

# White Mountain Research Center

Newsletter

University of California

F A L L — 2017

## Letter from WMRC Director, Glen MacDonald

The Fall Newsletter is here. Gosh, it is hard to believe another year is just about finished for the White Mountain Research Center (WMRC) – but what a year it has been! Of particular note for those who are meteorologically inclined was the huge snow year we had. Folks across the valley at Mammoth saw 618 inches (15.7 meters) at the Main Lodge. This was the second biggest snow year on record there. This produced a ski season that lasted into early August. The White Mountains got their fair share of the bounty, but we still had a good summer season at the higher elevation stations. Crooked Creek opened on June 6th and closed on October 22nd and Barcroft opened on June 30th and closed on October 16th.



Crooked Creek-February 2017. Note the roof of the main lodge on right.

As usual, plenty of people took advantage of our facilities this year, including of course the Owens Valley campus. Across all our facilities we hosted roughly 1400 students, faculty and other researchers who experienced the magnificence of the White Mountains, Owens Valley and the Eastern Sierra using the WMRC as a base of operations. These folks came from pretty much every UC campus, many California State University campuses, Stanford and colleges

throughout the United States including University of Nevada, New Mexico Tech, University of Hawaii, Yale, Dartmouth, University of Minnesota, University of North Carolina, Vassar College-NY, Central Washington University, University of Florida, Oregon State University and others. From the United Kingdom we had a contingent from the University of Durham. My apologies if I did not list your campus – there are many.

An important part of the WMRC mission is the fostering of graduate student research. Such research by Brian Smithers, an ecology doctoral student from UC Davis, made the Los Angeles Times and many other national and international outlets. Brian has found that in the race against climate change, the venerable bristlecone pines may be losing ground to limber pines in our White Mountain forests. In total we had roughly about 35 grad students from the UC's and variety of other colleges conducting research here this year. To help promote graduate research at the WMRC, we supported four students with our mini-grants this year. Look for some reports on their work in this newsletter!

Although we can celebrate a really great winter of snow for 2016-2017, we should not think that climate change is not a critical issue for us. The Western Regional Climate Center reported in September, that June, July and August of 2017 was the hottest summer period on record for California based upon their preliminary analysis. This comes on the heels of a 70 year general trend of summer warming in the State. As Brian Smithers' work suggests, this might have profound implications for the ecosystems of the White Mountains. In this regard we are proud — *continued*—

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## Letter from Director (continued)

to be part of the international program - Global Observation Research Initiative in Alpine Environments (GLORIA). The White Mountains is a node in the global observation network which is being studied by GLORIA to detect and understand the impacts of climate change at high elevation sites. The GLORIA volunteer team were here for downslope surveys from July 26<sup>th</sup> to the 31<sup>st</sup>. WMRC scientist, Dr. Jeff Holmquist and Jutta Schmidt-Gengenbach have been an important part of the WMRC GLORIA effort.

WMRC was also very happy to be able to reach beyond the academic community by providing two open gate days at Barcroft for people wishing to climb White Mountain Peak. In addition, we partnered with the Deepest Valley Cooperative Native Plant Propagation Center to hold two native plant sales open to the public. Of particular note, we provided eight well-attended public lectures for the local community here in the Owens Valley. Speakers for our free lectures came from a number of institutions including the Desert Research Institute, CSU Sacramento, Great Basin Bird Observatory, Snow Survey Associates, and the University of North Carolina, Chapel Hill. Topics ranged from Western Great Basin Landscapes As Climatic Time Machines to The Geology of Prehistoric Human Behavior. Our own Daniel Pritchett, WMRC Historian, presented a talk on "The White Mountain summit register: A century of history on California's third highest peak". What a great slate. We thank all of the speakers for sharing their time and expertise.

Indeed, it was another epic year at WMRC – and an honor to contribute to the education and research work of so many students, faculty and our local community. The WMRC really is an engaged outpost of the University of California here in the Owens Valley – and we hope to see this grow over the years. The great success we have had in 2017 and our aspirations for the future would not be possible without the dedication and hard work of our amazing permanent and seasonal staff. As Director I know how true this is. So, I thank all of you – students, faculty, researchers and our community who have been a part of the WMRC this year – and particularly thanks to our incredible WMRC staff. Here is to an epic 2018!



Chris Smallcomb, Warning Coordination Meteorologist at the National Weather Service forecast office in Reno, NV, presents a public lecture at WMRC entitled: *Winter 2017-18: Is it time to freak-out yet?*



Vassar College faculty and students stay at WMRC while on an Earth Science field trip to Death Valley and the Owens Valley.



Geology students and faculty from University of North Carolina, Chapel Hill departing Owens Valley Station to Crooked Creek Station.



Heading home in the snow-cat after the first trip into Crooked Creek Station, February 15, 2017.



# Behavioral Ecology of Praying Mantises in the Owens Valley, California

Story and photos by Mike Maxwell, National University, La Jolla, California

I have been conducting research on the behavioral ecology of praying mantises in the Owens Valley since 2006. The native mantis species *Stagmomantis limbata* exhibits sexual cannibalism -- the female's cannibalism of a courting male— in nature and captivity. This research investigates the interplay between resource availability and reproductive conflict between and within the sexes. My work has examined the effects of diet on female reproductive output, cannibalism towards the male, and male responses towards the female. While *Stagmomantis limbata* is my main study species, I have found at least four mantises in the Owens Valley: the native California mantis (*Stagmomantis californica*), the native ground mantis (*Litaneutria minor*), the introduced European mantis (*Mantis religiosa*), and the introduced Mediterranean mantis (*Iris oratoria*).



Male (right) in copulation with a female (left).



Headless male in copulation with a female.

My current research explores polyandry (multiple matings by females) and sperm competition in *S. limbata*. Male mantises have a problem—females might attack and consume them during courtship. The neurobiology of the mantis, however, allows for a decapitated male to inseminate the female. So, a male may inadvertently convert his body into offspring via cannibalism. But, a male must fertilize the eggs created from his body to reap this reproductive benefit. Herein lies a second problem—females may mate with multiple males in nature. The reproductive fates of cannibalized males is my current focus. At present, I am analyzing relative paternity through DNA fingerprinting of competing males in field encounters with females, along with staged mating experiments in captivity. I anticipate that these genetic results will shed light on sexual conflict in this intriguing biological system.

**NOTE:** KQED/Science just produced a very interesting video segment of Maxwell's research while at the White Mountain Research Center this fall. See this link:

<https://ww2.kqed.org/science/2017/11/14/praying-mantis-love-is-waaay-weirder-than-you-think-deep-look/>



# Playing Climate Change Leap-frog with Trees...in Very Slow Motion

Story and photos by Brian Smithers, PhD Candidate, University of California, Davis

One of the predictions of current climate change is that species will generally shift their ranges up in elevation in response to warming, but some species are likely to be better at that shift than others. Among the species that we would expect would respond to change slowly, Great Basin bristlecone pine has no equal. It's gnarled, twisted wood and famously long life spans are a testament to its ability to survive regardless of conditions. Bristlecone pine has been able to survive previous climate changes by shifting its range and there is little doubt that the species will survive this one in the same way. However, the rapid pace of recent warming has made for some interesting changes on the landscape in bristlecone pine forests that will likely mean different looking forests in the not-so-distant future.

Treeline is the ecological transition between two very different vegetation types: forest and alpine. Trees are limited in elevation by cold temperatures and because of this, we would expect treeline to move up in elevation in response to recent warming. In a recent paper in *Global Change Biology*, we found evidence for treeline advance of about 20 m in vertical distance throughout the Great Basin. In the White Mountains, treeline advance was even higher with advances as much as 150 m near Boundary Peak. However, this treeline advance does not look like we might expect it to given the species involved.



A bristlecone pine surviving despite most of the tree having died back in a perhaps drier or colder period.

Bristlecone pine is the dominant tree at treeline in much of the Great Basin. It is often found in almost pure stands, especially on carbonate soils like dolomite and limestone. Limber pine is also found throughout the Great Basin but often just below bristlecone pine in elevation where the two species coexist (In some places, like on the granitic soils of Boundary Peak, limber pine is the dominant tree at treeline but this is somewhat rare where bristlecone pine is present.). However, even where treeline is dominated by adult bristlecone pines, the majority of treeline advance is due to limber pine establishment. This is true even, and perhaps especially, on dolomite soils which are strongly associated with adult bristlecone pine. In the treeline forest stands of the Patriarch Grove (White Mountains), there are almost no cone-bearing limber pine trees among the stand of cone-bearing bristlecone pines. And yet in walking up to treeline, there is surprising amount of limber pine seedlings in and among the bristlecone pine adults. Upon reaching treeline, the mix becomes even more surprising as the vast majority of the recruitment of young trees is due to limber pine establishment.

Why is this happening? And what might this mean for the future of these forests? The first question is likely answered by looking at the two species' dispersal mechanisms. Bristlecone pine has small, winged seeds that are largely dispersed by wind, the vast majority of which fall to the ground and are eaten by rodents. Limber pine seeds have a very interesting relationship with Clark's nutcrackers, montane birds related to jays, that harvest seeds from closed cones and cache them underground for winter food, preferring limber pine over bristlecone pine seeds. Those seeds are buried at an optimum depth for germination and, perhaps more importantly, are hidden from rodents. Many of those seeds are ultimately consumed by nutcrackers, but not all of them are. In the right year, some of those forgotten seeds will germinate with a very small proportion of those seedlings surviving the first few years when they are most vulnerable. Clark's nutcrackers range widely and in some reports have been seen caching seeds up to 5 miles from their source. While the success of any one seedling is exceedingly low, an individual nutcracker caches thousands of seeds per year and when a bumper crop of seeds meets with a few wet summers in a row, infrequent pulses of regeneration can result. This dispersal mechanism appears to be a real advantage for limber pine in taking advantage of this newly available habitat upslope of treeline.

The second question is more difficult to answer and requires a decent amount of speculation. The relationship between limber pine and Clark's nutcracker is not new, nor is the fact that climate changes. While current climate warming is happening very quickly relative to most climate changes in the past, there is also evidence for very rapid climate changes in the not-too-distant past that would have affected bristlecone pine and limber pine. And yet, bristlecone pine trees have adapted or persisted in the



face of whatever weather can throw at them. It is unlikely that limber pine will replace bristlecone pine, but these forests are going to look different in the near future with new stands above current treeline looking much more mixed between the two species than current treeline. In some cases, we may even see a change from a bristlecone pine-dominated treeline to a limber pine-dominated one.



Above treeline at the Patriarch Grove in the White Mountains, young limber pine trees are establishing above adult bristlecone pine forests. Limber pine trees can be distinguished from bristlecone pines from their slightly more grey-green color and more shrub-like growth form when young; versus bristlecone pine's dark green color and more upright growth form.

It is very difficult to predict what a sub-alpine forest will look like long-term based on a 3-year study, especially when the trees involved live for thousands of years themselves. Perhaps over those thousands of years, the many young limber pine young trees will succumb to the harsh high-elevation Great Basin vagaries of weather, while the few bristlecone pines are able to survive. Or perhaps priority is the most important driver of species composition and this current limber pine advantage will ultimately exclude bristlecone pine. We don't

know and won't know for thousands of years, but we do know that climate change is having an effect on our forests in the White Mountains. Recent warming has opened up a real estate boom for young trees above current treeline and so far, limber pine has been far better than bristlecone pine at taking advantage of it. What will this actually mean for the future of bristlecone pine? We will have to wait a while to see the final results. Limber pine may have the advantage now, but in the long run, my money is on bristlecone pine. I'll have my descendants collect on that bet.



In some places in the White Mountains where bristlecone pine once stood before a cold snap killed them off, limber pine are now establishing in much greater numbers than bristlecone pine.



## Winter Wildlife Around the WMRC Crooked Creek Station

Story and photos by Ken Hickman, Naturalist, Wildlife Researcher, GLORIA Volunteer

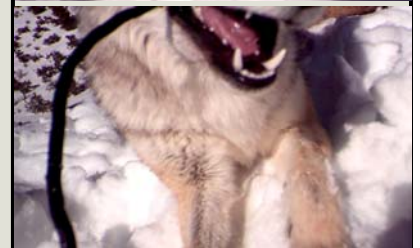
Winter was approaching fast in the White Mountains when I set the 4 motion-triggered camera traps around the WMRC Crooked Creek Station. All were 1/4 to 1/2 mile from the station, spread out, and set in locations with recent sign of wildlife transits. The idea was to scratch an itch of Dr. Brian Cypher, canid researcher and Associate Director of the Endangered Species Recovery Program at CSU Stanislaus, who questioned U.S. Forest Service Sr. Scientist, Connie Millar and me, "Are coyotes active in those subalpine zones over winter, or do they go downslope? Is prey out and available?"

And what a winter to try and find the answer! Only 3 of 4 cams worked well, running from September 2016 to May 2017; even after being buried by snow storms that the cameras thermo readings suggest dropped the temperature to under -10°F.

Combined, the 3 cams documented 15 mammal species and 6 birds, with many active in winter and out in snow. As for the coyotes, the cams photographed 14 different visits of several individuals, with the only major gap from December 16th to February 1st, when the cams were mostly under snow. So, while we did end up with a data hole, the general data set suggests that even at 10,150 feet, Crooked Creek doesn't shut down for the holidays. When the staff is away, the wildlife still plays...even during a winter for the record books.



September 2016 to May 2017 sampling from one of the camera traps.  
L-R: badger, spotted skunk, bobcat, mountain cottontail, pika, and a coyote.



February: A coyote digs out a camera trap and turns it and a rubber twist-tie into chew toys.



## A Flora of Adobe Valley

Story and photos by Sophia Winitsky, Graduate Student Researcher, WMRC Mini-grant recipient

For my master's thesis at Rancho Santa Ana Botanic Garden/Claremont Graduate University, I am undertaking a floristic inventory of the Adobe Valley and surrounding hills in Mono County, CA. This area has not been explored botanically, with any intensity, as evidenced by the less than 100 herbarium specimens that were recorded from the study area before I began my work. I knew I wanted to continue examining eastern Sierran shrublands after monitoring sagebrush plots as the 2015 CNPS Hudson intern.

In such an under-explored area with unique ecosystems, terrain, and conservation concerns, there are many reasons to perform a



River Spring Ecological Reserve; a transmontane spring supporting a vast desert wetland system.



*Calochortus excavates*, a severely threatened eastern California endemic bulb, found in abundant numbers this year.

mented are rare and many have not previously been recorded in the area. My study area received high levels of precipitation this past winter which allowed for many annual plants to germinate that may not be present each year, adding to the overall count of taxa new to the area. This winter I am working on identifying my specimens, traveling to herbaria that hold specimens of the region and preparing for my next field season. Thank you to WMRC for helping me fulfill my research goals!

Collecting in the diverse shrublands of the Adobe Valley.

floristic study. In the case of the Adobe Valley, one of my research goals is to document the flora of the alkali flat and meadow ecosystem; a habitat that is representative of the Owens Valley, but severely threatened. Having an extensive floristic survey may help protect the area from wind and other development projects, as well as help to inform agencies' and private land owners' management decisions.

This past field season, while staying at the White Mountain Research Center, I was able to collect over 1,300 specimens. Many of the species I docu-





# Studying Native Fish at White Mountain Research Center

Story and photos by Christi Kruse

Have you met the Owens Valley speckled dace and tui chub? These species are two of the native fish of the Owens Valley and the subjects of my research. If you visited the White Mountain Research Center (WMRC), Owens Valley Station this summer you may have seen my project. I am a beginning researcher under the mentorship of Nick Buckmaster, California Department of Fish and Wildlife, Jeff Holmquist, WMRC, and Natalie Jones, a UC San Diego post-doctoral scholar with the Shurin Lab. I am also a fortunate recipient of the WMRC's 2017 Mini Grant as well as the Desert Fishes Council's 2017 Conservation Grant. In addition to these awards, I am collaborating with Dr. Jon Shurin's research group, who has graciously loaned many of the materials for my work.



Researcher Christi Kruse standing with the mesocosm tanks. The black covers over the tanks create shade, slow evaporation, prevent avian predation and keep the water temperature cool.

One idea for tui chub and speckled dace conservation is to introduce both fishes into a shared refuge habitat. A refuge is a place that provides suitable habitat for fish, away from threats like predation or hybridization. Traditionally, a single refuge habitat would be used to host one fish species. Due to a shortage of suitable refuge habitats, managers would like to explore the possibility of introducing both tui chub and speckled dace into the same refuge to optimize use of these limited resources. It is unknown how tui chub and speckled dace interact in shared habitats, and my research project addresses this question.

I am studying the effects of competition between Owens speckled dace and Owens tui chub (represented by hybridized Owens tui chub). This study utilized 'mesocosms' to create replications of different fish communities to study species interactions in a more controlled environment than in the wild. In my project, a "mesocosm" or medium-sized world consisted of a 200-gallon plastic tank filled with water, pond sediment and aquatic invertebrates, creating a self-contained ecosystem in each tank.

I chose to study the tui chub and speckled dace because they present an important conservation challenge in the Owens Valley. Both fish are endemic to the Owens Valley, which means that this is the only place in the world where they are native. As locally evolved fishes, the tui chub and speckled dace are extremely tolerant to high and low temperatures, high salinity, and low dissolved oxygen levels. Despite these species' adaptations to the physiological stresses of the Owens River watershed, the introduction of predatory sport fish in combination with the hybridization of tui chub have caused extreme declines in the overall populations of tui chub and speckled dace. Managers are left with the challenge of keeping these native fishes alive while most of their historic habitats are unsuitable.



Owens speckled dace (top) and Owens hybrid tui chub (bottom) being measured to determine body condition.



I used 48 tanks, and randomly stocked each tank with one of six fish community combinations; each community was replicated eight times. The replication in this study allows me to assess consistency of results.

My project was conducted at WMRC for three months during the summer of 2017. Throughout the study I collected monthly data from each tank including: chlorophyll samples to measure primary production, zooplankton samples to measure planktonic invertebrate abundance, and the length and mass of each fish to measure body condition. Body condition is a modified ratio of length to mass that is used to track changes in growth over time and between treatments to determine how each fish community type affects tui chub and speckled dace respectively. The data collected on zooplankton and chlorophyll provide additional information on resources available to the fish and how the fish influenced the ecosystem throughout the study.

I am currently processing samples and analyzing the data. Preliminary results suggest that speckled dace in the treatment with only speckled dace or speckled dace with large tui chub had healthier body conditions than speckled dace in treatments with small tui chub. If you are interested in hearing more about my work I will be presenting at the WMRC 2018 Spring Lecture Series.



Nick Buckmaster, Environmental Scientist for the California Department of Fish and Wildlife, weighs a fish at the start of the project.



Volunteer Emma Hewitt uses a tube sampler to take a water column samples in order to collect zooplankton.



Volunteer Hillary Behr filters water in a process used to collect and preserve zooplankton.



Volunteers Renan Olivera (left) and Veronica Holmes (right) use a seine net to collect fish which will be measured to determine body condition.



Researcher Christi Kruse filters water from a syringe through a filter in order to collect a chlorophyll sample which will be used to measure primary production.



## From the Archives

By Daniel Pritchett

### Evaluation for listing on the National Register of Historic Places

WMRC and Inyo National Forest (INF) are currently in the process of renewing the Special Use Permits under which WMRC operates. As part of the permitting process, INF must consider structures more than 40 years old as potentially eligible for listing on the National Register of Historic Places. The register is the official list of the nation's historic places worthy of preservation under terms of the National Historic Preservation Act of 1966. There are structures more than 40 years old at all WMRC sites on INF land. If all such structures have to be managed as eligible for listing it might interfere with the operation of the Center. Therefore, we have engaged a consultant, Mary Farrell, to assist us in a formal evaluation of WMRC facilities. Farrell's recommendations (if accepted by INF) will determine which of the potentially eligible structures qualify for listing and which do not. This will make permit administration easier for INF and operations easier for WMRC.

The criteria for National Register eligibility are contained in the Code of Federal Regulations and further described in National Park Service publications. Historic properties that possess integrity of location, design, setting, materials, workmanship, feeling, and association can be eligible for the National Register if they:

- Are associated with events that have made a significant contribution to the broad patterns of our history; or
- Are associated with the lives of significant persons in or past; or
- Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction;
- or have yielded or may be likely to yield, information important in history or prehistory.

The process of assessing eligibility for WMRC facilities is arduous due to number of structures and the volume of information which must be gathered. Just attempting to determine the construction dates of all the structures at WMRC facilities has been a big task. I am doing the research and most of the writing in consultation with Ms. Farrell, who will sign the final document. We hope to send the completed report to INF by the end of this year.

We currently plan to recommend the summit lab be listed under criteria A, B, and C, and the Barcroft Quonset hut (aka the Pace lab) be listed under criteria A & B.

### James Terman Collection

Dr. James Terman recently contacted WMRC offering to share photographs and reminiscences of his work at WMRS in 1962. Dr. Terman was a grad student technician for an Indiana University Department of Physiology research project at White Mountain studying effects of ageing on acclimatization in a group of scientists who had participated in the Harvard Fatigue Laboratory expedition to the Andes in 1935. The project was led by Bruce Dill (Harvard) and Sid Robinson (Indiana University). Terman's photographs include numerous shots of the researchers and also the first photos we have of two mainstays of the early WMRS vehicle fleet: a WWII Navy surplus ambulance and a bomb service truck. There are references to these vehicles in early documents but these are the first photos I've seen.



Nello Pace (seated) and Bruce Dill standing in back of bomb service truck in 1962.



WMRS Navy ambulance.

If any readers of this newsletter have photos or reminiscences to share, please contact me at [skypilots@ucla.edu](mailto:skypilots@ucla.edu). Photos of WMRS facilities and/or equipment from before 1980 would be of particular interest.



# Monitoring Native Bees in Bishop's Gardens

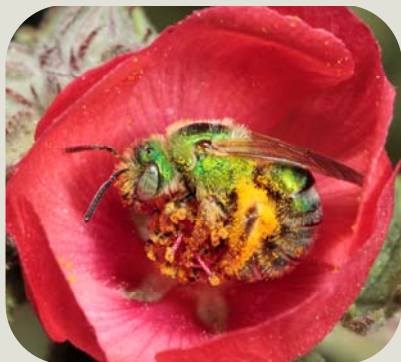
Story by Chris Jadallah, Researcher, UC Berkeley Urban Bee Lab  
Insect Photos by Rollin Coville

Did you know more than 1,600 species of bees call California home? They vary in size, shape, and color, and unlike the European honey bee, they do not make honey or live in hives. Most live a solitary life, nesting either in the ground or in cavities, while other species may be social. They emerge from their nests as adults just as their preferred flowers are in bloom. Our native bees pollinate nearly 90% of California's 6,000 flowering plant species, providing a key ecological service that is crucial to the health of agricultural, urban, and wild landscapes.

Native bees face a number of challenges that threaten their populations, namely habitat loss and fragmentation, increased pesticide use, disease, and climate change. University of California, Berkeley professor Dr. Gordon Frankie and the UC Urban Bee Lab have been studying the relationships between bees, plants, and people in California since 1987, with the goal of supporting native bee conservation via furthering understands of these relationships.

In 2005, Dr. Frankie began the Urban California Native Bee Survey, a long-term monitoring project to document bee diversity and bee-flower interactions in urban areas. As part of the project, we visit fifteen cities throughout the state to collect data in residential gardens, arboreta, community gardens, etc. Notably, we have found relatively high species diversity in most of the cities (some with over 100 bee species present!), with more than 400+ total species recorded on 500+ species of plants.

Bishop, California was added as a survey site in 2013. When in Bishop, we make collections from plants at the WMRC Owens Valley Field Station, the Bishop Community Garden, and several private residential gardens. We have noticed particularly high abundance and richness of bees in the summer months, especially on plants like *Helianthus annuus*, *Chilopsis linearis*, *Perovskia atriplicifolia*, *Eschscholzia californica*, *Sphaeralcea ambigua*, and more. To support bees in your garden, be sure that you have a wide variety of bee-attractive flowers that have overlapping bloom times so that pollen and nectar resources are available throughout the bee season that spans the spring, summer, and fall. For more information about bee gardening and how you can best support these important pollinators, check out our book, *California Bees and Blooms: A Guide for Gardeners and Naturalists* (2014).



Female *Agapostemon texanus* individual foraging on *Sphaeralcea ambigua*.



Chris Jadallah and Marissa Chase from the UC Berkeley Urban Bee Lab at Owens Valley Station.  
Photo: Denise Waterbury



Female *Megachile texana* individual cutting a leaf that she will use in her nest.

## Support White Mountain Research Center

White Mountain Research Center sends thanks to all donors, past and present, for their generosity in support of the Center. These donations help support research, education, and other public service events and activities at WMRC. Donations large and small to WMRC (in-kind or monetary) are very much appreciated. If you would like your donation to be used at a specific site within WMRC (Owens Valley, Crooked Creek, or Barcroft Stations), please indicate this information on the memo line of your check. All donations are tax-deductible.

To donate online: <https://giving.ucla.edu/Campaign/Donate.aspx?SiteNum=13>

Or please make your check payable to: UC Regents and send to:

White Mountain Research Center

3000 East Line Street

Bishop, CA 93514

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## 2016 WMRC Publications

- Basaran, K. E., M. Villongco, et al. (2016). "Ibuprofen Blunts Ventilatory Acclimatization to Sustained Hypoxia in Humans." *PLoS One* 11(1). Journal Article
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