despite the apparent assumption that it occurs relatively commonly (U.S. Fish and Wildlife Service, *op. cit.*). Here we describe two instances of predation by Largemouth Bass on *T. eques* that we documented during a study of the gartersnakes at Bubbling Ponds Fish Hatchery, Yavapai Co., Arizona, USA (34.765°N, 111.895°W; datum NAD83).

Largemouth Bass maintained in a single, earthen pond at the hatchery average 1.3–1.8 kg (400–500 mm standard length), with some larger individuals reaching over 2 kg. At 1030 h on 16 July 2010, we witnessed a neonate *T. eques* enter the pond, startled off the bank by our approach. Immediately, a Largemouth Bass engulfed the snake. After momentarily releasing the snake, the bass bit it again and appeared to swallow the snake. At 1000 h on 22 June 2011, a visitor to the hatchery observed a Largemouth Bass attacking the tail of an adult (ca. 600 mm total length) *T. eques* (Fig. 1). The snake struggled to continue swimming for ca.15 min. Eventually it was dragged under water, after which several other bass attacked it as well, and the snake was not seen again. Although the frequency with which bass prey on snakes appears to be low (J. R. Hodgson, pers. comm.), the implications of these observations for conservation of *T. eques* are clear; conversion of aquatic habitats to impoundments stocked with bass has the potential to seriously affect small local gartersnake populations.

We thank Don Altringer for providing the photo and detailed account of one of the predation events, and James R. Hodgson for additional information on bass diets.

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***THAMNOPHIS GIGAS* (Giant Gartersnake). MOVEMENT.** *Thamnophis gigas* historically inhabited marshes in the Central Valley of California, but currently inhabits rice fields and their supporting infrastructure of canals in the Sacramento Valley (northern portion of the Central Valley). Because of extensive habitat loss, *T. gigas* is listed as Threatened by the State of California and the U.S. Fish and Wildlife Service. Existing populations of *T. gigas* are often fragmented by inhospitable habitats (uplands, forests, most agriculture) and roadways. We report the movement of an individual *T. gigas* across a busy highway, and suggest that movement occurred through a culvert.

On 8 July 2010, one of us (ECH) captured, marked, and released a small (SVL = 362 mm; mass = 30 g) female *T. gigas* 349 m east of California Highway (CA Hwy) 99 in Sacramento Co., California, USA. On 5 July 2011, the same individual was recaptured 928 m to the west of the original capture location (579 m west of CA Hwy 99; Fig. 1). The individual had grown 263 mm and gained 104 g in the intervening year. She was subsequently captured on 6 July 2011, 99 m east of her location on 5 July 2011, and again on 7 July 2011, 133 m east of her location on 6 July 2011 (Fig. 1). She might represent a young female dispersing to establish a stable home range.

The snake's movement across CA Hwy 99 is significant because of the volume of traffic on and characteristics of CA Hwy 99 and characteristics of the box culvert through which the individual likely passed. CA Hwy 99 consists of four lanes of traffic (each direction is paved for a width of 13 m) separated by an 11 m median consisting of herbaceous vegetation. To the east, the road is bordered by 28 m of herbaceous vegetation, then a 9-m wide canal oriented north-south, with about 10 m between the east bank of this canal and the end of the east-west canal in which the individual was initially captured. A small (approx. 0.6 m diameter) cylindrical culvert connects the east-west canal to the north-south canal. To the west, CA Hwy 99 is bordered by 23 m of herbaceous vegetation, then a 5 m wide canal oriented north-south, with about 18 m between the west bank of this canal and the end of the east-west canal in which the individual

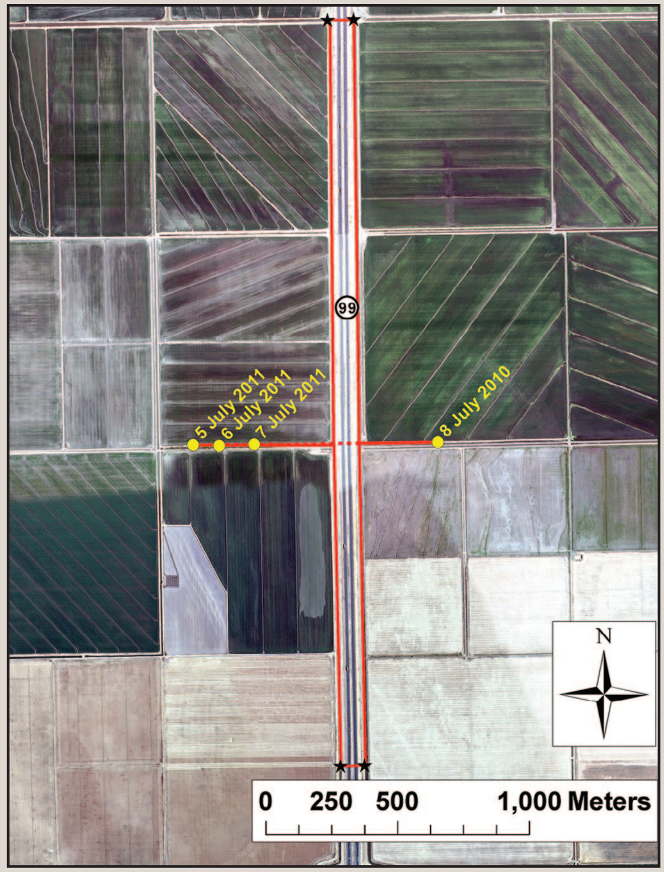

Fig. 1. Observations (yellow dots, with dates), locations of culvert openings (black stars), and potential movement paths (red lines; solid = culvert passage, dashed = direct overland route) of *Thamnophis gigas* #1461. Note that 2010 and 2011 observations are bisected by California Highway 99.

Fig. 2. The 1.8 m x 1.8 m box culvert 89 m long through which *Thamnophis gigas* #1461 likely passed. The culvert is located 1.2 km south of the east-west canal in which the individual was captured.

was subsequently captured. *Thamnophis gigas* are highly aquatic and rarely move more than a few meters from aquatic habitats (USGS, unpubl. data), so the total overland distance of 130 m (including the 14 m of north-south canals) itself represents a substantial barrier to movement.

In addition to the distance over which upland movements would have to occur, CA Hwy 99 has very high traffic volumes. In 2002, average annual daily traffic volume was 41,000 vehicles (CA DOT; www.dot.ca.gov). This volume of traffic is nearly four times that reported for US Hwy 441 in Florida, where culverts and barrier walls were constructed to reduce mortality of small vertebrates (Dodd et al. 2004. Biol. Conserv. 118:619–631). It is likely that residential and commercial development in the Natomas Basin have substantially increased traffic volumes since 2002. The high volume of traffic and great width of CA Hwy 99 make it highly unlikely that the individual crossed the road's surface.

If the individual did not cross over the road's surface, it could have crossed under CA Hwy 99 through culverts located 1.2 km south or 1.6 km north of the canal in which the individual was captured. The culvert to the south was a single box culvert approximately 1.8 m wide x 1.8 m tall x 89 m long, with an approximate water depth of 0.2 m and air clearance of 1.6 m (Fig. 2). Use of this culvert would imply a net movement of 3.3 km over 362 days. The culvert to the north was a double box culvert, with both passages measuring 2.1 m wide x 2.1 m tall x 102 m long. In contrast to the south culvert, these culverts are located near a pumping station, and were nearly filled with water (20 cm air space on 1 May 2012). Use of these culverts would imply a net movement of approximately 4.1 km. Because of the shallower depth and slower movement of water, greater light penetration, greater air space, and closer proximity to the canal in which the individual was captured, we suggest that the individual more likely passed through southern culvert than the northern culverts.

The characteristics of ideal culverts for wildlife crossings (wide, short length, allowing the penetration of light, and with fences to direct movement away from the road and into the culvert; Yanes et al. 1995. Biol. Conserv. 71:217–222.; Woltz et al. 2008. Biol. Conserv. 141:2745–2750) are in marked contrast to the long, narrow box culvert through which the individual likely passed. If individual *T. gigas* pass through culverts of this type and length, it is likely that bridges and culverts of shorter length or greater width would allow, at a minimum, genetic connectivity among populations separated by roadways. Examining the probability of use of culverts of different characteristics and enhancing culverts to improve passage rates of *T. gigas* will promote gene flow and could maintain demographic connectivity among otherwise fragmented populations.

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***THAMNOPHIS VALIDUS CELAENO* (Baja California Gartersnake). ARBOREALITY.** Terrestrial and arboreal habitats differ in the type and amount of prey they offer, vulnerability to predation, and in physical factors such as temperature and humidity. Many snake species are highly specialized for either terrestrial or arboreal life and rarely exploit alternative habitats (Shine et al. 2005. J. Therm. Biol. 30:179–185). However, some taxa display ontogenetic shifts in habitat use or use a broader range of habitats on occasion (Shine et al. 2002. Ethology 108:897–910). Species in the genus *Thamnophis* are primarily terrestrial, although some species occasionally climb in vegetation. For example, *T. sirtalis parietalis* (Red-sided Gartersnakes) use arboreal habitats to access higher temperatures than those available on the ground (Shine et al. 2005, *op. cit.*). *Thamnophis validus* is a semiaquatic species with a fragmented distribution in the water systems of the Cape Region, Baja California Sur, México (Grismer 2002. Amphibians and Reptiles of Baja California, including its Pacific Islands and the Islands in the Sea of Cortes. Univ. California Press, Berkeley. 399 pp.). *Thamnophis validus* is primarily nocturnal, which distinguishes it from many other gartersnakes (Rossman et al. 1996. The Garter Snakes: Evolution and Ecology. Univ. Oklahoma Press, Norman. 336 pp.), and is strongly tied to aquatic habitats (De Queiroz et al. 2001. Copeia 2001:1034–1042). Herein we report the first account of arboreal habitat use for *T. validus celaeno*.

FIG. 1. *Thamnophis validus celaeno* in El Chorro, Agua Caliente, Baja California Sur, México, *in situ*, exhibiting arboreal behavior.

On 30 August 2011, at 2045 h (air temp. = 28.7°C), we observed a juvenile female *T. validus celaeno* (SVL = 213 mm; total length = 286 mm; 7.5 g; cloacal temp. = 32.9°C) 40 cm above the ground in *Ambrosia monogyra* vegetation (Fig. 1) along the margin of a pond in El Chorro, Arroyo Agua Caliente, Baja California Sur, México (23.43996°N, 109.80757°W, datum: WGS84; elev. 182 m). This species has also been seen climbing on *Typha dominguensis* at this same locality and on *Baccharis salicifolia* in Cañon de la Zorra (A. Cota pers. comm.), both localities on the eastern slope of the Sierra de la Laguna, Baja California Sur. Because *T. validus* feed primarily on aquatic prey, we suggest that this may be a thermoregulatory behavior.

We thank to Raymundo Dominguez for plant identification, Abelino Cota and Franco Cota for their help in field and comments, and Diana Dorantes for English editing.

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