

SDNHM Field Report: Grinnell Resurveys in Joshua Tree National Park

Lori Hargrove, Philip Unitt, Drew Stokes, Scott Tremor, Lea Squires

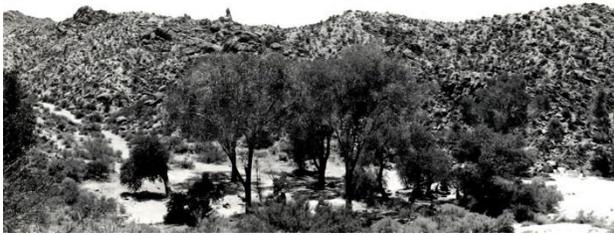
31 December 2017

Since our last report in May, our team from the San Diego Natural History Museum has surveyed five sites in Joshua Tree National Park in addition to the four on which we reported earlier. Four of the surveys encompassed both birds and mammals (Cottonwood Spring, 12-16 June 2017; Black Rock Spring, 10-14 September 2017; Upper Covington Flat, 15-18 September 2017; Stubbe Spring, 1-7 October 2017), while one focused on mammals alone (Pinto Basin, 16-20 June 2017;). All of these sites had been surveyed from 1945 to 1953 by biologists from the Museum of Vertebrate Zoology, University of California, Berkeley, as summarized by Alden H. Miller and Robert C. Stebbins in the book *The Lives of Desert Animals in Joshua Tree National Monument*.

Cottonwood Spring remains an important oasis, offering wildlife a reliable source of water, even if less copious than described by Smeaton Chase in 1919 in his book *California Desert Trails*. Water remains available at Stubbe Spring, but not at the rate of flow of about 2 quarts per minute estimated by John R. Hendrickson on 6 September 1950. No longer is there a tank with water about 4 feet deep. At Black Rock Spring, in 1946 Stebbins noted two natural pools 1 to 2 feet in diameter and 2 to 6 inches deep, as well as water in a trough made from an oil drum. But in 1953 a park employee told him there had been no water for the past three years. In September 2017 we found no water that birds or mammals could drink, only a damp spot at the base of a rock, attracting bees. The vegetative cover around all three springs is still substantial, in some views even thicker than in photos taken in the late 1940s and early 1950s. Cottonwood Spring has been the most altered, with past cycles of deliberate removal of trees followed by regeneration, which has favored the California fan palms that now cluster densely around the main water source. In May 1945 Alden Miller noted only three “middle-sized palms,” as well as about ten mature cottonwood trees. Unlike Pinyon Well and Quail Spring, on which we reported in May, none of the five sites covered in our latest visits have been burned recently. Nonetheless, at the sites with pinyon–juniper woodland, the stress from water deficit is obvious, through the considerable fraction of pinyons, junipers, and manzanitas standing dead.

Cottonwood Spring

Cottonwood Spring, near the south end of Joshua Tree National Park, is at ~3000 feet elevation one of our lower-elevation sites with many features of the Colorado Desert, such as the California fan palm. On our previous report, we mentioned the discovery of the Baja pocket mouse (*Chaetodipus rudinoris*) in this area. Our second visit in June 2017 did not yield any additional captures, unfortunately. But the capture of the desert pocket mouse (*Chaetodipus penicillatus*) in Pinto Basin in June 2017 as well as around Cottonwood Spring in September 2016 represents another species not reported from Joshua Tree by Miller and Stebbins on the basis of their field work in the 1940s and 1950s. But the desert pocket mouse was collected in Joshua Tree—mainly in Pinto Basin—as early as 1962 by biologists from California State University, Long Beach. In the case of the desert pocket mouse, confirmation by specimen is critical because the species is so similar to the long-tailed pocket mouse (*Chaetodipus formosus*), which is fairly widespread and common at lower elevations in Joshua Tree.



Cottonwood Spring, July 1946 (left, R. C. Stebbins) vs. June 2017 (right, L. Hargrove)



Cottonwood Spring, July 1946 (left, R. C. Stebbins), vs. June 2017 (right, L. Hargrove)



Cottonwood Spring (looking downstream), May 1945 (left, A. H. Miller) vs. June 2017 (right, L. Hargrove)

The importance of Cottonwood Spring to bats was clear just from the numbers swirling among the palms after dark. With the electronic detectors not available in the 20th century, Drew Stokes identified nine species: the pallid bat (*Antrozous pallidus*), western pipistrelle/canyon bat (*Parastrellus hesperus*), pocketed free-tailed bat (*Nyctinomops femorosaccus*), Mexican free-tailed bat (*Tadarida brasiliensis*), big brown bat (*Eptesicus fuscus*), Townsend's big-eared bat (*Corynorhinus townsendii*), hoary bat (*Lasiurus cinereus*), western yellow bat (*Lasiurus xanthinus*), and California myotis (*Myotis californicus*). His two nights of netting yielded 33 captures representing six of the nine species. Especially notable was

the large number of pallid bats (16 captured); the species has become very rare on the coastal slope of southern California. The pocketed and Mexican free-tailed bats are not on the park's list of mammals, but these are widespread species expected in the area, rarely captured by mist net, but readily detected and identified by ultrasonic call. The Townsend's big-eared and western yellow bats were not reported from Joshua Tree by Miller and Stebbins either. Townsend's big-eared is a widespread species that commonly roosts in mines, so it was presumably present in the mid-1900s but missed. But the western yellow bat, which roosts primarily in the skirts of fan palms, has a history of range expansion in southern California, as it has adapted to palms planted as urban landscaping. The collection of one at Cottonwood Spring on 2 August 1962 represented not only the first record of the western yellow bat for Joshua Tree, but the second for all of California, following the first at Palm Springs in 1945. Since the palms at Cottonwood Spring are native, perhaps the site is part of the western yellow bat's primitive range, but their recent increase must have favored the bat.



Pallid bat at Cottonwood Spring (photo by Drew Stokes).



Townsend's big-eared bat at Cottonwood Spring (photo by Drew Stokes).



Yellow bat at Cottonwood Spring (photo by Drew Stokes).

The two species of rodents previously found around Cottonwood Spring that we did not detect were the deer mouse (*Peromyscus maniculatus*) and the California or dusky chipmunk (*Tamias obscurus*). In 1941, two deer mice were collected “in an area of scattered junipers,” and one of our trap lines was in such habitat. And in 1945 the single chipmunk collected near Cottonwood Spring “had been feeding on juniper berries.” Thus the dying off of junipers—most of those near Cottonwood Spring are now dead—may be expected to disfavor these species already at the lower ends of the elevational ranges in this region.

On 13 June 2017 Lori Hargrove hiked from Cottonwood Springs to the base of Eagle Peak and up to 5040 feet elevation on the mountain’s west side, about a half mile short of the summit at 5350 feet. Miller and Stebbins had driven to Conejo Spring at north base of the mountain (no longer accessible by vehicle) and climbed it from that direction but reached the same area that Lori covered. Miller wrote that the chipmunks “showed up first at 4000 feet and were seen frequently thereafter.” The next day he collected one as low as 3500 feet. In 2017, Lori did not find a single chipmunk.

She did find one species of bird of pinyon–juniper and chaparral with an isolated population on Eagle Mountain, the Black-chinned Sparrow. But among other birds of these habitats Miller and Stebbins had also collected the Mountain Quail, California Scrub-Jay, Bushtit, and Spotted Towhee, which Lori did not encounter. A longer trip (requiring backpacking and carrying substantial water) might reveal these species, but clearly they are reduced from their number in 1945, if they survive on Eagle Mountain at all.



Dead juniper near Cottonwood Springs, June 2017 (photo by Lori Hargrove).



Pinyon trees on Eagle Mountain, elevation 5040 ft (photo by Lori Hargrove).

Around Cottonwood Spring itself our more notable birds included a family of Long-eared Owls, reported from this site repeatedly in the past but rare in Joshua Tree National Park. LeConte's Thrasher is widespread but sparse in the park on flatter terrain. On 13 June Lori counted at least nine (including juveniles) in washes between Cottonwood Spring and the base of Eagle Mountain. In the second week of June our bird list consisted almost entirely of locally breeding species, but we saw two species still in spring migration, one Willow Flycatcher on 13 June and Western Flycatchers daily from 12 to 16 June, with as many as seven individuals on 13 June. In spite of the changes in the trees around the spring over the past 70 years the area's breeding birds seem little changed. The only such species reported for Cottonwood Spring by Miller and Stebbins that we did not encounter were the Western Screech-Owl, Poor-will, and Lesser Goldfinch. Even though Cottonwood Spring is a popular birding spot, neither the screech-owl nor poor-will has been noted there in June or July by birders reporting to www.ebird.org, and even the goldfinch has been reported only once. At Cottonwood Spring in June 2017 we noted the Common Raven daily, up to eight individuals per day. In May 1945 Alden Miller observed just one pair on a single day only, one of his few sightings in the entire park of a species he called "surprisingly scarce."

Pinto Basin

The mammals of Pinto Basin are known better from specimens collected from 1961 to 1968 and now at California State University, Long Beach, than from the collections for MVZ in 1946. Our trapping in June 2017 yielded one species beyond those recorded in the area previously, the little pocket mouse (*Perognathus longimembris*), but it is expected in this low desert (elevation 1400-1450 feet around our traps). Among other pocket mice, our trapping yielded 35 desert pocket mice but no long-tailed pocket mice, whereas in 1946 Alden Miller and Henry Weston collected neither and the surveys out of Cal State Long Beach collected both.

Our motion-detecting cameras revealed two additional interesting species previously recorded in Pinto Basin, the kit fox (*Vulpes macrotis*) and round-tailed ground squirrel (*Xerospermophilus tereticaudus*). Concerning the round-tailed ground squirrel, Miller and Stebbins reported it in Joshua Tree only from Pinto Basin, on the basis of one specimen collected in 1962, "in an area often visited by naturalists but where this species had not been detected heretofore." Thus this species characteristic of hot, low deserts may have begun colonizing the park only within the past 60 years.



Kit fox photographed by motion-detecting camera in Pinto Basin, 18 June 2017.



Round-tailed ground squirrel photographed by motion-detecting camera in Pinto Basin, 19 June 2017. It was a hot day, but the temperatures recorded by these cameras are not reliable. Nevertheless, the round-tailed ground squirrel remains active even when it is remarkably hot.

The surveys by the team from Long Beach in the 1960s yielded specimens of six species of bats in Pinto Basin. Our three nights of survey by electronic detector revealed three of these, the pallid bat, California myotis, and western pipistrelle/canyon bat (by far the largest number of calls recorded), plus the pocketed free-tailed bat and possibly, on the basis of a single call, the long-eared myotis (*Myotis evotis*). The calls of the long-eared myotis aren't normally confused but are similar in pitch to those of the pallid bat, so the call detected in Pinto Basin was possibly a variant of a pallid bat call. The long-eared myotis is a species typical of wooded habitats in the foothills and mountains of southern California; it is not expected in low deserts and has not been recorded previously in Joshua Tree National Park; stronger evidence is needed for its identification here.

Black Rock Canyon

In Black Rock Canyon our rodent survey extended from the campground up to Black Rock Spring, near where the pinyon woodland begins. We recorded every species of mammal reported here by Miller and Stebbins with two exception: the bighorn sheep and the chipmunk. On 30 August 1946 Miller noted many fresh sheep tracks around the spring. Phil thought he might have heard one single call above Black

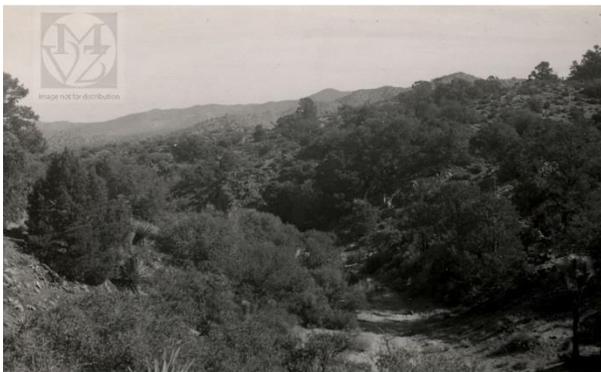
Rock Spring where the Panorama Loop Trail passes through a rocky gorge, but a half hour of listening and watching from a nearby ideal vantage point failed to yield any further hint of a chipmunk. The biologists from MVZ had collected three at Black Rock Spring in 1950.



“Black Rock Spring, outcrop of black rocks,” 16 Oct 1953 (left, R. C. Stebbins), 12 Sep 2017 (right, L. Hargrove).



“Black Rock Spring, mesquite 100 ft N of spring,” 16 Oct 1953 (left, R. C. Stebbins), 12 Sep 2017 (right, L. Hargrove).



“Black Rock Spring, looking NE down canyon, 200 ft above spring,” 16 Oct 1953 (left, R. C. Stebbins,), 12 Sep 2017 (right, L. Hargrove)

On the other hand, we captured five species of rodents not reported by Miller and Stebbins from Black Rock Spring. The desert woodrat, southern grasshopper mouse, and canyon mouse are widespread in Joshua Tree, so their absence from Black Rock Spring in the early collections was presumably an artifact of insufficient sampling. The deer mouse remains uncommon in Joshua Tree, as Miller and Stebbins reported; we trapped only two among the total of 132 rodents captured in Black Rock Canyon. The five captures of the spiny pocket mouse, however, represent a notable upslope and northwest extension of the range reported by Miller and Stebbins. This species is characteristic of rocky areas in the Colorado Desert, extending north to southernmost Nevada along the Colorado River. More than 30 miles west of the river in the central Mojave Desert, only three specimens from two localities are listed at www.vertnet.org. In Joshua Tree, Miller and Stebbins reported it from only two areas, Cottonwood Spring (where we also found it) and Forty-nine Palms Canyon on the north side of the park. Subsequently, it has been collected at a few additional sites: Camp Berdoo, Lost Palms Canyon, around the edge of Pinto Basin, and south of the headquarters at the Oasis of Mara—all points farther east and south. The point highest in elevation where it had been collected previously was at 3000 feet at the Forty-nine Palms Oasis, but we captured five individuals in Black Rock Canyon at elevations 4000-4200 feet. We retained one as a specimen—specimen confirmation is especially critical for the spiny pocket mouse as it can easily be confused with the San Diego pocket mouse, which we found abundant in Black Rock Canyon (representing 60 of the 132 rodents captured). Thus the spiny pocket mouse may be spreading upslope in Joshua Tree, in the process extending its range to the northwest.



Spiny pocket mouse captured at Cottonwood Spring (photo by Jack Daynes).

In spite of not being deployed close to any source of drinking water in Black Rock Canyon, our bat detectors picked up calls of possibly as many as nine species. The biologists from MVZ netted at Black Rock Spring from 30 August to 3 September 1950 but collected specimens of the western pipistrelle/canyon bat only. We recorded that species but picked up even more calls of the California myotis, also common in Joshua Tree. We also recorded calls of possibly up to three species not yet confirmed in Joshua Tree: the Mexican free-tailed bat (common and widespread, as noted above), the silver-haired bat (*Lasionycteris noctivagans*; a more northern species that reaches southern California as a migrant), and either the western small-footed myotis (*Myotis ciliolabrum*) or long-legged myotis (*M.*

volans). One such call was also picked up at Upper Covington Flat. *Myotis volans* is known previously in Joshua Tree at least from the three specimens that MVZ biologists collected in August and September 1950. But *M. ciliolabrum* is also possible at these sites, as it frequents woodland and chaparral and is known as near Joshua Tree as the San Bernardino Mountains to the west. It has been collected in habitat similar to that in Black Rock Canyon and Lower Covington Flat near Hesperia and on Clark Mountain in the Mojave Desert.

Among the birds a species of special interest in the hills above Black Rock Spring was the Mountain Quail. From 30 August to 4 September Miller and Russell saw several groups of up to about 12, some coming to drink at the spring. At the spring itself we saw, of the quail family, only a resident covey of Gambel's. We found Mountain Quail only higher in the mountains, a group of six at the crest of the Little San Bernardino Mountains off the Panorama Loop Trail on one morning, and a single bird heard calling high on the ridge to the southwest of the spring the next morning. Recognized as a seriously declining species in Joshua Tree, the quail is disfavored not only by the reduction of drinking water but by the dying back of plants on whose seeds it feeds.

In contrast, the California Towhee has spread into Joshua Tree since the 1950s. Miller and Stebbins were explicit in setting its eastern limit at Little Morongo Canyon 3 miles west of the west edge of the park. We already reported finding it in the mountains above Pinyon Well, and reports to www.ebird.org extend as far east as Jumbo Rocks Campground. We saw it every day from 12 to 15 September with up to six per day. Between Black Rock and Stubbe springs we now have a total of nine specimens, an adequate basis for comparison. One question is whether the plumage of the California Towhee has shifted to a paler color, as it has adapted to the semidesert Joshua Tree environment—desert populations of many birds and mammals are paler than their more coastal relatives that live in a more humid environment—Gloger's rule. Eyeballing the specimens suggests that 70 years has not been enough evolutionary time for the towhees to begin obeying Gloger's rule, if they ever will, but we have not yet analyzed them quantitatively.



Comparison of three specimens of the California Towhee from Joshua Tree National Park (left) with three from the San Jacinto Mountains and San Diego County (right).

Another species unrecorded by Miller and Stebbins in Black Rock Canyon was the Common Raven. No surprise, we saw it daily, with up to 27 per day.

Pinyon Jays were numerous; we saw from 35 to 75 per day, and they came regularly to feed on the seeds of pinyons right around Black Rock Spring. Some of their foraging is almost hover-gleaning, the flock looking like a swarm of butterflies hovering over the crowns of the pinyons. By sheer numbers the roving Pinyon Jays overcame the Scrub Jays attempting to defend their food source. Nevertheless, the dying off of so many pinyons even in this unburned area threatens the highly specialized Pinyon Jay. Though these are the largest numbers of the Pinyon Jay we have seen yet, they still do not match the largest flocks reported by Miller and Stebbins, "125 to 175" at Quail Spring in October.



Pinyon Jay at Black Rock Spring (photo by Lea Squires).

Other species of pinyon–juniper woodland and chaparral persisting at and above Black Rock Spring are the California Scrub-Jay (up to 25 per day), California Thrashers (3), Oak Titmouse (10), Bushtit (40), and Spotted Towhee (12). These are numbers larger than we have had of these species at any other site covered. The Black-chinned Sparrow (two seen above Black Rock Spring) is also in this category, but because this species is a summer visitor only and most individuals have departed by September we can't compare it.

The second week of September is the peak of fall migration of many of California's land birds, but we saw only a small trickle of migrants moving through, for example, no more than four Western Tanagers per day, and just one each of the Vaux's Swift, Olive-sided Flycatcher, Willow Flycatcher, Cassin's Vireo, Nashville Warbler, Townsend's Warbler, MacGillivray's Warbler, and Black-headed Grosbeak. We also encountered the vanguard of arrival of some winter visitors: one Merlin on 12 September and four

White-crowned Sparrows and two Dark-eyed Juncos on 15 September. Three species of irruptive winter visitors around Black Rock Spring were the Red-breasted Nuthatch (one or two seen daily), White-breasted Nuthatch (one or two seen almost daily), and the Mountain Chickadee (three on 12 September).



Red-breasted Nuthatch at Black Rock Spring (photo by Lea Squires).

Upper Covington Flat

At Upper Covington Flat we found evidence for change in the rodents not only in the apparent disappearance of the chipmunk but in the appearance of the long-tailed pocket mouse, of which we trapped six. Previous collections are all from 3200 feet elevation (at the north base of Eagle Mountain) or lower, whereas our sites of capture on Upper Covington Flat were at 4900 or, in one case, 5160 feet elevation. Also notable at Upper Covington Flat was the capture of two western harvest mice (*Reithrodontomys megalotis*). Miller and Stebbins reported this species, which prefers grassier, wetter habitat than Joshua Tree offers, east only to Little Morongo Canyon, west of the park boundary. It is on the park's list of mammals, however, as rare at Key's View, even farther southeast than Upper Covington Flat.

Though our effort toward birds at Upper Covington Flat was less than at Cottonwood Spring, Black Rock Spring, or Stubbe Spring, Lea Squires and Chris Swarth nevertheless observed 52 species from 15 to 18 September, a list augmented by migrants including the Vaux's Swift, Hammond's Flycatcher, Nashville Warbler, and Green-tailed Towhee, early arriving winter visitors such as the Vesper and Sage Sparrows, and one more wandering Mountain Chickadee. They found the Mountain Quail on 18 September only, counting 16 individuals at two sites along the east edge of Upper Covington Flat where canyons lead down toward Lower Covington Flat. Among the other resident woodland/chaparral species of concern

they recorded the Pinyon Jay (2/4 days, up to 50/day), California Thrasher (3/4 days, up to 3/day), Oak Titmouse (3/4 days, up to 4/day), Spotted Towhee (2/4 days, up to 12/day), and Bushtit (2/4 days, only 1 or 2 per day—a lack of larger flocks of this gregarious species suggests a lack of successful nesting in the area this year. Species that Lea and Chris found at Upper Covington Flat that Miller and Stebbins did not included the Common Raven (2/4 days, up to 15/day) and California Towhee (2/4 days, up to 8/day).



Mountain Quail at Upper Covington Flat (photo by Will Stahnke).

Stubbe Spring

Our last trip was to Stubbe Spring (not “Stubby,” as misspelled by Miller and Stebbins). Five miles from the nearest vehicular access, this site required backpacking and mule packing to carry our gear and water for a week. The spring still provides water in the bottom of a canyon, concealed under dense vegetation, as well as in a marshy area on a hillside. The current density of the vegetation, however, may be due to a decrease of the bighorn sheep. On 6 September 1950, Alden Miller wrote, “This area is heavily trampled and browsed by mountain sheep. As a result of this use, the sedge is clipped down to within a half inch of the ground, except where protected under or among *Chrysothamnus* [rabbitbrush shrubs]. The whole area looks like a sheep corral except it does not smell.”

The main focus of attraction in this area, however, is a mile and a half north of the spring at the edge of Juniper Flats, the area where on 6 and 8 September 1950 Robert E. Bailey collected two chisel-toothed kangaroo rats (*Dipodomys microps*), discovering a population isolated far to the south of those known at the time at Victorville and Clark Mountain. Since then, a few additional specimens have partially filled

the gap: one from Granite Pass, three from Rabbit Springs in Lucerne Valley, and, most notably, two from 3 miles northwest of Yucca Valley (in 1976) and thus barely over 5 miles from the northwestern corner of Joshua Tree National Park. Nevertheless, Juniper Flats still represents the species' southernmost known locality, and extirpation from the park would represent a northward retraction from the range. Therefore, we focused our rodent trapping in the area where the chisel-toothed kangaroo rat had been collected previously—not only in 1950, but by D. E. Harvey in 1969, Vernon Bleich in 1971, and Blair Csuti in 1975, for a total of 11 specimens preserved in museums, as far as we can determine through www.vertnet.org.

Unfortunately, we failed to trap any chisel-toothed kangaroo rats. Nevertheless, we are far from ready to declare the species extirpated from Joshua Tree. On our third night of trapping coyotes trashed our line of traps, scattering and opening most of them—the worst coyote disturbance Scott Tremor has encountered in all his years of rodent trapping. So our sampling was not at the level we had planned. Furthermore, on the hike in and out, Scott noticed burrow openings of the diameter proper for a kangaroo rat of this size, connected by runways typical of kangaroo rats, in a very open area along the trail to Juniper Flats, just about 2 miles southwest of the trailhead near Cap Rock. The only other kangaroo rat in the area is the smaller Merriam's. So these burrows as well as Juniper Flats merit further surveys. Scott has found multiple other species of kangaroo rat using and in some cases benefiting from disturbances that open up the habitat.

In spite of the coyotes, our rodent trapping was very productive—335 total captures of 211 individuals of 9 species. Besides the chisel-toothed kangaroo rat, the only rodents recorded near Stubbe Spring previously that we did not find were the canyon mouse and the chipmunk, more evidence for the precipitous decline of the latter in Joshua Tree. The dominant species were the cactus mouse (63 individuals captured), Merriam's kangaroo rat (57), and San Diego pocket mouse (54).

Although there is no good spot from which bats can drink at Stubbe Spring, the electronic detectors picked up calls of six species, again dominated by the California myotis. The six include the pocketed free-tailed and Mexican free-tailed, addressed above. This is the only site where we have recorded a call of the fringed myotis (*Myotis thysanodes*), a woodland species of which Miller and Stebbins collected just one specimen in Joshua Tree, from Lower Covington Flat.

Our motion-detecting cameras were especially productive at Stubbe Spring, yielding photos of the coyote (no surprise), gray fox, and bobcat, as well of the white-tailed antelope squirrel, a mouse of the genus *Peromyscus*, and the Greater Roadrunner, Loggerhead Shrike, and California Towhee. Evidence of the mountain lion was clear from tracks and scat and the several skeletons of the deer and bighorn sheep strewn near the spring.



Bighorn sheep skeleton below Stubbe Spring, October 2017 (photo by Lori Hargrove).



Bobcat caught by motion-detecting camera near Stubbe Spring, 7 October 2017.

Stubbe Spring yielded our biggest numbers of the Mountain Quail yet in Joshua Tree. We counted them as carefully as possible as they moved around the spring, coming up with a single-day minimum of 28 individuals on 9 October. Spot mapping of all observations through the week, including those Lori made around Pearl Spring on 4 October, implies at least 47 individuals in the area. We even captured three by net. The quail too are vulnerable to predators when they approach the spring, as attested by feathers scattered nearby.

Our list of 67 species of birds for the Stubbe Spring area is augmented by the species seen by Lori during her scouting trip on 1 May, including a Gray Vireo. By the time of our visit from 4 to 9 October such summer visitors had left, and we saw few migrants still moving south, just a few Orange-crowned and Black-throated Gray Warblers. But winter visitors had already arrived in substantial numbers, including five subspecies of the Dark-eyed Junco: *Junco hyemalis thurberi*, *montanus*, *cismontanus*, *mearnsi* (Pink-sided), and *caniceps* (Gray-headed). Interesting scarce winter visitors from coniferous forest at elevations higher than Joshua Tree reaches were at least two Cassin's Finches and at least one Townsend's Solitaire.

Except for the Mountain Quail and California Scrub-Jay, resident species of woodland/chaparral birds were few: only one California Thrasher all week; maximum four titmice per day (missed two days); only one flock of 10-12 Bushtits seen on two days only; maximum two Spotted Towhees per day (missed two days). A flock of Pinyon Jays flew through the Ryan Campground while we were packing for the trip, but we saw none at Stubbe Spring all week. As elsewhere in the park, many pinyon trees had recently died.



Mountain Quail at Stubbe Spring, October 2017 (photo by Lea Squires).



Mountain Quail at Stubbe Spring, October 2017 (photo by Lea Squires).



California Scrub-Jays at Stubbe Spring, October 2017 (photo by Lea Squires).



Cassin's Finch at Stubbe Spring, October 2017 (photo by Lea Squires).



Townsend's Solitaire at Stubbe Spring, October 2017 (photo by Lea Squire)



"Looking W. down Stubby Spring Canyon," 15 Oct 1953 (left, R. C. Stebbins), 4 Oct 2017 (right, L. Hargrove).



"Watering hole of Bighorn" at Stubbe Spring, 15 Oct 1953 (left, R. C. Stebbins), 4 Oct 2017 (right, L. Hargrove).

Summary

These observations represent the more obvious changes in the birds and mammals of Joshua Tree National Park. Identifying more subtle changes will require more detailed quantitative analysis.

The decrease of surface water in Joshua Tree threatens species that must drink, such as the Mountain Quail, bighorn sheep, and possibly the dusky or California chipmunk. Furthermore, the concentration of these species around dwindling sources of water exposes them to increased predation. The decrease of natural water sources diverts animals to campgrounds and artificial sources (for example, at Black Rock Campground we saw Pinyon Jays commuting from the pinyon woodland to drink at a leaky spigot).

On the basis of our observations so far, the chipmunk is the species most greatly decreased in Joshua Tree since the 1950s, possibly approaching extirpation. After 48 field days we still have only one observation. Counts as high as "15 animals counted in 2 hours of cruising along a pinyon-covered ridge above Lower Covington Flat" (Miller and Stebbins 1964:290) are no longer plausible. We have a trip to this area planned in 2018.

Other notably decreased species include the bighorn sheep, Mountain Quail, Oak Titmouse, and probably Pinyon Jay, Bushtit, and California Thrasher. Fires and the subsequent lack of regeneration, and the dying off trees and shrubs in unburned areas, threaten most species of these habitats, including in addition the California Scrub-Jay, Spotted Towhee, big-eared woodrat, pinyon mouse, brush mouse, and possibly the fringed myotis and long-legged myotis. Continuing drought could extirpate the western harvest mouse.

Although we were unable to confirm the persistence of the chisel-toothed kangaroo rat in Joshua Tree (uncollected since 1975), further searching is warranted.

Among birds, the Common Raven is the species of bird to have increased most conspicuously since the 1950s.

Three species of pocket mice of the genus *Chaetodipus* characteristic of the Colorado Desert, the Baja (*C. ruginosus*), spiny (*C. spinatus*), and desert (*C. penicillatus*), appear to have extended their ranges upslope and/or north into or within Joshua Tree National Park since the 1950s.

The pocket and Mexican free-tailed bats may be added to the list of the park's mammals on the basis of recordings of their ultrasonic calls; they are expected at Joshua Tree on the basis of habitat and previously known distribution.

The California Towhee has colonized Joshua Tree since the 1950s and is now fairly common and widespread in the Little San Bernardino Mountains, occurring southeast at least as far as the ridge above Pinyon Well.

Acknowledgments

Thanks to Krystal Solano, Saba Morsali, Ethan Good, Lacy McFarland, Naomi Fraga, Will Stahnke, Beth Kemton, Leo de la Rosa, and Chris Swarth for their help in the field (and for students Krystal, Saba, Ethan, and Lacy, in the lab as well). For help in the lab and office we also thank Jonathan Dain, Dave Fillion, Maria Gonzalez, Tawni Gotbaum, Allie Henderson, Jenny Johnson, Andrew Rivera, Lisa Rustin, and Elisa Yang. Thanks to Jack Daynes for his great photos. A huge thanks to the muleteers led by Mike Lewis, including also Greg Bruce, Terry Jorgensen, Ray Spence, and Mike Williams, without whom our trip to Stubbe Spring would have been impossible. Thank you to the staff of Joshua Tree National Park who facilitated our surveys: Michael Vamstad, Jeffrey Rangitsch, Cynthia Libby, Kristen LaLumière, Jeremy Freeman, Mary Oster, Jay Theuer, and James Bouknight. Thanks to the staff of the MVZ, especially Andrea Francesca Rios Dominguez, for help with access to historic field notes and photos, and to Steve Beissinger for overseeing Grinnell resurveys in the California deserts. Thank you to the National Science Foundation for making this research possible.



Mule team being led out from Stubbe Spring by Mike Lewis, Oct 2017 (photo by Lori Hargrove).