Prey enhancement	P_{fall} (Sept-Oct 1-yr lag)	0.002	0.001	0.072	0.038	1.91	0.002	0.001	0.068	0.036	1.88
Predation	P_{yr} (annual 2-4-yr lag)	-0.50	0.17	-0.138	0.048	-2.89	-0.193	0.186	-0.044	0.043	-1.04
Warm stress	T_{max} (Jul-Sept 1-2 yr lag; ln)	3.30	1.30	0.079	0.031	2.55	2.999	1.292	0.071	0.031	2.32
Cold effects	T_{min} (Nov-Mar 0-2 yr lag)	-0.047	0.015	-0.158	0.050	-3.16	-0.041	0.014	-0.136	0.046	-2.97
Tree lizard (890)											
Prey enhancement	P_{ws} (May-Oct 1-yr lag)	1.37E-03	6.46E-04	0.082	0.039	2.12	1.41E-03	6.28E-04	0.085	0.038	2.25
Predation	P_{yr} (annual 2-4-yr lag; ^2)	-3.01E-05	6.20E-06	-0.78	0.16	-4.86	-2.42E-05	7.62E-06	-0.094	0.029	-3.18
Warm stress	T_{max} (Jul-Aug 1-yr lag; ln)	-7.00	2.10	-0.181	0.054	-3.34	-8.89	2.00	-0.229	0.051	-4.44
Cold effects	T_{min} (Nov-Mar 1-2 yr lag; ln)	-0.39	0.14	-0.164	0.061	-2.70	-0.30	0.13	-0.125	0.055	-2.27
Desert spiny lizard (743)											
Prey enhancement	P_{cs} (Nov-Apr 1-2 yr lag)	0.002	0.001	0.150	0.090	1.69	0.046	0.021	0.146	0.068	2.15
Predation	P_{yr} (annual 2-4-yr lag; ln)	0.20	0.27	0.053	0.073	0.73	-0.46	0.27	-0.098	0.057	-1.72
Warm stress	T_{max} (Apr-May 1 yr lag; ln)	3.82	1.74	0.187	0.084	2.20	0.076	0.039	0.111	0.064	1.75
Cold effects	T_{min} (Nov-Mar 1-2 yr lag; ^2)	0.011	0.004	0.56	0.19	2.96	0.012	0.004	0.132	0.039	3.40

Figure Legends:

Fig. 1. Distribution of survey transects for lizards, weather stations, and vegetation communities in Organ Pipe Cactus National Monument (OPCNM). Inset map shows the distribution of four of the six subdivisions of the Sonoran Desert and the transitional nature of the study area.

Fig. 2. Temporal variation in local and regional abundances of five species of lizards in spring and summer over 25 years in Organ Pipe Cactus National Monument (1989-2013). Estimates are from *N*-mixture models and are adjusted for variation in detection probability.

Fig. 3. Temporal variation in precipitation during four time periods considered when assessing the influence of climatic variation on lizard populations over 25 years in Organ Pipe Cactus National Monument (1989-2013). Estimates are from 17 weather stations located throughout the monument. Trend estimates are based on linear mixed effects models with autoregressive-moving-average structures to adjust for temporal autocorrelation. Parameter estimates and significance levels are summarized in Table 2.

Fig. 4. Temporal variation in mean maximum (T_{max}) and mean minimum (T_{min}) daily temperature during various time periods considered when assessing the influence of climatic variation on lizard populations over 25 years in Organ Pipe Cactus National Monument (1989-2013). Estimates are from at 9 weather stations located throughout the monument. Trend estimates are based on linear mixed effects models with autoregressive-moving-average structures. Parameter estimates and significance levels are summarized in Table 2.

Fig. 5. Associations between lizard abundance and weather factors linked to four hypotheses that explained the influence of precipitation (*P,* mm) and temperature (*T,* °C) on spatiotemporal variation in lizard abundance in Organ Pipe Cactus National Monument over 25 years (1989-2013). Associations are shown for three species of lizards that exemplify differences in life history traits: the terrestrial, spring-summer breeding tiger whiptail; smaller, terrestrial, winter-spring breeding side-blotched lizard; and the arboreal ornate tree lizard. Regression lines are from linear mixed effects models with crossed random intercepts for transect and year, and are summarized in Table 4.

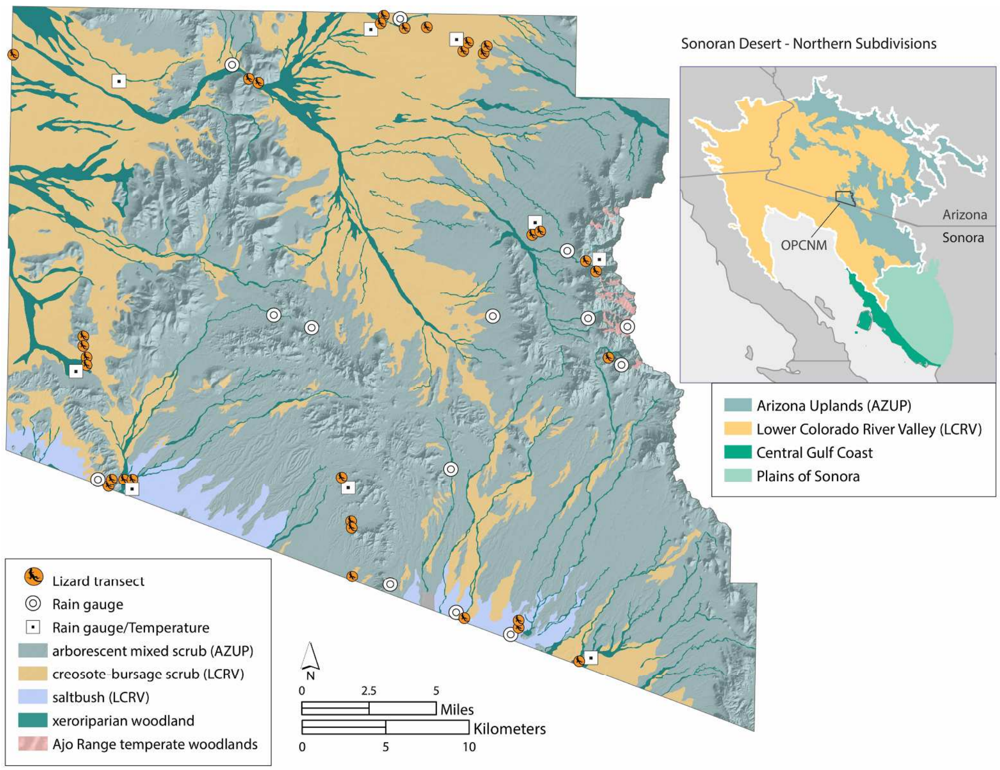

Fig. 1. Distribution of survey transects for lizards, weather stations, and vegetation communities in Organ Pipe Cactus National Monument (OPCNM). Inset map shows the distribution of four of the six subdivisions of the Sonoran Desert and the transitional nature of the study area.

116x88mm (600 x 600 DPI)

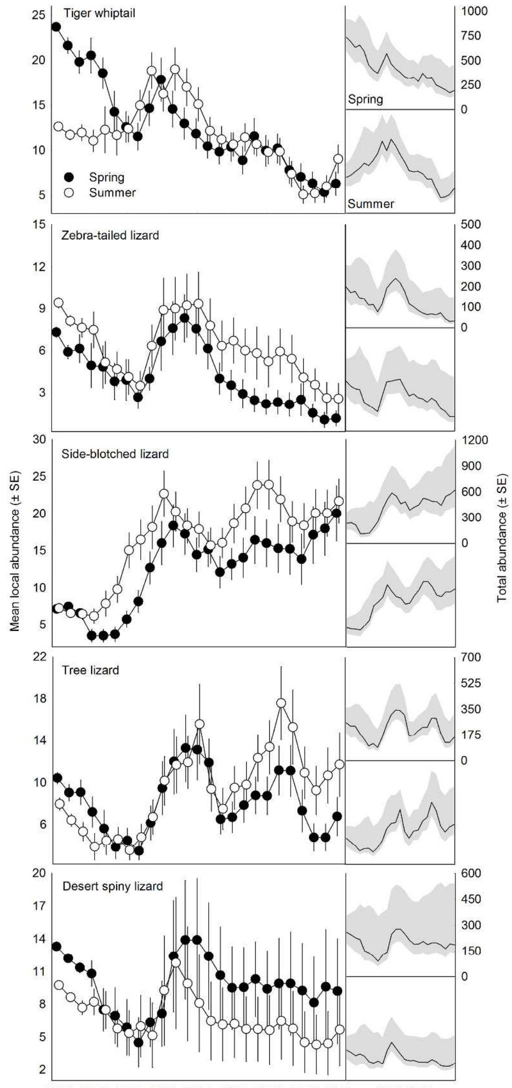

Fig. 2. Temporal variation in local and regional abundances of five species of lizards in spring and summer over 25 years in Organ Pipe Cactus National Monument (1989-2013). Estimates are from N-mixture models and are adjusted for variation in detection probability.

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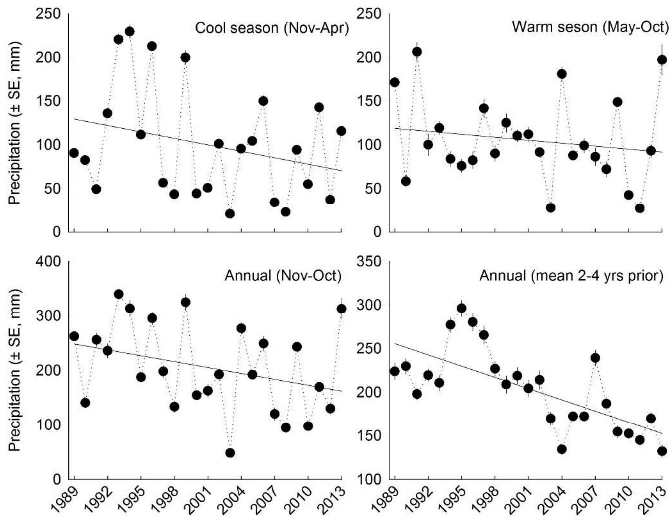

Fig. 3. Temporal variation in precipitation during four time periods considered when assessing the influence of climatic variation on lizard populations over 25 years in Organ Pipe Cactus National Monument (1989-2013). Estimates are from 17 weather stations located throughout the monument. Trend estimates are based on linear mixed effects models with autoregressive-moving-average structures to adjust for temporal autocorrelation. Parameter estimates and significance levels are summarized in Table 2.

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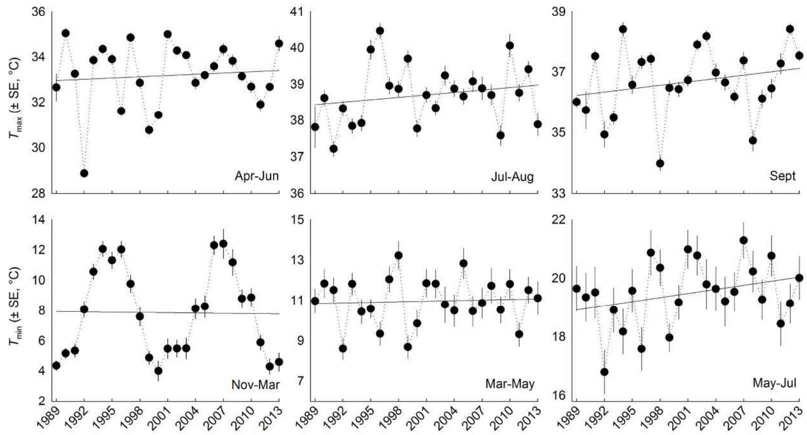

Fig. 4. Temporal variation in mean maximum (Tmax) and mean minimum (Tmin) daily temperature during various time periods considered when assessing the influence of climatic variation on lizard populations over 25 years in Organ Pipe Cactus National Monument (1989-2013). Estimates are from at 9 weather stations located throughout the monument. Trend estimates are based on linear mixed effects models with autoregressive-moving-average structures. Parameter estimates and significance levels are summarized in Table 2.

215x166mm (300 x 300 DPI)

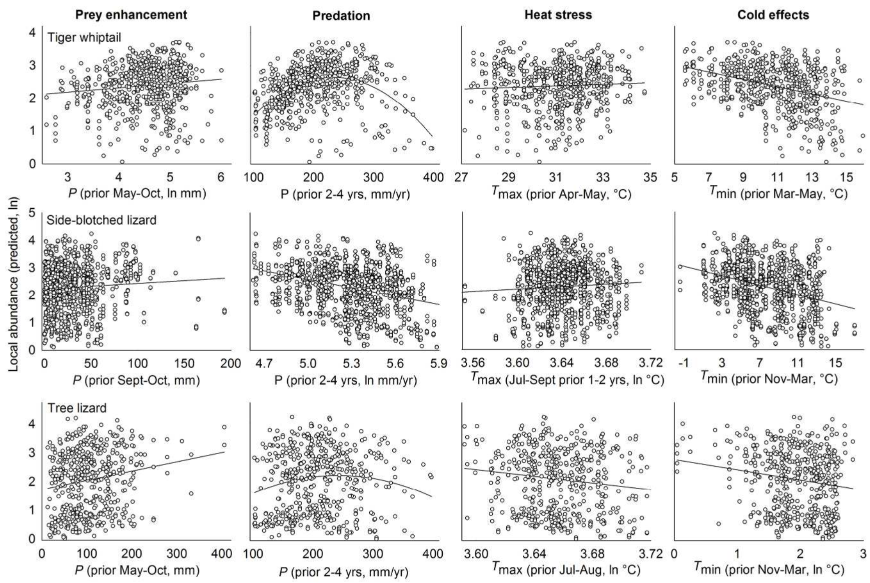

Fig. 5. Associations between lizard abundance and weather factors linked to four hypotheses that explained the influence of precipitation (P, mm) and temperature (T, °C) on spatiotemporal variation in lizard abundance in Organ Pipe Cactus National Monument over 25 years (1989-2013). Associations are shown for three species of lizards that exemplify differences in life history traits: the terrestrial, spring-summer breeding tiger whiptail; smaller, terrestrial, winter-spring breeding side-blotched lizard; and the arboreal ornate tree lizard. Regression lines are from linear mixed effects models with crossed random intercepts for transect and year, and are summarized in Table 4.

215x166mm (300 x 300 DPI)

Supporting Information

Appendix S1. Phenology of climatic effects on five focal species of lizards.

We synthesized the ecological literature and our field data on the five focal species of lizards in our analysis (Table S1) and used this information to develop hypotheses for the effects of climatic variation on abundances. In general, hypotheses are diagrammed in Fig. S1, and the resulting variables we employed as predicted effects are in Table S2. Here we provide details of the logic employed in representing each research hypothesis. All five species of lizards were represented similarly, but for one with divergent life history the application of climate variables was slightly modified as described below.

To avoid excessive complexity beyond established specifics and precision of knowledge of autecology and demographics (see Table S1), we treated the following four species identically:

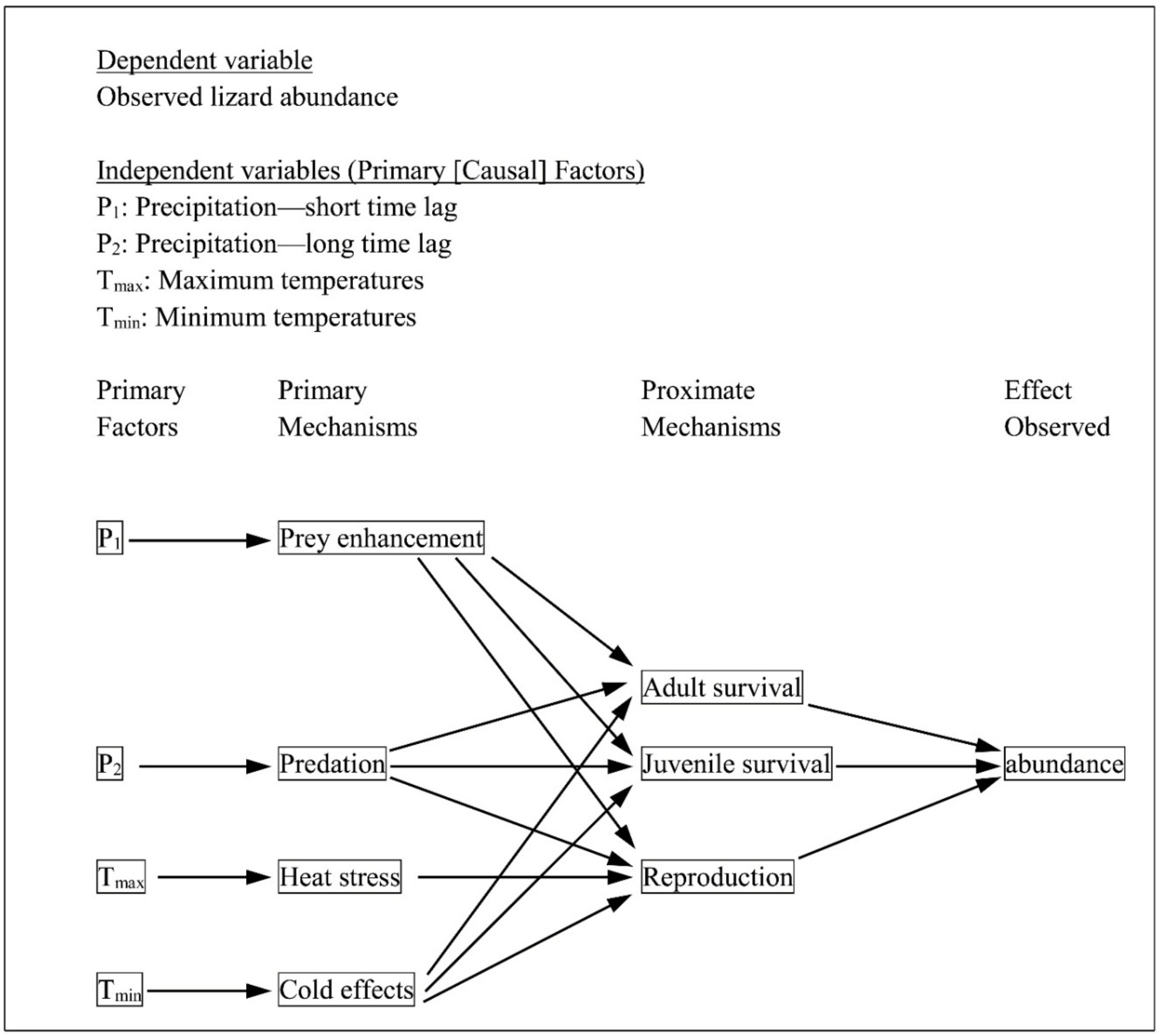

Figure S1. Diagrammatic representation of mechanistic connections of climate and weather variables to ecological hypotheses tested

Table S1. Ecological characteristic for five focal species of lizards we considered in the Sonoran Desert. Items shown in parentheses are subsidiary aspects of niche or phenology.

English name	Zebra-tailed lizard	Desert spiny lizard	Ornate tree lizard	Side-blotched lizard	Tiger whiptail
Scientific name	*Callisaurus draconoides*	*Sceloporus magister*	*Urosaurus ornatus*	*Uta stansburiana*	*Aspidoscelis tigris*
Family	Phrynosomatidae	Phrynosomatidae	Phrynosomatidae	Phrynosomatidae	Teiidae
Principal macrohabitat [1]	flats, bajadas, canyon bottoms	bajadas and flats	ubiquitous	ubiquitous	bajadas, flats, arid slopes
Lifestyle - microhabitat [1]	terrestrial	arboreal (terrestrial)	arboreal (saxicolous)	terrestrial, saxicolous	terrestrial
Egg-laying season [2]	(Apr) May-Aug (Sept)	May-Aug	(May) June-Aug (Sept)	Mar-May (Jun-Aug)	(Apr) May-Aug (Sept)
♀ Age (YR) at 1st reproduction [2]	1	1-1.5 (2)	(≈0.9) 1	(≈0.7) 1	1-1.5 (2)
T_b or T_{pref} [3]	39.08	35.03	35.85	36.23	40.14
Clutch frequency [4]	2	1-2	2-4	3-6	2-3
Mean clutch size [4]	4.6	7.8	6.9	4.2	2.6
Diet [4]	arthropods	arthropods (small lizards)	arthropods	arthropods	arthropods (small lizards)
Predominant foraging behavior	sit-wait	sit-wait	sit-wait	sit-wait	active forager
General life history type	iteroparous, multi-clutched	iteroparous, multi-clutched	≈ annual, multi-clutched	annual, multi-clutched	iteroparous, multi-clutched

[1] at OPCNM, [2] from literature and unpublished OPCNM field data, [3] estimated for OPCNM from literature, [4] from literature

The zebra-tailed lizard, desert spiny lizard, ornate tree lizard, and tiger whiptail all breed during the warm season (late April – early September), mature at ≈1 -1.5 years of age, and populations have approximately similar proportions of older adults and recruiting sub-adults from reproduction corresponding to predicted time-lagged effects of ≈1 year. A fifth species, the common side-blotched lizard, breeds earlier (February-May, with limited breeding through August), matures earlier (≤1 year of age), and has nearly annual population turnover throughout its range. Thus it is expected to show different time-lag effects, especially between spring and summer seasons. Differences in climate-based ecological hypotheses linked to this species are described below.

We represented the prey enhancement hypothesis using precipitation variables at short time lags (Table S2). This hypothesis predicts increases in precipitation augment arthropod activity and primary productivity, which increases arthropod productivity and thus yields rapid increases in prey availability. Increased food resources are assumed to translate into increased reproductive output of lizards at time lags dependent on reproductive phenology and time to maturity. For the four similar species, summer rainfall leads to enhanced hatchling production, and based on our observations, many of these hatchlings are large enough to be counted the following spring and all are large enough by the following summer. The same logic applies to winter rainfall, as well as annual rainfall as defined in Table S2, thus indicating an approximately 1-year lag time relating precipitation to observed abundance changes in lizards. For fall precipitation, we assume that increased rainfall results primarily in increased juvenile growth and survival, and hence we also based our predictions on a 1-year lag time. The same applies to the positive effects of fall precipitation on adult survival, although we suspect this effect and other similar ones are likely small.

The predation hypothesis assumes the strongest effect of increased long-term precipitation (>1-year time lag) results from increases in predator populations. These changes are caused by increased reproduction of predators in response to greater resource abundance, which results from bottom-up processes such as those identified by the prey enhancement hypothesis but at longer time lags. Although predator activity may also increase immediately (or at least at short time-lags, implying a <1-year time lag) in response to precipitation, we assumed this effect was small enough so that precipitation time lags linked to prey enhancement and predation variables could be separated. Although other factors such as intra- and interspecific competition may also operate at longer time lags in response to long-term precipitation, our predation hypothesis assumes these processes are weaker than predation. Further discussion of these issues is in the main text. We also considered 2-3-year time lags for precipitation linked to the predation hypotheses but this yielded somewhat weaker associations and is not presented in the results.

We represented high temperatures based on daily thermal maxima ($T_{\max}$; Table S2). As with $T_{\min}$, we found no associations with abundances at short lag times that would suggest direct mortality from overheating as an important factor in lizard population change, and we therefore focused on likely effects of $T_{\max}$ on activity and thence reproductive output as described by Sinervo et al. (2010) and others. Sinervo et al. (2010) highlighted the potential importance of $T_{\max}$ during the breeding season on restricting activity and we therefore partitioned our examination of this factor into several variables representing effects of spring and summer breeding and of high temperatures just after the breeding season (late summer and fall) on reproductive output and resulting abundances in subsequent breeding seasons. Thus, we considered T_{max} at time lags of 1 and 2 years (Table S2).

We represented cold-effects hypotheses with four daily minimum temperature variables (T_{min}; Table S2). We assumed that high T_{min} increased resting metabolism, reducing stored energy and subsequent reproductive output, and following the logic for precipitation variables, operated at a 1-year time lag. We initially suspected that low winter temperatures might cause freeze mortality, resulting in a negative effect on populations at lag times of <1 year, but discarded this hypothesis after exploratory analyses indicated no associations. Thus it appears that overwinter freezing mortality is not important to lizard population changes in our system; nor did we find evidence that overwinter starvation of adults and larger juveniles was an important factor in population change, which would also have appeared as a <1-year time lagged effect. We tested for cold effects in other seasons following the same logic as above for winter thermal minima. We tested variables for minimum warm-season temperature effects in the pre-breeding and breeding periods (Table S2, T_{minS} and T_{minBS}) to correspond with findings in the literature (Sinervo et al. 2010).

Slight modifications to time lags for various variables were needed to reflect the winter-spring breeding peak and high population turnover of the side-blotched lizard. These traits result in differences in reproductive output at different time lags for populations surveyed in summer versus spring. In summer, most observed individuals are subadults and small adults from the immediately preceding winter-spring breeding season (time-lag = 0 for some variables) whereas in spring all observed individuals are adults, predominantly those from the previous winter-spring plus a few older survivors (thus, time-lag = 1 for most models). We thus lagged weather factors an additional time step when assessing associations with spring abundance.

Table S2. Names and definitions of weather factors considered when assessing hypotheses for the effects of climatic variation on population dynamics of diurnal lizards in Organ Pipe Cactus National Monument over 25 years (1989-2013)..

Factor	Code	Time Period	Definition	Hypotheses
Precipitation	P_{ws}	Warm season	May through Oct of prior year	Prey enhancement
Precipitation	P_{cs}	Cool season	Nov 2 years prior through April of prior year	Prey enhancement
Precipitation	P_{fall}	Fall	Sept and Oct of prior year	Prey enhancement
Precipitation	P_{yr}	Annual	Sum of P_{cs} and P_{ws}	Prey enhancement
Precipitation	P_{yr234}	Annual	Mean P_{yr} 2-4 years prior	Predation
Temperature	T_{minW}	Cold season	1-2 years prior Nov to 0-1 year prior Mar	Cold effects
Temperature	T_{minA}	Annual	1-2 years prior Nov to 0-1 years prior Oct	Cold effects
Temperature	T_{minS}	Emergence, pre-breeding, breeding season	0-1 year prior Mar-May	Cold effects
Temperature	T_{minBS}	Breeding season	0-1 year prior May-Jul	Cold effects
Temperature	T_{maxSp}	Spring	prior April-May	Heat stress
Temperature	T_{maxSp}	Spring-early summer	prior April-June	Heat stress
Temperature	T_{maxSu}	Summer	prior July-August	Heat stress
Temperature	$T_{maxFall}$	Late summer	2-yr prior Sept.	Heat stress
Temperature	$T_{maxSpSu}$	Spring-summer	prior April-Sept	Heat stress
Temperature	$T_{maxSu\text{-}Sept}$	Mid-late summer	2-yr prior July-Sept.	Heat stress

References

Asplund KK, Lowe CH (1964) Reproductive cycles of the iguanid lizards *Urosaurus ornatus* and *Uta stansburiana* in southeastern Arizona. *Journal of Morphology* **115**, 27-33.

Ballinger RE (1977) Reproductive strategies: food availability as a source of proximal variation in a lizard. *Ecology*, 628-635.

Goldberg SR (2012) Reproduction of the yellow-backed spiny lizard, *Sceloporus uniformis* (Squamata: Phrynosomatidae) from California. *Bulletin, Southern California Academy of Sciences,* **111**, 25-28.

Goldberg, SR (2013) Reproduction in the ornate tree lizard (*Urosaurus ornatus*), from Sonora, Mexico. *Sonoran Herpetologist*, 26, 47-51.

Goldberg SR, Lowe CH (1966) The reproductive cycle of the western whiptail lizard (*Cnemidophorus tigris*) in Southern Arizona. *Journal of Morphology,* **118**, 543-548.

Hahn WE, Tinkle DW (1965) Fat body cycling and experimental evidence for its adaptive significance to ovarian follicle development in the lizard *Uta stansburiana*. *Journal of Experimental Zoology,* **158**, 79-85.

M'closkey RT, Deslippe RJ, Szpak CP, Baia KA (1990) Ecological correlates of the variable mating system of an iguanid lizard. *Oikos*, 63-69.

M'closkey RT, Deslippe RJ, Szpak CP, Baia KA (1990) Tree lizard distribution and mating system: the influence of habitat and food resources. *Canadian Journal of Zoology,* **68**, 2083-2089.

Michel L (1976) Reproduction in a southwest New Mexican population of *Urosaurus ornatus*. *Southwestern Naturalist*, 281-299.

Parker WS (1972) Ecological study of the western whiptail lizard, *Cnemidophorus tigris gracilis*, in Arizona. *Herpetologica,* **28**, 360-369.

Parker WS, Pianka ER (1973) Notes on the ecology of the iguanid lizard, *Sceloporus magister*. *Herpetologica*, 143-152.

Parker WS, Pianka ER (1975) Comparative ecology of populations of the lizard *Uta stansburiana*. *Copeia*, 615-632.

Pianka ER (1986) *Ecology and Natural History of Desert Lizards. Analyses of the Ecological Niche and Community Structure*. Princeton University Press, Princeton, New Jersey.

Reilly SM, McBrayer LB, Miles DB, editors (2007) *Lizard Ecology: The Evolutionary Consequences of Foraging Mode.* Cambridge University Press, Cambridge, New York.

Rosen PC, Lowe CH (1996) Ecology of the amphibians and reptiles at Organ Pipe Cactus National Monument, Arizona. Cooperative Park Studies Unit, National Biological Service, University of Arizona, Tucson, Technical Report no. **53**.

Sinervo B, Mendez-de-la-Cruz F, Miles DB, *et al*. (2010) Erosion of lizard diversity by climate change and altered thermal niches. *Science*, **328**, 894-899. (Supplement).

Tanner WW, Krogh JE (1973) Ecology of *Sceloporus magister* at the Nevada test site, Nye County, Nevada. *Great Basin Naturalist*, 133-146.

Tanner WW, Krogh JE (1975) Ecology of the zebra-tailed lizard *Callisaurus draconoides* at the Nevada test site. *Herpetologica*, 302-316.

Tinkle DW (1976) Comparative data on the population ecology of the desert spiny lizard, *Sceloporus magister*. *Herpetologica*, 1-6.

Turner FB, Medica PA, Lannom Jr JR, Hoddenbach GA (1969) A demographic analysis of fenced populations of the whiptail lizard, *Cnemidophorus tigris*, in southern Nevada. *Southwestern Naturalist*, 189-201.

Tinkle DW (1967) The life and demography of the side-blotched lizard, *Uta stansburiana*. *Miscellaneous Publications (University of Michigan Museum of Zoology)*, **132**, 1–182.

Tinkle DW, Dunham AE (1983) Demography of the tree lizard, *Urosaurus ornatus*, in central Arizona. *Copeia*, 585-598.

Van Loben Sels RC, Vitt LJ (1984) Desert lizard reproduction: seasonal and annual variation in *Urosaurus ornatus* (Iguanidae). *Canadian Journal of Zoology*, **62**, 1779-1787.

Vitt LJ, Ohmart RD (1974) Reproduction and ecology of a Colorado River population of *Sceloporus magister* (Sauria: Iguanidae). *Herpetologica*, 410-417.

Vitt LJ, Ohmart RD (1977) Ecology and reproduction of lower Colorado River lizards: I. *Callisaurus draconoides* (Iguanidae). *Herpetologica*, 214-222.

Vitt LJ, Ohmart RD (1977) Ecology and reproduction of Lower Colorado River lizards: II. *Cnemidophorus tigris* (Teiidae), with comparisons. *Herpetologica*, 223-234.

Vitt LJ, Van Loben Sels RC, Ohmart RD (1981) Ecological relationships among arboreal desert lizards. *Ecology*, **62**, 398-410.

Appendix S2. Correlations among climatic attributes linked to our four hypotheses.

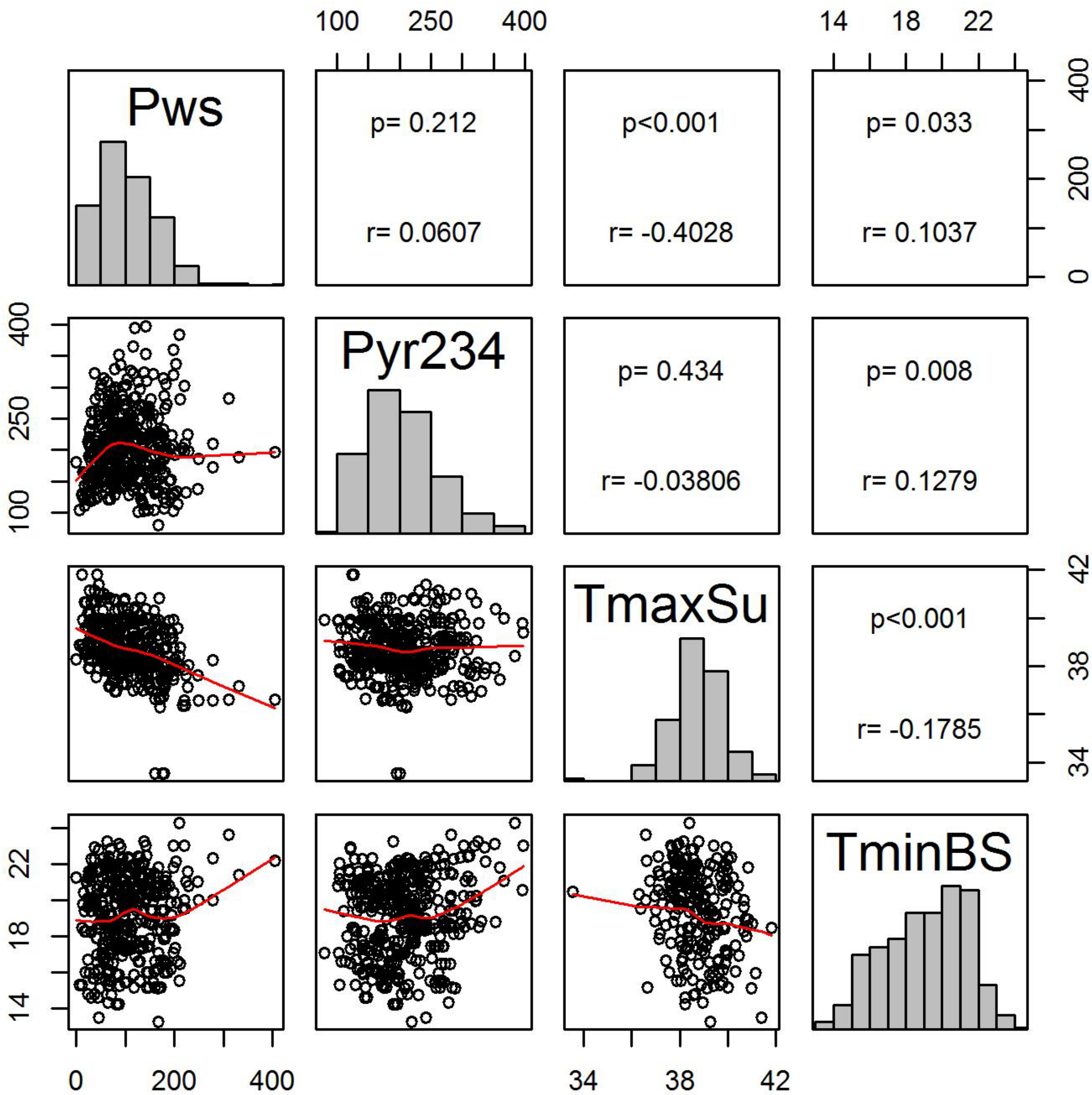

Figure S2A. Correlations between warm-season climatic attributes linked to each of our four hypotheses. Names and definitions of factors are in Table S2.

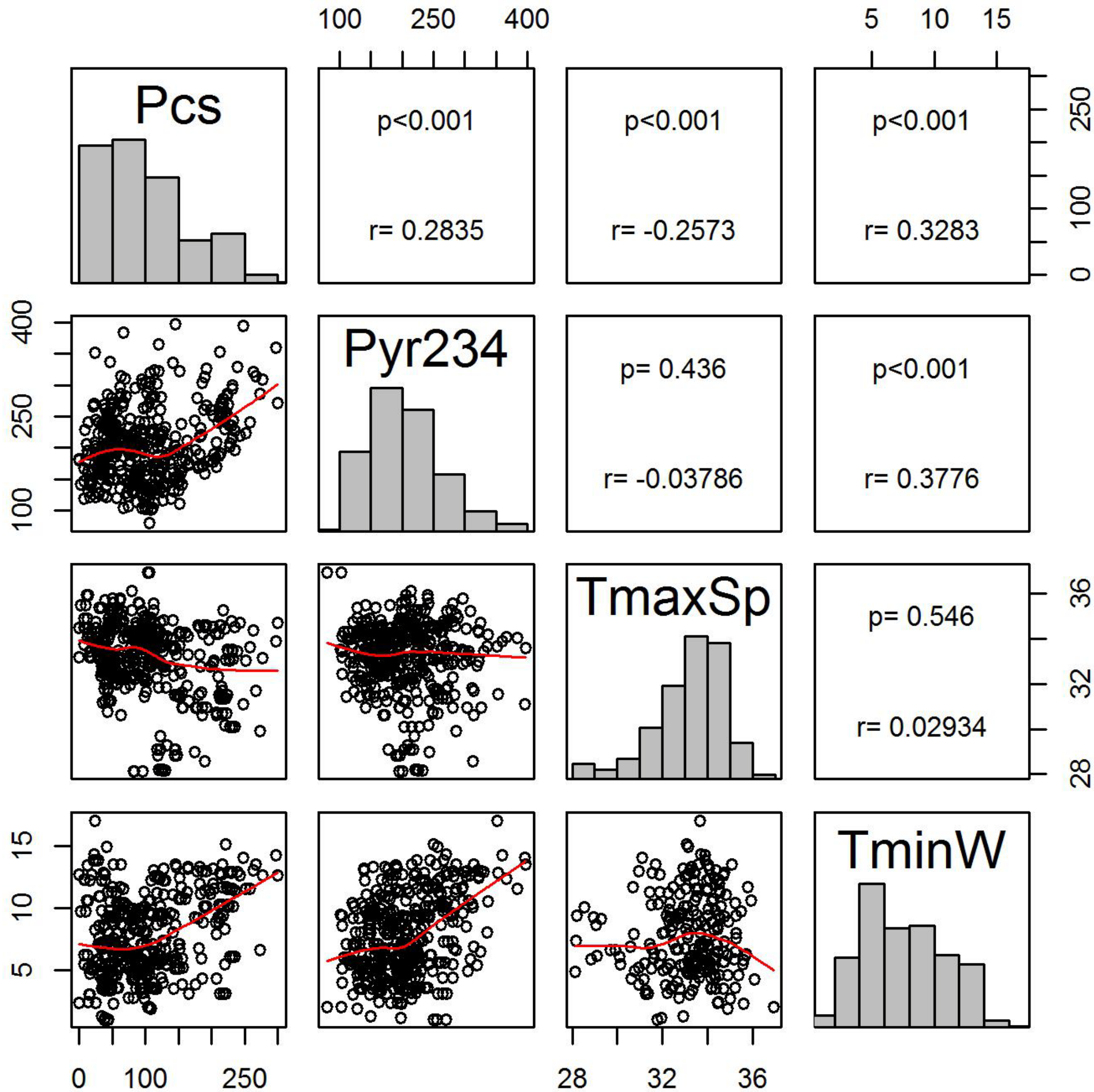

Figure S2B. Correlations between cool-season climatic attributes linked to each of our four hypotheses. Names and definitions of factors are in Table S2.

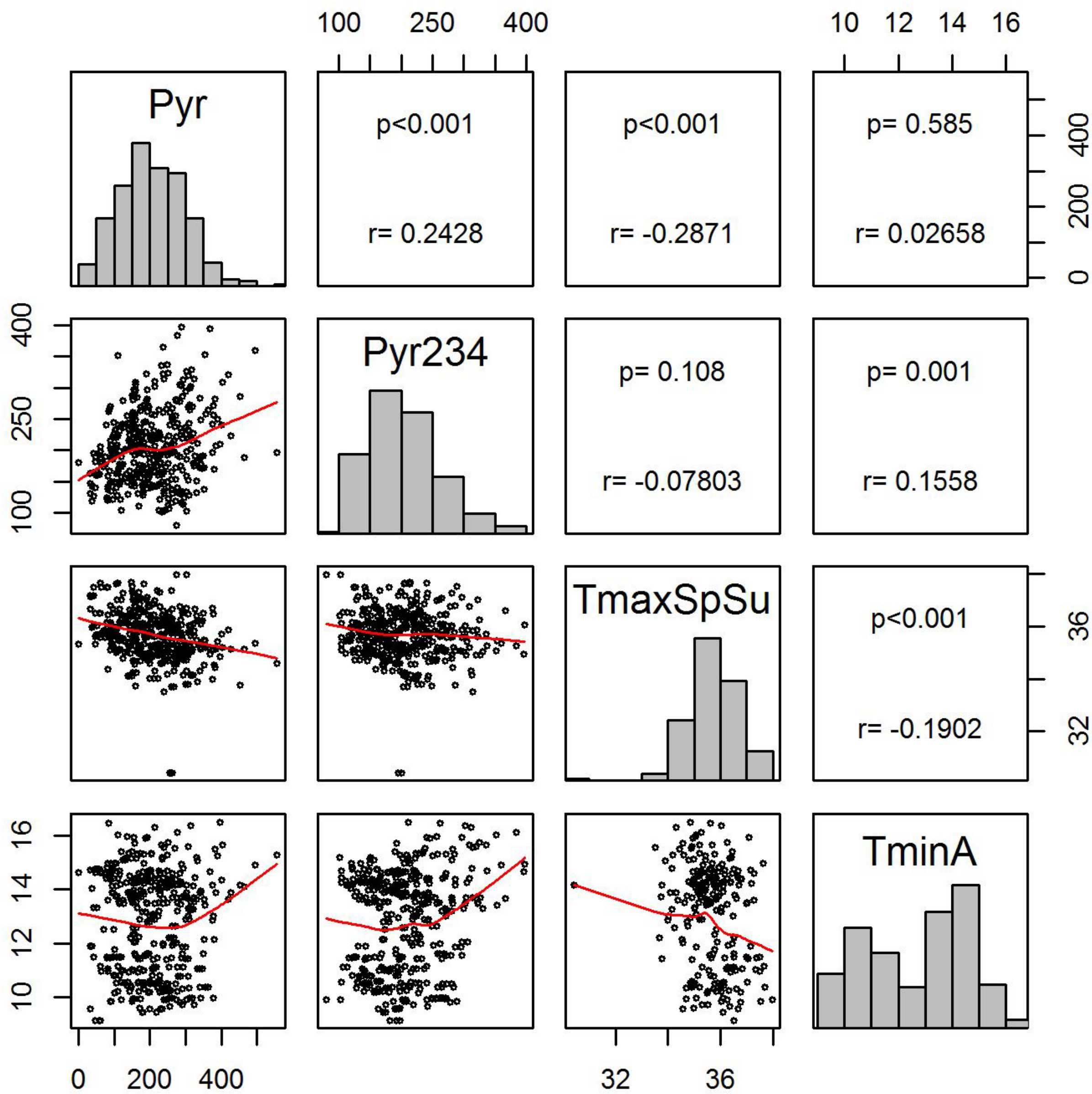

Figure S2C. Correlations between annual climatic attributes linked to each of four hypotheses. Names and definitions of factors are in Table S2.

Table S3. Binomial detection models for five species of lizards in Organ Pipe Cactus National Monument over 25 years (1989-2013). Each species was surveyed along line transects 3-8 times per day in both spring and summer of each year at up to 32 sites per year. Count data from these repeated daily surveys were modeled with hierarchical *N*-mixture models that explicitly considered variation in detection probability.

Species - season Factor	Estimate	SE	*Z*	*P*
Western whiptail - spring				
Intercept	-2.55	0.19	-13.79	<0.0001
Temperature	-0.051	0.072	-0.71	0.077
Temperature^2	-0.25	0.038	-6.58	<0.0001
Time after sunrise	0.10	0.075	1.36	0.18
Time after sunrise^2	-0.15	0.034	-4.29	<0.0001
Precipitation	0.11	0.025	4.43	<0.0001
Day of year	-0.12	0.030	-4.02	<0.0001
Rocky slope	-1.25	0.20	-6.29	<0.0001
Valley floor	0.24	0.14	1.69	0.091
Western whiptail - summer				
Intercept	-2.17	0.17	-12.42	<0.0001
Temperature	-0.10	0.057	-1.70	0.089
Temperature^2	-0.31	0.031	-10.22	<0.0001
Time after sunrise	0.35	0.056	6.31	<0.0001
Time after sunrise^2	-0.068	0.026	-2.51	0.012
Precipitation	-0.072	0.025	-2.93	0.0034
Rocky slope	-0.90	0.20	-4.41	<0.0001
Valley floor	0.26	0.156	1.69	0.091
Side-blotched lizard - spring				
Intercept	-3.57	0.22	-16.26	<0.0001
Temperature	-0.63	0.12	-5.42	<0.0001
Temperature^2	-0.22	0.037	-5.84	<0.0001
Precipitation	0.12	0.032	3.68	0.0002
Day of year	-0.20	0.042	-4.69	<0.0001
Desert shrubland	0.56	0.22	2.51	0.012
Xeroriparian woodland	0.17	0.23	0.74	0.46

Soil fine	-0.52	0.18	-2.89	0.0039
Side-blotched lizard - summer				
Intercept	-2.41	0.15	-16.26	<0.0001
Temperature	-0.52	0.070	-7.44	<0.0001
Temperature^2	-0.33	0.035	-9.48	<0.0001
Time after sunrise	-0.32	0.075	-4.32	<0.0001
Time after sunrise^2	0.072	0.035	2.01	0.045
Day of year	0.026	0.049	0.54	0.59
Day of year^2	-0.18	0.034	-5.37	<0.0001
Soil fine	-0.48	0.15	-3.21	0.0013
Zebra-tailed lizard - spring				
Intercept	-2.35	0.22	-10.48	<0.0001
Temperature	0.71	0.057	12.40	<0.0001
Temperature^2	-0.64	0.059	-10.71	<0.0001
Precipitation	0.23	0.047	4.95	<0.0001
Rocky slope	-1.30	0.30	-4.30	<0.0001
Valley floor	-0.77	0.30	-2.57	0.010
Desert shrubland	-0.53	0.39	-1.38	0.17
Xeroriparian woodland	0.82	0.30	2.72	0.0066
Zebra-tailed lizard - summer				
Intercept	-2.68	0.18	-14.72	<0.0001
Temperature	0.36	0.054	6.77	<0.0001
Temperature^2	-0.42	0.054	-7.72	<0.0001
Day of year	-0.17	0.058	-2.87	0.0041
Rocky slope	-1.15	0.37	-3.10	0.0020
Valley floor	-0.30	0.19	-1.54	0.12
Tree lizard - spring				
Intercept	-3.12	0.20	-15.46	<0.0001
Temperature	-0.29	0.050	-5.94	<0.0001
Temperature^2	-0.068	0.021	-3.28	0.0011
Time after sunrise	-0.34	0.046	-7.25	<0.0001
Time after sunrise^2	-0.13	0.030	-4.50	<0.0001
Precipitation	0.13	0.026	4.88	<0.0001
Desert shrubland	-0.022	0.26	-0.08	0.93
Xeroriparian woodland	0.83	0.20	4.09	<0.0001
Tree lizard - summer				

Intercept	-3.18	0.23	-14.11	<0.0001
Temperature	-0.76	0.071	-10.64	<0.0001
Temperature^2	-0.11	0.026	-4.43	<0.0001
Time after sunrise	0.033	0.058	0.57	0.57
Time after sunrise^2	-0.12	0.033	-3.66	0.0003
Day of year	-0.38	0.052	-7.38	<0.0001
Day of year^2	0.11	0.039	2.97	0.0030
Rocky slope	1.36	0.31	4.45	<0.0001
Valley floor	-0.074	0.23	-0.32	0.75
Desert spiny lizard - spring				
Intercept	-6.06	0.41	-14.81	<0.0001
Time after sunrise	-0.42	0.096	-4.40	<0.0001
Time after sunrise^2	-0.23	0.094	-2.42	0.016
Soil fine	1.47	0.39	3.81	0.0001
Desert spiny lizard - summer				
Intercept	-5.69	0.42	-13.50	<0.0001
Time after sunrise	-0.32	0.075	-4.25	<0.0001
Soil fine	1.35	0.40	3.37	0.0008

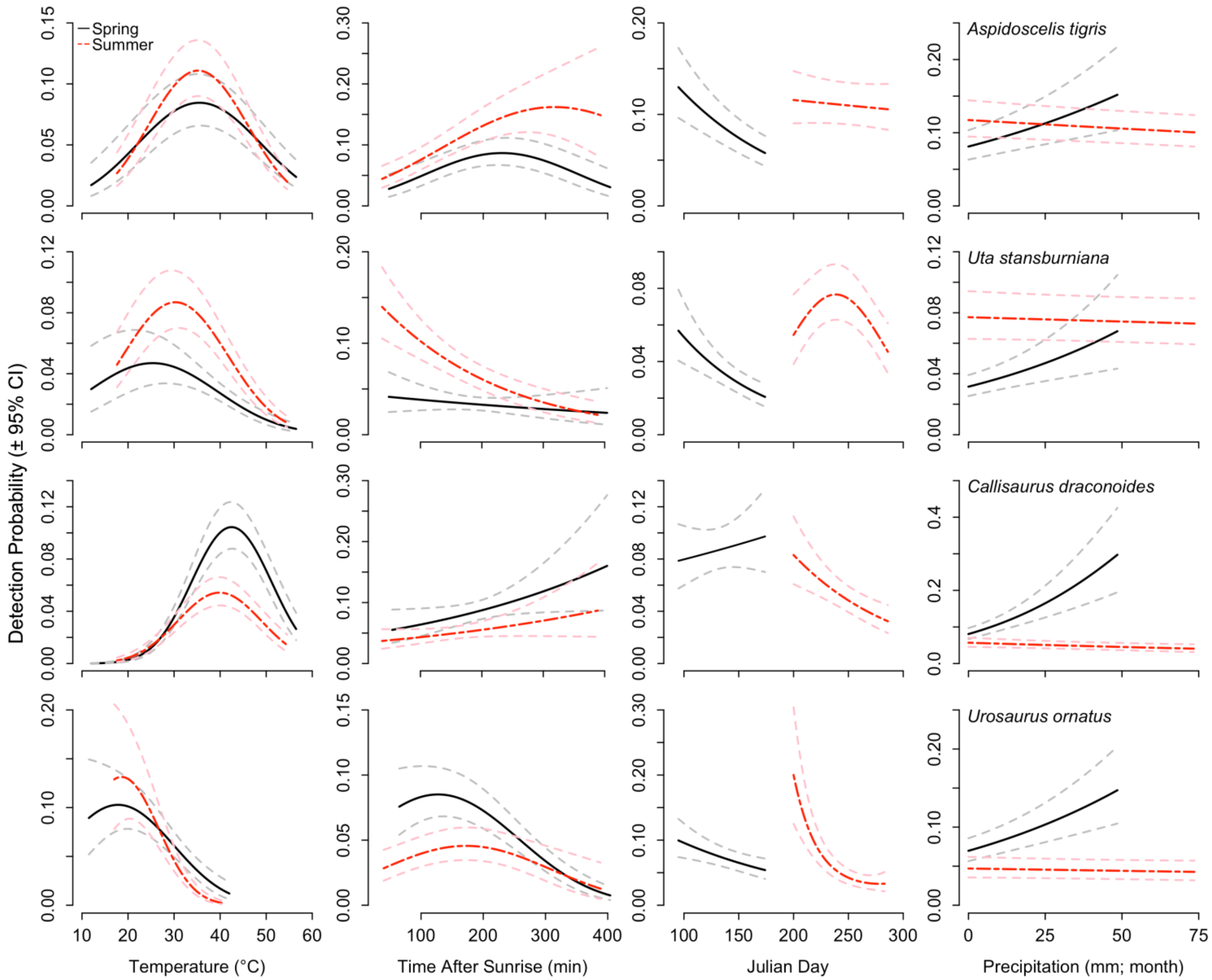

Figure S3. Effects of temperature, precipitation, and temporal factors on detection probability of four species of lizards in Organ Pipe Cactus National Monument, 1989-2013. Estimates are from binomial detection models summarized in Table S3

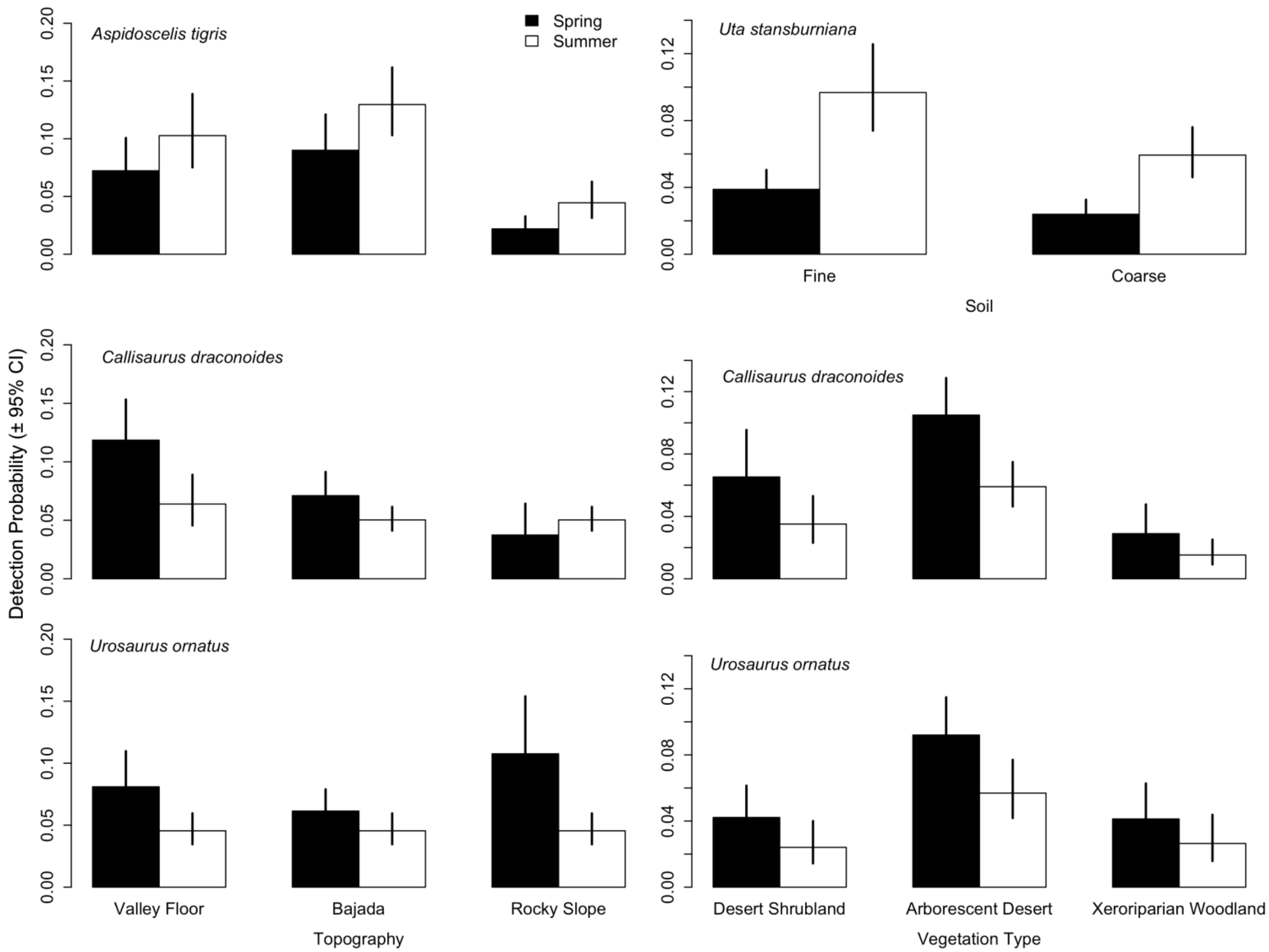

Figure S4. Effects of categorical covariates on detection probability of four species of diurnal lizards in Organ Pipe Cactus National Monument, 1989-2013. Estimates are from binomial detection models summarized in Table S3.

Table S4. Rankings of hypothesized models that explained the influence of local weather on spatiotemporal variation in abundance (ln no.) of five species of diurnal lizards in Organ Pipe Cactus National Monument over a 25-year period (1989-2013). *K* represents the number of model parameters, ΔAIC_c is the change in AIC between each model and the best approximating model, and AIC_c weights (w_i) are probabilities each model is the best approximating model in each model set. Variables representing each hypothesis are in Table 4.

Species Hypothesis	*K*	ΔAICc	w_i
Western whiptail			
Prey + predation + warm stress + cold effects	9	0.00	1.000
Prey + predation + cold effects	8	4.23	0.120
Predation + warm stress + cold effects	8	4.57	0.100
Predation + cold effects	7	8.09	0.020
Prey + predation + warm stress	8	9.93	0.010
Prey + predation	7	11.67	0.000
Prey + warm stress + cold effects	7	12.96	0.000
Prey + cold effects	6	17.66	0.000
Predation	6	17.99	0.000
Cold effects + warm stress	6	19.76	0.000
Prey + warm stress	6	22.06	0.000
Cold effects	5	23.99	0.000
Prey	5	25.72	0.000
Warm stress	5	31.00	0.000
Null	4	34.37	0.000
Side-blotched lizard			
Prey + predation + warm stress + cold effects	8	0.00	1.000
Predation + warm stress + cold effects	7	1.59	0.451
Prey + predation + cold effects	7	4.31	0.116
Predation + cold effects	6	5.91	0.052
Prey + warm stress + cold effects	7	6.07	0.048
Prey + predation + warm stress	7	7.88	0.019
Cold effects + warm stress	6	8.01	0.018

Prey + cold effects	6	9.59	0.008
Cold effects	5	11.48	0.003
Prey + predation	6	12.60	0.002
Predation	5	15.10	0.001
Prey + warm stress	6	16.02	0.000
Warm stress	5	18.86	0.000
Prey	5	19.67	0.000
Null	4	22.44	0.000
Zebra-tailed lizard			
Prey + warm stress + cold effects	8	0.00	1.000
Prey + cold effects	7	1.84	0.399
Cold effects + warm stress	7	3.40	0.183
Prey + predation + warm stress + cold effects	10	3.68	0.159
Cold effects	6	5.22	0.073
Prey + predation + cold effects	9	5.70	0.058
Predation + warm stress + cold effects	9	7.06	0.029
Predation + cold effects	8	9.00	0.011
Prey + warm stress	6	10.38	0.006
Warm stress	5	12.67	0.002
Prey + predation + warm stress	8	13.13	0.001
Prey	5	14.45	0.001
Null	4	16.71	0.000
Prey + predation	7	17.66	0.000
Predation	6	20.13	0.000
Tree lizard			
Prey + predation + warm stress + cold effects	9	0.00	1.000
Predation + warm stress + cold effects	8	2.41	0.299
Prey + predation + warm stress	8	5.22	0.074
Prey + predation + cold effects	8	8.72	0.013
Predation + cold effects	7	13.18	0.001
Prey + predation	7	15.26	0.000
Predation	6	22.09	0.000
Prey + warm stress + cold effects	7	22.67	0.000
Cold effects + warm stress	6	23.88	0.000
Prey + warm stress	6	25.95	0.000
Warm stress	5	28.47	0.000
Prey + cold effects	6	34.53	0.000

Cold effects	5	38.24	0.000
Prey	5	39.25	0.000
Null	4	45.14	0.000
Desert spiny lizard			
Prey + warm stress + cold effects	8	0.00	1.000
Cold effects + warm stress	7	1.09	0.579
Prey + predation + warm stress + cold effects	9	1.54	0.463
Predation + warm stress + cold effects	8	2.21	0.332
Cold effects	6	2.87	0.238
Prey + cold effects	7	3.07	0.216
Predation + cold effects	7	3.60	0.165
Prey + predation + cold effects	8	4.18	0.124
Prey + warm stress	6	7.57	0.023
Prey + predation + warm stress	7	8.22	0.016
Warm stress	5	8.43	0.015
Predation	5	8.97	0.011
Null	4	9.81	0.007
Prey + predation	6	9.91	0.007
Prey	5	9.98	0.007