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HABITAT CHARACTERISTICS OF SITES WITH YELLOW-BLOTCHED SALAMANDERS (*ENSATINA ESCHSCHOLTZII CROCEATOR*)

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***Abstract*.—I surveyed 11 tributary canyons to the Kern River Canyon at the southern edge of the Sierra Nevada of California in 1999-2000 to characterize quantitatively the sites where I found 23 juvenile and 16 adult Yellow-blotched Salamanders (*Ensatina eschscholtzii croceator*). Most salamanders I found were under logs and rocks on loamy soil, and sites with adult salamanders could be distinguished from those with juveniles based on soil moisture of cover sites, distance of cover from a stream, and aspect direction. Sites with salamanders irrespective of age class had > 55% mean canopy cover and generally were on slopes of 20-30^{o} with a NW-NE aspect. The mean soil temperature where salamanders were found was significantly lower than mean ambient air temperature (10.4 vs. 15.2^{o} C), and mean humidity under cover was significantly higher than mean ambient humidity (61.0% vs. 44.1%).**

Key Words.—Yellow-blotched Salamanders, habitat, central California, *Ensatina*, cover types

INTRODUCTION

The Yellow-blotched Salamander (*Ensatina eschscholtzii croceator*, Fig. 1) is one of seven subspecies of the polytypic salamander that occur along the Pacific coast of North America from British Columbia to Baja California (Stebbins 1951; Wake and Yanev 1986; Kuchta and Parks 2005). The salamander is considered a classic ring species with gene flow between subspecies along mountains that surround the Central Valley of California and with limited genetic exchange of southerly subspecies that close the ring (Wake and Yanev 1986; Wake and Schneider 1998). Some, though, consider this complex a superspecies that includes at least 11 species and semispecies (Highton 1998). *Ensatina* is relatively abundant throughout its range (Petranka 1998; Kuchta and Parks 2005); however, the yellow-blotched subspecies has a limited range that encompasses the Tehachapi Mountains north to the base of the Greenhorn Mountains of the southern Sierra Nevada chain (Petranka 1998; Stebbins 2003). Consequently, the subspecies is designated as a "species of special concern" by the California Department of Fish and Game.

FIGURE 1. Adult Yellow-blotched Salamanders (*Ensatina eschscholtzii croceator*) from a tributary canyon leading into the Kern River Canyon east of Bakersfield, Kern County, California.

Ensatina occur in a variety of forested or shrubby habitats, on hillsides and mountainous areas (Stebbins 1951; Kuchta and Parks 2005). In the more xeric southern portion of its range, this species is usually found in moist canyons with partial to full canopy cover (Stebbins 1951). *Ensatina* become ground active after fall, winter, and spring precipitation (Stebbins 1954). They most often are found under surface cover objects, such as logs and rocks (Stebbins 1951; Aubry et al. 1988; Bury and Corn 1988), but have also been found in rock talus (Herrington 1988; Bruce Bury, pers. comm.).

I searched for Yellow-blotched Salamanders in the Kern Canyon portion of their range during two seasons to determine the habitat features of adults and juveniles. As a species of concern in California, it is important to understand the specific parameters of the habitat that Yellow-blotched Salamanders are selecting in their environment if additional protection measures are deemed necessary in the future. Almost no ecological data has been collected for this subspecies of *Ensatina*. Fewer studies of basic natural history are published now than in previous decades (McCallum and McCallum 2006), yet the need for this information is critical if we are to protect the biodiversity of the planet (Bury 2006).

METHODS

Study area.—I searched 11 tributary canyons to the Kern River Canyon, Kern County, California (Fig. 2). The Kern River Canyon effectively marks the northern edge of the range of the Yellow-blotched Salamander and where it meets and intergrades with the Sierra Nevada *Ensatina* (*E. eschoscholtzii platensis*) to the north (Petranka 1998; Stebbins 2003). The lowest elevation canyons were Stark and Richbar canyons, and canyons to the east were at increasingly greater elevations and included Cow Flat Creek, Democrat Creek, an unnamed creek at the Democrat Springs Fire Station, Mill Creek, Sycamore Creek, Delonegha Creek, Greenhorn Creek, Little Creek, and Bradshaw/Lilly Creeks (Fig. 2). I searched approximately 500 m of canyon leading away from the Kern River where possible. Most of these tributary canyons rise fairly rapidly in elevation up the side of the

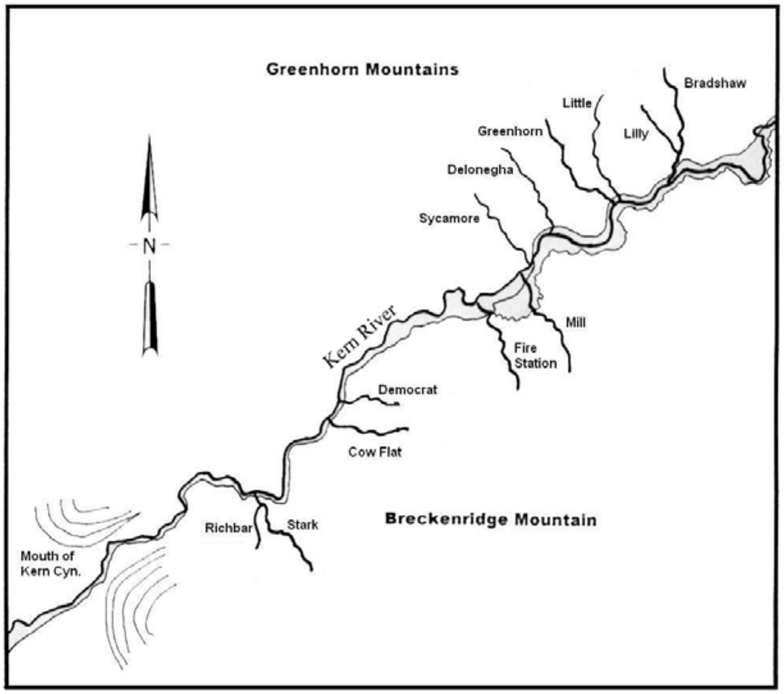

FIGURE 2. The 11 tributary canyons that lead into the Kern River Canyon where habitat characteristics were determined for adult and juvenile Yellow-blotched Salamanders (*Ensatina eschscholtzii croceator*). The canyon labeled Fire Station was unnamed on USGS topographical maps.

main canyon. Generally each canyon had a canopy of trees and shrubs. The lower elevation canyons from Mill Creek west emptied into the Kern River in a north or northwesterly aspect, whereas the higher elevation canyons from Sycamore Creek eastward emptied in a south or southeasterly aspect.

Data collection.—Surveys for salamanders were conducted during daylight hours from January to April of 1999-2000. Surveys involved 1-4 people searching through leaf litter, talus rock piles, and turning over (and replacing) rocks, logs, bark, and manmade objects on the ground surface. Habitat in each canyon was searched for 1-3 hours per visit and included scouring creek bottoms and adjacent upslope areas up to 100 m from the creek. Each creek area was surveyed 5 times in each year. The mean effort per canyon over both years was 11.4 person hours (s = 5.09), with a high of 21.4 person hours spent in the Fire Station canyon in 1999 and a low of 4.9 person hours in Cow Flat canyon in 2000.

When salamanders were found, I recorded a series of body measurements on each individual, including snout-vent length (SVL; in mm), total length (in mm), and mass (in g). I determined sex of Yellow-blotched Salamanders by differences in upper lip size and tail length and thickness (Stebbins 1985). After processing, salamanders were returned to their point of capture.

I recorded measures of the habitat at each cover site with a salamander present including soil temperature, soil moisture (soil samples taken and weighed before and after drying in the lab), soil type, air humidity under cover type after lifting the object, the percentage of tree or shrub canopy overhanging the cover site, the type of cover (rock, log, bark, litter, etc.), the distance of the site from water in the creek, elevation (from a topographic map), slope, and aspect. At the start of each survey, I recorded the air temperature, relative humidity, and percentage of cloud cover. A complete plant survey of each canyon was conducted in May and June 1999. Dominant trees and shrubs, and herbaceous plants were noted, as well as less abundant plant species. Also the average canopy cover of the creek area was estimated.

Statistical analyses.—I used the Mann-Whitney test to determine if there were differences in male and female SVL, total length, or mass. To determine if a linear combination of habitat parameters for sites with adult salamanders differed from sites with juveniles and if vegetation characteristics differed between canyons with salamanders versus those without, I used Logistic Regression with backward stepwise elimination of variables to find the best model to discriminate habitats. Significance was based on the G-test for slopes and overall model fit based on the Pearson goodness-of-fit test (using Minitab version 14.0). I compared aspect directions of slopes irrespective of age class to random direction using Rayleigh's Uniformity test (Oriana version 2.02C). Also, I compared the distribution of adult and juvenile salamanders on soil types and under cover types using the Kolmogorov-Smirnov test for Two Populations. Finally, I compared the mean ambient air temperature and humidity at the start of surveys to the mean cover and soil temperatures and mean

Table 1. Mean snout-vent length (SVL), total length (TL), and mass of Yellow-blotched Salamanders (*Ensatina eschscholtzii croceator*) found 1999-2000 in six canyons leading into the Kern River Canyon, California. The numbers in parentheses are standard errors of the mean. No significant differences were found between males and females for any variable.

Age/Sex	SVL (mm)	n	TL (mm)	n	Mass (g)	n
Male	69.5 (0.94)	6	135.2 (2.99)	6	7.57 (0.50)	6
Females	70.3 (2.37)	9	128.8 (3.55)	9	8.36 (0.63)	9
Adults[1]	69.9 (1.39)	16	131.3 (2.58)	15	7.93 (0.42)	16
Juveniles	34.3 (1.77)	23	56.0 (3.32)	22	1.33 (0.21)	22

[1]Includes one adult for which sex was not determined (tail missing)

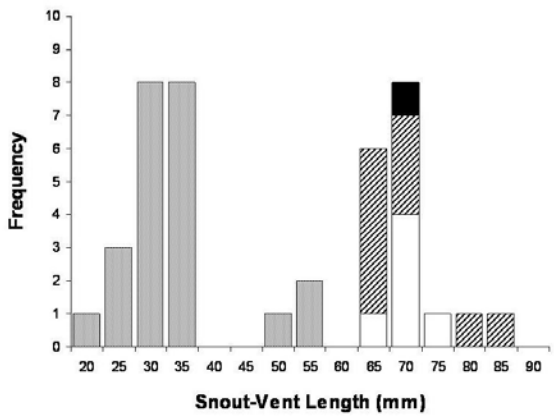

FIGURE 3. Histogram of individual juvenile (gray bars) and adult male (open), female (slanted lines), and unknown sex (black) Yellow-blotched Salamanders (*Ensatina eschscholtzii croceator*) found 1999-2000 in canyons leading into the Kern River Canyon, Kern County, California.

cover humidity of sites with salamanders using ANOVA. For all tests, α = 0.05.

RESULTS

I found Yellow-Blotched Salamanders in six of the 11 creeks surveyed. In two years of surveying, and trying to account for individuals by capture location and animal size (no marking was done), I found 39 Yellow-Blotched Salamanders: 16 adults and 23 juveniles (Fig. 3). No salamanders were found in Stark, Delonegha, Greenhorn, Little, or Bradshaw / Lilly creeks. Catch per person hour was 0.16 Yellow-blotched Salamanders for all canyons, 0.27 for canyons with salamanders, and 0.48 for the 3 canyons that contained 88% of all salamanders found. I found Yellow-blotched Salamanders as early as 26 January (the earliest date of surveying in the two years) and as late as 12 April (the latest date of surveying). Male Yellow-blotched Salamanders did not differ significantly from females either in mean SVL (W = 66.0, P = 0.509), total length (W = 61.0, P = 0.211), or mass (W = 82.5, P = 0.229). Juvenile Yellow-blotched Salamanders averaged only 50% the SVL of adults and only 16% the mass (Table 1).

The best model of habitat variables that distinguished sites with adults from sites with juveniles (Table 2) included soil moisture, distance from a creek, and aspect (G = 13.49, df = 3, P = 0.004; model fit χ^2 = 22.99, df = 24, P = 0.520). Adults were found under cover objects with drier soil, farther from a stream, and a more northwesterly direction of slope than juveniles (Table 2, Fig. 4). Irrespective of age class, the aspect where I found Yellow-blotched Salamanders was generally north-northwest to northeast (Fig. 4), which differed significantly from a uniform distribution (Z = 19.17, P < 0.001). The air temperature of a cover site (mean = 13.4^o C, SE = 0.79) did not differ significantly from ambient air temperature (mean = 15.2^o C, SE = 0.79; $F_{1, 44}$ = 2.497, P = 0.121), but cover soil temperature (mean = 10.4^o C, SE = 0.40) was significantly lower than ambient air temperature ($F_{1, 54}$ = 37.08, P < 0.001) and cover humidity (mean = 61.0%, SE = 1.91) was significantly higher than ambient air humidity (mean = 44.1%, SE = 3.03; $F_{1, 46}$ = 23.92, P < 0.001). Most salamanders were found on loamy soils, but a few were found on a variety of soil types from sandy to rocky (Fig. 5). I found Yellow-blotched Salamanders most often under logs and rocks, but 3 were found under bark (loose on the soil) and I found one under a piece of corrugated sheet metal (Fig. 5). I did not find any salamanders in leaf litter or under talus. The proportion of adults and juveniles found on different soil or cover types did not differ (Soil Type D_α = 0.155, P > 0.05; Cover Type D_α = 0.130, P > 0.05).

Vegetation characteristics of the 11 tributary canyons to the Kern River Canyon were generally similar (Table 3), but canyons in which salamanders were found differed significantly from canyons where they were not found (G = 12.39, df = 4, P = 0.015; model fit χ^2 = 0.00, df = 5, P = 1.00). The best fit model included all variables but the number of dominant shrubs. Canyons with Yellow-blotched Salamanders had less canopy cover, more species of trees, slightly fewer species of dominant trees, and fewer shrubs than canyons where I did not find salamanders (Table 3). Except for a fire-burned area of Bradshaw/Lilly Creeks, each canyon had 65-95% cover of trees and shrubs. Common trees in these canyons were interior Live Oak (*Quercus wislizenii*), Blue Oak (*Q. douglasii*), California Buckeye (*Aesculus californica*), Foothill Pine (*Pinus sabiniana*), and Sycamore (*Platanus racemosa*) (Appendix Table). By far the most common shrub in all canyons was Poison Oak (*Toxicodendron diversilobum*). Other relatively common shrubs were Seep Willow (*Baccharis emoryi*), Deer Lotus (*Lotus scoparius*), and Arroyo Willow (*Salix lasiolepis*). A variety of herbaceous moncots and dicots occurred in these canyons (up to 102 species in 37 families in a canyon). Although most herbaceous plants were native, most canyons had a heavy cover of grasses, most of which are not native to these canyons (or to North America).

TABLE 2. Mean values (± standard error) and sample sizes (n) of habitat variables measured at locations where Yellow-blotched Salamanders were found 1999-2000 in six canyons leading into the Kern River Canyon, California. For aspect, the values are the mean vector (± circular standard error). The last three measures were taken at the beginning of censuses in which salamanders were found.

Habitat Variable	Adults	n	Juveniles	n
Soil Temperature (ºC)	10.4 (0.681)	14	10.4 (0.484)	23
Soil Moisture (%)	21.1 (2.91)	8	30.9 (2.44)	18
% Canopy Cover	67.9 (8.82)	14	55.2 (6.75)	23
Cover Temperature (ºC)	13.2 (1.15)	10	13.6 (1.02)	17
Cover Humidity (%)	62.3 (3.15)	12	60.2 (2.32)	20
Distance from Creek (m)	14.8 (2.53)	11	7.2 (0.89)	20
Elevation (m)	587.1 (12.68)	10	615.4 (13.79)	17
Slope (º)	30.4 (3.23)	11	22.4 (2.53)	22
Aspect (º)	344.9 (18.7)	13	18.2 (5.75)	23
Common Data				
Air Temperature (ºC)	16.4 (1.14)	21		
Air Relative Humidity (%)	42.1 (2.98)	18		
% Cloud Cover	58.8 (8.36)	21		

DISCUSSION

With the exception of one creek system, I found Yellow-blotched Salamanders in all of the lower elevation canyons that are tributaries to the Kern River Canyon. I found Yellow-blotched Salamanders from late January to April (the rainy period) usually under rocks and logs and they were mostly associated with loamy soils. They were found fairly close to streams, although adults were found farther from water, on average, than were juveniles. Salamanders also were generally found partially or wholly under the canopy of trees, although occasionally an individual was found under cover in the open. Soils under cover were moist but not wet. Based on general vegetation, it is not apparent why Yellow-blotched Salamanders were

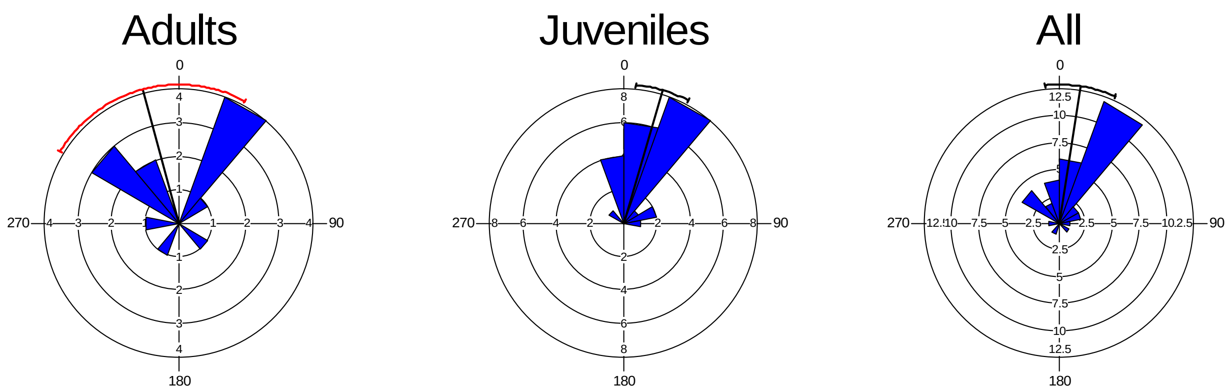

FIGURE 4. Aspect of slopes on which Yellow-blotched Salamanders (*Ensatina eschscholtzii croceator*) were found during surveys 1999-2000 of tributary canyons of the Kern River Canyon, Kern County, California.

absent from the higher elevation canyons because plant life is essentially the same in all 11 canyons. Elevation itself probably is not a factor because Yellow-blotched Salamanders have been found up to 2000 m in the Tehachapi Mountains (University of California, Museum of Vertebrate Zoology searchable database). The higher elevation canyons in the Kern River Canyon have a south, southwesterly aspect, which may cause soils to dry out more quickly than the north directed lower canyons, although I did not take measurements in areas where I did not find salamanders. I did find 3 Yellow-blotched Salamanders in Sycamore Canyon, a southerly directed canyon, in early April 1999, but they were found in a heavily treed part of the canyon and the aspect direction of the slope on which they were found was north to northeasterly.

As a species, *Ensatina* generally are found in areas with abundant leaf litter (Stebbins 1951), and retreat deep into leaf litter when conditions dry, at least in the northern parts of the range (Wisely and Golightly 2003). In northern Oregon, *Ensatina* were found in leaf litter close to the surface even when ambient above ground conditions were dry (Gnaedinger and Reed 1948). However, after eight years of study, Stebbins (1954) almost never found *Ensatina* in leaf litter in central and southern parts of the range. Few *Ensatina* were found in leaf litter at studies sites in Oregon and Washington also (Aubry et al. 1988; Bury and Corn 1988). In more southerly parts of the species range, *Ensatina* retreat into rodent burrows and deep into rock piles when conditions dry (Stebbins 1951). Stebbins (1949) specifically reported on 5 Yellow-blotched Salamanders at two localities in the southern part of the subspecies' range; they were found generally on northward-facing slopes and 3 were found under logs, although he found one in oak leaves and one in damp, loose soil at the base of an oak. I did not find any Yellow-blotched Salamanders in leaf litter during two years of searching in the Kern River Canyon area. Block and Morrison (1998) found Yellow-blotched Salamanders in the southern portion of the subspecies range associated with canyon Live Oak but avoided areas with Blue Oak. Blue Oaks were on the hillsides of canyons were I found Yellow-blotched Salamanders, but interior live oaks were in the moister bottoms of the canyons where most salamanders were located.

Ensatina are found rather abundantly under cover objects throughout their range (Stebbins 1951). In Oregon and

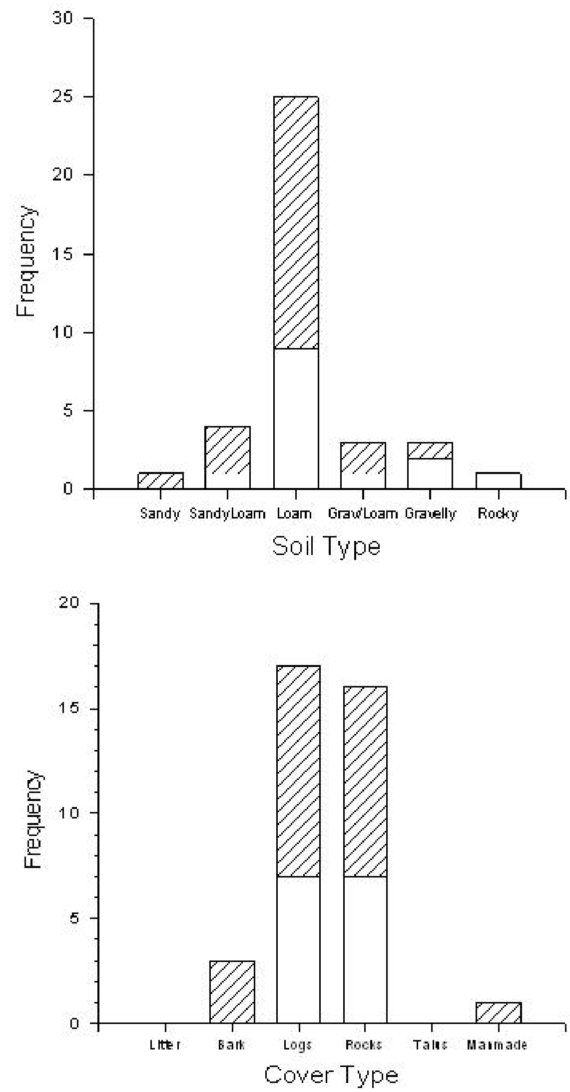

FIGURE 5. Soil and cover types where Yellow-blotched Salamander (*Ensatina eschscholtzii croceator*) juveniles (shaded) and adults (clear) were found in tributary canyons to the Kern River Canyon, California 1999-2000.

TABLE 3. The percentage canopy cover, mean elevation (m), direction, number of tree and shrub species, and the number of plant species considered dominant for canyons with and without Yellow-blotched Salamanders 1999-2000. Direction refers to the general compass heading of the canyon leading to the Kern River and both elevation and direction were from maps. Numbers in parenthesis are standard errors (SE).

Canyon	*Ensantina* Present?	% Canopy Cover	Elevation (m)	Direction	Dominant Trees (*N*)	Total Trees (*N*)	Dominant Shrubs (*N*)	Total Shrubs (*N*)
Richbar Creek	Y	70 – 90	490	N	4	5	5	10
Stark Creek	N	70 – 90	490	NW	4	5	5	10
Cow Flat Creek	Y	30 - 90	660	NW	2	8	1	5
Delonegha Creek	N	85 – 95	660	S	4	5	2	11
Mill Creek	Y	65 – 80	660	NW	3	9	3	14
Democrat Creek	Y	80 - 90	680	W	4	7	3	8
Fire Station	Y	85 – 95	680	NW	5	6	4	12
Sycamore Creek	Y	85 – 95	690	SE	4	5	2	7
Greenhorn Creek	N	85 – 95	700	S, SE	4	5	2	14
Little Creek	N	80 – 90	700	S, SE	4	5	2	12
Bradshaw-Lilly Creek	N	85 – 95	730	SW - SE	4	6	3	9
Bradshaw Lilly Creek[1]	N	(5 – 20)[1]						
Mean Values	Y	79.67 (4.74)	643.3 (31.1)	N/A	3.67 (0.42)	6.67 (0.67)	3.00 (0.58)	9.33 (1.36)
Mean Values	N	87 (2.00)	656 (43.0)	N/A	4.00 (0.00)	5.20 (0.20)	2.80 (0.58)	11.20 (0.86)

[1]Burned area of canyons

Washington, *Ensatina* have been found most often associated with cover from logs and bark (Aubry et al. 1988; Bury and Corn 1988). In a Douglas-fir forest in Oregon, 63.9% of *Ensatina* were found either under or inside logs, or under the bark on logs, and an additional 31.1% were found under bark on the ground (Bury and Corn 1988). Of those associated with logs, almost 43% were inside decomposing logs. Also in Douglas-fir forest of Oregon, Butts and McComb (2000) found that the number of *Ensatina* increased logarithmically with an increase in the amount of coarse woody debris. Greater than 95% of Yellow-blotched Salamanders at sites in the Tejon Ranch were found under logs and branches of oaks (Block and Morrison 1998). I found 43.6% of Yellow-blotched Salamanders under logs and another 10.3% under bark on the ground. However, 41% were found under rocks. No doubt this has to due with differences in availability of cover objects between these habitat types. Coarse woody debris is the main cover object of salamanders in conifer forests (Aubry et al. 1988; Bury and Corn 1988; Butts and McComb 2000), but is less prevalent in the canyons I searched. Although I did not quantify the availability of different cover types in the habitat, rocks were about as prevalent as logs. Even in forested parts of the range, *Ensatina* will use rocks if they occur in the habitat. In an area of clear-cut forest in Oregon, 12 *Ensatina* were found under a recently placed pile of gravel to boulder-sized basaltic rock (Hayes and Hayes 2003).

Almost anything on the ground in the rainy season seems to serve as cover for *Ensatina*, especially in the southern parts of its range (Stebbins 1951). Like most amphibians, *Ensatina* require fairly moist microsites to survive. In the southern parts of the range, this limits *Ensatina* to being mostly a canyon dweller that uses rather shallow, north facing slopes with high amounts of cover from trees and shrubs (Stebbins 1951, 1954). This is what I found for the yellow-blotched subspecies. Humidities under cover sites were significantly higher than ambient air humidity and the soil temperatures on which salamanders occurred were significantly lower than ambient air temperatures. Stebbins (1954) showed that the body temperature of *Ensatina* at his study sites was within 1^{o} C of the soil temperature where they were found. I found a mean soil temperature for sites with Yellow-blotched Salamanders (10.4^{o} C) almost exactly the same as the mean body temperature (10.8^{o} C) recorded by Stebbins (1954).

Ensatina are generally found abundantly in the northern part of their range; often they are the most abundant salamander in a community. Estimates of abundance have ranged from > 1700 *Ensatina* / ha in northern California (Stebbins 1954) to > 2800 per ha in Oregon (Gnaedinger and Reed 1948). The number of salamanders found per person hour during ground searches gives a relative estimate of abundance. In one study in moist forests of northern California and southwestern Oregon, catch of *Ensatina* per person hour was 10.23 (Welsh 1987), although other estimates of abundance range from 0.24-4.51 *Ensatina* per person hour in northern forests of California and Oregon (Aubry et al. 1988; Welsh and Lind 1988; Corn and Bury 1991; Gilbert and Alwine 1991; Butts and McComb 2000; McDade and Maguire 2005). My catch per person hour for Yellow-blotched Salamanders was < 0.50, even for the 3 canyons with the majority of salamanders. Stebbins (1949) noted that Yellow-blotched Salamanders were rarely encountered in their range, and Block and Morrison (1998) found 0.68 salamanders per person hour at the Tejon Ranch.

These data are only the second quantified data of habitat of the yellow-blotched subspecies of *Ensatina*, and the study by Block and Morrison (1998) focused on quantifying the vegetation around pit-fall traps with *Ensatina*, not the actual cover sites with salamanders. Although this subspecies occupies a relatively small area, additional work in other parts its range would help determine how variable habitat parameters are for the Yellow-blotched Salamander. The canyons in which I searched are heavily trampled by humans for recreation and cattle grazing adds additional disturbance to these moist microsites. Human disturbance will likely increase locally because the Kern River Canyon draws many people from the Bakersfield metropolitan area (> 700,000 in 2005) and from much of southern California. If this subspecies is shown to be declining, protection of these tributary canyons may be warranted.

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APPENDIX. Trees and shrubs found in or near the creek and on hillsides in canyons leading into the Kern River Canyon, California. Trees and shrubs determined to be dominant are bolded.

Canyon	Trees		Shrubs	
(Mean Canopy Cover)	Hillside	Creekside	Hillside	Creekside
Richbar/Stark (70-90%)	***Quercus wislizenii*** ***Aesculus californica*** ***Pinus sabiniana*** ***Platanus racemosa***	***Quercus douglassi*** ***Aesculus californica*** ***Pinus sabiniana*** *Quercus chryolepis*	***Toxicodendron diversilobum*** ***Baccharis emoryi*** ***Salix lasiolepis*** *Cephalanthus occidentalis*	***Toxicodendron diversilobum*** ***Lotus scoparius*** ***Ceanothus cuneatus*** *Ribes quercetorum* *Eriogonum fasciculatum* *Rhamnus ilicifolia* *Keckiella rothrockii*
Cow Flat Creek (90% lower, 30% upper)	***Quercus wislizenii*** ***Aesculus californica*** *Platanus racemosa* *Fraxinus latifolia* *Populus fremontii* *Sequoia sempervirens*	***Quercus wislizenii*** ***Aesculus californica*** *Umbellularia californica* *Pinus sabiniana*	***Toxicodendron diversilobum***	***Toxicodendron diversilobum*** *Isocoma acradenia* *Ribes quercetorum* *Keckiella rothrockii* *Mimulus aurantiacus*
Democrat Creek (80-90%)	***Quercus wislizenii*** ***Aesculus californica*** ***Platanus racemosa*** *Pinus sabiniana* *Umbellularia californica* *Alnus rhombifolia*	***Quercus wislizenii*** ***Quercus douglasii*** ***Aesculus californica*** *Pinus sabiniana*	***Toxicodendron diversilobum*** ***Baccharis emoryi*** *Sambucus mexicana* *Salix lasiolepis*	***Toxicodendron diversilobum*** ***Lotus scoparius*** *Sambucus mexicana* *Solanum xanti* *Mimulus aurantiacus* *Ribes quercetorum*
Unnamed Creek near Firestation (85-95%)	***Quercus wislizenii*** ***Aesculus californica*** ***Platanus racemosa*** *Pinus sabiniana*	***Quercus douglassi*** ***Quercus wislizenii*** ***Aesculus californica*** *Pinus sabiniana*	***Toxicodendron diversilobum*** ***Baccharis emoryi*** *Sambucus mexicana*	***Toxicodendron diversilobum*** ***Eriogonum fasciculatum*** ***Ceanothus cuneatus*** *Ribes quercetorum* *Ribes roezlii* *Sambucus mexicana* *Rhamnus ilicifolia* *Keckiella rothrockii* *Mimulus aurantiacus* *Solanum xanti* *Fremontodendron californicum*

Mill Creek (65-80%)	***Quercus wislizenii*** ***Platanus racemosa*** *Aesculus californica* Alnus *rhombifolia* *Populus fremontii* *Celtis douglasii* *Pinus sabiniana*	***Quercus wislizenii*** ***Quercus douglasii*** *Quercus chrysolepis* *Aesculus californica* *Pinus sabiniana*	***Toxicodendron diversilobum*** ***Baccharis emoryi*** ***Salix lasiolepis*** *Sambucus mexicana*	***Toxicodendron diversilobum*** *Encelia actoni* *Ribes quercetorum* *Ribes roezlii* *Sambucus mexicana* *Keckiella rothrockii* *Mimulus aurantiacus* *Ephedra viridis* *Lotus scoparius* *Eriogonum fasciculatum* *Ceanothus cuneatus* *Rhamnus ilicifolia*
Sycamore Creek (85-95%)	***Quercus wislizenii*** ***Aesculus californica*** ***Platanus racemosa*** *Pinus sabiniana*	***Quercus douglassi*** ***Quercus wislizenii*** ***Aesculus californica*** *Pinus sabiniana*	***Toxicodendron diversilobum*** ***Baccharis emoryi*** *Salix lasiolepis*	***Toxicodendron diversilobum*** *Eriogonum fasciculatum* *Ceanothus cuneatus* *Lotus scoparius* *Mimulus aurantiacus*
Delonegha Creek (85-95%)	***Quercus wislizenii*** ***Aesculus californica*** ***Platanus racemosa*** *Pinus sabiniana*	***Quercus wislizenii*** ***Quercus douglasii*** ***Aesculus californica*** *Pinus sabiniana*	***Toxicodendron diversilobum*** ***Baccharis emoryi*** *Salix lasiolepis*	***Toxicodendron diversilobum*** *L otus scoparius* *Artemisia tridentate* *Chrysothamnus nauseosus* *Eridictyon californicum* *Yucca whipplei* *Eriogonum fasciculatum* *Ceanothus cuneatus* *Salix lasiolepis* *Mimulus aurantiacus*
Greenhorn Creek (85-95%)	***Quercus wislizenii*** ***Aesculus californica*** ***Platanus racemosa*** *Pinus sabiniana*	***Quercus wislizenii*** ***Quercus douglasii*** ***Aesculus californica*** *Pinus sabiniana*	***Toxicodendron diversilobum*** ***Baccharis emoryi*** *Salix lasiolepis* *Sambucus mexicana*	***Toxicodendron diversilobum*** *Lotus scoparius* *Artemisia tridentate* *Chrysothamnus nauseosus* *Isocoma acradenia* *Sambucus mexicana* *Ephedra viridis* *Eridictyon californicum* *Yucca whipplei* *Eriogonum fasciculatum* *Ceanot hus cuneatus* *Mimulus aurantiacus*
Little Creek (80-90%)	***Quercus wislizenii*** ***Aesculus californica*** ***Platanus racemosa*** *Pinus sabiniana*	***Quercus douglassi*** ***Quercus douglasii*** ***Aesculus californica*** *Pinus sabiniana*	***Toxicodendron diversilobum*** ***Baccharis emoryi*** *Salix lasiolepis* *Sambucus mexicana*	***Toxicodendron diversilobum*** *Lotus scoparius* *Artemisia tridentate* *Chrysothamnus nauseosus* *Isocoma acradenia* *Sambucus mexicana* *Ephedra viridis* *Eridictyon californicum* *Yucca whipplei* *Eriogonum fasciculatum* *Ceanothus cuneatus* *Mimulus aurantiacus*
Bradshaw/Lilly Creeks (5-20%:fire area) (85-95%: below Hwy)	***Quercus wislizenii*** ***Aesculus californica*** ***Platanus racemosa*** *Pinus sabiniana* *Fraxinus latifolia*	***Quercus wislizenii*** ***Quercus douglasii*** ***Aesculus californica*** *Pinus sabiniana*	***Toxicodendron diversilobum*** ***Salix lasiolepis***	***Toxicodendron diversilobum*** ***Lotus scoparius*** *Isocoma acradenia* *Yucca whipplei* *Eriogonum fasciculatum* *Keckiella rothrockii* *Mimulus aurantiacus* *Solanum xanti*