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Distribution of the Western Black-headed Snake (*Tantilla planiceps*) in California: implications for management

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ABSTRACT.—The Western Black-headed Snake (*Tantilla planiceps*) is one species of a complex of cryptic, ground-dwelling species that are not well studied. Historical range maps in California were based on a small number of specimens and have been incrementally reinterpreted, typically showing a reduced area over time. More recently, with access to online sources for museum specimens and citizen science projects, locality data from verifiable observations have increased dramatically. We believe that current observations expand the range—but not outside of the historical lines—and reconnect populations that were considered disjunct over time. We recommend that biologists, herpetologists, naturalists, and citizen scientists report findings of this species so that future iterations of range maps can be based on observational data. We contend that this effort is essential to appropriate management of the species.

RESUMEN.—La culebrilla de cabeza negra occidental (*Tantilla planiceps*) es una especie que pertenece a un complejo de especies crípticas que habitan en el suelo y que no se han estudiado ampliamente. Los mapas de distribución históricos en California están basados en una pequeña cantidad de especímenes, dichos mapas han sido reinterpretados paulatinamente, mostrando por lo general una reducción del área a lo largo del tiempo. Más recientemente, con el acceso a recursos en línea de especímenes de museos y proyectos científicos de la comunidad, los datos de localización provenientes de observaciones verificables han aumentado dramáticamente. Consideramos que las observaciones actuales amplían el rango de distribución, no fuera de las líneas históricas, sino que reconectan poblaciones que se consideraron separadas a lo largo del tiempo. Recomendamos que los biólogos, herpetólogos, naturalistas y científicos ciudadanos informen sobre los hallazgos de esta especie para que futuras iteraciones de mapas de distribución puedan basarse en datos observacionales, haciendo a esta actividad esencial para una gestión adecuada de la especie.

Range maps that are used by biologists, land managers, wildlife watchers, and others were developed to assist in understanding species distributions and interpretations of aspects of their natural history (Stebbins 1954, 1966, Clause et al. 2020, Kohler et al. 2023). Shaded range maps are hypothetical representations based on point locality maps—maps developed with specific locations or reported observations—and often depict larger areas than the known range of a species and are meant to suggest the possibility of presence based upon factors such as available prey, microhabitat, and other features (Stebbins 1954, 2003, Tanner 1966). Over time, these maps can be modified to represent changes in a species' distribution due to population declines, taxonomic change, or a greater understanding of species that heretofore have received little to no study (Aspinall et al. 1998, Newbold 2010, Bloom et al. 2018, McGinnis and Stebbins 2018).

Updated editions of field guides to amphibians and reptiles written by Stebbins (1954, 1966, 1985, 2003), which focus on the western United States, are the basis for recognizing a species' range in California (Fig. 1). More recently, online access to myriad museum collections (i.e., www.vertnet.org), and websites such as iNaturalist (www.inaturalist.org) and the California Roadkill Observation System (www.wildlifecrossing.net/california [accessed 20 March 2023]) have added to the known distribution of some species. Additionally, professionals and amateurs studying amphibians and reptiles have greatly added to the known ranges of several species (e.g., Sweet 2019). Although these adjustments to the known ranges have aided our understanding of the distribution of some taxa [e.g.,

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Batrachoseps spp.], many species—some of which are possibly in decline—remain enigmatic or misunderstood, and thus, information related to their distribution may be outdated.

The ranges of some species, particularly those that are small, cryptic, nocturnal, or have largely subterranean habits, may be difficult to determine accurately. This is likely the case for the Western Black-headed Snake (*Tantilla planiceps*), which has all the characteristics of a species difficult to find. Its current known range consists of numerous patches from Alameda County, California, in the north, southward through the South Coast, Transverse and Peninsular Ranges in California, then extending through all of Baja California to Cabo San Lucas (Grismer 2002, Stebbins 2003, Flaxington 2021).

Our review of the reported distribution revealed a distinct change in the reported range (i.e., iterative contractions), with little to no clear explanation. We elected to investigate the current geographic distribution of *T. planiceps* to update our understanding of the species' range and to determine whether changes in the range map may affect conservation considerations for the species.

Methods

We examined the reported distribution (commonly accessed websites and references: www.iucnredlist.org, www.californiaherps.com, Brown 1997, Stebbins and McGinnis 2012, and Flaxington 2021) of the Western Black-headed Snake, which appeared to be based on multiple works by Stebbins (1954, 1966, 1985, 2003, *op. cit.*). We acknowledge that the various maps created for this species may have different scales and accuracy, but our goal was less about specific points and their precise location and more focused on the general distribution of the species in California. Online access to museum collections (i.e., www.vertnet.org [accessed 20 March 2023]) and websites such as iNaturalist (www.inaturalist.org [accessed 20 March 2023]) and the California Roadkill Observation System (www.wildlifecrossing.net/california [accessed 20 March 2023]) were utilized to collect additional data. The majority of the points we used were georeferenced by the institutions where they were curated, which we acknowledge is a process that can come with its own errors. For points that were not georeferenced, we utilized the best practice guidelines of the Global Biodiversity Information Facility (Chapman and Wieczorek 2006). Each location was found in Google Maps, with a decimal latitude and longitude coordinate assigned at the midpoint. We used the point-radius method, where we recorded the extent (in meters) from the midpoint to the farthest place that could still be within the locality as a measure of error (following Wieczorek et al. 2004). The measure of error was considered when mapping our locations; however, we note that the location information, including error distances when known, did not exceed the scale of the image for each location (i.e., each dot area includes the greatest error measured). Any specimens with only county-level data as well as observations from iNaturalist that were obscured (given a large polygon) were excluded from our data set. We also note that the scale of our map and our interpretation of the range follow typical occupied habitats rather than precise locations of known observations and were designed to be conservative.

Historical and current species occurrences for *T. planiceps* were collected from knowledgeable individuals and environmental compliance documents, and were queried from museum and online sources with verifiable observations (verifiable photo or specimen) and combined with our own observations of the species (Appendix 1). These data were compiled, digitized, and mapped, with the resulting map compared to earlier maps (Fig. 1). Finally, we applied a line (Fig. 2) that we feel estimates the likely current distribution, which was based on current and historical observations, topographic features, elevation, vegetation maps, personal communications with other biologists, and existing intact habitat. We acknowledge that our line is only an estimate and may not reflect the precise range or distribution of the species.

Results

The earliest published map for *T. planiceps* is that of Stebbins (1954), with subsequent range maps from updated field guides (Fig. 1). Stebbins made a clear effort to indicate contractions in the presumed distribution by reducing shaded areas and increasing gaps among the regions indicating the hypothetical range. Later maps produced by Stebbins (e.g., 1966, 1985, 2003) presented a range characterized by large distributional gaps, but the basis for those modifications was not stated. Our search for observational records and

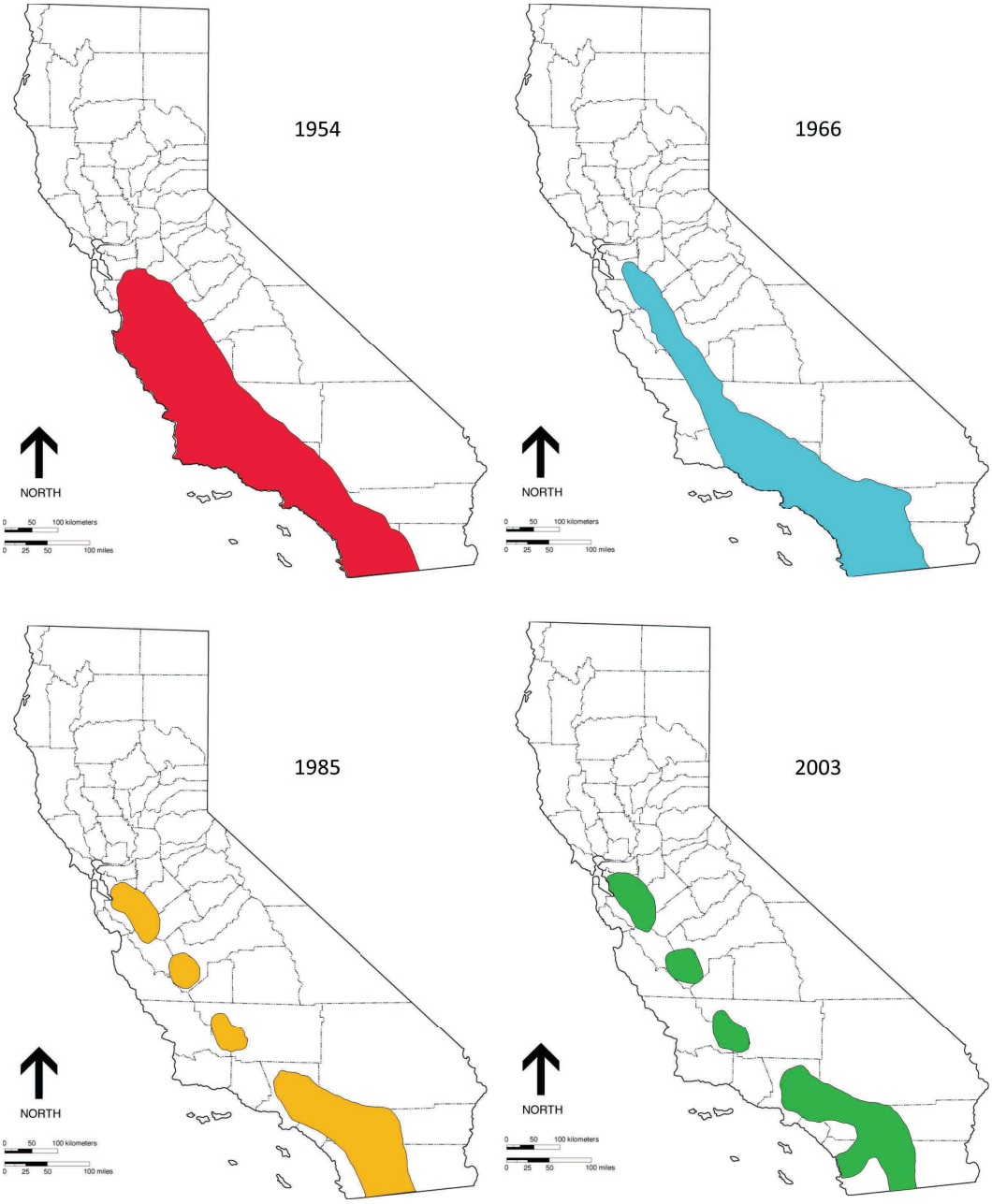

Fig. 1. Changes in the depiction of the range of *Tantilla planiceps* in California. Maps were derived from Stebbins (1954, 1966, 1985, 2003).

museum vouchers resulted in 423 data points that were highly likely (i.e., reported by a known expert or accompanied by a complete description of the specimen) or verified (i.e., specimen or photograph). Our digitized data, when placed on a map of the state of California, appeared to increase the range of the species significantly from that depicted by Stebbins (1985, 2003), such that it reflected a range similar to that reported earlier by Stebbins (1966). Similarly, the distribution map by Brown (1997), which appears to be a derivative of the map by Stebbins (1985),

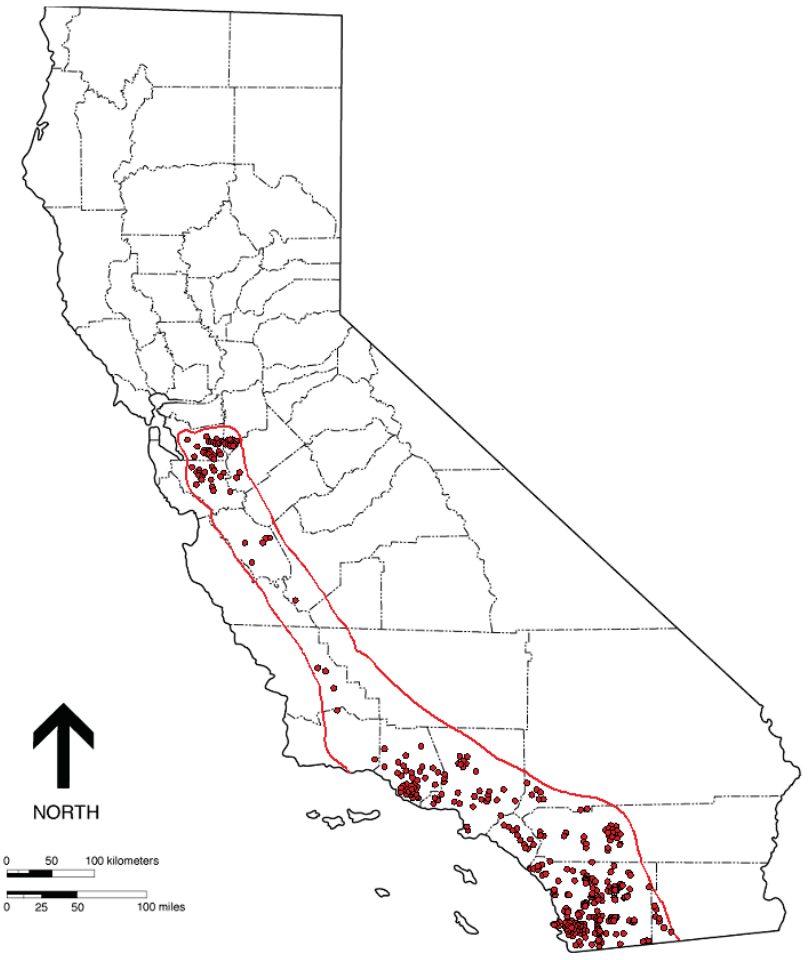

Fig. 2. Recommended range for *Tantilla planiceps* in California based on observations of the species. Red dots indicate known, verified observations from the years 1886 to 2021.

suggests a range contraction that differs from the current known observations (Fig. 2). More recently, Flaxington (2021) developed a range map that expands the range to a continuous distribution similar to Stebbins (1966) based on "combining topographic, precipitation, elevation, tectonic and vegetation charts, field observations (n = 2), textbooks, wildlife reports, museum records, communication with biologists, and other dynamics."

Discussion

We noted that Stebbins (1966) inferred a remarkably similar representation of the species' distribution to the one we propose herein. We speculate that the 1966 range map by Stebbins was based on habitat, yet was substantially representative of the potential distribution. Our range map differs in that it is supported by verified, updated observations. We found that in northern California there were no verifiable observations north of Corral Hollow Road (37.62° latitude) in Alameda County, California (as depicted by Stebbins 2003), and from that information we infer that the range does not reach into Contra Costa County, California (Fig. 2). Further, the data we collected and analyzed included 103 observations from southern California, from 2020 to 2021, that would have fallen outside of the range map reported by Stebbins (1985, 2003), Brown (1997), Stebbins and McGinnis (2012), and McGinnis and Stebbins (2018). Our updated distribution map does not concur with the

fragmented range published by Stebbins (1985, 2003), and Brown (1997), as well as with Stebbins and McGinnis (2012) and McGinnis and Stebbins (2018). Our map does, however, appear to follow more closely the map depicted by Flaxington (2021), who reported using habitat and climatic features, as well as observational information, to create his presumed range for the species.

A closer review of the data set shows that 85% of the observations have been reported south of Santa Barbara County. This may represent a species in potential decline in areas between San Benito and Santa Barbara Counties, but there are no existing data to support any status of the species in the region. It may also be attributed to large tracts of remote, roadless, and/or private lands in that region; this is particularly true for southeastern Monterey and western Kern and Kings Counties. Focused, systematic effort by researchers, land managers (public and private), and hobbyists is also limited for species like *T. planiceps*, which is fundamentally difficult to detect even where it persists.

We acknowledge that the use of data from unknown sources may include inherent biases, such as representing only reported observations (rather than a systematic survey of the state of California), not including significant portions of private property (i.e., areas closed to public access), including data from surveys with highly differential sampling efforts, possibly including errors related to georeferencing, and other potential biases. We also note that the highest abundance of recently reported observations appear to overlap heavily human-populated areas, which may facilitate observation of the species. However, we contend that the range of the species should be represented by an area most similar to Stebbins (1966). We recommend that the species be given significant attention, particularly in areas between San Benito and Santa Barbara Counties, so that it can be determined whether the species occurs widely throughout its range or in isolated, more fragile populations. Thomson et al. (2016) considers *T. planiceps* a species that "requires research and monitoring." Little is known and almost nothing has been published on *T. planiceps* in the 189 years since its initial description by Blainville (1835). Although we reviewed 114 published documents and publicly available reports, only 4 reported on the natural history or distribution of *T. planiceps* (Cole and Hardy 1983, Ely 1997, Evelyn and Henry 2014, Goldberg 2017). We believe this has resulted in a lack of understanding of the species' ecological needs (Thomson et al. 2016).

We contend that an understanding of the species' natural history, which is currently limited, may enhance surveys and add to distributional records (Kohler et al. 2023). Difficult-to-detect species with secretive lifestyles are sometimes described as rare, with the assumption that they have few individuals or their populations are diffuse. Although Banta and Morafka (1968) reported that this snake is rare, not enough data exist to fully understand its status. This has been similarly reported by Holycross and Mitchell (2020) for the closely related *T. hobartsmithi*. Recent data suggest that *T. planiceps* feed upon beetle larvae, presumed to be collected under objects used as cover (Alvarez 2022). Although this feeding behavior has not been specifically reported for *T. planiceps*, individuals of the species appear to frequently occur under objects used as cover, or underground, likely contributing to the paucity of observations (Klauber 1928, Cole and Hardy 1983). *Tantilla hobartsmithi*, which also occurs in California, is also known for this behavior and use of this microhabitat (Shaw and Campbell 1974). It is our contention, however, that an absence of observations does not indicate an absence of the species. Until more information about *T. planiceps* is gathered and disseminated, we contend that the species should be treated as if the population status is unknown throughout most of its range, particularly between San Benito and Santa Barbara Counties.

Land managers who conduct work within the range of *T. planiceps* should consider the species present and conduct trapping or pitfall studies that may support a better understanding of its distribution. Management decisions should also include consideration for the species within the proposed range and minimize anthropogenic disturbances to individuals or populations of this enigmatic species.

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APPENDIX 1. Four hundred and twenty-three point locations based on reported observations of *Tantilla planiceps* that produced the current hypothetical range (see Fig. 2) for the species in California.

Observation number	California County	Year[a]	Source[b]	Specimen number
1	Alameda	1943	MVZ	38955
2	Alameda	1943	MVZ	38954
3	Alameda	1946	MVZ	45598
4	Alameda	1953	MVZ	59779
5	Alameda	1957	MVZ	72257
6	Alameda	1960	MVZ	71918
7	Alameda	1960	MVZ	70426
8	Alameda	1961	MVZ	72492
9	Alameda	1963	MVZ	74889
10	Alameda	1965	MVZ	80044
11	Alameda	1966	MVZ	80923
12	Alameda	1969	CAS	122762
13	Alameda	1971	MVZ	99390
14	Alameda	1973	MVZ	111123
15	Alameda	1983	CAS	190338
16	Alameda	1984	MVZ	187696
17	Alameda	1997	Ely 1997	—
18	Alameda	2009	iNaturalist	2395
19	Alameda	2019	iNaturalist	23460855
20	Alameda	2019	iNaturalist	26819377
21	Fresno	1847	MCZ	R-12089
22	Fresno	1879	USNM	55387.60317
23	Fresno	1879	USNM	55388.60317
24	Fresno	1879	USNM	55391.60317
25	Fresno	1879	USNM	11766.60059
26	Fresno	1879	USNM	55389.60317
27	Fresno	1879	USNM	55390.60317
28	Fresno	1960	CAS	23242
29	Fresno	1975	CAS	190340
30	Imperial	1954	SBMNH	15
31	Imperial	1977	USNM	222784.6342
32	Imperial	1977	SDNHM	60196
33	Imperial	1977	SDNHM	60197
34	Imperial	1977	SDNHM	60198
35	Imperial	1979	SDNHM	62572
36	Imperial	1997	HSU	684
37	Los Angeles	1886	CAS	13211
38	Los Angeles	1886	CAS	13212
39	Los Angeles	1934	LACM	20466
40	Los Angeles	1951	LACM	20468
41	Los Angeles	1961	PSM	Herp-08312
42	Los Angeles	1961	KU	74363
43	Los Angeles	1962	BYU	18728
44	Los Angeles	1962	LACM	20467
45	Los Angeles	1970	LACM	115922
46	Los Angeles	1977	LACM	126552
47	Los Angeles	1977	LACM	126243
48	Los Angeles	1977	LACM	128465
49	Los Angeles	1983	LACM	135422
50	Los Angeles	1994	LACM	145533
51	Los Angeles	1995	LACM	145530
52	Los Angeles	2002	NPS	80802
53	Los Angeles	2004	NPS	220704
54	Los Angeles	2005	NPS	260505
55	Los Angeles	2005	NPS	240605
56	Los Angeles	2005	NPS	130605
57	Los Angeles	2005	NPS	150605
58	Los Angeles	2005	NPS	210705
59	Los Angeles	2006	NPS	180806
60	Los Angeles	2007	NPS	250707
61	Los Angeles	2007	NPS	110907
62	Los Angeles	2011	LACM	180781

Appendix 1. Continued.

Observation number	California County	Year[a]	Source[b]	Specimen number
63	Los Angeles	2011	iNaturalist	835557
64	Los Angeles	2012	iNaturalist	1164055
65	Los Angeles	2013	NPS	100713
66	Los Angeles	2013	NPS	240913
67	Los Angeles	2013	NPS	251013
68	Los Angeles	2013	iNaturalist	16770643
69	Los Angeles	2014	NPS	90514
70	Los Angeles	2014	NPS	60614
71	Los Angeles	2014	NPS	280814
72	Los Angeles	2014	iNaturalist	668675
73	Los Angeles	2015	NPS	170715
74	Los Angeles	2015	iNaturalist	1404539
75	Los Angeles	2015	iNaturalist	9276351
76	Los Angeles	2016	NPS	240616
77	Los Angeles	2016	iNaturalist	2868348
78	Los Angeles	2016	iNaturalist	2839590
79	Los Angeles	2016	iNaturalist	3300546
80	Los Angeles	2016	iNaturalist	4894305
81	Los Angeles	2017	iNaturalist	26879605
82	Los Angeles	2017	iNaturalist	7290353
83	Los Angeles	2017	iNaturalist	7801224
84	Los Angeles	2017	iNaturalist	7989924
85	Los Angeles	2017	iNaturalist	8528341
86	Los Angeles	2018	iNaturalist	16337393
87	Los Angeles	2018	iNaturalist	16981875
88	Los Angeles	2019	iNaturalist	21578822
89	Los Angeles	2019	iNaturalist	21717751
90	Los Angeles	2019	iNaturalist	21717810
91	Los Angeles	2019	iNaturalist	21722845
92	Los Angeles	2019	iNaturalist	21722992
93	Los Angeles	2019	iNaturalist	26074612
94	Los Angeles	2019	iNaturalist	23064929
95	Los Angeles	2019	iNaturalist	27736892
96	Los Angeles	2019	iNaturalist	31960905
97	Los Angeles	2019	iNaturalist	36657445
98	Los Angeles	2020	iNaturalist	55996583
99	Los Angeles	2020	iNaturalist	62090237
100	Los Angeles	2020	iNaturalist	61044742
101	Los Angeles	2020	iNaturalist	61481534
102	Los Angeles	2020	iNaturalist	41728214
103	Orange	1940	Pequegnat 1951	—
104	Orange	1941	Pequegnat 1951	—
105	Orange	1969	LACM	103727
106	Orange	1973	LACM	103728
107	Orange	1999	SDNHM	72297
108	Orange	2000	LACM	185956
109	Orange	2012	LACM	183138
110	Orange	2019	iNaturalist	36448575
111	Orange	2019	iNaturalist	26570233
112	Orange	2020	iNaturalist	44894215
113	Orange	2020	iNaturalist	63439036
114	Orange	2020	iNaturalist	49176836
115	Orange	2020	iNaturalist	45274448
116	Riverside	ND	LACM	22223
117	Riverside	ND	LACM	103730
118	Riverside	1940	LACM	20469
119	Riverside	1941	SDNHM	33760
120	Riverside	1946	SDNHM	37340
121	Riverside	1957	MVZ	66212
122	Riverside	1957	MVZ	66214
123	Riverside	1957	MVZ	66213
124	Riverside	1958	LACM	27914
125	Riverside	1958	LACM	103729

APPENDIX 1. Continued.

Observation number	California County	Year[a]	Source[b]	Specimen number
126	Riverside	1958	LACM	103731
127	Riverside	1958	MVZ	231873
128	Riverside	1959	LACM	103732
129	Riverside	1961	SDNHM	44270
130	Riverside	1963	MVZ	76767
131	Riverside	1963	MVZ	76768
132	Riverside	1963	MVZ	76769
133	Riverside	1964	LACM	22222
134	Riverside	1964	CAS	96887
135	Riverside	1966	LACM	103734
136	Riverside	1966	LACM	52609
137	Riverside	1968	LACM	103733
138	Riverside	1977	HSU	555
139	Riverside	1977	LACM	126196
140	Riverside	1977	LACM	126197
141	Riverside	1979	CCBER	9176
142	Riverside	1980	CCBER	13078
143	Riverside	2003	iNaturalist	9825636
144	Riverside	2005	USNM	564211.6559
145	Riverside	2005	USNM	564210.6559
146	Riverside	2005	USNM	564209.6559
147	Riverside	2009	iNaturalist	39475836
148	Riverside	2009	iNaturalist	337699
149	Riverside	2010	iNaturalist	58122204
150	Riverside	2010	iNaturalist	58122711
151	Riverside	2010	iNaturalist	58143480
152	Riverside	2010	iNaturalist	64172976
153	Riverside	2010	iNaturalist	55337805
154	Riverside	2010	iNaturalist	44966734
155	Riverside	2010	iNaturalist	44966741
156	Riverside	2011	iNaturalist	55556963
157	Riverside	2012	iNaturalist	92620
158	Riverside	2012	iNaturalist	44965138
159	Riverside	2014	iNaturalist	52383446
160	Riverside	2014	iNaturalist	52615116
161	Riverside	2014	iNaturalist	52388978
162	Riverside	2014	iNaturalist	52409647
163	Riverside	2014	iNaturalist	52420716
164	Riverside	2015	iNaturalist	16770642
165	Riverside	2015	iNaturalist	63450080
166	Riverside	2016	iNaturalist	2796084
167	Riverside	2017	iNaturalist	12615079
168	Riverside	2017	iNaturalist	6168303
169	Riverside	2018	iNaturalist	10612735
170	Riverside	2019	iNaturalist	21539619
171	Riverside	2019	iNaturalist	30405537
172	Riverside	2019	iNaturalist	31443061
173	Riverside	2019	iNaturalist	22729253
174	Riverside	2019	iNaturalist	25489559
175	Riverside	2019	iNaturalist	26311401
176	Riverside	2020	iNaturalist	41549849
177	Riverside	2020	iNaturalist	51313860
178	Riverside	2020	iNaturalist	41573193
179	Riverside	2021	iNaturalist	69246352
180	San Benito	1937	MVZ	25331
181	San Benito	1966	Tanner 1966	—
182	San Benito	1968	Banta and Morafka 1968	—
183	San Benito	2010	R. Henry, pers. comm.	—
184	San Benito	2010	R. Henry, pers. comm.	—
185	San Bernardino	1896	USNM	104400.6077
186	San Bernardino	1965	BYU	32371
187	San Bernardino	1965	BYU	32372
188	San Bernardino	1966	BYU	32373

Appendix 1. Continued.

Observation number	California County	Year[a]	Source[b]	Specimen number
189	San Bernardino	2020	iNaturalist	47222038
190	San Bernardino	2020	iNaturalist	51176486
191	San Bernardino	2020	iNaturalist	41578765
192	San Diego	ND	SDNHM	59533
193	San Diego	ND	SDNHM	R-162396
194	San Diego	ND	SDNHM	68875
195	San Diego	ND	SDNHM	11812
196	San Diego	ND	SDNHM	68877
197	San Diego	ND	SDNHM	18421
198	San Diego	1897	SDNHM	11259
199	San Diego	1915	SDNHM	40122
200	San Diego	1915	LACM	241467
201	San Diego	1915	LACM	241468
202	San Diego	1918	Stephens 1918	—
203	San Diego	1923	SDNHM	11260
204	San Diego	1925	SDNHM	64485
205	San Diego	1925	LACM	10190
206	San Diego	1926	SDNHM	71
207	San Diego	1926	SDNHM	211
208	San Diego	1926	SDNHM	204
209	San Diego	1926	LACM	66317
210	San Diego	1927	SDNHM	1031
211	San Diego	1928	SDNHM	483
212	San Diego	1928	SDNHM	1262
213	San Diego	1929	LACM	6664
214	San Diego	1929	SDNHM	1842
215	San Diego	1929	SDNHM	11890
216	San Diego	1929	LACM	1954
217	San Diego	1929	LACM	2006
218	San Diego	1929	LACM	2297
219	San Diego	1930	LACM	2334
220	San Diego	1930	SDNHM	2337
221	San Diego	1930	LACM	2633
222	San Diego	1930	LACM	2634
223	San Diego	1930	LACM	13753
224	San Diego	1930	LACM	20463
225	San Diego	1930	HSU	3047
226	San Diego	1931	LACM	15545
227	San Diego	1931	LACM	4354
228	San Diego	1931	CCBER	15985
229	San Diego	1932	CCBER	6587
230	San Diego	1933	USNM	20412
231	San Diego	1933	USNM	21291
232	San Diego	1934	USNM	22657
233	San Diego	1935	SDNHM	35555
234	San Diego	1935	LACM	23869
235	San Diego	1937	LACM	26749
236	San Diego	1937	CAS	27021
237	San Diego	1937	MVZ	27600
238	San Diego	1937	MVZ	28096
239	San Diego	1938	MVZ	29273
240	San Diego	1938	MVZ	28835
241	San Diego	1938	MVZ	29116
242	San Diego	1939	MVZ	31973
243	San Diego	1939	MVZ	32419
244	San Diego	1940	MVZ	32818
245	San Diego	1941	BYU	33997
246	San Diego	1941	BYU	34382
247	San Diego	1942	BYU	34789
248	San Diego	1942	USNM	35190
249	San Diego	1942	SDNHM	35175
250	San Diego	1942	SDNHM	35283
251	San Diego	1943	SDNHM	35646

APPENDIX 1. Continued.

Observation number	California County	Year[a]	Source[b]	Specimen number
252	San Diego	1946	SDNHM	37404
253	San Diego	1947	SDNHM	8663
254	San Diego	1948	SDNHM	39277
255	San Diego	1948	SDNHM	39321
256	San Diego	1949	SDNHM	39884
257	San Diego	1949	LACM	40290
258	San Diego	1950	SDNHM	20465
259	San Diego	1950	SDNHM	40625
260	San Diego	1950	LACM	2936
261	San Diego	1950	LACM	182425
262	San Diego	1951	LACM	41519
263	San Diego	1951	LACM	41756
264	San Diego	1951	LACM	41754
265	San Diego	1952	SDNHM	42061
266	San Diego	1952	LACM	182426
267	San Diego	1953	LACM	42653
268	San Diego	1954	LACM	42766
269	San Diego	1955	LACM	43089
270	San Diego	1955	LACM	43128
271	San Diego	1955	HSU	43135
272	San Diego	1956	LACM	43276
273	San Diego	1956	LACM	43297
274	San Diego	1956	CCBER	43400
275	San Diego	1957	CCBER	43572
276	San Diego	1958	USNM	43863
277	San Diego	1958	LACM	182427
278	San Diego	1959	USNM	20464
279	San Diego	1960	USNM	44128
280	San Diego	1960	LACM	44132
281	San Diego	1961	LACM	44268
282	San Diego	1963	CAS	53145
283	San Diego	1966	MVZ	48116
284	San Diego	1968	SDNHM	66783
285	San Diego	1970	MVZ	61049
286	San Diego	1970	LACM	47309
287	San Diego	1976	MVZ	57415
288	San Diego	1976	MVZ	57630
289	San Diego	1976	MVZ	58667
290	San Diego	1976	LACM	190337
291	San Diego	1988	MVZ	42430
292	San Diego	1988	MVZ	42429
293	San Diego	1990	MVZ	42903
294	San Diego	1994	BYU	27830
295	San Diego	1998	BYU	72208
296	San Diego	1998	BYU	185969
297	San Diego	2003	Brehme 2003	—
298	San Diego	2003	Brehme 2003	—
299	San Diego	2003	Brehme 2003	—
300	San Diego	2004	USNM	72296
301	San Diego	2004	iNaturalist	56745317
302	San Diego	2005	iNaturalist	1841112
303	San Diego	2006	iNaturalist	1841162
304	San Diego	2009	SDNHM	243958
305	San Diego	2009	iNaturalist	38629178
306	San Diego	2009	iNaturalist	494463
307	San Diego	2010	Rochester et al. 2010	—
308	San Diego	2011	iNaturalist	513768
309	San Diego	2011	iNaturalist	42641403
310	San Diego	2012	iNaturalist	316057
311	San Diego	2014	iNaturalist	36662923
312	San Diego	2014	iNaturalist	1737456
313	San Diego	2015	iNaturalist	1796347
314	San Diego	2015	iNaturalist	60043385

Appendix 1. Continued.

Observation number	California County	Year[a]	Source[b]	Specimen number
315	San Diego	2015	iNaturalist	21818375
316	San Diego	2015	iNaturalist	1923786
317	San Diego	2016	iNaturalist	4911455
318	San Diego	2016	iNaturalist	3813312
319	San Diego	2016	Richmond et al. 2016	—
320	San Diego	2017	iNaturalist	5373394
321	San Diego	2017	iNaturalist	5558043
322	San Diego	2017	iNaturalist	5605555
323	San Diego	2017	iNaturalist	5694677
324	San Diego	2017	iNaturalist	6405823
325	San Diego	2017	iNaturalist	7661030
326	San Diego	2017	C. Fischer, pers. comm.	—
327	San Diego	2018	iNaturalist	12003632
328	San Diego	2018	iNaturalist	12184385
329	San Diego	2018	iNaturalist	13639536
330	San Diego	2018	iNaturalist	15724200
331	San Diego	2018	R. Henry, pers. comm.	—
332	San Diego	2018	iNaturalist	10774992
333	San Diego	2019	iNaturalist	21131931
334	San Diego	2019	iNaturalist	21554595
335	San Diego	2019	iNaturalist	21646017
336	San Diego	2019	iNaturalist	23161526
337	San Diego	2019	iNaturalist	23161718
338	San Diego	2019	iNaturalist	23314839
339	San Diego	2019	iNaturalist	25902780
340	San Diego	2019	iNaturalist	26350555
341	San Diego	2019	iNaturalist	26784293
342	San Diego	2019	iNaturalist	27791817
343	San Diego	2019	iNaturalist	28979157
344	San Diego	2019	iNaturalist	28982854
345	San Diego	2019	iNaturalist	30350456
346	San Diego	2019	iNaturalist	34533533
347	San Diego	2020	iNaturalist	38915279
348	San Diego	2020	iNaturalist	39554618
349	San Diego	2020	iNaturalist	41409664
350	San Diego	2020	iNaturalist	41409790
351	San Diego	2020	iNaturalist	42207514
352	San Diego	2020	iNaturalist	49651989
353	San Diego	2020	iNaturalist	48986543
354	San Diego	2020	iNaturalist	51142720
355	San Diego	2020	iNaturalist	52284267
356	San Diego	2020	iNaturalist	69647223
357	San Diego	2020	iNaturalist	52751365
358	San Diego	2020	iNaturalist	53120731
359	San Diego	2020	iNaturalist	53437006
360	San Diego	2020	iNaturalist	54595474
361	San Diego	2020	iNaturalist	60489359
362	San Joaquin	1957	MVZ	72257
363	San Joaquin	1960	LACM	71099
364	San Joaquin	1960	LACM	71098
365	San Joaquin	1961	MVZ	72492
366	San Joaquin	1965	MVZ	80044
367	San Joaquin	1971	MVZ	99390
368	San Joaquin	1978	CCBER	150314
369	San Joaquin	1978	CCBER	150315
370	San Joaquin	1979	HSU	190339
371	San Joaquin	1979	USNM	171758
372	San Joaquin	1984	MVZ	187696
373	San Joaquin	2012	iNaturalist	19667111
374	San Luis Obispo	2014	Evelyn and Henry 2014	—
375	San Luis Obispo	2014	Evelyn and Henry 2014	—
376	San Luis Obispo	2017	iNaturalist	6977903
377	Santa Barbara	ND	MVZ	29719

APPENDIX 1. Continued.

Observation number	California County	Year[a]	Source[b]	Specimen number
378	Santa Barbara	1984	USNM	22231
379	Santa Barbara	1987	USNM	22587
380	Santa Barbara	1988	MVZ	190348
381	Santa Barbara	1992	LACM	26475
382	Santa Barbara	1992	LACM	26476
383	Santa Barbara	1992	CAS	26661
384	Santa Barbara	1993	MVZ	32320
385	Santa Barbara	1993	MVZ	32319
386	Santa Clara	1940	SDNHM	33661
387	Santa Clara	1969	MVZ	190336
388	Santa Clara	1970	MVZ	190335
389	Santa Clara	1971	SDNHM	111210
390	Santa Clara	1974	MVZ	116427
391	Santa Clara	1974	SDNHM	111211
392	Santa Clara	1974	SDNHM	116426
393	Santa Clara	1974	SDNHM	116427
394	Santa Clara	1975	SDNHM	128794
395	Santa Clara	1985	MVZ	190341
396	Santa Clara	1986	MVZ	190342
397	Santa Clara	1987	BYU	190343
398	Santa Clara	1987	BYU	190344
399	Santa Clara	1987	BYU	190345
400	Santa Clara	1987	USNM	190347
401	Santa Clara	1987	SDNHM	190346
402	Santa Clara	2020	iNaturalist	39263402
403	Santa Clara	2020	iNaturalist	63684803
404	Stanislaus	1969	SDNHM	122761
405	Stanislaus	1982	MVZ	179984
406	Ventura	1930	LACM	2727
407	Ventura	1950	CAS	13055
408	Ventura	1953	LACM	20470
409	Ventura	1980	CCBER	8899
410	Ventura	1984	CCBER	17610
411	Ventura	1984	CCBER	17916
412	Ventura	1985	CCBER	17133
413	Ventura	2012	iNaturalist	340751
414	Ventura	2017	iNaturalist	5172393
415	Ventura	2017	iNaturalist	5616593
416	Ventura	2017	iNaturalist	7715045
417	Ventura	2018	iNaturalist	11225493
418	Ventura	2018	iNaturalist	17133324
419	Ventura	2019	iNaturalist	22258539
420	Ventura	2019	iNaturalist	34434885
421	Ventura	2020	iNaturalist	53227053
422	Ventura	2020	iNaturalist	62266423
423	Ventura	2020	iNaturalist	55082540

[a]ND = no date

[b]Abbreviations for sources:
BYU – Brigham Young University, Provo, Utah
CAS – California Academy of Sciences, San Francisco, California
CCBER – Cheadle Center for Biological Diversity and Ecological Restoration, Santa Barbara, California
HSU – Humboldt State University, Arcata, California
LACM – Natural History Museum of Los Angeles County, Los Angeles, California
MCZ – Museum of Comparative Zoology, Cambridge, Massachusetts
MVZ – Museum of Vertebrate Zoology, Berkeley, California
NPS – National Park Service, Los Angeles, California
SBNHM – Santa Barbara Natural History Museum, Santa Barbara, California
SDNHM – San Diego Natural History Museum, San Diego, California
USNM – Smithsonian Institution, National Museum of Natural History, Washington, DC
iNaturalist – accessible at https://www.iNaturalist.com