

Western Ecological Research Center

Publication Brief for Resource Managers

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Mercury Contamination in Giant Gartersnakes

Giant gartersnakes (*Thamnophis gigas*) are a federally listed threatened species endemic to wetlands of the Central Valley of California. Habitat destruction is the main factor in the decline of giant gartersnake populations, but the effects of contaminants on this species are unknown. To contribute to the recovery of these snakes, the USGS began studies of the life history and habitat use of giant gartersnakes in 1995. As part of these studies, USGS scientists Dr. Glenn D. Wylie, Roger L. Hothem, Darrin R. Bergen, Lisa L. Martin, and Brianne E. Brussee in cooperation with Robert J. Taylor of the Trace Element Research Laboratory at Texas A&M University wanted to learn to what extent tissues of giant gartersnakes were contaminated by mercury and other trace elements. These scientists also wanted to determine if non-lethal samples from tail clips would be a valid indicator of contamination of these snakes in current populations. Results of their study appear in a recent issue of *Archive of Environmental Contamination and Toxicology*.

During a series of investigations from 1995 to the present, specimens of dead giant gartersnakes encountered in the field were collected and preserved. Most of these specimens were from the vicinity of Colusa National Wildlife Refuge in Colusa County and the Natomas Basin area of Sacramento and Sutter counties in California. The liver, brains, and tail clips of 23 of these specimens were analyzed for mercury and a variety of other elements. All tissue had detectable mercury concentrations. The overall geometric mean concentration in livers from all sites (0.393 $\mu\text{g/g}$, ww) was significantly higher ($p < 0.001$) than in brains (0.062 $\mu\text{g/g}$) and tails (0.081 $\mu\text{g/g}$), but concentrations of mercury did not differ between brains and tails ($p = 0.586$). Mercury concentrations ($\mu\text{g/g}$, ww) ranged from 0.08 to

Management Implications:

- Giant gartersnakes may be affected by mercury contamination.
- Tail clips provide a representative sample to determine mercury concentrations in living snakes.
- Further studies of contaminants in giant gartersnakes need to be conducted.

1.64 in livers, 0.01 to 0.18 in brains, and 0.02 to 0.32 in tail clips. These values did not differ between the sexes.

This study demonstrates that giant gartersnakes in California's Central Valley are chronically exposed to mercury within their current range, with tissue burdens comparable to another study in which corn snakes were experimentally dosed with mercury. Giant gartersnakes provide a trophic link in the bioaccumulation and transfer of mercury from cold-blooded prey items in aquatic habitats to predators of this snake, which include wading birds such as herons and egrets, as well as bullfrogs. Studies show decreased behavioral and physiological performance due to mercury exposure in some other colubrid snakes, and indicate that wild populations of giant gartersnakes may be at risk from mercury exposure. Impacts could include decreased predator-avoidance ability, a reduced success in the capture of prey items, as well as difficulty in shedding normally. Reduced neuromuscular and locomotor performance due to mercury exposure could potentially affect the daily activities and overall survival of these snakes in the wild by adversely affecting their ability to move between shelters and forage areas (including across roads), as well as the ability to perform daily movements required for regulating body temperature.

Mercury concentrations in tail clips were positively correlated with concentrations in livers and brains. Results indicate the potential value of using tail clips as a non-lethal sample to indicate contaminant concentrations in other tissues. Because tail clips are comprised of both skin and muscle, a variety of elements potentially could be detected by this sampling technique in future investigations of contaminants in giant garter-snakes.

Wylie, G.D., R. L. Hothem, D. R. Bergen, L. L. Martin, R. J. Taylor, and B. E. Brussee. 2009. Metals and trace elements in Giant Garter Snakes (Thamnophis gigas) from the Sacramento Valley, California, USA. Archive of Environmental Contamination and Toxicology 56:577–587.