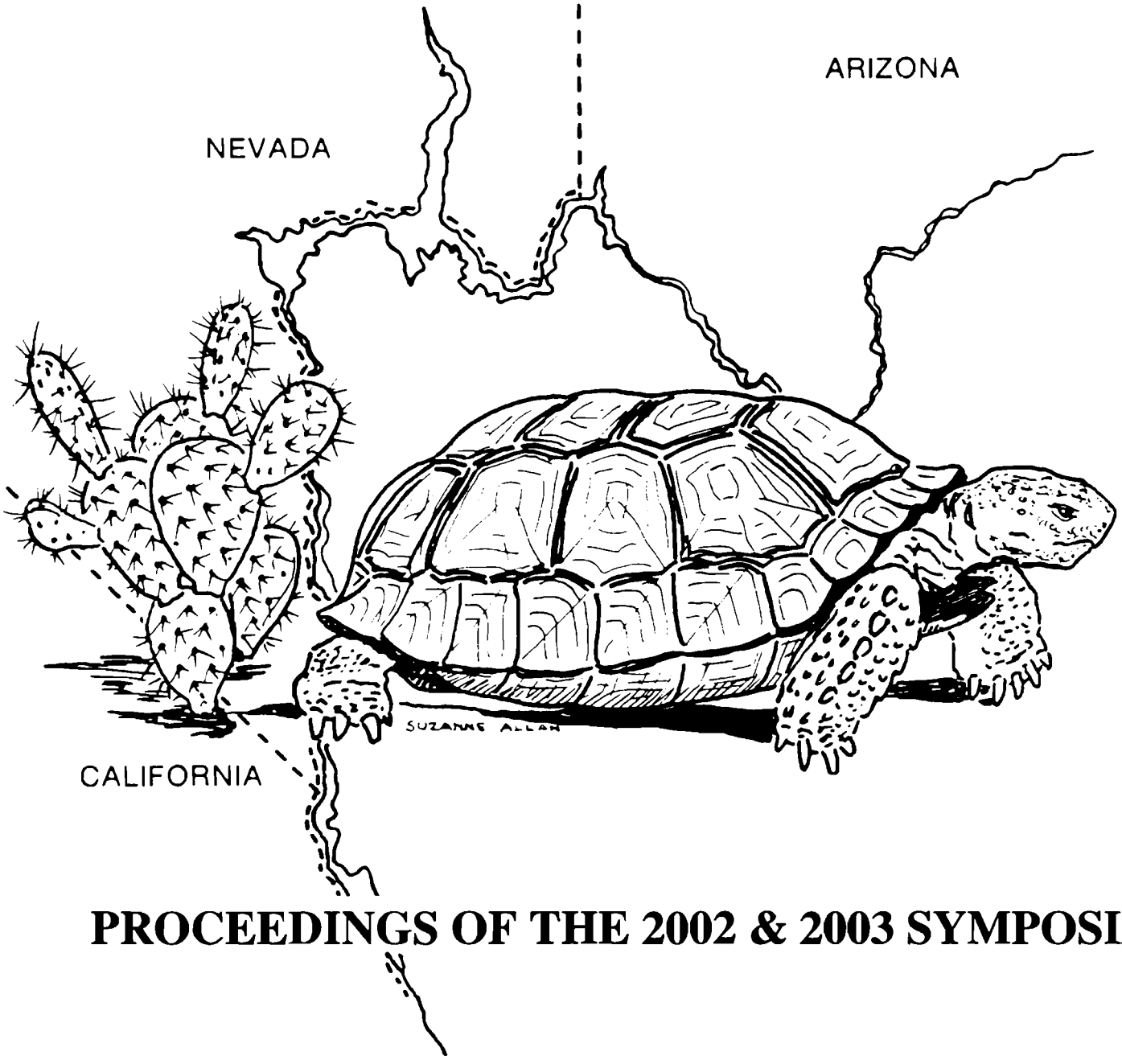
# THE DESERT TORTOISE COUNCIL




## PROCEEDINGS OF THE 2002 & 2003 SYMPOSIA

# ABSTRACTS AND PAPERS FROM THE

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# HABITAT USE BY DESERT TORTOISES AT THE FLORENCE MILITARY RESERVATION, PINAL COUNTY, ARIZONA

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The Florence Military Reservation (FMR) is a 10,421-ha site in Pinal County, Arizona, located approximately 80 km southeast of Phoenix. The Arizona Army National Guard uses FMR as a military training site, utilizing 14, 500 x 1000-m training areas (firing boxes) for ground support and artillery exercises. FMR contains gently sloping to nearly flat alluvial slopes in the north, and more rugged terrain with deeply incised washes to the south. Along the banks of the washes, cavities are eroded into the calcium carbonate (caliche) soils. In 2000, we initiated a four-year radio telemetry study to determine habitat use and movement patterns of desert tortoises at FMR, relative to military use.

We tracked up to 17 tortoises through 2002: 7 males, 7 females, and 3 juveniles. We estimated home range sizes up to 53.7 ha. Mean home range ($\pm$ 1 SD) for males (20.9 $\pm$ 19.56 ha) was twice the size as the mean home range for females (10.1 $\pm$ 8.69 ha). Home range size was variable within each sex, ranging from 6.32 to 69.16 ha in males and 2.8 to 25.8 ha in females. The length of time a tortoise has been monitored is not related to home range size. We determined habitat selection by use of compositional analysis. Tortoises used three habitat types, defined as vegetation associations: triangle leaf bursage-mixed cacti-mixed scrub association; creosote bush–triangle leaf bursage association; and a xeroriprarian scrub complex. Tortoises showed selection towards the xeroriparian scrub complex, which is typically associated with incised washes.

Tortoises used four types of shelter sites: caliche caves, soil burrows, woodrat middens, and pallets under clumps of vegetation. Caliche caves were the most utilized shelter type and are also associated with deeply incised washes. Tortoise restricted their movements within firing boxes primarily to washes, but we also observed them in bursage–mixed cacti association. The bursage-mixed cacti association typically occurs along flat benches between washes. Tortoises found in this association were either active or resting in pallets under clumps of bursage.

We determined nest-site selection by use of X-radiography. In May 2002 we located females and brought them to a central point to be X-rayed. We radiographed females using a HF-80 (MinXray) portable X-ray machine powered by a gasoline generator. We felt eggs by palpitation, but used radiographs to confirm presence of shelled eggs and to determine clutch size. We located nest sites by observing female movement patterns. Female desert tortoises

typically lay eggs in the loose soil of a burrow. They may remain in the burrow before and after oviposition. Field workers also looked for nests in the burrow entrance using hand trowels.

Four of the 7 monitored females produced eggs, and mean clutch size (± 1SD) was 5.0 ± 0.82. We suspect that 3 of the 4 tortoises nested in caliche caves. Although we found no nests in the shelter entrance by observers, females stayed at the shelter sites several weeks pre-and post- oviposition. The nest site for the fourth female was uncertain, as she was very mobile, moving from shelter site to shelter site during the time of oviposition.

The observed use of xeroriparian and bursage dominated habitats is important relative to National Guard training activities because of a preponderance of both habitat types within all firing boxes. We are currently in the process of mapping all caliche caves in the study area. If tortoises are indeed tied to the presence of caliche caves, this could be a useful tool in future firebox placement.

## DISEASE INCIDENCE ON SONORAN DESERT LONG TERM MONITORING PLOTS

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Through 2002, 16 monitoring plots within the Sonoran desert tortoise population in Arizona had been surveyed at least twice, in addition to a new plot added in 2002. Populations have generally remained stable through 1999 with the exception of a decline at the Maricopa Mountains plot in the late 1980's (Arizona Interagency Desert Tortoise Team [AIDTT], 2000). Since 2000, there have been apparent declines documented on the East Bajada (Black Mountains), San Pedro, and Hualapai Foothills plots (Averill-Murray *this volume*). Current monitoring plot protocol (Averill-Murray 2000) states that all tortoises should be visually inspected for clinical signs of upper respiratory tract disease (URTD) and cutaneous dyskeratosis (CD). We reviewed each plot's history to see if incidence of disease sign was correlated with population declines.

## METHODS

During each plot survey, field workers examined all captured tortoises for clinical signs of URTD (serous discharge bubbling or flowing from the nares or swollen eyes, eyelids, and conjunctiva [Brown et al. 2002]) and CD (gray-white dry, roughened, and flaky scutes [Jacobson et al. 1994; Dickinson et al. 2002]). We reviewed the 2000 update on Sonoran desert tortoise populations (AIDTT 2000) and recent plot reports (Woodman et al. 1999, 2000, 2001, 2002, 2003) to determine the relative numbers of tortoises showing signs of URTD and CD for each sampling period. We then compared numbers of tortoises with clinical disease signs to current and historic population estimates and numbers of carcasses found during each sampling period.

In 2002 researchers drew blood from tortoises on six different monitoring plots by jugular venipuncture. The University of Florida conducted enzyme linked immunosorbant assays (ELISA) to test for *Mycoplasma* (causative agent of URTD) and herpesvirus antibodies.

## RESULTS

Clinical signs for URTD have typically been relatively low (<10%) to non-existent on most plots. There are a few exceptions: Arrastra Mountains (29% in 2002), Bonanza Wash (23% in 2002), East Bajada (18% in 1990 and 33% in 2002), Harquahala Mountains (12% in 2001), and San Pedro Wash (11% in 2001). Field workers conducted CD exams on multiple surveys of 14 plots. Incidence of CD ranged from 0 to 65% and increased on four (29%) of the plots (Figure 1). There was no strong correlation between URTD and documented declines, but the number of tortoises with CD has increased dramatically on three plots (Table 1).

Field workers drew blood from 41 tortoises on six different long-term monitoring plots. No tortoises tested positive for URTD antibodies (Table 2). Twenty tortoises on four plots tested positive for herpes antibodies; 14 tortoises tested positive for both American and European isolates, and six tested positive for the European isolate only.

## DISCUSSION

Several tortoise population declines have occurred on long-term monitoring plots (Maricopa Mountains, San Pedro Wash, and East Bajada) and are backed up by large numbers of carcasses that accumulated between sampling periods. Other apparent declines can be attributed to several factors, including differences in data analysis (Averill-Murray *this volume*) and the difficulty of finding tortoises in the Sonoran Desert, especially during sub-optimal weather conditions (Van Devender 2002, Averill-Murray *this volume*).

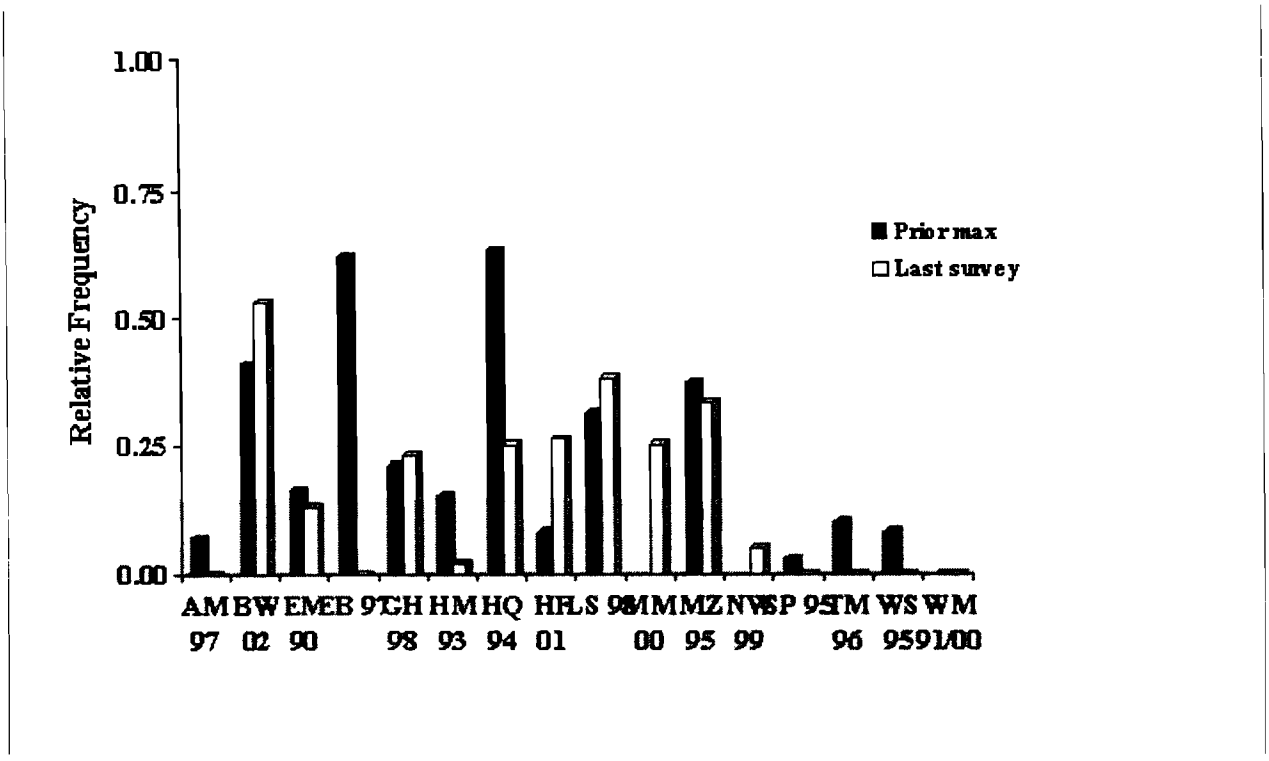


Figure 1. Relative frequency of desert tortoises on monitoring plots in Arizona with cutaneous dyskeratosis. For plots where CD has been documented on two or more consecutive sampling periods, the values for the prior max and latest survey period are given. Plot abbreviations are as follows: AM, Arrastra Mountains; BW, Bonanza Wash; EM, Eagletail Mountains; EB, East Bajada; GH, Granite Hills; HM, Harcuvar Mountains; HQ, Harquahla Mountains; HF, Hualapai Foothills; LS, Little Ship; MM, Maricopa Mountains; MZ, Mazatzal Mountains; NW; New Water Mountains; SP, San Pedro; TM, Tortilla Mountains; WS, West Silverbells; and WM, Wickenburg Mountains.

Field workers documented a high incidence of CD on the East Bajada Plot, but no other alarming disease frequencies were noted. Cutaneous dyskeratosis was present on over half the tortoises at two other plots (Bonanza Wash and Harquahala Mountains), but the population estimates have only declined slightly, with confidence intervals overlapping between sampling periods (Table 1). Care must be used when placing blame on one factor, such as CD, as the cause of a decline. We still do not understand the nature or cause of CD, nor its actual effects on the long-term health of tortoises (Dickinson et al. 2002).

Table 1. Comparison of population estimates (PE) with 95% confidence limits number of carcasses (CARC) relative frequency of desert tortoises showing clinical signs of upper respiratory tract disease (URTD) and relative frequency of tortoises with cutaneous dyskeratosis (CD) between years on selected Sonoran Desert, Arizona, long-term monitoring plots.

| Plot | CD | Year | PE | CARC | URTD |
|---|---|---|---|---|---|
| *Bonanza Wash* | 0.41 | 1992 | ------ | 13 | 0.06 |
| | 0.38 | 1997 | 27(16-38) | 2 | 0.08 |
| | 0.53 | 2002 | 17(8-26) | 2 | 0.23 |
| *East Bajada* | ------ | 1990 | ------ | 5 | 0.18 |
| | ------ | 1993 | 67(51-83) | 10 | 0.04 |
| | 0.62 | 1997 | 61(50-72) | 6 | 0.04 |
| | 0.65 | 2002 | 9(8-10) | 67 | 0.33 |
| *Harquahala Mountains* | 0.29 | 1988 | ------ | 4 | 0.00 |
| | 0.63 | 1994 | 15(13-17) | 0 | 0.00 |
| | 0.50 | 2001 | 10(6-14) | 3 | 0.12 |
| *Hualapai Foothills* | 0.09 | 1991 | ------ | 8 | 0.00 |
| | 0.13 | 1996 | 37(34-40) | 6 | 0.00 |
| | 0.26 | 2001 | 16(14-18) | 11 | 0.00 |
| *San Pedro Wash* | ------ | 1991 | ------ | 11 | 0.05 |
| | 0.03 | 1995 | 125(103-147) | 9 | 0.06 |
| | 0.00 | 2001 | 39(22-50) | 46 | 0.11 |

Upper Respiratory Tract Disease does not seem prevalent outside urban areas. Results from blood samples taken in conjunction with those described in this paper show few to no tortoises testing positive for *Mycoplasma* antibodies at isolated sites, while a high percentage of tortoises at Saguaro National Park (SNP) did test positive (Table 2). Only a few of the SNP tortoises showed clinical signs, and there have been few mortalities within the group of *Mycoplasma*-positive tortoises. To date, no tortoises occurring on monitoring plots have tested positive. The frequency of tortoises testing positive for herpesvirus antibodies is much higher. The significance of these results is not clearly understood, as the herpesvirus ELISA has only been validated on European *Testudo* and has yet to be validated for any *Gopherus* species (Brown et al. 2002).

Table 2. *Mycoplasma* ELISA results from Sonoran Desert tortoise research sites, Arizona. All sites are relatively isolated from major urban areas except for Saguaro National Park.

| Site | *n* | 0 | - |
|---|---|---|---|
| Florence Military Reservation, Pinal County | 13 | 0 | 13 |
| Various Monitoring Plots[1] | 41 | 0 | 41 |
| Ragged Top Mountain, Pima County | 18 | 2 | 16 |
| Saguaro National Park, Pima County | 25 | 21 | 4 |
| Sugarloaf Mountain, Maricopa County | 26 | 0 | 26 |

[1] Monitoring plots sampled include Bonanza Wash, Buck Mountain, East Bajada, Harcuvar Mountains, San Pedro Wash, and West Silverbell Mountains.

Sonoran desert tortoises live in disjunct populations along rocky slopes associated with desert mountain ranges (Van Devender 2002), so disease issues may be less of a problem on a range-wide scale in the Sonoran Desert (Howland and Rorabaugh 2002). Disease may be a secondary factor in tortoise declines, as other factors including natural population fluctuations, drought, and fragmented migration routes may influence or exacerbate disease issues within populations. To address desert tortoise population ecology and disease issues, monitoring plot protocols will continue to undergo revision as needed to better capture population information needs. Periodic blood sampling will continue, in addition to setting up a necropsy protocol for dead or dying tortoises found on research sites.

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