

The background of the slide is a photograph of a natural rock pool. Large, grey, moss-covered boulders are scattered across the landscape, with a small, clear pool of water nestled between them. The surrounding area is a green, grassy hillside under a clear sky.

# **Shrimp on the rocks: endangered species and diversity in California rock pools**

**Jamie Kneitel**

*California State University, Sacramento*

**Doug Bell**

*East Bay Regional Park District*

**Brent Helm**

*Helm Biological Consulting*

**Jake Schweitzer**

*Vollmar Natural Lands Consulting*

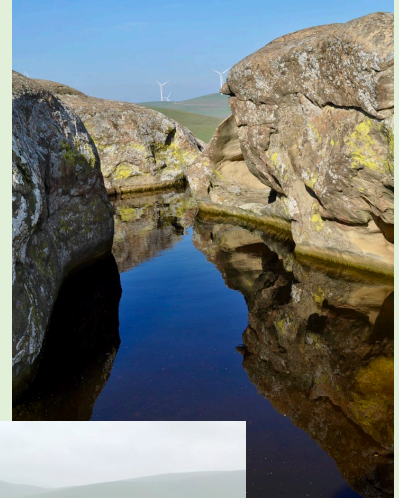
# Rocky Outline

- Rock Pool Ecology
- Fairy Shrimp
- Bureau of Reclamation Grant
- 30 x 30 Grant



# Ecology of Rock Pools

- Ephemeral freshwater pools – wet/dry
- Depressions in rock substrata
- Vary greatly in size
- Cultural - Ecological values but understudied

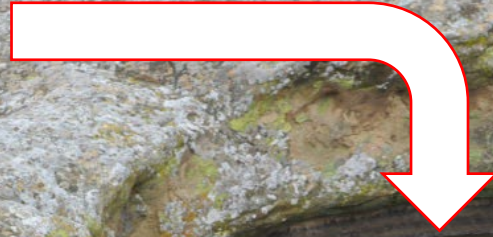




# Ecology of Rock Pools



- Wet phase only
- Migrate before drought
- Adults disperse



**Passive  
Dispersers**

- Survive drought
- Resting eggs
- Vectors to disperse



# Endangered and Threatened Fairy Shrimp



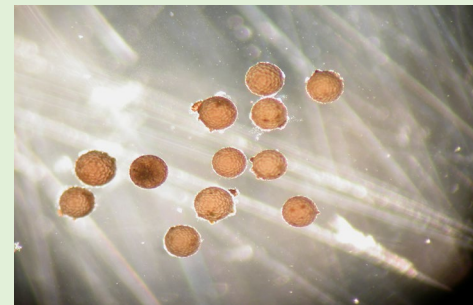
# Life Histories – Arrested Development



	<i>LFS</i>	<i>VPFS</i>
<i>Maturity</i>	22.4 days	18.0 days
<i>Reproduction</i>	43.0 days	39.7 days
<i>Longevity</i>	114 days	90.6 days
<i>Substrate</i>	Soil & Rock	Soil & Rock
<i>Landform</i>	bedrock escarpments, basin rim, floodplain	alluvial fan, bedrock, bedrock escarpments, basin rim, floodplain, high terrace, stream terrace, volcanic mud flow, low terra



Dry Rock Pools

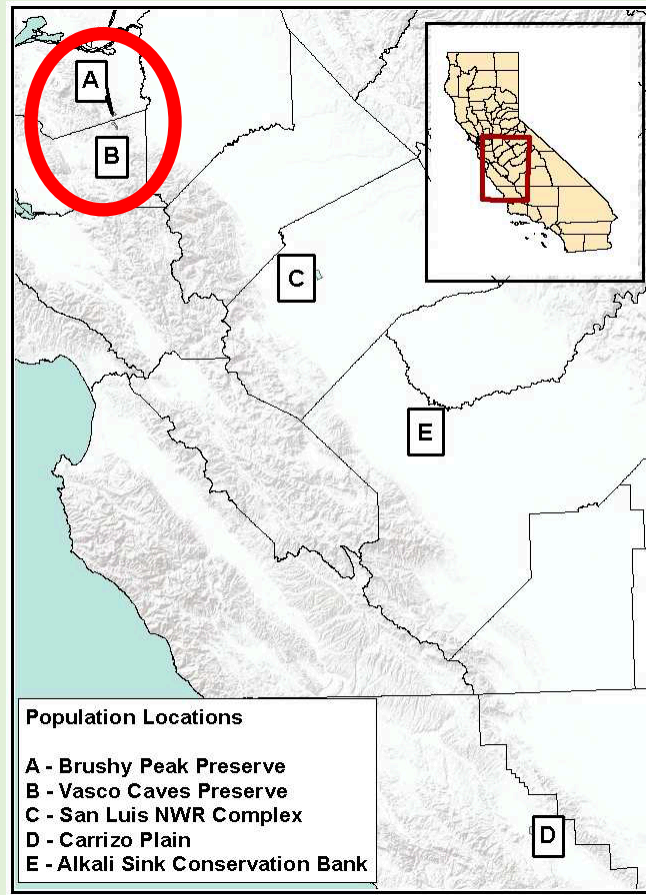


Fairy Shrimp Cysts



# LFS Distribution

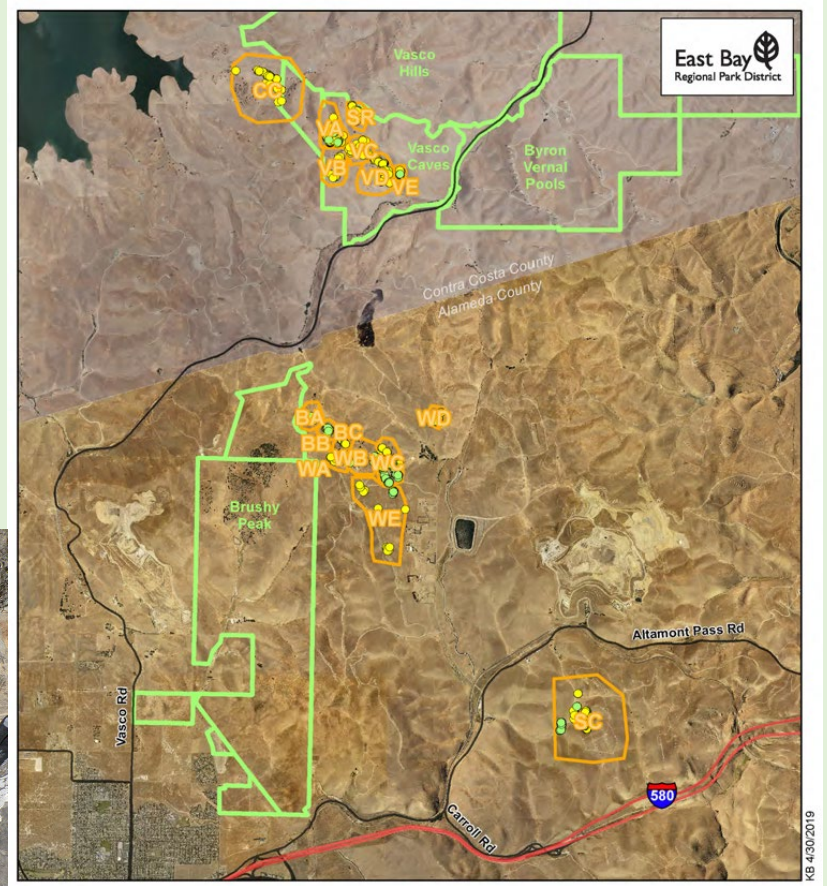
*Study Area*



2009-2012 LFS:  
Only two rock pools!

# Bureau of Reclamation Grant

- Wet /Dry Season Surveys
- Soil/Cyst Samples
- Genetic Differentiation
- Biotic/Abiotic Parameters
- Restoration Potential



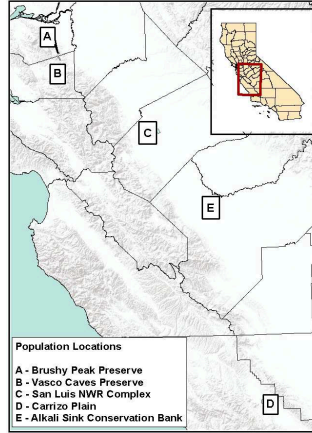
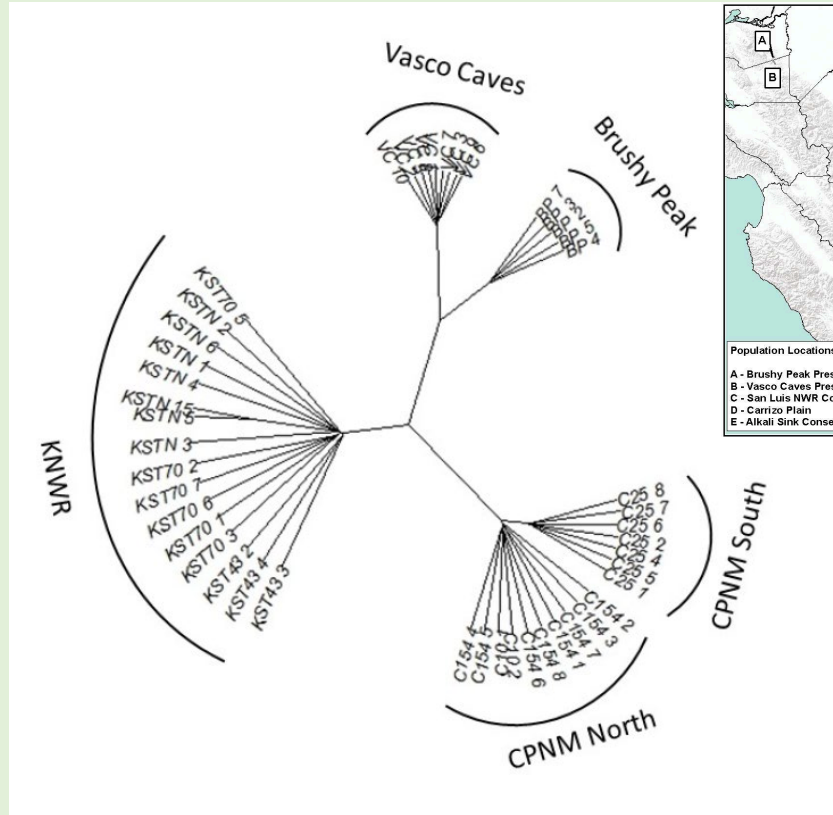


# Wet and Dry Season Surveys

- Contra Costa & Alameda Counties
- 2016 – 2022
- 931 pools sampled
  - LFS: 75 pools
  - VPFS: 652 pools

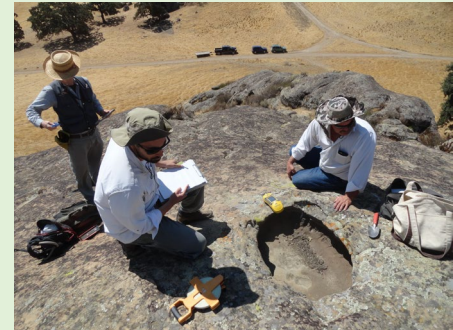
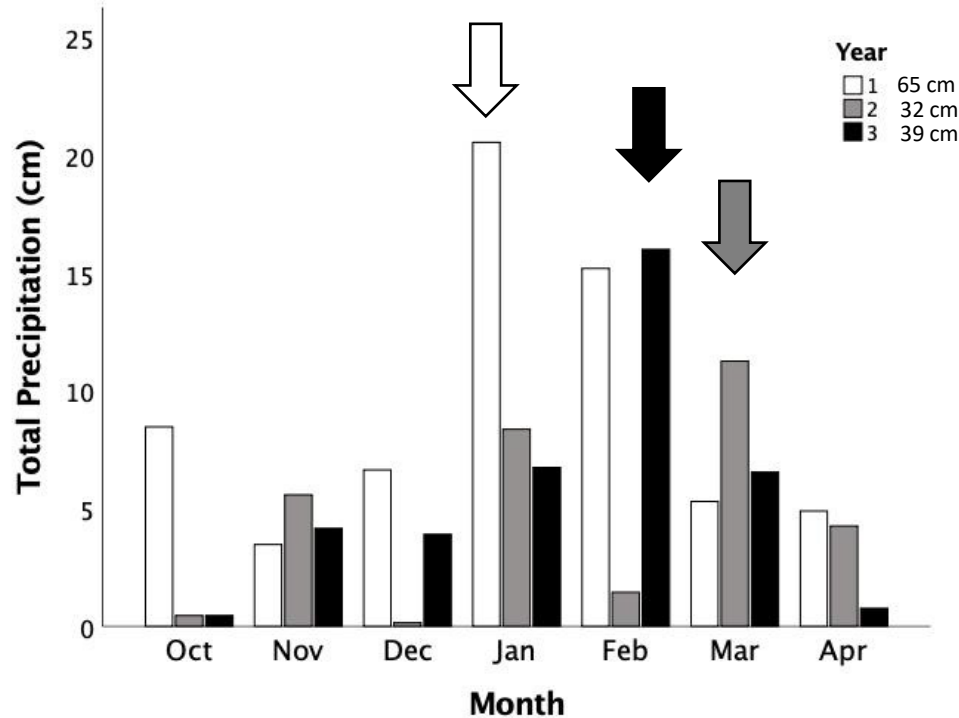


# Genetic Differentiation - LFS



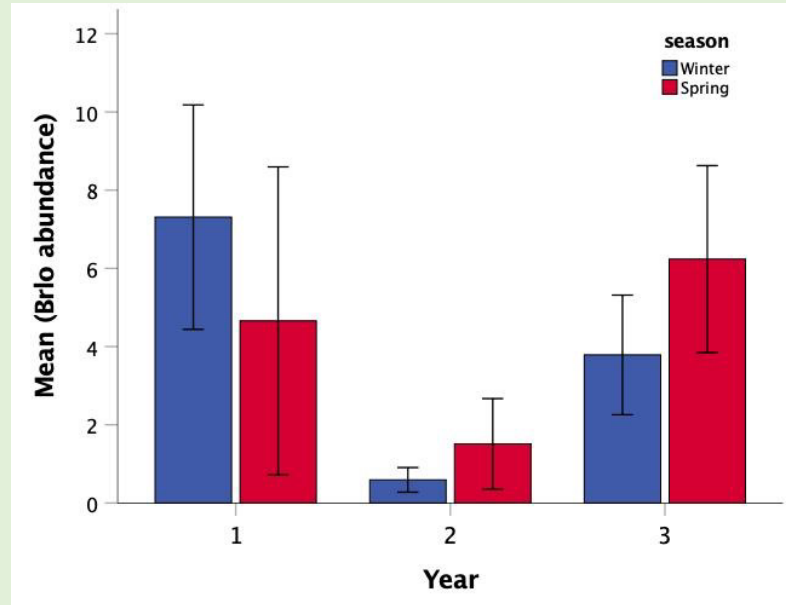


# Hydrological Regime



# Annual-Seasonal Patterns

*LFS*



Year\*\*\*

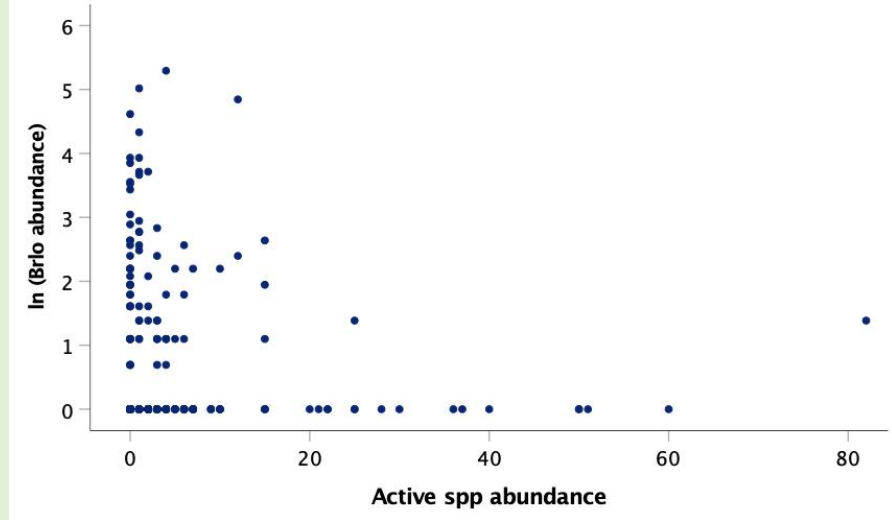
Season

Y x S\*\*\*



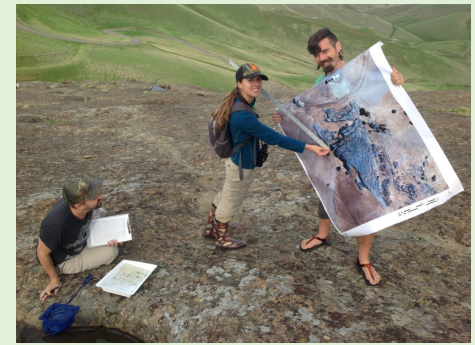
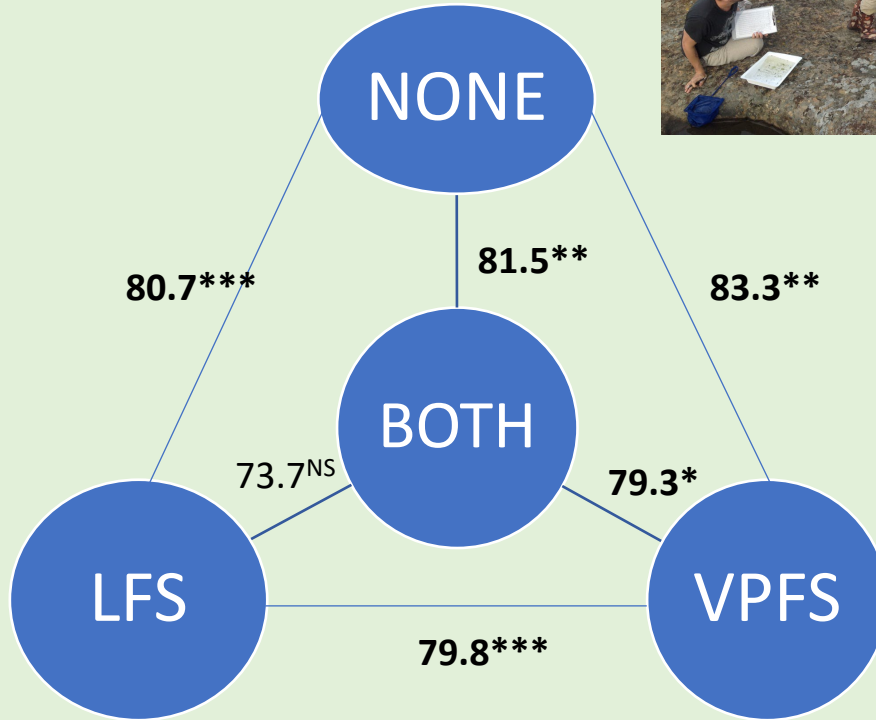
# Results: LFS

- DO (-)
- Turbidity (-)
- Chl-a (-)
- Active abundance (-)
- Phosphate (+)



# Community Level

- Coexistence
  - Year, Season
  - Depth (-)
  - Richness (+)
- Dissimilarity (Bray-Curtis) among community types





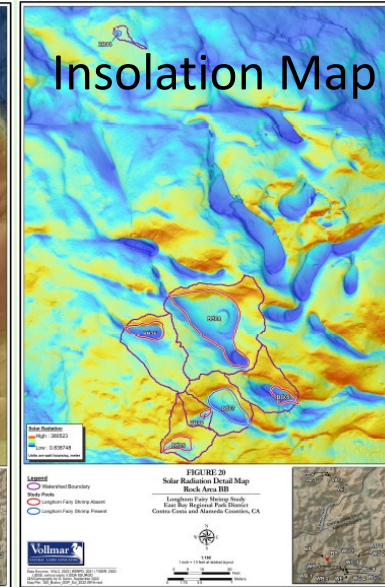
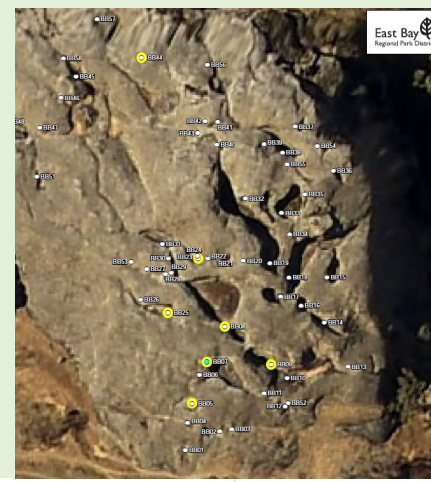
# Conclusions From BoR

- Fairy Shrimp species exhibit different patterns in space and time
  - Abiotic and biotic factors
- Hydro-regime dominant factor
  - Coexistence
  - Community differences



# 30x30 Mini Grant

- ID candidate introduction pools
- Experimental cyst production in the lab
- Detailed wet-season measurements



# 30x30 Mini Grant

- Experimental cyst production in the lab
- Hatched VPFS and CAFS, but no LFS





# 30x30 Mini Grant

- Restore land-locked rock pools!





# Goal



# Acknowledgements

*Bureau of Reclamation* - Daniel Strait, Thelma Sadler

*US Fish & Wildlife Service* - Alecia Hull, Jen Brown

*East Contra Costa Habitat Conservancy* - Abby Fateman

*East Bay Regional Park District* -

*GIS* - Kara Boettcher, Christie McKaskey, Nadia Targulian,

*Grants* - Tiffany Margulici, Jeff Rasmussen, Lisa Baldinger

*Others:* Chris Lyell, Tammy Lim, Dave Riensche, Kevin Dixon

*Livermore Area Recreation and Park District*

*Contra Costa Water District* – Cary Richardson

*California State University Sacramento* -

Abdelmajed Ali, Abby Brittton, Dalton Burroughs, Ryan Castle,

Alexa Harris, Randall Kido, Kayleigh Lampe, Kevin Marr,

Christine Mellon, John Ly, Lanisha McLean, Jennifer Nguyen,

Nestor Samiylenko, Nina Tortosa, Peter Harmon

*VNLC* – Joh Vollmar, Linnea Nuehaus, Eric Smith

*WES* – Mark Noyes, Beth Parvis, Maresa Scofield

*ESA* – Erika Walther

*Special Thanks* – Mary Belk







Thank You!

