Monitoring Giant Garter Snakes at Colusa National Wildlife Refuge: 2002 Progress Report

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Introduction

Giant garter snakes (*Thamnophis gigas*) are both federally and state listed as a threatened species and as such there is a desire to increase their populations so that they may eventually be delisted. In 1998 the USFWS Sacramento National Wildlife Refuge Complex was awarded a grant from the CVPIA B1(other) funds to purchase agricultural lands adjacent to the Colusa National Wildlife Refuge and create wetland habitat that would specifically benefit the population of giant garter snakes on the refuge (Figure 1). Construction of these wetlands was completed in fall 1999. In 2000 the USGS-BRD Dixon Field Station was awarded CVPIA B1(other) funds to monitor giant garter snakes in these wetlands as they develop over time and assess their habitat benefits for giant garter snakes with the goal of adaptively managing these wetlands to benefit this species. This report summarizes our progress for 2002, the third year of our monitoring study for giant garter snakes at Colusa National Wildlife Refuge.

Goals and Objectives

The goal of our project is to assess the benefits of the restored wetland habitat for giant garter snakes at Colusa NWR and develop a site-specific management plan for giant garter snakes based on our observations. Our objectives are 1) document the phenology of snake colonization of the restored habitat, 2) evaluate habitat use in the restored habitat, and 3) estimate the densities of giant garter snakes in the restored habitat and compare them with estimates from other habitats.

Methods

We sampled giant garter snakes by hand captures and trapping as developed in our previous work (Casazza et al., 2000). We focused our search in and around the restoration site and on the main canal north of the intersection of Able and Ohm roads (Figure 2). This search area has the highest concentration of snakes based on our previous work (Wylie et al. 1997) and is the most pertinent to colonization and use of the restored habitat. Captured snakes were measured for length and weight and their sex was determined using sexing probes. Individuals were scanned to detect PIT tags implanted in previous studies and previously unmarked snakes were implanted with PIT tags. The program CAPTURE was used to estimate densities of snakes per linear distance along the ditches we trapped based on mark-recapture information.

Ten of the female giant garter snakes we implanted with radios during 2001 began the winter of 2001-2002 with active radios. Snake movements were monitored with hand-held and vehicle mounted telemetry units (White and Garrott, 1990) weekly during the winter and daily after spring emergence from underground wintering habitat. Habitats used by relocated snakes were characterized according to our protocols. Home range estimates for radio-implanted snakes were calculated with the adaptive kernal method of Worton (1989).

Results and Discussion

We caught 128 individual giant garter snakes in 2002 of which 53 were males and 75 were females. Of the snakes caught in 2002, 31 were recaptures mostly from the previous two years. For comparison, in 2001 we caught 102 giant garter snakes (44 males and 58 females) and in 2000 we caught 81 giant garter snakes (28 males and 53 females). Trap and capture locations for 2002 are shown in Figures 1 and 2. Individual females ranged in size up to 1.1 m snout-vent length and 900 grams (Figures 3 and 4). The size distributions continue to reflect a healthy population of giant garter snakes with successful recruitment of the young. Density estimates range from 60 to 103 snakes per kilometer depending on the trapping location on the Refuge (Table 1), similar to values from 2001 (50-105/km).

Radios in three of the ten snakes failed at different times during the winter. Radios in remaining snakes also failed at various times over the summer with a radio in one snake lasting until fall. Analysis of movements showed home ranges varied from 7-95 ha (Tables 2-7) with movements restricted to Refuge land (Figures 5-10), showing greater fidelity to canal and restoration habitats on the Refuge compared to previous years. In maintaining water in summer for giant garter snakes the restoration area was likely effective in meeting the habitat needs of the snakes so they did not have to venture as far as in previous years to find aquatic habitat during summer. Also, vegetative cover has rapidly matured in the restored wetlands providing good habitat for snakes. This reduced movement also means snakes were less exposed to mortality factors such as predators and vehicles.

Cover classes for habitats used by giant garter snakes are shown in Figure 11. Snakes were generally in or on the edge of ditches and wetlands and almost always used vegetative cover. Use of terrestrial vegetation reflects the dry spring of 2002, similar to results for 2001. Although riprap accounts for only 3% of our observations, the riprap habitat at the intersection of Able and Ohm roads continues to be extremely valuable as an over-wintering site for giant garter snakes. Perennial pepperweed (*Lepidium latifolium*) has grown up substantially around the riprap and may inhibit snake use of this area during the active season because of restricted basking areas.

Results of our 2002 field season continue to show a healthy population of giant garter snakes in the vicinity of the restoration project. The potential for colonization and use of the restored habitat is being realized as indicated by our telemetry and trapping results. We have been successful in marking giant garter snakes and establishing base-line estimates of snake densities to monitor the effect the restored habitat will have on giant garter snake numbers on the Colusa National Wildlife Refuge in succeeding years as the restored habitat matures. The habitat measurements we are making will help us to devise a habitat management plant for the Refuge staff in procedures to further enhance habitat values for giant garter snakes on the Refuge and hopefully increase their population size.

Literature Cited

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Worton, B. J. 1989. Kernal methods for estimating the utilization distribution in home range studies. Ecology 70(1): 164-168.

White, G. C. and R. A. Garrott. 1990. Analysis of wildlife radio-tracking data. Academic Press, San Diego, CA. 383 pp.

Wylie, G. D., M. L. Casazza, and J. K. Daugherty. 1997. 1996 progress report for the giant garter snake study. USGS, Dixon Field Station, Dixon, CA.

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Tables and Figures

Table 1. Statistics regarding the number of snakes at the Colusa National Wildlife Refuge 2002.

Trapline Name	Population Estimate	Density (snakes/km)
J-Canal	103 " 28 (95% C.I. 66-186)	120
T24	60 " 14 (95% C.I. 42-102)	30

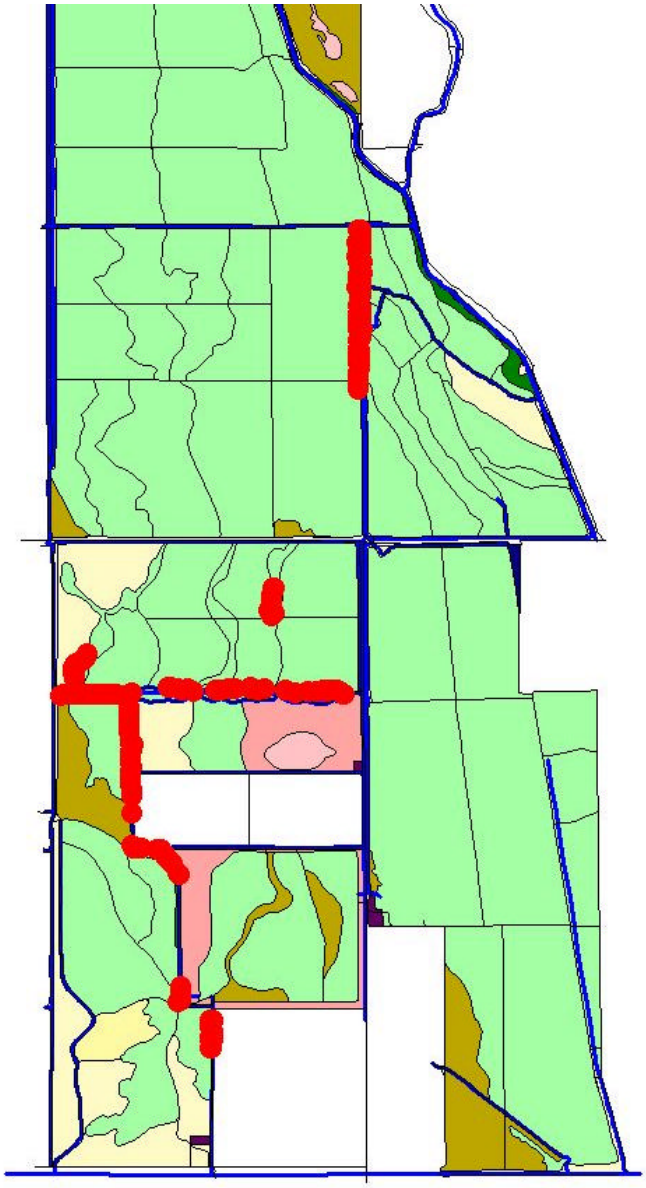

Figure 1. Trap locations for giant garter snakes at Colusa National Wildlife Refuge, 2002 field season

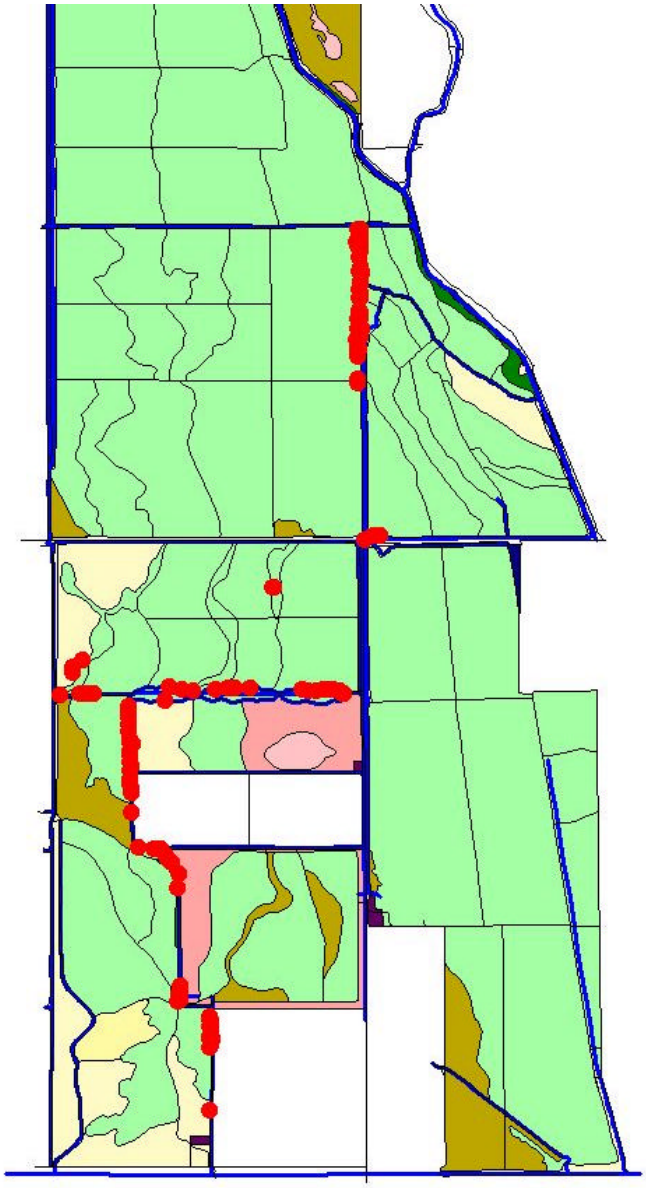

Figure 2. Capture locations for giant garter snakes at Colusa National Wildlife Refuge, 2002 field season.

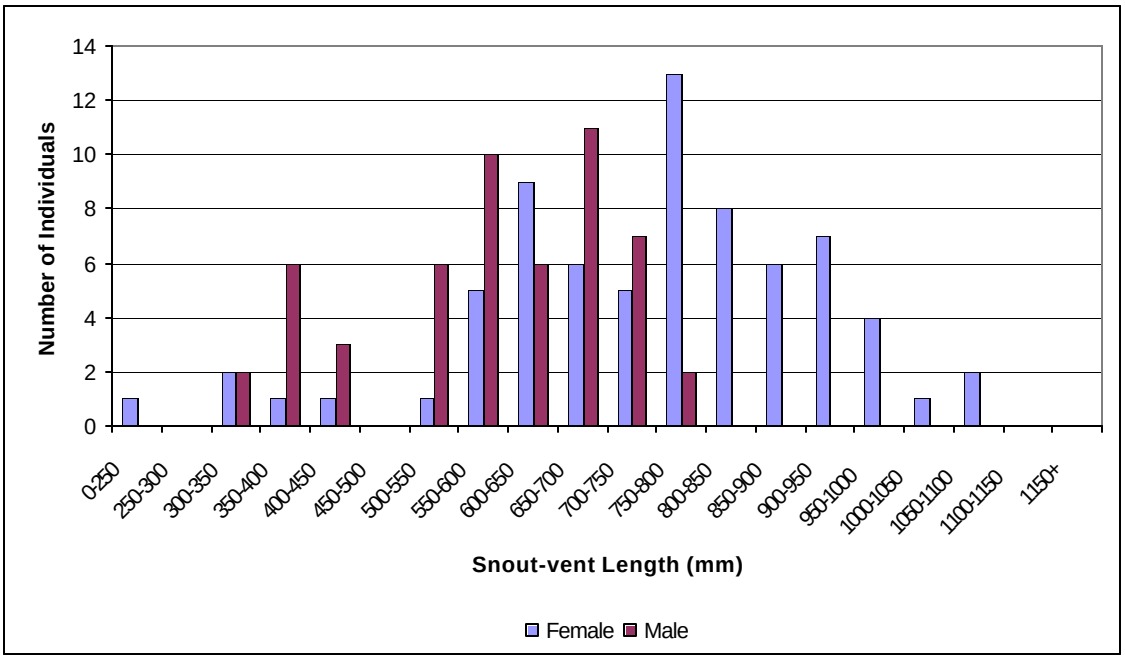

Figure 3. Length frequency distribution of giant garter snakes caught in 2002.

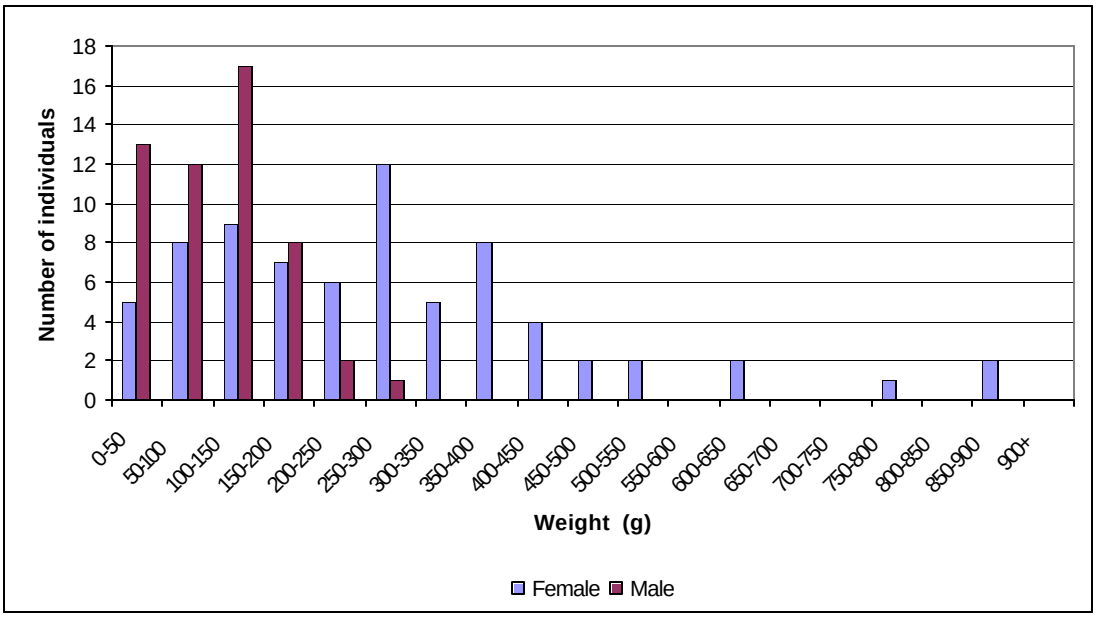

Figure 4. Weight frequency distribution of giant garter snakes caught in 2002.

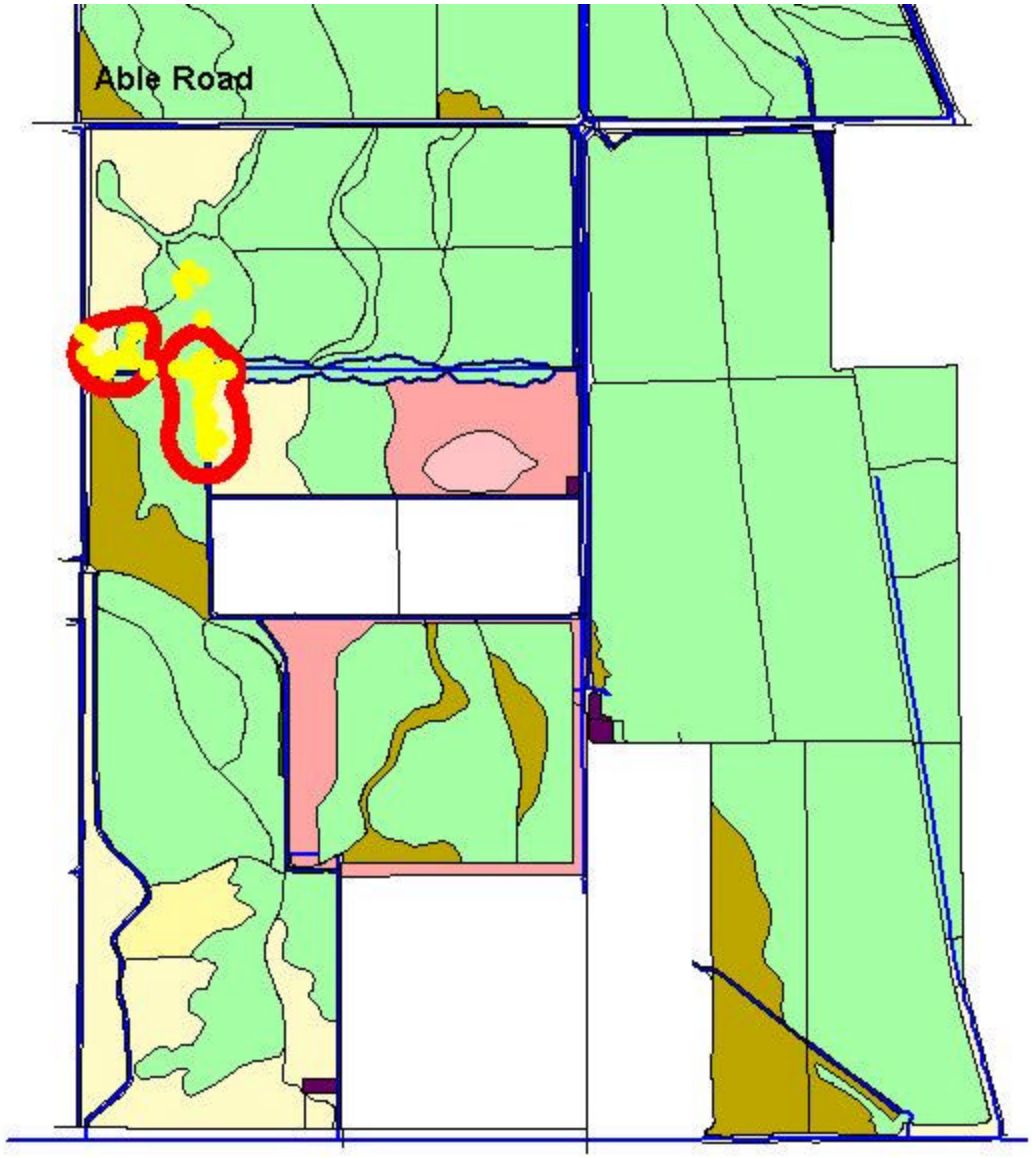

Figure 5. The red polygon represents the home range size calculated by the spatial analysis program Home Range, using the adaptive kernel method at a 95% confidence interval, for the giant garter snake with radio **frequency 4510**. The yellow dots represent the locations recorded for the snake each time it was tracked.

Table 2. Home range size in hectares for radio-marked giant garter snake.

Frequency	**Home Range size (ha)**
4510	14.4

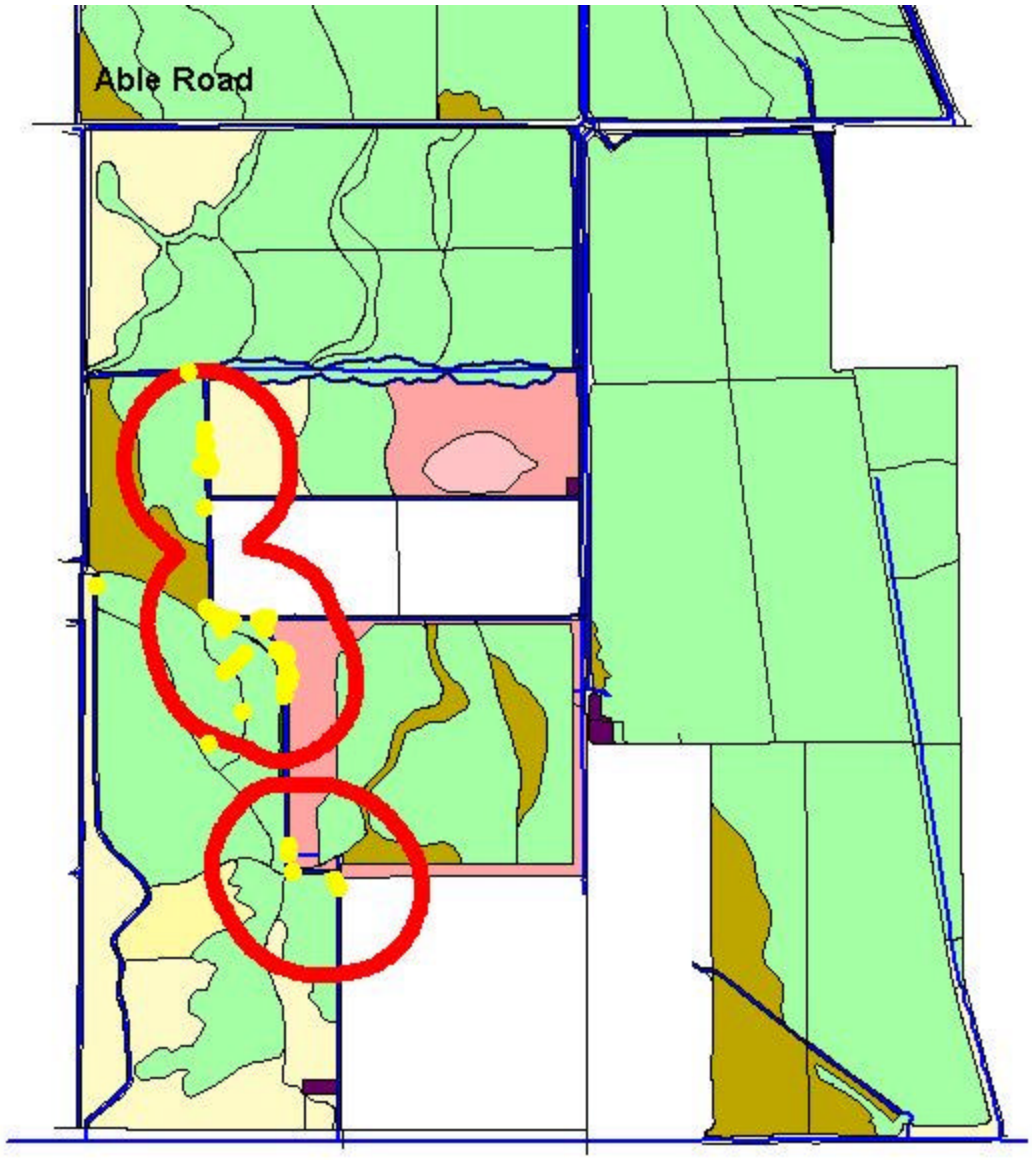

Figure 6. The red polygon represents the home range size calculated by the spatial analysis program Home Range, using the adaptive kernel method at a 95% confidence interval, for the giant garter snake with radio **frequency 4521**. The yellow dots represent the locations recorded for the snake each time it was tracked.

Table 3. Home range size in hectares for radio-marked giant garter snake.

Frequency	**Home Range size (ha)**
4521	94.6

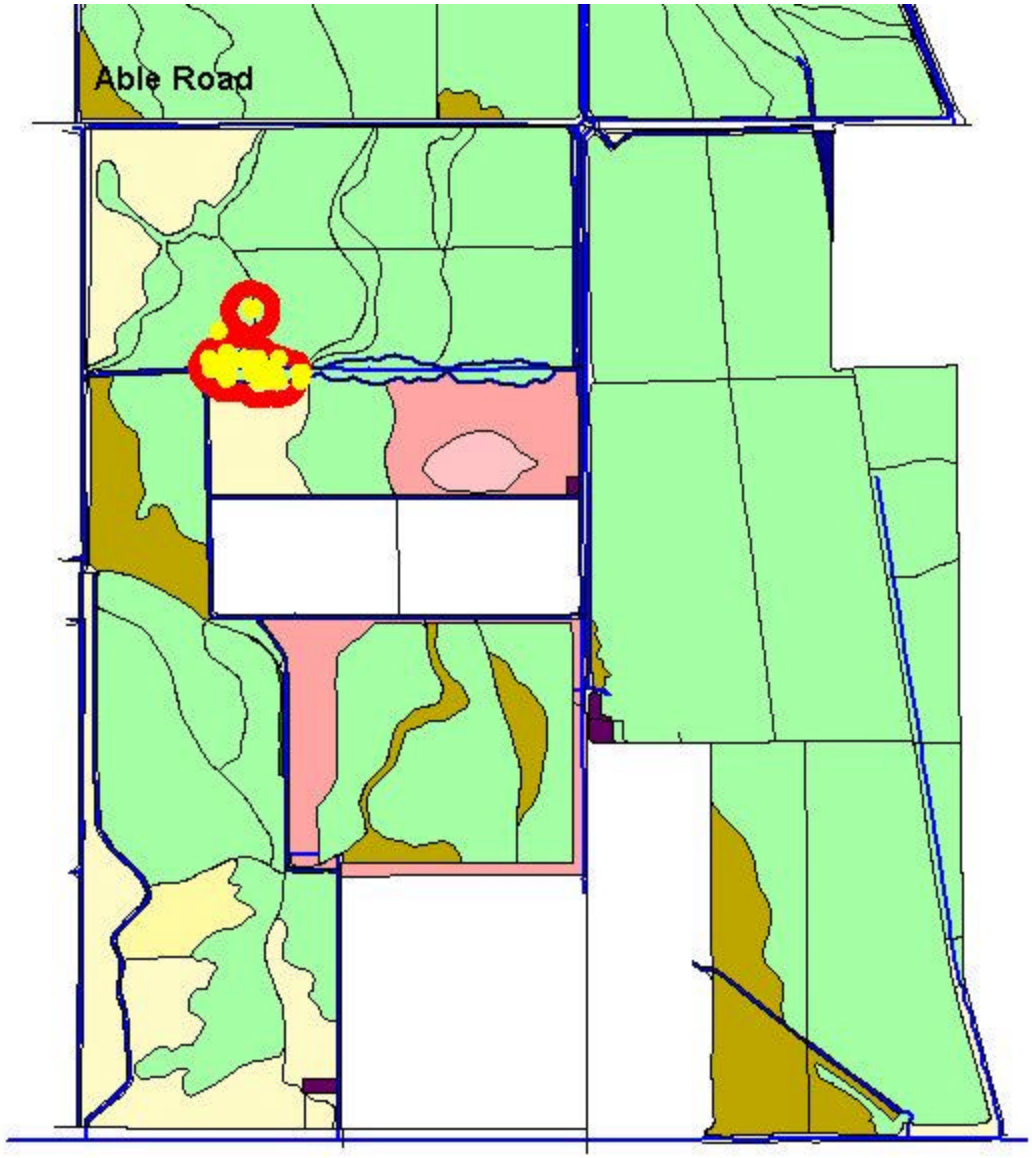

Figure 7. The red polygon represents the home range size calculated by the spatial analysis program Home Range, using the adaptive kernel method at a 95% confidence interval, for the giant garter snake with radio **frequency 4665**. The yellow dots represent the locations recorded for the snake each time it was tracked.

Table 4. Home range size in hectares for radio-marked giant garter snake.

Frequency	**Home Range size (ha)**
4665	6.7

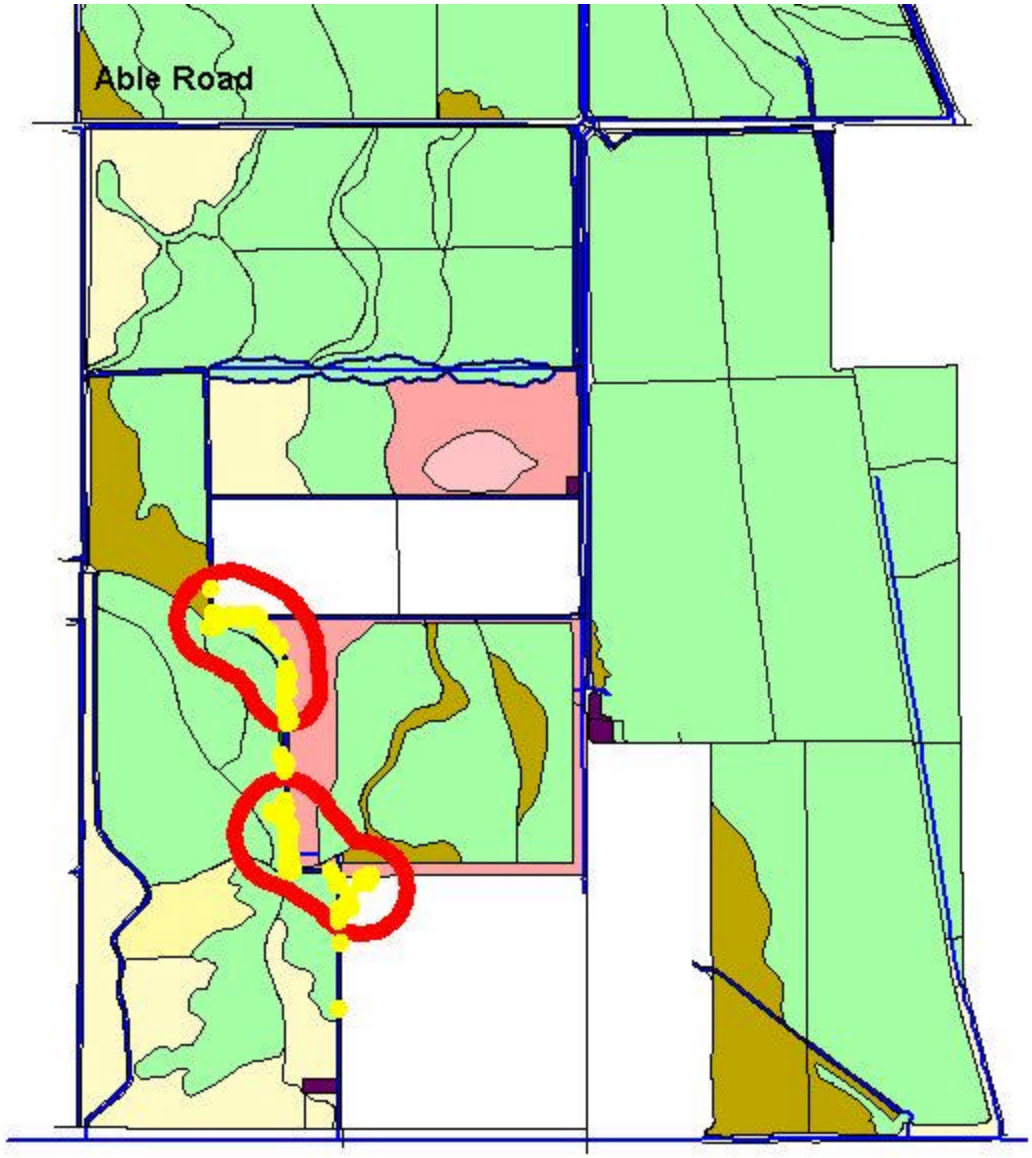

Figure 8. The red polygon represents the home range size calculated by the spatial analysis program Home Range, using the adaptive kernel method at a 95% confidence interval, for the giant garter snake with radio **frequency 4687**. The yellow dots represent the locations recorded for the snake each time it was tracked.

Table 5. Home range size in hectares for radio-marked giant garter snake.

Frequency	**Home Range size (ha)**
4687	31.8

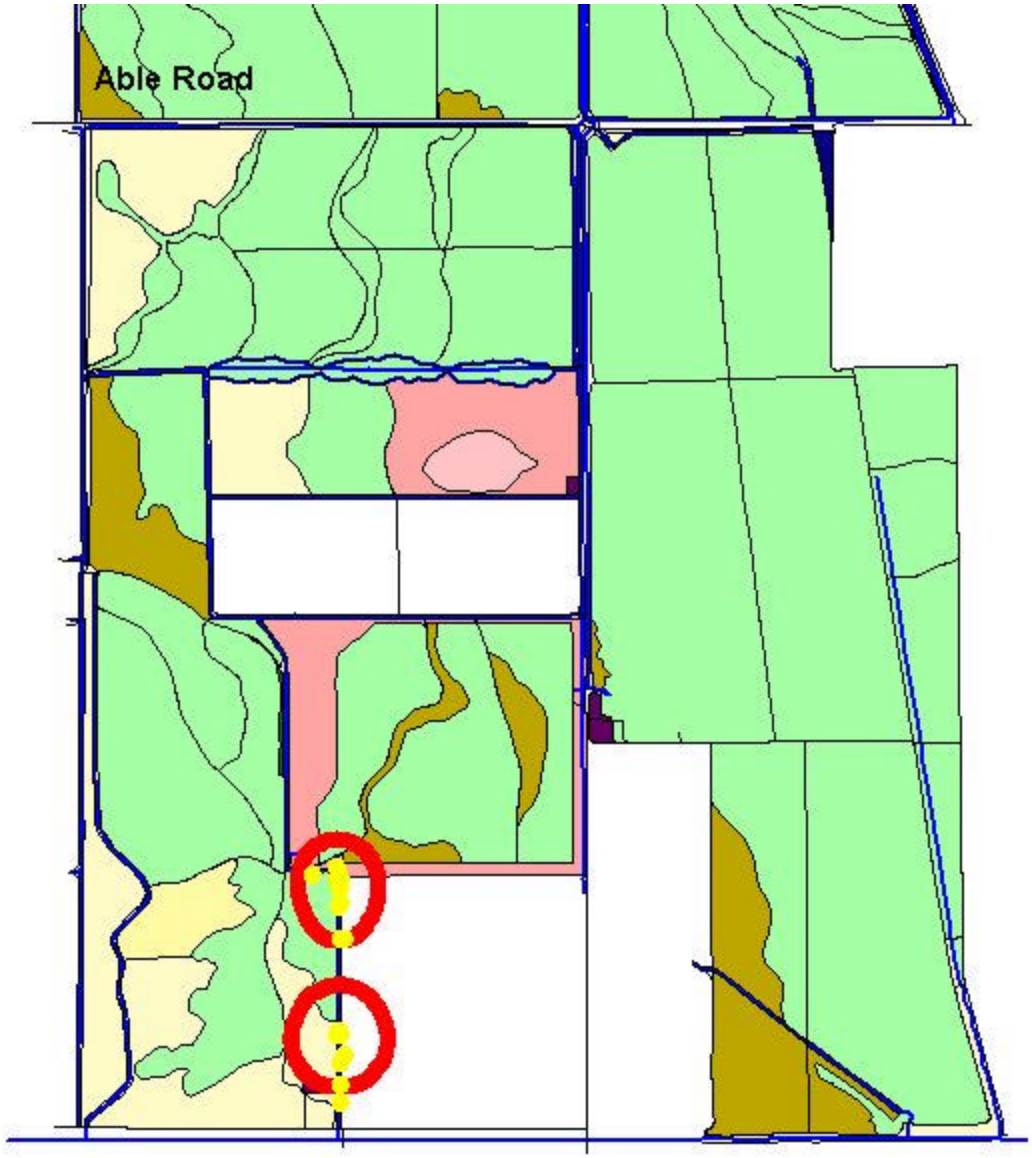

Figure 9. The red polygon represents the home range size calculated by the spatial analysis program Home Range, using the adaptive kernel method at a 95% confidence interval, for the giant garter snake with radio **frequency 4820**. The yellow dots represent the locations recorded for the snake each time it was tracked.

Table 6. Home range size in hectares for radio-marked giant garter snake.

Frequency	**Home Range size (ha)**
4820	15.0

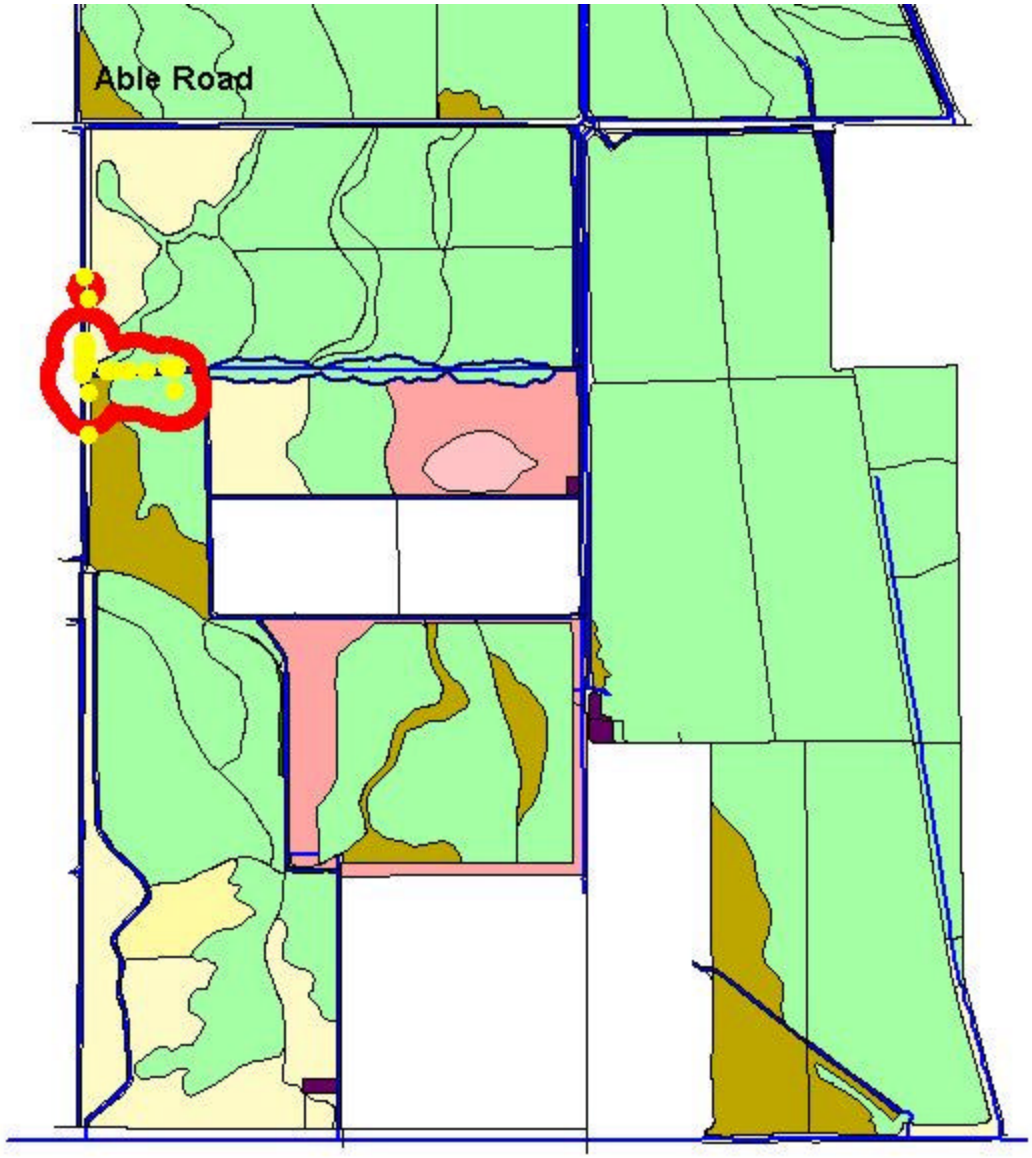

Figure 10. The red polygon represents the home range size calculated by the spatial analysis program Home Range, using the adaptive kernel method at a 95% confidence interval, for the giant garter snake with radio **frequency 4991**. The yellow dots represent the locations recorded for the snake each time it was tracked.

Table 7. Home range size in hectares for radio-marked giant garter snake.

Frequency	**Home Range size (ha)**
4991	13.6

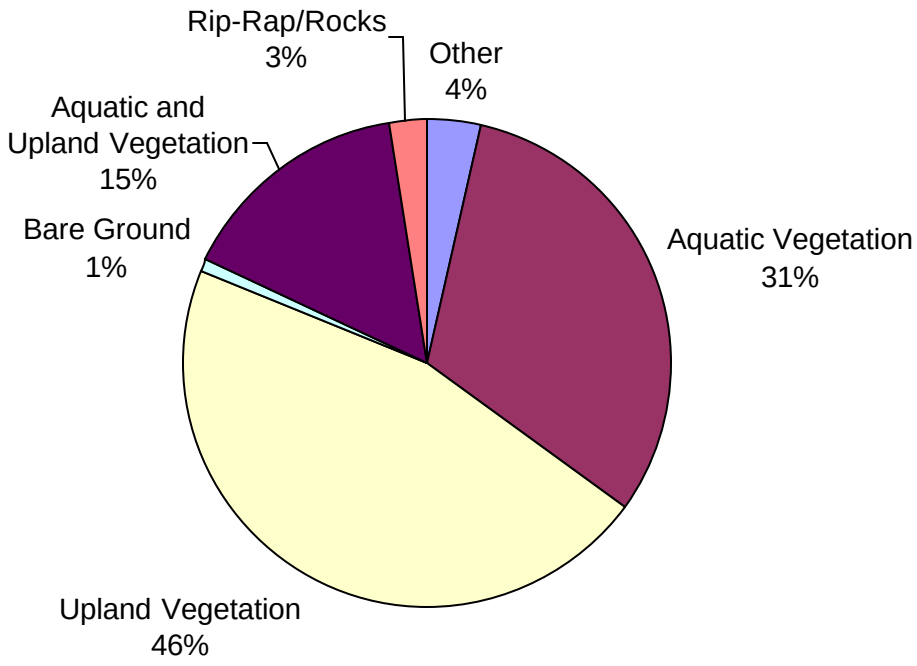

Figure11. Cover classes used by radio-marked giant garter snakes at Colusa National Wildlife Refuge, 2002 field season.