GIANT GARTER SNAKE

Thamnophis gigas

USFWS: Threatened

CDFG: Threatened

Species Account

Background

Status and Description. The giant garter snake was listed by the State of California as a threatened species on June 7, 1971. It was federally listed as threatened on October 20, 1993, (58 FR 54053) effective November 19, 1993. This species is one of the largest garter snakes, growing up to 4 feet in length (USFWS 1999). Females are usually larger than males with weighs from 500-1000 grams (Wylie et all 2010). The dorsal coloration is variable but typically brownish to olive with a black checkered pattern, a light yellow dorsal stripe, and two light-colored lateral stripes (USFWS 1999). The dorsal coloration and patterns of the species are highly variable depending on geographical location (Hansen 1980). The ventral coloration is cream to olive or brown and often mixed with orange in the species' northern range (USFWS 1999).

Range. The historic range of the giant garter snake was described as extending north from the Sacramento and Contra Costa Counties south to Buena Vista Lake, near Bakersfield, in Kern County (Fitch 1940). Prior to 1970, the species was recorded from 17 localities, five of which were located near Los Banos in Merced County (Hansen and Brode 1980). These records coincide with the historic location of large flood basins, fresh water marshes, and tributary streams (USFWS 1999). Surveys in the 1970's identified the species' range as being from Burrel, Fresno County north to Chico in Butte County and the Butte Basin in the Sacramento Valley (Hanson and Brode 1980; Rossman and Stewart 1987). California Department of Fish and Game located populations in the Central Valley agricultural land and rice production zones of Sacramento, Sutter, Butte, Colusa, and Glenn, western Yolo, and San Joaquin Counties (Hansen 1988). The Service recognizes 13 extant populations (58 FR 54053), including Butte Basin, Colusa Basin, Sutter Basin, American Basin, Yolo Basin-Willow Slough, Yolo Basin-Liberty Farms, Sacramento Basin, Badger Creek-Willow Creek, Caldoni Marsh, East Stockton-Diverting Canal and Duck Creek, North and South Grasslands, Mendota, and Burrel/Lanare. These populations extend from Fresno north to Chico and encompass 11 counties: Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, and Yolo.

Distribution within Plan Area. In Solano County, this species is associated with the Valley Floor Grassland and Vernal Pool Natural Community. The range of the giant garter snake in Solano County, based on only three known records (CDFG 2011), is confined to near the Yolo Bypass and the tidally influenced area in the eastern portion of the County (Wylie and Martin 2004). USGS conducted giant garter snake surveys in 2004 and 2005 at a number of locations, including the historical record sites in Solano County that they determined would be most likely to support this species, but none were found (Wylie and Martin 2004). Based on the paucity of giant garter snakes

records from Solano County and lack of recent observations (i.e. USGS surveys) it appears that the giant garter snake is very rare in or may have been extirpated from Solano County. Solano County fell within the lowest of the suitability categories in an analysis of the potential habitat distribution in the Sacramento Valley (Halstead et al 2010). However, a sizeable population of giant garter snakes is present in the western edge of the Yolo Bypass near Putah Creek (Hansen, pers. comm.), suggesting that populations could reestablish or expand into suitable habitat areas within the County in the future. The designated giant garter snake conservation area within the County (Figure 4-18) is primarily based on habitat characteristics of those areas and the known habitat preferences for the species.

Associated Covered and Special Management Species. Covered species that may be associated with the giant garter snake include: Sacramento splittail (*Pogonicheilus macrolepidotus*), which occurs in the open water of sloughs and backwaters, and may serve as a prey item for the giant garter snake; and the tri-colored blackbird *(Agelaius tricolor),* which breeds in beds of cattails and bulrushes. In addition, one Special Management Species may be associated with the giant garter snake: the Western pond turtle *(Actinemys marmorata)*, which occupies the same type of aquatic habitat as the giant garter snakes and requires adjacent uplands for egg laying.

Narrative Conceptual Model

This section provides a preliminary narrative conceptual model for giant garter snakes. This model will be used to guide the conservation and management programs. Following concepts developed by Atkinson (2004), the model describes the lifecycle, biology and habitat requirements of the species, followed by potential pressures affecting populations within the Plan Area. Pressures are agents that either promote or inhibit change in the state of the environment (Atkinson 2004).

Life Cycle and Biology. Giant garter snakes breed during March and April and the females give birth to 10 to 46 live young from late July to early September (Hansen and Hansen 1990). After the newborn snakes absorb their yolk sacs, they begin to feed on their own (USFWS 1999). Male snakes reach sexual maturity at 3 years while females reach sexual maturity at 5 years. The life span of wild giant garter snakes is unknown.

Predation and Survivorship. Potential predators of giant garter snakes that occur in Solano County include great blue heron *(Ardea herodias)*, great egret *(A. alba)*, American bittern *(Botaurus lentiginosus)*, red-tailed hawk *(Buteo jamaicensis),* red-shouldered hawk *(B. lineatus)*, and northern river otter *(Lontra canadensis)*. Aquatic predators such as the largemouth bass *(Micropterus salmoides)* and American bullfrog *(Rana catesbeiana)* may also prey on young giant garter snakes.
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There is little information on survivorship in giant garter snake populations, but presumably, as with many snake species, first-year survivorship is generally the lowest of all life stages (Parker and Plummer 1987).

Diet. Giant garter snakes feed primarily on aquatic vertebrates such as native and non-native fish and amphibians (Fitch 1941, Hansen 1980, Hansen 1988, Stebbins 2003) but will also occasionally eat birds (Stebbins 2003). Since many of their historic prey species, such as the Sacramento blackfish (*Orthodon microlepidotus*) and California red-legged frog (*Rana draytonii*), have become rare, giant garter snakes feed primarily on introduced non-native species

such as the common carp *(Cyprinus carpio)*, mosquito-fish *(Gambusia affinis)*, and American bullfrog, as well as common native species such as the Pacific treefrog *(Pseudacris regilla)* (Fitch 1941, Rossman 1996).

Habitat Requirements. Giant garter snakes are associated with dense emergent aquatic vegetation, such as cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.), in freshwater marshes, oxbows, and backwaters along slow flowing creeks. Giant garter snakes are also found along canals supporting beds of fringing cattails or bulrushes. An important component of the habitat is the amount of available edge, where the emergent vegetation meets the open water (Hansen 2010). Also important is the presence of upland areas where the snakes can escape floods and seek winter retreats (Hansen 1988, Hansen et al 2010). Historically upland areas within the giant garter snakes range generally supported grassland or valley oak woodland.

Suitable habitat in Solano County includes marshes, sloughs, ponds, small lakes, low gradient streams, and agricultural-associated wetlands, such as irrigation and drainage canals and flooded fields, and the adjacent uplands. Essential habitat components consist of: 1) adequate water during the snake's primary active period (i.e., early spring through mid-fall); 2) a suitable prey base; 3) abundant emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat; 4) upland habitat for basking, cover, and retreat sites; and 5) higher elevation uplands for cover and refuge from flood waters.

Aquatic Habitat. The important aquatic habitat elements for the giant garter snake include, permanent water deep enough to support sufficient aquatic prey species during the snake's active season but too deep to allow introduced invasive species such as yellow water primrose, abundant emergent aquatic vegetation such as cattails and bulrushes along the waters edge, mats of dead cattails and bulrushes for sunning, and an abundant prey base. All these elements may be present along canals and drains in eastern Solano County, but landscape level land use patterns may reduce local habitat suitability for giant garter snakes (see Landscape Level Patterns).

Upland Habitat. From November to mid-March, giant garter snakes use small mammal burrows, rip-rap along canal banks, and other underground retreats to escape cold temperatures. These retreats are usually, but not always, located above flood elevations and often include a degree of sun exposure (USFWS 1999). Giant garter snakes do not hibernate during the winter as much as they go underground to escape unfavorable surface conditions (e.g., cold temperatures); on warm winter days these snakes are often active on the surface (Wylie, 1997; Wylie et al 2010). Ground squirrel burrows and other underground retreats are also important for giant garter snakes to escape extreme heat and dry surface conditions during the summer months (USFWS 1999).

Habitat Use Patterns. Wylie et al. (1995 and 1997) radio-marked giant garter snakes and monitored their movements and habitat use using telemetry in the Sacramento Valley (see below). During the summer, habitat use of the telemetered snakes was; rice fields 20 percent, slough 7 percent, marsh 23 percent, and canals 50 percent. Rice fields were used by 55 percent of the telemetered snakes. Rice fields appear to be used primarily during July and August when the rice stems have attained a height and density to provide sufficient cover for the snakes. Wylie et al. (1995, 2005, 2010; Halstead et al 2010) suggested that rice fields

may have value to giant garter snakes as nursery areas, because female snakes used this habitat primarily during the period when they were incubating and giving birth to their young. In addition, there were fewer aquatic predators in rice fields (apparently due to extensive vegetative cover) than in more natural marsh habitats or along canals.

Landscape Level Patters. Wylie et al. (1996, 1997, 2002a and 2002b; Halstead et al 2010) studied giant garter snakes at 26 locations in California. These studies provide insight into the effects of landscape level land uses on the giant garter snake. In the Natomas Basin study, Wylie and his colleagues categorized giant garter snake habitat quality along canals, drains, or other water features, as good, marginal, or poor. They noted that the assessed quality of the habitat along a given water feature did not necessarily suggest use or non-use by giant garter snakes. In the Natomas Basin rice growing areas, providing suitable upland habitat is present, the giant garter snake can occur along canals and drains supporting what would otherwise be considered only marginal to poor quality aquatic habitat for this species. Apparently, the abundant surface water and emergent vegetation (*i.e.,* rice) associated with rice cultivation in effect provides an artificial marsh habitat for giant garter snakes during their active season. In addition, mosquito fish *(Gambusia affinis)* and Pacific tree frogs *(Pseudacris regilla)* are often present in large numbers in rice fields during the late summer, providing high quality foraging habitat for newborn giant garter snakes (USFWS 1999). Flooded rice fields may also facilitate movement or dispersal of snakes between otherwise widely separated linear water features. These factors appear to act in concert to allow giant garter snakes to persist along canals and drains (in rice cultivation areas) that otherwise would not likely support populations of this species.

Wylie et al. (2002a) and Hansen (pers. comm.) also reported that they captured few or no giant garter snakes in some water features supporting what they considered to be high quality aquatic habitat, but surrounded by a landscape of dry fallow fields. For example, along Elkhorn ditch, a water feature supporting good quality habitat surrounded by rice, snakes were present during 2000, however, no snakes were found during the surveys in 2002 when the surrounding areas had been converted into dry fallow fields. At another site supporting good quality aquatic habitat surrounded by dry fallow fields, one snake was captured during the 2002 season indicating that giant garter snakes were present, but apparently in very low densities. Although data are not extensive, the Natomas Basin study suggests that surrounding land use has a significant effect on the potential occurrence of giant garter snakes in a given water feature.

Rice is not cultivated in Solano County and the irrigation and flood control features flow through a landscape dominated by generally dry cropland. Because of the general lack of extensive flooded fields (*i.e.,* rice) in Solano County and the apparent landscape level relationships between the quality of the aquatic habitat and surrounding land uses, the giant garter snake is presumably restricted to areas supporting what would be classified as good quality habitat; areas that would have appropriate cover, high food availability, and upland refuge (Halstead et al 2010). Areas supporting what would generally be considered marginal to poor habitat or small isolated patches of good habitat are presumed to not support giant garter snakes in Solano County due to the lack of surrounding aquatic habitats (*i.e.,* rice fields). Potentially good quality habitat is characterized by several essential habitat components (USFWS 1999; Halstead et al 2010).

Hansen (2010) found the presence of the introduced yellow water primrose (Ledwigia hexapetala) altered open water habitats to the point they no longer provided viable foraging habitat for giant garternsnakes. Unlike other species of yellow water primrose that float at the water's surface, hexapetala grows underwater eventually choking the entire water column. The vegetation becomes too dense for prey species to survive and traps sediment. Eventually, the invaded portion of the waterbody fills with enough sediment and water primrose biomass that the formerly open water habitat becomes a peat bog. These invaded habitat are no longer able to provide the elements necessary to support giant gartersnakes.

Population Structure. Little information is available on the structure of giant garter snakes populations; much of what is available comes from the studies conducted by the United States Geological Survey (USGS) in the Colusa National Wildlife Refuge in Colusa County, Gilsizer Slough in Sutter County and along Badger Creek, west of State Highway 99 in Sacramento County (Wylie et al. 1995, 1997, 2002a, and 2002b). The USGS study sites are all relatively close to Solano County and have a similar climate, and their findings are generally applicable to Solano County.

During the 1995 field season at Gilsizer Slough, USGS biologists captured 91 giant garter snakes and observed an additional 71 individuals that were not captured. During the 1996 field season USGS captured 66 giant garter snakes (not previously caught in 1995) and observed an additional 79 that were not caught. The ratio of females to males at Gilsizer Slough and Badger Creek was approximately 1:1, but was about 2:1 at Colusa. Wylie et al. (1997) surmised that the skewed sex ratio at the Colusa site was due to the fact that traps were difficult to use at this site and most captures involved visual sightings; female giant garter snakes are generally larger than males, and therefore were easer to see and catch. Wylie et al. did not estimate total numbers of giant garter snakes in the study areas due to the low incidence of recaptures; however, given the large number of snakes they observed but did not capture, they considered it likely that the total population in the Gilsizer Slough study area (approximately 270 acres) was in the hundreds.

Dispersal and Movement Patterns. Wylie et al. (1997) found that most of their radio-marked snakes moved little from day to day, however, one individual moved 5 miles (8 kilometers) in response to dewatering of its habitat on the Colusa National Wildlife Refuge. Four radio-marked snakes moved from their underground winter retreats to nearby areas of bulrushes after extensive flooding on their wintering area during January (Wylie et al. 1997). Two other snakes radio-marked by Wylie et al. remained in their burrows, under water, for the duration of the flood event, but moved out of the burrows when the water subsided. At their Badger Creek study area, Wylie et al. (1997) found that giant garter snakes primarily stayed near the Marsh edge, but two snakes used burrows up to 164 ft (50 meters) away from the Marsh as retreats from hot weather during an August heat wave. Three of the radio-marked snakes, at the Badger Creek study area, wintered in the rip-rap along a railroad bed that bisects the Marsh, but one individual moved 820 ft (250 meters) from the Marsh to overwinter in a burrow near the railroad bed.

It is evident from Wylie's studies that in general giant garter snakes are fairly sedentary, but capable of moving relatively long distances (i.e., Up To 8 Km).

Land Use Practices. The land use practices or primary pressures that directly affect giant garter snakes in Solano County are conversion and fragmentation of natural wetland habitats. Extensive

agricultural development, and redirecting meandering lowland creeks, sloughs and backwaters into constructed channels has reduced potential giant garter snake habitat in eastern Solano County. Current land use practices in eastern Solano County have also greatly fragmented natural habitats including freshwater marshes and other wetlands.

Activities associated with the maintenance of canals and levees may impact any giant garter snakes that are extant in the County. Clearing of emergent aquatic vegetation, such as cattails and bulrushes, from canals to facilitate water flow could impact giant garter snake habitat. Levee maintenance work during the inactive season, involving driving heavy equipment on levees, grading or other ground disturbance, could result in the death of individual giant garter snakes hiding in ground squirrel burrows or other underground retreats. Clearing of vegetation during the active season may allow individual giant garter snakes to escape from areas where clearing is being conducted.

Rodent control programs aimed at California ground squirrels populations residing on levees could reduce or eliminate suitable underground retreats for giant garter snakes. Adult and young giant garter snakes use ground squirrel burrows as winter retreats and for shelter from dry surface conditions and high temperatures during the summer.

Road construction near areas that support giant garter snakes populations could result in greater impacts to these snakes through road kill.

Consequences of Land Use Practices. The primary consequences of the above land use practices, particularly habitat fragmentation, is the loss of connectivity between areas of suitable giant garter snake habitat in Solano County. Connectivity is an important landscape level concept to address when assessing the viability of a given area or patch of habitat for a specific species (Forman 1995). In general, fragments or isolated patches of otherwise suitable habitat for a given species are less likely to be viable for that species if they lack connectivity to other areas supporting suitable habitat. There is little information available on how large an area of habitat is required to support a viable population of giant garter snakes. In addition, little is known about the ability of giant garter snakes to move between isolated patches of suitable habitat. Wylie et al. (2002a) suggested that small ditches with an intermittent water supply limit giant garter snake movement. Shallow water also provide habitat for invasive species such as yellow water primrose (Hansen et al, 2010). Many of the water facilities in the northeastern portion of Solano County appear to be small and have an intermittent water supply. Water facilities with an intermittent flow are presumed to restrict or prevent giant garter snake movement between areas of good habitat because of the lack of emergent aquatic vegetation, upland cover, and food. However, this may not be the case in the southeastern portion of the County, the areas identified as potential giant garter snake habitat, because they may be connected through downstream sloughs and backwaters that could potential support giant garter snakes. In these areas, lack of connectivity may not be as serious of an issue. However, in general, habitat connectivity is an important issue in regards to the conservation and restoration of giant garter snake habitat in Solano County and could prove to be crucial in the reestablishment of populations.

Data Gaps, Uncertainties and Assumptions. Previous to the USGS surveys in 2004 and 2005 there was little information on the status of giant garter snakes populations in the Plan Area. Three records of the giant garter snake provide evidence of occurrence in the Plan Area, but information on the historical abundance of this species in the Area is lacking. The USGS surveyed a large amount of the potential habitat for giant garter snake in the Plan Area, including all the sites of historical

occurrence, and the surveys were conducted over an extensive time period during the giant garter snakes active season (April to September). No giant garter snakes were found during the USGS surveys. The lack of captures during the USGS surveys suggests that this species is very rare or possibly extirpated from the Plan Area, however, the USGS did not survey all areas of potential habitat (e.g., south of Liberty Farms). Recent surveys in the Yolo Bypass, south of Interstate 80, have revealed the presence of a robust population of giant garter snakes near the western edge of the Bypass (Eric Tattersall pers. comm. 2005). The proximity of this population, less that 4 miles east of the eastern boundary of Solano County, supports the possible that the giant garter snake may be present in unsurveyed habitat in the Plan Area.

Current Management and Monitoring Practices. There is currently no specific active management of habitat for the giant garter snake in the Plan Area. Plan Participants, however, are required to comply with protection measures for giant garter snakes in accordance with the State and federal endangered species acts when conducting operations and maintenance activities in their facilities.

There is currently no monitoring effort in the Plan Area specifically for giant garter snakes. Glenn Wylie and his colleagues at the USGS Dixon Field Station conducted surveys for the giant garter snake in the eastern portion of the Plan Area during the summers of 2004 and 2005. No giant garter snakes have been found within the Plan Area as a result of these survey efforts. However, these surveys could provide the basis for future monitoring of the giant garter snake in the Plan Area.

Key Monitoring and Adaptive Management Issues from Conceptual Model. Land use practices are the primary pressures that directly affect giant garter snakes in the Plan Area. The conversion and fragmentation of natural wetland habitats are the most important in this regard. Extensive agricultural development, and redirecting meandering lowland creeks, sloughs and backwaters into constructed channels has reduced potential giant garter snake habitat in the Plan Area and current land use practices have greatly fragmented natural habitats including freshwater marshes and other wetlands.

Secondary activities associated with the maintenance of canals and levees may impact giant garter snakes. Clearing of emergent aquatic vegetation, such as cattails and bulrushes, from canals to facilitate flood conveyance flows could alter or destroy giant garter snake habitat. Levee maintenance work during the inactive season, involving driving heavy equipment on levees, grading or other ground disturbance, could result in the death of individual giant garter snakes hiding in ground squirrel burrows or other underground retreats. Clearing of vegetation during the active season may allow individual giant garter snakes to escape from areas where clearing is being conducted. Water management activities that reduce water levels or alter flow timing may encourage invasive plant species, such as yellow water primrose, that alter or destroy giant gartersnake habitats.

Rodent control programs aimed at California ground squirrel populations residing on levees could reduce or eliminate suitable underground retreats for giant garter snakes. Adult and young giant garter snakes use ground squirrel burrows as winter retreats and for shelter from dry surface conditions and high temperatures during the summer.

Road construction near areas that support giant garter snakes populations could result in greater impacts to these snakes through road kill.

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