

DESERT REPORT

BY LINDA CASTRO AND FRAZIER HANEY

A COMMUNITY PROPOSAL FOR A MANAGEMENT PLAN

Mojave Trails National Monument



The Cadiz Dunes at the heart of the Monument

LINDA CASTRO

On February 12, 2016, President Barack Obama designated three national monuments in our desert – Sand to Snow, Mojave Trails, and Castle Mountains. For reasons that will be explained later in this article, the focus of this piece will be Mojave Trails National Monument which was placed under the management of the Bureau of Land Management (BLM) by the Presidential Proclamation. That Presidential Proclamations also required BLM to prepare a management plan for Mojave Trails within three years of its designation.

In the fall of 2016, BLM held what it called “envisioning” sessions for the Mojave Trails Monument. These public meetings took place in several locations near the monument and sought the public’s input on what they wanted to see in a management plan. BLM also hired a manager for the Monument and began seeking members of the public who would be willing to serve on a Monument Advisory Committee (which would be a subgroup of the existing Desert Advisory Council). BLM was on track to begin scoping meetings, but everything came to a halt with the November 2016 election.

In April 2017, President Trump issued an Executive Order for Interior Secretary Ryan Zinke to review most national monuments designated since 1996 to determine if they should be reduced in size or eliminated. The Mojave Trails Monument was included in this review. While Zinke’s review is now complete, neither the President nor Zinke has ever officially stated that this monument is safe from elimination or reduction in size. This has left Mojave Trails in a state of limbo. This is likely the primary

CONTINUED ON PAGE 14



Habitat and dust control

MIKE PRATHER

OWENS LAKE NO LONGER “TERMINAL”

A Destination for Birdwatchers

IN THIS ISSUE

- 1 A Community Proposal For A Management Plan: Mojave Trails NM
- 2 Owens Lake No Longer “Terminal”: A Destination For Birdwatchers
- 4 Desert Groundwater: A Resource At Risk
- 6 Rearranging The Planet To Save It: Do We Really Know What We’re Doing?
- 8 Death Valley’s Devils Hole: Smallest Known Habitat In The World For A Single Vertebrate Species
- 10 Rattlesnakes And Kangaroo Rats: Predator Prey Interactions
- 12 Progress At The Salton Sea: Incremental At Best
- 16 Counting Sheep: An Iconic Animal On The Edge Of Survival
- 18 Desert Updates
- 21 Outings

At the start of the 20th Century the unquenchable thirst of booming Los Angeles became a death sentence for Owens Lake. The completion of the Los Angeles first aqueduct in 1913 cut off the water to 62 miles of the Owens River, the lake’s lifeline. By the mid 1920s, the lake, and the hundreds of thousands of birds that she supported, were gone. When full, her water covered 110 square miles of the southern Owens Valley and was part of a hemispheric migration route for waterfowl and shorebirds.

1917 Sept. 24 – “The shore shallows are thronged with water birds. Avocets predominate; I estimated one bird every four feet of shoreline, which would make 1300 per mile!

“There are groups of Northern [Red-necked] Phalaropes swimming on the water just off the shore, with choruses of weaker “pits”; and ducks in groups farther off shore, with an occasional gull flying along low over the water add to the avian activity...

“Great numbers of water birds are in sight along the shore – Avocets, Phalaropes, and Ducks. Large flocks of shorebirds in flight over the water in the distance, wheeling about, show en masse, now silvery now dark, against the gray-blue of the water. There must literally be thousands of birds within sight of this

spot. En route around the south end of Owens Lake to Olancho saw water birds almost continuously.”

- Joseph Grinnell, Museum of Vertebrate Zoology, UC.

While Los Angeles built a world-class city of uncountable wealth, the people of the Owens Valley choked for eighty years on the worst hazardous dust source in the United States. Breathing PM10 dust particles, small enough to pass through cell membranes and on into the blood stream, was a hardship to anyone with chronic respiratory symptoms, and led to increased asthma in young people. Los Angeles was eventually compelled to control the dust created from their actions of years earlier. With the Clean Air Act's call for clean air throughout America, no matter where you live, even the Owens Valley at the foot of the High Sierra now experiences no more health-damaging dust storms.

The return of the lake's historic wildlife turned out to be a beneficial accident stemming from the Los Angeles dust control efforts, since water was the primary tool chosen for dust control at Owens Lake. In fact, nearly half of the flow of the Los Angeles Aqueduct was spread over the lakebed. As a result of this, the simple food web from the past was resurrected. Once again, primitive algae mats capture the sun's energy and are, in turn, fed upon by brine flies - thus setting the table for the birds. "Just add water and stir - instant lake!" a friend suggested to me.

But what protection was given to the newly returned flocks of birds? It was clear that Los Angeles would give up as little water as possible. "This is a dust project, not a wildlife project," said the Los Angeles Department of Water and Power (LADWP). But, guided by the Public Trust decision from Mono Lake which required the balancing of wildlife with the use of water by Los Angeles, collaboration began. The Eastern Sierra Audubon Society, the California Department of Fish and Wildlife, the California State Lands Commission, the Los Angeles Department of Water and Power, the California Native Plant Society, and Inyo County all worked creatively to craft the Owens Lake Master Project (OLMP). The

OLMP goals are dust control (for public health), water conservation (for Los Angeles) and habitat enhancement and protection (for the public trust).

One outstanding issue at Owens Lake is the LADWP interest in pumping groundwater from under the lake *onto the lakebed itself* to reduce the need to use water from their aqueduct. Groundwater and habitat work groups composed of multiple stakeholders have been working for several years on the preparation of a groundwater model and resource protection criteria. Their major concerns are potential impacts on wetlands, springs, water quality, subsidence, and private wells. The amount of water that might be pumped without harmful impacts is not known without a pumping test. A permit for such a test would be required from the California State Lands Commission, and Inyo County and Los Angeles would have to settle their disagreement over whether their 1991 Long Term Water Agreement applies to Owens Lake. Inyo County says it does, and Los Angeles says it does not.

In April 2018 Owens Lake became a part of the Western Hemisphere Shorebird Reserve Network (WHSRN) with the level designation of International Importance. It is the 50th site in the United States and the 104th WHSRN (www.whsrn.org) site overall. With at least 1% of the population of Least Sandpipers and American Avocets, as well as over 1% of the inland population of Snowy Plovers, the lake easily meets the criteria necessary to join the network. The Western Hemisphere Shorebird Reserve Network extends from Tierra del Fuego and Patagonia in South America to the far north of Alaska and Canada. Its goals are to help educate land and wildlife managers and focus on the science needed to fill avian knowledge gaps. The network makes it possible for all sites to communicate and plan with each other for the benefit of all shorebird species, many of which are in decline worldwide.

1911 Sept. 14 - "As we proceeded around the western margin of Owens Lake, great numbers of ducks and waders, scattered and in large masses, were seen on the beach and out on the water. At this season (of migration) a station on

the shore of Owens Lake should certainly produce some valuable observations."

- Joseph Grinnell, Museum of Vertebrate Zoology, UC

Owens Lake is the richest wildlife location in Inyo County, and public access has been greatly improved. Over 100,000 birds have been recorded at the lake in a single day. Most of these species of shorebirds and waterfowl migrate through in the spring (March-April) and fall (late August-September). All of these birds depend on unique habitats such as wetlands, terminal lakes, and tidal mudflats where abundant food is available and where they are able to rest for a few days. Well over 90% of these types of habitats have been lost in the last two centuries. Shorebirds, in particular, require specific habitats where they can put on large amounts of fat in order to have enough energy to fly 1,000 miles or more to their next stopover. Shorebirds are the marathons of migrants. As the Salton Sea in Southern California is drying up, Owens Lake is taking on increased significance in the western flyway.

See it for yourself! Every year on the last weekend of April the Owens Lake Bird Festival is held in Lone Pine. Organized by Friends of the Inyo (www.friendsoftheinyo.org) and its partners, fieldtrips of all kinds explore Owens Lake and the surrounding area. Thousands of shorebird migrants are present during their spring migration to the far north, putting on one of nature's most amazing sights for all to witness. Local history, geology, and natural history tours explore mining, wildflowers, film history, bird migration, dust control, and much more, making the weekend a rich experience. Owens Lake now has a future.

Mike Prather has been residing in Inyo County since 1972, when he and wife Nancy moved to Death Valley to teach in a two room school house. Mike has actively been working on land and water issues in the Owens Valley since 1980 with the Owens Valley Committee (past president), Eastern Sierra Audubon (past president) and Sierra Club (past chapter chair). He currently lives in Lone Pine.

DESERT GROUNDWATER

A Resource at Risk

Groundwater stored in our desert basin aquifers is an increasingly valuable and scarce resource, sustaining both people and groundwater dependent ecosystems. Desert springs, where groundwater surfaces, are rare and easily threatened sources of water, critically important for a wide range of desert plants and animals. Perennial springs and seeps often serve as the only source of water for vast desert areas. Almost wholly dependent on the surface expression of ancient water moving slowly through groundwater aquifers, even small drops in aquifer water levels caused by groundwater pumping can desiccate a spring and decimate the life dependent on the spring.

Unlike surface water flowing in streams and rivers, groundwater has been largely exempt from allocation rules that would limit unreasonable extraction, leaving groundwater basins easy prey to the mining and export of water. The failure of regulatory regimes to recognize the obvious connection between surface and groundwater has posed major problems across the US Southwest in the management of water resources.

In 2014, recognizing the dire overdraft situation in many of the state's groundwater basins, California enacted the Sustainable Groundwater Management Act (SGMA). That Act requires designated priority basins to return, over time, to sustainable status, defined as the absence of "undesirable results" such as overdrafts, subsidence, and "depletions of interconnected surface water, that have significant and unreasonable

adverse impacts on beneficial uses of the surface water."

The Act, however, offers little solace for California's desert basins. With only a handful of exceptions, desert basins have not been listed as priorities under the SGMA and will not be regulated under the Act for the foreseeable future, if ever. Moreover, a central theme of the Act – which continues preexisting California state groundwater policy – reposes control over groundwater extraction in local authorities. Local control has been far from adequate in effectively regulating desert groundwater resources, resulting in proposed projects like the unfortunately named Cadiz Valley Water Conservation, Recovery, and Storage Project, which would mine vast quantities of groundwater from a desert basin for export to coastal communities, while drying out an essential desert spring.

With some notable exceptions, such as the measures asserted to protect the Devils Hole pupfish and other listed species dependent on perennial groundwater, federal agency policy in the past has not been much help in reining in destructive groundwater extraction practices. The federal government has long deferred almost total control of groundwater resources to state authority, asserting federal rights, including reserved water rights, with apparent reluctance. However, many, perhaps most, desert groundwater basins lie under public lands, managed by the Bureau of Land Management (BLM).

BLM's organic act, the Federal Land Policy and Management Act, requires the

agency to protect ecological resources, including those dependent on surface flows of groundwater. Where desert springs exist on public lands, BLM is accordingly required to devise means to protect them, requiring the agency to assert control over groundwater extraction that may affect groundwater dependent ecosystems. Until recently, protecting springs and groundwater dependent life has not been a first rank priority for BLM as it sorts out how to balance desert land uses.

BLM's recent desert resource management plan amendments, the Western Solar Plan, and Desert Renewable Energy Conservation Plan (DRECP), newly accept enhanced responsibility for management of groundwater resources where projects may cause adverse impacts on desert springs and the species dependent on them. The DRECP's Conservation Management Actions require applicants for rights of way and other development projects to demonstrate a full understanding of basin hydrology, to put in place predictive modeling and monitoring systems, to establish trigger levels in appropriate cases to avert impacts to groundwater dependent ecosystems, and to provide compensation, for example, where overdraft conditions exist. It is not clear, however, how BLM's new direction in groundwater policy will fare under the new administration,

Unlike surface water flowing in streams and rivers, groundwater has been largely exempt from allocation rules that would limit unreasonable extraction, leaving groundwater basins easy prey to the mining and export of water.

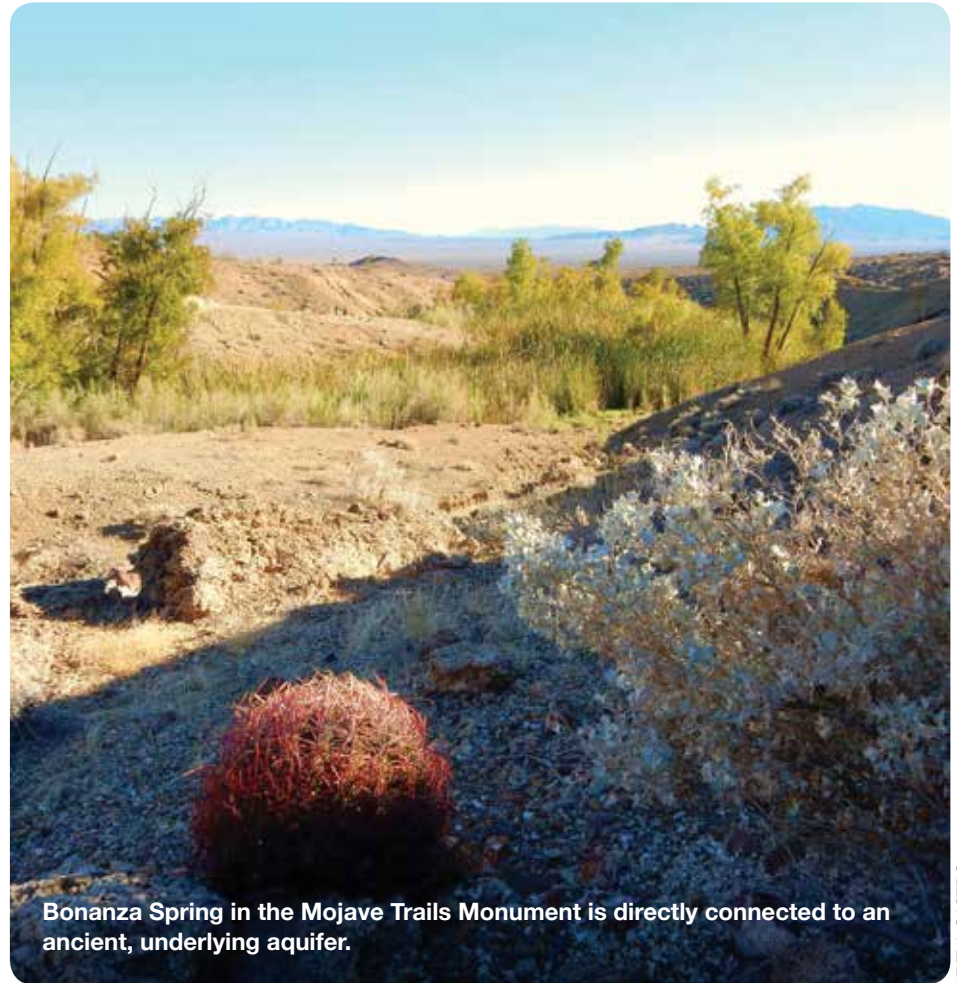
which has announced that it is considering significant changes in the DRECP.

The lack of comprehensive information about desert springs, seeps, and wetlands has retarded efforts to protect them. Several years ago, BLM in collaboration with several non-governmental organizations, recognized the need for a full inventory of springs on public lands in the Mojave Desert. The collaboration sponsored hydrogeologist Andy Zdon to collect location, water chemistry, ecosystem features, and other key data on over 300 Mojave springs. Zdon's initial report will be supplemented this year with another round of sampling of priority springs, providing BLM and the public for the first time with an accurate basis for analyzing threats to these vital water sources.

As in the case of BLM, state agencies have largely neglected to exercise regulatory powers to protect groundwater and groundwater dependent ecosystems. California's trustee agencies – the Department of Fish and Wildlife and the State Lands Commission – have legal duties to conserve and enhance resources under their management. Fish and Wildlife has a broad responsibility to reasonably protect all plant and animal species in the state, irrespective of whether they are listed as threatened or endangered. Clearly, the protection of groundwater dependent species and the water on which they depend is well within the scope of this agency's duties.

California's State Lands Commission holds significant desert acreage as school lands, and is legally committed to maximizing the economic value of those lands. Without ready access to groundwater, most of those lands will be close to worthless. Projects that mine aquifers underlying these lands should be of immediate concern to the Commission. Surface land ownership in California carries with it an overlying right to equitably share in the beneficial use of groundwater, which can and should be asserted by the Commission to limit mining and export of groundwater under state lands.

The public trust doctrine supplies another potential source of state authority to limit unreasonable groundwater



Bonanza Spring in the Mojave Trails Monument is directly connected to an ancient, underlying aquifer.

LINDA CASTRO

withdrawals. The public trust case law, beginning with the Audubon suit over diversions from tributaries of Mono Lake, has recently been expanded to potentially limit groundwater withdrawals affecting the Scott River. While the doctrine has traditionally extended only to the protection of tidelands and navigable bodies of water, there are strong arguments to expand its protections to all state natural resources, including desert springs. The idea behind the public trust, dating to Roman law, is that the sovereign holds title to natural resources, including water, in trust for the public at large, and alienation of those resources without reasonably balancing the needs of natural systems violates the trust.

One can hope that as the demand to extract increasing amounts of desert groundwater rises, federal and state

land and resource managers will assert all available authorities to protect the critical and delicate desert streams, springs, seeps and wetlands that depend on groundwater aquifers.

Bill Christian has worked in the Mojave Desert for The Nature Conservancy as a project director for 15 years, focused primarily on the Amargosa watershed. That work led to an interest in groundwater and groundwater dependent ecosystem conservation issues. He trained as a lawyer and has taught environmental law and policy at Claremont McKenna College for the past decade. He lives in Pasadena with his wife and three dogs.

The views expressed in this article are those of the author and are not necessarily those of The Nature Conservancy.

REARRANGING THE PLANET TO SAVE IT

Do We Really Know What We Are Doing?

The following article is an adaptation of one that appeared in American Scientist, the magazine of Sigma Xi, The Scientific Research Honor Society and appears with their permission.

Our human-defined era on Earth is only around 200,000 years old. But in the past few centuries alone, we have reshaped the planet by wars, mass migrations, population pressures for development, and the burning of fossil fuels so rapidly and extensively that flora and fauna extinction rates are soaring to the point that some recommend adopting extreme measures. Renowned biologist E. O. Wilson, in his 2016 book *Half-Earth*, proposes such a radical solution.

To curb our destruction of Earth's remaining plants and animals, Wilson would set aside half the planet from human intrusion to protect the greatest number of life-forms. Rather than divvying up the globe into actual hemispheres, he lists some 35 "Best Places in the Biosphere": biodiversity "reservoirs" worth keeping ourselves out of because of their relatively unspoiled plant and animal life. Otherwise, Wilson fears we will continue acting as an arrogant apex species, judging other life-forms to be subordinate and expendable – for him, our key misguided concept. Half-Earth thus may express his most sweeping wisdom about the planet – hands off half of it.

But one begins to worry that Wilson is eco-dreaming about these massive bio-preserves without figuring out how we might actually make treaties, pay for,

and protect them – which include, for example, whole islands such as immense New Guinea, and California's vast redwood forests stacked with 66 million dead trees ready to ignite. Because Wilson doesn't address such questions, the book feels more like a utopian vision than a detailed implementation strategy for ringing the globe with semi-Edens.

Nonetheless, Wilson is convinced humans will make the required leap of awareness and adapt to greener ways despite the odds, and he puts his full

faith in future techno-fixes. Advances in biology, nanotechnology, and robotics – "bnr" as he labels them – will help us change our dominance script. How so? He claims, "We are thinking organisms trying to understand how the world works. We will come awake."

But what nasty consequences could emerge from his *summa ecologica*? One obvious one is the constant need for efforts to keep out super-wealthy developers, corporations, resort companies, celebrities, and rogue countries with militias, as well as kings, potentates, and oligarchs with endless financial resources and takeover ambitions. If these numerous bio-preserves are the last pristine areas on the planet, flush with rare and native species, imagine the need to protect them, a perfect recipe for new international conflict, with legal, diplomatic, and military repercussions. Where will the "Keep Out" signs and sentries be posted?

If Wilson's half-Earth plan could be realized – negotiated, paid for, protected, and sustained – what goes on in the unpreserved other half? This area is where most of us would live, presumably not too concerned about harming already compromised nature, and



Desert Tortoise

TIGERHAWK VOK VIA CREATIVE COMMONS

some of us developing the saving “bnr” technologies to support both halves, the specifics of which Wilson does not elaborate. But we must also consider what problems might arise from separating high-tech civilization from healthy untouched nature.

Forced Removal

We have something of a model to contemplate. In California’s Mojave Desert, desert tortoises have been moved and resettled, or “translocated,” to make way for two kinds of projects – military ones and less polluting energy sources from wind, solar, and sun-mirror projects. These green energy solar fields in the Mojave reconfigure parts of the desert also dividing up the land in a new way. This division is not on the scale that Wilson proposes nor is it fully analogous. The Mojave version is more relocation and preservation than separation in half, but the revamped sections of Mojave for alternative energy along with their protected preserves are something of Wilsonian half-Earths – nature “reservoirs” split off from high-tech regions.

The vast Mojave spreads throughout southeastern California and southern Nevada for 48,000 square miles. On the west side of the Colorado River, one species of desert tortoise, *Gopherus agassizi*, is the Mojave’s most famous native inhabitant. It lives more than 50 years, can grow more than a foot long, withstand temperatures up to 60 degrees Celsius, and spends most of its time in various underground burrows. It needs anywhere from 10 to 100 acres for its home range, to which it is very dedicated and on which it depends. In 1990 it was listed as threatened.

In addition to their natural enemies – coyotes, ravens, badgers, and gila monsters – the tortoises have to contend with diseases, floods, drought and ever-higher temperatures, as well as development, habitat destruction, soil compaction, traffic roadkills, capture by humans, and vandalism. This has resulted in a 90-percent loss of their numbers in certain areas. With perhaps 100,000 remaining overall in the Sonoran and Mojave deserts, their population density has decreased from 200 adults per



Wind energy facility near Tehachapi, California

CRAIG DEUTSCHE

square mile in 1950 to 5 to 60 per square mile today. As their numbers continue to diminish, preservationists try to conserve desert habitat itself, while translocating hundreds of individuals, as well as reconnecting habitats fragmented by energy projects.

However, tortoises do not relocate well; hundreds have been transplanted with marginal success, 40 percent of them having died in the process. Just picking them up causes them to urinate water stored for the hottest months, and they soon languish and die. And there are only so many relocated tortoises able to survive with their tortoise neighbors in a place such as the 38-square-mile (25,000-acre) Mojave Desert Tortoise Preserve.

One scientist reported that a study of hundreds of translocated animals saw 50 percent of them dead five years after they were moved. Julie Cart, a reporter for the Los Angeles Times, framed the multiple ironies for environmentalists helping to build solar projects in the title of her article from 2012: “Sacrificing the Desert to Save the Earth.” Environmental organizations issued no legal challenges to the trashing of parts of this fragile ecosystem. In addition, energy rates increased for this “green” source, huge federal and state subsidies added to the public’s costs, and permits were bought speculatively and will likely never be used – all in the noble effort to

combat climate change.

The mirror-based solar power plant, called Ivanpah BrightStar, covers 3,500 acres alone. But compared with the millions of acres lost to producing fossil fuels, and the thousands of tons of pollution these plants save while generating electricity for hundreds of thousands of households, such solar plants seem like a very worthwhile trade-off.

But we need at least to own up to our new eco-economic calculus – we will disturb and potentially damage a small few for the large many: Ex Unibus Pluram (“From One, Many”). Have we seen this model before? It may be our favored strategy. We need your land, your space, your resources, so we will remove you to a preserve – dare we call it a “reservation”? – for a greater good. This pattern defines nature itself as “other,” as if we and our technologies are extreme contraries to tortoises and deserts. Will this precedent let the next claim for expropriating desert land and its focal creature for beneficial technology be easier to make?

Ironies Abound

The seemingly efficient power tower installations similar to that at Ivanpah actually need natural gas to start up in the morning after the cooldown at night, and they also need large quantities of water to operate – requirements

CONTINUED ON PAGE 20



Devils Hole: a crack in the ground

NEAL NURMI, NPS

DEATH VALLEY'S DEVILS HOLE

The smallest known habitat in the world for a single vertebrate species

The Devils Hole is managed by Death Valley National Park. It is an area of forty acres, located adjacent to the Ash Meadow National Wildlife Refuge in Nevada's Amargosa Valley, and a most remarkable and fascinating place.

Approximately 60,000 years ago, a narrow and unfathomably deep crack with almost vertical walls opened up in the limestone bedrock creating a small but abyssal cavern filled with groundwater. The crack was most likely caused by tectonic activity. No one thus far has

been able to find a way to measure how deep this fissure is. Divers have gone down as deep as 436 feet but from there were only able to see down to about 500 feet. The fissure, which is 10'x 60' on the surface, descends at an angle that is approximately twenty degrees from vertical. At 500 feet the fissure bends and becomes even more vertical. No human has ever seen what lies beyond that bend. No one knows how deep Devils Hole actually is.

What is known, however, is that

Devils Hole is connected to the Death Valley Regional Groundwater Flow System. This system is huge. It encompasses about 38,610 square miles which is slightly larger than the state of Indiana. One indication of the enormity of this system is that earthquakes from as far away as Japan, Chile, Indonesia and Mexico make waves in Devils Hole.

Devils Hole also has two daily tidal fluctuations, a high tide and a low tide due to gravitational forces from the moon. The phase of the moon determines the extent of the highs and lows. The shift can be as much as seven inches from high to low.

The tiny one-inch inhabitants of this crack in the ground are the Devils Hole pupfish (*Cyprinodon diabolis*). It is the smallest desert pupfish in existence, living in the smallest and most restricted known habitat in the world for a single vertebrate species. They are also one of the rarest species of fishes in the world. It is not known for certain how long they have been there. The best estimates at this time are between 10,000 and 20,000 years.

These pupfish are a classic example of divergent evolution. There are five different species of pupfish in the park which descended from one ancestral species. The Devils Hole pupfish have smaller bodies than other species, they lack pelvic fins and are less aggressive than other pupfish species. They produce one egg per spawning, and their life span is ten to fourteen months.

Their main habitat and spawning area is a shelf that is on average approximately 42 inches below the surface of the water. This leaves the population extremely vulnerable to human disturbance. Fish population numbers have been in decline as the pumping of groundwater for irrigation and development in the surrounding area increased in the mid-twentieth century. Other factors still unknown may also have played a role, but the decrease in water levels was and remains a major threat.

The presence of water in this arid desert was attractive to ranchers and developers. As early as 1914, two ranchers expressed an interest in using water from Devils Hole. Scientists were also

interested in Devils Hole – and in 1946, they thought that it should be protected. The American Society of Ichthyologists and Herpetologists recommended that the Death Valley National Park (DVNP) extend its boundaries to ensure the protection of the fish. National Park Service (NPS) was initially not very interested in the idea, but the scientific community actively supported it. See more at <https://tinyurl.com/y7t9a53s>.

In 1950, Carl Hubbs, an Oceanography professor at the Scripps Institute, gathered support for Devils Hole's protection, and a subsequent letter campaign to influential people proved successful. In 1951, Lowell Sumner, naturalist for the Pacific Region of the National Park System, declared that it would be in the national interest that Devils Hole be protected and become a detached unit of DVNP. In January 1952, President Harry Truman signed Presidential Proclamation 2961 designating Devils Hole part of the Park.

In the 1960's, a firm owned by Francis and Marilyn Caphhart started pumping groundwater in close proximity to Devils Hole, and the water level dropped precipitously, adversely affecting the fish. Eventually the Caphharts sued the Park Service over the vitally important water rights, but the U.S. Supreme Court decided that the Park Service had senior water rights based on President Truman's proclamation.

At that point, the management of Devils Hole became an interesting challenge. In 1967, an Interagency Task Force was formed. After the early 1980's, responsibility fell upon three different agencies. NPS is the landowner providing protection for the land; the U.S. Department of Fish and Wildlife is responsible for endangered species; and the Nevada Department of Fish and Game is involved because Devils Hole is in Nevada. Their first task was to develop a recovery plan for the fish.

The pupfish are counted twice annually, once in the spring and once in the fall. This protocol was initiated in 1972 and continues to this day. In 2006 the pupfish count fell to thirty-eight when Death Valley's Superintendent, JT Reynolds at that time, decided to

develop a different management plan. Researcher Kevin Brown explained the multilevel approach, which allows for people to work collaboratively, be pro-active, and have shared authority. See more at <https://tinyurl.com/y7t9a53s>.

The first level involves field scientists who collect the information and the data upon which decisions are made. Every Monday morning, a conference call provides updates to members of the various agencies. If an issue arises that they cannot resolve or if an action needs to be taken that is potentially detrimental to the fish, it is brought to the next level which is the Management Oversight Team (MOT). After the MOT, the next decision making level consists of the agencies' Regional Directors. Mike Reynolds, Death Valley's Superintendent is a member of the MOT, and he commented that this system has proven to work very well.

Researchers have been studying the Devils Hole pupfish since the late 1960's. In the early years, the studies were more "fish-centric." Researchers monitored the fish population, studied fish physiology and reproduction, observed fish behavior, and determined what foods they consumed. These initial studies were what led to multiple but unsuccessful

breeding attempts of the pupfish in refuges. Researchers came to understand that these pupfish are not like other pupfish species which are fairly easy to breed in aquaria. This is most likely due to the specific environmental adaptations evolved over many generations.

The characteristics of the Devils Hole aquatic environment tend to remain constant. Concentrations of dissolved oxygen of the water are very low (25% O² or 2.5 mg/l), whereas other aquatic habitats tend to be 8 mg/l; the temperature of the water is 33.5 degrees C (93 degrees F); and the pH (7.0) is neutral as it is buffered by the calcium carbonate leached from the surrounding limestone. These conditions create a habitat that is intolerable for most fish species. As Kevin Wilson, NPS aquatic ecologist, explained, the Devils Hole pupfish live their lives on the very edge of their physiological tolerance.

Even more challenging conditions exist when sunlight reaches the shelf and the shallow shelf experiences a short period of super-saturated dissolved oxygen and the water temperatures exceed 35 degrees C. In the summer time this can be for up to 4 ½ hours, promoting the growth of algae,

CONTINUED ON PAGE 15



Kevin Wilson points to the Devils Hole pupfish habitat. The shelf, which is the main habitat for the fish is the area covered with green algae.

NEAL NURMI, NPS

RATTLESNAKES AND KANGAROO RATS

Predator Prey Interactions

The links in this article take you to astonishing videos that illustrate the assertions of the article. They are a must-see. They can be found in the Notes section of www.desertreport.org. – Editor

In any predator-prey interaction, the predator is attempting to subdue the prey and the prey is attempting to evade capture. Because both parties will have been shaped by natural selection to overcome the other, predator-prey interactions frequently involve extreme physical feats, including very rapid attack and evasion behaviors. As a result, it is difficult to study predator-prey interactions in the field under natural circumstances. However, we have pioneered techniques to record encounters between two common denizens of the southwest deserts: rattlesnakes and kangaroo rats. We think the strike-and-evade interaction between these animals can be a model system for using high-speed videography of free-ranging animals to understand what factors shape the outcome of predator attacks.

Rattlesnakes are ambush predators. They hunt by ‘sitting’ on the ground in a position known as an ambush coil (Figure 1), and wait patiently for potential prey, such as a kangaroo rat, to unknowingly approach. If prey come close enough, the snake launches its head forward in a very fast predatory strike. To the human eye, this strike is just a blur of motion. Whether the strike hits or misses depends on the ability of the prey to quickly detect the oncoming head

of the snake and perform an evasive dodge. A human eyeblink lasts about a third of a second (or 333 milliseconds). Striking rattlesnakes will typically move from a coil to prey contact in under a tenth of a second, so kangaroo rats have an amazingly short window in which they can escape. You might think such a quick dodge wouldn’t be possible, but

kangaroo rats pull it off.

How do they do it? Their unique morphology gives a few clues (Figure 2). First, kangaroo rats have specialized hearing (check out those huge auditory bullae!) that increase their ability to detect quiet low frequency sounds. Both the strike of a rattlesnake and the swoop of an owl are only ALMOST silent—both predators produce subtle, low frequency bursts of sound when attacking. Kangaroo rats also have unique, enlarged hindlimb muscles that allow them to perform amazing, high-powered acrobatic leaps within milliseconds of perceiving a predator’s attack. This combination of super hearing and leaping allow them to avoid a rattlesnake strike in about a quarter of the time it takes you to blink an eye (https://youtu.be/jCxvIk8wS_8)!

Kangaroo rats are so good at avoiding snakes they can appear to be cocky about it. They perform a variety of harassing displays towards snakes, including kicking sand (<https://youtu.be/>



Figure 1. A sidewinder rattlesnake (*Crotalus cerastes*) in a stereotypical ambush coil.

GRACE FREYMILLER

A human eyeblink lasts about a third of a second. Striking rattlesnakes will typically move from a coil to prey contact in under a tenth of a second, so kangaroo rats have an amazingly short window in which they can escape.

be/cLfy-M9NWbI), drumming on the ground with their hind feet (<https://youtu.be/th-TqONTy5s>), and repeatedly approaching then jumping away (<https://youtu.be/Yc-qc6wfRKs>). These behaviors inform the snake that it has been detected and display the escape ability of the kangaroo rats, which then dissuades snakes from continuing to hunt in that area.

In our first studies of rattlesnakes and kangaroo rats, we used video cameras filming at 30 frames per second (fps) to record ambush hunting sidewinder rattlesnakes (*Crotalus cerastes*) throughout the night, recording any interactions that took place with desert kangaroo rats (*Dipodomys deserti*). From the recordings, two aspects of the kangaroo rats' antipredator responses were found to drastically increase their ability to avoid rattlesnakes. First, when a kangaroo rat performed any antipredator behavior that showed it knew where the snake was hiding (such as foot drumming or kicking sand at the snake), the rattlesnake never attempted to strike the kangaroo rat, even when it came close. Thus, it looks like rattlesnakes need the element of surprise. Second, of the 23 strikes we recorded, only one strike looked like it actually hit a kangaroo rat and this kangaroo rat still survived. The strikes were unsuccessful due almost entirely to the kangaroo rats being able to

rapidly leap out of the path of the strike (<https://youtu.be/YeesFjACFJo>).

Next, we decided to measure more precisely the speed that kangaroo rats could detect and jump away from a strike. To do this experimentally, we created a fake "snake" attack using a harmless spring-propelled cork launched out of tube at about the same speed as a rattlesnake strike (~2.8 m/s; Figure 3), just like the old "snake in a can" gag! We recorded kangaroo rats jumping away from our device using a faster camera that recorded 120 fps. In our previous experiment it looked to us like kangaroo rats who were "teasing" snakes with their antipredator behaviors were more "primed" and ready to avoid a strike, so we wanted to compare jumps of "primed" kangaroo rats and to jumps from rats that were blissfully unaware anything was amiss. To create a primed rat, we placed a rattlesnake near the device and allowed a kangaroo rat to see and interact with it. Once a kangaroo rat interacted with the snake, we

removed the snake and fired the device at the kangaroo rat when it returned. The differences between primed and unaware rats was stark. Primed kangaroo rats had quicker reaction times, faster take-off velocities, and jumped more vertically relative to the ground, indicating that they could more effectively avoid the strike than control kangaroo rats (<https://youtu.be/2IfLsqyl63I>). Furthermore, for primed kangaroo rats, the reaction times were among the fastest recorded for any small mammal, with approximately one-third of individuals reacting within about 20 milliseconds! The increased performance of snake-exposed kangaroo rats is likely the reason why rattlesnakes never attempted to strike kangaroo rats that were aware of them. That said, even kangaroo rats that were not exposed to snakes exhibited outstanding physical abilities, as they reacted in less than 40 milliseconds and displaced their body from the "strike" trajectory in less than 80 milliseconds,

CONTINUED ON PAGE 22

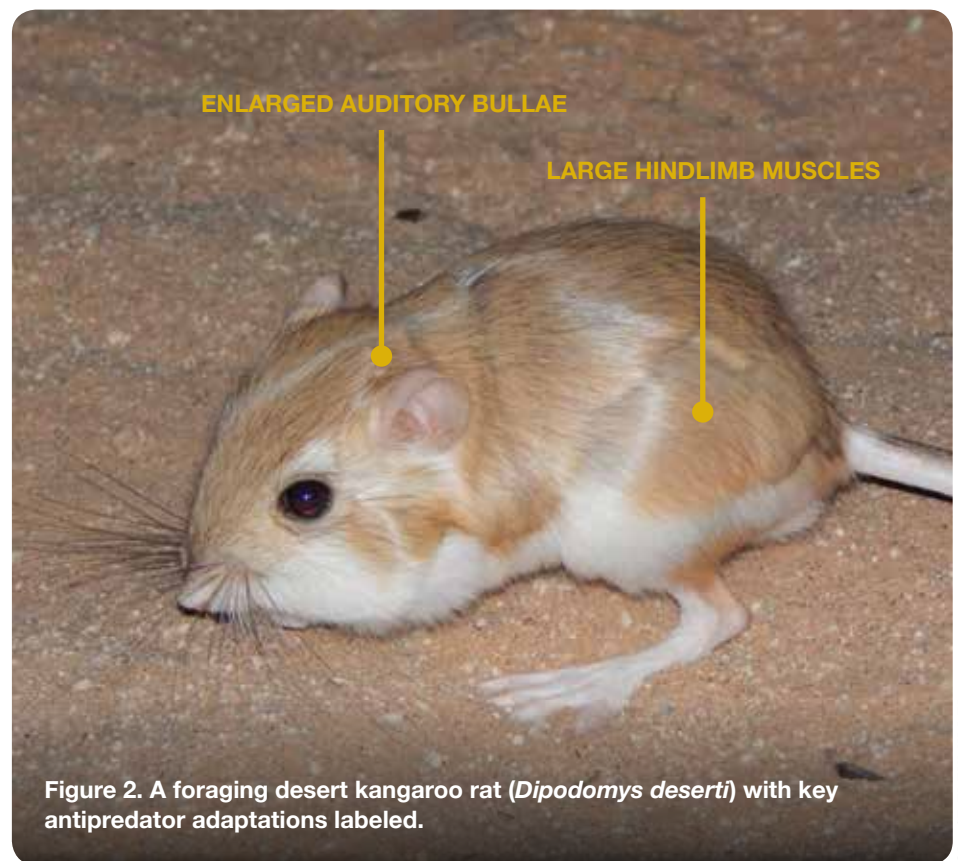


Figure 2. A foraging desert kangaroo rat (*Dipodomys deserti*) with key antipredator adaptations labeled.

GRACE FREYMILLER

PROGRESS AT THE SALTON SEA

Incremental at Best

The future of the Salton Sea in Southern California involves questions of water management, land use, and politics. At stake are significant issues of human health, wildlife habitat, and local economic concerns. The essence of the problem is that the level of the Salton Sea is falling, its salinity is increasing, and large areas of lakebed are becoming exposed along the perimeter. These problems were discussed in an article in the *Desert Report* in December 2017. The report here represents an update on efforts by the Salton Sea Task Force (SSTF) and the State Department of Water Resource (DWR) to implement a solution. Sources for this information are 1) a public meeting held on November 13, 2018, in Coachella, California, by the Salton Sea Task force, and 2) the very extensive website of Salton Sea Management Program (<http://resources.ca.gov/salton-sea>).

Before discussing specific restoration projects that are underway, there are several general items to report. The California Department of Fish and Wildlife (CDFW) has recently conducted a survey of fish-eating birds at the Salton Sea and has also attempted to monitor the population of tilapia, the only species of fish still viable in the lake. (<https://tinyurl.com/y7jsrf9z>.) The bird surveys were done from airplane overflights and were therefore limited to the large species. The results indicate that numbers of both brown pelicans and white pelicans are far down from previous years. Double crested cor-

morants are also down, although this summer they recovered slightly. These results correlate with the fact that tilapia numbers, which were estimated by gill netting (catch and release) at specific locations, are also at all-time lows. This data is obviously discouraging.

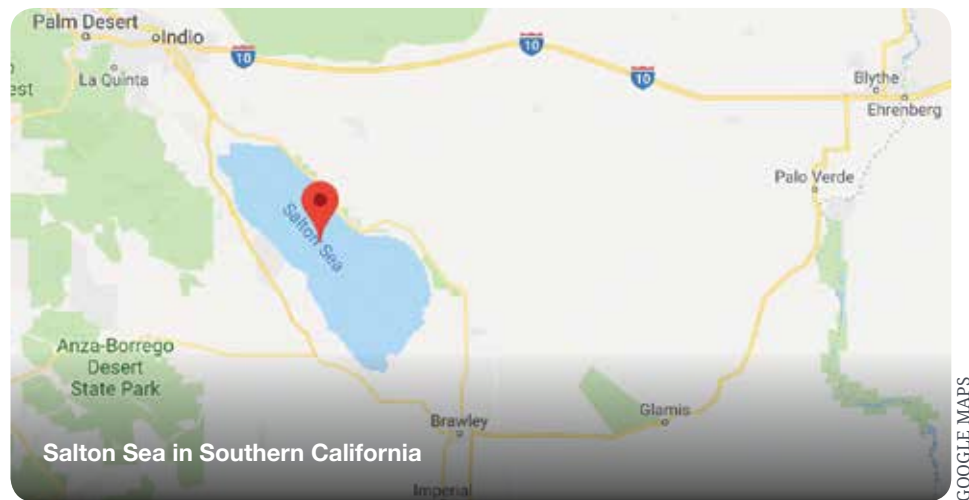
Surveys done by Audubon substantiate these results and also indicate a precipitous decline in numbers of grebes. More positively, the Audubon survey suggest that shorebird numbers were only slightly altered in the last year. This may be related to large increase in numbers of insects that were reported anecdotally.

The most significant observation to be made about progress at the Salton Sea is that with the management plan well into its second year, it is already far behind its promised schedule. This is in

part the result of a conscious decision to conduct planning for several projects in concert, now grouped and known as the Species Conservation Habitat (SCH), rather than pursuing them one at a time. This means that more time passes before construction is begun on any one of them. It is expected, perhaps hoped, that this will allow the last of the projects to finish ahead of schedule, and in any case should prevent some duplication of effort and thereby create some monetary saving.

A second cause of delay has been difficulty in obtaining easements and permits. The habitat projects involve creating wetlands and/or small ponds, and many of these are to be created on privately owned lands. Much of this land is owned by the Imperial Irrigation District, and questions about future liability have been difficult to resolve before the necessary permissions are given. Additionally, several endangered or threatened species (pupfish and several species of birds) are found on lands in question, and therefore consultation with several agencies, including federal and state Departments of Fish and Game, are required by law. Nothing is as simple as it might seem.

With the delay in implementing the larger management plan, several specific and smaller projects have been initiated. Within the larger (consolidated and delayed) SCH project is a smaller area, parcel 10, which is extremely emissive. The DWR is preparing to treat



this area for suppression of windblown dust with one of several relatively inexpensive measures: surface roughening, furrowing, and/or vegetation enhancement. While it is expected that the area will eventually be submerged as part of a wetland habitat, it is thought that temporary relief from windblown dust is warranted. Work here may begin in 2019. The second of the immediate efforts is known as the Alcott project, located slightly north of the Red Hill Bay Marina. Control Thermal Resources has leased a part of this land for geothermal exploration and is cooperating with the DWR to facilitate the construction of shallow ponds surrounding the industrial site. A favorable attribute of this project is that water will be supplied by several agricultural drains. The drain water can not be easily transported to other project areas, and water delivered from the Alamo River can not be sent to this site inexpensively.

A last specific project to mention occurs at the north end of the Salton Sea. As originally envisioned, wetlands would be created on parts of the exposed playa there, and waterless dust control measures would be used in other places. At the urging of several citizen groups and with approval of the Riverside Board of Supervisors, several more ambitious plans have been proposed that would create a relatively fresh-water lake at the north of the Salton Sea, separated from the rest of the Salton Sea by a berm or dyke. Obvious problems include cost for construction and the quantity of water available for such project. Currently the DWR is considering five alternatives for the north end to be included in the ten-year planning model. The more ambitious of these would certainly require coordination with the longer term proposals for the Salton Sea.

On December 8, 2017, the Salton Sea Task Force published a request for proposals for the long-term management of the Sea. The proposals were required to address a number of very specific issues: feasibility, water sources, land use, environmental impact, cross border cooperation, and several others. Eleven proposals were submitted and were reviewed

by a subcommittee of the Long Range Planning Committee of the Task Force. Three of these were recommended for a more careful engineering review that will be conducted by TetraTech, the current contractor for some parts of the present Ten Year Plan.

One proposal, called the *Bi-National Canal for Salton Sea Restoration and Colorado River Augmentation*, envisages a single canal bringing 2.3 million acre feet of water per year (AF/Y) from the Sea of Cortez to the Salton Sea. A desalination plant on the east side of the Sea would treat 1.8 million AF/Y for delivery to Coachella Valley Water District and Imperial Irrigation District for agricultural use. The projected constructions

costs were estimated to range between 3 and 6 billion dollars. Using the desalination plant, the salinity of the Salton Sea could be maintained at a desired level although means of disposal of the concentrated brine was not specifically addressed.

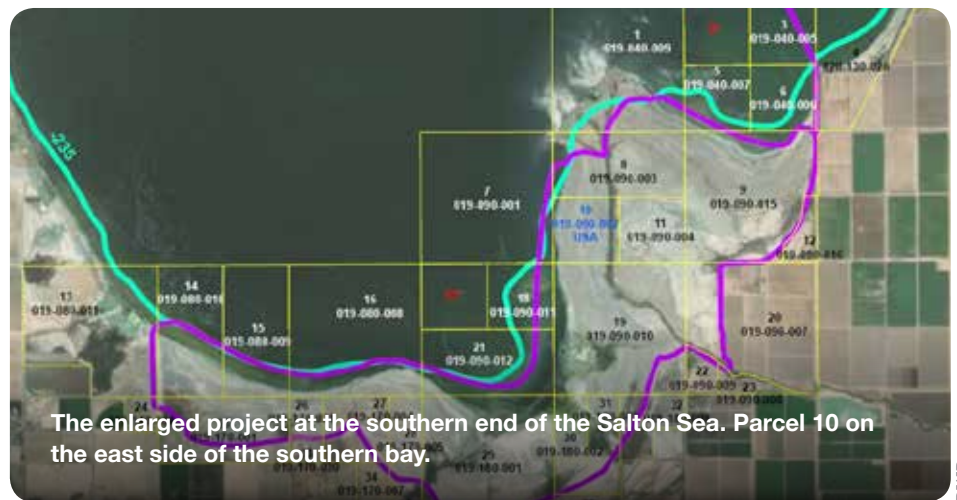
The second of the selected proposals was called the *Salton Trough Interconnection Project*. Groundwater would be obtained from saltwater wells in Mexico supplied by the Sea of Cortez. There would be a canal bringing this water to the Salton Sea with a parallel pipeline to return brine produced by desalination plants in the United States. Construction costs were estimated at 8 billion dollars.

CONTINUED ON PAGE 15



Site of the Alcott project north of the Alamo River. The three drains that will supply water are marked.

DWR



The enlarged project at the southern end of the Salton Sea. Parcel 10 on the east side of the southern bay.

DWR

A COMMUNITY PROPOSAL

CONTINUED FROM PAGE 1

reason why BLM has not moved forward with its work on a management plan, despite the fact that the Presidential Proclamation requires it to be completed by February 2019. Perversely, Secretary Zinke has prioritized the updating and creation of management plans for areas that have high potential for mineral extraction and for oil and gas leasing, and he has been ignoring other areas – even those having management planning already in motion when he was appointed. Given that a monument management plan would provide protections for the resources for which the monument was designated, rather than provide opportunities for extractive uses, it is not likely that the Administration will begin preparing a management plan for Mojave Trails any time soon.

Earlier this year, a coalition of most of the organizations that worked to have the desert monuments designated began discussing the possibility of preparing a community proposal for a management plan for either Mojave Trails or Sand to Snow. The coalition, which included CalWild and Conservation Lands Foundation, decided to prioritize Mojave Trails

because it is more threatened than Sand to Snow. (Threats include the monument review, the Cadiz water mining project, and a potential amendment to the Desert Renewable Energy Conservation Plan.)

The best way to protect lands is to unite community efforts in a common vision to influence BLM. Since it is not likely BLM is going to prepare a monument management plan any time soon, the coalition will prepare an alternative to guide the future planning effort. Once BLM is ready to begin its own planning process for Mojave Trails, the Community Alternative will need to be considered along with the agency-created alternatives. This should facilitate the agency's community engagement, and also provide better protections for the resources of the National Monument.

The planning group met in person for the first time this summer. Subgroups were formed, based on priority issues as well as participants' areas of expertise and interest. At this point, the subgroups are as follows: communications and outreach, mapping and zoning, functions and systems, tribal engagement, and travel planning. The work

products of these groups will be incorporated through regular working sessions into a draft Community Alternative Plan. Once in a shareable format, the coalition will begin outreach to local stakeholders to seek additional input to refine the ideas presented. With this outreach and input, the coalition hopes to put together a plan for Mojave Trails that reflects and addresses the entire community's ideas and concerns in spring 2019.

Linda Castro is the Assistant Policy Director for the California Wilderness Coalition (CalWild). She's a recovering attorney who doesn't miss her old job and who loves working to protect and conserve California's wild places.

Frazier Haney is the Associate Southern California Director for the Conservation Lands Foundation. He currently serves on the Bureau of Land Management's Desert Advisory Council as the Environmental Protection representative, and is a volunteer board member for The Wildlands Conservancy. Frazier lives in Joshua Tree, CA with his wife Jamie and their daughter Lily.

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Entry portal for the Mojave Trails National Monument

KYLE SULLIVAN, BLM

SALTON SEA

CONTINUED FROM PAGE 13

Although the initial investment would require borrowing money, the plan proposes to retire the loans by selling the desalinated water, some for agriculture and some to the State of California for the Salton Sea.

The third proposal, called the *Salton Sea Water Importation Project*, offers three alternative routes for bringing water from the Sea of Cortez to the Salton Sea. No desalinization is proposed, but instead the plan calls for a perimeter lake filled with sea water from the canal. It would be separated from a deeper, central lake by an extensive berm. As the perimeter lake became more saline, its water would be transferred to the central lake which would become increasingly saline and would eventually resemble the Dead Sea. If after 40 or 50 years, this central lake became problematic, desalinization could be considered at that time. **Exclusive of the cost of building the berm**, the expenses range from 1.4 to 3.4 billion dollars depending upon the route chosen and the number of lines built.

It should be obvious that only concepts have been outlined here and that approval and detailed planning of such a project will be very, very involved. The Salton Sea Task Force will evaluate these in the next two years in order to make some sort of recommendation. These proposals can all be reviewed online.

The one absolute conclusion from all this is that managing the Salton Sea, either short or long term, is an immense and extraordinarily complicated problem. The process bears watching by the public. If it proceeds too slowly, we suffer health consequences and lose species. If it proceeds too rapidly, serious errors will become inevitable. It is possible to follow progress rather carefully. (<http://resources.ca.gov/salton-sea>) This website also announces public meetings where reporting is done orally and limited questions from the public can be entertained. The work is too important to be left entirely to the “professionals.”

Craig Deutsche is managing editor of the Desert Report and has been closely following developments at the Salton Sea for several years.

DEATH VALLEY'S DEVILS HOLE

CONTINUED FROM PAGE 9

whereas the water is clear in the winter time. The characteristics of the water as well as the physical environment were meticulously replicated when the breeding refuges were built, but these efforts were to no avail.

Researchers and managing agencies faced another challenge when the Devils Hole pupfish population declined in the late 1990's. Since this time the decline was not linked to lowered water levels, this shifted the research from “fish-centric” towards a more holistic ecosystem approach. Researchers began to study both biotic (biological) and abiotic (physical) factors to gain a better understanding of the many different considerations that are involved.

The first ecosystem research was conducted between 1999 and 2001 by Kevin Wilson and Dean Blinn. This study developed the foundation for the long-term ecosystem monitoring that continues to take place at Devils Hole. The various studies that have been done subsequently, as well as the data collected through ongoing monitoring, provides management with the information needed to make science-based decisions to protect the Devils Hole pupfish and

the unique ecosystem that they reside in.

A great deal still remains to be learned. Three NPS scientists, Kevin Wilson, Jeff Goldstein (Fish Biologist), and Ambre Chaudoin (Fish Biologist Technician) continue to study these fish and their ecosystem with the aid of an up to date monitoring system.

And the latest news on Devils Hole? Kevin Wilson is delighted to report that the most recent fish count in October 2018 was 187, the highest count since 2004.

Birgitta Jansen has volunteered in Death Valley National Park since 2008. Currently she and her husband, photographer Neal Nurmi, are working together documenting Death Valley's backcountry cabins and other structures.

Jeffrey Goldstein has worked with a number of desert fishes in southern Nevada and California since obtaining his masters degree in 2007 from UNLV. He has been working closely with the Devils Hole pupfish since 2011 and has been the fisheries biologist and park dive officer for Death Valley National Park since 2015.



Devils Hole pupfish!

PHOTO COURTESY NPS

COUNTING SHEEP

An Iconic Animal on the Edge of Survival

All six of us clamored around three spotting scopes. We were at Anza Borrego Desert State Park in Borrego Springs, California, looking for elusive bighorn sheep during the annual July count.

“There’s a white butt,” Angelica, the recent biology graduate, excitedly exclaimed. Some shared the scope, and the rest of us lifted our binoculars, scanning the mountainside. There were four adult bighorn ewes and one yearling with small horns. We got out our data sheets and noted the time, number, and sex of the sheep.

There were about 75 of us scattered across the 600,000+ acre state park – the largest in California, and the second largest in the nation. We hiked through rugged canyons to palm oases in this varied landscape of badlands, unique geologic features, paleontological resources, and incredible dark skies. The mid-afternoon temperatures rose to over 100 degrees Fahrenheit, so we packed in a couple of gallons of water and electrolyte tablets and did our best to find shade. But the nights were temperate.

A week before the sheep count, biologists, Mike Puzzo, Janene Colby, and Mark Jorgensen spoke to us about the threats to bighorn sheep and the importance of this annual count. Anza Borrego Desert State Park Ranger Mike Puzzo emphasized the importance of this volunteer sheep count for collecting data on the endangered peninsular bighorn sheep. These sheep range from Mt. San Jacinto near Idyllwild, California, to the

distant south Peninsular Ranges of Baja California. Habitat fragmentation by freeways, along with disease transmitted from livestock and habitat loss due to housing developments, have contributed to their struggle for survival.

In particular, a deadly pneumonia that is transmitted from domestic sheep has had a devastating impact on bighorn sheep populations. According to environmental scientist Janene Colby, pneumonia can result in lamb mortality even if it does not kill adult sheep. She added, “We as Americans must decide if we

value wilderness. We all love to recreate – me included. For us, wilderness may be an escape or a place to connect with nature. For wildlife, it’s their home.”

I thought about Janene’s statement and the threats to bighorn sheep and other vulnerable wildlife. During the holidays in December, Janene is not sitting by a warm fire with family and friends, but filming mountain lions caching and feeding on bighorn sheep. She showed a video that she filmed of a mountain lion burying a sheep kill under twigs and brush, and then returning to feed off it. At times, the mountain lion looked directly into the camera. Janene mentioned that in all of her years tracking mountain lions she has never felt threatened, even though the cats are well aware of her presence. “People want to blame mountain lions for the demise of bighorn sheep,” she said, “but this is part of nature. Humans pose a far greater threat to the survival of bighorn.”

The passion of Janene and the other presenters was infectious. Mark Jorgensen, former superintendent of Anza Borrego Desert State Park, has dedicated his life to studying bighorn sheep, and he remembered visiting the park as a



Peninsular bighorn sheep in Anza-Borrego State Park

HILARY CLARK

child. Jorgensen noted that the peninsular bighorn sheep were rebounding in the park. Park managers work with local ranchers to remove livestock from sheep habitat. Staff have also taken out invasive and water-consumptive tamarisk trees to help with spring restoration, an essential water source for bighorn sheep.

All of us listened intently to Jorgensen as he spoke about the natural history of desert bighorn, which he wrote about in his work “Desert Bighorn Sheep – Wilderness Icon.” Fossil evidence suggests that ancestors of modern bighorn crossed over the Bering Land Bridge, which connected the continents of Asia and North America from about 75,000 to one million years ago. Today, biologists estimate that there are 3,000 to 5,000 bighorn sheep in California.

Jorgensen explained that sheep develop horns composed of keratin, the same material as our fingernails. As they age, they grow horns that will develop rings for each year of life, similar to growth rings around a tree. Male bighorns or rams will develop heavy horns that curl with age, whereas females or ewes will have thinner, less-pronounced horns. Both rams and ewes will use their horns to break open cacti to get at the succulent and nutritious pulp. Rams will butt and lock horns in an attempt to demonstrate their physical prowess to ewes, who reach mating age at two years old. We learned that at the age of two, ewes come into estrus in July in the low deserts, and in August at the higher elevations. Even in favorable conditions, a bighorn lamb has a less than 50 percent chance of surviving its first summer. If a lamb is fortunate enough to survive into adulthood, it will have an average lifespan of ten to fourteen years.

In addition to the threats of disease and predators, freeways sever wildlife corridors for bighorn sheep and can prevent them from breeding with other populations to create a strong gene pool. Scientists posit that the interbreeding of different bighorn populations could increase their immunity to certain diseases. Through extensive research and ongoing projects, scientists hope to remove barriers and obstacles to big-



A young peninsular bighorn

HILARY CLARK

horn sheep connectivity, for instance by modifying underpasses to create wildlife corridors.

Jorgensen and other scientists spoke about the threat of climate change and its uncertain impact on bighorn sheep. The drying of essential water sources is one obvious effect. However, a more insidious threat is that drought conditions can adversely affect the nutritional value of plants and diminish water quality. John Peterson, a hydrogeologist, notes that there is a scientific trend between water quality and drought, based on three years of water data samples taken at Anza Borrego Desert State Park. He notes that “with a few exceptions the best water quality was measured during the wet year (2016-2017) and the worst quality in the driest period (2017-2018).”

Scientists do not know how water quality impacts sheep, or even how much access to water they need. National Park Service wildlife biologist Bill Sloan notes: “Pregnant and lactating ewes need to drink much more frequently, several times a week. Male sheep inhabiting dry ranges have occasional access to water from snow or rain to replenish their supply, but their moisture needs could be supplemented

by cacti and succulents. A lot of numbers are bounced around as educated guesses, but the actual time without drinking has not been conclusively documented to my knowledge.”

In my three days of counting sheep, I thought about all that I had learned from those who have dedicated their lives to studying wildlife. In all, 225 bighorn sheep were observed during this 48th year of the annual count.

One volunteer, whose day job is working as a wildlife nutritionist at the San Diego Zoo, summed up the group consensus: “In all the years volunteering to count sheep, I never tire of it. It gives me satisfaction knowing the data we collect can help scientists better understand and protect these special animals.”

If you are interested in volunteering for the sheep count or learning more about Anza Borrego Desert State Park, please visit: www.parks.ca.gov/anzaborrego

Hilary Clark is an avid outdoor and public lands enthusiast who has worked out west as an environmental educator. She lives in the Mojave Desert and enjoys hiking, biking, and kayaking in her free time.

DESERT UPDATES

Death Valley Burros Heading to New Homes

The National Park Service and Peaceful Valley Donkey Rescue have signed a 5-year project agreement to capture and remove up to 2,500 burros from Death Valley National Park. The Death Valley work is part of Peaceful Valley's larger Wild Burro Project, which also includes burro relocations from Mojave National Preserve, NASA Goldstone Deep Space Communications, Fort Irwin National Training Center, and China Lake Naval Weapons Center. Mike Reynolds, Superintendent of Death Valley National Park, has said, "The National Park Service goal is to not have any nonnative burros in Death Valley because they are extremely destructive to fragile desert springs and vegetation. They compete with native animals, like desert tortoise and bighorn sheep for resources, and have a devastating impact on the park." This is different from the management goals of the Bureau of Land Management, which is mandated by Congress to maintain a healthy – but not excessive – population of burros. There will continue to be opportunities to see wild burros in other areas near Death Valley National Park. For more information about Peaceful Valley Donkey Rescue visit (<https://donkeyrescue.org/>).



Two wild burros in Death Valley National Park

MARK MEYERS, PEACEFUL VALLEY DONKEY RESCUE

Recognition for Jason Hashmi

The thirteen chapters of the Sierra Club in California have together given Jason Hashmi its Dan Sullivan award for 2018. This recognizes service to environmental work that is in support of the more visible efforts of officers and activists of the Club. Jason is a professional graphic designer, who for over fourteen years has done design and layout for the *Desert Report*. His service is invaluable. When I (editor) explain to people that the publication is done entirely by volunteers, they frequently express amazement. Sierra Club California gives four major awards each year, and it is gratifying that one our desert advocates has been appropriately recognized.

Closure for Vandalism at the Devil's Hole

On October 25, 2018, U.S. District Judge Andrew P. Gordon sentenced Trenton Sargent to twelve months and a day in prison and three years of supervised release. He was the third participant in the vandalism of the Devil's Hole pupfish habitat which occurred on April 30, 2016. All three pleaded guilty to charges which included damage to locks, the security system, scientific monitoring equipment, several signs, and violation of the Endangered Species Act. The other two, Edgar Reyes of and Steven Schwinkendorf, agreed to pay \$5,622.83 in restitution and were each sentenced to one year probation. Sargent received a more severe sentence as he had stepped into the water, and in doing so, he smashed pupfish eggs and larvae pupfish on the shallow water shelf of the pool. The Devil's Hole is a disjoint branch of Death Valley National Park, and it is the only natural habitat of the critically endangered Devils Hole pupfish (*Cyprinodon diabolis*).

Small Planes in Death Valley National Park?

Death Valley National Park's Chicken Strip is famous among recreational pilots for its dramatic desert scenery and the challenges it poses to small plane pilots. This airfield is an unpaved landing strip near Saline Valley Warm Springs that has been in use for decades. However, when the area was added to Death Valley National Park in 1994, landing at the Chicken Strip became a non-enforced violation of National Park Service (NPS) regulations. Now the NPS is planning to remove the irregularity.

“This proposed special regulation is really a deregulation,” explained Mike Reynolds, Death Valley National Park Superintendent. “It would remove any question about the legality of the airfield’s use by visitors. We believe this is a common sense approach that corrects a regulatory technicality.”

The Chicken Strip has been used by an average of 88 planes per year recently. Some pilots use it to access the nearby Warm Springs. Others are drawn by the challenge of the airstrip itself. Volunteers with the Recreation Aviation Foundation (RAF) maintain the airstrip at no cost to the taxpayers. “The RAF and the NPS have been successfully partnering for nearly ten years to make access to [the Chicken Strip] safe and available to the aviation community,” RAF board chairman John McKenna said.

Monitoring Planned for Desert Bighorn Sheep

The California Department of Fish and Wildlife (CDFW) has proposed to study and monitor desert bighorn sheep (*Ovis canadensis nelsoni*; hereafter DBS) populations throughout the California Desert District to collect the data needed to develop effective management strategies to ensure the survival of DBS. This proposal does not include the peninsular population of desert bighorn sheep, which is federally listed as endangered and covered under a Programmatic EIS.

The CDFW has proposed using helicopters to facilitate capturing, disease testing, genetic sampling, and collaring of DBS, as well as assisting in temporary camera installations. This method would require capture specialists to net-gun DBS from helicopters and would require brief helicopter touchdowns in Wilderness. The touchdowns would be to both drop off and retrieve personnel or to transport sheep to basecamps outside of Wilderness. The nature of the data collected, the methods, and the purpose would be similar to those reported for another study in Death Valley National Park (*Desert Report*, March 2018). CDFW proposes placing remote cameras at water sources during the hot summer months that would enable the CDFW to track the lambing status of marked individuals and collect demographic data (age and sex ratios) in ranges that meet the criteria to do so. The placement of some of these cameras would be in Wilderness.

Each year CDFW plans to capture no more than 80 DBS total across all ranges and land types including wilderness and will capture no more than 15 individuals in any one range. The exact capture locations are undetermined until aerial surveillance occurs and identifies a target animal. The captures are proposed to occur in October and November, and the study is expected to last five years.

The BLM will determine what action is necessary to preserve wilderness character through Minimum Requirements Analysis. Additionally, the BLM will proceed through the NEPA process analyzing the proposed action, range of alternatives, and cumulative effects. This notice is for disclosure purposes; specific comments may be directed to:

Leigh Karp, BLM California Desert District
22835 San Juan De Los Lagos, Moreno Valley, CA 92553
lkarp@blm.gov



Several organizations have made significant contributions for the printing expenses of *Desert Report*.

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REARRANGING THE PLANET TO SAVE IT

CONTINUED FROM PAGE 7

that almost contravene their claim to efficient and sustainable energy production. We know that the Ivanpah Bright-Source Solar Electric project incinerates many birds – called “streamers” – in its mirrored beams of light, perhaps as many as 1,500 to 3,500 per year or maybe even tens of thousands more, from preliminary estimates. Wind turbine farms, such as the vast one in the low hills and mountains west of the Mojave desert floor, may kill 300,000 birds per year – but again, in a grim calculus, not as many as the more than 500 million that collide with radio and cell towers and with glass in low-rise buildings. Although these tallies of “externalities” are somewhat contested, few biologists or environmental groups protest strongly – the obvious reason is the hoped-for global environmental benefit of these “green” installations.

Both the power tower systems and the solar panels need two other crucial components – towers and transmission lines. With new towers, ravens have new perches and can now better spy baby tortoises on the ground, so that their carcasses litter the bases of the towers. Ravens are native to this area and are protected from population control measures, but they are thriving at the expense of another native animal because of our interventions. Some have suggested the introduction of falcons to keep the ravens in check, but then we invoke the unforeseen Gordian knot-tangles of our techno-intrusions, well-intentioned or not. Redesigning the desert for our energy needs provokes a gaggle of new, hard-to-mitigate consequences.

And then we learn that the U.S. Marine Corps has annexed a very large area of BLM desert land for their Twenty-nine Palms Air Ground Training Program, and following the lead of the power companies, is also removing tortoises, but to make way for expanded military exercises. The justifications for such use lie in increased security from coordinated training on a large scale. But we must consider that droughts from climate change likely contributed to the collapse of millions of Syrian farms – a collapse that can be connected

Trade-offs abound. Are we willing to admit and tolerate them? Even if they might have been unnecessary to begin with?

to military conflicts in the Middle East. Although this connection would be a rationale for producing lots of alternative energy, to forestall social disintegration anywhere around the globe, the fighting of wars generates vast amounts of carbon dioxide, through air, land, and sea maneuvering and combat itself. The military practice operations in the Mojave might generate more carbon dioxide than nearby alternative energy projects can offset. Cutting back on both total fossil fuel and alternative energy use, and leaving alone the inconveniently-in-the-way tortoises, might ultimately save nations, lives, farms, and tortoises to boot.

So are we sanguine about these uses of the desert and further disruptions of its crucial species? How might we calculate that? At what point do the biologists hired to locate and extirpate the tortoises from their burrows begin to balk? At what point does the public begin to see the desert as a necessary – and beautiful – part of Earth’s ecosystems, its own kind of nature “reservoir,” and its tortoises as not expendable?

The obvious “moral” here is that any technology designed to save the Earth as a whole might seriously damage an individual species or habitat. Our newly reconfigured global ark, possibly segregated into our domain and nature’s, cannot take all aboard; indeed we tacitly concur that some may have to be thrown overboard or left to languish in resettlement zones, while others luxuriate in verdant preserves. Trade-offs abound. Are we willing to admit and tolerate them? Even if they might have been unnecessary to begin with?

There may be better ways that are not too far-fetched or distant. There are proposals to outfit every rooftop in America not with solar panels and their sprawling infrastructures, but with solar shingles that generate electricity to each individual house. And yet, I ask, What new disturbances will these visionary strategies invoke? What new creatures will suffer from our eagerness to save the planet from our old technology through the new? Why do we always rush to a new technological solution to our environmental woe, when the previous, once-new technology kickstarted the problem? These questions are difficult to answer in our rush to stave off ecological crisis.

Perhaps more to the point, what are we willing to sacrifice in our own lives to save the planet from ruin? If we are, as Wilson claims, rational creatures with the will and capacity for technological solutions to our environmental crisis, I hope we can also employ our ethical and imaginative intelligences to make those solutions compatible with terrains and creatures we have unfortunately viewed as expendable. Can we consume less, live on a smaller scale with less development, and not think first about what biome or creature has to make way for our seemingly beneficial technological innovations? Might we actually implement true sustainable ways of living – use only renewable resources, nothing toxic, with no loss of biodiversity? That advance might take more wisdom than we – Homo sapiens, though still something of an apex species – currently seem to have.

A bibliography for this article can be found online at www.desertreport.org by clicking on the “Notes” section.

Robert Louis Chianese is an emeritus professor of English at California State University, Northridge, a 1979 Mitchell Prize Laureate in Sustainability, a Fulbright Senior Specialist, and Past President of the American Association for the Advancement of Science, Pacific Division (2012), the only humanities professor selected in its 100-year history.



OUTINGS

California & Nevada Regional Conservation Committee Desert Committee

Sierra Club outings are open to non-members, unless otherwise noted. Participants are required to sign a standard liability waiver at the beginning of each trip. To read the Liability Waiver before you choose to participate, go to <http://www.sierraclub.org/outings/chapter/forms/>, or call 415-977-5528 to request a printed version.

For any questions concerning an outing, contact the leader. For questions about Desert Committee outings in general, or to receive the outings list by e-mail, please contact Kate Allen at kj.allen96@gmail.com or 661-944-4056. For the most current listing, visit the Desert Report website at www.desertreport.org and click on outings.

The Sierra Club California Seller of Travel number is CST 2087766-40. (Registration as a seller of travel does not constitute approval by the State of California.)

SIERRA CLUB LEADERS: Would you like to see your desert outings in the Desert Report? If you have a day hike, a multiday service trip or backpack planned for this winter or spring. Please send a write up to: Kate Allen, kj.allen96@gmail.com by February 15th and it will run in the March issue.

CAMPING AND HIKING IN DEATH VALLEY NATIONAL PARK

February 25-28, 2019

Monday-Thursday

On Monday we will meet at noon at the Panamint Springs Campground (\$10. per car) on Hwy. 190 just off Panamint Valley Road. In the afternoon we will hike to Darwin Falls. Tues. we will move to Mesquite Springs Campground and hike the rim of Ubehebe Crater. Weds. we will hike Titus Canyon and return to camp. Thurs. we will pack up and go to the Mesquite Dunes for a morning hike on the dunes before heading home. All hikes will be at a leisurely pace. For reservations contact Carol Wiley at earthlingwiley2000@yahoo.com or call 760-245-8734. Mojave Group/ CNRCC Desert Committee

AFTON CANYON OUTING

March 12-14, 2019

Tuesday-Thursday

Afton Canyon is in the new Mojave Trails National Monument and we will camp both nights in the campground near the Mojave River. We will meet on Tues. at noon and hike up one of the side canyons in the afternoon. Wednesday we will hike the Afton Canyon to some interesting sites and Thurs. morning hike to an area of hoodoos. Hike will be at a leisurely pace. For reservations contact Carol Wiley at earthlingwiley2000@yahoo.com or 760-245-8734. Mojave Group/ CNRCC Desert Committee

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SALT TRAM PROTECTION PROJECT

Various dates from November to March
Come help Marty Dickes, Wilderness Coordinator for the Ridgcrest BLM with a project to protect the historic Salt Tram in the Inyo Mountains from fire damage.

The Saline Valley Salt Tram was built in 1912 to transport salt 13.4 mi. over the Inyo Mountains to the Owens Valley. Last used in 1935, its wood towers and steel machinery remain today as a National Register Historic Site. Small trees have taken root near the tram towers, making them susceptible to destruction in a wildfire. With a BLM crew, volunteers will help establish firebreaks around several of the structures. The group will carpool to the Inyo crest in 4WD high-clearance vehicles for a two-night car camp at 8,700'. Volunteers will reach the work sites on foot and use hand tools to remove small pine trees. This promises to be a rewarding experience in one of the most awe-inspiring places in the desert. For dates and details contact Marty Dickes: mdickes@blm.gov, 760-384-5444.

JOIN US ON THE DESERT FORUM

If you find Desert Report interesting, sign up for the CNRCC Desert Committee's e-mail Listserv, Desert Forum. Here you'll find open discussions of items interesting to desert lovers. Many articles in this issue of Desert Report were developed through Forum discussions. Electronic subscribers will continue to receive current news on these issues — plus the opportunity to join in the discussions and contribute their own insights. Desert Forum runs on a Sierra Club Listserv system.

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Just send this e-mail:

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By return e-mail, you will get a welcome message and some tips on using the system. Questions? Contact Cal French, cal.french@gmail.com (805) 239-7338



RATTLESNAKES AND KANGAROO RATS

CONTINUED FROM PAGE 11



Figure 3. A desert kangaroo rat leaping in response to the rattlesnake strike simulator (RSS). Note: the black marking on the hindquarters is from fur dye and is not a coloration typical of kangaroo rats.

GRACE FREYMILLER

indicating that both control and primed kangaroo rats are elusive prey for snakes.

Although these studies were highly informative they didn't tell us why some kangaroo rats dodge the strike and others end up in snake stomachs. We have some guesses but we needed to be able to look more closely at the details of the strike and jump movements. Our current work is designed to provide insight into which, if any, of these hypotheses are supported by field data from actual encounters. With this goal in mind, we are deploying high-speed video cameras filming at a much higher frame rate (500 fps) to record natural interactions between rattlesnakes and kangaroo rats. By filming interactions simultaneously with two cameras, we can calculate the three-dimensional movements of both species and extract the velocity, acceleration, and reaction times of both parties. Although simple in principle, this is logistically difficult to execute under

field conditions. We must track snakes in the desert at night, and then carry about 300 pounds of camera gear to wherever we find them hunting, which is often many kilometers from the nearest road. And then, after making this haul, more often than not no encounters occur, and we end up walking the camera gear to another snake. So, we're still gathering the requisite data to test our ideas, but you can at least see some examples from our high speed cameras at our YouTube channel (https://youtu.be/jC xv1k8wS_8).

Malachi D. Whitford and Grace A. Freymiller are currently doctoral students in ecology and evolutionary biology at San Diego State University and are advised by Rulon W. Clark. Our research focuses on the interface of behavioral ecology and biomechanics of predator-prey interactions and we employ primarily field-based techniques to better understand how animals interact in nature.

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To receive *Desert Report* please see details on the back cover. Articles, photos, and original art are welcome. Please contact Craig Deutsche (craig.deutsche@gmail.com, 310-477-6670) about contributions well in advance of deadline dates: February 1, May 1, August 1, and November 1.

OUR MISSION

The Sierra Club California/Nevada Desert Committee works for the protection and conservation of the deserts of California, Nevada, and other areas in the Southwest; monitors and works with public, private, and non-profit agencies to promote preservation of our arid lands; sponsors education and service trips; encourages and supports others to work for similar objectives; and maintains, shares, and publishes information about the desert.

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From community issues and action to lobbying on a national level, membership helps you take action on many issues. As a member, you'll have opportunities to get involved with local chapters, as well as be part of a large national network of environmental advocates. Your voice will be heard through congressional lobbying and grassroots action. www.sierraclub.org/membership

NEXT DESERT COMMITTEE MEETINGS

WINTER MEETING

Feb. 16 & 17
2019

This will be in the Shoshone Flower Building. The co-chairs will be Terry Frewin & Anne Henry

SPRING MEETING

Date, Location, and Chair to be determined

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