Eliza Springs Daylighting: Response of Barton Springs Salamanders to Habitat Expansion Nathan F. Bendik





Figure 1. Location of the four major springs of the Barton Springs group.



## Eliza Spring Modifications



- 1903 Amphitheater
- 1920s Outflow buried
- 1920s Masonry infill









	ENDANGERED WILDLIFE Permit Number: TE839031-3 Effective: 11/1/2020 Expires: 9/30/2033
Issuing Office:	DRD Signature:
Department of the Interior U.S. Fish & Wildlife Service Endangered Species Permit Office 500 Gold Avenue S.W. P.O. Box 1306, Room 6034 Albuquerque, NM 87103-1306	Deputy Regional Director Date Octo Cm 26, 2020
Permittee:	
Mr. Jorge L. Morales Director, Watershed Protection Departmen City of Austin 505 Barton Springs Rd., Suite 1100	
Austin, Texas 78704 Phone: 512/974-3438	
Austin, Texas 78704 Phone: 512/974-3438 e-mail: Jorge.Morales@austintexas.gov	F0.0ED 47.00 60.0ED 40
Austin, Texas 78704 Phone: 512/974-3438 e-mail: Jorge.Morales@austintexas.gov Authority: Statutes and Regulations: 16 USC 1539( Location where authorized activity may be cond The Barton Springs Complex (Barton Spri Barton Spring) and a protective buffer of a Park, in the City of Austin, in Travis Cour	50 CFR 17.22, 50 CFR 13. cted: gs Pool (BSP) / Parthenia Springs, Eliza Spring, Old Mill Spring, Upper proximately 150 feet surrounding the entire cluster of springs within Zilker y, Texas.
Austin, Texas 78704 Phone: 512/974-3438 e-mail: Jorge.Morales@austintexas.gov Authority: Statutes and Regulations: 16 USC 1539( Location where authorized activity may be cond The Barton Springs Complex (Barton Spri- Barton Spring) and a protective buffer of a Park, in the City of Austin, in Travis Cour Reporting requirements: Annual REPORT DUE: February 1	50 CFR 17.22, 50 CFR 13. cted: gs Pool (BSP) / Parthenia Springs, Eliza Spring, Old Mill Spring, Upper proximately 150 feet surrounding the entire cluster of springs within Zilker 7, Texas.
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#### Endangered Species Act 10a1B permit



Barton Springs Salamander

Austin Blind Salamander

HH. The City will reconstruct or restore salamander habitat within Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring to the maximum extent feasible. This activity includes:

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Barton Springs Pool HCP – Terms and Conditions

TE 839031-1

1. Restoration (daylighting) of the outflow stream from Eliza Spring, which currently travels underground and flows into the bypass structure.





## Questions

- Has carrying capacity increased?
- Survival- similar between new stream and spring pool?
- Movement- can sals travel between the stream-run and spring-pool areas?

#### Methods: capturerecapture

- Capture salamanders -> photograph -> release
  - October 2014 August 2022
  - Stream started flowing in September 2017
- Hierarchical sampling design
  - Repeat 3x per sampling event (3 days within a ~week span)
  - Perform sampling event once every 3 months
- Measure each salamander from photo
- Crop heads in photos -> match images in Wild-ID (Bolger et al. 2012)
- Process Wild-ID output in R to make capture history dataset
- Use statistical models to generate estimates of abundance (N), survival (S) and movement probability (ψ)



#### 3 months



Match rank 1/20: 20200812\_\$A77935 (0.0090)



Photo 3884/4772: 20201104\_\$A78638



Match rank 4/20: 20161028\_SA55234 (0.1517)

*n* = 11,547 salamanders, 29 primary periods, 87 surveys

Error bars = 95% credence intervals



**Amphitheater Pool** 

New Stream







### Movement



Amphitheater Pool

Daylighted Stream

### Movement



Size Flow





# Take-aways

- Total abundance is higher after stream restoration ( carrying capacity)
- Survival is higher for juveniles in the stream
- Salamanders can move between sites, and this is influenced by flow rates
- Stream habitat restoration was successful





Figure 12. View of higher velocities associated with steepened eroded channel, looking upstream.





# Acknowledgements

**COA Team:** Dee Ann Chamberlain, Sarah Donelson, Matt Westbrook, Scott Hiers, Lindsey Sydow, Radmon Rice, Michael Markowski

Former COA Team members:

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# Links to Daylighting project info

- <u>https://www.austintexas.gov/blog/restoring-eliza-springs-stream</u>
- <u>https://www.youtube.com/watch?v=yAut1u3VoHo&ab\_channel=ATX</u> <u>N%7CCityofAustin</u>