



Reptile and Amphibian Surveys of the Yosemite Transect - 2004

Overview - During the 2004 field season, reptiles and amphibians were surveyed intensively at seven areas. These areas included Porcupine Flat, Vogelsang Lake, Merced Lake, Hetch Hetchy, Yosemite Valley, Foresta, and Pate Valley. In addition, we conducted transect sampling along the Merced and Tuolumne Rivers. Fieldwork was conducted throughout the summer beginning in June and lasted until the end of August. A total of 37 days were spent in the field with team sizes ranging from two – five individuals. We recorded 18 species and collected 416 specimens from 117 distinct localities (fig. 1; table 1). Specimen data can be retrieved from the MVZ database by querying for accessions 13908 and 13957 at <http://elib.cs.berkeley.edu/mvz/>.

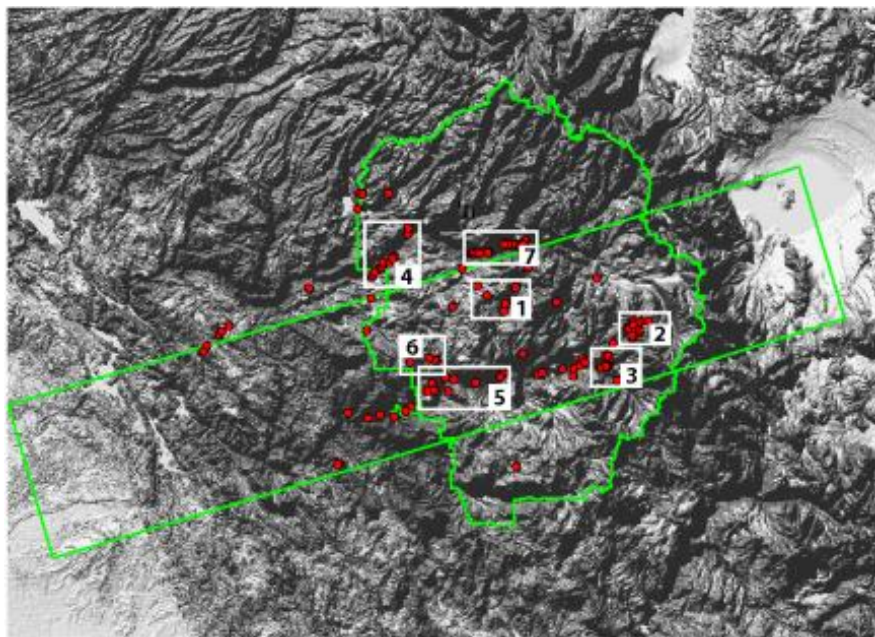


Figure 1. Map of the Yosemite transect (green outline) and localities (red circles) of reptiles and amphibians collected during the 2004 field season. White boxes indicate focal survey sites; 1. Porcupine Flat, 2. Vogelsang Lake, 3. Merced Lake, 4. Hetch Hetchy, 5. Yosemite Valley, 6. Foresta, and 7. Pate Valley.

Table 1. List of species recorded during the 2004 field season including the number of specimens collected per species.

Common Name	Scientific Name	Total
mount lyell salamander	<i>Hydromantes platycephalus</i>	7
yosemite toad	<i>Bufo canorus</i>	17
pacific treefrog	<i>Hyla regilla</i>	62
Bullfrog*	<i>Rana catesbiana</i>	23
mountain yellow-legged frog	<i>Rana muscosa</i>	1

western whiptail lizard	<i>Aspidoscelis tigris</i>	9
gilbert skink	<i>Eumeces gilberti</i>	4
northern alligator lizard	<i>Elgaria coerulea</i>	6
southern alligator lizard	<i>Elgaria multicaudata</i>	3
sagebrush lizard	<i>Sceloporus graciosus</i>	48
western fence lizard	<i>Sceloporus occidentalis</i>	181
rubber boa	<i>Charina bottae</i>	2
gopher snake	<i>Pituophis catenifer</i>	4
night snake	<i>Hypsiglena torquata</i>	3
california whipsnake	<i>Masticophis lateralis</i>	3
western aquatic garter snake	<i>Thamnophis couchii</i>	24
western terrestrial garter snake	<i>Thamnophis elegans</i>	8
western rattlesnake	<i>Crotalus viridis</i>	11
	Grand Total	416

*species found just outside the border of Yosemite National Park

Porcupine Flat (21 –26 June)

Locality	Latitude	Longitude	Species
10 Lakes trail near Colby Mt	37.89616	-119.54510	<i>Elgaria coerulea</i> , <i>Thamnophis elegans</i>
3.5 mi on Hwy 120 SW of entrance to White Wolf Campground	37.83400	-119.69728	<i>Sceloporus graciosus</i>
From May Lake Trailhead to May Lake	37.84105	-119.49166	<i>Sceloporus occidentalis</i>
Harden Lake	37.89416	-119.67750	<i>Hyla regilla</i> , <i>Thamnophis elegans</i>
Mammal site at turnout ~3.5 mi E of White Wolf junction	37.83890	-119.59295	<i>Sceloporus graciosus</i>
McSwain Meadow trap line	37.85193	-119.62811	<i>Hyla regilla</i> , <i>Bufo canorus</i>
North Dome	37.76022	-119.55880	<i>Sceloporus graciosus</i> , <i>S. occidentalis</i>
Porcupine Flat, N of road in creek	37.81188	-119.56390	<i>Hyla regilla</i>
Porcupine Flat	37.80701	-119.56500	<i>Elgaria coerulea</i>
Pothole Dome	37.87863	-119.41233	<i>Sceloporus occidentalis</i>
Return trail from North Dome	37.76936	-119.55708	<i>Sceloporus graciosus</i>
Upper White Wolf camp	37.86644	-119.64773	<i>Hyla regilla</i>
Yosemite Creek Campground	37.82693	-119.59547	<i>Sceloporus graciosus</i> , <i>S. occidentalis</i>
Yosemite Creek on 10 Leuker Trail	37.58540	-119.57218	<i>Sceloporus graciosus</i>
Yosemite Creek trail to 10 Lakes	37.86342	-119.57195	<i>Sceloporus graciosus</i>

Family	Species	Commonness	Number of localities	Numbers captured
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Hylidae	<i>Hyla regilla</i>	Common	4	4
Bufoidea	<i>Bufo canorus</i>	Uncommon	1	1
Phrynosomatidae	<i>Sceloporus graciosus</i>	Common	7	18
Phrynosomatidae	<i>Sceloporus occidentalis</i>	Common	4	25
Anguidae	<i>Elgaria coerulea</i>	Uncommon	2	4
Colubridae	<i>Thamnophis elegans</i>	Common	1	3

Vogelsang Lake (13-19 July)

We surveyed lakes and ponds throughout the Vogelsang Area extending in an approximate 2.5 miles radius from our base camp at Fletcher Lake. We spent each day hiking to different areas searching for amphibians and reptiles. At night we searched for new populations of the mount lyell salamander (*Hydromantes platycephalus*) along rocky slopes of the northern, eastern, and western faces of Fletcher Peak extending from Townsley Lake to Vogelsang Lake.

Grinnell and colleagues described in their original field notes how ubiquitous the mountain yellow-legged frog (*Rana muscosa*) was in their day at Vogelsang and Fletcher Lakes. We only observed *R. muscosa* at an unnamed lake 1 km by trail E of Evelyn Lake. We observed at least 12 tadpoles at different stages of metamorphosis and an equal number of adult frogs on the edge of the pond. We collected one individual. The area surrounding this unnamed lake also contained dozens of tosemite toad (*Bufo canorus*) toadlets.

Locality	Latitude	Longitude	Species
0.5 km N of Tuolumne Pass, trail from Tuolumne Meadows to Vogelsang High Sierra Camp	37.81046	-119.33971	<i>Bufo canorus</i>
E end of Townsley Lake	37.79273	-119.32830	<i>Bufo canorus</i>
E side of Vogelsang Lake	37.78827	-119.34250	<i>Hydromantes platycephalus</i>
Fletcher Creek, SE of Emeric Lake	37.77634	-119.38064	<i>Bufo canorus</i> , <i>Hyla regilla</i>
Pond ~0.25 km W of Boothe Lake	37.79993	-119.35178	<i>Hyla regilla</i>
Pond ~0.5 km NE of Evelyn Lake	37.80342	-119.33291	<i>Bufo canorus</i> , <i>Hyla regilla</i>
Pond ~0.5 km NE of Townsley Lake	37.79744	-119.32874	<i>Hyla regilla</i>
Pond at S end of Vogelsang Lake	37.78476	-119.34244	<i>Hyla regilla</i>
Pond NE of Evelyn Lake	37.81044	-119.32504	<i>Hyla regilla</i>
Pond NW of Evelyn Lake	37.80799	-119.33141	<i>Hyla regilla</i>
Pond on E side of trail, Tuolumne Pass, trail from Tuolumne Meadows to Vogelsang High Sierra Camp	37.80494	-119.34035	<i>Hyla regilla</i> , <i>Thamnophis elegans</i>
SW end of Boothe Lake	37.79834	-119.34946	<i>Hyla regilla</i>
SW end of Townsley Lake	37.79275	-119.32952	<i>Bufo canorus</i>
Unnamed lake, ~1 km E (by trail) of Evelyn Lake	37.81059	-119.30991	<i>Bufo canorus</i> , <i>Hyla regilla</i> , <i>Rana muscosa</i>

Family	Species	Commonness	Number of localities	Numbers captured
Bufoidea	<i>Bufo canorus</i>	Uncommon	6	17

Hylidae	<i>Hyla regilla</i>	Common	10	33
Ranidae	<i>Rana muscosa</i>	Rare	1	1
Plethodontidae	<i>Hydromantes platycephalus</i>	Rare	2	5
Colubridae	<i>Thamnophis elegans</i>	Uncommon at high elevation	1	1

Notable observations:

- Discovery of a new population of *Hydromantes platycephalus* from Vogelsang lake (two localities).
- Breeding populations of *Rana muscosa* and *Bufo canorus* at unnamed lake 0.5 km east of Evelyn Lake

Merced Lake (20-26 July)

Our work around the vicinity of Merced Lake included transect sampling along the trail leading to Vogelsang Lake and surveys of Babcock, Merced, and Washburn Lakes. A ranger at the Merced Lake High Sierra Camp mentioned a fern-grotto near Echo Valley that contained salamanders, however we were unable to find any in the area. We also collected specimens along the Merced River from Merced Lake through Little Yosemite Valley, stopping at Echo Valley, Bunnell Point, Moraine Dome, and Little Yosemite Valley Campground. We mostly encountered lizards during the day (*Sceloporus occidentalis* and *S. graciosus*) basking on rocks and logs, but we also observed pacific treefrogs, *Hyla regilla*. The mammal team observed a western rattlesnake (*Crotalus viridis*) along the trail leading through Little Yosemite Valley, just outside of the Little Yosemite Valley Campgrounds.

Locality	Latitude	Longitude	Species
~0.2 mi S of junction to Vogelsang Pass and Merced Lake, ~1.6 mi E of Merced Lake	37.74199	-119.39129	<i>Hyla regilla</i> , <i>Sceloporus occidentalis</i>
~1 mi NE of Merced Lake along trail to Vogelsang Lake	37.7412	-119.39444	<i>Sceloporus graciosus</i>
~1.2 mi NE of Merced Lake along trail to Vogelsang Lake	37.74214	-119.39345	<i>Sceloporus graciosus</i>
~100 m E of Merced Lake High Sierra Camp	37.73821	-119.40529	<i>Charina bottae</i>
~300 m W of Little Yosemite Valley Campground (by air)	37.72992	-119.52447	<i>Sceloporus graciosus</i> , <i>S. occidentalis</i>
0.7 mi N of Echo Valley junction, Echo Valley	37.75249	-119.44099	<i>Elgaria coerulea</i>
1 km E of Merced Lake	37.73946	-119.40217	<i>Thamnophis elegans</i>
100 m E of Merced High Sierra Camp	37.73811	-119.40462	<i>Sceloporus graciosus</i> , <i>S. occidentalis</i>
Babcock Lake	37.7569	-119.39650	<i>Hyla regilla</i> , <i>Thamnophis elegans</i>
Base of Moraine Dome along trail	37.73639	-119.48036	<i>Hyla regilla</i> , <i>Sceloporus graciosus</i> , <i>S. occidentalis</i>
Bridge over Merced River, 0.6 mi W of Echo Valley	37.7413	-119.44614	<i>Hyla regilla</i>
East side of Bunnell Point along trail	37.73778	-119.45824	<i>Hyla regilla</i>
Echo Valley	37.74715	-119.43634	<i>Sceloporus graciosus</i> , <i>S. occidentalis</i>
Junction between John Muir Trail and Mist Trail, Yosemite Valley	37.7252	-119.45930	<i>Sceloporus graciosus</i>
Junction to Vogelsang Pass and Merced Lake, 1.8 mi E of Merced Lake	37.74397	-119.38708	<i>Sceloporus graciosus</i>
Near Little Yosemite Valley Campground	37.73116	-119.52009	<i>Sceloporus graciosus</i> , <i>S. occidentalis</i>

NW end of Washburn Lake	37.71835	-119.37406	<i>Sceloporus occidentalis</i>
On trail between Babcock Lake trail and Merced Ranger Station	37.74231	-119.39352	<i>Elgaria coerulea</i> , <i>Sceloporus occidentalis</i>
W side of Fletcher Creek, SE of Babcock Lake	37.75745	-119.39050	<i>Hyla regilla</i> , <i>Thamnophis elegans</i>

Family	Species	Commonness	Number of localities	Numbers captured
Hylidae	<i>Hyla regilla</i>	Common	6	11
Anguillidae	<i>Elgaria coerulea</i>	Uncommon	2	2
Phrynosomatidae	<i>Sceloporus graciosus</i>	Common	9	16
Phrynosomatidae	<i>Sceloporus occidentalis</i>	Common	8	60
Colubridae	<i>Thamnophis elegans</i>	Common	3	3
Boidae	<i>Charina bottae</i>	Rare	1	2

Hetch Hetchy (6-11 August; 25 August)

Our survey of the Hetch Hetchy area included visual encounter surveys during the day and driving along Hetch Hetchy Road during night at low speeds in search of nocturnal snakes. During the day we observed western fence lizards, *Sceloporus occidentalis*, but not at the high abundance they are found in other areas of the park. We also encountered the whiptail lizards, *Aspidoscelis tigris*, foraging in arid hillsides covered by thick manzanita. At night we were successful in finding snakes on the warm road after sunset. Unfortunately, we found two dead snakes and a dead spotted skunk on the night of the monthly Camp Mather Star Gazers meeting, most likely due to heavy traffic caused by this event. This impact of the traffic this monthly event generates after the reservoirs closure at 9pm (sundown) on the fauna of Hetch Hetchy is worth investigating. We found fewer species of snakes in Hetch Hetchy compared to our previous year's survey, most likely due to the drier conditions and later date of our survey this year.

Locality	Latitude	Longitude	Species
~0.5 mi S of Ranger Station, Hetch Hetchy	37.88845	-119.85043	<i>Sceloporus occidentalis</i>
1.5 mi N of entrance station on E side of road, Hetch Hetchy	37.90305	-119.83464	<i>Sceloporus occidentalis</i> , <i>Aspidoscelis tigris</i>
Between Kibbie Ridge and Kibbie Creek, vicinity of Lake Eleanor	38.00946	-119.87469	<i>Sceloporus occidentalis</i> , <i>Crotalus viridis</i>
Cherry Lake Rd (17), ~5 mi N (by road) of Hwy. 120	37.86377	-119.98044	<i>Pituophis catenifer</i>
First entrance gate, Hetch Hetchy	37.88374	-119.85378	<i>Thamnophis elegans</i>
Hetch Hetchy Road (between Ranger Station and Dam)	37.91219	-119.80981	<i>Hyla regilla</i> , <i>Hypsiglena torquata</i> , <i>Pituophis catenifer</i> , <i>Crotalus viridis</i>
Hetch Hetchy Reservoir Dam	37.94723	-119.78532	<i>Masticophis lateralis</i>
N side of Hetch Hetchy Reservoir	37.95725	-119.78432	<i>Sceloporus occidentalis</i> , <i>Aspidoscelis tigris</i>
Shower at Ranger Camp, Hetch Hetchy	37.89314	-119.84165	<i>Hyla regilla</i>
Trail to Lake Eleanor Camp	37.98698	-119.88412	<i>Sceloporus graciosus</i>

Family	Species	Commonness	Number of localities	Numbers captured

Hylidae	<i>Hyla regilla</i>	Common	2	7
Teiidae	<i>Aspidoscelis tigris</i>	Common	2	3
Phrynosomatidae	<i>Sceloporus graciosus</i>	uncommon	1	1
Phrynosomatidae	<i>Sceloporus occidentalis</i>	Common	4	7
Colubridae	<i>Thamnophis elegans</i>	Uncommon	1	1
Colubridae	<i>Hypsiglena torquata</i>	Uncommon	1	3
Colubridae	<i>Pituophis catenifer</i>	Uncommon	2	3
Colubridae	<i>Masticophis lateralis</i>	Uncommon	1	1
Viperidae	<i>Crotalus viridis</i>	Uncommon	2	2

Yosemite Valley (8-11 August)

Our work in Yosemite Valley included a transect from the valley floor up 4-mile trail, a survey of Cascade Creek, and searching for the mount lyell Salamander at Bridalveil Falls. Cascade Creek deserves further work, because historical records show that a single specimen of the arboreal salamander (*Aneides lugubris*) was collected from the area, representing the only known specimen of this species ever collected in Yosemite.

Locality	Latitude	Longitude	Species
~0.5 - 1.5 mi from trailhead of 4-mile trail trailhead, Yosemite Valley	37.72983	-119.59753	<i>Sceloporus occidentalis</i>
~50 m up Glacier Point Trail, Yellowpine Camp, Yosemite Valley	37.72437	-119.60287	<i>Sceloporus graciosus</i> , <i>S. occidentalis</i>
4-mile trail trailhead, Yosemite Valley	37.73151	-119.59934	<i>Sceloporus graciosus</i>
Base of Bridalveil Falls in spray zone just W of pool	37.71617	-119.65128	<i>Hydromantes platycephalus</i>
Cascade Creek, Yosemite Valley	37.72374	-119.71124	<i>Elgaria multicarinata</i> , <i>Sceloporus occidentalis</i> , <i>Thamnophis couchii</i>

Family	Species	Commonness	Number of localities	Numbers captured
Plethodontidae	<i>Hydromantes platycephalus</i>	Rare	1	2
Anguidae	<i>Elgaria multicarinata</i>	Uncommon	1	1
Phrynosomatidae	<i>Sceloporus graciosus</i>	Common	2	7
Phrynosomatidae	<i>Sceloporus occidentalis</i>	Common	3	21
Colubridae	<i>Thamnophis couchii</i>	Common	1	9

Foresta Road (5-11 August)

In our previous years survey we installed a pitfall array on a rocky, arid hillside at the bottom of Foresta Road, approximately 100 yards behind several trash dumpsters. We opened the pitfall array again this year and were able to record a new species for this site, the gilbert skink (*Eumeces gilberti*), which was not recorded in our previous years trapping effort. In general, trapping success with the pitfall array was higher this year.

Locality	Latitude	Longitude	Species
~1.5 mi by road off Big Oak Flat Road on Foresta Road	37.70284	-119.74478	<i>Sceloporus occidentalis</i>

~2.0 mi by road off Big Oak Flat Rd. on Foresta Rd.	37.70265	-119.70567	<i>Sceloporus occidentalis</i>
~2.0 mi by road off Big Oak Flat Rd. on Foresta Rd.	37.70265	-119.70567	<i>Elgaria multicarinata</i> , <i>Sceloporus occidentalis</i>
1 mi E of Crane Flat, Big Oak Flat Rd.	37.74808	-119.78035	<i>Masticophis lateralis</i>
Big Oak Flat Road, 0.4 mi W of Foresta Rd.	37.71557	-119.73821	<i>Masticophis lateralis</i>
Foresta Rd.	37.70403	-119.73315	<i>Aspidoscelis tigris</i> , <i>Eumeces gilberti</i> , <i>Sceloporus occidentalis</i>
Hodgdon Meadows Campground	37.7976	-119.86618	<i>Sceloporus graciosus</i>
Tamarack Creek	37.7505	-119.72898	<i>Sceloporus graciosus</i>
Tamarack Flat	37.7512	-119.73296	<i>Sceloporus graciosus</i>

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Pate Valley**	37.93151 to 37.93106	-119.59417 to -119.55691	<i>Hyla regilla</i> , <i>Sceloporus occidentalis</i> , <i>Thamnophis couchii</i> , <i>Crotalus viridis</i>
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* represents 21 distinct localities

** represents 12 distinct localities

Family	Species	Commonness	Number of localities	Numbers captured
Hylidae	<i>Hyla regilla</i>	Common	6	8
Phrynosomatidae	<i>Sceloporus occidentalis</i>	Common	18	44
Colubridae	<i>Thamnophis couchii</i>	Common	3	3*
Viperidae	<i>Crotalus viridis</i>	Common	8	9

*One gravid female specimen contained 12 offspring, each of which was given a unique MVZ voucher specimen number and tissue samples collected.

Molecular Genetic Analyses

The western fence lizard (*Sceloporus occidentalis*) is distributed broadly throughout Yosemite National Park and occurs in a variety of habitats ranging from low elevation chaparral, oak woodland, and riparian zones to high elevation talus in the Canadian zone. This small, diurnal lizard exhibits a remarkable amount of phenotypic diversity along elevational gradients (fig. 1), making it an ideal candidate for molecular genetic analyses. In addition, the scientific literature suggests that the high-elevation subspecies *S. occidentalis taylori* may warrant species status due to its unique morphological features (e.g., extensive blue ventral pigmentation, dark dorsal pigmentation, and large size). Our goals are to quantify the genetic variation in this species, determine if phenotypic diversity is correlated with genetic diversity, and evaluate the uniqueness of the high elevation “*taylori*” phenotype.

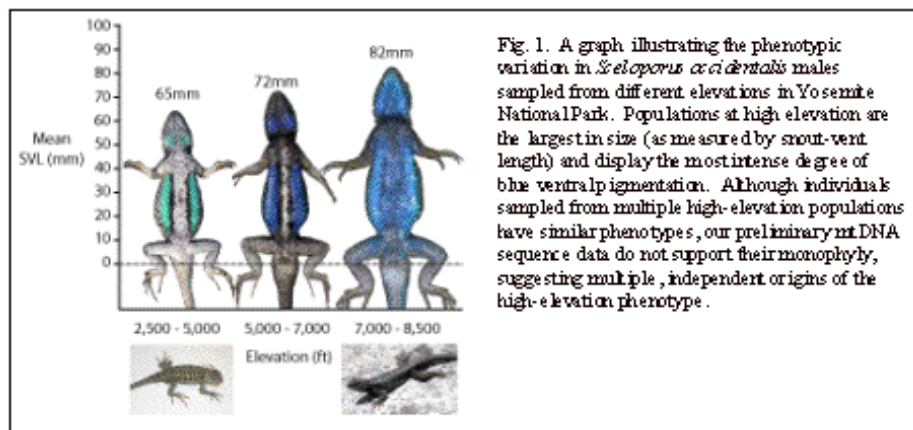


Figure 2. A graph illustrating the phenotypic variation in *Sceloporus occidentalis* males sampled from different elevations in Yosemite National Park. Populations at high elevation are the largest in size (as measured by snout-vent length) and display the most intense degree of blue ventral pigmentation. Although individuals sampled from multiple high-elevation populations have similar phenotypes, our preliminary mtDNA sequence data do not support their monophyly, suggesting multiple, independent origins of the high-elevation phenotype.

Our preliminary mtDNA sequence data (1,371 base pairs) from the 16S, ND1, and tRNA genes for 96 *Sceloporus occidentalis* reveal deep genetic divergences within Yosemite National Park. Phylogenetic analysis of these data using maximum parsimony supports four major lineages within Yosemite (fig. 2). These four lineages coincide with western, northern, southern, and south-eastern regions, although the separations between these lineages are not clear. Interestingly, the northern and western lineages, which include populations from Glen Aulin, North Dome, Pate Valley, Foresta, Hetch Hetchy, and Arch Rock, are more closely related to populations in San Diego Co., Alpine Co., and Oregon, than they are to the remaining Yosemite populations (including Tenaya Lake, Glacier Point, May Lake, Merced Lake, Wawona, and Little Yosemite Valley). Thus far, the south-eastern lineage is represented by only one population from Washburn Lake, however, uncorrected sequence divergence estimates range from 2.1 – 5.2% in comparison to other Yosemite populations.

During our 2003 survey we discovered a contact zone between the western and southern lineages in the Foresta area. The sequence divergence between the lizards found at the Foresta contact zone is ~6%. During the 2004 field season we concentrated on collecting lizards from two elevational transects (ranging from ~8,500 – 4,000 ft.) to identify additional contact zones. These transects include the Grand Canyon of the Tuolumne (from Glen Aulin to Hetch Hetchy) and the Merced River (from Merced Lake to Yosemite Valley). Although we did not find a contact zone along either transect, we discovered high degrees of genetic similarity (uncorrected sequence divergence: 0.00 – 0.1%) between haplotypes from high and low elevations. This result suggests that genetic diversity is not correlated with phenotypic diversity (illustrated in fig. 1).

The unique phenotypic characteristics of the high elevation populations ascribed to *Sceloporus occidentalis taylori* appear to have arisen independently in the northern and southern lineages (fig. 2). Thus, the genetic uniqueness of *S. o. "taylori"* is questionable, and this taxon may not represent a distinct evolutionary lineage.

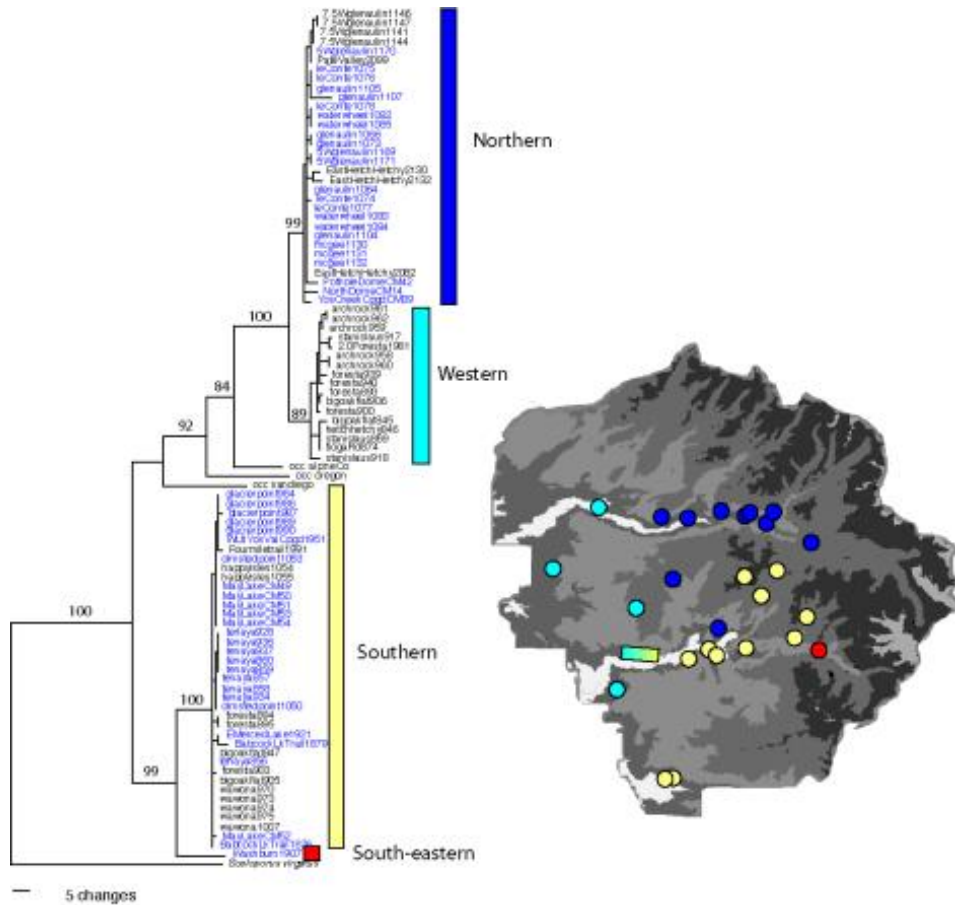


Figure 3. Phylogeographic structure of the western fence lizard (*Sceloporus occidentalis*) in Yosemite based on a parsimony analysis of 1.3 kb of mtDNA sequence data collected for 96 individuals from 27 populations. Numbers above nodes represent bootstrap values. Colored circles represent the four most divergent lineages with average levels of uncorrected sequence divergence exceeding 6%. An area of secondary contact in the Foresta Area between the western and southern lineages is indicated by the bi-colored rectangle. Populations exhibiting the *S. o. "taylori"* phenotype are indicated with blue text.