THE PEREGRINE

ENDEMIC ENVIRONMENTAL SERVICES

Central California Vernal Pool - Photo By/Credit: Barry Nerhus

VERNAL POOLS, A DIVERSE WETLAND ECOSYSTEM

Vernal pools, a type of seasonal wetland, are characterized by their distinctive annual water cycling, filling with cool rainwater in the winter and eventually draining in the hot and dry summer months. They are home to many unique plants and animals, many of which are endangered and endemic to their natural range. The California Central Valley is a critical location for these pools, threatened by development. Since January 2021, Endemic senior biologist, Scott Whitman, has been conducting research for his master's degree on vernal pools. Along with Whitman, Endemic staff aided in conducting this research, enhancing the scope of the work and allowing staff to gain experience with field surveys and special status aquatic species.

STAFF SPOTLIGHT: SCOTT WHITMAN, MS

Endemic staff working on-site with Whitman conducted weekly aquatic netting surveys, utilizing handheld dip nets to catch and sample aquatic organisms. They counted and measured endangered species, assessed the diversity of aquatic species in pools by counting other species present, and collected measurements of a range of environmental parameters important to mapping the progression of vernal pool ecosystems. Scott's work focuses on the vernal pool tadpole shrimp (*Lepidurus packardi*) and the California Tiger Salamander (*Ambystoma californiense*), both endangered and endemic Californian species. The research will assess the species' occurrence patterns in ponds and growth over time to help predict when and where it occurs. In addition to forming a component of Whitman's thesis, this research will aid in managing and conserving the site's species and supporting land use modeling and habitat conservation in the California Central Valley region!

"THE CALIFORNIA CENTRAL VALLEY IS A CRITICAL LOCATION FOR VERNAL POOLS, THREATENED BY DEVELOPMENT."

PATTERNS OF COOCCURRENCE AND BODY SIZE OF VERNAL POOL TADPOLE SHRIMP (LEPIDURUS PACKARDI) AND CALIFORNIA TIGER SALAMANDER (AMBYSTOMA CALIFORNIENSE)

Scott Whitman, CSU Sacramento

THE CO-OCCURENCE OF ENDEMIC CALIFORNIAN SPECIES

The cooccurrence of species is a crucial component for maintaining the stability and diversity of ecosystems, given the interdependency of many species. Cooccurrence has been observed to be particularly prevalent in ecosystems prone to recurring disturbance events that disrupt states of equilibrium. Dynamic and highly variable seasonal wetlands and vernal pools represent such a habitat type. Characterized by annual cycles of inundation and drying, vernal pools were once widespread in the California Central Valley but now have been reduced from their historical coverage throughout the state by over 90%. Among the many endangered and endemic species found in California vernal pools are the vernal pool tadpole shrimp (*Lepidurus packardi*) and the California tiger salamander (*Ambystoma californiense*).

"VERNAL POOLS WERE ONCE WIDESPREAD IN THE CALIFORNIA CENTRAL VALLEY BUT NOW HAVE BEEN REDUCED FROM THEIR HISTORICAL COVERAGE THROUGHOUT THE STATE BY OVER 90%."

Although widely different in life histories and strategies, these species have been observed to cooccur throughout vernal pools in the California Central Valley and to play key ecological roles in vernal pool communities. In addition, their endangered species status has implications for land use and environmental policy. Nonetheless, data gaps in the patterns of *L. packardi* and *A. californiense* may demonstrate potential factors that may drive such co-occurrence. With both species having been observed to participate in gape-limited predation or competition, cooccurrence thus may also play a role in shaping the body size trends of these species as well.

This study examined if the patterns of spatial and temporal occurrence and body size growth of *A. californiense* and *L. packardi* were associated with the presence of one another. Data for this study was drawn from annual aquatic species inventories conducted by the US Fish and Wildlife Service's Don Edwards San Francisco Bay National Wildlife Refuge between January and April of 2015. The surveys were conducted utilizing dip and seine nets to collect and measure aquatic organisms in 58 pools over 181 surveys.

Patterns of cooccurrence of *L. packardi* and *A. californiense* were assessed using Fisher Exact Tests to examine the occurrence association of the two species during each pool surveyed across the dataset, treating species occurrence as a binary categorical variable. Body size trends of each species over time were modeled using linear mixed models in R, with pool depth and inundation period modeled as covariates and pool identity as a random effect.

It was found that *A. californiense* was highly associated with the presence of *L. packardi*, with over 75% of *A. californiense* being found cooccurring alongside *L. packardi*. This high occurrence correlation may result from overlapping aquatic habitat criteria, and the preference *A. californiense* larvae have for predating *L. packardi* over other available prey. On the other hand, the mean body sizes of both species were not observed to vary based on cooccurrence with the second species, although pool depth was found to correlate with *L. packardi* body size.

Further examination of environmental variables in vernal pools may be necessary to fully understand the factors influencing the body size trends of species beyond gape-limited predation and competition. The results of this study will be of use to the occurrence modeling of both species and the development of land management policy throughout the California Central Valley, given the imperiled status of both the vernal pool habitat and these species.

MAPS: MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP

Phylicia Sanchez, Endemic Biologist

Monitoring Avian Productivity and Survivorship (MAPS) is a research effort developed by the Institute for Bird Populations (IBP) in response to widespread population declines in various avian populations. MAPS banding stations across the U.S., Canada, and Mexico utilize IBP's standardized protocols to collect long-term data on population and demographic parameters for land bird species across multiple spatial scales. The Institute for Conservation and Research (ICRE) recently concluded the second year of its MAPS research within Riverside County. Endemic Environmental happily served as a sponsor for these efforts.

Without data on demographic parameters like survivorship and productivity, comprehensive research efforts wouldn't be able to feasibly test the competing hypotheses that attempt to account for observed population changes. Fortunately, research efforts like MAPS offer the potential to highlight the life cycle stage at which population changes are happening. Ultimately, specifying the reasons for population decline will help to better focus management actions and conservation strategies."

THE PRESIDENTS CORNER

A word from CEO of Endemic Environmental, Barry Nerhus

REGARDING RECENT ENDEMIC SPONSORSHIP

Endemic was a proud sponsor of the Prado Basin MAPS Station this past spring and summer, managed by my non-profit, the Institute for Conservation Research and Education (ICRE). MAPS (Monitoring Avian Productivity and Survivorship) is a global avian research program spearheaded by the Institute for Bird Populations (IBP). The Prado Basin MAPS Station is at the Orange County Water District within the Santa Ana River riparian floodplain.

This season's effort was the second year of the MAPS station's operation; everything ran smoothly thanks to Endemic biologists **Phylicia Sanchez** and **Thea Wang**, who kept all the supplies, protocols, tools, and data in order. Thanks to the efforts of the dozens of volunteers, We have banded 1000s of passerines with recaptures from the previous year. A very special thanks to **Dr. Peter Bloom, Dick Zembal, Dana Kamada, and Karly Moore** for sharing their expertise to the MAPS team. Endemic also recognizes SAWA as sponsor of this year's MAPS station. Can't wait to continue next year!

FUN FACT

By The Institute for Bird Populations (IBP)

"Since 1989, more than 1,200 MAPS stations spread across nearly every state and Canadian province have collected more than 2.5 million bird capture records."

Thank you for reading and supporting Endemic in its mission to navigate todays environmental challenge's with innovative solutions.