



## Featured Publication

MVZ Assistant Professor and Assistant Curator of Herpetology Rebecca Tarvin, MVZ Graduate Student Kannon Pearson

### Losing Amphibian Diversity Also Means Losing Poison Diversity

While frog and salamander declines worldwide have made scientists outspoken about the need to preserve amphibian genetic diversity, MVZ Faculty Curator Rebecca Tarvin and Graduate Student Kannon Pearson, emphasize another important reason for conserving these animals: their poisons. Tarvin and Pearson's work focuses on the poisons of the colorful harlequin toads of Central and South America. In a recent paper published in the journal [\*Toxicon: X\*](#), they emphasize how little is known about the toxins these animals produce, or why they have them at all. Dr Tarvin said, "In Central America, there's nine species of *Atelopus*, and seven of them have been assessed for toxin diversity and quantity...but the majority of the *Atelopus* species actually live in South America, where a minority of the studies have been done. We don't know if they're toxic or not...by losing these animals, we're probably losing some chemical diversity, as well. They have some toxins that are found nowhere else in the world."



A harlequin toad gets a water spritz before its back is swabbed. (Photo by Jose Vieira)



A harlequin toad, *Atelopus hoogmoedi*, from Oriximiná in the Brazilian state of Pará. (Photo courtesy of Jaime Culebras)



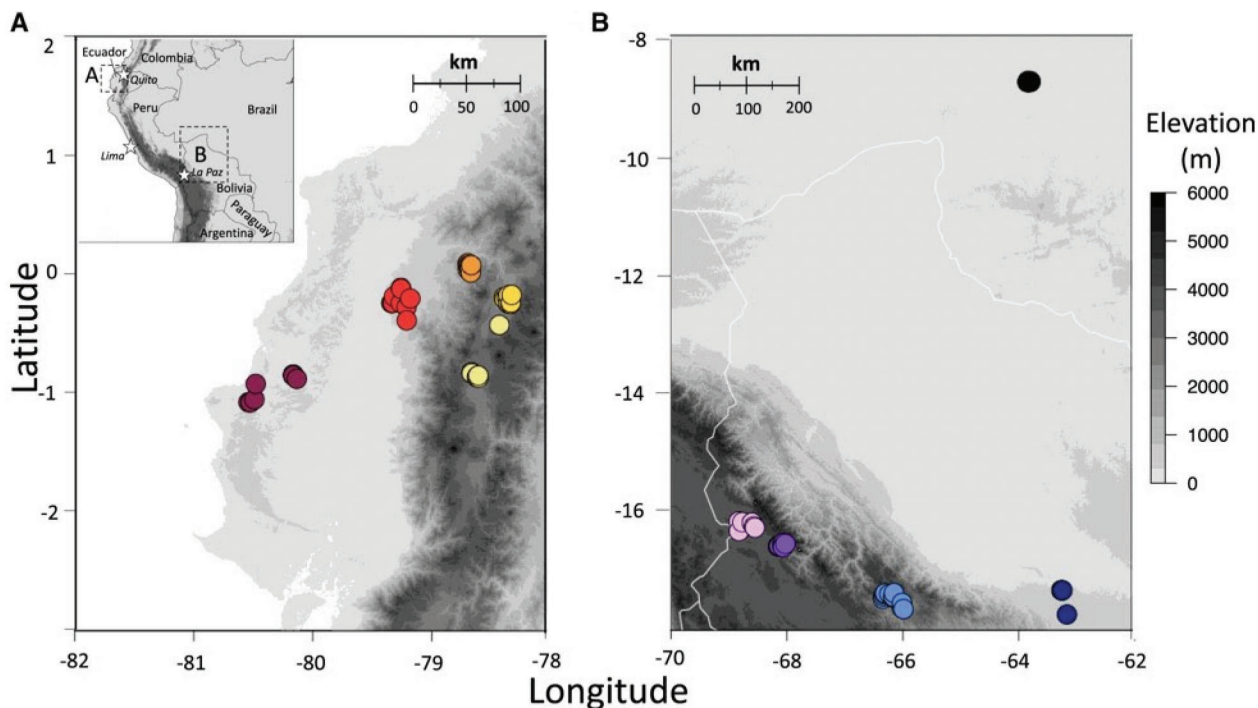
Graduate student Kannon Pearson with two rough-skinned newts in San Mateo County. Like their look-alike cousin, the California newt, these salamanders have toxic skin. (Photo by Cheri L. Pearson)

# Recent Publication by MVZ Researchers

MVZ Professor Michael Nachman, Postdoc Elizabeth J. Beckman, Graduate Students Kennedy Agwamba and Mallory Ballinger, Former MVZ Postdocs Ke Bi and Andreas S. Chavez and Former Graduate Students Taichi A Suzuki and Felipe Martins

## High-Elevation Adaptation in Wild House Mice

In a recent paper published in the journal *Genetics* Dr. Michael Nachman and his lab used gene sequencing to uncover the history of house mice (*Mus musculus domesticus*) in the Andes Mountains of South America and to identify genetic signatures of natural selection associated with high elevation. The conditions at high elevation, particularly the low oxygen available in the ambient air, impose a significant and chronic environmental challenge to metabolically active animals with lowland ancestry like house mice. The study found that house mice colonized high elevations independently in the north and south of the Andes Mountain range and that the genetic basis of high-elevation adaptation was distinct in each case.



Sampling map of *Mus musculus domesticus*. Circles indicate sampling localities for elevational transects in (A). Northern transect (n = 50) and (B) Southern transect (n = 46). Inset shows regions of western South America depicted in (A) and (B) with major cities indicated by white stars.



# MVZ Faculty News

MVZ Affiliated Professor Noah Whiteman

## How to Eat a Poison Butterfly

In a study in the journal [\*Current Biology\*](#), MVZ Affiliated Faculty Noah Whiteman reports monarch-like genetic mutations in the genomes of four organisms that are known to eat monarchs: the black-headed grosbeak, a migratory bird that snacks on the butterflies at their overwintering home in Mexico; the eastern deer mouse, a close relative of the Mexican black-eared deer mouse that feeds on butterflies that fall to the ground; a tiny wasp that parasitizes monarch eggs; and a nematode that parasitizes insect larvae that feed on milkweed. Dr. Whiteman's study reveals that the monarch's toxins move up the food chain from plants to insect herbivores and then to predators and parasitoids. The predators and parasitoids have evolved resistance to the toxins at the same sites that were changing in the monarch. "It solves this mystery from 40 years ago where the biology was pretty well worked out, but we just couldn't go down to the lowest level of organization possible, the genome, to see how grosbeaks are doing this...It looks like, amazingly, they are evolving resistance using the same kind of machinery in the same places in the genetic code as the monarch and the aphids, the bugs and the beetles, that feed on milkweeds, as well."



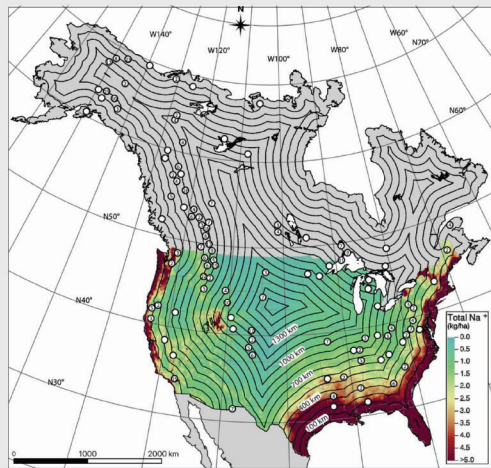
Above: Video showing black-backed orioles and black-headed grosbeaks eating monarch butterflies at the El Rosario Monarch Butterfly Reserve in Mexico. (Video by Brett Hartl)

Below: Cluster of monarch butterflies in California (left) and the black-headed grosbeak (right) one of few birds that can eat them without vomiting. (Photos courtesy of Mark Chappell, UC Riverside)



# MVZ Community News

## MVZ Affiliated Professor Robert Dudley and Graduate Student Aleksey Maro Salt Seeking Behaviors in Vertebrate Herbivores



All animals require salt to live, but how do wild herbivores such as deer and elk obtain sufficient amounts from their diet? Plants contain little salt, but oceanic salts can be carried atmospherically hundreds of kilometers inland, and then accumulate within vegetation. A paper recently published in the *Journal of Biogeography* by MVZ Affiliated Professor Robert Dudley and Affiliated Graduate Student Aleksey Maro hypothesizes that an animal's distance from the ocean correlates to the likelihood of it visiting a salt lick. Dr. Dudley and Maro describe how salt lick locations are distributed across North

America relative to ocean proximity. Their results - that licks occurred significantly less often within, and more often beyond, 500 km inland, and at significantly higher elevations than would be expected by chance - demonstrate how geographical variation in salt availability over large distances may influence animal foraging behavior.

Albers Equal Area Conic projection of the study area in North America, with circles representing ungulate-patronized salt lick sites, a georeferenced copy of the National Atmospheric Deposition Program's 2018 total sodium deposition map (NADP, **2018**) over the continental United States (kg/ha), and lines depicting 100 km increments from the marine coastline. Licks located within 100 km of one another were aggregated into a single location yielding  $n = 109$  sites, represented by circles that contain the number of licks averaged.



# MVZ Graduate Student Profile

Meet First Year MVZ Graduate Student Kannon Pearson



Graduate student Kannon Pearson with two rough-skinned newts in San Mateo County (left). Professor Rebecca Tarvin and members of the Tarvin lab group (right).

In the fall of 2021 Kannon Pearson joined Dr. Rebecca Tavin's lab as a graduate student. Kannon transferred to UC Berkeley as an undergraduate from Foothill College in Los Altos but his journey to the MVZ really started with a simple google search, "I was keen on getting into research at Cal, so I googled all the professors listed on the faculty directory of the IB webpage and found the Tarvin Lab. I was intimidated by the prospect of contacting professors I'd never met, but decided to reach out to Becca anyway." In March of 2020, after some introductions Kannon was offered a spot as an undergraduate researcher in Dr. Tarvin's lab and two years later his undergraduate honors thesis on harlequin toad chemical defenses has been published in [\*Toxicon: X\*](#) (see Featured Publication above).

In addition to continuing his research in toxin detection in harlequin toads Kannon volunteers for [\*Berkeley Splash\*](#), a UC initiative that allows local high school and middle school students to take classes from university students and faculty. Kannon created a course about the ins and outs of transferring to UC Berkeley from a community college. "In my experience, the community college route often carries a stigma. But, the traditional path from high-school to four-year university is inaccessible to many (including my younger self). Community college is a place...to explore academic interests or start a new career without the pressure of restrictive admission or expensive tuition. I received a phenomenal education at community college, and I think it's important for students to be aware of the transfer option."



# MVZ Undergraduate Student News

Archives URAP Margaret Asperheim, Senior, Linguistics

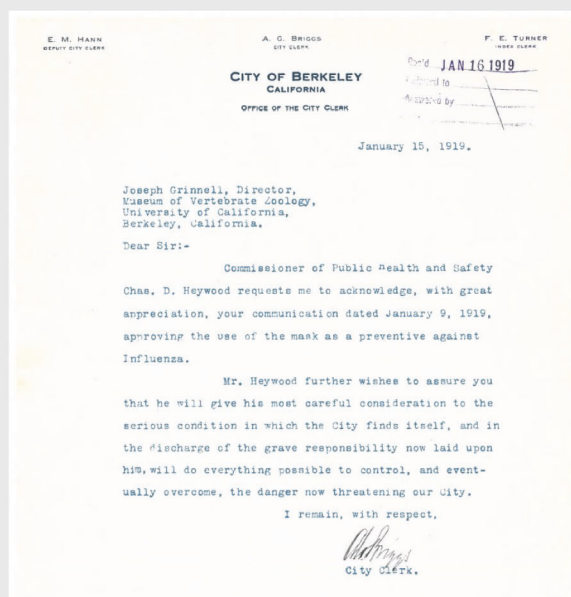
## Precedented Times



As an intern at the MVZ this past semester, I spent most of my time sifting through reams of historical correspondences, many of them written a hundred years ago or earlier. I met the whole original cast: Joseph Grinnell, director and ornithologist; Margaret Wythe, Grinnell's assistant and a formidable biologist herself; curators Eugene Hall, Edna Fisher, and Joseph Dixon; and of course Annie Alexander and Louise Kellogg, always funding something or other and therefore spoken of with reverence by the strapped-for-cash researchers. The decades between us gradually slipped away; I could almost look over and see Margaret typing up a report for *The Condor*, or Annie and Louise headed off on another collecting jaunt. It truly is a privilege to be able to connect yourself to a history, to meet and know the people who came before you: to remember that you're not alone.

Life has been difficult these last few years, to put it mildly; I'm sure I don't have to explain to anyone why. The word unprecedented, though, has been tossed around a lot, and after this semester at the MVZ I take issue with it. As I mentioned, I've been mostly reading through letters and messages sent between MVZ researchers and their correspondents. As a scientific authority, the MVZ was often consulted by private citizens on matters of animal identification, good agricultural practices, etc. Apparently, it also dabbled in public health. Rifling through a folder of miscellany one day, I came across a letter from the Berkeley City Clerk to Joseph Grinnell, commending him for "approving the use of the mask as a preventative against Influenza". Our story isn't unprecedented. Maybe that makes it a little less exciting, but for me it's also a lot less terrifying. Someone sat where I'm sitting now, doing the same work, dealing with the same crisis: a support system through the decades.

Occasionally in correspondence, you catch glimpses of history in the everyday lives of the researchers: the world wars affecting the time it takes a specimen to reach another institution, the draft thinning the ranks of field collectors. History is always happening to us, making life more tragic and more difficult and more irritating, but also connecting us, not only across space but across time. To forget our predecessors is to isolate ourselves, and we certainly don't need any more isolation these days. This apprenticeship taught me more about the past than I've ever learned in a class. Archive work tells you that history is made up of people like me.



# Support the MVZ

To sustain our leadership in discovery and understanding of vertebrate diversity, and to protect the collection for future generations, we depend on donations. Any gifts, large or small, make a difference.

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Banner Image by Jackie Childers.

Elegant Bronzeback (*Dendrelaphis formosus*), Sarawak, Malaysian Borneo (2015).