COAST HORNED LIZARD

Phrynosoma blainvillii Gray 1839

Status Summary

Phrynosoma blainvillii is a Priority 2 Species of Special Concern, receiving a Total Score/Total Possible of 49% (54/110). During the previous evaluation, it was also considered a Species of Special Concern under the name *P. coronatum* (see the "Taxonomic Relationships" section) (Jennings and Hayes 1994a).

Identification

Phrynosoma blainvillii has the typical oval, flattened body form of a horned lizard and reaches a maximum SVL of 11.4 cm (Stebbins 2003). It has a row of large horns behind the head, with the two central horns usually longer than the rest and separated at their base. Two rows of large pointed fringe scales run down each side of the body. Large pointed scales also occur on the throat in two or three rows on each side. The dorsum of the body and tail have randomly scattered large, pointed, keeled scales. The general dorsal coloration is tan, yellowish, brown, reddish, or gray, with large dark blotches. Coloration can vary within and between populations and with respect to substrate color. Ventral coloration is cream, beige, or yellow, with dusky spotting (Stebbins 2003).

Coast Horned Lizard: Risk Factors

Ranking Criteria (Maximum Score)	Score
i. Range size (10)	0
ii. Distribution trend (25)	20
iii. Population concentration/ migration (10)	0
iv. Endemism (10)	7
v. Ecological tolerance (10)	7
vi. Population trend (25)	10
vii. Vulnerability to climate change (10)	3
viii. Projected impacts (10)	7
Total Score	54
Total Possible	110
Total Score/Total Possible	0.49

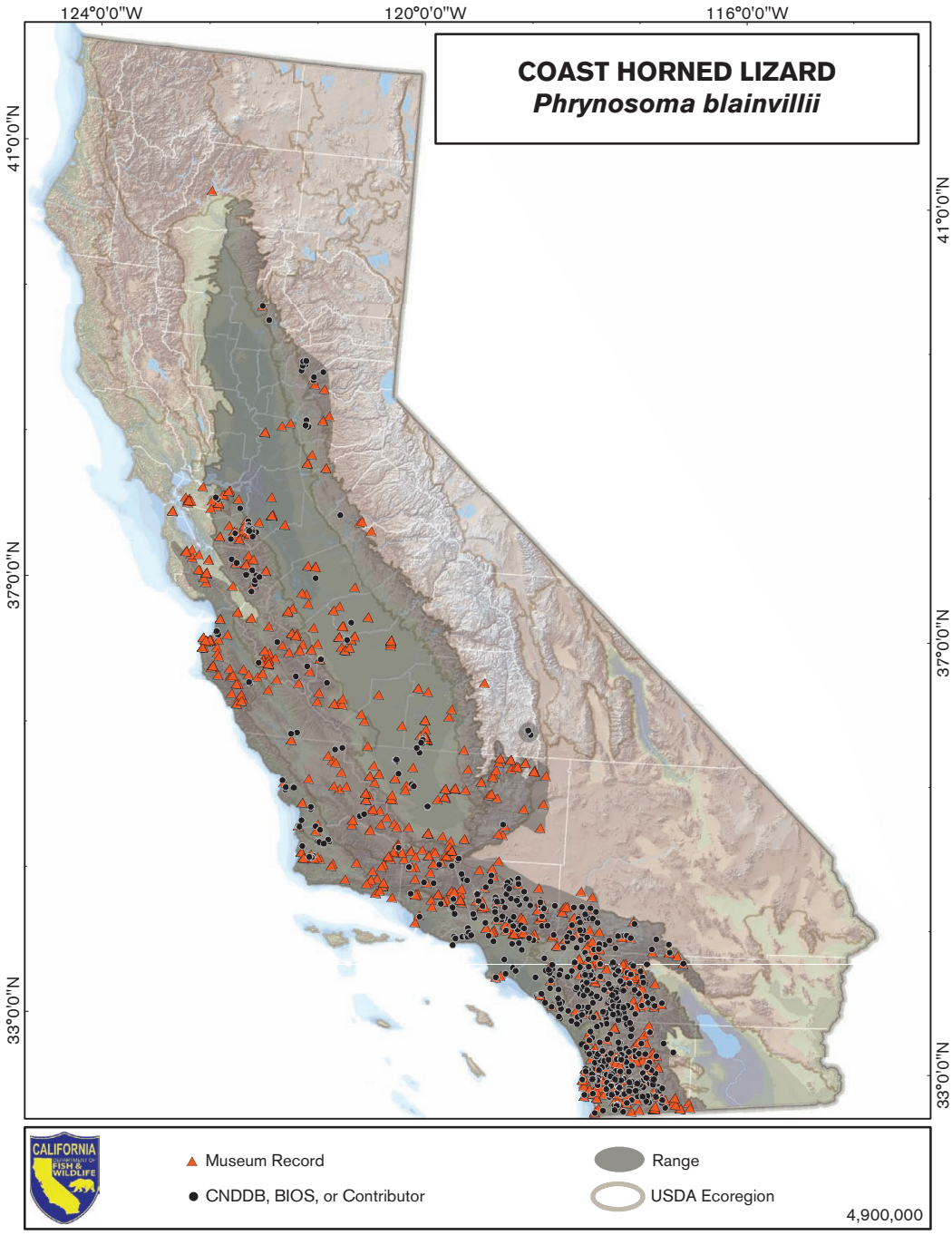

PHOTO ON PREVIOUS PAGE: Coast horned lizard, Kern County, California. Courtesy of Nicholas Hess.

Phrynosoma blainvillii may be confused with the desert horned lizard (*P. platyrhinos*) where the ranges of the two species meet in a small region of the southern and eastern part of the range of *P. blainvillii* in California. *Phrynosoma platyrhinos* is easily distinguishable based on a single row of fringe scales down each side of the body, a single row of pointed scales on either side of the throat, and smaller keeled scales on the dorsum.

Taxonomic Relationships

Phrynosoma blainvillii is a member of a species complex that has had a tumultuous taxonomic history, with several species and subspecies recognized by different researchers over time (Klauber 1936, Reeve 1952, Brattstrom 1997). During the previous Species of Special Concern evaluation (Jennings and Hayes 1994a), a single species, *P. coronatum*, was recognized, and California populations were considered as two subspecies: the California coast horned lizard (*P. c. frontale*) and the San Diego coast horned lizard (*P. c. blainvillii*). Recent studies on morphological, ecological, and genetic variation among populations support the recognition of only a single taxon in California, *P. blainvillii*, leading to a revised species-level taxonomy that restricts the species name *P. coronatum* to populations in Baja California Sur, Mexico (Montanucci 2004, Leaché et al. 2009). Three clades have been identified in California based on mitochondrial DNA: northern Baja California, southern California, and northern California (Leaché et al. 2009; see "Distribution" trend). However, two nuclear loci did not distinguish among the clades in California, and ecological and morphological data show substantial overlap among the clades (Montanucci 2004, Leaché et al. 2009). Therefore, we do not recognize any of these clades as conservation units at this time.

Life History

Phrynosoma blainvillii adults are typically active in California from February to November, with peak activity between April and July (Banta and Morafka 1968, Hager and Brattstrom 1997, Fisher et al. 2002, Alberts et al. 2004, Gerson 2011). Hatchlings are active from mid to late summer into November (Banta and Morafka 1968, Hager 1996, Hager and Brattstrom 1997, Fisher et al. 2002, Alberts et al. 2004). Diurnal activity switches from midday peaks in the spring to more crepuscular activity in summer and early fall (Heath 1965, Hager and Brattstrom 1997).

Most information on reproduction has been collected in the southern part of the range in California. Goldberg (1983) looked at reproductive condition in 164 specimens collected mostly from March to September in Los Angeles, Riverside, San Bernardino, San Diego, Ventura, and Riverside Counties. Reproductive activity occurred from March to June, with females commonly ovipositing in May. Clutch sizes usually average around 11–12 eggs (Stebbins 1954, Howard 1974, Pianka and Parker 1975, Goldberg 1983). Goldberg (1983) reported that a single female appeared to be yolking a second clutch, suggesting the possibility for multiple clutches per year in this species, though how common this may be is unknown. In northern Baja California and southern California, males have spermatozoa present from April until early June (Howard 1974), and oviposition occurs from late May to July with an incubation period of about 60 days (Howard 1974, Pianka and Parker 1975). Montanucci (1968) observed mating in the field as late as May in Merced County. Howard (1974) observed 25 mm SVL hatchlings in late July and early August in northern Baja California. These animals had attained sizes averaging 42 mm SVL by October. First-year males emerged from winter dormancy at ~51 mm SVL. Animals in this population were sexually mature around 75 mm SVL (Howard 1974). Pianka and Parker (1975) reported minimum female SVL at maturity as 73 mm in Baja California and southern California. Goldberg (1983) reported that the smallest mature males were 62 mm SVL, and the smallest females were 73 mm SVL in southern California.

Annual adult survival estimates from radio-tracked animals in Riverside County were roughly twice as high for males as females: males 62% (95%, CI 42–81%) and females 34% (95%, CI 15–53%) (estimates assume animals of unknown fate are dead; Alberts et al. 2004). Most deaths were due to predation (31% birds, 23% snakes), followed by road mortality (15%), with the rest due to unknown causes (Alberts et al. 2004). Average home range size varied from 1.9 to 4.0 ha across habitat types, with smaller ranges and lower activity levels observed during a drought year (Alberts et al. 2004).

Surface activity is determined partly by temperature. Adults in a Riverside County population had field active body temperatures ranging from 13.3°C to 39.4°C (mean 34.5°C), and hatchlings had a narrower range of temperatures ranging from 21.1°C to 41.1°C (mean 34.4°C) (Alberts et al. 2004). Animals were not active when ground surface temperatures were below 19.4°C or above 57.3°C (Alberts et al. 2004). Gerson (2011) reported capturing lizards when surface temperatures were up to 63°C in a Merced County population. Pianka and Parker (1975) reported a mean field active body temperature for 15 animals of 36.7°C. The critical thermal minima and maxima are –3°C and 46.7°C, respectively (Brattstrom 1965).

Ants can make up 90% of prey items and 45% of prey volume in stomach contents (n = 214; Pianka and Parker 1975), although many other insect prey are also consumed depending on availability (Stebbins 1954, Miller and Stebbins 1964, Alberts et al. 2004). About half of the prey found in scat was *Pogonomyrmex* ants (*P. rugosus* and *P. californicus*) (Riverside County; Alberts et al. 2004). Other ant prey and non-ant insects were taken as well. In Merced County, every scat examined contained beetles, but not every scat contained ants, suggesting less reliance on ant prey in this area (M. Gerson, unpublished data). See the "Nature and Degree of Threat" section for effects of nonnative ants.

Habitat Requirements

Phrynosoma blainvillii is found in a variety of habitat types, including sage scrub, dunes, alluvial scrub, annual grassland, chaparral, oak woodland, riparian woodland, Joshua tree woodland, coniferous forest, and saltbush scrub (Grinnell and Grinnell 1907, Klauber 1939, Stebbins 1954, Banta and Morafka 1968, Montanucci 1968, Tollestrup 1981, Hager and Brattstrom 1997). However, microhabitat preferences are much narrower. *Phrynosoma blainvillii* needs loose, fine soils for burrowing, open areas for thermoregulation, and shrub cover for refugia (Jennings and Hayes 1994a). In undisturbed sage scrub habitat in Riverside County, animals preferred leafy plant species with relatively dense foliage for cover, overwintering, and aestivation (Alberts et al. 2004). In the absence of shrubs, *P. blainvillii* may rely instead upon California kangaroo rat (*Dipodomys californicus*) burrows for refugia (Shedd et al. 2011). In a mark–recapture study in San Bernardino and Riverside Counties, Hager and Brattstrom (1997) observed *P. blainvillii* in the open 64% of the time, in the shade of vegetation 14% of the time, next to vegetation 7% of the time, and in rodent burrows 5% of the time.

Pitfall trapping at 21 sites in 4 counties in southern California revealed that within sites, *P. blainvillii* abundance was positively correlated with the presence of organic soils and chaparral vegetation and negatively associated with nonnative Argentine ant (*Linepithema humile*) presence (Fisher et al. 2002). At a larger scale, the abundance of *P. blainvillii* between sites was positively associated with the presence of native ants and chaparral vegetation and negatively associated with canopy height. Similar to patterns in abundance, *P. blainvillii* presence was positively associated with sandy soils and chaparral vegetation and negatively associated with Argentine ant presence.

Distribution (Past and Present)

Phrynosoma blainvillii occurs from northern Baja California north along the coast, continuing into

the Central Valley and Coast Range, and east to the Sierra Nevada foothills and the western edge of the Mojave Desert (Leaché et al. 2009). The southern and northern California clades (see the "Taxonomic Relationships" section) roughly correspond in range to the previously recognized subspecies *Phrynosoma coronatum blainvillii* and *P. c. frontale*, respectively. The northern Baja California clade extends from Ensenada, Mexico, north into San Diego County. The southern California clade slightly overlaps with the northern Baja California clade in San Diego County and continues north to the Los Angeles Basin and east to the San Gabriel Mountains and the edge of the Mojave Desert. A third group, the northern California clade, comprises the rest of the range in California, from the Los Angeles basin north through the Central Valley and Coast Ranges.

Historically, this species occurred in California from an isolated record in Shasta County in the north, south along the edges of the Sacramento Valley, through much of the south Coast Ranges, the San Joaquin Valley, the Sierra Nevada foothills, south along the coast to the Mexican border, and throughout the Transverse and Peninsular Ranges, ending along the western edge of the desert slope (Jennings 1988c). Recent field observations in the NAFHA database document this species at Kennedy Meadows in Tulare County; further information about the status here is needed. Jennings and Hayes (1994a) estimated that *P. blainvillii* has disappeared from 35% of its historical range in northern California and from 45% of its historical range in southern California. Remaining populations in the northern end of its range in the Coast Range and in the Sierra Nevada foothills from Butte County to Fresno County are highly disjunct (Jennings and Hayes 1994a; J. Shedd, pers. comm.).

Trends in Abundance

Declines in the early decades of the twentieth century were partly due to collecting for the curio trade in the Los Angeles basin. Jennings (1987) estimated that at least 115,000 *Phrynosoma blainvillii* were harvested over a 45-year period, with substantial collecting ending around the 1930s. Due to collecting, lizards were noted as being scarce or absent in many areas where they had formerly been abundant (Grinnell and Grinnell 1907, Bryant 1911, Van Denburgh 1922). Agriculture and development has led to declines in more recent decades (see the "Nature and Degree of Threat" section).

It is very difficult to estimate population sizes for horned lizards because their cryptic coloration and behavior make them difficult to detect. In sage scrub habitat in Riverside County, *P. blainvillii* density was estimated as 3–4 adults/km of road transect traveled and 1.1–4.2 adults/ha, with a total of 402 lizards (adults and juveniles) captured over 5 years (Alberts et al. 2004). In Merced County, Gerson (2011) captured 145 individuals (adults and juveniles) on 2.4 ha of transect over an 8-month period, roughly 60 lizards/ha. Lizards were patchily distributed at this site, and transects were purposefully placed in areas with high lizard abundance (M. Gerson, pers. comm.). The sites in both studies experienced controlled burns and grazing and supported a mix of native and introduced plants (Alberts et al. 2004, Gerson 2011).

Nature and Degree of Threat

Major threats to *Phrynosoma blainvillii* include urbanization, agriculture, off-highway vehicles, flood control structures, energy development, and nonnative Argentine ants (Grinnell and Grinnell 1907, Montanucci 1968, Jennings 1987, Jennings and Hayes 1994a; J. Shedd, pers. comm.). These threats may be more pronounced in the southern part of the range (S. Sweet, pers. comm.). Leatherman (1996) observed a single *P. blainvillii* that had apparently died from getting its horns stuck in an erosion control blanket. Introduced Argentine ants have displaced native ant prey over parts of central and southern California and appear to be spreading largely as a commensal with human development (Ward 1987, Holway 1995, Holway 1998). In choice tests, lizards preferred

native ants to Argentine ants, and Argentine ants were not detected in field-collected scat, suggesting that they are not commonly taken as prey (Suarez et al. 2000). In the laboratory, growth rates were lower for animals raised experimentally on Argentine ant diets relative to native diets (Suarez and Case 2002). However, lizards will shift their diets to include more non-ant prey in Argentine ant-invaded areas (Suarez et al. 2000).

The effects of wildfire on *P. blainvillii* are complex and only beginning to be studied. In southern California, capture rates increased by about 30% in chaparral habitat a few years post-fire compared to unburned reference plots (Rochester et al. 2010). No changes were detected in coastal sage scrub habitat, though both habitat types lost substantial vegetative cover. The positive response to fire in chaparral was likely due to the creation of open habitat and the fact that ant prey communities appeared to be unaffected (Rochester et al. 2010). However, the proportion of plots occupied in chaparral habitat decreased in response to fire, possibly due to direct mortality effects of fire. Population increases in burned areas were hypothesized to be due to recolonization from unburned refugia. If so, then the timing and distribution of fire across the landscape would affect how lizards are able to respond and whether the net effect of fire on populations is positive or negative. Additionally, monitoring for this study detected very few *P. blainvillii* in grassland habitats. Because repeated or high-intensity fires can lead to conversion of shrubland to grassland, this also represents a potential threat.

Under climate change, the probability of large (>200 ha) fires and area burned is expected to increase in the northern coastal part of the range and the Sierran foothills, and be largely unchanged in the Central Valley (Fried et al. 2004, Lenihan et al. 2008, Westerling and Bryant 2008). In the southern part of the range where wildfire is common, there is little consensus on future fire dynamics because of the difficulty in modeling Santa Ana weather events (Westerling et al. 2004, Westerling and Bryant 2008). Land use in the Central Valley is predominantly agricultural; thus, habitat availability is likely to remain low in this area. Elsewhere in the range, large decreases are expected in shrubland with concomitant increases in grassland (Lenihan et al. 2008, PRBO 2011).

Status Determination

Documented extirpations and declines in this species, coupled with a moderate ecological sensitivity, justify a Priority 2 Species of Special Concern status.

Management Recommendations

Protecting remaining populations from further habitat loss and disturbance is the most important management strategy for this species. The presence/absence and abundance of *Phrynosoma blainvillii* appears to be determined by local, rather than regional-scale factors, so management strategies should focus on protecting local populations (Fisher et al. 2002). Because they tend to rely on crypsis rather than speed for protection, they may be particularly sensitive to land uses that increase the likelihood of animals being crushed or killed, including off-highway vehicle use and grazing. Preventing the spread of Argentine ants into *P. blainvillii* habitat is difficult but also important for the persistence of the species. Given that Argentine ants prefer moist microhabitats, xeric landscaping and reducing artificial surface water may be beneficial for native ants and horned lizards in developed areas.

Monitoring, Research, and Survey Needs

Existing populations should be monitored to determine trends in population abundance. An important research question is the extent to which small habitat fragments, on the order of a few hectares or less, can support viable populations of this lizard. Given the high human population density in much of its range, the effects of human commensal predators, including raccoons, skunks, ravens, and domestic cats should be studied, with control measures

implemented as feasible. Continued work on the effects of Argentine ants, including follow-up studies on shifts in lizard diet after their long-term establishment, would provide valuable information on whether *Phrynosoma blainvillii* can adjust to this widespread invasive ant. More research is needed on the effects of introduced plants, which may increase cover, affect native ant prey, and influence thermoregulation and locomotion (Germano et al. 2001, Alberts et al. 2004, Newbold 2005, Rieder et al. 2010). Grazing and fire can have positive effects by maintaining open habitat and negative effects by facilitating the spread of invasives or through direct mortality (Kimball and Schiffman 2003, Alberts et al. 2004, HilleRis-Lambers et al. 2010). The effects of cattle grazing on *P. blainvillii* need more study. Cattle and other grazers may help maintain open habitats that are favorable to *P. blainvillii* but also may degrade habitat through soil compaction. The net effect of grazing and fire as management strategies requires more study and likely needs to be determined at the site scale. The effects of wildfire on *P. blainvillii* should continue to be studied, particularly given the uncertainty concerning future fire dynamics in the southern part of the range.