SAN JOAQUIN VALLEY GIANT GARTER SNAKE TRAPPING EFFORT 2006

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Introduction

The giant garter snake (*Thamnophis gigas*) is endemic to the Central Valley of California. Historically, the range of the giant garter snake extended from Sacramento, south to Buena Vista Lake in Kern County (Beam and Menges 1997). Conversion of wetlands for urban development and agriculture has led to extensive habitat loss, reducing the range by approximately one third (Hansen and Brode 1980). The giant garter snake was listed as rare in the state of California in 1971. When the California Endangered Species Act was passed in 1984, the giant garter snake was designated as threatened (California Fish and Game Code §2050-2116) due to habitat loss throughout its range (California Department of Fish and Game 2000). In 1993, the giant garter snake was listed as threatened under the Federal Endangered Species Act (U.S. Fish and Wildlife Service 1993).

The giant garter snake is a highly aquatic species found in still or slow moving waterways with mud bottoms, such as freshwater marshes, sloughs, and irrigation or drainage canals. They inhabit areas with emergent vegetation, which provide cover and foraging habitat (U.S. Fish and Wildlife Service 1991). Historically, the giant garter snake preyed on Sacramento blackfish (*Orthodox microlepidotus*), thick-tailed chub (*Gila crassicuda*), and California red-legged frogs (*Rana aurora draytonii*) (Rossman et al. 1996). With the extirpation of these native species, giant garter snakes now prey on introduced species such as mosquito fish (*Gambusia affinis*), carp (*Cyprinus carpio*), and bullfrogs (*Rana catesbeiana*) (Brode 1988).

Surveys conducted in 1975-76 by the California Department of Fish and Game found giant garter snakes to be present at several locations in the San Joaquin Valley (Hansen and Brode 1980). However, no giant garter snakes were observed in these same areas during surveys conducted from 1986-1988 (Hansen 1988). Fish and Game biologists, working cooperatively with the Grassland Water District, trapped areas throughout the San Joaquin Valley from 1997-2004. As a result of these surveys, giant garter snakes have been located

on private land, as well as on the Mendota and Volta Wildlife Areas (Dickert 2003).

Our primary goal during 2006 was to trap for giant garter snakes on Department-owned lands in support of a larger effort being conducted by Eric Hansen. Separately, we used this opportunity to experiment with the use of aquatic drift fences, and to trap in areas where snake presence was unknown. During 2006, the U.S. Fish & Wildlife Service contracted E. Hansen to investigate giant garter snake presence within areas of the San Joaquin Valley. His efforts, as well as trapping from previous years, yielded tissue samples that were contributed to a genetic study conducted by Dr. Tag Engstrom, CSU Chico, examining genetic variation amongst extant subpopulations of giant garter snakes (E.C. Hansen 2007). As part of a collaborative effort, we conducted trapping on Department-owned properties known to harbor giant garter snakes, and collected additional tissue samples for genetic analysis. We followed the same basic trapping regime as E. Hansen, but on a much smaller scale due to personnel availability, so that our data might be compared. Some areas we trapped had connectivity to trapping sites of E. Hansen.

Study Area

Trapping was conducted on the Volta Wildlife Area, Los Baños Wildlife Area, and the Mud Slough Unit of the Los Baños Wildlife Area Complex in western Merced County (Figure 1). Terrain on these properties is relatively flat, with elevations ranging from 95 to 108 feet. All three properties have upland habitat, as well as permanent water and temporary aquatic habitat. With the exception of one trapping site at Volta Wildlife Area, tule (*Scirpus* spp) and cattail (*Typha* spp) dominated the edges of trapping sites and low herbaceous plants were also present in some areas. The San Joaquin Valley climate consists of hot, dry summers and cool winters with an average annual rainfall of 8.27 inches (Los Baños Wildlife Area unpublished data 1970-2000).

Volta Wildlife Area is approximately 6.8 miles north-west of the city of Los Baños. The area is owned by the Bureau of Reclamation and managed by the

California Department of Fish and Game. During previous trapping efforts, giant garter snakes have been captured in Field 26, Field 10, and the Volta Wasteway. These sites were targeted during 2006 to increase the chance for collection of tissue samples. In addition, the Department recently acquired land encompassing Mosquito Ditch, so this area was also trapped due to its connectivity with the Wasteway and Field 10 (see Figure 2). Field 26 is a permanent wetland that is adjacent to the Volta Wasteway. We conducted trapping along a narrow, deep channel that is perpendicular to the Wasteway and is primarily lined with tule and patches of cattail. The Wasteway is a permanent water delivery system that flows south to north through the Wildlife Area, and we trapped along tule bank. The Wasteway then passes through the Mosquito Gates water control structure and flows into Mosquito Ditch, which is a narrow water delivery canal lined with iodine bush (*Allenrolfea occidentalis*) and low herbaceous plants. Prior to the water control structure, the Wasteway floods partially to the west and primarily to the east of the Mosquito Gates into an area known as Field 10. The western portion of Field 10 is shallow with little current and was the site of our drift fences. The eastern portion flowed along a narrow channel and into a large, shallow pond-like area. Water was too shallow to float traps within the pond so we opted to trap along the initial intake channel.

The Los Baños Wildlife Area (Figure 3) is approximately 3.7 miles north of the city of Los Baños. We trapped in Goose Lake, a shallow, permanent water body primarily edged with cattail. The Mud Slough Unit (Figure 4) is approximately 3.7 miles northeast of the city of Los Baños, and the area we trapped (a portion of Mud Slough proper) was lined with tule, cattail, iodine bush and low herbaceous plants.

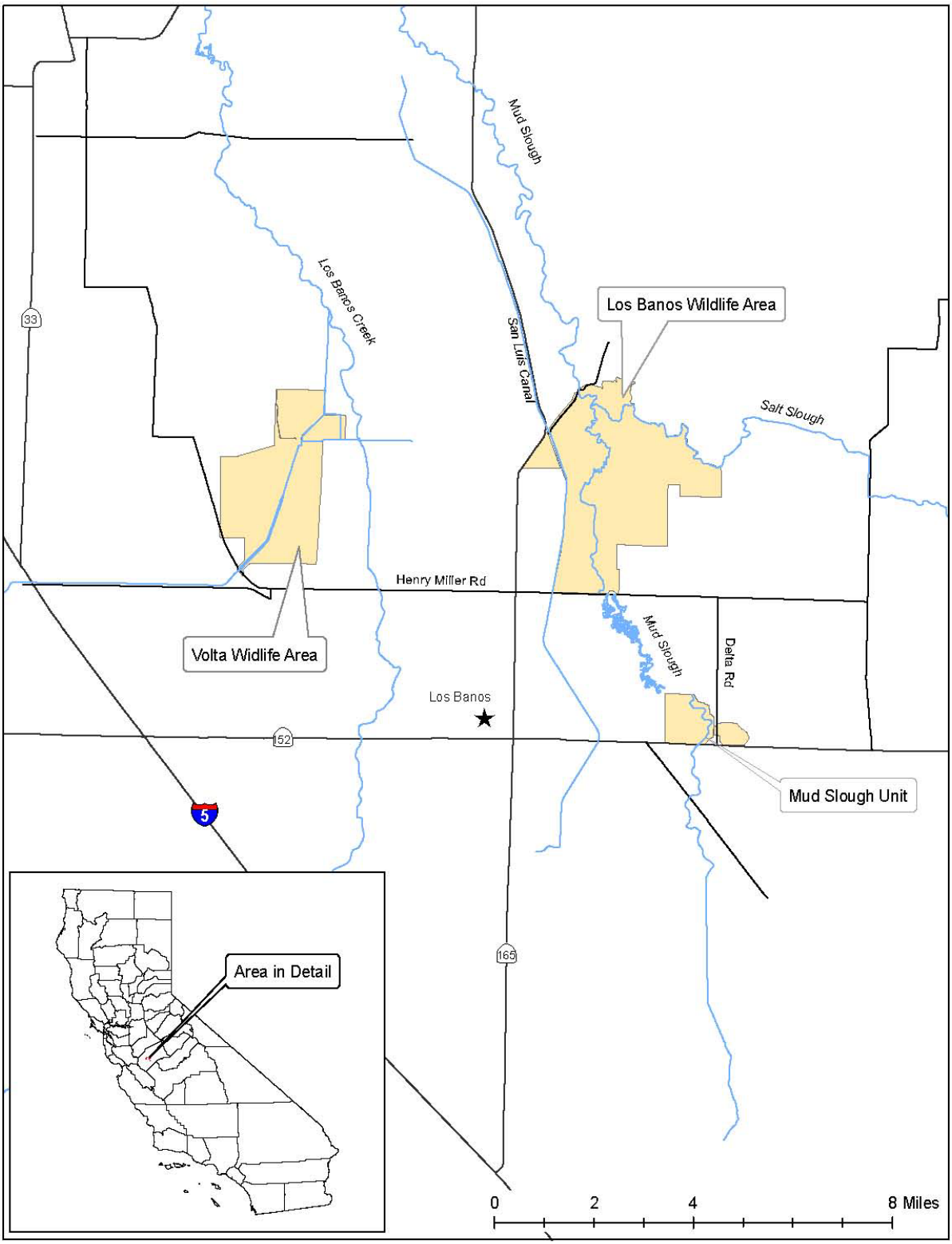

Figure 1. Giant garter snake trapping locations in the San Joaquin Valley, 2006.

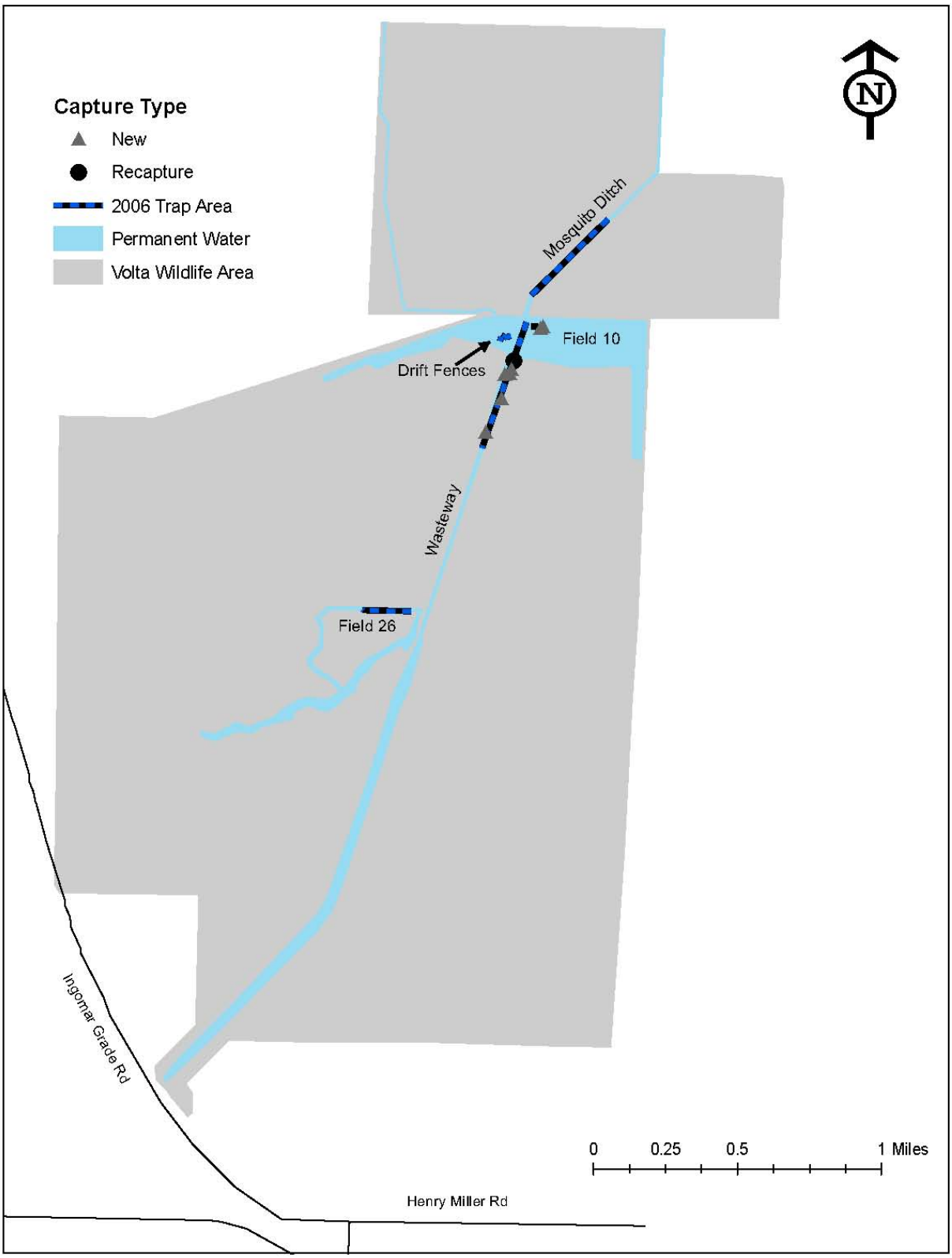

Figure 2. Giant garter snake trap sites and capture locations at Volta Wildlife Area, 2006.

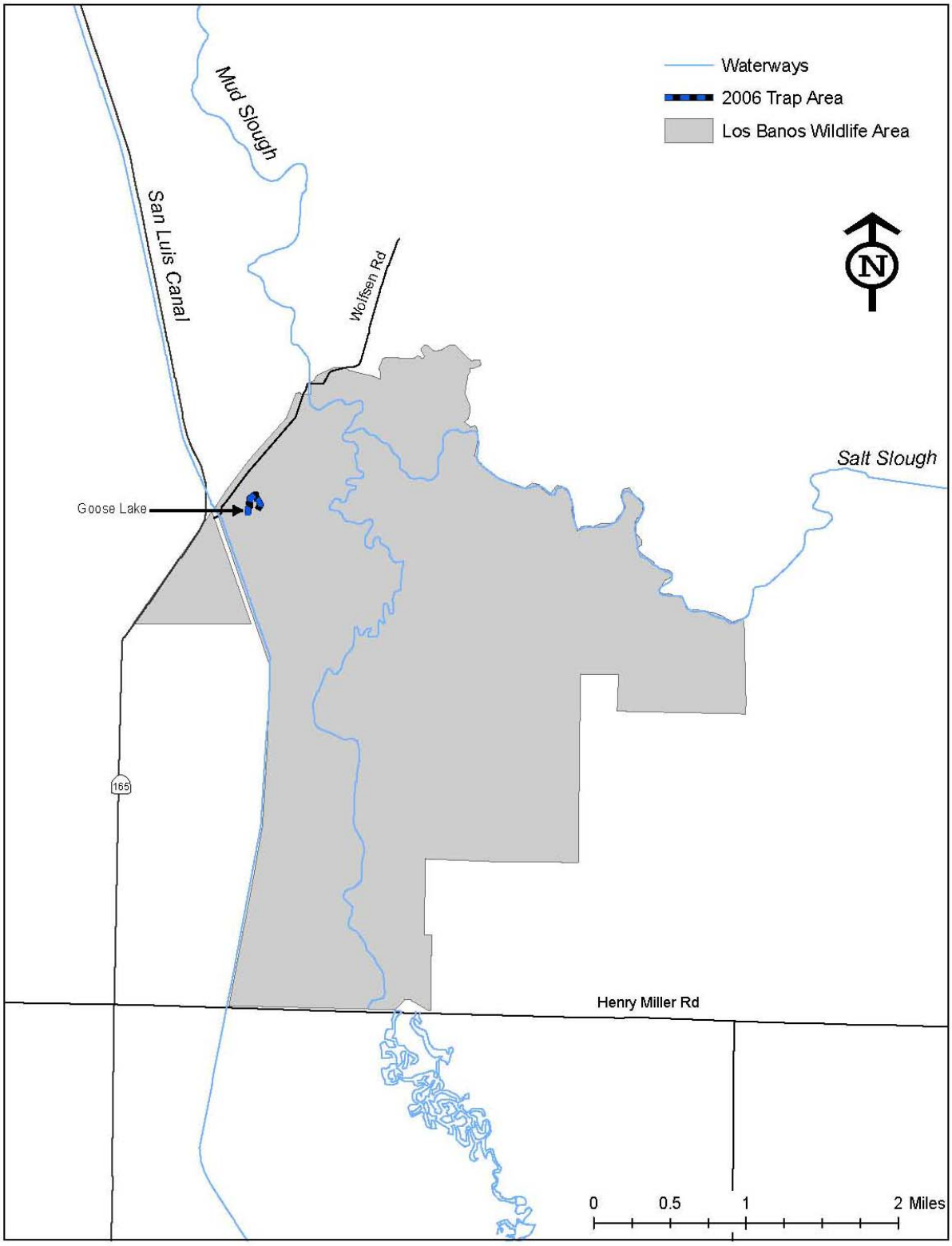

Figure 3. Giant garter snake trap sites at Los Baños Wildlife Area, 2006.

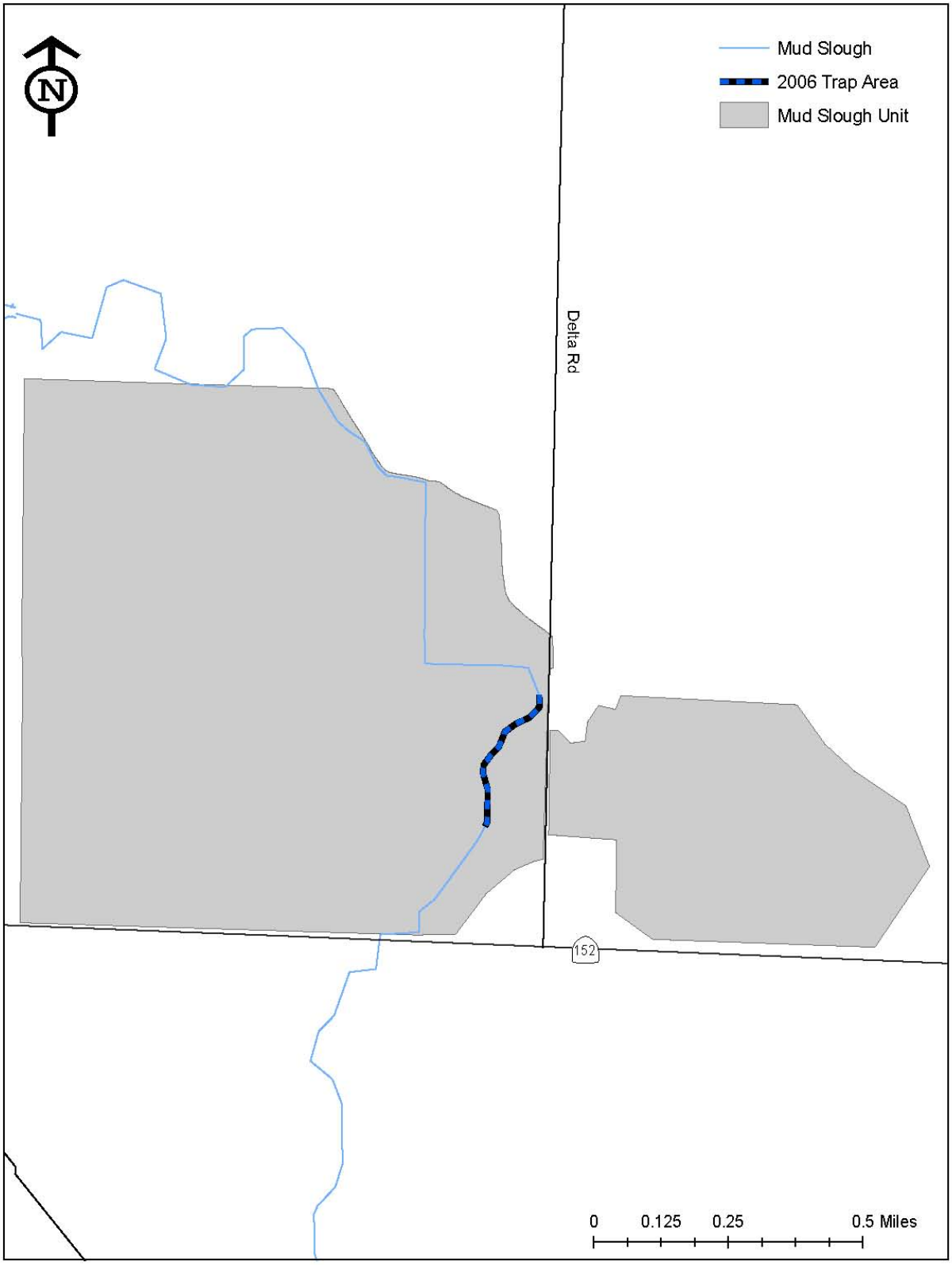

Figure 4. Giant garter snake trap sites at the Mud Slough Unit of Los Baños Wildlife Area, 2006.

Methods

We trapped for snakes using floating, modified eel pot traps (Casazza et al. 2000) and placed them 30 feet (10 meters) apart along banks, tying them to emergent vegetation. The distance between traps sometimes varied due to bank structure. For each trapping session we usually set 50 traps for a total of 14 days, after which the traps were moved to a new location within the same body of water and were set for another 14 days. With fluctuating water levels at most sites, we removed traps that could no longer float sufficiently and re-set them once water levels rose. The last trapping sessions of the field season at Volta Wildlife Area lasted longer than 14 days due to personnel and scheduling changes. Also, a permanent body of water on the Los Baños Wildlife Area, Goose Lake, hadn't previously been trapped. We set a trap line along the edge, encompassing approximately ¾ of the pond's perimeter, and left them in place throughout the duration of our trapping.

For drift fences, we used pre-staked silt fencing to create two fences on the western portion of Field 10. We placed one end of each fence perpendicular to the tule edge and extended it approximately three meters into the tule. For our first fence, we used a 100 foot section of silt fence and extended it straight out from the bank, placing ten traps along it. For the second fence, we placed two 100 foot sections end to end, giving us a fence which supported 22 traps. We positioned the fence arms so that they extended toward one another but did not meet. This created a cove-like area with a small opening allowing for other animals to pass through (Figure 5). We tied traps to the fence stakes, spaced them approximately 20 feet apart, and alternated them along each side of the drift fence (see Figure 6). We experimented with various tying techniques during trapping.

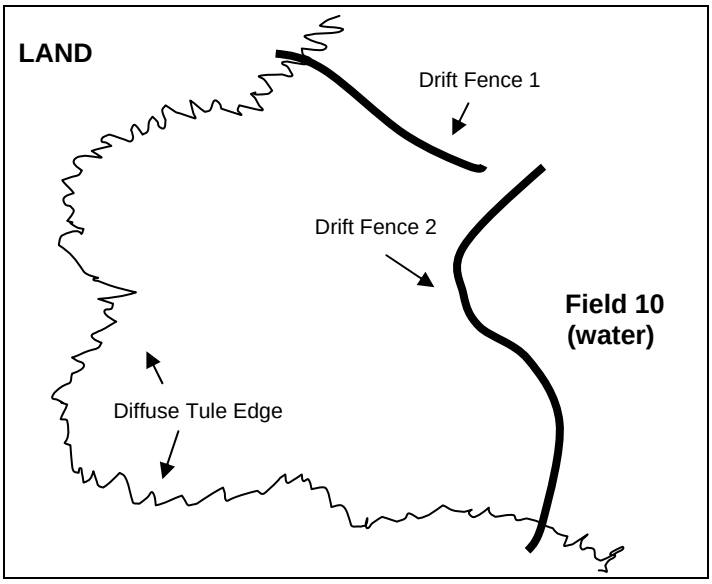

Figure 5. Aerial depiction of 2006 drift fences at Volta Wildlife Area, Field 10 west.

Figure 6. Volta Wildlife Area drift fence and trap arrangement in Field 10 west, 2006.

For all giant garter snakes captured, we scanned them for passive integrated transponder (PIT) tags. Because snakes in this area have been tagged here in the past, this would allow us to gather information on recaptured individuals. We transported our captured giant garter snakes to an office for further processing and tissue collection, and held them overnight for observation. The following day, we released the snakes at their original capture site. During processing, we recorded morphological measurements to support identifying the snake to species. Some of these measurements included supralabial, infralabial, preocular, postocular, and dorsal row scale counts (Rossman et al. 1996). We also measured physical characteristics such as snout to vent length (SVL) and mass, and we implanted snakes with PIT tags for all individuals weighing at least 25 grams. We sketched and photographed each snake to indicate the location of any cysts or lumps on the snake's body, as well as any unique features such as scars or unusual patterning. We collected tissue samples by clipping 2-3 mm from the tip of the tail. To record the location of each snake trap, we used global positioning system (GPS) units. This information was incorporated into a geographic information system (GIS), which includes giant garter snake trapping location and capture data from 1998 to the present.

Results

During 2006, we trapped at Volta Wildlife Area, Los Baños Wildlife Area, and the Mud Slough unit of the Los Baños Wildlife Area Complex between May 22nd and July 21st. Field 10, which is directly connected to the Wasteway, and the Volta Wasteway are the only locations where we succeeded in capturing snakes. Table 1 provides a summary for each trapping session and site. The number of trap days was calculated by multiplying the number of days per session by the number of active traps. We captured a total of seven garter snakes, which included three males and four females; one individual was recaptured once, yielding a total of eight snake captures (Table 2).

Table 1. 2006 San Joaquin Valley trapping efforts for the giant garter snake, *Thamnophis gigas*.

Trapping Location	Session Number	Session Dates	# of Traps Set	# of Trap Days[a]	# of Snake Captures
Volta Wildlife Area					
Wasteway	1	May 22 – June 5	50	700	1
Wasteway	2	June 5 – June 19	50	635	3
Wasteway	3	June 27 – July 21	50	1200	2
Mosquito Ditch	1	May 22 – June 5	50	592	-
Field 26	1	June 5 – June 19	50	700	-
Field 10 East Channel	1	June 27 – July 21	24	600	2
Field 10 Drift Fences	1	June 27 – July 19	32	704	-
Los Baños Wildlife Area					
Goose Lake	1	June 28 – July 19	50	1049	-
LBWA Mud Slough Unit					
Mud Slough	1	May 23 – June 6	50	700	-
Mud Slough	2	June 6 – June 20	50	700	-

[a] Trap days estimated from field notes; in areas with decreasing water, traps were inactivated until water returned to sufficient levels.

Table 2. Giant garter snake capture data from Volta Wildlife Area, 2006.

Capture Date	PIT Tag Number	Sex	SVL (mm)	Mass (g)	Capture Site
06/02/06	445D544608	M	360	26	Wasteway Session # 1
06/08/06	445D2C240B	F	730	211	Wasteway Session # 2
06/10/06	445D2F747F	F	611	200	Wasteway Session # 2
06/19/06	451E4A1675	F[a]	457	59	Wasteway Session # 2
06/28/06	451E4A5864	F	592	192	Wasteway Session # 3
07/12/06	451F7F2D5E	M	379	28	Field 10 East Session # 1
07/13/06	445E2A7F25	M	376	29	Field 10 East Session # 1

[a] = individual was also recaptured on 07/16/06.

We were able to implant PIT tags and collect DNA samples from all seven snakes. Two of the snakes had cysts, which indicate that parasites may be present, but all appeared healthy otherwise. None of the snakes we captured

during 2006 contained PIT tags from previous years. During 2006 we did not obtain sufficient data to calculate population estimates.

Discussion

The main purpose of our trapping effort this season was to collect tissue samples from San Joaquin Valley giant garter snakes to contribute to T. Engstrom's genetic research project. Over the years, it has been noted that many of the snakes observed or captured at Volta Wildlife Area and surrounding properties often vary significantly in morphological features from snakes in the Sacramento Valley. Advances in genetic sampling and analyses since we last collected tissue samples from Los Baños populations have created another opportunity to study these animals. This information could be vital to the conservation and future recovery of the giant garter snake throughout the state of California. Small or closed populations of giant garter snakes found to have distinct genetic variation could potentially result in taxonomic changes, and in turn might warrant further protection or a new listing status for this species. Due to an inability to contact T. Engstrom, our tissue samples remain unused at the time of this report preparation.

Secondary to tissue sample collection, we experimented with the use of drift fences to capture giant garter snakes in bodies of water with a high ratio of open water to vegetated edge. One potential benefit of drift fence trapping is to direct snakes from shallow water areas where trapping is not possible, toward deeper water where traps can float properly. We selected a location at Volta Wildlife Area that has a large expanse of calm, open water where snakes were observed in 2003. We did not capture any snakes using drift fences but feel that this method could be a valuable sampling technique. Unlike vegetation at the water's edge, drift fences create a complete barrier and thus could be more successful at guiding snakes to the traps. Our lack of success in drift fence captures may be due to several reasons. The peak period of dispersal for this species is likely just after emergence in early spring, but we did not begin our trapping efforts until almost June and may have missed much of their movement.

Also, the duration of our trapping was relatively short and we had to experiment with our tying techniques part way through trapping in order to keep traps flush with the fencing. Since drift fences are fixed and we only erected them in one area, it is possible that the site we chose wasn't heavily used by snakes. In addition to trapping for a longer duration, using drift fences in multiple locations, and using more efficient trap tying techniques, we feel that different placement of the drift fences might also improve our chances for capture. Our fences were placed perpendicular to the water's edge and extended into the tule, but passage around or underneath may still have been possible. It would likely be more effective if we cut through the tule and extended the fence to solid ground. Also, a less intrusive method might be to place drift fences parallel to the water's edge to intercept snakes crossing from one side to the other, or those entering the water from a basking site.

Our ability to conduct trapping during 2006 was only possible due to recent completion of another project, availability of qualified personnel, and possession of already pre-modified eel pot traps. Though this effort was minimal, we gained valuable information which could be applied to future giant garter snake projects in the San Joaquin Valley.

Recommendations

Future research should continue to evaluate drift fences as an alternate trapping method for shallow or low flow areas. Continued use of 50-trap, two week sessions should be utilized whenever possible to conform to other giant garter snake projects in the Sacramento and San Joaquin Valleys. This method also allows for calculation of population estimates and enables comparison between results of various researchers for future monitoring efforts. Above all, radio telemetry on snakes in the Los Baños area could provide crucial answers to movement and habitat use questions that currently remain unanswered in the San Joaquin Valley. Currently, local management decisions concerning giant garter snakes are made primarily using data from Sacramento Valley snake populations. Because of the difference in habitat and land use between these

two areas, management decisions for one population based on data obtained from another could prove detrimental to the snake's recovery. In an attempt to recover giant garter snake populations in the San Joaquin Valley, future research and conservation efforts should continue.

Acknowledgements

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