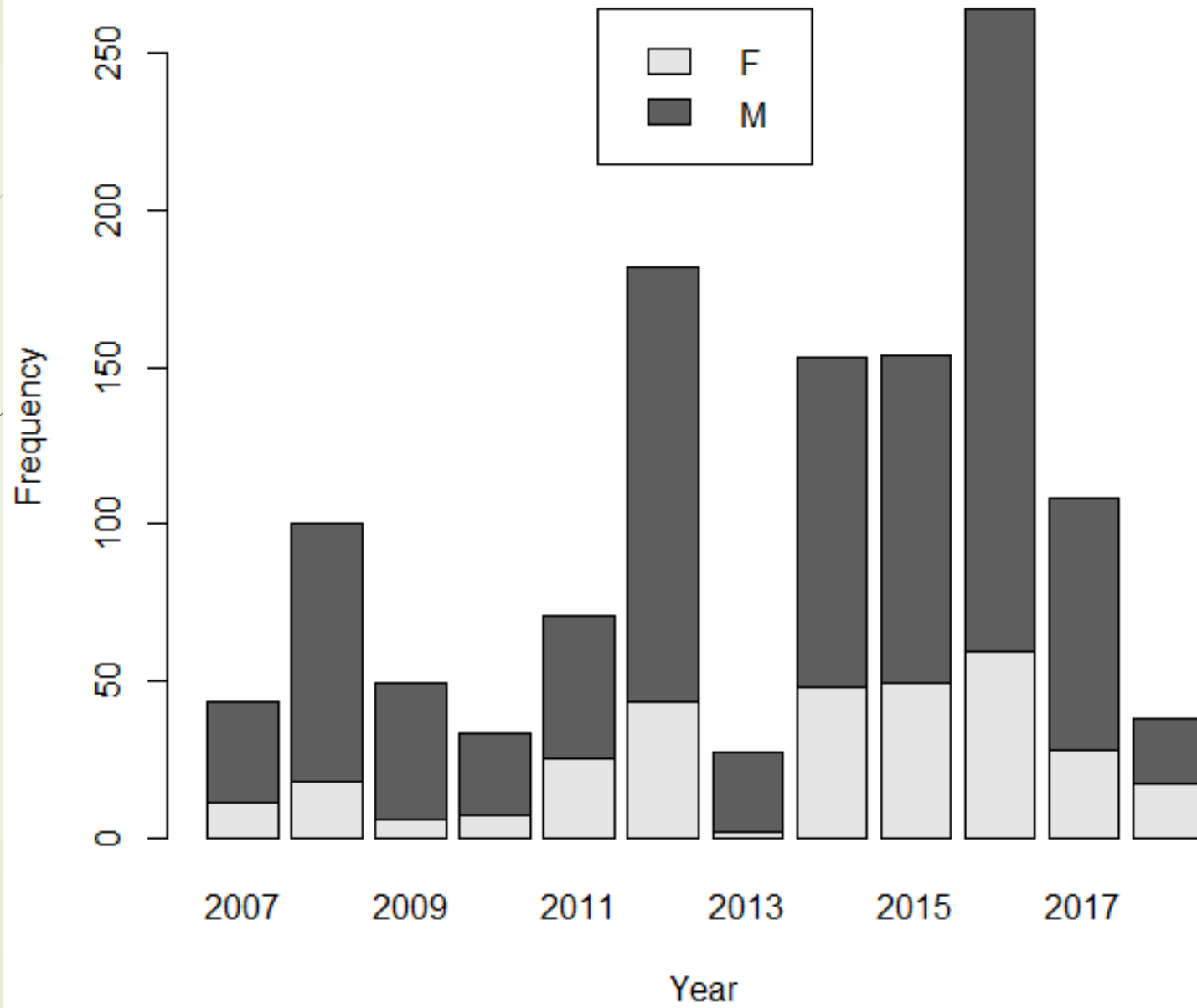
- 1,174 observations
  - 891 Little Tennessee River
  - 283 Tuckasegee (no fish until 2011)
    - Includes Oconaluftee
    - Dillsboro dam removed



# Annual total encounters

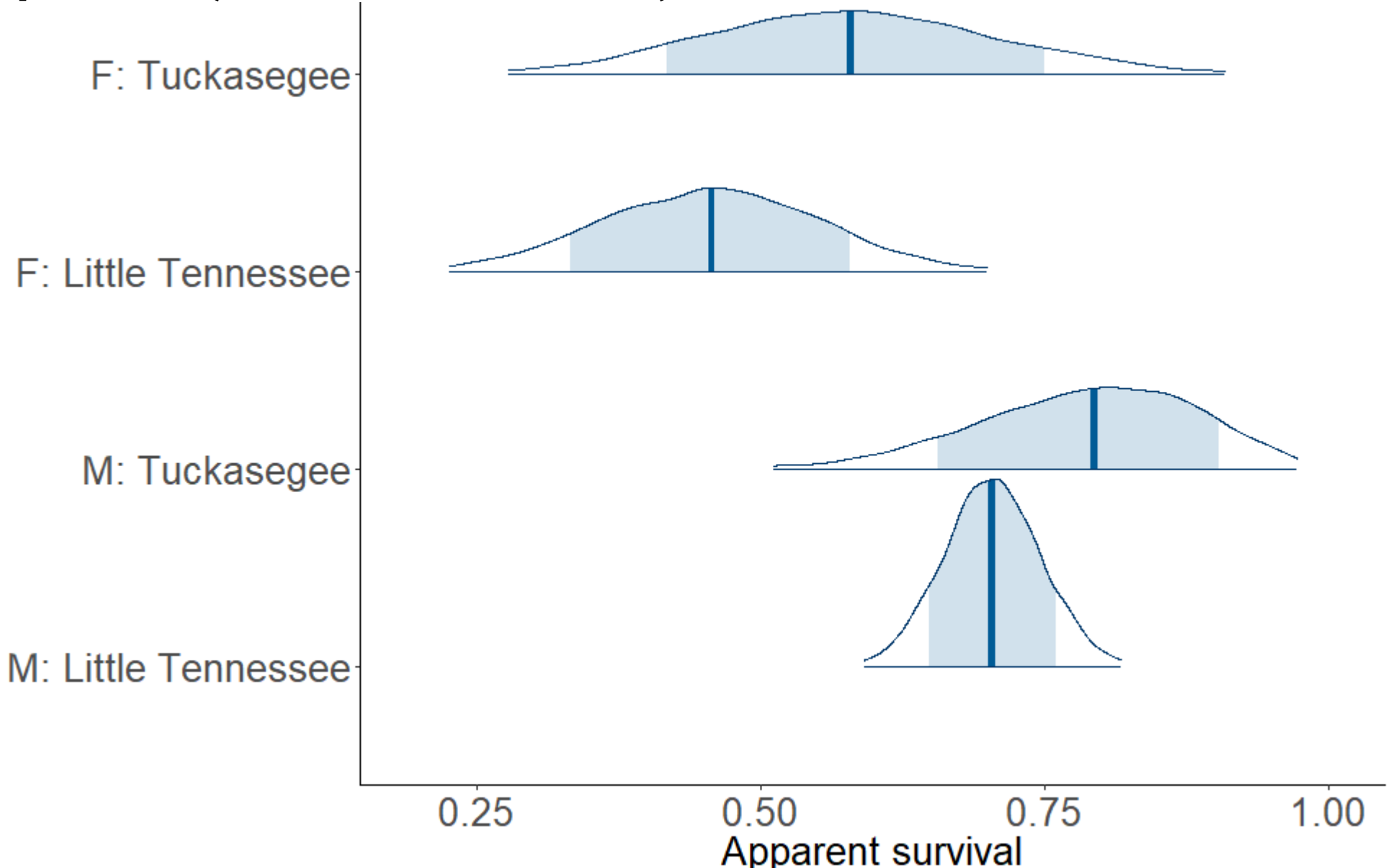


Year	Encounter Number			
	1	2	3	4
2007	42	0	0	0
2008	99	1	0	0
2009	39	9	0	0
2010	29	2	2	0
2011	65	5	1	0
2012	153	26	3	0
2013	22	4	1	0
2014	120	24	9	0
2015	125	25	4	0
2016	195	62	7	0
2017	108	0	0	0
2018	29	5	2	2



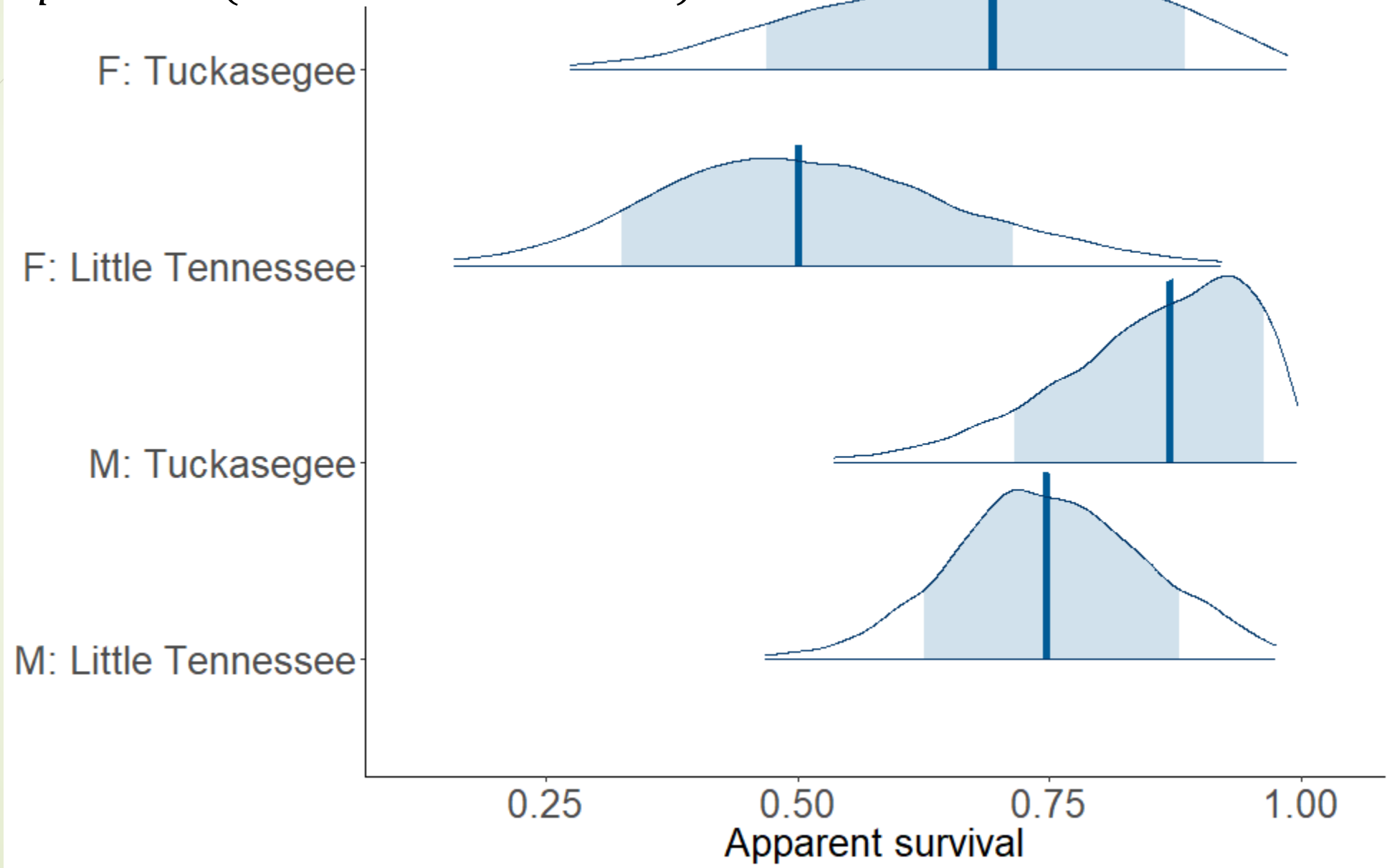
# Individual Effects Only:

$p = 0.09$  (95% CI = 0.06 – 0.13)



# Individual Effects + Year Effect:

$p = 0.09$  (95% CI = 0.06 – 0.14)



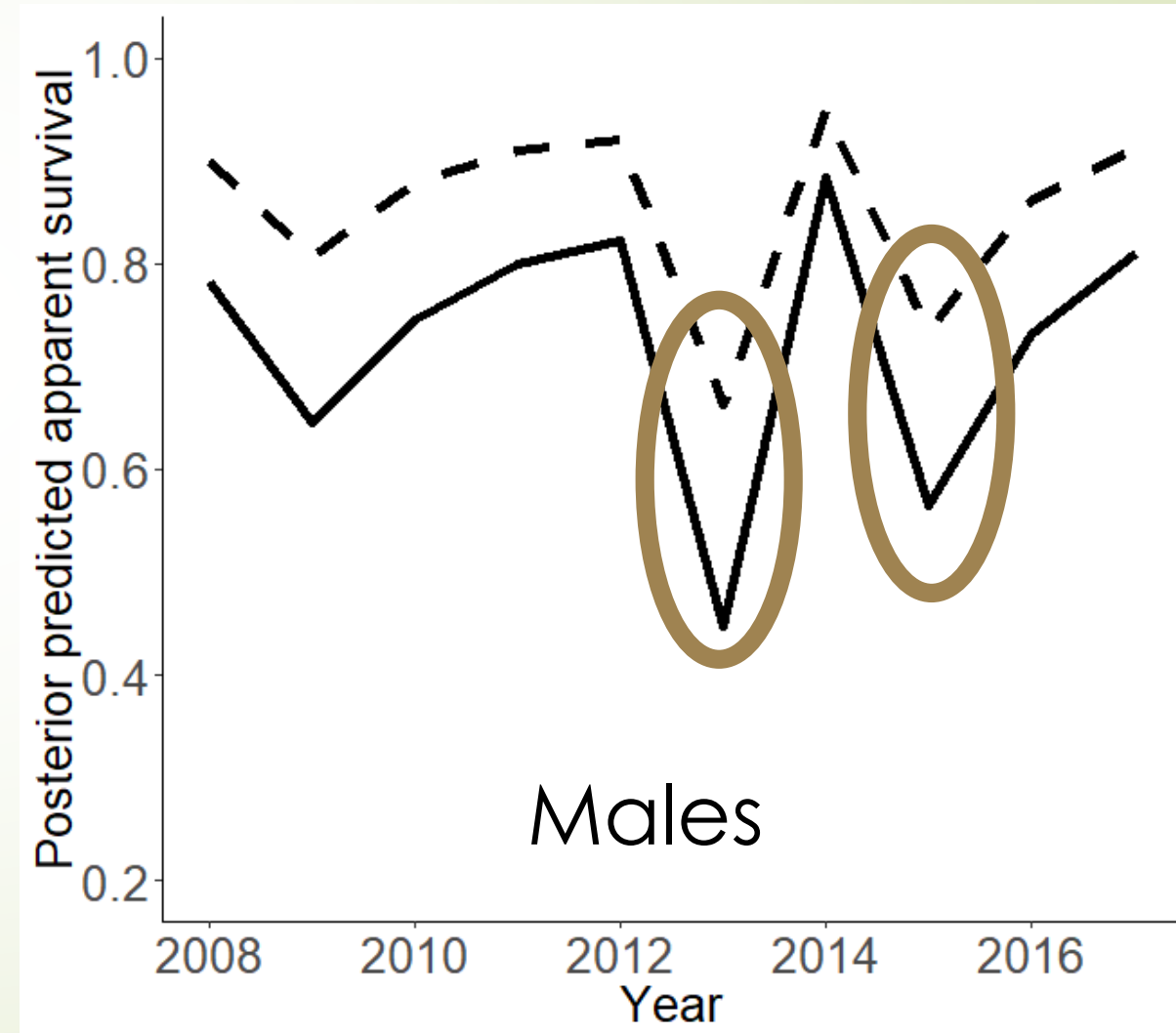
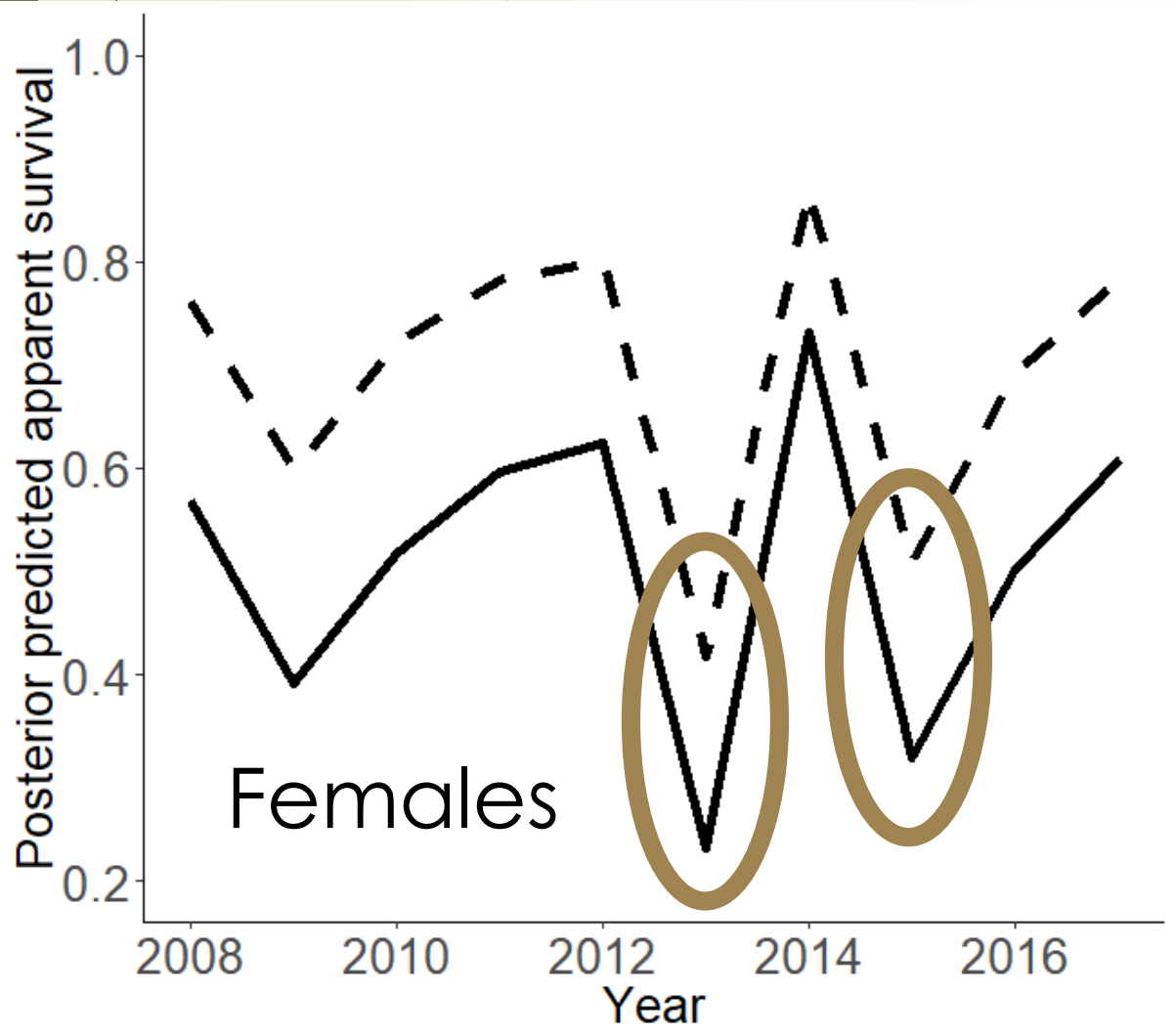
# Individual Effects + Year Effect:



Tuckasegee River



Little Tennessee River



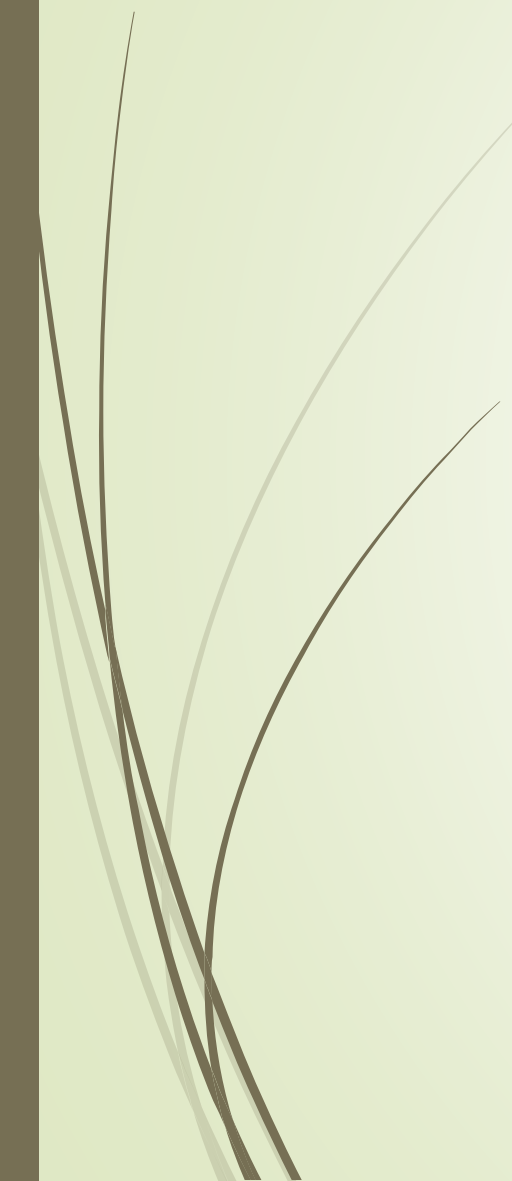
# Summary

- Males outnumber Females
- Detection is low
- Male apparent survival > Female apparent survival
  - Tuckasegee Males<sup>1</sup>
    - Moved to lower reaches in winter
    - Moved to spawning areas in upper reaches late winter/early spring
  - Tuckasegee Females<sup>1</sup>
    - No major movements all season
- Annual variability
  - Low apparent survival in 2013 and 2015

<sup>1</sup>Stowe, K.A. 2014. Movement patterns and habitat use by juvenile and adult Sicklefin Redhorse (*Moxostoma* Sp.) in the Tuckasegee River Basin. MS Thesis. WCU.



## Next steps

- Incorporate **total length** as predictor of individual survival
  - Incorporate **temperature** and **discharge/flow** as predictor of annual apparent survival
  - Model selection (WAIC)
- 



# Acknowledgements

Sicklefin Redhorse CCA Partnership

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