Short Communication

Confiscation and rehabilitation of native and alien turtle species (*Malayemys* spp.) intended for prayer animal release in the Angkor Landscape

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Cambodia is both a transit and a source country for illegally trafficked wildlife, with many species being trafficked to neighbouring countries or sold domestically (Gray *et al*., 2017; Heinrich *et al*., 2019). Chelonians are among the most consistently targeted species, often for consumption, medical use, and pet markets (Stanford, *et al*., 2020; Cox *et al*., 2022; Nguyen, 2023). An alternative incentive for chelonian trafficking, less represented within the scientific literature, is their use in prayer-animal release events. These events are primarily carried out by Buddhists, the dominant religious group in Cambodia, where approximately 95% of the population identifies as Buddhist (Manira *et al*., 2019).

In Cambodia, prayer-animal release is viewed by many as a demonstration of kindness and benevolence towards the animals, with the belief that participants will gain some form of merit or good karma for releasing the animal into the wild (Magellan, 2019). Buddhism teaches compassion for all living organisms, and the act of prayer-animal release is meant to be a physical display of this compassion. However, if not performed under scientific guidance, introducing new animals through prayer-animal release can have detrimental ecological impacts (Liu *et al*., 2013). Non-native species can introduce foreign diseases and parasites, to which native populations have no resistance. The presence of these non-native species can disrupt the local ecosystems, leading to altered food webs and the decline of native biodiversity. These changes can have cascading effects, resulting in long-term environmental harm, an outcome well-documented in species such as the pond slider *Trachemys scripta*, which has become the most abundant and invasive terrapin worldwide (Fanaru *et al*., 2024). Prayer-animal release with native species also demands careful consideration. Releasing native species can pose similar risks, including transmission of diseases or possible genetic interference, resulting in the loss of biodiversity (Awoyemi *et al*., 2016). Most animals used for prayer-animal release in Cambodia are native; wildlife trafficking records have shown over 95% of all confiscations in Cambodia between 2001–2018 were native species (Heinrich *et al*., 2020).

On 28 August 2023, the Siem Reap Provincial Department of Environment (PDoE) confiscated 11 snail-eating turtles (*Malayemys* spp.) and one red-eared slider *T. scripta elegans* from an illegal trader at Angkor Wat. We suspected that these turtles were intended for prayer-animal release because they were being sold next to the temple inside Angkor Wat, a popular prayer-animal release site. While we could not confirm the intentions of those involved in their trade, the purchase of turtles at this location is highly unlikely to be for any other

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purpose in our experience. The turtles were transported to the PDoE Angkor Landscape office where they were temporarily housed in tubs with shallow water to allow them to hydrate while avoiding possible drowning of any weaker animals. The following day, the 12 turtles were transported to the Angkor Centre for Conservation of Biodiversity (ACCB) in transport crates lined with wet towels to avoid potential further dehydration. Unfortunately, one of the snail-eating turtles succumbed to its injuries before arriving at ACCB, whereas the remainder arrived in poor condition.

Morphological characteristics enabled ACCB staff to correctly identify two distinct species from the eleven snail-eating turtles rescued. Six were Mekong snail-eating turtles *M. subtrijuga* (Fig. 1a), a species with two distinct allopatric populations: one isolated population restricted to the island of Java in Indonesia, likely due to anthropogenic introduction or a naturally occurring relict population, and another with an extensive distribution across the lower Mekong River system of the Indochinese Peninsula, spanning Cambodia, Laos, Vietnam and northeastern Thailand (Dawson *et al*., 2020). Five were Malayan snail-eating turtles *M. macrocephala* (Fig. 1b), a species native to northern and central Thailand, south through peninsular Thailand to northwestern peninsular Malaysia (Ihlow *et al*., 2015, 2016; Dawson *et al*., 2018). Trade records confirm the presence of *M. macrocephala* in food markets in Vientiane and Champassak provinces in Laos (Auer, 2011; Suzuki *et al*., 2015). *Malayemys macrocephala* is not known to naturally occur in Cambodia, but its distribution approaches extreme western Cambodia and could thus marginally extend into a small area of the country, though this has yet to be confirmed (Dawson *et al*., 2018). The phenotypical differences used by ACCB staff to distinguish these species included the number of nasal stripes, because *M. macrocephala* generally has four or fewer nasal stripes, whereas *M. subtrijuga* typically has six or more. *Malayemys macrocephala* also has a much wider infraorbital stripe that seldom extends above the loreal seam in front of the eye, compared to *M. subtrijuga* which has a narrower infraorbital stripe that usually connects to the supraorbital stripe on the snout (Fig. 1) (Brophy, 2004).

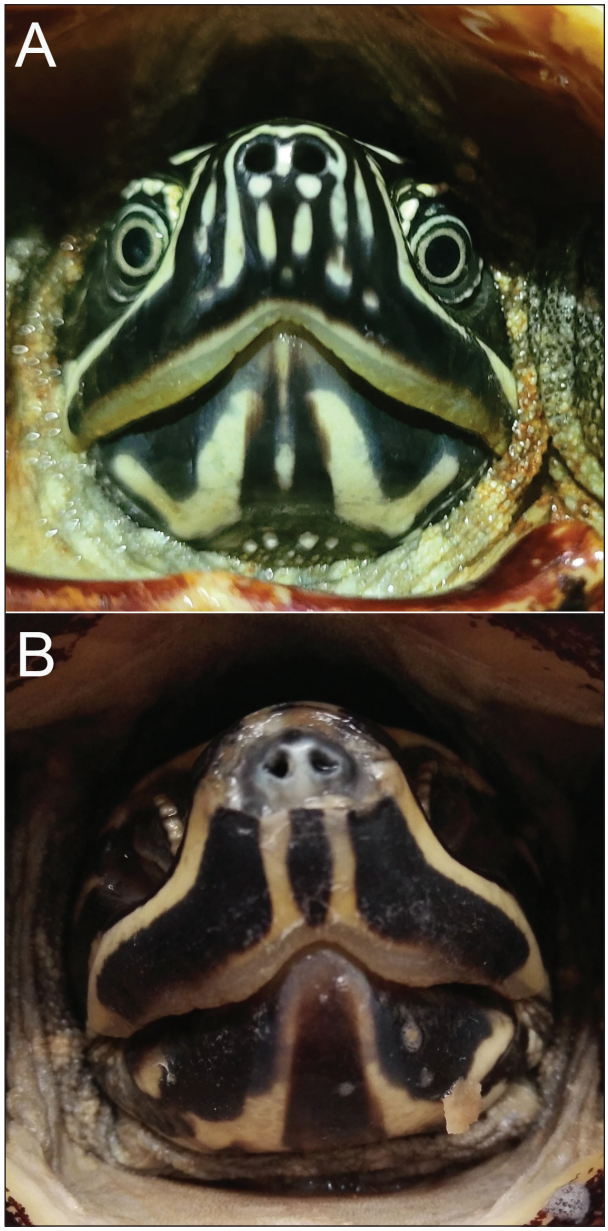

Fig. 1 Variations in nasal markings between A) *Malayemys subtrijuga* (© ACCB / Maria Blümm) and B) *M. macrocephala* (© ACCB / Jason Miller). *Malayemys subtrijuga* has six or more nasal stripes, whereas *M. macrocephala* has four or fewer nasal stripes.

Preliminary examination of the turtles upon arrival at ACCB showed that all were severely dehydrated (Fig. 2a) and presented with a lesser or greater degree of septicaemic cutaneous ulcerative disease (SCUD, also known as shell rot) on the plastron and/or carapace (Fig. 3). Complications with shell health are common in rescued turtles (Cortés *et al*., 2022) and in our experience, confiscated snail-eating turtles almost always display signs of SCUD. This suggests that the physiology of these two species is severely prone to environmental stressors, which is also consistent with other reports of *Malayemys* in human care (Dawson *et al*., 2018).

Three of the turtles also presented bilateral keratitis, a simultaneous infection of the cornea in both eyes, resulting in their eyes displaying a white colouration (Fig. 2b). We also noted that these three turtles displayed

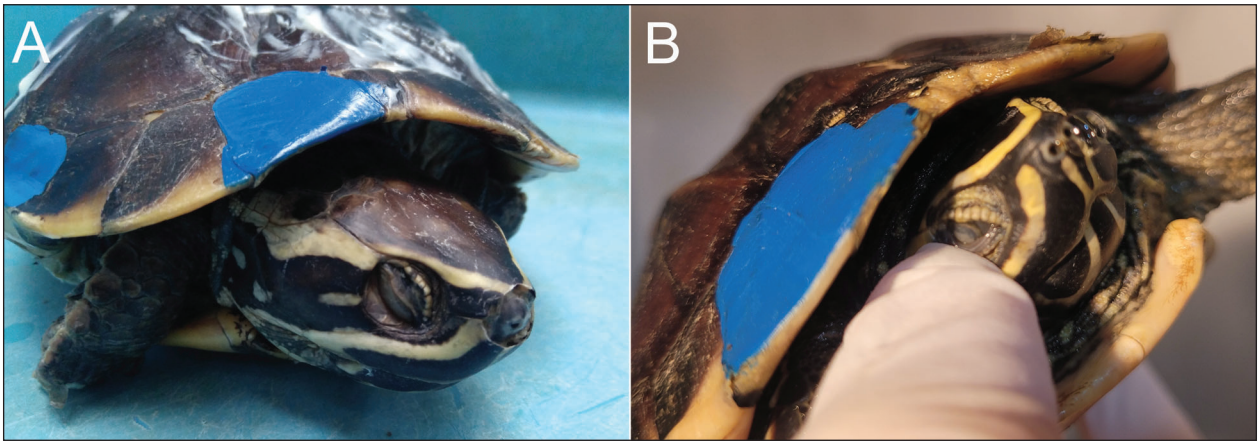

Fig. 2 Two confiscated snail-eating turtles before treatment began at ACCB. These showed signs of weakness such as closed eyes and relaxed limbs, whereas the sunken eyes (A) indicated a high degree of dehydration. The white corneal colouration of the eye (B) is a symptom of keratitis. All of the turtles showed similar signs of weakness and dehydration. Topical ointment (A) can also be seen on the shell as part of treatment and blue nail varnish was painted on differing scutes to identify individuals (© ACCB / Maria Blümm).

Fig. 3 Three confiscated snail-eating turtles after arrival at ACCB, all with plastron damage caused by septicaemic cutaneous ulcerative disease. Lesions are indicated by white arrows (© ACCB / Maria Blümm).

sunken eyes and produced a severe odour from their oral cavities. Although showing no obvious signs of disease aside from severe dehydration and SCUD, a fourth turtle suddenly became very weak 24 hrs after its arrival at ACCB. Despite intensive treatment and husbandry care from the ACCB veterinary team, all four turtles regrettably died less than 48 hours after their arrival on site. At the time of writing, all of the remaining turtles from the confiscation are receiving intensive treatment, antibiotics, non-steroidal anti-inflammatory drugs (NSAIDs), and fluid therapy, in addition to being placed on a treatment schedule for shell care (Doneley *et al*., 2017).

On 15 September 2023, Siem Reap PDoE confiscated a further five *M. macrocephala* from traders at Angkor Wat and we suspect again these were intended for prayer-animal release. These turtles were also transported to ACCB for rehabilitation and they too showed signs of severe dehydration and SCUD. One had a hole pene-

trating its carapace (Fig. 4). The extent of this wound was found to have completely perforated the shell and damaged a lung and the turtle unfortunately died several days later as a consequence. Another turtle had buoyancy issues, being unable to submerge itself fully. The prognosis for this turtle at the time of writing was poor, because the buoyancy concerns most likely stemmed from internal complications requiring an extended period of intensive care.

Our experience with rescued *M. subtrijuga* turtles is that the species generally does not adjust well to an ex-situ environment. The poor state of health of turtles on arrival at ACCB and the intensive treatment required often result in major problems during their acclimation. Despite the high standards of husbandry ensured by ACCB veterinary staff and keepers, these turtles often continue to develop minor SCUD. As a result, ACCB strives to release *M. subtrijuga* individuals in suitable, secure habitats in collaboration with government authorities, following scientific guidance from experienced staff and conservation allies. To this end, staff ensure that their medical condition has improved and that no further medication is required. The turtles must also exhibit clear signs they are healthy and active, to maximise the prospects for survival on release back into the wild.

Confiscation of *M. macrocephala* turtles also pose concerns. Although most animals used in prayer-animal release in Cambodia are native species, release of *M. macrocephala* appears to be increasing. *Malayemys macrocephala* is readily available in Thailand, where the species is frequently caught and sold for prayer-animal release (Dawson *et al*., 2018). The presence of *M. macrocephala* in confiscations by Siem Reap PDoE suggests continued illegal wildlife trade between the native range of this species (Thailand, Malaysia, Myanmar; see above) and Cambodia. It also suggests that introductions of non-native species are frequently occurring to the Angkor Landscape due to prayer-animal release events (Heinrich *et al*., 2020), although this needs to be verified by a larger field study in the area.

ACCB focuses primarily on Endangered and Critically Endangered turtles and birds native to Cambodia. *Malayemys macrocephala* is currently classified by the IUCN Red List as Least Concern, whereas *M. subtrijuga* is classified as Near Threatened (Cota, 2021; Horne *et al*., 2021). Neither is a priority species for ACCB and resource constraints prevent long-term care for either species. However, addressing the ecological challenges unintentionally posed by prayer-animal releases involving both species is essential. Investigating the frequency and scale of *M. macrocephala* releases in Cambodia, and understanding the origins and pathways is crucial for developing targeted conservation strategies. If a native *M. macrocephala* population exists in western Cambodia, then release plans could be considered. Until confirmed, no confiscated *M. macrocephala* can be released in Cambodia because they are currently considered a non-native species.

Fig. 4 A snail-eating turtle with a small, but deep hole in the carapace which perforated the shell and damaged a lung (© ACCB / Maria Blümm).

Education could play a key role in influencing prayer-animal release practices. Religion has been of interest to many biologists worldwide who believe that there is potential for this to have a positive impact on conservation (Liu *et al*., 2013). Practices such as prayer-animal releases can adapt to current ecological realities without losing their core values of compassion for wildlife (Wasserman *et al*., 2019). If performed under the guidance of ecological experts and with native species, these could have a positive impact. This large undertaking begins with educating those who have the most influence: monks. Since 2021, ACCB's outreach and education programme has focused on capacity building of Buddhist monks and laypeople at six pagodas in four provinces. This effort is specifically focused on addressing conservation issues, including a sustainable approach to prayer-animal release. Further educational programmes such as this likely offer a way forward in bridging the gap between science, religion and tradi-

tion. For example, Liu *et al*. (2013) found that organisers of prayer-animal release events with ecological knowledge were less likely to release invasive species. While releasing native species can still have a negative impact if not guided by science, this demonstrates the influence of education on traditional and religious practices, as well as the open-mindedness of those organising these events.

The continued release of non-native species such as *M. macrocephala* through prayer-animal release could be a major driver of ecological change. The typical survival rate of a species released into a novel habitat has been found to be extremely low and relies on what is known as a propagule, the minimum number of organisms required to reproduce and survive under favourable conditions (Liu *et al*., 2013; Awoyemi *et al*., 2016). Dawson *et al*. (2018) suggested that religious practices such as prayer-animal release could introduce *M. macrocephala* into areas outside of the species distribution. With large or frequent release events, *M. macrocephala* would be increasingly likely to establish itself in areas such as the Angkor Landscape, if this has not already occurred. *Malayemys subtrijuga* and *M. macrocephala* are closely related, and Ihow *et al*. (2016) documented past introgression and relatively low differentiation in the mitochondrial DNA of the two species. The establishment of *M. macrocephala* in the Angkor Landscape could threaten the genetic integrity of native *M. subtrijuga* in this area through interbreeding. Such genetic pollution of native chelonian species by anthropogenically introduced species is well documented in the genus *Trachemys* and has been shown to have negative implications for conservation (Parham *et al*., 2013). We consequently recommend surveys to establish whether *M. macrocephala* currently resides at the known prayer-animal release locations within the Angkor Landscape. Collaborations are also essential between conservationists and religious leaders to ensure that prayer-animal releases are conducted in an ecologically responsible manner and thereby mitigate the associated risks.

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