Comal Springs Riffle Beetle Population Assessment

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BIO-WEST, Inc.

USGS science for a changing world

AUBURN UNIVERSITY

EDWARDS AQUIFER AUTHORITY

Background

- ***Heterelmis comalensis*, the Comal Springs riffle beetle (CSRB)**
- **Listed as endangered 1997**
- **Has 15.56 *ha* designated critical habitat**
- **Edwards Aquifer Habitat Conservation Plan**
  - **Poly-cotton cloth lure monitoring twice per year at 30 sites**
  - **Long-term goal of 15 - 20 adults per lure**
- **National Academy of Sciences, Engineering, and Medicine (2017)**
  - **Recommended a validation study from the same and new spring outlets to account for life history and flow effects on population estimates**

Background

Previous attempts to estimate the population were challenged

- **Unknown extent of surficial and subterranean population**
- **Identifying suitable variables**
- **Difficulties in upholding model assumptions**

Study Design

- **Introduce team members to the habitat**
  - **Dr. Shannon Brewer**
  - **Dr. Bill Link**
  - **Dr. Andy Royle**
- **Develop a design based on our knowledge of life history and ecology**
- **Meet with the Work Group to discuss finer details of the design before sampling**
- **Adaptive management - Consider slight modifications during and after the first sampling**

Study Design

- Randomly select springs - TPWD map & supplements
- Repeated sampling 70 sites
  - 17% of mapped springs
- 3 events in 2022 & 2 in 2023
- 4 – 5 week intervals per lure
- About 2 weeks between sampling events
- Divide subpopulations (Lucas et al. 2016)

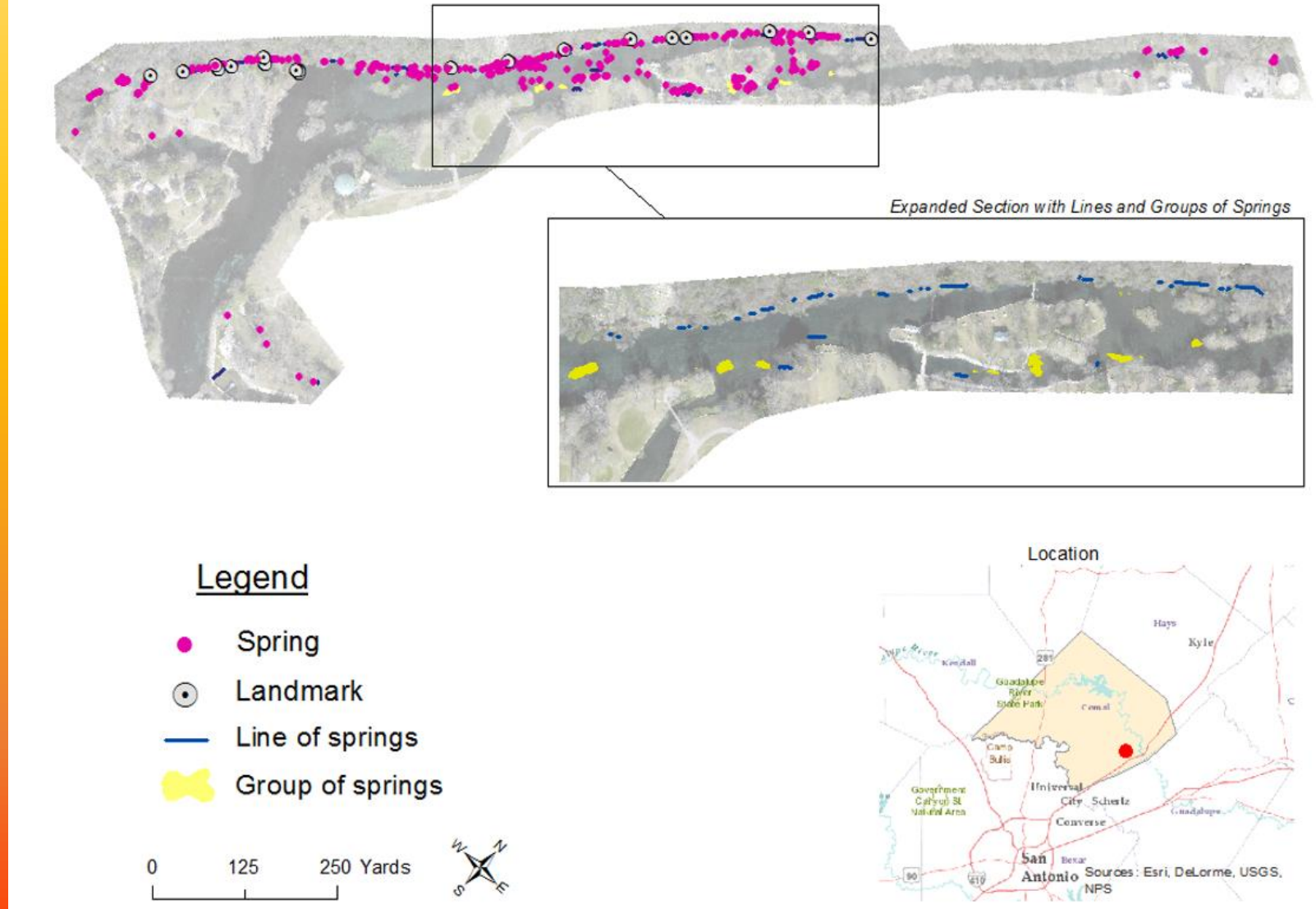
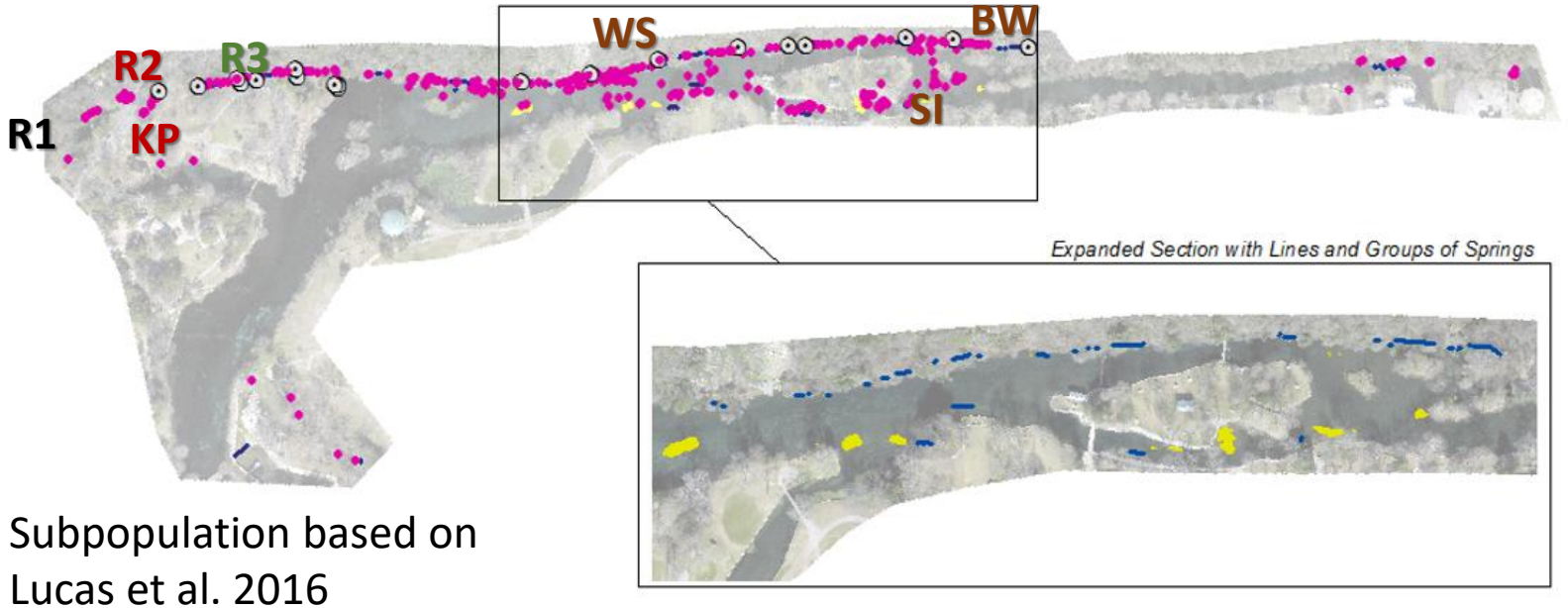


Figure 1. Map of the various springs and groups of springs that comprise Comal Springs.

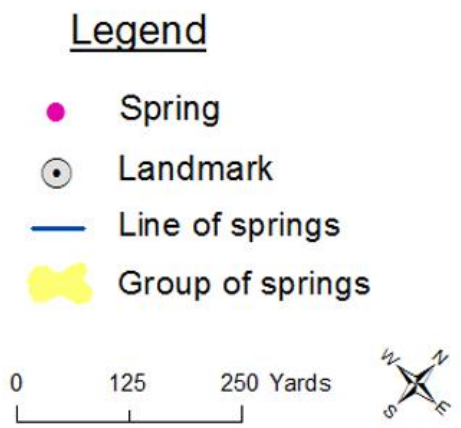
From: TPWD – Norris and Gibson

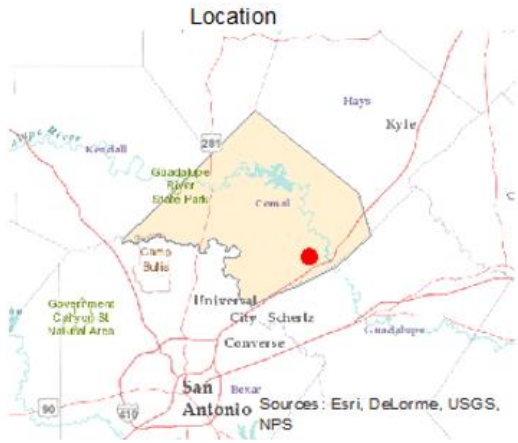
Study Design

- **Spring Run 1**
  - **7 lures**
- **Spring Run 2 + KP**
  - **5 lures**
- **Spring Run 3**
  - **19 lures**
- **Western Shoreline + Spring Island + Backwater**
  - **47 lures**
- **Other areas?**



Subpopulation based on Lucas et al. 2016





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Covariates

- **Spring-level covariates**
  - **Temperature, DO, Conductivity, flow, days deployed, biofilm category**
    - **Measured for each replicate**
  - **Wentworth substrate, DOC, Phosphorus, other water quality measures**
    - **Taken at least once**
- **Sampling-event-level covariates**
  - **Cumulative precipitation, subpopulation, Julian Days, measured Q**
- **Consider other variables**

Analysis

Estimates will be made from multiple methods

- **N-mixture models**
  - **Difficulties with mark and recapture (Houston et al. 2015)**
  - **Issues with model assumptions (immigration/emigration, life-history)**
  - **Design accommodates other analytical methods**
- **Bayesian fitting using Markov chain Monte Carlo**
- **Depletion sampling?**
- **Random Forests**
- **Root-mean-square error estimates of simulated data to estimate precision**
- **Sensitivity analysis to show how estimates may be biased**

Relevant information for the EAHCP

Our goal is to complete the most comprehensive study of the CSRB population at Comal Springs

- **Help guide current monitoring effort**
  - **Lure locations**
  - **Number of lures**
- **Confirm or update the Long Term Biological Goals**
- **Elicit more specific questions (e. g., ecosystem services)**

Post-study review

- **Highlight most important environmental parameters**
- **Critique any shortcomings**

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Questions?