

Successful nest intervention for declining turtle species - the northwestern pond turtle *Actinemys marmorata* and southwestern pond turtle *Actinemys pallida*

SARAH M. FOSTER¹, STEPHEN GERGENI², KELLY A. DAVIDSON³, LUCY STEVENOT⁴ & JEFF A. ALVAREZ^{5*}

¹Foster Wildlife Surveys, 774 5th Avenue, Sacramento, CA 95818, USA

²1306 61st Street, Sacramento, CA 95819, USA

³Mt. View Sanitary District, P.O. Box 2757, Martinez, California 94553, USA

⁴P.O. Box 4957, Petaluma, California 94955, USA

⁵The Wildlife Project, PO Box 188888, Sacramento, CA 95818, USA

*Corresponding author e-mail: jeff@thewildlifeproject.com

INTRODUCTION

The northwestern pond turtle (*Actinemys marmorata*) and the southwestern pond turtle (*Actinemys pallida*) are both recognised as of conservation concern in California and have been reported to be in decline for several decades (Jennings & Hayes, 1994; Bury et al., 2012; Thompson et al., 2016). Both Bury et al. (2012) and Thompson et al. (2016) have attributed declines in both species to destruction or loss of nesting habitat; absence of protection for nesting sites; and a putative lack of information on nesting ecology. Our understanding of the nesting ecology of the species has benefitted from a species review (Bury et al., 2012) and publications dealing with nest site predation (Alvarez et al., 2014), atypical nesting behaviour (Alvarez & Davidson, 2018), and nest site selection (Riensch et al., 2019, Davidson & Alvarez, 2020). Both northwestern and southwestern pond turtles occur at our study site (at a ratio of 1:2 respectively) and we report here on a successful intervention to repair two nests, one that was predated and the other that was abandoned before completion.

We undertook a 6-year turtle nesting-ecology study (2013 – 2019) in Moorhen Marsh, a 21-acre man-made freshwater marsh that is associated with a waste-water treatment facility. During this study, we followed female *A. marmorata* and *A. pallida* from aquatic refuge sites to their presumed nesting locations in upland areas surrounding the aquatic breeding habitat. Each nesting female that was located was observed from approx. 50 m away, and typically behind cover, so that nest construction, oviposition, nest completion, and finally the return to aquatic refuge habitat could be closely observed using binoculars. As the two turtle species are not readily identifiable at this distance, hereafter they are referred to as *Actinemys* sp. Data on each of these nest locations were collected, a protective cage (modified from Graham, 1997) was secured over the nest, and the nest site was monitored until hatching (Davidson & Alvarez, 2020).

On 20th June 2015 a nesting turtle (*Actinemys* sp.) was located and observed. Following the completion of the nest, a protective cage was placed over the nest, which was then



Figure 1. Western pond turtle (*Actinemys* sp.) eggs (indicated by arrows) within a nest cavity that were left exposed by a predation attempt. The nest was plugged manually and produced viable neonates the following winter.

monitored. The following day the caged nest was examined and found to have been partially excavated. The nest plug was removed and the soil layer covering the eggs was missing so that the eggs were exposed (Fig. 1). We removed the cage, replaced a small amount of loose soil over the eggs, and then fashioned a funnel shaped plug from damp soil collected in the immediate area which was mixed with pond water. The new plug was pressed into the opening of the nest chamber and spread firmly into the surrounding soil. The newly sealed nest was monitored for the next 8 months.

The following nesting season, on 26th June 2016, a pond turtle (*Actinemys* sp.) was found nesting in upland habitat about 2 m from aquatic refuge habitat. At some time in the process of nesting the turtle was disturbed, probably by the

presence of observers, which were only about 20 m from the nesting turtle. It immediately fled to aquatic refuge habitat. Upon investigation the nest was found to be incomplete with the eggs exposed. A similar procedure to that used the previous year was used to plug this nest and it was covered by a protective cage and monitored.

Both nests were very closely monitored. In late February 2015 and late February 2016 respectively, each of the two nests showed signs of emergence of nestling pond turtles. Within 3-4 days of a small (1 cm) opening, in what was presumed to be the nest chamber, hatchlings emerged. The nest from 2015 produced eight live neonate turtles, and the nest from 2016 produced seven live neonates and a single undeveloped egg. These counts are within the range reported by Holland (1994) for normal clutch size which averaged 6.1/ nest and ranged from 1-13.

Although we cannot be certain, we believe that the only nesting attempt where our presence disturbed the turtle prior to the completion of its nest was that reported for 26th June 2016. Our approach to limiting turtle disturbance, by remaining 50 m away from a nesting turtle, was inferred to be effective as all other turtles engaged in active nest construction appeared to complete their nests.

Our work here suggests that the process of nest construction may be disrupted by predation attempts, which Alvarez et al. (2014) reported as “at a high level” at this site, or disturbance during the process of nest completion. Intervention at an early stage, presumably before environmental conditions affect eggs, can include recreating and placing nest plugs, which can lead to greater reproductive success. This is particularly important for species where nesting failure may be a contributing factor in their decline (Bury et al., 2012). To limit or eliminate disturbance to nesting turtles, we suggest maintaining a distance of at least 50 m which consequently requires the use of binoculars or a spotting scope to observe nesting turtles (Davidson & Alvarez, 2020). Nesting turtles should only be approached after the female has completed the nest, at which time the nest can be located, documented, and protected.

ACKNOWLEDGEMENTS

We are grateful to the Mt. View Sanitary District and their Board of Directors for support of turtle studies at Moorhen Marsh, Martinez, CA. This work benefited by a review and constructive comments from an anonymous reviewer. Work herein was conducted under a Lake and Streambank Alteration Agreement (1600-2016-0347-R3) provided by the California Department of Fish and Wildlife.

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Accepted: 29 April 2021