HABITAT ASSOCIATIONS OF THE ALAMEDA WHIPSNAKE

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Abstract: Surveys of 22 sites in Alameda and Contra Costa Counties reveal that the Alameda whipsnake, *Masticophis lateralis euryxanthus*, is associated with open canopy chaparral and coastal scrub communities, although it also utilizes adjacent grassland and oak savannah associations. Rock outcrops and talus with deep crevices and rodent burrows were important features at sites which support this snake. A lizard community comprised of at least two species which always included the western fence lizard, *Sceloporus occidentalis*, was also present in moderate to high numbers at whipsnake sites. When all of these features occur on south, southwest or southeast facing slopes, the habitat appears optimal for the Alameda whipsnake.

The Alameda whipsnake (*Masticophis lateralis euryxanthus*) is listed by the state of California as Threatened and recognized by the federal government as a Category 1 candidate species for listing. Its geographic range encompasses much of Alameda and Contra Costa Counties (Stebbins 1985). Development of the remaining open space in its range creates a need for a set of habitat parameters by which the potential of such sites as Alameda whipsnake habitat can be judged. Beyond the fact that this reptile is most often sighted in or near chaparral or northern coastal scrub communities, information on its habitat preference is unavailable. The purpose of this study was to evaluate habitat associations of the Alameda whipsnake based on snake trapping surveys of undeveloped locations of the East Bay region. If a set of habitat parameters suggest Alameda whipsnake presence, then spring trapping surveys may be initiated to more accurately ascertain the snake's presence or absence.

STUDY AREA

Between April, 1989, and June, 1992, surveys and habitat evaluations for the whipsnake were conducted at 22 locations in Alameda and Contra Costa Counties (Fig. 1). All sites but one were selected for survey in response to proposed development. One pre-designated site, Big Springs Canyon in Tilden Regional Park, was chosen for a long term trapping study because of its history of whipsnake sightings and because there is no threat of future development. All sites are characterized by stand(s) of chaparral or coastal scrub (Munz and Keck 1973).

METHODS

The trap used was a modified version of that developed by Fitch (1951). The elongate trap bodies were constructed of 2.0 cm redwood with 0.3 cm mesh ends and ventilation windows on each side. Traps averaged 18 cm wide, and lengths ranged from 25 to 60 cm. The hardware cloth funnel was positioned so that half of the opening was on each side of a drift fence end. A hinged, clear mylar flap over the funnel opening (2.5 cm diameter) within the trap's body prevented escape by captive snakes.

Drift fences were flexible fiberboard held upright by wooden stakes. Fence height ranged from 30 to 40 cm high and their lengths ranged from 11 to 19 m. A funnel trap was positioned at each end of a trapline so that the trap's funnel was vertically bisected by the drift fence. In this design, snakes intercepted and moving along either side of the fence were directed into a trap. During the course of this work we tested the whipsnakes response to drift fences. Both in the field and in outdoor enclosures we released Alameda whipsnakes along one side of a drift fence. Although an adult Alameda whipsnake may be able to easily crawl over an object of drift-fence height or greater, none of the snakes did so. Instead snakes chose to drift along the fence base. Perhaps this strong thigmotropic behavior of many small vertebrates makes the Fitch trapping system effective.

Each trap functions as an independent capture unit. This assumption is supported by numerous trapping records for several snake species which show only one of the two funnel traps of a trapline producing all the snake captures. For this study, one trap day is defined as one funnel trap and the associated drift fence in the field for 24 hours (i.e. one trapline in the field for 24 hours equals two trap days).

Traplines were in place at Tilden (site 1) for two eight-month periods in 1990 and 1991 (April through November), at site 2 and 3 from April through November in 1989, and 1990 respectively, site 21 for one month in late spring and from August through October, and all other sites for three months during the spring and early summer period (approximately April through June) at sites 4-20 and 22.

Trapline numbers ranged from 8 to 20 per site, depending on the area of the shrub community. Most were within or on the edge of chaparral or coastal scrub stand. This placement was based upon our prior

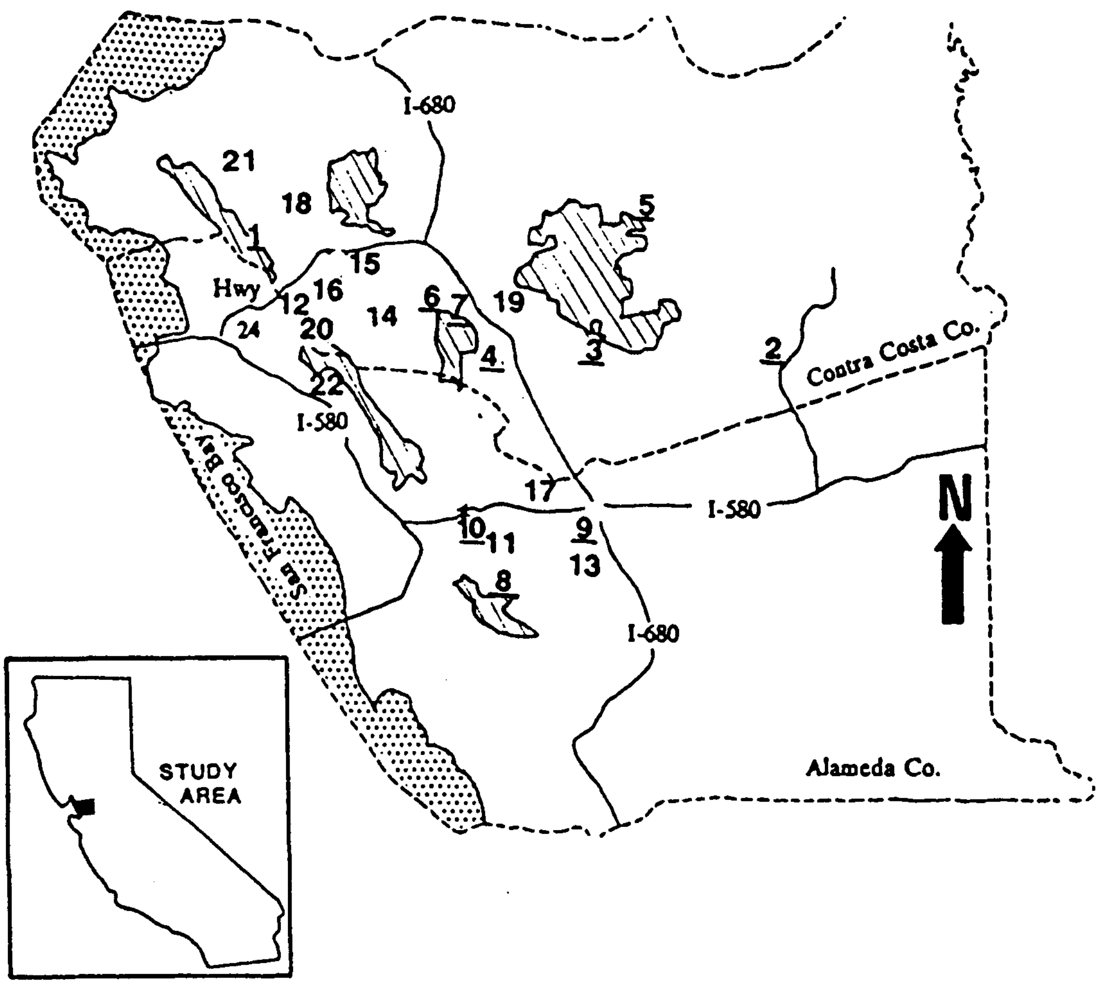

Fig. 1. Location of the 22 sites surveyed for the Alameda whipsnake in Alameda and Contra Costa Counties. Underlined numbers (1-10) indicate whipsnake capture sites. Hatched areas indicate state and regional parks.

experience in the Hayward Hills and Tilden Park, which demonstrated Alameda whipsnake presence within or adjacent to native brush habitats. In addition, approximately 20% of traplines were also positioned outside of the brush community in adjacent grassland or oak savannah associations in order to assay these vegetation types as possible secondary Alameda whipsnake habitat. We checked traps daily during warm weather and every other day during cool spells. During the course of checking traplines, visual searches of the area enabled hand captures of free-ranging whipsnakes. All Alameda whipsnakes captured were sexed (except for hatchlings), measured (total length), palpated to retrieve partially digested prey items, and marked for individual recognition by clipping the edge of a specific ventral scale.

Because this trapping technique captures nearly all small terrestrial vertebrates moving through a trapline area, available prey items were sampled at each site. The lizard fauna obtained in this manner formed the basis for

Table 1. Alameda whipsnake captures, capture effort, and site characteristics from 22 sites in Alameda and Contra Costa Counties.

Site[1]	Number Captured[2] A+J (H)	Trap Days[3]	Canopy Cover[4]	Slope Exposure	Rock Outcrops[5]	Lizard Prey[6] FL	WS	AL	WW
1	17 (3)	11,000	open	S,SE,SW	>3	+	+	+	-
2	6 (7)	5,542	open	S,SE	>3	+	+	-	s
3	10 (0)	4,000	open	S,SE	>3	+	-	s	+
4	4 (0)	1,890	open	E,NE	1-2	+	+	+	-
5	3 (0)	1,750	open	S	1-2	+	+	+	-
6	3 (0)	1,500	partial	SE	>3	+	+	+	-
7	2 (0)	1,080	partial	SE	1-2	+	+	+	-
8	1 (0)	1,600	open	S,SW	>3	+	-	+	-
9	1 (0)	1,700	open	E,NE	>3	+	s	+	-
10	1 (0)	1,500	partial	SE	0	+	-	m	-
11	0 (0)	1,500	partial	E	0	+	s	m	-
12	0 (0)	1,500	open	SW	>3	+	m	s	-
13	0 (0)	1,500	closed	E	0	+	m	m	-
14	0 (0)	1,950	closed	E,W	0	+	-	+	-
15	0 (0)	2,160	closed	SE,NW	0	+	-	+	-
16	0 (0)	1,500	closed	NE	0	+	-	m	-
17	0 (0)	1,500	closed	SE	0	+	m	m	-
18	0 (0)	1,400	closed	E	0	+	m	m	-
19	0 (0)	1,080	closed	NW	0	+	-	+	-
20	0 (0)	1,750	closed	NE	0	+	m	+	-
21	0 (0)	2,150	closed	W	0	+	+	+	-
22	0 (0)	1,450	partial	SW	0	s	-	+	-

[1] Site number corresponds to those on Fig. 1.
[2] A+J = adult and juveniles (H = hatchlings).
[3] One drift fence with a trap at each end in the field for 24 hours = two trap days.
[4] Canopy cover of shrub community:
open = no more that 75% of the total scrub area covered with scrub crowns
partial = 75-90% of scrub area covered by scrub crowns
closed = 90% or more of the scrub area covered by scrub crowns.
[5] Rock outcrop abundance = number of outcrops/ha.
[6] Lizard prey abundance:
FL = northwestern fence lizard
WS = western skink (sites 1, 4, 6, 7, 9, 11-14, 18-21) and Gilbert skink (sites 2 and 5)
AL = southern alligator lizard
WW = western whiptail
+ (abundant) = 5 or more captures/1,000 trap days
m (moderate abundance) = between 2.5 and 4.9 captures/1,000 trap days
s (scarce) = between 0.1 and 2.4 captrures/1,000 trap days
- (absent) = none captured

found that small- and medium-sized desert striped whipsnakes (*M. t. taeniatus*) also ate only lizards. As feeding specialists Alameda whipsnakes are dependent on a large standing crop of relatively few prey species and apparently cannot readily switch to alternate, non-lizard prey (Drummond 1983). Hence areas with abundant populations of western fence lizards and at least one other lizard species provide more feeding opportunities than areas with smaller populations of fewer species, especially if one prey item becomes temporarily scarce.

The presence of the western fence lizard, the only wide-spread heliothermic lizard with the Alameda whipsnake's range, is probably a principal indicator of an adequate prey base. Prey selcetion studies demonstrated lizards (Larsen et al. 1991). Parker and Brown (1980) that primarily visual, as opposed to olfactory stimulus triggers whipsnake feeding response (Larsen et al. 1991). Throughout our study, we saw western fence lizards basking and moving far more often than the secretive skink and alligator lizard. Hammerson (1979) demonstrated that the Alameda whipsnake maintains a body temperature equal to, and often surpassing that of western fence lizard during sunny days. In turn the whipsnake may achieve neuro-muscular coordination equal to or greater than that of its primary prey. However, to sustain such body temperatures through basking in open terrain would expose the whipsnake to its diurnal predators. Open canopy shrub communities provide a sunlight-shade mosaic within which foraging Alameda whipsnakes may thermoregulate while at the same time receive visual and physical protection from avian predators.

In order for this basking-foraging system to function, solar penetration of brush canopy opening should be near maximum, and thus the Alameda whipsnake's preference for southeast through southwest facing slopes. North facing slopes have particularly low solar input during the spring when male whipsnakes move extensively seeking mates (Swaim, in prep.).

Sunlight penetration through an open canopy scrub on slopes facing the morning sun would permit morning warming of the whipsnake and its prey, whereas slopes facing away from the morning sun may not. Two west facing slopes were surveyed during this study, and trapping efforts at both failed to produce Alameda whipsnakes. Each site had a closed canopy, and this in combination with no morning solar input may account for this snake's absence.

Abundant retreat sites for the whipsnake is perhaps of no greater importance than for other snake species. Retreat availability may, however, ensure that this diurnal snake can rapidly escape from avian predators and periods of thermal extremes. In addition to cover, the relationship between rock outcrop presence and whipsnake presence may also be partially related to a more diverse and abundant lizard prey base than is found where outcrops are absent.

The reasons for the whipsnakes association with each of the habitat features documented in this study have yet to be fully detailed. The 22 site survey demonstrates that where southerly exposures, open canopy scrub, rock outcrops and diverse and abundant lizard populations occur within the geographic range of the Alameda whipsnake, this species will probably be present. The physical features and vegetation structure of a site can be evaluated at any time of the year. However, lizard abundance must be estimated during the spring and/or early summer. The validity of such an estimate also rests heavily on the observation skill of the surveyor.

The use of these parameters during the EIR process would be a first step to ensure that areas which express a potential for supporting this threatened species are not overlooked but are instead recommended for trapping surveys. In this manner, proposed project impacts on the Alameda whipsnake and its habitat can be fully assessed and mitigated.

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