



## United States Department of the Interior

U.S. GEOLOGICAL SURVEY  
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December 9, 2024

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Dear Ms. Kim Smith and Dr. Preston,

This letter transmits the U.S. Geological Survey (USGS) Western Ecological Research Center's Draft Final: San Diego Western Pond Turtle Monitoring and Restoration Effort January-December 2022. This work was completed under agreement number 548642.

Please note that this information is preliminary or provisional and is subject to revision. It is being provided to meet the need for timely best science. The information has not received final approval by the USGS and is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the unauthorized use of this draft data for interpretation or resource decision-making.

Please direct any questions to me at (619) 206-5686.

Sincerely,

Principal Investigator



# **San Diego Pond Turtle Monitoring and Restoration Effort, January 2022-December 2022**



# San Diego Pond Turtle Monitoring and Restoration Effort, January 2022-December 2022

By: Jeremy Sebes, Chris Brown, and Robert N. Fisher

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U.S. GEOLOGICAL SURVEY  
WESTERN ECOLOGICAL RESEARCH CENTER

## Data Summary

Prepared for:

### **San Diego Association of Governments**

Research authorized by:

**California Department of Fish and Wildlife**  
Scientific Collecting Permit (Entity) and MOU: SCP838

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Cover photographs: Top left, habitat at Sycuan Peak Ecological Reserve, by Jeremy Sebes. Top right, pond turtle at Ritchie Creek. Bottom, pond turtle in Tijuana River Watershed, by Jeremy Sebes.

## TABLE OF CONTENTS

Introduction.....	1
Study Area .....	2
Methods.....	2
Results.....	4
Discussion .....	9
Acknowledgments.....	10
Literature Cited .....	10

### **Tables**

Table 1.	Pond turtle sites surveyed .....	13
Table 2.	Species detections during pond turtle surveys .....	14
Table 3	All detected pond turtle age classes .....	15
Table 4.	Individual detected pond turtle age classes.....	15
Table 5.	Nonnative aquatic species (NAS) detected/removed from pond turtle restoration sites .....	16

### **Figures**

Figure 1.	Overview map – watersheds .....	17
Figure 2.	Overview map – survey sites and pond turtle detections.....	18
Figure 3.	San Juan and Santa Margarita River watershed survey locations.....	19
Figure 4.	San Luis Rey River watershed survey locations.....	20
Figure 5.	San Dieguito River watershed survey locations .....	21
Figure 6.	San Diego River watershed survey locations.....	22
Figure 7.	Sweetwater River watershed survey locations (1 of 2).....	23
Figure 8.	Sweetwater River watershed survey locations (2 of 2).....	24
Figure 9.	Otay River watershed survey locations.....	25
Figure 10.	Tijuana River watershed survey locations .....	26
Figure 11.	Pond turtle eggs discovered at Wheatley Preserve .....	26

### **Appendices:**

Appendix A.	Habitat photos from 2022 surveys in San Diego County .....	27
Appendix B.	Native species photos from 2022 surveys in San Diego County .....	30
Appendix C.	Photos of NAS from 2022 surveys in San Diego County .....	32
Appendix D.	Photos from camera stations during 2022 surveys in San Diego County .....	35

## INTRODUCTION

The western pond turtle (*Actinemys pallida*, formerly *A. (Emys) marmorata*) is California's only extant native freshwater turtle (Thomson et al. 2016). Until 2014 this turtle was considered a single species (Spinks et al. 2014). Recently the species has undergone taxonomic revisions with different agencies using variations of the taxonomy for the southern clade. The U.S. Fish and Wildlife Service recognizes the southern group as *Actinemys marmorata pallida* and the California Department of Fish and Wildlife recognizes it as *Emys marmorata*. Following the taxonomic revision to recognize two distinct species, we will refer to it as the southwestern pond turtle (*Actinemys pallida*; pond turtle) (Turtle Taxonomy Working Group 2021). This species has been declining throughout its range and has been extirpated from much of coastal southern California (Bury and Germano 2008, Thomson et al. 2016). Historically, the pond turtle inhabited coastal draining streams, ponds, and lakes, fed primarily on small aquatic invertebrates and vegetation, and had no native aquatic predators (Bury and Germano 2008). However, threats to the pond turtle now include altered hydrology (dams and diversions), habitat fragmentation, direct mortality from roads and development, and predation by nonnative aquatic species (NAS) including American bullfrogs (*Lithobates catesbeianus*, bullfrog) and largemouth bass (*Micropterus salmoides*) (Brattstrom and Messer 1988, Stephenson and Calcarone 1999). Due to recent declines, the pond turtle was identified as a Species of Special Concern by California Department of Fish and Wildlife (CDFW) in 1994 (Jennings and Hayes 1994, Thomson et al. 2016) and was petitioned for listing by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act in 1992 and again in 2012 (Center for Biological Diversity 2012). In 1997, the pond turtle was included as one of the 75 species that the San Diego Multiple Species Conservation Program (MSCP) aims to conserve within coastal San Diego County (City of San Diego 1998). The San Diego Management and Monitoring Program (SDMMP) supports the MSCP and has developed the Management Strategic Plan to define the management area (the western portion of San Diego County; MSPA) with distinct management units (11 management units grouping preserves and preserve complexes; MU) within the MSPA to assist with prioritizing management actions to conserve the 75 species covered by the MSCP, including the pond turtle (SDMMP 2013).

The USGS conducts research on the natural history of and threats and impacts to reptiles and amphibians in coastal southern California to understand the demography of rare and listed taxa in the region, which includes the MSPA. Our research aims to study the responses of the pond turtle to large scale threats, such as drought and wildfire, as well as localized threats, such as from nonnative taxa. Specifically, our research seeks to understand the causes of decline of the pond turtle on conserved lands within the MSPA and how the populations respond to management actions including pond turtle translocations and NAS removal.

Translocations of pond turtles and removal of nonnative species have been the primary tools used for restoration of pond turtle populations within the MSPA of San Diego County, CA (Brown et al. 2015) since 2009. In 2009, the USGS partnered with San Diego Zoo and CDFW to study the effects of removing NAS and headstarting (raising hatchlings in a controlled environment before releasing them to the wild) pond turtles at CDFW's Sycuan Peak Ecological Reserve (SPER). In 2014, the USGS translocated 18 adult pond turtles from private ponds in the Pine Valley Creek watershed to ponds at CDFW's Rancho Jamul Ecological Reserve (RJER) to

begin evaluating the effectiveness of translocating adult pond turtles as a conservation tool, and its potential to restore the pond turtle to the Otay River watershed. In 2019, the USGS translocated 12 pond turtles in the San Dieguito watershed from Black Canyon to a pond near the headwaters of Scholder Creek at The Nature Conservancy's Wheatley Preserve. This pond had previously been enhanced for native species by removing NAS and planting native plants to create refugia. In 2022, the USGS translocated six additional pond turtles from Black Canyon to the Wheatley Preserve to inform restoration potential at San Dieguito River Park Joint Powers Authority's (JPA's) Santa Ysabel Gorge Preserve, and conducted surveys on other conserved lands to find additional translocation study sites.

This 2022 effort builds on the previous work by the USGS and its partners in support of pond turtle restoration and management in the MSPA (Brown et al, 2020a and 2020b). Here we report on the search for new pond turtle populations, continued monitoring of translocated individuals and removal of NAS from 1 January 2022 to 31 December 2022. This work was completed as part of SANDAG agreement 548642. Specific activities reported here are summarized in Table 1. This work is part of our larger study to assess the pond turtle population in southern California. Pond turtle translocations and habitat restoration efforts have been collaborative between the USGS and our partners: San Diego Zoo, CDFW, SDMMMP, San Diego Association of Governments (SANDAG), City of San Diego (City), County of San Diego (County), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), Endangered Habitats Conservancy (EHC), Department of Defense (DOD) and The Nature Conservancy (TNC).

## **STUDY AREA**

The study area included the following eight coastal watersheds in San Diego County: San Juan's Aliso-San Onofre subbasin, Santa Margarita, San Luis Rey, San Dieguito, San Diego, Sweetwater, Otay, and Tijuana watersheds (Table 1, Figure 1).

## **METHODS**

### ***Site Selection***

Within these watersheds, 21 sites were selected to survey for pond turtles (Figure 2). Two sites were part of our San Diego long term monitoring program on DOD property, three sites were part of the USGS/SANDAG pond turtle restoration program, and 16 sites were on conserved lands within the MSPA. Sites generally had water present, historical pond turtle records, and habitat features known to be associated with pond turtle presence. This report covers pond turtle surveys as well as NAS species removal surveys at RJER, SPER, TNC Wheatley Preserve, and San Dieguito River Park JPA's Santa Ysabel Gorge Preserve.

### ***Survey Overview***

Surveys for native and NAS were conducted following the USGS protocols for aquatic species in the south coast ecoregion (USGS 2006a–d). Semi-aquatic species were also included in these methods and results since they are commonly detected in aquatic environments during these surveys. Survey methods included daytime visual encounter surveys, nighttime visual encounter surveys for bullfrogs, timelapse and motion triggered cameras, and trapping. Daytime visual encounter surveys were used to determine species presence and activity as well as to remove

bullfrogs if they were detected. Trapping was used to assess native and NAS presence and to capture turtles to assess their health.

When NAS were removed from the traps or detected/removed on visual encounter surveys, we followed the guidelines set by the American Veterinary Medical Association (AVMA) (Leary et al. 2020) and a joint committee of American Fisheries Society, the American Institute of Fishery Research Biologists, and the American Society of Ichthyologists and Herpetologists (Jenkins et al. 2014) to euthanize. These guidelines were approved by the USGS Western Ecological Research Center (WERC) Institutional Animal Care Use Committee (IACUC). These guidelines are designed to minimize pain and distress for the animals. For field application we placed the NAS in a plastic bag with 0.5 mg/L clove oil until breathing ceased and then put the animal on ice before ultimately placing it into a -20°C freezer at the lab.

### ***Daytime Visual Encounter Surveys***

Daytime visual encounter surveys were conducted to assess riparian and aquatic habitat and determine presence of active aquatic species. Surveys were conducted by walking the creek and pond perimeter and recording any native or nonnative amphibians or reptiles encountered in accordance with the USGS stream survey protocol (USGS 2006a). Dip-nets, seine nets, snorkeling, and opportunistic hand-capturing were used to detect species underneath aquatic vegetation, floating material, and overhanging banks and tree roots.

### ***Nighttime Visual Encounter Surveys***

Nighttime visual encounter surveys were conducted at four sites, Wheatley Preserve, Rancho Jamul Ecological Reserve, Sycuan Peak Ecological Reserve, and Santa Ysabel Gorge Preserve following the USGS protocols for aquatic species (USGS 2006d). These surveys involved slowly walking along the creeks and pond shorelines searching with headlamps, spotlights, and binoculars. Surveys typically began at twilight when reflected eyeshine became detectable and nocturnal activity began to increase. When time permitted, multiple passes of the site were made until activity began to wane. These surveys augment the trapping and daytime visual encounter surveys, often providing earliest detection of juvenile aquatic species at the sites (e.g., pond turtles, red-legged frogs, and arroyo toads).

Detected species were recorded, noting age, sex, and behavior. Target species were captured, checked for pit tags, measured, and photographed. Native species were marked, if not already marked, and released at the site of capture. Nonnative aquatic species were collected and returned to the lab for gut analysis (Smith et al. 2024). Methods of capture included using hand capture, dip nets, and seines nets. For nonnative bullfrogs, .22 caliber rimfire rifles with lead free frangible ammunition were used. A gunshot wound to the brain is within the guidelines set by the AVMA to euthanize (Leary et al. 2020). Bullfrogs were disposed of at the USGS laboratory following SDSU Foundation protocols if recovery was possible.

### ***Camera Surveys***

Trail cameras were deployed at monitoring sites to detect different age classes of pond turtles. Cameras were set to take motion triggered photos and timelapse photos every 5 to 15 minutes



depending on camera type. When supported, cameras were set to take infrared photos from dusk to midnight to capture nighttime activity of pond turtles and potential NAS.

### ***Trapping Surveys***

Trapping surveys were used to capture pond turtles and other native and NAS. Trapping surveys were useful for removing NAS including red swamp crayfish (*Procambarus clarkii*) (Appendix C), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), African clawed frogs (*Xenopus laevis*), and bullfrog larvae. Methods followed Madden-Smith et al. (2005) and the “USGS western pond turtle (*Actinemys pallida*) trapping survey protocol for the south coast ecoregion” (USGS 2006b). Trapping surveys used up to three different size funnel traps to increase the probability of capturing the various aquatic species that could be present. Our large turtle traps are custom sized Turtle Nets from Memphis Net & Twine with 20” hoops and 1.5” mesh. These are flat mouthed traps with floats to leave an air space for trapped turtles to breathe. Our small turtle traps are Promar TR-503 collapsible live bait traps modified with floats to provide an air space. We also employ Gee’s galvanized G-40 minnow traps to detect smaller fishes, invertebrates, and African clawed frogs.

Traps were baited with freshly frozen commercial mackerel or canned sardines. The traps work by forcing the animals to enter the funnel opening to get the bait and once inside they can’t escape. Turtle traps were deployed with floats to provide an area for trapped animals to surface and breathe. Traps were visited daily to check for animals and to change bait. Traps were left from one to five days in the water depending on amount of available habitat, weather conditions, initial capture rates, and access. We considered the number of “trap nights” for a site to be equal to the number of traps set (regardless of type), multiplied by the number of nights the traps were left in the environment.

## **RESULTS**

### ***Overview***

Watershed and site names, site locations, and number of trap nights were summarized (Table 1). Species detected at each site were tallied and categorized into native or NAS groupings (Table 2). Overall number of turtles, total number of individuals trapped, and age classes detected were summarized for each site (Table 3, Table 4). Total number of NAS detected/removed from pond turtle restoration sites were also summarized (Table 5). Overall, we found a range of 1 to 27 pond turtles during our 2022 surveys at 11 of the 21 sites and 8 of the 8 watersheds. Most of the sites had water but one was dry. We detected NAS at 17 of the 21 sites.

### **San Juan Watershed (Aliso-San Onofre subbasin)**

#### ***Cocklebur Canyon***

On 30 April 2022, we set 5 large turtle traps and 6 small turtle traps baited with mackerel for one day of trapping during a field trip of students from California State Polytechnic University, Pomona on Marine Corps Base, Camp Pendleton in the San Juan watershed (Figure 3). One adult pond turtle was recaptured from previous years’ surveys. Three red swamp crayfish were detected during this short trapping event.



## **Santa Margarita Watershed**

### ***Naval Weapons Station Fallbrook***

On 5–8 July 2022, we placed 8 large turtle traps, 18 small turtle traps, and 3 minnow traps baited with mackerel in two tributaries to the Santa Margarita River on Naval Weapons Station Fallbrook (Figure 3). We captured seven pond turtles in the traps. Other species detected included two-striped garter snake (*Thamnophis hammondi*), red-eared slider (*Trachemys scripta elegans*), bullfrog, mosquitofish (*Gambusia affinis*), green sunfish, and red swamp crayfish.

## **San Luis Rey Watershed**

### ***Jeff Valley***

We set 6 large turtle traps and 4 small turtle traps in 2 ponds within Jeff Valley on 27–29 September 2022 in the San Luis Rey watershed (Figure 4). Bullfrogs, mosquitofish, and largemouth bass were detected at the ponds. No native species were detected.

### ***West Fork San Luis Rey River***

In a stretch of West Fork San Luis Rey River upstream from Lake Henshaw in a USGS restoration site, we set 9 large and 21 small turtle traps baited with mackerel throughout approximately one kilometer of the waterway (Figure 4). Traps were deployed from 22 August 2022 to 25 August 2022. We captured 12 individual pond turtles in the traps. Other species detected included two-striped garter snake, Baja California treefrog (*Pseudacris hypochondriaca*) (Appendix B), arroyo chub (*Gila orcutti*) (Appendix B), common carp (*Cyprinus carpio*) (Appendix C) and green sunfish.

### ***Kumpohui Creek Tributary***

Seven visual encounter surveys were performed between 18 January 2022 and 10 November 2022 around the perimeters of the two ponds at the TNC Wheatley Preserve that are part of the San Luis Rey River watershed (Figure 4). These ponds are close to the Scholder Creek restoration site, which is in the San Dieguito River watershed. Species detected included western toad (*Anaxyrus boreas halophilus*) and Baja California treefrog.

## **San Dieguito Watershed**

### ***Scholder Creek (Wheatley Preserve)***

As a restoration sight, eight trap nights split between the weeks of 31 May 2022 and 26 September 2022 were conducted to check on the health and presence of the previously translocated twelve pond turtles. We recaptured three of the previously translocated pond turtles and translocated six additional pond turtles to the main pond from Lower Santa Ysabel Creek in Black Canyon bringing the total translocated to 18 (Figure 5) (Appendix A). Other native species detected during the surveys included two-striped garter snake, western toad, Baja California treefrog, and California red-legged frog (*Rana draytonii*) (Appendix B).

In addition to the recaptured adult turtles, USFWS biologists uncovered a pond turtle nest during weed management at the vegetation restoration site approximately 20 meters southwest of the main pond. They contacted USGS, covered the eggs with soil, moistened the soil, and marked

the location with pin flags. USGS then installed time lapse trail cameras facing the nest to record any potential hatchling activity or disturbance (Figure 11).

We conducted trapping, daytime visual encounter, and nighttime visual encounter surveys at Wheatley Preserve to detect and subsequently remove nonnative aquatic species to improve the conditions for pond turtles. During trapping surveys, a red-eared slider was detected/removed from the main pond. No bullfrogs were detected during the nine nighttime visual encounter surveys and no bullfrog calls were heard during eight days of trapping and 37 daytime site visits.

### ***Scholder Creek – Kennel Pond***

At this restoration site, four bullfrog eradication surveys were conducted between 18 January 2022 and 7 July 2022 (Figure 5). Bullfrog eradication began here in 2021 in support of the restoration efforts at the Wheatley Preserve. Fifty bullfrogs were detected/removed from the site in 2021 and only one bullfrog was detected and removed in 2022. Other species detected included Baja California treefrog, mosquitofish, and green sunfish.

### ***Lower Santa Ysabel Creek***

We set 16 small turtle traps in Black Canyon downstream from Lake Sutherland to support the restoration effort upstream at the TNC Wheatley Preserve Pond on Scholder Creek (Figure 5). During the trapping event from 31 May through 3 June 2022 we captured ten pond turtles. Six of those turtles were translocated to the restoration site. On 26 September 2022, we returned with the intent to translocate more turtles, but the creek was completely dry. During a recurring Stream Temperature Intermittency Conductivity (STIC) survey near Pamo Valley on 1 March 2022 a juvenile pond turtle was detected in Lower Santa Ysabel Creek on the western edge of Figure 5. Other species detected were California treefrog (*Pseudacris cadaverina*) (Appendix B) and Baja California treefrog

### ***Santa Ysabel Gorge Preserve***

One trapping survey of 152 trap nights, two daytime and two nighttime visual encounter surveys were performed between 13 July 2022 and 18 August 2022 as USGS initiated pond turtle restoration work at the three ponds on San Dieguito River Park JPA's Santa Ysabel Gorge Preserve that are upstream from Lake Sutherland (Figure 5). No turtles were detected during surveys, although there have been reports from communication with land managers of Emydidae turtles in the ponds and pond turtles were observed by the land manager upstream on an adjacent property in 2022. We detected two-striped garter snake, western toad, Baja California treefrog and detected/removed NAS including bullfrogs, bluegill (*Lepomis macrochirus*), and largemouth bass.

### **San Diego Watershed**

#### ***Bailey Creek***

A trapping survey was conducted from 17–20 October 2022 at Bailey Creek to assess the presence of native or NAS (Figure 6). We set 13 large turtle traps, 10 small turtle traps, and 4 minnow traps that were baited with mackerel and deployed them in two ponds over the four-night trapping period. The traps captured brown bullhead (*Ameiurus nebulosus*) (Appendix C)

and largemouth bass (*Micropterus salmoides*) (Appendix C). We also detected several bullfrogs during the surveys.

### ***Upper San Diego River***

Upper San Diego River is a long-term monitoring site for pond turtles since 2008. We survey this site by visual encounter surveys due to difficult access. Surveys at this site in 2022 targeted arroyo toad (*Anaxyrus californicus*). During this survey on 24–25 May 2022, we detected 20 pond turtles throughout an approximately 10-kilometer section of the San Diego River between the Cedar Creek Falls trail from Ramona Estates and the San Diego River Falls upstream from Temescal Creek (Figure 6). We detected no other turtle species at this site however bullfrogs and nonnative fish were present in some reaches.

### ***Paine Bottom***

On 13–16 September 2022 we assessed a series of four ponds at Paine Bottom for a potential pond turtle restoration site (Figure 6). Three of the ponds were dry but, the largest pond was holding water. We set 10 large turtle traps, 8 small turtle traps, and 3 minnow traps that were baited with mackerel and monitored over the four-night period. We did not detect any animals with the traps; however, we did visually identify three bullfrogs around the pond.

### ***Ritchie Creek***

Ritchie Creek is a tributary to the San Diego River (Figure 6). An unknown Emydidae turtle was detected on 21 July 2021 during a visual encounter survey at the pond at Ritchie Creek (Molden et al. 2022). On 13 September 2022 we placed 1 large turtle trap and 6 small turtle traps in the nearly dry pond on Ritchie Creek. Four adult pond turtles were confirmed to be in that pond. The only other species detected was bullfrog.

### ***Mason Valley Pond in Cuyamaca Rancho State Park***

During the week of 9 August 2022, we set 5 large turtle traps, 12 small turtle traps, 4 minnow traps in Mason Valley Pond located in the San Diego River watershed (Figure 6). The traps did not capture any animals over the four-night trapping session.

## **Sweetwater River Watershed**

### ***Sweetwater River in Cuyamaca Rancho State Park***

During the week of 9 August 2022, we set 7 small turtle traps baited with mackerel in the upper reaches of Sweetwater River, which was mostly dry, and these traps captured five pond turtles in a medium-sized pool (Figure 7). Our previous pond turtle capture from this site was by hand during visual encounter surveys one kilometer downstream in 2009. Other species detected in the Sweetwater River included two-striped garter snake, Baja California treefrog, rainbow trout (*Oncorhynchus mykiss*) (Appendix B), and brown bullhead.

### ***Sweetwater River above-Loveland Reservoir***

This section of Sweetwater River is directly north of Interstate 8 in Alpine (Figure 7). We found a few small pools with water and deployed 7 small turtle traps. The traps captured only red swamp crayfish. Other species detected included California treefrog, Baja California treefrog,

unarmoured threespine stickleback (*Gasterosteus aculeatus williamsoni*) (Appendix B), and mosquitofish.

### ***Crestlake***

This is an artificial lake along Galloway Valley, a tributary to Harbison Canyon, which feeds into the Sweetwater River below Loveland Dam at Dehesa. A daytime visual encounter survey was performed on 9 August 2022, but the lake was dry (Figure 8). No native or NAS were detected.

### ***Sycuan Peak Ecological Reserve***

Three daytime and two nighttime visual encounter surveys were performed on 9–10 Feb 2022 and 26 May 2022. Eleven trapping nights were performed on 6–9 June 2022, 27–29 July 2022, and 11–14 October 2022 (Figure 7). We captured a total of 27 individual pond turtles including 24 recaptures. Two of these were new juveniles and one was a new adult. Other species detected included California treefrog and Baja California treefrog. The NAS detected/removed included African clawed frog, green sunfish, and red swamp crayfish.

### ***Sweetwater Reservoir Open Space***

We logged four trap nights with 6 large turtle traps and 9 small turtle traps at two large sand ponds that were upstream from the main reservoir in the Sweetwater River (Figure 8). We detected three common snapping turtles (*Chelydra serpentina*) (Appendix C) and 32 red-eared sliders in the traps. Also detected were bullfrogs, brown bullhead, common carp, and bluegill.

## **Otay River Watershed**

### ***Rancho Jamul Ecological Reserve***

Eight trap nights, three daytime visual encounter surveys, and 19 nighttime visual encounter surveys were conducted in Jamul Creek and the ponds at RJER between 3 March 2022 and 16 November 2022 (Figure 9). We trapped three recaptured pond turtles that were previously translocated from Oak Canyon. Six adult red-eared sliders were caught and detected/removed from the main Pump Pond near Jamul Creek, to improve the pond turtle habitat. We also detected/removed 402 bullfrogs, 496 African clawed frogs, 24 brown bullhead, 46 mosquitofish, and 3,738 red swamp crayfish. Other species detected were two-striped garter snake, western toad, and Baja California treefrog.

## **Tijuana River Watershed**

### ***Lower Cottonwood Creek***

On 12 April and 18 May 2022 during arroyo toad surveys, we hand-captured two pond turtles (Figure 10). On 18 July we attempted to trap at the pools these turtles were occupying but the pools were dry. On 18 to 21 July 2022, a nearby large pool was trapped to determine pond turtle presence below Barrett Lake in Cottonwood Creek. We set 6 large turtle traps, 8 small turtle traps, and 4 minnow traps that were baited with mackerel. The traps captured 38 bullfrogs of all age classes. Also detected at the site were two-striped garter snake and Baja California treefrog. On 19 July 2022 a daytime visual encounter survey was conducted in the Hauser Canyon section

of the creek. In the small pools, red swamp crayfish were detected. We plan to set traps when there is more water.

### ***Potrero Creek***

A daytime visual encounter survey on Bureau of Land Management property was conducted on 17 March 2022 on a one-kilometer stretch of the creek (Figure 10). The creek did not have sufficient pooling during the survey to indicate good pond turtle habitat. The only species detected was California treefrog.

## **DISCUSSION**

In 2022, we found pond turtles at all translocation sites (Sycuan Peak ER, Rancho Jamul ER, and Wheatley Preserve). The Sycuan Peak ER population continued to produce new and juvenile pond turtles which appear to be moving throughout the available habitat at the site.

The Rancho Jamul ER population appears to be stable but not producing new juveniles. USGS is testing new methods for invasives control at this site as bullfrogs, crayfish, and African clawed frogs still pose a large threat to the productivity of pond turtles. In total, we detected/removed 402 bullfrogs and 3,738 crayfish from the site. We also detected/removed six red-eared sliders from the main Pump Pond on site.

Results from surveys at TNC Wheatley Preserve indicates both pond turtles and red-legged frog translocation efforts are having success. We translocated six more pond turtles to the reserve in 2022. During warm, sunny days, we detected pond turtles basking on logs at the upper end of the main pond. In this area of the pond, they can escape potential threats due to the abundant habitat structure (Appendix D). We also see pond turtles swimming near the cattails by the dam but rarely observe them basking in the more open areas on the dam side of the pond.

The USFWS Partners for Fish and Wildlife Program continues to make progress with TNC in improving habitat around the main pond and along the shoreline. They removed nonnative vegetation (grasses, mustard, and Himalayan blackberry) and planted native species that can provide structure. The plants along the shoreline, such as willows and cattails, offer partial shade during hot months and protection from predators. The upland plantings, including buckwheat, sages, and bunchgrass, provide protection when turtles move upland to nest or aestivate. The discovered pond turtle nest was in the upland revegetation site. We will monitor the population to see if the pond turtles make use of the new habitat features.

We installed bullfrog fencing along the property across and adjacent to Scholder Creek. While we did not detect bullfrogs on the TNC Wheatley Preserve in 2022, bullfrogs are present nearby. We will continue to conduct surveys to identify potential source populations to either remove or mitigate through additional fencing. Additionally, we detected/removed a red-eared slider from the preserve that has been difficult to capture. Since the beginning of this project, four red-eared sliders have been detected/removed from the preserve. The bullfrog fencing should also deter movement of nonnative turtles into the reserve from downstream.

We are evaluating the potential for restoration of pond turtles on the San Dieguito River Park JPA's Santa Ysabel Gorge Preserve where there have been previous efforts to detect/remove invasives. Arroyo toads are present on site and pond turtles are present in the creek upstream from the site, but bullfrogs have rebounded since the River Park's previous efforts. We are working as teams using different methods to determine the most effective tools and timing. We want to be able to determine what produces the most effective bullfrog removal for future restoration efforts as well.

Our inventory and monitoring surveys in San Diego County have produced some notable findings. We captured five pond turtles in Upper Sweetwater on Cuyamaca SP one kilometer further upstream from our previous record in 2009. While this area has some recreational use from hiking, wading, and fishing, it is noteworthy that the pond turtle population there has managed to persist through the fire and drought conditions.

We also were able to trap the pond turtles at Ritchie Creek Pond verifying and supporting the detection from the 2021 visual encounter survey. However, we were unable to capture pond turtles along the Sweetwater River adjacent to I-8.

## ACKNOWLEDGMENTS

Bureau of Land Management, California Department of Fish and Wildlife, California Department of Parks and Recreation, City of San Diego Public Utilities Department, Corte Madera Ranch, County of San Diego, Endangered Habitats Conservancy, Marine Corps Base Camp Pendleton, Naval Weapons Station Fallbrook, San Diego River Park Foundation, San Dieguito River Park Partners, Sweetwater Authority, The Wildlands Conservancy, U.S. Border Patrol, U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Navy, Vista Irrigation District, Judy and Chuck Wheatley and The Nature Conservancy have provided and coordinated access to the reserves.

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**Table 1.** Pond turtle sites surveyed from 1 January 2022 to 31 December 2022. This table includes the number of trap nights, visual encounter daytime surveys, and visual encounter nighttime surveys.

Watershed	Site Name	Start Date	End Date	Surveys			Reaches	Start <sup>3</sup>		End <sup>3</sup>	
				Trap Nights <sup>1</sup>	Day VE <sup>2</sup>	Night VE <sup>2</sup>		Latitude	Longitude	Latitude	Longitude
San Juan	Cocklebur Canyon	30-Apr-22	30-Apr-22	11	0	0	1	33.2505	-117.4318	33.2505	-117.4318
Santa Margarita	Naval Weapons Station Fallbrook	5-Jul-22	8-Jul-22	116	0	0	5	33.3508	-117.3137	33.3668	-117.2611
San Luis Rey	Jeff Valley	27-Jul-22	29-Jul-22	30	0	0	2	33.3026	-116.8372	33.3052	-116.8365
	West Fork San Luis Rey River	22-Aug-22	25-Aug-22	120	0	0	4	33.2896	-116.7579	33.2993	-116.7618
	Kumpohui Creek Tributary	18-Jan-22	10-Nov-22	0	0	7	2	33.2005	-116.7421	33.2010	-116.7444
San Dieguito	Scholder Creek	18-Jan-22	20-Nov-22	384	37	9	4	33.1993	-116.7577	33.1981	-116.7560
	Scholder Creek Kennel Pond	18-Jan-22	7-Jul-22	0	0	4	1	33.2019	-116.7603	33.2019	-116.7603
	Lower Santa Ysabel Creek	31-May-22	3-Jun-22	64	0	0	5	33.1205	-116.8405	33.1252	-116.8041
	Santa Ysabel Gorge Preserve	13-Jul-22	18-Aug-22	152	2	2	2	33.1197	-116.7201	33.1197	-116.7201
San Diego	Bailey Creek	17-Oct-22	20-Oct-22	108	0	0	2	33.1118	-116.6417	33.1148	-116.6355
	Upper San Diego River	24-May-22	25-May-22	0	2	0	17	32.9916	-116.7377	33.0588	-116.6920
	Paine Bottom	13-Sep-22	16-Sep-22	72	0	0	1	33.0432	-116.6532	33.0432	-116.6532
	Ritchie Creek	13-Sep-22	16-Sep-22	28	0	0	1	33.0275	-116.6879	33.0275	-116.6879
	Mason Valley Pond	9-Aug-22	12-Aug-22	84	0	0	1	33.0151	-116.5566	33.0151	-116.5566
Sweetwater	Rancho Cuyamaca State Park	9-Aug-22	12-Aug-22	28	0	0	2	32.8959	-116.5955	33.0151	-116.5566
	Crestlake	9-Aug-22	9-Aug-22	0	1	0	1	32.8465	-116.8214	32.8465	-116.8214
	Sweetwater River-Loveland	10-Aug-22	10-Aug-22	28	0	0	2	32.8351	-116.6440	32.8384	-116.6388
	Sycuan Peak Ecological Reserve	9-Feb-22	14-Oct-22	1155	3	2	11	32.7707	-116.8135	32.7729	-116.7969
	Sweetwater Reservoir Open Space	3-Oct-22	6-Oct-22	60	0	0	2	32.7058	-116.9593	32.7092	-116.9577
Otay	Rancho Jamul Ecological Reserve	3-Mar-22	16-Nov-22	520	3	19	18	32.6676	-116.8623	32.6941	-116.8685
Tijuana	Lower Cottonwood Creek	12-Apr-22	21-Jul-22	72	1	0	5	32.6558	-116.6799	32.6767	-116.6720
	Potrero Creek	17-Mar-22	17-Mar-22	0	1	0	4	32.6042	-116.6824	32.5976	-116.6777
Grand Total				3032	50	43	93				

<sup>1</sup>Trap nights equals number of traps put out at a site (regardless of trap type) multiplied by the number of days the traps were left in the water.

<sup>2</sup>VE = visual encounter survey.

<sup>3</sup>Locations obtained in WGS84 datum in decimal degrees.

**Table 2.** Species detections during pond turtle surveys from 1 January 2022 to 31 December 2022 in San Diego County.

		Native									Nonnative											
Watershed	Block	Pond turtle	Two-striped gartersnake	Western toad	California treefrog	Baja California treefrog	California red-legged frog	Threespine stickleback	Arroyo chub	Rainbow trout	Common snapping turtle	Red-eared slider	American bullfrog	African clawed frog	Brown bullhead	Common carp	Green sunfish	Bluegill	Mosquitofish	Largemouth bass	Red swamp crayfish	Total Species Observed
San Juan	Cocklebur Canyon	1																			3	4
Santa Margarita	Naval Weapons Station Fallbrook	8	1									1	459				27		50		503	1049
San Luis Rey	Jeff Valley												12						1	3		16
	West Fork San Luis Rey	16	3			1			32							5	38					95
	Kumpohui Creek Tributary			802		24																826
San Dieguito	Scholder Creek	3	6	1		16	8					2										36
	Scholder Creek Kennel Pond					1							1				3		2			7
	Lower Santa Ysabel Creek	10			2	1																13
	Santa Ysabel Gorge Preserve		3	2		6							232					24		7		274
San Diego	Bailey Creek												2		11					1		14
	Upper San Diego River	20																				20
	Paine Bottom												3									3
	Ritchie Creek	4											9									13
	Mason Valley Pond																					0
Sweetwater	Rancho Cuyamaca State Park	5	1			1				6					3							16
	Sweetwater River-Loveland				1	1		1											1		86	90
	Sycuan Peak Ecological Reserve	52			14	11								209			281				681	1248
	Sweetwater Reservoir Open Space										3	32	1		3	6		9			1	55
Otay	Rancho Jamul Ecological Reserve	3	9	3		31						6	402	496	24				46		3738	4758
Tijuana	Lower Cottonwood Creek	2				2							38									42
	Potrero Creek				1																	1

**Table 3.** Total number of pond turtles detected during 2022 surveys in San Diego County.

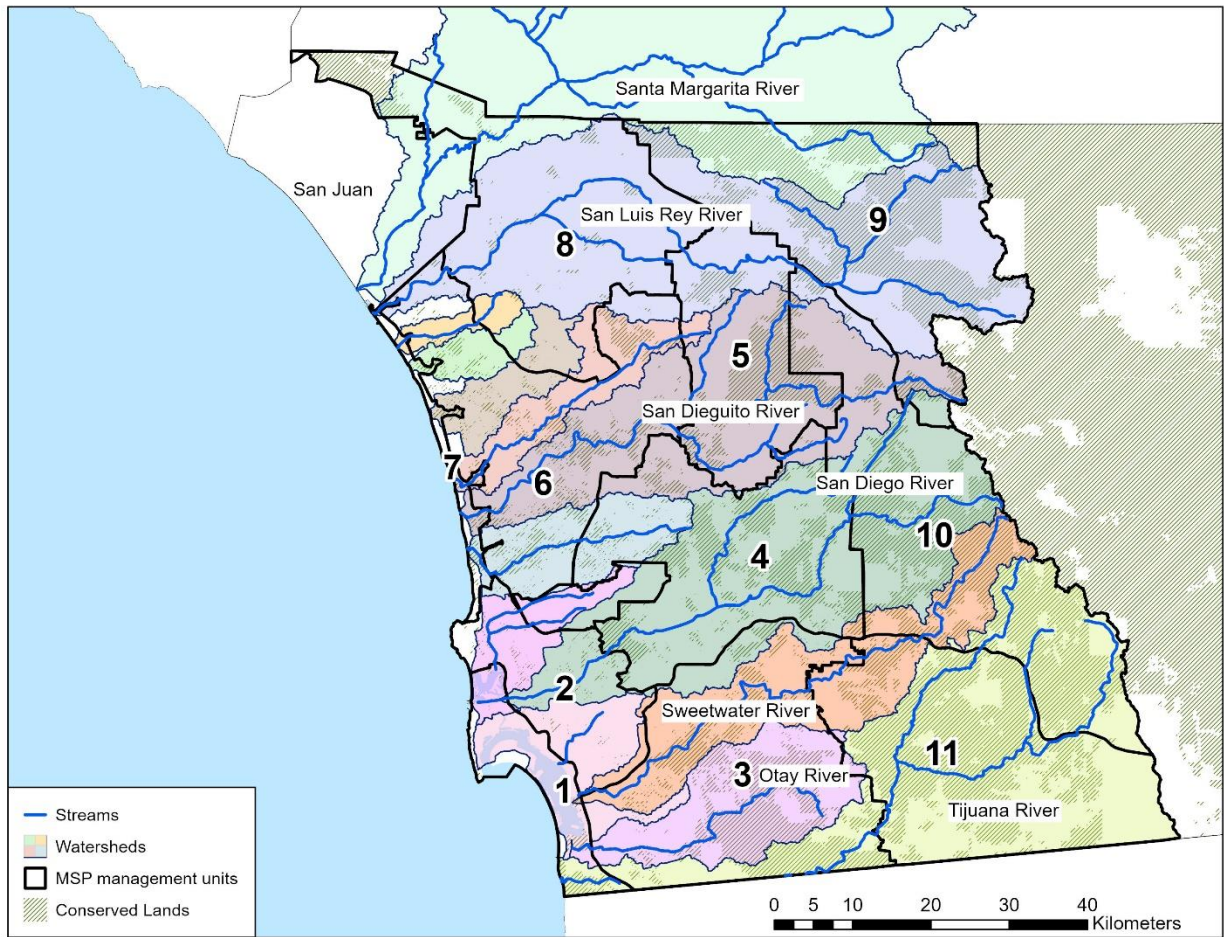
Watershed	Site	Age			Total
		Adult	Juvenile	Unknown	
San Juan	Cocklebur Canyon	1			1
Santa Margarita	Naval Weapons Station Fallbrook	6	2		8
San Luis Rey	West Fork San Luis Rey River	13	3		16
San Dieguito	Scholder Creek	3			3
	Lower Santa Ysabel Creek	8	2		10
San Diego	Upper San Diego River	11	8	1	20
	Ritchie Creek	4			4
Sweetwater	Rancho Cuyamaca State Park	4	1		5
	Sycuan Peak Ecological Reserve	43	9		52
Otay	Rancho Jamul Ecological Reserver	3			3
Tijuana	Lower Cottonwood Creek	2			2
<b>Grand Total</b>		<b>98</b>	<b>25</b>	<b>1</b>	<b>124</b>

**Table 4.** Total number of verified individual pond turtles detected during 2022 surveys in San Diego County.

Watershed	Site	Age			Total
		Adult	Juvenile	Unknown	
San Juan	Cocklebur Canyon	1			1
Santa Margarita	Naval Weapons Station Fallbrook	5	2		7
San Luis Rey	West Fork San Luis Rey River	9	3		12
San Dieguito	Scholder Creek	3			3
	Lower Santa Ysabel Creek	8	2		10
San Diego	Upper San Diego River	11	8	1	20
	Ritchie Creek	3			3
Sweetwater	Rancho Cuyamaca State Park	4	1		5
	Sycuan Peak Ecological Reserve	21	6		27
Otay	Rancho Jamul Ecological Reserve	3			3
Tijuana	Lower Cottonwood Creek	2			2
<b>Grand Total</b>		<b>70</b>	<b>22</b>	<b>1</b>	<b>93</b>

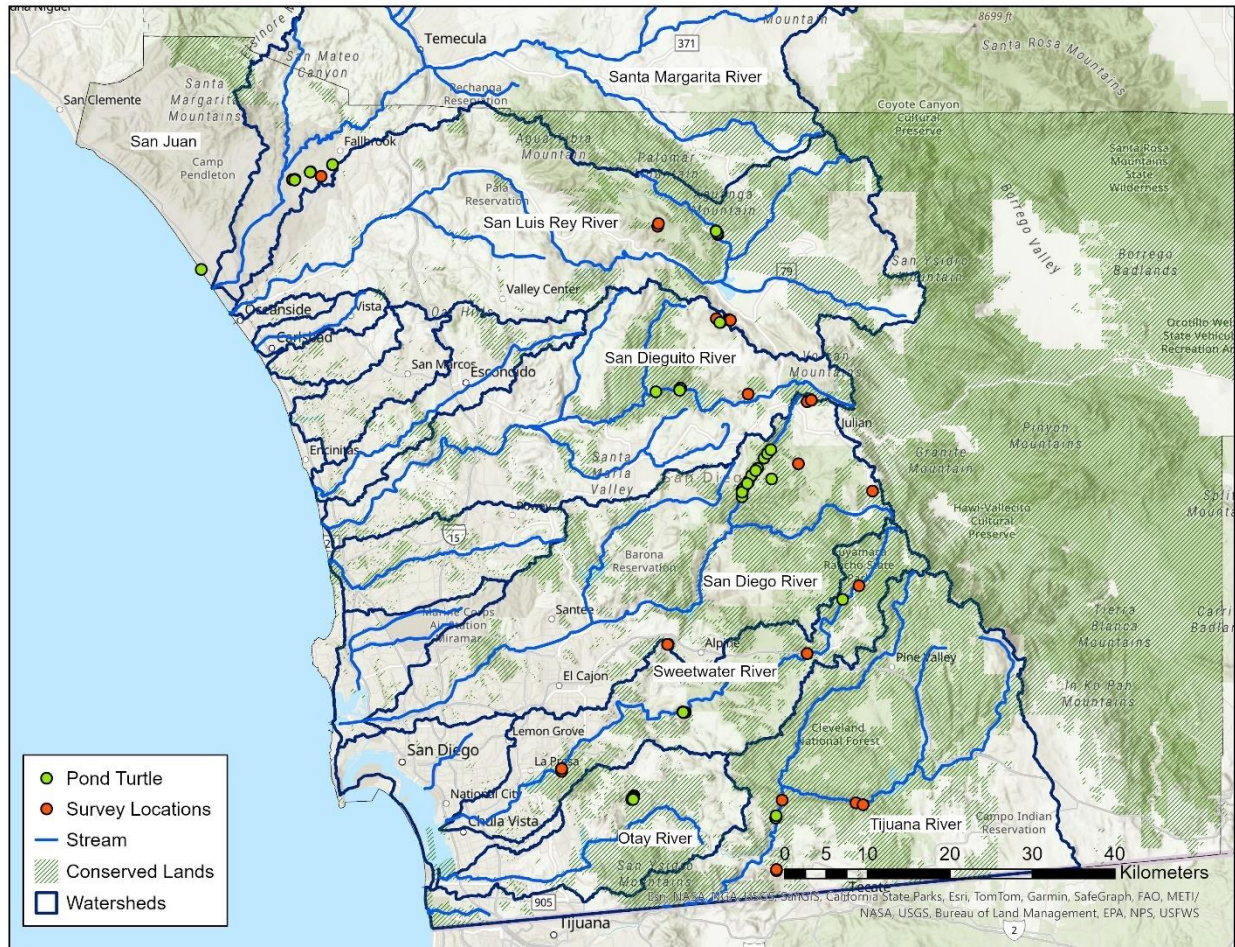
**Table 5.** Total number of NAS detected/removed from pond turtle restoration sites during 2022 surveys in San Diego County.

Site	Red-eared slider	American bullfrog	African clawed frog	Green sunfish	Bluegill	Largemouth bass	Red swamp crayfish	Total
Scholder Creek	1							1
Scholder Creek Kennel Pond		1						1
Santa Ysabel Gorge Preserve		232			24	7		263
Sycuan Peak Ecological Reserve			298	281			679	1258
Rancho Jamul Ecological Reserve	6	402	496				3738	4642
<b>Total</b>	<b>7</b>	<b>635</b>	<b>794</b>	<b>281</b>	<b>24</b>	<b>7</b>	<b>4417</b>	6165



**Figure 1.** Map showing watersheds surveyed for pond turtles from 1 January 2022, to 31 December 2022, in San Diego County. Included in this study were the San Juan, Santa Margarita, San Luis Rey, San Dieguito, San Diego, Sweetwater, Otay, and Tijuana watersheds.



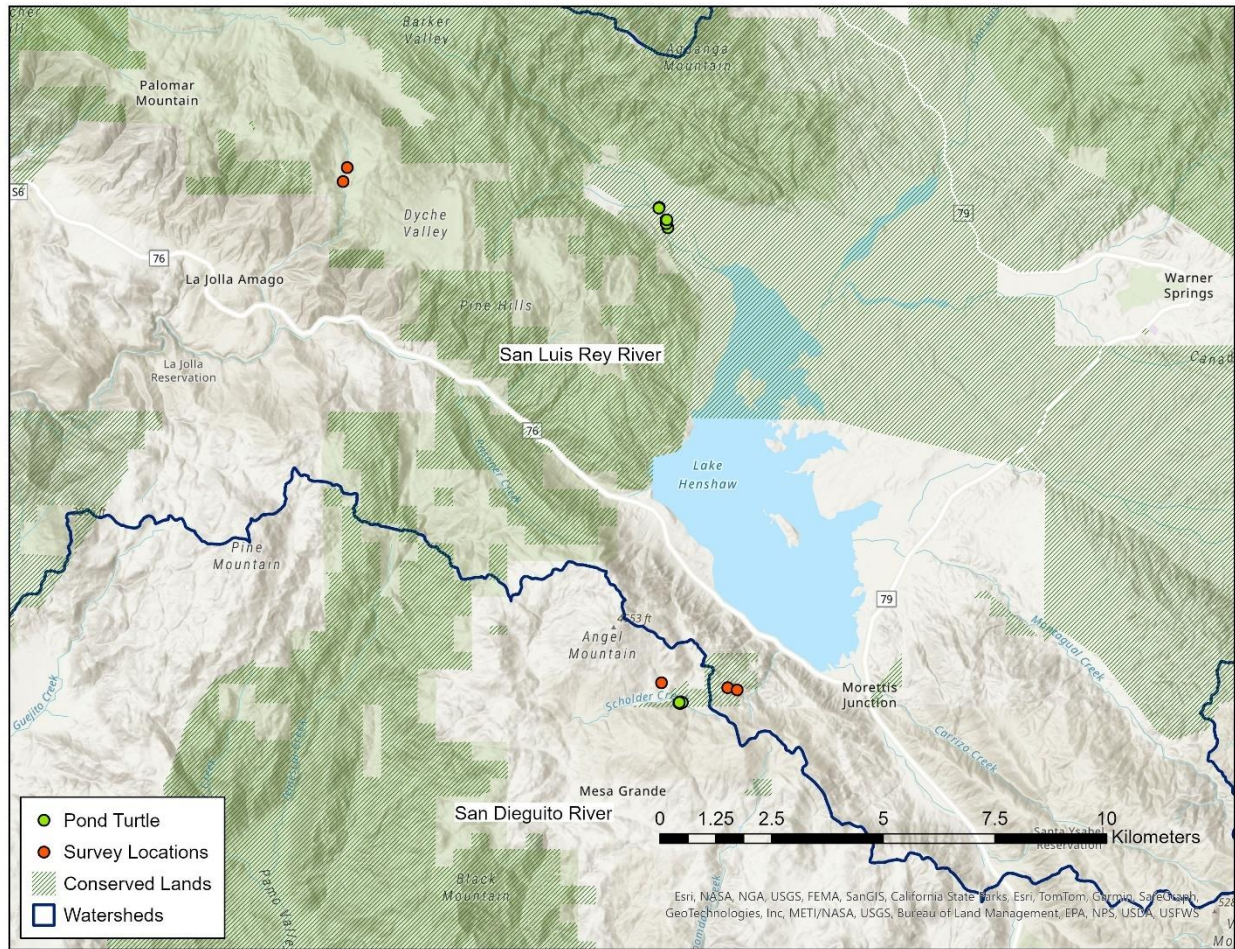


**Figure 2.** Map showing survey locations for pond turtles in San Diego County watersheds from 1 January 2022 to 31 December 2022. Red dots represent survey locations and green dots represent pond turtle records.



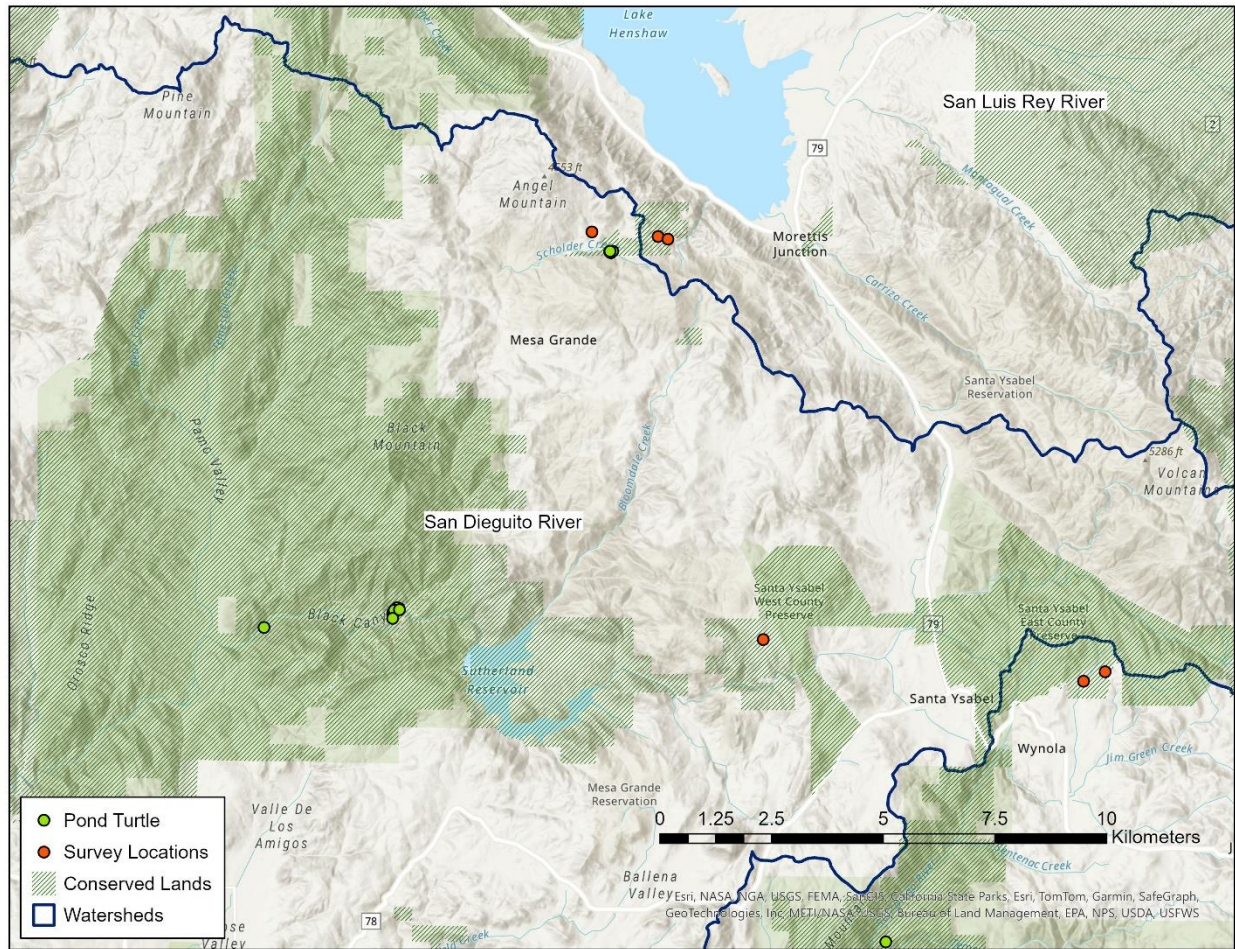


**Figure 3.** Map showing survey locations for pond turtles in San Juan and Santa Margarita watersheds from 1 January 2022 to 31 December 2022. Red dots represent survey locations and green dots represent pond turtle records.



**Figure 4.** Map showing survey locations for pond turtles in San Luis Rey watersheds from 1 January 2022 to 31 December 2022. Red dots represent survey locations and green dots represent pond turtle records.



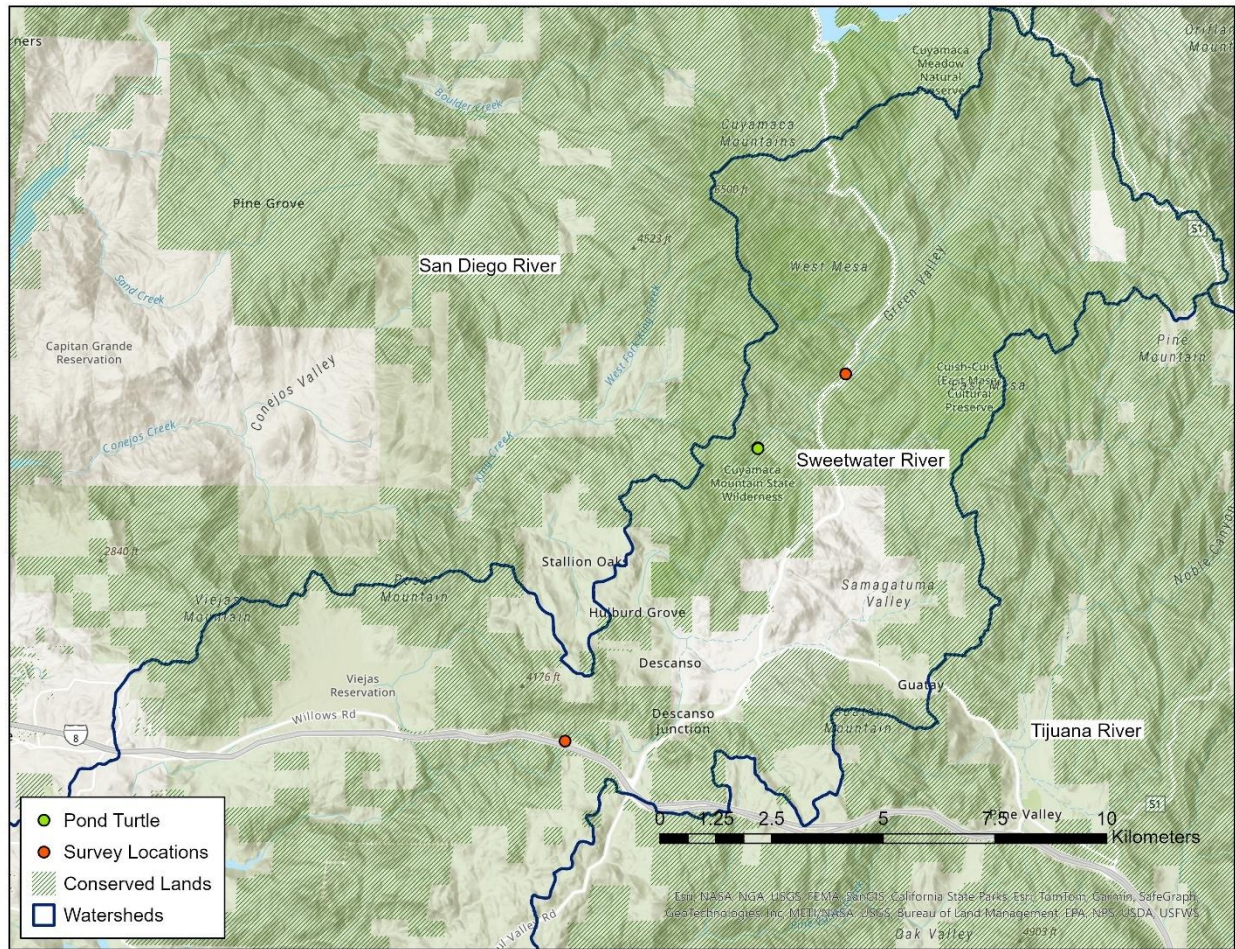


**Figure 5.** Map showing survey locations for pond turtles in San Dieguito watershed from 1 January 2022 to 31 December 2022. Red dots represent survey locations and green dots represent pond turtle records.



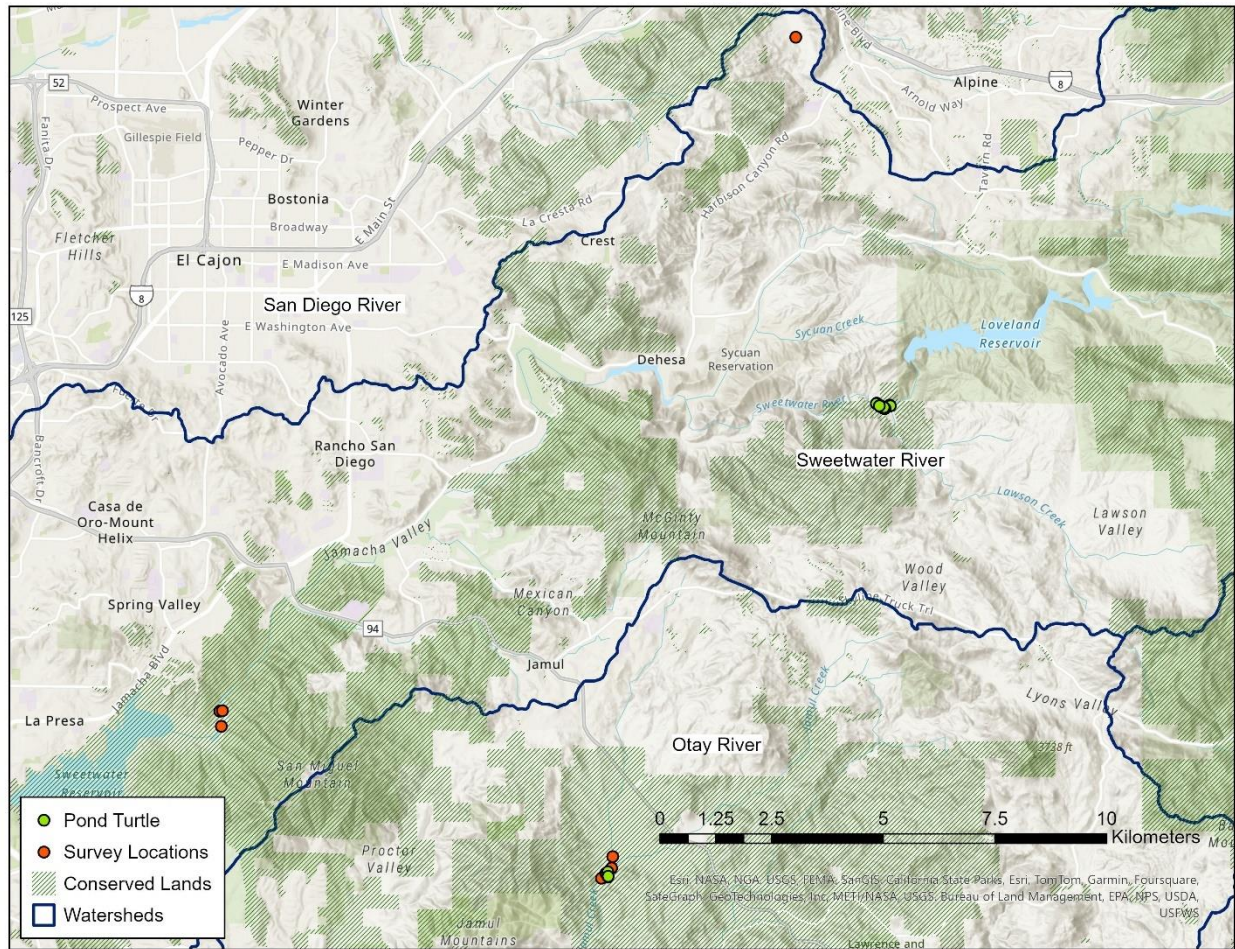






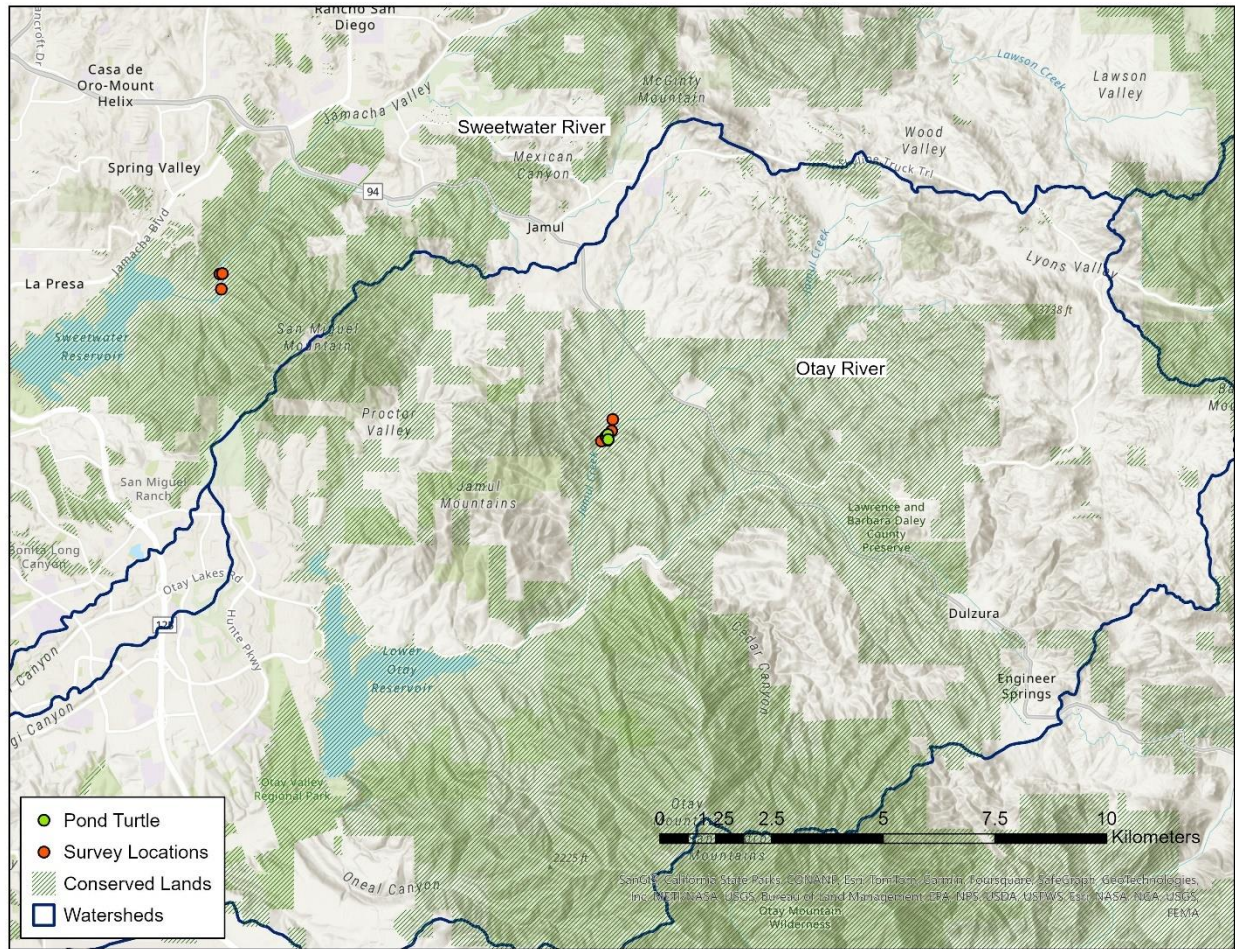
**Figure 7.** Map 1 of 2 showing survey locations for pond turtles in Sweetwater River watershed from 1 January 2022 to 31 December 2022. Red dots represent survey locations and green dots represent pond turtle records.





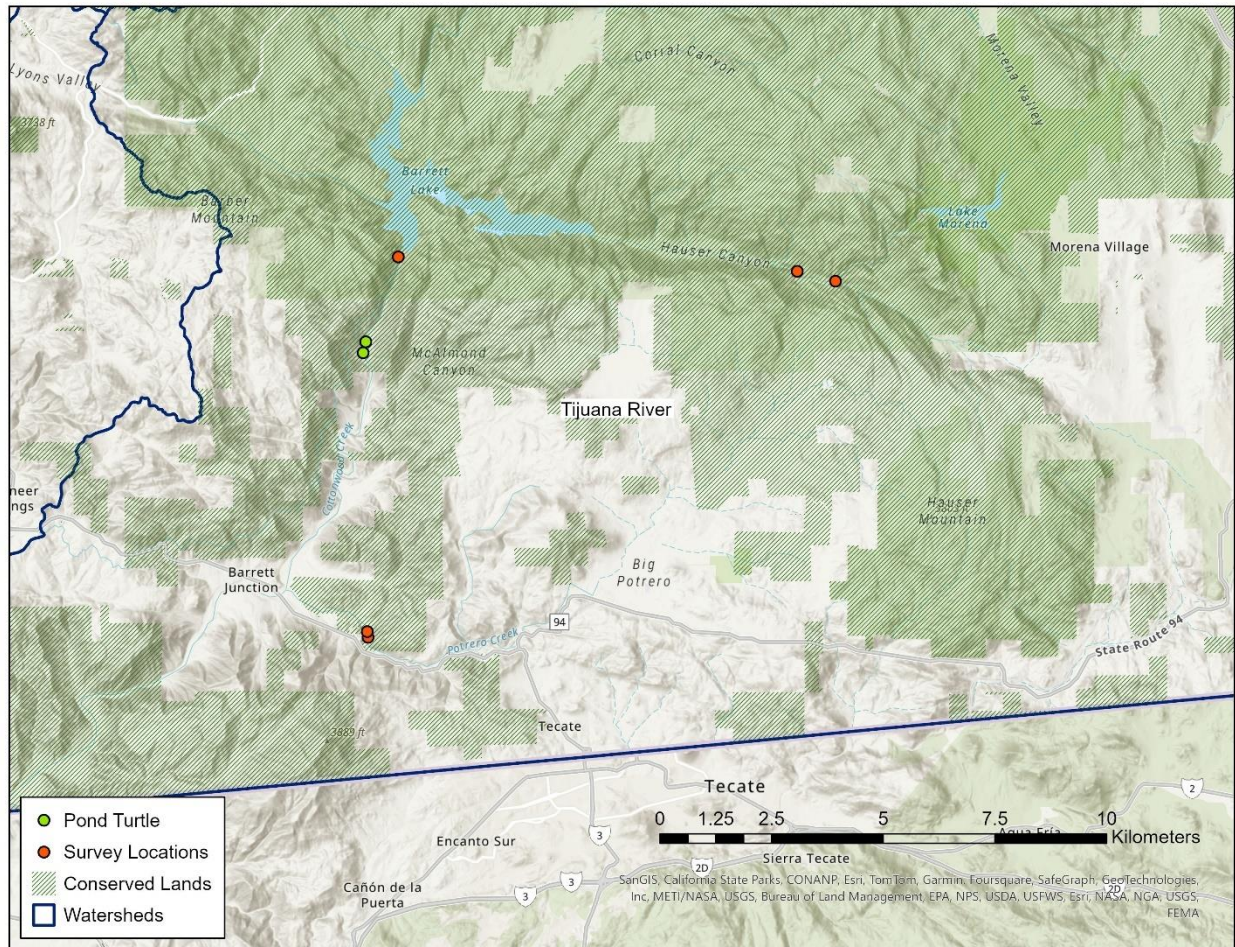
**Figure 8.** Map 2 of 2 showing survey locations for pond turtles in Sweetwater River watershed from 1 January 2022 to 31 December 2022. Red dots represent survey locations and green dots represent pond turtle records.





**Figure 9.** Map showing survey locations for pond turtles in Otay River watershed from 1 January 2022 to 31 December 2022. Red dots represent survey locations and green dots represent pond turtle records.





**Figure 10.** Map showing survey locations for pond turtles in Tijuana River watershed from 1 January 2022 to 31 December 2022. Red dots represent survey locations and green dots represent pond turtle records.



**Figure 11.** Pond turtle eggs uncovered at Wheatley Preserve during invasive vegetation management (a). Eggs were covered, moistened, and cameras were placed to detect activity (b). In spring of 2023 (26 May 2023) the nest was excavated to find at least two of the eggs appeared to hatch cleanly. Photographs by Chris Brown.



**Appendix A.** Habitat photos from 2022 surveys in San Diego County.



Scholder Creek, photograph by Jeremy Sebes



San Dieguito River Park JPA's Santa Ysabel Gorge Preserve, photograph by Jeremy Sebes



Lower Santa Ysabel Creek, photograph by Jeremy Sebes



Upper San Diego River, photograph by Jeremy Sebes



The pond at Ritchie Creek, photograph by Jeremy Sebes



Rancho Cuyamaca State Park, photograph by Jeremy Sebes





Sycuan Peak Ecological Reserve, photograph by Jordyn Ochoa



Rancho Jamul Ecological Reserve, photograph by Jeremy Sebes



Lower Cottonwood Creek, photograph by Jeremy Sebes

**Appendix B.** Photos of native species from 2022 surveys in San Diego County.



Arroyo chub (*Gila orcutti*), photograph by Dhafir Williams



Rainbow trout (*Onchorhynchus mykiss*), photograph by Dhafir Williams



Unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*), photograph by Jeremy Sebes





California red-legged frog (*Rana draytonii*), photograph by Jeremy Sebes



California treefrog (*Pseudacris cadaverina*), photograph by Jeremy Sebes



Baja California treefrog (*Pseudacris hypochondriaca*), photograph by Jeremy Sebes

**Appendix C.** Photos of NAS from 2022 surveys in San Diego County.



Common snapping turtle (*Chelydra serpentina*), photograph by Jeremy Sebes



Red-eared slider (*Trachemys scripta elegans*), photograph by Jeremy Sebes



American bullfrog (*Rana catesbeianus*). photograph by Jeremy Sebes





African clawed frog (*Xenopus laevis*), photograph by Jeremy Sebes



Brown bullhead (*Ameiurus nebulosus*), photograph by Dhafir Williams



Bluegill (*Lepomis macrochirus*), photograph by Jeremy Sebes



Green sunfish (*Lepomis cyanellus*), photograph by Jeremy Sebes



Largemouth bass (*Micropterus salmoides*), photograph by Jeremy Sebes



Red swamp crayfish (*Procambarus clarkii*), photograph by Jeremy Sebes



**Appendix D.** Photos from camera stations.



Pond turtle basking on floating log placed along shoreline of the Wheatley Preserve Pond at Scholder Creek for enhanced structure.