

Monitoring the removal of the non-native slider turtle (*Trachemys scripta*) and evaluating its effects on the native Sonoran mud turtle (*Kinosternon sonoriense*) at Montezuma Well (Montezuma Castle National Monument)



Interim Report to Western National Parks Association

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## Background

This report describes preliminary progress on a project funded by Western National Parks Association, to remove non-native slider turtles from Montezuma Well, a unit of Montezuma Castle National Monument in central Arizona. Montezuma Castle NM was established to preserve and interpret prehistoric dwelling sites and other cultural remains of the Sinagua people. The Montezuma Well unit also protects a unique, carbonate-rich limestone spring pool that supports an extraordinary aquatic ecosystem that is rich in endemic species. The Sonora mud turtle is the only aquatic vertebrate found in Montezuma Well, but the species is considered to be at risk from the much larger red-eared slider turtle, which was introduced some time in the last century. The objectives of this project are to remove the non-native slider through live-trapping methods, and measure the response of the mud turtles and other parts of the Well ecosystem after the removal of the non-native turtle. In addition to accomplishing this objective, this project will also provide substantial new biological and ecological data on the Sonora mud turtle, which is one of the least-studied turtles in North America.

## Methods

Fieldwork on this project was begun in May 2007, and has consisted primarily of two components: 1) live-trapping turtles to remove the sliders, and to collect biological data on the health of the mud turtle population; and 2) intensive behavioral observations of both the mud turtles and the sliders. We have used baited hoop traps and basking traps to capture turtles during the first three months of project work. We record information on size, weight, health (injuries, etc.), and reproduction of all turtles that are caught. Slider turtles are removed from the Well area and donated to the Phoenix Herpetological Society, which provides a home for them in artificial habitat, without risk that they will return to the wild. We individually mark mud turtles for future recognition, using a system of notches around the margin of their shells. Reproductive data are collected by x-raying adult female turtles, using a portable x-ray system.

One of the ways that slider turtles may negatively affect mud turtles is through direct competition for basking space and other resources in the Well. Our behavioral observations are directed toward collecting data on use of basking sites by the two turtle species, and other interactions between them. We have mapped the Well with a grid system, to facilitate recording locations where we see turtles. Once or twice per week, we observe turtles from the rim of the Well, noting their number, location, activity, and interactions, in relation to time of day and weather. In addition to providing data on activity and possible competition, these observations also give us important information on how and where in the Well to trap for the two species.

## **Preliminary results**

We have conducted 11 trapping sessions at Montezuma Well between the beginning of May and the beginning of August, totaling over 200 person-hours of effort. This has resulted in the capture of 110 mud turtles (including animals captured, released, and captured again at later trapping session) and six sliders (all sliders have been removed from the Well). Three of the sliders were females with eggs (7, 9, and 12 eggs, respectively) so there is a multiplier effect that is not evident when counting simply the number of turtles removed. Given that females can produce multiple clutches per year, the multiplier effect is likely greater than the number of eggs counted to date as well. We have also made 11 trips for behavioral and basking observations, totaling 55 hours of observation time.

We have begun to synthesize the data collected, in terms of numbers of turtles captured, recapture rates, size and condition of individual turtles, reproductive condition of females, and behavioral patterns. **Figure 1** shows a graph of weight of mud turtles in relation to size (carapace shell length). This

relationship provides us with a way to gauge the health and condition of the turtles, and may be used to compare the condition of the turtles before and after the slider turtles are removed. **Table 1** shows the reproductive status of female Sonora mud turtles over the spring / summer period. **Figure 2** shows a female mud turtle, with eggs, as seen in an x-ray photograph.

Products from the project to date include a manuscript on unusual mud turtle diet information discovered during the first three months of the project. This manuscript "Reptile prey in the diet of the Sonora mud turtle (*Kinosternon sonoriense*) with a brief review of saurophagy in North American turtles" will be submitted to the professional research journal *Southwestern Naturalist* 

We have also collaborated with the Interpretation Division staff at Montezuma Castle National Monument in producing an interpretive flyer describing the project, called "Turtles in Trouble" (see attached). This flyer is posted at the visitor contact station at Montezuma Well, at the USGS offices in Flagstaff, Arizona, and is also available as a handout.

Work on the project is of much interest to visitors, particularly children. During the first three months of the study, we have had a total of 186 visitor contacts. Our work site at the Well is directly adjacent to a main visitor trail, and visitors always are interested to see us working with the turtles. In addition to talking about the biology of the turtles and of Montezuma Well itself, our discussions with visitors invariably include discussing the problems that non-native species can cause, and why unwanted pets such as turtles should not be released into the wild.

## **Future plans**

We will continue regular trapping of turtles through the summer and fall, to establish a population baseline and measures of seasonal activity and behavior. We will concentrate on trying and evaluating other capture techniques that specifically target slider turtles. The baited hoop traps have so far had only limited success in capturing sliders, an unexpected result. Traps that take advantage of the basking behavior of sliders hold greater promise. We are also testing out netting methods (floating trammel nets) and direct search and capture techniques.

In addition to our testing techniques that capture sliders most efficiently, we are also examining seasonal activity as it relates to capturing the turtles. The project may have started too late this year to catch sliders during their peak activity. During the first trapping session we caught three sliders, but in the 10 trapping sessions since then, we have only caught a total of three more. We anticipate there will be an increase in activity in the late summer or early fall, before the turtles become more or less inactive during the winter. This should provide another opportunity to catch more sliders. Trapping will resume early in the spring, when turtles begin to become active again. Data collected this summer will provide a valuable comparison for changes in the Well ecosystem after the sliders are removed.

**Figure 1**. Relationship between body size (carapace length [CL] in mm) and weight (WT) in grams for Sonora mud turtles from Montezuma Well and nearby Wet Beaver Creek, Yavapai County, Arizona. M = males, F = females, JM = juvenile male, J = juvenile (sex unknown).



**Figure 2**. Radiograph of female mud turtle from Wet Beaver Creek, Yavapai County, Arizona (code BJM, 17 August, 2007) showing 8 eggs. Turtle was captured within the Montezuma Well section of the creek. Anterior of turtle is toward the top.



| Code | Eggs | Date      | Capture<br>Frequency |
|------|------|-----------|----------------------|
| AI   | 4    | 27-Jul-07 |                      |
| AIM  |      | 01-May-07 | 1                    |
| AIW  |      | 01-May-07 | 1                    |
| AKX  | 6    | 15-May-07 | 1                    |
| ALW  | 0    | 15-May-07 | 1                    |
| AM   | 0    | 15-May-07 | 1                    |
| AM   |      | 20-Jun-07 | 2                    |
| AMW  | 6    | 22-May-07 | 1                    |
| ANO  | 6    | 01-Jun-07 | 1                    |
| ANW  | 5    | 06-Jun-07 | 1                    |
| ANW  | 3    | 27-Jul-07 | 2                    |
| ANX  | 0    | 06-Jun-07 | 1                    |
| AOX  |      | 20-Jun-07 | 1                    |
| BINU |      | 01-May-07 | 1                    |
| BIW  | 4    | 17-Jul-07 | 1                    |
| BIX  | 1    | 17-Jul-07 | 1                    |
| BJM  | 8    | 17-Jul-07 | 1                    |
| BJO  | 1    | 17-Jul-07 | 1                    |
| BJP  | 2    | 17-Jul-07 | 1                    |
| BJV  | 3    | 17-Jul-07 | 1                    |
| BKN  | 4    | 03-Aug-07 | 1                    |
| BKO  | 3    | 17-Jul-07 | 1                    |
| BPW  | 0    | 27-Jul-07 | 1                    |
| CV   | 7    | 15-May-07 | 1                    |

, F

**Table 1.** Reproductive status of female Sonora mud turtles at Montezuma Well and nearby Wet Beaver Creek, Yavapai County, Arizona. Mean clutch size for all females observed with eggs is 4.5.