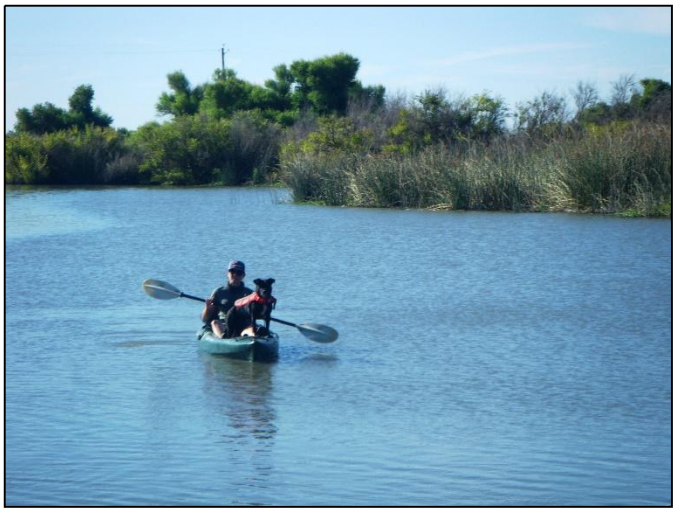

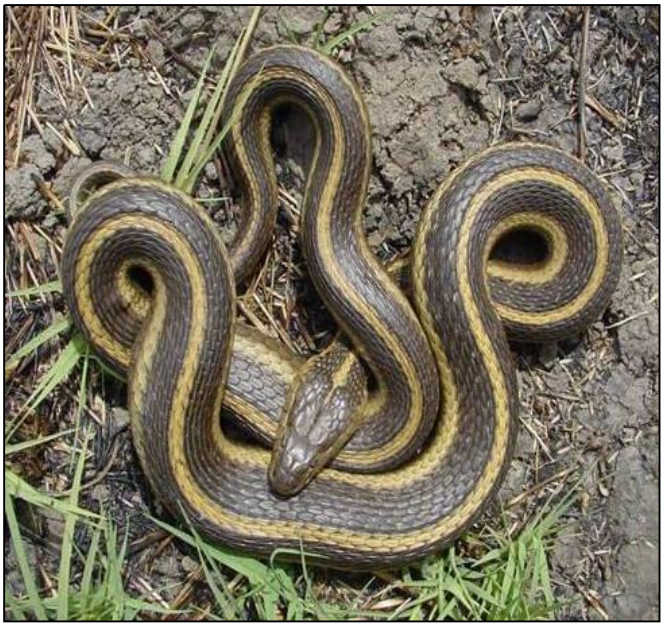

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Recommended Guidelines for the Use of Detection Dogs to Survey for Giant Garter Snakes

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March 2018

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Table of Contents

Photographs

Section 1. Introduction

1.1 Statement of Need for the Use of Detection Dogs to Survey for Giant Garter Snakes

The giant garter snake (GGS) (Photo 1) is federally and State listed as a threatened species endemic to California's Central Valley. GGS are closely associated with aquatic ecosystems (Fitch 1940) (Photo 2), such as low-gradient streams, valley floor wetlands, and marshes. These snakes require wetlands for foraging (fish and amphibians are their prey), upland areas for basking, upland refugia as summer shelter (mostly mammal burrows; see Photo 3), and higher-elevation upland refugia for winter brumation (Hansen and Brode 1980; Hansen 1988; U.S. Fish and Wildlife Service [USFWS] 1999, 2012; Title 58, Federal Register [FR], Sections 54053–54066.). GGS typically emerge from brumation in March, are active (foraging and breeding) from April through September, and seek winter refuge in October (Brode 1988; Hansen and Brode 1993; Wylie et al. 1997; USFWS 1999, 2012). Where wetlands have been reclaimed for agriculture, this species is associated with rice fields and supporting water supply channels (Hansen and Brode 1993; Hansen 1988; Wylie et al. 1997; USFWS 1999).

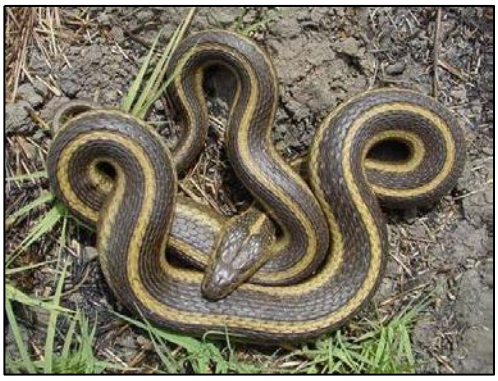

Photo 1. Giant Garter Snake

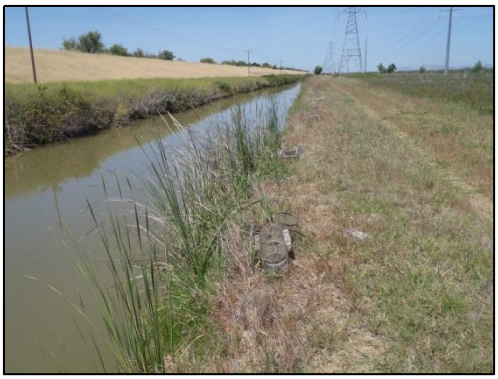

Photo 2. Giant Garter Snake Habitat

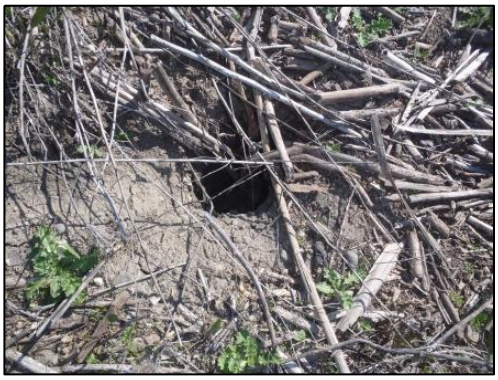

Photo 3. Characteristic Mammal Burrow Used as Shelter by Giant Garter Snakes

Agricultural and urban development have reduced California's total wetlands by an estimated 91% since the 1780s (Dahl 1990), with approximately 43% of freshwater wetlands in the Central Valley lost or converted since 1939 (Frayer et al. 1989). This loss of GGS habitat has resulted in extirpations and steep population declines throughout the southern two-thirds of the species' former range (USFWS 1999, 2012).

GGS are elusive: these snakes frequently occur in low-density populations in which individuals are difficult to detect. Visual surveys are not recommended because the snake is "both wary and cryptic, and it readily drops from emergent vegetation into water upon approach" (Halstead et al. 2011). Detection challenges have resulted in a poor understanding of occupancy patterns throughout much of the species' range.

Adding to these challenges, current survey protocols do not account for occupancy of burrows throughout the year and the snake's distribution during the inactive season. The current recommended adaptive survey protocol (Halstead et al. 2011) calls for extensive live-trapping during the active season when water temperatures are above 20°C. The recommended trapping entails setting at least 50 traps and checking them daily for a minimum of 30 days. This laborious method can be used only during a certain time of year and only in aquatic habitat, and thus provides no information on the use of terrestrial habitat by the species. Another method of detection, analysis of environmental DNA (eDNA), could potentially detect small amounts of GGS DNA in bodies of water and outside mammal burrows; however, surveyors collecting eDNA samples would benefit from a follow-up survey method in aquatic environments to focus live trapping efforts, if the survey goal requires handling, or may need an efficient way to narrow down the possible locations of GGS and thus focus the eDNA sampling effort (such as in terrestrial environments).

The abilities of scent-detection dogs offer a viable alternative or complimentary approach to live trapping and eDNA sampling to more effectively characterize GGS occupancy than one method alone, whether in aquatic or terrestrial environments. Dogs are able to distinguish among a vast amount of olfactory information in their environment. They have been used with great success to assist in surveys for several species of reptiles, such as pythons (Romagosa et al. 2011), indigo snakes (Stevenson et al. 2010), invasive brown tree snakes (Engeman et al. 1998), and desert tortoises (Cablk and Heaton 2006). In 2016, H. T. Harvey & Associates detection dog team trained two dogs on the scent of GGS and successfully surveyed for and determined presence of GGS in a slough in the southern extent of its range. The results were corroborated by eDNA sampling. The success of this survey suggests that properly trained dogs and handlers can effectively detect the presence of GGS in their natural environment.

1.2 Detection Dog and Handler Qualifications

Many survey protocols and guidelines for special-status species require that biologists are approved by resource agencies, based on the biologists' experience and qualifications, given a set of minimum standards. The same rigor should be exercised for surveys of species using detection dog-handler teams. To ensure efficient and rigorous data collection efforts, and the highest quality results, rigorous and science-based training is necessary for any detection dog and handler. Detection dogs and handlers must meet or exceed the standards and criteria

outlined in the *Giant Garter Snake Scent Detection Dog Team Validation Guidelines* (H. T. Harvey & Associates 2018). Before detection dog-handler teams deploy on GGS surveys, documentation demonstrating that the standards and criteria outlined in the *Giant Garter Snake Scent Detection Dog Team Validation Guidelines* (H. T. Harvey & Associates 2018) have been met or exceeded must be provided to the California Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service.

In addition to the dog-handler team's demonstrated proficiency in GGS scent detection, the handler should have knowledge of GGS natural history and ecology. This can be attained through attendance at a GGS Workshop event or through direct field experience with a biologist holding a Recovery and Interstate Commerce Permit (Section 10(a)(1)(A) of the ESA) for GGS.

Section 2. GGS Occupancy Survey Guidelines for Detection Dog Teams

2.1 Survey Guideline Evolution

Using detection dogs to survey for GGS is in its infancy. Detection dogs have proven effective for surveys of several other cryptic species that are difficult to detect using other methods, and they are often most valuable in these circumstances. Training, trials, and surveys conducted by the H. T. Harvey & Associates' detection dog group have indicated that there is a high likelihood that the use of dogs to detect GGS can improve survey efficiency and efficacy compared to other methods, especially in areas of low abundance. However, many questions remain to be answered. This draft guideline document recommends strategies 1) to ensure the safety of GGS and of detection dog teams; 2) that have proven effective with other species and during training and trial for GGS; and 3) wherein data are collected in a standardized fashion to build a dataset that will aid in the continual improvement of these guidelines and the ability to eventually arrive at quantitative assessments of GGS occupancy based on results of detection dog surveys.

2.2 Surveys of GGS Occupancy in Aquatic Habitats

The goal of surveying for GGS in and near their aquatic habitat is to detect the snakes during their active period, when they are mobile in the water, basking near emergent vegetation on banksides, or temporarily sheltering in natural or human-made refugia near the water source. Therefore, aquatic surveys should be conducted during the snake's active season (April–September). Future studies aimed at determining the amount of time the snakes' scent persists after the active period, or the environmental variables that affect the persistence of the scent, may expand this survey window. Surveys should only be conducted after each detection dog has undergone a sufficient *burn-in* and *acclimation* period (Appendix A) after the initial training phases.

2.2.1 Surveys of Waterways and Wetlands

Where shores or banks of aquatic habitats are accessible, detection dog teams can survey along the water for the presence of GGS scent emanating from the water, snakes basking or resting outside of the water, *residual scent* along the banks where snakes have recently basked, or scent escaping from refugia (cracks in the soil, small mammal burrows, rip rap, etc.). Resulting *changes of behavior*, *proximity alert behavior*, or *passive final responses* will indicate that a snake is currently present or has recently been present, but there will likely be few instances in which the snake can be visually confirmed. This highlights the importance of each dog-handler team demonstrating competency and reliability through presentation of qualifications, as described in Section 1.2.

A detection dog shall have the ability to perform a reliable *final response* when it has reached the target. Only passive *final responses* are acceptable (e.g. sit, down, or stare) to indicate the presence of a GGS that is found on the ground surface. Furthermore, the dog shall reliably perform the trained *final response* without coming into

contact with the snake. Handlers shall also possess the skill to identify and respond to the dog's *proximity alert behaviors* to increase the likelihood that a GGS will be recognized at a greater distance from the animal. Wind and weather conditions will influence the distance that the dog will recognize the target scent.

Surveying aquatic habitats and refugia present unique situations for detection of scent. Detection dogs are trained to follow a scent to the source. When snakes are underwater and the scent is dispersed throughout the water column, the dog will likely not be able to source the scent. The handler should be able to identify the dog's *change of behavior* and *proximity alert behaviors* and, if trained properly, the dog will get as close to the target source as possible before offering a *final response*. During GGS surveys previously conducted by H. T. Harvey & Associates (Powers et al. 2016), handlers often observed the dogs recognizing the scent and attempting to follow the scent to find the source, but conditions typically make it impossible to locate a single snake within a large body of water or canal. However, *proximity alert behaviors* have unique characteristics that handlers can easily recognize. Because it is not always possible for the dog to source the scent and therefore perform a *final response*, the handler must record if the dog presents *proximity alert behaviors*, even with no *final response*, during surveys.

Detection dog teams conducting occupancy surveys in aquatic habitat during the active period shall record *proximity alert behaviors* if/when they are presented. Depending on the goal of the survey, these behaviors can infer presence or narrow down areas for further examination.

Survey Area: GGS have been observed using burrows for refuge during the active period as much as 50 meters away from the water's edge (Wylie *et al.* 1997). The survey area should include the perimeter of the aquatic feature desired to be surveyed, as well as a 50-meter buffer from the bank or shore. Handlers should not attempt to survey inaccessible areas, and shall indicate areas not able to be surveyed, and the constraints that led to the decision, on a map when results are reported.

Survey Transects: Detection dog surveys differ from traditional human survey efforts in that the survey coverage area depends on terrain and localized weather conditions, especially wind speed and direction and the amount of relative humidity. Survey patterns can vary daily or within a survey day. The dog handler shall direct the dog to search the study area so that all areas with suitable refuge have been searched to achieve 100% coverage. The survey shall also ensure that the entire bank or shoreline has been searched for scent in the water or along the water's edge.

Environmental Conditions: Dogs have the ability to search in a wide array of weather and wind conditions, within reasonable parameters that are safe for the dog and handler. When temperatures exceed 27° C (80° F), the handler should remain aware of the dog's signs of overheating. In addition to the physiological dangers of overheating, the dog will not perform effectively and the scent detection ability will decrease. In addition, as temperatures rise, odor dissipates and rises as heat rises from the ground. Therefore, it becomes more difficult for the dog to recognize and follow the *scent plume* to source. The handler shall have the ability to recognize signs of their dog overheating and recognize scenting behaviors that indicate subpar scenting conditions. At 29° C (85° F), great caution should be

used during survey (e.g. short, shaded transects and frequent breaks) and surveys shall not be conducted in excess of 32° C (90° F). During warmer months, detection dog teams should maximize survey time and efficiency by initiating surveys at first light. Other environmental conditions such as cold weather, cloud cover, wind speed, and precipitation do not present limitations for effective surveys, but have unique effects on odor in the environment. Surveys with detection dogs differ from those of human-based surveys in that the survey approach varies depending on the environmental conditions. Therefore, survey transects can vary in spacing and direction between days and within the same day if local conditions shift. For this reason, we do not provide guidance on the general survey approach, but rather rely on the expertise of the handler. It is crucial that scent-detection dog teams receive proper training and practice working in a wide variety of weather and wind conditions so that the handler and dog understand how to navigate and work successfully in a variety of weather conditions.

Equipment and Other Specifications: All surveys conducted by scent detection dog teams during the GGS active period shall be performed on-leash with a maximum lead length of 7 meters. The leash will allow the handler to remain within visual distance of the dog in order to recognize the dog's changes of behavior and proximity alert behaviors. The leash will allow the handler to slow the dog's pace or re-direct the dog quickly, if needed. Scent detection dog handlers shall not permit the detection dog to touch a basking snake. A GPS unit shall be used to record the survey tracks of the handler and/or the detection dog. Handlers may choose to survey with a handler assistant to navigate and aid in recording necessary data.

Data to Record:

Standardized data collection is imperative to the evolution and refinement of this survey protocol. The required recordation of the data below is aimed to assist in the characterization of optimum survey conditions and strategy. Please be precise and thorough to aid in the general understanding of how best to use detection dogs to survey for GGS.

General

- Name of handler, handler assistant (if applicable) and dog
- Date of survey
- General location
- Site description that may include habitat types present, substrate/soils, topography/elevation, and surrounding land-use activity
- Habitat characteristics including presence of burrows/over-wintering sites, amount and type of cover present, including upland and emergent vegetation, presence of prey species, distance to nearest available habitat, and other species observed

At the Start and End of Each Survey

- Time
- Temperature, relative humidity, wind direction, average wind speed, cloud cover, and precipitation
- Water temperature

If *Proximity Alert Behaviors* or a *Final Response* is Observed

- Location and description of *proximity alert behaviors*, and *final response*, if/ when behaviors are presented.
- Snake observed or not
- If snake not observed, handler approximation of location of source or *residual scent* and statement of reasoning (e.g. wind direction)
- Snake suspected to be in burrow or other refugia, basking in emergent vegetation, or underwater
- Habitat characteristics in the immediate vicinity of *proximity alert* behaviors or *final response*

If Dog Performs a *Final Response* to a Snake on the Ground Surface

- Acceptable dog behaviors, such as:
    - Dog performs a trained passive *final response* (such as sit, down, or stare)
    - Dog did not touch GGS
        - *Final response* performed at what distance GGS
        - Minimum distance at which dog approached GGS

- Unacceptable dog behaviors, such as:
    - Dog chases or lunges at GGS
    - Dog barks at or in the direction of GGS
    - Dog scratches in or around the location of GGS or occupied burrow
    - Dog attempts to retrieve or place mouth on GGS
- The behavior of the snake when found
    - Snake flees on approach, and:
        - Escapes to crevice or burrow
        - Escapes to terrestrial vegetation
        - Escapes to aquatic vegetation
        - Escapes to water
        - Other (describe)
    - If fleeing, snake:
        - Moves away from handling team
        - Moves toward handling team
    - Snake remains in place, and:
        - Remains motionless
        - Coils, concealing head and/or engages in caudal luring
        - Coils and displays threatening behavior such as head flattening, tail shaking, or striking
    - Expand upon above behaviors in narrative form, as needed.
- Habitat characteristics in the immediate vicinity of *final response*

Data to Report:

- All recorded data, as described above
- Map of search area, specifying areas surveyed and excluded
- Survey information including effort (i.e. number of searching hours), number of acres or linear feet surveyed, and search pattern or style used

Reporting:

- The survey team shall provide the Sacramento U.S. Fish and Wildlife Service Field Office and California Department of Fish and Wildlife with all of the above information in writing, no more than 90 calendar days after completing the last field survey at each project site.

2.2.2 Surveys on Kayak

Where shores or banks of aquatic habitats are inaccessible, it may be necessary to survey from a kayak. On the water, the detection dog can search for the presence of GGS scent emanating from the water or *residual scent* wafting from the banks where snakes have recently basked. Surveying with a detection dog from a kayak requires special preparation beyond the standard criteria for detection dog training. The dog must be properly conditioned to the kayak before embarking on surveys so it is comfortable, confident, and concentrated on the task of scenting despite being bound to a vessel. The dog-handler team must practice and be tested to ensure

competency on a kayak. For example, the handler must be able to recognize the dog's *proximity alert behaviors* and *final response* and be able to determine the direction the dog wishes to go, under these unique circumstances. The handler should be an experienced kayaker and demonstrate the ability to paddle while observing the dog. A handler assistant is required for kayak surveys, either on land within sufficient distance for communication or in a kayak, so data can be properly recorded and the handler can concentrate on the dog and maneuvering the vessel.

Before conducting surveys from a kayak, the dog-handler team must meet the criteria in the *Giant Garter Snake Scent-Detection Dog Team Validation Guidelines* (HTH 2018) specific to surveys from a small vessel or kayak.

Survey Area: The survey area shall include the perimeter of the aquatic feature to be surveyed, as well as meandering transects within the water body.

Survey Transects: The kayak transects will be chosen at the discretion of the handler taking into account current environmental and weather conditions. To avoid excessive backtracking, survey transects on the water should be initiated at the furthest downwind position possible and continue upwind in a diagonal fashion. Width of transects will vary depending on wind speed. Light wind (1–5 km/h) or lack of wind will require closely spaced transects while stronger winds (5 km/h or greater) will allow for widely spaced, and fewer, transects. Areas of the water with deep vegetation or debris may require a more detailed search by the team.

Equipment and Other Specifications: Scent detection dog handlers shall not permit the detection dog to touch a basking snake, or follow a snake moving in the water. A GPS unit shall be used to record the survey tracks of the handler and/or the detection dog. Waterproof containers for data recording devices should be used. Handlers must perform kayak surveys with a handler assistant to aid in recording necessary data. The detection dog and handler must wear a personal floatation device.

Data to Record:

- All data specified in Section 2.2.1

Data to Report:

- All data specified in Section 2.2.1
- Location of reference ponds, specification of which is occupied and unoccupied by GGS, and source of information pertaining to the known occupancy of the ponds
- Date of reference survey(s)
- Names and roles of surveyors involved
- Results of reference survey(s)

2.3 Surveys of GGS Occupancy in Over-Wintering Upland Habitats

The goal of surveying for GGS in their upland habitat is to detect the snakes during their inactive period, when they are sheltering in small mammal burrows or other natural and human-made objects for an extended period of time. Therefore, upland surveys will normally be conducted from October through March. Surveys for GGS that are housed in burrows has not yet been tested, so the techniques herein are intended to guide the methods that should be employed during testing of this method. As more data are gathered, this technique will be refined.

A detection dog should have the ability to perform a passive *final response* (e.g. sit, down, or stare) to indicate the presence of GGS in a burrow. In section 2.2, it was suggested that the handler record *proximity alert behaviors* because of the difficulty or impossibility of locating a single snake in a water column. Situations may arise during inactive season surveys in which it is informative to record *proximity alert behaviors* because of inaccessible areas or potential for *residual scent* in water bodies. Handlers shall record all dog behaviors that would aid managers in making decisions regarding occupancy or identify areas of further study.

Survey Area: Over-wintering snakes have used burrows as far as 250 meters (820 feet) from the edge of summer aquatic habitat (G. Hansen 1988; Wylie *et al.* 1997). Therefore, surveys during the inactive period shall include a buffer of 250 meters from the water source, or less depending on the property boundaries and limits of suitable habitat at the site being surveyed. Handlers should not attempt to survey inaccessible areas, and shall indicate areas not able to be surveyed, and the constraints that led to the decision, on a map when results are reported.

Survey Transects: Detection dog surveys differ from traditional human survey efforts in that the survey coverage area depends on terrain and localized weather conditions, especially wind speed and direction and the amount of relative humidity. Survey patterns can vary daily or within a survey day. The dog handler shall direct the dog to search the study area so that all areas with suitable refuge have been searched to achieve 100% coverage.

Equipment and Other Specifications: During the GGS inactive period, handlers can choose whether to use a leash during surveys depending on the search style, presence of hazards to the dog, preference of the handler, or characteristics of the dog. A GPS unit shall be used to record the survey tracks of the handler and/or the detection dog. Handlers may choose to survey with a handler assistant to navigate and aid in recording necessary data.

Data to Record:

- All data specified in Section 2.2.1

Data to Report:

- All data specified in Section 2.2.1

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