PROGRESS REPORT: 2003 SAN JOAQUIN VALLEY GIANT GARTER SNAKE CONSERVATION PROJECT

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INTRODUCTION & BACKGROUND:

The giant garter snake, *Thamnophis gigas* (Rossman & Stewart 1987), was designated as a federally threatened species throughout its range in October 1993 and (USFWS 1993). Giant garter snakes are endemic to the Central Valley of California, and historically occurred throughout the San Joaquin and Sacramento Valleys (Hansen and Brode 1980). They are thought to have occurred as far north as Butte County and south to Kern County, within the boundaries of the foothills of the Coastal and Sierra Nevada ranges. The current range of the giant garter snake is confined to the Sacramento Valley and isolated portions of the San Joaquin Valley (USFWS 1999).

The giant garter snake is primarily an aquatic species that feeds on small fishes, tadpoles, and frogs (Fitch 1941). Historically, prey items included thick-tailed chub (*Gila crassicauda*), Sacramento blackfish (*Orthodox microlepidus*), and the California red-legged frog (*Rana aurora draytoni*), all of which have been extirpated from the giant garter snake's current range (Rossman et al 1996). The habitat requirements of giant garter snakes include wetland areas with sufficient emergent vegetation for cover, openings in the vegetation for basking, and access to rodent burrows for shelter and winter periods of reduced activity (USFWS 1993). Giant garter snakes tend to be absent from rivers that support populations of large predatory fish as well as watercourses that have sand, gravel or rocky substrates (Hansen 1980). Giant garter snakes are less active or dormant from October until April when they emerge to breed and forage. Giant garter snakes are viviparous, giving birth to 10 to 46 young from late July through early September (Hansen and Hansen 1990). Snakes can grow to a total length of 120cm (Stebbins 1985), and become sexually mature in 3 (males) to 5 (females) years (USFWS 1993).

Loss of historic habitat has occurred throughout the range as a result of conversion of wetlands for development of agricultural lands and urban expansion. Farming practices such as intensive vegetation control along canal banks and livestock grazing at waters edge, and replacement of native vegetation by non-native invasive species have degraded much of the remaining habitat. Additionally, giant garter snakes face increased threats from parasites and predation by both native (raccoons, skunks, opossums, foxes, hawks,

egrets and herons) and invasive (large mouth bass, catfish, feral cats, and bullfrogs) species (USFWS 1993, Carpenter et al 2002).

Passage of the Central Valley Project Improvement Act in 1992 has provided wetland managers with dependable water supplies and allows management practices that will benefit and improve giant garter snake habitat. However, associated management practices, such as increased canal dredging to improve water delivery capability and more intensive water level manipulation, can potentially adversely impact giant garter snakes. Consequentially, the U.S. Bureau of Reclamation (BOR) has been funding research in the Central Valley on the distribution and ecology of giant garter snakes. The overall goals are to: 1) document locations of snake populations as well as potential locations where snakes have not been found but may disperse in the future; 2) gather information that can lead to recommendations for improvements in the standard avoidance and minimization measures issued by FWS to govern construction and waterway maintenance; and 3) gather information that will be used for future giant garter snake habitat restoration and species recovery actions.

Surveys for giant garter snakes have been conducted annually by California Department of Fish and Game (CDFG) personnel on state and private lands within the Grasslands Ecological Area (GEA) of the northern San Joaquin Valley since 1998. The only survey conducted on San Luis National Wildlife Refuge (SLNWR) prior to 2003 was a limited effort on C Canal in 1998. In that same year, giant garter snakes were captured south and west of SLNWR in Los Banos Creek, Agatha Canal, and Mud Slough South (Wylie 1999). Both of these water courses flow through the refuge and were historical locations of captures of giant garter snakes (Stebbins 1985). In 2003 Refuge staff, using BOR funding provided through the FWS Sacramento FWO, initiated a project was conducted by USFWS to determine the presence/absence and population densities of giant garter snakes on SLNWR. This work was closely coordinated with parallel survey efforts being conducted by CDFG and represents the first year of what is planned as a three-year survey project on the Refuge.

SURVEY AREAS:

A total of eight sites were surveyed on SLNWR. Survey sites were established on the Kesterson unit of the refuge including Los Banos Creek, Mud Slough North (Figure 1), and Sand Slough (Figure 2), and the San Luis unit of the refuge, including Deadman Slough, Winton Marsh and two sites on the San Joaquin River (Figure 3).

METHODS:

Snake Trapping and Handling

We used modified floating minnow traps (Casazza et al 2000), placed approximately 10 meters apart, against the banks or at the edges of stands of cattails, bulrush or other emergent vegetation along the length of the survey site (Dickert 2003). Areas with steep vertical or undercut banks with little or no vegetation were avoided because such

locations lacked points of attachment for traps and generally had high water velocity, which would have increased probability of trap loss. Each trap was assigned a site number, a session number and a trap number. Each site was recorded in UTM coordinates using a Trimble GPS unit. Multiple survey sites were trapped at any given time with up to 170 traps deployed at any individual site. Some sites were covered in their entirety by a single trap line, while others were long enough that they had to be trapped in segments (sessions). In those instances the segments, or sessions, were trapped sequentially along the stream-course until the entire survey site was covered. Each survey site, or session, was trapped continuously for a minimum of fourteen days. All traps were checked daily and non-target captures such as fish, amphibians, and crayfish were recorded as type and size class for prey base information and removed from the traps. Air and water temperature were recorded at the beginning of each trap line each day prior to checking traps.

Handling and processing of captured giant garter snakes followed procedures previously established by CDFG. Under those protocols, any snakes captured were to be placed in cloth bags, and transported in a cooler with a cold pack to prevent overheating. Care was taken not to place the bagged snake to close to the cold pack to prevent injury to the snake. Snakes were taken to a central location, at the CDFG office at the Los Banos Wildlife Area, for processing. Snakes were weighed to the nearest gram and measured to the nearest millimeter with a flexible tape measure to determine total length and snout to vent length. Snakes were sexed using a lubricated probe (Zulich 2003), as well as by visual comparison and morphological measurements. Species identification was confirmed using established physical markers including pattern, coloration, and various scale measurements and counts (Rossman et al 1996). Snakes were fitted with passively induced transponder (PIT) tags to provide mark/recapture data as well as individual identification. Snakes were then returned to the location of capture and released. Population densities were estimated using mark/recapture data.

Habitat Description and Assessment

The overall characteristics of the eight survey sites were described and evaluated in the context of suitability as giant garter snake habitat. Bank-side vegetation was identified and recorded at the location of each trap. Upland habitat characteristics were recorded at each site using California Native Plant Society's vegetation rapid assessment. This method consists of identifying homogenous areas of vegetation and delineating each of these areas as a "stand". Stands were identified based upon the California Native Plant Society's definition as described in the vegetation rapid assessment protocol. Dominant species and size/extent of the stand were identified & recorded. Each stand was identified as a vegetative series using descriptions in *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995). The rapid vegetation assessment protocol was modified for our use in that we confined our assessment to within 200 meters of the waters edge. This resulted in an approximately 400-450 meter wide corridor for the length of each trap site.

Data Compilation and Management

Survey data accumulated in the 2003 field season included information about trap location and timing, prey availability, water and air temperature and bank-side vegetation. This data was entered into a Grasslands-wide giant garter snake database. Data entry was still in progress at the time of report preparation. This database was designed by CDFG using Microsoft Access software and will contain survey information collected by Refuge staff and CDFG staff on refuge, state, and private lands for each year of this multi-year project. The database will be maintained by CDFG at the Los Banos office. A working and compatible copy of this database will be maintained at the San Luis NWRC office. Habitat data collected using the California Native Plant Society's vegetation rapid assessment protocol was used to create a permanent file with descriptions of upland habitat at each site. Hard copies of Vegetation Rapid Assessment forms contained in the permanent file are referenced to a spatial database created using ARCMAP software. This spatial database contains maps of survey areas and associated habitat types. Both the vegetation assessment file and the database will be maintained at the San Luis NWRC office.

RESULTS AND DISCUSSION

Snake Trapping and Handling

A total of 16,797 trap days were accumulated from May until August of 2003. Approximately 10 km of canals, sloughs, and creeks were surveyed. No giant garter snakes were observed or captured on refuge lands during the 2003 trapping season. Two valley garter snakes (*Thamnophis sirtalis fitchi*) and one yellow bellied racer (*Coluber constrictor mormon*) along with numerous fish, bullfrogs, and invertebrates were captured and released. Non-target captures were primarily minnows (*Menidia*, *Notropis,* and *Pimephales* ssp.), Mosquito fish (*Gambusia affinis*), sunfish (*Lepomis* ssp.), carp (*Cyprinus carpio*), bullheads (*Ictalurus* ssp.), bullfrogs (*Rana catesbeiana*), crayfish (Cambarinae), and shrimp (Palaemonidae).

SLNWR survey crew members participated in handling, measuring, weighing, sexing, species identification, and PIT tagging of giant garter snakes captured by CDFG under direct supervision of the CDFG lead biologist.

Despite the fact that no giant garter snakes were caught at the Refuge locations surveyed during the 2003 season, there is much available habitat on SLNWR. There are several possibilities as to why snakes were not captured at the sites surveyed in 2003, including extirpation of giant garter snakes from this area. Other possible factors include low population density, lack of suitable habitat, high predation pressure, or disease. The modified floating minnow trap used for this survey has been shown to have a very low (2.3-3.7%) capture rate (Casazza et al 2000). All sites appear to have adequate prey base, summer water, high water refugia, and good vegetation characteristics. However, certain habitat suitability factors at each site may not meet the requirements of giant garter snakes. In the case of Los Banos Creek, the large variation in water flow and narrow corridor of bank side vegetation may lower the quality of this site for use by giant garter snakes. Likewise, high water velocity and variable flow rates might reduce habitat quality

for giant garter snakes in Mud Slough. There are some backwater marshes and channels, although these areas are often dry during times of low flow, thus potentially making them poor quality sites. Interestingly, the CDFG crews trapped the portions of Los Banos Creek and Mud Slough on State lands during the same time in 2003 and also recorded no captures. San Joaquin River site 1 has a number of good characteristics, but the surface vegetation may present a barrier to movement to and from, as well as across, the surface of the water. Deadman Slough appears to have a very large bullfrog population.

Despite the lack of giant garter snakes captured, the 2003 survey season was successful in several ways. Equipment was purchased and 400 traps were constructed, all of which can be used for future surveys. Literature and spatial data was collected and files created to form a foundation of information pertaining to giant garter snakes. The 2003 survey effort resulted in a more detailed knowledge of available habitat for giant garter snakes on San Luis NWR. Vegetation assessments of survey areas, as well as anecdotal information gathered while investigating possible trapping sites, can be used in future survey site selection. Information about other habitat characteristics, such as prey base and streamside vegetation, can also be used to evaluate and prioritize future surveys. However, no conclusions can be drawn from the 2003 survey. The lack of captures may or may not indicate a lack of giant garter snakes in the areas surveyed. Since such low capture rates have been attributed to the modified floating minnow traps, it is possible that giant garter snakes were present but not captured. New trap designs, and trapping/surveying methods need to be investigated.

Habitat Description and Assessment

A small section of Los Banos Creek runs within refuge boundaries, and consists mostly of cattail-lined banks with short stretches of open grass areas. The substrate is mud and the bank side cattail (*Typha ssp*) & tule (*Scirpus ssp*.) stands are narrow (~ 1.5m). The surrounding uplands are former agricultural fields that are dominated by introduced annual grasses. The depth and flow rate of Los Banos Creek is extremely variable due to intermittent agricultural run-off, dropping as much as 30 cm in on 24 hour period (pers observation).

Mud Slough North has a deep mud substrate. Some small (<1 ha) shallow channels leading off the main channel form expanses of still water with thick emergent vegetation. The bank side habitat varies from cattail/tule stands to dense pepperweed (*Lepidium latifolium*), to open short grass areas to vertical or undercut banks void of vegetation. Uplands consist of alkali sacaton (*Sporobulus airoides*) dominated communities or saltgrass (*Distichlis spicata*) dominated communities with scattered iodine bush (*Allenrolfea occidentalis*). Managed seasonal wetlands and a few vernal pools are also present. Mud Slough also has variable flow, but due to it's relatively larger size, the variation is not as extreme as Los Banos Creek. Water velocity can be swift at times of high flow.

Sand Slough is an anabranch of Salt Slough. During the summer, its primary source of water is outflows from Swan Lake, a permanent wetland at the upstream end of the area

surveyed. The slough has a mud substrate and highly variable flow rates. The banks of Sand Slough are primarily lined with cattails, thick enough in limited stretches to fill in the entire channel. Uplands are saltgrass dominated communities with scattered areas of invasive weeds such as yellow starthistle (*Centaurea solstitialis*), prickly lettuce (*Lactuca serriola*), and annual grasses. Unfortunately, Swan Lake was drawn down in July due to a previously scheduled habitat restoration project, resulting in Sand Slough becoming dewatered due to lack of flows.

The two areas surveyed on San Joaquin River (SJR) are dissimilar in structure, type of vegetation and flow rate. SJR site 1 is ringed by a thick growth of cattail/tule and 90% of the water surface is covered by duckweed (*Lemna* ssp.) and azolla (*Azolla* ssp.). The flow is minimal due to a large beaver dam at the downstream end of the trap-line. The upstream end of the trap-line begins in an old oxbow remnant that is ringed with willow (*Salix ssp*.) trees. There are a few scattered willow trees along the rest of the trap-line as well, but trees overhang the water in only a few very small areas. Since the San Joaquin River forms the refuge boundary in this area, the uplands were assessed only on the west side of the trap site. These uplands are saltgrass communities with several canals and levees. Uplands on the east side of the river are in pasture. The extensive floating plant cover affects the temperature of the water. Temperatures at the surface are much higher in areas where *Lemna* and *Azolla* are present, while temperatures are lower near the bottom due to the shading effect. SJR site 2 consists of a series of large, broad expanses of open water alternating with small narrow bottlenecks. These bottlenecks result from a narrowing of the river channel due to topography or beaver dams. The narrow bottlenecks have large stands of cattail/tule, some overhanging willow trees, and swift water flow. The large open areas have stands of cattail/tule growing intermittently with stands of grasses and sedges with few or no trees, and a reduced flow. The uplands adjacent to the river have a twenty to fifty meter wide forested riparian corridor identified as black willow series. Outside this riparian corridor, uplands west of the river are saltgrass communities with canals and levees present. The uplands east of the river are dominated by annual grasses. Both areas have a mud substrate.

Deadman Slough is a natural slough channel into which receives much of its water as outflows from managed wetlands on the San Luis unit of the refuge. This slough serves as a reservoir for re-using water among refuge wetlands, and in most years forms a permanent wetland basin. It has minimal flow and the bank side vegetation consists largely of stands of cattails and tule with intermittent areas of low growing, grassy vegetation. The uplands are saltgrass communities. The substrate is mud.

Winton Marsh is a permanent wetland with minimal flow. The bank side vegetation consists of thick stands of tule and cattails. The uplands are primarily saltgrass with weeds, such as pepperweed, thistle, and prickly lettuce, invading some areas. The area also contains several adjacent canals and levees. The substrate is mud.

The habitat requirements of giant garter snakes in the Grasslands Ecological area are still poorly understood. In the 2003 season, we looked at habitat in two ways; on a very small scale by identifying species of vegetation immediately surrounding each trap, and on a

very large scale by using the vegetation rapid assessment over large areas of uplands. Perhaps a more intermediate scale method designed to look at the linear habitat of a water course and its submergent and emergent vegetation, as well as, bank-side vegetation and the adjacent uplands would give a better, more accurate view. The methods used should also incorporate information about water quality, depth, flow rate, velocity, and sediment loads. Vegetation and/or habitat assessment methods designed for riverine or riparian habitat types may provide these techniques.

Data Compilation and Management

Survey data accumulated in the 2003 field season about trap location and timing, prey availability, water and air temperature and bank-side vegetation is in the process of being entered into a grasslands-wide giant garter snake database. This database will contain survey information collected by San Luis NWRC staff and CDFG staff for each year of this multi-year project. The database is being maintained by CDFG at the Los Banos office and there are some technical problems with the software that are still to be worked out. A working and compatible copy of this database will be maintained at the San Luis NWRC office as soon as possible. Habitat data for all 2003 survey sites in the form of Vegetation Rapid Assessment field data forms are referenced to a spatial database created using ARCMAP software. This spatial database contains maps of survey areas and associated habitat types. Both the vegetation assessment file and the database are maintained at the San Luis NWRC office.

RECOMMENDATIONS

Based on present knowledge of habitat needs of giant garter snakes, there is a significant amount of available habitat on SLNWR that has not been investigated. Surveys on these areas should be conducted and habitat data should be collected so that we can clearly understand the status and needs of giant garter snakes in SLNWR and the Grasslands area.

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2003 Survey Sites
Los Banos Creek and Mud Slough North

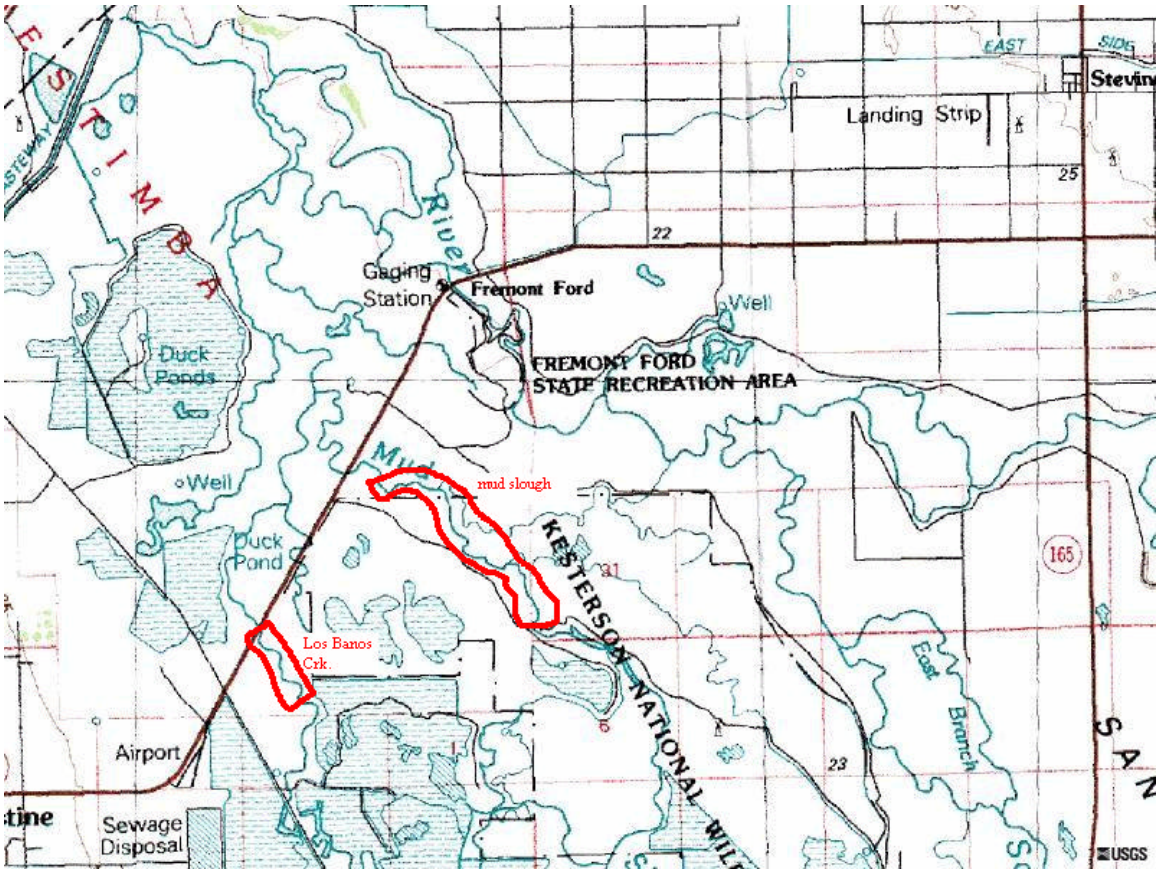

Figure 1.

2003 Survey Sites
Sand Slough

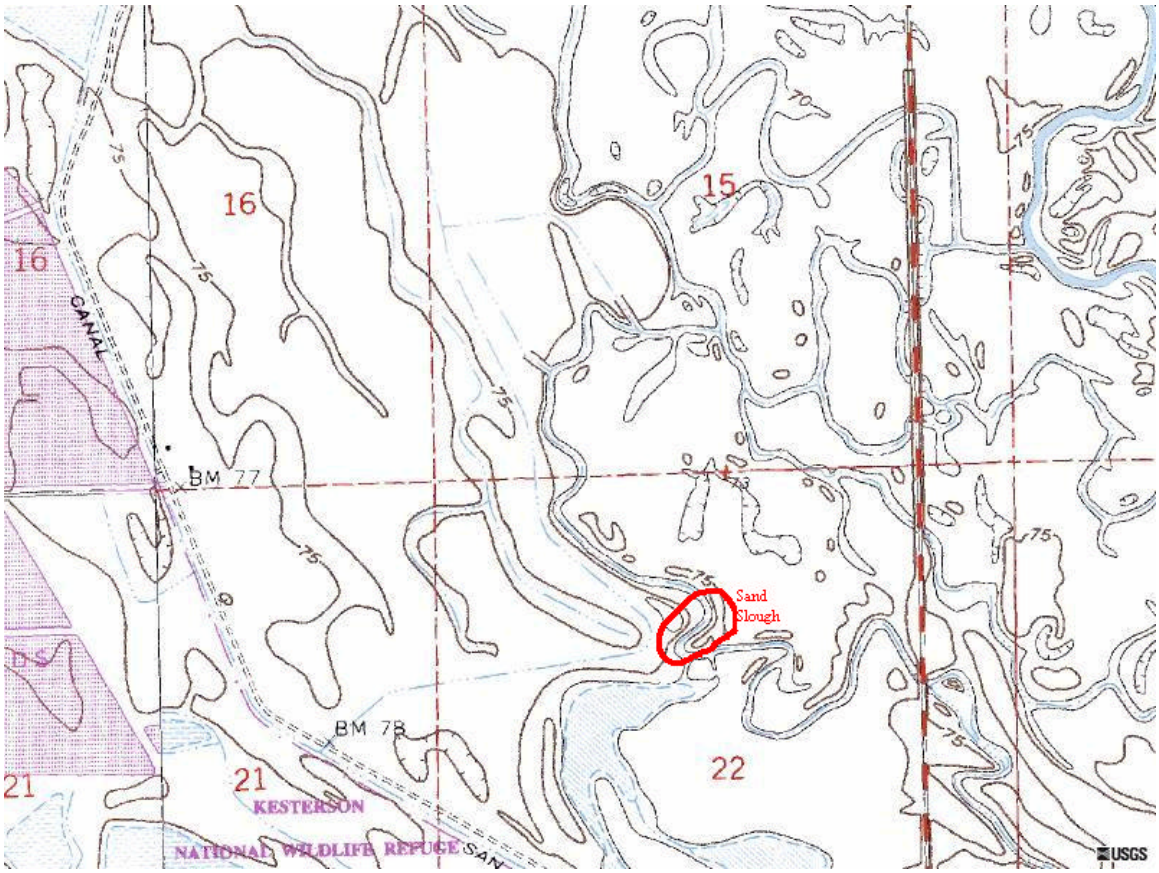

Figure 2.

2003 Survey Sites
Deadman Slough, Winton Marsh, and San Joaquin River # 1& 2

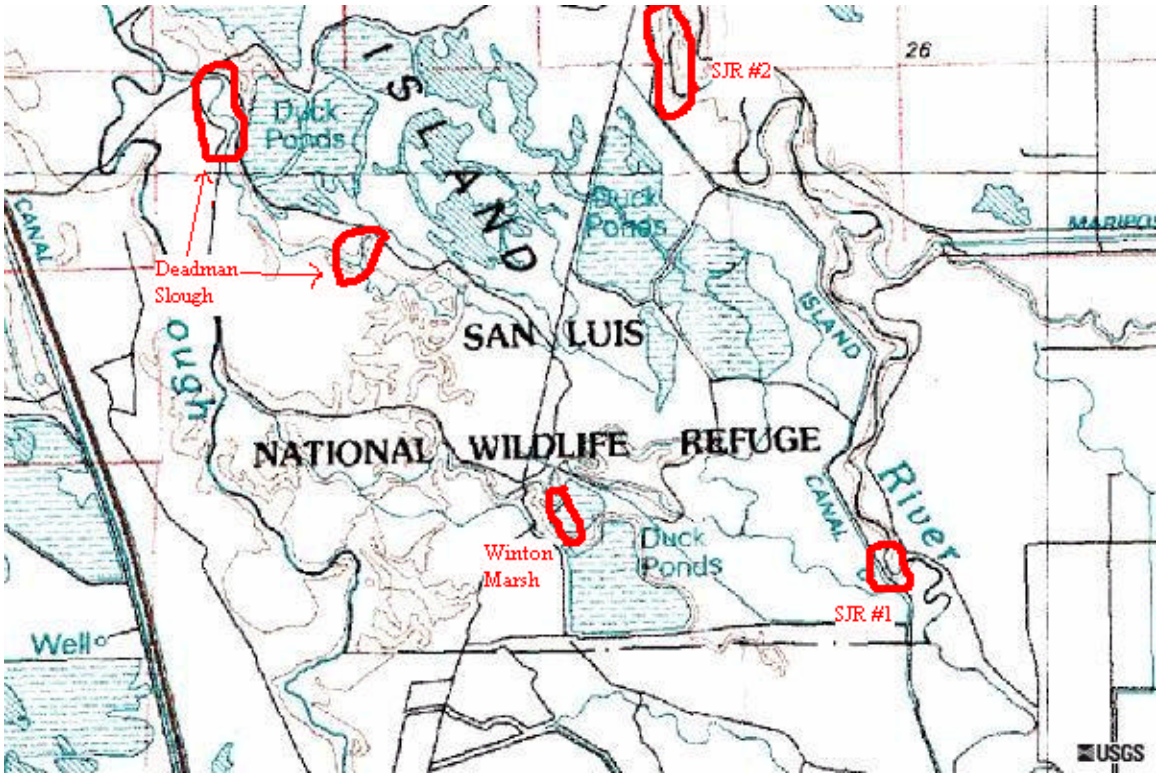

Figure 3.