COMMON GARTER SNAKE, SOUTHERN POPULATIONS

Thamnophis sirtalis (Linnaeus 1758)

Status Summary

Thamnophis sirtalis is a Priority 1 Species of Special Concern, receiving a Total Score/Total Possible of 72% (72/100). During the previous evaluation, garter snakes in this part of the range were also considered Species of Special Concern (Jennings and Hayes 1994a).

Identification

Southern coastal populations of *Thamnophis sirtalis* have not been formally described as a distinct taxon, so we limit our description here to *T. sirtalis* in general. *Thamnophis sirtalis* is a medium-sized species, with a head slightly wider than the neck and keeled dorsal scales (Stebbins 2003). *Thamnophis sirtalis* can reach up to 128 cm TL in California, with adult males from coastal California 46.3 cm SVL on average and females 58.0 cm SVL on average (J. Boundy, unpublished data). Color pattern varies widely in this species, but garter snakes typically have a dark dorsal background color with lighter dorsal and lateral stripes which can be faint or absent. California *T. sirtalis* tend to have red or orange coloration on the head and/or sides (Stebbins 2003). *Thamnophis sirtalis* in the southern part of its California range

Common Garter Snake, Southern Populations: Risk Factors

Ranking Criteria (Maximum Score)	Score
i. Range size (10)	10
ii. Distribution trend (25)	25
iii. Population concentration/ migration (10)	Data deficient
iv. Endemism (10)	10
v. Ecological tolerance (10)	7
vi. Population trend (25)	10
vii. Vulnerability to climate change (10)	3
viii. Projected impacts (10)	7
Total Score	72
Total Possible	100
Total Score/Total Possible	0.72

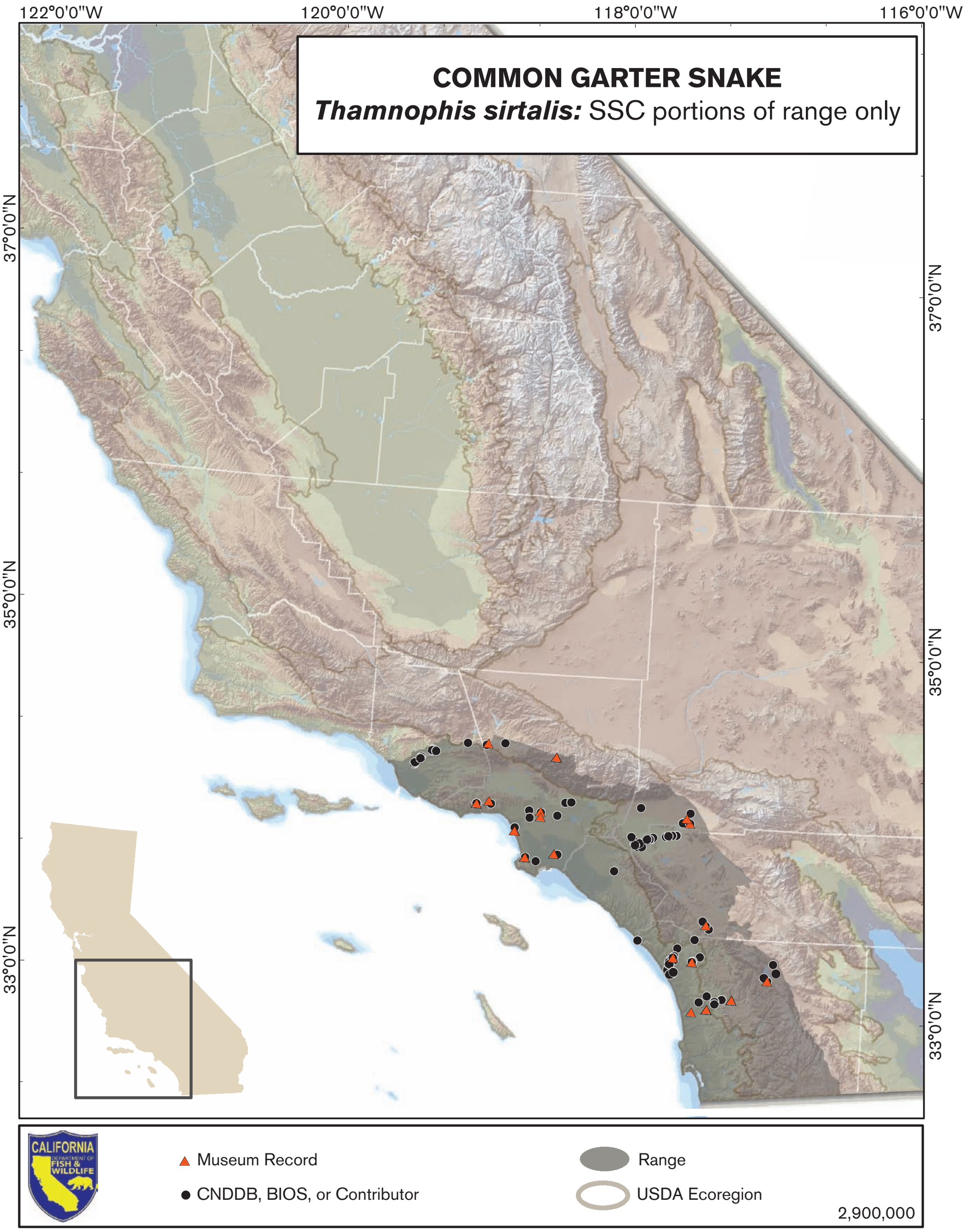

PHOTO ON PREVIOUS PAGE: Common garter snake, Orange County, California. Courtesy of Jeff Lemm.

potentially co-occurs with the coast garter snake (*Thamnophis elegans terrestris*) and the two-striped garter snake (*T. hammondii*) (Stebbins 2003).

Taxonomic Relationships

Some sources consider coastal garter snake populations from southern California to be California red-sided garter snakes (*Thamnophis sirtalis infernalis*) (e.g., Barry and Jennings 1998, Stebbins 2003) and others refer to them as red-spotted garter snakes (*T. s. concinnus*) (e.g., Boundy and Rossman 1995, Janzen et al. 2002). Jennings and Hayes (1994a) based their evaluation of the putative taxon, the South Coast garter snake, on personal communications with J. Boundy and S. Sweet. Morphological and genetic studies that will help to clarify the status of this taxon are still pending. One study is a comparison of color and morphological variation among *T. sirtalis* from the south coast, central coast, and central valley of California (E. Ervin, pers. comm.; C. Mahrdt, pers. comm.). A phylogeographic study by Janzen et al. (2002) looked at *T. sirtalis* populations along the west coast of the United States but excluded populations from southern California. Another study sequencing two populations of southern *T. sirtalis* is underway for comparison with Janzen et al.'s (2002) study (R. Fisher, pers. comm.).

Life History

While the species *Thamnophis sirtalis* is one of the most well-studied North American snakes (Rossman et al. 1996), very little is known about populations from southern coastal California. Given that *T. sirtalis* is extremely widespread, occurring throughout much of Canada and in all but one state in the continental United States, life history variation among populations is pronounced (reviewed in Rossman et al. 1996, Ernst and Ernst 2003). We therefore limit our discussion to very general *T. sirtalis* biology and documented information from California where possible.

Like all members of the genus *Thamnophis*, young are live-born from midsummer to early fall. Cunningham (1959b) reported that an 89 cm SVL female *T. sirtalis* from Tapia Park, Los Angeles County, gave birth in late August to 20 young (18 live) that were about 25 cm in TL. Another 59 cm SVL female from the same area was carrying 12 embryos (Cunningham 1959b). A single female from farther north in San Benito County gave birth to six young, also in late August (Banta and Morafka 1968). Elsewhere, average litter sizes range from 7.6 in British Columbia (Gregory and Larsen 1993) to 32.5 in Maryland (McCauley 1945). Neonates range in size from 15 cm SVL (Manitoba; Gregory 1977, Gregory and Larsen 1993, Larsen et al. 1993) to 20 cm SVL (Lassen County, California; Jayne and Bennett 1990). Females mature at SVL of 43–57 cm, and males mature at 36–38 cm SVL, although this trait is highly variable across populations (Rossman et al. 1996). Time to maturity can take up to 4 years in some populations (e.g., Lassen County; Jayne and Bennett 1990). The proportion of females that are reproductively active in a given year ranges from 29% to 88% across populations (summarized in Rossman et al. 1996), suggesting that not every female breeds every year.

Thamnophis sirtalis can be active year-round in some southern localities (e.g., the Florida Everglades; Dalrymple et al. 1991). Rüthling (1915) anecdotally reported that *T. sirtalis* was rarely encountered around Los Angeles in the winter. Hansen and Tremper (unpublished data in Rossman et al. 1996) note that lowland California *T. sirtalis* are active from February to October, but there is a post-August drop in activity associated with a seasonal reduction in aquatic habitat. Most activity is diurnal, although crepuscular and nocturnal activity has been observed when anurans, a primary prey item, are breeding (Ernst and Ernst 2003). Nocturnal activity has also been observed in lowland California, with *T. sirtalis* active at night during warm rains (R. Hansen and R. Tremper, unpublished data in Rossman et al. 1996).

Thamnophis sirtalis are generalized predators (reviewed in Rossman et al. 1996).

However, diet data are not available from the southern range of *T. sirtalis* in California. Data from northern populations show that anurans are a large part of the diet. Anurans were the most common prey observed eaten by California *T. sirtalis*, comprising 58% of prey items (*n* = 48 snakes, localities include Siskiyou and Humboldt Counties; Fitch 1941). Also consumed were earthworms (24% of prey items), and rarer prey (5% or less of prey items) such as fish, leeches, and slugs (Fitch 1941). In northern California at Eagle Lake (Lassen County, 1555 m), regurgitation of 36 adults revealed that 33% of individuals contained anurans (mostly western toads, *Bufo boreas*), and 90% of prey items were anurans (Kephart and Arnold 1982). Fish (6% of animals, 2% of prey items) and leeches (11% of animals and 8% of prey items) were taken less frequently (Kephart and Arnold 1982). In the northern Sierra Nevada near Truckee, Nevada County, anurans comprised 56% of prey volume (mostly Pacific tree frogs, *Pseudacris regilla*), while 33% of prey volume was fish. Rarer prey items (5% or less of total prey volume) included mice and leeches (*n* = 88 snakes; White and Kolb 1974). Juvenile *Thamnophis sirtalis* in California have also been observed to consume newly metamorphosed newts (*Taricha torosa*) (S. Barry, unpublished data).

Habitat Requirements

Thamnophis sirtalis in southern California is thought to be restricted to marsh and upland habitats near permanent water and riparian vegetation (Grinnell and Grinnell 1907, Fitch 1941, Von Bloeker 1942; S. Sweet, pers. comm., in Jennings and Hayes 1994a). Data are scarce, but habitat preferences may be quite narrow. Some observational data suggest that this taxon may avoid restored marshlands, although the reasons for this are not clear (R. Fisher, pers. comm.).

Distribution (Past and Present)

Thamnophis sirtalis was historically known from scattered localities along the southern coastal plain from the Santa Clara River Valley in Ventura County to around San Pasqual in San Diego County (Klauber 1929, Jennings and Hayes 1994a; S. Sweet, pers. comm. in Jennings and Hayes 1994a; E. Ervin and C. Mahrdt, unpublished data). The historical elevation range is thought to be from near sea level at Ballona Creek and Playa del Ray Marsh in Los Angeles County to ~832 m at Lake Henshaw in San Diego County (Von Bloeker 1942; R. Fisher, pers. comm. in Jennings and Hayes 1994a). Jennings and Hayes (1994a) estimated that 75% (18/24) of historic localities no longer supported populations due to anthropogenic and natural habitat loss (e.g., urbanization, flooding). Of the six extant localities identified by Jennings and Hayes (1994a), it is now suspected that populations remain in only three localities, with possible extirpations including Camp Pendleton and San Luis Rey (R. Fisher, pers. comm.).

Trends in Abundance

Historical accounts suggest that *Thamnophis sirtalis* was once quite common (Grinnell and Grinnell 1907, Bogert 1930, Von Bloeker 1942). Current populations are thought to be abundant at Lake Henshaw in San Diego County, rare along the Santa Clara River, and virtually extirpated elsewhere (S. Barry, pers. comm., R. Fisher, pers. comm.).

Nature and Degree of Threat

Extirpations and population declines in this taxon have been attributed to habitat loss and fragmentation due to urbanization, agriculture, and flood control projects, as well as natural events such as floods and droughts (De Lisle et al. 1986, Jennings and Hayes 1994a). At remaining sites, urbanization in Riverside County continues to impact the Santa Margarita River wetlands at Camp Pendleton, and increased dam height in the Prado Basin may have a negative flooding impact (R. Fisher, pers. comm.). Introduced aquatic predators and water snakes (genus *Nerodia*) may also negatively impact *Thamnophis sirtalis* (Jennings and Hayes 1994a; R. Fisher, pers. comm.).

Under climate change, mean annual temperatures are projected to increase throughout the southern California range of *T. sirtalis*, with warmer winters and summers and earlier spring warming expected (reviewed in PRBO 2011). There is less certainty about future precipitation patterns, with estimates ranging from little change to roughly 30% decreases in rainfall (Snyder and Sloan 2005, PRBO 2011). Snowpack reductions of up to 90% are predicted in southern California (Snyder et al. 2004). Warmer and potentially drier conditions may affect availability of intermittent and ephemeral water bodies and therefore limit activity. Increases and decreases in fire probability and extent have been predicted for southern California. 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). How *T. sirtalis* responds to fire is unknown. Fire may have direct mortality effects, and may alter aquatic and terrestrial habitat quality. Predicted vegetation shifts due to climate change include decreases in chaparral and shrubland and increases in grassland area (Lenihan et al. 2008, PRBO 2011). The potential impact of such vegetation shifts on *T. sirtalis* populations is unknown.

Status Determination

Thamnophis sirtalis in southern California has a very small range in a heavily human-impacted part of the state. In addition, these populations have been extirpated from most of their historical range, which justifies a Priority 1 Species of Special Concern designation.

Management Recommendations

Given the paucity of ecological information on southern populations, it is difficult to make management recommendations beyond the protection of existing habitat at this time. Future management strategies may include removal of invasive animals and plants, restoration of flow regimes, and repatriation of extirpated sites. The research needs outlined below will help to inform the eventual development of a management strategy for this taxon.

Monitoring, Research, and Survey Needs

Almost no ecological or life history information is available for this taxon, and this data gap needs to be addressed at the few remaining sites in southern California where *Thamnophis sirtalis* persists. Monitoring to determine population abundance and to verify extirpation is needed across sites. As remaining habitat is identified and extant populations are found and stabilized, human-mediated repatriation, perhaps in combination with captive breeding, may be the most effective strategy to repopulate extirpated sites. Studies on movement and dispersal are needed to determine connectivity among remaining populations, and genetic studies on both the differentiation of this taxon from other *T. sirtalis* populations and the level of among-population variability are needed. Finally, the importance and impacts of nonnative species as predators and prey should be investigated further.