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Western Red-tailed Skink (*Plestiodon gilberti rubricaudatus*) Distribution and Habitat Use in Southern Nevada, USA

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Abstract.—**Western Red-tailed Skinks (*Plestiodon gilberti rubricaudatus*) are a Species of Conservation Priority in Nevada and a Species of Greatest Conservation Need in Arizona. Information about this species is lacking, especially for Nevada. We conducted a study from 2006–2011 to determine distribution, abundance, and habitat use of the Western Red-tailed Skink on the Nevada National Security Site (NNSS) in southern Nevada, USA. We used stand-alone funnel traps set in rocky habitats as our primary trapping method. We detected skinks at 28 of the 154 trapping sites and documented 38 individual skinks during 31,119 trap days. Occupied sites occurred in 10 vegetation associations and 12 geological formations at an average elevation of 1,727 m ± 197 m (range, 1,310–2,095 m). Using an occupancy modeling framework, we found that skinks were most likely to occur at mid-elevation sites with south-facing slopes. The model also weakly suggested that Sagebrush-dominated sites and wet or mesic sites were more likely to harbor skinks. Other measurable sources of variation among sampled sites (e.g., vegetation and substrate classifications) had little apparent effect on skink occurrence. Genetic analysis of 33 skinks from the NNSS indicated all belong to a mitochondrial clade that is restricted to central-eastern California and southwestern Nevada (Inyo clade).**

Key Words.—Inyo clade; lizards, natural history; phylogeny; stand-alone funnel trap

Introduction

Western Red-tailed Skinks (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*; Fig. 1), hereafter referred to as skink(s), occur in northern Baja Mexico, Mexico, and southern California, west-central Arizona, and southern Nevada, USA, usually in isolated populations (Stebbins 2003). It is considered a Species of Conservation Priority in Nevada (Wildlife Action Plan Team 2012), a Species of Greatest Conservation Need in Arizona (Arizona Game and Fish Department 2012), but has no special status in California (California Department of Fish and Wildlife 2015). It is also considered a sensitive species on the Nevada National Security Site (NNSS) because it is on the Nevada At-Risk Plant and Animal Tracking List of the Natural Heritage Program. It is one of four subspecies of *Plestiodon gilberti* and the widest ranging of the four (Stebbins 2003). Richmond and Reeder (2002) studied the phylogeny of the whole *Plestiodon skiltonianus* species group including Western Red-tailed Skinks, Western Skinks (*Plestiodon skiltonianus*), and the San Lucan Skink (*Plestiodon lagunensis*). They identified three distinct but distantly related mitochondrial clades of Western Red-tailed Skinks including the southwestern clade, the Sierran clade, and the Inyo clade.

It is surprising that given its conservation status, few formal studies investigating distributional limits and habitat affinities have been conducted for this species (Jones 1981; Morrison et al. 1999), particularly in Nevada. Based on the literature, skinks are often found in rocky areas near intermittent or permanent streams and springs (Macey and Papenfuss 1991; Morrison and Hall 1999; Stebbins 2003) or in open, rocky areas with scattered vegetative cover (Rodgers and Fitch 1947). Jones (1985) describes skink habitat as being found in Juniper and Chaparral Woodland above 1,200 m or Riparian Woodland directly connected to upland habitats. Macey and Papenfuss (1991) found skinks at elevations between 1,220 and 2,440 m. Morrison et al. (1999) found skinks on lower slopes that were more open and perhaps warmer than the more shaded and protected mid-slopes with greater shrub litter, less juniper litter, and less coarse gravel than was available in the area. Although not specific to skinks, south-facing slopes are favored by some reptiles (Edgar et al. 2010) and are often preferred by snakes for their hibernacula (e.g., Hamilton and Nowak 2009).

Most of the available information for skinks in Nevada is limited to collection records only. Before our study, 49 records of skinks had been documented in Nevada with a majority of locations in the Spring

Figure 1. Adult male (left) and hatchling (right) Western Red-tailed Skink (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*). The adult was captured south of Topopah Spring (Site #86), June 4, 2008 and the hatchling was captured at Schooner Wash (Site #32), July 31, 2008. (Photographed by Derek B. Hall).

Mountains (Table 1). Five historical skink records were found on the NNSS, most of which were from opportunistic sightings, rather than from studies focused on skinks. Skinks are known to be secretive and rarely seen above ground (Macey and Papenfuss 1991; Morrison et al. 1999), and may become fossorial during the latter, drier parts of summer and fall (Vitt et al. 1977). This makes them difficult to detect, and as a result it can be challenging to determine their presence-absence in a given study area. Given its conservation status, historical presence on the NNSS, and limited information on skinks in Nevada, we conducted a study to determine the distribution, abundance, and habitat affinities of skinks on the NNSS. Additional objectives included gathering information about natural history, ecology, and the placement of these skinks within the phylogeny of the *P. skiltonianus* species group.

Materials and Methods

Study area.—The NNSS is located in south-central Nevada, USA, approximately 105 km northwest of Las Vegas, and encompasses approximately 3,561 km^2. It is located in an area of southern Nevada that lies between the Great Basin Desert and the Mojave Desert as defined by Jaeger (1957). Transitional areas between the two deserts are also present having been created by gradients in precipitation, elevation, temperature, and soils. Unique combinations of physical site conditions have resulted in several different vegetation associations (Ostler et al. 2000). Based on these vegetation associations, three distinct vegetation regions occur on the NNSS: Great Basin Desert, Mojave Desert, and Transition regions. The Great Basin Desert region is a cold desert with dominant plant species consisting of sagebrush species (*Artemisia* spp.), Singleleaf Pinyon (*Pinus monophylla*), and Utah Juniper (*Juniperus osteosperma*). The Mojave Desert region is a hot desert with dominant plant species being Creosote Bush (*Larrea tridentata*) and White Bursage (*Ambrosia dumosa*). The Transition region is transitional between the Great Basin and Mojave Desert regions with dominant plant species consisting of Blackbrush (*Coleogyne ramosissima*), Nevada Jointfir (*Ephedra nevadensis*), and Burrobrush (*Hymenoclea salsola*; Ostler et al. 2000). Elevation ranges from < 1,000 m to 2,340 m above sea level. Average maximum

Table 1. Location and number of Western Red-tailed Skinks (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*) captured in Nevada.

Location	# Skinks	Source(s)
Newberry Mountains	2	University of Nevada Las Vegas, Marjorie Barrick Museum; Nevada Department of Wildlife Database
McCullough Mountains	2	Banta 1962
Spring Mountains	34	Banta 1962; Brigham Young University, Monte L. Bean Museum; University of Nevada Las Vegas, Marjorie Barrick Museum; University of California, Berkeley, Museum of Vertebrate Zoology; Carnegie Museum of Natural History, Jonathan Richmond, pers. comm.
Sheep Range	2	Hardy 1948
Grapevine Peak	2	Rodgers and Fitch 1947
Montezuma Range	2	Jonathan Richmond, pers. comm.
Nevada National Security Site (Historical sightings)	5	Medica et al. 1990; Boone and Sowell 1999

temperatures range from 32° to 38° C in the summer and from 10 to 16° C in the winter. Average minimum temperatures range from 13° to 25° C in the summer and -7° to 2° C in the winter. At higher elevations, mostly in the northern NNSS, temperatures are 6° to 8° C cooler (National Oceanic and Atmospheric Administration 2006). Average annual precipitation ranges from 13 cm at the lower elevations to 33 cm at the higher elevations (Special Operations and Research Division, unpubl. report). Most of the precipitation is received between December and March in the form of rain or snow with lesser amounts of rain usually received during July and August from summer thunderstorms.

***Site selection*.—**Because the NNSS covers such a large area, we used a 5 × 5 km grid to select sampling areas. We randomly selected grids and we made field visits to look for one to three sites suitable for sampling within each grid. To maximize the probability of catching an uncommon, hard-to-detect species, we evaluated suitability for sampling based primarily on the presence of rock features and secondarily in wet or mesic areas (e.g., springs, ephemeral washes with mesic vegetation) and Gambel Oak (*Quercus gambelii*) thickets or large shrubs with lots of litter when possible. Sites (patches identified as suitable for sampling) varied in size based on the rock and vegetation features but were typically between 0.1 ha and 0.5 ha in size. We did not sample sites > 1 km from a road due to the difficulty of getting traps to those sites. We non-randomly selected some additional grid cells to ensure relatively complete geographic coverage within NNSS. We also selected four of the five historical skink sites for sampling.

***Data collection*.—**For each site, we measured the following data in the field or estimated using GIS or topographic maps: Universal Transverse Mercator coordinates (North American Datum 1983), elevation (m) estimated from USGS 7.5 minute topographic maps, percentage slope using a clinometer, aspect using a compass, soil/substrate (i.e., soil texture, rock size class, litter), geologic formation from digitized GIS map (Slate et al. 1999), landform (U.S. Department of Agriculture, Natural Resources Conservation Service. 2012. National Soil Survey Handbook, Title 430-VI. Available at http://soils.usda.gov/technical/handbook/. Archived by WebCite at http://www.webcitation.org/6GRrNRLMV [Accessed 3 December 2014]), dominant and novel plant species present, and vegetation association from a GIS map. At some sites, slope and aspect varied so much we categorized it as varied. We measured slope to the nearest 1% and assigned it into three categories; flat = 0–10%, moderate 11–40%, steep > 41%. We measured aspect to the nearest 10° and split it into two categories; north = 280° to 90°, south = 100° to 270°. We also categorized each site as dry, mesic, or wet based on the presence of water and certain plant species. Sites containing mesic vegetation such as Basin Wildrye (*Leymus cinereus*), Skunkbrush Sumac (*Rhus trilobata*), Rock Spirea (*Holodiscus dumosus*), sedge (*Carex* spp.), Gambel Oak, or snowberry (*Symphoricarpos* spp.) we considered mesic. Sites with perennial water we considered wet (i.e., springs, seeps). The remaining sites we categorized as dry.

***Trapping*.—**During our pilot trapping season in 2006, we evaluated the effectiveness of trap arrays using drift fences with pit fall traps and funnel traps (15 sites) and stand-alone funnel traps (28 sites). We used a combination of both trap arrays and stand-alone funnel traps at two of the 15 sites. We did not capture any skinks in any of the drift fence arrays during our pilot study; however, we did capture two skinks in stand-alone funnel traps at one site (Site #20). We did not include information from the 15 sites where trap arrays were used, including the skink captures, in the statistical analysis but this information is reported in the Results section. Installing the drift fence arrays was very labor-intensive and limited to non-rocky, level terrain. Because of the difficulty of installing drift fence arrays and lack of capture success, we decided to only use stand-alone funnel traps without drift fences. We also determined trapping protocol (i.e., number of traps to use, how many days to trap, and trapping season) from first year results (National Security Technologies 2007). Trapping continued during 2007–2011 between late April and the middle of October. The trapping protocol generally entailed setting 30 stand-alone, box-type funnel traps (61 cm long × 21 cm wide × 21 cm tall) at a site for two weeks. We set traps along vegetation or rocks to act as natural drift fences to funnel skinks into the traps similar to Fitch (1987). We sampled three to four sites concurrently per two-week session. We set traps on Monday, checked them every 1–3 d (Enge 2001), and closed them on Thursday of the first week. We repeated this process the second week and then we moved traps to new sites. At some sites, we trapped for more than two weeks and we sampled some sites during multiple years. We also recorded observations of skinks seen during trapping activities. For each captured skink, we recorded the weight and snout-vent length (SVL), marked individuals by toe-clipping, and stored the toe or a small piece of the tail (about 5 mm) in 95% ethanol for genetic analysis. We wanted to know to which clade(s) skinks on the NNSS belong, understand their evolutionary origin, and investigate how they relate to other skink populations throughout their range.

***Data analysis*.—**We used a custom Zero-Inflated Poisson (ZIP) regression model (Zuur et al. 2009) to represent the expected number of skink captures during each survey bout. We assumed no false presences, and therefore assumed that unoccupied sites would result in zero skink observations. In addition, we assumed site occupancy was fixed within our study period (i.e., no sites were colonized or extirpated within the duration over which surveys were conducted). We modeled site-occupancy as a Bernoulli trial in which the occupancy probability (ψ) was a logit-linear function of environmental covariates:

$$logit(\Psi)=\beta_0 + \beta_1 \cdot elev + \beta_2 \cdot elev^2 + \beta_{3\text{-}4} \cdot south + \beta_5 \cdot moist + \beta_{6\text{-}9} \cdot veg + \beta_{10\text{-}12} \cdot substrate + \beta_{13\text{-}14} \cdot ecoregion \quad \text{[eq 1]}$$

where β1 through β14 represent linear regression coefficients, *elev* represents elevation (standardized), *south* is a categorical variable representing aspect (three categories: north-facing slopes [intercept], south-facing slopes, or mixed-aspect sites), *moist* is a binary categorical variable representing either dry or wet/mesic sites, *veg* is a categorical variable representing the dominant vegetation (five levels: woodland [intercept], sagebrush, Blackbrush, ephedra, and White Bursage), *substrate* represents the dominant substrate composition (four levels: litter [intercept], soil, rock, and boulder), and *ecoregion* is the ecoregion classification (three levels: Great Basin [intercept], Mojave, and transition). We explored several plausible two-way interactions among the environmental covariates in our models, but these models failed to converge due to inadequate sample size. In addition, we excluded several additional measured covariates (slope, landform, and geological site classification) on the basis of both lack of sufficient *a priori* rationale for inclusion and preliminary statistical tests indicating lack of explanatory power (Chi-square Test of Independence or Fisher exact test, $P > 0.25$).

We modeled the expected number of skink captures (excluding recaptures and two captures at Site #20 in 2006) at occupied sites as a Poisson random variable in which the mean expected count per 180 trap-nights (typical effort for a single survey bout) was assumed to be invariant among surveyed sites. We used an offset term to the linear formula representing the total survey effort in units of 180 trap nights to accommodate for the variation in effort among survey bouts:

$$Log(caps) = offset_{site} + \beta_0 \quad \text{[eq 2]}$$

We fitted this ZIP model using Markov-Chain Monte Carlo (MCMC) in a Bayesian framework using JAGS software (Plummer 2003), which was called from R using the package R2Jags (R Core Team 2018; Su and Yajima 2015). We ran three MCMC chains with 40,000 iterations each. We discarded the first 20,000 iterations of each chain as a Burn In and retained every tenth iteration to reduce serial autocorrelation (Raftery and Lewis 1996). We assessed convergence of the MCMC algorithm on the joint posterior distribution using the Gelman-Rubin diagnostic, confirming convergence if the value was ≤ 1.01 (Gelman et al. 2013). We assigned all free parameters uninformative uniform priors except for the regression coefficients, which we regularized by assigned weakly informative Gaussian priors centered on zero (McElreath 2018). We computed credible intervals for all fitted parameters using the 90% highest posterior density (HPD) bounds (McElreath 2018).

We assessed model goodness-of-fit using posterior predictive checks, in which we generated thousands of new datasets from the fitted model and scrutinized the results for any notable discrepancies between the simulated and observed data (Kery 2010). We first compared the total residual error of the simulated data (SSEsim; sum of squared errors between simulated skink counts and expected skink counts at each site) versus the sum of squared residual error for the actual observations (SSEobs). We computed a Bayesian *P*-value (goodness-of-fit statistic) as the fraction of MCMC iterations for which SSEsim exceeded SSEobs and interpreted a value near 0.5 (0.25 to 0.75) as indicative of adequate model fit (Gelman et al. 2013; Kery 2010). In addition, we performed a visual goodness-of-fit check by overlaying the observed histogram of site-level skink counts (i.e., number of surveyed sites with zero observations, one observation, etc.) on the distribution of counts expected under the fitted model. Code (R and Jags) and data for running these analyses can be accessed from GitHub (https://github.com/kevintshoemaker/redtailedskink).

Genetic analyses.—For genetic analyses we followed the protocol in Richmond and Reeder (2002), which entailed extracting mitochondrial DNA from muscle using standard proteinase-K and phenol/chloroform extraction methods (Hillis et al. 1996). We used the polymerase chain reaction to amplify about a 1,500 base pair fragment of the mitochondrial genome encompassing much of the ND4 protein-coding gene and the flanking histine, serine, and leucine transfer RNA genes. DNA sequences were linked and edited using Sequencher v3.0 (Gene Codes Corp., Ann Arbor, Michigan, USA), manually aligned by eye, and then added to a large ND4 sequence database for the *P. skiltonianus* complex maintained at the San Diego Field Station of the U.S. Geological Survey (Jonathan Richmond, pers. comm.). We conducted phylogenetic analyses using codon and transfer RNA partitioned models of nucleotide evolution (transfer RNA sequences were combined due to their short length) and Bayesian methods implemented in MrBayes version 3.2 (Ronquist et al. 2012). Two independent analyses were run in MrBayes for 5 × 106 steps (10% burn-in), and we combined the results after

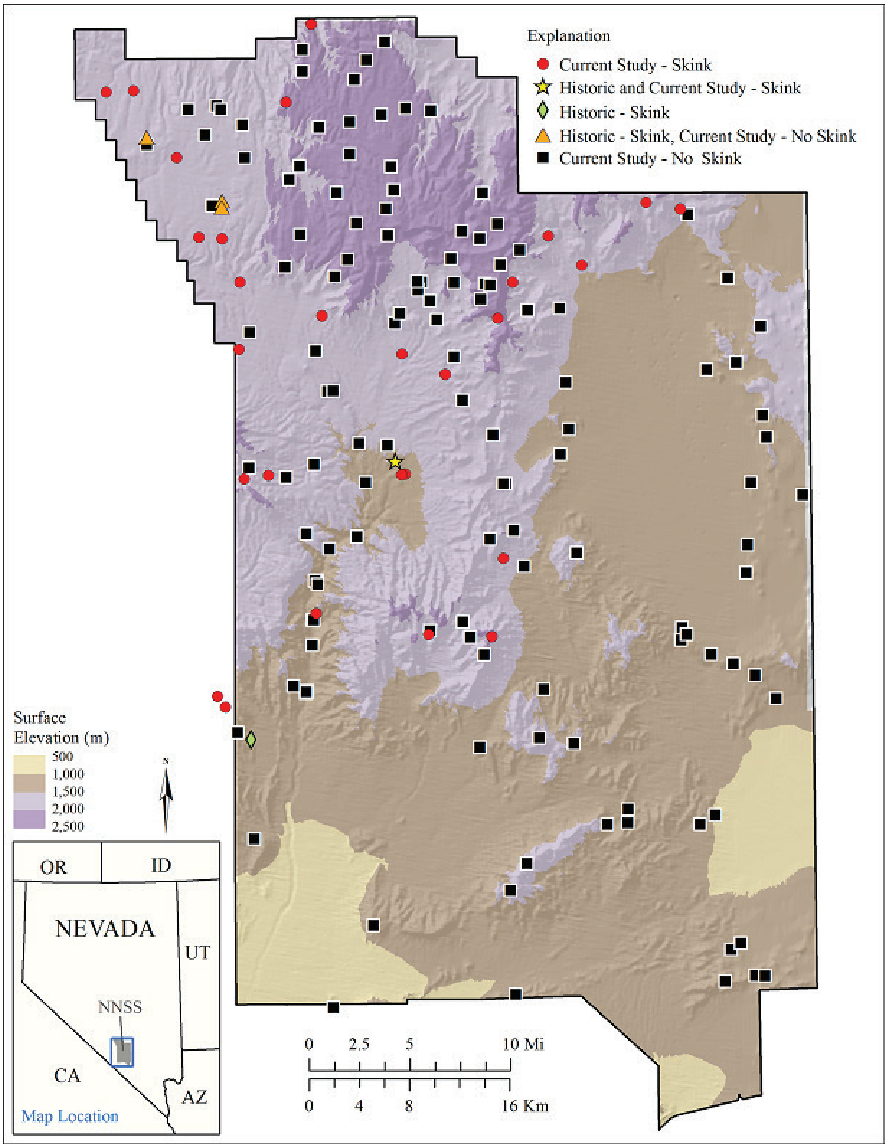

Figure 2. Distribution of Western Red-tailed Skinks (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*) by elevation class, including locations of all 168 trap sites (black squares) and skink capture sites (red dots = current study, orange triangle and green diamond = historic, and yellow star = both historic and current study) on the Nevada National Security Site (NNSS), Nevada, USA. (Bechtel Nevada 2002).

ensuring that parameter values had reached stationarity and converged between runs. Clade support was based on the posterior probabilities of the inferred branches of the phylogeny, where probabilities ≥ 0.95 were considered strongly supported (Rannala and Yang 1996).

Results

We captured 38 individual skinks at 28 of 154 (18.2%) trapping sites during 31,119 trap days (Appendix Table 1). We captured two additional skinks during the first year (2006), and we documented five recaptures during the study. Including these, we captured 40 skinks 45 times at 29 of 168 sites (17.3%) during 33,851 trap days, which greatly expands the known distribution of skinks on the NNSS (Fig. 2). This number of captures over the number of trap days equates to 0.1% trap success or one skink capture per 752 trap days. We re-sampled 16 sites during the study period and captured skinks at eight of these sites. No skinks were captured during April, September, or October, whereas 11 captures occurred during May, 19 during June, 13 during July, and two during August. Additionally, we observed only one skink aboveground during the 6 y of trapping. This occurred on 2 June 2010 at 1355 (Site #140). Average SVL of skinks captured was 81.0 mm ± 13.0 mm (n = 40; range, 33.3–96.0 mm). Weights ranged from 0.5 to 24.0 g with an average of 13.1 g ± 5.6 g (n = 38). Of

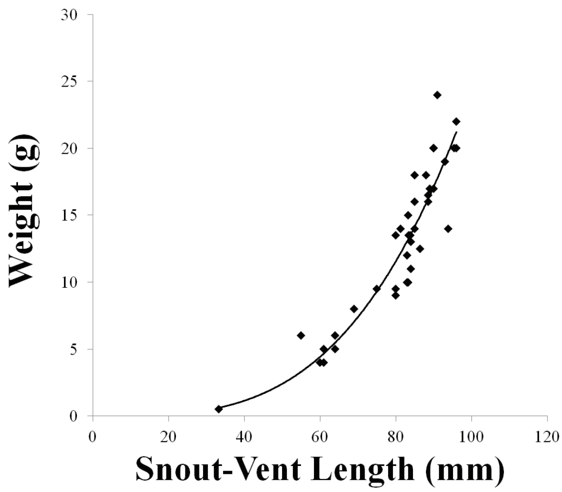

Figure 3. Relationship of weight to snout-vent length of 38 captures of Western Red-tailed Skinks (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*) on the Nevada National Security Site (NNSS), Nevada, USA.

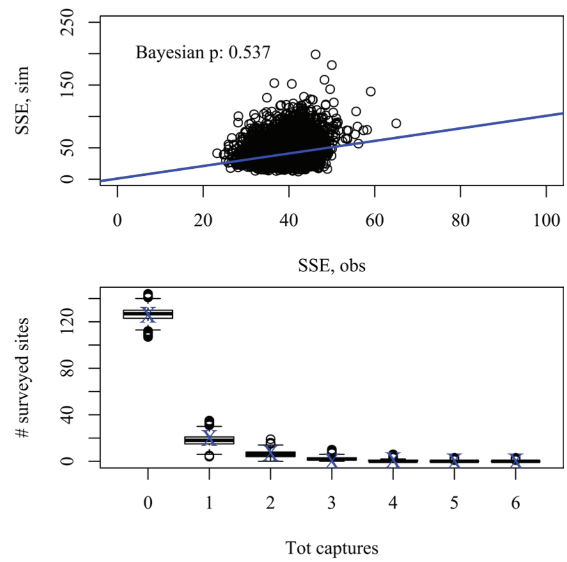

Figure 4. Posterior predictive checks (goodness-of-fit tests) for a zero-inflated Poisson (ZIP) model of captures of Western Red-tailed Skinks (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*). (Top) sum of squared residual error (SSE) for simulated data generated under the fitted model versus observed data. The blue line indicates a 1:1 line, and the Bayesian P-value indicates the fraction of simulated SSE values exceeding the corresponding SSE for the observed data (*P*-values between 0.25 and 0.75 generally suggest adequate model fit). (Bottom) Expected number of sites expected to yield zero to six total captures under the fitted model (box plots) versus the corresponding observations (X symbols).

the 40 skinks captured, we classified 32 as adults (≥ 75.0 mm SVL), seven as subadults (55.0–69.0 mm SVL), and one as a hatchling (33.3 mm SVL). The best fit of SVL and weight was a power curve fitted to the data (Weight = 0.00005SVL3.3393; r^2 = 0.934; Fig. 3).

We trapped four of five historical sites and found skinks at only one of these (Site #20). We did not trap at the historical Yucca Mountain site but did trap at three sites in more suitable habitat upslope from the historical site. We captured skinks in a variety of habitats from springs to dry, rocky slopes. Skink capture sites were located in 10 vegetation associations ranging from Blackbrush to Pinyon-juniper at an average elevation of 1,727 m ± 197 m (range, 1,310–2,095 m) and in 12 unique geological formations with a variety of substrates in different landforms (Appendix Table 2).

Our Bayesian occupancy model successfully converged on the joint posterior distribution and showed adequate goodness-of-fit (Bayesian *P*-value about 0.45; Fig. 4). We estimated total occupancy at our study sites to be 40% (90% credible interval 0.31 to 0.53). Our occupancy model indicated that skinks occurred more often than expected on sites characterized by south-facing slopes (90% Bayesian credible interval excludes zero; Figs. 5, 6). In addition, skinks were far more likely to occur at mid-elevations within our study area (Figs. 5, 6). We were unable to detect any evidence for an effect of moisture, ecoregion, substrate, or vegetation association on the probability of skink occupancy, although we detected a weakly positive effect of Sagebrush-dominated habitats and wet and mesic sites (Figs 5, 6).

Sequence data from 33 of 40 skinks (genetic samples were not taken from seven individuals due to skinks escaping before samples were taken and some skinks were captured before we started taking genetic samples) show that NNSS skinks are members of the Inyo clade (Richmond and Reeder 2002; Richmond and Jockusch 2007; Fig. 7) as expected based on geography. The Inyo Clade is one of three major mitochondrial clades currently known for the Western Red-tailed Skink and occurs from southwest Nevada (Nye and Esmeralda counties) into central-eastern California (Inyo and Mono counties). These data add 18 new haplotypes to the Inyo clade bringing the total to 28 and more than doubling the number that were previously known for this lineage. Of these 18, only one was shared outside of the NNSS in Esmeralda County to the northwest.

Discussion

We captured relatively few skinks for the huge trap effort we expended during this study. Nonetheless, we captured nearly as many skinks during this study as had been documented previously in all of Nevada. Our work illustrates the difficulty in studying and monitoring a secretive species. Reasons for low trap success are unknown but are likely because skinks do not spend a lot of time moving around in the open aboveground and our trapping method relies on skinks coming in contact with the funnel traps in order to be captured. Perhaps

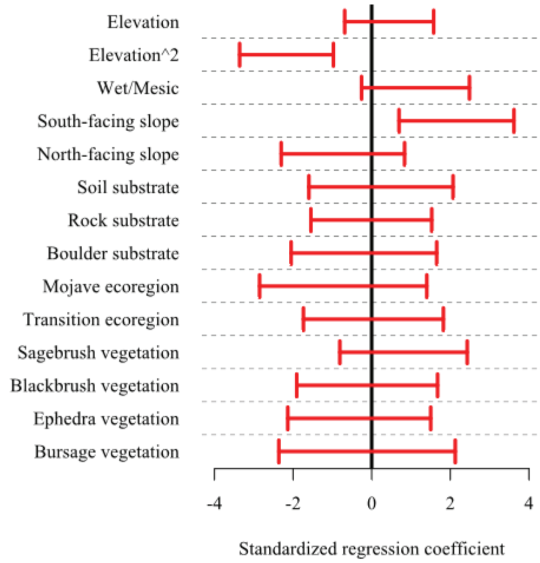

Figure 5. Standardized regression coefficient estimates (90% Bayesian credible interval, logit scale) for a model of site-occupancy for Western Red-tailed Skinks (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*) at the Nevada National Security Site (NNSS), Nevada, USA. Overlap with zero (vertical line) indicates lack of strong evidence for an effect of the respective environmental covariate on skink occupancy.

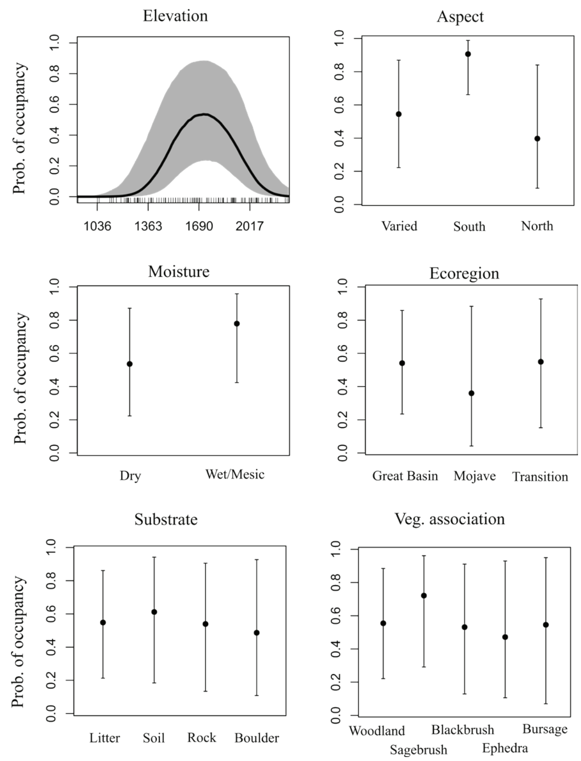

Figure 6. Partial-dependence plots illustrating the effect of six environmental covariates on the probability of occupancy of Western Red-tailed Skinks (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*) based on zero-inflated Poisson (ZIP) model of skink captures. Error bars are the 90% Bayesian credible intervals.

using some kind of bait or possibly skink pheromones could increase capture success. This warrants further investigation.

The greatest number of skinks we caught at any given site was four in 2008 (Site #87). At eight sites, we caught two skinks and at 20 sites we caught one skink. In another study, trapping occurred at Site #87 for 525 trap days in 2009, with only one skink capture, a recapture from 2008 (Hansen et al. 2010). These low capture numbers per site suggest that skinks occur in low densities, but it could also be due to their fossorial habits or a combination of both. Morrison et al. (1999) used pitfall traps without drift fences in eastern California and captured 26 skinks during 48,000 trap days for a capture rate of 0.05% or one skink per 1,846 trap days. This suggests that stand-alone funnel traps as used in our study may be a more efficient technique for catching skinks than using pitfall traps without drift fences. Our technique of using natural features such as rocks or vegetation to funnel skinks into stand-alone funnel traps is a valid technique for catching skinks. It is the most practical, cost-effective way to sample rocky habitats because it is virtually impossible to dig holes for pitfalls or install drift fences in these substrates. We also captured numerous other reptile and mammal species, including Great Basin Skinks (*Plestiodon skiltonianus utahensis*), giving us distribution patterns of this species in addition to Western Red-tailed Skinks (Hall and Greger 2016). Although sampling was limited to sites within 1 km of roads for logistical reasons, we do not think this affected our skink capture success due to the relatively low traffic volumes experienced on roads near trapping sites, most of which had fewer than five vehicle passes on average per day.

We recaptured five skinks at short distances of 1–23 m from their original capture location. During another concurrent study, one skink was recaptured a year apart (Site #87) and it had grown 8 mm (75 to 83 mm) during that year and was 3 g heavier (9.5 to 12.5 g; Appendix Table 1). We only captured one hatchling during our study, with a SVL of 33.3 mm. It had a bright red tail and contrasting black and crème dorsal stripes (Fig. 1). In contrast to Jones (1985), who found that stripes and color pattern is lost at 65–70 mm SVL, we found that at SVL up to 69 mm (subadult) the stripes were dark and prominent, and above 75 mm SVL (adult), the stripes tended to fade to varying degrees with some individuals losing all their stripes above 90 mm SVL. A study by Richmond and Reeder (2002) based on 25 specimens belonging to the Inyo mitochondrial clade documented an average SVL of 80.2 mm ± 6.9 mm (range, 66.8–97.9 mm), which was similar to our results. Most skink captures occurred between late May and July, with a tendency for increased captures within a few days of thunderstorms. The associated cooler temperatures and

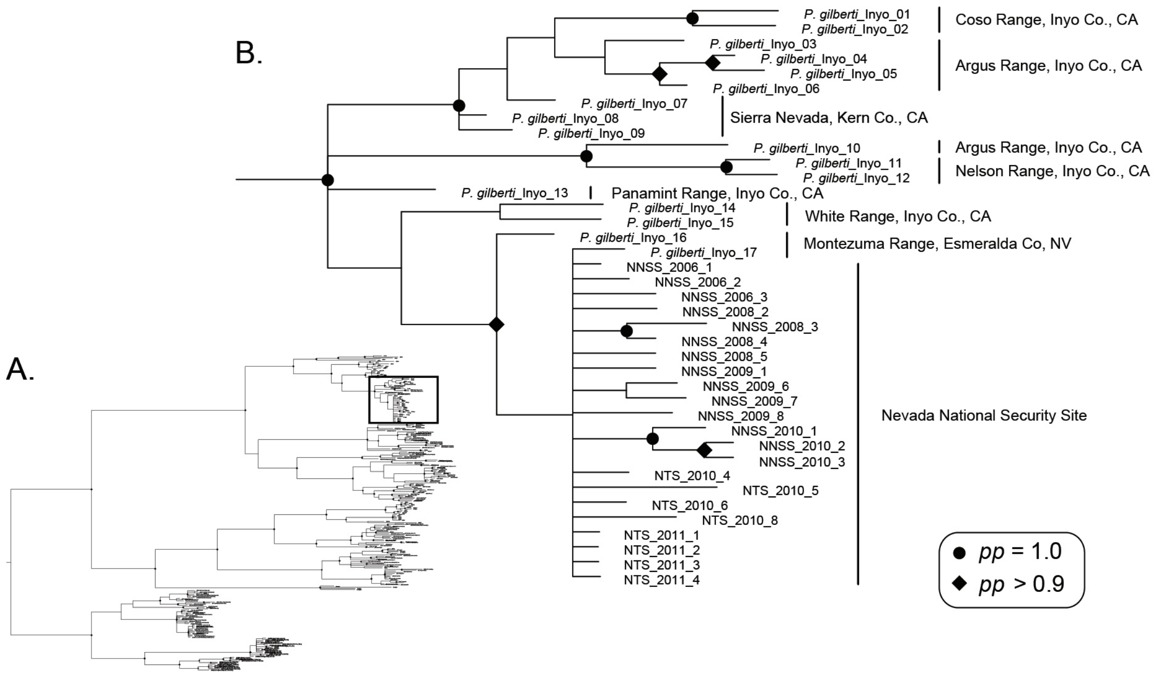

Figure 7. Estimated phylogenetic relationships of mitochondrial DNA haplotypes for (A) the *Plestiodon skiltonianus* species complex, which includes Western Red-tailed (*Plestiodon gilberti rubricaudatus*) and Western Skinks (*Plestiodon skiltonianus*); black box indicates the placement of the (B) Inyo clade, which includes haplotypes from central-east California and southwestern Nevada. Vertical bars denote haplotypes recovered from the same regional area (i.e., *Plestiodon gilberti*_Inyo_01 & 02 were both recovered in the Coso Range, Inyo County, California, USA). Samples from the Nevada National Security Site (NNSS), Nevada, USA, are labeled by collection year, and only unique haplotypes were included in the analysis. Statistically well-supported branches are indicated by their posterior probabilities (*pp*).

increased humidity tended to increase overall reptile activity.

Historically, one skink was captured near Yucca Mountain in Creosote Bush Scrub (Boone and Sowell 1999) at an elevation of 1,130 m during 6,336 trap days and 1,000 person-days noosing between 1991 and 1995. The skink was captured on 24 May 1995 after a very wet winter and spring (more than twice the average precipitation) at a site on an alluvial fan near the mouth of a large canyon coming off the east side of Yucca Mountain. We believe that this was an anomalous capture in non-skink habitat and represented a migration event during an extremely wet year. We suspect the skink moved from better habitat higher up the slope of Yucca Mountain, possibly down the canyon to its capture location due to the unusual wet conditions. For these reasons, we did not trap at the historic site but we trapped three sites upslope on Yucca Mountain and captured three individual skinks five times at two of these sites during May 2010, further supporting the supposition that typical skink habitat occurs on the rocky slopes of Yucca Mountain at higher elevations rather than the alluvial fans at lower elevations.

Documented skink locations on the NNSS generally occurred at elevations within the range of that reported by Jones (1985) and Macey and Papenfuss (1991) in the Inyo and White mountains of eastern California with two exceptions. Macey and Papenfuss (1991) found skinks present to 2,700 m and concluded that skinks occur away from water between 1,830 m and 2,440 m and most common around water between 1,220 m and 2,440 m. We found skinks away from water at elevations as low as 1,463 m and the highest elevation where we documented skinks was 2,095 m (Site #145). The lowest elevation where we documented skinks was around water (Twin Spring, Site #9) at 1,310 m.

We captured skinks in a variety of habitats across a wide range of elevations in several different vegetation associations and geological formations. Important skink habitat features identified in this study were mid-elevations with lower and upper elevations of the NNSS being avoided by skinks, and sites dominated by southern exposures. Results also weakly suggested that sagebrush-dominated sites and wet or mesic sites were more likely to harbor skinks. Anecdotal observations at skink capture sites further suggest that volcanic rock formations prone to fracturing to create deep cracks and presence of thick vegetative litter and plant cover, especially in the absence of rock cracks, were also important habitat factors. These apparent habitat preferences support the idea presented by Wogan and Richmond (2015) who determined that precipitation and temperature are major factors in determining the distributional limits of Western Red-tailed Skink, Western Skink, and San Lucan Skink with the larger-bodied Western Red-tailed Skinks inhabiting hotter and more xeric environments than the smaller-bodied Western and San Lucan skinks. To survive in the hotter, more xeric environments, these skinks need the increased moisture, plant cover and litter, and deep cracks to prevent desiccation. These habitats also attract an abundance of insects that provide food for skinks. Perhaps the southern exposure preference is for thermoregulation purposes to stay warm during the cooler, inactive season.

All NNSS skinks are part of the Inyo clade. The Inyo clade derives its name from its regional affinity to Inyo County, California, and includes skink populations of the low and middle elevations of the White, Inyo, Argus, and Panamint ranges as well as a population in the eastern and southern Sierra Nevada. A noteworthy observation is that even within the Inyo clade, juvenile skinks on the NNSS have red tails while juveniles in the Panamint Range have blue tails (Stebbins 2003). Additionally, skinks captured from the Willow Creek area (Clark County, Nevada, USA), about 66 km southeast from the nearest NNSS location, belong to the Southwest clade, a completely different evolutionary lineage within *P. gilberti* (Jonathan Richmond, pers. comm.). Currently it is unknown whether there is any geographic overlap between the two lineages. This suggests that there may have been some kind of historic barrier (e.g., distance, non-continuous suitable habitat) to gene exchange or that the NNSS was independently colonized from populations to the west and northwest and the Willow Creek skinks from populations to the southeast. We have stored genetic material for the future in hopes that more detailed techniques will be developed to determine relatedness and patterns of dispersal at a much finer scale.

This study greatly increases the knowledge about skink distribution, abundance, and habitat preferences on the NNSS. We believe that these habitat preferences can be extrapolated to adjacent areas in southern Nevada with similar habitats and climate. Another important finding from this study is the identification of the evolutionary lineage of NNSS skinks and how they fit into the overall phylogeny of the *P. skiltonianus* species complex.

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Literature Cited

Arizona Game and Fish Department. 2012. Arizona's State Wildlife Action Plan 2012-2022. Arizona Game and Fish Department, Phoenix, Arizona, USA. 233 p.

Banta, B.H. 1962. Notes on the distribution of the Western Red-tailed Skink, *Eumeces gilberti rubricaudatus* Taylor, in southern Nevada. Herpetologica 18:129–130.

Bechtel Nevada. 2002. Nevada Test Site Orthophoto Site Atlas. Geographic Information Systems, Remote Sensing Department DOE/NV/11718. Bechtel Nevada, Las Vegas, Nevada, USA. 528 p.

Boone, J.L., and C.L. Sowell. 1999. *Eumeces gilberti rubricaudatus*. Herpetological Review 30:52.

California Department of Fish and Wildlife (CDFW). 2015. California State Wildlife Action Plan, 2015 Update: A Conservation Legacy for Californians. Gonzales, A.G., and J. Hoshi (Eds.). California Department of Fish and Wildlife and Ascent Environmental, Inc., Sacramento, California. 804 p.

Edgar, P., J. Foster, and J. Baker. 2010. Reptile Habitat Management Handbook. Amphibian and Reptile Conservation, Bournemouth, England.

Enge, K.M. 2001. The pitfalls of pitfall traps. Journal of Herpetology 35:467–478.

Fitch, H.S. 1987. Collecting and life-history techniques. Pp. 143–164 *In* Snakes: Ecology and Evolutionary Biology. Seigel, R.A., J.T. Collins, and S.S. Novak (Eds.). Macmillan, New York, New York, USA.

Gelman, A., H.S. Stern, J.B. Carlin, D.B. Dunson, A. Vehtari, and D.B. Rubin. 2013. Bayesian Data Analysis. 3rd Edition. CRC Press, Boca Raton, Florida, USA.

Hall, D.B., and P.D. Greger. 2016. Distribution and habitat partitioning of two skink species on the Nevada National Security Site in south-central Nevada. Herpetological Review 47:552–555.

Hamilton, B.T., and E.M. Nowak. 2009. Relationships between insolation and rattlesnake hibernacula. Western North American Naturalist 69:319–328.

Hansen D.J., D.C. Anderson, D.B. Hall, P.D. Greger, and W.K. Ostler. 2010. Ecological Monitoring and Compliance Program 2009 Report. DOE/NV/25946-946. National Security Technologies, Las Vegas, Nevada, USA. 112 p.

Hardy, R. 1948. The Greater Western Skink in Nevada and Utah. Herpetologica 4:165.

Hillis, D.M., B.K. Mable, A. Larson, S.K. Davis, and E.A. Zimmer. 1996. Nucleic acids: sequencing and cloning. Pp. 321–381 *In* Molecular Systematics. 2nd Edition. Hillis, D.M., C. Moritz, and B.K. Mable (Eds.). Sinauer Associates, Sunderland, Massachusetts USA.

Jaeger, E.C. 1957. The North American Deserts. Stanford University Press, Redwood City, California, USA.

Jones, B.K. 1981. Distribution, Ecology, and Habitat Management of the Reptiles and Amphibians of the Hualapai-Aquarius Planning Area, Mohave and Yavapai Counties, Arizona. Technical Note 353, U.S. Bureau of Land Management, Denver, Colorado, USA. 131 p.

Jones, B.K. 1985. *Eumeces gilberti* Van Denburgh Gilbert's Skink. Catalogue of American Amphibians and Reptiles Report 372:1–3.

Kery, M. 2010. Introduction to WinBUGS for Ecologists: Bayesian Approach to Regression, ANOVA, Mixed Models and Related Analyses. Academic Press, Burlington, Massachusetts, USA.

Macey, J.R., and T.J. Papenfuss. 1991. Reptiles. Pp. 291–360 *In* Natural History of the White-Inyo Range, Eastern California. Hall, C.A., Jr. (Ed.). University of California Press, Berkeley, California, USA.

McElreath, R. 2018. Statistical Rethinking: A Bayesian Course with Examples in R and Stan. CRC Press, Boca Raton, Florida, USA.

Medica, P.A., O.L. Haworth, and M.S. Kelly. 1990. *Eumeces gilberti rubricaudatus*. Herpetological Review 21:40.

Morrison, M.L., and L.S. Hall. 1999. Habitat relationships of amphibians and reptiles in the Inyo-White Mountain, California and Nevada. Pp. 233–237 *In* Proceedings: Ecology and Management of Pinyon-juniper Communities within the Interior West. Monsen, S.B., and R. Stevens (compilers). Proceedings RMRS-P-9, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, Utah, USA.

Morrison, M.L., P.A. Aigner, L.A. Nordstrom, and L.S. Hall. 1999. Habitat characteristics of sympatric Gilbert's and Western skinks. Herpetological Review 30:18–20.

National Oceanic and Atmospheric Administration (NOAA). 2006. Climatology of the Nevada Test Site. SORD 2006-3. National Oceanic and Atmospheric Administration, Silver Spring, Maryland, USA. 165 p.

National Security Technologies, LLC. 2007. Ecological and Monitoring Compliance Program 2006 Report. DOE/NV/25946-174. National Security Technologies, Las Vegas, Nevada, USA. 133 p.

Ostler, W.K., D.J. Hansen, D.C. Anderson, and D.B. Hall. 2000. Classification of vegetation on the Nevada Test Site. DOE/NV/11718-477. Bechtel Nevada, Las Vegas, Nevada, USA. 566 p.

Plummer, M. 2003. JAGS: a program for analysis of Bayesian graphical models using Gibbs sampling. Pp. 1-10 *In* Proceedings of the 3rd International Workshop on Distributed Statistical Computing 124 (125.10). Plummer M., K. Hornik, F. Leisch, and A. Zeileis (editors). Vienna, Austria.

R Core Team. 2018. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.

Raftery, A.E., and S.M. Lewis. 1996. Implementing mcmc. Pp. 115–130 *In* Markov Chain Monte Carlo in Practice. Gilks, W.R., S. Richardson, and D.J. Spiegelhalter (Eds.). CRC Press, Boca Raton, Florida, USA

Rannala B., and Z. Yang. 1996. Probability distribution of molecular evolutionary trees: a new method of phylogenetic inference. Journal of Molecular Evolution 43:304–311.

Richmond, J.G., and E.L. Jockusch. 2007. Body size evolution simultaneously creates and collapses species boundaries in a clade of scincid lizards. Proceedings of the Royal Society of Britain 274:1701–1708.

Richmond, J.G., and T.W. Reeder. 2002. Evidence for parallel ecological speciation in scincid lizards of the *Eumeces skiltonianus* species group (Squamata: Scincidae). Evolution 56:1498–1513.

Rodgers, T.L., and H.S. Fitch. 1947. Variation in the skinks (Reptilia: Lacertilia) of the skiltonianus group. University of California Publications in Zoology 48:169–220.

Ronquist, F., M. Teslenko, P. van der Mark, D.L. Ayres, A. Darling, S. Höhna, B. Larget, L. Liu, M.A. Suchard, and J.P. Huelsenbeck. 2012. MrBayes 3.2: efficient Bayesian phylogenetic inference and model choice across a large model space. Systematic Biology 61:539–542.

Slate, J.L., M.E. Berry, P.D. Rowley, C.J. Fridrich, K.S. Morgan, J.B. Workman, O.D. Young, G.L. Dixon, V.S. Williams, E.H. McKee, et al. 1999. Digital Geologic Map of the Nevada Test Site and vicinity, Nye, Lincoln, and Clark Counties, Nevada, and Inyo County, California. Open-File Report 99-554-A, U.S. Geological Survey, Denver, Colorado, USA. 53 p.

Stebbins, R.C. 2003. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin, New York, New York, USA.

Su, Y., and M. Yajima, 2015. R2jags: Using R to Run 'JAGS'. R package version 0.5-7. https://CRAN.R-project.org/package=R2jags.

Vitt, L.J., J.D. Congdon, and N.A Dickson. 1977. Adaptive strategies and energetics of tail autotomy in lizards. Ecology 58:326–337.

Wildlife Action Plan Team. 2012. Nevada Wildlife Action Plan. Nevada Department of Wildlife, Reno, Nevada. 566 p.

Wogan, G.O.U., and J.Q. Richmond. 2015. Niche divergence builds case for ecological speciation in skinks of the *Plestiodon skiltonianus* species complex. Ecology and Evolution 5:4683–4695.

Zuur, A., E.N. Ieno, N. Walker, A.A. Saveliev, and G.M. Smith. 2009. Mixed Effects Models and Extensions in Ecology with R. Springer Science+Business Media. New York, New York, USA.

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Kevin T. Shoemaker is an Assistant Professor in the Department of Natural Resources and Environmental Science at University of Nevada, Reno, USA. Kevin's expertise in population ecology and biostatistics has led to his involvement in numerous projects that span the vertebrate taxonomic spectrum from reptiles to mammals and birds. The overall goal of Kevin's work is to develop creative and efficient solutions for conserving and managing wild populations. Kevin is passionate about helping to train the next generation of quantitative conservation scientists and is also actively involved in the Society for Conservation Biology and The Wildlife Society. (Photographed by James P. Gibbs).

Paul D. Greger recently retired from over 25 y of ecological work at the Nevada National Security Site, USA. Paul began work at the site revegetating disturbed habitats and also worked on many wildlife studies over his career. These studies included large mammal population studies such as Mule Deer (*Odocoileus hemionus*), Mountain Lions (*Puma concolor*), and feral Horses (*Equus caballus*). Paul also conducted bird monitoring in numerous habitats and worked on lizard, tortoise, and small mammal monitoring on standard plots over many years. Paul's present interests and activities include fairy shrimp and snake collection, travel, golf, and fly fishing. (Photographed by Paul D. Greger).

Appendix Table 1. Site number, date, snout-vent length (mm), weight (g), and description of all captures of Western Red-tailed Skinks (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*) on the Nevada National Security Site (NNSS), Nevada, USA, including historic captures.

Site Number	Date	SVL (mm)	Weight (g)	Description (Sex; Age; Coloration)
9	11 May 2006	96	22	Male; Adult; No stripes
9	11 May 2006	91	24	Male; Adult; No stripes
18	24 May 2006	69	8	Subadult; Stripes
19	25 May 2006	85	Not taken	Adult; Faint stripes
20	25 May 2006	89	17	Adult; Stripes
20	25 May 2006	90	17	Male; Adult; No stripes
26	08 Jul 2006	61	4	Subadult; Dark stripes, red tail
28	08 Jul 2006	55	6	Subadult; Dark stripes, purple/orange tail
29	11 Aug 2011	80	13.5	Adult
32	23 Jul 2008	93.8	14	Male; Adult; Faint stripes
32	31 Jul 2008	33.3	0.5	Hatchling; Bright pink tail
34	10 Aug 2006	64	6	Subadult; Stripes, red tail
63	15 Jul 2010	61	5	Subadult; Dark stripes
70	29 Jun 2010	85	16	Female; Adult; No stripes
83	23 Jun 2011	96	20	Adult
86	04 Jun 2008	83.4	13.5	Male: Adult; Faint stripes
87	24 Jun 2008	75	9.5	Adult: Stripes
87	25 Jun 2009	83	12.5	Recapture from 2008; 1 m from original capture
87	26 Jun 2008	90	20	Adult; Faint stripes
87	30 Jun 2008	86.4	12.5	Adult; No stripes
87	30 Jun 2008	83	10	Adult; No stripes
89	23 Jun 2010	83.9	13.5	Adult; No stripes
93	31 Jul 2008	84	13	Adult
110	09 Jun 2009	80	9	Adult; Faint stripes
110	11 Jun 2009	Recapture	Recapture	Recapture; 1 m from original capture
112	02 Jun 2009	90	20	Adult; Faint stripes
112	09 Jun 2009	92	Not taken	Adult; No stripes
112	11 Jun 2009	Recapture	Recapture	Recapture; 7 m from original capture
114	25 Jun 2009	80	9.5	Adult; Stripes
115	27 Jul 2011	64	5	Subadult
115	28 Jul 2011	84	11	Adult; Stripes
116	15 Jul 2009	60	4	Subadult; Dark stripes
117	13 Jul 2009	83	12	Adult; Faint stripes
117	15 Jul 2009	85	14	Adult; Faint stripes
118	20 Jul 2009	85	18	Male; Adult; No stripes
132	18 May 2010	93	19	Male; Adult; Faint stripes
132	19 May 2010	Recapture	Recapture	Recapture; 19 m from original capture
132	19 May 2010	88	18	Male; Adult; Faint stripes

Appendix Table 1 (continued). Site number, date, snout-vent length (mm), weight (g), and description of all captures of Western Red-tailed Skinks (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*) on the Nevada National Security Site (NNSS), Nevada, USA, including historic captures.

Site Number	Date	SVL (mm)	Weight (g)	Description (Sex; Age; Coloration)
137	20 May 2010	83.2	15	Male; Adult; Faint stripes
137	25 May 2010	Recapture	Recapture	Recapture;13 m from original capture
139	04 Jun 2010	95.4	20	Male; Adult
140	04 Jun 2010	88.5	16.5	Male; Adult; Faint stripes
140	08 Jun 2010	Recapture	Recapture	Recapture; 23 m from original capture
140	08 Jun 2010	81.3	14	Adult; No stripes
145	15 Jul 2010	83.2	10	Adult; Stripes
157	23 Jun 2011	88.5	16	Adult; Faint stripes
20 (1-Historic)	30 May 1979	Not taken	Not taken	Male
2-Historic	02 Jun 1982	87	Not taken	Male; Adult; No stripes
23 (3-Historic)	13 Sep 1988	91	Not taken	Female; Adult
25 (4-Historic)	05 May 1992	94	21.3	Male; Adult; No stripes
5-Historic	24 May 1995	79	11	Adult

Appendix Table 2. Habitat information for the 29 capture sites of Western Red-tailed Skinks (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*) on the Nevada National Security Site (NNSS), Nevada, USA.

Site Number	#Captures	Elevation (m)	% Slope	Aspect (degrees)	Geology	Moisture	Landform	Soil/Substrate	Vegetation Association
9	2	1310	35	220	Rhyolite of Windy Wash	Wet	Hillslope/Spring	Rock/Litter	Ephedra nevadensis-Grayia spinosa Shrubland
18	1	1463	2	260	Young alluvial deposits	Mesic	Draw	Sand/Boulders	Ericameria nauseosa-Ephedra nevadensis Shrubland
19	1	1463	33	140	Pahute Mesa and Rocket Wash Tuffs	Dry	Mesa slope/Cliff	Loamy sand/Boulders	Miscellaneous
20	2	1488	5	110	Pahute Mesa and Rocket Wash Tuffs	Dry	Rock outcrop/Draw/ Mesa edge	Loamy sand/Rock/ Desert pavement	Chrysothamnus viscidiflorus-Ephedra nevadensis Shrubland
26	1	1615	10	180	Ammonia Tanks Tuff	Wet	Wash/Hillslope/ Tank	Boulder/Rock/Sand	Artemisia nova-Chrysothamnus viscidiflorus Shrubland
28	1	1848	4	250	Trail Ridge Tuff	Mesic	Rock outcrop/Wash/ Borrow pit	Rock/Gravel/Boulder	Artemisia nova-Chrysothamnus viscidiflorus Shrubland
29	1	1539	4	160	Older tunnel beds	Wet	Wash/Spring/Adit/ Dirt road	Gravel	Coleogyne ramosissima-Ephedra nevadensis Shrubland
32	2	1683	Varied	350	Trail Ridge Tuff	Mesic	Wash/Cliff	Rock/Boulder/Sand	Artemisia nova-Chrysothamnus viscidiflorus Shrubland
34	1	1744	18	Varied	Pahute Mesa and Rocket Wash Tuffs	Dry	Knoll	Rock/Boulder/Loamy sand	Artemisia nova-Chrysothamnus viscidiflorus Shrubland
63	1	2043	Varied	200	Rainier Mesa Tuff	Dry	Knoll/Rock outcrop	Rock/Gravel	Artemisia nova-Chrysothamnus viscidiflorus Shrubland
70	1	1692	0-10	250	Colluvium	Mesic	Wash/Cliff	Rock/Gravel/Sand	Artemisia tridentata-Chrysothamnus viscidiflorus Shrubland
83	1	2018	28	320	Rainier Mesa Tuff	Dry	Mountain slope/ Rock outcrop	Rock/Litter	Pinus monophylla/Artemisia tridentata Woodland
86	1	1695	Varied	Varied	Young alluvial deposits	Mesic	Mountain valley/ Rock outcrop	Rock/Litter	Pinus monophylla/Artemisia tridentata Woodland
87	4	1921	1	Varied	Ammonia Tanks Tuff	Mesic	Mesa top/Rock outcrop	Rock/Boulder/Litter	Miscellaneous
89	1	2012	Varied	170	Bullfrog Tuff	Dry	Mesa slope	Boulder/Rock/Sand/ Litter	Pinus monophylla/Artemisia nova Woodland
93	1	1677	Varied	Varied	Pahute Mesa and Rocket Wash Tuffs	Mesic	Canyon/Wash/Cliff	Rock/Gravel/Sand	Ephedra nevadensis-Grayia spinosa Shrubland
110	2	1601	Varied	110	Tuff of Twin Peaks	Wet	Butte slope/Draw/ Spring/Building	Sand/Gravel/Litter	Coleogyne ramosissima-Ephedra nevadensis Shrubland
112	3	1784	Varied	Varied	Older tunnel beds	Wet	Butte slope/Spring	Litter/Gravel	Ephedra viridis-Artemisia tridentata Shrubland

Appendix Table 2 (continued). Habitat information for the 29 capture sites of Western Red-tailed Skinks (*Plestiodon* [*Eumeces*] *gilberti rubricaudatus*) on the Nevada National Security Site (NNSS), Nevada, USA.

Site Number	#Captures	Elevation (m)	% Slope	Aspect (degrees)	Geology	Moisture	Landform	Soil/Substrate	Vegetation Association
114	1	1671	2	80	Trail Ridge Tuff	Mesic	Wash/Rock outcrop	Sand/Rock/Gravel	Artemisia nova-Chrysothamnus viscidiflorus Shrubland
115	2	1753	Varied	200	Ammonia Tanks Tuff	Dry	Mesa slope/Rock outcrop	Rock/Litter/Boulders	Pinus monophylla/Artemisia nova Woodland
116	1	1905	35	270	Trail Ridge Tuff	Mesic	Mesa slope/Ravine/ Rock outcrop	Rock/Gravel	Artemisia nova-Chrysothamnus viscidiflorus Shrubland
117	2	1896	30	Varied	Trail Ridge Tuff	Dry	Mountain valley/ Rock outcrop	Rock/Gravel	Artemisia nova-Chrysothamnus viscidiflorus Shrubland
118	1	1845	Varied	110	Slope-facies Carbonate Rocks	Mesic	Wash/Canyon	Gravel/Litter/Rock	Pinus monophylla/Artemisia nova Woodland
132	3	1555	Varied	Varied	Tiva Canyon Tuff	Mesic	Hillslope/Rock outcrop/Ravine	Rock/Gravel	Coleogyne ramosissima-Ephedra nevadensis Shrubland
137	2	1494	20	220	Tiva Canyon Tuff	Dry	Hillslope/Rock outcrop	Rock/Litter/Gravel	Coleogyne ramosissima-Ephedra nevadensis Shrubland
139	1	1768	60	160	Ammonia Tanks Tuff	Dry	Hillslope/Cliff/Rock outcrop	Rock/Soil/Litter	Pinus monophylla/Artemisia tridentata Woodland
140	4	1872	Varied	Varied	Ammonia Tanks Tuff	Dry	Ridge/Rock outcrop	Rock/Soil	Pinus monophylla/Artemisia tridentata Woodland
145	1	2095	Varied	Varied	Rainier Mesa Tuff	Dry	Mesa slope/Cliff	Rock/Litter	Pinus monophylla/Artemisia nova Woodland
157	1	1634	Varied	Varied	Rainier Mesa Tuff	Dry	Ridge/Rock outcrop	Litter/Gravel/Rock	Coleogyne ramosissima-Ephedra nevadensis Shrubland