Demography and Movements of the Southwestern Pond Turtle (*Actinemys pallida*) in the Río Santo Domingo Watershed, Baja California, Mexico

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Abstract - We studied a remote and robust population of *Actinemys pallida* (Southwestern Pond Turtle) in the upper Río Santo Domingo (RSD) watershed, Sierra San Pedro Mártir, Baja California, Mexico. We conducted cursory assessments in 2014 and 2015 and intensive trap-based surveys in 2016 and 2022. We captured and marked 486 unique turtles a total of 597 times. Using closed-population models within years, we estimated the total abundance of one 3.8-km study reach to be 511.1 (CI = 395.7–686.5) turtles in 2016 and 663.8 (467.2–1011.0) turtles in 2022, equivalent to instream densities of 134.5 turtles/river-kilometer (rkm) in 2016 and 174.7 turtles/rkm in 2022. The proportion of juveniles among detected turtles was 0% in 2014, 4.6% in 2015, 21.7% in 2016 and 19.6% in 2022. In 73.5 trap-nights (TN), we recorded 532 captures, equivalent to an average of 7.24 turtles/TN or 0.30 turtles/trap-hour. The RSD population appears to be one of the largest known in Baja California and is relatively large across the range of the Southwestern Pond Turtle. Thirty-three turtles recaptured more than 1 year apart had moved up to 1.6 km downstream and 2.3 km upstream, averaging a net upstream movement of 240 m. Adult males and females both had an average straight carapace length (SCL) of 112 mm, which is small for Southwestern Pond Turtles, but expected in the regional context. In addition to a regionally significant population of Southwestern Pond Turtles, this isolated, perennial watercourse supports a micro-endemic fish and 2 regionally rare amphibians and warrants protection as a globally significant biodiversity reserve.

Introduction

Actinemys pallida (Seeliger) (Southwestern Pond Turtle) occurs in arroyos, streams, rivers, ponds, cattle tanks, and other seasonal and perennial waterbodies (Ernst and Lovich 2009, Legler and Vogt 2013) from the Coast Ranges of central California to northern Baja California (Rhodin et al. 2021). The southern edge of its confirmed range is generally considered to be the Sierra San Pedro Mártir (SSPM; Legler and Vogt 2013), though an outlying and disjunct population was

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reported by Valdez-Villavicencio et al. (2016) from the Vizcaíno Desert of northern Baja California, 95.5 km south of the nearest occurrence. Previously designated as a subspecies of *Actinemys marmorata* (Baird & Girard) (Western Pond Turtle), the Southwestern Pond Turtle was recognized as a unique species following an examination of 89 nuclear single nucleotide polymorphisms (SNPs) by Spinks et al. (2014), which strongly supported a southern geographic cluster corresponding to Seeliger's (1945) subspecific description of *A. m. pallida* (Rhodin et al. 2017). Spinks et al. (2014) further noted the apparent distinctiveness of Baja California populations, which may represent an undescribed species (Rhodin et al. 2017). The Southwestern Pond Turtle is the only freshwater turtle native to the state of Baja California, Mexico. The Southwestern Pond Turtle is of conservation concern throughout its range and appears to be at greater risk of decline than its sister species, the Western Pond Turtle, which generally occurs in higher density (Manzo et al. 2021). Like many other turtle species in the deserts of the Southwest, Southwestern Pond Turtle populations have declined as a result of drought, introduced predators, habitat loss, and wetland degradation (Bury et al. 2012). However, there are still sites that support robust populations (Germano 2010, Germano and Bury 2001). Despite apparent range contraction in Baja California, there are watersheds with less human disturbance where populations of Southwestern Pond Turtles persist (Peralta-García and Valdez-Villavicencio 2015). However, relatively little has been published about Mexican populations, and it is important to determine their status and population trends to inform appropriate conservation and management strategies. Our objective was to conduct a systematic demographic assessment of the Southwestern Pond Turtle and to estimate the population size in an upper tributary of the Río Santo Domingo.

Methods

Study area

The Sierra San Pedro Mártir (SSPM) of northern Baja California encompasses a biodiverse region at the junction of the Californian and Sonoran Desert ecological provinces. The upper elevations and ravines of the SSPM harbor unique assemblages of plants and animals, including the southernmost occurrences of many northern, montane, Californian, and conifer species (Thorne et al. 2010). Several perennial streams traverse this transitional desert region, increasingly strained by drought and rising water demands. We conducted our study in an upper basin tributary to the Río Santo Domingo (RSD), which drains the western face of the SSPM. The RSD represents a notable riparian and aquatic refuge that supports numerous vertebrate species of conservation interest (Fig. 1). Specifically, the RSD supports 1 micro-endemic fish, *Oncorhynchus mykiss nelsoni* (Evermann) (San Pedro Mártir Rainbow Trout; Ruiz-Campos et al. 2014). The presence of trout in portions of this basin suggests the stable availability of cool water over long periods, indicative of hydrological stability. Further, this watershed also supports 2 regionally rare amphibians, *Rana draytonii* Baird and Girard (California Red-legged Frog; Peralta-García et al. 2016, Richmond et al. 2014) and *Anaxyrus californicus* (Camp) (Arroyo Toad;

Peralta-García et al. 2016, USFWS 2014). The ecological integrity and richness of rare vertebrates of the RSD are regionally—and perhaps globally—significant.

Our study area is a meandering, perennial tributary stream on the western slope of the SSPM at an elevation of ~600 m. The stream comprises a series of bedrock pools up to 2 m in depth as well as shallow runs, glides, and braided channels. Bedrock pools are thickly vegetated by *Typha domingensis* Persoon (Southern Cattail) and *Schoenoplectus californicus* (C.A. Meyer) Soják (Tule). Backwater pools support *Ludwigia peploides* (Kunth) P.H. Raven (Floating Primrose-Willow), and seepy banks support such species as *Anemopsis california* (Nuttall) Hooker & Arnott (Yerba Mansa) and *Erythranthe cardinalis* (Douglas ex Bentham) Spach (Scarlet Monkeyflower). Floodplain forests are dominated by *Populus fremontii* S. Watson (Fremont Cottonwood), *Platanus racemosa* Nuttall (Western Sycamore), and *Salix lasiolepis* Bentham (Arroyo Willow) (Minnich 1987, Solis-Soleto et al. 2022, Thorne et al. 2010, Wiggins 1980). Adjacent to the riparian areas are woodlands of *Quercus agrifolia* Née (Coast Live Oak) surrounded by Sonoran Desert vegetation typical of middle-elevation slopes and characterized by such species as *Adenostoma fasciculatum* Hooker & Arnott (Chamise), *Cylindropuntia* spp. (chollas), *Opuntia* spp. (prickly pears), *Lophocereus schottii* (Engelmann) Britton & Rose (Senita Cactus), and *Fraxinus parryi* Moran (Chaparral Ash). There are sparsely scattered *Pinus jeffreyi* Balfour (Jeffrey Pine) (Minnich 1987). The area

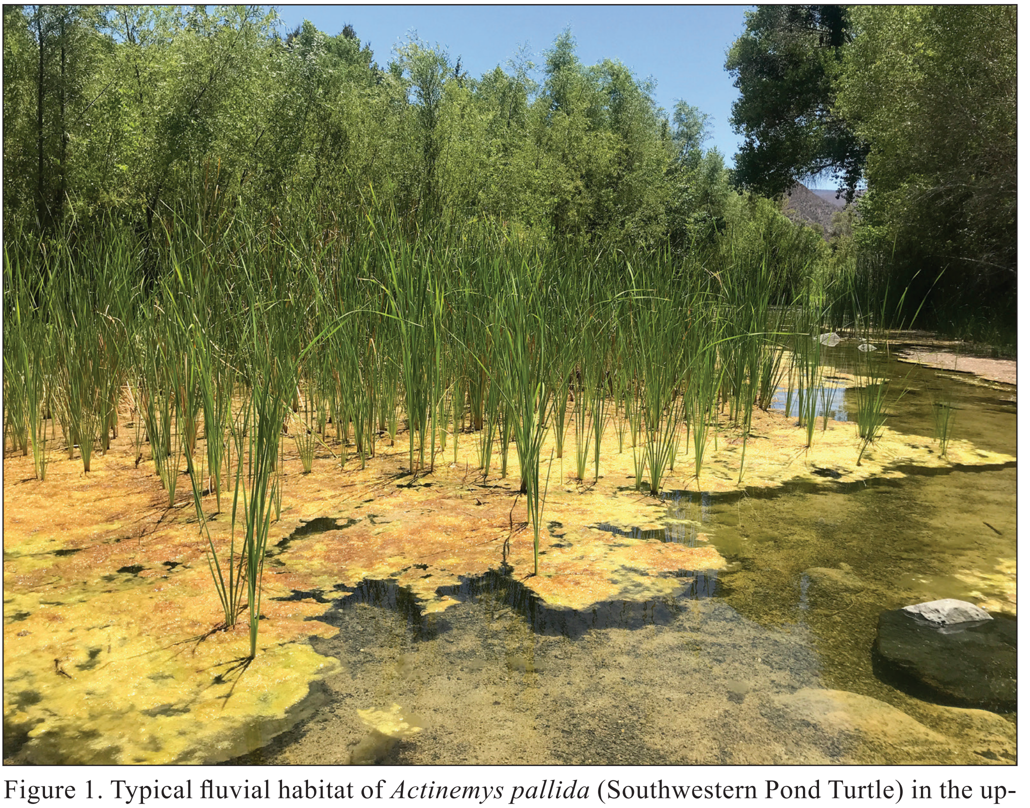

Figure 1. Typical fluvial habitat of *Actinemys pallida* (Southwestern Pond Turtle) in the upper watershed of Río Santo Domingo, Baja California, Mexico.

appears to be devoid of aggressively invasive plants such as *Tamarix ramosissima* Ledeb (Saltcedar; M.T. Jones, unpubl. data). At present, this tributary stream is privately owned and has no direct road access. Lower elevations of the study stream are intermittent, but evidently connected to the ocean by high flows in some years, as evidenced by the record of an ammocoete-stage *Entosphenus tridentatus* (Richardson) (Pacific Lamprey) found in an upper basin tributary in 1997 (Ruiz-Campos et al. 2000, 2014). Like other streams draining the west slopes of the SSPM, our study site has alkaline flows with pH exceeding 8 (Ruiz-Campos et al. 2023).

We directed most of our effort along a 3.8-km "focal study area" that was a continuous reach of canyon with free-flowing stream, which we surveyed and trapped in all years. The entire segment was underlain by bedrock and broken rock, characterized by a series of bedrock pools as defined by Ruiz-Campos et al. (2023). Our focal study area was nested within a longer segment of suitable habitat, of which we opportunistically trapped and surveyed an additional 2.1 km of canyon.

Survey effort

We conducted 4 surveys on 19–21 March 2014 (2 observers), 5 August 2015 (4 observers), 23–26 July 2016 (5 observers), and 1–4 August 2022 (6 observers), during which we captured turtles using baited traps and visual surveys in pools, as described below. We conducted 1762.95 hours of trapping (73.5 trap-nights [TN]), with effort distributed as follows: 2014: 1 baited hoop trap for 72 trap-hr (3.0 TN); 2015: 1 trap for 6 trap-hr (0.3 TN); 2016: 11 traps for 660 trap-hr (27.5 TN); and 2022: 22 traps for 1024.95 trap-hr (42.7 TN). In 2014, we used 1 single-opening hoop trap 0.5 m in diameter stabilized by 2 PVC posts connected to the first and last hoop to stretch the trap open (Memphis Net and Twine Co., Memphis, TN) baited with sardines in soybean oil, and in subsequent years we used minnow-style collapsible traps ~91 cm (36 in) long, with openings ~13 cm (5 in) wide (TR-502, Promar, Gardena, CA), also baited with sardines in soybean oil. We set minnow traps primarily in lateral scour pools, mid-channel pools, and backwater pools as defined by Ruiz-Campos et al. (2023), but also in plunge pools, step pools, and glides. We secured traps to sturdy vegetation with twine, submerged halfway with at least 1 empty 2-L plastic bottle for flotation. We checked traps at least every 12 hr. While setting and checking traps, and in addition to our trap runs, we visually searched for turtles in open water, and we "muddled" for turtles under banks, in algae mats, and in aquatic vegetation. Generally, we conducted visual surveys and trapping for ~12 hours each day, except for travel days spent accessing or leaving the canyon, on which we typically searched for 2–6 hours. In bedrock pools deeper than 1 m, we used a face mask and snorkel to search under boulders, in rock overhangs, and amongst branches and overhanging vegetation. Our combined visual survey effort while setting, checking, and pulling traps across years was ~396 person-hours. Only captures and recaptures (by trap or by hand) from the focal study area were used for subsequent population-size estimation, but other reported demographic parameters are based on captures and recaptures throughout the contiguous stream system.

Turtle processing

We marked all captured turtles using the shell-notch code of Holland (1994). We weighed each turtle to the nearest 0.1 g using either a digital pharmaceutical scale or a spring-loaded scale. We measured straight carapace length (SCL; Method D of Iverson and Lewis 2018), carapace width (CW), shell depth (SD), and straight plastron length (SPL; Method H of Iverson and Lewis 2018) using dial calipers. We classified as juveniles all turtles with SCL ≤ 90 mm, the minimum size that males were observed courting in southern California by Holland (1994). When possible, we estimated the number of growth periods visible on the abdominal scutes of each turtle. Turtles whose scutes were completely worn or did not exhibit any evidence of recent growth were not assigned a precise age in years. We photographed the carapace and plastron of every turtle. Upon recapture of a marked turtle, we visually confirmed the animal's identity by comparing it against the archived photographs. We assessed the reliability of our growth-ring estimates in 2 ways: first, we evaluated our ring count upon recapture for all turtles that were assigned a precise age upon initial capture. Second, we re-assessed, from archived photographs, all the turtles recaptured in multiple years for which we had assigned an initial age estimate.

Population estimation and statistical inference

We analyzed capture–recapture data for our study reach using closed-population models in the package 'Rcapture' (Rivest and Baillargeon 2022) in R v. 4.2.2 (R Core Team 2023). We selected closed-population models within year because of the short duration of our discrete sampling periods. Following Rivest and Baillargeon (2022), we estimated the total population size for 2016 and 2022 using the function 'closedp' and evaluated models M0 (which assumes capture probabilities for all individuals are constant over time) and Mt (where capture probabilities vary among sampling occasions). We selected the best model based on Bayesian information criterion (BIC; Stone 1979). We analyzed recapture data separately for each of 2 years with sufficient sampling data, 2016 and 2022. We used each day as a distinct sampling event. In July 2016, the 4 sampling events were 23, 24, 25, and 26 July. In August 2022, the sampling events occurred on 1, 2, 3, and 4 August. We modeled only the recaptures that occurred along the focal study area that was sampled in all 4 years of study. We did not explicitly test for closure, but we did evaluate longer-term patterns of movement. We estimated confidence intervals for the Mt model using the function 'closedpCI.t' in 'Rcapture'.

We elected not to estimate population size using open-population models because of the differing level of effort in 2014–2015. However, we did use open-population models to estimate capture probability in 2016, using the function 'openp' in 'RCapture' and each year (2014, 2015, 2016, 2022) as sampling events. For all statistical comparisons, we set alpha = 0.05.

We tested for significant differences in sex ratio in 2016 and 2022 with a chi-square goodness-of-fit using χ^2 distribution (right-tailed) test. We tested for evidence of sexual size dimorphism using two-tailed, two-sample *t*-tests with pooled variance. We compared the estimated age in years of juveniles assessed in the field and recaptured more than 1 year later, to estimated ages derived from digital photographs of the same turtle using linear regression. Chi-square, *t*-tests, and linear regression tests were performed using the online tool Statistics Kingdom (2024) and confirmed using the R package 'car' (Fox and Weisberg 2019).

Results

We captured 486 unique turtles a total of 597 times, including recaptures within the same year: 395 turtles were captured once, 74 turtles captured twice, 14 turtles captured three times, and 3 turtles captured 4 times. Of 597 capture events, including recaptures within year, 532 (89%) were in traps (equivalent to an average of 7.24 turtles/TN or 0.30 turtles/trap-hour), 57 (9.6%) were made by hand, and 8 (1.3%) while snorkeling. The proportion of juveniles in each annual sample, excluding recaptures within the same year, was recorded as 0 of 25 (0%) in 2014, 1 of 22 (4.6%) in 2015, 44 of 203 (21.7%) in 2016, and 53 of 270 (19.6%) in 2022 (Fig 2). Of our 486 initial (i.e., unique individual) capture events, 190 (39%) were females, 193 (40%) were males, 5 (1%) were adults of undetermined sex, and 98 (20%) were juveniles ≤90 mm SCL (Table 1). The observed female:male ratio did not differ significantly from 1:1 in 2016 ($\chi^2 = 0.63$, df = 1, $P = 0.43$) or in 2022 ($\chi^2 = 0.02$, df = 1, $P = 0.89$) as determined by a chi-square goodness-of-fit using χ^2 distribution (right-tailed) test.

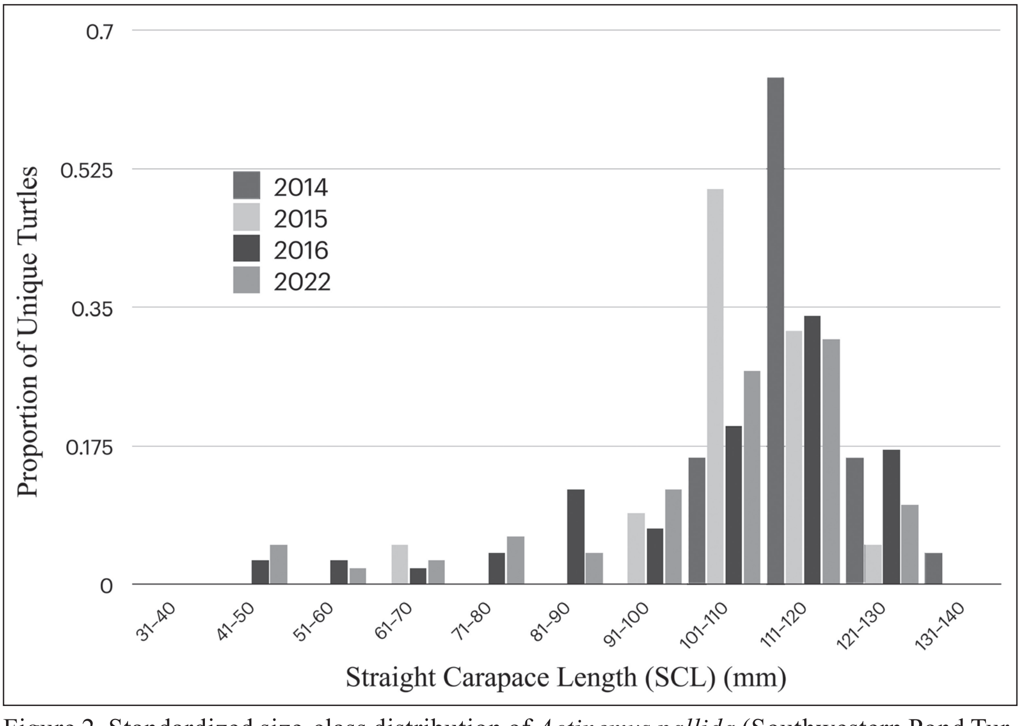

Figure 2. Standardized size-class distribution of *Actinemys pallida* (Southwestern Pond Turtle) in the upper watershed of Río Santo Domingo, Baja California, Mexico, in 2014, 2015, 2016, and 2022. Straight-carapace length (SCL) size class in millimeters (mm) is shown on the *x*-axis, and proportion of captured individuals is shown on the *y*-axis.

Based on the two-tailed, two-sample *t*-tests with pooled variance, males and females differed significantly in mass ($t = 2.075$, df = 378, $P = 0.039$), straight plastron length ($t = 2.765$, df = 354, $P = 0.006$), carapace width ($t = 4.577$, df = 379, $P < 0.001$), and shell depth ($t = 4.642$, df = 379, $P < 0.001$), but not in straight carapace length ($t = -0.41$, df = 379, $P = 0.685$) (Table 2). The effect size was generally low for most comparisons (less than 0.5 mm; Table 2).

For both intensive sampling events (2016 and 2022), the best recapture model of the 2 that were evaluated was "Mt" (Table 3). We estimated abundance with confidence intervals for model "Mt" to be 511.1 (SE = 71.6; CI = 395.7–686.5) turtles in 2016 and 663.8 (SE = 130.1; CI = 467.2–1011.0) turtles in 2022. These estimates are equivalent to instream densities of 134.5 turtles/river-km (rkm) in 2016 and 174.7 turtles/rkm in 2022 within the focal study area.

Table 1. Demographic summary of *Actinemys pallida* (Southwestern Pond Turtle) and annual sampling effort in the Río Santo Domingo, Baja California, Mexico. Recaptures within a given year are excluded here, but data does include individuals captured one year and recaptured another year.

Year	Date(s)	Trap-nights	Females	Males	Unknown	Juveniles
2014	19–21 Mar	3.0	13	12	0	0
2015	5 Aug	0.3	14	6	1	1
2016	23–26 July	27.5	74	84	1	44
2022	1–4 Aug	42.7	108	106	3	53

Table 2. Mass and body size dimensions of male and female *Actinemys pallida* (Southwestern Pond Turtle) from upper Río Santo Domingo watershed, Baja California, Mexico, and results of *t*-test comparisons. SCL = straight carapace length , SPL = straight plaston length , CW = carapace width, and SD = shell depth.

	Males				Females				*t*-test			Effect
	n	Avg	Median	SD	*n*	Avg	Median	SD	*P*	*t*	df	size
Mass (g)	191	184.2	182	35.1	189	193.2	197	48.7	0.039	2.075	378	0.21
SCL (mm)	191	112.1	111	7.6	190	111.7	112	9.5	0.685	-0.41	379	0.04
SPL (mm)	179	95.3	95	6.2	177	97.4	98	7.7	0.006	2.765	354	0.29
CW (mm)	191	85.2	85	6.6	190	88.3	89	6.5	<0.001	4.577	379	0.47
SD (mm)	191	36.7	36	4.5	190	38.6	39	3.4	<0.001	4.642	379	0.48

Table 3. Closed-population models for the *Actinemys pallida* (Southwestern Pond Turtle) population in the upper Santo Domingo watershed, Baja California, Mexico, for 2016 and 2022. AIC = Akaike's information criterion, BIC = Bayesian information criterion.

Year	Model	Abundance	SE	Deviance	df	AIC	BIC
2016							
	M0	571.3	83.2	116.1	13	162.79	169.37
	Mt	511.1	71.6	19.1	10	71.79	88.26
2022							
	M0	764.2	154.0	67.11	5	101.15	107.68
	Mt	663.8	130.1	4.01	3	42.05	55.11

We recaptured 33 turtles ~1 year or more after their initial capture. The median distance between multi-year recapture locations was 70 m. The mean distance between recapture locations was 401 m (SD = 653 m). The greatest downstream movement was 1621 m, and the largest upstream movement was 2297 m. Turtles averaged a net 240 m upstream movement. All these findings are influenced by the bounds of our 5.9-km survey area, and so they are likely an underestimate of the largest movements that occurred during this time.

Of 33 turtles recaptured ~1 year or more apart, 10 (30.3%) exhibited visible growth rings upon their initial capture. Of these, 8 (80%) were recaptured 6 or 7 years later and had transitioned to an adult without countable annuli during the interval between recaptures. Two (20%) were captured in August 2015 and again in July 2016. One was estimated to have 4 growth periods in both events, and the other estimated to have 2 growth periods in both events. Further, we blindly assessed (from archived photographs) the estimated number of growth rings for all 10 turtles and compared these values to those assessed in the field for the same turtle using simple linear regression. The fitted line did not capture the data well ($R^2 = 0.43$; $F = 5.19$; df = 1,7; $P = 0.57$).

Eighteen turtles were found dead and apparently killed by a vertebrate predator, including 1 in 2015, 12 in 2016, and 5 in 2022. Of the dead turtles found in 2016, one had been marked during an earlier trip. Of those found dead in 2022, two had been marked previously. Two dead turtles appeared to have been killed recently (i.e., within the past several days). Both had their heads chewed away, and blood was visible on the rocks where the turtles were found. Further, 5 adult turtles (1.04%) had at least 1 aural abscess, and 2 adult turtles had bilateral aural abscesses upon their initial capture (Fig. 3). Two turtles (0.40%) were missing 1 eye, and 6 turtles (1.24%) had shell injuries involving bone fractures (Fig. 4).

Discussion

Our findings revealed a demographically robust population of Southwestern Pond Turtles near the extreme southern edge of the species' range (but see the notable southern extension of 95.5 km reported by Valdez-Villavicencio et al. 2016), and we report multi-year patterns of movement within a stream system unfragmented by roads, development, or significant hydrological alteration. Context for our findings is best summarized by Manzo et al. (2021), who compiled population size and average annual count data for 81 populations of Southwestern Pond Turtles (but who did not include data from the population on which we report here). Only 2 populations (2.5%) were estimated to contain >100 adults, compared to our within-year estimates for 2016 and 2022 of 511.1 and 663.8, respectively (but see Muth et al. 2024).

The sampled area of 3.8 km appears to support one of the larger known populations of Southwestern Pond Turtles (Manzo et al. 2021), and possibly the largest known in Baja California. Our population estimates are also likely conservative given that they occurred over short sampling periods and an unknown subset of turtles were likely using the upland habitat at these times and therefore were

Figure 3. Adult female *Actinemys pallida* (Southwestern Pond Turtle) from the upper watershed of Río Santo Domingo, Baja California, Mexico, with bilateral aural abscesses.

Figure 4. Adult male *Actinemys pallida* (Southwestern Pond Turtle) from the upper Río Santo Domingo watershed, Baja California, Mexico, with carapace injury of undetermined cause.

unavailable for sampling. We also present preliminary findings that indicate growth may not occur at regular or predictable intervals within the calendar year, as well as inconsistency in observer assessments of growth rings at this site.

We speculate that the unfragmented nature of this river system has supported the persistence of large population of Southwestern Pond Turtles. Our results from this isolated riparian system also provide a useful baseline for an assessment of population- and individual-level responses to ongoing environmental change, including an increasing risk of severe drought (Manzo et al. 2021). Perhaps notably, juveniles were nearly absent from our sampling events in 2014 and 2015 but comprised approximately one-fifth of our sample in 2016 and 2022. We hesitate to attribute this to a real phenomenon because the level of effort, and the total number of captures, were substantially lower in the first 2 years of our study, so the observed difference could be due to random chance. However, northern Mexico sustained an extended period of drought in the years immediately prior to our study (Haeffner et al. 2018, Purcell et al. 2017), which is noted as a significant threat to population persistence in other populations of Southwestern Pond Turtles (Manzo et al. 2021) and could have affected nest development or hatchling survival in the years preceding our initial effort.

Despite temporally sparse sampling effort in each year, we documented instream movements by adult turtles of 1.6 rkm downstream and 2.3 rkm upstream from the focal study area, providing documentation of the species' movements within unfragmented stream systems. Our maximum observed movement of 2.3 km is comparable to, though not as large as, the maximum movement distance of 2.5 km reported by Holland (1992) and 2.6 km reported by Purcell et al. (2017). We also observed a net upstream movement of 240 m, which could represent an adaptation to frequent flood-displacement (Jones and Sievert 2009). However, large movements exceeding 1 km were rare, suggesting that our 3.8-km study area is appropriately sized for within-year closed-population modeling. Dispersal in vertebrates is difficult to adequately assess without radiotelemetry and/or genetic estimates of gene flow (Cayuela et al. 2018, Koenig et al. 1996), and our limited data should be considered a very conservative estimate of this species' potential instream movements.

The adult turtles in this population are relatively small, which is consistent with regional patterns, and likely consistent with counter-gradient growth across thermal gradients evident in the *Actinemys* clade (Snover et al. 2015). This pattern is also consistent with a hypothesized negative association between adult body size and population density in a related emydine species, *Glyptemys insculpta* (Le Conte) (Wood Turtle; Jones et al. 2019). Adult turtles in this population are smaller than those in an isolated desert oasis farther south (Valdez-Villavicencio et al. 2016). If the small average body size and the apparently slow growth rate are not related to cooler water temperature of the study area, it could indicate that this relatively unaltered system is less nutrient-rich than systems in southern California. Nevertheless, the studied population does show the expected high biomass of a healthy and undisturbed turtle population (Iverson 1982), as well as an even sex ratio.

The perennial streams of the Upper Santo Domingo watershed represent regionally significant conservation opportunities, especially in the context of increasing regional water demand, climate change, and desertification of the Sonoran Desert and increasingly severe droughts in the range of the Southwestern Pond Turtle (Manzo et al. 2021). Turtles in this population are subject to active depredation from an unknown predator. Mammalian predators known to occur in the vicinity of the site during our study include *Procyon lotor* (L.) (Northern Raccoon), *Bassariscus astutus* (Lichtenstein) (Ringtail), *Urocyon cinereoargenteus* (Schreber) (Gray Fox), *Canis latrans* Say (Coyote), and *Spilogale gracilis* Merriam (Western Spotted Skunk). Avian predators are also numerous in this canyon and include owls (Strigidae and Tytonidae) and *Corvus corax* L. (Common Raven). *Ardea alba* L (Great Egret), known from the vicinity of the SSPM, is also known to kill *Actinemys* spp. (Germano and Buchroeder 2018).

We recommend that this population is monitored at 5- to 10-year intervals using low-impact capture–mark–recapture techniques in combination with remote-detection methods such as passive integrated transponder (PIT) tags to detect animals moving along the stream system. We also suggest that this research complement long-term monitoring of the hydrologic system, as well as the local natural communities, vegetation, aquatic invertebrates, trout, amphibians, and birds, to assess the full suite of biological resources at the site. Based on the vertebrate guild alone, which in addition to the robust population of Southwestern Pond Turtles also supports a micro-endemic fish and 2 regionally rare amphibians, this watershed warrants full protection as a globally significant biodiversity reserve.

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