Data Summary for the TransNet Environmental Mitigation Program Grant Agreement 5001140 Regarding Southwestern Pond Turtle Restoration at Sycuan Peak Ecological Reserve, March 2012

Data Summary

Prepared for:

SANDAG
TransNet Environmental Mitigation Program

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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U.S. GEOLOGICAL SURVEY
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ABSTRACT
The southwestern pond turtle (*Emys marmorata pallida*) was once widespread and common in southern California but has experienced sharp declines. This species is heavily impacted by fragmentation, recreation, and the introduction of nonnative aquatic species which compete with and directly predate upon it (Holland 1991; Brattstrom & Messer 1988). This species has only moderate legal protection statewide. In San Diego the southwestern pond turtle is a covered (protected) species in the Multiple Species Conservation Program (MSCP) which requires monitoring and management. However, very few populations of the southwestern pond turtle remain in the MSCP area of San Diego with no recruitment of this species having been observed in over a decade. In 2005 the largest population in the MSCP, consisting of approximately 38 mature individuals and no juveniles, was determined to be in the Sweetwater River at Sycuan Peak Ecological Reserve (Madden-Smith et al. 2005). With controlled access and over three kilometers to the nearest main road, the largest stressor to the southwestern pond turtle at this site is nonnative aquatic species.

In 2009 the U.S. Geological Survey (USGS) began removing nonnative species from Sycuan Peak Ecological Reserve (SPER) with the goal of restoring the aquatic habitat for southwestern pond turtles and stimulating recruitment. Nonnative aquatic species removed include American bullfrogs (*Lithobates catesbeianus*), African clawed frogs (*Xenopus laevis*), sunfish (*Lepomis* spp.), largemouth bass (*Micropterus salmoides*), and crayfish (*Procambarus* spp.). In connection with the nonnatives removal, eggs were harvested from gravid female southwestern pond turtles to establish a captive rearing program at the San Diego Zoo to headstart turtles for reintroduction to the Sweetwater River.

Following the nonnatives removal, the southwestern pond turtle population was monitored to determine if there were any initial beneficial effects of the removal of nonnative aquatic species. Two juvenile southwestern pond turtles were detected at SPER, one first detected in 2010 (and again in 2011) and a second juvenile detected in 2011. These were the first detections of successful recruitment of this species in the MSCP in over a decade. Recolonization by nonnatives was also monitored and compared with the different seasonal water discharge events that can occur at SPER. The type, timing, and amount of effort required for maintenance of nonnatives reduction depends on the type of water discharge (intentional water release or natural overtopping of Loveland Reservoir) for that year.

INTRODUCTION
The southwestern pond turtle (*Emys marmorata pallida*) remains one of the rarest covered (protected) species within the Multiple Species Conservation Program (MSCP) in San Diego County with only three populations known to have females, the largest population estimated to be between 30-81 individuals and no populations showing recruitment (Madden-Smith et al. 2005). Sycuan Peak Ecological Reserve (SPER) (Figure 1) was created as part of the reserve system for the MSCP and currently is inhabited by the largest MSCP population of southwestern pond turtles.

The U.S. Geological Survey (USGS) recently began work on SANDAG TransNet Environmental Mitigation Program Land Management Grant Agreement 5001140 to conduct southwestern pond turtle restoration and nonnatives removal at SPER. The USGS in conjunction with the San Diego Zoo and the California Department of Fish and Game (CDFG) has continued

work begun on the southwestern pond turtle by USGS in 2002 in efforts to enhance and restore the population at SPER. This is the largest population within the MSCP but had no detectable recruitment in recent (2002-2003) surveys (Madden-Smith et al. 2005). Southwestern pond turtles (and other native aquatic species) are heavily impacted by nonnative species in the riparian habitat which include American bullfrogs (*Lithobates catesbeianus*), African clawed frogs (*Xenopus laevis*), sunfish (*Lepomis* spp.), largemouth bass (*Micropterus salmoides*), crayfish (*Procambarus* spp.), and nonnative turtles. Much like nonnative plants, these aquatic nonnatives can spread throughout the riparian areas and directly impact the natives through predation and also indirectly through competition (Holland 1991; Brattstrom & Messer 1988). Similar to revegetation efforts, successful pond turtle restoration efforts include removal of nonnatives and headstarting of the native turtles (Spinks et al. 2003).

The restoration effort at SPER is designed as an experiment within an adaptive management framework that initially focuses on removing the nonnative predators that are negatively impacting the turtles. In prior surveys there were no juvenile southwestern pond turtles observed at SPER (Madden-Smith et al. 2005). As has been seen in many impaired pond turtle populations (Holland 1991) co-located with nonnative predators, recruitment had not been detected at this site. To test the hypothesis that removing nonnative predators results in increasing recruitment and to evaluate the overall health of the population, nonnative species removal is followed by monitoring consisting of surveying for turtles and potentially re-invading of nonnative species in order to measure success.

Additional efforts include a new collaboration with the San Diego Zoo. This collaboration involves the establishment of a reserve population of southwestern pond turtles at the San Diego Zoo to support future headstarting of juveniles for SPER and other reserves within the MSCP. This is similar in concept to seed banking for plants. Headstarting of southwestern pond turtles involves captive breeding individuals and raising them to a size in which they are resistant to predation. Headstarting combined with restoration efforts has proved to be a successful method of conservation for southwestern pond turtles (Spinks et al. 2003). This effort stands to be a major milestone for the conservation of southwestern pond turtle in the southernmost portion of its range. Due to the fact that the San Diego County populations of southwestern pond turtles are severely fragmented and are suffering from the effects of nonnative species (Madden-Smith et al. 2005, Bury and Germano 2008), aggressive and active management can effectively enhance the populations of this species (Spinks et al. 2003).

STUDY AREA

Sycuan Peak Ecological Reserve lies along the Sweetwater River downstream from Loveland Reservoir and is managed by the California Department of Fish and Game. Access is controlled and the nearest paved road is over three kilometers from the reserve. SPER contains a mix of chaparral and sage scrub upland and riparian with oak and sycamore along the Sweetwater River and Lawson Creek. The flow of the Sweetwater River through the reserve is seasonal, but deep pools persist through the dry seasons.

Figure 1. Overview of Study Site. Sycuan Peak Ecological Reserve is located downstream of Loveland Reservoir along the Sweetwater River. Blue lines indicate property boundary in reference to the occupied turtle habitat. Southwestern pond turtles are known from four large pool complexes within the site.

The southwestern pond turtles inhabit and move between the large, deep pools along the Sweetwater River. Four separate pooling complexes can be identified based on continuity, permanence, morphology, and substrate (Figure 1 and Table 1). Pools 1 and 2 are predominately bedrock and bolder lined while pools 3 and 4 have sandy bottoms and banks (see Appendix). During the 2010 and 2011 surveys, Pools 1 and 3 were never observed to dry completely. Pools 2 and 4 did dry completely during the late fall.

Table 1. **Study Site Overview.** Overview of pool complexes at Sycuan Peak Ecological Reserve that contain suitable habitat for southwestern pond turtles. Coordinates are in WGS84 and represent the general location of the center of the pool complex.

Name	Latitude	Longitude	General Description
Pool 1	32.772304	-116.800899	Most downstream turtle pool complex with large, deep bedrock pools
Pool 2	32.771747	-116.799467	Second most downstream turtle pool complex with shallow bedrock and sandy bottom pools
Pool 3	32.772224	-116.798829	Third most downstream turtle pool complex with predominately sandy bottoms and shorelines
Pool 4	32.772527	-116.797894	Most upstream turtle pool complex with predominately sandy bottoms and shorelines, can dry completely in some years

METHODS

The field component of this project consisted of using a suite of techniques for detecting aquatic nonnative species and southwestern pond turtles. These included visual encounter, baited hoop net trapping, minnow net trapping, seine netting, and dip netting surveys (Figure 2). Survey methods follow established USGS protocols (U.S. Geological Survey 2006a, 2006b, 2006c) and utilize standardized trapping techniques (Ashton et al. 2001; Rathbun et al. 2002). Large hoop traps were set parallel to shore in most cases and anchored to shore with a rope (tied to the center top of the trap) so that the traps did not drift or sink. The top of the traps were raised above the water's surface with floats to allow captured turtles (and other species) to surface for air (see Figure 2). The traps were baited with either punctured cans of sardines or frozen fish in a plastic hardware cloth net to prevent consumption by the turtles; the bait simply served as an attractant to the trap. Minnow traps without bait were anchored to the shore but were often allowed to sink to the lower portions of the pools for trapping African clawed frogs (small openings prevent trapping juvenile turtles). Survey methods target nonnative aquatic invertebrates (crayfish), amphibians (American bullfrogs and African clawed frogs), turtles, and fish. Time lapse camera stations were also used to augment trapping efforts by detecting basking turtles that do not enter or can escape from the baited hoop traps. Survey locations, effort, and results are presented in Tables 2, 3, and 4.

Figure 2. Trapping Methods. Examples of large hoop traps with floats and small minnow traps.

Animal captures were recorded electronically and entered into the USGS Multi-Taxa database server. Date, time, location of capture, species, and age class were recorded for all aquatic animals observed. All nonnative aquatic species observed were removed from the site. Each southwestern pond turtle captured was measured, weighed, and sex was determined based on morphological traits (Holland 1991). Measurements included carapace length, carapace width, carapace height, and plastron length (see Appendix). General health condition and number of annuli were also recorded. Upon initial capture, a small (approximately 3-5mm) tail-tip tissue sample of each southwestern pond turtle was collected and stored in 95% ethanol. Southwestern pond turtles were checked for tags or tagged with an Avid® radio-frequency identification (RFID) microchip (encoded with a unique identification number). The microchips were inserted inside the body cavity anterior to the right rear leg following methods of Buhlmann and Tuberville (1998) and a triangular notch was made with a small triangular file on the femoral scute to indicate that the individual was tagged. Both methods assist in future recognition of the individual. Most southwestern pond turtles were released near the point of capture immediately following processing. Females were x-rayed and gravid female southwestern pond turtles were taken to the San Diego Zoo where they were kept in quarantine until eggs were laid (Figure 3). The females were returned to the site as soon as they fully recovered. Eggs were incubated for the San Diego Zoo's captive rearing program (see Program Match section).

Figure 3. Gravid Southwestern Pond Turtles. Gravid southwestern pond turtle x-radiograph (left) and quarantined egg-laying facility (right).

RESULTS

Results are summarized and presented in tables below according to task. Survey data for all tasks are stored in the San Diego Management and Monitoring Program's South Coast Multi-Taxa Database and are also presented in California Department of Fish and Game's Biogeographic Information and Observation System (BIOS) as DS701 (Pond Turtles and Aquatic Invasives – Sycuan Peak). Representative photos of observed species are included in the Appendix.

Late-Season Nonnatives Removal

Late-season surveys included intensive and continuous trapping in the late summer and fall of 2009, trapping until nonnatives were no longer being detected. These intensive surveys included the use of baited hoop traps, minnow traps, seine and dip netting, and visual encounter surveys. Nonnatives removed include sunfish, African clawed frogs, American bullfrogs, and crayfish (Table 2). During these surveys, one gravid female with five fertile eggs was captured. All five eggs produced juveniles which are currently being reared at the San Diego Zoo.

Table 2. Late-Season Nonnatives Removal Summary. Results of nonnatives removal by pool for each species with total trap hours by pool included.

Species	Pool Complex				Total
	1	2	3	4	
Sunfish (*Lepomis* spp.)	42	14	3	0	59
Crayfish (*Procambarus* spp.)	33	87	12	7	139
American bullfrog (*Lithobates catesbeianus*)	1	1	3	4	9
African clawed frog (*Xenopus laevis*)	17	16	88	2	123
Total nonnatives removed:	93	118	106	13	330
Total trap hours:	2,822	2,809	3,060	1,582	10,273

Pre-Season Nonnatives Removal

Pre-season nonnatives removal surveys included trapping in early spring of 2010. While employing multiple intensive techniques, these surveys detected only a few nonnatives with only juvenile sunfish and no African clawed frogs detected by any method, including visual searches (Table 3). These surveys showed initial success of late-season removal which if maintained may allow for increased southwestern pond turtle activity during the breeding season. This also indicated that a less intensive series of springtime surveys may be suitable for continued control of nonnatives at the site. During these surveys, three gravid females with a total of six fertile eggs were captured. These eggs produced five new juveniles which are currently being reared at the San Diego Zoo.

Table 3. Pre-Season Nonnatives Removal Summary. Results of nonnatives removal by pool for each species with total trap hours by pool included.

Species	Pool Complex				Total
	1	2	3	4	
Sunfish (*Lepomis* spp.)	0	0	0	1	1
Crayfish (*Procambarus* spp.)	0	0	1	11	12
American bullfrog (*Lithobates catesbeianus*)	0	0	2	2	4
African clawed frog (*Xenopus laevis*)	0	0	0	0	0
Total nonnatives removed:	0	0	3	17	17
Total trap hours:	1,814	1,259	2,167	1,067	6,307

Mid-Season Nonnatives Removal/Turtle Monitoring

Mid-season surveys included intensive trapping events dispersed through the summer of 2011, targeting southwestern pond turtle activity and removing any nonnatives that may have moved downstream from the overtopping of Loveland Reservoir. Nonnatives removed included sunfish, largemouth bass, African clawed frogs, and crayfish (Table 4).

Turtle trapping for detection of recruitment yielded 22 southwestern pond turtle captures including captures of 2 juvenile southwestern pond turtles (Figure 4). These were the two youngest southwestern pond turtles detected in the MSCP in over ten years and documents the first evidence of recruitment in the wild in that time. This natural recruitment of southwestern pond turtles at this site occurred while also harvesting eggs from several gravid females indicating the presence of at least four reproductively viable female southwestern pond turtles.

Table 4. Mid-Season Nonnatives Removal/Turtle Monitoring Summary. Results of nonnatives removal and turtle monitoring by pool for each species with total trap hours by pool included.

Species	Pool Complex				Total
	1	2	3	4	
Sunfish (*Lepomis* spp.)	29	1	-	-	30
Largemouth bass (*Micropterus salmoides*)	-	4	1	-	5
Crayfish (*Procambarus* spp.)	8	20	33	30	91
African clawed frog (*Xenopus laevis*)	9	15	6	5	35
Total nonnatives removed:	46	40	40	35	161
Western pond turtle (*Emys marmorata*)	11	7	2	2	22
Total trap hours:	2,915	2,430	2,662	2,010	10,017

Figure 4. Juvenile Southwestern Pond Turtles. During monitoring after nonnatives removal, two juvenile southwestern pond turtles were observed. The first juvenile (left) was observed in 2010 and again in 2011, the second (right) was observed on multiple occasions in 2011.

Seasonal Fluctuations in Water Discharge

The flow of the Sweetwater River through SPER is in part controlled by the Sweetwater Water Authority which manages Loveland Reservoir upstream from SPER as a municipal water source. Water discharging from Loveland Reservoir is either through intentional high volume water releases (managed release) or through overtopping events (water filling the reservoir is allowed to spill over the dam spillway). During the nonnatives removal program at SPER, both discharge profiles were observed (Figure 5).

In 2010, water was released intentionally from the reservoir. High wintertime flows were observed with no springtime or summer flow. During surveys in 2010, multiple individuals of only two nonnative species were observed at SPER (the American bullfrog and crayfish) with only one individual juvenile sunfish observed. The average nonnatives capture rate was less than 0.2 captures per 100 trap hours.

In 2011, Loveland Reservoir was allowed to overtop. Moderate springtime flows were observed without the high winter flows associated with the intentional water release. During the 2011 surveys, three additional nonnatives were observed in larger numbers (sunfish, largemouth bass, and African clawed frogs). The average nonnatives capture rate was greater than 1.4 captures per 100 trap hours. This was much less than the initial nonnatives capture rate of over 4.0 captures per 100 trap hours, but was much greater than during 2010. The long sustained springtime discharge associated with the overtopping of Loveland Reservoir may potentially facilitate the immigration of nonnative aquatic species.

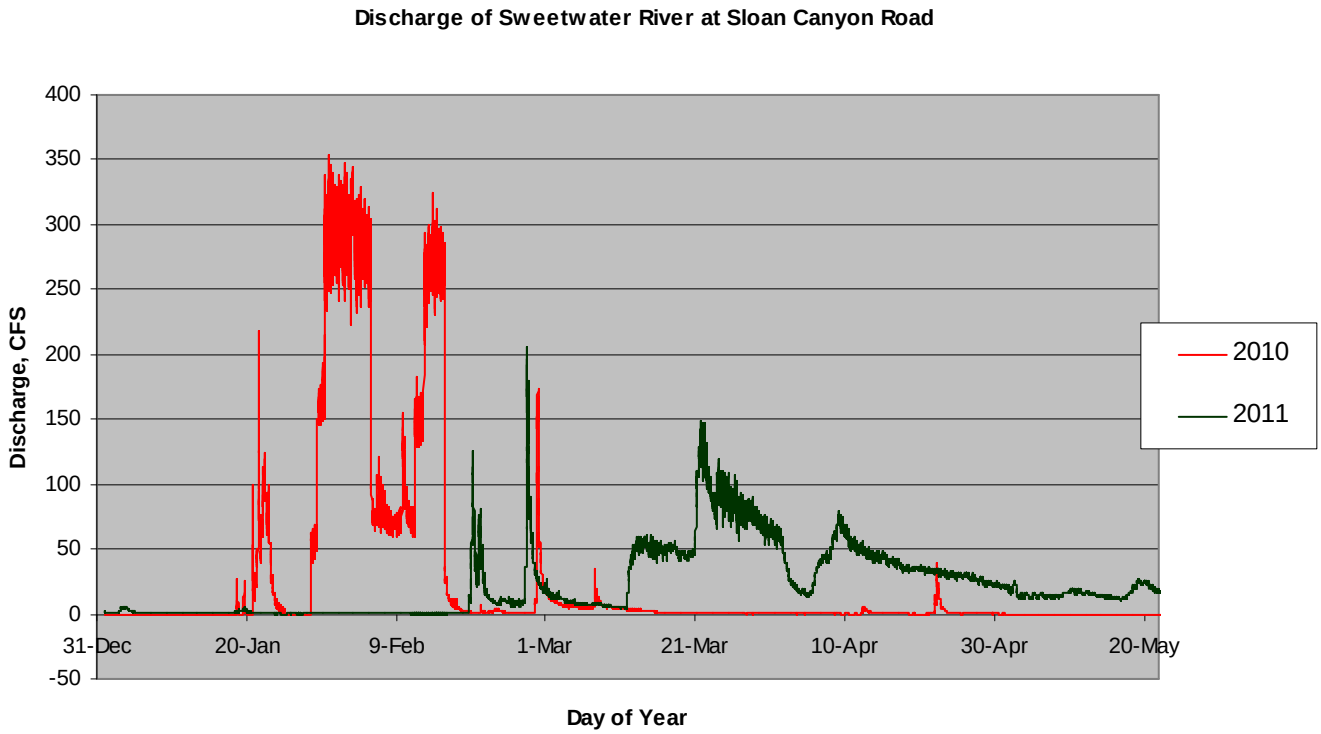

Figure 5. Discharge of Sweetwater River at Sloan Canyon Road. The discharge of Sweetwater River at Sloan Canyon Road as measured at the USGS Gauging Station for January through May of 2010 and 2011. Discharge was measured in cubic feet per second (CFS). The high flows (over 250 CFS) in 2010 resulted from the intentional water release from Loveland Reservoir. The moderate spring flows from 2011 result from the overtopping of Loveland Reservoir. Stream flow data are provisional (U.S. Geological Survey 2012).

MONITORING AND MANAGEMENT RECOMMENDATIONS

Southwestern Pond Turtle Monitoring

Based on recent monitoring (2002-2008) resulting in no detections of natural recruitment, success of the recent (2009-2011) nonnatives maintenance was determined by the detection of natural recruitment (defined as the presence of younger age classes) in the population of southwestern pond turtles at SPER. Turtle surveys utilizing visual encounter surveys, baited hoop traps, and camera stations can all detect juvenile southwestern pond turtles.

During the warm summer and early fall months, visual encounter surveys can be used to quickly determine if younger turtles are present at the site and if nonnatives have re-invaded. These surveys are also used to gather information on habitat, weather, water conditions, and disturbance in addition to the presence of aquatic species. In addition, visual encounter surveys can be used to determine whether the seasonal conditions provide adequate basking habitat for camera stations or if baited trapping is required or if a combination of the two methods is most suitable (i.e., one pool may have large, sunny areas for basking and another pool may not). Prior to setting baited hoop traps or camera stations, visual encounter surveys should be conducted to determine optimal placement of traps or cameras.

Baited hoop traps at SPER have yielded capture rates of 0.001 to 0.006 southwestern pond turtles per trap hour with the highest capture rates in August and September. Because of the variable capture rates of baited hoop traps, this method should be applied at minimum in two one week sample periods at least one week apart in the late summer or early fall. Resulting in direct capture of individuals, this method allows for positive identification and accurate assessment of age, sex, and growth of individual turtles.

Camera stations positioned on potential basking areas increases detectability of southwestern pond turtles by photographing individuals that may not be entering traps or may be able to easily escape from traps (i.e., very young juveniles and hatchlings). In August of 2011, camera stations successfully detected a basking juvenile southwestern pond turtle three weeks before being captured in a baited hoop trap. Camera stations can run continuously for five weeks (being checked regularly) for the same cost in labor as one week of trapping. However, with no individual being captured, this method does not allow for accurate individual identification or precise age assessment.

Nonnative Aquatic Species

Initial results illustrate that nonnatives control at SPER has direct benefits for the southwestern pond turtle and can be a successful strategy to restore the species in the reserve. The two juvenile southwestern pond turtles observed during the post nonnatives removal surveys were the first signs of successful recruitment of the species in the MSCP region in over a decade.

The different water management strategies along the Sweetwater River affect the success of the nonnatives removal over time. Water that is intentionally released or allowed to overtop from Loveland Reservoir provides connectivity between SPER and off site pools and allows nonnatives to spread throughout the system. In years where water flows from Loveland Reservoir, periodic maintenance of nonnatives at the main pools at SPER will be necessary to allow the wild recruitment to persist.

Nonnatives removal following overtopping events associated with high rainfall years should begin after discharge from Loveland Reservoir terminates. Two one week surveys consisting of trapping, visual encounter, seine, and dipnet methods in the spring and early summer will capture adults potentially before breeding. Two one week surveys consisting of trapping and visual encounter methods in the fall when water levels are lowest will capture residual adults and juveniles.

Nonnatives removal following wintertime water releases should focus on American bullfrogs with visual encounter surveys as early as March or April before any dispersing bullfrogs have an opportunity to breed. In addition, two one week surveys consisting of trapping and visual encounter methods in the late summer and fall appear to be effective at removing any maturing aquatic nonnatives that dispersed into the site during the water release.

Nonnative Vegetation
Nonnative vegetation such as giant reed (*Arundo donax*) can alter the streambed of the site by filling in pools and reducing water availability which impacts turtle habitat. While not present in much of SPER, some small stands of giant reed exist downstream of the main turtle pools. These stands of giant reed should be monitored as removal of these stands may expand the available habitat for the southwestern pond turtles.

Southwestern Pond Turtle Headstarting
Headstarting (the captive rearing of juvenile turtles to a size where risk of predation has been eliminated) of southwestern pond turtles has been successful in augmenting populations at restoration sites elsewhere in their range (Spinks et al. 2003). A robust headstarting program includes captive rearing of wild eggs as well as captive reproduction. The objective is to have a diverse founder population in captivity to protect against stochastic events while maintaining wild genetics as much as possible.

During 2009 and 2010, eggs were harvested from gravid female southwestern pond turtles captured during the restoration work at SPER to establish a captive rearing program at the San Diego Zoo. These eggs produced 10 juveniles currently being reared in isolation and off display at the San Diego Zoo. Nine of the juveniles were from the same mother, five from 2009 and four from 2010. Four or five of these juveniles make excellent candidates for reintroduction to SPER leaving a sufficient number of siblings for a reserve population at the San Diego Zoo. It is also recommended to continue moderate egg harvesting to build this reserve population and to augment the SPER population with headstarted individuals.

Release of headstarted turtles within the first two to four years has had successful results with site fidelity (the tendency for the juveniles to remain at the release site without wandering) (Tryon and Herman 1990, Tryon 2009). However, two options for release should be examined to determine success of release methods for the southwestern pond turtle specifically in San Diego. One option is to slowly introduce the juveniles to the site by using enclosures at the site in which the juveniles can be contained for several months before being completely released, this is a soft release. The other option is to release the juveniles directly at the site with no enclosure. Both release methods have been successful for bog turtles (*Clemmys muhlenbergii*) (Tryon and Herman 1990, Tryon 2009). Regardless of method, released juveniles should be monitored regularly after release using radio telemetry. This can be used to recapture the individuals to assess health and determine where they are moving throughout the site.

ACKNOWLEDGEMENTS AND PROGRAM MATCH

Southwestern Pond Turtle Headstarting

Combined with the nonnatives removal program is a headstarting program overseen by the San Diego Zoo. During the trapping surveys, San Diego Zoo staff assisted with southwestern pond turtle monitoring and capture of gravid female southwestern pond turtles. Gravid females were taken to the San Diego Zoo and kept until eggs were laid, then returned to the site. The San Diego Zoo staff then incubated and hatched the eggs; juveniles were raised in isolated enclosures (Figure 6). To date, three different females from SPER have produced four fertile clutches having a total of ten hatchlings. When large enough, the juveniles can be released at SPER. This component of the program was paid for by the San Diego Zoo and its employee contributions program.

Figure 6. Southwestern Pond Turtle Headstarting. Eggs from gravid females from Sycuan Peak Ecological Reserve (upper left) were incubated in the San Diego Zoo Reptile House incubation facility (upper right). As hatchlings emerged (lower left) they were transferred to isolated enclosures (lower right).

Field Assistance and Site Access

The California Department of Fish and Game provided and coordinated access to the reserve. Without this support, this restoration would not be possible.

Fieldwork and Animal Care

We would like to thank the following people for the many hours of fieldwork, animal care, equipment care, and curation: (USGS) Denise Clark, Jeffery Markert, Carlton Rochester, (San Diego Zoo) Tito Caducoy, Kim Lovich, Tommy Owens, Brandon Scott, (CDFG) Steven Choy, and Natalie Uriarte.

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Appendix
Study Area, Methods and Species Photos

STUDY AREA PHOTOS:


The lower pools (Pools 1 (left) and 2 (right)) were characterized by more boulders and bedrock with moderate to open canopy. Having deeper pools and a larger amount of basking and foraging areas, the lower pools supported the majority of the southwestern pond turtle population at SPER.


The upper pools (Pools 3 (left) and 4 (right)) were characterized by soft sand and gravel bottoms, more emergent vegetation and a less open canopy. These pools dry seasonally but still provided habitat for southwestern pond turtles.

Pool 1 during low flow conditions that predominated at SPER (left) and during the high flows of a water release (right). The red arrows indicate the same point on the rocky ledge above the pool.

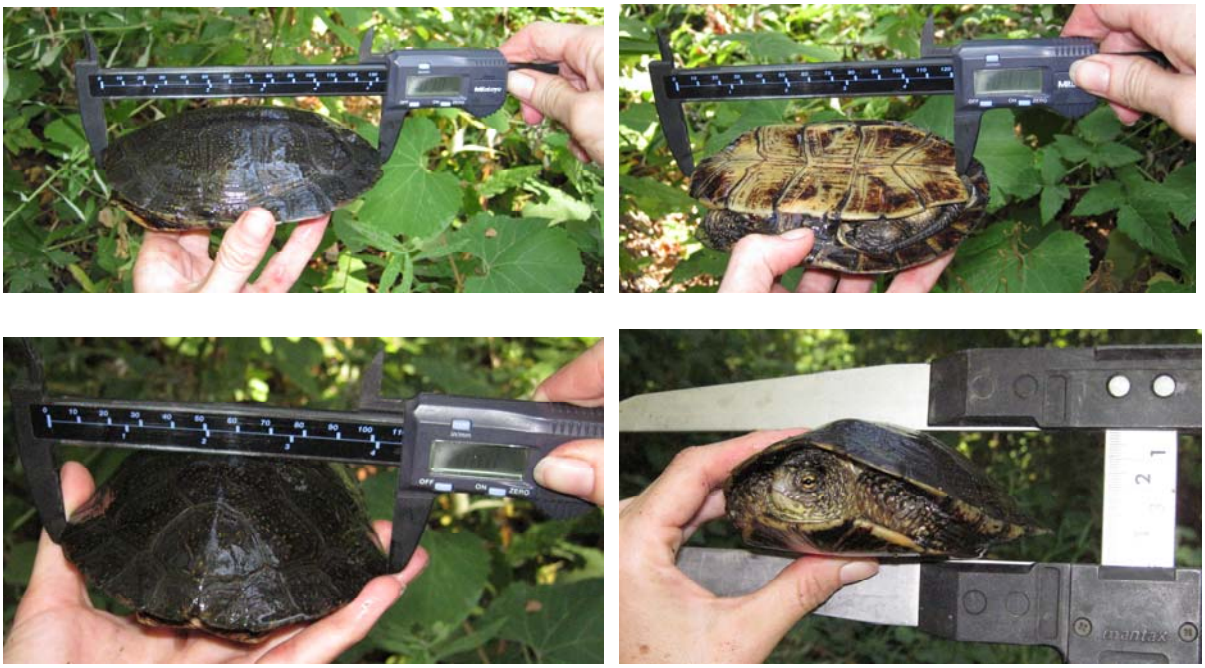
TRAPPING AND OBSERVATION METHODS:


Minnow traps (left) and baited hoop traps (right) work very well for the fully aquatic nonnative species.




Time delayed cameras positioned at the site (upper left) were useful for detection of southwestern pond turtle activity when the turtles were not entering the baited traps. This camera took photos of an adult southwestern pond turtle foraging in the evening (upper right) as well as juvenile and adult turtles basking during the day time (middle right and bottom).

MEASURING AND MARKING TURTLES:

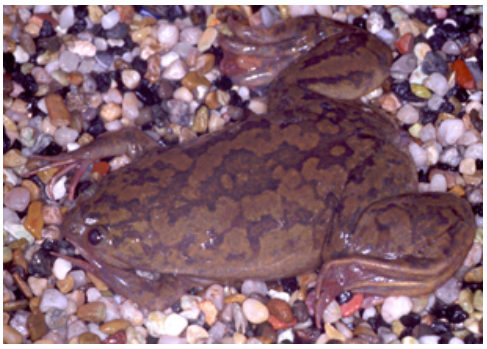


Turtles were measured using either small or large calipers. Carapace (upper left) and plastron (upper right) lengths, width (lower left), and carapace height (lower right) were recorded.

Turtles were weighed using a PESOLA® spring scale (left) and were marked with Avid® microchips (upper right, shown with microchip scanner) and notched (lower right) on the plastron near the point of microchip insertion.

NONNATIVE AQUATIC SPECIES:


American bullfrog (*Lithobates catesbeianus*) adult and larvae.



African clawed frog (*Xenopus laevis*) adult and larvae.


Largemouth bass (*Micropterus salmoides*) and sunfish (*Lepomis* spp.).

Crayfish (*Procambarus* spp.)

SOUTHWESTERN POND TURTLES






All southwestern pond turtles were photographed for tracking health conditions through time. Overall southwestern pond turtles at SPER exhibited good health with no observations of any illness or lesions. Coloration was variable between individuals and was particularly noticeable on the ventral surfaces.

Adult male southwestern pond turtles typically exhibit a vent positioned posterior to the edge of the carapace (upper left) and a concave plastron (lower left). In contrast, adult female southwestern pond turtles typically have a vent positioned anterior to or very near to the edge of the carapace (upper right), a flatter plastron and a taller carapace (lower right).