Giant Garter Snake: The Role of Rice and Effects of Water Transfers

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Main Points

Effects on the federally and state threatened giant garter snake are a major concern under a long-term (10-year) plan to transfer water from sellers in the Sacramento Valley to users south of the Delta or in the San Francisco Bay Area.

Water will be made available for transfer from cropland idling, crop shifting, groundwater substitution, reservoir release, and conservation. A maximum of 60,693 acres of rice land would be fallowed each year if the full amount of 565,614 acre feet of surface water is transferred annually.

This level of idling potentially could have major impacts on this snake given the current importance of the rice landscape in the Sacramento Valley to the species’ continued survival.

Giant garter snakes in the Sacramento Valley have a strong association with natural wetlands and aquatic agricultural habitats, particularly rice and associated water conveyances. Actions that degrade or eliminate habitats in the south-central portion of the Sacramento Valley near historical tule marsh are likely to have more serious consequences for the persistence of giant garter snakes than actions taken farther north and toward the edges of the valley.

Impacts may be especially severe in areas adjacent to state and federal wildlife refuges, which may function as the core snake habitat to lead recovery efforts.

The lower densities of snakes in rice than in wetlands is currently offset by the extent of rice, though local climatic conditions and global-scale market forces can lead to relatively large fluctuations in acreage under production over short time spans. Further, dependence on croplands leaves the snakes vulnerable to broad-scale changes in agricultural management, such as fallowing large areas of rice fields and conversion to incompatible crops (e.g., orchards, vineyards, row crops), or encroaching urbanization.

Thus preserved habitat managed for the snake, with corridors linking suitable habitat blocks, is crucial for the survival of the species.

Environmental commitments to reduce impacts to snakes will need to be carefully monitored and adaptively managed to ensure that robust snake populations are maintained.

Examples of successful short-term mitigation for impacts of drought on snakes include completing an emergency restoration project in the Delta that pumped well water into a marsh to preserve rapidly drying habitat and obtaining permission and funding for unrestricted pumping of wells to maintain key snake habitat in the Grasslands Ecological Area in the San Joaquin Valley.

Given continuing water shortages and a geographic imbalance between supply and demand, water transfers are likely to be an increasing part of California’s water future. Hence, transfers will need to be done wisely to benefit snakes and other wildlife, while at the same time supporting both nearby and distant human communities.
Purpose

The purpose of this document is to provide a high-level synthesis of the state of knowledge of potential effects of long-term transfers of water from the Sacramento Valley on the federally and state threatened giant garter snake (*Thamnophis gigas*). Water transfers also have the potential to affect wetland-dependent birds and other wildlife that use managed wetlands and cultivated rice fields in the Sacramento Valley.

Issue Description

Effects on the giant garter snake are a major concern under the long-term (10-year; 2015–2024) plan to transfer water from sellers in the Sacramento Valley to users located south of the Delta (or in the San Francisco Bay Area) (BOR and SLDMA 2015, BOR 2015a). Water will be made available for transfer from cropland idling, crop shifting, groundwater substitution, reservoir release, and conservation. A maximum of 60,693 acres of rice land would be fallowed each year for 10 years if the full amount of 565,614 acre feet of surface water is transferred annually as a result of cropland idling/crop shifting (USFWS 2015, 2016).

This level of rice-land idling potentially could have major impacts on giant garter snakes given the current importance of the rice landscape in the Sacramento Valley to the species’ continued survival. This document summarizes key aspects of giant garter snake biology, current threats to the species, and concerns for snakes from fallowing rice.

Background

The giant garter snake is endemic to the floor of California’s Central Valley, with the historical range including natural wetlands from northern Butte County south to Buena Vista Lake near Bakersfield, Kern County (USFWS 2012). The current known range extends from Chico, Butte County, south to Mendota Wildlife Area, Fresno County. The populations north of the Sacramento–San Joaquin River Delta are believed to be relatively stable. By contrast, those in the San Joaquin Valley—where numbers are few, distribution is discontinuous, and habitat quality is low—appear to be in serious and notable decline and are at high risk of extirpation. The more numerous populations of the giant garter snake in the Sacramento Valley may reflect the availability of alternative habitat provided by rice cultivation in that region. Because of habitat loss and threats to the species, the giant garter snake is listed as both federally and state threatened.
The giant garter snake inhabits marshes, sloughs, ponds, small lakes, low gradient streams, and other waterways and agricultural wetlands such as irrigation and drainage canals, rice fields, and adjacent uplands (USFWS 2012). Except for the limited uplands, all have slow-moving, relatively warm water and emergent vegetation. Giant garter snakes depend upon rodent burrows to thermoregulate, to provide cover during ecdysis (the shedding of skin), and for over-wintering. These snakes feed on small fishes, tadpoles, and frogs. Breeding occurs in March and April, with females giving birth to live young from late July though early September. Giant garter snakes typically are inactive, or greatly reduce their activities, during the late fall and winter months.

**Key Habitat Needs**

Specific habitat needs of the giant garter snake include adequate water during the snake’s active season, emergent herbaceous wetland vegetation for escape and foraging habitat, grassy banks and openings in waterside vegetation for basking, and higher elevation upland habitat for cover and refuge from flooding (USFWS 2012). Radio-telemetry data suggest that giant garter snakes rarely move more than a few meters from aquatic habitats during the active season (Halstead et al. 2015).

Wylie et al. (2010) found that giant garter snakes will persist in areas dominated by rice by foraging in flooded rice fields after the rice plants have grown sufficiently to provide cover from predators. Giant garter snakes apparently do not tolerate seasonal wetlands managed for waterfowl if there is no aquatic habitat available during the active summer season. A combination of Body Condition Index and snake density in three habitat types, strongly indicates that perennial emergent marshes provide the highest quality habitat, rice agriculture is acceptable habitat, and seasonal winter wetlands is the least suitable habitat (Wylie et al. 2010). Habitat suitability modeling based on a landscape-level GIS analysis of habitat features for the giant garter snake in the Sacramento Valley showed a strong association of these snakes with natural wetlands and aquatic agricultural habitats, including rice and associated water conveyances (Halstead et al. 2010).

Haltsead et al. (2014) used occupancy modeling to examine the distribution of giant garter snakes at the landscape scale in the Sacramento Valley. They emphasized the relative strength of historic and contemporary variables (landscape-scale habitat, local microhabitat, vegetation composition and relative prey counts) for predicting giant garter snake occurrence. Models showed a greater probability of occurrence near historical marsh, with the importance of distance to historical marsh thought to reflect dispersal limitations of giant garter snakes. Thus probability of occurrence was greatest along the center of the floor of the Sacramento Valley and decreased to the north and
toward the edges of the valley. Results suggest that preserving and restoring areas near historical marsh, and minimizing activities that reduce the extent of marsh or marsh-like habitats (e.g., rice agriculture, canals) near historical marsh may benefit giant garter snakes. Thus, actions that degrade or eliminate habitat in the south-central portion of the Sacramento Valley near historical tule marsh are likely to have more serious consequences for the persistence of giant garter snakes than actions taken farther north and toward the edges of the valley.

Threats

The giant garter snake faces a host of threats, but the most serious ones are the continued loss and fragmentation of habitat from both urban and agricultural development, and the potential loss of habitat associated with changes in rice production (USFWS 2012). Activities such as water management and water transfers are also of particular concern because they exacerbate the losses from development and from loss of rice production. The remaining threats (e.g., introduced predators, road mortality, flood control and maintenance actions, and potentially climate change and water quality) are secondary to direct habitat loss; habitat fragmentation in the Sacramento Valley could become a critical issue in the snake’s survival should large-scale habitat changes occur.

Rangewide, many of the remaining populations of the giant garter snake occur in relatively small, isolated patches of suitable habitat surrounded by heavily altered landscapes, though the degree of isolation and genetic divergence vary geographically (Wood et al. 2015). Snake populations in the Sacramento Valley generally have higher connectivity (except across the Sacramento River) than in the Delta and San Joaquin Valley, where there is greater genetic differentiation among these more geographically isolated populations. Thus preserved habitat managed for the snake, with corridors linking suitable habitat blocks, is crucial for the survival of the species. Otherwise prolonged periods of drought, flooding, or diminished habitat quality are likely to cause further population declines.

Rice Agriculture and Fallowing

The rice industry is an important factor to consider in assessing habitat for giant garter snakes. Although rice agriculture serves as an alternative habitat for the giant garter snake in the absence of suitable natural wetlands, rice lands are of lower quality (lower snake densities) compared to naturally occurring perennial marsh. The lower quality of rice habitat for the snakes is currently offset by its extent. In recent years, California producers have annually cultivated about 202,343 hectares (500,000 acres) of rice, the vast majority of which is in the Sacramento Valley. Yet rice, like other agricultural
commodities, is subject to both local climatic conditions and global-scale market forces, which can lead to relatively large fluctuations in acreage under production over short time spans. Likewise, dependence of the Sacramento Valley populations on agricultural croplands leaves the giant garter snake vulnerable to broad-scale habitat loss from changes in agricultural management, such as fallowing large areas of rice fields, changes to incompatible crops (e.g., orchards, vineyards, row crops), or encroaching urbanization.

Fallowing rice can have significant and complex impacts on the giant garter snake depending on the time frame and how the fallowing is conducted.

*Fallowing that results in barren fields and dewatering of associated ditches.* Giant garter snake habitat can be substantially reduced or eliminated locally when rice fields are left out of production because of limits on water availability (high water prices, drought restrictions, water transfers or selling of water rights) or when growing rice is not economically viable. Snakes depend not only on the rice fields themselves (mainly mid-June through August, i.e., only one-third of the snake’s active season) but more so on the associated irrigation and, particularly, drainage canals (or ditches), which provide more stable aquatic habitat than the rice fields themselves (B. Halstead pers. comm.). When de-watered, these conveyances lose all or most of their ability to support giant garter snake populations (references in USFWS 2012). Radio-tracked snakes are known to leave previously occupied rice-land sites when fallowing is continued for more than one season (Wylie et al. 2008, E. Hansen cited in USFWS 2012).

*Fallowing of rice as a part of a crop rotation program.* Rice fields left out of rice production temporarily to sustain rice production over the long term pose different challenges (USFWS 2012). If such fields are planted with a rotation crop, especially one that is irrigated, essential habitat components for snakes may be maintained as long as water remains in canals (B. Halstead pers. comm.). Also, the long-term values to the snakes may be enhanced if the rice crop is made more sustainable when it otherwise might be eliminated. Rice crop rotation is likely to have the additional benefit of reducing farm chemical input and maintaining water quality (details in USFWS 2012). In such a setting, an irrigated rotation crop will likely keep water conveyances charged with water, and it is more likely to assist in prey production for snakes compared with a fallowed field that is left bare.

The permanent conversion of rice fields to alternative crops that do not require summer flooding of the fields will reduce the amount of available habitat overall. The irrigation needs of the alternative crops, however, will determine the amount of remaining aquatic habitat available for the garter snake and its prey (references in USFWS 2012).
Fallowing fields alternately in a “checkerboard” pattern will also minimize the impact to the giant garter snake.

Agricultural practices such as tilling, grading, harvesting, or mowing may kill or injure giant garter snakes (references in USFWS 2012). Giant garter snakes that over-winter near canals within or adjacent to rice fields are especially vulnerable to earth moving activities required to shape flood-irrigated fields, form rice checks, and install irrigation boxes. Most snakes are associated with canals when this work is done, such that shaping or scraping banks is especially problematic (B. Halstead pers. comm.).

The growing of wild rice may have more adverse effects than growing the more common long- and short-grain rice varieties, which are harvested after irrigation has ceased and fields have dried. Because radio-marked giant garter snakes have been observed moving from rice fields into nearby canals as water recedes prior to harvest (Wylie et al. 2008), they are presumed to be absent when mechanical harvesters enter the fields. By contrast, wild rice is harvested while the field is inundated with water. The effects of mechanical harvesting on snakes in fields with water and prey are unknown, but the harvesting is suspected to disrupt hunting, basking, or other behaviors.

**Water Transfers**

Water transfers are increasingly being used to move water from users with discretionary supplies to those with critical needs. Water transfers occur annually between water users within any water district, and transfers between districts are becoming more common. Regular long-term contractual water transfers have the potential to significantly reduce the amount of rice lands. Impacts may be especially severe in areas adjacent to state and federal wildlife refuges, which may function as the core snake habitat to lead recovery efforts (USFWS 2012).

Water transfers can be conducted with an emphasis on minimizing the effects on the giant garter snake. The USFWS’s biological opinion is that the Long-term Water Transfers (2015-2024), as proposed, are not likely to jeopardize the continued existence of the giant garter snake (USFWS 2015, 2016; BOR 2015b, Appendix A). The opinion does recognize, however, that the project will likely result in the loss of an unknown number of snakes from increased mortality from temporary loss of habitat, increased competition for resources, reduced reproductive rates, and increased mortality from predation. The expectation is that crop idling and shifting will temporarily remove suitable snake habitat and may also reduce reproduction, recruitment, and survival of snakes, and these effects will extend beyond the project time frame. However,
Reclamation is implementing a comprehensive conservation strategy with a number of specific environmental commitments. The strategy focuses on maintaining suitable habitat conditions for snakes in priority areas throughout the project action area. Water will be maintained in areas most important to snakes and will not be transferred in habitat priority conservation areas. Reclamation will also identify where idling has occurred, collect data and verify habitat conditions, synthesize species data, and implement adaptive management measures to assure effective implementation of the conservation measures.

**Water Transfers and Drought**

Interest in water transfers is heightened during periods of drought when additional pressure is exerted on already tight water supplies. At the same time, innovative solutions have been used to maintain environmental habitat, including that for the giant garter snake, during drought. For example, in 2014 the California Department of Fish and Wildlife, in cooperation with The Nature Conservancy, completed an emergency restoration project at the Cosumnes River Preserve that pumped well water into appropriately named “Snake Marsh” to preserve rapidly drying habitat ([https://cdfgnews.wordpress.com/2014/09/22/](https://cdfgnews.wordpress.com/2014/09/22/)). Similarly, U.S. Fish and Wildlife Service recently provided funding for unrestricted pumping of wells to maintain key snake habitat at Volta Wildlife Area in the Grasslands Ecological Area near Los Banos (Ric Ortega pers. comm.).

In the long term, any such drought solutions will need to be compatible with the state’s Sustainable Groundwater Management Act of 2014, which provides a framework for sound groundwater management that will provide reliable water supplies and a buffer against drought and climate change ([http://groundwater.ca.gov/](http://groundwater.ca.gov/)).

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