Wildlife Disease & Toxicology Workshop

Friday, November 8, 2019 ***Agenda***

Sacramento State Union, Foothill Suite (3rd Floor), Sacramento, CA

7:15 - 8:00 Registration & Breakfast Refreshments
8:00 - 8:15 Welcome and Opening Remarks

Session 1 – Herpetofaunal Disease

8:15 - 8:45 Emerging Infectious Amphibian and Reptile Diseases of Concern for California ~ Laura Patterson, *California Department of Fish and Wildlife*

8:45 - 9:15 *Batrachochytrium dendrobatidis* and Amphibian Disease in Central California Amphibians ~ *Dr. Gretchen Padgett-Flohr, Surf to Snow Environmental Resource Management*

9:15 - 9:45 Rapid Detection of the Invasive Amphibian Chytrid Fungus: Field DNA/eDNA Extraction and Analysis Using a Handheld Thermocycler ~ *Colleen Kamaroff, National Park Service*

9:45 - 10:00 *Morning Break*

Session 2 – Environmental Contaminants

10:00 - 10:30 Anticoagulants: Our New DDT ~ *Lisa Owens Viani, Raptors Are The Solution*

10:30 - 11:00 Ecological Crossroads, Wildlife Traps and Toxicant Trends for Forest Lands Cannabis Cultivation ~ *Dr. Greta Wengert, Integral Ecology Research Center*

11:00 - 11:30 Considering Reproductive and Lethal Contaminant Effects on Amphibians ~ *Dr. Max Lambert, UC Berkeley*

Session 3 – Avian Disease

11:30 - 12:00 Diseases of Wild Birds in California ~ *Krysta Rogers, California Dept. of Fish and Wildlife*

12:00 - 1:00 *Lunch and concurrent poster session (lunch served on-site)*

Avian Disease (con't.)

1:00 - 1:30 Sticktight fleas Take Hold in a Southern California Burrowing Owl Population: Implications for Artificial Burrow Design and Management ~ *Susanne Marczak, San Diego Zoo*

1:30 - 2:00 Important Diseases of Raptors ~ *Dr. Michelle Hawkins, California Raptor Center, UC Davis School of Veterinary Medicine*

Session 4 – Mammalian Disease

2:00 - 2:30 White-nose Syndrome and California Bats: Risk Assessment and Response Strategy ~ *Katrina Smith, National Park Service*

2:30 - 3:00 Ecology of Mange Infection and the San Joaquin Kit Fox ~ *Dr. Jaime Rudd, California Dept. of Fish and Wildlife*

3:00 - 3:15 *Afternoon Break*

3:15 - 3:45 Sarcoptic Mange in Endangered San Joaquin Kit Foxes: Implications for Conservation ~ *Dr. Brian Cypher, CSU Stanislaus Endangered Species Recovery Project*

3:45 - 4:15 Plague and Hantavirus in California: Ecology, Risk, and Surveillance ~ *Greg Hacker, California Dept. of Public Health*

4:15 - 4:45 Surveillance of Feral Swine Diseases in California ~ *Rebecca Mihalco, USDA Animal & Plant Health Inspection Services, Wildlife Services*

4:45 - 5:00 ***Closing remarks***

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Oral Presentation Abstracts

Presenting Author in **bold**

Session 1: Herpetofaunal Disease 8:15am – 9:45am

EMERGING INFECTIOUS AMPHIBIAN AND REPTILE DISEASES OF CONCERN FOR CALIFORNIA

Laura Patterson, California Department of Fish and Wildlife, Wildlife Branch, 1812 9th Street, Sacramento, CA (Laura.Patterson@wildlife.ca.gov)

Typically when people think about major diseases afflicting herpetofauna in California, amphibian chytridiomycosis and upper respiratory tract disease come to mind. In fact, a paper published in *Science* earlier this year asserted that the chytridiomycosis panzootic, implicated in declines of over 500 species with at least 90 presumed extinctions, represents the greatest recorded loss of biodiversity attributable to a disease in history. In addition to the many amphibian and reptile diseases currently known to occur in California, others are causing large-scale population declines that appear to be spreading throughout the continent and world, which will likely be transported here eventually. I will discuss some of these emerging infectious diseases, including how they impact herpetofauna, what the risks to California species may be, and how you can assist with surveillance and minimizing their spread.

Laura Patterson works as the California Department of Fish and Wildlife's Statewide Amphibian and Reptile Conservation Coordinator. She earned a B.S. in Wildlife and Fisheries Biology from UC Davis and an M.S. in Biological Conservation from Sacramento State University, where she researched the comparative ecology of native western pond turtles and invasive red-eared sliders. In her current capacity, she prepares status reviews for amphibians and reptiles that have been petitioned for listing under the California Endangered Species Act, issues research MOUs, coordinates the development and implementation of conservation strategies and recovery plans, creates and amends regulations, and works with the Department's Wildlife Investigations Lab and partners to identify, respond to, and try to find treatments and cures for diseases impacting amphibians and reptiles in California.

BATRACHOCHYTRIUM DENDROBATIDIS AND AMPHIBIAN DISEASE IN CENTRAL CALIFORNIA AMPHIBIANS

Gretchen Padgett-Flohr, National Science Fellow, Southern Illinois University - Carbondale, and Surf to Snow Environmental Resource Management, 2246 Camino Ramon, San Ramon, CA (gretchen.flohr@s2serm.com)

Amphibian chytridiomycosis has been identified as a disease responsible for the decline and extinction of many amphibian taxa world wide, but little research has been conducted on the disease in Mediterranean climates. To address this gap in the data I studied the amphibian assemblage present across a ~6,475 ha site in central California and investigated the occurrence of the etiological agent, *Batrachochytrium dendrobatidis* (Bd) from organismal, community, landscape and historical perspectives. My studies showed that Bd was a novel pathogen introduced into California ca. 1961 that has since become established as an endemic pathogen throughout most of central California. The listed amphibian species that occur in central California can be infected with Bd but appear to be resistant to manifesting amphibian chytridiomycosis, and the data from the studies herein could support one of two hypotheses: that natural selection acting over the past 48 years has selected for those individuals that were resistant to the disease; or that the species on my site have always been resistant to Bd. The research I conducted further supports the hypothesis that Bd is locally vectored by native amphibians (*P. regilla*) moving between ponds and that local ecological constraints likely limit vectoring of Bd by non-native species. These findings contribute substantially to elucidating and understanding the responses of amphibian populations to disease/pathogen introduction and lay groundwork for future investigations into the host-pathogen-environment relationship as it relates to declining amphibian populations. My studies and

experiences also showed that amphibian disease, prior to approximately 2001, was ignored as a potential factor in amphibian declines and that we ignore other pathogens and diseases of amphibians to our own peril. Bd is not the end-all, be-all disease solely impacting our vulnerable amphibian populations and species.

Dr. Gretchen Padgett-Flohr is currently a Principal at an environmental consulting firm located in San Ramon, CA. A research scientist first and foremost, she has over 30 peer-reviewed publications primarily focused on native California amphibians and amphibian disease in California species. She has participated as a guest speaker and trainer at sensitive amphibian workshops in California and co-authored the original California red-legged frog (*Rana draytonii*) survey protocol later adopted by the U.S. Fish and Wildlife Service (USFWS). She has also trained and monitored agency professionals at USFWS, California Department of Fish and Wildlife, and stewards of preserve properties throughout her career.

RAPID DETECTION OF THE INVASIVE AMPHIBIAN CHYTRID FUNGUS: FIELD DNA/EDNA EXTRACTION AND ANALYSIS USING A HANDHELD THERMOCYCLER

Colleen Kamaroff, National Parks Service, Resources Management and Science Division, Yosemite National Park, 5083 Foresta Rd., El Portal, CA (colleen_kamoroff@nps.gov),
Co-authors: Rob 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 experienced 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 frogs, 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.

Colleen Kamoroff is a Wildlife Biologist for Yosemite National Park where she works restoring aquatic habitat and native aquatic species including the Sierra Nevada yellow-legged frog, Yosemite toad, California red-legged frog, and western pond turtle. Colleen completed her Bachelor's degree in Wildlife Fish and Conservation Biology at UC Davis and her Master's in Natural Resources at Washington State University. A primary focus of her research has been using environmental DNA (eDNA) techniques to aid in restoration and management projects, particularly using eDNA surveys to detect invasive species and disease. Colleen has designed and implemented an eDNA program for Yosemite National Park where they survey for American bullfrog, non-native trout and the Amphibian Chytrid fungus. Her most recent work uses an in-the-field qPCR for rapid detection of the Chytrid fungus from frog skin swabs and eDNA techniques.

Session 2: Environmental Contaminants 10:00 am – 11:30 am

ANTICOAGULANTS: OUR NEW DDT

Lisa Owens Viani, Raptors are the Solution (RATS), A Project of Earth Island Institute, 2150 Allston Way, Suite 460, Berkeley, CA (raptorsarethesolution@gmail.com)

Is rat poison our new DDT? My talk describes the epidemic of wildlife mortality being caused by rat poison in the food web. I will explain its impacts on birds of prey as well as on coyotes, bobcats, mountain lions, and Pacific fishers, among other animals. I will discuss regulatory changes affecting over-the-counter purchase of rodenticides, loopholes in the law and possible legislative and legal solutions, alternatives to rodenticides, and what individuals and municipalities can do to help beneficial predators thrive and continue to provide us with their free, natural, pest control services.

Lisa Owens Viani is a long time environmental writer and wildlife advocate,. She co-founded and directs Raptors Are The Solution, a project of Earth Island Institute. "R.A.T.S." educates people about the ecological role of raptors and the enormous danger to raptors and all wildlife, as well as pets and children, from the wide use and availability of rat poisons. RATS partners with other NGOs, agencies, scientists, municipalities, and others to work toward eliminating toxic rodenticides from the food web.

ECOLOGICAL CROSSROADS, WILDLIFE TRAPS AND TOXICANT TRENDS FOR FOREST LANDS CANNABIS CULTIVATION

Greta M. Wengert, Integral Ecology Research Center, 239 Railroad Ave., P.O. Box 52, Blue Lake, CA
Mourad W. Gabriel, Integral Ecology Research Center, 239 Railroad Ave., P.O. Box 52, Blue Lake, CA and University of California California Davis, One Health Institute, Wildlife Health Center, Davis, CA
(gwengert@iercecology.org, mgabriel@iercecology.org)

Illegal and unregulated cannabis cultivation on Western forest lands has emerged significantly over a very short period with rapid anthropogenic alteration and input on the environment to create ideal cultivation conditions. The use of toxicants, including pesticides at these locations, is one form of input cultivators use that pose risks to both the natural resources and humans interacting within and near these settings. I will discuss these current ecological traps and toxicant trends at these sites using a unique California state-wide data set collected over six years. Finally, in addition to discussing these toxicant threats, preliminary data on wildlife responses before and after the removal of threats will be presented.

Dr. Greta Wengert co-founded and Co-directs the Integral Ecology Research Center, a non-profit scientific research organization headquartered in Northwestern California. Greta earned her B.S. in Natural Resources at Cornell University, her M.S. in Wildlife Ecology at Humboldt State University, and her Ph.D. in Ecology at the University of California Davis, School of Veterinary Medicine, and has over 20 years of ecological research experience throughout California, Nevada, and Oregon. Her research focuses on the relationships among forest vertebrates and how natural and human influences impact these relationships. As a subject matter expert, Dr. Wengert leads several research projects which concentrate on the direct and indirect environmental impacts from cannabis cultivation on wildlife populations and their ecosystems in the Western US. In addition to authoring numerous book chapters and peer-reviewed scientific papers on impacts from cannabis cultivation, Dr. Wengert also serves on the speaker's bureau for the Executive Office of the White House's National Marijuana Initiative. She also teaches at Humboldt State, encourages youth engagement with natural communities through citizen science, and serves on the executive board of the North Coast Chapter of the Wildlife Society.

Dr. Mourad Gabriel is Co-Director of the Integral Ecology Research Center, a non-profit scientific research organization, and is also a Research Associate at the University of California Davis, School of Veterinary Medicine, One Health Institute and Wildlife Health Center. He leads several research programs through his organization, which focus on investigating the threats to wildlife populations of conservation concern from both infectious and non-infectious disease agents. He serves as a subject matter expert on cannabis cultivation for the Executive Office of the White House's Office of the National Drug Control Policy (ONDCP) and Public Lands Drug Coordinating Committee under both the Obama and Trump administrations. Recently Dr. Gabriel and his collaborators were awarded the 2018 Executive Office of the White House ONDCP excellence award for national marijuana investigations and documentation of toxicants used at cannabis cultivation sites on forest lands, in addition to their 2017 and 2015 White House awards. Currently, his research concentrates on the ecological interactions cannabis cultivation has with the Western United States natural resources.

CONSIDERING REPRODUCTIVE AND LETHAL CONTAMINANT EFFECTS ON AMPHIBIANS

Max H. Lambert, Department of Environmental Science, Policy, and Management, 130 Hilgard Way, UC Berkeley, Berkeley, CA (lambert.mrm@gmail.com)

Amphibians have long been considered 'canaries in the coalmine' for environmental contaminants. However, the effects of pollution on wild amphibian populations is notoriously challenging to discern. This problem is increasingly complicated as habitats become polluted from many sources and by diverse types of contaminants. I will discuss the complexity of understanding how pollution might impact wild amphibians and what this means in practice for managing amphibian populations. Given the need to assess threats to and manage amphibians in an ever-changing world, I will highlight some of the approaches and tools that practitioners can use to assess whether habitats are polluted and whether this contamination is important enough to impact amphibians. I will focus on reproductive and lethal contaminants to provide a broad survey of contaminant sources and effects.

Dr. Max Lambert is a David H. Smith conservation biology postdoctoral fellow. He is based out of UC Berkeley and the University of Washington, where he studies how best to manage urban amphibian population in contaminated ponds. His dissertation work at Yale University focused on reproductive contaminants known as endocrine disrupting chemicals, and whether these contaminants cause wild amphibian to switch sexes in urban and suburban environments. Beyond work on amphibians and pollutants, Dr. Lambert is also focused on the conservation of turtles – particularly western pond turtles – in human-modified landscapes.

Session 3: Avian Disease 11:30 am – 2:00 pm

DISEASES OF WILD BIRDS IN CALIFORNIA

Krysta Rogers, Wildlife Investigations Laboratory, California Department of Fish and Wildlife, 1701 Nimbus Rd, Rancho Cordova, CA (Krysta.Rogers@wildlife.ca.gov)

There are over 600 wild birds that utilize a variety of habitats in California. Given the high diversity of wild birds, as well as the high visibility, birds can be an important indicator of environmental health. It is critical we understand the potential threats to different avian species to ensure this biodiversity is maintained. Mortality investigation is an important component of this effort and improves our knowledge about an avian species' vulnerability to infections and other threats, the ecology of specific pathogens, and the detection of new or emerging diseases. This information may aid in the identification of measures that may help mitigate mortality during disease outbreaks or highlight specific threats for different species. Mortality may be attributable to diseases, nutritional deficiencies, natural and human-made toxins, adverse weather, or trauma. The species of bird and its age, breeding status, and/or migratory pattern also may influence disease occurrence and exposure to certain toxins. An overview of select causes of mortality for wild birds in California will be presented. The disease ecology for select pathogens and the potential impacts to the affected species will be discussed. Diseases and toxins of emerging concern will be identified as will diseases of potential zoonotic concern. Measures that may reduce the likelihood of human-aided disease transmission during the handling of wild birds will be considered.

Krysta Rogers is a senior environmental scientist at the Wildlife Investigations Laboratory for the California Department of Fish and Wildlife. She is the statewide lead for avian investigations in which she regularly conducts mortality investigations, disease and contaminant surveillance, and population health monitoring for a diversity of avian species. She holds both a Bachelor's and Master of Science degree in wildlife biology from Humboldt State University. Her expertise includes avian biology, disease ecology, trapping and handling, and diagnostic sampling.

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 (smarczak@sandiegozoo.org)
Co-Authors: 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.

Susanne Marczak serves as the Senior Research Coordinator for the Burrowing Owl Recovery Program at the San Diego Zoo Institute for Conservation Research (ICR). Her role involves coordinating ICR's research and conservation efforts for western burrowing owls throughout Southern California. Susanne's primary projects focus on the monitoring and research of the remaining burrowing owl breeding population in San Diego County, as well as the establishment of a new breeding node in the region. Susanne earned bachelor's degrees in Ecology, Behavior and Evolution and Economics from the University of California, Los Angeles. Since joining the Institute in 2009, she has had the opportunity to work with a wide variety of species, including giant pandas, kangaroo rats, pocket mice, and desert tortoises.

IMPORTANT DISEASES OF RAPTORS

Michelle G. Hawkins, California Raptor Center, School of Veterinary Medicine, University of CA, Davis, CA (mghawkins@ucdavis.edu)

The goals of this presentation are to discuss important common and emerging diseases identified from raptors from rehabilitation centers in California. Some diseases such as the West Nile Virus have emerged over the last 15 years in California in many raptor species, whereas St. Louis Encephalitis Virus, a recent emerging virus on the West Coast, has not yet been thoroughly evaluated in raptors. Herpesviruses have been reported in virtually every species of bird evaluated, and until recently studies have indicated that herpesviruses from pigeons, falcons, and owls are caused by *Columbid herpesvirus-1*. But our laboratory has identified a novel herpesvirus in great-horned owls that can cause a multitude of different clinical signs including ocular disease and potentially cancer. *Chlamydial* infections are caused by a group of intracellular gram-negative bacteria that have potential health implications for raptors and humans. In the past twenty years a number of birds of prey have been presented to the California Raptor Center (CRC), University of California, Davis, CA with clinical signs and other abnormalities similar to those found in parrots with *C. psittaci*. Due to its infectious and perceived zoonotic potential, it is important to educate wildlife rehabilitation staff on the clinical presentations of *Chlamydia* spp. in wild birds to prevent transmission to other birds, and potentially to humans. *Micnemidokoptes* mite infestations in golden eagles and bald eagle hepatitis are two emerging diseases in eagles that warrant discussion in detail. Along with *Micnemidokoptes* mites another hemoparasite, *Sarcocystis calchesi* has been identified in non-raptors in California, and in Europe it is thought this disease is carried by Accipiters as the definitive host. However, there are times when owls can be aberrant hosts for other *Sarcocystis*,

and studies to determine whether this organism may be causing disease in owls as well are going forward at this time. Finally, we will also discuss secondary anticoagulant rodenticide and lead intoxications and their effects in raptors.

Dr. Michelle Hawkins received her veterinary degree from the University of Pennsylvania in 1997. She completed a residency and fellowship in Companion Avian and Exotic Animal Medicine and Surgery at the University of California, Davis in 2001 where she began caring for patients from the California Raptor Center. After two years in exotic animal practice, she joined the faculty of the University of California, Davis School of Veterinary Medicine in 2003. Since that time she has been directly involved with the California Raptor Center, and became the Center Director in 2013. Her research interests include infectious diseases of wild raptors, and new medical therapies for common diseases of raptors.

Session 4: Mammalian Disease 2:00 pm – 4:45 pm

WHITE-NOSE SYNDROME AND CALIFORNIA BATS: RISK ASSESSMENT AND RESPONSE STRATEGY

Katrina J. Smith, National Park Service, 333 Bush Street, Suite 500, San Francisco, CA (katrina_j_smith@nps.gov)

The first detection of the fungal pathogen causing white-nose syndrome (WNS) in bats has been recorded in California. The high mortality associated with this disease in hibernating bats could change California's bat species assemblage and therefore its natural pest control services. Though the simple presence of the pathogen does not yet indicate bat population decline, many conservation groups are responding to provide disease surveillance and population monitoring across the state. Consequently, public outreach surrounding the benefits of bats and the importance of equipment decontamination amplifies this proactive response. Research teams continue to investigate active management strategies including treatment options which destroy the fungus in the environment or on the bodies of hibernating bats. However, the most strategic response to this threat focuses instead on roost and foraging habitat protection, robust population monitoring, and collaborative conservation strategies. Therefore, I encourage and invite participation in landscape-scale programs such as the North American Bat Monitoring Program. In addition, I provide an overview of disease surveillance and public outreach strategies for those who may wish to help expand bat conservation in California.

Katrina Smith is an acting regional Wildlife Ecologist with the National Park Service (NPS) serving Interior Regions 8, 9, 10, and 12 (Lower Colorado Basin, Columbia-Pacific Northwest, California-Great Basin, Pacific Islands). Katrina has been working on bat population monitoring, white-nose syndrome response, and public outreach in California since 2011. Most of her experience has been gained at Lava Beds National Monument working collaboratively with the Klamath Inventory and Monitoring Network to develop and implement the Cave Monitoring Protocol and with the NPS Regional White-nose Syndrome Response Team to design and implement bat monitoring and white-nose syndrome surveillance. In her recent position as Program Manager and Acting Chief of Natural Resource Management, she continued to address resource protection issues, provide mentorship through the Mosaics-in-Science diversity internship program, and facilitate critical monitoring across many disciplines. She holds a Master of Science degree in Natural Resources: Wildlife from Humboldt State University and a Bachelor of Science in Ecology and Environmental Biology from the University of Wisconsin-Eau Claire.

THE ECOLOGY OF MANGE INFECTION AND THE SAN JOAQUIN KIT FOX

Jaime Rudd, Wildlife Investigations Laboratory, California Department of Fish and Wildlife, 1701 Nimbus Road, Rancho Cordova, CA (Jamie.Rudd@wildlife.ca.gov)

Traditionally, diseases have been considered part of a natural process and little attention had been given to their role in species persistence, management, and conservation. However, there is growing concern

among ecologists about disease-induced extinctions in vulnerable populations given the rise in reported infectious diseases which have resulted in mass mortality events and local population extirpations of free-ranging wildlife. Mange is a ubiquitous disease caused by microscopic mites belonging to several different families, including the family Sarcoptidae. This family has three important genera that infest humans, domestic animals, and wildlife: Sarcoptes, Notoedres, and Trixacarus. *Sarcoptes scabiei* is the first human disease with a known etiology and has been documented in over 100 mammalian species worldwide. *S. scabiei* mites are highly contagious and fairly host-specific but spillover into novel host species does occur. These spillover events can result in devastating epizootics which are often fatal, thus leading to local population extinctions. For example, despite progressive conservation efforts to preserve remaining San Joaquin kit fox (*Vulpes macrotis mutica*; kit fox hereafter) habitat and its adaptability in the face of ongoing human impacts, a recent sarcoptic mange epizootic threatens the stability of one of the largest kit fox populations in the state. Therefore, understanding the various transmission pathways for mite spread and maintenance, which can be exacerbated by kit fox biology and behavior, is an important factor when considering the future conservation and survival of this species.

Dr. Jaime Rudd received her Bachelor of Science at Humboldt State University and her PhD at UC Davis. She is currently an environmental scientist with the Wildlife Investigations Lab at the California Department of Fish and Wildlife where she investigates disease outbreaks and causes of mortality in mountain lions and non-game, threatened, and endangered wildlife. Prior to wildlife work, Jaime worked as a veterinary technician for over 10 years. Her interests are wildlife disease and conservation, wildlife and forensic pathology, drinking coffee, and adopting cats.

SARCOPTIC MANGE IN ENDANGERED SAN JOAQUIN KIT FOXES: IMPLICATIONS FOR CONSERVATION

Brian L. Cypher, California State University-Stanislaus, Endangered Species Recovery Program, P.O. Box 9622 Bakersfield, CA (bcypher@esrp.csustan.edu)

Sarcoptic mange is a disease caused by an infestation of the mite (*Sarcoptes scabiei*). It afflicts many species of mammals but had never been reported in kit foxes – until 2013. In the spring of that year, sarcoptic mange was detected in a population of endangered San Joaquin kit foxes (*Vulpes macrotis mutica*) inhabiting the city of Bakersfield, CA. It likely was interspecifically transferred from infected coyotes (*Canis latrans*); mange appears to be endemic in coyotes in the San Joaquin Valley as well as throughout California. Despite efforts to capture and treat foxes, the disease rapidly spread throughout the city. High fox densities, overlapping den use between adjacent family groups, and long dispersal movements likely facilitated disease transmission. Unless foxes are treated, mange is 100% fatal with death occurring in about 4-5 months post-infection. Annual city-wide population monitoring was initiated in 2015 and the number of kit foxes detected has declined significantly. Monitoring also has been conducted in natural habitats surrounding Bakersfield, but mange has not been detected in exurban foxes, possibly due to much lower densities in these areas. However, in early 2019, mange was detected in kit foxes in the city of Taft, which is located about 30 km west of Bakersfield. It is unclear whether this new infection site represents another interspecific spillover event or whether an infected fox from Bakersfield somehow traveled to Taft. Monitoring efforts will continue to document the course of both the Bakersfield and Taft mange epidemics.

Dr. Brian Cypher is a Research Ecologist with the Endangered Species Recovery Program at CSU-Stanislaus. His primary interest is the ecology and conservation of wild canids. Since 1990, he has conducted extensive work with endangered San Joaquin kit foxes, but also has been working with island foxes, coyotes, red foxes, and gray foxes. He also routinely works with a variety of other rare species in the San Joaquin Valley, including kangaroo rats, shrews, antelope squirrels, and even plants.

PLAGUE AND HANTAVIRUS IN CALIFORNIA: ECOLOGY, RISK, AND SURVEILLANCE

Greg Hacker, California Department of Public Health – Vector-Borne Disease Section, 8633 Bond Road, Elk Grove, CA (Greg.Hacker@cdph.ca.gov)

It is the responsibility of the California Department of Public Health – Vector-Borne Disease Section to monitor vector-borne diseases such as plague, caused by the bacterium *Yersinia pestis*, and hantavirus pulmonary syndrome, caused by Sin Nombre virus. Surveillance for these rodent-borne pathogens in California allows for a better understanding of the ecology of the pathogens and their hosts, and provides data used to inform the public about risks for disease transmission. Here I provide a summary of the basic ecology of plague and hantavirus in California. I also provide summary statistics and other analyses associated with surveillance for these pathogens, with an emphasis on the utility, limitations, and biases of our surveillance program. I will end with a review of the risks of transmission for these pathogens with a focus on reducing exposure risks for wildlife biologists.

Greg Hacker is an Associate Public Health Biologist with the California Department of Public Health (CDPH) – Vector-Borne Disease Section (VBDS) which is responsible for monitoring diseases such as West Nile virus, Lyme disease, plague, hantavirus, and other human pathogens transmitted by vectors in California. Greg has worked for CDPH since 2013 and has focused primarily on the surveillance of rodent and tick-borne diseases. He is also the GIS lead for VBDS and strives to provide a geographic context to all diseases monitored by the Section. Recently, Greg has been part of a team summarizing plague activity in California from 1983-2016.

SURVEILLANCE OF FERAL SWINE DISEASES IN CALIFORNIA

Rebecca Mihalco, USDA Animal Plant Health INspection Service (APHIS) Wildlife Services, 3419A Arden Way, Sacramento, CA (rebecca.l.mihalco@aphis.usda.gov)

Feral swine are widespread in California. In addition to causing damage to property, agriculture, and natural resources, they can carry a wide variety of diseases that can affect humans as well as wild and domestic animals. USDA APHIS Wildlife Services' National Wildlife Disease Program has a national surveillance program for feral swine diseases including pseudorabies, swine brucellosis, classical swine fever, and African swine fever. Pseudorabies and swine brucellosis are not currently found in domestic swine in the United States, however, they have been detected in feral swine. Both pseudorabies and swine brucellosis are zoonotic and can be transmitted to non-porcine species. Pseudorabies is often fatal to non-porcine species such as dogs, cats, and wildlife. I will provide an overview of these diseases and their detection in feral swine within California. While neither classical swine fever nor African swine fever have been detected in the United States, these diseases have the potential to have considerable impacts on United States agriculture. African swine fever is a growing concern because of its recent spread through Asia and its ability to remain viable in processed meat products. I will discuss the Wildlife Services' surveillance efforts for African swine fever in feral swine.

Rebecca Mihalco is a Wildlife Biologist with USDA Wildlife Services (WS) California program in Sacramento, CA. Rebecca has been working as a Wildlife Disease Biologist since 2015. In that capacity, she coordinated and participated in WS California's surveillance of highly pathogenic avian influenza, feral swine diseases, plague and tularemia, and leptospirosis. She serves on an interagency working group for African swine fever surveillance and response. Rebecca is an emergency responder for disease outbreaks and other emergency efforts.

Chapter Announcements

Annual Winter Mixer with Association of Environmental Professionals and the American Planning Association!

Date: **December 10, 2019**, Time 5:30pm-7:30pm
Location: Rio City Cafe, 1110 Front Street, Sacramento, CA
Members and non-members alike are welcome to raise a glass in celebration of the holiday season and a successful year of programs, professional development, and networking events! Appetizers and the first round are on us! The event is FREE for AEP, APA, and TWS members and $20 for non-members if you register before December 3. After December 3, the cost is $20 for both members and non-members. Please help us give back to our community by bringing a donation of non-perishable, non-expired food or personal care items for the River City Food Bank. Visit their **website** to see their donation wishlist.
RSVP here by December 3! https://aepsuperior.org/programs-and-events/event/64/AEP/APA/TWS-Holiday-Party

Chapter Elections are approaching for 2020! We are looking to break into 2020 with a full Executive board – though 2019 was a busy year for us, we are looking to improve in 2020! We're looking for a ***President Elect (Vice President)*** to lead the vision for the Chapter (3 year commitment). We need someone to help record action items and track votes at board meetings as ***Secretary!*** If you'd like to volunteer with broader impact to the TWS community, we need a ***Chapter Representative to the Western Section.*** If you are interested in serving in any of these elected positions, please contact us at sac.shasta@gmail.com and help us *do more to serve you*!

In Memoriam: Randi Logsdon

With much sadness, our Chapter mourns the recent passing of Randi Joy Logsdon, dedicated wildlife biologist and longtime Wildlife Society member.

Randi transitioned from nearly two decades in computer software engineering to meet her calling in a second profession of wildlife biology. After receiving a B.S. in Biology from Humboldt State University, she joined the California Department of Fish and Wildlife (CDFW) conducting great gray owl surveys and mammal trapping. She later coordinated review of scientific collecting permits and research MOUs, directly contributing to statewide conservation with California endangered species status reviews and recovery strategies. Randi led the drafting of the Mohave ground squirrel conservation strategy in conjunction with the Desert Renewable Energy program. Later with CDFW's Water Branch, Randi led the mitigation and protections documentation for aquatic resources for the contentious delta WaterFix project, earning a CDFW Employee Excellence Award. In her recent role with the Bay Delta Region's Cannabis Permitting Unit, Randi drafted streambed alteration agreements and oversaw California tiger salamander conservation on the Santa Rosa Plain.

Randi served on the Sac-Shasta Chapter board as Editor of the Magpie newsletter from 2009 through 2013. For years after, she continued to draft Chapter event summaries and submitted photos for issues of the Magpie. She played a critical role in helping to document the Chapter's history for its 50th anniversary in 2016, tracking down names and years for past board members, and assisting with celebration activities. Randi regularly contributed to other board committees, including student outreach and conservation affairs. She felt strongly about engaging students and underrepresented communities in the wildlife field, and was active with the Western Section TWS student affairs and diversity committees, and career symposium at the annual Western Section meeting.

We remember Randi for her poise, resilience, warmth, and generous disposition; her passing leaves a void in our community. The Sac-Shasta Chapter will be honoring her memory with a memorial award fund to annually support underserved and aspiring and early career wildlife biologists. We will also compile stories, photos and statements from friends and colleagues from the TWS community to include in our winter Magpie newsletter. If you would be interested in making a monetary donation to the memorial fund, or a contribution for the Magpie, please reach out to us at sac.shasta@gmail.com. We request Magpie contributions no later than ***December 1, 2019.***

Poster Presentation Abstracts

CARRYOVER EFFECTS OF SALINIZATION ON WATER RETENTION IN JUVENILE WOOD FROGS (LITHOBATES SYLVATICUS)

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Road salt, a deicing agent commonly used in northern latitudes, is of increasing environmental concern due to its adverse effects on amphibians living in roadside wetlands. A recent study reported male wood frogs (*Lithobates sylvaticus*) migrating to roadside ponds displaying higher water retention than male frogs migrating to woodland ponds, which is the first documented phenotypic effect of elevated salinity from road salt runoff on adult amphibians. However, the reason for the observed difference is unknown and could be a consequence of larval developmental conditions. To gain insight on how developmental conditions might affect water retention in metamorphosed wood frogs, we raised wood frog larvae under freshwater and saline conditions at ambient and elevated temperatures in 50-gallon mesocosms. We subsequently measured dehydration rates of randomly selected metamorphosed frogs (n = 93) using suspended wire mesh desiccation chambers. No significant difference was found among dehydration rates of juvenile frogs raised under different treatments. However, juveniles raised in saline conditions were significantly larger than those raised in freshwater conditions. Our results demonstrate that there is no variation in desiccation risk between juvenile wood frogs raised in saline or freshwater conditions, but frogs raised in saline environments could have a possible survival advantage due to their larger body size.

THE INS AND OUTS OF PARASITOLOGY IN THE SALT MARSH HARVEST MOUSE AND SYMPATRIC RODENTS

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The salt marsh harvest mouse (*Reithrodontomys raviventris*, SMHM) is a federally endangered wetland specialist, endemic to the salt and brackish marshes of the San Francisco Bay Estuary. SMHM recovery is often solely focused on habitat restoration, but cryptic threats, e.g. disease, have been ignored. Habitat modifications associated with urbanization, including the diking of tidal wetlands into seasonal ponds, likely influence interspecific dynamics between SMHM and both native and non-native rodents. These changes could in turn lead to increased competition for resources and parasite mediated competition via spillover. Mild climate, diverse rodent communities, aquatic habitat, feral cats, and nearby cattle can facilitate pathogen transmission at our study site in the Suisun Marsh. We sought to determine if the parasite load in SMHM is affected by these factors and others including duration of standing water,

proximity to urban areas, seasonality, and rodent diversity. We collected ectoparasites, blood, and feces from 650 rodents trapped year-round at eight sites in Suisun Marsh, from April 2018 to April 2019. We identified fleas and ticks to explore relationships among ectoparasites (species and loads), rodent species (diversity and density), and seasonality to investigate the potential for vector-borne pathogen exposure. We found that SMHM share flea species typically associated with non-native rodents, indicating that parasite transmission occurs. We will also conduct assays on feces and blood to detect endoparasites—which negatively affect rodent fitness and are of concern due to nearby cattle and the aquatic habitat. This project is the first effort to comprehensively investigate pathogen dynamics in the rodent community of Suisun Marsh. Preliminary data indicate that there are complex interactions between pathogens, SMHM, and other rodents. Results of this study will ultimately allow managers to finally incorporate this threat in recovery planning.

SUBLETHAL ANTICOAGULANT RODENTICIDE EXPOSURE IN RED-TAILED HAWKS (BUTEO JAMAICENSIS) WINTERING IN THE AGRICULTURAL LANDSCAPE OF THE SACRAMENTO VALLEY, CALIFORNIA

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The vast agricultural landscape of California's Central Valley supports a wintering raptor population among the most abundant and diverse in the United States and Canada, and provides some of the last remaining compatible habitat for birds of prey in the region. On industrial farms, anticoagulant rodenticides (ARs) are an important component of integrated pest management strategies for controlling rodent pests that have populations inflated by food production, leaving raptors that commonly hunt pest rodents at an elevated risk of AR exposure in these systems. We have little understanding of sublethal exposure rates in wild raptor populations, as most of our knowledge is based on data collected from sick or injured birds brought into rehabilitation centers and carcasses; a knowledge gap that is mainly due to the logistically challenging nature of sampling wild raptors on the landscape. Therefore, it is important to begin to document and quantify the level at which non-target AR exposure is occurring in raptors, the impacts on the health of individuals, and the consequences at the population level. Our objective is to quantify the prevalence of sublethal exposure to ARs in wild Red-tailed Hawks (*Buteo jamaicensis*) hunting in the agricultural landscape of the Sacramento Valley using blood samples. In winter 2019, we sampled 14 Red-tailed Hawks of which 5 (35.7%) were positive for trace (<5 ppb) AR exposure for one or two of the following compounds: Bromadiolone, Brodifacoum, and Difethialone. We plan to sample hawks again in winter 2020 and to investigate how AR exposure may be related to immune stress and blood parasite load.
