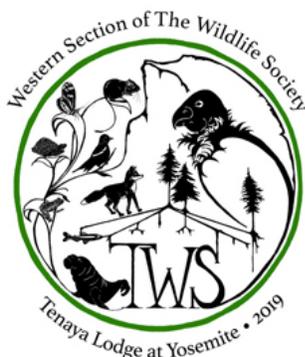


# TWS-WS 2019 Annual Meeting

## ABSTRACTS



## DEATH & TAXAS

Extinction and Speciation During the Anthropocene

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### Ecology and Conservation of Amphibians and Reptiles I

(sorted by presentation order)

#### **A NEW ROAD CROSSING STRUCTURE FOR SMALL ANIMALS: CASE STUDY WITH THE YOSEMITE TOAD.**

**Cheryl S. Brehme**; US Geological Survey; 4165 Spruance Road, San Diego, CA, 92101; (619) 225-6427; cbrehme@usgs.gov; Stephanie L. Barnes, Robert N. Fisher

Many small animal populations, especially amphibians that must migrate between aquatic and terrestrial habitats, are susceptible to negative impacts from roads within their habitat. Over a 4-month period in 2017, Sierra National Forest recorded 92 Federally threatened Yosemite toad (*Anaxyrus canorus*) mortalities along a single forest service road. Narrow tunnels with directional barriers are a standard mitigation solution to reduce amphibian road mortality. However, these systems may act to filter migratory movements of populations that disperse over large areas. In 2018 we tested a new and novel passage prototype, an 8-inch high elevated road segment using road mats designed for use by heavy equipment at construction sites. The prototype was installed on top of the road along a toad mortality "hotspot" with directional barrier fencing, and provides a safe crossing nearly 100 feet wide while allowing both light and rain to pass through. We monitored toad activity along fencing and under the passage using specialized cameras and conducted regular road mortality surveys. Initial results show that toads used the passage and mortality was greatly reduced. This study supports a broader research program to inform best management practices for barrier and crossing systems for sensitive amphibians and reptiles in California.

*Ecology and Conservation of Amphibians and Reptiles I*

#### **BULLFROG CONTROL (*LITHOBATES CATESBEIANUS*) AS A MEANS TO ENHANCE ARROYO TOAD (*ANAXYRUS CALIFORNICUS*) AND WESTERN POND TURTLE (*EMYS MARMORATA PALLIDA*) POPULATION.**

**Denise R. Clark**; USGS; 4165 Spruance Road Suite 200, San Diego, CA, 92101; (619) 225-6435; drclark@usgs.gov; Christopher W. Brown, Robert N. Fisher

The American bullfrog (*Lithobates catesbeianus*) is an invasive aquatic species that has been documented as a major predator of native reptiles and amphibians, including the endangered arroyo toad (*Anaxyrus californicus*) and the western pond turtle (*Emys marmorata pallida*; a federal and state listed species of concern). USGS has been actively controlling for bullfrogs on several properties throughout southern California as part of habitat enhancement research for both the arroyo toad and western pond turtle. Control methods used consisted of 22 long rifle cartridges, air rifles, gigs, hand nets, hand captures, minnow traps and seines as approved by the California Department of Fish and Wildlife Regional Biologist. Surveys generally occurred between spring and fall and were conducted in any pool with the potential of harboring bullfrogs, bullfrog tadpoles, and egg masses. In addition, stomach contents were also analyzed to identify species being consumed by bullfrogs. Our ongoing research has shown that substantial reductions in bullfrog populations have had a positive impact on both arroyo toad and western pond turtle populations.

*Ecology and Conservation of Amphibians and Reptiles I*

### **EFFECTS OF VERNAL POOL HYDROPERIOD ON LARVAL OCCUPANCY OF THREATENED CALIFORNIA TIGER SALAMANDERS IN THE CENTRAL VALLEY.**

**Amanda M. Kissel**; Conservation Science Partners; 5 Old Town Square, Suite 205, Fort Collins, CO, 80524; (970) 484-2898; amanda@csp-inc.org; Eric C. Hansen, Meghan Halabisky, Rick D. Scherer, Maureen E. Ryan, Brett G. Dickson

Understanding the link between hydroperiod and persistence of wetland obligate species is critical for managing wetlands under climate change, particularly for vernal pools in the Central Valley of California which maintain a number of threatened and endangered species. We explored the relationship between larval occupancy of the federally listed California tiger salamander (*Ambystoma californiense*) and hydroperiod dynamics of vernal pools in the San Joaquin Valley, California. We used a spectral mixture analysis, a remote sensing technique to identify water on the landscape, coupled with Bayesian mixed-effects models to estimate daily surface area of 150 vernal pools over a 20-year timespan. We then modeled occupancy of *A. californiense* larvae as a function of site attributes and hydroperiod covariates developed from the surface area estimates. We found that the probability of occupancy decreased (from 0.41 to 0.26) as hydroperiod length increased, suggesting *A. californiense* larvae occupy vernal pools that are likely to dry sooner if precipitation is reduced under future climate change. Our results demonstrate how these methods can be used to identify wetlands that are likely to be occupied by *A. californiense* larvae under climate change scenarios, information that can proactively guide management decisions for *A. californiense* and other wetland-obligate species.

*Ecology and Conservation of Amphibians and Reptiles I*

### **CANINE SCENT DETECTION SURVEYS AS AN EFFECTIVE TOOL TO IDENTIFY CALIFORNIA TIGER SALAMANDERS IN UPLAND HABITAT IN EASTERN ALAMEDA COUNTY.**

**Jerry D. Roe**; Sapere Environmental; 135 Glasgow Circle, Danville, CA, 94526; (925) 719-1916; jroe@sapereenv.com; Travis Mcclary

A canine trained to detect the residual scent of California tiger salamander (*Ambystoma californiense*) was employed along portions of a 5-mile gas pipeline for the Pacific Gas & Electric Company's Gas Line 131 R-649, 700 & 707 Replacement Project in northern Livermore, Alameda County, California. The canine surveyed 50 feet on either side of the alignment using meandering transects. Surveys were initiated during early morning hours within 30 minutes of sunrise to take advantage of favorable weather conditions and focused on sections of the alignment with suitable habitat including small mammal burrows and soil fissures were present. A total of 20 positive alerts were recorded. Habitat features were detected using a combination of air scenting followed by ground tracking to the source, e.g. burrows (ground squirrel and gopher) and fissures in the soil. Detection alerts were categorized into priority levels based on the handler's

and biologist's confidence of the alert and presence of habitat features: Priority 1 - point source location, high probability of California tiger salamander occupancy; Priority 2 - localized area (scent pool), high likelihood of recent occupancy; and Priority 3 - localized scent pool but site lacked observable habitat features, presence unlikely. This case study suggests that training the canine on multiple scent sources, i.e. scat, carcasses, and live California tiger salamanders is critical to generalize the canine on the residual scent of both live and dead individuals and the importance of conducting surveys in favorable weather conditions to maximize scent detection.

*Ecology and Conservation of Amphibians and Reptiles I*

### **EVOLUTIONARY PAST, PRESENT, AND FUTURE OF THE YOSEMITE TOAD (*ANAXYRUS CANORUS*): A TOTAL EVIDENCE APPROACH TO DELINEATING CONSERVATION UNITS.**

Paul A. Maier; San Diego State University; 5500 Campanile Drive, SDSU Dept Biology, San Diego, CA, 92182-4614; maierpa@gmail.com; Steven M. Ostoja, Andres Aguilar, Amy G. Vandergast, **Andrew J. Bohonak**

Species that are most vulnerable to climate change are often habitat specialists, local endemics, and/or have low intrinsic growth rates. Yosemite toads (*Anaxyrus canorus*) are one such alpine endemic, having been extirpated from up to 69% of their historical range. Our goal is to understand how current connectivity and historical evolutionary processes (e.g., lineage divergence, secondary admixture) will impact Yosemite toad persistence in the face of climate change, using genomic data. Major lineage formation and fusion were shaped in this species during repeated bouts of Pleistocene glaciation, leading to three major contact zones. Modern genetic connectivity is analyzed as a network of environmental and climatic interactions, layered on this lineage structure. Models of natural selection under future climate change predict the specific areas in which connectivity can mitigate the loss of genetic diversity. Overall, this collection of studies provide an example of how conservation strategies can incorporate the many temporal processes (ancient, recent, and current) that have shaped current genetic diversity patterns, and use a "total evidence" approach to predict future adaptive potential.

*Ecology and Conservation of Amphibians and Reptiles I*

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## Ecology and Conservation of Amphibians and Reptiles II

(sorted by presentation order)

### **USING DYNAMIC OCCUPANCY AND STATE SPACE MODELS TO IDENTIFY TRENDS IN A POPULATION OF CALIFORNIA RED-LEGGED FROG (*RANA DRAYTONII*).**

**Matthew J. Sharp Chaney**; Midpeninsula Regional Open Space District; 330 Distel Circle, Los Altos, CA, 94022; (650) 625-6573; mchaney@openspace.org; Brian J. Halstead

Conservationists working to recover California red-legged frog (CRLF) require methods for assessing trends in CRLF populations over time. This study uses a dynamic occupancy model to determine the number of ponds occupied by CRLF at a preserve in La Honda California over a ten-year period. In addition, the population of breeding female CRLF in each individual pond, and a site-wide analysis combining 13 ponds, was estimated through time using a state space model. Precipitation amounts and the maximum depth of each of the thirteen ponds on site were compared with egg mass detections. Results indicated that CRLFs occupied an average of 25% more ponds per year than surveys suggested. The population trend indicates that the number of breeding female CRLFs is generally stable after recovering from a drought that occurred from 2010 to 2015. Egg mass detections had a moderate positive correlation with rainfall, and no correlation with maximum possible pond depth. The results from the dynamic occupancy model, and state space model, are valuable for assessing population trends if the number of CRLF does not approach zero in a given year. These methods can contribute to CRLF recovery by providing statistically robust estimates of population trends over time.

*Ecology and Conservation of Amphibians and Reptiles II*

### **THERMAL ECOLOGY OF THE FEDERALLY ENDANGERED BLUNT-NOSED LEOPARD LIZARD (*GAMBELIA SILA*).**

**Kat N. Ivey**; California Polytechnic State University, San Luis Obispo; 1 Grand Ave., San Luis Obispo, CA, 93407; (805) 235-0551; ivey.kathleen@yahoo.com; Emily Taylor, Michael Westphal

Recognizing how climate change will impact populations can aid researchers and managers in making decisions about the conservation of endangered species. The blunt-nosed leopard lizard (*Gambelia sila*) is a federally endangered lizard found in the arid deserts of the San Joaquin Valley and the Carrizo Plain. It has been extirpated from most of its range due to habitat destruction and alteration. We collected field-active body temperatures of *G. sila*, combined with operative temperature model data, preferred body temperatures (29.7 C), and thermal tolerance (41 C) data for the population, which allowed us to (1) calculate the number of hours lizards are thermally constrained, (2) project how this number will change in the future as ambient temperatures rise, and (3) assess the importance of shade-providing shrubs and burrows in the current/future thermal ecology of *G. sila*. In addition, we used telemetry data, field-active body temperatures, and operative temperatures to evaluate temperature-based activity estimation as a means of predicting lizard activity and microhabitat use. Lizards maintained body temperatures just below critical thermal maximum but exceeded preferred body temperature throughout most of the day. Overall, our data suggest shrubs and burrows provide an important refuge and aid in thermoregulation for this species.

*Ecology and Conservation of Amphibians and Reptiles II*

*Student Paper*

### **CANOPY EFFECTS ON EARLY STAGE VITAL RATES FOR NORTHERN RED-LEGGED FROGS AND POTENTIAL IMPACTS TO POPULATION GROWTH RATES.**

**Kelcy W. McHarry**; Institute for Wildlife Studies; PO Box 1104, Arcata, CA, 95518; (541) 505-2951; mcharry@iws.org; Brian R. Hudgens, Jessica M. Abbott

Habitat characteristics at breeding sites may influence amphibian vital rates and population persistence, but the impact may differ among populations. Our research investigated the effect of canopy cover on early stage vital rates for several populations of Northern red-legged frogs (*Rana aurora*). We evaluated if the effect of canopy cover differed among populations, and if so whether the effect varied with ambient air temperatures. We reared eggs and conducted mark-recapture surveys for tadpoles in enclosures with contrasting canopies. We built matrix models to evaluate if observed effects of canopy cover on tadpole survival impacted population growth rates. Egg hatch success did not differ between canopy treatments or among sites. The effect of canopy cover on tadpole survival varied among populations but there was no evidence that there was an interaction between canopy cover and local air temperature. For the populations where a canopy cover effect was detectable, population growth rates varied from approximately stable assuming tadpole survival observed in the open canopy treatments, to 30% annual decreases assuming tadpole survival observed in closed canopy treatments. Our results demonstrate canopy cover availability can influence tadpole survival and alter population trajectories.

*Ecology and Conservation of Amphibians and Reptiles II*

### **EFFECTS OF TEMPERATURE AND HYDROPERIOD ON NORTHERN RED-LEGGED FROG.**

**Lindsey Gordon**; Institute for Wildlife Studies; 140 H Street, Blue Lake, CA, 95525; (217) 827-5201; gordon@iws.org; Brian Hudgens, Jessica Abbott, Kelcy McHarry, Melissa Harbert

Climate change has been implicated in the decline and extirpation of numerous species and threatens the stability of biological communities around the globe. Amphibians, a taxonomic group dependent both on temperature for developmental processes and water for breeding habitats, face a diversity of threats involving climate change. The northern red-legged frog (*Rana aurora*), a California Species of Special Concern, will likely be impacted by climate change through increased temperatures and decreased precipitation in the western United States. The Institute for Wildlife Studies started collecting demographic data in northern California and central Oregon beginning in 2016 to examine how temperature and hydroperiods, seasonal patterns of water levels influence *R. aurora* tadpole development. We conducted a mark-recapture study of *R. aurora* tadpoles contained in field mesocosms at seven field sites to track tadpole development through metamorphosis. Temperature and drying rates, influencing water levels, varied among sites and years. We found that temperature influenced *R. aurora* developmental rates based on the time of season. Likewise, changes in water depth effect development of late stage tadpoles. Understanding how temperature and hydroperiods impact larval growth is an important component for managing and potentially mitigating the effects of climate change for amphibian conservation.

*Ecology and Conservation of Amphibians and Reptiles II*

*Student Paper*

### **FROM POOP TO SCOOP: A NOVEL METHOD TO SURVEY BLUNT NOSED LEOPARD LIZARD AND SYMPATRIC LIZARDS USING GENETICS AND NONINVASIVE FECAL SAMPLES.**

**Mark J. Statham**; University of California, Davis; One Shields Avenue, Davis, CA, 95616; (530) 754-7932; statham@ucdavis.edu; Michael F. Westphal, Ben N. Sacks

Noninvasive genetic sampling is a powerful technique for the study of elusive or otherwise difficult to monitor species. While such methods are widely used in birds and mammals, they have never been successfully applied on a large scale in reptiles. The blunt-nosed leopard lizard (*Gambelia sila*) is an endangered species endemic to the San Joaquin Desert of California. Presently, *G. sila* is monitored for regulatory purposes solely via visual surveys. Here we describe a novel genetic method for definitive typing of fecal samples from *G. sila* and sympatric lizard species. We developed two PCR-based assays that produce fluorescently labelled amplicons of species-specific fragment length for six lizard species in the study area. Tests on known samples indicated 100% accuracy. We successfully identified to species 78% of field-collected samples (n = 329). The majority of these samples (82%; 210 of 257) were confirmed as *G. sila*, followed by *Aspidoscelis tigris* (western whiptail; 10.5%), and small numbers of three other lizard species. Beyond the immediate application of these techniques for the study and monitoring of *G. sila*, our ability to recover usable DNA and to differentiate among a diverse group of lizards highlights the broad potential for noninvasive sampling in reptiles.

**CONSERVATION OF AN ENDEMIC REPTILE: CREATION AND POTENTIAL APPLICATIONS OF A RANGEWIDE HABITAT MODEL FOR THE FLAT-TAILED HORNED LIZARD (*PHRYNOSOMA MCALLII*).**

**Patricia M. Valcarcel**; WRA, Inc.; 2169-G East Francisco Blvd, San Rafael, CA, 94122; (415) 524-7542; valcarcel@wra-ca.com; Michael Rochelle, Kevin Clark, Melissa Stepek, Rob Lovich, Lin Piest, Felicia Sirchia, Bradford Hollingsworth

Understanding environmental variables correlated with presence of a species can aid in landscape-scale conservation planning. The flat-tailed horned lizard (*Phrynosoma mcallii*) has a restricted range in the southwestern United States and northwestern Mexico and is listed as a state sensitive species throughout its range. A Rangewide Management Strategy has been prepared to guide management of habitat and populations; however, no rangewide model had been created. We prepared a "living" rangewide habitat suitability model for *P. mcallii* with the intention that the model can be updated and refined as new information is gathered. Nearly 8,000 occurrence records and 28 environmental layers were reviewed in the process of generating a presence-only model on the MaxENT platform. Spatial and sampling biases were noted and model parameters adjusted to reduce biases. Model ground truthing focused on three survey areas within the Borrego Badlands Management Area. At the range-wide scale, land cover appears to be the most important factor determining potentially suitable habitat but some climate variables were also influential. This presentation reviews the methods to create the base of the living model, notes for sampling strategies for model creation, and potential applications of the model since it was created.

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# Ecology and Conservation of Amphibians and Reptiles III

(sorted by presentation order)

## **RATTLESNAKE COLORATION AFFECTS DETECTION BY PREDATORS.**

**Mallory V. Harmel**; California Polytechnic State University- San Luis Obispo; 3341 Buckcreek Drive, Reno, NV, 89519; (408) 706-0677; malloryharmel@gmail.com; Hayley L. Crowell, Emily N. Taylor

Crypsis, or the ability of an animal to avoid detection by other animals, is strongly related to the organism's coloration. Southern Pacific rattlesnakes (*Crotalus oreganus helleri*) vary in coloration within and among populations, suggesting selection on coloration within specific habitats and environments. The purpose of this study was to investigate the effect of coloration on likelihood of being attacked by a predator, on latency to attack, and to observe where on the snakebody predators tend to attack. Clay snake models representing four commonly observed color morphs of rattlesnakes (light color, dark color, intermediate color with white pattern, intermediate color with dark cream pattern) were placed in grassy and wooded habitats at a reserve in central coastal California, and marks made on the models by predators' teeth, beaks, and claws were quantified. We found that model type was a significant predictor of the overall number of attack marks, with dark snakes being attacked significantly more often than light snakes. The latency to attack did not differ significantly among model types. Model type was related to where on the models the marks were made although the location of the marks on the models was not significantly different. Our data show that coloration can play a large role in crypsis, and suggest that dark-colored rattlesnakes, which have the most contrast with the golden-colored grasses and therefore have the lowest crypsis, are most at risk from predation.

*Ecology and Conservation of Amphibians and Reptiles III*

*Student Paper*

## **EAT, PREY, LIVE: THERMAL ECOLOGY AND ENERGY REQUIREMENTS OF COASTAL AND INLAND POPULATIONS OF PACIFIC RATTLESNAKES (*CROTALUS OREGANUS*).**

**Hayley L. Crowell**; California Polytechnic State University; 1 Grand Ave., San Luis Obispo, CA, 93407; (301) 693-3414; hlcrowel@calpoly.edu; Emily N. Taylor

Understanding the effects of changing temperatures on ectothermic species is crucial if land managers and researchers are to make informed decisions about how to mitigate the predicted loss of diversity as a result of anthropogenic climate change. We used field-active body temperature data from free-ranging snakes to calculate field metabolic rates and average annual energy expenditure of 4 populations (2 inland and 2 coastal) of Pacific rattlesnakes (*Crotalus oreganus*) on the Central Coast of California. Snake body temperature data were collected via internal implantation of ThermoChron iButton temperature loggers from 2006 to 2017 during the snakes' active season (April-Oct). Despite dramatically different ambient temperatures at the field sites, snakes at inland and coastal sites thermoregulate such that they experience similar mean daily body temperatures. However, inland snakes are significantly larger in mass than their coastal counterparts and therefore have higher overall metabolic rates and energetic requirements. Operative temperature models were used throughout each of the four field sites in order to characterize microhabitat temperatures available and calculate thermal quality of the landscape. In combination with predicted increases in ambient temperature, probable changes in body temperatures, activity times, and energy requirements were extrapolated for each site through the year 2100.

*Ecology and Conservation of Amphibians and Reptiles III*

*Student Paper*

## **A COMPARATIVE STUDY OF HOME RANGE AND MOVEMENT PATTERNS OF COASTAL AND INLAND PACIFIC RATTLESNAKES.**

**Sebastian Gonzales**; California Polytechnic State University, San Luis Obispo; 680 Skyline Dr., San Luis Obispo, Ca, 93405; (530) 315-6031; sgonza86@calpoly.edu; Hayley Crowell, Emily Taylor

Few studies have compared home range size among different populations of snake within a given species. In this study, we compared the home ranges and daily movement patterns of coastal and inland populations of adult, male Pacific rattlesnakes (*Crotalus oreganus*) with the goal of identifying any differences across populations that could potentially be attributed to differences in their local climate. Using radio telemetry, we tracked 27 snakes (n/coastal=14, n/inland=13), from April to October of 2017. Individuals were tracked 4-5 times per week at random times throughout the day, and location was recorded via handheld GPS. Larger mean 95% home ranges were observed in the two inland sites compared to the two coastal sites (t-test;  $p=0.0172$ ), while 50% home ranges were similar across all four populations. No difference in mean daily movement was observed between inland and coastal sites. However there was significant difference in mean daily movement between the two individual inland locations (Tukey HSD;  $p=0.0169$ ). Potential causes for the observed differences in home range size across these populations include varying levels of thermal quality as well as relative food scarcity within the coastal and inland habitats.

*Ecology and Conservation of Amphibians and Reptiles III*

*Student Paper*

### **DEVELOPMENT OF A QUANTITATIVE POLYMERASE CHAIN REACTION ASSAY AND ENVIRONMENTAL DNA SAMPLING METHODS FOR GIANT GARTERSNAKES (*THAMNOPHIS GIGAS*).**

**Gregory Schumer;** Genidaqs; 3300 Industrial Blvd suite 100, West Sacramento, CA, 95691; (916) 231-1687; greggs@fishsciences.net; Scott Blankenship, Eric Hansen

Giant gartersnakes (*Thamnophis gigas*) are a visually evasive species living at low density, which results in low detection probability using standard field survey methods (e.g., traps, video). Enhancing survey method sensitivity through use of eDNA survey techniques would improve compliance monitoring under the Endanger Species Act, recovery planning for *T. gigas*, and evaluation of California's Central Valley tule marsh habitat on which this species depends. We designed and validated diagnostic qPCR assays for identifying fragments of the Cytochrome B (CytB) and the NADH dehydrogenase 4 (ND4) genes of the *T. gigas* mitochondrial genome. The ND4 qPCR assay was shown to be not specific to *T. gigas* DNA and amplified DNA from closely related and co existing *Thamnohpsis*. The CytB *T. gigas* qPCR assay proved specific to a species and reliably detected *T. gigas* DNA. Coordinated field sampling was conducted at aquatic sites with an observed and documented population of *T. gigas* with the intent of refining eDNA sample collection and survey protocol. This presentation will provide an overview of qPCR assay development, refinement of eDNA field survey protocol, and the application of an eDNA survey to establish a contemporary occupancy model for *T. gigas*.

*Ecology and Conservation of Amphibians and Reptiles III*

### **SPATIAL AND TEMPORAL PATTERNS OF GIANT GARTERSNAKE (*THAMNOPHIS GIGAS*) DECLINE AND EXTINCTION IN CALIFORNIA'S CENTRAL VALLEY: PRIORITIZING RECOVERY IN A STATE.**

**Eric C. Hansen;** Consulting Environmental Biologist; 4200 North Freeway Boulevard, Suite 4, Sacramento, CA, 95835; (916) 214-7848; echansen@sbcglobal.net; Rick D. Scherar

Endemic to the low-gradient streams, wetlands and marshes of California's Great Central Valley, giant gartersnake (*Thamnophis gigas*) populations have long been associated with declines corresponding with deteriorating habitat quality and perennial wetland loss. Now absent from more than half of their former range, *T. gigas* have been extirpated from the once-expansive wetlands of Tulare and Buena Vista lakes and presently occupy only a small number of localities in the central San Joaquin Valley associated with rapid declines. Recovery strategies address this loss by emphasizing the more robust *T. gigas* populations associated with rice agriculture in the Sacramento Valley, which in turn may be used to reestablish populations and genetic variation where extinctions have occurred. However, recent work suggests genetic variation is low for *T. gigas* throughout its range and that alarming and unexpected declines are occurring even in localities intended to serve as anchors for repatriation and recovery. While recent work provides new insights on vital rates such as growth, survival, and fecundity that will be key to managing extant populations, acting quickly to describe and preserve genetic diversity and adaptive traits may be crucial to maintaining the species under scenarios of increasing water scarcity and projected climate change.

## **5 SIMPLE STEPS FOR MASTERING R.**

**Mitchell A. Gritts**; Nevada Department of Wildlife; 6980 Sierra Center Parkway, Reno, NV, 89509; (775) 688-1405; mitchellgritts@gmail.com;

The popularity of R has increased dramatically over the last several years. It ranks as the number 7 most popular programming language by Institute of Electrical and Electronics Engineers' annual ranking of programming languages. R is used extensively in wildlife ecology, and is one of the go-to languages for data science and big data. Companies like Microsoft and Oracle have begun including it within some of their products. That being said, learning R can be tricky, especially if you have little programming experience, and the learning curve is steep. Mastering R takes years of effort. I will present a few of the methods I've learned over the years that I wish I had known when I started working with R. As R's use in wildlife ecology research increases it is critical to equip all R users with the tools to help them succeed.

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# Ecology and Conservation of Bats I

(sorted by presentation order)

## **ISLAND AREA AND DIET BREADTH EXPLAIN THE DIVERSITY AND DISTRIBUTIONS OF BATS AMONG THE SAN JUAN ISLANDS.**

**Rochelle M. Kelly**; University of Washington; Department of Biology, box 351800, Seattle, WA, 98195; (925) 360-7413; rmkelly@uw.edu; Sharlene E. Santana, Leah J. Rensel

Island Biogeography Theory (IBT) is one of the most well-known postulations explaining patterns of species diversity among oceanic islands, and it has been widely used to inform conservation within human altered landscapes. In this study, we investigate the effects of island area, isolation, and habitat quality (e.g., forest cover, snag density) in shaping the diversity of bats among the San Juan Archipelago. We test whether Pacific Northwest bats follow IBT predictions, and also evaluate whether differences in species morphological or ecological traits influence their distribution patterns. We assessed bat communities using acoustic and mist net surveys along the Northwest coast of Washington and 21 of the San Juan Islands, representing a gradient of size, forest cover, and isolation. In total, we documented nine species across the islands and coastal mainland. Whereas island area strongly influenced patterns of species richness, neither isolation nor habitat quality were significant at the scale of our study. Additionally, we found that dietary breadth, as opposed to body size, best predicted the prevalence of species across the islands. Our study provides insight into how geographic factors affect the diversity of bat communities as well as how ecological traits mediate species distributions in fragmented landscapes.

*Ecology and Conservation of Bats I*

*Student Paper*

## **EFFECTIVENESS OF ABANDONED MINE RECLAMATION FOR THE CONSERVATION OF BATS.**

Casey Devine-Rosser; Christopher Newport University; Dept. of Organismal & Env. Biology, 1 Avenue of the Arts, Newport News, VA, 23606; (757) 630-6187; casey.devinerosser.13@cnu.edu; Rick E. Sherwin, Jason Williams, Linda S. DeLay, **Rick E. Sherwin**

There has been growing concern regarding the long-term viability of bat colonies and even species that habitually roost in abandoned mines. Initially, managers were concerned that the concentration of large numbers of individuals in the same location leaves them susceptible to vandalism, abandoned mine reclamation, and/or stochastic perturbations. The simplest solution to this problem has been to install bat compatible closures over entrances of biologically important features, while sealing those which are biologically insignificant or cannot be safely secured. To date, thousands of bat compatible closures have been installed in the western United States and tens of thousands of dangerous abandoned mines have been permanently sealed. Despite the apparent success of these efforts, there is increasing debate regarding the acceptability by bats of different gate designs, construction materials, and structural enhancements. In recent years anecdotal observations that bats reject gates which include culverts (installed to maintain the integrity of the portal and structural support for the gate) have been used to suggest that culverts will not be used by bats. In this study we will present data from our long term monitoring of colonies of Townsend's big-eared bats in abandoned mines throughout the western U.S. This talk will focus on the short and long term response of bats to traditional bat gates compared with gates installed in culverts. Response variables include types of use (pre and post closure), numerical and/or behavioral changes, and spatio-temporal changes in dynamics of roost use. We compare sites closed with traditional bat gates and gates which include culverts in areas impacted by large scale abandoned mine reclamation programs (i.e., all mines either gated or closed), and in areas where the only treatments are the gates (i.e., no concurrent closures of other mines in the landscape).

*Ecology and Conservation of Bats I*

## **ROOST SELECTION IN A HOARY BAT (*LASIURUS CINEREUS*) MIGRATORY STOPOVER**

## **LOCATION IN NORTHERN CALIFORNIA.**

**Skye Salganek** ; Humboldt State University ; 1 Harpst Street, Arcata, CA, 95521; (505) 610-4282; [skye@humboldt.edu](mailto:skye@humboldt.edu); Theodore J. Weller, Joseph M. Szewczak

As North America becomes increasingly fragmented in the Anthropocene, it is important to conserve stopover locations for migratory species and understand the variables that drive habitat selection during migration. The hoary bat (*Lasiurus cinereus*) is a species that makes seasonal long-distance migrations to access suitable seasonal habitat. Humboldt Redwoods State Park, California is one of the few known locations where hoary bats can be captured in abundance during the autumn. Potential explanations for the capture reliability at this site include its role as a migratory stopover location, an area important to their reproductive biology, or an overwintering site. Our objective was to identify important habitat variables in daytime roost selection and determine occupancy of this area during the winter. In 2017 and 2018, we used VHF telemetry to track 15 hoary bats to 29 roost locations. We supplemented our data with an additional 10 roost locations obtained from three individuals outfitted with GPS transmitters in 2014. Variables from 78 used and available roost sites were extracted by spatial analysis of remotely sensed data. We used multiple logistic regression models including variables such as canopy height, solar radiation, and distance to roads to evaluate significant characteristics in roost selection.

*Ecology and Conservation of Bats I*

*Student Paper*

## **BATS IN THE MEGAFIRE: HOW HIGH INTENSITY WILDFIRE IS SHAPING NOCTURNAL FOOD WEBS IN THE WESTERN SIERRAS.**

**Haley Mirts**; 120 C St, Apt #5, Davis, CA, 95616; (530) 680-2025; [hemirts@ucdavis.edu](mailto:hemirts@ucdavis.edu); Rahel Sollmann, Angela White, Hillary Young

The coniferous forests of the Sierra Nevada are undergoing unprecedented ecological change owing to drought, pests, and large high-severity wildfires (aka "megafires"). These impacts can cause fundamental changes to food webs, and thus ecosystem stability. The primary focus of this research is to investigate 1) how understudied bat communities respond to megafires 2) and whether this response is driven by prey availability. Data were collected at 27 sites of varying burn severity (unburned, mixed and high severity) within and adjacent to the perimeter of the 2014 King Fire in the Eldorado National Forest, between June and September 2017. Nocturnal insects were surveyed using blacklight traps to estimate prey availability and biomass. 17 Species of bats were detected using acoustic recordings, including several species listed as CSSC. The bat species detected varied in their response to fire, with most species displaying aversion to moderately burned habitat. We report results of the wildfire impacts, community restructuring, and the influence of prey availability. This study contributes valuable information about how megafires restructure ecological communities and networks. Megafires are predicted to become more frequent across the Western United States, and studies like the present one can help manage post-fire habitat by influencing forestry policy.

*Ecology and Conservation of Bats I*

*Student Paper*

## **COLLABORATIVE ACOUSTIC MONITORING CAN PROVIDE EFFICIENT MULTIPLE-SPECIES MONITORING OF BATS IN CALIFORNIA.**

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Bats are important components of biodiversity and ecosystem integrity, but are often overlooked or under sampled in conservation assessments due to challenges of monitoring their populations. Recent advances in echolocation detection hardware and software applications used to detect species presence and characterize activity levels have ameliorated some of these challenges. I present the results of acoustic monitoring efforts in California during 2016-2018, highlighting the variety of contributors to the data compilation. Summer deployments of detectors have resulted in identification of large proportions of the local bat species assemblage after only a few nights of unattended monitoring. Additionally, new detections of species of conservation concern provide data useful for updating species distributions and habitat associations within the state. The North American Bat Monitoring Program provides a flexible

framework for survey effort allocation that can be employed to achieve statistically robust monitoring at multiple spatial scales, including at the statewide level. A relatively low-cost statewide, multiple-species bat monitoring program that requires moderate levels of engagement by individuals is achievable if data and resources are pooled and coordinated.

*Ecology and Conservation of Bats I*

## **ELUCIDATING PATTERNS OF BAT SPECIES OCCUPANCY ACROSS A DISTURBED LANDSCAPE IN CALIFORNIA'S CENTRAL VALLEY.**

**Trinity N. Smith**; Humboldt State University; 1 Harpst St, Arcata, CA, 95521; (775) 340-4754; trinity.smith@humboldt.edu;

California's Central Valley, one of the most productive agricultural regions in the world, is home to 17 species of resident and migratory bats. The Central Valley ecoregion has been identified as a crisis ecoregion, and a high number of species are at risk due to habitat conversion and drought. In response to high intensity drought from 2011-2016, California Department of Fish and Wildlife implemented the Terrestrial Species Stressor Monitoring (TSM) project, which in part aimed to collect baseline occupancy data and habitat associations for bats. We conducted bat surveys using SM3BAT acoustic detectors at 274 sites spanning the Central Valley in both the driest year on record (2016) and the wettest year on record (2017). The resulting bat species detections were processed using Kaleidoscope software and were then manually vetted. These detection histories will be used to determine species-specific occupancy patterns for bats in the Central Valley, which can be used by managers to assess critical habitat areas.

*Ecology and Conservation of Bats I*

*Student Paper*

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## Ecology and Conservation of Bats II

(sorted by presentation order)

### THE USE OF SCENT DOGS DEMONSTRATES SPATIAL FATALITY PATTERNS AT A CALIFORNIA WIND FARM.

**Dave S. Johnston**; 983 University Ave Bldg D, Los Gatos, CA, 95032; (408) 448-3226; djohnston@harveyecology.com; Jeff P. Smith, Andrea K. Wuenschel, M. Murrelet Halterman, Michele L. Childs

Few studies have shown spatial differences among fatalities at wind turbines. Fatality studies using human searchers may not provide a high enough percentage of fatalities to detect spatial relationships. We hypothesized that a better searcher efficiency rate might lead to a better understanding of fatality patterns. We used scent dogs to increase our ability to detect fatalities at a project with 48 turbines at Altamont Pass in California where most previous studies suggest few bat fatalities. We used a Hot Spot analysis in ArcGIS 10.4.1 (ESRI, Inc., Redlands, CA) to quantify the degree to which fatalities were spatially clustered. The first year we found 229 bats including 133 (58%) *Tadarida brasiliensis*, 84 (37%) *Lasiurus cinereus*, and seven (3%) *Lasiurus blossevillii*. The hot spot analysis identified one turbine with 17 fatalities as a strong hot spot ( $P < 0.01$ ) and another turbine with 12 fatalities as a moderate hot spot ( $P < 0.03$ ). Additionally, five of seven western red bat fatalities were distributed within a narrow (~213 meters) east - west band occurring between latitudes 37.711743 deg and 37.708948 deg. Knowing spatial differences in fatality rates among turbines or within projects could be useful for developing mitigation strategies for new projects.

*Ecology and Conservation of Bats II*

### MANAGING FARMLANDS TO CONSERVE BATS.

**Elissa M. Olimpi**; University of California, Davis; 1088 Academic Surge, One Shields Ave., Davis, CA, 95616; eolimpi@gmail.com; Stacy M. Philpott

Agricultural lands account for ~40% of Earth's terrestrial surface area, contributing to a global biodiversity crisis. The expansion and intensification of agriculture make it critical to develop guidelines for conservation within these working landscapes. Existing strategies for conserving farmland bats, such as the addition of bat houses and creation of treelines and hedgerows, are often not feasible for farmers interested in conserving insectivorous bats due to concerns relating wildlife to food safety risks. To inform bat management in farmlands, we conducted an acoustic survey of bats on farms in the California Central Coast and in nearby natural areas to see which existing farm and landscape features promote bats. We recorded over 36,000 bat calls and 12 species, and found that bats strongly preferred woodlands to farm fields. Within farm fields, we found that farms with more crop diversity had greater activity of forest-associated bats, regardless of available habitat surrounding farms. At the landscape level, we found the most concentrated bat use of woodlands in long, narrow woodland fragments in intensive agricultural landscapes, despite significant anthropogenic impacts to these woodlands. Our research provides two new management strategies to conserve farmland bats.

*Ecology and Conservation of Bats II*

### IMPACTS OF TROUT INTRODUCTION ON BAT ACTIVITY AT HIGH-ELEVATION LAKES IN THE SIERRA NEVADA.

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Beginning in the late 1800s, land managers introduced trout to the majority of the Sierra Nevada's historically fishless high-elevation watershed to promote recreational angling. Most studies on the impacts of these introductions have focused on aquatic ecosystems and revealed a starkly lower relative abundance

and diversity of most macroinvertebrate groups at fish-containing lakes, but much less is known about the effects on terrestrial consumers of these emerging insects. We investigated bats' use of high-elevation (>3000m) lakes as a source of highly profitable prey, predicting that bats are more active at fishless lakes where macroinvertebrate abundance is greater. In summer 2014, we collected nighttime acoustic recordings of bats at 3 pairs of fish-containing and fishless lakes in Sequoia-Kings Canyon National Park. We identified bats to acoustic clade using Sonobat and report on diel and seasonal timing of bat activity at high-elevation lakes and bat activity with respect to fish presence using GLMs. Contrary to our predictions, call activity of high-frequency bats were more numerous at fish-containing lakes, corroborating the results of the only other study done to date on impacts of introduced trout on bat activity. We discuss various limitations of acoustic data and suggest that future work include in-person surveys and diet estimation to more robustly describe patterns in calling activity with bat abundance and feeding patterns.

*Ecology and Conservation of Bats II*

*Student Paper*

#### **ASSESSMENT OF THE STATUS OF THE TOWNSEND'S BIG-EARED BAT IN CALIFORNIA.**

**Leila S. Harris**; Department of Wildlife, Fish, and Conservation Biology; University of California, Davis, CA, 95616; (650) 455-6184; leiharris@ucdavis.edu; Michael L. Morrison, Joseph M. Szewczak, Scott D. Osborn

Townsend's big-eared bat (*Corynorhinus townsendii*, COTO) is a California Species of Special Concern. Pierson and Rainey (1998) conducted the only previous statewide field study of its status. We assessed COTO's current California distribution by revisiting previously-known roosts and other sites. We compiled roost information by searching literature and databases and contacting biologists/managers for unrecorded sites. Our sample framework was NABat's 10km by 10km grid. We surveyed 2 winters and 3 active seasons during 2014-2017. We sampled 304 grid cells (206 summer, 98 winter) and surveyed 620 potential roosts. We located COTO at 209 active season non-maternity roosts, 84 maternity roosts, and 80 hibernacula. Half of maternity roosts were in mines, 29% in caves, and the remainder in other structures. 58% of roosts had sign of disturbance. We confirmed COTO at 53 of 80 historical summer sites and 37 of 63 historical winter sites. We determined status of two-thirds of Pierson and Rainey's sites. Of those, about half remained active. That study reported 39-43 maternity colonies. We documented 84; however, it is unlikely this represents population expansion. Further, decadal persistence does not equate to stable populations. COTO remains well-distributed in California, but suitable roosts will continue to decrease unless actively managed.

*Ecology and Conservation of Bats II*

*Student Paper*

#### **LONG-TERM BANDING OF CALIFORNIA LEAF-NOSED BATS ALONG THE LOWER COLORADO RIVER TO DETERMINE MOVEMENTS AND LONGEVITY.**

**Patricia Brown**; Brown-Berry Biological Consulting; , Bishop, CA; patbobbat@aol.com; Philip Leitner, Albert Beck, Bruce Miller

California leaf-nosed bats (*Macrotus californicus*) are residents of the Sonoran Desert in California and Arizona and are active all year. These populations are interesting in part as the northern margin of the semitropical distribution of a non-hibernating Phyllostomid genus. In 1958, a long-term banding study was initiated to examine demography and movements of these bats in the temperate zone along the Lower Colorado River (LCR). The bats were captured principally in the winter in warm mines along the LCR in seven mountain ranges. In 60 years, over 15,000 bats have been banded, and almost 5,000 individuals have been recaptured between one and eight times, for a total of over 8,500 recapture events. Roost fidelity is high, with occasional movements between adjacent mountain ranges between years and seasonally. The longest interval between initial banding and recapture is 16 years which is an impressive age for a bat of tropical ancestry. At the time of banding, the degree of tooth wear (1-4) was recorded initially and during subsequent recaptures, to establish a metric to determine the approximate age of unbanded bats in the population.

*Ecology and Conservation of Bats II*



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# Ecology and Conservation of Birds I

(sorted by presentation order)

## **DETERMINING PREVALENCE AND DIVERSITY OF AVIAN POX IN CALIFORNIA HUMMINGBIRDS.**

**Hanna E. Baek**; San Francisco State University; 101 Orr Road, Alameda, CA, 94502; (818) 577-6365; hbaek@mail.sfsu.edu; Lisa A. Tell, Ravinder Sehgal

The presence and impact of avian diseases on hummingbirds have been severely understudied despite the strong presence of hummingbirds in California. How is disease impacting hummingbird populations in California? This research is focusing on a viral disease known as avian pox, which is caused by species in the genus Avipoxvirus. Avian pox can be transmitted by mosquitoes and contact with contaminated surfaces. Avian pox can lead to difficulty breathing and eating through the development of wart-like lesions on the skin of infected birds. PCR analysis of blood samples, feather samples, and skin swabs of two species of hummingbird: Anna's hummingbird (*Calypte anna*) and Allen's hummingbird (*Selasphorus sasin*) is ongoing. Avian pox has been detected via PCR; however, further testing and analysis must be done. The project's goal is to estimate the prevalence of avian pox in these two species of hummingbird as well as to determine which species of Avipoxvirus are infecting hummingbirds. A secondary goal is to determine if infection can be detected in different types of samples, particularly in feathers.

*Ecology and Conservation of Birds I*

*Student Paper*

## **INVESTIGATING RELATIVE DISTURBANCE RISK TO SEABIRDS AND PINNIPEDS IN NORTHERN CALIFORNIA.**

**Claire Nasr**; Humboldt State University, Wildlife Department; 1 Harpst Street, Arcata, CA, 95521; (530) 520-1628; cmn15@humboldt.edu; Daniel C. Barton, Shannon Brinkman

Rocky coastlines incur high impacts from human use, but these places are also essential habitat for seabirds and pinnipeds (seals and sea lions). Understanding risks of disturbance to marine wildlife from human use can inform science-based cooperative management in areas where humans and wildlife overlap. Marine wildlife use coastal rocks to breed, rest, and engage in social interaction and exhibit different habitat use during the breeding and non-breeding season. Temporal change in use is determined by oceanographic variability, which influence prey availability, and consequently shape obligate behaviors such as caring for young. Peak timing of human use occurs in spring/summer, coinciding with breeding seasons for colonial seabirds and gregarious pinnipeds. The high potential of spatial and temporal overlap between human and seabird use of rocky coastlines (especially in the summer months) could lead to high risk of disturbance events such as flushing individuals from nests or separating mom-pup pairs. We investigate relative risk of disturbance to marine wildlife from human use activities using spatial overlap analysis in Trinidad, California. Results will identify targeted management areas, provide a risk assessment based on seasonal use patterns, and help target specific user groups for education, outreach and enforcement for marine wildlife protection.

*Ecology and Conservation of Birds I*

*Student Paper*

## **INTEGRATING NEST SITE SELECTION AND SURVIVAL CONSEQUENCES FOR GREATER SAGE-GROUSE IN THE ANTHROPOCENE.**

**Shawn T. O'Neil**; Western Ecological Research Center, U.S. Geological Survey; 800 Business Park Dr. Suite D, Dixon, CA, 95620; (701) 741-4361; soneil@usgs.gov; Peter S. Coates, Brianne E. Brussee, Mark A. Ricca, Shawn P. Espinosa, David J. Delehanty

Mass decline, extirpation, and extinction of species brought on by the degradation of global ecosystem function and services are hallmark traits of the contemporary Anthropocene. In the southwestern U.S., species such as the greater sage-grouse (*Centrocercus urophasianus*) are threatened by continued habitat

loss resulting from direct and indirect anthropogenic disturbances, including energy development, increased extent and severity of wildfire, cheatgrass invasion, and increased predator densities. Under these conditions, sage-grouse may exhibit maladaptive habitat selection patterns, brought on by strong breeding site fidelity in areas undergoing rapid environmental change. Understanding these patterns is critical for species conservation, in part because habitat mapping efforts typically fail to account for this decoupling between habitat selection and reproductive success. We demonstrate a two-stage modeling approach that integrates nest site selection by sage-grouse and the probability of nest success at the population level. Importantly, this approach can be used to infer the relative probability that a habitat is selected while also contributing positively to breeding productivity, thereby identifying high probability source habitats. We apply this technique to local nesting sage-grouse populations and discuss implications for managing habitat and populations of sensitive species in the Anthropocene. Findings are preliminary and provided for best timely science.

*Ecology and Conservation of Birds I*

### **LINKING MICRO AND MACRO-SCALE HABITAT FACTORS TO VITAL RATES OF DECLINING RING-NECKED PHEASANTS IN THE CENTRAL VALLEY OF CALIFORNIA.**

**Ian A. Dwight**; U.S. Geological Survey; 800 Business Park Drive, Dixon, CA, 95620; (916) 838-0351; idwight@usgs.gov; Peter S. Coates, Jessica H. Vogt, Joseph P. Fleskes, Daniel P. Connelly, Scott C. Gardner

Avian species within agricultural landscapes of California have experienced considerable declines in recent decades. Large-scale changes in farming practices have been reported as major drivers of population dynamics, but effects of habitat conditions at multiple spatial scales on probability of occurrence and demographic rates (e.g., nesting and brood rearing) are not well documented for many species. We evaluated factors influencing demographic rates of ring-necked pheasant (*Phasianus colchicus*; hereafter, pheasant), a potential biomonitor species, within the Central Valley of California. Specifically, we measured environmental characteristics directly at nest and brood locations in the field, as well as within a Geographic Information System, to characterize large-scale effects relative to radio-marked female pheasant (n = 190) across five study areas during 2013-2017. We used these environmental factors as covariates in models of selection and survival. Our models indicate that management actions focused on promoting increased perennial grass cover at the microsite level and proportion of upland vegetation at larger spatial scales would be most influential toward increasing recruitment rates of pheasant. Evaluating environmental factors influencing selection and fitness can help guide management aimed at increasing productivity of pheasant and native farmland bird species. Findings are preliminary and provided for timely best science.

*Ecology and Conservation of Birds I*

### **LANDSCAPE AND VEGETATION FEATURES IMPROVE RESTORATION SUCCESS FOR BIRDS: USING THE RIPARIAN BIRD INDEX TO EVALUATE CREEK RESTORATION IN CALIFORNIA RANGELANDS.**

**Kathleen E. Grady**; Sonoma State University; 1801 E Cotati Blvd, Rohnert Park, CA, 94928; (415) 728-8193; kgrady121@gmail.com; Derek J. Girman, Tom A. Gardali

In Marin and Sonoma Counties in California, riparian restoration aims to counter the negative effects - a decline in riparian habitat and its associated benefits - that grazing has often had. We examined avian response to riparian restoration on grazed lands to measure restoration success. We conducted avian surveys on 40 plots within 20 sites in seven years between 2001 and 2016. Sites ranged from 0 to 27 years since revegetation. All surveys were scored using the Riparian Bird Index (RBI), a richness index that gives higher scores for species more closely associated with riparian vegetation. RBI scores were found to increase with increasing restoration age. Vegetation data were collected in 2016 to examine the effect of local vegetation on RBI score. Canopy cover and non-willow tree canopy were found to be significant predictors of RBI score. At the landscape scale, the highest-ranked model suggests that corridor width and the size and proximity of the nearest protected area were significant for RBI score. Our study shows that riparian restoration within this study area has been successful for birds. We suggest restoration planners

target sites close to large protected areas, plant diverse native tree species to increase canopy cover, and maximize the width of restored areas.

*Ecology and Conservation of Birds I*

## **REPRODUCTIVE SUCCESS OF COMMON RAVENS INFLUENCES NEST PREDATION RATES OF THEIR PREY: IMPLICATIONS FOR EGG-OILING TECHNIQUES.**

**Brianne E. Brussee**; U.S. Geological Survey; 800 Business Park Dr. Suite D, Dixon, CA, 95818; (530) 669-5071; bbrussee@usgs.gov; Peter S. Coates

Increased abundance and distribution of Common Ravens (*Corvus corax*) across western North America is a likely characteristic of the Anthropocene, and effective measures are often needed to minimize raven impacts on sensitive prey species. We designed a 6-year study using remote videography on nests of ravens and their prey (black-crowned night-herons, *Nycticorax nycticorax*) on Alcatraz Island. Our goals were to: 1) document effects of oiling raven eggs, a technique designed to kill eggs, on raven reproduction; and 2) estimate subsequent impacts of reduced raven hatching success on night heron nest and chick survival. Results from Bayesian multinomial logistic exposure models revealed that daily predation rates on night-heron nests and chicks were the highest during years when ravens nested successfully. Daily predation rates on night heron nests and chicks decreased during years with raven egg-oiling, and the lowest daily predation rates for nests occurred during years when ravens did not naturally nest on the island. Survival of night heron eggs and chicks was also highest during years when ravens were present but not nesting on Alcatraz. Our results suggest that egg-oiling can be a viable localized method to reduce raven recruitment and may aid in the conservation of sensitive avian species.

*Ecology and Conservation of Birds I*

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# Ecology and Conservation of Birds

## II

(sorted by presentation order)

### **RIPARIAN BIRDS AND BATS RELY ON FOOD CHAINS THAT BEGIN IN RIVERS.**

**Breeanne K. Jackson**; Yosemite National Park; PO Box 700, El Portal, CA, 95318; (209) 379-1454; breezy\_jackson@nps.gov; Sarah L. Stock, Leila S. Harris, Joseph M. Szewczak, Lynn N. Schofield, Michelle A. Desrosiers

River regulation can modify natural flow regimes with deleterious effects on aquatic communities. While the effects of flow manipulation on the physical environment and populations and assemblages of aquatic organisms has been described more thoroughly, how and to what extent river regulation influences ecosystem processes like food-web architecture is less studied. Emergent aquatic insect prey can provide an important food resource to riparian birds and bats with concomitant consequences for nutrient cycling through aquatic-terrestrial food webs. We used stable isotopes of carbon and nitrogen to compare food web architecture (trophic position and reliance on an aquatic-nutritional pathway) leading to birds and bats between a regulated river system and an unregulated river system located on the west slope of the Sierra Nevada, CA. We found that both birds and bats derived greater than 50% of their nutrition from food webs supported by photosynthesis by algae. In addition, bats occupied a similar trophic position to predatory fish in other systems. We observed no difference in food web architecture leading to birds and bats attributable to river regulation despite strong reliance on aquatic-terrestrial food webs.

*Ecology and Conservation of Birds II*

### **GIS TOOLS TO PREDICT NESTING HABITAT SUITABILITY OF WOODPECKERS AND BAT OCCUPANCY FOR POST-FIRE PLANNING IN THE SIERRA NEVADA.**

**Brent R. Campos**; Point Blue Conservation Science; 3820 Cypress Drive #11, Petaluma, CA, 94954; (530) 665-6413; bcampos@pointblue.org; Quresh S. Latif, Zachary L. Steel, Ryan D. Burnett, Victoria A. Saab

Burned forests provide habitat for many wildlife species. Land managers need information about habitat needs of these species to reduce negative impacts from post-fire management. Woodpeckers are focal species for informing management of recently burned forests. Bats are of increasing management concern, but little information exists on their habitat associations in post-fire landscapes in the Sierra Nevada. Habitat suitability models can be important tools for identifying areas that are likely to be used by wildlife in newly burned forest. Given limited time and funding for new wildlife surveys, managers need to be able to quickly apply these models soon after wildfire occurs. Here we present predictive models and user-friendly tools that map woodpecker nesting habitat and bat occupancy across burned mixed-conifer and true fir forests of the Sierra Nevada. We developed tools for four species of woodpecker using nest location data from three wildfires in the northern Sierra Nevada 1-5 years post-fire. We also developed tools for seven species of bat using data collected from three wildfires in the Sierra Nevada 1-13 years after fire. The tools are operable with limited technical expertise and provide data-driven information to inform management of these species in post-fire landscapes of the Sierra Nevada.

*Ecology and Conservation of Birds II*

### **PREDICTIVE TRAITS INDICATE AVIAN RESPONSE TO ANTHROPOGENIC NIGHTLIGHT AND NOISE.**

**Ashley A. Wilson**; California Polytechnic State University; 1 Grand Ave, San Luis Obispo, CA, 93407; (520) 339-9852; awilso76@calpoly.edu; Neil H. Carter, Jesse R. Barber, Eliot Miller, Clinton D. Francis

Anthropogenic nightlight and noise (ANLN) pollutants can alter species' physiology, behavior, and life

history by masking biologically relevant cues, as well as impairing species' abilities to interpret and react to sensory stimuli. Although evidence that ANLN influence several different species is mounting, an understanding of which fundamental traits of an organism-- whether they are morphological, physiological, or ecological-- are related to susceptibility to ANLN is unknown. Here, we analyze the relationship between functional traits and relative effect sizes to ANLN and other anthropogenic stressors to evaluate changing bird abundances at a continental scale. Observations of 140 species were compiled from Project FeederWatch's citizen science database during the winters between 2007 and 2012. Of these species, 41% and 26% altered their abundance in response to noise and nightlight, respectively. We extracted traits related to each species' foraging attributes, body size, visual and acoustic capabilities and paired them with several macroecological variables that reflect urbanization impacts. Establishing predictive traits will provide managers and policy makers inference on how unstudied species will respond to ANLN. Additionally, this trait-based approach has the potential to inform mitigation efforts through an understanding of the mechanisms by which ANLN affects wildlife.

*Ecology and Conservation of Birds II*

*Student Paper*

## **CALIFORNIA'S RANGELANDS MATTER FOR BIRDS.**

**Mel Preston**; POB 705, Pescadero, CA, 94060; (650) 879-0804; mpreston@pointblue.org; Ryan DiGaudio, Hilary Allen, Bonnie Eyestone, Libby Porzig

Roughly half of the land in California is categorized as rangeland, much of which (22 million acres) is privately owned. In addition to its use for livestock grazing, rangelands provide important habitat for wildlife and numerous ecosystem services. About 17 million acres of rangeland in California are oak woodland and grassland habitat, approximately 80% of which is privately owned. In this study we assess the abundance and richness of bird species across oak woodland and grassland habitat in California rangelands. We use breeding season point count data collected between 2015 and 2018 to illustrate bird community structure and abundance on rangelands found throughout California, specifically around the edges of the Sacramento and San Joaquin valleys and in the Central Coast region. Although management and grazing regimes varied across sites, we did not evaluate the effect of management as part of this study. We compare our findings to various statewide, regional, and habitat-specific conservation objectives and population targets in order to evaluate the conservation value of rangelands in terms of supporting landbird populations. Our findings highlight the importance of rangelands for landbirds, and underscore the need to protect remaining rangeland from conversion and fragmentation.

*Ecology and Conservation of Birds II*

## **WHITE-HEADED WOODPECKER (*PICOIDES ALBOLARVATUS*) NESTING HABITAT SELECTION: ARE THEY MAKING GOOD CHOICES?**

**Kathryn L. Purcell**; US Forest Service, Pacific Southwest Research Station; 2081 E. Sierra Avenue, Fresno, CA, 93710; (559) 916-4634; kpurcell@fs.fed.us; Eric McGregor, Jim Baldwin

We studied white-headed woodpeckers (*Picoides albolarvatus*) in the Sierra Nevada, California and collected data on nesting habitat at three spatial scales. Habitat selection models at the nest site and 125-ha scales best predicted white-headed woodpecker nest occurrence. At the nest site scale, white-headed woodpeckers nested in areas with open canopy, fewer large trees, more snags, and in more decayed substrates compared to random plots but no variables were important for nest survival. At the 1-ha scale, white-headed woodpeckers nested in areas with more conifers and fewer snags but again no variables were important for nest survival. At the 125-ha scale, models for habitat selection and nest survival were in agreement. Nests were found and were more successful in areas of higher canopy cover of conifers with high edge density. Viewed across multiple spatial scales, white-headed woodpeckers selected heterogeneous landscapes. At nest sites they selected areas with low canopy cover while at the home range scale they selected and were more successful within forests of moderate canopy cover and high edge density. Taken together, our results suggest white-headed woodpeckers nest in areas with access to decayed snags, forest openings, and moderate canopy cover at the landscape scale.

*Ecology and Conservation of Birds II*

## **THE EFFECTS OF NOISE AND LIGHT POLLUTION ON BIRD AND BAT DIVERSITY.**

**Jennifer Phillips**; 1 Grand Ave, San Luis Obispo, CA, 93657; (559) 960-0520; jnphilli26@gmail.com;  
Helen Payne, Waverly Davis, Clinton Francis

Over evolutionary timescales the sensory environment has provided reliable channels for acoustic and visual communication and biological rhythms. Recently, the rise in multimodal anthropogenic pollution--noise and nightlight--present conditions that could fundamentally disrupt the ways in which organisms interact and respond to environmental cues. Because these stimuli typically co-occur in today's human-dominated world, understanding their combined influence is an urgent conservation priority. Here, we test the effects of noise and nightlight on bird and bat diversity in a pinon-juniper forest in northwest New Mexico. We measured species richness in both bird and bat communities, using presence/absence surveys and nesting attempts to determine bird diversity, and passive acoustic detectors to determine bat species diversity. We expect Noise to decrease bird and bat diversity and decrease avian nesting attempts, whereas Light increases avian nesting attempts but increases depredation. For bats, we expect to see increases in bat diversity at lights due to increased insect activity. Thus, we expect Light+Noise will have mixed effects on bird and bat diversity.

*Ecology and Conservation of Birds II*

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# Ecology and Conservation of Birds III

(sorted by presentation order)

## **OCCUPANCY MODELS AND STABLE ISOTOPE ANALYSES INDICATE POTENTIAL COMPATIBILITY OF CALIFORNIA SPOTTED OWL CONSERVATION AND PRIVATE LAND MANAGEMENT.**

**Brendan K. Hobart**; University of Wisconsin - Madison; 1630 Linden Dr., Madison, WI, 53706; (262) 422-8533; bkhobart@wisc.edu; Kevin N. Roberts, Brian P. Dotters, William J. Berigan, Sheila A. Whitmore, Martin G. Raphael, John J. Keane, R.J. Gutierrez, M. Zachariah Peery

California spotted owls (*Strix occidentalis occidentalis*) inhabit mixed-ownership landscapes throughout the Sierra Nevada but most previous research on this subspecies has occurred on public lands. Thus, relatively little is known about the impact of private lands - and forest management upon them - on California spotted owl ecology and conservation. Therefore, we conducted the first large-scale private-public cooperative study of California spotted owls inhabiting mixed-ownership landownerships. We surveyed 151 spotted owl territories from 2013 to 2017 within two study systems: one comprised primarily of public lands (national forests) where the owl population has declined over the last ~20 years and a set of study areas comprised mostly of private lands on which relatively high estimates of site occupancy were recently reported. Multistate occupancy models indicated higher occupancy and reproduction probabilities in the private-land dominated study area but suggested that such differences were the result of variation in topographic and land-cover conditions that may promote populations of key spotted owl prey species. Follow-up stable isotope analyses suggest a positive relationship between spotted owl population status and dietary proportion of early-seral associated small mammals (*Thomomys* and *Neotoma* spp.). Our research thus indicates that private lands may play a critical role in spotted owl conservation.

*Ecology and Conservation of Birds III*

*Student Paper*

## **STICKTIGHT FLEAS TAKE HOLD IN A SOUTHERN CALIFORNIA BURROWING OWL POPULATION: IMPLICATIONS FOR ARTIFICIAL BURROW DESIGN AND MANAGEMENT.**

**Susanne A. Marczak**; San Diego Zoo Institute for Conservation Research; 15600 San Pasqual Valley Rd., Escondido, CA, 92027; (858) 342-2962; smarczak@sandiegozoo.org; Colleen L. Wisinski, Lisa A. Nordstrom

The sticktight flea (*Echindnophaga gallinacea*) is a common and widespread ectoparasite with a broad host range, including western burrowing owls (*Athene cunicularia hypugaea*). Chicks and adult females are particularly susceptible during continued and concentrated exposure to flea eggs laid within their nesting burrows. Typically, the prevalence of fleas on owls decreases over the course of the breeding season as juvenile owls grow larger and spend less time within the burrow. Since we began monitoring breeding burrowing owls in San Diego County in 2013, we have witnessed varying levels of flea infestations. However, in 2018 we observed an outbreak of sticktight fleas on both juvenile and adult burrowing owls at locations in San Diego, Riverside, and Imperial counties. We documented declines in body conditions of owls due to atypically high levels of fleas, potentially resulting in decreased survivorship of both adult and juvenile individuals. In this presentation we report on multiple cases of infestation, the variety of methods used to treat wild owls and their burrows, and the subsequent results of those treatment methods. Additionally, we make management recommendations to help reduce the prevalence of stick-tight fleas and other parasites within artificial burrows.

*Ecology and Conservation of Birds III*

## **QUANTIFYING RELATIONSHIP BETWEEN HABITAT AND PREY REMOVAL OF NESTING BARN OWLS IN NAPA VALLEY VINEYARDS.**

**Dane A. St. George;** Humboldt State University; 1 Harpst Street, Wildlife Department, Arcata, CA, 95521; (585) 402-5919; das984@humboldt.edu; Matthew D. Johnson

Habitat provision for natural enemies of agricultural pests is a common practice in integrated pest management (IPM) solutions. Winegrape farmers in Napa Valley, California have installed nest boxes in vineyards to attract barn owls (*Tyto alba*) to help manage economically damaging rodents, but the magnitude of the pest control service delivered by barn owls has yet to be rigorously tested. We used nest box cameras to document prey delivery rates of nesting barn owls to provide an index of rodent removal and prey species composition. Preliminary data suggest that individual chicks receive 157 prey deliveries from the time of hatch until dispersal, consisting primarily of voles (*Microtus* sp.) and pocket gophers (*Thomomys bottae*). Prey delivery rate peaked between weeks four and five with a peak average of 7.35 prey deliveries per chick per night and overall average of 2.85 prey deliveries per chick per night. Data also suggest that landscape heterogeneity may contribute to variation in prey delivery rate. Elucidating these trends may help with the strategic placement of nest boxes in vineyards and incentivize farmers to conserve habitat important for nesting barn owls and other local wildlife.

*Ecology and Conservation of Birds III*

*Student Paper*

### **BROAD-SCALE MONITORING FOR BROAD-SCALE CHALLENGES: BIOACOUSTICS AND THE CALIFORNIA SPOTTED OWL.**

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Understanding the influence of broad-scale ecological processes on threatened species and communities requires commensurate sampling. Yet implementing such methods can be challenging. The California spotted owl faces an array of such threats, notably the risk of large, severe fire, habitat modification, and the invasion of the barred owl. In 2017 and 2018 we conducted passive acoustic surveys across the northern Sierra Nevada (>6,200 km<sup>2</sup>). We then pursued three objectives: 1) evaluate the potential of acoustic surveys for long-term, landscape-scale population monitoring with a power analysis parameterized with field data; 2) assess coarse- and fine-scale spotted owl habitat associations across an unprecedented area with multi-scale occupancy models; and 3) explore different bioacoustic analyses to extract nuanced ecological information that goes beyond simple occupancy. Preliminary results indicate that acoustic monitoring has the power to detect small (2%) annual population changes across broad spatial scales; that spotted owl site occupancy is approximately four times greater than barred owl occupancy in the study area (0.43, 0.09); and acoustic monitoring can be used to assess pair status and possibly individual identity. These results suggest that we can meet critical information needs for threatened species using an approach with vast potential for community ecology.

*Ecology and Conservation of Birds III*

*Student Paper*

### **SPACE USE, FORAYS, AND HABITAT SELECTION BY CALIFORNIA SPOTTED OWLS (*STRIX OCCIDENTALIS OCCIDENTALIS*) DURING THE BREEDING SEASON: NEW INSIGHTS FROM HIGH RESOLUTION**

**Rachel V. Blakey;** The Institute for Bird Populations/University of Missouri; PO Box 1346, Point Reyes, CA, 94956; (626) 660-8049; rachelvblakey@gmail.com; Rodney B. Siegel, Elisabeth B. Webb, Colin P. Dillingham, Rachel L. Bauer, Matthew Johnson, Dylan C. Kelsner

Fauna of late-seral stage forests historically have been difficult to detect and track in rugged terrain, leading to challenges in movement characterization and conservation. We investigated movement of a late-seral specialist of conservation importance, the California Spotted Owl (*Strix occidentalis occidentalis*) using automated GPS loggers affixed to 15 owls in the northern Sierra Nevada, California. We used > 17,000 locations from individual owls to characterize home range size, movement distances, habitat selection (roosting and foraging) and use of the US Forest Service's designated Protected Activity Centers (PACs) during the breeding season (April-August). Roosting and foraging owls selected stands with high canopy cover and large trees at multiple spatio-temporal scales. PACs protected less than one quarter of foraging space use (volume of use) and fewer than half of observed roosts during the breeding season.

Previously undocumented foraging behavior was recorded for non-breeding female owls, which travelled farthest of all owls and visited up to six PACs during a single breeding season. Given the owls' selection for later seral forest and tendency to travel long distances, the limited habitat protection afforded by the current PAC regime may be inadequate for this wide-ranging species.

*Ecology and Conservation of Birds III*

## **ASSESSING MITIGATION RELOCATION STRATEGIES FOR BURROWING OWLS IN SOUTHERN CALIFORNIA.**

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In Southern California, western burrowing owl (*Athene cunicularia hypugaea*; BUOW) has experienced population declines and contraction of its breeding range due in large part to development. Passive relocation and active translocation are two methods used to avoid direct take when occupied burrows are within a planned development. However, the relative effectiveness of these relocation strategies has never been tested compared to non-relocated owls. Perhaps one of the most significant obstacles facing successful animal relocations is the problem of long-distance dispersal from the intended relocation site, which increases risk exposure and mortality rates. We evaluated the relative effectiveness of relocation with and without the addition of artificial conspecific cues (e.g. call/playback) as a conservation method for BUOW. During 2017 and 2018, 78 relocated and control BUOW across four counties were monitored throughout the year using satellite telemetry, site visits, and camera traps. For actively-translocated owls, we found that conspecific cues were associated with shorter dispersal distances, and the owls settled in sites with less exotic grass and more bare ground than either origin or release site. We discuss the implications of our findings and present lessons learned with applications for conservation and management of BUOW.

*Ecology and Conservation of Birds III*

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# Ecology and Conservation of Mammals I

(sorted by presentation order)

## **IMPACT OF MOUNTAIN LION PREDATION ON PRONGHORN POPULATIONS IN NORTHEASTERN CALIFORNIA: ARE LIONS USING A CHANGING LANDSCAPE AGAINST NOVEL PREY?**

**David K. Garcelon**; Institute for Wildlife Studies; 140 H Street, Blue Lake, CA, 95525; (707) 844-3516; garcelon@iws.org; Brian R. Hudgens, Jonathan D. Ewanyk, Matthew P. Brinkman

Pronghorn in northeastern California underwent a large population decline in the early 1990's. The population did not recover to its former numbers and continued to show a 5% annual decline. From 2014-2016, we initiated an investigation into what factors might be limiting growth in the population. Over that period we captured and placed GPS telemetry collars on 48 adult female and 42 juvenile pronghorn. Vital rates were investigated and we found that the pregnancy rate (88%) was within the range found in other stable populations, and juvenile survival (44%) was equal to or higher than most other published studies. However, adult female annual survival was low (69%). We were able to assign 59% (n = 17) of known mortality to predation, of which 80% were attributed to mountain lions. Mountain lions are ambush predators and pronghorn generally occupy open stage-steppe habitats, making ambush less probable. With the expansion of juniper woodland into sage habitat, lions may be benefiting from increased opportunity to close the distance on an otherwise unapproachable prey species. Current data suggests that if mountain lion predation impacts were removed, pronghorn population growth rates would be positive.

*Ecology and Conservation of Mammals I*

## **CANNABIS LAND USE CHANGE AND ITS POTENTIAL CONSEQUENCES.**

**Phoebe Parker-Shames**; UC Berkeley; 130 Mulford Hall, Berkeley, CA, 94720-3114; (541) 500-7333; phoebe\_parkershames@berkeley.edu; Van Butsic, Justin Brashares

Many states in the Western US are now engaged in a large-scale experiment with the decriminalization of recreational cannabis, but the effects of this policy change on the environment are largely unknown. To examine the potential landscape impact of cannabis production on wildlife habitat and communities, we conducted land use mapping of the industry in Humboldt and Mendocino counties in Northern California, and Josephine County in Southern Oregon. After mapping more than one million cannabis plants, we found that the industry is spatially small and clustered, but rapidly increasing, especially in Oregon post-legalization. This creates localized point source disturbances for wildlife. In Oregon, production is concentrated along river corridors, with potential for runoff and terrestrial wildlife access. Production characterization differs between states, and may reflect local regulations, suggesting its impact may also be coupled with local regulation. Preliminary research connects land use development to wildlife disturbance using occupancy modeling and activity patterns of medium to large mammals and songbirds. These data indicate a diel activity shift rather than wholesale avoidance by most species of mammals. As a rapidly expanding industry, cannabis provides an opportunity to study interactions between policy, land use change, and wildlife across regulatory contexts and scales.

*Ecology and Conservation of Mammals I*

*Student Paper*

## **MODELING WILDLIFE MOVEMENT BEHAVIOR TO IDENTIFY MITIGATION LOCATIONS ALONG LINEAR BARRIERS.**

**Eric S. Abelson**; USFS Pacific Southwest Research Station; 1731 Research Park Dr., Davis, CA, 95616; (530) 641-3742; eabelson@fs.fed.us; Samuel A. Cushman

Wildlife movement is increasingly impinged upon by human based infrastructure. Linear barriers (e.g.

roads) are a ubiquitous and disruptive landscape feature for wildlife daily and long-range movements. Departments of transportation, conservation agencies and land-owning agencies face perennial questions of where to locate mitigation activities (e.g. wildlife-safe underpasses) to reduce barrier effects of linear barriers like roads.

Movement modeling for conservation is often focused on connecting discrete aspects of the landscape, however this does not present a holistic view of wildlife movement. To identify wildlife "super-highways," and where they intersect with roads, I use a matrix of nodes across the landscape and full-factorial modeling approaches. The study area is ~2000 km<sup>2</sup> in California's Central Sierra Nevada Mountains.

To assess behavioral, physiological and modeling limitations I compile and present results from over 150 discrete models for deer, *Odocoileus hemionus*. Taken together, these models identify the role of modeling method (i.e. circuit theory, resistant kernel, least cost path), dispersal distance, response to urbanization, node quantity, linear versus non-linear resistance calculation and least-cost path smoothing. I will present insights on modeling approaches and their implications for locating mitigation structures. In addition I will discuss sources that play important roles in shifting wildlife movement corridors.

*Ecology and Conservation of Mammals I*

### **WHAT DO MIGRANTS DO DIFFERENTLY? IDENTIFYING HABITAT FOR PARTIALLY MIGRATORY POPULATIONS.**

**Derek B. Spitz;** University of Oregon; P.O. Box 1676, Bishop, CA, 93515; (831) 737-3120; spitzderek@gmail.com; Mark Hebblewhite, Thomas R. Stephenson

Migratory species are threatened by global declines, but our ability to conserve these populations is often limited by our understanding of the relationship between migratory behavior and habitat. Most migratory populations are partially migratory, displaying both migration and year-around residency. The resource hierarchy hypothesis predicts that the most important resource limiting a species distribution act at the coarsest spatial scales. Building on this foundation, we hypothesized that migration and residency represent contrasting scale-specific approaches to managing trade-offs between forage and predation risk, and that the distribution of migrant and resident habitats can predict the local prevalence of migration. To test these hypotheses, we quantified migratory status- (resident/migrant) specific differences in winter resources selection by federally-endangered Sierra bighorn (*Ovis canadensis sierrae*) across three spatial scales. Residents showed stronger coarse-scale selection for safety from predators and stronger fine-scale selection for forage, while in migrants this pattern was reversed. Spatial predictions from our coarse-scale resource selection models strongly predicted the local prevalence of migration (pseudo  $R^2 = 0.87$ ). This analytical approach provides a novel basis for estimating the prevalence of migration across large landscapes. Our results can inform a variety of management actions including reintroductions and translocations.

*Ecology and Conservation of Mammals I*

### **FENCING AND THE FORAGING BEHAVIOR OF A LARGE CARNIVORE - ARE MOUNTAIN LIONS SELECTING FOR AN EASY LIFESTYLE IN CALIFORNIA'S WINE COUNTRY?**

**Alexandra Hettena;** Audubon Canyon Ranch - Living with Lions; P.O. Box 1195, Glen Ellen, CA, 95442; (415) 860-9830; alex.hettena@egret.com; Quinton Martins

Mountain lions (*Puma concolor*) inhabit densely human populated regions of the San Francisco North Bay Area, where fences and habitat fragmentation may hinder wildlife movement. We fitted mountain lions in Sonoma and Napa counties with GPS collars to test for differences in hunting success, diet between public open space and private properties, and distance from property boundaries (fences). Between October 2016 and October 2017, we identified 148 feeding sites of four collared mountain lions; 112 prey items (75.7%) were black-tailed deer (*Odocoileus hemionus columbianus*). Mountain lions killed 96 deer (85.71%) on private lands, constituting 87.01% of the area, killing deer in proportion to the habitat available to them ( $p = 0.9428$ ). Distribution of distances from GPS clusters to fence lines on private lands differed significantly

from that of public lands ( $p = 5.287e^{-13}$ ), with more clusters occurring closer to the fence lines on private land. Lions showed a slight preference for public land ( $p = 0.0001$ ), yet successfully foraged in a fragmented landscape, possibly benefiting from fences on private properties that alter the behavior of their main prey. Investigation of the effects of fences and other human-constructed barriers on lion and deer demography will inform landscape-scale management of these influential wild animals.

*Ecology and Conservation of Mammals I*

*Student Paper*

### **ANTICOAGULANT RODENTICIDE EXPOSURE IN CALIFORNIA MOUNTAIN LIONS (*PUMA CONCOLOR*).**

Jaime L. Rudd; California Department of Fish and Wildlife; 1701 Nimbus Road, Suite D CDFW - WIL, Rancho Cordova, CA, 95670; (916) 358-2378; Jaime.Rudd@wildlife.ca.gov; Stella C. McMillin, Mark W. Kenyon Jr. , Robert H. Poppenga, Deana L. Clifford, **Deana L. Clifford**

As part of a statewide mountain lion (*Puma concolor*) health study initiated in 2016 we determined the prevalence and geographic distribution of non-target anticoagulant rodenticide exposure in necropsied mountain lions. We used liquid chromatography/mass spectroscopy to detect rodenticides in liver samples from 111 (77 male: 34 female) mountain lion carcasses from 37 counties collected between February 2016 and 2017. Anticoagulant rodenticides (ARs) were detected in 105 of 111 (94.5%) lions sampled from 35 counties. First generation ARs (FGARs) were detected in 81 individuals (73%) from 33 counties and second generation ARs (SGARs) were detected in 102 individuals (92%) from 35 counties. Seventy-eight individuals (70%) were exposed to both SGARs and FGARs. Diphacinone was the most common FGAR, detected in 67% of sampled individuals. Brodifacoum was the most common SGAR, detected in 90% of sampled individuals. Exposure to ARs was not associated with lower body condition. Although only one year of data, we demonstrate that exposure to ARs is widespread in California's mountain lions. We recommend continued AR testing screening of mountain lion carcasses to monitor population health and measure the effectiveness of regulatory changes intended to reduce non-target wildlife exposure to rodenticides.

*Ecology and Conservation of Mammals I*

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# Ecology and Conservation of Mammals II

(sorted by presentation order)

## **TULE ELK HABITAT SELECTION IN THE CARRIZO PLAINS REGION.**

**Adam S. Mohr**; Humboldt State University ; 1 Harpst St., Arcata, CA, 95521; (608) 769-5980; asm107@humboldt.edu; Tim W. Bean

Tule elk are an iconic elk subspecies endemic to the warm, dry climates of the Central Valley and Coastal Range in California. The state's tule elk populations have steadily grown since reintroduction efforts began in the 1970s, yet managers are still missing crucial information regarding how these elk select habitat on their historical range and how they respond to the drastic seasonal variations and periodic droughts that characterize a Mediterranean climate. I used location data collected between 2005-2017 from GPS-collared tule elk living in and around the Carrizo Plain National Monument to model the way elk respond to different environmental factors at the home range and larger population-range scale. I related elk use locations to a variety of covariates including: vegetation type, topography, distance to roads and distance to water. Additionally, I used annual time series of MODIS satellite imagery to determine how tule elk habitat selection changes in relation to fine-scale temporal variations in forage quantity and quality. These results will help managers address long-standing questions regarding how tule elk are able to thrive in their highly dynamic and unpredictable environments.

*Ecology and Conservation of Mammals II*

*Student Paper*

## **LAYERED LANDSCAPES OF FEAR: BLACK-TAILED DEER NAVIGATE SPATIOTEMPORAL VARIATION IN RISK FROM HUNTERS AND CARNIVORES.**

**Kaitlyn M Gaynor**; University of California - Berkeley; kgaynor@berkeley.edu; Alex McInturff, Justin S. Brashares

Animals experience landscapes of fear, often conceptualized as static patterns of risk from one predator. However, prey usually face spatiotemporally-variable risk from several predators. We studied how black-tailed deer (*Odocoileus hemionus*) navigate multiscalar risk from hunters and mountain lions (*Puma concolor*) at the UC Hopland Research and Extension Center in Mendocino County. To model spatiotemporal variability in hunter encounter and kill risk, we compiled 20 years of harvest data and deployed fine-scale GPS trackers on >300 hunters. We modeled mountain lion spatial occupancy and temporal activity using a grid of 38 camera traps. Finally, we used camera trap data and GPS collars on 13 deer to assess spatiotemporal responses of deer to patterns of risk. Hunters and mountain lions exhibit strong patterns of space use, with hunters active near roads, and lions adjacent to BLM land. Within these activity areas, hunters are diurnal and kill more deer in open habitats, while mountain lions are more nocturnal, killing deer in closed habitats. Deer do not avoid areas of predator activity outright, but seasonally adjust the timing of their activity and habitat selection to balance risk. We highlight non-lethal effects of hunting and predation on an economically and ecologically important game species.

*Ecology and Conservation of Mammals II*

*Student Paper*

## **THE STRONG CORRELATION BETWEEN DECLINING CALIFORNIA DEER HARVESTS AND DECLINING TIMBER REMOVED.**

**G. Kent Webb**; San Jose State University; 13315 Simon Lane, Los Altos Hills, CA, 95192-0244; (650) 917-0898; g.webb@sjsu.edu;

Using historic deer harvests as a basis for estimation, the California deer population peaked at about two million around 1960 and has fallen by about 75 percent to its present level. Times series analysis of a variety of annual climate, wildfire, and timber data for 1978 to 2016 reveals one variable very highly

correlated to the reported deer harvest. Board Feet of Timber Removed from California Land is positively correlated and, as a variable in a linear regression equation, explains 63 percent of the variation in a two year moving average of the reported buck harvest for the following year. Numerous equation and variable specifications were evaluated using stepwise regression. Adding Palmer's Drought Index to the equation created the best model; the two variables explained 75 percent of the variation. Precipitation and Average Temperature were significantly correlated to reported harvest in some equation specifications. Wildfire variables, Acres Burned and Number of Fires, were not significantly correlated. Also, a report on a suburban deer management project where does were sterilized resulting in a population decline from 175 to about 60 over almost six years, below the San Jose community's desired level: the effort to design fencing for a sustainable population.

*Ecology and Conservation of Mammals II*

## **PREDICTIVE MODEL-GUIDED FECAL PELLET SAMPLING FOR DENSITY ESTIMATION AND GENETIC CHARACTERIZATION OF TULE ELK IN COLUSA AND LAKE COUNTIES, CA.**

**Tom Batter**; Mammalian Ecology and Conservation Unit, UC Davis; 1 Shields Ave, Davis, CA, 95616, Davis, CA, 95616; (402) 630-2778; tbatter@ucdavis.edu; Josh Bush, Ben Sacks

The tule elk (*Cervus canadensis nannodes*) is a subspecies of elk endemic to California nearly driven to extinction in the late 19th century. Currently >5,000 tule elk occur in 22 recognized populations. The California Department of Fish & Wildlife currently employs aerial survey counts as an index of abundance. However, count indices can be misleading, prompting an interest in fecal DNA spatially explicit capture-recapture methods to formally estimate density and abundance. Systematic collection of DNA samples also helps clarify distribution and facilitates investigation of connectivity and genetic substructure within populations, which are poorly understood and have implications for the effects of management actions on maintenance of genetic diversity. We developed a predictive maximum entropy (MaxEnt) model for tule elk in Colusa and Lake Counties, CA, to guide fecal pellet sampling for these DNA applications. During June-September 2017 and 2018 we conducted sampling surveys to test the model and obtain genetic samples across three subpopulations. We collected 513 pellets in 2017 and 315 in 2018 (where sampling was curtailed by the Mendocino Complex Fire). Here we present preliminary results related to density, abundance, and population structure.

*Ecology and Conservation of Mammals II*

*Student Paper*

## **BEHAVIORAL PLASTICITY IN A SHORT DISTANCE MULE DEER MIGRATION. TO GO OR NOT TO GO?**

**Jerrod L. Merrell**; University of Nevada, Reno; 121 Southend Dr, Dayton, NV, 89403; (775) 225-1857; jmerrell@cabnr.unr.edu; Kelley M. Stewart, Shelly D. Blair

Migration maximizes accessibility of high-quality forage in variable systems. This ubiquitous behavior is found in taxa worldwide. Large herbivores in Africa use long distance migrations to obtain seasonally productive forage. Mule deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*) of the western US migrate to lower elevations when snow leaves high elevation forage inaccessible. A migratory herd of Rocky Mountain mule deer (*Odocoileus hemionus hemionus*) and Columbian Black-tailed deer (*Odocoileus hemionus columbianus*) found on the western slope of the Sierra Nevada Mountains in California show plasticity in migration behavior. The average migration distance for this herd is 32 km. In these migrations we see back and forth movement between habitat patches. These exploratory movements range from less than 1 km to more than 38 km. We hypothesize these individuals are testing forage quality in holdover locations and then deciding to continue with migration or move back to seasonal range. We have observed 95 migrations from 32 collared female deer. Individual variation in migration ranges from 25-141 days. Plasticity in migration behavior allows for optimal use of higher quality forage and may be an adaptation to changing climate conditions.

*Ecology and Conservation of Mammals II*

## **RELATIONSHIP BETWEEN MULE DEER REPRODUCTION AND RESOURCE SELECTION: QUID PRO QUO.**

**Nathan J. Jackson**; University of Nevada, Reno; 1664 N Virginia Street, Reno, NV, 89557; (520) 551-1960; njackson@cabnr.unr.edu; Kelley M. Stewart, Kevin T. Shoemaker, Darren A. Clark, Michael J. Wisdom

Mule deer (*Odocoileus hemionus*) have experienced periodic population declines across most of their range in recent decades. While most populations are considered to have stabilized in recent years, mule deer continue to be at the forefront of management concern among state and federal wildlife agencies. Effective management of mule deer requires an understanding of how they interact with their environment. We conducted our study on the Starkey Experimental Forest in northeastern Oregon. We evaluated resource selection by mule deer using a Random Forest machine-learning approach. We assessed temporal variation in resource selection across three time periods: third trimester of pregnancy, 30 days post-parturition, and following the loss of offspring. Mule deer selected for further distances to roads during late stage pregnancy and after the loss of offspring. In contrast, mule deer selected for distances closer to roads during the 30 days post-parturition. We observed higher selection for distances closer to water while rearing young than the other two time periods. Our analysis also incorporated space use by elk. Mule deer showed avoidance for areas with high probability of elk use across all time periods.

*Ecology and Conservation of Mammals II*

*Student Paper*

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# Ecology and Conservation of Mammals III

(sorted by presentation order)

## **COMPETITIVE INTERACTIONS BETWEEN DESERT KIT FOXES (*VULPES MACROTIS ARSIPUS*) AND COYOTES (*CANIS LATRANS*) IN THE MOJAVE DESERT.**

**Erica C. Kelly**; CSU Stanislaus, Endangered Species Recovery Program ; One University Circle, Turlock, CA, 95382; (661) 835-7810; ekelly@esrp.csustan.edu; Brian L. Cypher, David J. Germano, Paul T. Smith

We assessed competitive interactions between desert kit foxes (*Vulpes macrotis arsipus*) and coyotes (*Canis latrans*) in the Mojave Desert in California from 2009-2014. We analyzed food item use by the two canids relative to prey abundance to assess exploitative competition and used camera stations to investigate interference competition. Desert kit foxes and coyotes consumed many of the same food items, but generally in different proportions. Kit foxes primarily consumed rodents and invertebrates while coyotes primarily consumed lagomorphs and rodents. Desert kit foxes consistently had lower dietary diversity than coyotes, indicating that desert kit foxes are more specialist consumers while coyotes are more generalist. Differences in item proportions and specialization may ameliorate exploitative competition. We also found that desert kit foxes and coyotes did not appear to partition habitat on a landscape scale resulting in potential for interference competition. Strategies such as den use by foxes may be sufficient to reduce such competition and maintain coexistence. Competition may increase in drought years when foods are less available. Also, competitive interactions could be altered as human disturbance increases in the Mojave Desert (e.g., subsidization of coyotes with anthropogenic foods).

*Ecology and Conservation of Mammals III*

## **PARASITE SAFARI: USING CITIZEN SCIENCE TO UNDERSTAND HERBIVORE PARASITE EXPOSURE RISK AT EAST AFRICAN WATERING HOLES.**

**Georgia C. Titcomb**; University of California, Santa Barbara; 1117 Noble Hall, Santa Barbara, CA, 93106; (919) 914-3989; georgiatitcomb@gmail.com; Jenna Hulke, Amanda Orens, John N. Mantas, Benard C. Gituku, Hillary S. Young

Water is a critical resource for a rich diversity of herbivores. However, herbivore aggregation at water sources can increase exposure to both fecal-oral parasites (e.g. parasitic nematodes) and directly-transmitted pathogens (e.g. viruses, bacteria). In arid climates where water is a limiting resource, watering holes can enable parasite survival in the environment and drive higher aggregation rates that promote pathogen spread. Furthermore, increased interspecific contact may also facilitate rapidly-adaptive and virulent pathogens. Our work at Ol Pejeta Conservancy in Central Kenya uses experimental water manipulation to study herbivore water use and parasite exposure risk. Using five sets of filled and manipulated (drained and refilled) water pans plus controls, we examine herbivore responses to water manipulation over two full years of camera trapping. Nearly 3,000 citizen science volunteers are assisting us in answering two specific questions from these photos: 1) For which herbivore species does water cause increased aggregation and parasite exposure risk? 2) Are interspecific contact rates increased in the presence of water? We report on our preliminary results of this work, and we anticipate that our findings will provide key insights into the relationship between water, parasites, and hosts in an important hotspot of mammal diversity and conservation activity.

*Ecology and Conservation of Mammals III*

*Student Paper*

## **IMPACT OF URBAN-SUBURBAN LANDSCAPE CONVERSION ON CANID SPECIES PRESENCE IN THE SIERRA NEVADA FOOTHILLS.**

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Human-altered environments have been shown to influence how animals utilize space. Landscape conversion, especially expansion of urban and suburban settings, are known to have complex impacts on wildlife populations, particularly for mammalian carnivores. The lower Sierra Nevada Foothills region has recently experienced increased landscape conversion along with human population expansion. We investigated the distribution of gray fox (*Urocyon cinereoargenteus*) and coyotes (*Canis latrans*), two locally common species, to examine the predicted influence of human-altered landscapes on species presence. From 2014-2017, we systematically collected a total of 576 scat samples along predetermined ground transects. Using mitochondrial DNA, we were able to identify samples to species resulting in 218 samples as originating from gray fox and 139 from coyotes. We then produced a predictive Maximum Entropy (MaxEnt) habitat model to examine species presence relative to various environmental variables, including human-land use type. Here we present preliminary results regarding the impacts human-altered landscapes have on the predicted species presence of these two carnivores.

*Ecology and Conservation of Mammals III*

*Student Paper*

### **COMBINING PARTICIPATORY MAPPING WITH FINE-SCALE SPATIAL DATA TO UNDERSTAND LIVESTOCK-PREDATOR CONFLICT AT MULTIPLE SCALES.**

**Alex McInturff**; UC Berkeley; 1923 9th St, APT B, Berkeley, CA, 94710; (205) 447-3741; amcinturff@gmail.com; Jennifer R. B. Miller, Kaitlyn M. Gaynor, Justin S. Brashares

Fear of livestock predation drives carnivore declines in pastoral landscapes throughout the world. Spatial risk models have made important strides in identifying patterns of conflict at broad geographic scales, but a dearth of georeferenced data has limited inference at the finer scales at which husbandry practices occur. Here we present a novel combination of participatory mapping of rancher risk perceptions with a unique 10-year data set of GPS-located coyote attacks on sheep on a California ranch to show conflict patterns at unprecedentedly fine scales. Analysis of GPS data shows that while vegetation patterns predictably shape conflict at large scales, NDVI and water availability are unexpectedly pronounced drivers of conflict within individual pastures. This finding surprised participating ranchers and has profound implications for future drought conditions. Ranchers typically summarized their risk perceptions for whole pastures, and thus did not identify the intra-pasture drivers of conflict produced by the data analysis. Nevertheless, because ranchers decide which pastures are grazed, their perceptions are always partially determinative of inter-pasture patterns of risk exposure, making their knowledge a key consideration in understanding risk. Further data collection and exchange between scientists and ranchers has broad potential to better predict livestock predation and reduce conflict.

*Ecology and Conservation of Mammals III*

*Student Paper*

### **OUTFOXED NO MORE: SIERRA NEVADA RED FOX CAPTURES REVEAL NEW INSIGHTS INTO HABITAT USE AND REPRODUCTION.**

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Many unanswered questions remain regarding the ecology, population size, and population trend of the rare and state-threatened Sierra Nevada red fox (SNRF) in California. After several seasons without success, California Department of Fish and Wildlife biologists captured and collared one male and two female SNRFs in winter and spring of 2018. One of the females was pregnant when captured in April. The three foxes were thoroughly examined and samples were collected for disease exposure and genetics. All three foxes were fitted with satellite tracking collars. Although all three collars failed prematurely, they provided valuable data while still functioning, including the approximate location of the pregnant female's den and significant movements. We will present data on seasonal home range estimates, movement patterns, reproduction, den site characteristics, animal health and disease exposure, and the genetic relationships of the captured foxes to other foxes identified across the study area (using noninvasive techniques over the past decade).

*Ecology and Conservation of Mammals III*

**"GOING TO CALIFORNIA" (A LED ZEPPELIN SONG ABOUT WOLF DISPERSAL?).  
CALIFORNIA WOLF MANAGEMENT UPDATE.**

**Kent Laudon;** CDFW; 601 Locust St, Redding, CA, 96001; (530) 215-0751;  
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California is the most recent U.S. state to be recolonized by gray wolves. Since the male wolf OR-7 dispersed from northeastern Oregon and entered California 7 years ago, at least 10 additional wolves have entered California from other states. During this short time frame two pairs have successfully reproduced in California. One of those packs - dubbed the Lassen Pack - persists and had its second litter in 2018. Monitoring and management is challenging because wolves travel widely and use large, often remote areas. In working landscapes, wolf conservation and management is further complicated by the presence of livestock and land ownership and management patterns. In California this is magnified because most citizens lack of experience living with wolves, and the lack of some tools to mitigate wolf-caused livestock damage. As CDFW works to conserve wolves and minimize impacts to livestock producers, we strive to collaborate closely with communities within wolf range and to develop good two-way communication, information dissemination, and relationships. CDFW's wolf monitoring and management is adaptive and multifaceted and involves working closely with both wolves and people.

*Ecology and Conservation of Mammals III*

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# Ecology and Conservation of Mammals IV

(sorted by presentation order)

## TEMPORAL AND SPATIAL DENSITY ESTIMATES OF PYGMY RABBIT POPULATIONS ACROSS THE GREAT BASIN.

**Miranda M. Crowell**; University of Nevada, Reno; 10640 N McCarran Blvd Apt F-342, Reno, NV, 89503; (425) 223-9932; mirandamaurine@gmail.com; Marjorie D. Matocq, Kevin T. Shoemaker

Sagebrush habitats are considered one of the most imperiled ecosystems in North America, raising severe concerns about the conservation for many of the 350+ wildlife species that depend on these habitats. In 2005 and 2010, pygmy rabbits (*Brachylagus idahoensis*), a sagebrush specialist, were denied listing under the Endangered Species Act (ESA) due to a lack of information about how their populations are changing across their continuous range. To investigate how pygmy rabbit populations are changing across the Great Basin, we used a Spatially-Explicit Capture-Recapture (SECR) approach to estimate pygmy rabbit densities temporally (5 sites monitored annually from 2016-2018) and spatially (14 sites monitored for at least one year). Estimated densities at our study sites ( $n = 14$ ) ranged from 15 to  $< 1$  pygmy rabbits per Ha, and decreased substantially throughout our study period (2016-2018) at 4 out of 5 sites. We will soon begin investigating abiotic and vegetation characteristics that may be contributing to changes in estimated pygmy rabbit densities both temporally and spatially.

*Ecology and Conservation of Mammals IV*

*Student Paper*

## STAND OCCUPANCY BY FISHER AND TREE SQUIRRELS IN NORTHERN CALIFORNIA: INVESTIGATING THE INFLUENCE OF MASTING HARDWOODS.

**Andria M. Townsend**; Humboldt State University; 1 Harpst Street, Arcata, CA, 95503; (630) 487-9319; amd94@humboldt.edu; Aaron Facka, Sean Matthews, Micaela Szykman Gunther

Sciurids are an important prey species for fisher (*Pekania pennanti*), especially when other prey species are absent. In California, Western gray squirrel (*Sciurus griseus*) and Douglas squirrel (*Tamiasciurus douglasii*) should be highly ranked prey where they occur. Masting trees including black oak (*Quercus kelloggii*) and tanoak (*Notholithocarpus densiflorus*) produce an important food source for tree squirrels, therefore forested stands containing these trees may be useful to fishers for efficient foraging. We tested the hypotheses that rates of tree squirrel and fisher occupancy and detection would be greatest in stands that should produce the most mast. We collected data for 44 weeks throughout 2017 using remote cameras in 87 stands in the northern Sierra Nevada Mountains. Stands were dominated by compositions of conifer, or co-dominant with conifers and tanoak or black oak. We constructed competing models in a single species occupancy framework testing the effect of stand type and other co-variates. Detection and occupancy rates varied among species and stand types. Douglas squirrels had high occupancy rates (0.96-0.99) irrespective of stand type. Gray squirrels and fishers had the highest rates of occupancy and detection in tanoak-dominated stands. Our data highlight the value of specific mast-bearing species for the conservation of carnivores.

*Ecology and Conservation of Mammals IV*

*Student Paper*

## EVALUATION OF RANGE-WIDE OCCUPANCY AND SURVEY METHODS FOR THE GIANT KANGAROO RAT (*DIPODOMYS INGENS*).

**Alyssa E. Semerdjian**; Humboldt State University; 3050 L K Wood Blvd Apt A, Arcata, CA, 95521; (858) 342-7474; aes495@humboldt.edu; Robert Stafford, Michael F. Westphal, H. Scott Butterfield, W. Tim Bean

A solid understanding of habitat suitability and occupancy is essential to effectively manage species.

Suitability maps help managers identify areas that meet the needs of wildlife, locate potential movement corridors, and predict how species' ranges might shift with changing climate. Occupancy maps are critical tools to ensure that a species of interest is found in prospective management areas. Though recent studies have analyzed habitat suitability for giant kangaroo rats (*Dipodomys ingens*; GKR), occupancy data is lacking in parts of its range. Satellite imagery was used to detect recent GKR sign across their known range, along with non-invasive methods including manned flights, UAV surveys, sign surveys, and track plates. Satellite surveys returned a range-wide map of GKR occupancy that largely matched habitat suitability estimates, though more area was found to be suitable than is occupied. Manned flights matched trapping and satellite survey data in the areas where the surveys occurred and sign surveys proved to be predictive of giant kangaroo rat occupancy on a site level. Track plates and drone surveys were not successful, though with protocol modifications they likely could be. Findings of this study are designed to assist managers as they make conservation decisions for the GKR.

*Ecology and Conservation of Mammals IV*

*Student Paper*

### **HAWAIIAN HOARY BAT OCCUPANCY AND DISTRIBUTION ON O'AHU - A 1ST YEAR ANALYSIS.**

**Joel L. Thompson**; WEST, Inc.; 2725 NW Walnut Blvd, Corvallis, OR, 97330; (307) 214-2799; jthompson@west-inc.com; Leigh Ann Starcevich, Troy Rintz, Erica Adamczyk, Donald Solick

Hawaiian hoary bat (*Lasiurus cinereus semotus*) is the only land mammal endemic to Hawaii and is listed as Endangered at both the state and federal levels. Hawaiian hoary bat is regularly included as a covered species in Habitat Conservation Plans developed for actions that may result in incidental take of the species; however, determination of recovery benefits has been challenging due to the paucity of information concerning threats, limiting factors, life history, and ecology of the species. In collaboration with Hawaii's Endangered Species Research Committee, we initiated a multi-year study in 2017 to investigate the distribution and seasonal occupancy of Hawaiian hoary bat on the island of O'ahu. The objectives of the initial year of study were to 1) provide information on bat occupancy, distribution, and detection probabilities for the island of O'ahu, and 2) examine seasonal changes in distribution by estimating seasonal changes in occupancy. Acoustic bat detectors were deployed using an equiprobable generalized random tessellation stratified (GRTS) sample and as of fall 2018, 87 acoustic bat detectors were being monitored across O'ahu. In this presentation we describe the sampling design and methods for data collection and summarize results of the first year of field studies and occupancy analysis.

*Ecology and Conservation of Mammals IV*

### **RANGE-WIDE OCCUPANCY ANALYSIS OF MOHAVE GROUND SQUIRRELS.**

**Erica L. Orcutt**; University of California, Davis; Enviro Sci & Policy, 2133 Wickson Hall, One Shields Avenue, Davis, CA, 95616; (408) 507-8362; elorcutt@ucdavis.edu; Barbara M. Leitner, David K. Delaney, Philip Leitner

The Mohave ground squirrel (*Xerospermophilus mohavensis*) is a California Threatened species, found only in the western Mojave Desert. Research on its resource requirements has identified key food plants in an area of high-quality habitat in the northern portion of the range. However, these data are not necessarily representative of the species' resource-use in other areas. This study represents the first range-wide analysis of resource selection for Mohave ground squirrels and aims to test if resources found to be important in the northern portion of the range are also important for other populations. Camera surveys were conducted on public lands in 2011-2012 to determine detection/non-detection and were paired with vegetation surveys on the camera sites. Occupancy analysis was then employed to assess the importance of herbaceous and shrub species for site occupancy. This analysis revealed a strong negative relationship between Mohave ground squirrel site occupancy in areas with increasing creosote (*Larrea tridentata*) density and in sites where alien grasses dominated native herbs. While these results failed to clearly show positive resource selection for particular food plants, they suggest an additional negative impact of invasive grasses in the Mojave Desert.

*Ecology and Conservation of Mammals IV*

*Student Paper*

## **SMALL MAMMAL DISTRIBUTIONS ACROSS VEGETATION ISLANDS.**

Francis X. Villablanca; Cal Poly San Luis Obispo; 1 Grand Avenue, San Luis Obispo, CA, 93407; (805) 756-2200; fvillabl@calpoly.edu; Juliana Trunzo, Stephanie Little, **Juliana P. Trunzo**

Oceano Dunes State Vehicular Recreation Area (ODSVRA) is characterized by having vegetation islands separated by large areas of open sand. Small mammal populations exist on the majority of these islands, but the abundance and diversity of small mammals varies across them. Understanding small mammal populations at the ODSVRA is part of the Park's Habitat Monitoring System (HMS2) which has an explicit goal "to detect changes in species and/or communities overtime" by implementing strategies "to both detect changes in particular species and to evaluate ecological health." Recently the ODSVRA has begun revegetating large areas of once open sand, thus creating new habitat and adjoining habitat islands (previously existing habitat). The addition of new habitat in the vicinity of existing vegetation islands allows study of the effect of increasing island size and decreasing isolation between islands. The data we present provide a baseline of abundance and distributions of small mammals at vegetation islands throughout the park, including islands that have been recently connected through revegetation, based on trapping monthly for one year. We see a pattern that small mammal diversity and island size are correlated which suggests that the adding of vegetation will increase diversity.

*Ecology and Conservation of Mammals IV*

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# Ecology and Conservation of Martens and Fishers

(sorted by presentation order)

## **MULTI-SPECIES CARNIVORE MONITORING: INVESTIGATING STATISTICAL POWER TO DETECT MARTEN AND FISHER POPULATION DECLINES USING SPATIALLY-EXPLICIT SIMULATIONS.**

Jody M. Tucker; U.S Forest Service, Pacific Southwest Region; 24545 Highway 120, Groveland, CA, 95321; (559) 359-5888; jtucker@fs.fed.us; Katie M. Moriarty, Jessie D. Golding, Martha M. Ellis, **Jody M. Tucker and Katie M. Moriarty**

Surveying for multiple species simultaneously increases cost-effectiveness and allows insights into community ecology. However, multi-species monitoring may not be effective for rare species. We assessed the statistical power to detect population trends for marten and fisher using a single survey framework. We used a spatially-explicit, individually-based framework to simulate biologically realistic populations and then simulated population declines to assess statistical power to detect this decline while varying grid size, detection probability, number of visits, effective survey areas, sampling frequency, and sampling location. We (1) tested whether we could effectively detect declines for both species; (2) explored trade-offs in power between number of visits, detectability, effective survey area, and proportion of landscape surveyed, (3) evaluated power for various survey frequencies to inform cost-efficiency, and (4) assessed power of irregular sampling (variable sampling locations over time). Simulations with low detection probability or irregular sampling locations were unable to detect declines regardless of sampling intensity. But with moderate detectability and number of visits we were able to simultaneously detect declines in both species as long as survey devices encompassed an effective survey area >6.75 km<sup>2</sup> and occurred in fixed locations over time.

*Ecology and Conservation of Martens and Fishers*

## **MOVEMENT CHARACTERISTICS EXPLAIN ENERGETIC EXPENDITURES OF A CRYPTIC CARNIVORE, THE PACIFIC MARTEN.**

**Marie E. Martin**; University of Wisconsin-Madison; 1630 Linden Drive, Madison, WI, 53706; (630) 340-2910; memartin5@wisc.edu; Katie M. Moriarty, Jonathan N. Pauli

Energetic balance is critical to the survival and persistence of free-ranging species. Quantifying energetic requirements can inform our understanding of species' ecology, including their vulnerability and response to shifting biotic and abiotic conditions. While techniques exist to derive expenditures and activity patterns of wildlife, there is limited research linking field metabolic rate (FMR) with behavior of free-ranging terrestrial species. We tested the efficacy of movement characteristics (e.g., velocity, distance, motion variance) in predicting expenditures of a small forest carnivore, the Pacific marten (*Martes caurina*) in northern California. We paired the doubly-labeled water technique to measure CO<sub>2</sub> production with movement data derived from GPS collars to quantify relationships between movement and expenditure. Average FMR (+/- SD) for female and male martens (n=8, 3F:5M) was 627 kJ (+/- 142.0 kJ) and 913 kJ (+/- 61.88 kJ), respectively. Body-weight and movement velocity accounted for the majority of variation in FMR (R<sup>2</sup>=0.93 and p=0.0203); mass-specific FMR was positively related to velocity (R<sup>2</sup>=0.69 and p=0.0419). Our results suggest changes in behavior, such as increased movement velocity, are important and influential factors in energetic expenditures of forest carnivores. In the future, we will estimate FMR of additional GPS-collared animals to further disentangle the relationships between landscape composition and energetic budgets.

*Ecology and Conservation of Martens and Fishers*

*Student Paper*

## **ESTIMATING ENERGY EXPENDITURE AND TOTAL BODY WATER CONTENT OF**

## **FISHERS IN CALIFORNIA WITH DOUBLY LABELED WATER.**

**Aaron N. Facka**; , OR; (575) 650-7880; anfacka@gmail.com; Roger A. Powell

The current understanding of fisher energetics is still largely hypothetical because no estimates of energy have been taken in the field from wild fishers. We used the Doubly Labeled Water (DLW) method to estimate energy expenditure of fishers in their natural environments. In the autumns of 2012-2017 we enriched 54 (36 F; 18 M) wild caught fishers with DLW. Background levels of 2H and 18O in fishers were 148 ppm and 1989 ppm and we enriched fishers to an average of 407 ppm for 2H and 2395 +/- 68 ppm for 18O. We released all enriched fishers back into the wild and recaptured 32 of them (60%; 20 F; 12 M) 2 to 13 days later. Fishers were recaptured an average of 4.5 +/- 2.9 days after enrichment. Twenty one (65%) fishers lost weight (-0.10 +/- 0.19 kg). Estimates of total body water were consistent over time and similar for female (0.73 +/- 0.04) and male (0.72 +/- 0.035) fishers. From preliminary analysis, energetic expenditure for fishers was 585 kcal/day (1.5 times higher than the reported maintenance cost of active fishers). Estimates of energy have important implications for management of species as conditions change.

*Ecology and Conservation of Martens and Fishers*

## **DIETARY OVERLAP OF FISHERS AND PACIFIC MARTENS IN RESPONSE TO TREE MORTALITY IN SIERRA NEVADA FORESTS.**

**G. Brad Smith**; Department of Wildlife Ecology, University of Wisconsin; 1630 Linden Dr., Madison, WI, 53706; gbsmith3@wisc.edu; Jonathan N. Pauli, Jody M. Tucker

Shifts in primary producers within forest communities can have cascading effects on higher trophic levels, including carnivores. In the Sierra Nevada mountains, a high severity, multi-year drought (2012-2015), coupled with bark-beetle outbreaks, has resulted in widespread tree mortality that has dramatically altered the composition of forests. Fishers (*Pekania pennanti*) and Pacific martens (*Martes caurina*) are two carnivores of conservation concern associated with late-successional mixed forests throughout this region. It is currently unknown how these recent changes in forest conditions affect prey sources for fisher and marten. We predicted that tree mortality would simplify the available forage, and drive increased competition between these two similar species. To quantify these impacts, we identified hair samples (n = 128) collected from fishers and martens from 2006-2018 for analysis of stable isotope signatures. Preliminary results show variation in dietary inputs amongst locations, and limited dietary overlap between fishers and martens, in general. We are currently exploring temporal trends in dietary composition, niche dynamics, and competitive overlap for martens and fishers for the pre-drought (2006-2011), drought (2012-2015), and tree mortality (2016-present) periods.

*Ecology and Conservation of Martens and Fishers*

*Student Paper*

## **THE INFLUENCE OF FOREST CONDITIONS ON THE SURVIVAL AND REPRODUCTION OF FEMALE FISHERS.**

**Sean M. Matthews**; Oregon State University; 234 Strand Agriculture Hall, Corvallis, OR, 97331; (530) 351-2418; sean.matthews@oregonstate.edu; David S. Green, J. Mark Higley

Conservation planning relies on a strong understanding of the habitat suitability for at-risk species. This is often accomplished by assuming habitat-use patterns indicate habitat quality. Recent critiques have challenged this assumption and advocated for more direct evidence for how changes in habitat correspond to numerical changes in wildlife populations. The fisher (*Pekania pennanti*) is a mid-sized, mature-forest-obligate in the family Mustelidae and proposed for protection under the U.S. Endangered Species Act. It is suspected that forest management threatens fisher populations in the Pacific states by means of losses of mature forests, habitat fragmentation, and changes in forest composition and structure. Habitat models available for fisher, however, are based solely on surrogate habitat-use patterns and not direct demographic parameters. We evaluated the influence of annual forest conditions at the scale of individual home ranges on the survival and reproductive patterns of female fishers on the Hoopa Indian Valley Reservation. We radio-marked 85 female fishers between 2004 and 2016 and monitored their survival and reproduction. Preliminary results suggest the density of drivable roads and habitat with sparse to no forest canopy

negatively influenced fisher survival. Our results will offer guidance for forest conditions that support fisher survival and reproductive success.

*Ecology and Conservation of Martens and Fishers*

## **AN ASSESSMENT OF HABITAT USED BY REPRODUCTIVE FEMALE FISHERS (*PEKANIA PENNANTI*) IN THE SOUTHERN SIERRA NEVADA.**

**Rebecca E. Green**; PSW Research Station, USFS; 54325 McKinley Grove Rd, Shaver Lake, CA, 93664; (559) 841-6318; regreen@ucdavis.edu; Kathryn L. Purcell, Douglas A. Kelt, Craig M. Thompson, Heiko U. Wittmer, Nathan M. Hebert, Eric L. McGregor

The fisher (*Pekania pennanti*) is a forest carnivore of conservation concern in the southern Sierra Nevada. Prior to this study, information on fisher reproductive habitat was extremely limited. Between 2007 and 2012, we documented radio-collared female fishers at reproductive dens (natal = 45, maternal = 95) in spring, then revisited these dens in summer to assess forest conditions. We compared characteristics of habitat used by reproductive females with available habitat at 3 spatial scales. At the structure scale, California black oaks (*Quercus kelloggii*) and white firs (*Abies concolor*) were used more than expected, incense cedars (*Calocedrus decurrens*) were used in proportion to availability, and pines (*Pinus* sp.) were used less than expected. At the site scale, canopy cover immediately around dens and random trees was relatively high (ca. 72%) as was understory cover (ca. 56%), but these measures did not differ between den and random sites. Finally, when compared to available stands, den stands had higher density and basal area of large California black oaks, higher basal area of large snags, higher stand density indices, denser canopy cover, and steeper slopes. We consider conservation implications of these findings within the context of extensive tree mortality in this region.

*Ecology and Conservation of Martens and Fishers*

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# The Anthropocene: Decline & Extinction I

(sorted by presentation order)

## THE DEMISE OF "CALIFORNIA'S" BLACKBIRDS: AN HISTORICAL PERSPECTIVE.

**Edward C. Beedy**; Beedy Environmental Consulting; 12213 Half Moon Way, Nevada City, CA, 95959; (530) 274-7232; tbeedy@comcast.net;

The tricolored blackbird (*Agelaius tricolor*) is a near-endemic California passerine that now forms the largest breeding colonies of any North American land bird, after the extinction of passenger pigeon (*Ectopistes migratorius*) in 1914. Unlike their close relative, the widespread and territorial red-winged blackbird (*Agelaius phoeniceus*), the tricolored blackbird has a very limited geographic range and is nearly restricted to California - more than 99% of the global population occurs within the state. The number of tricolored blackbirds plummeted during the 20th Century due to a variety of factors including on-going habitat losses through widespread conversion of natural habitats to agriculture and urbanization, pesticide applications resulting in insufficient insect resources, and chronic destruction of breeding colonies by the harvest of their nesting substrates. The conservation of the tricolored blackbird is a matter of increasing concern owing to population declines, and because the species' habit of nesting in large colonies make it more vulnerable to nesting failures that can affect thousands of nests at a single colony. Due to this dramatic decline across the species' range, the California Fish and Game Commission made a final determination to list the tricolored blackbird as Threatened under the California Endangered Species Act in April 2018.

*The Anthropocene: Decline & Extinction I*

## LIFE ON THE EDGE - THE AMERICAN PIKA IN BODIE, CALIFORNIA: A 65 YEAR CASE STUDY OF GENETIC EROSION IN A SPECIES OF SPECIAL CONCERN.

**Kelly B. Klingler**; University of Nevada, Reno; 1664 N Virginia St, Reno, NV, 89557; (585) 721-8470; kbrieklingler@gmail.com; Lyle B. Nichols, Mary M. Peacock

In an age when wildlife populations are under threat from human-mediated change, genetic monitoring enables conservation biologists to test hypotheses regarding population viability. Here, we document genetic changes in an iconic American pika (*Ochotona princeps*) metapopulation within Bodie State Historic Park (Mono County, CA) located at the southwestern end of this species' range across a 65 year time frame. The results of this study reveal declines in allelic richness (AR) and observed heterozygosity (Ho), increased population substructure, and reductions in effective population size (Ne). It is likely that the ongoing collapse of suitable habitat due to a changing regional climate, and the subsequent decline in patch occupancy tracked by annual censusing, have directly contributed to these patterns of diversity loss. Finally, we place this local case study of genetic erosion within the context of broad-scale patterns of population structure within and between subspecific pika lineages that highlight the role of isolation and dispersal ability in pika genomic differentiation. Future monitoring programs should incorporate similar monitoring protocols for a larger number of populations associated with each of the five subspecies of the American pika to enable greater understanding of the geographic distribution of species-wide genomic diversity and ultimately, evolutionary potential.

*The Anthropocene: Decline & Extinction I*

## ASSESSING METHODS FOR CENSUSING ISLAND SPOTTED SKUNKS ON THE CALIFORNIA CHANNEL ISLANDS.

**Ellie Bolas**; University of California Davis; 1 Shields Ave, Davis, CA, 95616; (919) 357-5901; ebolas@ucdavis.edu; Kevin Crooks, Rahel Sollmann, Paula Power, Christina Boser, Erin Boydston, Victoria Bakker, Adam Dillon, Dirk Van Vuren

Island spotted skunks (*Spilogale gracilis amphiala*) are an endemic subspecies on two of the California Channel Islands, Santa Cruz and Santa Rosa. Island spotted skunks are a species of special concern in California, however, little is known about their status. Based on trapping on both islands, captures of skunks have decreased dramatically in recent years, suggesting the potential for extinction. We added a second monitoring method, wildlife cameras, to test whether both cameras and traps had low numbers of skunk detections, and to determine temporal variation in detections and effects of habitat. In July - December 2017, we deployed 30 wildlife cameras at trap sites on each island, concurrent with trapping efforts. We found that on both islands, cameras and traps used during the summer had equivalent low numbers of skunk detections. However, detections of skunks on cameras in the fall doubled as compared to the summer and cameras detected more skunks in areas with steeper slopes and shrub cover. These results suggest that island spotted skunks may be rare on both islands. However, monitoring efforts in the fall or in more favorable habitats may improve efforts to census of island spotted skunks.

*The Anthropocene: Decline & Extinction I*

*Student Paper*

### **SAMPLING ACROSS TWENTY YEARS REVEALS LOSS OF DIVERSITY AND GENETIC CONNECTIVITY IN THE COACHELLA VALLEY FRINGE-TOED LIZARD LINKED TO FRAGMENTATION AND DROUGHT.**

**Amy G. Vandergast;** USGS Western Ecological Research Center; 5165 Spruance Road, Suite 200, San Diego, CA, 92101; (619) 225-6445; avandergast@usgs.gov; Dustin A. Wood, Mark Fisher, Cameron W. Barrows, Andrew R. Thompson

Droughts in southern California are predicted to increase in frequency and severity with climate change. The Coachella Valley Fringe-Toed Lizard (*Uma inornata*) is a federally threatened, Aeolian sand dune obligate, endemic to the Coachella Valley, CA. Historically, *U. inornata* formed a large interconnected metapopulation across the valley, with local dune habitat and population size fluctuations linked to cyclical droughts and flooding. Over the past several decades, Aeolian habitat has declined to 5-16 % of the historic amount and is highly fragmented by highways and development in the urban communities of Palm Springs, Palm Desert and Indio, raising concerns that movement and gene flow among remaining habitat is limited. We examined population genetic structure across the range in three sample periods (1996, 2007 and 2017) spanning twenty years and least two severe droughts. Using a combination of microsatellites and snps, we found patterns of decreasing genetic connectivity and diversity over time, consistent with reduced movement and gene flow among increasingly isolated sand dunes and low effective population sizes due to genetic drift in sites with small and fluctuating census sizes. Recovery criteria for this species include maintaining genetic integrity. Using simulations, we evaluated assisted gene flow options versus a "no action" scenario to determine possible impacts of such actions on future genetic diversity and structure. The results of our studies can help guide development of a species genetic management plan.

*The Anthropocene: Decline & Extinction I*

### **EFFECTS OF FUTURE LAND USE CHANGES ON TRICOLORED BLACKBIRD HABITAT IN THE FOOTHILL GRASSLAND REGION OF THE SIERRA NEVADA.**

**Daniel A. Airola;** Northwest Hydraulic Consultants; 114 Merritt Way, Sacramento, CA, 95864; (916) 494-1283; d.airola@sbcglobal.net; Tara Collins, Chris McColl, Michael Lozano, Deren Ross

The California-threatened Tricolored Blackbird has declined due to loss of historic wetland habitats and recently from active colonies destruction during agricultural operations, conversion of open lands to perennial crops and development, and pesticide use. The grassland region of the eastern Central Valley and Sierra Nevada foothills between Placer and eastern Stanislaus counties (central foothills), annually supports about 50,000 breeding Tricolored Blackbirds, or ~30% of the statewide population. Colony sites in this area are subject to habitat loss, especially in Sacramento and Placer counties where >70% of the central foothill breeding population nests. We conducted a species conservation assessment in the central foothills region that considered several key factors. Lands were rated for habitat value based on the size and frequency of breeding populations over 2014-2018. Habitat conversion threats were determined from models that predict future regional build-out and from land use plans and project proposals. Existing and potential future conservation lands also were mapped. We then overlaid habitat value, threats, and

conserved lands to identify the extent to which important habitats are conserved and threatened. Our results can contribute importantly to species conservation by directing development away from key habitats, establishing appropriate mitigation needs, and identifying priority areas for conservation.

*The Anthropocene: Decline & Extinction I*

## **EXTIRPATION AND RECOLONIZATION OF MOUNTAIN LIONS IN THE EASTERN UNITED STATES: IMPLICATIONS FOR CONSERVATION IN THE FAR WEST.**

**Lynn M. Cullens**; Mountain Lion Foundation; PO Box 1896, Sacramento, CA, 95812; (916) 606-1610; LCullens@mountainlion.org; Robert B. Wielgus, Jay Tischendorf, David Furedy, Rachel A. Masoud

Although the record of extirpation is incomplete, the reality is undeniable. The mountain lion (*Puma concolor*) once ranged coast to coast, and the impact of its absence within Eastern ecosystems is profound. A human population a tenth the size of today's was able to eliminate every breeding population east of the Rockies and north of Florida within 200 years. While many would argue that the species' resilience and adaptability make it impossible to imagine such an outcome in the West, pockets of mountain lions already exhibit signs of severe genetic isolation, and human-caused mortality appears to be at a historic high. While the "comeback cat" is hailed by the media, we see crossed eyes and kinked tails in Southern California, and worry that over-hunting in the Black Hills may create the very conflicts that will eventually decrease human tolerance of local and dispersing lions. But we believe that eastern states can serve as vast examples of what happens when you lose a major predator, compelling western states to take heed. And as western states take a more tolerant, measured, and scientific approach to mountain lions, their experience and best practices will have an influence on agencies in the East.

*The Anthropocene: Decline & Extinction I*

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# The Anthropocene: Decline & Extinction II

(sorted by presentation order)

## TIPTON KANGAROO RATS: SLIDING TOWARD EXTINCTION BEFORE OUR VERY EYES?

**Brian L. Cypher**; CSU-Stanislaus, Endangered Species Recovery; One University Circle, Turlock, CA, 95382; (661) 835-7810; bcypher@esrp.csustan.edu; Scott Phillips, Tory Westall, Erin Tennant, Larry Saslaw, Erica Kelly, Christine Van Horn Job

Tipton kangaroo rats (*Dipodomys nitratooides nitratooides*: TKR) once were widely distributed in arid scrub habitats in the southern San Joaquin Valley. Much of this habitat has been destroyed and remaining habitat is limited to small fragments. We conducted surveys by live-trapping on 44 sites and detected TKR on 15 sites. Sites with TKR had larger alkali scalds and no obvious sign of past tilling compared to sites without TKR. Also, sites with TKR usually had sparse ground cover and seepweed was present. Finally, a larger competitor, Heermann's kangaroo rat (*D. heermanni*), was either absent or present in relatively low numbers at sites with TKR, and abundance was inversely related with that of TKR. An estimated 30,000 ha of moderate-high quality habitat and 60,000 ha of lower quality habitat remain. However, habitat is still being lost and we documented conversion of several sites with TKR. Furthermore, TKR were extirpated on several other sites due to catastrophic events and changes in habitat management. Thus, this species is still in rapid decline and remaining populations are at high risk of extirpation. Enhanced conservation efforts are warranted to avoid extinction, as may have befallen the closely related Fresno kangaroo rat (*D. n. exilis*).

*The Anthropocene: Decline & Extinction II*

## THE BEAR NECESSITIES: ECOLOGICAL EFFECTS OF THE WORLD'S LARGEST TERRESTRIAL OMNIVORE, *URSUS ARCTOS*.

**Sean M. Denny**; Bren School, University of California, Santa Barbara; Bren Hall, 2400 University of California, Santa Barbara, Santa Barbara, CA, 93117; (858) 847-8647; smdenny@bren.ucsb.edu; Molly Hardesty-Moore, Alexis M. Mychajliw, Ian M. McCullough, Scott D. Cooper, William J. Ripple, Thomas M. Newsome, Peter S. Alagona

Large mammals have declined dramatically in the last 500 years, mirroring a larger trend in anthropogenic megafaunal loss that extends back to the late Pleistocene. Concurrently, there has been a diminishment in the ecosystem roles played by large mammals, with consequences for ecosystem function, integrity, and resilience. In response, conservationists are working to stem these declines and facilitate large mammal recovery, with some success in North America and Europe. A delineation of the ecosystem impacts of large mammals is needed to predict and plan for repercussions of such extinctions and recoveries. The brown bear (*Ursus arctos*), the world's largest terrestrial omnivore, illustrates the ecological consequences of both large mammal loss and recovery. During the last two centuries, brown bear ranges have contracted across three continents, but specific North American and European populations have recovered. We review the ecological effects of brown bears, both past and present, direct and indirect, to illuminate the broader ecological consequences of changing densities and distributions of this iconic omnivore. We also discuss how human activities and climate change are altering brown bear ecology, and identify research priorities in the context of rapid, global change.

*The Anthropocene: Decline & Extinction II*

*Student Paper*

## SAN JOAQUIN KIT FOX DEMOGRAPHIC AND ECOLOGICAL ATTRIBUTES IN THE CARRIZO PLAIN CORE AREA HIGHLIGHT LOCAL AND RANGE-WIDE VARIATION.

**Tory L. Westall**; CSU-Stanislaus, Endangered Species Recovery; One University Circle, Turlock, CA, 95382; (661) 835-7810; twestall@esrp.csustan.edu; Brian Cypher, Erica Kelly, Christine Van Horn Job,

Larry Saslaw, Abigail Gwinn

Endangered San Joaquin kit foxes (*Vulpes macrotis mutica*) persist as a metapopulation consisting of three core and several satellite populations. We investigated demographic and ecological attributes of kit foxes in the Carrizo Plain core area during 2016, a year of lower food availability, and during 2018, a year of higher food availability. The mortality rate in 2018 was less than half that for 2016 and was the lowest rate recorded among populations throughout the range. Reproductive success was markedly higher in 2018. Home range and core area sizes in 2018 were approximately one-third of those in 2016 and were the smallest recorded among populations throughout the range. In the Carrizo Plain core area, Heteromyid rodents and invertebrates were the primary dietary items, and specialization on kangaroo rats increased with increasing abundance of this resource. Results from this and previous studies emphasize that demographic and ecological attributes can vary markedly and rapidly in a given location with climate-driven variation in resource availability. Furthermore, the attributes we observed are consistent with the presence of high quality habitat in core areas and the patterns we observed highlight the importance of conserving such habitat to help buffer against stochastic processes.

*The Anthropocene: Decline & Extinction II*

### **PREDATORS, GENETICS, AND CLIMATE CHANGE: PRIORITIZING CONSERVATION ACTIONS FOR ENDANGERED HAWAIIAN TREE SNAILS.**

**Melissa Price**; 1910 East-West Rd., Rm 101, Honolulu, HI, 96822; (808) 956-7774; pricemel@hawaii.edu; Zac Forsman, Robert J. Toonen, David Sischo, Philip Kitamura, Ingrid Knapp, Michael G. Hadfield

Endemic Hawaiian tree snails (*Achatinellinae*) have been rapidly disappearing due to introduced predators and habitat disturbance, and only remain in fragmented refugia. Declines have been particularly precipitous in the last five years. All populations are at the highest elevations available, over steep precipitation gradients, and are likely impacted by climate change as native habitats are becoming warmer and drier. Using restriction-site associated DNA sequencing (RADseq) we generated millions of DNA sequences from across the genomes of 67 populations representing 28 species, 6 genera, and 3 subfamilies. We constructed whole and partial mitochondrial genomes, and evaluated nuclear and mitochondrial single nucleotide polymorphisms (SNPs). Alarming, we see evidence of limited connectivity among populations for species where multiple populations remain, with a large number of fixed differences among geographic sites. Together with low heterozygosity, this suggests a decreased capacity for adaptation to environmental change. In this presentation we will discuss these results in light of other threats to species persistence, including predators and climate change. Our results are currently informing decisions to combine populations in predator-free enclosures and captive-bred populations in ways that will maximize adaptive ability and species persistence. 10. Tweetable Abstract: "How to minimize extinction risk for 28 Hawaiian tree snail species? Consider predators, genetics, & shifting climate."

*The Anthropocene: Decline & Extinction II*

### **ASSESSING EFFECTIVENESS OF MANAGEMENT ACTIONS FOR THE BI-STATE DISTINCT POPULATION SEGMENT OF GREATER SAGE-GROUSE.**

**Mark A. Ricca**; 1 US Geological Survey, Western Ecological Research Center; 800 Business Park Dr., Suite D, Dixon, CA, 95620; (560) 669-5089; mark\_ricca@usgs.gov; Peter S. Coates, Steven R Mathews, Brian G. Prochazka, Mary B. Meyerpeter, Steve Abele, Shawn P. Espinosa, Scott C. Gardner, Sheri L. Lisius, David J. Delehanty

Sage-grouse (*Centrocercus urophasianus*) occurring along the border of California and Nevada (Bi-State) at the extreme southwestern extent of the species' range are classified as a Distinct Population Segment (DPS). Several assessments under the Endangered Species Act (ESA) by the U.S. Fish and Wildlife Service (FWS) have occurred for the DPS over the past decade owing to threats that include conifer expansion, wildfire, drought, and localized isolation. During 2012, a multi-agency and stakeholder team identified a suite of management actions aimed at ameliorating those threats, and FWS withdrew the proposed rule to list the DPS as threatened in 2015. However, a court recently ordered that listing be re-

evaluated, in part so that effectiveness of implemented management actions towards improving habitat suitability and population viability can be better quantified. We used data from multi-year telemetry monitoring of the DPS to evaluate: 1) population viability of individual subpopulations and entire DPS in relation to prolonged drought, 2) observed and predicted effectiveness of tree removal on improving sage-grouse frequency of use, habitat suitability, and demographic performance, and 3) potential impacts of reducing subsidized irrigated water sources. These preliminary findings are provided to meet the need for timely best science.

*The Anthropocene: Decline & Extinction II*

## **LAST CHANCE TO SAVE, THE RUSH TO CONSERVE HAWAII'S ICONIC LAND SNAIL FAUNA.**

**David R. Sischo**; Hawaii Department of Land and Natural Resources; 1151 Punchbowl St. Rm. 325, Honolulu, HI, 96813; (808) 587-0033; david.r.sischo@hawaii.gov;

With over 750 species in ten families the Hawaiian Islands experienced one of the most diverse land snail radiations in the world. From legends to lei, and later to theories of evolution, the iconic land-snail species of the Islands are important components of healthy forest ecosystems, and have influenced local culture and scientific thought for centuries. With 99% of snail species being single island endemics, they are vulnerable to a host of anthropogenic disturbances. Unfortunately, due largely to introduced invasive predators and climate change, what hasn't already vanished is facing imminent extinction. Catastrophic declines observed in wild populations within the past two years have foreshadowed the end for many species. In a rush to prevent extinction, the Hawai'i Department of Land and Natural Resources Snail Extinction Prevention Program (SEPP), and partners across the state, are "manning the lifeboats" using novel techniques involving captive propagation, predator-proof fencing, translocation, and reintroduction, to stabilize and recover some of the island's, and arguably the world's, most vulnerable species. Here we will report on the status of wild populations, as well as the techniques being employed in extinction intervention.

*The Anthropocene: Decline & Extinction II*

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# The Anthropocene: Pathogens & Invasive Species

(sorted by presentation order)

## **MODELING SCENARIOS FOR THE MANAGEMENT OF AXIS DEER (*AXIS AXIS*) IN HAWAII.**

**Steven C. Hess**; U.S. Geological Survey, PIERC; PO Box 44, Hawaii National Park, HI, 96718; (808) 985-6410; shess@usgs.gov; Seth W. Judge, Lucas B. Forini

Introduced ungulates cause agricultural damage and degradation of native biodiversity throughout Hawaiian ecosystems. These ungulates include feral livestock which have been successfully managed and eradicated on many other oceanic islands, but also more recently introduced wild species which are more difficult to control. The Hawaii Interagency Biosecurity Plan has identified ungulate control as the single most expensive invasive species problem in the state largely because of costly barriers necessary to separate areas managed for sustained-yield hunting from those where ungulates are eradicated. Large numbers of a wild ungulate species, axis deer (*Axis axis*), have been removed from Maui and Molokai during recent years, partly under product marketing initiatives, but substantial population reductions have not yet occurred. Long-term solutions that are being considered to reduce annual management costs will include land use prioritization modeling with stakeholders to minimize ingress, protect native species from extinction, and to facilitate both population control and sustained-yield hunting. Population modeling would also inform seasonal and daily bag limits to manage for desired levels of abundance; selective removals of females could be particularly effective for reducing adult sex ratio bias and population growth rates similar to "earn-a-buck" programs used in other states to manage overabundant deer.

*The Anthropocene: Pathogens & Invasive Species*

## **INVASIVE PLANT *ARUNDO DONAX* REDUCES MAMMALIAN PREDATOR USE OF HABITAT IN A SOUTHERN CALIFORNIA RIPARIAN SYSTEM.**

**Molly Hardesty-Moore**; UC Santa Barbara; Ecology, Evolution, and Marine Biology, UC Santa Barbara, SANTA BARBARA, CA, 93106-9620; (530) 913-7255; mhardestymoore@ucsb.edu; Devyn Orr, Douglas J. McCauley

The invasive plant *Arundo donax* is known to have significant impacts on riparian ecosystems in southern California, including by decreasing abundance and diversity of plants, birds, and arthropods, but little is known regarding its effects on mammalian predators. This study investigated the influence of *Arundo* on mammal assemblages in the Santa Clara River (SCR) Valley in Ventura County, in order to 1) determine if *Arundo* alters habitat quality for mammalian predators and propose potential mechanisms, and 2) examine effects of seasonality and fire on the impact of *Arundo*. We used remote cameras to compare mammalian predator use of habitat with differing abundance of *Arundo* along the SCR between Fall 2016 and Spring 2018. Small mammal abundance was estimated using mark-recapture. Overall, we found that *Arundo* decreases habitat quality for mammalian predators in this region. However, there was variation by species: coyotes were found to have lower probability of occupancy in *Arundo*, but bobcat occupancy did not differ by habitat type. Small mammals similarly did not differ overall by habitat type, indicating a prey source for predators in *Arundo*. There was no effect of seasonality or fire. This study suggests *Arundo donax* could be altering how mammals use riparian habitat.

*The Anthropocene: Pathogens & Invasive Species*

*Student Paper*

## **ERADICATION OF INVASIVE RATS ALTERS ABOVEGROUND CARBON STORAGE ON A TROPICAL ISLAND.**

**Ana Miller-ter Kuile**; UC Santa Barbara; ana00@ucsb.edu; Devyn Orr, Maggie Klope, Carina Motta, Rodolfo Dirzo, Hillary S. Young

Invasive rats occur on half of the world's islands and are destructive to island biodiversity. Rat eradication can successfully recover island species, with much attention paid to seabird recovery. However, because rats are abundant, generalist omnivores, their eradication likely drives changes in ecosystem processes and functions in addition to species-specific recovery. To date, few studies document these ecological shifts, and these focus primarily on seabird-maintained processes. We show how rat eradication on a tropical island (Palmyra Atoll, Central Pacific) altered ecosystem aboveground carbon storage through the release of tree species from seed predation. We measured aboveground carbon storage across a series of forest plots before and after rat eradication and observed a significant increase in total seedling carbon following eradication. While seedling carbon did not significantly increase total forest carbon in the short term, it shifted the composition of carbon in the system significantly toward faster-cycling carbon. Using population data, we projected that carbon storage will continue to increase in the absence of rats over the long term. Ecological shifts, such as changes in carbon storage, can promote or inhibit recovery of island species and ecosystems, and we suggest that future eradications consider ecological shifts as conservation priorities.

*The Anthropocene: Pathogens & Invasive Species*

*Student Paper*

### **RISK, SPREAD, AND CONTROL OF *FUSARIUM* DIEBACK - SHOT HOLE BORERS IN SOUTHERN CALIFORNIA.**

**Shannon C. Lynch**; University of California Santa Cruz; 1152 High Street, Santa Cruz, CA, 95060; (951) 534-2819; sclynch@ucsc.edu; Akif Eskalen, Gregory S. Gilbert

The exotic pest-disease complex *Fusarium* dieback (FD) is a serious threat to the viability of native riparian and oak woodland plant communities in Southern California. FD is formed by two invasive shot hole borer (SHB) beetle species (*Euwallacea* sp.), each associated with specific fungal pathogen species (*Fusarium* sp.). The broad host range has fostered rapid spread throughout urban-wildland forests and commercial avocado groves throughout the region. Our research goal is to support the development of a policy and management response in-line with the magnitude of the problem. Our objectives are to 1) Develop a predictive model for which specific sites are most vulnerable to FD invasion and impacts based on an understanding of the evolutionary ecology of the fungi and beetles, beneficial endophyte distribution, environmental conditions, and landscape factors; 2) Identify endophytic candidates for consideration as a management response. We established 260 permanent study plots containing at least 50 geo-referenced trees in FD-infested and non-infested oak woodlands, riparian corridors, and avocado groves throughout Southern California. Antagonism assays indicate that local endophytic bacteria collected from xylem of selected trees in a subset of plots formed zones of inhibition against the fusaria pathogens, showing promise of environmentally safe biocontrol treatments.

*The Anthropocene: Pathogens & Invasive Species*

*Student Paper*

### **PREDICTABILITY OF INVASIVE ARGENTINE ANT DISTRIBUTION ACROSS MEDITERRANEAN ECOREGIONS OF CALIFORNIA.**

Jonathan Q. Richmond; US Geological Survey; 4165 Spruance Rd. Ste 200, San Diego, CA, 92101; (619) 225-6434; jrichmond@usgs.gov ; Tritia Matsuda, Cheryl S. Brehme, Emily E. Perkins, Robert N. Fisher, **Tritia A. Matsuda**

Detailed information about environmentally limiting factors for invasive species is rarely considered when designing local management strategies to control their establishment and spread. We tested for limiting effects of different abiotic factors on the presence the invasive Argentine ant *L. humile* within and across ecoregions of San Diego County, California, where *L. humile* threatens a variety of native fauna and flora. We surveyed linear transects that started at edge types representing different sources of moisture (i.e. urban, road, streams and lakes). *L. humile* reached peak abundance in the coastal terrace and native species peaked in the inland foothills. *L. humile* presence was negatively associated with increased distance from an edge, but the magnitude of this effect increased in the more xeric, inland parts of the landscape. Site occupancy by *L. humile* was best predicted by an interaction between ecoregion and distance-to-edge, with urban edges showing a stronger effect than roads, streams, or lakes; however edge effects were diminished in the coastal terrace, where climate conditions are most favorable for *L. humile*. Results suggest that a

spatially informed management strategy may improve success for controlling *L. humile* in Mediterranean coastal regions, given that features of the local environment can be exploited to suppress further spread and establishment.

*The Anthropocene: Pathogens & Invasive Species*

## **EFFORTS TO ERADICATE INVASIVE NUTRIA FROM CALIFORNIA.**

**Valerie K. Cook**; California Department of Fish and Wildlife; 1700 9th St., Sacramento, CA, 95811; (916) 654-4267; [valerie.cook-fletcher@wildlife.ca.gov](mailto:valerie.cook-fletcher@wildlife.ca.gov);

Following their eradication in the 1960s, a reproducing population of invasive nutria (*Myocastor coypus*) has once again been discovered in California. Native to South America, nutria are large, semi-aquatic rodents, reaching up to 20 pounds in size and strongly resembling beavers and muskrats. In March 2017, a pregnant nutria was trapped in a private wetland in Merced County. Since that time, over 300 additional nutria have been confirmed in or taken from private and public wetlands, ponds, rivers, sloughs, and irrigational canals in San Joaquin, Stanislaus, Merced, Tuolumne, Mariposa, and Fresno Counties. If allowed to persist, nutria will severely impact California's ecosystems and resources, causing loss of wetlands, soil erosion, increased sedimentation, damage to agricultural crops and levees, and reduced stability of banks, dikes, and roadbeds, as they have done in Louisiana, Delmarva Peninsula, and the Pacific Northwest. The California Department of Fish and Wildlife and partner agencies have implemented eradication efforts to prevent significant environmental, agricultural, and economic impacts in the Sacramento-San Joaquin River Delta watershed. Components of the eradication campaign, including outreach, pursuing landowner permissions, survey and trapping efforts, utilization of an electronic data collection and mapping system, and future project phases, will be presented.

*The Anthropocene: Pathogens & Invasive Species*

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# The Anthropocene: Recovery & Re-Wilding

(sorted by presentation order)

## **QUANTIFYING BENEFITS OF A PLUG AND POND MEADOW RESTORATION IN MARIPOSA COUNTY, CA - STATUS AND PRELIMINARY MONITORING RESULTS.**

**Melissa C. Odell**; Sierra Foothill Conservancy; P.O. Box 691, Mariposa, CA, 95338; (559) 341-6232; melissa@sierrafoothill.org; Amy Merrill, Joe R. Medley, Helen Loffland, Billy Freeman

Sierra Nevada meadows are hotspots of biodiversity. These meadows also play a critical role in the water system of California, providing 60 percent of the state's developed water supply. With a changing climate, restoring the function of meadow systems is critical; doing so is predicted to capture water, attenuate floods, and sustain summer stream flows, all while improving habitat for wildlife. In partnership with several organizations and grantors, Sierra Foothill Conservancy (SFC) has embarked upon a large-scale plug and pond restoration of Bean Creek Preserve, located in northern Mariposa County, California. Construction was completed in Fall 2016. In consort with the restoration, SFC is participating in the Sierra Meadow Restoration and Research Partnership (SMRRP), Point Blue Conservation Science's Rangeland Watershed Initiative, and collection of restoration co-benefit data. The National Fish and Wildlife Foundation has funded 3 years of post-restoration data collection, focusing on species-specific benefits (great gray owl, western pond turtle, willow flycatcher), ground water quantity, stream water quality, greenhouse gas pond flux, livestock forage and meadow grazing outreach with private landowners. Preliminary data will be presented, along with challenges, successes, future research plans, and current status of the re-watering of 40 acres of wet meadow habitat.

*The Anthropocene: Recovery & Re-Wilding*

## **NORTHERN ELEPHANT SEALS: A TALE OF IMMINENT EXTINCTION AND ASSISTED RECOVERY OVER 50 YEARS.**

Sarah G. Allen; National Park Service; Point Reyes National Seashore, Point Reyes Station, CA, 94956; (510) 541-4241; sarah\_allen@nps.gov; Mark Lowry, Richard Condit, Brian Hatfield, Ryan Berger, Patrick Robinson, Sarah Codde, Dawn Goley, Ben Becker , **Ben Becker**

Predictions of species extinction rates are alarming for the coming century and resource managers are challenged to plan for resistance and recovery of species, often applying untested methods. For marine animals over the past several decades, recovery and planning actions have been complex and often ineffective. Among marine mammals, though, northern elephant seals (*Mirounga angustirostris*) stand out for experiencing unparalleled recovery, enabled in part by simple protection. In California, recovery over the past 50 years, measured by estimated births, grew from 132 at one colony in 1958 to 40,684 over 11 primary colonies in 2010. Most colonies are on park coastal beaches that management diligently protects where seals breed and molt. Some colonies grew at astounding rates (average annual increase at Piedras Blancas  $\lambda=8.09$  (1992-1995), while a few grew and then declined (Farallon Islands  $\lambda=1.8$  (1973-1980) to 0.9 (1981-2010)), mostly due to loss of haul out space. Recovery has been disrupted by elevated pup mortality during ENSO events, which simultaneously stimulated colonization at new sites. Management is now challenged to facilitate future expansion where human interactions are increasing. The elephant seal tale of reappearance/recovery also provides insights into planning for the endurance of other species over the next century.

*The Anthropocene: Recovery & Re-Wilding*

## **ECOLOGICAL RECOVERY FROM CATASTROPHIC HISTORIC DISTURBANCE IN THE SIERRA NEVADA: IMPLICATIONS FOR CONTEMPORARY LAND MANAGEMENT CHALLENGES.**

**Daniel W. Shaw**; California State Parks; PO Box 377, Tahoe Vista, CA, 96148; (530) 525-9535; daniel.shaw@parks.ca.gov; Luke J. Zachmann, Brett G. Dickson

I use a case study of California State Parks in the Sierra Nevada to discuss ongoing recovery on lands that were among the most degraded in the American West. David Beesley's book *Crows Range, An Environmental History of the Sierra Nevada*, compares the impact of logging, mining, grazing, and chronic burning in the 1800s to an ice age in terms of complete landscape alteration. Parks inherited lands at the epicenter of this disturbance, including mining sites such as Malakoff Diggins State Historic Park and Plumas Eureka State Park. Ongoing recovery under a stewardship approach including both preservation and conservation has implications for social and ecological land management challenges such as forest health, biodiversity, and carbon sequestration. Incorporating historic disturbance into our understanding of contemporary forest and land condition also helps inform current critiques of public land management. Our recently published empirical data from a long-term forest stewardship program in the Lake Tahoe Basin indicates a promising story for naturally recovering lands as well as lands managed with prescribed burning. Consideration of a combination of management approaches that compliment ongoing recovery from historic disturbance could benefit public land planning efforts in the face of alarming climate change, wildfire, and other challenges.

*The Anthropocene: Recovery & Re-Wilding*

### **BUENA VISTA LAKE SHREWS: ON THE BRINK OF EXTINCTION BUT HIGHLY RECOVERABLE.**

**Brian L. Cypher**; CSU-Stanislaus, Endangered Species Recovery; One University Circle, Turlock, CA, 95382; (661) 835-7810; bcypher@esrp.csustan.edu; Erin Tennant, Jesus Maldonado, Larry Saslaw, Tory Westall, Jacklyn Mohay, Erica Kelly, Christine Van Horn Job

The Buena Vista Lake shrew (*Sorex ornatus relictus*: BVLS) formerly inhabited seasonal and permanent wetlands and riparian areas in the southern San Joaquin Valley (SJV). Approximately 95% of these habitats have been lost, leaving only isolated remnants suitable for BVLS. We conducted surveys in the historic range, conducted a taxonomic review of shrews in the SJV via genetic analyses, and developed conservation recommendations. Surveys were conducted in 13 general locations and BVLS were detected in just six. Three of the sites were created wetlands, two sites were along canals, and just one site was a natural wetland. The presence of BVLS in the created wetlands indicates that wetland restoration or creation could be an effective conservation strategy. Taxonomic analyses indicated that there is considerable genetic connectivity and admixture between shrew populations in the northern and southern portions of the SJV. Also, while some of the small populations retain moderate levels of genetic diversity, the southern SJV shrew populations retain unique alleles and conservation of these shrews is important for maintaining population-wide genetic diversity. Thus, although very few extant populations were found, potential extension of the range and high suitability of created habitats may enhance the outlook for recovery of BVLS.

*The Anthropocene: Recovery & Re-Wilding*

### **RESULTS OF 20-YEARS OF CONDOR RECOVERY ON CALIFORNIA'S CENTRAL COAST.**

**Joe Burnett**; Ventana Wildlife Society; 9699 Blue Larkspur Lane, Suite 105, Monterey, CA, 93940; (831) 747-4104; joeburnett@ventanaws.org; Melissa Clark, Amy List, Mike Stake, Kelly Sorenson

In 1997, Ventana Wildlife Society joined the California Condor Recovery Program to help reestablish condors in central California; Pinnacles National Park joined local efforts in 2003. As of December 31, 2017, the wild population for Central California, co-managed with Pinnacles, was 90 condors. In 2006, we documented the first nest in central California and the first in a coastal redwood. This nest failed from egg breakage due to extremely thin eggshells. From 2006-2015, we conducted research that determined the DDT metabolite, DDE, was causing eggshell thinning in condors that consumed contaminated marine mammal carcasses. Initially, we determined hatch success to be low, however, hatch success normalized over the course of the 10-year study period. We expect the DDE threat to continue to diminish with time and hatch success to continue to increase. Lead poisoning, from the ingestion of spent lead ammunition in

carcasses, is the leading mortality threat and the biggest hurdle to establishing a self-sustaining condor population. We mitigate the lead threat by treating condors with elevated blood lead, providing lead-free carcasses to condors, and conducting public outreach. With a statewide lead ammunition ban going in to effect in 2019, the hope for a self-sustaining wild condor population could be within reach.

*The Anthropocene: Recovery & Re-Wilding*

## **THE REINTRODUCTION GAP: COULD THE CALIFORNIA GRIZZLY EVER BE REINTRODUCED?**

**Elizabeth S. Forbes**; UC Santa Barbara; 1117 Noble Hall, Santa Barbara, CA, 93106; (978) 314-4303; elizabethforbes@ucsb.edu;

Reintroductions, particularly of large mammals, are increasingly being considered to reverse global biodiversity loss. However, reintroductions are difficult due to the many human-mediated landscape changes that occur between a species' extinction and its proposed return. Therefore, identifying potential reintroduction sites within increasingly novel landscapes depends on identifying the coupled social and biophysical variables that drive landscape change over time, and acknowledging the place-based historical contexts of that change. Certain combinations of social and biophysical variables resulted in extinctions in the past, but others may now favor reintroductions. We term the suite of coupled social and biophysical changes that must occur to enable a successful reintroduction to a landscape of interest the reintroduction gap. We illustrate the reintroduction gap with a case study: the iconic California grizzly bear, extinct for almost a century, has long captured the imagination of Californians. What would a suitable reintroduction landscape look like for the California grizzly? We integrate diverse data and research methods from history, ecology, and the social sciences to bridge the reintroduction gap and envision potential futures for the California grizzly. Our work more broadly demonstrates that heavily interdisciplinary approaches will be increasingly necessary to meet the complex challenges of modern reintroductions.

Co-authors: Peter Alagona, Ian McCullough, Bruce Kendall, Sarah Anderson, Scott Cooper, Andrea Adams, Kevin C. Brown, Molly Hardesty-Moore, Elizabeth Hiroyasu, Robert Heilmayr, Alexis Mychajliw, Jennifer Martin, Chris Miljanich, Zoe Welch, Jolie Colby, Sean Denny, Brian Tyrrell

*The Anthropocene: Recovery & Re-Wilding*

*Student Paper*

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# The Anthropocene: Speciation & Hybridization

(sorted by presentation order)

## PHYLOGEOGRAPHIC ASSESSMENT OF THE HEERMANN'S KANGAROO RAT (*DIPODOMYS HEERMANNI*).

**Bridgett B. Downs**; Texas A&M University; 8233 Kurten Cemetery Rd, Bryan, TX, 77808; (760) 214-2807; bridgettbenedict@gmail.com; Adrian A. Castellanos, Jessica E. Light

The Heermann's kangaroo rat (*Dipodomys heermanni*; Rodentia: Heteromyidae) is a Californian endemic primarily found in the dry, gravelly grassland and open chaparral habitats of the San Joaquin Valley. Current taxonomy (based on morphology and habitat use) recognizes nine subspecies within this kangaroo rat species. Management practices of *D. heermanni* primarily are based on this classification, but this taxonomy may not accurately reflect unique lineages in need of conservation. Using molecular and morphological data, we performed a phylogeographic assessment of *D. heermanni* across the full geographic range of the species. Phylogenetic and network analyses of mitochondrial data from over 90 museum specimens (representing all nine subspecies distributed across the range of the species) revealed no substantial genetic differentiation within *D. heermanni*. Similarly, a geometric morphometric analysis of the crania of over 200 adult *D. heermanni* museum specimens (again representing all subspecies across the geographic distribution of species) resulted in no apparent morphological clustering across geography. Our results indicate that recognition of all nine subspecies is likely unwarranted and that conservation and management practices of *D. heermanni* are in need of revision.

*The Anthropocene: Speciation & Hybridization*

*Student Paper*

## COLOR PATTERNS AND ZONES OF INTERGRADATION IN THE ALAMEDA WHIPSNAKE (*MASTICOPHIS LATERALIS EURYXANTHUS*) AND CHAPARRAL WHIPSNAKE (*M. L. LATERALIS*).

Karen E. Swaim; Swaim Biological Inc.; 4435 First Street, PMB 312, Livermore, CA, 94551; (925) 455-8770; kswaim@swaimbio.com; E.J. Britt, M. Yacelga, R. Stoelting, J.Q. Richmond, C. Swaim, **Eric J. Britt**

The Alameda whipsnake (*Masticophis lateralis euryxanthus* Riemer 1954) is one of two subspecies of the California whipsnake (*Masticophis lateralis* [Hallowell 1853]). The subspecies are purportedly distinguished based on differences in phenotype in the form of color characters. However, the geographic boundaries and phenotypic distinctiveness of the two forms have never been examined in a formal quantitative analysis. From an evaluation of nine color characters, when we assessed each character individually in a geographic context, nonparametric tests identified population-level and ontogenetic variation in many of the supposed diagnostic character states, and notable intergradation among states near the putative southern range boundary of *M. l. euryxanthus*. However, results of multivariate statistical analyses showed that the two subspecies were statistically different when all characters were considered collectively. The zone of morphological intergradation occurs within the same geographic area where *M. lateralis* populations show genetic admixture between regionally divergent clusters, suggesting that the two morphs display at least some evolutionary distinctiveness. These findings provide the first quantitative evidence that protection for the Alameda whipsnake under the CESA/ESA is warranted, although further work is needed to more precisely delimit the geography of the transition zone in terms of the nuclear genome and morphology.

*The Anthropocene: Speciation & Hybridization*

## CONTRACTIONS AND EXPANSIONS: INVESTIGATING THE TRAJECTORY OF THE SIERRA NEVADA RED FOX AND ITS ASSOCIATES.

**Cate B. Quinn**; University of California, Davis; One Shields Ave, Davis, CA, 95616; (703) 489-5350; cbquinn@ucdavis.edu; Brian E. Hatfield, Gregory A. Green, Sarah Stock, Benjamin N. Sacks

The Sierra Nevada red fox (*Vulpes vulpes necator*) experienced major declines in the twentieth century, making it the most endangered of montane red fox subspecies native to the western United States. In particular, the Sierra Nevada distinct population segment (DPS) of the subspecies is currently represented by a single population in the central Sierra Nevada believed to number <50 breeding individuals. Currently the most pressing threats to the Sierra Nevada DPS are inbreeding, combined with the potential for outbreeding depression and genomic replacement from nonnative red fox. Understanding and managing these threats necessitates a widening of focus from the occupied portion of the Sierra Nevada mountain range to consider red fox population dynamics across the historical range, as well as of neighboring mountain ranges. Here we use microsatellite and mitochondrial data from red fox populations in the Pacific Crest and Rockies to present updates on the genetic status of both the Sierra Nevada and Southern Cascade DPS, investigate their relationships to associate montane populations, and identify the most urgent information needs for conservation planning.

*The Anthropocene: Speciation & Hybridization*

## **DOES NATURAL SELECTION AFFECT GENE FLOW BETWEEN NONNATIVE AND NATIVE RED FOX POPULATIONS?**

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The Sacramento Valley red fox (SVRF, *Vulpes vulpes patwin*) is endemic to the northern Central Valley of California. It is considered a State Species of Greatest Conservation Need due to its apparent decline in abundance from historical levels, low genetic effective population size, and its restricted distribution. Along with habitat loss, hybridization with nonnative red foxes of captive-bred origin has been identified as a threat to the SVRF. Genetic monitoring (2007-2018) indicated low levels of overall gene flow across a stable zone of hybridization. However, particular genes related to the unique evolutionary histories of the two populations (i.e. tameness, thermal tolerance, etc.) could be under positive or negative selection, which would result in their being transferred at far greater or lower rates than selectively neutral markers. Because these functional genes can often define populations, it is important to identify selectively shared genes. Using a reduced representation, genotyping-by-sequencing (GBS) approach, we sequenced individuals from the native (n=43), nonnative (n=48), and hybrid (n=14) ranges as well as from reference populations (n=81). We identified thousands of high-quality single nucleotide polymorphisms (SNPs) and conducted outlier tests to identify genomic regions potentially under selection within the native and nonnative populations.

*The Anthropocene: Speciation & Hybridization*

*Student Paper*

## **IDENTIFYING GENOME-INFORMED MANAGEMENT UNITS FOR AN ENDANGERED SPECIES IN CALIFORNIA'S SAN JOAQUIN DESERT.**

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Speciation is a biological process, but species delineation is a sociological process involving value judgments including criteria such as utility and need. Recognizing this, the Federal Endangered Species Act allows for the designation of management units below the species level (Discrete Populations Segments = DPSs). Rapidly advancing techniques for collecting genomic data is providing new opportunities to define management units for threatened and endangered species through identification of their evolutionary significant units (ESUs). However, signals from different genetic markers can lead to different ESU inferences, requiring careful consideration about the underlying causes of signal discordance. Genetic data on the endangered blunt-nosed leopard lizard *Gambelia sila*, a species endemic to the San Joaquin Desert of California, can be used to align the existing management units with ESUs defined by genomic (restriction site associated DNA sequences) and other more traditional data types (i.e. microsatellites and mtDNA). We use a dichotomous key to evaluate whether a hybrid assemblage isolated

from both parent species (*G. sila* and the long-nosed leopard lizard *G. wislizenii*) merits the same protections as *G. sila*. We argue that our data improve the capacity to manage these species in one of the world's most severely compromised landscapes.

*The Anthropocene: Speciation & Hybridization*

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## Wildfire and Wildlife

(sorted by presentation order)

### **PATTERNS OF WOODBORING BEETLE ACTIVITY FOLLOWING RECENT FIRES AND BARK-BEETLE OUTBREAKS IN MONTANE FORESTS OF CALIFORNIA.**

Chris Ray; Institute for Bird Populations; PO Box 1346, Point Reyes Station, CA, 94956; (415) 233-0684; [cray@birdpop.org](mailto:cray@birdpop.org); Daniel R. Cluck, Rodney B. Siegel, Angela M. White, Gina L. Tarbill, Christine A. Howell, Sarah C. Sawyer, **Robert (Bob) L. Wilkerson**

Increasing frequency and severity of drought in the western United States has contributed to increased forest fire frequency, fire season length, and frequency of bark-beetle outbreaks that kill large numbers of trees. Predicted changes in climate are expected to perpetuate these trends, especially in montane habitats, prompting interest in best practices for managing western forests and conserving the wildlife they support. Woodboring beetles colonize dead trees and speed succession of habitats altered by fire or bark beetles, while serving as forage for early-successional habitat specialists, including several woodpecker species. To understand how tree mortality affects this prey base, we sampled larval and adult woodboring beetle activity, tree and stand characteristics, and woodpecker foraging sign within montane forests of California at 16 sites burned or attacked by bark beetles in the previous 1-8 years. Woodborer activity was generally higher at sites burned mid-season. In burned sites, some adult woodborer taxa were more common in severely burned stands, while larval woodborer activity was inversely related to bark-beetle presence and was more common on pines, smaller trees and southern bole aspects. Similarly, in bark-beetle outbreak sites, larval woodborers were most common at the site richest in pine and lowest in bark-beetle activity.

*Wildfire and Wildlife*

### **IMPACT OF WILDFIRES ON BARN OWL (*TYTO ALBA*) HABITAT SELECTION IN A VINEYARD AGROECOSYSTEM IN NAPA VALLEY.**

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In the world-renowned wine growing region of Napa Valley, California, wine producers install nest boxes to attract barn owls (*Tyto alba*) which may reduce rodent crop damage. Annual monitoring of 297 nest boxes began in 2015, and devastating wildfires burned over 60,000 hectares in the region in 2017. The fires burned homes and businesses, as well as some vineyards and uncultivated habitat. Little is known about how barn owls respond to drastic landscape changes such as wildfires and this study addresses that gap. Occupancy surveys and GPS tagging before and after these wildfires reveal changes in habitat selection at the nest and hunting scales in a Before-After-Control-Impact study design. Owls were found breeding in recently burned areas that were previously unoccupied, suggesting that wildfires may change the landscape in a way that encourages nest box occupancy. Data from GPS transmitters provide further insight into the effects of the fires on hunting habitat selection. These results have implications for the potential of barn owls to provide rodent pest control as vineyard owners increasingly install nest boxes and as wildfires increase in the western United States.

*Wildfire and Wildlife*

*Student Paper*

### **EFFECTS OF FOREST FIRE AND DROUGHT-INDUCED TREE MORTALITY ON HABITAT SELECTION BY CALIFORNIA SPOTTED OWLS IN YOSEMITE NATIONAL PARK.**

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Climate change is increasing the frequency and severity of drought in the western United States, contributing to a corresponding increase in "mega-fires" characterized by large areas of high severity burn, and to high tree mortality in unburned stands. We examined habitat characteristics of spotted owl (*Strix*

*occidentalis occidentalis*) territories found between 2004 and 2017 within Yosemite National Park, including within the footprint of the 2013 Rim fire, to assess how fire and drought may have affected habitat use and selection. Burn severity and tree mortality were not determining factors in territory location, and the proportion of territories within the fire's perimeter did not change after 2013. Prior to the fire, territories were characterized by higher canopy cover, density, and tree height than overall available habitat, but after the fire, territories were not significantly different from random locations, as much of the landscape experienced a reduction in tree cover. Our results suggest short-term resilience of spotted owls to the observed habitat changes, with pre-disturbance characteristics appearing to play a much larger role in driving post-disturbance territory selection, perhaps because of high territory fidelity or the acceptance of a reduction of habitat quality given sufficiently good conditions prior to disturbance.

*Wildfire and Wildlife*

## **SHORT-TERM RESILIENCE OF GREAT GRAY OWLS TO A MEGAFIRE IN CALIFORNIA, USA.**

Rodney B. Siegel; Institute for Bird Populations; P.O. Box 1346, Point Reyes Station, CA, 94956; (415) 663-1436; rsiegel@birdpop.org; Morgan W. Tingley, Joanna X. Wu, Sarah L. Stock, Joseph R. Medley, Ryan S. Kalinowski, Angeles Casas, Marcie Lima-Baumback, Adam C. Rich, **Stephanie A. Eyes**

Throughout western North America, longer, hotter fire seasons and dense fuels are yielding more frequent, larger, and higher-severity wildfires. Wildlife species associated with late-seral forest characteristics may be particularly vulnerable to habitat loss stemming from changing fire regimes. Great Gray Owl (*Strix nebulosa*) is a California endangered species that typically nests in large snags in well-shaded forests adjacent to montane meadows. The 2013 Rim Fire burned nearly a quarter of all known or suspected Great Gray Owl territories in California at the time. We analyzed 13 years (2004 - 2016) of Great Gray Owl detection/non-detection data from 144 meadows inside and outside the Rim fire perimeter, in Yosemite National Park and Stanislaus National Forest. Bayesian hierarchical modeling revealed that persistence of owls at meadows increased post-fire inside and outside the fire perimeter. These dynamics were unrelated to post-fire forest structure variables describing stands around the individual meadows, suggesting factors other than the fire were favorable to Great Gray Owls during the post-fire years. Great Gray Owl populations in the Sierra Nevada appear to have been largely resilient to effects of the Rim Fire during the three years after it burned.

*Wildfire and Wildlife*

## **HABITAT SELECTION BY NORTHERN GOSHAWKS (*ACCIPITER GENTILIS*) IN A FIRE-PRONE FOREST IN THE SIERRA NEVADA, CALIFORNIA.**

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The northern goshawk (*Accipiter gentilis*) is an apex predator of coniferous forests likely to be affected by changing fire regimes. We tracked 15 Northern Goshawks using GPS loggers over 4 years to investigate roosting and foraging habitat selection in the context of a spatially heterogeneous fire regime. We evaluated movements at landscape, home range, daily and foray spatial scales. Goshawks selected late-seral stage habitat for both roosting and foraging at multiple spatial scales. Less than 2% of Northern Goshawk roosts were in recently burned areas and goshawks avoided high severity burned areas when foraging across all scales, but selected for low-medium severity burned areas at the landscape scale. No goshawks migrated, but four individuals undertook forays, up to 15 km from their nest location, and others may have left and not returned to our study areas. High severity fires are likely to destroy both foraging and roosting habitat for northern goshawks, but lower severity burns may provide foraging opportunities for this generalist predator. Given the dependence of goshawks on late-seral forests, threat of high severity fire, and their apparent selection of lower-severity burned areas, future studies could examine effects of fuel reduction treatments or other management strategies on this species.

*Wildfire and Wildlife*

## **FACTORS INFLUENCING EFFECTIVENESS OF FUEL BREAKS FOR CONTAINING RANGELAND WILDFIRES WITHIN THE GREAT BASIN.**

**Cali Roth**; U.S., Geological Survey; 800 Business Park Dr Suite D, Dixon, CA, 95620; (330) 592-9319; croth@usgs.gov; Peter Coates, Mark Ricca, Michele Crist, Julie Heinrichs, Douglas Shinneman

Iconic sagebrush ecosystems of the American West are threatened by wildfires that kill sagebrush and facilitate invasion by flammable annual grasses. The result is a non-analog positive feedback loop that has greatly increased wildfire frequency, severity, and extent. Finding methods to effectively thwart this novel Anthropocene-disturbance regime lie at the forefront of national conservation efforts. Networks of fuel breaks are a management tool that may minimize catastrophic losses of sagebrush to fire by reducing hazardous fuel loads, disrupting fuel continuity, and facilitating critical on-the-ground staging of initial attack and suppression operations. However, little is known about the broad-scale effectiveness of fuel breaks at containing wildfires in sagebrush ecosystems, or the tradeoffs between fire suppression and sagebrush disturbance produced by fuel break installation and maintenance. We leveraged extensive multi-agency databases of fuel breaks coupled with annual wildfire severity and extent maps in a retrospective analysis to identify suites environmental variables and fuel-break design characteristics associated with probabilities of halting the spread and reducing the severity of wildfires across the Great Basin. Results can also help managers identify other areas for targeted fuel break installations. Findings are preliminary and provided for timely best science.

*Wildfire and Wildlife*

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## **Wildlife Professionals: Agency Coordination & Collaboration**

(sorted by presentation order)

### **COLLABORATION: CRUCIAL TO MITIGATING CONFLICT WITH MOUNTAIN LIONS.**

**Korinna Domingo**; Mountain Lion Foundation; 1225 8th St #435, Sacramento, CA, 95814; (818) 415-0920; conservation@mountainlion.org;

The Mountain Lion Foundation has been actively collaborating with agencies including the California Department of Fish and Wildlife, UC Davis Wildlife Health Center, the Santa Monica Mountains National Recreation Area, 4-H, and the UC Hopland Research & Extension Center to reduce the number of mountain lions (*Puma concolor*) killed on depredation permits. The partnerships have demonstrated non-lethal protection for people, pets and livestock, and have implemented direct measures in response to specific conflicts. Nonprofit organizations become effective partners by listening carefully to agency staff, identifying those areas where agencies lack resources or capacity to accomplish common goals, and offering to fill those gaps. A comprehensive new agency-sanctioned California Mountain Lion Brochure was created under the leadership of WildFutures. With CDFW, the Mountain Lion Foundation is developing a suite of educational brochures to address remains disposal, deterrent devices, hazing, enclosures, fencing, guardian animals, and large herd husbandry. As with similar collaborative carnivore protection efforts throughout the West, long-term solutions require mutual acceptance of a dearth of longitudinal scientific data, development of clearly communicated action models, and solutions that are both sensitive to local differences and scalable to large landscapes.

*Wildlife Professionals: Agency Coordination & Collaboration*

### **THE CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE (CDFW) SCIENCE INSTITUTE - SUPPORTING COLLABORATIVE SCIENCE FOR ACTION.**

**Christina Sloop**; California Department of Fish and Wildlife; 1416 9th Street, Rm 1237, Sacramento, CA, 95814; (916) 261-1159; christina.sloop@wildlife.ca.gov; Whitney Albright, Junko Hoshi

Established in 2012, the Science Institute features an internal science support program endeavoring to facilitate quality, visibility and integrity of science conducted and used within CDFW. The CDFW mission is managing California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. Science conducted or applied in CDFW is thus generally used to inform critical decisions guiding land, fisheries, and wildlife management, conservation, animal and environmental health, law enforcement, regulatory compliance, and permitting. Defensible scientific information is a primary element of this decision-support framework. In May 2019, the Science Institute will release a five-year action plan focused to promote visibility and transparency of CDFW science activities, encourage collaborative partnerships, support high standards in scientific conduct, foster science capacities, and build a strong science community. Collaborative partnerships are critical to assuring the high-level scientific capacity and rigor needed to inform decisions supporting the CDFW mission. This presentation is intended to familiarize the wildlife management community with the Science Institute and serve as an invitation to join the discussion on CDFW's role in supporting wildlife and conserving biodiversity in California.

*Wildlife Professionals: Agency Coordination & Collaboration*

### **SUPPORTING INTEGRATION OF CLIMATE ADAPTATION STRATEGIES INTO CDFW WILDLIFE AND LAND MANAGEMENT PRACTICES.**

**Whitney L. Albright**; California Department of Fish and Wildlife; 1416 9th Street, Sacramento, CA, 95816; whitney.albright@wildlife.ca.gov; Armand Gonzales, Dylan MacArthur-Waltz, Rachel Portillo

Climate change and associated biological impacts pose a major challenge to natural resource management. It has become increasingly important to integrate climate science and adaptation strategies into long-term conservation planning as well as on-the-ground land management and resource assessment efforts. The California Department of Fish and Wildlife (CDFW) manages 749 properties throughout the state totaling over 1,100,000 acres of fish and wildlife habitat. As a steward of the state's natural resources, CDFW has the opportunity and an obligation to manage CDFW lands for climate risks to ensure resilience of fish, wildlife, and the ecosystems on which they depend to environmental change. The CDFW Science Institute Climate Program evaluated the resilience and vulnerability of CDFW lands to inform long-term strategic planning and on-the-ground resource management decisions. The presentation will cover project background, assessment results, and opportunities to disseminate and apply the final products. The discussion will include an overview of climate vulnerability and resilience information for specific lands and associated wildlife, as well as offer ecoregional trends. This project was made possible through close collaboration with the Stanford's Woods Institute for the Environment and the Haas Center for Public Service, a partnership that will be highlighted in the presentation.

*Wildlife Professionals: Agency Coordination & Collaboration*

### **AGENDA-DRIVEN SCIENCE: RECOGNIZING AND AVOIDING THE PITFALLS.**

**R. J. Gutierrez**; University of Wisconsin; 539 Old Roundhouse Rd, McKinleyville, CA, 95519; (612) 916-1987; gutie012@umn.edu; Gavin M. Jones, M. Zachariah Peery

We believe science advocacy is essential to foster science-based wildlife conservation and management. However, the boundary between science advocacy, where one attempts to interpret scientific research to facilitate its correct use in policy making and management applications, and advocacy science, where one allows a conservation objective to dictate the structure of research such that one derives a result favorable to that objective, is often blurred. Therefore, much controversy exists in practice and in the literature about the proper role of advocacy by scientists working in conservation and wildlife management. We discuss an extreme form of advocacy that we label agenda-driven science. We define agenda-driven science as intentionally engaging in activities outside of professional norms to promote desired outcomes, either as part of the production or dissemination of science. These activities are focused on either achieving a desired outcome or obfuscating existing information rather than on elucidating information. As such it has potential to undermine the credibility of science and scientists. We present activities that, when considered collectively, might indicate agenda-driven science. We urge all scientists and wildlife managers to be mindful of agenda-driven science as it may exacerbate the polarized political and social views of science developing in the Anthropocene.

*Wildlife Professionals: Agency Coordination & Collaboration*

### **CREATING COLLABORATIVE LANDSCAPE CONSERVATION OPPORTUNITIES THROUGH REGULATORY FRAMEWORK - SB34 ADVANCED MITIGATION LAND ACQUISITION GRANTS PROGRAM.**

**Cody Hanford**; Transition Habitat Conservancy; P.O. Box 723100, Pinon Hills, CA, 92372; (865) 414-0931; cody@transitionhabitat.org; Armand Gonzales, Junko Hoshi, Jill Bays, Peter Satin, Tim Shields

The SB34 Advanced Mitigation Land Acquisition Grants Program (Program) was born amid the push by federal and state entities to increase renewable energy production. The Program sought to facilitate mitigation impacts to threatened and endangered species in which CDFW would coordinate habitat acquisition and restoration using in lieu fees from developers. Though overshadowed by the massive scope of the DRECP's 22 million-acre plan, the Program's framework has provided a unique opportunity for collaborative landscape conservation. The strategic purchase and management of nearly 10,000 acres of mitigation lands has provided a direct benefit for desert tortoise and other species. Moreover, the two land trusts who hold these parcels, Mojave Desert Land Trust and Transition Habitat Conservancy, have used their regional stakeholder status to provide additional habitat benefits for over 500,000 acres within the California Desert. Through the talk, partners under the Program will present on-the-ground successes and challenges for perpetual conservation of the SB34 lands. After eight years of this unprecedented program, they have identified the pressing needs for near-future management and prospects for continued habitat

improvement. These details will be introduced and discussed, focusing on the critical resource gaps and the science to inform and conduct best management practices.

*Wildlife Professionals: Agency Coordination & Collaboration*

## **CALIFORNIA BIODIVERSITY COUNCIL: 28 YEARS OF INTERAGENCY COORDINATION AND COLLABORATION.**

**Don Yasuda**; California Biodiversity Council, Interagency Alignment Team; 4277 Patterson Dr, Diamond Springs, CA, 95619; (530) 409-5405; [dyasudaTWS@gmail.com](mailto:dyasudaTWS@gmail.com); Kamyar Guivetchi, Denny Grossman

The California Biodiversity Council (CBC) was formed in 1991 to improve coordination and cooperation between the various resource management and environmental protection organizations with a stake in conserving biodiversity in California. Currently membership includes over 40 organizations at federal, state, and local levels. The preamble statement originally made in 1991 remains true today that “To effectively conserve California's biological resources and maintain social and economic viability, public agencies and private groups must coordinate resource management and environmental protection activities, emphasizing regional solutions to regional issues and needs. The CBC issued a resolution in 2013 to Strengthen Agency Alignment for Natural Resource Conservation and created an Interagency Alignment Team. In 2014 a second resolution to Implement the Strategic Growth Council's Integrated Regional Planning Initiative was adopted. The importance of coordination, collaboration, and partnerships was reaffirmed with the signing of an Executive Order in September 2018 by California Governor Jerry Brown establishing the California Biodiversity Initiative. Examples of interagency coordination and collaboration by the CBC and members will be provided as a means to explore new opportunities to contribute to successfully supporting the California Biodiversity Initiative's three immediate steps to understand, protect, and manage California's biodiversity and seven broad Roadmap areas.

*Wildlife Professionals: Agency Coordination & Collaboration*

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## Wildlife Professionals: Consultant Case Studies

(sorted by presentation order)

### **A DIFFERENT WAY TO ASSESS WILDLIFE CONNECTIVITY.**

**John Ko**; LSA; 20 Executive Park, Suite 200, Irvine, CA, 92614; (949) 553-0666; john.ko@lsa.net;

The California High-Speed Rail Authority and the Federal Railroad Administration are teaming to construct an 800-mile high-speed train system connecting the Bay Area to San Diego, with a spur to Sacramento. Trains will travel at speeds of 220-mph and require fenced separation to avoid collisions with humans and wildlife. The Bakersfield to Palmdale Section passes through a regionally significant wildlife habitat linkage, the Tehachapi Connection. As part of the Wildlife Connectivity Assessment (WCA) used to analyze potential project effects to wildlife movement, a Local Permeability Analysis (LPA) was developed to quantify the change in relative movement cost for nine focal species: mountain lion, desert tortoise, mule deer, western gray squirrel, American badger, Tipton kangaroo rat, San Joaquin kit fox, blunt-nosed leopard lizard, and desert kit fox. Unlike most regional least-cost corridor analysis, the LPA evaluated wildlife movement at a local scale along the entire length of the project alignment. The LPA analyzed movement cost rasters for each focal species, developed from topography, elevation, land cover, and road density GIS raster data. This modeling approach has application on other regionally significant transportation projects for analyzing impacts to wildlife movement and justify mitigation options.

*Wildlife Professionals: Consultant Case Studies*

### **NON-INVASIVE SURVEY METHODS FOR DETECTING THE ENDANGERED BUENA VISTA LAKE SHREW (*SOREX ORNATUS RELICTUS*).**

Erin N. Tennant; California Department of Fish and Wildlife; 1234 E. Shaw Ave, Fresno, CA, 93710; (661) 477-9239; erin.tennant@wildlife.ca.gov; Brian Cypher, Larry Saslaw, Tory Westall, Jacklyn Mohay, Erica Kelly, Christine Van Horn Job, **Larry R. Saslaw**

When surveying for any wildlife species, but particularly an endangered species, it is important to have non-invasive survey techniques available to prevent possible injury or death. For small mammals, like the Buena Vista Lake shrew (*Sorex ornatus relictus*: BVLS), live-trapping in Sherman-style box traps, or using pit fall traps, are common detection techniques. However, both methods have caused mortalities. In order to reduce impacts from live-trapping and possibly have better detection success, we investigated three potential non-invasive survey methods: track tubes, scat tubes, and camera traps. These three techniques were initially tested in areas with high detection rates of shrews during previous live-trapping surveys. We found that Reconyx camera traps specifically designed with a close focal distance outperformed all other survey methods. Track tubes were the least effective method. We followed up with a comparison test of scat tubes, camera traps, and small Sherman live-traps. We found that cameras outperformed live-traps ( $X^2 = 42.24$ , 1 df,  $P < 0.0001$ ) and scat tubes ( $X^2 = 16.35$ , 1 df,  $P < 0.0001$ ). Furthermore, of the 24 camera stations that detected shrews during the test, 21 detected them on the first night. Use of cameras is highly recommended for conducting surveys for BVLS.

*Wildlife Professionals: Consultant Case Studies*

### **CALIFORNIA TIGER SALAMANDERS, EXCLUSION FENCING AND HIGH-SPEED RAIL CONSTRUCTION - A CASE STUDY.**

**Marcus D. Jones**; Rincon Consultants; 7080 N Whitney Ave Suite 101, Fresno, CA, 93720; (559) 375-2717; Marcusjones@rinconconsultants.com; Krista Tomlinson

California High-Speed Rail has been under construction in the central valley for a few years with potentially adverse effects to wildlife. As construction expands, the interaction between construction and

wildlife has become a common occurrence. The potential for adverse effects to sensitive biological resources is managed through the implementation of mitigation and avoidance measures. The use of wildlife exclusion fencing (WEF) as an avoidance measure in California tiger salamander (CTS) habitats is a unique tool designed to separate construction from occupied habitats. The project's use of WEF, in conjunction with cover-boards, has had variable success and continues to raise questions about the effectiveness of exclusion fencing and its role in conservation of CTS. Early results observed on this project, has indicated that fencing placement and material selection plays a significant role in the efficacy of WEF. The use of cover-boards has proven to be an efficient tool to shelter CTS along WEF; however, placement and season of use play significant roles in ensuring cover-board success. Wildlife encounters at construction sites will continue to increase. Evaluating the effectiveness of protective measures during construction will provide critical information to refine conservation efforts, and ensure wildlife will always have a place in California.

*Wildlife Professionals: Consultant Case Studies*

## **IMPACTS OF TRANSIENT HUMAN COMMUNITIES ON WILDLIFE AND HABITAT, AND BIOLOGICAL FIELD STAFF MONITORING PRACTICES AND SAFETY.**

**Devin Barry**; GEI Consultants, Inc.; 2868 Prospect Park Drive, Suite 400, Rancho Cordova, CA, 95670; (916) 341-9125; [dbarry@geiconsultants.com](mailto:dbarry@geiconsultants.com); Kelly Fitzgerald-Holland, Sarah Norris, Autumn Eberhardt

Environmental mitigation measures aim to minimize habitat degradation but do not consider the potential impacts of transient human populations on the environment (e.g., species, habitats, water quality) and human health and safety. This case study, which focuses on an urban parkway in Sacramento County, California, examines impacts of transient encampments on both the health and safety of biologists conducting the surveys, and on the species and habitat quality. Human occupation in urban parkway environments introduces a unique set of health and safety risks for biologists, which require consideration during planning and implementation phases of a project as these relate to staff numbers, time-of-day scheduling, equipment needs, and additional training requirements. We discuss the various risks encountered and provide recommendations to mitigate health and safety risks. We present anecdotal observations about the impacts of transient human populations on wildlife and habitats -- specifically the abundance and species diversity of nesting bird populations and vegetative and aquatic communities -- and conclude that transient communities have an adverse effect on wildlife behaviors. Without social and legal reforms that effectively address transient communities, biological consultants need to implement additional health and safety precautions, training, and awareness when working in these urban environments beyond what is typically required for field survey.

*Wildlife Professionals: Consultant Case Studies*

## **NESTING BEHAVIOR OF BIRDS STUDIED OVER TWO YEARS DURING MAJOR LEVEE IMPROVEMENT CONSTRUCTION.**

**Brook M. Constantz**; GEI Consultants Inc.; 2868 Propspect Park Dr #400, Ranch Cordova, CA, 95670; (650) 868-4809; [bconstantz@geiconsultants.com](mailto:bconstantz@geiconsultants.com); Hannah Dunn

From 2017-2018, the West Sacramento Area Flood Control Agency (WSAFCA) improved a 9,200-meter (7-mile) levee section along the west side of the Sacramento river in West Sacramento, California. During the project duration, biologists from GEI Consultants monitored nest behavior and success for all species protected under the Migratory Bird Treaty Act. Monitoring was conducted inside and up to 400 meters (1,312 feet) from the construction limits during the nesting bird season, and monitoring was expanded to the waterside of the levee during the 2018 construction season. GEI biologists monitored the behavior of nesting birds throughout and adjacent to the construction limits, collecting over 1,000 nest monitoring logs and documenting over 100 active nests in an area of 240 hectares (600 acres). This study focuses nesting preferences, behavior, and success for a variety of the nesting birds observed during construction monitoring, including Swainson's hawk (*Buteo swainsonii*), bushtits (*Psaltriparus minimus*), and northern mockingbirds (*Mimus polyglottos*). In particular, nesting preferences for waterside passerine (Passeriformes) species (n = 12), for which nests were documented (n = 54), were analyzed and compared for tree density and nest clustering. Further, results of nesting behavior (i.e., timing of courtship, nest

building, incubation, and fledging) and success of several key species are reported from the two years of data collection and analysis.

*Wildlife Professionals: Consultant Case Studies*

## **OPPORTUNITIES AND CHALLENGES IN RESTORING HABITAT OCCUPIED BY SENSITIVE SPECIES.**

**Charles H. Holland;** Westervelt Ecological Services; 600 N Market Blvd, Suite 3, Sacramento, CA, 95834; (530) 908-2101; [hholland@westervelt.com](mailto:hholland@westervelt.com); Krista Tomlinson

The High Speed Rail (HSR) has begun construction in the San Joaquin Valley, and the section between Bakersfield and Fresno crosses through diverse valley floor habitats. Permitting for the project has addressed nine state and/or Federally listed threatened or endangered species, and five wetland habitats. HSR is committed to landscape level habitat restoration and preservation, and Westervelt Ecological Services has been working since 2016 to secure 8 properties totaling over 2,200 acres to aid in achieving the conservation objectives required in the project permits. This session will look at the challenges and opportunities associated with securing, restoring, and preserving this scale of habitat spread across the southern San Joaquin valley. In addition, many of these sites have required habitat enhancement or restoration activities to improve species habitat or increase wetland acreage/function. Performing habitat enhancing activities on sites occupied listed species can prove complicated from both a permitting and implementation standpoint. This talk will be co-presented by Westervelt and CDFW, and will provide insights in the planning process as well as share on-the-ground examples of how work was conducted in habitat occupied by San Joaquin Kit Fox, California tiger salamander, burrowing owl, Tipton kangaroo rat, and San Joaquin antelope squirrel.

*Wildlife Professionals: Consultant Case Studies*

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# Wildlife Techniques and Technologies

(sorted by presentation order)

## **AN IMPROVED CAMERA TRAP FOR AMPHIBIANS, REPTILES, SMALL MAMMALS, AND LARGE INVERTEBRATES.**

**Michael T. Hobbs**; Hobbs Ecology; 4316 Bayne Place, San Jose, CA, 95130; mhobbs2928@gmail.com; Cheryl S. Brehme

Camera traps are valuable sampling tools commonly used to inventory and monitor wildlife communities but are challenged to reliably sample small animals. We introduce a novel active camera trap system enabling the reliable and efficient use of wildlife cameras for sampling small animals, particularly reptiles, amphibians, small mammals and large invertebrates. It surpasses the detection ability of commonly used passive infrared (PIR) cameras for this application and eliminates problems such as high rates of false triggers and high variability in detection rates among cameras and study locations. The system, which employs a HALT trigger, is capable of coupling to digital PIR cameras and is designed for detecting small animals traversing small tunnels, narrow trails, small clearings and along walls or drift fencing.

*Wildlife Techniques and Technologies*

## **CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE EXPLORES UTILIZING BIOLOGICAL SCENT DETECTION CANINES FOR SCIENCE.**

**Helayna Pera**; 1701 Nimbus Road, Rancho Cordova, CA, 95670; (916) 850-9986; helayna.pera@wildlife.ca.gov; Harvest Vieira, Sandra Jacks, Virginia O'Rourke, Jodi Berg, Jennifer Carlson, Lynette Shimek

Since 2006, the California Department of Fish and Wildlife has had a successful law enforcement K9 program, but what about using scent detection dogs for science? Staff at the Department are exploring the effectiveness of utilizing the amazing scent detection capabilities of dogs for science. However, before deploying a dog to collect data, consistent training and adherence to protocols is key to any effective scent detection dog work. Using the successful law enforcement K9 program as a platform, Department scientists are building a scientific component while adhering to standardized training and certification requirements. This ensures effective and reliable data collection, offsets liability and safety concerns to not only the handler, canine, and general public but to wildlife species, and provides consistency amongst Department canine handlers. We recognize the need for a scientific based program not only for deployment of canine handlers but to also review projects being submitted to the Department for use to find sensitive resources such as endangered species.

*Wildlife Techniques and Technologies*

## **ESTIMATING HOME RANGES USING DIFFERENT CURRENCIES AND ANIMALS' PERCEPTION ABOUT THEIR ENVIRONMENTS.**

**Roger A. Powell**; Department Applied Ecology, North Carolina State University; Campus Box 7617, Raleigh, NC, 27695-7617; (218) 235-8808; newf@ncsu.edu; Shannon Barber-Meyer, Christopher S. DePerno, Aaron N. Facka, Thomas Gable, Nocholas P. Gould, Susan A. Mansfield, L. David Mech, Lynn L. Rogers, Stephen Windels

Most researchers estimate home ranges using telemetry location estimates. With an appropriate estimator, this approach produces utilization distributions that approximate probability distributions for where animals spend time. Today, essentially all home ranges estimated use time as their currency. Estimating home ranges using energy expenditure and importance of resources provides different insights into why animals use space as they do. Weighting each telemetry location by rate of energy expenditure at that time

produces a new utilization distribution. For some animals, energy expenditure in their home range cores is higher, and in the home range peripheries lower, than time spent in those areas. Home range estimators have parameters that must be chosen to be appropriate to the biology of study animals and research technology. Choosing those parameters based on perceptual distances for sight, sound, smell and memory produce different utilization distribution yet, explaining different aspects of why animals use space as they do. We present data for fishers (*Pekania pennanti*), black bears (*Ursus americanus*) and wolves (*Canis lupus*) to illustrate how using different currencies and perceptual distances affect utilization distributions, home range overlap, and home range cores.

*Wildlife Techniques and Technologies*

### **AREAS OF CONSERVATION EMPHASIS (ACE) VERSION 3: BIODIVERSITY, SIGNIFICANT HABITATS, CONNECTIVITY, AND PREDICTED CLIMATE RESILIENCE MAPS FOR CALIFORNIA.**

**Melanie Gogol-Prokurat**; California Department of Fish and Wildlife; 1416 9th Street, 12th floor, Sacramento, CA, 95814; (916) 324-9265; melanie.gogol-prokurat@wildlife.ca.gov;

The Areas of Conservation Emphasis (ACE) project was developed by the California Department of Fish and Wildlife (CDFW) to provide an easily accessible and standardized way to view a mapped summary of the best available, conservation-relevant, statewide data in California, including biodiversity, significant habitats, connectivity, and predicted climate resilience. ACE analyzes and summarizes species location and distribution model information from CDFW mapped data products including the California Wildlife Habitat Relationships system (CWHR), the California Natural Diversity Database (CNDDDB), and the Survey of California Vegetation, to show the distribution of biodiversity, species richness, rarity, and irreplaceability across the state and in each ecoregion. The terrestrial data is summarized and displayed in a standardized hexagon (2.5 mi<sup>2</sup>) grid, and the aquatic data is compiled by HUC12 watershed. The ACE maps provide a coarse level view of information for conservation planning purposes, ranging from ecological research and modeling to local land-use planning and conservation decision-making.

*Wildlife Techniques and Technologies*

### **ROCK CORRALS, A NOVEL AND LOW-TECH APPROACH TO THE SUCCESSFUL RELOCATION OF FOOTHILL YELLOW-LEGGED FROG (*RANA BOYLI*) EGG MASSES.**

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Foothill yellow-legged frog (*Rana boylei*, FYLF), currently a Candidate for Threatened Status under the California Endangered Species Act, reside in numerous Sierra Nevada foothill streams. Many foothill streams, such as Greenhorn Creek located in Nevada County, contain mine tailings due to California's hydraulic mining days from the 1800s. Greenhorn Creek has been mined for gravel for the past 50 years, and also happens to be home to a breeding population of FYLF. In a typical year the annual harvesting of gravel coincides with FYLF breeding season, and therefore, for the last few years local biologists have conducted capture and relocation of the frogs where the gravel harvesting takes place. FYLF typically attach their egg masses to the downstream side of cobble-sized rocks to ensure stability within the current, but may also attach them to bedrock, boulders, or substrates too large to move safely. With the newly issued Incidental Take Permit for the project, in 2018 biologists negotiated with CDFW to test a novel egg mass relocation method. This innovative approach involved biologists detaching egg masses from their original substrate and relocating them into a "rock corral" within the stream current. Herein we present the methods and results of the relocation of over 1,000 adults, juveniles, and FYLF egg masses.

*Wildlife Techniques and Technologies*

### **CAMERA TRAP MONITORING OF CULVERT USAGE UNDER VASCO ROAD WITH**

## **EMPHASIS ON CALIFORNIA RED-LEGGED FROGS AND CALIFORNIA TIGER SALAMANDERS.**

**Travis WC McCleary**; Sapere Environmental; 135 Glasgow Circle, Danville, CA, 94526; (925) 719-1916; [tmcclary@sapereenv.com](mailto:tmcclary@sapereenv.com); Jerry Roe

Culverts are an effective tool to decrease the effects of habitat fragmentation posed by busy roads and provide a means for safe passage for a variety of wildlife species. Eight culverts were installed under a one-mile segment of Vasco Road in eastern Contra Costa County, California in conjunction with a Caltrans Local Assistance road safety improvement project to increase road permeability and decrease road mortality. Various box and pipe culvert designs were constructed with variable angles and line of sight configurations. Time-lapse and passive infrared trail cameras were deployed on seven selected culverts to evaluate wildlife usage and efficacy with an emphasis placed on California red-legged frogs (*Rana draytonii*) and California tiger salamander (*Ambystoma californiense*). Trail cameras were deployed during two consecutive wet seasons, from January 27, 2017 to July 4, 2017, and November 2, 2017 to May 31, 2018, for a total of 2,979 trap nights. Data were analyzed to quantify capture events, images, and culvert crossings; frequency of use by species; and performance of camera configurations (time lapse vs. motion detection) across taxa. A total of 4.41 million photos recorded resulted in 7,208 total capture events, including 47 California red-legged frog capture events (1,035 images) and 14 California tiger salamander capture events (173 images). Thirty-two species were documented using the culverts with 9.86% of non-rodent capture events resulting in successful crossings. No crossing events were recorded for California red-legged frogs or California tiger salamanders; however, behavioral responses exhibited by reptile and mammal species suggest individuals spend little time within culverts during crossing events, and images indicate wildlife utilize culverts for other functions. Further study is needed to determine how amphibians use culverts and how culvert design can be improved to facilitate amphibian crossings.

*Wildlife Techniques and Technologies*

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# Yosemite Restoration I

(sorted by presentation order)

## **A MULTI-SCALE APPROACH TO RESTORING AN AQUATIC REPTILE.**

**Laura N. Van Vranken**; University of California, Merced; 4154 Tudal Ave, Merced, CA, 95348; (760) 207-3920; lauranvan@gmail.com; Rob L. Grasso, Danielle Edwards

Recent advances in genetic and genomic tools have improved our ability to detect patterns of population structure and differentiation across multiple spatial scales, particularly for non-model organisms. We aim to leverage these tools to characterize population and landscape genetic patterns for the Western pond turtle (*Emys [Actinemys] marmorata*) in an understudied portion of their range: the central Sierra Nevada and foothill region within and surrounding Yosemite National Park. Uncovering patterns of demography and structure within and between populations will allow us to guide pond turtle management in this region, primarily with the goal to direct reintroduction efforts of an extirpated population in Yosemite Valley. Preliminary results through mitochondrial DNA analyses present two distinct clades in the central Sierra, with the Merced River corridor acting as a barrier to the distribution of the southern clade. Future work will further identify population dynamics, including effective population sizes, genetic diversity, and gene flow, as well as determine if populations are adapted to their respective environmental conditions. These efforts will reveal patterns at the population and local landscape level, previously undocumented in this species, as well as inform conservation and management efforts for pond turtles in this region.

*Yosemite Restoration I*

## **CONSERVATION EFFORTS FOR THE CALIFORNIA RED-LEGGED FROG (*RANA DRAYTONII*) IN YOSEMITE NATIONAL PARK.**

**Robert L. Grasso**; Yosemite National Park; 5083 Foresta Road, El Portal, CA, 95318; (209) 379-1438; rob\_grasso@nps.gov; Jessie Bushell, Colleen D. Kamoroff, Rachel Mazur

Yosemite NP Session Presentation by Rob Grasso on CA red-legged frog The federally threatened California red-legged frog (*Rana daytonii*) is perhaps restricted to less than 10 sites remaining in the Sierra Nevada. After successful eradication of the invasive American bullfrog (*Rana catesbeianus*), the red-legged frog was introduced to Yosemite Valley starting in 2016 in an effort to re-establish a large population stronghold in a significant area of its former range. In partnership with the San Francisco Zoo and the Yosemite Conservancy the park is planning to release close to 1,000 adult frogs in Yosemite Valley by the end of 2020. The park will provide a historical overview for the project as well as an update on status of the introductions to date. An update to the ongoing effort to remove bullfrogs from two historically occupied red-legged frog habitats (Swamp Lake & Gravel Pit Lake) in Yosemite's wilderness will also be provided as well the long-term strategy for reintroducing the red-legged frog into these sites.

*Yosemite Restoration I*

## **IN-SITU DETECTION OF THE INVASIVE AMPHIBIAN CHYTRID FUNGUS: FIELD DNA EXTRACTION AND ANALYSIS USING A HANDHELD THERMOCYCLER.**

**Colleen D. Kamoroff**; Yosemite National Park ; 5083 Foresta Rd, El Portal, CA, 95318; (209) 379-1920; colleen\_kamoroff@nps.gov; Rob L. Grasso, Caren S. Goldberg

The amphibian chytrid fungus, *Batrachochytrium dendrobatidis* or Bd, is an invasive skin disease associated with mass mortality and extinction of amphibians worldwide. In the Sierra Nevada, two endangered yellow-legged frogs, *Rana sierrae* and *R. muscosa*, are highly susceptible to Bd and have experience dramatic declines and extirpations due in part to the disease. Yosemite National Park is monitoring and managing yellow-legged frog populations by testing and treating for Bd as part of species recovery efforts. During the 2018 field season, Yosemite piloted Biomeme's mobile qPCR platform for onsite results from Bd samples. We visited three known Bd positive sites, swabbed yellow-legged frog and

collected environmental DNA (eDNA) filtered water samples. We collected samples in duplicate and analyzed the samples using traditional DNA extraction and qPCR methods as well as Biomeme's in-situ DNA extraction and handheld thermocycler. We detected Bd DNA consistently for all yellow-legged frog swabs and some eDNA samples using in-situ methods. All results from Biomeme's extraction and analysis methods were available within an hour after sampling. This is the first method for rapid field testing of Bd which will likely have strong implications for future management or species recovery efforts.

*Yosemite Restoration I*

## **RESTORATION EFFORTS FOR THE SIERRA NEVADA YELLOW-LEGGED FROG (*RANA SIERRAE*) IN YOSEMITE NATIONAL PARK.**

**Robert L. Grasso**; Yosemite National Park; 5083 Foresta Road, El Portal , CA, 95318; (209) 379-1438; rob\_grasso@nps.gov; Roland A. Knapp, Colleen D. Kamoroff, Jessie Bushell, Rachel Mazur

This presentation is part of the Yosemite NP Session talks. The federally endangered Sierra Nevada Yellow-legged frog (*Rana sierrae*) has experienced sharp declines in the Sierra Nevada including Yosemite National Park over the last 30 years largely due to fish stocking and the highly invasive amphibian fungal pathogen (*Batrachochytrium dendrobatidis*, Bd) that causes chytridiomycosis. Today, park populations of this once abundant frog are now increasing both naturally and due to restoration and recovery efforts underway in Yosemite. However, in several areas of the park that are now fishless this frog is not likely to recolonize on their own. In collaboration with the University of California, Santa Barbara, the San Francisco Zoo, and the Yosemite Conservancy the park is planning a new strategy to restore frogs in extirpated landscapes. The park will provide a historical overview of the project from fish stocking to current frog reintroduction efforts as well as showcase new insights to the winter ecology of this species.

*Yosemite Restoration I*

## **RETURNING ENDANGERED SIERRA NEVADA BIGHORN SHEEP TO YOSEMITE'S WILDERNESS.**

**Tom R. Stephenson**; California Department of Fish and Wildlife; 787 N Main St, Bishop, CA, 93514; (760) 873-4305; tom.stephenson@wildlife.ca.gov; Sarah L. Stock, John D. Wehausen

Species restoration projects have become increasingly more common on national park lands where endangered wildlife species are less subject to widespread threats, such as habitat destruction and livestock. For the past two decades, endangered Sierra Nevada bighorn sheep (*Ovis canadensis sierrae*) have been the focus of large-scale recovery efforts spanning the southern Sierra Nevada range and encompassing breeding and wintering habitat in three national parks. In order to down-list the subspecies, the appropriate number of females must be attained across four geographically distinct recovery units while preventing contact and disease transmission between Sierra bighorns and domestic sheep. In 1914, Sierra bighorns were declared extirpated from Yosemite National Park. Here we describe reintroduction and augmentation efforts that returned Sierra bighorns to Yosemite and that recently led to achieving the recovery goal of 50 yearling and adult ewes in the Yosemite area. However, the population remains vulnerable to malnutrition, disease, avalanche accidents, predation, and genetic inbreeding. This project supports the concept that while a large population can ride out these threats, a small population needs careful tracking of survivorship and reproduction, and the willingness to intervene by reintroducing and augmenting bighorns from source herds into previously occupied areas.

*Yosemite Restoration I*

## **THE SAN FRANCISCO ZOO AND GARDEN'S ROLE IN CONSERVING RARE SPECIES IN YOSEMITE NATIONAL PARK.**

**Jessie Bushell**; San Francisco Zoo and Gardens; , CA, 94132; (415) 753-7080 X7079; jessieb@sfoo.org;

Rob Grasso, Rochelle Stiles, Jarrod Willis

The San Francisco Zoo and Gardens and Yosemite National Park are partnering to protect aquatic species and restore them to Yosemite. At first, the two entities partnered to probe questions about disease transmission, animal behavior, and species husbandry that directly impacts species restoration efforts. Then in 2015, the Zoo opened a facility committed to rearing and treating three federally listed (Sierra Nevada yellow-legged frogs, California red-legged frogs (CRLF), and Yosemite toads) and one special-status (western pond turtle) to the park. Since that time, the Zoo has reared CRLFs that have been released into the Yosemite Valley, reared Yosemite toads from eggs to post-metamorphic toads, and played a pivotal role in trouble-shooting disease dynamics in Yosemite's western pond turtles. The Zoo-Park partnership has proven to be critical to Yosemite's aquatic species recovery efforts.

*Yosemite Restoration I*

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## Yosemite Restoration II

(sorted by presentation order)

### **HUMAN-BEAR MANAGEMENT AT YOSEMITE NATIONAL PARK: FINALLY, A STORY OF SUCCESS.**

**Caitlin J. Lee-Roney**; National Park Service; PO Box 577, Yosemite, CA, 95389; (209) 372-0476; caitlin\_lee-roney@nps.gov; Ryan M. Leahy, Katie M. Patrick, Rachel Mazur

Yosemite National Park has over a hundred and fifty year history of human-bear incidents. In 1998, conflicts hit their peak, totaling an astounding 1,584 incidents that equated to \$659,569 in damage. Yet since then, incidents have sharply declined to the point when in 2018, they totaled less than 30, even as visitation skyrocketed to almost five million visitors per year. We explore the reasons things got so bad, and then the research, politics, inventions, trial-and-error, and hard work it took to improve the situation so dramatically.

*Yosemite Restoration II*

### **MANAGING CLIMBING ACCESS TO AVOID DISTURBANCE TO NESTING PEREGRINE FALCONS IN YOSEMITE NATIONAL PARK.**

Crystal L. Barnes; Yosemite National Park; 9039 Village Drive, Yosemite, CA, 95389; (740) 279-9785; turtalleo@hotmail.com; Sarah L. Stock, **Crystal L. Barnes**

Peregrine Falcon (*Falco peregrinus*) populations are increasing as the threat of DDT diminishes across their breeding range. They occur often in popular climbing areas, and land managers are faced with the dilemma of providing access for climbers while protecting an increasing number of active nests. In Yosemite National Park, over a ten-year period (2009-18), we confirmed an increase in the number of nest locations from five to thirty. Concurrently, we increased the initial number of climbing closures to protect the birds from disturbance from five to fifteen. To build and maintain climber access and trust, we implemented an adaptive approach by systematically closing certain routes adjacent to and within view of active nests, promptly lifting closures when nests were not active, shrinking closure areas based on tolerance levels of individual pairs, reducing the overall closure period, and communicating and messaging the closures directly with climbers. We used these strategies in relation to nesting activity and behavior of each nesting pair. Since initiating this adaptive approach and increasing communication with climbers, climbers have shown higher levels of compliance and tolerance with the closures and an increasing appreciation for the success of the peregrines.

*Yosemite Restoration II*

### **RACCOONS IN YOSEMITE: ENDANGERED SPECIES AND TRASH FOR DINNER WHILE LIONS ARE AT THE TABLE?!**

**Katie Patrick**; Yosemite National Park; 9039 Village Drive, Yosemite, CA, 95389; (209) 372-0476; katie\_patrick@nps.gov; Binta Wold, Esther Kukielka, Caitlin Lee-Roney, Beatrice Lopez, Sean Matthews, David Green, Rachel Mazur

Raccoons (*Procyon lotor*) have an unnaturally high population size in Yosemite Valley due to the availability of human food subsidies. Several species restorations are underway in the Valley, including California red-legged frogs (*Rana draytonii*) and western pond turtles (*Actinemys marmorata*). Yosemite wildlife managers needed to know more about these predators to mitigate their potential impacts. We conducted a two-year study from 2017 to 2018 to assess the populations, distribution, and food habits of Valley raccoons. We also assessed the extent of their conflict with humans, and whether they carried zoonotic disease. We used GPS collars, remote cameras, and scat sampling. Results showed the raccoon population to be about 40 animals, to carry roundworm (*Baylisascaris procyonis*), and to interact frequently with humans. Raccoons frequented areas of California red-legged frog releases. Mountain lions

predated at least three raccoons. We discuss the implications of these findings to management and species restoration efforts.

*Yosemite Restoration II*

## **BIG WALL BATS**

**Breeanne K. Jackson**; Yosemite National Park; P.O. Box 700, El Portal, CA, 95318; (209) 379-1454; breezy\_jackson@nps.gov; Breeanne K. Jackson, Sarah L. Stock, James B. Miller, Eric Bissell

Yosemite climbers frequently encounter roosting bats. However, park managers know little about how climbers may be impacting bats, or if climbers may be a vector for spreading *Pseudogymnoascus destructans*, the fungus causing white-nose syndrome (WNS). Since WNS was first documented in eastern North America in 2006, more than 5.7 million bats have died and entire roost colonies have been wiped out. Recent detections of WNS in three species of bats in Washington state underscore the potential for WNS to travel great distances in little time--potentially through human vectors. The vertical cliffs of Yosemite, such as El Capitan, are known for world class climbing, yet virtually nothing is known about the 17 bat species (including 5 California species of concern and 6 species susceptible to WNS) that roost upon them. Scientists have identified cavers as having spread Pd between caves and disturbing bats but whether and to what extent climbers play a role is yet unknown. We are launching a multi-faceted outreach and citizen-science program to engage climbers in bat conservation and describe how bats use the high cliffs of Yosemite to roost and hibernate.

*Yosemite Restoration II*

## **A TECHNOLOGY BOOST TO YOSEMITE WILDLIFE MANAGEMENT.**

**Ryan M. Leahy**; National Park Service; PO Box 577, Yosemite, CA, 95389; (209) 372-0476; ryan\_leahy@nps.gov; Caitlin J. Lee-Roney, Katie M. Patrick, Rachel Mazur

Yosemite National Park has over a one hundred and fifty year history of human-bear incidents. Problems peaked in 1998, when Yosemite recorded over 1500 human-bear incidents. Since that time, Park managers have drastically reduced that number to a low of under 20 in 2018. Success came as a result of funding, research, bear-proofing, enforcement, and new educational programs. It also came as a result of instituting new technologies. Two of the most successful of these were upgraded VHF collars to GPS collars, and creating an interactive website to teach people about the Park's bears. We discuss how we use these technologies and suggest ways others may do the same.

*Yosemite Restoration II*

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## Poster Session

(sorted alphabetically by author's last name)

### **VOCAL BEHAVIOR OF CHESTNUT-BACKED CHICKADEES (*POECILE RUFESCENS*) IN RESPONSE TO AUDITORY CUES.**

**Ashley M. Abitz**; Humboldt State University; 2980 Mack Road Apt C, Arcata, CA, 95521; (925) 783-7093; ama719@humboldt.edu;

Birds use vocalizations in a variety of contexts and their calls can encode information relating to the individual and the environment. A member of the Paridae family (chickadees, tits, and titmice), Black-capped chickadees (*Poecile atricapillus*) are able to recognize the calls of avian predators and they use variations of their "chick-a-dee" as an alarm signal to recruit flock members. The "chick-a-dee" call is combinatorial in nature and often is divided into four distinct call-notes. A common resident in the Pacific Northwest, the chestnut-backed chickadee has its own "chick-a-dee" call that uses a different set of call-notes from the black-capped chickadee. Additionally, chestnut-backed chickadees lack the whistled two-toned song of their black-capped cousins. A previous study revealed that chestnut-backed chickadees do not alter their calls similar to heterospecifics; however, this study did not take individual call-notes into consideration. I will play avian predator calls to wild chestnut-backed chickadees and record their resulting vocalizations. I will quantify note-usage by converting the audio recordings into sonograms and comparing these values across different types of predators. This serves to both evaluate how chestnut-backed chickadees use their call-notes and to confirm whether they can or cannot detect a predator by sound alone. (Work in progress)

*Poster Session*

*Student Paper*

### **INCORPORATING HUMAN PERSPECTIVES INTO THE ROLE OF DIVERSITY AND INCLUSION IN WILDLIFE SCIENCE.**

**Bayan W. Ahmed**; TWS-WS Diversity Committee; 6808 Castro Verde way, Elk Grove, CA, 95757; (916) 743-6600; bwa27@humboldt.edu; Jaelyn Aliperti, Chris Collier, Korinna Domingo, Ximena Gil

Studies have found that diverse workplaces are positively correlated with enhanced innovation, productivity, communication, and problem-solving. Inclusivity among individuals from underrepresented backgrounds allows for creative and effective approaches to conducting scientific research. Wildlife biology is a multidisciplinary science that would likely benefit from the inclusion of diverse people and perspectives; however, it has been suggested that the field of wildlife biology fails to adequately reflect the diverse communities it represents. The Wildlife Society Western Section (TWS-WS) Diversity Committee paired a short film with a digital questionnaire to bring attention to the various perspectives regarding diversity among biologists in the field and to examine whether these perspectives are adequately reflected in wildlife team composition and project goals. We filmed 7 projects and interviewed 19 students, professors, and project leads. The film will debut during the TWS-WS 2019 conference. The online questionnaire examines people's different social dimensions (demographics, economic status, barriers) and their perspective on diversity. We hypothesized that most wildlife biologists recognize the importance of increasing diversity but these ideals are not adequately represented in practice. We recommend researchers and employers change this by proactively incorporating diversity into team composition and management strategies. Follow the conversation using the hashtag #DiversifyWildlife.

*Poster Session*

### **PREVALENCE OF BLOOD PARASITES IN ACORN WOODPECKERS IN RESPONSE TO CLIMATE VARIABLES.**

**Wilmer S. Amaya-Mejia**; San Francisco State University; 885 Portola Drive, San Francisco, CA, 94127; (571) 285-6658; amayamejiaws@gmail.com; Sahas Barve, Tierra Groff, Natasha Hagemeyer, Eric L.

Walters, Walt D. Koenig, Ravinder N.M. Sehgal

Vector-transmitted diseases results from a dynamic interaction between hosts, parasites, and vectors. However, if predicted climate change patterns continue, this relationship may be disrupted. Using a data set that was initiated in 1974, we can study how rates of infection fluctuate in the acorn woodpecker (*Melanerpes formicivorus*) population located in Hastings, California in correlation with weather patterns. Preliminary results from juveniles sampled in 2016-2018 showed low levels of infections by *Leucocytozoon* sp. Given the life cycle of haemosporidians there is an increased probability of false negatives in juvenile birds; therefore, future testing will focus on sampling adult woodpeckers and will also model environmental factors that are supportive of vector populations. We will test how precipitation, a value that is expected to be affected by climate change, influences prevalence of infection by conducting a longitudinal study in conjunction with cross-sectional sampling following extreme precipitation events, such as droughts or heavy rainfall. Our aim is to study the influence of rainfall on haemosporidian infections in acorn woodpeckers and develop a model to predict how future climate change patterns can affect avian diseases ecology.

*Poster Session*

*Student Paper*

### **RACCOON HABITAT AND SPACE USE IN YOSEMITE VALLEY.**

**Erika L. Anderson**; Institute for Natural Resources; , Portland, OR; (970) 948-3042; erikalindsay8@gmail.com; Sean Matthews, David Green, Caitlin Lee-Roney, Elizabeth Wold, Esther Kukielka, Beatriz Martinez-Lopez, Rachel Mazur

Human activities and development are increasingly influencing natural landscapes and pose a risk for negative human-wildlife interactions. National Parks, tasked with preserving natural resources and providing recreational opportunities, are often flashpoints of human-wildlife interactions. The availability of anthropogenic food (e.g., sandwiches, chips, candy) in National Parks prompt human-wildlife interactions by altering the behavior of wide-range of species. Raccoons (*Procyon lotor*) present a unique management challenge in Yosemite National Park (YNP) because of their ability to take advantage of anthropogenic food resources, capacity to serve as a reservoir for zoonotic diseases, impacts on native-species restoration, and influences on the foraging behavior of apex predators. The Yosemite Valley (YV) portion of YNP has a resident population of 1,035 people, hosts approximately 4.3 million visitors annually, and is the epicenter of human-raccoon interactions in YNP. To better understand how raccoons use anthropogenic food resources in YV, we placed GPS and VHF collars on 8 individuals and monitored their movements. We modeled the space use of raccoons as a first step in developing a management plan to reduce negative human-raccoon interactions.

*Poster Session*

### **BAT ACTIVITY IN CALIFORNIA REDWOOD FORESTS ACROSS A SUMMER FOG-CLIMATE GRADIENT.**

**Chelsea L. Andreozzi**; University of California, Berkeley; 2029 Hearst Ave #4, Berkeley, CA, 94709; (561) 676-0613; candreozzi@berkeley.edu; Adina M. Merenlender

Fog provides critical hydrologic inputs to coastal ecosystems and may mitigate the impacts of higher temperatures and drought associated with climate change. Little is known about how fog patterns affect terrestrial fauna species distribution and behavior. We investigated bat species distribution in Mendocino and Sonoma County coast redwood forests at 15 sites, surveying across high and low summer fog habitat conditions in protected and working forests. Acoustic detectors were deployed for a minimum of 4 consecutive nights at each site in early and late summer 2018, with one detector in riparian corridor and a second in nearby forest cover. Temperature and humidity were recorded to relate bat activity to microclimate. Preliminary results show that bat species detected at a study site ranged between 4 to 11. Significant differences in detection rates were observed in same-site early and late summer comparisons, emphasizing the need for more intensive monitoring to accurately survey species presence and understand activity patterns. This ongoing research will ultimately address the value of California redwood forests as

refugia for Western bats, as well as shed light on how climate variables interact with forest management practices to produce habitat conditions that are more or less favorable to different species.

*Poster Session*

*Student Paper*

### **BASAL HOLLOW ROOST SELECTION BY THE TOWNSEND'S BIG-EARED BAT AND OTHER BATS ON THE NORTH COAST OF CALIFORNIA.**

**Amon J. Armstrong**; Humboldt State University; 1882 Golf Course Road, Bayside, CA, 95524; (415) 272-4878; aja40@humboldt.edu; Joseph M. Szewczak

The state of California lists the Townsend's big-eared bat (*Corynorhinus townsendii*) as a species of special concern because of population declines due mainly to habitat loss and disturbance. This species roosts in open cavity structures, typically caves, throughout the western United States. On the north coast of California, this species and others will roost in basal hollows of trees. Because knowledge of the characteristics of basal hollows and landscape associations that correlate with their use remains limited, we measured 135 tree hollows at 9 sites in Del Norte, Humboldt, and Mendocino counties and collected guano for one year (2017-2018). We used the weight of monthly guano collected in basal hollows as an index of bat use. Species were identified by DNA analysis at Northern Arizona University's "Species from Feces" lab. In an initial test of 15 guano samples, 47% of bats identified were Townsend's big-eared bats. The top ranked generalized additive model ( $n = 27$  hollows), using tree hollow measurements versus guano mass response, indicated more bat activity in hollows with higher and wider openings and larger enclosures above the opening. Quantifying basal hollow roost preferences will support forest management and conservation practices. This is a graduate project with some analyses forthcoming, therefore is not complete.

*Poster Session*

*Student Paper*

### **AN OVERVIEW OF NEON RODENT POPULATION DATA IN THE SAN JOAQUIN VALLEY REGION.**

**Emily J. Artz**; National Ecological Observatory Network; 4727 W SHAW SUITE 101, FRESNO, CA, 93711; (559) 396-4106; eartz@battelleecology.org; Jessica Bolis, Kate Thibault

The National Ecological Observatory Network is a long term, continental scale ecological monitoring project funded by the NSF. NEON data is collected in 20 ecoregions across the lower 48 states, Alaska, Hawaii, and Puerto Rico, and includes small mammal, insect, soil, plant, and climate monitoring . Nat both terrestrial and aquatic sites. NEON's ecological monitoring began in the San Joaquin Valley Experimental Range in the fall of 2016. Between the 2016-2017 and 2017-2018 field season, small mammal trapping captured a dramatic shift in the abundance, species, and population demographics of rodents inhabiting the range: in some areas, capture rates increased by a factor of 4 during peak activity. Blood samples were also collected from captured animals to monitor the presence of lyme, hantavirus, and other rodent-born disease. NEON's broad suite of co-located data measures variation in weather, plant diversity, plant biomass, and soil chemistry. This data suite presents exciting opportunities to monitor this kind of dramatic demographic change in the long term, with in depth data on habitat factors likely to affect rodent activity and the prevalence of rodent-born diseases in the population.

*Poster Session*

### **DNA METABARCODING METHODS TO ELUCIDATE TROPHIC INTERACTIONS OF SALT MARSH HARVEST MOUSE, AND APPLICATIONS TO OTHER SMALL MAMMAL STUDIES.**

**Cody M. Aylward**; University of California, Davis; One Shields Ave, Davis, CA, 95616; cmaylward@ucdavis.edu; Leila S. Harris, Douglas A. Kelt, J. Mark Statham

Understanding species' dietary niches can be a critical component of wildlife conservation and management. DNA metabarcoding uses next generation sequencing techniques to match millions of DNA

sequences amplified from scat to a database of genetic data from potential prey items. These data can be used to draw inferences about community food webs. Competition with sympatric species is a key research priority for the endangered San Francisco Bay endemic, salt marsh harvest mouse (*Reithrodontomys raviventris*). Recent foraging data suggest salt marsh harvest mouse may have a more diverse diet than previously believed, and the role of invertebrate prey is largely unknown. Data collection is underway for a preliminary analysis of dietary overlap between salt marsh harvest mouse and sympatric competitors, western harvest mouse (*Reithrodontomys megalotis*) and house mouse (*Mus musculus*). To evaluate the capacity of this technique to identify invertebrate prey items and inform sister studies, bat guano was collected during bat foraging surveys from 2015-2018, and from the Yolo Causeway colony of Mexican free-tailed bats (*Tadarida brasiliensis*), potentially the largest such colony in California. Dietary data will be used to explore the role of these bats as a potential control on agricultural pests in the Central Valley. Preliminary data from these pilot studies (anticipated December 2018) may be used to inform impact assessments and management strategies.

*Poster Session*

*Student Paper*

### **WEEDING THROUGH THE IMPACTS OF LEGAL CANNABIS: THE CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE AND CANNABIS CULTIVATION.**

**Angela D. Baker**; California Department of Fish and Wildlife; P.O. Box 944209, Sacramento, CA, 94244; (916) 651-3123; [angela.baker@wildlife.ca.gov](mailto:angela.baker@wildlife.ca.gov); Margaret Mantor

Although the negative impacts of illegal cannabis cultivation are well-recognized, legal cultivation activities may also negatively affect wildlife. These potential impacts include pollution from pesticides and fertilizers, impacts to water from diversions and crossings, site development impacts from habitat loss and fragmentation, and site use impacts that include road use, noise, and artificial light. The California Department of Fish and Wildlife (CDFW) uses several tools to protect and conserve fish and wildlife resources from impacts related to cannabis cultivation: environmental monitoring, permitting, restoration, and enforcement. CDFW is monitoring stream flow and water quality to study how rivers and streams are being affected by water diversions. CDFW is responsible for permitting projects that may substantially adversely affect fish and wildlife resources and includes measures to avoid and minimize adverse impacts in those permits. CDFW implements the Cannabis Restoration Grant Program, which funds restoration projects to improve anadromous salmonid habitat in watersheds most heavily impacted by cannabis cultivation. CDFW's wildlife officers work with growers to bring their facilities into compliance, and remove illegal grows, growers, illegal water impoundments, and extremely toxic chemicals frequently associated with illegal grows.

*Poster Session*

### **"SCOUTING": THE ROLE OF SUMMER MOVEMENTS ON INFORMATION GATHERING FOR WINTER HABITAT BY NORTH AMERICAN PORCUPINES.**

**Pairsa N. Belamaric**; Humboldt State University; 1 Harpst St, Arcata, CA, 95521; (206) 718-4948; [pairsa.belamaric@humboldt.edu](mailto:pairsa.belamaric@humboldt.edu); William T. Bean

Species are often challenged by periodic changes in food availability and habitat quality, which may provide strong selective pressure for animals to strategically "scout" for important resources when exploratory movements are less costly. North American porcupines experience a drastic shift in forage quality from summer - a time of abundant, high quality forage - to winter, a nutritional bottleneck. Evidence from GPS and telemetry data in northwestern California suggest that porcupines may be "scouting" for food or cover during the summer to inform selection of habitat during winter when movement is costly. To monitor and compare porcupine use of winter habitat between seasons, we deployed 30 camera traps under evergreen trees in the dunes from May 2017 to March 2018. Some trees were experimentally baited with apples and salt in a 5 gallon bucket during one or both seasons, to determine if supplementing trees with desirable food and shelter during summer would increase the probability of those trees being visited during winter. Structural and nutritional qualities of each tree were also quantified and included in models, along with baiting treatment and season, to determine which factors best predict observed rates of visitation by porcupines.

### **RESOURCE SELECTION IN DESERT BIGHORN SHEEP: TRADEOFFS ASSOCIATED WITH REPRODUCTION AND NEONATE AGE.**

**Marcus E. Blum**; University of Nevada, Reno; 1664 N Virginia St, MS 186, Reno, NV, 89557; (979) 450-3092; mblum@cabnr.unr.edu; Kelley M. Stewart, Mike Cox, Brian Wakeling

Selection of resources that effect the development of a fetus and increase probability of survival for neonates is essential for maintaining viable populations in large ungulates. Therefore, it is crucial that biologists understand how species select resources across gestation to increase their ability to manage recruitment. Desert bighorn sheep (*Ovis canadensis nelsoni*) populations have dwindled across their range over the last several decades and translocations have been a key management strategy for recolonizing areas. To increase understanding of sheep resource selection during gestation and following parturition, we captured and collared 30 adult, female sheep on Lone Mountain (west of Tonopah, NV). In addition to receiving collars, all individuals were given vaginal implant transmitters to provide parturition timing information. We used a machine learning algorithm, random forest, to identify habitat selection during gestation, following parturition events, and following the mortality of neonates. Our results indicated that adults shifted resource selection from areas with higher nutritional availability to more precipitous terrain immediately following parturition events. In addition, our results indicated that females shifted resource selection to areas with higher quality vegetation and reduced terrain ruggedness following the mortality of a neonate and as neonate age progressed. If no room is available for an oral presentation, please consider for a poster presentation.

### **BARRED OWL PLAYBACK SURVEY PROTOCOL: WHAT CALLS ELICIT A RESPONSE?**

**Nicole A. Bogle**; Humboldt State University; 1 Harpst St, Arcata, CA, 95521; (209) 505-2453; nab373@humboldt.edu;

West coast wildlife managers in the United States have had to formulate new survey protocol in response to recent barred owl expansion (*Strix varia*) which has negatively impacted two subspecies of the spotted owl, the federally listed Northern spotted owl (*Strix occidentalis caurina*), and the California spotted owl (*Strix occidentalis occidentalis*). Analyzing barred owl response to playback call types could yield better survey design in order to increase detection probability and/or survey efficiency. We analyzed a total of 639 barred owl call back survey responses from Green Diamond Resource Company's "property wide" Strix surveys between March 2013 and August 2017 conducted in northwest California. Barred owl response varied significantly based on call type used. Conspecific playback call types elicited proportionately more responses than spotted owl calls. The "8-note" conspecific call elicited significantly higher responses whereas the "cackle/duet" call elicited a lower than expected response. Seasonal (March-May, July August), and annual response changes to call back surveys were not observed. Future research comparing multiple survey designs may yield useful information on which barred owl call types to use during surveys.

### **THE CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS PROGRAM: UPDATES TO RANGE AND DISTRIBUTION MAPS FOR CALIFORNIA SPECIES AND SUBSPECIES.**

**Joel A. Boros**; California Department of Fish and Wildlife; 1416 9th Street, 12th Floor, Sacramento, CA, 95814; (916) 445-2438; joel.boros@wildlife.ca.gov; Melanie Gogol-Prokurat, Sandra Hill

The California Wildlife Habitat Relationships (CWHR) is an information system for California's Wildlife managed by the California Department of Fish and Wildlife (CDFW). CWHR contains life history, geographic range maps, habitat relationships, and management information for more than 700 species of

amphibians, birds, mammals, and reptiles in California. Available CWHR products include a queryable database program that can be used to develop and compare potential species lists for user-specified locations or habitats in California, species life history information, and geographic range maps for each species. CWHR range maps and habitat distribution maps for each species, which show suitable habitat within each species range, are now available for viewing and download on the CDFW Biogeographic Information and Observation System (BIOS) website. CWHR is currently developing and adding range maps and information for subspecies beginning with Species of Greatest Conservation Need (SGCN), which include listed species and Species of Special Concern.

*Poster Session*

***ESCHERICHIA COLI AND SALMONELLA ENTERICA IN ROOSEVELT ELK (CERVUS CANADENSIS ROOSEVELTI) AND CATTLE: ENTERIC PATHOGENS AT THE WILDLIFE-DOMESTIC INTERFACE .***

**Emily A. Buck**; Humboldt State University; 1765 Virginia Way, Arcata, CA, 95521; (541) 337-7749; eab30@humboldt.edu; Richard N. Brown, Carrington A. Hilson

Direct or indirect contact between domestic animal and wildlife populations carries risks for transmission of infectious agents, and wildlife are often implicated as sources of contamination that can cause outbreaks of illness in humans. *Salmonella enterica* and *Escherichia coli* are both ubiquitous, well-characterized, bacterial pathogens with the potential to cause mild to serious disease and death in humans, domestic cattle and wildlife. *Cryptosporidium* sp. is a apicomplexan intestinal parasite that primarily causes disease in young animals and can have a significant impact on commercial livestock. In northern California, the Roosevelt elk (*Cervus canadensis roosevelti*) population utilizes a variety of habitats including pastures of commercial cattle operations in both Humboldt and Del Norte counties: the shared space, forage and possible interactions between these species is of concern to ranchers. We are testing elk and cattle feces for prevalence and strains of *E. coli*, *S. enterica*, and *Cryptosporidium* sp. including elk groups both associated and not associated with cattle. The prevalence and strain types of these pathogens will provide insight into the nature and degree of interactions. This project, utilizing elk GPS collar data to augment range overlap analysis, is a first step in examining pathogen communities among these populations. This is a work in progress.

*Poster Session*

*Student Paper*

**RESILIENCE IN ECOLOGICAL COMMUNITIES: MONITORING WILDLIFE RECOVERY POST MEGAFIRE.**

**Kendall L. Calhoun**; UC Berkeley; 2216 Parker Street, Berkeley, CA, 94704; (209) 879-3995; kendallcalhoun@berkeley.edu; Justin Brashares

Megafire is one of the many ways global change has disturbed ecosystems in the western US, with catastrophic consequences for both wildlife and humans. The 2018 Mendocino Complex fire, now the largest fire in California history, is a striking example of this. The River Fire, part of the larger Mendocino complex, burned 3,000 acres of the Hopland Research and Extension Center. Hopland lies at the interface between wilderness and human development and houses a variety of ranching activities as well as a diverse community of wildlife. The goal of this project is to understand how megafire impacts habitat usage and recovery of wildlife communities within this mixed use space. Using wildlife monitoring techniques (camera traps/acoustic equipment) I record species distributions of mammals and birds across the burned landscape. Using these observations, I plan to analyze how patch size and connectivity across the burned landscape may influence recovery. In conjunction with pre-burn data, I will also use multi-species models to compare community composition before and after the fire. The reestablishment of species may be critical for maintaining long term resilience within the system. These findings will inform future conservation and management decisions in preparation for future environmental shocks.

*Poster Session*

*Student Paper*

## **USING AN INTEGRATED POPULATION MODEL FRAMEWORK TO EVALUATE IMPACTS OF GEOTHERMAL ACTIVITY ON SAGE-GROUSE POPULATIONS AND GUIDE ENERGY AND CONSERVATION PLANNING.**

**Peter S. Coates**; U.S. Geological Survey, Western Ecological Research Center; 800 Business Park, Road, Dixon, CA, 95620; (530) 669-5073; pcoates@usgs.gov; Brian G. Prochazka, Mark A. Ricca, Shawn T. O'Neil, John D. Boone, Elisabeth M. Ammon, David J. Delehanty

Geothermal power is a fast-growing sector of renewable energy, and a greater understanding of its mechanistic effects on wildlife population dynamics is needed as the nation seeks more clean energy sources. We constructed an integrated population model (IPM) for greater sage-grouse (*Centrocercus urophasianus*) using lek counts and demographic data from two geothermal sites (n female sage-grouse = 159) within the Great Basin to estimate factors related to annual population rate of change ( $\lambda$ ) as a function of individual vital rates while accounting for potential confounding environmental factors. We sought to disentangle indirect (e.g., avian predation) from direct (e.g., noise pollution) effects associated with geothermal activities across each vital rate. Findings indicate that reproductive life stages limited  $\lambda$ , and were strongly associated with increased common raven (*Corvus corax*) abundance and distance from geothermal infrastructure. We also provide a spatially-explicit example application of the IPM to design existing or planned energy development projects with the goal of mitigating adverse impacts to local sage-grouse populations. These findings are preliminary and provided to meet the need for timely best science.

*Poster Session*

## **ESTIMATING THE EFFECTS OF OFF-HIGHWAY VEHICLES ON OAK-CHAPARRAL BIRDS USING COMMUNITY MODELING.**

**Jerry S. Cole**; The Institute for Bird Populations; P. O. Box 1346, Point Reyes Station, CA, 94956; (415) 663-1436; jcole@birdpop.org; Nicole L. Michel, Rodney B. Siegel, Nicolas Somilleda Jr.

Increased participation in outdoor vehicular recreation has led to an expansion of natural areas accessed by the public. Yet the effects of recreation on birds and other wildlife on those lands remains unclear. We assessed the effect of off-highway vehicles (OHVs) on the abundance and diversity of bird species occurring on a state-managed OHV recreation area near Hollister, California. We used a hierarchical community distance sampling model to compare bird community and species-level abundance and Shannon's Diversity Indices in park regions open and closed to OHV users during 2012-2014. We also tested whether the extent of surrounding land area covered by OHV trails affected avian abundance and diversity. We found no significant effects of OHV use, nor of area of OHV trails, on the bird community as a whole, although we found significant responses in several individual species. We found diversity was significantly lower in OHV use areas during the spring, but not during the winter. Within OHV use areas, we found no effect of the cover of OHV trails on diversity during either season. Our results suggest that under careful management, OHV recreation may have only minor effects on the avian community in parks managed specifically for vehicular recreation.

*Poster Session*

## **MOTION ACTIVATED INSIGHT: A TRAIL CAMERA STUDY IN SONOMA COUNTY REGIONAL PARKS.**

**Christopher J. Collier**; Sonoma County Regional Parks; 872 Union Street, Arcata, CA, 95521; (775) 997-4685; chrisjamescollier@gmail.com; Lenihan C. Mazur

Sonoma County Regional Parks (SCRIP) manages 56 parks comprising 11,000 acres in California. Currently more than 90 percent of land in Sonoma County is privately owned, making SCRIP parklands vital habitat for wildlife. Beginning in April 2016, a survey utilizing remote sensing cameras was deployed to inform natural resource managers of wildlife presence within Sonoma County parks. Motion activated

cameras were placed along trails in 11 parks and monitored biweekly. A diverse array of species, some previously undocumented, were observed. The detection of black bear (*Ursus americanus*) and mountain lion (*Puma concolor*) subsequently led managers at SCRIP to install bear-proof infrastructure and educational displays in several parks. A severe fire event took place in October 2017, and comparisons with baseline data allowed for an evaluation of wildlife response. Data was used to collaborate with other organizations, informing larger, landscape level decision-making. Additionally, the study provided SCRIP with photographs and video that were shared on social media platforms, connecting the public to wildlife in a new and meaningful way. To help guide management decisions, agencies may benefit from deploying trail cameras as an alternative to more costly, invasive methods of research.

*Poster Session*

*Student Paper*

### **IT'S A TRAP! AN EVALUATION OF DIFFERENT PASSIVE TRAP TYPES TO CONTROL THE INVASIVE RED SWAMP CRAYFISH (*PROCAMBARUS CLARKII*) IN SANTA MONICA MOUNTAIN STREAMS.**

Angela De Palma-Dow; Invasive Species Coordinator, Department of Water Resources ; 255 N. Forbes Street, Lakeport , CA, 95453; (530) 304-1809; adepalmadow@gmail.com; **Joseph N. Curti**

The invasive red swamp crayfish poses a significant threat to physical and aquatic diversity in Santa Monica Mountain streams. Crayfish are known to consume adult, juvenile and egg forms of native fish, frogs, and benthic macroinvertebrates. In addition, crayfish can disrupt nutrient and sediment dynamics by burrowing into streambanks. Mountain Restoration Trust has managed crayfish populations in the Santa Monica Mountains for ten years, yet evaluation of trap type effectiveness has been constant source of uncertainty. In this two-week field experiment, we compared effectiveness across 12 standard and modified trap designs in catching the most crayfish while catching the least bycatch. The most effective trap for catching crayfish was the black cylindrical mesh trap, followed by the red mesh trap, and both the standard and silver modified black traps. When considering effect on native arroyo chub bycatch, both standard and modified black traps caught less chub than cylindrical and red mesh traps, however, the cylindrical mesh was the best performer by catching the most crayfish and not catching any tadpoles. When managing for crayfish in streams, we recommend deploying a combination of trap types in order to maximize crayfish catch efficiency and limit negative impacts on native bycatch.

*Poster Session*

### **DEMOGRAPHIC VARIATION IN ASSEMBLAGES OF BRAZILIAN FREE-TAILED BATS AT A MIGRATORY STOPOVER ROOST IN EASTERN NEVADA.**

**Joseph R. Danielson**; Great Basin National Park; 100 Great Basin National Park, Baker, NV, 89311; joseph.danielson.09@cnu.edu; Richard E. Sherwin, Jason A. Williams, Bryan T. Hamilton, Kelsey L. Ekholm

The Brazilian free-tailed bat (*Tadarida brasiliensis*) is widespread and abundant, with large aggregations often found in caves and abandoned mines. Although roosting associations of this species have been studied for decades, intensive demographic studies have seldom been conducted. The objective of this study was to evaluate demographic composition of assemblages of *T. brasiliensis* at a migratory stopover roost in eastern Nevada by documenting sex, age, and reproductive status from 2015-2018. Adult males dominated captures from spring until late summer when adult females and juveniles were captured with more regularity. The sex ratio of adults varied greatly each year depending on season while sex ratio of juveniles was nearly even overall. While all males were non-reproductive, female reproductive status varied within and among years suggesting some level of maternity use within the roost. Seasonal variation in demographic composition of bat assemblages at this site may provide insight into the migratory behavior of this species and the importance of protecting migratory roosts for *T. brasiliensis*.

*Poster Session*

## **PRESENCE, DIVERSITY, AND ABUNDANCE OF NEOTROPICAL MIGRANT AND RESIDENT BIRDS AT THE DESERT STUDIES CENTER.**

**Francine A. De Castro**; Sacramento City College; 2477 Sycamore Lane Apt F3, Davis, CA, 95616; (858) 774-2180; Fadelara@ucdavis.edu; Stanley Wright

The Desert Studies Center (DSC) just south of Baker, California is an oasis on the western side of the Mojave National Preserve. Home to the endangered Mojave Tui Chub, the DSC's two man-made ponds, including the tamarisk and mesquite that grow around them, provide important habitat for both resident and neotropical migratory birds. Since these efforts began in 2015, 22 different species of birds have been banded at the DSC using USGS BBL bands. Banding has occurred every year since 2015, for a period of 2-5 days during the end of May, from sunrise to 90 deg F and in the evenings from <90 deg F to 8PM. A total of 158 net hours over the last four years yielded a total of 103 captured and banded birds- a combination of 92 neotropical migrants, and 11 Mojave residents. Morphometrics and evaluations were recorded for each bird per USGS BBL standards, and the vast majority of birds were determined to be AHY. This poster will highlight the diversity and abundance of the resident and neotropical migrant birds at the DSC per the data collected over our study period.

*Poster Session*

*Student Paper*

## **PRELIMINARY RESULTS OF AN ANALYSIS OF A DISJUNCT POPULATION OF RED-BELLIED NEWT (*TARICHA RIVULARIS*).**

**Joie de Leon**; San Jose State University/Swaim Biological, Inc; One Washington Square, San Jose, CA; JoieMdeLeon@gmail.com;

The red-bellied newt (*Taricha rivularis*), an endemic Northern California salamander, recently warranted listing as a California Priority 2 Species of Special Concern. A disjunct population of red-bellied newts was recently discovered in a small area of the Stevens Creek watershed, approximately 130 km outside its central range in Sonoma, Mendocino, Humboldt, and Lake Counties. This successfully breeding population has the potential of aiding in the persistence of this declining amphibian species and act as a bioindicator of environmental stress. An analysis of the Santa Cruz Mountain population of red-bellied newts would aid land managers in ensuring the survival of this disjunct population.

*Poster Session*

*Student Paper*

## **ORNAMENT MORPHOLOGY AND SOFT TISSUE AND SKELETAL CORRELATES IN ALEUTIAN CACKLING GEESE (*BRANTA HUTCHINSII LEUCOPAREIA*).**

**Matthew D. Delgado**; Humboldt State University; 4098, Eureka, CA, 95503; (707) 845-7371; Matthew.Delgado@Humboldt.edu; Jeffrey M. Black

Aleutian cackling geese (*Branta hutchinsii leucopareia*) display ornaments on their heads and necks during intraspecific interactions. We determined whether the morphology of these ornaments in Aleutian geese (n = 50) was correlated to indices of individual quality (e.g. honest signal and badge of status theory). We also examined the linear relationship between wing spurs, ornament morphology, and indices of individual quality. The smoothness of the lower neck ring ornament was positively associated with gizzard mass in both sexes. Males showed a uni-modal distribution of this trait, whereas females were multi-modal. Wing spur size was positively correlated to heart size in both sexes, and positively correlated with cheek patch area in male geese. Ornament irregularities, which are tied to an individual's ability to precisely deposit melanin in feathers and environmental wear, may reflect an individual's health as influenced by parasite load, food acquisition, and/or metabolic stress from migration. Ornament attributes such as smoothness and size may signal vital information to conspecifics in Aleutian cackling geese.

*Poster Session*

## **INVESTIGATING ROAD-CROSSING FREQUENCY AND COLLISION RISK FOR ELK IN**

## **NORTHEASTERN CALIFORNIA: A CASE-STUDY OF THE HIGHWAY 97 CORRIDOR.**

**Danielle C. Deming;** California Department of Fisheries and Wildlife; 1724 Ball Mtn Little Shasta Rd, Montague, CA, 96064; (757) 839-4238; dcdeming88@gmail.com; Reid T. Plumb

America's highways cross through habitat of many wildlife species which could negatively affect wildlife populations as well as increase the probability of collisions. In northeastern California, populations of Roosevelt (*Cervus canadensis roosvelti*) and Rocky Mountain Elk (*C. c. nelsoni*) have continued to grow and re-populate their historical distribution after being extirpated from the state; increasing the probability of vehicle wildlife interactions. We used empirical data from 11 GPS-collared female elk to quantify road-cross-frequency, investigate cross locations, and prioritize collision risk mitigation areas that may benefit from wildlife crossing structures. We further investigated environmental variables we hypothesized to affect cross frequency and propensity. Cross frequency varied along the highway 97 corridor, but indicated specific high use areas. Analysis of variables driving cross frequency and propensity is ongoing. Understanding factors driving elk crossings will provide valuable information for transportation planners to determine the best mitigation practices necessary to reduce wildlife-vehicle collisions and prioritize areas for mitigation efforts.

*Poster Session*

## **NOVEL THERAPIES FOR TREATING BURNED WILDLIFE.**

**Andrew R. Di Salvo;** UC Davis, California Department of Fish & Wildlife; Wildlife Health Center, 1089 Veterinary Medicine Drive, VM3B, Davis, CA, 95616; (530) 219-7599; ardisalvo@ucdavis.edu; Jamie L. Peyton, Deana L. Clifford

Three bears suffering burns to their paws caused by wildfires were rescued and treated at the California Department of Fish & Wildlife (CDFW) Wildlife Investigations Laboratory. CDFW and the UC Davis Integrative Medicine service employed the latest therapies to manage pain and accelerate healing, including specially formulated medications, laser therapy, pulsed electromagnetic field therapy, and acupuncture. Additionally, sterilized tilapia skin was applied directly to the burns to establish a "biologic bandage" on each paw. Tilapia skin grafts have previously been used to successfully treat human burn patients in Brazil, but to our knowledge this is the first time it has been used on animals. Collagen in the tilapia skin promotes wound healing and tissue regeneration, while the rough outer layer protects exposed nerve endings and reduces pain. All bears were successfully treated and returned to the wild within two months of their rescue. Two of the three bears have survived since their release in January 2018, while the survival status of the bear released in September 2018 is unknown. By employing novel therapies to accelerate healing, we hope to decrease the time injured wildlife spends in captivity, thereby minimizing habituation and maximizing an animal's chance of returning to the wild.

*Poster Session*

*Student Paper*

## **CROSS-VALIDATING MULTIPLE POPULATION ESTIMATION TECHNIQUES FOR COLUMBIAN BLACK-TAILED DEER (*ODOCOILEUS HEMIONUS COLUMBIANUS*).**

**Janelle A. Dorcy;** University of California, Berkeley; 738 Canterbury Avenue, Livermore, CA, 94550; (925) 963-5726; janelle.dorcy@gmail.com; Alex McInturff, Kaitlyn M. Gaynor, Brett J. Furnas, Justin S. Brashares

Black-tailed deer (*Odocoileus hemionus*) are an ecologically and economically important species throughout the Western US. Deer population estimates derived from harvest data and visual counts have historically provided uncertain results, hindering management. In collaboration with the California Department of Fish and Wildlife, we aim to improve methods of population estimation for Columbian black-tailed deer (*Odocoileus hemionus columbianus*). We conduct fieldwork at the University of California Hopland Research and Extension Center in Mendocino County, where decades of research have made the deer population one of the most-well studied in the nation. We are now cross-validating and integrating population estimation methods using multiple data sources. A grid of 37 Reconyx HyperFire cameras, operating continuously since June 2016, provides data for N-mixture models and buck-doe and adult-fawn ratios. We are also using genetic mark-recapture methods from fecal pellets, using a novel,

cost-effective, and efficient method of collection and are comparing two spatially variable study designs. Finally, we deployed GPS collars on 43 does and 7 bucks, which are providing information on home range size to parameterize statistical models of population estimation. Ultimately, integrated modeling using camera, genetic, and movement data will inform more precise population estimates. [This project is a student work-in-progress.]

*Poster Session*

### **PERSISTENCE OF GREATER SAGE-GROUSE FOLLOWING WILDFIRE.**

**Ian F. Dudley**; Idaho State University; 921 S 8th Ave, Pocatello, ID, 83209; (530) 902-9080; dudlian@isu.edu; Peter S. Coates, Mark A. Ricca, Dawn M. Davis, Scott C. Gardner, David J. Delehanty

Loss and degradation of sagebrush (*Artemisia* spp.) ecosystems has resulted in concordant declines of the Greater Sage-grouse (*Centrocercus urophasianus*), a sagebrush obligate species. In the Great Basin, increased fire frequency and intensity and progressive expansion of invasive annual grasses are predicted to further reduce sage-grouse populations through habitat loss and by nullifying positive effects of favorable weather cycles. Following the 126,000-hectare Rush Fire in northeastern California and northwestern Nevada, we used radio telemetry to locate, monitor, and measure 80 sage-grouse nests and 219 sage-grouse brood locations during 2015-2018 to compare sage-grouse micro-habitat selection and survival within and outside the burned area. We further quantified sage-grouse disproportionate habitat use relative to availability at multiple spatial scales in burned and unburned areas both before, using fortuitously collected historic data, and after the fire event. Using information-theoretic modeling, we report factors that influenced sage-grouse nest-site and brood-site selection, and survival to better understand the capacity for sage-grouse to persist, at least temporarily, in severely altered sagebrush habitat. In doing so, we provide wildlife managers with context for adaptive management of sage-grouse under prevailing fire regimes. These findings are preliminary and provided to meet the need for timely best science.

*Poster Session*

*Student Paper*

### **DIET COMPOSITION OF MOUNTAIN LIONS ON THE MODOC PLATEAU.**

**Jonathan D. Ewanyk**; Institute for Wildlife Studies; 140 H Street, Blue Lake, CA, 95525; (707) 844-3516; Ewanyk@Iws.org; David K. Garcelon, Micaela S. Gunther

Diet composition of mountain lions (*Puma concolor*) varies regionally and is central to understanding the dynamics of predator-prey interactions. In a 2014-16 study, the Institute for Wildlife Studies found that the majority of known mortalities for collared adult female pronghorn (*Antilocapra americana*) on the Modoc Plateau were attributed to mountain lions. To better understand prey selection by mountain lions in this montane desert ecosystem, 21 mountain lions (14 male, 7 female) were fitted with GPS collars and monitored for hunting behavior. From February 2016 through August 2018, we investigated 258 GPS clusters (spatially aggregated points) to determine feeding events of large prey items. We found mule deer (*Odocoileus hemionus*) to be the primary prey, followed by feral horses (*Equus caballus*), coyotes (*Canis latrans*), livestock, pronghorn, and elk (*Cervus canadensis*). Mule deer were observed in the diet of all study animals except for one male, which predominately preyed on feral horses. Diet composition in this high desert ecosystem may be influenced by habitat characteristics, which are currently being investigated as part of a broader study. We hope to elucidate the relationship between habitat and prey selection for this cosmopolitan carnivore prior to impending wolf recolonization of the study area.

*Poster Session*

*Student Paper*

### **EVALUATION OF POND RESTORATION EFFORTS TO ENHANCE CRLF HABITAT.**

**Hannah Fertel**; East Bay Municipal Utility District; 500 San Pablo Dam Road, Orinda, CA, 94563; (510) 986-7667; hannah.fertel@ebmud.com; Jessica Purificato, Jonathan D. Price

East Bay Municipal Utility District manages 140 ponds over 29,000 acres of watershed land under a Low-Impact Habitat Conservation Plan (HCP). The HCP, implemented in 2008, was created to protect and enhance the habitat of several native species found on the watershed, including the California red-legged frog - federally threatened species. One of the long-term projects intended to maintain and expand CRLF populations on EBMUD watershed lands has been the restoration of ponds to increase habitat integrity and suitability for CRLF breeding. This has usually been accomplished through alteration of the depth or shape of a pond to impact a pond's hydroperiod. Over the 10 years since the inception of the HCP, 36 ponds have been restored to promote CRLF reproduction. Though many of the restored ponds now support breeding populations of CRLF, these restoration efforts may have unintended consequences, as prolonging a pond's hydroperiod has been found to facilitate the presence of invasive bullfrogs as well. This project seeks to review CRLF and bullfrog populations in these watershed ponds before and after treatment to evaluate the relative success of the restoration efforts and inform future management decisions.

*Poster Session*

### **FIRE AND HABITAT EXPLAIN GEOGRAPHIC VARIATION IN TYPE I SONGS OF HERMIT WARBLERS IN CALIFORNIA, USA.**

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As an epiphenomenon, geographic variation in song dialects may help us better understand the functional diversity of traits within an avian species. Hermit warblers (*Setophaga occidentalis*) sing a highly-stylized, type I song to attract mates, in contrast with a repertoire of more complex, type II songs to defend their territories. There is often a single, dominant type I song, or a low diversity of type I songs, within the same geographic area. This study provides the first comprehensive description and mapping of Hermit Warbler type I song dialects throughout California, USA. During the period 2009 to 2014, we recorded type I songs from 1,576 males from 101 study areas across the state from April to July. We used those locations and a pre-existing range map for the species to create a maximum entropy-based breeding habitat suitability map for the entire state. We classified the songs into dialects consisting of 35 local forms within 14 regional super-forms. We modeled the effects of distance between territories, habitat quality, and recent fire history (10 years) at the local (315 km<sup>2</sup>) and regional (8,000 km<sup>2</sup>) scales to explain whether birds sang the same dialect as each other. We found that the probability of singing the same dialect declined with distance between breeding territories. The probability of sameness increased with local habitat quality but decreased with regional habitat quality; song sameness declined with the amount of local fire but increased with the amount of regional fire. These findings demonstrate how multi-scale patterns in habitat availability and fire history explain the diversity of song dialects. Taken together, they suggest that fire at the local scale and mass effects of rival dialects at the regional scale disrupt the uniformity of song dialects within a locale.

*Poster Session*

### **INTEGRATING TELEMETRY DATA INTO SPATIAL CAPTURE-RECAPTURE TO BETTER INFER REST SITE SELECTION OF RINGTAILS IN NORTHWESTERN CALIFORNIA.**

Kathleen P. Gundermann; Oregon State University; Mail Stop: INR, P.O. Box 751, Portland, OR, 97207; (717) 222-9135; kpgund@gmail.com; Cale H. Myers, J. Mark Higley, **David S. Green**, Sean M. Matthews

The ringtail (*Bassariscus astutus*) is a fully-protected species in California, but little is known about their basic ecology. Like other procyonids and forest carnivores, ringtails use diurnal rest sites to provide shelter, protection from predators, and sites to raise young. Understanding the characteristics of these rest sites will inform forest management and conservation efforts. We trapped and fixed VHF radio-collars to 19 adult ringtails on the Hoopa Valley Indian Reservation in 2008. Using triangulation and walk-in methods, ringtails were tracked to rest sites on 441 occasions. In the current research, we are integrating these VHF telemetry data with the spatial capture histories of ringtails to determine the habitat qualities selected for by ringtails at rest sites and more broadly at the habitat scale using spatial capture-recapture. In addition to understanding the qualities of the rest sites themselves, by using spatial capture-recapture we will also estimate the population size and habitat preferences through the integration of multiple data

sources in a single analytical framework. These results from the Hoopa Valley Indian Reservation will help improve our understanding of multi-scale resource selection by ringtails. With increased knowledge of rest site, habitat associations, and ringtail density, habitat can be better managed for ringtails.

*Poster Session*

### **AVIAN UTILIZATION AND SPECIES RICHNESS AT A LARGE-SCALE PHOTOVOLTAIC SOLAR FACILITY IN SAN LUIS OBISPO COUNTY, CALIFORNIA.**

**Jessica L. Griffiths**; Althouse and Meade, Inc.; 1602 Spring St, Paso Robles, CA, 93446; (847) 334-1196; [jg@alt-me.com](mailto:jg@alt-me.com); Jason D. Dart, Daniel E. Meade

With the rapid expansion of California's renewable energy infrastructure, concerns have arisen about the effect of these facilities on bird populations. Topaz Solar Farms (TSF) is a large solar energy facility (550-megawatt) located on the Carrizo Plain in San Luis Obispo County, California. Point counts were conducted at TSF during construction (2012-14) and for three years post-construction (2015-17) in onsite areas (solar panel arrays, power lines, and substation) and adjacent offsite grassland areas. Avian utilization did not differ significantly between on and offsite areas overall, but was significantly higher onsite than offsite in dry summer months. Average avian species richness was significantly higher in onsite areas, with several species detected only in onsite areas. Construction of the TSF did not negatively impact avian utilization and resulted in an increase in species richness. This may be due to the presence of structural components such as arrays and power lines that provide shade, shelter, and perches for birds which were lacking within the area prior to facility development. Thus, the development of TSF may have created an artificial habitat that benefits bird species via provision of resources that would otherwise not be available within the surrounding habitat.

*Poster Session*

### **EFFECTS OF SINGLE LEAF PINYON AND UTAH JUNIPER REMOVAL ON MULE DEER POPULATION IN THE TOIYABE RANGE, CENTRAL NEVADA.**

**Jason Gundlach**; University of Nevada-Reno; 672 Tarn Way, Reno, NV, 89503; (920) 960-9589; [jgundlach@cabnr.unr.edu](mailto:jgundlach@cabnr.unr.edu); Kelley M. Stewart

The Toiyabe Range in Nevada is home to one of the most prolific populations of mule deer (*Odocoileus hemionus*) in the state. Nonetheless, annual surveys indicate low overwinter survival of young of the year in this population. Habitat on winter range is primarily composed of woodlands containing Single-leaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus occidentalis*). This pinyon and juniper woodland (PJ) provides minimal nutritional value to mule deer while outcompeting herbaceous understory vegetation, therefore we are investigating how the removal of these trees on winter ranges affects the population of mule deer that use this habitat. Roughly 1,050 hectares of PJ were removed and will be compared with a designated control area. We collared 20 adult female mule deer to assess the response of the population to that treatment. We will assess the effect of this removal on adult survival during winter, as well as the effects on home range size, resource selection, and movement patterns. We hypothesize that adult survival will increase, winter home range sizes will contract, and release of water from PJ removal will improve the nutritional quality of herbaceous vegetation throughout mule deer winter range, resulting in higher adult body condition. \*Work in Progress\*

*Poster Session*

### **ROOST USE AND LANDSCAPE-SCALE MOVEMENT PATTERNS OF TOWNSEND'S BIG-EARED BATS (*CORYNORHINUS TOWNSENDII*) IN WHITE PINE COUNTY, NEVADA.**

**Laura M. Hancock**; University of Massachusetts Amherst; 250 S County Road, Leyden, MA, 01301; (985) 237-0244; [lhancock@umass.edu](mailto:lhancock@umass.edu); Jason A. Williams, Megan Moran, Rick E. Sherwin

Frequently, spatially or temporally limited evidence is used to inform larger scale management and

conservation decisions. This is especially true for harder to study taxa such as bats (e.g. small, nocturnal, able to fly). For example, historically, a single roost survey would be performed to inform roost management. However, more recent research shows that this limited evidence is likely not enough to determine whether a roost is important habitat, thus limiting the power to make viable management decisions. With the continuing spread of diseases such as white nose syndrome, habitat loss, and climate change, it is more critical than ever to gain a better understanding of the nuanced needs of bats in high risk areas to prevent further population losses and declines. In summer and fall of 2018, we used multiple tracking and monitoring techniques to gain a better understanding of where Townsend's big-eared bats (*Corynorhinus townsendii*) are using the landscape in White Pine County, Nevada. Specifically, we used Bat Call Detector Recorders (BCDRs), internal roost surveys, and radio telemetry to understand how Townsend's big-eared bats are using different roost types (e.g. caves, abandoned mines) and landscape features, which will ultimately help us to better inform conservation of this species.

*Poster Session*

*Student Paper*

### **DEMOGRAPHIC PLASTICITY IN GIANT GARTERSNAKE POPULATIONS IN MANAGED WETLANDS AND AGRICULTURAL AREAS.**

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Population models are a valuable tool for managing wildlife populations and estimates of demographic rates are an essential component of those models. *Thamnophis gigas* (giant gartersnake) has been eliminated from more than one half of its former range. Although factors such as habitat degradation and diminished water quality are attributed to these declines, the demographic trajectories of declining populations are only now emerging for *T. gigas*. The correlates of habitat and environment affecting demographic parameters also remain unclear. We used capture-mark-recapture data to estimate survival, growth rates and asymptotic size, and size at first reproduction in female *T. gigas* in populations at managed wetlands and at sites embedded in agricultural settings and evaluated the hypothesis that these vital rates varied among sites. Model-selection results indicated that *T. gigas* in agricultural areas grew more quickly but grew to a similar asymptotic length as those in managed wetlands and indicated lower survival and earlier age at first reproduction in agricultural areas. Central to developing management plans needed to prevent further extirpations in a variety of settings, this work contributes information needed to identify sensitive vital rates and to compare and track the status and trajectories of populations vital to the species' recovery.

*Poster Session*

### **AMPHIPOD PREDATION ON NORTHERN RED-LEGGED FROG EMBRYOS.**

**Melissa A. Harbert;** Institute for Wildlife Studies; PO Box 1104, Arcata, CA, 95518; (707) 822-4258; harbert@iws.org; Brian Hudgens

This study tested whether amphipods (*Cranogonyx* sp.), traditionally thought to be detritivores, prey on Northern Red-legged Frog (*Rana aurora*) embryos at the Humboldt Bay National Wildlife Refuge in California (HBNWR). Following observations of embryo disappearance associated with amphipods, we performed experiments in which embryos were subjected to one of four treatments: enclosed chambers with all predators excluded, enclosed chambers with only amphipods present, chambers with fine mesh screen allowing access by all small predators including amphipods, and chambers open to all predators. Trials with the last 2 treatments were repeated at a nearby site with no amphipods (BL). We found that average predation rates of viable embryos were similar among open/screened chambers at HBNWR and open chambers at BL (21-25%), while the average predation rate in amphipod-only chambers was 15%. Predation rates were  $\leq 1\%$  for predator exclusion chambers at HBNWR and screened chambers at BL. We conclude that embryo predation by amphipods does occur and has the potential to be as important a mortality factor as predation by all other macroinvertebrate/vertebrate predators. However, the significance of this interaction is likely to be highly context-dependent and affected by factors such as amphipod density/food availability and the size/cohesiveness of eggmasses.

**THE HIGHWAY 89 STEWARDSHIP TEAM - MITIGATION, RESEARCH AND EDUCATION TO IMPROVE WILDLIFE PASSAGE.**

**Sara M. Holm**; CA Department of Fish and Wildlife; 1701 Nimbus Rd. St. A, Rancho Cordova, CA, 95670; (530) 346-6305; sara.holm@wildlife.ca.gov;

A CalTrans carcass database was analyzed to evaluate hotspots for deer mortality on Highway 89. Grants were obtained to fund a deer telemetry study by CDFW to pinpoint current crossing of the highway by collared animals and to identify movement corridors and barriers. Grants also funded remote camera arrays to capture incidental animal use near or across the highway, and the construction of three underpasses. The number of deer or wildlife using an area, the intensity of roadkill or accidents, and physical features of the landscape were considered when identifying locations. The Team hired a teacher and built a curriculum for students in Sierra County. Students received in-class instruction and participated in many activities where they learned from agency professionals about the field of transportation ecology and the Team's efforts. The Team found that the combination of the carcass database, GPS deer collars, and remote cameras were ideal for informing decisions about mitigation needs. Twenty collared deer have crossed in the footprint of the Kyburz Flat fence and underpass. Thousands of photos of deer, and other species, have been captured on the cameras. The outreach has brought awareness to the management required to maintain wildlife, and support for the Team's work. Highway 89 but will serve a broader audience in the transportation ecology field.

*Poster Session*

**IDENTIFYING MOVEMENT BARRIERS FOR PRONGHORN IN THE MODOC PLATEAU.**

**Brian Hudgens**; Institute for Wildlife Studies; 140 H St, Blue Lake, CA, 95525; (707) 496-4725; hudgens@iws.org; David Garcelon, Justin Brice, Colton Wise

Habitat fragmentation has long been recognized as contributing to wildlife population declines and loss of biodiversity. Most research addressing the issue of habitat fragmentation has focused on identifying landscape features that facilitate movement between disjunct habitat patches, such as corridors. However, the hallmark of a fragmented landscape is the imposition of movement barriers. Pronghorn are especially sensitive to movement barriers, particularly fencing. We used location data from 45 adult pronghorn inhabiting the Modoc Plateau tracked from 2014-2016 to identify movement barriers at two spatial scales. At the landscape scale, we used habitat suitability to identify areas where large regions of unfavorable habitat isolate patches of favorable habitat. Within patches of highly suitable habitat, we identified regions with barriers to pronghorn movement based on directional movement analysis. At a more local scale, we identified which fences within a region pose the most significant barrier to pronghorn movement based on the number of approaches to a fence segment and the probability that an approaching animal crossed the fence segment. Each of these analyses identified different kinds of movement barriers, and represent complimentary approaches to directing efforts to reconnect fragmented landscapes.

*Poster Session*

*Student Paper*

**EXPLORING HUMAN PERCEPTIONS AND CONFLICT SURROUNDING HUMAN-SEAL USE OF BEACHES IN CALIFORNIA AND HAWAII.**

**Leilani S. Konrad**; San Diego State University; 1799 Missouri St, San Diego, CA, 92109; (818) 458-0886; lkonrad@sdsu.edu; Arielle Levine

People's perceptions of wildlife are influenced by their broader values and differences in these values and perceptions can contribute to human-wildlife conflict. This research explores how values and broader environmental beliefs influence people's perceptions of wildlife, as well as the potential for human-wildlife conflict examining increasing seal use of beaches in heavily populated coastal areas. Specifically, we look at perceptions of California Harbor Seals in La Jolla, California, where conflict over seals' use of

a beach has endured for 25 years and perceptions of Hawaiian Monk Seals in Oahu, Hawaii, where increasing seal populations are leading to more human interactions with growing potential for conflict. Using archival research, surveys, and interviews, we explore the sources of conflict in each location, including levels of conflict using the Conservation Conflict Transformation Framework (Madden and McQuinn, 2014), environmental beliefs using the New Environmental Paradigm (Dunlap, 2008), and value orientations based on Schwartz's (1994) norm-activation model. By combining multiple frameworks, we seek to identify core factors contributing to conflict in each of these distinctly different study sites and influencing people's perceptions of seals. This paper is a work-in-progress, but we will present preliminary findings from both archival analysis and the Hawaii case study.

*Poster Session*

*Student Paper*

## **THE EFFECTS OF THE MENDOCINO COMPLEX FIRE ON HABITAT USE AND MOVEMENT IN BLACK-TAILED DEER AND OTHER LARGE MAMMALS.**

**Samantha E. Kreling**; UC Berkeley, College of Natural Resources; 137 Mulford Hall #3114, Berkeley, CA, 94720; (415) 871-1615; skreling32@berkeley.edu; Kaitlyn M. Gaynor, Alex McInturff, Justin S. Brashares

Following centuries of fire suppression, growing populations, and changing climate, wildfires in the Western United States have become more frequent and intense. While landscape studies have made important findings about this new regime of megafires, little research has been conducted on the immediate effects of fire on large mammal behavior and habitat selection. In July 2018, the largest fire in California history, the Mendocino Complex Fire, burned over 400,000 acres. The University of California Hopland Research and Extension Center is located on the southwestern edge of the Mendocino Complex burn area and offers a unique study opportunity. Using data from 30 GPS-collared black-tailed deer (*Odocoileus hemionus*) and a grid of 37 camera traps, we are undertaking one of the first studies of large mammal behavioral responses to megafires. We aim to assess the relative changes in activity patterns and habitat use of the collared black-tailed deer and large mammals detected on camera traps in relation to post-fire resource distribution and other landscape variables through standard movement ecology metrics. We expect to find increased relative activity, home range size, and movement rates post-fire, as resources will be less available throughout the landscape and concentrated in certain areas. Additionally, we expect to find greater deer and other large mammal presence in areas less affected by fire, where food resources may be more accessible. Paper is a work in progress.

*Poster Session*

*Student Paper*

## **PELAGIC CORMORANT NESTING SUCCESS AND OCEANIC CONDITIONS IN NORTHERN CALIFORNIA.**

**Jade Morning Sky Little**; Undergrad; 1743 Hutchison Drive Apt 338, Davis, CA, 95616; (760) 567-8031; jmorningskylittle@hotmail.com; Daniel Barton, Shannon Brinkman, Claire Nasr

Nesting success is an important component of the growth of coastal seabird populations. Nesting success can be defined as the proportion of nesting or laying pairs that raise young to the age of fledging (i.e., the age when a fully-feathered offspring voluntarily leaves the nest for the first time). This study focused on the nesting success of one coastal seabird species, Pelagic Cormorant (*Phalacrocorax pelagicus*). Coastal bird species roles can be observed by not only aiming focus to their behavior and physiology but also their interactions with environmental conditions. Upwelling productivity in the California Current system brings abundant food to the ocean surface and increases food web abundance and complexity. Nesting site observations were analyzed and compared to changes in oceanic conditions in the area across a 5 year interval from 2014-2018, a time period which includes an el Nino event and extreme warm water in the northeast Pacific Ocean (the blob). The objective of this study was to examine and analyze the relationship between oceanic conditions and the nesting success of the coastal bird species, Pelagic Cormorants. This study provides information on how local-scale oceanic variations influence coastal bird species populations and provides important context for conservation efforts.

*Poster Session*

*Student Paper*

## **BROOD TRANSLOCATION AS A POPULATION RESTORATION METHOD FOR GREATER SAGE-GROUSE.**

**Mary B. Meyerpeter**; U.S. Geological Survey, Western Ecological Research Unit; 800 Business Park Road, Dixon, CA, 95620; (530) 902-9542; mmeyerpeter@usgs.gov ; Peter S. Coates, Mark A. Ricca, Brian G. Prochazka, David J. Delehanty

Translocation often is used to restore populations of wildlife, including greater sage-grouse (*Centrocercus urophasianus*). However, translocated grouse typically exhibit high mortality rates, a propensity to disperse away from release sites, and low reproductive success, meaning that large numbers of individuals must be translocated to compensate for low reproduction at release sites. Minimizing the number of individuals removed from a source population while simultaneously increasing the probability of restoration at the release site is desirable. We used an Integrated Population Model (IPM) to identify the potential of brood translocation (relocating female grouse with their young chicks) as a technique to reduce impacts on the source population and increase colonization of the release site. We predicted that translocating sage-grouse with their broods would result in higher population growth per individual compared to translocating female sage-grouse pre-nesting and simultaneously reduce impacts on the source population. We are testing the effectiveness of brood translocation to restore an imperiled sub-population of sage-grouse in eastern California. We present a protocol for brood translocation, including a soft-release system to prevent brood abandonment. Preliminary observational results suggest that translocating females with broods reduces female dispersal from release site and promotes juvenile recruitment.

*Poster Session*

*Student Paper*

## **MEASURING THE REGIONAL IMPACTS OF PINYON AND JUNIPER REMOVAL ON BAT AND SMALL MAMMAL COMMUNITIES IN THE NORTHERN GREAT BASIN.**

**Danielle Miles**; University of Nevada, Reno; 1664 N Virginia, Reno, NV, 89557; (727) 422-9092; Daniellcmiles@nevada.unr.edu; Kevin T. Shoemaker

Across the northern Great Basin, many land stewardship agencies such as the Bureau of Land Management and the U.S. Forest Service are clearing large tracts of pinyon and juniper woodlands (PJ) to restore habitat for the greater sage-grouse and other sagebrush-dependent species. We are using these conifer removal projects as experimental replicates for investigating the effects of conifer removal on bats, small mammals, and other "non-target" wildlife communities. Bat populations can be extremely sensitive to alterations in vegetation structure and may depend on PJ woodlands for foraging and roosting. In contrast, terrestrial small mammal species tend to have much smaller home ranges, and some species are suspected to be sagebrush-dependent. We are monitoring these wildlife communities seasonally at 15 fixed transects distributed across five regions of northern Nevada in a "before-after-control-impact" study design. Here we report preliminary results from two years of field data, including (1) baseline information about the under-studied bat and small mammal communities of the region prior to PJ removal, (2) preliminary information on the habitat associations for the dominant members of these communities, and (3) information about treatment effects in transects where PJ was removed before 2016.

*Poster Session*

*Student Paper*

## **DESIGNING AN AUTOMATED COUNTER FOR MONITORING BAT HOUSE OCCUPANCY.**

**Shahroukh Mistry**; California State University, Chico; Biological Sciences Department, Chico, CA, 95929; (530) 879-4345; smistry@csuchico.edu; Abdullah Albazroun, Colleen A. Hatfield, Carissa Leveille, Karin Metzgar, Alex Vorboril, Ozgul Yasar

Bat boxes are a common method for providing roosting habitat in urban and otherwise altered environments. While bat boxes are increasingly popular, little data exists on their occupancy or the emergence patterns of bats. To address this lack of information, we formed a collaboration with capstone

engineering students of the Mechanical and Mechatronic Engineering Department at California State University, Chico. The primary goal of this project is to design and build a data acquisition system that will monitor the roosting patterns of the bat population living within the bat boxes at the CSU Chico Big Chico Creek Ecological Reserve and the Agricultural Teaching and Research Center. This device will also serve as a prototype that could be universally adapted to most bat boxes. Using an array of distance and break-beam sensors, the counter will estimate the daily ingress and egress of the bats, the timing of activity patterns as well as allowing for the study of correlation with daylight, temperature and seasonality. The population data gathered from this system will allow researchers to better understand bat box occupancy rates, seasonal patterns of bat abundance, and help in future bat box design and placement.

*Poster Session*

## **EFFECTS OF WILDFIRE ON THE STRUCTURE OF CARNIVORE COMMUNITIES IN NORTHERN CALIFORNIA.**

**Erin E. Morrison**; Oregon State University; 1236 Eagle Way, Virginia Beach, VA, 23456; (757) 469-9626; e.morrison430@gmail.com; Taylor R. Peltier, David S. Green, Sean M. Matthews, Roger A. Powell

Wildfires are a habitat-altering ecological disturbance that can affect carnivore populations. The frequency and intensity of wildfires in the western United States have increased in recent years and it is critical to understand these effects. To investigate how wildfires may affect carnivore communities, we implemented a pilot trail camera project in areas burned by a wildfire in 2014 on the Klamath National Forest in northern California. In 2017, we deployed seven cameras in burned areas and eight cameras in non-burned habitat that had similar elevation and canopy cover to the pre-fire condition of burned areas. We hypothesized that occupancy rates of generalists and specialists are influenced by habitat availability, interspecific competitive interactions, and prey availability. Using single-season occupancy models, our results indicate that generalist species, such as grey fox (*Urocyon cinereoargenteus*) and coyote (*Canis latrans*), occurred at higher occupancy rates in burned areas compared to unburned areas, while forest-obligate species, such as fisher (*Pekania pennanti*), occurred at lower occupancy rates in burned areas compared to unburned areas. Further monitoring will be needed to determine if the increase in occupancy of generalists in burned areas may have negative effects on sensitive species being able to return to these areas.

*Poster Session*

## **USE OF DNA SEQUENCING TO IDENTIFY THE ORIGIN OF WESTERN POND TURTLES IN CAPTIVE BREEDING PROGRAMS.**

**Rachel L. Morrow**; C.S.U. Fresno; 40593 Big Oak Flat Road South, Oakhurst, CA, 93644; (559) 760-9107; cherryblossom94@mail.fresnostate.edu; Joshua S. Reece

Captive breeding programs must maintain a balance between preserving the genetic purity and genetic diversity of a population in order to build a viable population for future reintroduction. This may be difficult due to the limited number of extant wild individuals for establishment of founder populations, leading to an increased risk of inbreeding or outbreeding depression in consequent generations. We are collaborating with zoos and animal-holding facilities to aid in conservation of threatened and endangered species through captive breeding. At CSU Fresno, we are using DNA sequencing to identify the species and geographic origin of wild-bred Western Pond Turtles (genus *Actinemys*) in the programs we are collaborating with. Results will be used to inform wildlife managers for the development of captive breeding protocols and reintroduction plans that are sensitive to species and geographic origin. We have used the NADH dehydrogenase subunit 4 (ND4) mitochondrial gene marker to identify species and geographic origin for 33 captive individuals including 17 northern species (*Actinemys marmorata*) and sixteen southern species (*Actinemys pallida*) individuals. Once *A. marmorata* and *A. pallida* males and females have been identified, breeding will be managed in consideration of species, geographic origin, and the subsequent risks of outbreeding and inbreeding depression.

*Poster Session*

*Student Paper*

## **CLIMATE CHANGE VULNERABILITY IS PHYLOGENETICALLY CLUSTERED FOR MOST OF CALIFORNIA'S BIRDS.**

**Shelby P. Moshier**; California State University, Fresno; 2837 E Emerald Ave, Fresno, CA, 93720; (559) 970-5106; [spmoshier@mail.fresnostate.edu](mailto:spmoshier@mail.fresnostate.edu); Gurjap Dhaliwal, Joshua S. Reece

Anthropogenic climate change is a major threat for many at-risk species. One way of assessing the impact of climate change is through vulnerability assessments, which quantitatively evaluate the susceptibility of species to threats. While vulnerability assessments can identify which species are most at-risk, it can be unclear as to how species' vulnerability is distributed phylogenetically and what would be lost in terms of evolutionary diversity if certain lineages were extirpated. We examined the distribution of quantitative climate change vulnerability scores, International Union for Conservation of Nature (IUCN) ranks, and NatureServe conservation status assessments for 299 California avian taxa on a phylogenetic tree to evaluate the phylogenetic distribution of avian climate change vulnerability and extinction risk. We cumulatively analyzed binned scores in R to calculate Faith's Index of Phylogenetic Diversity (PD) and disparity as assessed by the Net Relatedness Index (NRI). Removing species at elevated risk levels from the California avian phylogeny resulted in the loss of more disparity (measured by NRI) and phylogenetic diversity (PD) than would be expected if the same number of taxa were randomly removed from the tree. Thus, climate change threatens both overall evolutionary diversity and disparity in California's birds.

*Poster Session*

*Student Paper*

## **FERAL HORSES DISRUPT GREATER SAGE-GROUSE LEKKING ACTIVITY IN THE GREAT BASIN.**

**Diana A. Munoz**; US Geological Survey/UC Davis; 800 Business Park Drive Suite D, Dixon, CA, 95620; (818) 531-5966; [damunoz@ucdavis.edu](mailto:damunoz@ucdavis.edu); Peter S. Coates

Greater sage-grouse (*Centrocercus urophasianus*; hereafter, sage-grouse) and feral horses (*Equus ferus caballus*) co-occur within Great Basin sagebrush ecosystems of western North America. In recent decades, sage-grouse populations have declined substantially while concomitantly feral horse populations have increased. Although multiple studies have reported feral horses adversely impacting native ungulate species, direct interactions between feral horses and sage-grouse have not been documented previously. We used Bayesian multinomial logistic models to examine the response of breeding male sage-grouse to the presence of native (i.e. mule deer, pronghorn) and non-native (i.e. cattle, feral horses) ungulates on active sage grouse leks (traditional breeding grounds) during 2013-2018. We found sage-grouse were five times more likely to be on active leks concurrent with native ungulates compared to non-native ungulates. Of the four different ungulate species, sage-grouse were least likely to be at leks when feral horses were present. Our results suggest that the presence of feral horses negatively influences sage-grouse lekking activity. Because sage-grouse population growth is sensitive to breeding success, disruption of leks by feral horses could reduce breeding opportunities and limit breeding areas within sage-grouse habitat. Findings are preliminary and provided for timely best science.

*Poster Session*

*Student Paper*

## **BLUNT-NOSED BLING: ARE RADIO COLLARS A STRESSOR TO BLUNT-NOSED LEOPARD LIZARDS (*GAMBELIA SILA*)?**

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The federally-endangered blunt-nosed leopard lizard (*Gambelia sila*) inhabits the rapidly disappearing San Joaquin Desert of California. A variety of techniques are employed to better understand the remaining populations of blunt-nosed leopard lizards, including deployment of radio collars around the lizards' necks. Sublethal effects of radio collars may be detected by examining

hormonal evidence of stress. Corticosterone (CORT) is a glucocorticoid hormone and mediator of stress, and high plasma CORT levels may suggest an animal is under some form of physiological stress. After the completion of a three month radiotelemetry project, we collected blood samples from twenty five collared and six uncollared blunt-nosed leopard lizards. To measure stress reactivity, or the rise in CORT from baseline following an acute stressor, lizards were placed inside breathable cotton bags for one hour, after which an additional blood sample was collected. We will present data comparing baseline CORT in blood samples from collared and uncollared lizards (to detect chronic stress) as well as stress reactivity (to examine the acute stress response). Examining these endocrine profiles will provide much-needed data on the extent to which radio collars may stress individual lizards, allowing us to refine our field methods for tracking sensitive species.

*Poster Session*

### **ESTIMATES OF CALF SURVIVAL AND FACTORS INFLUENCING MORTALITY IN NORTHWESTERN CALIFORNIA.**

**Erin M. Nigon**; Humboldt State University/CDFW; 2908 Loop Road, Fortuna, CA, 95540; (218) 343-3321; emn213@humboldt.edu; Richard Brown, Carrington Hilson, Micaela Szykman-Gunther, Tim Bean

Juvenile survival of ungulates is known to be highly variable, yet it is fundamental to understand the dynamics and trends of wildlife populations. Factors influencing calf survival are poorly understood in northwestern California. The objectives of this study were 1) to estimate summer calf survival, annual calf survival, and determine recruitment rates for Roosevelt elk (*Cervus canadensis roosevelti*) in the area, 2) to evaluate the effects of sex, study area, estimated birth weight, and birthdate on summer calf survival, and 3) to identify factors influencing elk survival by investigating mortalities across all age classes. During 2017 and 2018, our study captured and marked 58 calves and 29 cow elk in Del Norte and Humboldt counties. Preliminary analysis suggested that summer survival was high, with survival rate varying during the first 14 weeks of life. Annual calf survival also appears to have been high, but the analysis is ongoing. A total of 42 mortalities (tagged and opportunistic) was investigated from December 2016 through October 2018, but this work will continue through May 2019. This work is an ongoing collaboration and this information will be used by the California Department of Fish and Wildlife in the management of this game species.

*Poster Session*

*Student Paper*

### **REGIONAL CONSERVATION INVESTMENT STRATEGIES PROGRAM: A NEW CONSERVATION TOOL.**

**Ami Olson**; California Department of Fish and Wildlife; P.O. Box 944209, Sacramento, CA, 94244; (916) 653-9767; ami.olson@wildlife.ca.gov; Shannon Lucas, Ron Unger

On September 22, 2016, Governor Brown signed Assembly Bill 2087, establishing the California Department of Fish and Wildlife's (CDFW) Regional Conservation Investment Strategies (RCIS) Program. The RCIS Program encourages development of regional conservation strategies to identify opportunities for philanthropic investments and advance mitigation that would result in effective regional conservation. The RCIS Program uses a science-based approach to identify and prioritize region-specific conservation actions to help California's declining and vulnerable species by protecting, restoring, and reconnecting their habitats, and facilitating adaption and resilience to climate change, invasive species, and other stressors. These actions may include land protection, habitat restoration, installation of wildlife crossings, and removal of fish passage barriers. The RCIS Program consists of three components: Regional Conservation Assessments (RCAs), Regional Conservation Investment Strategies (RCISs), and Mitigation Credit Agreements (MCAs). Strategies are developed in an RCIS and actions may be carried out through an MCA, which creates credits that may be used as compensatory mitigation for impacts under state and federal laws. This poster will further explain each of the Program component's benefits and uses in relation to conservation and recovery of sensitive species during this Anthropocene and how the Program relates to other CDFW conservation planning instruments.

*Poster Session*

## **CAPTURE, HOLDING AND RELEASE OF A NATIVE POND TURTLE (*ACTINEMYS PALLIDA*) POPULATION.**

**Brock A. Ortega;** Dudek; 605 Third Street, Encinitas, CA, 92024; (760) 479-4254; [bortega@dudek.com](mailto:bortega@dudek.com);

As a result of construction monitoring for a dam retrofit project in the City of San Diego, the presence of a small and relatively isolated population of eight southwestern pond turtles (*Actinemys pallida*) were discovered. Because the water was going to be nearly completely removed for an extended period, it was decided that they would be captured and maintained within an off-site facility until the project was complete. The turtles were trapped in coordination with The California Department of Fish and Wildlife and U.S. Geological Survey. Due to unforeseen circumstances, the project remained in stasis for longer than the expected two- to four-month period and the turtles were maintained in a facility for over 13 months. Upon release, the turtles were fitted with radio-transmitters and tracked for an extended period to learn more about survivorship, periods of activity, and habitat use. In this poster, we will outline the unique circumstances surrounding this effort, the site design of the holding facility, health issues and treatment, ultimate release, and long-term post-release radio-tracking results of the five surviving turtles.

*Poster Session*

## **USE OF NONINVASIVE DNA TO STUDY ABUNDANCE AND STRUCTURE OF BLACK BEAR POPULATIONS IN THE LAKE TAHOE BASIN.**

**Julia D. Owen;** University of California, Davis; One Shields Ave/ Old Davis Rd., Davis, CA, 95616; (619) 933-0774; [jdownen@ucdavis.edu](mailto:jdownen@ucdavis.edu); Camilo J. Sanchez, Shelly Blair, Sara Holm, Benjamin N. Sacks

As urban areas continue to sprawl into adjacent wilderness, the number of human-wildlife interactions continue to increase. The American black bear (*Ursus americanus*) commonly habituates to human resources in regions of urban-wildland interface. Since 1957, California's Department of Fish and Wildlife has relied on bear tags and hunting data as crude indices of regional abundance to inform black bear management. These indices are inadequate for characterizing abundance in smaller problem areas and provide no understanding of bear population structure, such as between developed and wildland habitats. We conducted a pilot study in the Lake Tahoe Basin to learn how bear populations respond in terms of abundance and structure to extended spatial and temporal interaction with urbanization, and to develop noninvasive sampling methods for both neighborhoods and wildland areas. We collected black bear fecal samples in ten 4x4 km plots of land on the California side of the Basin, including 5 in human development and 5 in adjacent wildland. Here, we discuss preliminary findings with respect to the efficacy of scat sampling, sampling strategy, and population abundance and structure.

*Poster Session*

*Student Paper*

## **THE EFFECTS OF HUMAN DISTURBANCE AND DROUGHT ON INTRAGUILD INTERACTIONS OF MAMMALIAN MESOPREDATORS IN CALIFORNIA.**

**Molly K. Parren;** Humboldt State University ; 1 Harpst St, Arcata, CA, 95521; (802) 233-3396; [Molly.Parren@humboldt.edu](mailto:Molly.Parren@humboldt.edu);

In 2014 California was declared to be in a Drought State of Emergency. This pronouncement resulted in the creation of the Terrestrial Species Stressor Monitoring (TSM) Program implemented by the California Department of Fish and Wildlife to establish baseline data on terrestrial vertebrates in the Mojave Desert and Central Valley of California. Between 2016 and 2017, 589 camera traps were deployed throughout these two eco-regions documenting mammalian mesopredator presence in a drought year (2016) and a post-drought year (2017). Sites were distributed across a variety of land cover types with varying levels of human disturbance, providing the opportunity to examine how human disturbance, combined with drought, might be influencing mesopredator species. The objectives of this study were to examine spatial patterns of mesopredator co-occurrence at a large spatial scale across varying levels of human disturbance, and to investigate how drought might mediate co-occurrence. We expected to find higher levels of co-

occurrence in areas of increased human disturbance, especially in 2016 when drought conditions may have attracted mesopredators to anthropogenic water sources.

*Poster Session*

*Student Paper*

### **ESTABLISHING A NEW BURROWING OWL BREEDING NODE IN SAN DIEGO COUNTY.**

**Savannah R. Perez**; San Diego Zoo Institute for Conservation Research; 15600 San Pasqual Valley Rd., Escondido, CA, 92027; (760) 703-3621; sperez@sandiegozoo.org; Colleen L. Wisinski, Michael T. Stevens, Danielle M. Angel, Susanne A. Marcak, Sarah M. Hennessy, Lisa A. Nordstrom

Population sustainability of the western burrowing owl (*Athene cunicularia hypugaea*, BUOW) is uncertain due to habitat loss. As part of a multi-agency collaboration, increased efforts to create suitable BUOW habitat and new breeding nodes have been undertaken in San Diego County to help stabilize the population. At Rancho Jamul Ecological Reserve (RJER), the California Department of Fish and Wildlife established a Burrowing Owl Habitat Management Area. We have encouraged ground squirrel settlement for natural burrow creation and installed artificial burrows for BUOW translocation. Five pairs of BUOW that were anticipated to be impacted by development at Brown Field Municipal Airport were translocated to RJER in 2018. After a soft-release period, they were monitored during the breeding season and beyond through site visits, camera traps, and satellite telemetry. We used techniques such as artificial conspecific cues (e.g. call playback) and supplemental feeding to dampen dispersal and increase juvenile survival. This effort adds to our understanding of active translocation as a tool for both conservation and mitigation. We present lessons learned in the first year of this multi-year effort to establish a new subpopulation of BUOW.

*Poster Session*

### **SEASONAL PATTERNS IN BAT ACTIVITY AT LAVA BEDS NATIONAL MONUMENT.**

**Janette Perez-Jimenez**; National Park Service; 1 Indian Well Headquarters, Tulelake, CA, 96134; (510) 460-2821; janette.perezj@gmail.com; Katrina Smith

Home to 14 bat species, Lava Beds National Monument is committed to monitoring bat activity using a variety of methods. Historically, park staff have spent time monitored maternity colonies of three species in caves, but management response to threats such as disease and human disturbance requires baseline information for all species in all seasons. Here, we share results from summer and winter acoustic monitoring efforts that begin to document species presence and activity within the monument on a seasonal basis. We also examine the relationship between environmental covariates and bat species composition and activity levels. This study supports a broader effort to document seasonal activity trends to inform management actions such as white-nose syndrome surveillance, public outreach, and habitat protection.

*Poster Session*

### **USING SPATIALLY EXPLICIT CAPTURE-RECAPTURE TECHNIQUES TO DETERMINE BLACK BEAR (*URSUS AMERICANUS*) DENSITY AND SPACE-USE IN AN ARID MOUNTAIN ECOSYSTEM.**

**Steffen D. Peterson**; Humboldt State University; 1 Harpst Street, Arcata, CA, 95521; (920) 203-5046; Steffen.Peterson@humboldt.edu; Daniel C. Barton, Jared F. Duquette, Micaela S. Gunther

Black bear (*Ursus americanus*) populations have grown and recolonized historic range in California, and unharvested populations are currently poorly monitored by existing programs. In the Warner Mountains, increasing issuance of depredation permits has underscored the importance of population monitoring. To study population-level density, space-use, and demographics in this unharvested population, 10 non-invasive sampling grids, comprising a 3x3 arrangement of 4 km<sup>2</sup> grid-cells, were established across the 1,464 km<sup>2</sup> study area. Hair-snares were constructed within each grid-cell and spaced > 2 km. Lured hair-

snare traps were monitored over five 10d sessions in summer 2018. Additionally, 6 trail cameras were deployed within each grid to estimate cub:adult ratio for this population and to examine temporal effects on detection and visitation rates. Microsatellites were used to estimate individual identity and sex of hair-snared bears and to develop a multi-session capture history. Spatially explicit capture-recapture (SECR) models incorporated landscape covariates of elevation, slope, percent forest cover, and distances of roads and streams calculated for each grid-cell to develop competing density models. We further tested for sex effects on density and habitat associations. Lastly, we attempted to fit anisotropic (i.e., elliptical) sex-specific detection functions as an implicit model of differences in space-use between males and females.

*Poster Session*

*Student Paper*

### **BAT ACOUSTIC MONITORING IN THE SIERRAS AND THE CENTRAL VALLEY.**

**Joshua S. Reece**; CSU Fresno; , Fresno, CA; joshua\_reece@csufresno.edu; David Lent, Shelby Moshier, Rachel Morrow, Chrisonna Graves

Bats are among the most species groups of mammals. They are important components of the many ecosystems that they inhabit and they confer valuable ecosystem services to humans. Bat diversity is high in California and within the Yosemite, Sequoia, and Kings Canyon (SEKI) National Parks. However, systematic inventories of bat species and spatio-temporal patterns of diversity are lacking. These data are particularly important to gather as White-Nose Syndrome, a disease that decimates bat populations throughout eastern North America, has not yet but may spread into California. Throughout the Summer and Fall of 2018, SEKI Park biologists, the Sequoia Parks Conservancy, and researchers and students from CSU Fresno teamed up to conduct an initial survey of bat diversity throughout the park at high and low elevation sites. We surveyed three locations: Wuksachi Lodge, Mineral King, and Potwisha using both acoustic monitoring and mist-net captures. Our goal was to get an initial assessment of bat diversity at these sites and to pair our efforts with the goal of increasing interaction with the public. Public presentations on bat natural history were given to visitors at each site, including live filming of any captured bats, and presentation of acoustic data. Here we present on the results of those surveys.

*Poster Session*

### **JOINING FORCES TO STREAMLINE ENVIRONMENTAL COMPLIANCE: TWO NATIONAL PARK SERVICE UNITS, ONE ENVIRONMENTAL ASSESSMENT FOR INVASIVE PLANT MANAGEMENT.**

**Julie L. Remp**; EMPSi; 3005 Center Green Dr. Suite 205, Boulder, CO, 80301; (303) 317-3214; julie.remp@empsi.com; Meredith Zaccherio

In an age of condensed environmental planning and federal agencies overextended to consult, authorize, and implement resource management direction, development of new methodologies are essential to land and species conservation. Here we look at an example of two National Park Service (NPS) units collaborating on a joint Invasive Plant Management Plan and Environmental Assessment with associated Endangered Species Act consultation to better synchronize NPS actions and programs. This coordinated NPS management plan and consultation improved consultation efficiency and promoted inter-agency collaboration throughout California. It will enhance conservation and recovery efforts of listed species within the Santa Monica Mountains and Redwood National Park. This joint approach provides a regulatory framework, which the NPS intends to use as an example for future invasive plant management plans in eleven other California parks and parks nationwide.

*Poster Session*

### **BALD EAGLE (*HALIAEETUS LEUCOCEPHALUS*) NESTING TRENDS AND DISTURBANCE SOURCES IN THE EAST BAY REGIONAL PARK DISTRICT.**

**David L. Riensche**; East Bay Regional Park District; 2950 Peralta Oaks Court, Oakland, CA, 94605;

(510) 544-2319; driensche@ebparks.org; Shane T. Cano , Gaetano J. Palazzo

The bald eagle (*Haliaeetus leucocephalus*) is an Endangered Species Act success story. Illegal shooting, habitat loss, and the pesticide DDT once threatened our national icon with extinction. Fortunately, the bald eagle population has recovered due to numerous conservation efforts. Specifically in the East Bay Regional Parks, established bald eagle nests have been protected at Lake Chabot and Lake Del Valle, two reservoirs open to public recreation. Since 2012, both nesting sites have been monitored by staff and trained volunteers. Analysis of the data collected between 2012 and 2017 provides an overview of their nesting trends and disturbance sources in urban-wildland interface. Their long-term breeding success, occurring within the East Bay Regional Park District, has averaged 1.27 fledglings per nesting pair. Disturbance sources such as red-tailed hawk (*Buteo jamaicensis*), common raven (*Corvus corax*), and american crow (*Corvus brachyrhynchos*) make up 42% of disturbances at Lake Chabot and 36% at Lake Del Valle. This information will aid in the future management and protection of nesting bald eagles.

*Poster Session*

### **DEVELOPMENT OF WESTERN POND TURTLE STUDIES IN SUISUN MARSH.**

**Melissa K. Riley**; California Department of Fish and Wildlife; 2825 Cordelia Road, Suite 100, Fairfield, CA, 94534; (209) 628-0247; Melissa.Riley@wildlife.ca.gov;

The western pond turtle (*Actinemys marmorata*) (WPT) is the last remaining native freshwater turtle in California and is designated as a species of special concern due to population declines. In other parts of its range such as Washington, WPT are listed as endangered due to causes such as habitat loss and disease. In the Suisun Marsh, WPT are thought to be widespread based on observational data; however, there have been no formal studies of their population status or habitat requirements. The California Department of Fish and Wildlife and UC Davis have partnered to study WPT in the Suisun Marsh. Current projects include a mark-recapture study on Grizzly Island Wildlife Area, as well as a telemetry study on the Hill Slough Wildlife Area where tidal restoration is planned. So far it appears that populations are large and healthy within Suisun Marsh. In additions, WPT are utilizing a variety of aquatic and terrestrial habitats within tidal and managed wetlands. Insights gained from these projects will aide managers in efforts to conserve WPT, especially in response to impending changes that may occur due to sea level rise and the conversion of managed wetlands to tidal.

*Poster Session*

### **CHARACTERIZATION OF A BLACK BEAR MICROSATELLITE MULTIPLEX OPTIMIZED FOR NONINVASIVELY COLLECTED SAMPLES IN CALIFORNIA.**

**Camilo J. Sanchez**; University of California, Davis; 2718 Anza Ave, Davis, CA, 95616; (530) 400-3865; casanchez@ucdavis.edu; Julia Owen, Stevi Vanderzwan, Michael Buchalski, Ben Sacks

California black bear management lacks a noninvasive genetic abundance monitoring program for sustainable harvest and population control. To that end, we aimed to test and optimize a microsatellite multiplex genotyping assay for individual identification and sex determination of black bears from DNA extracted from scat. Primers for 14 autosomal loci and a sex marker were divided into two multiplex assays by identifying primer conflicts and maximizing the distance between allele size ranges of different loci labeled with the same fluorescent dye. We then used 100 field-collected bear scat samples genotyped in triplicate to assess error in fecal DNA analysis, specifically, allelic dropout and false allele rates, validated with 5 paired scat and buccal swab samples from captive zoo bears. We anticipate this study will result in a high-resolution genetic assay for individual identification and sex determination in California black bears that can be used for estimating abundance and population structure.

*Poster Session*

### **MODELING AND MAPPING HABITAT SUITABILITY FOR FORAGING ACTIVITY OF**

## **CRYPTIC FOLIAGE-ROOSTING BATS IN CENTRAL COASTAL CALIFORNIA.**

**Bethany C. Schulze**; CSU Monterey Bay; P.O. Box 8043, Santa Cruz, CA, 95061; (831) 359-3754; bschulze@csumb.edu; Fred G. Watson, Jennifer M. Duggan, Winifred F. Frick

We detected and modeled bat habitat selection for foraging activity in the Monterey Bay Area, California, to explore a potential method for determining regional distribution of two species of cryptic foliage-roosting bats, hoary bats and red bats. We postulated that foraging activity of these bat species would in part be determined by the extent of forest and grassland cover, and the proximity to urbanization. We walked transects in natural and urban areas and monitored bats using an Echometer Touch bat detector. We also collected data from passive acoustic monitoring and mist netting efforts. All acoustic calls were analyzed to identify bats species using Sonobat software. We will determine available habitat based on a buffer area surrounding each transect, detector, or netting site. Models will be constructed based on chosen land cover covariates at multiple spatial scales and compared using Akaike's Information Criterion. We expect that the results will support the postulate that hoary bats and red bats select specific natural areas at further distances from urbanization for foraging. We will use the results to guide site selection for a more in-depth spatial analysis of habitat use for foraging.

*Poster Session*

## **EFFECTS OF GPS TRACKING DEVICES ON SAGE-GROUSE DEMOGRAPHIC RATES AND BEHAVIOR.**

**John P. Severson**; U.S. Geological Survey; 800 Business Park Dr. Suite D, Dixon, CA, 95620; (618) 559-2955; jpseverson@usgs.gov; Peter S. Coates, Brian G. Prochazka, Mark A. Ricca, Michael L. Casazza, David J. Delehanty

Wildlife researchers assume that tracking devices do not alter behavior or demographics, yet violations can bias ecological inference and misinform conservation actions. GPS units have improved our understanding of space use, but information on effects to demographics and behaviors is lacking. We evaluated survival and habitat selection using VHF and GPS units on >1,200 Greater Sage-Grouse (*Centrocercus urophasianus*), across multiple populations within the Great Basin. Survival was generally lower for GPS compared to VHF-marked grouse, but relative differences varied by sex, age, and season. We attributed decreased survival to features of GPS units that might increase susceptibility to predation such as greater unit weight, unit placement, and a reflective solar panel. Although habitat selection was generally similar, we observed some significant differences in selection of vegetation and terrain characteristics that may be related to predation risk or altered breeding success. Our results indicate that demographic parameters derived from GPS should be interpreted with caution, and design modifications aimed at reducing survival impacts would be beneficial. We provide body-mass based guidelines where survival impacts are reduced, but stress that more research on behavior is needed to assess tradeoffs associated with these units. Findings are preliminary and provided for timely best science.

*Poster Session*

## **WHEN THE FISHER'S AWAY, THE MICE WILL PLAY: THE EFFECTS OF MIXED-SEVERITY WILDFIRE ON SMALL MAMMAL OCCUPANCY IN NORTHERN CALIFORNIA AND SOUTHERN OREGON.**

**Christopher A. Sirakowski**; Portland State University; 1825 SW Broadway, Portland , OR, 97201; (512) 225-4406; sir3@pdx.edu; David S. Green, Sean M. Matthews

Wildfires play a major role in the structure and composition of landscapes and the general ecology of the Pacific Northwest. The Klamath-Siskiyou eco-region in northern California and southern Oregon has been experiencing an increase in the frequency, scale, and intensity of wildfires in recent years. Understanding the effects of wildfires on small mammal communities is an important, yet understudied, aspect of the response of wildlife to wildfires. Two wildfires burned areas on and adjacent to a long-term study area of wildlife in 2014. We will investigate the effects of these wildfires on the occupancy of small mammals such as *Neotoma fuscipes*, *Glaucomys sabrinus*, and *Tamias* spp. using occupancy analyses of data collected during fall field seasons using track plate stations. The longitudinal data set that we have

includes years of data before the fires occurred, allowing us to disentangle any effects of the wildfires from any naturally occurring variation. This research is important in determining what lasting effects these increases in wildfire frequency are going to have on predator-prey dynamics.

*Poster Session*

*Student Paper*

### **CLARIFYING BREEDING SYSTEM, BREEDING PHENOLOGY AND INFANTICIDE FROM A REINTRODUCED POPULATION OF FISHERS.**

**Kevin P. Smith**; North Carolina State University; (530) 513-6540; kpsmith0@gmail.com; Aaron N. Facka, Roger A. Powell

Current knowledge of fisher (*Pekania pennanti*) breeding strategies and timing of mating is limited and comes primarily from captive fishers. We used photographic data collected from 2010 through 2017 on a population of reintroduced fishers in northern California to test several hypotheses about fisher reproduction, breeding, and male-female interactions. We use logistic and linear regression to evaluate the timing and frequency of male visitation and reproduction at 262 reproductive dens used by 50 individual females. Of 46 documented copulations and 593 male visits, 100% and 95% occurred while females had kits in their natal dens. Seventy five percent of documented male visits occurred before 31 March and 95% of occurred before 18 April. Mating occurred during a short period (mean = 3.1 +/- 1.6 days) and all copulations were documented < 2 weeks following parturition. We documented fishers of both sexes breeding with multiple partners in the same year, demonstrating a polygynandrous mating system. We found no evidence for male directed infanticide, suggesting males were not motivated to kill kits by either hunger or competition. Our results add precision to the timing of the reproductive cycle and provide the first descriptions of male-female interactions for wild fishers.

*Poster Session*

### **SELECTIVITY OF MICROTRASH MATERIAL TYPE BY CALIFORNIA CONDORS.**

**Marie G. Solis**; California Polytechnic State University, San Luis Obispo; 1 Grand Avenue, San Luis Obispo, CA, 93407; (805) 286-1829; mgsolis@calpoly.edu; Francis X. Villablanca

California condors consume non-food items, including anthropogenic waste, and provision it to their young. Consuming "microtrash" can cause mortality, especially in nestlings. There are several possible reasons explaining why condors might consume microtrash. One is that these birds require a source of bone (and calcium) because they feed primarily on muscle and viscera, and confuse microtrash for bone. Another is to provide material with enough binding potential to form into pellets, removing indigestible items. A third possibility is that this is an adaptive behavior of food stressed individuals. The first two explanations would be more likely if California condors had a preference for the materials they consume. The third explanation would be supported if condors simply took available materials. Therefore, to explore these explanations, we test the hypothesis that when California condors take microtrash, they show no material selectivity. We did this by sampling microtrash from six roadside pullouts in the Los Padres National Forest. Those samples will be compared to condor necropsy microtrash data, categorized by material type - glass, plastic, metal, other. Our prediction is that if condors are not selective, then proportions of microtrash types collected from pullouts should match the proportions of microtrash documented in necropsies.

*Poster Session*

*Student Paper*

### **BEHAVIORAL ECOLOGY OF RIPARIAN BRUSH RABBITS AT THE SAN JOAQUIN RIVER NATIONAL WILDLIFE REFUGE.**

**Celia M. Tarcha**; CSU Stanislaus Endangered Species Recovery Program; 1 University Circle, Turlock, CA, 95382; (408) 668-5653; ctarcha@csustan.edu; Patrick A. Kelly

The riparian brush rabbit (*Sylvilagus bachmani riparius*; RBR) is a state- and federally-listed species found in just a few areas of the northern San Joaquin Valley of central California. It requires the dense brush associated with riparian areas for food and for protection from predators. Loss of habitat to agriculture and urban development restricted its range to two locations in San Joaquin County requiring its reintroduction beginning in 2002 to the San Joaquin River National Wildlife Refuge (NWR). This project studied the behavioral ecology of RBR on San Joaquin River NWR from February to August 2017 using camera traps. The primary objectives of the research were to study the activity patterns and behavior of RBR as well as their usage of different resources on the NWR, specifically, plant communities restored in the early 2000s and artificial feed sites deployed to sustain levee-stranded RBR during major flooding in spring 2017. Initial results showed an increase in interactions between RBR and other species at artificial feed sites. Although a variety of behaviors were recorded during the study, vigilance and foraging behaviors were the most prominent across sites. Paper is a work in progress.

*Poster Session*

*Student Paper*

### **IT'S GETTING HOT IN HERE: SALT MARSH HARVEST MOUSE SURVIVAL AND RECOVERY AFTER A WILDFIRE.**

Melissa K Riley; California Department of Fish and Wildlife; 2825 Cordelia Road, Suite 100, Fairfield, CA, 94534; (209) 628-0247; [Melissa.Riley@wildlife.ca.gov](mailto:Melissa.Riley@wildlife.ca.gov); Laureen Barthman-Thompson, Sarah Estrella, Candice Rose, Katherine Smith, Sadie Trombley, **Sadie Trombley**

The salt marsh harvest mouse (*Reithrodontomys raviventris* sp., SMHM) is endemic to the tidal marshes of the San Francisco Bay Estuary. SMHM have been listed as endangered since the 1970s, but in the Suisun Marsh current populations appear to be thriving. Recently, a wildfire burned more than 80% of the vegetation within the trapping grid at a long term SMHM monitoring site on the Grizzly Island Wildlife Area, Joice Island Unit. Initial trapping one week after the fire showed that a surprising number of SMHM survived, however capture efficiency was lower than average for the time of year. The wildfire presents an opportunity as an interesting case study to explore how the SMHM and associated small mammal community respond after a fire event. Managers will benefit from this knowledge as wildfires and other catastrophic events become more common with global climate change. This case study will also provide insight into the response of SMHM to current management practices such as prescribed burns that are used to control invasive vegetation species.

*Poster Session*

### **THE ROLE OF ELEMENTARY SCHOOL STUDENTS AND CITIZEN SCIENTISTS IN MONARCH BUTTERFLY RECOVERY.**

**Melissa Tu**; Harris & Associates; 4685 Da Vinci St, San Diego, CA, 92130; (760) 822-6175; [melissa.tu@weareharris.com](mailto:melissa.tu@weareharris.com); Katie Laybourn, Andrew Turpin

Topic: Ecology and Conservation of Invertebrates The Role of Elementary School Students and Citizen Scientists in Species Recovery. The monarch butterfly (*Danaus plexippus plexippus*) is a declining species that is being reviewed by the United States Fish and Wildlife Service (USFWS) for listing under federal Endangered Species Act. The listing decision is expected in July 2019. Prior to the decision, the USFWS, environmental consultants, biologists, and land owners are working together on candidate species conservation agreements. Citizen scientists are documenting monarch locations using iNaturalist. Students at Carmel Del Mar Elementary School in northern San Diego, California are planting native plant/monarch gardens. The gardens are dominated with native narrow leaf milkweed (*Asclepias fascicularis*), native nectar plants including monkeyflower, black and white sage, and, and native wildflowers including poppies, blue-eyed grass, owl's clover, and others. The gardens are an opportunity to propagate monarchs and to teach the students to be the future stewards of the native local flora and fauna.

*Poster Session*

## **MULTI-YEAR MONITORING OF A SYMPATRIC POPULATION OF NEWTS (*TARICHA TOROSA* AND *T. GRANULOSA*) IN A COASTAL POND.**

**Maxwell F. Westphal**; US Bureau of Land Management; 1417 Sally Street, Hollister, CA, 95023; (831) 630-9313; mfwestphal11@gmail.com; Emme Nix, Eva Gruber, Michael F. Westphal

Species are expected to undergo significant range shifts as a response to global warming. If range shifts are not uniform in direction and rate among allopatric species, we can expect to see an increase in sympatry among closely-related species, with unpredictable ecological effects and implications for conservation. We tracked the reproduction of two coexisting species of newt that are almost wholly allopatric but can be found in sympatry in a narrow, probably primordial contact zone in coastal Central California. Teasing apart short-term and long-term effects in ecological systems requires multi-year sampling. We conducted uniform sampling of the larval newt guild in 2017 and 2018. We confirmed that *T. torosa* breeds earlier than *T. granulosa*, and is largely absent by the end of the summer months whereas relatively young *T. granulosa* can be present into winter. Large overwintering *T. granulosa* discovered in early 2017 were not detected in early 2018. We discuss these patterns in a framework of pond-breeding amphibian management that considers late-season drawdowns and reintroduction of Californian red-legged frogs (*Rana draytonii*), a known prey item of newts.

*Poster Session*

## **MINIMIZING CARNIVORE CONFLICTS WITH PROPER CARCASS DISPOSAL.**

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All livestock owners face legal, financial and community challenges when disposing of domestic animal remains, and concerns associated with uncovered livestock carcasses are increasing for both people and scavengers. Isolated bone piles that have traditionally been tolerated on remote ranches or open range are unacceptable on the outskirts of cities or where smaller acreages predominate. The vast majority of mountain lion depredation permits are issued adjacent to ranchette properties that house small livestock. Scavenging species are imperilled when exposed carcasses lure them closer to human habitation, where they are perceived as safety risks, come into conflict with domestic animals, or are exposed to drugs, poisons, and disease. Varying substantially from county to county, there is little accessible information about how to legally and safely dispose of carcasses. We researched carcass disposal regulations, methods, and services for every California county, reviewed state law, and contacted state and county agencies. The Mountain Lion Foundation has published general information about the topic, as well as an online county by county spreadsheet, listing approved methods and nearest facilities. This is a topic where agencies, rural residents, ranchers, wildlife organizations and wildlife professionals can collaborate with common goals to improve opportunities and reduce risks.

*Poster Session*

## **DETERMINING THE PREFERRED INTERNAL BODY TEMPERATURE OF PACIFIC RATTLESNAKES, *CROTALUS OREGANUS*.**

**James M. Whelan**; California Polytechnic University, San Luis Obispo; 1 Grand Ave, San Luis Obispo, CA, 93405; (541) 727-1656; jawhelan@calpoly.edu; Hayley L. Crowell, Emily Taylor

Internal body temperatures of ectotherms are affected by their environment, size, sex, and food availability. In the wild, other factors may keep organisms from reaching their preferred internal body temperature such as predation, substrate, and refugia. Bearing this in mind, the trait may be plastic between populations. The way these factors affect *Crotalus oreganus* are unclear and we aimed to determine the preferred internal body temperature while taking these factors into account as well as determining whether or not there is a difference in preferred internal body temperatures between sites. To do this we implemented the use of a thermal gradient and a temperature logger to record internal body temperatures, in ten-minute intervals, of individual snakes from four separate field sites. Data was recorded for 12-hour periods in identical conditions. We expected to see snakes at coastal sites to have lower preferred internal body temperatures compared to inland snakes. We determined that there was no

difference in the body temperatures across sites ( $p=0.18$ ) with or without taking morphometrics into account. A factor that should be investigated next is how seasonality may change this outcome due to activity rates shifting throughout the year.

*Poster Session*

*Student Paper*

### **CALIFORNIA STATE SAFE HARBOR AGREEMENT PROGRAM.**

**Madeleine J. Wieland**; California Department of Fish and Wildlife; P.O. Box 944209, Sacramento, CA, 94244; (916) 322-9680; madeleine.wieland@wildlife.ca.gov; Ryan L. Mathis

The California Endangered Species Act (CESA) prohibits the hunting, pursuit, catch, capture, or kill of listed or candidate species. Many of these species occur primarily or exclusively on privately owned property. Private landowners are often willing participants in efforts to recover listed species; however, some may be reluctant to support or attract listed species on their properties, due to concern about land use restrictions that may occur if listed species colonize on their property or subsequently increase in numbers as a result of land management. Safe Harbor Agreements (SHAs) encourage landowners to voluntarily manage their lands to benefit listed species without subjecting those landowners to additional regulatory restrictions as a result of their conservation efforts. Through a SHA, the California Department of Fish and Wildlife (CDFW) can authorize incidental take (take that results from, but is not the purpose of, an otherwise lawful activity) of a listed species if implementation of the agreement is reasonably expected to provide a net conservation benefit to the species, among other provisions. In addition, at the end of the agreement period, participants may return the enrolled property to the baseline conditions that existed at the beginning of the SHA. SHAs promote conservation and recovery while protecting landowners. Get yours today!

*Poster Session*

### **AN OUNCE OF PREVENTION: USING INFRA-RED TECHNOLOGY TO PROACTIVELY MANAGE A BAT ROOST.**

**Jason A. Williams**; Nevada Department of Wildlife; 1218 N. Alpha Street, Ely, NV, 89301; 775-289-1655, x23; jasonw@ndow.org; Joel Thompson, Rene Braud

Advances in technology allow improved management of species which historically have been challenging to study, and can allow researchers and managers more insight into behavior. We installed an infra-red beam-break system on a Mexican free-tailed bat seasonal roost in central Nevada to monitor roost activity. The system runs continuously and passively, and provides data on a daily basis to managers via cellular connection, thus requiring minimal field maintenance. While this beam-break system and the data it provides are instrumental to a nearby commercial wind production facility, the use of this technology has broader implications. Insight into changes in activity patterns across different scales, from hourly to spanning multiple years, may be examined; and variables, such as weather, which can affect activity patterns, may be investigated.

*Poster Session*

### **PRONGHORN FAWN SURVIVAL AND POPULATION DYNAMICS IN NORTHEAST CALIFORNIA.**

**Colton Wise**; Institute for Wildlife Studies; 140 H Street, Blue Lake, CA, 95525; (832) 244-8271; wise@iws.org; David Garcelon, Brian Hudgens

California's Modoc Plateau population of pronghorn (*Antilocapra americana*) has experienced a steady decline since the winter of 1992-1993. Declines in ungulate populations are typically associated with factors causing high fawn mortality, such as severe weather conditions, decreases in habitat quality, or increased predation. To better understand how fawn survival impacts population dynamics for this area we monitored 53 fawns with VHS or GPS collars in 2015, 2016, and 2018. The overall fawn survival rate for

the first four months after birth was 44%. Overall fawn survival was similar for each year (2015 = 44%, n=24; 2016 = 44%, n=18; and 2018 = 45%, n=11), as was survival between agricultural (45%, n=30) and non-agricultural habitat (43%, n=23). Survival for female fawns was 57% (n=24) and 34% (n=29) for males. Fawn survival rates in our study area were generally higher than reported in studies from other areas. Modeling suggests that fawn survival alone does not explain the steady decline in this pronghorn population. We are examining other vital rates, such as pregnancy rates and adult survival, and landscape characteristics to better elucidate the factors influencing the decline of the pronghorn population in this area.

*Poster Session*

## **REINTRODUCING THE WESTERN POND TURTLE TO YOSEMITE VALLEY.**

**Sidney M. Woodruff**; National Park Service; PO Box 484, El Portal, CA, 95318; (256) 454-5967; sidney\_woodruff@nps.gov; Ninette Daniele, Molly Thompson, Rob Grasso, Jessie Bushell, Rachel Mazur

Western pond turtles (*Emys marmorata*), a California species of special concern, disappeared from Yosemite Valley in Yosemite National Park in 1958. The most definitive causes for the disappearance in Yosemite Valley were likely from the deliberate introduction of the invasive American bullfrog in the 1950s, increases in mesocarnivore species from high food availability, and reductions in Western pond turtle habitat from past management actions. The Aquatic Wildlife program staff at Yosemite National Park have begun restoring Western pond turtles to the Valley through a head-start program with the San Francisco Zoo, starting the summer of 2016, to re-establish the species with a self-sustaining, breeding population. Determining turtle abundance and age/sex ratios through capture-mark-recapture methods will assist in understanding effective donor population sites and sizes to ensure sustainable populations for both the Valley and the existing donor sites. In the 2018 summer field season, we captured 495 Western pond turtles across 20 sites within Yosemite National Park and the Greater Yosemite area. Four experimental turtle individuals that were previously translocated to the Valley were tracked twice per month for condition and movement. With these combined efforts, an overall understanding will inform the next phase of the reintroduction for this imperiled species.

*Poster Session*